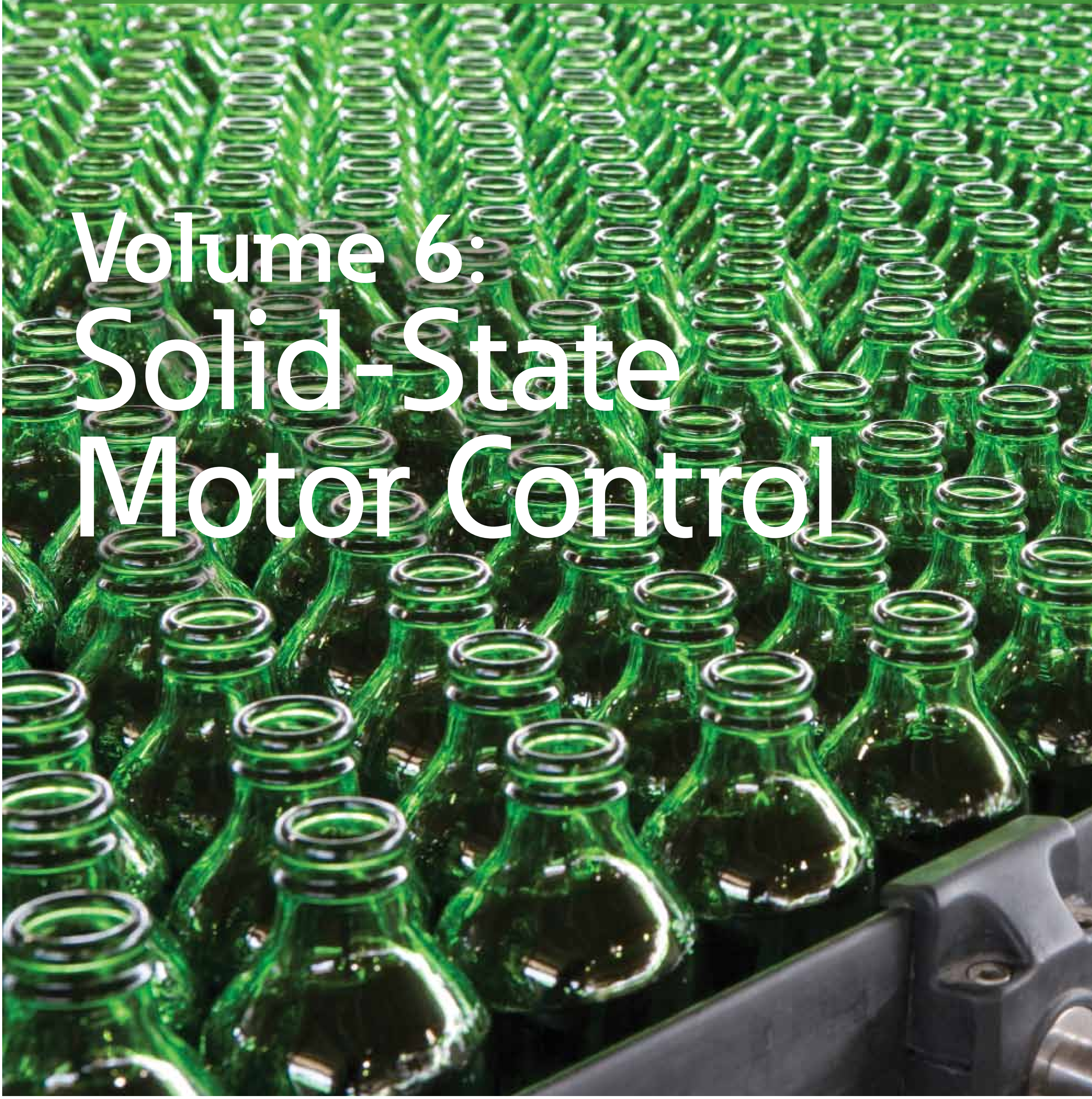
Electrical Sector Solutions

Volume 6: Solid-State Motor Control



EATON

Powering Business Worldwide

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Powering Business Worldwide

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In addition, Eaton is committed to creating and maintaining powerful customer relationships built on a foundation of excellence. From the products we manufacture to our dedicated customer service and support, we know what's important to you.

Solutions

Eaton takes the complexity out of power systems management with a holistic and strategic approach, leveraging our industry-leading technology, solutions and services. We focus on the following three areas in all we do:

- Reliability—maintain the appropriate level of power continuity without disruption or unexpected downtime
- Efficiency—minimize energy usage, operating costs, equipment footprint and environmental impact
- Safety—identify and mitigate electrical hazards to protect what you value most

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As we grow, it becomes increasingly difficult to include all products in one or two comprehensive catalogs. Knowing that each user has their specific needs, we have created a library of catalogs for our products that when complete, will contain 14 volumes. Since the volumes will continuously be a work in progress and updated, each volume will stand alone. Refer to our volume directory, MZ08100001E, for a quick glance of where to look for the products you need. The 14 volumes include:

- Volume 1—Residential and Light Commercial (CA08100002E)
- Volume 2—Commercial Distribution (CA08100003E)
- Volume 3—Power Distribution and Control Assemblies (CA08100004E)
- Volume 4—Circuit Protection (CA08100005E)
- Volume 5—Motor Control and Protection (CA08100006E)
- Volume 6—Solid-State Motor Control (CA08100007E)
- Volume 7—Logic Control, Operator Interface and Connectivity Solutions (CA08100008E)
- Volume 8—Sensing Solutions (CA08100010E)
- Volume 9—Original Equipment Manufacturer (CA08100011E)
- Volume 10—Enclosed Control (CA08100012E)
- Volume 11—Vehicle and Commercial Controls (CA08100013E)
- Volume 12—Aftermarket, Renewal Parts and Life Extension Solutions (CA08105001E)
- Volume 13—Counters, Timers and Tachometers (CA08100015E)—Available in electronic format only
- Volume 14—Fuses (CA08100016E)—Available in electronic format only

These volumes are not all-inclusive of every product, but they are meant to be an overview of our product lines. For our full range of product solutions and additional product information, consult Eaton.com/electrical and other catalogs and product guides in our literature library. These references include:

- The Consulting Application Guide (CA08104001E)
- The Eaton Power Quality Product Guide (COR01FYA)

If you don't have the volume that contains the product or information that you are looking for, not to worry. You can access every volume of the catalog library at Eaton.com/electrical in the Literature Library.

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Icons

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Contact Us

If you need additional help, you can find contact information under the Customer Care heading of Eaton.com/electrical.

Reduced Voltage Motor Starters

1

Soft Start Controllers

S611 Soft Starters

S811 Soft Starters

Learn Online

Drawings Online

Soft Start Controllers

Contents

Description	*Page*

Product Overview

Type S701

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. The S701 provides the user with the ability to adjust initial torque, ramp up and down time, and also select kick start for high inertial loads.

Type S701 with Auxiliary Contact

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. With the auxiliary contact, it is possible to control an external bypass to reduce heating and increase acceleration and deceleration times.

The unit provides the user with the ability to adjust initial torque, ramp up and down time and also select kick start for high inertia loads.

Type S701 with Brake

The S701 soft start controller with DC injection brake is designed to control acceleration and deceleration of three-phase motors. Brake current is adjustable from 0–50A DC. The ramp-up feature is adjustable from 0.5–10 seconds. Torque adjustment is adjustable with or without break loose (kick start) function.

Semiconductor Reversing Contactor

The S511 device is a semiconductor reversing contactor designed to switch three-phase motors forward and reverse. Unicore electronics and thermal design ensures high switching capacity and long lifetime.

DS6

Eaton’s DS6 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install, and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 40 to 180 amperes.

DS7

Eaton’s DS7 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install, and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 4–32A in four frame sizes.

Type S701, Soft Start Controllers

Contents

Type S701, Soft Start Controllers

Product Description

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. The S701 provides the user with the ability to adjust initial torque, ramp up and down time, and also select kick start for high inertial loads.

Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The S701 unit controls current on two of three motor phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

Features

- Rated operational voltage up to 600 Vac
- Control voltage range from 24–480 Vac/Vdc
- Adjustable ramp times (0.5–10 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature
- Soft stop (0.5–10 seconds)
- Unlimited number of START/STOP operations per hour
- IP20 finger protection
- Fractional to 15 hp motors at 480V (20 hp at 600V)

Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- CSA certified
- UL listed (E108212)
- cUL listed

Catalog Number Selection

S701 Soft Starters

S701 C 15 N 3 S

Soft Start Controller — S701

Line Voltage
- **C** = 208–240 Vac
- **D** = 380–415 Vac
- **E** = 380–480 Vac
- **G** = 550–600 Vac

Ampere Rating
- **03** = 3.5A
- **15** = 15A
- **25** = 25A

Options
- **N** = No special options
- **B** = Braking

Number of Poles
- **3** = (Only three at this time)

Control Options
- **S** = Standard
- **BP** = Auxiliary contact

Product Selection

S701E15N3S

S701E25N3S

Soft Start Controllers

Max. Current	Line Voltage	Control Voltage (Vac/Vdc)	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0 SF	200V 1.15 SF	230V 1.0 SF	230V 1.15 SF	460V 1.0 SF	460V 1.15 SF	575V 1.0 SF	575V 1.15 SF	Catalog Number
3.5	208–240	24–240	7.5	N/A	N/A	1	1	1	1	N/A	N/A	N/A	N/A	**S701C03N3S**
3.5	380–415	24–300	N/A	1.1	N/A	N/A	N/A	N/A	N/A	1-1/2	1-1/2	N/A	N/A	**S701D03N3S**
3.5	440–480	24–300	N/A	N/A	1.5	N/A	N/A	N/A	N/A	2	2	N/A	N/A	**S701E03N3S**
3.5	500–600	24–300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	2	**S701G03N3S**
15	208–240	24–240	4	N/A	N/A	3	3	3	3	N/A	N/A	N/A	N/A	**S701C15N3S**
15	380–480	24–300	N/A	5.5	7.5	N/A	N/A	N/A	N/A	10	7-1/2	N/A	N/A	**S701E15N3S**
15	500–600	24–300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	10	**S701G15N3S**
25	208–240	24–240	7.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	N/A	N/A	**S701C25N3S**
25	380–480	24–300	N/A	11	12.5	N/A	N/A	N/A	N/A	15	15	N/A	N/A	**S701E25N3S**
25	500–600	24–300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	20	**S701G25N3S**

Technical Data and Specifications

Soft Starters—S701_03N3S

Description	S701C03N3S	S701D03N3S	S701E03N3S	S701G03N3S
Maximum current capacity	3.5	3.5	3.5	3.5
Trip Class				
10A	3.5	3.5	3.5	3.5
10	3.5	3.5	3.5	3.5
20	2.8	2.8	2.8	2.8
30	2.1	2.1	2.1	2.1
Electrical Characteristics				
Line voltage (Vac)	208–240	380–415	440–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–240	24–300	24–300	24–300
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms	70 ms
Control Characteristics				
Ramp time (secs)	0.5–10	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10	0.5–10
Environment Characteristics				
Temperature–operating (no derating)	–30° to 40°C	–30° to 40°C	–30° to 40°C	–30° to 40°C
Current rating 50°C	N/A	N/A	N/A	N/A
Limited duty cycle 50°C	N/A	N/A	N/A	N/A
Current rating 60°C	N/A	N/A	N/A	N/A
Limited duty cycle 60°C	N/A	N/A	N/A	N/A
Temperature–storage	–30° to 80°C	–30° to 80°C	–30° to 80°C	–30° to 80°C
Altitude (meters)–no derating	2000	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30°	Vertical ±30°	Vertical ±30°	Vertical ±30°
Impulse withstand voltage IEC 947-4-1	4000V	4000V	4000V	4000V
Rated insulation voltage (Ui)	660V	660V	660V	660V
Installation category	III	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle
Power dissipation for continuous operation	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle	4 W/A x duty cycle
Cooling method	Natural convection	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20	IP20
Pollution degree	3	3	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE

Soft Starters—S701_15N3S

Description	S701C15N3S	S701E15N3S	S701G15N3S
Maximum current capacity	15	15	15
Trip Class			
10A	15	15	15
10	15	15	15
20	12	12	12
30	10	10	10
Electrical Characteristics			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–240	24–480	24–480
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms
Control Characteristics			
Ramp time (secs)	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10
Environment Characteristics			
Temperature–operating (no derating)	–30° to 40°C	–30° to 40°C	–30° to 40°C
Current rating 50°C	12.5A	12.5A	12.5A
Limited duty cycle 50°C	15A on-time max. 15 min. duty cycle max. 0.8	15A on-time max. 15 min. duty cycle max. 0.8	15A on-time max. 15 min. duty cycle max. 0.8
Current rating 60°C	10A	10A	10A
Limited duty cycle 60°C	15A on-time max. 15 min. duty cycle max. 0.65	15A on-time max. 15 min. duty cycle max. 0.65	15A on-time max. 15 min. duty cycle max. 0.65
Temperature–storage	–30° to 80°C	–30° to 80°C	–30° to 80°C
Altitude (meters)–no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30°	Vertical ±30°	Vertical ±30°
Impulse withstand voltage IEC 947-4-1	4000V	4000V	4000V
Rated insulation voltage (Ui)	660V	660V	660V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE	UL, CSA, CE

Soft Starters—S701_25N3S

Description	S701C25N3S	S701E25N3S	S701G25N3S
Maximum current capacity	25	25	25
Trip Class			
10A	25	25	25
10	25	25	25
20	20	20	20
30	15	15	15
Electrical Characteristics			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–240	24–300	24–300
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms
Control Characteristics			
Ramp time (secs)	0.5–10	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–10	0.5–10	0.5–10
Environment Characteristics			
Temperature–operating (no derating)	–30° to 40°C	–30° to 40°C	–30° to 40°C
Current rating 50°C	20A	20A	20A
Limited duty cycle 50°C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60°C	17A	17A	17A
Limited duty cycle 60°C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature–storage	–30° to 80°C	–30° to 80°C	–30° to 80°C
Altitude (meters)–no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30°	Vertical ±30°	Vertical ±30°
Impulse withstand voltage IEC 947-4-1	4000V	4000V	4000V
Rated insulation voltage (Ui)	660V	660V	660V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE	UL, CSA, CE

Dimensions

Approximate Dimensions in Inches (mm)

Soft Starters—S701...N3S

Catalog Number	W	H	D	Weight in Lbs (kg)
S701C03N3S	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
S701D03N3S	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
S701E03N3S	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
S701G03N3S	0.89 (22.5)	3.94 (100)	5.01 (127)	0.6 (270)
S701C15N3S	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
S701E15N3S	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
S701G15N3S	1.77 (45)	3.94 (100)	5.04 (128)	1.52 (690)
S701C25N3S	3.54 (90)	3.94 (100)	5.04 (128)	2.53 (1150)
S701E25N3S	3.54 (90)	3.94 (100)	5.04 (128)	2.53 (1150)
S701G25N3S	3.54 (90)	3.94 (100)	5.04 (128.	2.53 (1150)

Type S701, Soft Start Controllers with Auxiliary Contact

Contents

Type S701, Soft Start Controllers with Auxiliary Contact

Product Description

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. With the auxiliary contact, it is possible to control an external bypass to reduce heating and increase acceleration and deceleration times.

The unit provides the user with the ability to adjust initial torque, ramp up and down time and also select kick start for high inertia loads.

Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The auxiliary contact is designed to work in conjunction with an across-the-line contactor. The purpose of the contactor is to provide a parallel current path once the soft starter has brought the motor up to speed. Once the soft start controller reaches end of ramp, the auxiliary contact will close and send a signal to close the bypass contactor, thus providing a low impedance path for the current to the motor. The S701 unit controls current on two of three motor phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor protector or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

Features

- Rated operational voltage up to 600 Vac
- Control voltage range from 24–300 Vac/Vdc
- Adjustable ramp times (0.5–20 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature (0–85% adjustment)
- Kick start for 200 ms
- Soft stop (0.5–20 seconds)
- IP20 finger protection
- Available up to 30A (with Bypass installed)
- Auxiliary contact for up-to-speed indication

Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Bypass option allows for greater current capacity in the unit
- Bypass option helps to reduce heat in the enclosure
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- UL listed (E108212)
- cUL listed

Listed Listed

Product Selection

For S701 catalog number selection, see **Page V6-T1-5**.

S701

Soft Start Controllers with Auxiliary Contact

Max. Current	Line Voltage	Control Voltage (Vac/Vdc)	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating 200V 1.0 SF	1.15 SF	230V 1.0 SF	1.15 SF	460V 1.0 SF	1.15 SF	575V 1.0 SF	1.15 SF	Catalog Number
Ratings without Bypass														
25	208–240	24–240	5.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	N/A	N/A	**S701C25N3BP**
25	380–480	24–300	N/A	12.5	12.5	N/A	N/A	N/A	N/A	15	15	N/A	N/A	**S701E25N3BP**
25	500–600	24–300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20	20	**S701G25N3BP**
Ratings with Bypass														
30	208–240	24–240	7.5	N/A	N/A	7-1/2	7-1/2	10	7-1/2	N/A	N/A	N/A	N/A	**S701C25N3BP**
30	380–480	24–300	N/A	15	15	N/A	N/A	N/A	N/A	20	15	N/A	N/A	**S701E25N3BP**
30	500–600	24–300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	20	**S701G25N3BP**

Technical Data and Specifications

Soft Starters with Auxiliary Contact—S701_25N3BP

Description	S701C25N3BP	S701E25N3BP	S701G25N3BP
Maximum current capacity with bypass (without bypass)	30 (25)	30 (25)	30 (25)
Trip Class			
10A	30 (25)	30 (25)	30 (25)
10	30 (25)	30 (25)	30 (25)
20	24 (20)	24 (20)	24 (20)
30	19.5 (15)	19.5 (15)	19.5 (15)
Electrical Characteristics			
Line voltage (Vac)	208–240	380–480	500–600
Operating frequency (Hz)	50/60	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.	5 mA AC max.
Minimum operational current	50 mA	50 mA	50 mA
Control voltage (Vac/Vdc)	24–240	24–300	24–300
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA	1 mA
Response time max.	70 ms	70 ms	70 ms

Soft Starters with Auxiliary Contact—S701_25N3BP, continued

Description	S701C25N3BP	S701E25N3BP	S701G25N3BP
Control Characteristics			
Ramp time (secs)	0.5–20	0.5–20	0.5–20
Ramp settings (% LRT)	85%	85%	85%
Kick start settings (% LRT)	85%	85%	85%
Soft stop (secs)	0.5–20	0.5–20	0.5–20
Environmental Characteristics			
Temperature—operating (no derating)	–30° to 40°C	–30° to 40°C	–30° to 40°C
Current rating 50°C	20A	20A	20A
Limited duty cycle 50°C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60°C	17A	17A	17A
Limited duty cycle 60°C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30° to 80°C	–30° to 80°C	–30° to 80°C
Altitude (meters)—no derating	2000	2000	2000
Humidity	95% noncondensing	95% noncondensing	95% noncondensing
Operating position (no derating)	Vertical ±30°	Vertical ±30°	Vertical ±30°
Impulse withstand voltage IEC 947-4-1	4000V	4000V	4000V
Rated insulation voltage (Ui)	660V	660V	660V
Installation category	III	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for continuous operation	2 W/A without bypass	2 W/A without bypass	2 W/A without bypass
Power dissipation with semiconductor bypassed	5 W/A max. with bypass	5 W/A max. with bypass	5 W/A max. with bypass
Cooling method	Natural convection	Natural convection	Natural convection
Degree of protection	IP20	IP20	IP20
Pollution degree	3	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE	UL, cUL, CE

Dimensions

Approximate Dimensions in Inches (mm)

Soft Starters with Auxiliary Contact—S701_25N3BP

Catalog Number	W	H	D	Weight in Lbs (kg)
S701C25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
S701E25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
S701G25N3BP	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)

Type S701, Soft Start Controllers with Brake

Contents

Type S701, Soft Start Controllers with Brake

Product Description

The S701 soft start controller with DC injection brake is designed to control acceleration and deceleration of three-phase motors. Brake current is adjustable from 0–50A DC. The ramp-up feature is adjustable from 0.5–10 seconds. Torque adjustment is adjustable with or without break loose (kick start) function.

Application Description

The S701 line of soft start controllers is specifically designed to be a low cost option for soft starting small (15 hp and down) three-phase motors. The braking option is a DC injection system, allowing for fast stopping of a three-phase motor. The S701 unit controls current on two of the three phases to control the torque being applied to the motor, allowing for smooth starting of a motor. The S701 is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

Features

- Rated operational voltage up to 480 Vac
- Control voltage range from 24–300 Vac/Vdc
- Adjustable ramp times (0.5–20 seconds)
- Adjustable initial torque control (0–85%)
- Kick start feature (0–85% adjustment)
- Kick start for 200 ms
- IP20 finger protection
- Braking control adjustable from 0–50A DC
- Slow speed: 7.5% or 10% of nominal speed

Benefits

- Reduced wear on bolts, gears, chains, clutches, shafts and bearings
- Braking option allows for quick stopping of loads
- Brake control can help eliminate expensive mechanical brakes
- Allows for controlling the inrush current to the motor
- Reduced water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear

Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- UL listed (E108212)
- cUL listed

Listed Listed

Product Selection

For S701 catalog number selection, see **Page V6-T1-5**.

S701E25B3S

Soft Start Controllers with Brake

			Three-Phase Motor kW Rating (50 Hz)			hp Rating						
		Control				200V		230V		460V		
Max. Current	Line Voltage	Voltage (Vac/Vdc)	230V	380–400V	440V	1.0 SF	1.15 SF	1.0 SF	1.15 SF	1.0 SF	1.15 SF	Catalog Number
25	208–240	24–240	5.5	N/A	N/A	5	5	7-1/2	5	N/A	N/A	**S701C25B3S**
25	380–480	24–300	N/A	12.5	12.5	N/A	N/A	N/A	N/A	15	15	**S701E25B3S**

Technical Data and Specifications

Soft Starters with Brake—S701_25B3S

Description	S701C25B3S	S701E25B3S
Maximum current capacity	25	25
Trip Class		
10A	25	25
10	25	25
20	20	20
30	15	15
Electrical Characteristics		
Line voltage (Vac)	208–240	380–480
Operating frequency (Hz)	50/60	50/60
Leakage current	5 mA AC max.	5 mA AC max.
Minimum operational current	1A	1A
Control voltage (Vac/Vdc)	24–240	24–300
Pickup voltage max.	20.4 Vac/Vdc	20.4 Vac/Vdc
Dropout voltage min.	5 Vac/Vdc	5 Vac/Vdc
Max. control current for no operation	1 mA	1 mA
Response time max.	100 ms	100 ms
Control Characteristics		
Ramp time (secs)	0.5–10	0.5–10
Ramp settings (% LRT)	85%	85%
Kick start settings (% LRT)	85%	85%
Soft stop (secs)	0.5–10	0.5–10
Brake current	0–50 Vdc	0–50 Vdc

Soft Starters with Brake—S701_25B3S, continued

Description	S701C25B3S	S701E25B3S
Environmental Characteristics		
Temperature—operating	–30° to 40°C	–30° to 40°C
Current rating 50°C	20A	20A
Limited duty cycle 50°C	25A on-time max. 15 min. duty cycle max. 0.8	25A on-time max. 15 min. duty cycle max. 0.8
Current rating 60°C	17A	17A
Limited duty cycle 60°C	25A on-time max. 15 min. duty cycle max. 0.65	25A on-time max. 15 min. duty cycle max. 0.65
Temperature—storage	–30° to 80°C	–30° to 80°C
Altitude (meters)—no derating	2000	2000
Humidity	95% noncondensing	95% noncondensing
Operating position	Vertical ± 0°	Vertical ± 0°
Impulse withstand voltage IEC 947-4-1	4000V	4000V
Rated insulation voltage (Ui)	660V	660V
Installation category	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2 W/A x duty cycle	2 W/A x duty cycle
Power dissipation for continuous operation	2 W/A	2 W/A
Cooling method	Natural convection	Natural convection
Degree of protection	IP20	IP20
Pollution degree	3	3
Agency approvals	UL, cUL, CE	UL, cUL, CE

Dimensions

Approximate Dimensions in Inches (mm)

Soft Starters with Brake—S701_25B3S

Catalog Number	W	H	D	Weight in Lbs (kg)
S701C25B3S	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)
S701E25B3S	3.54 (89.9)	3.94 (100.1)	5.04 (128.0)	2.53 (1150)

Contents

Type S511, Semiconductor Reversing Contactors

Product Description

The S511 device is a semiconductor reversing contactor designed to switch three-phase motors forward and reverse. Unicore electronics and thermal design ensures high switching capacity and long lifetime.

Application Description

The S511 line of solid-state reversing contactors is specifically designed for high speed operations or when long contactor life is required. The reversing contactors are intended for small motor applications (5 hp and below). The S511 unit can be used in a variety of applications including fans, pumps, conveyors, doors, hoists, cranes, etc. It is designed to be used with a manual motor starter or a full voltage starter. These devices provide the necessary overload protection for the motor and also provide line isolation for the motor. Short-circuit protection can be provided by fuses or circuit breakers.

Features

- Rated operational voltage up to 480 Vac
- Control voltage ranges of 5–24 Vdc and 24–240 Vac/Vdc
- Unlimited number of START/STOP operations per hour
- IP20 finger protection
- AC-3 current rating of 10A
- AC-4 current rating of 8A

Benefits

- Extremely high switching rates possible
- Very long life expectancy and no contacts or movable parts to replace
- Compact design (45 mm wide) leads to significant panel savings

Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CE marked
- CSA certified
- UL listed

Listed

1

Product Selection

Reversing Solid-State Contactors

Max. Current	Line Voltage	Control Voltage	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating 200V 1.0 SF	200V 1.15 SF	230V 1.0 SF	230V 1.15 SF	460V 1.0 SF	460V 1.15 SF	Catalog Number
10	208–480	5–24 Vdc	2.2	4	4	2	2	3	2	5	5	**S511E10N3D**
10	208–480	24–240 Vac/Vdc	2.2	4	4	2	2	3	2	5	5	**S511E10N3S**

Technical Data and Specifications

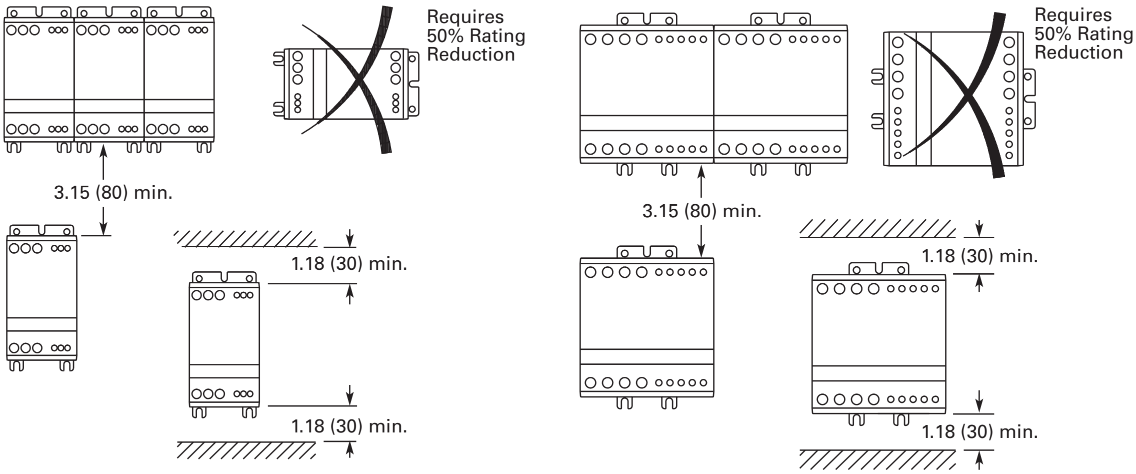
Semiconductor Reversing Contactors—S511E10N3_

Description	S511E10N3D	S511E10N3S
Maximum current capacity	10	10
Trip Class		
10A	10	10
10	10	10
20	8	8
30	6.5	6.5
Electrical Characteristics		
Line Voltage (Vac)	208–480	208–480
Operating frequency (Hz)	50/60	50/60
Control voltage	5–24 Vdc	24–240 Vac/Vdc
Pickup voltage max.	4.25 Vdc	20.4 Vac/Vdc
Dropout voltage min.	1.5 Vdc	7.2 Vac/Vdc
Max. control voltage	26.4 Vdc	253 Vac/Vdc
Response time max.	1/2 cycle	1 cycle
Interlock time max.	80 ms	150 ms
Control Characteristics		
Operation current AC-3	10	10
Operation current AC-4	8	8
Duty cycle	Continuous operation	Continuous operation
Leakage current	1 mA AC max.	1 mA AC max.
Minimum operation current	10 mA AC	10 mA AC
Environmental Characteristics		
Temperature—operating	0° to 60°C	0° to 60°C
Temperature—storage	–20° to 80°C	–20° to 80°C
Altitude (meters)	2000	2000
Humidity	95% noncondensing	95% noncondensing
Operating position	Vertical ±30°	Vertical ±30°
Impulse withstand voltage IEC 947-4-1	4000V	4000V
Rated insulation voltage (Ui)	660V	660V
Installation category	III	III
Vibration	IEC 68-2-6 5g 10–150 Hz	IEC 68-2-6 5g 10–150 Hz
Power dissipation for intermittent operation	2.2 W/A x duty cycle	2.2 W/A x duty cycle
Power dissipation for continuous operation	2.2 W/A	2.2 W/A
Cooling method	Natural convection	Natural convection
Degree of protection	IP20	IP20
Pollution degree	3	3
Agency approvals	UL, CSA, CE	UL, CSA, CE

Mounting Instructions

IMPORTANT: The controller is designed for vertical mounting in free air. If the controller is mounted horizontally, the load current must be reduced to 50% of rated current.

Recommended Mounting Distances



Dimensions

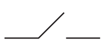
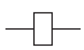
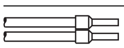
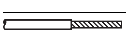
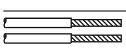
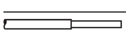
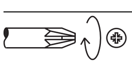
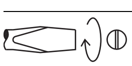
Approximate Dimensions in Inches (mm)

Semiconductor Reversing Contactors—S511E10N3_

Catalog Number	W	H	D	Weight in Lbs (kg)
S511E10N3D	1.77 (45.0)	3.94 (100.1)	5.04 (128.0)	1.52 (690)
S511E10N3S	1.77 (45.0)	3.94 (100.1)	5.04 (128.0)	1.52 (690)

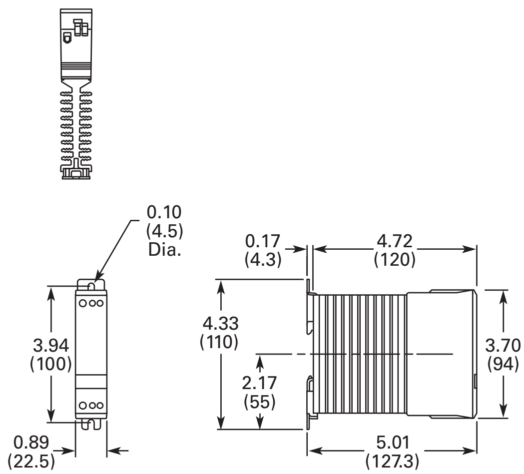
Also refer to dimension drawings on **Page V6-T1-18**.

Cable Requirements and Sizing

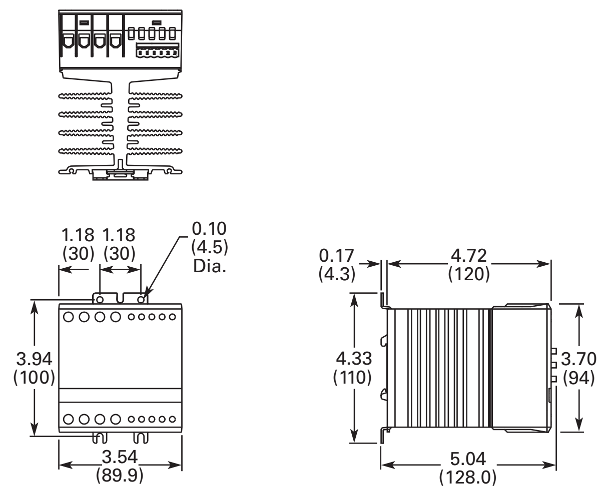
75°C	 AWG (mm^2)	 AWG (mm^2)
	18–12 (0.75–4)	20–16 (0.5–1.5)
	2–18 (2 x 1)	2 x 20–18 (2 x 0.5–0.75)
	18–10 (0.75–4)	20–16 (0.5–1.5)
	2 x 18–14 (2 x 0.75–2.5)	2 x 20–16 (2 x 0.5–1.5)
	18–10 (0.75–4)	20–16 (0.5–1.5)
	2 x 18–16 (0.75–6)	2 x 20–16 (2 x 0.5–1.5)
	Posidrive 1 4.4 in-lb. max. 0.5 Nm max.)	N/A
	4 mm 4.4 in-lb max. (0.5 Nm max.)	3 mm 3.5 in-lb max. (0.4 Nm max.)

Approximate Dimensions in Inches (mm)

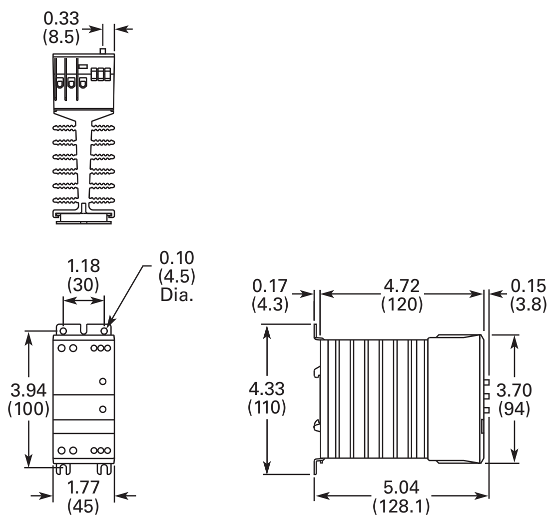
22.5 mm Frame



90 mm Frame



45 mm Frame



DS6 Soft Start Controllers

Contents

Description	*Page*

DS6 Soft Start Controllers

Product Description

Eaton's DS6 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install, and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 40 to 180 amperes.

Application Description

With its small size, it can easily fit in place of existing soft starters, wye-delta starters, or across-the-line NEMA® and IEC starters. This feature allows easy upgrades to existing systems. The product is designed to be wired in the three-phase line feeding the three motor input leads as is done for normal across-the-line starting. The starter uses silicon controlled rectifiers (SCRs) to ramp the voltage to the motor, providing smooth acceleration and deceleration of the load. After the motor is started, the internal run bypass contactor closes, resulting in the motor running directly across-the-line. Internal run bypass significantly reduces the heat generated as compared to non-bypass starters. The soft stop option allows for a ramp stop time that may be longer than the coast-to-stop time. An external over-load protection is needed.

Operation

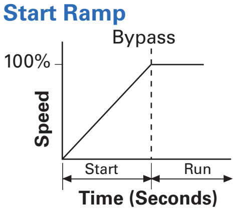
Voltage Ramp Start

This start method provides a voltage ramp to the motor, resulting in a constant torque increase. This most commonly used form of soft start mode allows you to set the initial voltage value and the duration of the ramp to full voltage conditions.

Bypass contactor(s) close after ramp time has elapsed.

- Adjustable initial voltage 30–92% of full voltage
- Adjustable ramp time 1–30 seconds

Start Ramp

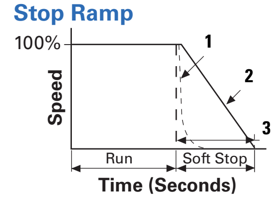


Soft Stop

Allows for a controlled stopping of load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or product damage. Setting the soft stop time to a value of 0 turns off this feature.

- Soft stop time = 0–30 seconds

Stop Ramp



1 = Coast to Stop (Speed)
2 = Soft Stop Ramp (Voltage)
3 = Soft Stop Time

Features and Benefits

- Run bypass mode greatly reduces internal heating created by the power dissipation across the SCRs. The bypass contactor directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Less heat minimizes enclosure size and cooling requirements, and maximizes the life of all devices in the enclosure
- LED displays device status and provides fault indication
- Variable ramp times and voltage control (torque control) settings provide unlimited starting configurations, allowing for maximum application flexibility
- Soft stop control suits applications where an abrupt stop of the load is not acceptable. Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts, and bearings
- Minimizes the peak inrush current's stress on the power system
- Manages peak starting torque to diminish mechanical system wear and damage
- 24 Vdc control module enhances personnel and equipment safety

Protective Features

- There are two auxiliary relays—
  - First relay is a TOR relay which closes when the TOR is achieved (internal bypass relays close)
  - The second relay is a RUN relay which closes when the RUN signal is initiated and opens when RUN signal is removed. It remains closed during stop ramp time, if set to a value greater than 0. The RUN relay will also open if a fault occurs
- Mains connection—The mains connection is monitored for an open condition and/or undervoltage
- Motor connection—The motor connection is monitored for an open condition
- SCR faults—SCR performance is monitored during the ramp cycle for proper operation
- Heat sink over/under temperature—High ambient temperatures, extended ramp times, and high duty cycle conditions may cause the DS6 to exceed its thermal rating. When temperature goes under –5°C, unit will trip as well. The DS6 is equipped with sensors that monitor the temperature of the device. The soft starter will trip in over/under temperature conditions, preventing device failure
- Bypass relay—The DS6 can detect if the bypass relay fails to close after the ramp start or opens while the motor is running. The DS6 will trip on a bypass dropout fault if either of these conditions occur. The device does not start when bypass relay is closed and start signal is applied
- 24 Vdc low voltage—If the control voltage falls below 20 Vdc at any time during operation, the unit will fault

Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL listed (E251034)
- CSA certified
- CE marked
- C-Tick

Instructional Leaflets

- Instruction Leaflet IL03901001E

Product Selection

DS6 Soft Start Horsepower Ratings

Please refer to Application Note AP03900001E for additional information on proper size selection.

DS6 25–75 hp Model

DS6 Soft Start Controllers—Horsepower Ratings—10 Second Ramp, 1 Start per Hour, 300% Current Limit at 40°C

Rated Current (A)	Motor Power (hp) 200V	230V	460V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
40	10	10	30	HFD3150L	150A Class RK5	XTOB040DC1 ②	C440A1A045SAX	**DS6-34DSX041N0-N**
52	15	20	40	HFD3200L	200A Class RK5	XTOB057DC1 ②	C440B1A100SAX	**DS6-34DSX055N0-N**
65	20	25	50	HJD3250	200A Class RK5	XTOB065DC1 ②	C440B1A100SAX	**DS6-34DSX068N0-N**
77	25	30	60	HKD3300	300A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX081N0-N**
96	30	30	75	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX099N0-N**
124	40	50	100	HKD3400	500A Class RK5	XTOB125GC1S	C440A1A005SAX ④	**DS6-34DSX134N0-N**
156	50	60	125	HLD3450	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	**DS6-34DSX161N0-N**
180	60	75	150	HLD3500	500A Class RK5	XTOB220LC1 ③	C440A1A005SAX ④	**DS6-34DSX196N0-N**

DS6 100–150 hp Model

10 Second Ramp, 1 Start per Hour, 400% Current Limit at 40°C

Rated Current (A)	Motor Power (hp) 200V	230V	460V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
27	7.5	10	20	HFD3150L	150A Class RK5	XTOB040DC1	C440A1A045SAX	**DS6-34DSX041NO-N**
34	10	10	30	HFD3200L	200A Class RK5	XTOB040DC1	C440A1A045SAX	**DS6-34DSX055NO-N**
40	15	15	30	HJD3250	200A Class RK5	XTOB057DC1 ②	C440A1A045SAX	**DS6-34DSX068NO-N**
52	15	20	40	HKD3300	300A Class RK5	XTOB057DC1 ②	C440B1A100SAX	**DS6-34DSX081NO-N**
65	20	25	50	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX099NO-N**
80	30	30	75	HKD3350	500A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX134NO-N**
96	30	40	75	HLD3450	500A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX161NO-N**
124	40	50	100	HLD3500	500A Class RK5	XTOB150GC1S	C440A1A005SAX ④	**DS6-34DSX196NO-N**

Notes

① Maximum values may be higher than allowed per NEC® 430.52 and UL 508A 31.1.
② XTOBXDIND Panel Mounting Adapter must be used with this overload.
③ XTOBXTLL line and load lugs must be used with this overload.
④ ZEB-XCT300 current transformer must be used with this overload.

DS6 Soft Start kW Ratings

Please refer to Application Note AP03900001E for additional information on proper size selection.

DS6 25–75 hp Model

DS6 Soft Start Controllers—kW Ratings According to IEC 60947-4-2—10 Second Ramp, 1 Start per Hour, 300% Current Limit at 40°C

Rated Current (A)	Motor Power (kW) 230V	400V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
41	11	22	HFD3150L	150A Class RK5	XTOB057DC1 ②	C440A1A045SAX	**DS6-34DSX041N0-N**
55	15	30	HFD3200L	200A Class RK5	XTOB057DC1 ②	C440B1A100SAX	**DS6-34DSX055N0-N**
68	15	37	HJD3250	200A Class RK5	XTOB070GC1 ②	C440B1A100SAX	**DS6-34DSX068N0-N**
81	22	45	HKD3300	300A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX081N0-N**
99	30	55	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX099N0-N**
134	30	75	HKD3400	500A Class RK5	XTOB150GC1S	C440A1A005SAX ④	**DS6-34DSX134N0-N**
160	45	90	HLD3450	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	**DS6-34DSX161N0-N**
196	55	110	HLD3500	500A Class RK5	XTOB220LC1 ③	C440A1A005SAX ④	**DS6-34DSX196N0-N**

DS6 100–150 hp Model

10 Second Ramp, 1 Start per Hour, 400% Current Limit at 40°C

Rated Current (A)	Motor Power (kW) 230V	400V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C440 Overload	Catalog Number
28.8	7.5	11	HFD3150L	150A Class RK5	XTOB040DC1	C440A1A045SAX	**DS6-34DSX041NO-N**
37.5	11	18.5	HFD3200L	200A Class RK5	XTOB040DC1	C440A1A045SAX	**DS6-34DSX055NO-N**
46	11	22	HJD3250	200A Class RK5	XTOB057DC1 ②	C440B1A100SAX	**DS6-34DSX068NO-N**
56	15	30	HKD3300	300A Class RK5	XTOB065DC1 ②	C440B1A100SAX	**DS6-34DSX081NO-N**
68	18.5	37	HKD3350	350A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX099NO-N**
90	22	45	HKD3350	500A Class RK5	XTOB100GC1S	C440B1A100SAX	**DS6-34DSX134NO-N**
106	30	55	HLD3450	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	**DS6-34DSX161NO-N**
134	37	75	HLD3500	500A Class RK5	XTOB160LC1 ③	C440A1A005SAX ④	**DS6-34DSX196NO-N**

Considerations

1. Either XTOB, C306 or C440 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

Power Supply

Eaton's PSG and ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power The light-weight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

Power Supply Selection

Description	Catalog Number
85–264V input and 24V output	**ELC-PS01**
380–480V input and 24V output	**PSS25F**
100–240 Vac input and 24 Vdc output	**PSG60E**
380–480 Vac input and 24 Vdc output	**PSG60F**

Notes

① Maximum values may be higher than allowed per NEC 430.52 and UL 508A 31.1.
② XTOBXDIND Panel Mounting Adapter must be used with this overload.
③ XTOBXTLL line and load lugs must be used with this overload.
④ ZEB-XCT300 current transformer must be used with this overload.

Technical Data and Specifications

DS6 Soft Start Controllers

Description	Unit	DS6-34DSX041N0-N	DS6-34DSX055N0-N	DS6-34DSX068N0-N	DS6-34DSX081N0-N
General					
Standards		IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2
Certifications		UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to +55°C	–25 to +55°C	–25 to +55°C	–25 to +55°C
Altitude		0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection degree		IP 20	IP 20	IP 20	IP 20
Protection against contact		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11 ms	8g/11 ms	8g/11 ms	8g/11 ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Dimensions in inches (mm) (W x H x D)		3.66 x 6.89 x 5.47 (93.0 x 175.0 x 138.9)	3.66 x 6.89 x 5.47 (93.0 x 175.0 x 138.9)	3.66 x 6.89 x 5.47 (93.0 x 175.0 x 138.9)	3.66 x 6.89 x 5.47 (93.0 x 175.0 x 138.9)
Weight in lbs (kg)		4.00 (1.8)	4.00 (1.8)	4.00 (1.8)	4.00 (1.8)
Main Circuit					
Rated operation voltage	V	200–460 Vac	200–460 Vac	200–460 Vac	200–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Rated operation current	I_e	40	52	65	77
Motor Power Ratings					
200V	hp	10	15	20	25
230V	hp	10	20	25	30
460V	hp	30	40	50	60
230V	kW	11	15	15	22
400V	kW	22	30	37	45
Overload cycle according to EN 60947-4-2		40A: AC53a; 3–5; 75–10	52A: AC53a; 3–5; 75–10	65A: AC53a; 3–5; 75–10	77A: AC53a; 3–5; 75–10

DS6 Soft Start Controllers, continued

Description	Unit	DS6-34DSX041N0-N	DS6-34DSX055N0-N	DS6-34DSX068N0-N	DS6-34DSX081N0-N
Wire Specifications					
Power terminals (box terminals)					
Single conductor	AWG	12–2/0	12–2/0	12–2/0	12–2/0
Terminal torque	lb-in	53–80	53–80	53–80	53–80
Control-signals					
Single conductor	AWG	16 min.	16 min.	16 min.	16 min.
Terminal torque	lb-in	3.5	3.5	3.5	3.5
Powerpart					
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Control Commands					
Supply voltage control board U_s					
Nominal voltage	Vdc	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Nominal current ramp, TOR	mA	65	65	65	65
Current peak (closing shorting contactors)		600 mA/50 ms	600 mA/50 ms	600 mA/50 ms	600 mA/50 ms
Voltage to the control terminals (rated control voltage)					
DC driven		+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Input current at 24 Vdc	mA	14	14	14	14
Relay Outputs					
Number of relays		2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)
Maximum voltage	V	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc
Maximum current	A	3 amps, resistive	3 amps, resistive	3 amps, resistive	3 amps, resistive
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

DS6 Soft Start Controllers, continued

Description	Unit	DS6-34DSX099N0-N	DS6-34DSX134N0-N	DS6-34DSX161N0-N	DS6-34DSX196N0-N
General					
Standards		IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2
Certifications/marking		UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to +55°C	–25 to +55°C	–25 to +55°C	–25 to +55°C
Altitude		0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection degree		IP 20	IP 20	IP 20	IP 20
Protection against contact		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11 ms	8g/11 ms	8g/11 ms	8g/11 ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Dimensions in inches (mm) (W x H x D)		3.66 x 6.89 x 5.47 (93.0 x 175.0 x 138.9)	4.25 x 8.46 x 7.01 (108.0 x 214.9 x 178.1)	4.25 x 8.46 x 7.01 (108.0 x 214.9 x 178.1)	4.25 x 8.46 x 7.01 (108.0 x 214.9 x 178.1)
Weight in lbs (kg)		4.00 (1.8)	8.16 (3.7)	8.16 (3.7)	8.16 (3.7)
Main Circuit					
Rated operation voltage	V	200–460 Vac	200–460 Vac	200–460 Vac	200–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Rated operation current	I_e	96	124	156	180
Motor Power Ratings					
200V	hp	30	40	50	60
230V	hp	30	50	60	75
460V	hp	75	100	125	150
230V	kW	30	30	45	55
400V	kW	55	75	90	110
Overload cycle according to EN 60947-4-2		96A: AC53a; 3–5; 75–10	124A: AC53a; 3–5; 75–10	156A: AC53a; 3–5; 75–10	180A: AC53a; 3–5; 75–10

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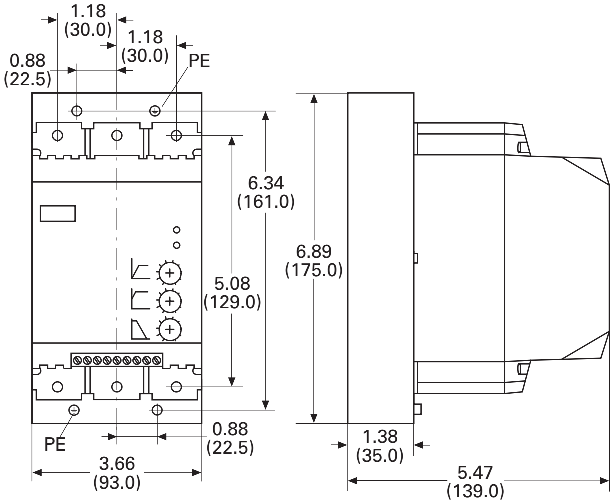
DS6 Soft Start Controllers, continued

Description	Unit	DS6-34DSX099N0-N	DS6-34DSX134N0-N	DS6-34DSX161N0-N	DS6-34DSX196N0-N
Wire Specifications					
Power terminals (box terminals)					
Single conductor	AWG	12–2/0	12 AWG–350 kcmil	12 AWG–350 kcmil	12 AWG–350 kcmil
Terminal torque	lb-in	53–80	44–123	44–123	44–123
Control-signals					
Single conductor	AWG	16 min.	16 min.	16 min.	16 min.
Terminal torque	lb-in	3.5	3.5	3.5	3.5
Powerpart					
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Control Commands					
Supply voltage control board U_s					
Nominal voltage	Vdc	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Nominal current ramp, TOR	mA	65	65	65	65
Current peak (closing shorting contactors)		600 mA/50 ms	600 mA/50 ms	600 mA/50 ms	600 mA/50 ms
Voltage to the control terminals (rated control voltage)					
DC driven		+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Input current at 24 Vdc	mA	14	14	14	14
Relay Outputs					
Number of relays		2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)
Maximum voltage	V	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc
Maximum current	A	3 amps, resistive	3 amps, resistive	3 amps, resistive	3 amps, resistive
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

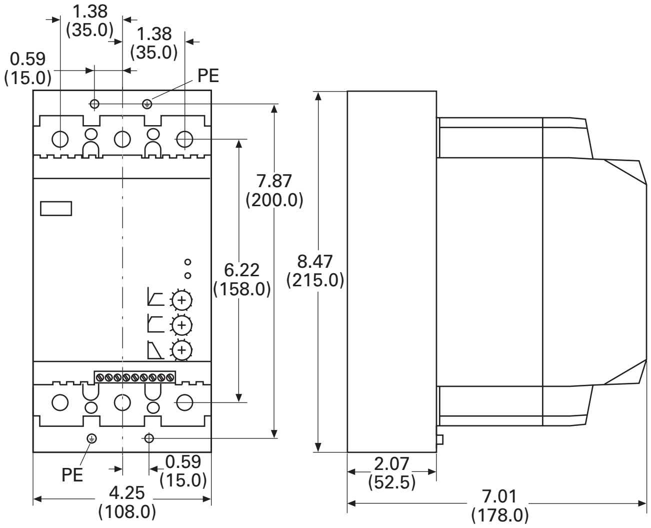
Dimensions

Approximate Dimensions in Inches (mm)

25–75 hp Models



100–150 hp Models



DS7 Soft Start Controllers

Contents

DS7 Soft Start Controllers

Product Description

Eaton's DS7 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install, and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 4–32A in four frame sizes.

Application Description

With its small size, it can easily fit in place of existing soft starters, wye-delta starters, or across-the-line NEMA® and IEC starters. This feature allows easy upgrades to existing systems. The product is designed to be wired in the three-phase line feeding the three motor input leads as is done for normal across-the-line starting. The starter uses silicon controlled rectifiers (SCRs) to ramp the voltage to the motor, providing smooth acceleration and deceleration of the load. After the motor is started, the internal run bypass relay closes, resulting in the motor running directly across-the-line. Internal run bypass significantly reduces the heat generated as compared to non-bypass starters. The soft stop option allows for a ramp stop time that may be longer than the coast-to-stop time. An external overload protection relay is needed.

Operation

Voltage Ramp Start

This start method provides a voltage ramp to the motor, resulting in a constant torque increase. This most commonly used form of soft start mode allows you to set the initial voltage value and the duration of the ramp to full voltage conditions.

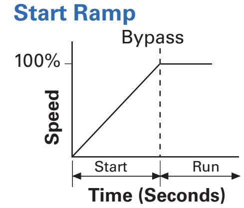
- Adjustable initial voltage 30–92% of full voltage (120/230 Vac control voltage)
- Adjustable initial voltage 30–100% of full voltage (24 Vac/Vdc control voltage)
- Adjustable ramp time 1–30 seconds
- Bypass relays close at the end the ramp time (TOR)

Soft Stop

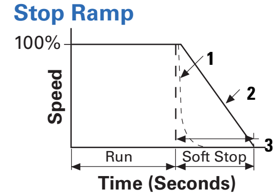
Allows for a controlled stopping of load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or product damage. Setting the soft stop time to a value of 0 turns off this feature.

- Soft stop time = 0–30 seconds

Start Ramp



Stop Ramp



1 = Coast to Stop (Speed)
2 = Soft Stop Ramp (Voltage)
3 = Soft Stop Time

Auxiliary Contacts

Auxiliary contacts are provided to indicate soft start controller status.

Frame Size 1 (4A to 12A)—One Relay

The auxiliary relay indicates when the soft starter is at Top-of-Ramp (TOR).

Frame Size 2 (16A to 32A)—Two Relays

One auxiliary relay indicates when the soft starter is at Top-of-Ramp (TOR).

One auxiliary relay indicates that a RUN command is present, including start ramp, bypass, and stop ramp times.

Features and Benefits

- Run bypass mode greatly reduces internal heating created by the power dissipation across the SCRs. The bypass relay directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Less heat minimizes enclosure size and cooling requirements, and maximizes the life of all devices in the enclosure
- LED displays device status and provides fault indication
- Variable ramp times and voltage control (torque control) settings provide unlimited starting configurations, allowing for maximum application flexibility
- Soft stop control suits applications where an abrupt stop of the load is not acceptable. Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts, and bearings
- Minimizes the peak inrush current's stress on the power system. Peak starting torque can be managed to diminish mechanical system wear and damage.
- 24 Vac/Vdc control voltage enhances personnel and equipment safety. 120/230 Vac control voltage is also available
- Auxiliary relays indicate status of the soft start controllers
  - The TOR relay is active until motor stop command is received and/or the soft start controller detects a fault condition
  - RUN relay is active during the start ramp, bypass, and stop ramp

Protective Features

- Mains connection—The mains connection is monitored for a phase loss and/or undervoltage during ramp up
- Motor connection—The motor connection is monitored for an open condition during the ramp
- SCR faults—SCR performance is monitored during the ramp cycle for proper operation
- Heat sink over/under temperature—High ambient temperatures, extended ramp times, and high duty cycle conditions may cause the DS7 to exceed its thermal rating. When temperature goes under –5°C, unit will trip as well. The DS7 is equipped with sensors that monitor the temperature of the device as well. The soft starter will trip in over/under temperature conditions, preventing device failure
- Warning is indicated for an over temperature condition for the next start
- Bypass relay
  - The DS7 can detect if the bypass relay fails to close after the ramp start or opens while the motor is running
  - The DS7 will also detect a condition whereas the bypass relay is closed when the RUN command is given
  - The DS7 will trip on a bypass dropout fault if either of these conditions occur

Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL® listed
- CSA certified
- CE marked
- C-Tick

Instructional Leaflets

- Instruction Leaflet IL03901001E

Product Selection

DS7 Soft Start Horsepower Ratings

Please refer to Application Note AP03901006E for additional information on proper size selection.

DS7 Soft Start Controller—Frame 1

DS7 Soft Start Controllers—Horsepower Ratings— 10 Second Ramp, One Start per Hour, 300% Current Limit at 40°C [1]

Rated Current (A)	Motor Power (hp) 200V	230V	480V	Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) [2]	Recommended XTOE Overload [2]	MMP [2]	Connection Kit to MMP	Catalog Number
3.7	0.75	0.75	2	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPR004BC1	XTPAXTPCB	**DS7-340SX004N0-N** [4]
										DS7-342SX004N0-N [5]
6.9	1.5	2	3	HFD3015	15A Class RK5	XTOB006BC1 [1]	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX007N0-N** [4]
										DS7-342SX007N0-N [5]
7.8	2	2	5	HFD3020	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPR010BC1	XTPAXTPCB	**DS7-340SX009N0-N** [4]
										DS7-342SX009N0-N [5]
11	3	3	7.5	HFD3030	20A Class RK5	XTOB012BC1	XTOE020BCS	XTPR012BC1	XTPAXTPCB	**DS7-340SX012N0-N** [4]
										DS7-342SX012N0-N [5]
15.2	3	5	10	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX016N0-N** [4]
										DS7-342SX016N0-N [5]
22	5	7.5	15	HFD3060	40A Class RK5	XTOB024CC1	XTOE045CCS	XTPR025BC1	XTPAXTPCC	**DS7-340SX024N0-N** [4]
										DS7-342SX024N0-N [5]
32	7.5	10	20	HFD3070	50A Class RK5	XTOB032CC1	XTOE045CCS	XTPR032BC1	XTPAXTPCC	**DS7-340SX032N0-N** [4]
										DS7-342SX032N0-N [5]

DS7 Soft Start Controller—Frame 1

DS7 Soft Start Controllers—Horsepower Ratings— 10 Second Ramp, One Start per Hour, 400% Current Limit at 40°C [1]

Rated Current (A)	Motor Power (hp) 200V	230V	480V	Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) [2]	Recommended XTOE Overload [2]	MMP [2]	Connection Kit to MMP	Catalog Number
3	0.5	0.5	1.5	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPR004BC1	XTPAXTPCB	**DS7-340SX004N0-N** [4]
										DS7-342SX004N0-N [5]
4.8	1	1	3	HFD3015	15A Class RK5	XTOB006BC1 [1]	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX007N0-N** [4]
										DS7-342SX007N0-N [5]
6.9	1.5	2	3	HFD3020	20A Class RK5	XTOB006BC1	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX009N0-N** [4]
										DS7-342SX009N0-N [5]
9	2	2	5	HFD3030	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPR010BC1	XTPAXTPCB	**DS7-340SX012N0-N** [4]
										DS7-342SX012N0-N [5]
11	3	3	7.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX016N0-N** [4]
										DS7-342SX016N0-N [5]
17.5	5	5	10	HFD3060	40A Class RK5	XTOB016CC1	XTOE045CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX024N0-N** [4]
										DS7-342SX024N0-N [5]
22	5	7.5	15	HFD3070	50A Class RK5	XTOB024CC1	XTOE045CCS	XTPR025BC1	XTPAXTPCC	**DS7-340SX032N0-N** [4]
										DS7-342SX032N0-N [5]

Notes

[1] Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
[2] Selections are based on motor FLA value at 480V.
[3] Not to be used with 230V.
[4] 24 Vac/Vdc device.
[5] 120/230 Vac device.

DS7 Soft Start kW Ratings

Please refer to Application Note AP03901006E for additional information on proper size selection.

DS7 Soft Start Controller—Frame 2

DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2—10 Second Ramp, One Start per Hour, 300% Current Limit at 40°C [1]

Rated Current (A)	Motor Power (kW) 230V	Motor Power (kW) 400V	Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) [2]	Recommended XTOE Overload [2]	MMP [2]	Connection Kit to MMP	Catalog Number
3.8	0.75	1.5	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPR004BC1	XTPAXTPCB	**DS7-340SX004N0-N** [4]
									DS7-342SX004N0-N [5]
7	1.5	3	HFD3015	15A Class RK5	XTOB006BC1 [1]	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX007N0-N** [4]
									DS7-342SX007N0-N [5]
9	2.2	4	HFD3020	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPR010BC1	XTPAXTPCB	**DS7-340SX009N0-N** [4]
									DS7-342SX009N0-N [5]
12	3	5.5	HFD3030	20A Class RK5	XTOB012BC1	XTOE020BCS	XTPR012BC1	XTPAXTPCB	**DS7-340SX012N0-N** [4]
									DS7-342SX012N0-N [5]
16	4	7.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX016N0-N** [4]
									DS7-342SX016N0-N [5]
24	5.5	11	HFD3060	40A Class RK5	XTOB024CC1	XTOE045CCS	XTPR025BC1	XTPAXTPCC	**DS7-340SX024N0-N** [4]
									DS7-342SX024N0-N [5]
32	7.5	15	HFD3070	50A Class RK5	XTOB032CC1	XTOE045CCS	XTPR032BC1	XTPAXTPCC	**DS7-340SX032N0-N** [4]
									DS7-342SX032N0-N [5]

DS7 Soft Start Controller—Frame 2

DS7 Soft Start Controllers—kW Ratings According to IEC 60947-4-2—10 Second Ramp, One Start per Hour, 400% Current Limit at 40°C [1]

Rated Current (A)	Motor Power (kW) 230V	Motor Power (kW) 400V	Maximum Allowable Breaker Size	Maximum Allowable Fuse Size	Recommended XTOB Overload (Direct Connect) [2]	Recommended XTOE Overload [2]	MMP [2]	Connection Kit to MMP	Catalog Number
2.5	0.33	1	HFD3015	15A Class RK5	XTOB004BC1	XTOE005BCS	XTPR004BC1	XTPAXTPCB	**DS7-340SX004N0-N** [4]
									DS7-342SX004N0-N [5]
3.8	0.75	1.5	HFD3015	15A Class RK5	XTOB006BC1 [1]	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX007N0-N** [4]
									DS7-342SX007N0-N [5]
7	1.5	3	HFD3020	20A Class RK5	XTOB006BC1	XTOE020BCS	XTPR6P3BC1	XTPAXTPCB	**DS7-340SX009N0-N** [4]
									DS7-342SX009N0-N [5]
9	2.2	4	HFD3030	20A Class RK5	XTOB010BC1	XTOE020BCS	XTPR010BC1	XTPAXTPCB	**DS7-340SX012N0-N** [4]
									DS7-342SX012N0-N [5]
12	3	5.5	HFD3035	25A Class RK5	XTOB016CC1	XTOE020CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX016N0-N** [4]
									DS7-342SX016N0-N [5]
16	4	7.5	HFD3060	40A Class RK5	XTOB016CC1	XTOE045CCS	XTPR016BC1	XTPAXTPCC	**DS7-340SX024N0-N** [4]
									DS7-342SX024N0-N [5]
24	5.5	11	HFD3070	50A Class RK5	XTOB024CC1	XTOE045CCS	XTPR025BC1	XTPAXTPCC	**DS7-340SX032N0-N** [4]
									DS7-342SX032N0-N [5]

Notes

[1] Actual motor FLAs vary. Verify these devices cover the motor specific FLA.
[2] Selections are based on motor FLA value at 480V.
[3] Not to be used with 230V.
[4] 24 Vac/Vdc device.
[5] 120/230 Vac device.

Considerations

1. Either XTOB or XTOE or equivalent overload protection devices may be selected. In addition, manual motor protectors—MMP series can also be considered.
2. Isolation contactor is required for mains isolation.

24 Vdc Control Power

Eaton's ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The light-weight, DIN rail mounted devices have a wide input voltage range and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

AC Control Power

24, 120, or 230 volts AC may be used for control power in accordance with the model requirements.

DC Power Supply Selection

Description	Catalog Number
85–264V input and 24V output	**ELC-PS01**
380–480V input and 24V output	**PSS25F**

Technical Data and Specifications

DS7 Soft Start Controllers

Rated Control Circuit Voltage 24 Vac/Vdc Voltage 110/230 Vac	Unit	DS7-340SX004NO-N DS7-342SX004NO-N	DS7-340SX007NO-N DS7-342SX007NO-N	DS7-340SX009NO-N DS7-342SX009NO-N	DS7-340SX012NO-N DS7-342SX012NO-N
General					
Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/marking		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to 55°C	–25 to 55°C	–25 to 55°C	–25 to 55°C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	0.2	0.35	0.35	0.6
Radio interference		B	B	B	B
Dimensions (W x H x D)	mm	45 x 130 x 95	45 x 130 x 95	45 x 130 x 95	45 x 130 x 95
	in	1.77 x 5.12 x 3.74	1.77 x 5.12 x 3.74	1.77 x 5.12 x 3.74	1.77 x 5.12 x 3.74
Weight	kg	0.35	0.35	0.35	0.35
	lb	0.77	0.77	0.77	0.77
Main Circuit					
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I_e	4	7	9	12
Motor Power Ratings					
200V	hp	0.75	1.5	2	3
230V	hp	0.75	2	2	5
480V	hp	2	3	5	10
230V	kW	0.75	1.5	2.2	3
400V	kW	1.5	3	4	5.5
Overload cycle according to EN 60947-4-2		4A: AC53a; 3-5; 75-10	7A: AC53a; 3-5; 75-10	9A: AC53a; 3-5; 75-10	12A: AC53a; 3-5; 75-10

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DS7 Soft Start Controllers, continued

Rated Control Circuit Voltage 24 Vac/Vdc Voltage 110/230 Vac	Unit	DS7-340SX004NO-N DS7-342SX004NO-N	DS7-340SX007NO-N DS7-342SX007NO-N	DS7-340SX009NO-N DS7-342SX009NO-N	DS7-340SX012NO-N DS7-342SX012NO-N
Wire Specifications					
Power terminals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11
Control signals					
Single conductor—solid or stranded	AWG	18–10	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11	11
Power Section					
Rated impulse withstand voltage	U_{imp} 1.2/ 50_s	4 kV	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500	500
Control Commands—Vac/Vdc					
Supply voltage control board U_s nominal	Vdc	20.4–26.4	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	1.6	1.6	1.6	1.6
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0	+3–0
Relay Outputs					
Number of relays		1 (TOR)	1 (TOR)	1 (TOR)	1 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	1A	1A	1A	1A
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–100%	30–100%	30–100%	30–100%
Control Commands—Vac					
Supply voltage control board U_s nominal	Vac	102–253	102–253	102–253	102–253
Current consumption at 24 Vac/Vdc	mA	4	4	4	4
Pick-up voltage	Vac	102–230	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28	0–28
Relay Outputs					
Number of relays		1 (TOR)	1 (TOR)	1 (TOR)	1 (TOR)
Maximum voltage	Vac	250	250	250	250
Maximum current	A	3A	3A	3A	3A
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

DS7 Soft Start Controllers, continued

Rated Control Circuit Voltage 24 Vac/Vdc Voltage 110/230 Vac	Unit	DS7-340SX016NO-N DS7-342SX016NO-N	DS7-340SX024NO-N DS7-342SX024NO-N	DS7-340SX032NO-N DS7-342SX032NO-N
General				
Standards		IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking	IEC/EN 60947-4-2; GB14048.6; UL508; CSA-C22.2 No 0-M91; CSA-C22.2 No 14-05 CE marking
Certifications/marking		UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick	UL/CE/CSA/C-Tick
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to 55°C	–25 to 55°C	–25 to 55°C
Altitude		0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 2.5% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical
Protection class		IP20	IP20	IP20
Protection class applies to the front and operator control and display elements. Protection type from all sides is IP00.		With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved	With optional covers from the NZM range, protection type IP40 from all sides can be achieved
Busbar tag shroud		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2
Shock resistance		8g/11ms	8g/11ms	8g/11ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2
Mean heat dissipation at rated duty cycle	W	0.8	1.1	1.5
Radio interference		B	B	B
Dimensions (W x H x D)	mm	45 x 150 x 118	45 x 150 x 118	45 x 150 x 118
	in	1.77 x 5.12 x 3.74	1.77 x 5.12 x 3.74	1.77 x 5.12 x 3.74
Weight	kg	0.4	0.4	0.4
	lb	0.88	0.88	0.88
Main Circuit				
Rated operational voltage	V	230–460 Vac	230–460 Vac	230–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated operation current AC 53	I_e	16	24	32
Motor Power Ratings				
200V	hp	3	5	10
230V	hp	5	7.5	10
480V	hp	10	15	25
230V	kW	4	5.5	7.5
400V	kW	7.5	11	15
Overload cycle according to EN 60947-4-2		16A: AC53a; 3-5; 75-10	24A: AC53a; 3-5; 75-10	32A: AC53a; 3-5; 75-10

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DS7 Soft Start Controllers, continued

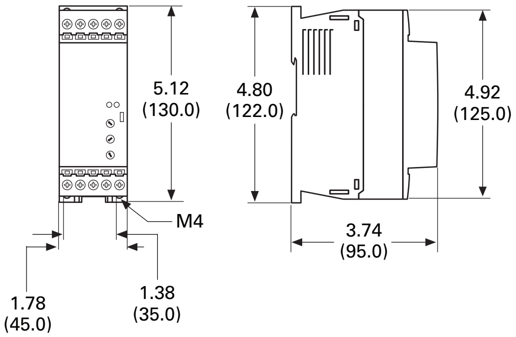
Rated Control Circuit

Voltage 24 Vac/Vdc Voltage 110/230 Vac	Unit	DS7-340SX016NO-N DS7-342SX016NO-N	DS7-340SX024NO-N DS7-342SX024NO-N	DS7-340SX032NO-N DS7-342SX032NO-N
Wire Specifications				
Power terminals				
Single conductor—solid or stranded	AWG	18–6	18–6	18–6
Terminal torque	lb-in	11	11	11
Control Signals				
Single conductor—solid or stranded	AWG	18–10	18–10	18–10
Terminal torque	lb-in	11	11	11
Power Section				
Rated impulse withstand voltage	U_{imp} 1.2/ 50_s	4 kV	4 kV	4 kV
Rated insulation voltage		500	500	500
Control Commands—Vac/Vdc				
Supply voltage control board U_s nominal	Vdc	20.4–26.4	20.4–26.4	20.4–26.4
Current consumption at 24 Vac/Vdc	mA	1.6	1.6	1.6
Pick-up voltage		+17.3–+27	+17.3–+27	+17.3–+27
Drop-out voltage		+3–0	+3–0	+3–0
Relay Outputs				
Number of relays		2 (TOR, Ready)	2 (TOR, Ready)	2 (TOR, Ready)
Maximum voltage	Vac	250	250	250
Maximum current	A	1A	1A	1A
Soft Start Functions				
Ramp times				
Start ramp	s	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30
Initial voltage % line voltage		30–100%	30–100%	30–100%
Control Commands—Vac				
Supply voltage control board U_s nominal	Vac	102–253	102–253	102–253
Current consumption at 102–253 Vac	mA	4	4	4
Pick-up voltage	Vac	102–230	102–230	102–230
Drop-out voltage	Vac	0–28	0–28	0–28
Relay Outputs				
Number of relays		2 (TOR, Run)	2 (TOR, Run)	2 (TOR, Run)
Maximum voltage	Vac	250	250	250
Maximum current	A	3A	3A	3A
Soft Start Functions				
Ramp times				
Start ramp	s	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%

Dimensions

Approximate Dimensions in Inches (mm)

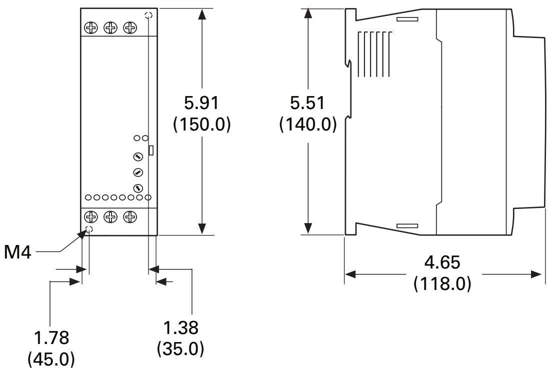
Frame Size 1



Catalog Numbers

DS7-340SX004N0-N	DS7-342SX004N0-N
DS7-340SX007N0-N	DS7-342SX007N0-N
DS7-340SX009N0-N	DS7-342SX009N0-N
DS7-340SX012N0-N	DS7-342SX012N0-N

Frame Size 2



Catalog Numbers

DS7-340SX016N0-N	DS7-342SX016N0-N
DS7-340SX024N0-N	DS7-342SX024N0-N
DS7-340SX032N0-N	DS7-342SX032N0-N

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Solid-State Starters

Contents

Description	*Page*

Product Overview

Type S611

The S611 soft starter is a powerful combination of performance capability, application flexibility, and the industry's best user interface experience.

Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 26A through 414A applications.

The S611 has integrated bypass and overload protection. The S611 is available as a component for panel mounting or in enclosed control—NEMA type 1, 12, 3R, 4, 4X.

Type S801

Eaton's S801 line of reduced voltage soft starters is very compact, multi-functional, easy to install and easy to program. Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 11A all the way through 1000A applications, and is suitable for mounting in motor control centers or in enclosed control (NEMA 1, 4, 4X and 12) applications.

Type S811

Eaton's S811 offers all the popular features of the S801, and adds enhanced functionality with the new DIM (Digital Interface Module), communications, metering, monitoring and diagnostics capabilities.

Eaton's Line of S811 reduced voltage soft starters is very compact, multi-functional, easy to install and easy to set operating parameters. Designed to control the acceleration and deceleration of three-phase motors up to 690V, the line is available from 11–1000A.

The S811 is designed to be a complete package combining the silicon controlled rectifiers (SCRs), bypass contactor and overload in one, very compact unit. The S811 is available as a component for panel mounting, in motor control centers or in enclosed control (NEMA Type 1, 3R, 4, 4X, 7/9 and 12).

Type S611, Solid-State Soft Starter

Contents

Description	*Page*

Type S611, Solid-State Soft Starters

Product Description

Eaton revolutionized the reduced voltage control marketplace with its advanced feature set and user-friendly user interface module to enhance system performance and reduce commissioning times. The S611 adds enhanced functionality with network communications, metering, monitoring and diagnostics capabilities.

The Eaton line of S611 reduced voltage soft starters is multi-functional, easy to install and easy to program. Designed to control the acceleration and deceleration of three-phase motors up to 600V, the line is available from 26 amps through 414 amps.

The S611 is designed to be a complete package combining the SCRs, bypass contactor and overload in one unit.

Application Description

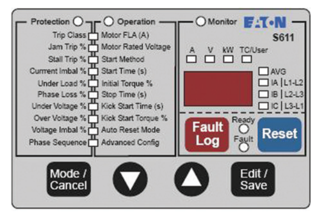
Designed to control the acceleration and deceleration of three-phase motors, the S611 soft starter uses Silicon Controlled Rectifiers (SCRs) to control the voltage to soft start and soft stop the motor. After the motor is started, internal run bypass contactors close, resulting in the motor running directly across-the-line. The built-in solid-state overload protects the motor from overload conditions with sophisticated algorithms that model true motor heating, resulting in better motor protection and fewer nuisance trips. Advanced protective and diagnostic features reduce downtime.

A voltage ramp start or current limit start is available. Kick start is available in either starting mode. The soft stop option allows for a ramp stop time that is longer than the coast to stop time. The pump control option provides a smooth transition for starting and stopping a motor and eliminating the “water-hammer” effect that can damage pipes, valves and pumps.

The S611 offers an impressive array of advanced protective features. Not only are the protective features selectable, but many offer variable settings allowing the user to fine tune the soft starter to meet specific system requirements.

The S611 has an easy to use User Interface Module (UI) that allows the user to configure the device and to read system parameters and values. The UI includes an LED display and keypad to scroll through the various parameters. The UI allows the user to modify control parameters, enable or disable protections, set communication variables, monitor system values such as line voltages and currents, and access the fault queue.

User Interface Module (UI)



The UI can be removed from the S611 and remote mounted. Kits are available to door mount the UI, enabling users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door. This will help eliminate the possibility of an arc flash incident.

Communications

The S611 has built-in communication capabilities through two communications ports to connect the soft starter to a variety of networks, including Modbus (resident), DeviceNet™, PROFIBUS®, and Ethernet.

The S611 communication parameters can be configured with the UI or through the Fieldbus.

Advanced communication configuration settings provide the system integrator with powerful tools to facilitate system optimization.

Network Communications Reference

Description	Catalog Number
Modbus communication adapter without I/O	**C441M**
Modbus communication adapter with 120 Vac I/O	**C441N**
Modbus communication adapter with 24 Vdc I/O	**C441P**
DeviceNet communication adapter with 120 Vac I/O	**C441K**
DeviceNet communication adapter with 24 Vdc I/O	**C441L**
PROFIBUS communication adapter with 120 Vac I/O	**C441S**
PROFIBUS communication adapter with 24 Vdc I/O	**C441Q**
Ethernet IP/Modbus TCP communication adapter with 120 Vac I/O	**C441R**
Ethernet IP/Modbus TCP communication adapter with 24 Vdc I/O	**C441T**
Communication adapter	**C440-COM-ADP**

Operation

Starting and Stopping Modes

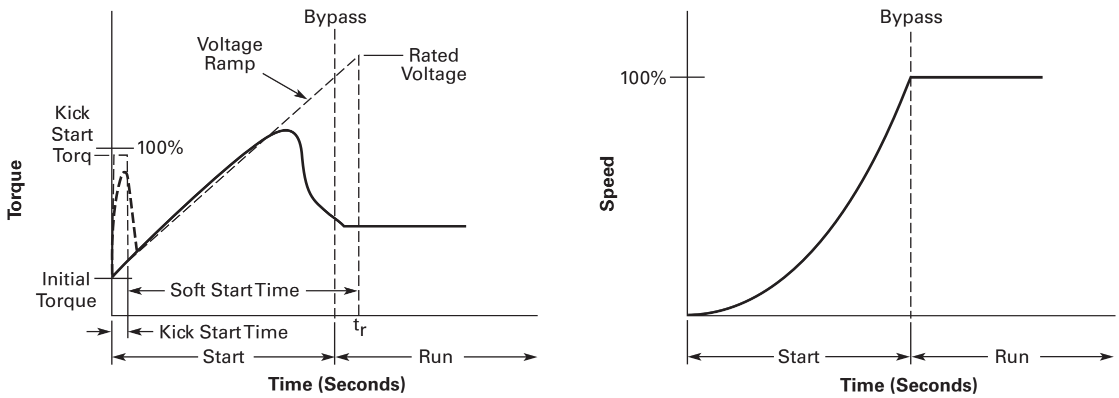
The S611 has a variety of starting and stopping methods to provide superior performance in the most demanding applications. The motor can be started in either Voltage Ramp Start or Current Limit Start mode. Kick Start and Soft Stop are available within both starting modes.

Voltage Ramp Start

Provides a voltage ramp to the motor resulting in a constant torque increase. The most commonly used form of soft start, this start mode allows you to set the initial torque value and the duration of the ramp to full voltage conditions. Bypass contactors close after ramp time.

- Adjustable initial torque 0–85% of locked rotor torque
- Adjustable ramp time 0.5–180 seconds (can be extended with factory modification)

Starting Characteristics—Ramp Start

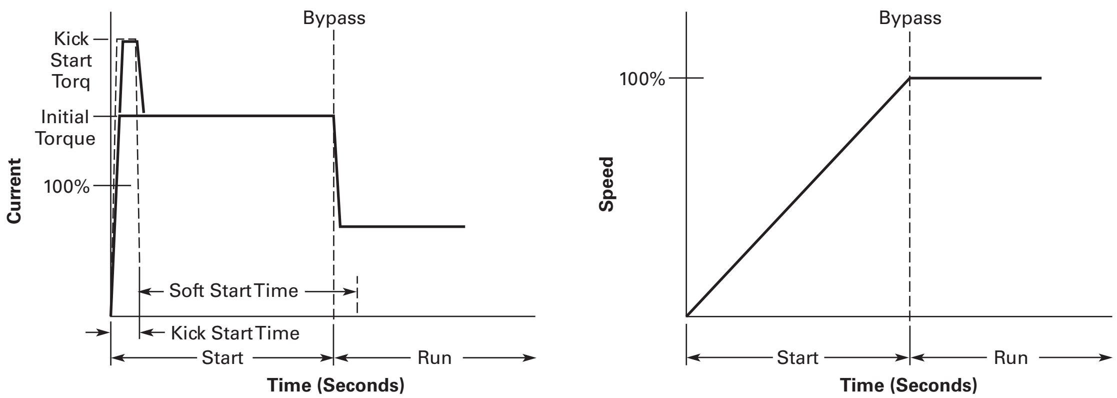


Current Limit Start

Limits the maximum current available to the motor during the start phase. This mode of soft starting is used when it becomes necessary to limit the maximum starting current due to long start times or to protect the motor. This start mode allows you to set the maximum starting current as a percentage of locked rotor current and the duration of the current limit. Bypass contactors close after current limit time.

- Maximum current of 0–85% locked rotor current
- Adjustable ramp time 0.5–180 seconds (can be extended with factory modification)

Starting Characteristics—Current Limit Start



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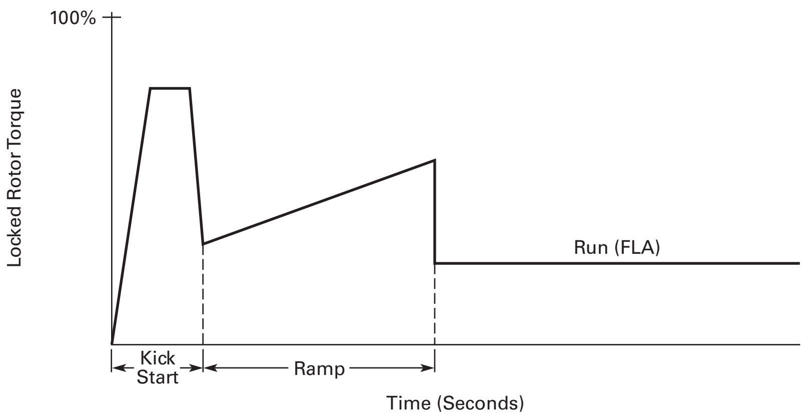
Kick Start

Selectable feature in both Voltage Ramp Start and Current Limit Start modes. Provides a current and torque "kick" for 0 to 2.0 seconds. This provides greater initial current to develop additional torque to breakaway a high friction load.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

Starting Characteristics—Kick Start

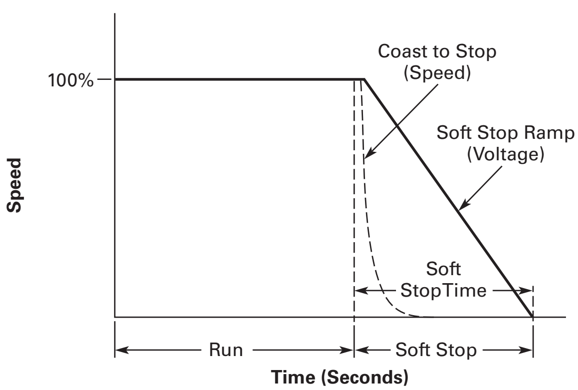


Soft Stop

Allows for a controlled stopping of a load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or load damage.

- Stop time = 0–60 seconds

Starting Characteristics—Soft Stop

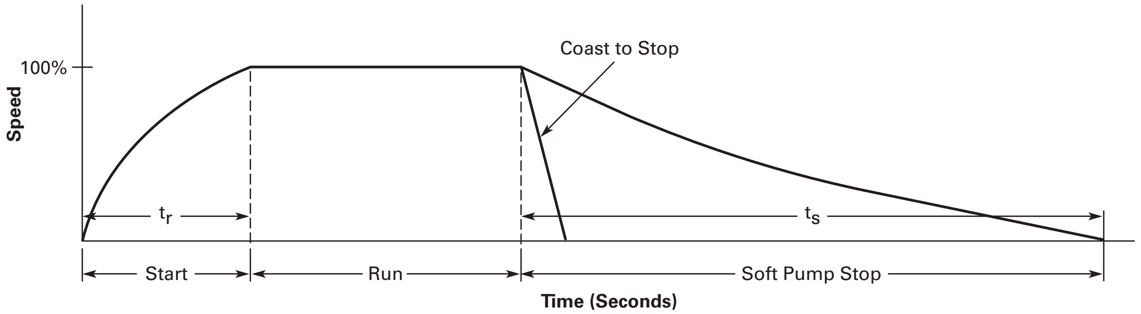


Pump Control Option

This option is intended to reduce the potential for water hammer in a centrifugal pump system by using a starting and stopping algorithm developed for pump control. Upon a start command, the speed of the motor is increased, under the control of the S611 soft starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors close and the pump operates as with any other starter.

Upon a stop command, the bypass contactors are opened and the motor speed is decreased in a tapered manner, to gradually slow the flow until the motor is brought to a stop.

Pump Control Option



Edge and Level Sensing Control

Edge or Level Sensing is selected with the Start Control parameter in the Advanced Configuration Menu. Factory default is Level Sensing.

Edge Sensing

Edge sensing requires 120 Vac power be momentarily applied to the Start terminal (with the Permissive terminal 120 Vac) to initiate a start under all conditions. After a stop or fault occurs, the 120 Vac must be reapplied to the start terminal before another start can occur. This control configuration should be used when restarting of the motor after a fault or stop must be supervised manually or as a part of a control scheme. The cycling of 120 Vac power to the Permissive terminal before starting is required regardless of the position of the auto reset parameter.

Level Sensing

Level sensing will enable a motor to restart after a fault is cleared without cycling 120V AC to the Permissive terminal as long as:

- Permissive terminal is supplied with 120 Vac
- The auto reset parameter is set to enabled
- All faults have cleared or have been reset

This control configuration should be used where it is desirable to restart a motor after a fault without additional manual or automatic control. An example of this condition would be on a remote pumping station where it is desirable to automatically restart a pump after a power outage without operator intervention.

Note: If the auto reset feature is used, CAUTION must be exercised to assure that any restart occurs in a safe manner.

Features and Benefits

- The User Interface Module (UI) provides an intuitive, easy-to-use human interface with powerful configuration capabilities to maximize system performance
- Door or device mounted UI enables users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door, eliminating the possibility of an arc flash incident
- System operating parameters can be monitored enterprise-wide through a communications network. Increase uptime by providing data for process management and preventive diagnostics
- Run bypass mode greatly reduces internal heating created by the greater power dissipation in the SCRs. Bypass contactors directly connect the motor to the line and improves system efficiency by reducing internal power losses
- Internal solid-state overload protection provides accurate current measurement and trip settings. Sophisticated algorithms solve a series of differential equations that model true motor heating and cooling, resulting in superior motor overload protection while minimizing nuisance trips. Advanced selectable protective features safeguard the motor and system against a variety of system faults
- Internal run bypass contactors and overload protection eliminate the need for additional devices, reducing enclosure sizes minimizing installation and wiring time and reducing overall assembly size and cost
- Wide range of overload FLA settings (50–100% of rated frame current) and a selectable trip class (5–30) offers users the flexibility to fine tune the starter to match specific application requirements
- Variable ramp times and torque control settings provide unlimited starting configurations, allowing for maximum application flexibility
- Kick-start feature enables soft starting of high friction loads
- Soft stop control for applications where an abrupt stop of the load is not acceptable
- Pump control option with sophisticated pump algorithms on both starting and stopping that minimize the pressure surges that cause water hammer. The pump control option will maximize the life of the pump and piping systems while minimizing the downtime caused by system failure
- Six SCRs control all three motor phases, providing smooth acceleration and deceleration performance
- Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts and bearings
- Reduce the peak inrush current's stress on the power system
- Minimize peak starting torque to diminish mechanical system wear and damage
- 120 Vac control voltage enhances ease of connections
- The S611 lends itself to serviceability. The PCBs and contactors can be replaced in the field

Protective Features

All protective features can be configured, enabled or disabled with the UI or through the communications network.

Motor Overload

The S611 includes electronic overload protection as standard. The overload meets applicable requirements for a motor overload protective device. The overload protects the motor from over heat conditions with the use of sophisticated algorithms that model true motor heating, resulting in superior motor protection and fewer nuisance trips.

The S611 calculates a thermal memory value. A 100% value represents the maximum safe temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur removing power to the motor. Upon trip, the S611 stores the calculated motor heating value and will not allow a motor re-start until the motor has cooled. This feature ensures the motor will not be damaged by repeated overload trip, reset and re-start cycles.

The thermal memory value can be monitored through the UI or the communications network. The thermal memory value can be of great use in determining an impending overload trip condition. Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs halting the process. Costly system downtime can be avoided.

The trip current is adjusted to match the specific application requirements by entering the motor nameplate full load current rating and trip class. The FLA adjustment includes a 2 to 1 adjustment range. The overload trip class is adjustable from class 5 through class 30. The overload is ambient temperature compensated - meaning its trip characteristics will not vary with changes in ambient temperature. The overload protection can be enabled, disabled, or disabled on start.

Short Circuit

The use of a short circuit protective device in coordination with the S611 is required in branch motor circuits by most electrical codes. Short circuit coordination ratings with both fuses and Eaton molded case circuit breakers are available providing customers with design flexibility. The S611 has short circuit coordination ratings as an open component, an enclosed starter, and in a motor control center. The short circuit ratings can go up to 100KA.

Jam

Excessive current and torque up to locked rotor levels can occur in a jam condition. The condition can result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Jam protection prevents the stress and damage from a jam during normal run. After the motor is started, a current greater than 300% FLA setting will cause the starter to trip on a jam fault.

Stall

Excessive current and torque up to locked rotor levels can occur in a stall condition. The condition can lead to an overload trip and result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Stall protection prevents stress and damage to a motor that has not come up to speed, or stalled after the soft start time. The S611 will trip to protect the system in the event that the motor did not get to the rated speed in the defined soft start period. A current greater than 200% FLA at the end of the soft start period will cause the starter to trip on a stall fault.

Pole Over Temperature

High ambient temperatures, extended ramp times and high duty cycle conditions may cause the S611 power pole conductors to reach a temperature that exceeds their thermal rating. The S611 is equipped with sensors that monitor the temperature of the power poles. Over temperature protection occurs if the device's thermal capacity is exceeded. The soft starter will trip in over temperature conditions, preventing device failure.

The device pole temperature value can be monitored through the UI or the communications network. This feature can be of use in determining an impending over temperature trip condition. Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs, halting the process. Costly system shutdown can be avoided.

Phase Loss

Loss of a phase can cause a significant increase in the current drawn in the remaining two phases. Phase loss can lead to motor damage before an eventual overload trip occurs. Phase loss is typically an indication of a failure in the electrical distribution system. The S611 will detect a phase loss and trip if any phase current drops below a preset value. The phase loss trip level is adjustable from 0% to 100% of the average of the other two phase levels with an adjustable trip delay of 0.1 to 60 seconds.

Phase Imbalance

Phase current or voltage imbalance can cause a significant increase in the current drawn in the remaining two phases. Phase imbalance can lead to motor damage before an eventual overload trip. Phase imbalance is typically an indication of a failure in the electrical distribution system or the motor. The S611 will detect both current and voltage phase imbalances and trip if any phase becomes imbalanced as compared to the average of the other two phases.

The phase current imbalance trip level is adjustable from 0% to 100% of the average of the current in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

The phase voltage imbalance trip level is adjustable from 0% to 100% of the average of the voltage in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

Reset Mode

The S611 can be set up for automatic or manual reset on trip. The manual reset mode requires the operator to physically press the RESET button located on the soft starter. The overload can be manually reset through the UI or through the communications network.

The automatic reset mode allows the soft starter to be automatically reset as soon as the trip condition is no longer present. With the automatic reset mode, after the fault is no longer present, the motor will be restarted as soon as a valid start signal is present.

Phase Reversal

The S611 can determine if the proper line phase sequence is present by default. The device will trip if the line phase sequence is something other than A-B-C. The S611 can be configured to operate under reversed phase conditions (A-C-B).

Shorted SCR Detection

The S611 monitors the operation of the power poles and will trip under a shorted SCR condition.

Open SCR Detection

The S611 monitors the operation of the power poles and will trip under an open SCR condition.

Low Current

Low current conditions can be a result of a loss of load or a failure in the mechanical system. The S611 has low current protection that will trip if the average RMS current falls below a preset value. The low current protection can be programmed as a percent of motor FLA from 0% to 100%.

Low Voltage

Low voltage conditions can result from disturbances in the electrical power distribution system. Low voltage conditions can cause a malfunction and damage to electrical equipment. The S611 has low voltage protection that will trip if the average RMS voltage falls below a preset value. The low voltage protection can be programmed as a percent of nominal voltage from 1% to 99% with a trip delay of 0.1 to 60 seconds.

High Voltage

High voltage conditions can result from disturbances in the electrical power distribution system. High voltage conditions can cause malfunctions or failures of electrical equipment. The S611 has high voltage protection that will trip if the average RMS voltage is greater than a preset value. The high voltage protection can be programmed as a percent of nominal voltage from 101% to 120% with a trip delay of 0.1 to 60 seconds.

Monitoring Capabilities

The S611 has an impressive array of system monitoring capabilities that allow users to access real time process and diagnostic data. This data can be viewed at the device with the UI or through a communications network. Data over a communications network can provide valuable insight into the condition of the equipment and processes. Maintenance and production personnel can monitor critical operational and maintenance data from a central control station that can be located far away from the production facility. Process data can be monitored to determine system anomalies that may indicate a need for preventive maintenance or an Impeding failure.

Adjustments made through the communications network can reduce costs by minimizing the time traveling to the location where the motor controls are located. When faults do occur, real time fault data can assist maintenance in troubleshooting and planning repair resources. Remote reset signals can be given to tripped devices without the need for manual intervention by maintenance personnel.

Average Line Current

Provides the average of the three phase RMS line currents in amps, accurate to within 2%. Current data can be used to indicate a need for maintenance. Increased currents in a fixed load application can indicate a reduction in system efficiencies and performance, signifying system maintenance is due.

Average Pole Current

Provides the average of the three phase RMS pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications, and will differ in inside-the-delta applications.

Average Line Current as a % FLA

Provides the average RMS line current as a percentage of the S611 FLA setting.

Three-Phase Line Currents

Provides three RMS phase line currents in amps, accurate to within 2%. Imbalances or changes in the relative phase current to one another can indicate anomalies in the motor or electrical distribution system.

Three-Phase Pole Currents

Provides three RMS phase pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications.

Three-Phase Line Voltages

Provides the individual RMS three phase line voltages. Imbalances or changes in the relative phase voltage to one another can indicate anomalies in the motor or electrical distribution system. Voltage can be used to monitor electrical distribution system performance. Warnings, alarms and system actions to low or high voltage conditions can be implemented.

Percent Thermal Memory

Provides the real time calculated thermal memory value. The S611 calculates thermal memory value. A 100% value represents the maximum safe temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur, removing power to the motor.

The thermal memory value can be of great use in determining an impending overload trip Condition. Alarms can be implemented in the process monitoring system warning of an Impending trip before a trip occurs, halting the process. Costly system downtime can be avoided.

Pole Temperature

Increases in pole temperature are caused by increases in ambient temperature, start/stop times and start duty cycles. Changes in pole temperatures represent a change in system operating conditions. Identifying unexpected operating conditions or changes can prompt maintenance and aid in process evaluation activities.

Power Monitoring

S611 can monitor power and it can be displayed on the UI.

Start Count

Number of starts are stored in the device and can be displayed using field bus.

Diagnostics

Fault Queue

Current fault and a fault queue containing the last nine system faults can be read through the UI or communications network. Fault identification can minimize troubleshooting time and cost and prevent arc flash incidents. The fault queue can be remotely accessed through a communications network to assist in planning maintenance resources. 30 different faults can be identified by the S611.

Control Status

The S611 provides data that represents system conditions that can be read through the UI or the communications network. This data identifies the status of the system and the control commands the system is requesting of the S611. This can be used for advanced Troubleshooting and system integration activities.

Field Serviceability

In the case of maintenance, the S611 provides easy access and replacement of key components including control board and internal bypass contactors—significantly increasing its service life. If a component ever needs to be replaced, this straightforward operation can be completed by an end-user without the need to call in an outside service technician or engineer. These components are stocked and available for order and quick fulfillment—ensuring your operation continues with minimal downtime.

Standards and Certifications

- IEC 60947-4-2
- UL listed
- CSA certified (3211 06)

Instructional Leaflets

- Instruction Manual: MN03902011E
- Quick Start Guide: MN03901003E

Catalog Number Selection

S611 Soft Starters

S 611 B 125 N 3 S

S = Soft Starter

611 = Non-combination soft starter

Frame Size
A = 52–77 Amps
B = 99–125 Amps
C = 156–180 Amps
D = 242 Amps
E = 302–361 Amps
F = 414 Amps

Ampere Rating	
052 = 52A	**180** = 180A
065 = 65A	**242** = 242A
077 = 77A	**302** = 302A
099 = 99A	**361** = 361A
125 = 125A	**414** = 414A
156 = 156A	

Options
N = No options
P = Pump control

Number of Poles
3 = Three-pole device

S = Standard soft starter

Product Selection

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a question arises, consult with your local Eaton Representative or call the Eaton Technical Resource Center.

Horsepower Ratings

Note: Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

S611

Standard Duty—300% Current for 15 Seconds, 115% Continuous

Maximum Current (Amps)	Horsepower Rating 208V	240V	480V	600V	Catalog Number
52	15	15	40	50	**S611A052N3S**
65	20	20	50	60	**S611A065N3S**
77	25	25	60	75	**S611A077N3S**
99	30	30	75	100	**S611B099N3S**
125	40	40	100	125	**S611B125N3S**
156	50	60	125	150	**S611C156N3S**
180	60	60	150	150	**S611C180N3S**
242	75	75	200	250	**S611D242N3S**
302	100	100	250	300	**S611E302N3S**
361	125	150	300	350	**S611E361N3S**
414	150	150	350	450	**S611F414N3S**

Standard Duty Plus—350% FLA for 30 Seconds, 115% Continuous

Maximum Current (Amps)	Horsepower Rating 208V	240V	480V	600V	Catalog Number
52	15	15	40	50	**S611A052N3S**
65	20	20	50	60	**S611A065N3S**
71	20	25	60	75	**S611A077N3S**
99	30	30	75	100	**S611B099N3S**
119	40	40	100	125	**S611B125N3S**
156	50	60	125	150	**S611C156N3S**
180	60	60	150	150	**S611C180N3S**
242	75	75	200	250	**S611D242N3S**
302	100	100	250	300	**S611E302N3S**
361	125	150	300	350	**S611E361N3S**
407	150	150	350	400	**S611F414N3S**

Note: Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

S611

Heavy Duty—500% FLA for 30 Seconds, 125% Continuous

Maximum Current (Amps)	Horsepower Rating 208V	240V	480V	600V	Catalog Number
49	15	15	40	50	**S611A052N3S**
83	25	30	60	75	**S611B099N3S**
142	40	60	125	150	**S611C156N3S**
225	75	75	200	200	**S611D242N3S**
256	75	100	200	250	**S611E361N3S**
285	100	125	250	300	**S611F414N3S**

Severe Duty—600% FLA for 30 Seconds, 125% Continuous

Maximum Current (Amps)	Horsepower Rating 208V	240V	480V	600V	Catalog Number
41	10	15	30	40	**S611A052N3S**
69	20	30	60	60	**S611B099N3S**
117	30	50	100	125	**S611C180N3S**
187	60	75	150	200	**S611D242N3S**
213	75	75	150	200	**S611E361N3S**
238	75	100	200	250	**S611F414N3S**

Accessories

Optional Accessory Kits

Description	S611 Current Rating	Accessory Kit Part Number
User interface remote mounting kit —3.28 ft (1m)	52–414A	**S611-RMK-100**
User interface remote mounting kit—6.56 ft (2m)	52–414A	**S611-RMK-200**
User interface remote mounting kit—9.84 ft (3m)	52–414A	**S611-RMK-300**
User interface communication cable—3.28 ft (1m)	52–414A	**D77E-QPIP100**
User interface communication cable—6.56 ft (2m)	52–414A	**D77E-QPIP200**
User interface communication cable—9.84 ft (3m)	52–414A	**D77E-QPIP300**
Lug kit—mechanical	52–77A	**S611-LUG-M01**
	99–125A	**S611-LUG-M02**
	156–242A	**S611-LUG-M03**
	302–414A	**S611-LUG-M04**

Options

Pump Control

For pump control option, change the **8th** digit in the Catalog Number to **P**, as in S611XXX**P**3S.

Replacement Parts

S611 Replacement Components

Description	Part Number
User interface	**S611-KEYPAD**
User interface communication cable—0.25m (0.82 ft)	**D77E-QPIP25**
Control board assembly—52A standard	**S611-PCB-052S**
Control board assembly—65A standard	**S611-PCB-065S**
Control board assembly—77A standard	**S611-PCB-077S**
Control board assembly—99A standard	**S611-PCB-099S**
Control board assembly—125A standard	**S611-PCB-125S**
Control board assembly—156A standard	**S611-PCB-156S**
Control board assembly—180A standard	**S611-PCB-180S**
Control board assembly—242A standard	**S611-PCB-242S**
Control board assembly—302A standard	**S611-PCB-302S**
Control board assembly—361A standard	**S611-PCB-361S**
Control board assembly—414A standard	**S611-PCB-414S**
Control board assembly—52A pump	**S611-PCB-052P**
Control board assembly—65A pump	**S611-PCB-065P**
Control board assembly—77A pump	**S611-PCB-077P**
Control board assembly—99A pump	**S611-PCB-099P**
Control board assembly—125A pump	**S611-PCB-125P**
Control board assembly—156A pump	**S611-PCB-156P**
Control board assembly—180A pump	**S611-PCB-180P**
Control board assembly—242A pump	**S611-PCB-242P**
Control board assembly—302A pump	**S611-PCB-302P**
Control board assembly—361A pump	**S611-PCB-361P**
Control board assembly—414A pump	**S611-PCB-414P**
Frame A/B CT	**S611-CT-AB**
Frame C/D CT	**S611-CT-CD**
Frame E/F CT	**S611-CT-EF**
Contactor assembly—52–180A	**C25DNY172**
Contactor assembly—242–414A	**C25DNY173**

Technical Data and Specifications

Soft Starters—S611

Description		S611 Soft Starter (Partial Catalog Number) S611A052	S611A065	S611A072	S611B099
Max. current capacity	A	52	65	77	99
FLA range	A	26–52	32.5–65	38.5–77	48–99
Dimensions					
Width	inch (mm)	11.58 (294)	11.58 (294)	11.58 (294)	11.58 (294)
Height	inch (mm)	19.45 (494)	19.45 (494)	19.45 (494)	19.45 (494)
Depth	inch (mm)	7.46 (189)	7.46 (189)	7.46 (189)	7.46 (189)
Weight	lb (kg)	24 (11)	24 (11)	24 (11)	24 (11)
General Information					
Bypass mechanical lifespan		10M	10M	10M	10M
Insulating voltage	V	660	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
Electrical Information					
Operating voltage	V	130–600	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
Cabling Capacity (IEC 947)					
Number of conductors		1	1	1	1
Wire sizes	AWG	14–2/0	14–2/0	14–2/0	14–2/0
Type of connectors		Lug	Lug	Lug	Lug
Control Wiring					
Wire sizes	AWG	22–12	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5	3.5
Maximum size	AWG	12	12	12	12
Control Power Requirements					
Voltage range (120V ±10%)	V	108–132	108–132	108–132	108–132
Steady state current	A	0.375	0.375	0.375	0.375
Inrush current	A	0.5	0.5	0.5	0.5
Ripple	%	1	1	1	1
Relays (1) Class A and C					
Voltage AC—maximum	V	120	120	120	120
Voltage DC—maximum	V	24	24	24	24
Amps—maximum	A	3	3	3	3
Environment					
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000	6000

Soft Starters—S611, continued

Description		S611 Soft Starter (Partial Catalog Number) S611B125	S611C156	S611C180	S611D242
Max. current capacity	A	125	156	180	242
FLA range	A	62.5–125	78–156	90–180	120–242
Dimensions					
Width	inch (mm)	11.58 (294)	11.58 (294)	11.58 (294)	11.58 (294)
Height	inch (mm)	19.45 (494)	20.83 (529)	20.83 (529)	20.83 (529)
Depth	inch (mm)	7.46 (189)	8.37 (213)	8.37 (213)	8.37 (213)
Weight	lb (kg)	24 (11)	33 (15)	33 (15)	38 (17)
General Information					
Bypass mechanical lifespan		10M	10M	10M	10M
Insulating voltage	V	660	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
Electrical Information					
Operating voltage	V	130–600	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
Cabling Capacity (IEC 947)					
Number of conductors		1	1	1	1
Wire sizes	AWG	2–600 kcmil	2–600 kcmil	2–600 kcmil	2–600 kcmil
Type of connectors		Lug	Lug	Lug	Lug
Control Wiring					
Wire sizes	AWG	22–12	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5	3.5
Maximum size	AWG	12	12	12	12
Control Power Requirements					
Voltage range (120V ±10%)	V	108–132	108–132	108–132	108–132
Steady state current	A	0.375	0.375	0.375	0.375
Inrush current	A	0.5	0.5	0.5	0.5
Ripple	%	1	1	1	1
Relays (1) Class A and C					
Voltage AC—maximum	V	120	120	120	120
Voltage DC—maximum	V	24	24	24	24
Amps—maximum	A	3	3	3	3
Environment					
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000	6000

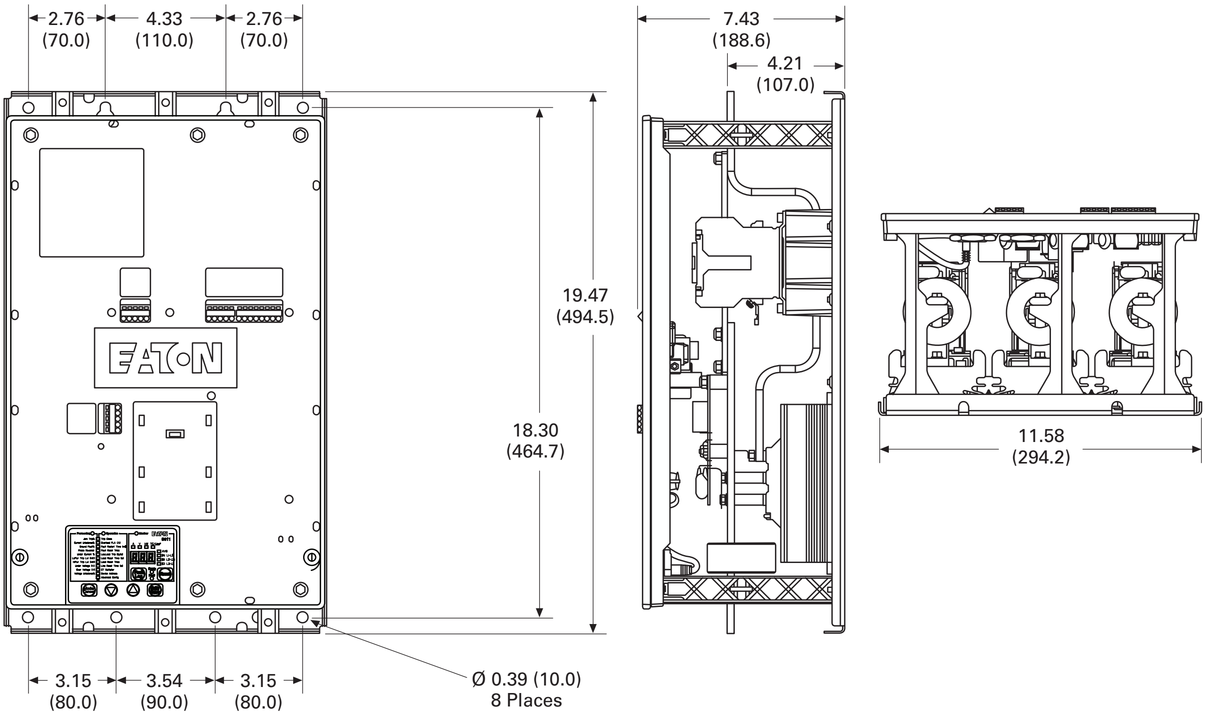
Soft Starters—S611, continued

Description		S611 Soft Starter (Partial Catalog Number) S611E302	S611E361	S611F414
Max. current capacity	A	302	361	414
FLA range	A	151–302	180.5–361	207–414
Dimensions				
Width	inch (mm)	17.56 (446)	17.56 (446)	17.56 (446)
Height	inch (mm)	31.15 (791)	31.15 (791)	31.15 (791)
Depth	inch (mm)	9.54 (242)	9.54 (242)	9.54 (242)
Weight	lb (kg)	86 (39)	86 (39)	102 (46)
General Information				
Bypass mechanical lifespan		10M	10M	10M
Insulating voltage	V	660	660	660
Ramp time range	Seconds	0.5–180	0.5–180	0.5–180
Vibration resistance—non-operating	g	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units	3g up to 242A units, 2g on 302A to 414A units
Vibration resistance—operating	g	1	1	1
Shock resistance	g	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units	15g up to 242A units, 5g on 302A to 414A units
Electrical Information				
Operating voltage	V	130–600	130–600	130–600
Operating frequency	Hertz	47–63	47–63	47–63
Overload setting (frame)	% FLA	50–100	50–100	50–100
Trip class		5, 10, 20, 30	5, 10, 20, 30	5, 10, 20, 30
Cabling Capacity (IEC 947)				
Number of conductors		2	2	2
Wire sizes	AWG	2–600 kcmil	2–600 kcmil	2–600 kcmil
Type of connectors		Lug	Lug	Lug
Control Wiring				
Wire sizes	AWG	22–12	22–12	22–12
Number of conductors		2 (or one 12–14 AWG)	2 (or one 12–14 AWG)	2 (or one 12–14 AWG)
Torque requirements	lb-in	3.5	3.5	3.5
Maximum size	AWG	12	12	12
Control Power Requirements				
Voltage range (120V ±10%)	V	108–132	108–132	108–132
Steady state current	A	0.75	0.75	0.75
Inrush current	A	1	1	1
Ripple	%	1	1	1
Relays (1) Class A and C				
Voltage AC—maximum	V	120	120	120
Voltage DC—maximum	V	24	24	24
Amps—maximum	A	3	3	3
Environment				
Temperature—operating	°C	–20° to 50°C	–20° to 50°C	–20° to 50°C
Temperature—storage	°C	–40° to 85°C	–40° to 85°C	–40° to 85°C
Altitude	Meters	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m	<2000m, derate 0.5% per 100m >2000m
Humidity	%	<95% non-condensing	<95% non-condensing	<95% non-condensing
Operating position		Vertical, line side up	Vertical, line side up	Vertical, line side up
Pollution degree IEC947-1		3	3	3
Impulse withstand voltage IEC947-4-1	V	6000	6000	6000

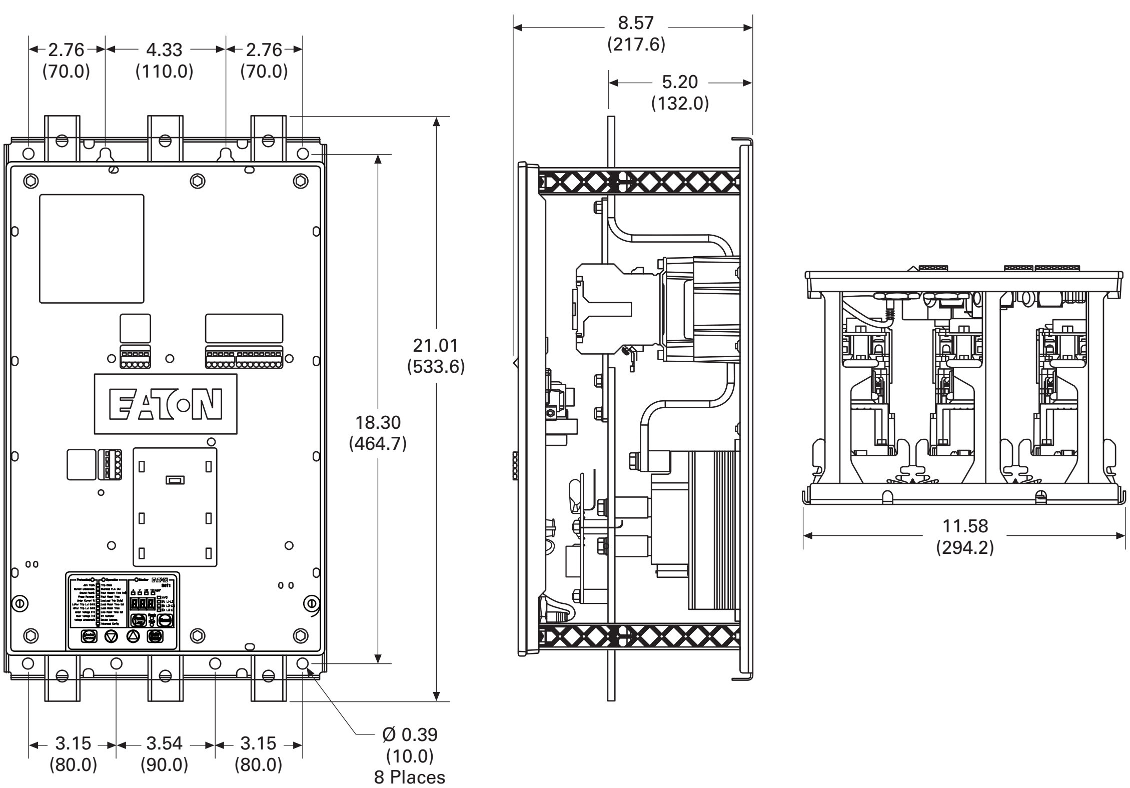
Dimensions

Approximate Dimensions in inches (mm)

A and B Frame

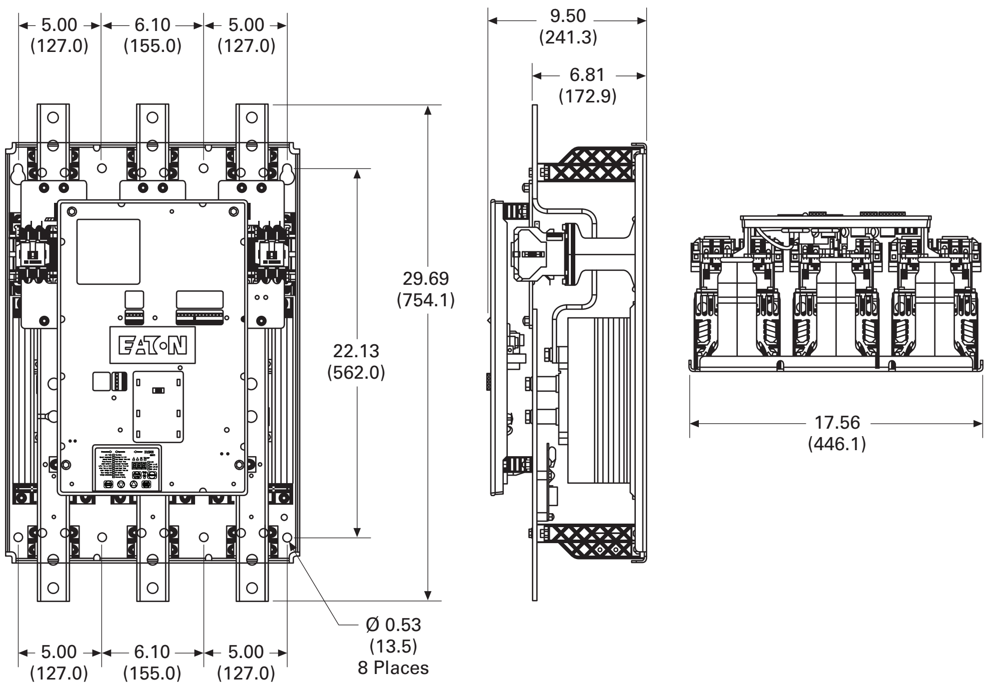


C and D Frame



Approximate Dimensions in inches (mm)

E and F Frame



Type S801, Soft Starters

Contents

Type S801, Soft Starters

Product Description

Eaton's S801 line of reduced voltage soft starters is very compact, multi-functional, easy to install and easy to program. Designed to control acceleration and deceleration of three-phase motors, the line is available for current ranges from 11A all the way through 1000A applications, and is suitable for mounting in motor control centers or in enclosed control (NEMA 1, 4, 4X and 12) applications.

Application Description

The S801 line of soft starters is designed to be the smallest, most compact soft starter in the market today. With this small size, it can easily fit in place of existing soft starter designs, wye-delta starters or across-the-line NEMA and IEC starters. This feature allows easy retrofits of existing motor control centers or enclosures, and saves the expense of replacing existing structure or adding a new one to house a soft starter.

The product is designed to work with three-phase motors in a delta (three-lead) configuration. The S801 works with all motors from fractional horsepower up to motors requiring 1000A of steady-state current. The built-in overload (in ranges from 11–1000A) and run bypass contactor make installation and setup quick and easy. The overload also offers some advanced protective functions to give additional motor protection.

With the pump control option, it is the No. 1 soft starter available for pumping applications. This unique soft stopping control provides a smooth transition for stopping a motor and eliminates the "water-hammer" effect that can damage pipes, valves and pumps.

Operation

Overload Functionality

Overtemperature
Protects the device from overheating. Starter will shut down at 100°C.

Stall
Selectable protective feature, unit trips to protect system in event motor can not get to rated speed in the defined ramp period.

Jam
Selectable protective feature, unit trips to prevent damage to motor during normal run.

Phase Loss
Selectable protective feature, trips under voltage loss condition to any phase.

Phase Reversal
Selectable protective feature, trips when phase rotation is something other than A-B-C.

Kick Start
Selectable feature that provides a current "kick" of up to 550% of full load current for 0 to 2.0 seconds. This provides the additional torque required at startup to break free a motor.

Ramp Start
Provides a constant increase in torque to the motor.

Current Limit Start
Limits the maximum current available to the motor during the startup phase.

Soft Stop
Allows for a controlled stopping of a frictional load.

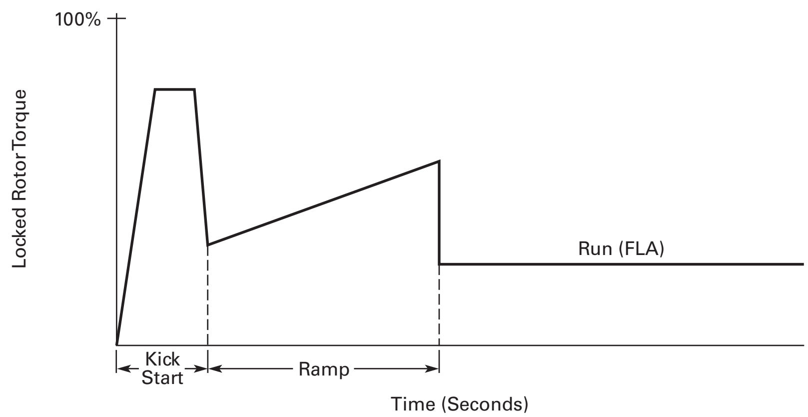
Shorted SCR Detection
Monitors for shorted SCR in the power polls.

Starting Characteristics

Kick Start
Provides an initial boost of current to the motor to help break free the rotor and start spinning the motor.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

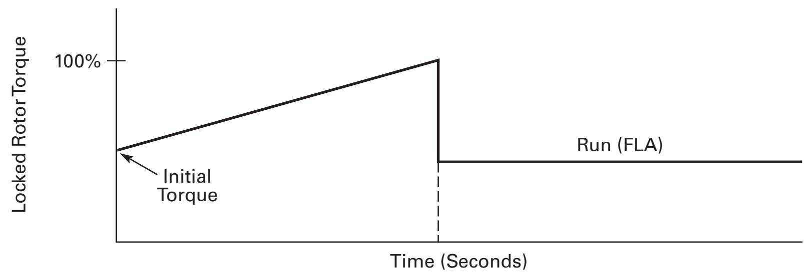
Starting Characteristics—Kick Start



Ramp Start
The most commonly used form of soft start. This allows you to set the initial torque value (of the ramp) and then raises it to full voltage conditions.

- Adjustable initial torque = 0–85% of locked rotor torque
- Adjustable ramp time = 0.5–180 seconds (can be extended with factory modification)

Starting Characteristics—Ramp Start

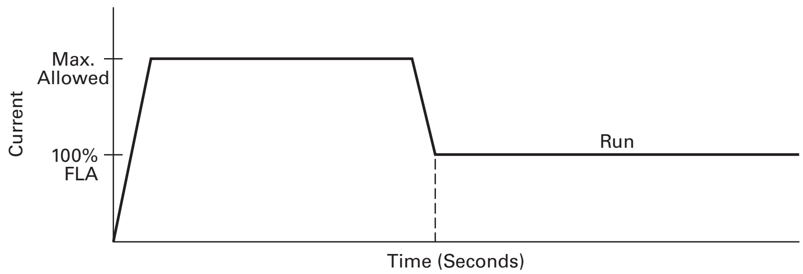


Current Limit

This mode of soft starting is used when it becomes necessary to limit the maximum starting current due to long start times or to protect the motor.

- Maximum current of 0–85% locked rotor current
- Adjustable ramp time = 0.5–180 seconds and can be extended to 360 seconds as a factory installed option

Starting Characteristics—Current Limit

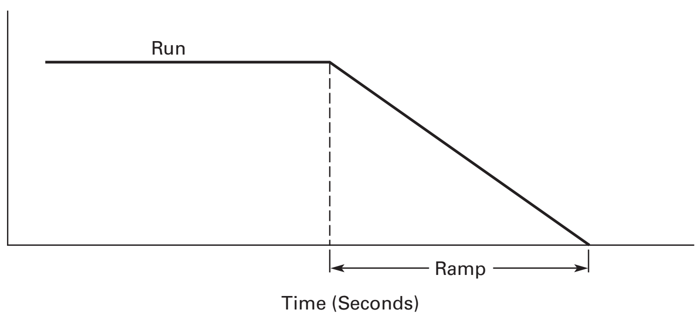


Soft Stop

Used when an extended coast-to-rest period is desired. Often used with high friction loads where a sudden stop may cause system or product damage.

- Stop time = 0–60 seconds

Starting Characteristics—Soft Stop



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Features

- Built-in overload protection
- Built-in run bypass contactor
- Adjustable ramp times
- Adjustable torque control
- Adjustable kick start control
- Programmable overload settings, 31–100% (3.2:1) of rated current for the unit
- Physically fits in place of most NEMA and IEC starters
- Easy to use control interface module
- Soft stop control
- Multiple trip class settings (5, 10, 20 and 30)
- Six SCR control
- Optional pump control
- Optional extended ramp time
- Optional CIM door mount kit for safety
- Optional IP20 protection
- Optional Inside-the-delta mode

Benefits

- Reduced wear on belts, gears, chains, clutches, shafts and bearings
- Allows for controlling the inrush current to the motor
- Reduced inrush current leads to more stable power grid and can lower peak demand charges
- Elimination of water-hammer in pumping applications
- Less shock to product on conveyor lines and material handling gear
- 24 Vdc control enhances personnel and equipment safety

Standards and Certifications

- IEC 947 compliant
- EN 60947-4-2
- CSA certification
- cULus listed (File No. E202571)
- CE marked

c UL us Listed

User Manuals

A comprehensive user manual is available and can be downloaded free of charge from www.eaton.com by performing a document search for MN03902008E.

The Inside-the-Delta User Manual can be found by searching for Pub. No. MN03902009E.

Catalog Number Selection

S801 Open Soft Starters ①②

S 801 N66 N 3 S

S = Soft Starter

801 = Non-combination soft starter

Ampere Rating

N37 = 37A	**U50** = 500A ④
N66 = 66A	**V36** = 360A
R10 = 105A	**V42** = 420A
R13 = 135A	**V50** = 500A
T18 = 180A	**V65** = 650A
T24 = 240A	**V72** = 720A
T30 = 304A	**V85** = 850A
U36 = 360A	**V10** = 1000A
U42 = 420A	

Options

N = No options
P = Pump control
V = 690V option ③

Number of Poles

3 = Three-pole device

B = Level sensing
D = Inside the delta
L = Extended ramp start
S = Standard soft starter overload
W = Without CIM (Control Interface Module)

Notes

① T-, U- and V-Frames require lug kits found on **Page V6-T1-74**.
② All units require a 24 Vdc power supply found on catalog **Page V6-T1-74**, or equivalent.
③ 690V is available only from T18 thru V85. Not available on U-Frames.
④ U-Frame 500A unit does not have IEC certification.

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Product Selection

Standard Duty Ratings

The table below is the base ratings for the soft starter. The tables included in this catalog are meant to be a selection table for different applications, but to match a unit to your exact application, consult with your local Eaton representative or call our Technical Resource Center.

Standard Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	300%	30 sec.	3	50°C
Full voltage	500%	10 sec.	3	50°C
Wye-delta	350%	20 sec.	3	50°C
80% RVAT	480%	20 sec.	2	50°C
65% RVAT	390%	20 sec.	3	50°C
50% RVAT	300%	20 sec.	4	50°C

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a question arises, consult with your local Eaton representative or call our Technical Resource Center.

S801

Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C

	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V ①		
Max. Current	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	Catalog Number ②③
Frame Size N												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	**S801N37N3S**
66	18.5	30	37	20	15	20	20	50	40	60	50	**S801N66N3S**
Frame Size R												
105	30	55	59	30	25	40	30	75	60	100	75	**S801R10N3S**
135	40	63	80	40	30	50	40	100	75	125	100	**S801R13N3S**
Frame Size T												
180	51	90	110	60	50	60	60	150	125	150	150	**S801T18N3S**
240	75	110	147	75	60	75	75	200	150	200	200	**S801T24N3S**
304	90	160	185	100	75	100	100	250	200	300	250	**S801T30N3S**
Frame Size U												
360	110	185	220	125	100	150	125	300	250	350	300	**S801U36N3S**
420	129	220	257	150	125	175	150	350	300	450	350	**S801U42N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S801U50N3S** ④
Frame Size V												
360	110	185	220	125	100	150	125	300	250	350	300	**S801V36N3S**
420	129	220	257	150	125	175	150	350	300	450	350	**S801V42N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S801V50N3S**
650	200	355	425	250	200	250	200	500	450	600	500	**S801V65N3S**
720	220	400	450	—	—	300	250	600	500	700	600	**S801V72N3S**
850	257	475	500	—	—	350	300	700	600	900	700	**S801V85N3S**
1000	277	525	550	—	—	400	350	800	700	900	800	**S801V10N3S** ⑤

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.

② For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.

③ For two-wire (level sensing) control, change the last digit from **S** to **B**.

④ U-Frame 500A does not have IEC certification.

⑤ For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

S801

Standard Duty—25 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C

	Three-Phase Motors											
	kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V [1]		
Max. Current	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	Catalog Number [2][3]
Frame Size N												
34	9	15	18.5	10	7-1/2	10	10	25	20	30	25	**S801N37N3S**
63	15	30	33	20	15	20	20	40	40	60	50	**S801N66N3S**
Frame Size R												
96	25	45	55	30	25	30	30	75	60	75	75	**S801R10N3S**
120	33	63	63	40	30	40	40	75	75	100	100	**S801R13N3S**
Frame Size T												
150	45	80	90	50	40	50	50	100	100	150	125	**S801T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S801T24N3S**
278	80	147	160	75	75	100	75	200	200	250	250	**S801T30N3S**
Frame Size U												
320	90	160	185	100	75	125	100	250	200	300	250	**S801U36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801U42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S801U50N3S** [4]
Frame Size V												
320	90	160	185	100	75	125	100	250	200	300	250	**S801V36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801V42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S801V50N3S**
610	185	315	375	250	150	200	200	500	450	600	500	**S801V65N3S**
680	200	375	445	—	200	250	200	600	500	700	600	**S801V72N3S**
810	250	450	500	—	—	300	300	700	600	900	700	**S801V85N3S**
890	290	510	560	—	—	400	350	700	600	900	700	**S801V10N3S** [5]

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.

Notes

[1] 690V is available only from T18 thru V85. Not available on U-Frames.
[2] For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.
[3] For two-wire (level sensing) control, change the last digit from **S** to **B**.
[4] U-Frame 500A does not have IEC certification.
[5] For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

S801

Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 50°C

	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V ①		
Max. Current	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	Catalog Number ②③
Frame Size N												
34	9	15	18.5	10	7-1/2	10	10	25	20	30	25	**S801N37N3S**
63	15	30	33	20	15	20	20	40	40	60	50	**S801N66N3S**
Frame Size R												
96	25	45	55	30	25	30	30	75	60	75	75	**S801R10N3S**
120	33	63	63	40	30	40	40	75	75	100	100	**S801R13N3S**
Frame Size T												
150	45	80	90	50	40	50	50	100	100	150	125	**S801T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S801T24N3S**
278	80	147	160	75	75	100	75	200	200	250	250	**S801T30N3S**
Frame Size U												
320	90	160	185	100	75	125	100	250	200	300	250	**S801U36N3S**
460	110	200	220	125	100	150	125	300	250	350	300	**S801U42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S801U50N3S** ④
Frame Size V												
320	90	160	185	100	75	125	100	250	200	300	250	**S801V36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801V42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S801V50N3S**
610	185	315	375	250	150	200	200	500	450	600	500	**S801V65N3S**
680	200	375	445	—	200	250	200	600	500	700	600	**S801V72N3S**
830	257	450	500	—	—	300	300	700	600	900	700	**S801V85N3S**
960	302	510	540	—	—	350	300	800	700	900	800	**S801V10N3S** ⑤

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.
② For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.
③ For two-wire (level sensing) control, change the last digit from **S** to **B**.
④ U-Frame 500A does not have IEC certification.
⑤ For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

S801

Standard Duty—50 Second Ramp, 2 Starts per Hour, 300% Current Limit at 50°C

	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V ①		
Max. Current	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	Catalog Number ②③
Frame Size N												
21	5.5	10	11	5	5	5	5	15	10	15	15	**S801N37N3S**
42	11	18.5	22	10	10	15	10	30	25	40	30	**S801N66N3S**
Frame Size R												
60	15	30	33	15	15	20	15	40	40	50	50	**S801R10N3S**
80	22	40	45	25	20	30	25	60	50	75	60	**S801R13N3S**
Frame Size T												
115	33	59	63	30	30	40	30	75	75	100	100	**S801T18N3S**
150	45	80	90	50	40	50	50	100	100	150	125	**S801T24N3S**
192	55	100	110	60	50	60	60	150	125	200	150	**S801T30N3S**
Frame Size U												
280	80	150	160	75	75	100	75	200	200	250	250	**S801U36N3S**
340	110	180	200	100	100	125	100	250	200	350	300	**S801U42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801U50N3S** ④
Frame Size V												
280	80	150	160	75	75	100	75	200	200	250	250	**S801V36N3S**
340	110	180	200	100	100	125	100	250	200	350	300	**S801V42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S801V65N3S**
480	147	257	295	150	150	200	150	400	350	500	450	**S801V72N3S**
590	180	315	375	200	150	200	200	500	400	600	500	**S801V85N3S**
650	205	370	415	250	200	250	200	500	450	600	500	**S801V10N3S** ⑤

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.
② For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.
③ For two-wire (level sensing) control, change the last digit from **S** to **B**.
④ U-Frame 500A does not have IEC certification.
⑤ For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

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S801

Standard Duty—15 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V [1] 1.0SF	575–690V [1] 1.15SF	Catalog Number [2][3]
Frame Size N												
29	7.5	12.5	15	7-1/2	7-1/2	10	7-1/2	20	15	25	20	**S801N37N3S**
49	12.5	22	25	15	10	15	15	30	30	40	40	**S801N66N3S**
Frame Size R												
73	18.5	37	40	20	20	25	20	50	40	60	60	**S801R10N3S**
94	25	45	55	30	25	30	30	60	60	75	75	**S801R13N3S**
Frame Size T												
155	45	80	90	50	40	60	50	100	100	150	125	**S801T18N3S**
219	63	110	132	60	60	75	60	150	150	200	150	**S801T24N3S**
280	80	150	160	75	75	100	75	200	200	250	250	**S801T30N3S**
Frame Size U												
345	100	185	200	100	100	125	100	250	200	350	300	**S801U36N3S**
405	110	200	250	125	100	150	125	300	250	400	350	**S801U42N3S** [4]
Frame Size V												
345	100	185	200	100	100	125	100	250	200	350	300	**S801V36N3S**
405	110	200	250	125	100	150	125	300	250	400	350	**S801V42N3S**
465	140	250	280	150	125	150	150	350	300	450	400	**S801V50N3S**
530	160	280	335	150	150	200	150	450	350	500	450	**S801V65N3S**
590	180	315	375	200	150	—	200	500	400	600	500	**S801V72N3S**
651	200	355	425	—	—	—	—	600	450	700	600	**S801V85N3S**
754	220	400	465	—	—	—	—	600	500	800	700	**S801V10N3S** [5]

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.

Notes

[1] 690V is available only from T18 thru V85. Not available on U-Frames.
[2] For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.
[3] For two-wire (level sensing) control, change the last digit from **S** to **B**.
[4] U-Frame 500A does not have IEC certification.
[5] For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

S801

Standard Duty—30 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V [1] 1.0SF	575–690V [1] 1.15SF	Catalog Number [2][3]
Frame Size N												
21	5.5	10	12.5	5	5	5	5	15	10	15	15	**S801N37N3S**
40	11	18.5	22	10	10	10	10	30	25	30	30	**S801N66N3S**
Frame Size R												
55	15	25	30	15	15	20	15	40	30	50	40	**S801R10N3S**
75	22	37	45	20	20	25	20	50	50	60	60	**S801R13N3S**
Frame Size T												
151	45	80	90	50	40	50	50	100	100	150	125	**S801T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S801T24N3S**
264	80	140	160	75	75	100	75	200	150	250	200	**S801T30N3S**
Frame Size U												
300	90	160	185	100	75	100	100	200	200	300	250	**S801U36N3S**
340	100	180	200	100	100	125	100	250	200	350	300	**S801U42N3S** [4]
380	110	200	220	125	100	150	125	300	250	350	300	**S801U50N3S**
Frame Size V												
300	90	160	185	100	75	100	100	200	200	300	250	**S801V36N3S**
340	100	180	200	100	100	125	100	250	200	350	300	**S801V42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S801V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S801V65N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S801V72N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S801V85N3S**
560	160	277	325	200	150	250	200	500	400	600	500	**S801V10N3S** [5]
For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-75**.												

Notes

[1] 690V is available only from T18 thru V85. Not available on U-Frames.
[2] For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.
[3] For two-wire (level sensing) control, change the last digit from **S** to **B**.
[4] U-Frame 500A does not have IEC certification.
[5] For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

Severe Duty Ratings

The table below is the base ratings for the soft starter. The tables included in this catalog are meant to be a selection table for different applications, but to match a unit to your exact application, consult with your local Eaton representative or call our Technical Resource Center.

Severe Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	450%	30 sec.	4	50°C
Full voltage	500%	10 sec.	10	50°C
Wye-delta	350%	65 sec.	3	50°C
80% RVAT	480%	25 sec.	4	50°C
65% RVAT	390%	40 sec.	4	50°C
50% RVAT	300%	60 sec.	4	50°C

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where the ramp time is over 30 seconds, the number of starts per hour exceeds 4, or the current limit set is over 300%. *Example:* 35-second ramp, 5 starts per hour, 350% current limit at 40°C ambient.

S801

Severe Duty—>30 Second Ramp, >4 Starts per Hour or >300% Current Limit

Max. Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number ①②
Frame Size N												
22	5.5	10	11	5	5	7-1/2	5	15	10	20	15	**S801N37N3S**
42	11	18.5	22	10	10	15	10	30	25	40	30	**S801N66N3S**
Frame Size R												
65	15	30	33	15	15	20	15	50	40	50	50	**S801R10N3S**
80	22	40	45	25	20	30	25	60	50	75	60	**S801R13N3S**
Frame Size T												
115	33	59	63	30	30	40	30	75	75	100	100	**S801T18N3S**
150	45	80	90	50	40	50	50	100	100	150	125	**S801T24N3S**
192	55	100	110	60	50	75	60	150	125	200	150	**S801T30N3S**
Frame Size U												
240	75	110	147	75	60	75	75	200	150	200	200	**S801U36N3S**
305	90	160	185	100	75	100	100	250	200	300	250	**S801U42N3S**
365	110	185	220	125	100	150	125	300	250	350	300	**S801U50N3S** ③
Frame Size V												
240	75	110	147	75	60	75	75	200	150	200	200	**S801V36N3S**
305	90	160	185	100	75	100	100	250	200	300	250	**S801V42N3S**
365	110	185	220	125	100	150	125	300	250	350	300	**S801V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S801V65N3S**
480	147	257	295	150	150	200	150	400	350	500	450	**S801V72N3S**
525	160	280	335	150	150	200	150	450	350	500	450	**S801V85N3S**
600	185	315	375	200	150	250	200	500	450	600	500	**S801V10N3S** ④

Notes

① For a longer ramp acceleration time of 0.5 to 360 seconds, see **Page V6-T1-75**.

② For two-wire (level sensing) control, change the last digit from **S** to **B**.

③ U-Frame 500A unit does not have IEC certification.

④ For more information on optimum performance of the 1000A Frame Size V S801, see Appendix C of MN03902008E.

Inside-the-Delta Standard Duty Ratings

S801

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575V 1.0SF	1.15SF	Catalog Number
Frame Size N												
65	10	18.5	18.5	15	15	15	15	40	30	50	50	**S801N37N3D**
114	18.5	30	37	30	25	30	30	75	60	100	75	**S801N66N3D**
Frame Size R												
182	30	55	59	50	40	60	50	125	100	150	125	**S801R10N3D**
234	40	63	80	60	50	75	60	150	125	200	150	**S801R13N3D**
Frame Size T												
311	51	90	110	100	75	100	100	250	200	250	250	**S801T18N3D**
415	75	110	147	125	100	125	125	300	250	300	300	**S801T24N3D**
526	90	160	185	150	125	150	150	400	300	400	400	**S801T30N3D**
Frame Size U												
623	110	185	220	200	150	250	200	450	400	550	450	**S801U36N3D**
727	129	220	257	250	200	300	250	550	450	700	550	**S801U42N3D**
865	150	257	300	250	250	300	250	600	550	750	700	**S801U50N3D** ①②
Frame Size V												
623	110	185	220	200	150	250	200	450	400	550	450	**S801V36N3D**
727	129	220	257	250	200	300	250	550	450	700	550	**S801V42N3D**
865	150	257	300	250	250	300	250	600	550	750	700	**S801V50N3D**
1125	200	355	425	400	300	400	300	750	700	900	750	**S801V65N3D**
1246	—	—	—	—	—	—	—	—	—	—	—	**S801V72N3D**
1471	—	—	—	—	—	—	—	—	—	—	—	**S801V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S801V10N3D** ③

Notes

① 15 sec. start, 300% inrush, 40°C, 1 start every 15 minutes. If these start parameters are exceeded, please refer to 290 mm V-Frame, 865A Inside-the-Delta Starter.
② U-Frame 500A unit does not have IEC certification.
③ For more information on optimum performance of the 1000A Frame Size V Inside-the-Delta S801, see Appendix C of MN03902009E.

S801

Inside-the-Delta Standard Duty—25 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575V 1.0SF	1.15SF	Catalog Number
Frame Size N												
58	9	15	18.5	15	10	15	15	40	30	50	40	**S801N37N3D**
108	15	30	33	30	25	30	30	60	60	100	75	**S801N66N3D**
Frame Size R												
164	25	45	55	50	40	50	50	125	100	125	125	**S801R10N3D**
206	33	63	63	60	50	60	50	125	125	150	150	**S801R13N3D**
Frame Size T												
257	45	80	90	75	60	75	60	150	150	250	200	**S801T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S801T24N3D**
477	80	147	160	125	125	150	125	300	300	400	400	**S801T30N3D**
Frame Size U												
554	90	160	185	150	125	200	150	400	300	450	400	**S801U36N3D**
646	110	200	220	200	150	250	200	500	400	550	450	**S801U42N3D**
796	140	250	280	250	200	250	250	550	500	700	600	**S801U50N3D** ①②
Frame Size V												
554	90	160	185	150	125	200	150	400	300	450	400	**S801V36N3D**
646	110	200	220	200	150	250	200	500	400	550	450	**S801V42N3D**
796	140	250	280	250	200	250	250	550	500	700	600	**S801V50N3D**
1055	185	315	375	400	250	300	300	800	700	900	750	**S801V65N3D**
1176	200	375	445	—	300	400	300	900	800	900	900	**S801V72N3D**
1358	—	—	—	—	—	—	—	—	—	—	—	**S801V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S801V10N3D** ③

Notes

① 15 sec. start, 300% inrush, 40°C, 1 start every 15 minutes. If these start parameters are exceeded, please refer to 290 mm V-Frame, 796A Inside-the-Delta Starter.

② U-Frame 500A unit does not have IEC certification.

③ For more information on optimum performance of the 1000A Frame Size V Inside-the-Delta S801, see Appendix C of MN03902009E.

S801

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 50°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number
Frame Size N												
58	9	15	18.5	15	10	15	15	40	30	50	40	**S801N37N3D**
108	15	30	33	30	25	30	30	60	60	100	75	**S801N66N3D**
Frame Size R												
164	25	45	55	50	40	50	50	125	100	125	125	**S801R10N3D**
206	33	63	63	60	50	60	60	125	125	150	150	**S801R13N3D**
Frame Size T												
257	45	80	90	75	60	75	75	150	150	250	200	**S801T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S801T24N3D**
477	80	147	160	125	125	150	125	300	300	400	400	**S801T30N3D**
Frame Size U												
554	90	160	185	150	125	200	150	400	300	450	400	**S801U36N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801U42N3D**
796	140	250	280	250	200	250	250	550	450	700	600	**S801U50N3D** ①
Frame Size V												
554	90	160	185	150	125	200	150	400	300	450	400	**S801V36N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801V42N3D**
796	140	250	280	250	200	250	250	550	450	700	600	**S801V50N3D**
1055	185	315	375	400	250	300	300	750	700	900	750	**S801V65N3D**
1176	200	375	445	—	—	—	—	—	—	—	—	**S801V72N3D**
1358	257	450	500	—	—	—	—	—	—	—	—	**S801V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S801V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V Inside-the-Delta S801, see Appendix C of MN03902009E.

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S801

Inside-the-Delta Standard Duty—50 Second Ramp, 2 Starts per Hour, 300% Current Limit at 50°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575V 1.0SF	1.15SF	Catalog Number
Frame Size N												
36	5.5	10	11	7-1/2	7-1/2	7-1/2	7-1/2	25	15	25	25	**S801N37N3D**
73	11	18.5	22	15	15	25	15	50	40	60	50	**S801N66N3D**
Frame Size R												
103	15	30	33	25	25	30	25	60	60	75	75	**S801R10N3D**
138	22	40	45	40	30	50	40	100	75	125	100	**S801R13N3D**
Frame Size T												
199	33	59	63	50	50	60	50	125	125	150	150	**S801T18N3D**
257	45	80	90	75	60	75	75	150	150	250	200	**S801T24N3D**
324	55	100	110	100	75	100	100	250	200	300	250	**S801T30N3D**
Frame Size U												
485	80	150	160	125	125	150	125	300	300	400	400	**S801U36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S801U42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801U50N3D** ①
Frame Size V												
485	80	150	160	125	125	150	125	300	300	400	400	**S801V36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S801V42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801V50N3D**
727	129	220	257	250	200	250	250	550	500	700	550	**S801V65N3D**
816	147	257	295	250	250	300	250	600	550	750	700	**S801V72N3D**
1021	180	315	375	300	250	300	300	750	600	900	750	**S801V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S801V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V Inside-the-Delta S801, see Appendix C of MN03902009E.

S801

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575V 1.0SF	1.15SF	Catalog Number
Frame Size N												
47	7.5	12.5	15	10	10	15	10	30	25	40	30	**S801N37N3D**
83	12.5	22	25	25	15	25	25	50	50	60	60	**S801N66N3D**
Frame Size R												
126	18.5	37	40	30	30	40	30	75	60	100	100	**S801R10N3D**
162	25	45	55	50	40	50	50	100	100	125	125	**S801R13N3D**
Frame Size T												
266	45	80	90	75	60	100	75	150	150	250	200	**S801T18N3D**
379	63	110	132	100	100	125	100	250	250	300	250	**S801T24N3D**
485	80	150	160	125	125	150	125	300	300	400	400	**S801T30N3D**
Frame Size U												
580	100	185	200	150	150	200	150	400	300	550	450	**S801U36N3D**
695	110	200	250	200	150	250	200	450	400	600	550	**S801U42N3D**
798	140	250	280	250	200	250	250	550	450	700	600	**S801U50N3D** ①
Frame Size V												
580	100	185	200	150	150	200	150	400	300	550	450	**S801V36N3D**
695	110	200	250	200	150	250	200	450	400	600	550	**S801V42N3D**
798	140	250	280	250	200	250	250	550	450	700	600	**S801V50N3D**
908	160	280	335	250	250	300	250	700	550	750	700	**S801V65N3D**
1021	—	—	—	—	—	—	—	—	—	—	—	**S801V72N3D**
1125	—	—	—	—	—	—	—	—	—	—	—	**S801V85N3D**

Note

① U-Frame 500A unit does not have IEC certification.

1

S801

Inside-the-Delta Standard Duty—30 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number
Frame Size N												
36	5.5	10	12.5	7-1/2	7-1/2	7-1/2	7-1/2	25	15	25	25	**S801N37N3D**
69	11	18.5	22	15	15	15	15	50	40	50	50	**S801N66N3D**
Frame Size R												
96	15	25	30	25	25	30	25	60	50	75	60	**S801R10N3D**
130	22	37	45	30	30	40	30	75	75	100	100	**S801R13N3D**
Frame Size T												
257	45	80	90	75	60	75	75	150	150	250	200	**S801T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S801T24N3D**
448	80	140	160	125	125	150	125	300	250	400	300	**S801T30N3D**
Frame Size U												
503	90	160	185	150	125	150	150	300	300	450	400	**S801U36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S801U42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801U50N3D** ①
Frame Size V												
503	90	160	185	150	125	150	150	300	300	450	400	**S801V36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S801V42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S801V50N3D**
727	129	220	257	250	200	250	250	550	450	700	550	**S801V65N3D**
796	—	—	—	—	—	—	—	—	—	—	—	**S801V72N3D**
865	—	—	—	—	—	—	—	—	—	—	—	**S801V85N3D**

Note

① U-Frame 500A unit does not have IEC certification.

Inside-the-Delta Severe Duty Ratings

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where the ramp time is over 30 seconds, the number of starts per hour exceeds 4, or the current limit set is over 300%.

Example: 35-second ramp, 5 starts per hour 350% current limit at 40°C ambient.

S801

Inside-the-Delta Severe Duty

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number
				200V		230V		460V		575V		
	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
Frame Size N												
39	5.5	10	11	7-1/2	7-1/2	10	7-1/2	25	15	30	25	**S801N37N3D**
73	11	18.5	22	15	15	25	15	50	40	60	50	**S801N66N3D**
Frame Size R												
111	15	30	33	25	25	30	25	75	60	75	75	**S801R10N3D**
138	22	40	45	40	30	50	40	100	75	120	100	**S801R13N3D**
Frame Size T												
199	33	59	63	50	50	60	50	125	125	150	150	**S801T18N3D**
257	45	80	90	75	60	75	75	150	150	250	200	**S801T24N3D**
324	55	100	110	100	75	100	100	250	200	300	250	**S801T30N3D**
Frame Size U												
415	75	110	147	125	100	125	125	300	250	300	300	**S801U36N3D**
526	90	160	185	150	120	150	150	400	300	450	400	**S801U42N3D**
623	110	185	220	200	150	250	200	450	400	550	450	**S801U50N3D** ①
Frame Size V												
415	75	110	147	125	100	125	125	300	250	300	300	**S801V36N3D**
526	90	160	185	150	120	150	150	400	300	450	400	**S801V42N3D**
623	110	185	220	200	150	250	200	450	400	550	450	**S801V50N3D**
727	129	220	257	250	200	250	250	550	450	700	550	**S801V65N3D**
816	147	257	295	250	250	300	250	600	550	750	700	**S801V72N3D**
908	160	280	335	250	250	300	250	700	550	750	700	**S801V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S801V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V Inside-the-Delta S801, see Appendix C of MN03902009E.

Accessories

Lug Kits

The T and U frame (200 mm) and V frame (290 mm) each have different lug options based on your wiring needs.

Each lug kit contains three lugs that can be mounted on either the load or line side.

Lug Kit

Lug Kits

Frame Size	Frame Designation	Description	Catalog Number
200 mm SSRV	T, U	2 cable connections, 4 AWG to 1/0 cable	**EML22**
		1 cable connection, 4/0 to 500 kcmil cable	**EML23**
		2 cable connections, 4/0 to 500 kcmil cable	**EML24**
		1 cable connection, 2/0 to 300 kcmil cable	**EML25**
		2 cable connections, 2/0 to 300 kcmil cable	**EML26**
290 mm SSRV	V	2 cable connections, 4/0 to 500 kcmil cable	**EML28**
		4 cable connections, 4/0 to 500 kcmil cable	**EML30**
		6 cable connections, 4/0 to 500 kcmil cable	**EML32**
		4 cable connections, 2/0 to 300 kcmil cable	**EML33** ①

Power Supplies

24 Vdc power supply that can be used with the S801 SSRV or as a stand-alone device.

Power Supplies

Description	Catalog Number
85–264 Vac input 24 Vdc output	**PSG240E**
360–575 Vac input 24 Vdc output	**PSG240F**

Lug Cover Kits

Replacement covers for the T- and V-Frame are available in case of damage to the existing covers.

Lug Cover Kits

Description	Catalog Number
Lug cover T-, U-Frame	**EML27**
Lug cover V-Frame	**EML34**

IP20 Kits

IP20 Kits

Description	Catalog Number
N-Frame kit	**SS-IP20-N**
R-Frame kit	**SS-IP20-R**
T- and U-Frame kit	**SS-IP20-TU**
V-Frame kit	**SS-IP20-V**

Surge Suppressors

The surge suppressor can mount on either the line or load side of the soft starter. It is designed to clip the line voltage (or load side induced voltage).

Surge Suppressor

Surge Suppressors

Description	Catalog Number
600V MOV for 200 mm and 290 mm units	**EMS39**
690V MOV for 200 mm and 290 mm units ②	**EMS41**

Notes

① The EML33 does not have a CSA listing.

② T-Frame only.

Mounting Plates

The mounting plates are designed to help make it easy to install or retrofit the soft starter into enclosures and MCCs. The soft starter can be mounted onto the plate prior to installation. The mounting plate is designed with tear drop mounting holes for easier installation.

Mounting Plates

Description	Catalog Number
Mounting plate N-Frame	**EMM13N**
Mounting plate R-Frame	**EMM13R**
Mounting plate T-, U-Frame	**EMM13T**
Mounting plate V-Frame	**EMM13V**

Vibration Plates

The vibration plates allow the soft starter to be applied in high shock and vibration applications. The vibration plate allows vibration up to 5g and shock in up to 40g. The soft starter is mounted onto the vibration plate prior to installation in the panel.

Vibration Plates

Description	Catalog Number
Vibration plate N-Frame	**EMM14N**
Vibration plate R-Frame	**EMM14R**
Vibration plate T-, U-Frame	**EMM14T**
Vibration plate V-Frame	**EMM14V**

Adapter Plates

The adapter plate allows customers to retrofit a V-Frame 290 mm soft starter with the U-Frame 200 mm soft starter.

Adapter Plates

Description	Catalog Number
Adapter plates ②	**EMM13U**

Control Wire Connector

Control Wire Connector

Description	Catalog Number
12-pin, 5 mm pitch connector for control wiring	**EMA75**

Control Interface Module

The Control Interface Module (CIM) is available as a replacement part in two versions.

CIM

Description	Catalog Number
Blank cover (filler)	**EMA68**
CIM for standard unit	**EMA71**
CIM for pump control option	**EMA72**
Panel mounting kit	
3 ft cable	**EMA69A**
5 ft cable	**EMA69B**
8 ft cable	**EMA69C**
10 ft cable	**EMA69D**

Options

Pump Control

For pump control option, use the following table to select the product you are looking for. For sizing information, use the tables on **Pages V6-T1-60** to **V6-T1-73**.

Pump Control Option

Frame Size	Max. Current	Catalog Number
N	37	**S801N37P3S**
	66	**S801N66P3S**
R	105	**S801R10P3S**
	135	**S801R13P3S**
T	180	**S801T18P3S**
	240	**S801T24P3S**
	304	**S801T30P3S**
U	360	**S801U36P3S**
	420	**S801U42P3S**
	500	**S801U50P3S** ①
V	360	**S801V36P3S**
	420	**S801V42P3S**
	500	**S801V50P3S**
	650	**S801V65P3S**
	720	**S801V72P3S**
	850	**S801V85P3S**
	1000	**S801V10P3S**

Extended Ramp

For a longer ramp acceleration time of 0.5–360 seconds, change the last digit in the catalog number from **Page V6-T1-60** to **L**.

Extended Ramp Option

Frame Size	Max. Current	Catalog Number
N	37	**S801N37N3L**
	66	**S801N66N3L**
R	105	**S801R10N3L**
	135	**S801R13N3L**
T	180	**S801T18N3L**
	240	**S801T24N3L**
	304	**S801T30N3L**
U	360	**S801U36N3L**
	420	**S801U42N3L**
	500	**S801U50N3L** ①
V	360	**S801V36N3L**
	420	**S801V42N3L**
	500	**S801V50N3L**
	650	**S801V65N3L**
	720	**S801V72N3L**
	850	**S801V85N3L**
	1000	**S801V10N3L**

Extended Ramp and 690V Option

For voltage ratings of 690V, use the table below.

690V Option

Frame Size	Max. Current	Catalog Number
T	180	**S801T18V3L**
	240	**S801T24V3L**
	304	**S801T30V3L**
V	360	**S801V36V3L**
	420	**S801V42V3L**
	500	**S801V50V3L**
	650	**S801V65V3L**
	720	**S801V72V3L**
	850	**S801V85V3L**

Cooling Fan Kit

The EMM18 cooling fan kit mounts on either side of any frame size S801 Soft Starter to provide additional printed circuit board cooling in high ambient operating temperatures.

Cooling Fan Kit

Description	Catalog Number
Fan Kit	**EMM18**

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information, see Pub 51719.

Technical Data and Specifications

Soft Starters—S801

Description	S801 Soft Starter (Partial Catalog Number) S801N37	S801N66	S801R10	S801R13
Max. current capacity	37	66	105	135
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1	1	1	1
Wire sizes	14–2	14–2	14–4/0	14–4/0
Type of connectors	Box lug	Box lug	Box lug	Box lug
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Soft Starters—S801, continued

Description	S801 Soft Starter (Partial Catalog Number) S801T18	S801T24	S801T30	S801U36
Max. current capacity	180	240	304	360
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1 or 2	1 or 2	1 or 2	1 or 2
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50 C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Notes

① U-Frame 500A unit does not have IEC certification.

② UL recognized component.

Soft Starters—S801, continued

Description	S801 Soft Starter (Partial Catalog Number) S801U42	S801U50 ①	S801V36	S801V42
Max. current capacity	420	500	360	420
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1 or 2	1 or 2	2, 4 or 6	2, 4 or 6
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.4	1.4
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Note

① U-Frame 500A unit does not have IEC certification.

Soft Starters—S801, continued

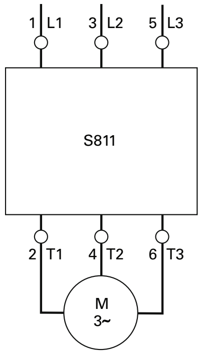
Description	S801 Soft Starter (Partial Catalog Number) S801V50	S801V65	S801V72	S801V85	S801V10 ①
Max. current capacity	500	650	720	850	1000
Dimensions					
Width in inches (mm)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)	11.03 (280.2)
Height in inches (mm)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)	16.57 (420.8)
Depth in inches (mm)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)	7.23 (183.7)
Weight in lbs (kg)	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs	103 (46.8) with lugs 91 (41.4) without lugs
General Information					
Bypass mechanical lifespan	10M	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g	15g
Electrical Information					
Operating voltage	200–600V	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)					
Number of conductors	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6
Wire sizes	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)					
Wire sizes in AWG	22–14	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31	3.31
Control Power Requirements					
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.4	1.4	1.4	1.4	1.4
Inrush current amps	10	10	10	10	10
Ripple	1%	1%	1%	1%	1%
Relays (1) Class A and C					
Voltage AC—maximum	240	240	240	240	240
Voltage DC—maximum	120	120	120	120	120
Amps—maximum	3	3	3	3	3
Environment					
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V	6000V

Note

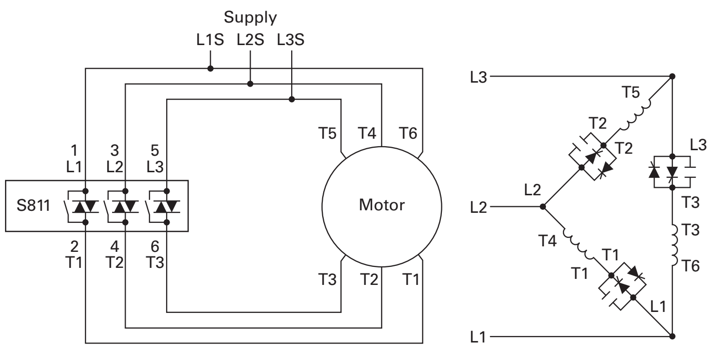
① UL recognized component.

Wiring Diagrams

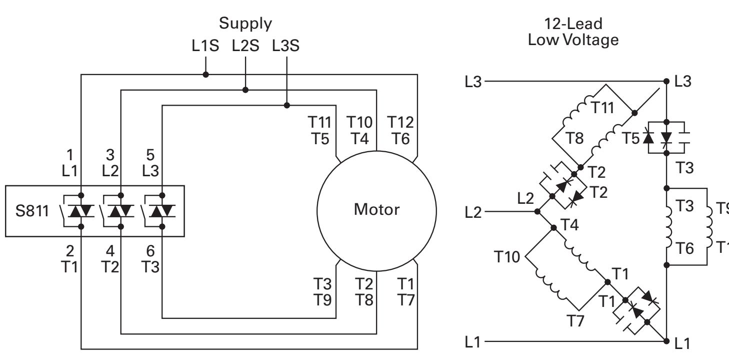
Line Connected Soft Starter



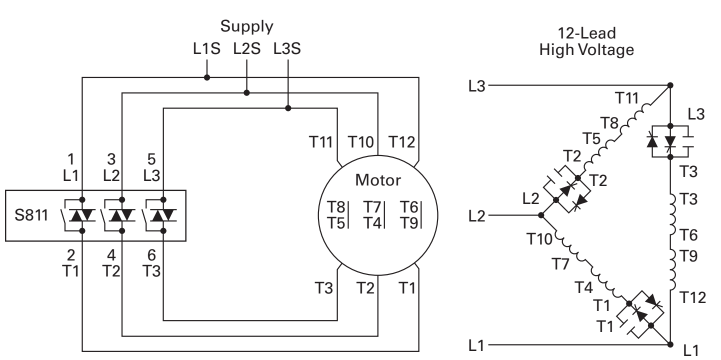
Inside-the-Delta Connected Soft Starter for a 6-Lead Motor



Inside-the-Delta Connected Soft Starter for a 12-Lead Low Voltage Motor



Inside-the-Delta Connected Soft Starter for a 12-Lead High Voltage Motor



Dimensions

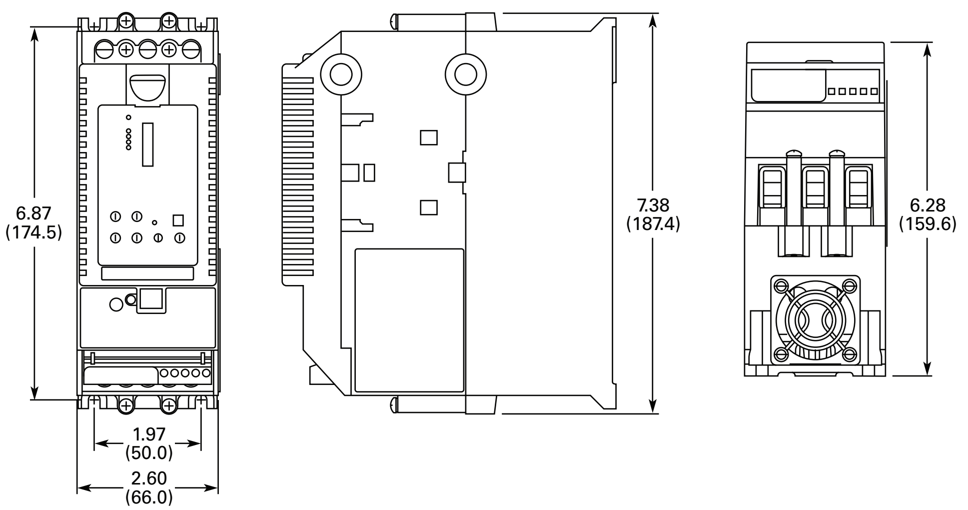
Approximate Dimensions in Inches (mm)

Soft Starters—S801

Partial Catalog Number	W	H	D	Weight in Lbs (kg)
S801N37	2.60 (66.0)	7.38 (187.4)	6.63 (168.4)	5.8 (2.6)
S801N66	2.60 (66.0)	7.38 (187.4)	6.63 (168.4)	5.8 (2.6)
S801R10	4.37 (111.0)	7.92 (201.1)	7.03 (178.6)	10.5 (4.8)
S801R13	4.37 (111.0)	7.92 (201.1)	7.03 (178.6)	10.5 (4.8)
S801T18	7.65 (194.4)	12.71 (322.9)	6.69 (169.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801T24	7.65 (194.4)	12.71 (322.9)	6.69 (169.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801T30	7.65 (194.4)	12.71 (322.9)	6.69 (169.8)	48 (21.8) with lugs 41 (18.6) without lugs
S801U36	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S801U42	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S801U50	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S801V36	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V42	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V50	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V65	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V72	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V85	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs
S801V10	11.03 (280.2)	16.57 (420.8)	7.23 (183.7)	103 (46.8) with lugs 91 (41.4) without lugs

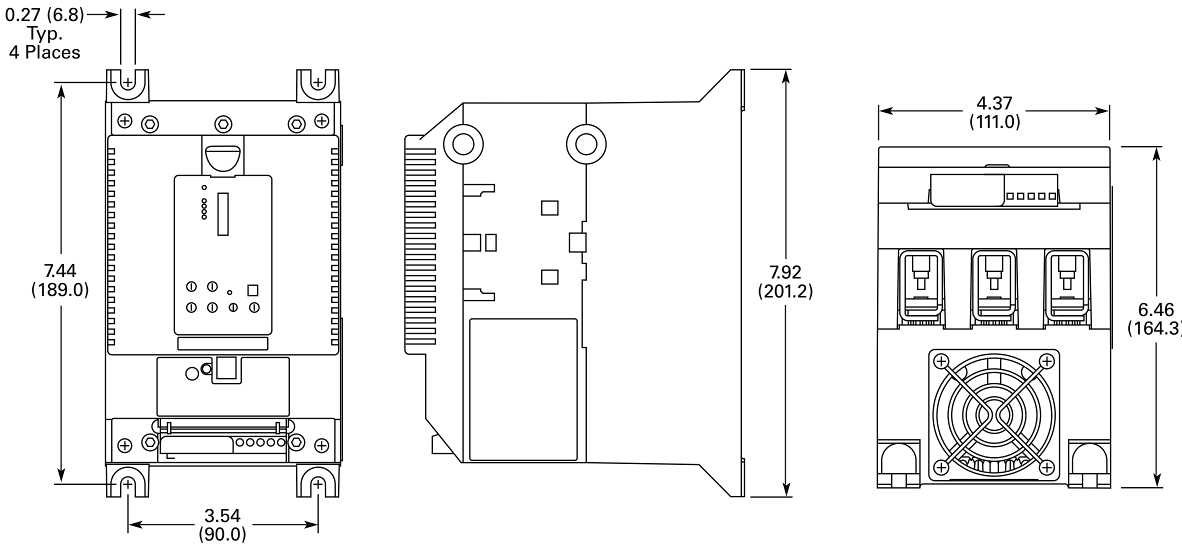
Also refer to dimension drawings below and on **Pages V6-T1-82** and **V6-T1-83**.

N-Frame (65 mm) S801

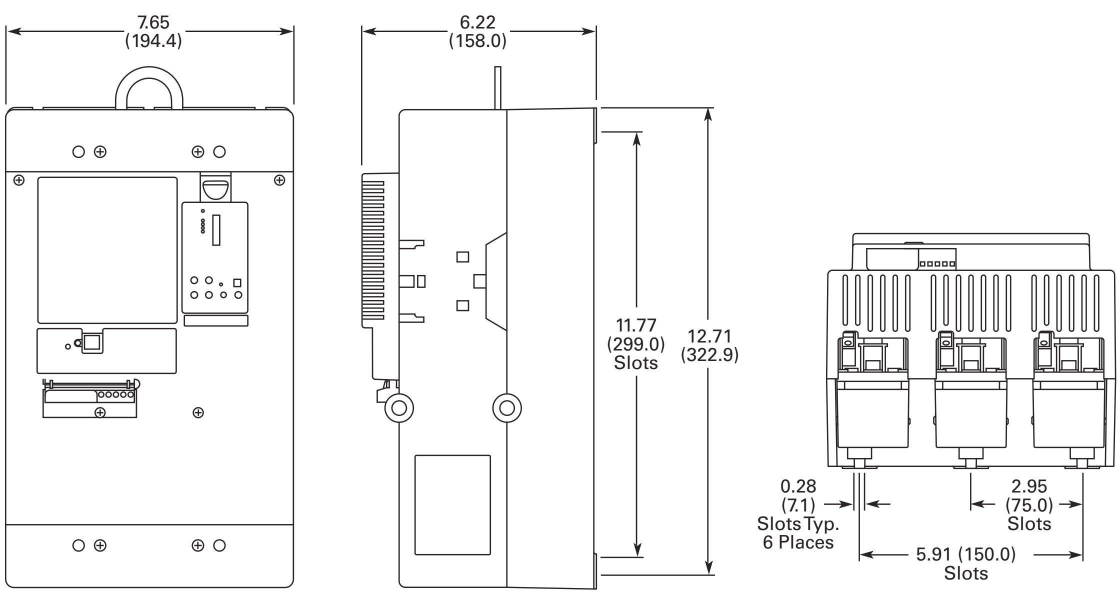


Approximate Dimensions in Inches (mm)

R-Frame (110 mm) S801

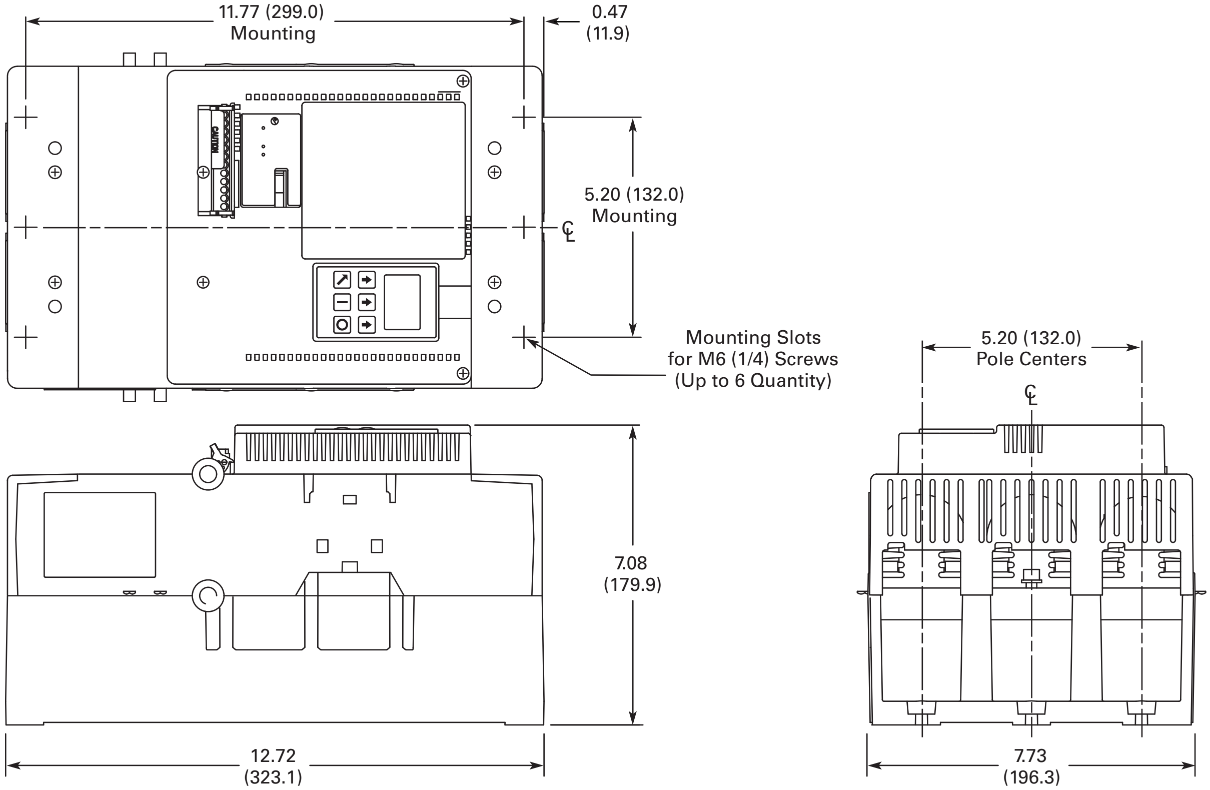


T-Frame (200 mm) S801

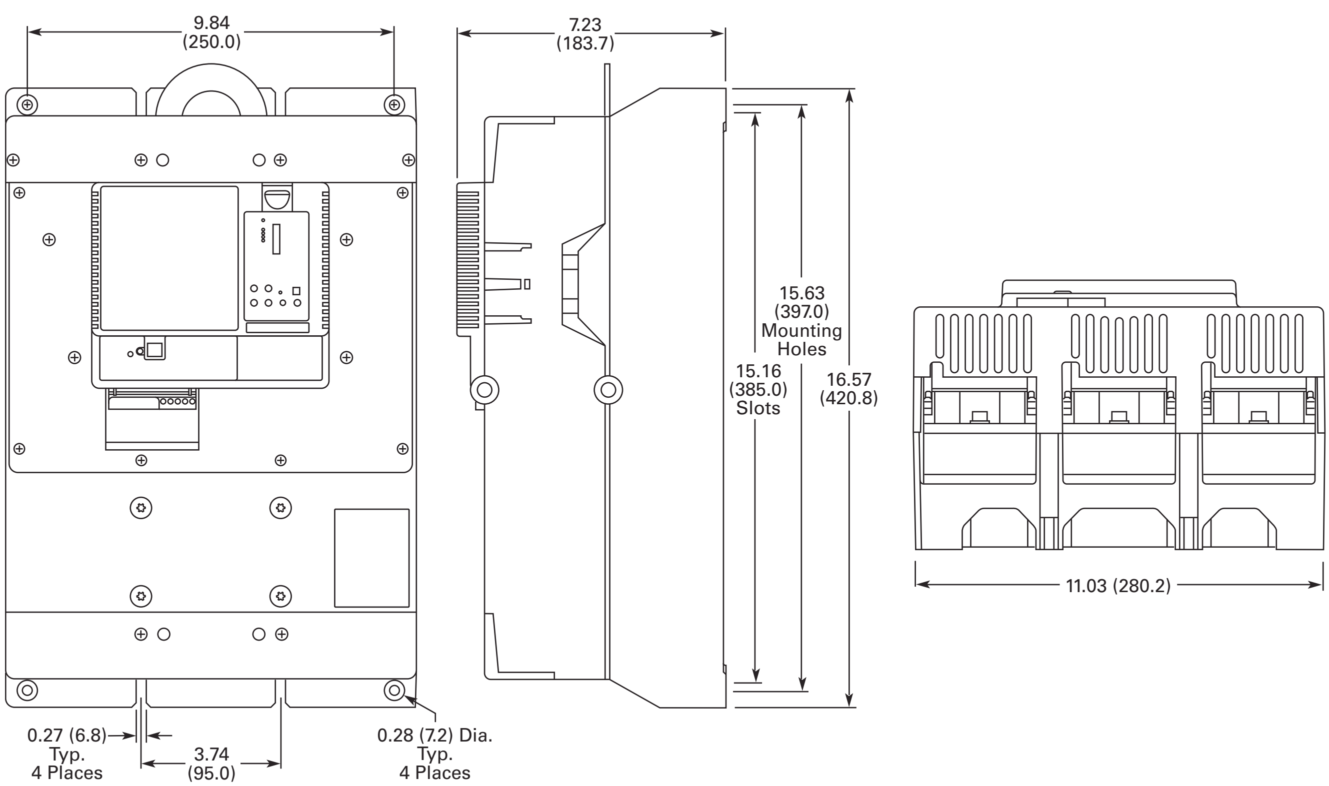


Approximate Dimensions in Inches (mm)

U-Frame (200 mm) S801



V-Frame (290 mm) S801



Type S811, Soft Starters with DIM

Contents

Type S811, Soft Starters with DIM

Product Description

Eaton's S811 offers all the popular features of the S801, but adds enhanced functionality with the new DIM (Digital Interface Module), communications, metering, monitoring and diagnostics capabilities.

Eaton's line of S811 reduced voltage soft starters is very compact, multi-functional, easy to install and easy to set operating parameters. Designed to control the acceleration and deceleration of three-phase motors up to 690V, the line is available from 11–1000A.

The S811 is designed to be a complete package combining the silicon controlled rectifiers (SCRs), bypass contactor and overload in one, very compact unit. The S811 is available as a component for panel mounting, in motor control centers or in enclosed control (NEMA Type 1, 3R, 4, 4X, 7/9 and 12).

Application Description

Designed to control the acceleration and deceleration of three-phase motors, the S811 soft starter uses SCRs to control the voltage to soft start and soft stop the motor. After the motor is started, internal run bypass contactors close, resulting in the motor running directly across-the-line. The built-in solid-state overload protects the motor from overload conditions with sophisticated algorithms that model true motor heating, resulting in better motor protection and fewer nuisance trips. Advanced protective and diagnostic features reduce downtime.

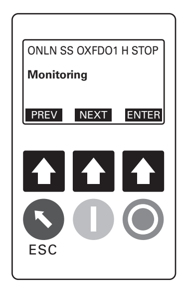
A voltage ramp start or current limit start is available. Kick start is available in either starting mode. The soft stop option allows for a ramp stop time that is longer than the coast to stop time. The pump control option provides a smooth transition for starting and stopping a motor and eliminating the "water-hammer" effect that can damage pipes, valves and pumps.

The S811 offers an impressive array of advanced protective features. Not only are the protective features selectable, but many offer variable settings and adjustable time delays to ride through system discrepancies.

The S811 has an easy to use Digital Interface Module (DIM) that allows the user to configure the device and to read system parameters and monitor system values. The DIM includes an LCD display and keypad to scroll through the various menus. The DIM allows the user to modify control parameters, enable or disable protections, set communication variables, monitor system parameters such as line voltages and currents, and access the fault queue.

The DIM can be removed from the S811 and remote mounted. Kits are available to door mount the DIM, enabling users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door. This will help eliminate the possibility of an arc flash incident.

Digital Interface Module (DIM)



Communications

The S811 has built-in communication capabilities through Eaton's QC (Quick Connect) Port. QCPort™ enables the soft starter to be connected to a variety of networks, including DeviceNet™, EtherNet/Modbus, EtherNet/IP and PROFIBUS. The advantage of QCPort is that multiple control components can be connected to one Eaton D77D gateway.

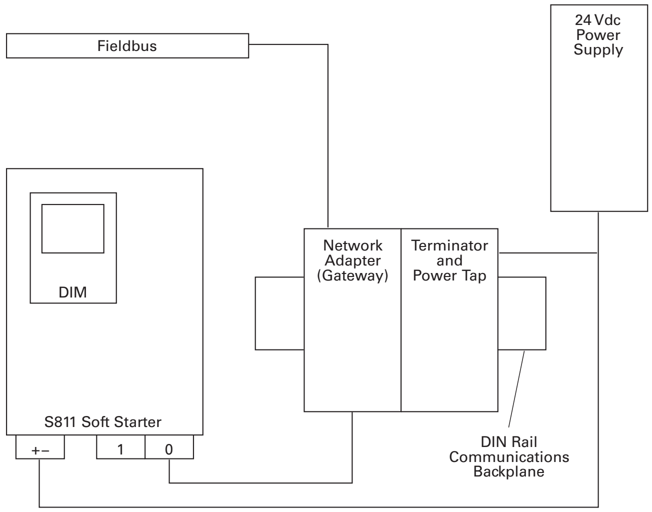
The gateway concentrates data from the devices into a single node. Configuration is simple—a single press of the gateway's Auto Configuration button sets the system up for default operation. This automatically configures the I/O assemblies to the QCPort system devices. The data from these devices are then assembled into single input and output messages

The S811 communication parameters can be configured with the DIM or through the Fieldbus using CH Studio Component Manager. Advanced communication configuration settings provide the system integrator with powerful tools to facilitate system optimization

Communications Reference

Description	Part Number
DeviceNet network adapter	**D77D-DNA**
EtherNet Modbus network adapter	**D77D-EMA**
EtherNet/IP network adapter	**D77D-EIP**
PROFIBUS network adapter	**D77D-PNA**
Terminator and power tap	**D77E-QPLR**
DIN rail communications backplane, 7-position	**D77E-BP7**
DIN rail communications backplane, 12-position	**D77E-BP12**
85–264 Vac input, 24 Vdc output	**PSG240E**
360–575 Vac input, 24 Vdc output	**PSG240F**

S811 Connection



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Operation

Starting and Stopping Modes

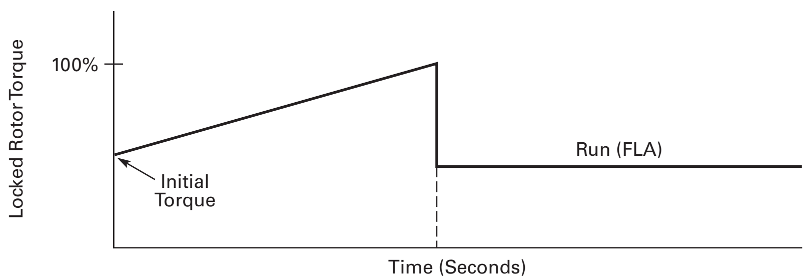
The S811 has a variety of starting and stopping methods to provide superior performance in the most demanding applications. The motor can be started in either voltage ramp start or current limit start mode. Kick start and soft stop are available within both starting modes.

Voltage Ramp Start

Provides a voltage ramp to the motor resulting in a constant torque increase. The most commonly used form of soft start, this start mode allows you to set the initial torque value and the duration of the ramp to full voltage conditions. Bypass contactors close after ramp time.

- Adjustable initial torque 0–85% of locked rotor torque
- Adjustable ramp time 0.5–180 seconds (can be extended with factory modification)

Starting Characteristics—Ramp Start

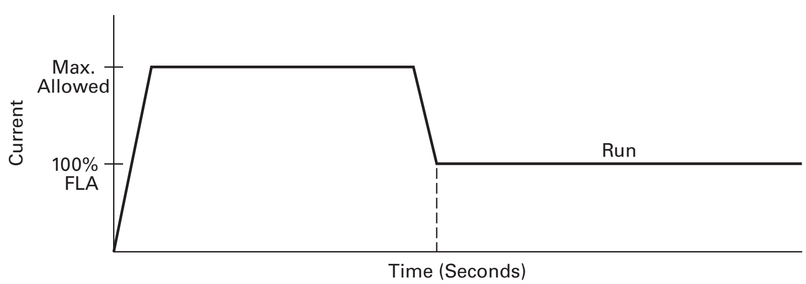


Current Limit Start

Limits the maximum current available to the motor during the start phase. This mode of soft starting is used when it becomes necessary to limit the maximum starting current due to long start times or to protect the motor. This start mode allows you to set the maximum starting current as a percentage of locked rotor current and the duration of the current limit. Bypass contactors close after current limit time.

- Maximum current of 0–85% locked rotor current
- Adjustable ramp time 0.5–180 seconds (can be extended with factory modification)

Starting Characteristics—Current Limit Start

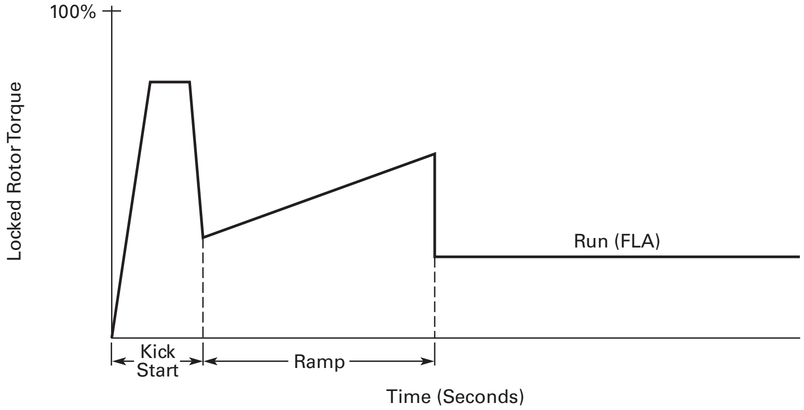


Kick Start

Selectable feature in both voltage ramp start and current limit start modes. Provides a current and torque "kick" for 0 to 2.0 seconds. This provides greater initial current to develop additional torque to breakaway a high friction load.

- 0–85% of locked rotor torque
- 0–2.0 seconds duration

Starting Characteristics—Kick Start

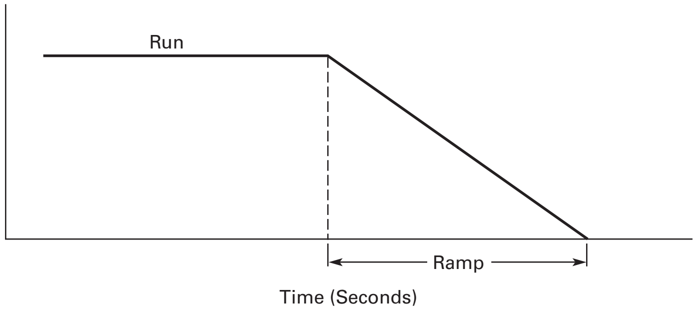


Soft Stop

Allows for a controlled stopping of a load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or load damage.

- Stop time = 0–60 seconds

Starting Characteristics—Soft Stop



Edge and Level Sensing Control

Edge Sensing

Edge sensing requires +24 Vdc power be momentarily applied to Pin 1 (with terminal P at +24 Vdc) to initiate a start under all conditions. After a stop or fault occurs, the +24 Vdc must be removed, then reapplied to pin 1 before another start can occur. This control configuration should be used when restarting of the motor after a fault or stop must be supervised manually or as a part of a control scheme. The cycling of +24 Vdc power to Terminal 1 before starting is required regardless of the position of the auto reset switch on the DIM.

Level Sensing

Level sensing will enable a motor to restart after a fault is cleared without cycling +24 Vdc power to Terminal 1 as long as:

- Terminal P is supplied with +24 Vdc (to start from Terminal Block, Input #3 must also be enabled)
- The auto reset switch on the DIM is set to enabled
- All faults have been reset

This control configuration should be used where it is desirable to restart a motor after a fault without additional manual or automatic control. An example of this condition would be on a remote pumping station where it is desirable to automatically restart a pump after a power outage without operator intervention.

Note: If the auto reset feature is used, CAUTION must be exercised to ensure that any restart occurs in a safe manner.

Features and Benefits

- Communication capabilities with various protocols
- The DIM (Digital Interface Module) provides an intuitive, easy-to-use human interface with powerful configuration capabilities to maximize system performance
- Door or device mounted DIM enables users to safely configure, commission, monitor and troubleshoot the system at the electrical panel without opening the enclosure door, eliminating the possibility of an arc flash incident
- System operating parameters can be monitored enterprise-wide through a communications network. Increase uptime by providing data for process management and preventive diagnostics
- Run internal bypass mode greatly reduces internal heating created by the greater power dissipation in the SCRs. Bypass contactor directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Internal solid-state overload protection provides accurate current measurement and trip settings. Sophisticated algorithms solve a series of differential equations that model true motor heating and cooling, resulting in superior motor overload protection while minimizing nuisance trips. Advanced selectable protective features safeguard the motor and system against a variety of system faults
- Internal run bypass contactors and overload protection eliminate the need for additional devices, reducing enclosure sizes, minimizing installation and wiring time, and reducing overall assembly size and cost
- Wide range of overload FLA settings (31–100% of rated current) and a selectable trip class (5–30) offers users the flexibility to fine tune the starter to match specific application requirements
- Variable ramp times and torque control settings provide unlimited starting configurations, allowing for maximum application flexibility
- Kick-start feature enables soft starting of high friction loads
- Soft stop control for applications where an abrupt stop of the load is not acceptable
- Pump control option with sophisticated pump algorithms on both starting and stopping that minimize the pressure surges that cause water hammer. The pump control option will maximize the life of the pump and piping systems while minimizing the downtime caused by system failure
- Six SCRs control all three motor phases, providing smooth acceleration and deceleration performance
- Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts and bearings
- Reduce the peak inrush current's stress on the power system
- Manage peak starting torque to diminish mechanical system wear and damage
- 24 Vdc control voltage enhances personnel and equipment safety
- Removable, lockable control terminal block reduces maintenance costs. Also provides the opportunity for OEMs to reduce assembly and test costs by utilizing pre-assembled wire harnesses

Protective Features

All protective features can be configured, enabled or disabled with the DIM or through the communications network.

Motor Overload

The S811 includes electronic overload protection as standard. The overload meets applicable requirements for a motor overload protective device. The overload protects the motor from over heat conditions with the use of sophisticated algorithms that model true motor heating, resulting in superior motor protection and fewer nuisance trips.

The S811 calculates a thermal memory value based on the heat energy introduced into the motor during the start process. A 100% value represents the maximum safe internal temperature of the motor.

When the thermal memory value reaches 100%, an overload trip will occur removing power to the motor. Upon trip, the S811 stores the calculated motor heating value and will not allow a motor re-start until the motor has a thermal memory value of less than 100%. This feature ensures the motor will not be damaged by repeated overload trip, reset and re-start cycles.

The thermal memory value can be monitored through the DIM or the communications network. The thermal memory value can be of great use in determining an impending overload trip condition.Alarms can be implemented in the process monitoring system warning of an impending trip before a trip occurs halting the process. Costly system downtime can be avoided.

The trip current is adjusted to match the specific application requirements by entering the motor nameplate full load current rating and trip class. The FLA parameter is adjustable from 32% to 100% of the unit's rated current. The overload trip class is adjustable from class 5 through class 30. The overload is ambient temperature compensated—meaning its trip characteristics will not vary with changes in ambient temperature. The overload protection can be enabled, disabled, or disabled on start.

Short Circuit

The use of a short-circuit protective device in coordination with the S811 is required in branch motor circuits by most electrical codes. Short-circuit coordination ratings with both fuses and Eaton molded case circuit breakers are available providing customers with design flexibility. The S811 has short-circuit coordination ratings as an open component, an enclosed starter, and in a motor control center.

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Jam

Excessive current and torque up to locked rotor levels can occur in a jam condition. The condition can result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Jam protection prevents the stress and damage from a jam during normal run. After the motor is in bypass, a current greater than 300% FLA setting will cause the starter to trip on a jam fault.

Stall

Excessive current and torque up to locked rotor levels can occur in a stall condition. The condition can lead to an overload trip and result in stress and damage to the motor, load, mechanical system, and the electrical distribution system. Stall protection prevents stress and damage to a motor that has not come up to speed during the soft start time. The S811 will trip to protect the system in the event that the motor did not get to the rated speed in the defined soft start period. A current greater than 200% FLA at the end of the soft start period will cause the starter to trip on a stall fault.

Pole Over Temperature

High ambient temperatures, extended ramp times and high duty cycle conditions may cause the S811 power pole conductors to reach a temperature that exceeds their thermal rating. The S811 is equipped with sensors that monitor the temperature of the power poles. Over temperature protection occurs if the power pole's thermal capacity is exceeded. The soft starter will trip in over temperature conditions, preventing device failure.

Each power pole temperature value can be monitored through the DIM or the communications network. This feature can be of use in determining an impending over temperature trip condition.

When using a communications network, alarms can be implemented in the process monitoring system warning of an impending trip before the trip occurs, halting the process.

Phase Loss

Loss of a phase can cause a significant increase in the current drawn in the remaining two phases. Phase loss can lead to motor damage before an eventual overload trip occurs. Phase loss is typically an indication of a failure in the electrical distribution system. The S811 will detect a phase loss and trip if any phase current drops below a preset value. The phase loss trip level is adjustable from 0% to 100% of the average of the other two phase levels with an adjustable trip delay of 0.1 to 60 seconds.

Phase Imbalance

Phase current or voltage imbalance can cause a significant increase in the current drawn in the remaining two phases. Phase imbalance can lead to motor damage before an eventual overload trip. Phase imbalance is typically an indication of a failure in the electrical distribution system or the motor. The S811 will detect both current and voltage phase imbalances and trip if any phase becomes imbalanced as compared to the average of the other two phases.

The phase current imbalance trip level is adjustable from 0% to 100% of the average of the current in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

The phase voltage imbalance trip level is adjustable from 0% to 100% of the average of the voltage in the other two phases with an adjustable trip delay of 0.1 to 60 seconds.

Reset Mode

The S811 can be set up for automatic or manual reset on trip. The manual reset mode requires the operator to physically press the RESET button located on the Soft Starter. The trip can be manually reset through the DIM or through the communications network. The trip can also be electrically reset by energizing a 24 Vdc input on the control terminal block.

The automatic reset mode allows the Soft Starter to be automatically reset as soon as the trip condition is no longer present. With the automatic reset mode, after the fault is no longer present, the motor will be restarted as soon as a valid start signal is present.

Phase Reversal

The S811 can determine if the proper line phase sequence is present by default. The device will trip if the line phase sequence is something other than A-B-C. The S811 can be configured to operate under reversed phase conditions (A-C-B).

Shorted SCR Detection

The S811 monitors the operation of the power poles and will trip under a shorted SCR condition.

Open SCR Detection

The S811 monitors the operation of the power poles and will trip under an open SCR condition.

Low Current

Low current conditions can be a result of a loss of load or a failure in the mechanical system. The S811 has low current protection that will trip if the average rms current falls below a preset value. The low current protection can be programmed as a percent of motor FLA from 0% to 100%.

Low Voltage

Low voltage conditions can result from disturbances in the electrical power distribution system. Low voltage conditions can cause a malfunction and damage to electrical equipment. The S811 has low voltage protection that will trip if the average rms voltage falls below a preset value. The low voltage protection can be programmed as a percent of nominal voltage from 1% to 99% with a trip delay of 0.1 to 60 seconds to accommodate short temporary voltage drops during the start process.

High Voltage

High voltage conditions can result from disturbances in the electrical power distribution system. High voltage conditions can cause malfunctions or failures of electrical equipment. The S811 has high voltage protection that will trip if the average rms voltage is greater than a preset value. The high voltage protection can be programmed as a percent of nominal voltage from 101% to 120% with a trip delay of 0.1 to 60 seconds.

Monitoring Capabilities

The S811 has an impressive array of system monitoring capabilities that allows users to access real time process and diagnostic data. This data can be viewed at the device with the DIM or through a communications network. Data over a communications network can provide valuable insight into the condition of the equipment and processes. Maintenance and production personnel can monitor critical operational and maintenance data from a central control station that can be located far away from the production facility. Process data can be monitored to determine system anomalies that may indicate a need for preventive maintenance or an impeding failure. Adjustments made through the communications network can reduce costs by minimizing the time traveling to the location where the motor controls are located. When faults do occur, real time fault data can assist maintenance in trouble-shooting and planning repair resources. Remote reset signals can be given to tripped devices without the need for manual intervention by maintenance personnel.

Average Line Current

Provides the average of the three-phase rms line currents in amps, accurate to within 2%. Current data can be used to indicate a need for maintenance. Increased currents in a fixed load application can indicate a reduction in system efficiencies and performance, signifying system maintenance is due.

Average Pole Current

Provides the average of the three-phase rms pole currents in amps, accurate to within 2%. The pole current is the current through the Soft Starter. The line and pole current will be identical in inline applications, and will differ in inside-the-delta applications.

Average Line Current as a % FLA

Provides the average rms line current as a percentage of the S811 FLA setting.

Three-Phase Line Currents

Provides three rms phase line currents in amps, accurate to within 2%. Imbalances or changes in the relative phase current to one another can indicate anomalies in the motor or electrical distribution system.

Three-Phase Pole Currents

Provides three rms phase pole currents in amps, accurate to within 2%. The pole current is the current through the soft starter. The line and pole current will be identical in in-line applications, and will differ in inside-the-delta applications.

Three-Phase Line Voltages

Provides the individual rms three-phase line voltages. Imbalances or changes in |the relative phase voltage to one another can indicate anomalies in the motor or electrical distribution system. Voltage can be used to monitor electrical distribution system performance. Warnings, alarms and system actions to low or high voltage conditions can be implemented.

Percent Thermal Memory

Provides the real time calculated thermal memory value. The S811 calculates thermal memory value. A 100% value represents the maximum safe internal temperature of the motor. When the thermal memory value reaches 100%, an overload trip will occur, removing power to the motor.

The thermal memory value can be of great use in determining an impending overload trip condition. When using a communications network, alarms can be implemented in the process monitoring system warning of an impending trip before the trip occurs, halting the process. Costly system downtime can be avoided.

DC Control Voltage

Monitors level of the 24 Vdc control voltage. Fluctuations in control voltage can cause component malfunction and failure. System control voltage data can be used to implement warnings, alarms and system actions to low or high voltage conditions.

Pole Temperature

Increases in power pole temperature are caused by increases in ambient temperature, start/stop times and start duty cycles. Changes in pole temperatures represent a change in system operating conditions. Identifying unexpected operating conditions or changes can prompt maintenance and aid in process evaluation activities.

PCB Device Temperature

An increase in printed circuit board (device) temperature is a strong indication of an increase in ambient temperature. High ambient temperature operation can be identified with the device temperature data. Device temperature increases can be due to undersized enclosures, failure of cooling fans or blocked venting. High operating temperatures will reduce the life of all electrical equipment in the enclosure.

Start Count

Start count data can be used to monitor system output, schedule preventative maintenance, identify system anomalies and identify changes in system operation.

Diagnostics

Fault Queue

Current fault and a fault queue containing the last nine system faults can be read through the DIM or communications network. Fault identification can minimize troubleshooting time and cost, and prevent arc flash incidents. The fault queue can be remotely accessed through a communications network to assist in planning maintenance resources. Thirty different faults can be identified by the S811.

Control Status

The S811 provides data that represents system conditions that can be read through the DIM or the communications network. This data identifies the status of the system and the control commands the system is requesting of the S811. This can be used for advanced troubleshooting and system integration activities.

Breaker Status

The S811 has provisions to read and display circuit breaker status. Eaton communicating cover control or other communicating protective device is required to take advantage of this feature.

Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL listed (NMFT-E202571) Frame N37 to V85
- UL recognized (NMFT2)–Frame V10
- CE marked
- CSA certified (3211 06)
- CSA elevator (2411 01)

Instructional Leaflets

- User manual MN03902002E
- Inside-the-Delta user manual MN03902009E
- Outline drawings:
  - 65 mm, N-Frame: 10-8574
  - 110 mm, R-Frame: 10-8575
  - 200 mm, T-Frame: 10-8576
  - 200 mm, U-Frame: 10-8857
  - 290 mm, V-Frame: 10-8577

Catalog Number Selection

S811 Open Soft Starters ①

S 811 T 30 N 3 S

S = Soft Starter

811 = Non-combination soft starter

Frame Size ②

- **N** = 65 mm
- **R** = 110 mm
- **T** = 200 mm
- **U** = 200 mm
- **V** = 290 mm

Ampere Rating

37 = 37A	**24** = 240A	**65** = 650A
66 = 66A	**30** = 304A	**72** = 720A
10 = 105A	**36** = 360A	**85** = 850A
13 = 135A	**42** = 420A	**10** = 1000A
18 = 180A	**50** = 500A ③	

Options

- **N** = No options
- **P** = Pump control
- **V** = 690V option (Frame T18 through V85) ④

Number of Poles

- **3** = Three-pole device

- **S** = Standard soft starter (configurable for edge or level control)
- **D** = Inside-the-delta
- **L** = Extended ramp start
- **W** = Without DIM

Notes

① All units require a 24 Vdc power supply found on catalog **Page V6-T1-107**, or equivalent.
② T-, U- and V-Frames require lug kits found on **Page V6-T1-107**.
③ U-Frame 500A unit does not have IEC certification.
④ Not available in U-Frame.

Product Selection

Standard Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	300%	30 sec.	3	50°C
Full voltage	500%	10 sec.	3	50°C
Wye-delta	350%	20 sec.	3	50°C
80% RVAT	480%	20 sec.	2	50°C
65% RVAT	390%	20 sec.	3	50°C
50% RVAT	300%	20 sec.	4	50°C

Motor applications and customer needs come in many different varieties. With the standard and severe duty rating tables, we have attempted to provide guidelines on what the soft starter is capable of. If the application falls under these categories, you can use these charts. For other applications, or when a question arises, consult with your local Eaton representative or call our Technical Resource Center.

S811

Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V [1] 1.0SF	575–690V [1] 1.15SF	Catalog Number
Frame Size N												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	**S811N37N3S**
66	18.5	30	37	20	15	20	20	50	40	60	50	**S811N66N3S**
Frame Size R												
105	30	55	59	30	25	40	30	75	60	100	75	**S811R10N3S**
135	40	63	80	40	30	50	40	100	75	125	100	**S811R13N3S**
Frame Size T												
180	51	90	110	60	50	60	60	150	125	150	150	**S811T18N3S**
240	75	110	147	75	60	75	75	200	150	200	200	**S811T24N3S**
304	90	160	185	100	75	100	100	250	200	300	250	**S811T30N3S**
Frame Size U												
360	110	185	220	125	100	150	125	300	250	350	300	**S811U36N3S**
420	129	220	257	150	125	175	150	350	300	450	350	**S811U42N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S811U50N3S** [2]
Frame Size V												
360	110	185	220	125	100	150	125	300	250	350	300	**S811V36N3S**
420	129	220	257	150	125	175	150	350	300	450	350	**S811V42N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S811V50N3S**
650	200	355	425	250	200	250	200	500	450	600	500	**S811V65N3S**
720	220	400	450	—	—	300	250	600	500	700	600	**S811V72N3S**
850	257	475	500	—	—	350	300	700	600	900	700	**S811V85N3S**
1000	277	525	550	—	—	400	350	800	700	900	800	**S811V10N3S** [3]

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

[1] 690V is available only from T18 thru V85. Not available on U-Frames.
[2] 500A rating does not have IEC certification.
[3] For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

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S811

Standard Duty—25 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V ① 1.0SF	575–690V ① 1.15SF	Catalog Number
Frame Size N												
34	9	15	18.5	10	7-1/2	10	10	25	20	30	25	**S811N37N3S**
63	15	30	33	20	15	20	20	40	40	60	50	**S811N66N3S**
Frame Size R												
96	25	45	55	30	25	30	30	75	60	75	75	**S811R10N3S**
120	33	63	63	40	30	40	40	75	75	100	100	**S811R13N3S**
Frame Size T												
150	45	80	90	50	40	50	50	100	100	150	125	**S811T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S811T24N3S**
278	80	147	160	75	75	100	75	200	200	250	250	**S811T30N3S**
Frame Size U												
320	90	160	185	100	75	125	100	250	200	300	250	**S811U36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811U42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S811U50N3S** ②
Frame Size V												
320	90	160	185	100	75	125	100	250	200	300	250	**S811V36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811V42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S811V50N3S**
610	185	315	375	250	150	200	200	500	450	600	500	**S811V65N3S**
680	200	375	445	—	200	250	200	600	500	700	600	**S811V72N3S**
810	250	450	500	—	—	300	300	700	600	900	700	**S811V85N3S**
890	290	510	560	—	—	400	350	700	600	900	700	**S811V10N3S** ③

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.

② 500A rating does not have IEC certification.

③ For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

S811

Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 50°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V ① 1.0SF	575–690V ① 1.15SF	Catalog Number
Frame Size N												
34	9	15	18.5	10	7-1/2	10	10	25	20	30	25	**S811N37N3S**
63	15	30	33	20	15	20	20	40	40	60	50	**S811N66N3S**
Frame Size R												
96	25	45	55	30	25	30	30	75	60	75	75	**S811R10N3S**
120	33	63	63	40	30	40	40	75	75	100	100	**S811R13N3S**
Frame Size T												
150	45	80	90	50	40	50	50	100	100	150	125	**S811T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S811T24N3S**
278	80	147	160	75	75	100	75	200	200	250	250	**S811T30N3S**
Frame Size U												
320	90	160	185	100	75	125	100	250	200	300	250	**S811U36N3S**
460	110	200	220	125	100	150	125	300	250	350	300	**S811U42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S811U50N3S** ②
Frame Size V												
320	90	160	185	100	75	125	100	250	200	300	250	**S811V36N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811V42N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S811V50N3S**
610	185	315	375	250	150	200	200	500	450	600	500	**S811V65N3S**
680	200	375	445	—	200	250	200	600	500	700	600	**S811V72N3S**
830	257	450	500	—	—	300	300	700	600	900	700	**S811V85N3S**
960	302	510	540	—	—	350	300	800	700	900	800	**S811V10N3S** ③

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.
② 500A rating does not have IEC certification.
③ For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

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S811

Standard Duty—50 Second Ramp, 2 Starts per Hour, 300% Current Limit at 50°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V ① 1.0SF	575–690V ① 1.15SF	Catalog Number
Frame Size N												
21	5.5	10	11	5	5	5	5	15	10	15	15	**S811N37N3S**
42	11	18.5	22	10	10	15	10	30	25	40	30	**S811N66N3S**
Frame Size R												
60	15	30	33	15	15	20	15	40	40	50	50	**S811R10N3S**
80	22	40	45	25	20	30	25	60	50	75	60	**S811R13N3S**
Frame Size T												
115	33	59	63	30	30	40	30	75	75	100	100	**S811T18N3S**
150	45	80	90	50	40	50	50	100	100	150	125	**S811T24N3S**
192	55	100	110	60	50	60	60	150	125	200	150	**S811T30N3S**
Frame Size U												
280	80	150	160	75	75	100	75	200	200	250	250	**S811U36N3S**
340	110	180	200	100	100	125	100	250	200	350	300	**S811U42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811U50N3S** ②
Frame Size V												
280	80	150	160	75	75	100	75	200	200	250	250	**S811V36N3S**
340	110	180	200	100	100	125	100	250	200	350	300	**S811V42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S811V65N3S**
480	147	257	295	150	150	200	150	400	350	500	450	**S811V72N3S**
590	180	315	375	200	150	200	200	500	400	600	500	**S811V85N3S**
650	205	370	415	250	200	250	200	500	450	600	500	**S811V10N3S** ③

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.
② 500A rating does not have IEC certification.
③ For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

S811

Standard Duty—15 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C

Max. Current	Three-Phase Motors kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575–690V ① 1.0SF	575–690V ① 1.15SF	Catalog Number
Frame Size N												
29	7.5	12.5	15	7-1/2	7-1/2	10	7-1/2	20	15	25	20	**S811N37N3S**
49	12.5	22	25	15	10	15	15	30	30	40	40	**S811N66N3S**
Frame Size R												
73	18.5	37	40	20	20	25	20	50	40	60	60	**S811R10N3S**
94	25	45	55	30	25	30	30	60	60	75	75	**S811R13N3S**
Frame Size T												
155	45	80	90	50	40	60	50	100	100	150	125	**S811T18N3S**
219	63	110	132	60	60	75	60	150	150	200	150	**S811T24N3S**
280	80	150	160	75	75	100	75	200	200	250	250	**S811T30N3S**
Frame Size U												
345	100	185	200	100	100	125	100	250	200	350	300	**S811U36N3S**
405	110	200	250	125	100	150	125	300	250	400	350	**S811U42N3S**
Frame Size V												
345	100	185	200	100	100	125	100	250	200	350	300	**S811V36N3S**
405	110	200	250	125	100	150	125	300	250	400	350	**S811V42N3S**
465	140	250	280	150	125	150	150	350	300	450	400	**S811V50N3S**
530	160	280	335	150	150	200	150	450	350	500	450	**S811V65N3S**
590	180	315	375	200	150	—	200	500	400	600	500	**S811V72N3S**
651	200	355	425	—	—	—	—	600	450	700	600	**S811V85N3S**
754	220	400	465	—	—	—	—	600	500	800	700	**S811V10N3S** ②

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.

② For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

1

S811

Standard Duty—30 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C

	Three-Phase Motors kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V [1]		
Max. Current	**230V**	**380–400V**	**440V**	**1.0SF**	**1.15SF**	**1.0SF**	**1.15SF**	**1.0SF**	**1.15SF**	**1.0SF**	**1.15SF**	**Catalog Number**
Frame Size N												
21	5.5	10	12.5	5	5	5	5	15	10	15	15	**S811N37N3S**
40	11	18.5	22	10	10	10	10	30	25	30	30	**S811N66N3S**
Frame Size R												
55	15	25	30	15	15	20	15	40	30	50	40	**S811R10N3S**
75	22	37	45	20	20	25	20	50	50	60	60	**S811R13N3S**
Frame Size T												
151	45	80	90	50	40	50	50	100	100	150	125	**S811T18N3S**
215	63	110	132	60	60	75	60	150	150	200	150	**S811T24N3S**
264	80	140	160	75	75	100	75	200	150	250	200	**S811T30N3S**
Frame Size U												
300	90	160	185	100	75	100	100	200	200	300	250	**S811U36N3S**
340	100	180	200	100	100	125	100	250	200	350	300	**S811U42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811U50N3S**
Frame Size V												
300	90	160	185	100	75	100	100	200	200	300	250	**S811V36N3S**
340	100	180	200	100	100	125	100	250	200	350	300	**S811V42N3S**
380	110	200	220	125	100	150	125	300	250	350	300	**S811V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S811V65N3S**
460	140	250	280	150	125	150	150	350	300	450	400	**S811V72N3S**
500	150	257	300	150	150	200	150	400	350	500	450	**S811V85N3S**
560	160	277	325	200	150	250	200	500	400	600	500	**S811V10N3S** [2]

For **Pump Option**, replace character **8** with **"P"** and also, see **Page V6-T1-108**.

Notes

[1] 690V is available only from T18 thru V85. Not available on U-Frames.

[2] For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

Severe Duty

Severe Duty Ratings

Starting Method	Ramp Current % of FLA	Ramp Time Seconds	Starts per Hour	Ambient Temperature
Soft start	450%	30 sec.	4	50°C
Full voltage	500%	10 sec.	10	50°C
Wye-delta	350%	65 sec.	3	50°C
80% RVAT	480%	25 sec.	4	50°C
65% RVAT	390%	40 sec.	4	50°C
50% RVAT	300%	60 sec.	4	50°C

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where the ramp time is over 30 seconds, the number of starts per hour exceeds 4, or the current limit set is over 300%. *Example:* 35-second ramp, 5 starts per hour, 350% current limit at 40°C ambient.

S811

Severe Duty—>30 Second Ramp, >4 Starts per Hour or >300% Current Limit

	Three-Phase Motors											
	kW Rating (50 Hz)			hp Rating (60 Hz)								
				200V		230V		460V		575–690V ①		
Max. Current	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	Catalog Number
Frame Size N												
22	5.5	10	11	5	5	7-1/2	5	15	10	20	15	**S811N37N3S**
42	11	18.5	22	10	10	15	10	30	25	40	30	**S811N66N3S**
Frame Size R												
65	15	30	33	15	15	20	15	50	40	50	50	**S811R10N3S**
80	22	40	45	25	20	30	25	60	50	75	60	**S811R13N3S**
Frame Size T												
115	33	59	63	30	30	40	30	75	75	100	100	**S811T18N3S**
150	45	80	90	50	40	50	50	100	100	150	125	**S811T24N3S**
192	55	100	110	60	50	75	60	150	125	200	150	**S811T30N3S**
Frame Size U												
240	75	110	147	75	60	75	75	200	150	200	200	**S811U36N3S**
305	90	160	185	100	75	100	100	250	200	300	250	**S811U42N3S**
Frame Size V												
240	75	110	147	75	60	75	75	200	150	200	200	**S811V36N3S**
305	90	160	185	100	75	100	100	250	200	300	250	**S811V42N3S**
365	110	185	220	125	100	150	125	300	250	350	300	**S811V50N3S**
420	129	220	257	150	125	150	150	350	300	450	350	**S811V65N3S**
480	147	257	295	150	150	200	150	400	350	500	450	**S811V72N3S**
525	160	280	335	150	150	200	150	450	350	500	450	**S811V85N3S**
575	172	303	370	200	150	250	200	500	450	600	500	**S811V10N3S** ②

Notes

① 690V is available only from T18 thru V85. Not available on U-Frames.

② For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

1

Inside-the-Delta Standard Duty Ratings

S811

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number
Frame Size N												
65	10	18.5	18.5	15	15	15	15	40	30	50	50	**S811N37N3D**
114	18.5	30	37	30	25	30	30	75	60	100	75	**S811N66N3D**
Frame Size R												
182	30	55	59	50	40	60	50	125	100	150	125	**S811R10N3D**
234	40	63	80	60	50	75	60	150	125	200	150	**S811R13N3D**
Frame Size T												
311	51	90	110	100	75	100	100	250	200	250	250	**S811T18N3D**
415	75	110	147	125	100	125	125	300	250	300	300	**S811T24N3D**
526	90	160	185	150	125	150	150	400	300	400	400	**S811T30N3D**
Frame Size U												
623	110	185	220	200	150	250	200	450	400	550	450	**S811U36N3D**
727	129	220	257	250	200	300	250	550	450	700	550	**S811U42N3D**
865	150	257	300	250	250	300	250	600	550	750	700	**S811U50N3D** ①②
Frame Size V												
623	110	185	220	200	150	250	200	450	400	550	450	**S811V36N3D**
727	129	220	257	250	200	300	250	550	450	700	550	**S811V42N3D**
865	150	257	300	250	250	300	250	600	550	750	700	**S811V50N3D**
1125	200	355	425	400	300	400	300	750	700	900	750	**S811V65N3D**
1246	—	—	—	—	—	—	—	—	—	—	—	**S811V72N3D**
1471	—	—	—	—	—	—	—	—	—	—	—	**S811V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S811V10N3D** ③

Notes

① 15 sec. start, 300% inrush, 40°C, 1 start every 15 minutes. If these start parameters are exceeded, please refer to 290 mm V-Frame, 865A inside-the-delta starter.

② U-Frame 500A unit does not have IEC certification.

③ For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

S811

Inside-the-Delta Standard Duty—25 Second Ramp, 4 Starts per Hour, 300% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number
				200V		230V		460V		575V		
	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
Frame Size N												
58	9	15	18.5	15	10	15	15	40	30	50	40	**S811N37N3D**
108	15	30	33	30	25	30	30	60	60	100	75	**S811N66N3D**
Frame Size R												
164	25	45	55	50	40	50	50	125	100	125	125	**S811R10N3D**
206	33	63	63	60	50	60	50	125	125	150	150	**S811R13N3D**
Frame Size T												
257	45	80	90	75	60	75	60	150	150	250	200	**S811T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S811T24N3D**
477	80	147	160	125	125	150	125	300	300	400	400	**S811T30N3D**
Frame Size U												
554	90	160	185	150	125	200	150	400	300	450	400	**S811U36N3D**
646	110	200	220	200	150	250	200	500	400	550	450	**S811U42N3D**
796	140	250	280	250	200	250	250	550	500	700	600	**S811U50N3D** [1,2]
Frame Size V												
554	90	160	185	150	125	200	150	400	300	450	400	**S811V36N3D**
646	110	200	220	200	150	250	200	500	400	550	450	**S811V42N3D**
796	140	250	280	250	200	250	250	550	500	700	600	**S811V50N3D**
1055	185	315	375	400	250	300	300	800	700	900	750	**S811V65N3D**
1176	200	375	445	—	300	400	300	900	800	900	900	**S811V72N3D**
1358	—	—	—	—	—	—	—	—	—	—	—	**S811V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S811V10N3D** [3]

Notes

[1] 15 sec. start, 300% inrush, 40°C, 1 start every 15 minutes. If these start parameters are exceeded, please refer to 290 mm V-Frame, 796A inside-the-delta starter.

[2] U-Frame 500A unit does not have IEC certification.

[3] For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

1

S811

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 300% Current Limit at 50°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575V 1.0SF	1.15SF	Catalog Number
Frame Size N												
58	9	15	18.5	15	10	15	15	40	30	50	40	**S811N37N3D**
108	15	30	33	30	25	30	30	60	60	100	75	**S811N66N3D**
Frame Size R												
164	25	45	55	50	40	50	50	125	100	125	125	**S811R10N3D**
206	33	63	63	60	50	60	60	125	125	150	150	**S811R13N3D**
Frame Size T												
257	45	80	90	75	60	75	75	150	150	250	200	**S811T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S811T24N3D**
477	80	147	160	125	125	150	125	300	300	400	400	**S811T30N3D**
Frame Size U												
554	90	160	185	150	125	200	150	400	300	450	400	**S811U36N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811U42N3D**
796	140	250	280	250	200	250	250	550	450	700	600	**S811U50N3D** ①
Frame Size V												
554	90	160	185	150	125	200	150	400	300	450	400	**S811V36N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811V42N3D**
796	140	250	280	250	200	250	250	550	450	700	600	**S811V50N3D**
1055	185	315	375	400	250	300	300	750	700	900	750	**S811V65N3D**
1176	200	375	445	—	—	—	—	—	—	—	—	**S811V72N3D**
1358	257	450	500	—	—	—	—	—	—	—	—	**S811V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S811V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

S811

Inside-the-Delta Standard Duty—50 Second Ramp, 2 Starts per Hour, 300% Current Limit at 50°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number
				200V		230V		460V		575V		
	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
Frame Size N												
36	5.5	10	11	7-1/2	7-1/2	7-1/2	7-1/2	25	15	25	25	**S811N37N3D**
73	11	18.5	22	15	15	25	15	50	40	60	50	**S811N66N3D**
Frame Size R												
103	15	30	33	25	25	30	25	60	60	75	75	**S811R10N3D**
138	22	40	45	40	30	50	40	100	75	125	100	**S811R13N3D**
Frame Size T												
199	33	59	63	50	50	60	50	125	125	150	150	**S811T18N3D**
257	45	80	90	75	60	75	75	150	150	250	200	**S811T24N3D**
324	55	100	110	100	75	100	100	250	200	300	250	**S811T30N3D**
Frame Size U												
485	80	150	160	125	125	150	125	300	300	400	400	**S811U36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S811U42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811U50N3D** ①
Frame Size V												
485	80	150	160	125	125	150	125	300	300	400	400	**S811V36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S811V42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811V50N3D**
727	129	220	257	250	200	250	250	550	500	700	550	**S811V65N3D**
816	147	257	295	250	250	300	250	600	550	750	700	**S811V72N3D**
1021	180	315	375	300	250	300	300	750	600	900	750	**S811V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S811V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

S811

Inside-the-Delta Standard Duty—15 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number
Frame Size N												
47	7.5	12.5	15	10	10	15	10	30	25	40	30	**S811N37N3D**
83	12.5	22	25	25	15	25	25	50	50	60	60	**S811N66N3D**
Frame Size R												
126	18.5	37	40	30	30	40	30	75	60	100	100	**S811R10N3D**
162	25	45	55	50	40	50	50	100	100	125	125	**S811R13N3D**
Frame Size T												
266	45	80	90	75	60	100	75	150	150	250	200	**S811T18N3D**
379	63	110	132	100	100	125	100	250	250	300	250	**S811T24N3D**
485	80	150	160	125	125	150	125	300	300	400	400	**S811T30N3D**
Frame Size U												
580	100	185	200	150	150	200	150	400	300	550	450	**S811U36N3D**
695	110	200	250	200	150	250	200	450	400	600	550	**S811U42N3D**
798	140	250	280	250	200	250	250	550	450	700	600	**S811U50N3D** ①
Frame Size V												
580	100	185	200	150	150	200	150	400	300	550	450	**S811V36N3D**
695	110	200	250	200	150	250	200	450	400	600	550	**S811V42N3D**
798	140	250	280	250	200	250	250	550	450	700	600	**S811V50N3D**
908	160	280	335	250	250	300	250	700	550	750	700	**S811V65N3D**
1021	—	—	—	—	—	—	—	—	—	—	—	**S811V72N3D**
1125	—	—	—	—	—	—	—	—	—	—	—	**S811V85N3D**

Note

① U-Frame 500A unit does not have IEC certification.

S811

Inside-the-Delta Standard Duty—30 Second Ramp, 4 Starts per Hour, 450% Current Limit at 40°C Ambient

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz)			hp Rating (60 Hz)								Catalog Number
				200V		230V		460V		575V		
	230V	380–400V	440V	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
Frame Size N												
36	5.5	10	12.5	7-1/2	7-1/2	7-1/2	7-1/2	25	15	25	25	**S811N37N3D**
69	11	18.5	22	15	15	15	15	50	40	50	50	**S811N66N3D**
Frame Size R												
96	15	25	30	25	25	30	25	60	50	75	60	**S811R10N3D**
130	22	37	45	30	30	40	30	75	75	100	100	**S811R13N3D**
Frame Size T												
257	45	80	90	75	60	75	75	150	150	250	200	**S811T18N3D**
365	63	110	132	100	100	125	100	250	250	300	250	**S811T24N3D**
448	80	140	160	125	125	150	125	300	250	400	300	**S811T30N3D**
Frame Size U												
503	90	160	185	150	125	150	150	300	300	450	400	**S811U36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S811U42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811U50N3D** ①
Frame Size V												
503	90	160	185	150	125	150	150	300	300	450	400	**S811V36N3D**
580	100	180	200	150	150	200	150	400	300	550	450	**S811V42N3D**
646	110	200	220	200	150	250	200	450	400	550	450	**S811V50N3D**
727	129	220	257	250	200	250	250	550	450	700	550	**S811V65N3D**
796	—	—	—	—	—	—	—	—	—	—	—	**S811V72N3D**
865	—	—	—	—	—	—	—	—	—	—	—	**S811V85N3D**

Note

① U-Frame 500A unit does not have IEC certification.

Inside-the-Delta Severe Duty Ratings

Severe duty ratings are defined as any combination of parameters that exceed the standard duty ratings where the ramp time is over 30 seconds, the number of starts per hour exceeds 4, or the current limit set is over 300%.

Example: 35-second ramp, 5 starts per hour 350% current limit at 40°C ambient.

S811

Inside-the-Delta Severe Duty

Max. Continuous Motor Line Current	Three-Phase Motor kW Rating (50 Hz) 230V	380–400V	440V	hp Rating (60 Hz) 200V 1.0SF	200V 1.15SF	230V 1.0SF	230V 1.15SF	460V 1.0SF	460V 1.15SF	575V 1.0SF	575V 1.15SF	Catalog Number
Frame Size N												
39	5.5	10	11	7-1/2	7-1/2	10	7-1/2	25	15	30	25	**S811N37N3D**
73	11	18.5	22	15	15	25	15	50	40	60	50	**S811N66N3D**
Frame Size R												
111	15	30	33	25	25	30	25	75	60	75	75	**S811R10N3D**
138	22	40	45	40	30	50	40	100	75	120	100	**S811R13N3D**
Frame Size T												
199	33	59	63	50	50	60	50	125	125	150	150	**S811T18N3D**
257	45	80	90	75	60	75	75	150	150	250	200	**S811T24N3D**
324	55	100	110	100	75	100	100	250	200	300	250	**S811T30N3D**
Frame Size U												
415	75	110	147	125	100	125	125	300	250	300	300	**S811U36N3D**
526	90	160	185	150	120	150	150	400	300	450	400	**S811U42N3D**
623	110	185	220	200	150	250	200	450	400	550	450	**S811U50N3D** ①
Frame Size V												
415	75	110	147	125	100	125	125	300	250	300	300	**S811V36N3D**
526	90	160	185	150	120	150	150	400	300	450	400	**S811V42N3D**
623	110	185	220	200	150	250	200	450	400	550	450	**S811V50N3D**
727	129	220	257	250	200	250	250	550	450	700	550	**S811V65N3D**
816	147	257	295	250	250	300	250	600	550	750	700	**S811V72N3D**
908	160	280	335	250	250	300	250	700	550	750	700	**S811V85N3D**
—	—	—	—	—	—	—	—	—	—	—	—	**S811V10N3D** ②

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information on optimum performance of the 1000A Frame Size V S811, see Appendix E of MN03902002E.

Accessories

Lug Kits

The T and U frame (200 mm) and V frame (290 mm) each have different lug options based on your wiring needs.

The T and U frame (200 mm) and V frame (290 mm) soft starters each have different lug options based on your wiring needs. Each lug kit contains three lugs that can be mounted on either the load or line side.

Lug Kit

Lug Kits

Frame Size	Frame Designation	Description	Catalog Number
200 mm SSRV	T, U	2 cable connections, 4 AWG to 1/0 cable	**EML22**
		1 cable connection, 4/0 to 500 kcmil cable	**EML23**
		2 cable connections, 4/0 to 500 kcmil cable	**EML24**
		1 cable connection, 2/0 to 300 kcmil cable	**EML25**
		2 cable connections, 2/0 to 300 kcmil cable	**EML26**
290 mm SSRV	V	2 cable connections, 4/0 to 500 kcmil cable	**EML28**
		4 cable connections, 4/0 to 500 kcmil cable	**EML30**
		6 cable connections, 4/0 to 500 kcmil cable	**EML32**
		4 cable connections, 2/0 to 300 kcmil cable	**EML33** ①

Power Supplies

24 Vdc power supply that can be used with the S811 SSRV or as a stand-alone device.

Power Supplies

Description	Catalog Number
85–264 Vac input 24 Vdc output	**PSG240E**
360–575 Vac input 24 Vdc output	**PSG240F**

Lug Cover Kits

Replacement covers for the T- and V-Frame are available in case of damage to the existing covers.

Lug Cover Kits

Description	Catalog Number
Lug cover T-, U-Frame	**EML27**
Lug cover V-Frame	**EML34**

IP20 Kits

IP20 Kits

Description	Catalog Number
N-Frame kit	**SS-IP20-N**
R-Frame kit	**SS-IP20-R**
T- and U-Frame kit	**SS-IP20-TU**
V-Frame kit	**SS-IP20-V**

Surge Suppressors

The surge suppressor can mount on either the line or load side of the soft starter. It is designed to clip the line voltage (or load side induced voltage).

Surge Suppressor

Surge Suppressors

Description	Catalog Number
600V MOV for 200 mm and 290 mm units	**EMS39**
690V MOV for 200 mm and 290 mm units ②	**EMS41**

Notes

① The EML33 does not have a CSA listing.
② T-Frame only.
③ For more information, see Pub. 51719.

Mounting Plates

The mounting plates are designed to help make it easy to install or retrofit the soft starter into enclosures and MCCs. The soft starter can be mounted onto the plate prior to installation. The mounting plate is designed with tear drop mounting holes for easier installation.

Mounting Plates

Description	Catalog Number
Mounting Plate N-Frame	**EMM13N**
Mounting Plate R-Frame	**EMM13R**
Mounting Plate T-, U-Frame	**EMM13T**
Mounting Plate V-Frame	**EMM13V**

Vibration Plates

The vibration plates allow the soft starter to be applied in high shock and vibration applications. The vibration plate allows vibration up to 5g and shock in up to 40g. The soft starter is mounted onto the vibration plate prior to installation in the panel.

Vibration Plates

Description	Catalog Number
Vibration plate N-Frame	**EMM14N**
Vibration plate R-Frame	**EMM14R**
Vibration plate T-, U-Frame	**EMM14T**
Vibration plate V-Frame	**EMM14V**

Adapter Plates

The adapter plate allows customers to retrofit a V-Frame 290 mm soft starter with the U-Frame 200 mm soft starter.

Adapter Plates

Description	Catalog Number
Adapter plates ②	**EMM13U**

Control Wire Connector

Control Wire Connector

Description	Catalog Number
12-pin, 5 mm pitch connector for control wiring	**EMA75**

Control Interface Module

The Control Interface Module (CIM) is available as a replacement part in two versions.

CIM

Description	Catalog Number
Blank cover (filler)	**EMA68**
CIM for standard unit	**EMA71**
CIM for pump control option	**EMA72**
Panel mounting kit	
3 ft cable	**EMA69A**
5 ft cable	**EMA69B**
8 ft cable	**EMA69C**
10 ft cable	**EMA69D**

Options

Pump Control

For pump control option, change the **8th** digit in the catalog number to **P**.

Pump Control Option

Frame Size	Max. Current	Catalog Number
N	37	**S811N37P3S**
	66	**S811N66P3S**
R	105	**S811R10P3S**
	135	**S811R13P3S**
T	180	**S811T18P3S**
	240	**S811T24P3S**
	304	**S811T30P3S**
U	360	**S811U36P3S**
	420	**S811U42P3S**
	500	**S811U50P3S** ①
V	360	**S811V36P3S**
	420	**S811V42P3S**
	500	**S811V50P3S**
	650	**S811V65P3S**
	720	**S811V72P3S**
	850	**S811V85P3S**
	1000	**S811V10P3S**

Extended Ramp

For a longer ramp acceleration time of 0.5–360 seconds, change the last digit in the catalog number from **Page V6-T1-93** to **L**.

Extended Ramp Option

Frame Size	Max. Current	Catalog Number
N	37	**S811N37N3L**
	66	**S811N66N3L**
R	105	**S811R10N3L**
	135	**S811R13N3L**
T	180	**S811T18N3L**
	240	**S811T24N3L**
	304	**S811T30N3L**
U	360	**S811U36N3L**
	420	**S811U42N3L**
	500	**S811U50N3L** ①
V	360	**S811V36N3L**
	420	**S811V42N3L**
	500	**S811V50N3L**
	650	**S811V65N3L**
	720	**S811V72N3L**
	850	**S811V85N3L**
	1000	**S811V10N3L**

Extended Ramp and 690V Option

690V ratings are available on the T- and V-Frames by changing the **8th** digit in the 0.0 to **V**.

690V Option

Frame Size	Max. Current	Catalog Number
T	180	**S811T18V3L**
	240	**S811T24V3L**
	304	**S811T30V3L**
V	360	**S811V36V3L**
	420	**S811V42V3L**
	500	**S811V50V3L**
	650	**S811V65V3L**
	720	**S811V72V3L**
	850	**S811V85V3L**

Cooling Fan Kit

The EMM18 cooling fan kit mounts on either side of any frame size S801 Soft Starter to provide additional printed circuit board cooling in high ambient operating temperatures.

Cooling Fan Kit

Description	Catalog Number
Fan Kit	**EMM18**

Notes

① U-Frame 500A unit does not have IEC certification.

② For more information, see Pub 51719.

Technical Data and Specifications

Soft Starters—S811

Description	S811 Soft Starter (Partial Catalog Number) S811N37	S811N66	S811R10	S811R13
Max. current capacity	37	66	105	135
FLA range	11–37	20–66	32–105	42–135
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1	1	1	1
Wire sizes	14–2	14–2	14–4/0	14–4/0
Type of connectors	Box lug	Box lug	Box lug	Box lug
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Soft Starters—S811, continued

Description	S811 Soft Starter (Partial Catalog Number) S811T18	S811T24	S811T30	S811U36
Max. current capacity	180	240	304	360
FLA range	56–180	75–240	95–304	112–360
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1 or 2	1 or 2	1 or 2	1 or 2
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.0	1.0
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Soft Starters—S811, continued

Description	S811 Soft Starter (Partial Catalog Number) S811U42	S811U50 ①	S811V36	S811V42
Max. current capacity	420	500	360	420
FLA range	131–420	156–500	112–360	131–420
General Information				
Bypass mechanical lifespan	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g
Electrical Information				
Operating voltage	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)				
Number of conductors	1 or 2	1 or 2	2, 4 or 6	2, 4 or 6
Wire sizes	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil	4 AWG to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)				
Wire sizes in AWG	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31
Control Power Requirements				
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.0	1.0	1.4	1.4
Inrush current amps	10	10	10	10
Ripple	1%	1%	1%	1%
Relays (1) Class A and C				
Voltage AC—maximum	240	240	240	240
Voltage DC—maximum	120	120	120	120
Amps—maximum	3	3	3	3
Environment				
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V

Note

① U-Frame 500A unit does not have IEC certification.

1

Soft Starters—S811, continued

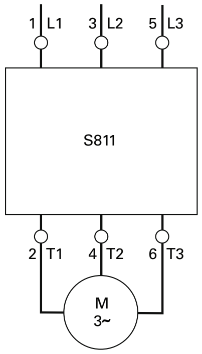
Description	S811 Soft Starter (Partial Catalog Number) S811V50	S811V65	S811V72	S811V85	S811V10 ①
Max. current capacity	500	650	720	850	1000
FLA range	156–500	203–650	225–720	265–580	320–1000
General Information					
Bypass mechanical lifespan	10M	10M	10M	10M	10M
Insulating voltage Ui	660V	660V	660V	660V	660V
Ramp time range	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)	0.5–180 seconds (0.5–360 seconds extended ramp)
Resistance to vibration	3g	3g	3g	3g	3g
Resistance to shock	15g	15g	15g	15g	15g
Electrical Information					
Operating voltage	200–600V	200–600V	200–600V	200–600V	200–600V
Operating frequency	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz	47–63 Hz
Overload setting	30–100%	30–100%	30–100%	30–100%	30–100%
Trip class	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30	5, 10, 20 and 30
Cabling Capacity (IEC 947)					
Number of conductors	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6	2, 4 or 6
Wire sizes	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil	2/0 to 500 kcmil
Type of connectors	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit	Add-on lug kit
Control Wiring (12-Pin)					
Wire sizes in AWG	22–14	22–14	22–14	22–14	22–14
Number of conductors (stranded)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)	2 (or one AWG 12)
Torque requirements in lb-in	3.5	3.5	3.5	3.5	3.5
Solid, stranded or flexible max. size in mm^2	3.31	3.31	3.31	3.31	3.31
Control Power Requirements					
Voltage range (24V ±10%)	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4	21.6–26.4
Steady-state current amps	1.4	1.4	1.4	1.4	1.4
Inrush current amps	10	10	10	10	10
Ripple	1%	1%	1%	1%	1%
Relays (1) Class A and C					
Voltage AC—maximum	240	240	240	240	240
Voltage DC—maximum	120	120	120	120	120
Amps—maximum	3	3	3	3	3
Environment					
Temperature—operating	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C	–30 to 50°C (no derating) consult factory for operation >50°C
Temperature—storage	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C	–50 to 70°C
Altitude	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m	<2000m—consult factory for operation >2000m
Humidity	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing	<95% noncondensing
Operating position	Any	Any	Any	Any	Any
Pollution degree IEC947-1	3	3	3	3	3
Impulse withstand voltage IEC947-4-1	6000V	6000V	6000V	6000V	6000V

Note

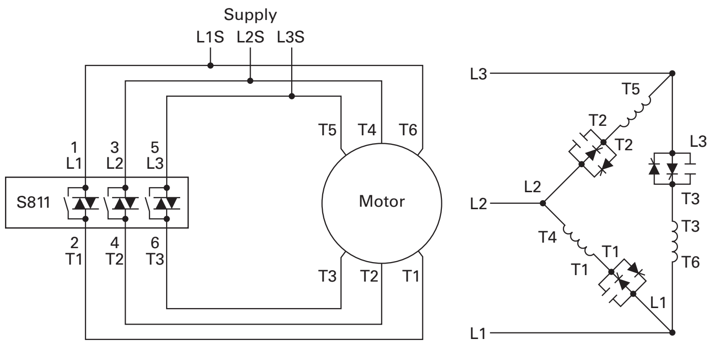
① UR recognized product.

Wiring Diagrams

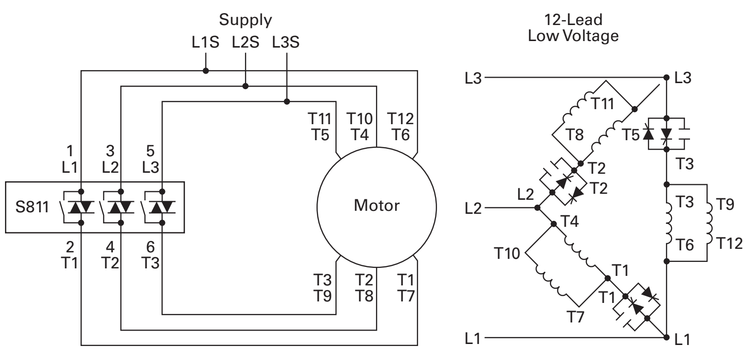
Line Connected Soft Starter



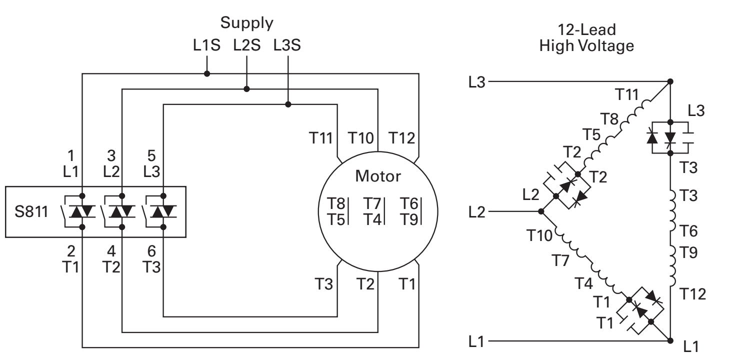
Inside-the-Delta Connected Soft Starter for a 6-Lead Motor



Inside-the-Delta Connected Soft Starter for a 12-Lead Low Voltage Motor



Inside-the-Delta Connected Soft Starter for a 12-Lead High Voltage Motor



Dimensions

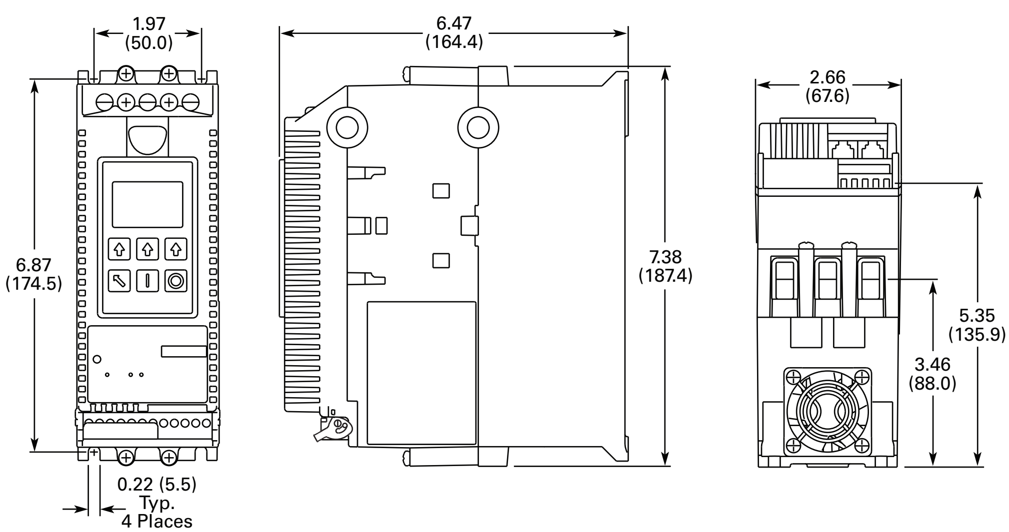
Approximate Dimensions in Inches (mm)

Soft Starters—S811

Partial Catalog Number	W	H	D	Weight in Lbs (kg)
S811N37	2.66 (67.6)	7.38 (187.4)	6.47 (164.4)	5.8 (2.6)
S811N66	2.66 (67.6)	7.38 (187.4)	6.47 (164.4)	5.8 (2.6)
S811R10	4.38 (111.3)	7.92 (201.2)	6.66 (169.2)	10.5 (4.8)
S811R13	4.38 (111.3)	7.92 (201.2)	6.66 (169.2)	10.5 (4.8)
S811T18	7.67 (194.8)	12.71 (322.9)	6.39 (162.4)	48 (21.8) with lugs 41 (18.6) without lugs
S811T24	7.67 (194.8)	12.71 (322.9)	6.39 (162.4)	48 (21.8) with lugs 41 (18.6) without lugs
S811T30	7.67 (194.8)	12.71 (322.9)	6.39 (162.4)	48 (21.8) with lugs 41 (18.6) without lugs
S811U36	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S811U42	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S811U50	7.73 (196.3)	12.72 (323.1)	7.08 (179.9)	48 (21.8) with lugs 41 (18.6) without lugs
S811V36	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V42	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V50	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V65	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V72	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V85	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs
S811V10	11.05 (280.6)	16.57 (420.8)	7.35 (186.6)	103 (46.8) with lugs 91 (41.4) without lugs

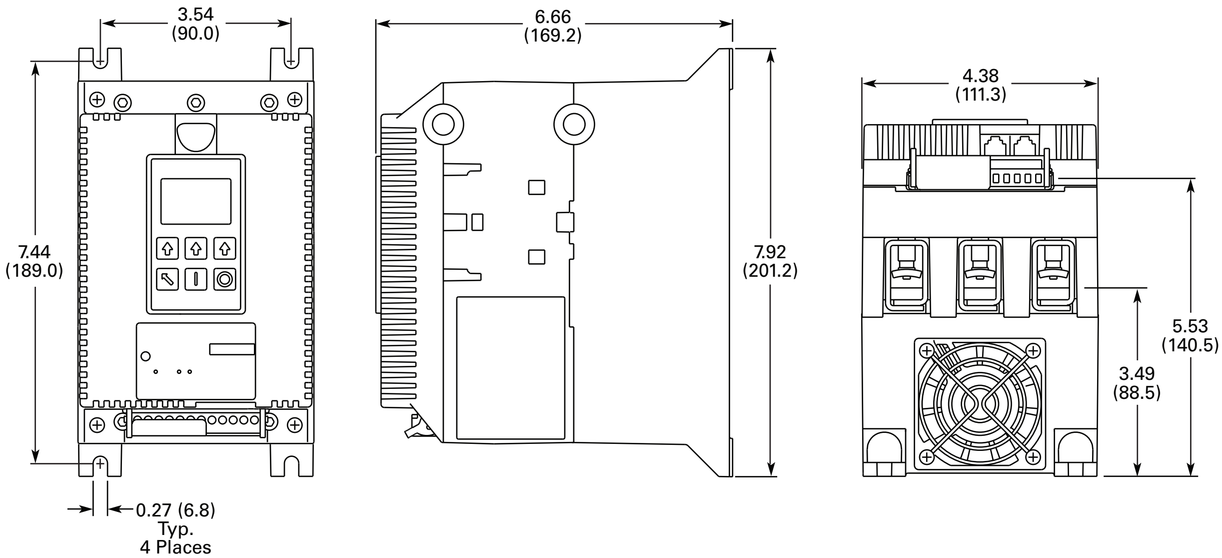
Also refer to dimension drawings below and on **Pages V6-T1-115** and **V6-T1-116**.

N-Frame (65 mm) S811

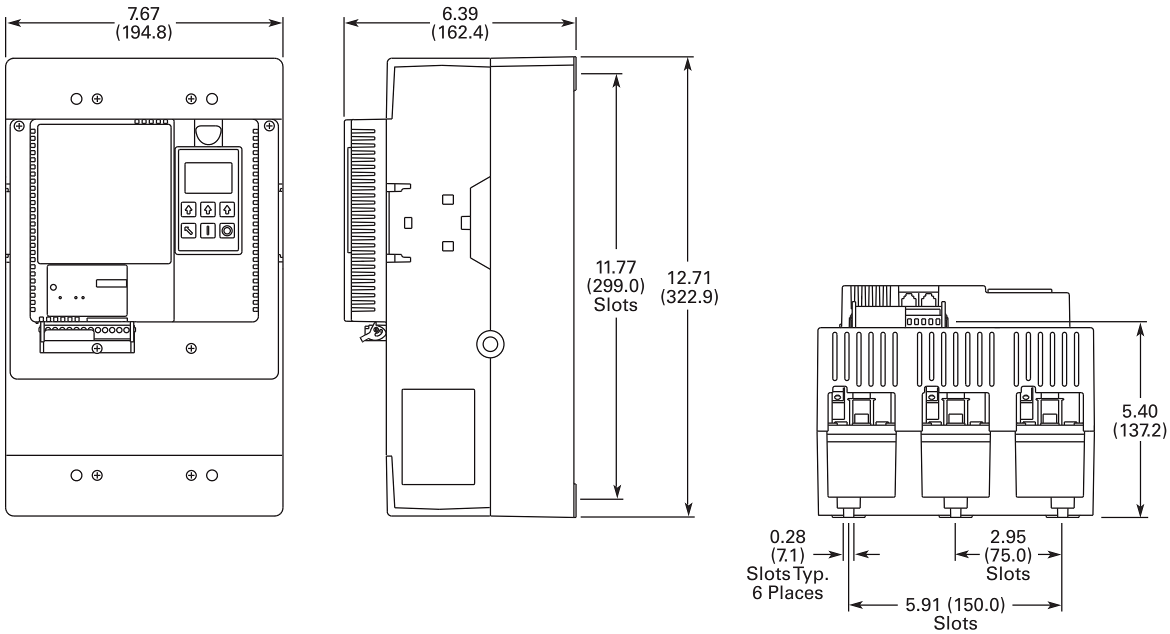


Approximate Dimensions in Inches (mm)

R-Frame (110 mm) S811



T-Frame (200 mm) S811



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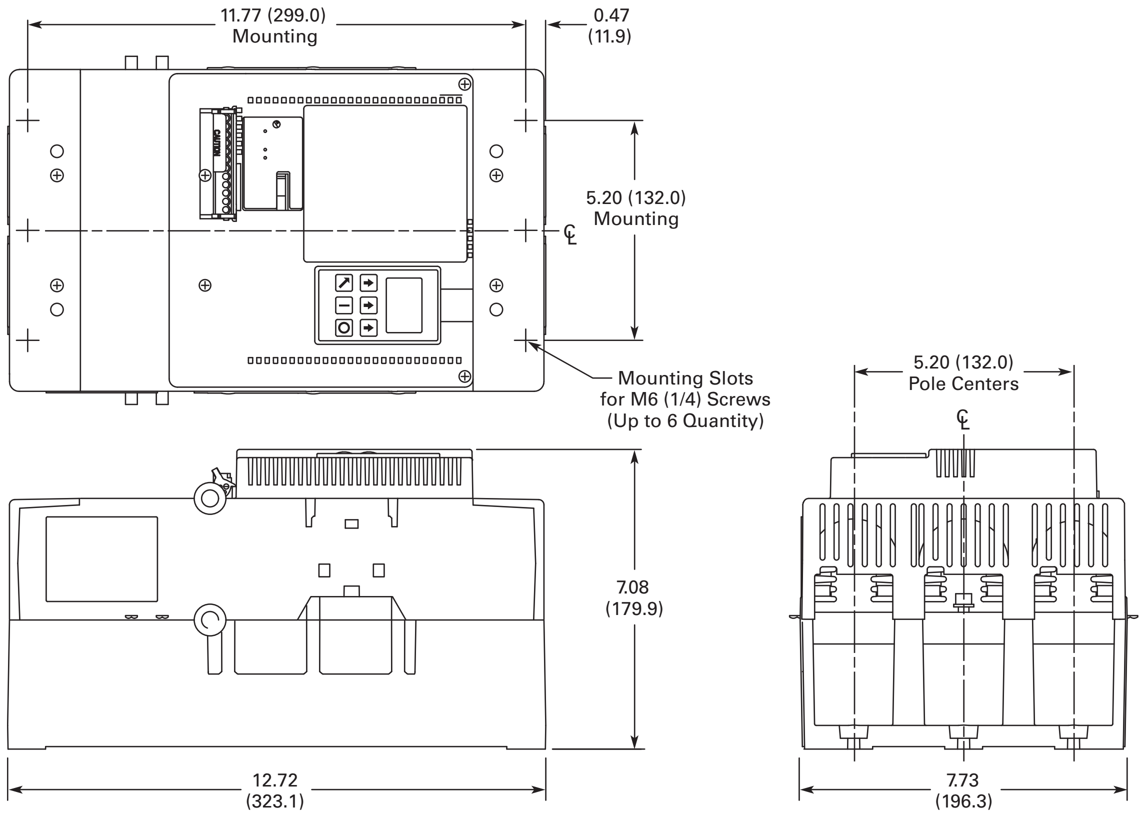
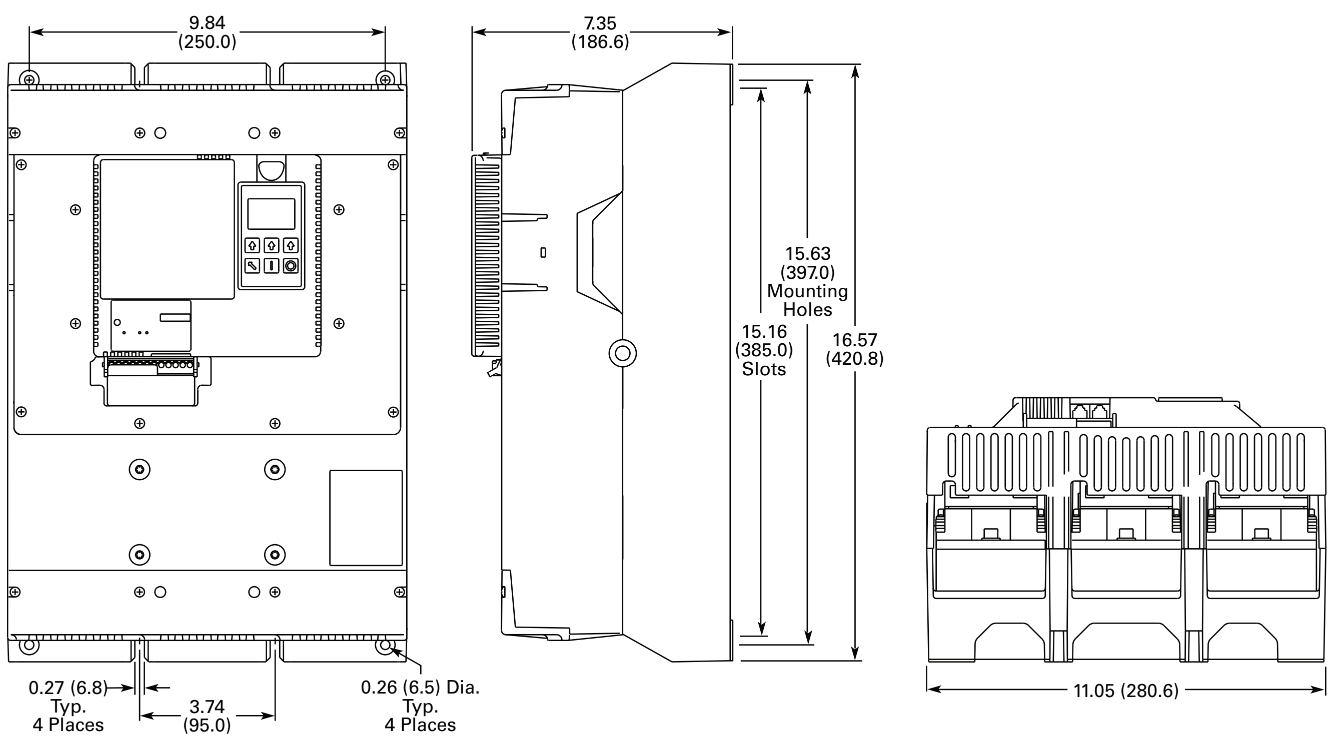
Approximate Dimensions in Inches (mm)

U-Frame (200 mm) S811



V-Frame (290 mm) S811



Adjustable Frequency Drives

M-Max

H-Max

CPX9000

Learn Online   Drawings Online   An Eaton Green Solution

NFX9000 Drives

Contents

Product Description

NFX9000 Adjustable Frequency AC Drives from Eaton's electrical sector are designed to provide adjustable speed control of three-phase motors. These microprocessor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The NFX9000 volts-per-hertz product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the NFX9000 make it ideal for hassle free installation where size is a primary concern.

Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 2 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1/2 hp size range.

The standard drive includes a digital display, operating and programming keys on the keypad.

The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. The drives feature RS-485 serial communications.

Features and Benefits

NFX9000 Adjustable Frequency AC Drives

Feature	Customer Benefit
V/Hz control	Provides 150% starting torque and advanced low speed control
Clearly laid out and easy to understand keypad with four-character LED display, four status indicating LEDs, speed potentiometer, and five function keys	Most informative operator's interface in this class of VFD, provided as standard. All parameters, diagnostic information and metering values are displayed with a bright four-character LED display
One analog input, four programmable, intelligent digital inputs, one programmable relay	Provide enhanced application flexibility
Serial communication port (RS-485)	Direct connection to serial communications networks
Single-phase or three-phase input capability on 115/240 Vac rated units	Operate three-phase motor with single-phase supply

Standards and Certifications

- NEMA, IEEE, NEC: Design Standards
- UL Listed
- cUL Listed
- CE Marked

Listed Listed

Catalog Number Selection

NFX9000 Drives

NFX 001 A 0 - 2

Base Catalog Number

Horsepower
F25 = 1/4 hp
F50 = 1/2 hp
001 = 1 hp
002 = 2 hp

Series
A

Enclosure
0 = IP20

Voltage
1 = 115 Vac
2 = 240 Vac

Product Selection

NFX9000

NFX9000 Basic Controller IP20

Description hp ①	Volts ②	Input Ampere Single-/Three-Phase Rating	Continuous Output Ampere Rating	Catalog Number
1/4	90–130	6.0/—	1.6	**NFXF25A0-1**
1/2		9.0/—	2.5	**NFXF50A0-1**
1/4	200–240	4.9/—	1.6	**NFXF25A0-2**
1/2		6.5/—	2.5	**NFXF50A0-2**
1		9.7/—	4.2	**NFX001A0-2**
2		—/9.0	7	**NFX002A0-2**

Notes

① Horsepower ratings are based on the use of a 240V or 480V NEMA B, four- or six-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the NFX9000 rated continuous output current.

② For 208V, 380V or 415V applications, select the unit such that the motor current is less than or equal to the NFX9000 rated continuous output current.

Technical Data and Specifications

2

General Specifications

NFX9000 Drives

Description	Specification
Output Ratings	
Horsepower	90V–132V: 1/4–1/2 hp 200–240V: 1/2–2 hp
Frequency range	0.1–400 Hz
Overload rating	150% for 60 seconds
Frequency resolution	Digital: 0.1 Hz
Frequency accuracy	Digital: ±0.01% of max. frequency Analog: ±0.2% of max. frequency
Undervoltage carryover limit	0.3 to 25 seconds
Motor Performance	
Motor control	V/Hz
Constant torque	Standard
Speed regulation	0.5% of base speed
Input Power	
Voltage at 50/60 Hz ±3 Hz	100V–120V: –10% +10%/single-phase 200V–240V: –10% +5%/single-phase 200V–240V: –10% +5%/three-phase
Displacement power factor	Better than 0.95
Efficiency	Typically greater than 95%
Design Type	
Microprocessor	32-bit
Converter type	Diode
Inverter type	Insulated gate bipolar transistor
Waveform	PWM Volts/Hertz
Environment	
Operating temperature	–10° to 40°C
Humidity	20 to 90% non-condensing
Maximum elevation	1000 meters (3300 ft)
Enclosure	
Standard	Protected chassis (IP20)
Protective Features	
Ground fault	Standard
Overload protection	Standard
Overcurrent	Standard
Overvoltage	Standard
Undervoltage	Standard
Overtemperature	Standard
Overload limit	Standard

Set Up Adjustments, Performance Features, Operator Control and External Interface

Keypad

Description	Specification
Alphanumeric display	Standard, 1 x 4 character
Digital indications	RUN/STOP and FORWARD/REVERSE
Diagnostics	Last three trips with cause
LED status indicators	Four (RUN/STOP and FORWARD/REVERSE)
Operator functions	RUN/STOP, speed control (digital or potentiometer), RESET, MODE keys and ENTER

I/O Terminal Block

Description	Specification
Analog inputs	One input: 0–10 Vdc, 4–20 mA Potentiometer: 1 kohm to 2 kohm Analog voltage: Nominal 10 Vdc (10 kohm input impedance) Analog current: Nominal 4–20 mA (250 ohm)
Digital inputs	Four programmable inputs
Digital outputs	One Form A relay contact

Programmable Parameters

Description	Specification
Out of the box	Factory settings loaded for quick start-up
Accel. and decel.	2 separately adjustable Linear or S Curve times: 0.1–600 seconds
DC injection braking	①
External fault	Terminal input
Jog	Terminal input
Fault reset	STOP/RESET or terminal input
I/O	NO-NC selectable
Jump frequencies	Three (with adjustable width)
Parameter security	Programmable software lock
Preset speeds	Two preset speeds
Reversing	Keypad or terminal
Speed setting	Keypad, terminal or pot
RUN/STOP control	Keypad or terminal
Stop modes	Decel, coast or DC injection

Reliability

Description	Specification
Pretested components	Standard
Surface mount technology	Standard (PCBs)
Computerized testing	Standard
Final test with full load	Standard
Eaton's Engineering Systems and Service	National network of AF drive specialists

Note

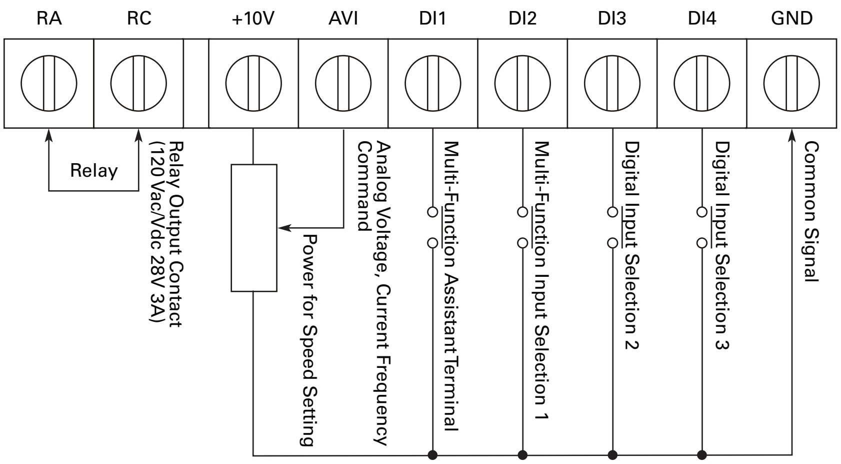
① The motor can be electronically stopped in the shortest possible time, without using an optical external braking resistor.

Watts Loss

Catalog Number	Horsepower	Volts	Watts Loss 9 kHz
NFXF25A0-1	1/4	115 Vac	20W
NFXF50A0-1	1/2		20W
NFXF25A0-2	1/4	230 Vac	20W
NFXF50A0-2	1/2		20W
NFX001A0-2	1		38W
NFX002A0-2	2		75W

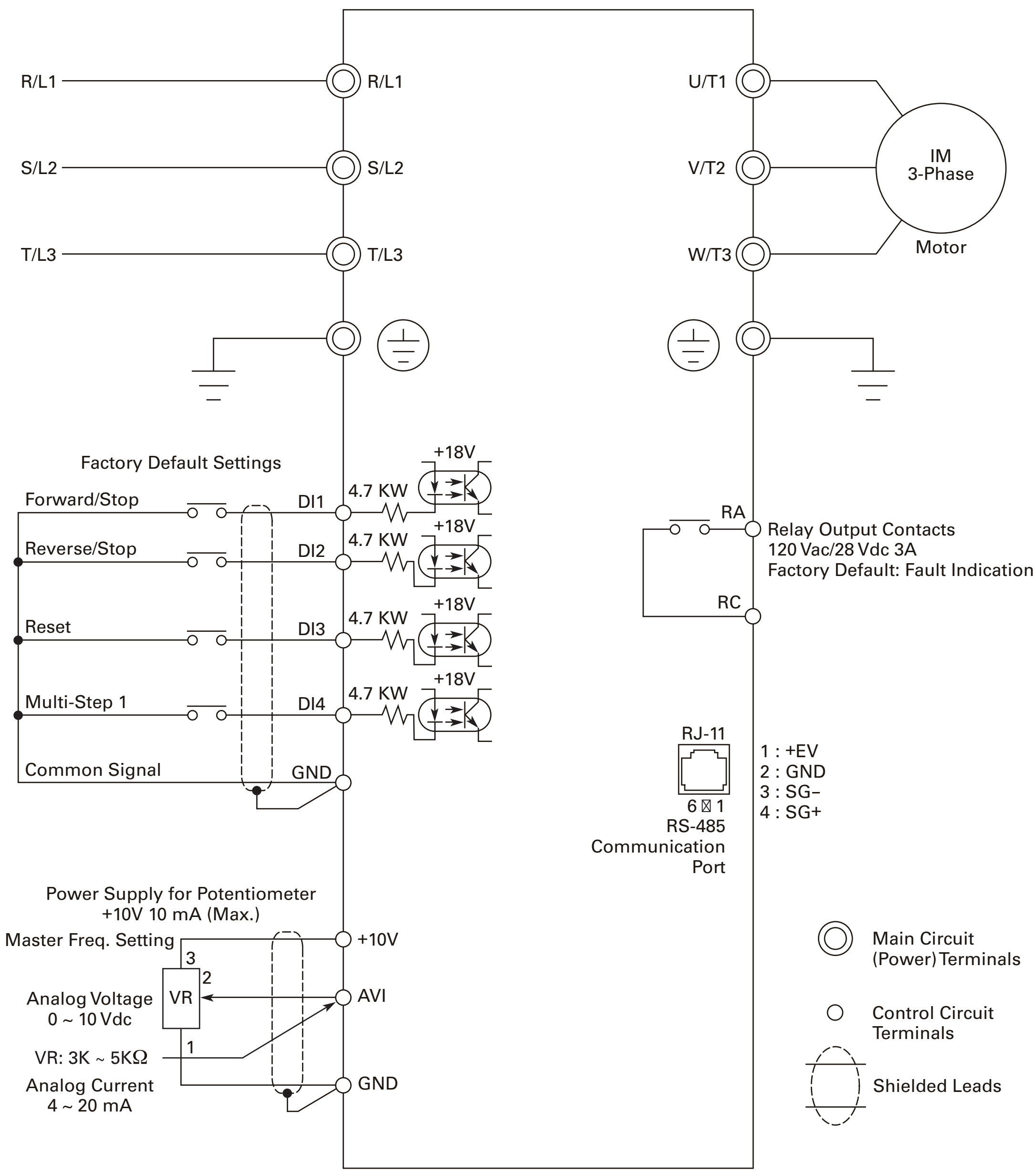
Wiring Diagrams

Control Terminal Wiring (Factory Settings)



Wire Gauge: 22 – 24 AWG
Torque: 4 Kgf-cm

Basic Wiring Diagram



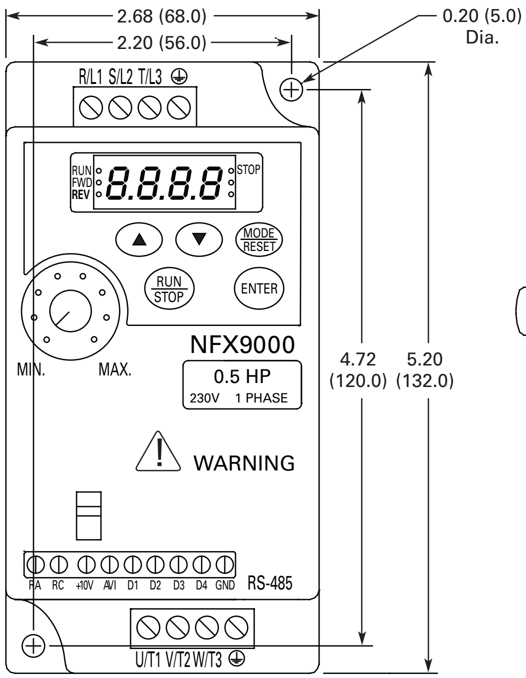
Note: Do not plug a modem or telephone line to the RS-485 communication port, permanent damage may result. Terminals 1 and 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

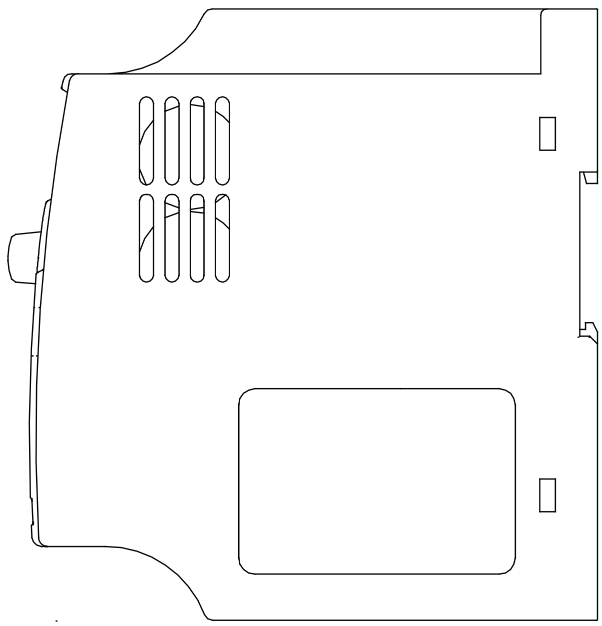
- Use power terminals R/L1 and S/L2 for single-phase connection to models NFXF25A0-1, NFXF50A0-1, NFXF25A0-2, NFXF50A0-2 or NFX001A0-2.
- Use power terminals R/L1, S/L2 and T/L3 for three-phase connection to models NFXF25A0-2, NFXF50A0-2, NFX001A0-2 or NFX002A0-2.
- Single-phase power must not be used for model NFX002A0-2.

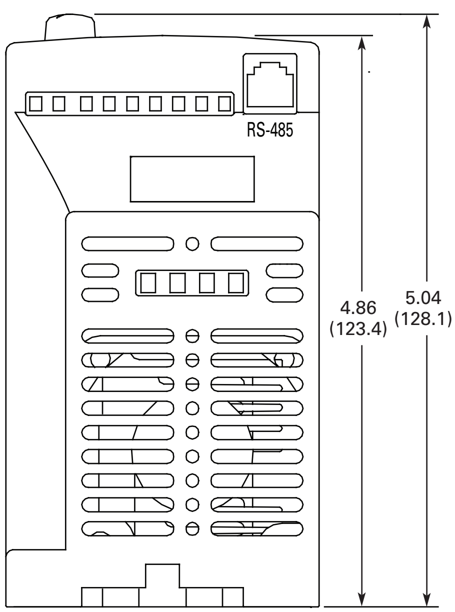
Dimensions

Approximate Dimensions in Inches (mm)

1/4 to 2 hp Drive







M-Max Series Drives for Machinery Applications

Contents

Product Description

Eaton's M-Max™ Series Sensorless Vector Adjustable Frequency AC Drives are the next generation of drives specifically engineered for today's machinery applications. These micro-processor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements. The M-Max product line uses a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) that provide quiet motor operation, high motor efficiency, and smooth low-speed performance. The size and simplicity of the M-Max make it ideal for hassle-free installation. Models rated at 575 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 7-1/2 hp. Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1/2 to 10 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 3 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1-1/2 hp size range.

The standard drive includes a digital display, and operating and programming keys on a visually appealing, efficient application programming interface. The display provides drive monitoring, as well as adjustment and diagnostic information. The keys are used for digital adjustment and programming of the drive, as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections.

Features

- Ease of use—preset application macros, startup wizard, diagnostic capabilities
- Compact, space-saving design
- Rugged and reliable—150% for one minute, 50C rated, conformal coated boards
- DIN rail and screw mountable
- Side-by-side installation
- Industry leading efficiency delivers energy savings to the customer
- Integrated EMC filters make the unit suitable for commercial and industrial networks
- Available in the enclosure class IP20 as standard, options for IP21 and NEMA® 1
- Brake chopper as standard in three-phase, applications of frames 2 (FS2) and larger
- Temperature-controlled fan
- RS-485/Modbus® as standard
- PID controller as standard
- Several fieldbus options

Standards and Certifications

Product

- Complies with EN61800-3 (2004)

Safety ①

- 61800-5-1
- EN60204-1
- CE
- UL
- cUL
- IEC
- RoHS compliant

EMC (At Default Settings)

- EMC Category C2, C3, and C4 (Level H): With an internal RFI filter option

Note

① See unit nameplate for more detailed approvals.

Catalog Number Selection

MMX 1 1 AA 1D1 F 0 – 0

Description
MMX = Base catalog number

Phase
1 = Single-phase
3 = Three-phase

Voltage	
1 = 120V	**4** = 480V
2 = 230V	**5** = 575V

Software Designation Series
AA

Output Current
1D6 = 1.6A
010 = 10A

EMC Filter
F = Filter
N = No filter

Enclosure Class
0 = NEMA 0 or IP20

Option
0 = Full version

Product Selection

M-Max

M-Max Basic Controller

hp ①	Volts ②	100% Continuous Current I_N (A)	Nominal Input Current (A)	Frame Size	Catalog Number
1/4	100–120V single-phase in 230V three-phase out	1.7	9.2	FS2	**MMX11AA1D7N0-0** ③
1/2		2.4	11.6		**MMX11AA2D4N0-0** ③
3/4		2.8	12.4		**MMX11AA2D8N0-0** ③
1		3.7	15		**MMX11AA3D7N0-0** ③
1-1/2		4.8	16.5	FS3	**MMX11AA4D8N0-0** ③
1/4	200–240V single-phase in 230V three-phase out	1.7	4.2	FS1	**MMX12AA1D7F0-0**
1/2		2.4	5.7		**MMX12AA2D4F0-0**
3/4		2.8	6.6		**MMX12AA2D8F0-0**
1		3.7	8.3	FS2	**MMX12AA3D7F0-0**
1-1/2		4.8	11.2		**MMX12AA4D8F0-0**
2		7	14.1		**MMX12AA7D0F0-0**
3		9.6	15.8	FS3	**MMX12AA9D6F0-0**
1/4	200–240V three-phase in 230V three-phase out	1.7	2.7	FS1	**MMX32AA1D7N0-0** ③
1/2		2.4	3.5		**MMX32AA2D4N0-0** ③
3/4		2.8	3.8		**MMX32AA2D8N0-0** ③
1		3.7	4.3	FS2	**MMX32AA3D7N0-0** ③
1-1/2		4.8	6.8		**MMX32AA4D8N0-0** ③
2		7	8.4		**MMX32AA7D0N0-0** ③
3		11	13.4	FS3	**MMX32AA011N0-0** ③
1/2	380–480V three-phase in 460V three-phase out	1.3	2.2	FS1	**MMX34AA1D3F0-0**
3/4		1.9	2.8		**MMX34AA1D9F0-0**
1		2.4	3.2		**MMX34AA2D4F0-0**
1-1/2		3.3	4	FS2	**MMX34AA3D3F0-0**
2		4.3	5.6		**MMX34AA4D3F0-0**
3		5.6	7.3		**MMX34AA5D6F0-0**
4		7.6	9.6	FS3	**MMX34AA7D6F0-0**
5		9	11.5		**MMX34AA9D0F0-0**
7-1/2		12	14.9		**MMX34AA012F0-0**
10		14	18.7		**MMX34AA014F0-0**
1	575V three-phase in 575V three-phase out	1.7	2.0	FS3	**MMX35AA1D7N0-0** ③
2		2.7	3.6		**MMX35AA2D7N0-0** ③
3		3.9	5.0		**MMX35AA3D9N0-0** ③
5		6.1	7.6		**MMX35AA6D1N0-0** ③
7-1/2		9.0	10.4		**MMX35AA9D0N0-0** ③

Notes

① Horsepower ratings are based on the use of a 240V, 460V, and 575V NEMA B, four- or six-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the MMX rated continuous output current.

② For 208V, 380V, or 415V applications, select the unit such that the motor current is less than or equal to the MMX rated continuous output current.

③ For MMX11_, MMX32_, and MMX35_, there are no options for units with filters.

2

Accessories

M-Max Copy/Paste Module

Description	Catalog Number
Module is plugged onto the front of the drive to provide: upload/download of all parameters, direct link to a PC via USB interface for parameter assignment via MaxConnect software, and copying of parameters for a series of devices or when exchanging devices. No PC required	**MMX-COM-PC**

Kits ①

Description	Catalog Number
Type 1 and IP21 kit for frame 1	**MMX-IP21-FS1**
Type 1 and IP21 kit for frame 2	**MMX-IP21-FS2**
Type 1 and IP21 kit for frame 3	**MMX-IP21-FS3**

Optional Communication Modules

Description	Catalog Number
Communication adapter kit	**MMX-NET-XA**
CANopen network card	**XMX-NET-CO-A**
PROFIBUS DP network card with serial connection	**XMX-NET-PS-A**
PROFIBUS DP network card with Sub-D connection	**XMX-NET-PD-A**
DeviceNet network card	**XMX-NET-DN-A**

Line Reactors ②

Description	Catalog Number
3% Line Reactor, Single-Phase	
1/2 hp, 240V	**K64-000988-8091**
1 hp, 240V	**K64-000988-0120**
2 hp, 240V	**K64-000988-0180**
3 hp, 240V	**K64-000988-0250**
3% Line Reactor, Three-Phase	
1/2 hp, 240V	**K64-000989-2091**
1 hp, 240V	**K64-000989-4091**
2 hp, 240V	**K64-000989-8091**
3 hp, 240V	**K64-000989-0120**
1 hp, 480V	**K64-000989-2091**
2 hp, 480V	**K64-000989-4091**
3 hp, 480V	**K64-000989-4091**
5 hp, 480V	**K64-000989-8091**
7-1/2 hp, 480V	**K64-000989-0180**
10 hp, 480V	**K64-000989-0250**
1 hp, 575V	**K64-000989-2091**
2 hp, 575V	**K64-000989-8091**
3 hp, 575V	**K64-000989-8091**
5 hp, 575V	**K64-000989-4091**
7-1/2 hp, 575V	**K64-000989-0180**
10 hp, 575V	**K64-000989-0180**

Notes

① Type 1 kit provides conduit entry plate.

② Additional input and output reactors are available. Consult Eaton representative for a complete listing.

2

Technical Data and Specifications

Ratings

M-Max Basic Controller IP20 Standard Ratings

Description	Specification
Protections	
Overcurrent protection	Trip limit 4.0 x I_H instantaneously
Overvoltage protection	115/230V series: 437 Vdc; 400V series: 874 Vdc; 575V series: 1048 Vdc trip level
Undervoltage protection	115/230V series: 183 Vdc; 400V series: 333 Vdc; 575V series: 460 Vdc trip level
Ground fault protection	Ground fault is tested before every start. In case of ground fault in motor or motor cable, only the frequency converter is protected
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes

Programmable Parameters

Description
Application macros: basic, pump, fan and high load (hoist)
Programmable start/stop and reverse signal logic (sinking or sourcing)
Reference scaling
Programmable start and stop functions
DC-brake at start and stop
Programmable V/Hz curve
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions (all fully programmable; off, warning, fault)
Current signal input fault
External fault
Fieldbus communication
Eight preset speeds
Analog input range selection, signal scaling and filtering
PID controller
Skip frequencies

Specifications

M-Max Series Drives

Description	Specification
Input Ratings	
Input voltage (V_{in})	+10%/–15% (575V units: +15%/–15%)
Input frequency (f_{in})	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
Output Ratings	
Output voltage	0 to V_{in} ①
Continuous output current	Continuous rated current I_N at ambient temperature max. 122°F (50°C), overload 1.5 x I_N max. 1 min/10 min
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current (I_H)	Current 2 x I_N for 2 seconds in every 20-second period Torque depends on motor
Control Characteristics	
Control method	Frequency control (V/Hz) open loop or sensorless vector control
Switching frequency	1.5 to 16 kHz; default 6 kHz
Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy ± 1% V/Hz Panel reference: resolution 0.01 Hz
Field weakening point	30 to 320 Hz
Acceleration time	0 to 3000 sec
Deceleration time	0 to 3000 sec
Braking torque	DC brake: 30% x T_n (without brake option)
Brake Resistor (Minimum Values) ②	
230V Series	FS2 35 ohms and FS3 26 ohms
400V Series	FS2 75 ohms and FS3 54 ohms
575V Series	FS3 103 ohms
Ambient Conditions	
Ambient operating temperature	14°F (–10°C), no frost to 122°F (+50°C): Rated loadability I_N
Storage temperature	–40°F (–40°C) to 158°F (70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 6560 ft (2000m)
Vibration	EN 60068-2-6; 3 to 150 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, IEC 68-2-27 UPS Drop test (for applicable UPS weights); storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	IP20

Notes

① Exception: 115V single-phase in, 230V three-phase out.

② Only three-phase FS2 and FS3 drives are equipped with brake chopper circuit.

Standards

I/O Specifications

- Digital inputs DI1–DI6 are freely programmable. The user can assign multiple functions to a single input
- Digital, relay, and analog outputs are freely programmable

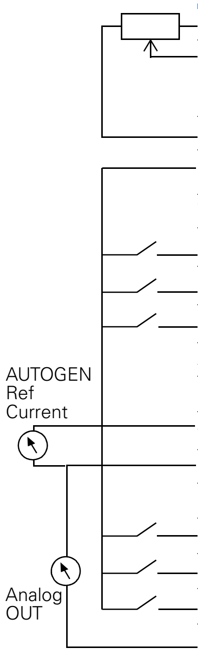
Includes:

- Six digital inputs
- Two analog inputs
  - 4–20 mA
  - 0–10V
- One analog output
- One digital output
- Two relay outputs
- RS-485 interface

Reliability

- Pretested components: standard
- Computerized testing: standard
- Final test with full load: standard
- Conformal-coated boards
- 50°C rated
- 150% for one minute/ 10 mm
- 200% for two seconds/ 20 sec.
- Eaton Electrical Services and Systems: national network of AF drive specialists

M-Max I/O Interface



Terminal		Signal	Factory Preset	Description
1	+10V	Ref. output voltage	—	Maximum load 10 mA
2	AI1	Analog signal in 1	Freq. reference P)	0—+10V Ri = 200k ohms [min.]
3	GND	I/O signal ground	—	—
6	24V	24V output for DIs	—	±20%, max. load 50 mA
7	GND	I/O signal ground	—	—
8	DI1	Digital input 1	Start forward P)	0—+30V Ri = 12k ohms min.
9	DI2	Digital input 2	Start reverse P)	—
10	DI3	Digital input 3	Preset speed P)	—
A	A	RS-485 signal A	FB communication	—
B	B	RS-485 signal B	FB communication	—
4	AI2	Analog signal in 2	PI actual value P)	0[4]–20 mA, Ri = 200k ohms
5	GND	I/O signal ground	—	—
13	GND	I/O signal ground	—	—
14	DI4	Digital input 4	Preset speed B1 P)	0—+30V Ri = 12k ohms min.
15	DI5	Digital input 5	Fault reset P)	0—+30V Ri = 12k ohms min.
16	DI6	Digital input 6	Disable PI contr. P)	0—+30V Ri = 12k ohms min.
18	AO	Analog output	Output frequency P)	0(2)–10V, RL = 500 ohms
20	DO	Digital signal out	Active = READY P)	Open collector, max. load 48V/50 mA
22	RO11	Relay out 1	Active = RUN P)	Max. switching load: 250 Vac/2A or 250 Vdc/0.4A
23	RO12			
24	RO21	Relay out 2	Active = FAULT P)	Max. switching load: 250 Vac/2A or 250 Vdc/0.4A
25	RO22			
26	RO23			

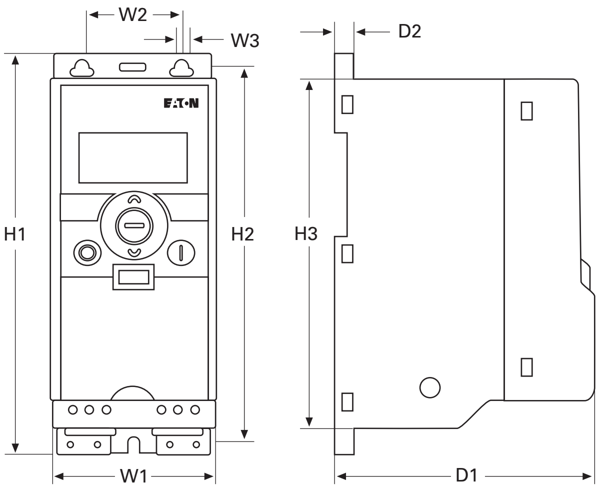
Note

P) Parameter-selectable function.

Dimensions

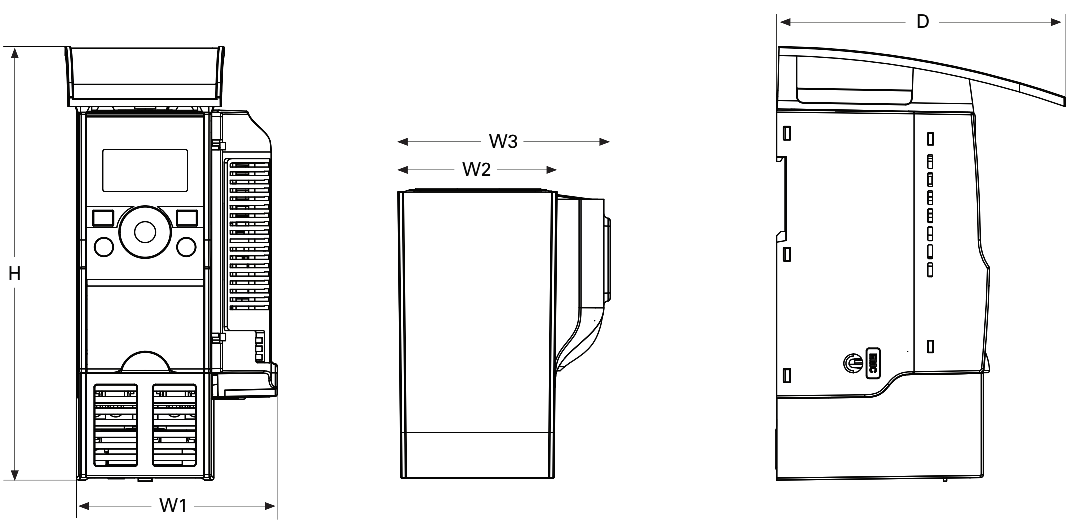
Approximate Dimensions in Inches (mm)

M-Max Drives



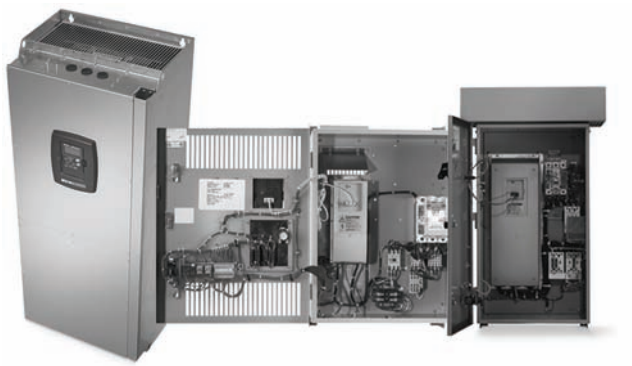
Frame Type	H1	H2	H3	W1	W2	W3	D1	D2	Weight Lbs (kg)
FS1	6.16 (156.5)	5.79 (147.0)	5.40 (137.3)	2.58 (65.5)	1.49 (37.8)	0.17 (4.5)	3.88 (98.5)	0.27 (7.0)	1.213 (0.550)
FS2	7.68 (195.0)	7.20 (183.0)	6.69 (170.0)	3.54 (90.0)	2.46 (62.5)	0.22 (5.5)	4.00 (101.5)	0.27 (7.0)	1.543 (0.699)
FS3	10.33 (262.5)	9.93 (252.3)	9.50 (241.3)	3.94 (100.0)	2.95 (75.0)	0.22 (5.5)	4.27 (108.5)	0.27 (7.0)	2.183 (0.990)

NEMA 1/IP21 M-Max Drives and Communication Adapter Kit



Frame Type	H	W1	W2	W3	D
FS1	8.14 (206.7)	3.77 (95.7)	2.99 (75.9)	3.98 (101.2)	5.41 (137.5)
FS2	9.90 (251.5)	4.72 (120.0)	3.97 (100.8)	4.94 (125.5)	5.68 (144.2)
FS3	12.26 (311.5)	5.12 (130.1)	4.36 (110.8)	5.33 (135.3)	6.32 (160.5)

SVX9000 Drives



Contents

Description	*Page*
SVX9000 Drives	

Product Overview

With the SVX9000 Series Sensorless Vector Control, Eaton's expanded Eaton drive offering now covers a complete line of PWM adjustable frequency (speed) drives in ratings from:

- 208V—3/4 to 100 hp I_H; 1 to 100 hp I_L
- 230V—3/4 to 100 hp I_H; 1 to 125 hp I_L
- 480V—1 to 1900 hp I_H; 1-1/2 to 2200 hp I_L
- 575V—2 to 2000 hp I_H; 3 to 2300 hp I_L

The Eaton family of drives includes HVX9000, H-Max, M-Max, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

A full range of enclosure types and options are available to meet a wide array of applications—from simple variable torque to more complex industrial applications such as conveyors, mixers and machine controls.

Application Description

Application Engineering

Proper selection and application of all drive system components is essential to assure that an adjustable frequency drive system will safely and reliably provide the performance required for any given application. The party responsible for the overall design and operation of the facility must make sure that qualified personnel are employed to select all components of the drive system, including appropriate safety devices. Eaton's AF Drives Application Engineering Department is prepared to provide assistance to answer any questions about the technical capabilities of Eaton drives.

Motor Selection

The basic requirement of motor selection is to match the torque vs. speed capability of the motor to the torque vs. speed requirement of the driven load.

Motor Torque vs. Speed Capability

As the speed of a motor is reduced below its 60 Hz base speed, motor cooling becomes less effective because of the reduced speed of the self-cooling fan. This limitation determines the maximum torque for continuous operation at any operating speed. The maximum intermittent operating torque is determined by the motor's torque vs. current characteristics and the output current capability of the adjustable frequency controller.

Multiple Motor Operation

A number of motors can be connected in parallel to a single controller. Since the frequency of the power supplied by the controller is the same for each motor, the motors will always operate at the same speed. Application Engineering assistance must be requested for all multiple motor applications to assure compliance with all controller design limitations.

Special Types of Motors

Standard NEMA Designs A and B three-phase motors are the only motors recommended for use in the majority of applications, but other types of motors are occasionally used. If the existing motor used in the application or the motor proposed for use with the drive system is a type other than NEMA Design A or B, Application Engineering assistance must be requested to make certain that the drive is properly applied.

Product Selection Guide

Controller Selection

The basic requirement of controller selection is to match the output current, voltage and frequency capabilities of the controller with the requirements of the connected motor.

Output Current

The controller must be selected and applied such that the average operating motor current and horsepower do not exceed the continuous current and horsepower ratings of the controller. The intermittent operating current must not exceed the intermittent current rating of the controller.

Motor Protection

Eaton adjustable frequency drives include electronic motor overload protection circuits that are designed to meet the requirements of NEC article 430-2 provided that only one motor is connected to the output of the controller.

Output Voltage and Frequency

When they are shipped, AF controllers are adjusted to provide a maximum output voltage and frequency equivalent to the input line voltage and frequency. The controllers can be adjusted to operate above line frequency, but a hazard of personal injury or equipment damage may exist when the motor is operated above base speed. Before adjusting the drive to operate above line frequency, make sure that the motor and the driven machinery can safely be operated at the resulting speed.

Features

Controller Features

Operator Control and Interface Requirements

Since there are many possible configurations and many ways of achieving a specific end result, it pays to consider the operator control and interface requirements carefully. A simplified and more economical drive package can often be achieved by selecting from standard product offerings rather than specifying a custom designed configuration.

Installation Compatibility

The successful application of an AC drive requires the assurance that the drive will be compatible with the environment in which it will be installed. In planning the installation, be sure to carefully consider the heat produced by the drive, the altitude and temperature limits and the need for clean cooling air. Other important considerations include acoustical noise, vibration, electromagnetic compatibility, power quality, controller input harmonic current and power distribution equipment requirements.

Auxiliary Equipment and Accessories

Adjustable drives are generally designed to have a motor directly connected to the controller output terminals with no other equipment connected in series or parallel. Motor starters, disconnect switches, surge absorbers, DV/DT suppression circuits, output chokes, output transformers and any other equipment under consideration for installation on the output of the controller should not be installed without first requesting Application Engineering assistance. Power factor correction capacitors must never, under any circumstances, be connected at the output of the controller. They would serve no useful purpose, and they may damage the controller.

Enclosure Definitions

- **NEMA Type 1/IP21**—Enclosures are intended for indoor use primarily to provide a degree of protection against contact with enclosed equipment and provide a degree of protection against a limited amount of falling dirt in locations where unusual service conditions do not exist. Top or side openings in the NEMA Type 1/IP21 enclosure allow for the free exchange of inside and outside air while meeting the UL rod entry and rust resistance design tests.
- **NEMA Type 12/IP54**—Enclosures are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt and dripping noncorrosive liquids. To meet UL drip, dust and rust resistance tests, NEMA Type 12/IP54 enclosures have no openings to allow for the exchange of inside and outside air.
- **Chassis IP00**—Similar to Protected Chassis IP20 except power terminals are protected by plastic shielding only. Primarily intended to be mounted inside a surrounding protective enclosure.
- **NEMA Type 3R**—Similar in design to NEMA Type 12/IP54 except with more stringent design and test requirements.

2

Motor Protection

DV/DT and Peak Motor Voltage Solutions

Today's AFD products offer significantly improved performance, but at the potential cost of motor insulation stress. The fast switching time of the IGBT devices used in newer AFDs can cause a transmission line effect in the output power leads to the motor, leading to possibly damaging voltage levels. To meet this need, NEMA has introduced a motor in MG1, Part 31, which provides an insulation system designed to maintain normal motor life in AFD applications. For existing motors, a motor protection scheme is required for longer cable runs. Eaton offers three standard solutions for existing systems.

- **MotoRx** This solution provides an energy recovery system which clamps the peak motor voltage to a safe level for standard motors. This option is used when the distance between a single motor and the drive is 600 ft or less.
- **Output Line Reactor** This option provides an output line reactor, reducing the DV/DT of the AFD output voltage and lessening the transmission line effect, to lower the peak voltage at the motor terminals.

Product Availability Codes

The product availability codes indicate the type of facility (warehouse, Mod Center or factory) that the product will ship from and, if it is not in stock, the number of working days needed to assemble the product from receipt of the order to shipment from the designated facility. Please note that this lead-time does not include any in-transit time from our facility to your facility.

Product Availability Codes

Code	Description
W	Warehouse stocked item. Shipped on customer request date. If item is backordered, please check Vista/VISTALINE or contact your Customer Support Center for product availability.
F1	Factory assemble-to-order. Shipped from factory within 1 working day after receipt of order on Vista.
FA	Factory assemble-to-order. Shipped from factory within 2–3 working days after receipt of order on Vista.
FB	Factory assemble-to-order. Shipped from factory within 4–10 working days after receipt of order on Vista.
FC	Factory assemble-to-order. Shipped from factory within 11–15 working days after receipt of order on Vista.
FD	Factory assemble-to-order. Shipped from factory within 16–20 working days after receipt of order on Vista.
FP	Factory assemble-to-order. Shipped from factory on negotiated promise date.
MA	Mod Center assemble-to-order. Shipped from Mod Center within 1–3 working days after receipt of order on Vista.
MB	Mod Center assemble-to-order. Shipped from Mod Center within 4–10 working days after receipt of order on Vista.
MP	Mod Center assemble-to-order. Shipped from Mod Center on negotiated promise date.

Product availability codes contained herein for a given product may be quantity sensitive and are subject to change without notice. For the most current information, refer to the Product Identification Inquiry (PIN) screen on Vista.

SVX9000 Open Drives

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Description — *Page*

SVX9000 Open Drives

Product Description

SVX9000 Series Adjustable Frequency Drives from Eaton's electrical sector are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is compromised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

Features

- Robust design—proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12/ IP54 keypad on all drives
- The SVX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" precision application programs consisting of:
  - Basic
  - Standard
  - Local/remote
  - Multi step speed control
  - PID control
  - Multi-purpose control
  - Pump and fan control with auto change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- Hand-held auxiliary 24V power supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake chopper standard from: 1–30 hp/380–500V 3/4–15 hp/208–230V
- NEMA Type 1/IP21 and NEMA Type 12/IP54 enclosures available, Frame Sizes FR4–FR9
- Open chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

2

Standards and Certifications

Product

- IEC 61800-2

EMC (At Default Settings)

- Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

Safety

- UL 508C

Catalog Number Selection

SVX9000 Adjustable Frequency Drives

SVX 010 A 1 – 4 A 1 B 1 _ _ _ _ _ _

Product Family
SVX = Open drives
SVX = Open drives FR10 and greater

Horsepower Rating	
F07 = 3/4 hp	**800** = 800 hp
F15 = 1-1/2 hp	**900** = 900 hp
007 = 7-1/2 hp	**H10** = 1000 hp
010 = 10 hp	**H12** = 1200 hp
050 = 50 hp	**H13** = 1350 hp
125 = 125 hp	**H15** = 1500 hp
350 = 350 hp	**H16** = 1600 hp
700 = 700 hp	**H20** = 2000 hp

AFD Software Series
A = Standard software

Enclosure ③
0 = Chassis
1 = NEMA Type 1/IP21
2 = NEMA Type 12/IP54

Voltage Rating
2 = 230 (208–240) V
4 = 480 (380–500) V
5 = 575 (525–690) V

Keypad
A = Alphanumeric

Input Options ①
1 = Three-phase, EMC H
2 = Three-phase, EMC N
4 = Three-phase, EMC L

Brake Chopper Options ②
N = No brake chopper circuit
B = Internal brake chopper circuit

Board Modifications
1 = Standard boards
2 = Conformal (varnished) coating ④

Options
Options appear in alphabetical order.
Extended I/O Card Options
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT + 24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input
Communication Cards
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
CK = Ethernet IP
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 connector)
C6 = CanOpen (slave)
C7 = DeviceNet
C8 = Modbus (D9 Type connector)
D3 = RS-232 with D9 connection

Power Module

FR10 – 000 – 4 – A N S

Frame Code

Horsepower
Example: **150** = 150 hp
(See chart above)

Voltage
4 = 380–500V
5 = 525–690V

Cooling Type
A = Air

Brake Option
N = No brake chopper
B = Brake chopper

Varnishing	
S = Standard	**V** = Varnished

Notes

① All 230V drives and 480V drives up to 200 hp (IH) are only available with input option **1** (EMC Level H). 480V drives 250 hp (IH) or larger are available with input option **2** (EMC Level N). 480V drives are available with input option **4** (EMC Level L). 575V drives 200 hp (IH) or larger are only available with input option **2**. 575V drives up to 150 hp (IH) are only available with input option **4** (EMC Level L).

② 480V drives up to 30 hp (IH) are only available with brake chopper option **B**. 480V drives 40 hp (IH) or larger come standard with brake chopper option **N**. 230V drives up to 15 hp (IH) are only available with brake chopper option **B**. 230V drives 20 hp or larger come standard with brake chopper option **N**. All 575V drives come standard without brake chopper option (N). **N** = **No** brake chopper.

③ 480V drives 250 hp (I_H) and larger are available with enclosure style **0** (chassis); 690V drives 200 hp (I_H) and larger are available with enclosure style **0** (chassis).

④ Factory promise delivery. Consult sales office for availability.

Product Selection

230V SVX9000 Drives

SVX9000 Open Drives

208–240V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	W	3/4	3.7	1	4.8	**SVXF07A1-2A1B1**
		1	4.8	1-1/2	6.6	**SVX001A1-2A1B1**
		1-1/2	6.6	2	7.8	**SVXF15A1-2A1B1**
		2	7.8	3	11	**SVX002A1-2A1B1**
		3	11	—	12.5	**SVX003A1-2A1B1**
FR5	W	—	12.5	5	17.5	**SVX004A1-2A1B1**
		5	17.5	7-1/2	25	**SVX005A1-2A1B1**
		7-1/2	25	10	31	**SVX007A1-2A1B1**
FR6	W	10	31	15	48	**SVX010A1-2A1B1**
		15	48	20	61	**SVX015A1-2A1B1**
FR7	W	20	61	25	75	**SVX020A1-2A1N1**
		25	75	30	88	**SVX025A1-2A1N1**
		30	88	40	114	**SVX030A1-2A1N1**
FR8	W	40	114	50	140	**SVX040A1-2A1N1**
		50	140	60	170	**SVX050A1-2A1N1**
		60	170	75	205	**SVX060A1-2A1N1**
FR9	W	75	205	100	261	**SVX075A1-2A1N1**
		100	261	125	300	**SVX100A1-2A1N1**

208–240V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	F1	3/4	3.7	1	4.8	**SVXF07A2-2A1B1**
		1	4.8	1-1/2	6.6	**SVX001A2-2A1B1**
		1-1/2	6.6	2	7.8	**SVXF15A2-2A1B1**
		2	7.8	3	11	**SVX002A2-2A1B1**
		3	11	—	12.5	**SVX003A2-2A1B1**
FR5	F1	—	12.5	5	17.5	**SVX004A2-2A1B1**
		5	17.5	7-1/2	25	**SVX005A2-2A1B1**
		7-1/2	25	10	31	**SVX007A2-2A1B1**
FR6	F1	10	31	15	48	**SVX010A2-2A1B1**
		15	48	20	61	**SVX015A2-2A1B1**
FR7	W	20	61	25	75	**SVX020A2-2A1N1**
		25	75	30	88	**SVX025A2-2A1N1**
		30	88	40	114	**SVX030A2-2A1N1**
FR8	FP	40	114	50	140	**SVX040A2-2A1N1**
		50	140	60	170	**SVX050A2-2A1N1**
		60	170	75	205	**SVX060A2-2A1N1**
FR9	FP	75	205	100	261	**SVX075A2-2A1N1**
		100	261	125	300	**SVX100A2-2A1N1**

2

480V SVX9000 Drives

SVX9000 Open Drives

380–500V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	W	1	2.2	1-1/2	3.3	**SVX001A1-4A1B1**
		1-1/2	3.3	2	4.3	**SVXF15A1-4A1B1**
		2	4.3	3	5.6	**SVX002A1-4A1B1**
		3	5.6	5	7.6	**SVX003A1-4A1B1**
		5	7.6	—	9	**SVX005A1-4A1B1**
		—	9	7-1/2	12	**SVX006A1-4A1B1**
FR5	W	7-1/2	12	10	16	**SVX007A1-4A1B1**
		10	16	15	23	**SVX010A1-4A1B1**
		15	23	20	31	**SVX015A1-4A1B1**
FR6	W	20	31	25	38	**SVX020A1-4A1B1**
		25	38	30	46	**SVX025A1-4A1B1**
		30	46	40	61	**SVX030A1-4A1B1**
FR7	W	40	61	50	72	**SVX040A1-4A1N1**
		50	72	60	87	**SVX050A1-4A1N1**
		60	87	75	105	**SVX060A1-4A1N1**
FR8	W	75	105	100	140	**SVX075A1-4A1N1**
		100	140	125	170	**SVX100A1-4A1N1**
		125	170	150	205	**SVX125A1-4A1N1**
FR9	W	150	205	200	261	**SVX150A1-4A1N1**
		200	245	250	300	**SVX200A1-4A1N1**

380–500V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	F1	1	2.2	1-1/2	3.3	**SVX001A2-4A1B1**
		1-1/2	3.3	2	4.3	**SVXF15A2-4A1B1**
		2	4.3	3	5.6	**SVX002A2-4A1B1**
		3	5.6	5	7.6	**SVX003A2-4A1B1**
		5	7.6	—	9	**SVX005A2-4A1B1**
		—	9	7-1/2	12	**SVX006A2-4A1B1**
FR5	F1	7-1/2	12	10	16	**SVX007A2-4A1B1**
		10	16	15	23	**SVX010A2-4A1B1**
		15	23	20	31	**SVX015A2-4A1B1**
FR6	F1	20	31	25	38	**SVX020A2-4A1B1**
		25	38	30	46	**SVX025A2-4A1B1**
		30	46	40	61	**SVX030A2-4A1B1**
FR7	W	40	61	50	72	**SVX040A2-4A1N1**
		50	72	60	87	**SVX050A2-4A1N1**
		60	87	75	105	**SVX060A2-4A1N1**
FR8	W	75	105	100	140	**SVX075A2-4A1N1**
		100	140	125	170	**SVX100A2-4A1N1**
		125	170	150	205	**SVX125A2-4A1N1**
FR9	W	150	205	200	261	**SVX150A2-4A1N1**
		200	245	250	300	**SVX200A2-4A1N1**

SVX9000 Open Drives

380–500V, Open Chassis Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10 ①	W	250	330	300	385	**SPX250A0-4A2N1**
		300	385	350	460	**SPX300A0-4A2N1**
		350	460	400	520	**SPX350A0-4A2N1**
FR11	W	400	520	500	590	**SPX400A0-4A2N1**
		500	590	—	650	**SPX500A0-4A2N1**
		—	650	600	730	**SPX550A0-4A2N1**
FR12	FP	600	730	—	820	**SPX600A0-4A2N1**
	W	—	820	700	920	**SPX650A0-4A2N1**
	FP	700	920	800	1030	**SPX700A0-4A2N1**
FR13	FP	800	1030	900	1150	**SPX800A0-4A2N1**
		900	1150	1000	1300	**SPX900A0-4A2N1**
		1000	1300	1200	1450	**SPXH10A0-4A2N1**
FR14	FP	1200	1600	1500	1770	**SPXH12A0-4A2N1**
		1600	1940	1800	2150	**SPXH16A0-4A2N1**
		1900	2300	2200	2700	**SPXH19A0-4A2N1**

575V SVX9000 Drives

525–690V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR6	W	2	3.3	3	4.5	**SVX002A1-5A4N1**
		3	4.5	—	5.5	**SVX003A1-5A4N1**
		—	5.5	5	7.5	**SVX004A1-5A4N1**
		5	7.5	7-1/2	10	**SVX005A1-5A4N1**
		7-1/2	10	10	13.5	**SVX007A1-5A4N1**
		10	13.5	15	18	**SVX010A1-5A4N1**
		15	18	20	22	**SVX015A1-5A4N1**
		20	22	25	27	**SVX020A1-5A4N1**
		25	27	30	34	**SVX025A1-5A4N1**
FR7	W	30	34	40	41	**SVX030A1-5A4N1**
		40	41	50	52	**SVX040A1-5A4N1**
FR8	W	50	52	60	62	**SVX050A1-5A4N1**
		60	62	75	80	**SVX060A1-5A4N1**
		75	80	100	100	**SVX075A1-5A4N1**
FR9	W	100	100	125	125	**SVX100A1-5A4N1**
		125	125	150	144	**SVX125A1-5A4N1**
		150	144	—	170	**SVX150A1-5A4N1**
		—	170	200	208	**SVX175A1-5A4N1**

Note

① FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

SVX9000 Open Drives

525–690V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR6	F1	2	3.3	3	4.5	**SVX002A2-5A4N1**
		3	4.5	—	5.5	**SVX003A2-5A4N1**
		—	5.5	5	7.5	**SVX004A2-5A4N1**
		5	7.5	7-1/2	10	**SVX005A2-5A4N1**
		7-1/2	10	10	13.5	**SVX007A2-5A4N1**
		10	13.5	15	18	**SVX010A2-5A4N1**
		15	18	20	22	**SVX015A2-5A4N1**
		20	22	25	27	**SVX020A2-5A4N1**
		25	27	30	34	**SVX025A2-5A4N1**
FR7	FP	30	34	40	41	**SVX030A2-5A4N1**
		40	41	50	52	**SVX040A2-5A4N1**
FR8	FP	50	52	60	62	**SVX050A2-5A4N1**
		60	62	75	80	**SVX060A2-5A4N1**
		75	80	100	100	**SVX075A2-5A4N1**
FR9	FP	100	100	125	125	**SVX100A2-5A4N1**
		125	125	150	144	**SVX125A2-5A4N1**
		150	144	—	170	**SVX150A2-5A4N1**
		—	170	200	208	**SVX175A2-5A4N1**

525–690V, Open Chassis Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	FP	200	208	250	261	**SPX200A0-5A2N1**
		250	261	300	325	**SPX250A0-5A2N1**
		300	325	400	385	**SPX300A0-5A2N1**
FR11	FP	400	385	450	460	**SPX400A0-5A2N1**
		450	460	500	502	**SPX450A0-5A2N1**
		500	502	—	590	**SPX500A0-5A2N1**
FR12	FP	—	590	600	650	**SPX550A0-5A2N1**
		600	650	700	750	**SPX600A0-5A2N1**
		700	750	800	820	**SPX700A0-5A2N1**
FR13	FP	800	820	900	920	**SPX800A0-5A2N1**
		900	920	1000	1030	**SPX900A0-5A2N1**
		1000	1030	1250	1180	**SPXH10A0-5A2N1**
FR14	FP	1350	1300	1500	1500	**SPXH13A0-5A2N1**
		1500	1500	2000	1900	**SPXH15A0-5A2N1**
		2000	1900	2300	2250	**SPXH20A0-5A2N1**

Accessories

Demo Drive and Power Supply

Demo Drive and Power Supply

Description	Catalog Number
9000X demo drive	**9000XDEMO**
Hand-held 24V auxiliary power supply—Used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**

NEMA Type 12/IP54 Conversion Kit

The NEMA Type 12/IP54 kit option is used to convert a NEMA Type 1/IP21 to a NEMA Type 12/IP54 drive. The NEMA Type 12/IP54 kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

NEMA Type 12/IP54 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm) Length	Width	Height	Approximate Weight Lb (kg)	Catalog Number
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	**OPTN12FR4**
FR5		16 (406)	8 (203)	7 (178)	5 (2.3)	**OPTN12FR5**
FR6		21 (533)	10 (254)	5 (127)	7 (3.2)	**OPTN12FR6**

Flange Kits

Flange Kit NEMA Type 12/IP54

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12/IP54 fan components. Metal shroud not included.

Flange kits for NEMA Type 12/IP54 enclosure drive rating are determined by rating of drive.

Flange Kit NEMA Type 12/IP54— Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number
FR4	W	**OPTTHRFR4**
FR5		**OPTTHRFR5**
FR6		**OPTTHRFR6**

Flange Kit NEMA Type 12/IP54—Frames 4–9 ①

Frame Size	Delivery Code	Catalog Number
FR4	FP	**OPTTHR4**
FR5		**OPTTHR5**
FR6		**OPTTHR6**
FR7		**OPTTHR7**
FR8		**OPTTHR8**
FR9		**OPTTHR9**

Flange Kit NEMA Type 1/IP21

Flange kits for NEMA Type 1/IP21 enclosure drive rating are determined by rating of drive.

Flange Kit NEMA Type 1/IP21—Frames 4–9 ①

Frame Size	Delivery Code	Catalog Number
FR4	FP	**OPTTHR4**
FR5		**OPTTHR5**
FR6		**OPTTHR6**
FR7		**OPTTHR7**
FR8		**OPTTHR8**
FR9		**OPTTHR9**

Note

① For installation of an SVX9000 NEMA Type 1/IP21 drive into a NEMA Type 12/IP54 oversized enclosure.

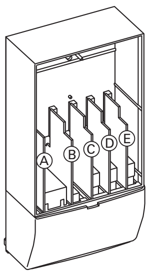
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
2 RO, therm—SPX only	B	**OPTA3**	**A3**	—	■	■	■	■	■	■
Encoder low volt +5V/15V/24V—SPX only	C	**OPTA4**	**A4**	—	■	■	■	■	■	■
Encoder high volt +15V/24V—SPX only	C	**OPTA5**	**A5**	—	■	■	■	■	■	■
Double encoder—SPX only	C	**OPTA7**	**A7**	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO—SPX only	A	**OPTA8**	**A8**	—	■	■	■	■	■	■
3 DI (encoder 10–24V), out +15V/+24V, 2 DO (pulse+direction)—SPX only	C	**OPTAE**	**AE**	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	■	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
Communication Cards										
Modbus ③	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Johnson Controls N2 ③	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave) ④	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD1**	**D1**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD2**	**D2**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series local/remote keypad (replacement keypad)	—	**KEYPAD-LOC/REM**	—	—	—	—	—	—	—	—
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**	—	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	**PP00104**	—	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

④ SPX9000 drives only (FR10 and larger).

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/ Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Control Panel Options

Factory Options

Description	Factory Installed Option Code	Field Installed NEMA Type 1/IP21 Catalog Number
Local/Remote Keypad SVX9000 Control Panel—This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	**A**	**KEYPAD-LOC/REM**
Keypad Remote Mounting Kit—This option is used to remote mount the SVX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft cable, keypad holder and mounting hardware.	—	**OPTRMT-KIT-9000X**

Miscellaneous Options

Description	Catalog Number
9000XDrive—A PC-based tool for controlling and monitoring of the SVX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	**9000XDRIVE**
SVDrivecable—6 ft (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000XDrive option to avoid damage to the SVX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	**SVDRIVECABLE**
External Dynamic Braking Resistors—Used with the dynamic braking chopper circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into standard duty and heavy-duty. Standard duty is defined as 20% duty or less with 100% braking torque, while heavy-duty is defined as 50% duty or less with 150% braking torque.	①

Open Drive Options

Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

For brake chopper circuit selection and adder—NEMA Type 1/IP21, NEMA Type 12/IP54, Chassis, consult the factory. Delivery code is FP.

Conformal (Varnished) Coating ②

Chassis Frame	Delivery Code
FR4	FP
FR5	FP
FR6	FP
FR7	FP
FR8	FP
FR9	FP
FR10	FP
FR11	FP
FR12	FP
FR13	FP
FR14	FP

Conformal Coated Board Kits ③

Field Installed Catalog Number	Factory Installed Option Designator
OPT_V ④	⑤

Notes

① Consult factory.
② See Product Selection on **Pages V6-T2-19** to **V6-T2-22**, 208–240V, 380–500V, 525–690V. Consult the factory for adder.
③ See option catalog numbers on **Page V6-T2-24**.
④ Replace "__" with the correct catalog number from **Page V6-T2-24**. Example: OPT**C2**V.
⑤ Construct catalog numbers for factory installed per Catalog Number Selection on **Page V6-T2-18**.

Replacement Parts

SVX9000 Drives Spare Units

208–690V, Frames 4–12

Description	Catalog Number
Control unit–Includes the control board, blue base housing, installed SVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See **Page V6-T2-24** for standard and option boards and keypad.	**CSBS0000000000**

SVX9000 Drives Replacement Parts

208–240V, Frames FR4–FR8

Frame	4					5			6		7			8			Delivery Code	Catalog Number
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60		
Control Board																		
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**
Power Boards																		
	1																FB	**VB00308-0004-2**
		1															FB	**VB00308-0007-2**
			1														FB	**VB00308-0008-2**
				1													FB	**VB00310-0011-2**
					1												FB	**VB00310-0012-2**
						1											FB	**VB00313-0017-2**
							1										FB	**VB00313-0025-2**
								1									FB	**VB00313-0031-2**
									1								FB	**VB00316-0048-2**
										1							FB	**VB00316-0061-2**
											1						FB	**VB00319-0075-2**
												1					FB	**VB00319-0088-2**
													1				FB	**VB00319-0114-2**
														1			FB	**VB00322-0140-2**
															1		FB	**VB00322-0170-2**
																1	FB	**VB00322-0205-2**
Electrolytic Capacitors																		
	2	2	2														W	**PP01000**
				2	2												W	**PP01001**
						2	2										W	**PP01002**
								2									W	**PP01003**
									2	2							W	**PP01004**
											2	2	2	4	4		W	**PP01005**
																4	W	**PP01099**
Cooling Fans																		
	1	1	1	1	1												W	**PP01060**
						1	1	1									W	**PP01061**
									1	1							W	**PP01062**
											1	1	1				W	**PP01063**
														1	1	1	FC	**PP01123** ②
	1	1	1	1	1												W	**PP01086**
						1	1	1	1	1							FC	**PP01088**
											1	1	1				W	**PP01049**
														1	2	2	FC	**CP01180**
														1	1	1	FC	**PP08037**

Notes

① I_L only; has no corresponding I_H rated hp rating.

② PP00061 capacitor not included in main fan; please order separately.

208–240V, Frames FR4–FR8, continued

Frame	4					5			6		7			8			Delivery	
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	Code	Catalog Number
IGBT Modules																		
	1	1															W	**CP01304**
			1														W	**CP01305**
				1	1	1											W	**CP01306**
							1										W	**CP01307**
								1									W	**CP01308**
									1								W	**PP01022**
										1							W	**PP01023**
											1						W	**PP01024**
												1					W	**PP01025**
													1				W	**PP01029**
														1			W	**PP01026**
															1	1	W	**PP01027**
Choppers/Rectifiers																		
									1								W	**CP01367**
										1							W	**CP01368**
Diode/Thyristor Modules																		
											3	3	3				W	**PP01035**
														3	3	3	W	**CP01268**
Rectifying Boards																		
											1	1	1				W	**VB00242**
														1	1	1	W	**VB00227**

380–500V, Frames FR4–FR9

Frame	4						5			6			7			8			9		Delivery	
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	Code	Catalog Number
Control Board																						
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**
Power Boards																						
	1																				FB	**VB00208-0003-5**
		1																			FB	**VB00208-0004-5**
			1																		FB	**VB00208-0005-5**
				1																	FB	**VB00208-0007-5**
					1																FB	**VB00208-0009-5**
						1															FB	**VB00210-0012-5**
							1														FB	**VB00213-0016-5**
								1													FB	**VB00213-0022-5**
									1												FB	**VB00213-0031-5**
										1											FB	**VB00216-0038-5**
											1										FB	**VB00216-0045-5**
												1									FB	**VB00216-0061-5**
													1								FB	**VB00219-0072-5**
														1							FB	**VB00219-0087-5**
															1						FB	**VB00219-0105-5**
																1					FB	**VB00236-0140-5**
																	1				FB	**VB00236-0168-5**
																		1			FB	**VB00236-0205-5**

Note

① I_L only; has no corresponding I_H rated hp rating.

380–500V, Frames FR4–FR9, continued

Frame	4						5			6			7			8			9		Delivery Code	Catalog Number
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200		
Electrolytic Capacitors																						
	2	2	2	2																	W	**PP01000**
					2	2															W	**PP01001**
							2	2													W	**PP01002**
									2												W	**PP01003**
										2	2	2									W	**PP01004**
													2	2	2	4	4	4	8	8	W	**PP01005**
Cooling Fans																						
	1	1	1	1	1	1															W	**PP01060**
							1	1	1												W	**PP01061**
										1	1	1									W	**PP01062**
													1	1	1						W	**PP01063**
																1	1	1			FC	**PP01123** ②
																			1	1	FC	**PP01080** ③
	1	1	1	1	1	1															W	**PP01086**
							1	1	1												FC	**PP01088**
										1	1	1	1	1	1						W	**PP01049**
																1	1	1			FC	**CP01180**
																			1 ④	2	W	**PP01068**
																			1	1	FC	**PP09051**
IGBT Modules																						
	1	1	1																		W	**CP01304**
				1	1																W	**CP01305**
						1	1														W	**CP01306**
								1													W	**CP01307**
									1												W	**CP01308**
										1											W	**PP01020**
											1										W	**PP01022**
												1									W	**PP01023**
													1								W	**PP01024**
														1							W	**PP01025**
															1						W	**PP01029**
																1					W	**PP01026**
																	1	1			W	**PP01027**
Chopper/Rectifiers																						
										1	1										W	**CP01367**
												1									W	**CP01368**
Diode/Thyristor Modules																						
													3	3	3						W	**PP01035**
																3	3	3			W	**CP01268**
																			3	3	W	**PP01037**

Notes

① I_L only; has no corresponding I_H rated hp rating.
② PP00061 capacitor not included in main fan; please order separately.
③ PP00011 capacitor not included in main fan; please order separately.
④ For FR9 NEMA Type 12/IP54 you need two PP01068 internal fans.

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380–500V, Frames FR4–FR9, continued

Frame	4						5			6			7			8			9			
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	Delivery Code	Catalog Number
Rectifying Boards																						
													1	1	1						W	**VB00242**
																1	1	1			W	**VB00227**
																			1	1	W	**VB00459**
Rectifying Module Sub-Assembly																						
																			1	1	W	**FR09810**
Power Module Sub-Assemblies																						
																			1		W	**FR09-150-4-ANS** ②
																				1	W	**FR09-200-4-ANS** ②

380–500V, Frames FR10–FR12

Frame	10			11			12				
hp (I_H):	250	300	350	400	500	550	600	650	700	Delivery Code	Catalog Number
Control Board											
	1	1	1	1	1	1	1	1	1	W	**VB00561** ③
Shunt Boards											
	6									FC	**VB00537**
		6								FC	**VB00497**
			6				12	12	12	FC	**VB00498**
				9						FC	**VB00538**
					9					FC	**VB00513**
						9				FC	**VB00514**
Driver Boards											
				3	3	3				FC	**VB00489**
	1	1	1				2	2	2	FC	**VB00487**
Driver Adapter Board											
	1	1	1				2	2	2	FC	**VB00330**
ASIC Board											
	1	1	1	1	1	1	2	2	2	FC	**VB00451**
Feedback Interface Board											
							2	2	2	FC	**VB00448**
Star Coupler Board											
							1	1	1	FC	**VB00336**
Power Modules											
	1	1	1	2	2	2	2	2	2	FC	**FR10820** ④
	2	2	2							FC	**FR10828**
	1									FC	**FR10-250-4-ANS** ②
		1								FC	**FR10-300-4-ANS** ②
			1				2	2	2	FC	**FR10-350-4-ANS** ②
				3						FC	**FR11–400-4-ANS** ②
					3					FC	**FR11-500-4-ANS** ②
						3				FC	**FR11-550-4-ANS** ②

Notes

① I_L only; has no corresponding I_H rated hp rating.

② See **Page V6-T2-18** for details.

③ SPX9000 drives only (FR10 and larger).

④ Rectifying board not included.

380–500V, Frames FR10–FR12, continued

Frame	10			11			12			Delivery	
hp (I_H):	250	300	350	400	500	550	600	650	700	Code	Catalog Number
Electrolytic Capacitors											
	2	2	2	3	3	3	4	4	4	FC	**PP00060**
	12	12	12	18	18	18	24	24	24	FC	**PP01005**
Fuses											
	1	1	1	1	1	1	2	2	2	FC	**PP01094**
	2	2	2	2	2	2	4	4	4	FC	**PP01095**
Cooling Fans and Isolation Transformers											
	2	2	2	3	3	3	4	4	4	FC	**VB00299**
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ①
	2	2	2				4	4	4	FC	**PP01068**
	1	1	1	1	1	1	2	2	2	FC	**PP01096**
	1	1	1				2	2	2	FC	**FR10844**
	1	1	1	3	3	3	2	2	2	FC	**FR10845**
	1	1	1				2	2	2	FC	**FR10846**
	1	1	1	3	3	3	2	2	2	FC	**FR10847**
Rectifying Board											
	1	1	1	2	2	2	2	2	2	FC	**VB00459**

525–690V, Frames FR6–FR9

Frame	6									7		8			9				Delivery	
hp (I_H):	2	3	5 ②	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ②	Code	Catalog Number
Control Board																				
	1	1	1	1	1	1	1	1	1	1	1					1	1	1	W	**VB00252**
Driver Boards																				
	1																		FB	**VB00404-0004-6**
		1																	FB	**VB00404-0005-6**
			1																FB	**VB00404-0007-6**
				1															FB	**VB00404-0010-6**
					1														FB	**VB00404-0013-6**
						1													FB	**VB00404-0018-6**
							1												FB	**VB00404-0022-6**
								1											FB	**VB00404-0027-6**
									1										FB	**VB00404-0034-6**
Power Boards																				
										1									FB	**VB00419-0041-6**
											1								FB	**VB00419-0052-6**
												1							FB	**VB00422-0062-6**
													1						FB	**VB00422-0080-6**
														1					FB	**VB00422-0100-6**
Power Modules																				
															1				FC	**FR09-100-5-ANS** ③
																1			FC	**FR09-125-5-ANS** ③
																	1		FC	**FR09-150-5-ANS** ③
																		1	FC	**FR09-175-5-ANS** ③

Notes

① PP00060 capacitor not included in main fan; please order separately.
② I_L only; has no corresponding I_H rated hp rating.
③ See **Page V6-T2-18** for details.

525–690V, Frames FR6–FR9, continued

Frame	6									7		8			9				Delivery Code	Catalog Number
hp (I_H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①		
Electrolytic Capacitors																				
	2	2	2	2	2	2	2	2	2										FC	**PP01093**
										2	2	4	4		8	8	8	8	FC	**PP01041**
														4					FC	**PP01040**
Fuses																				
												1	1	1	1	1	1	1	W	**PP01094**
												2	2	2	2	2	2	2	W	**PP01095**
Cooling Fans																				
	1	1	1	1	1														W	**PP01061**
						1	1	1	1										W	**PP01062**
										1	1								W	**PP01063**
												1	1	1					FC	**PP01123**
	1	1	1	1	1	1	1	1	1	1	1								W	**PP01049**
												1	1	1					FC	**CP01180**
															1	1	1	1 ②	W	**PP01068**
															1	1	1	1	FC	**PP01080**
Fan Power Supply																				
																1	1	1	FC	**VB00299**
IGBT Modules																				
	3	3	3	3	3	3	3	3	3										FC	**PP01091**
										1	1								FC	**PP01089**
												1	1	1					FC	**PP01127**
IGBT/Diode (Brake)																				
	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	FC	**PP01040**
Diode Module																				
	1	1	1	1	1	1	1	1	1										FC	**PP01092**
Diode/Thyristor Modules																				
										3	3								FC	**PP01071**
															3	3	3	3	FC	**PP01072**
Rectifying Boards																				
										1	1								FC	**VB00442**
															1	1	1	1	FC	**VB00460**
Rectifying Module Sub-Assemblies																				
																1	1	1	W	**FR09810**
																1	1	1	FC	**FR09811**

Notes

① I_L only; has no corresponding I_H rated hp rating.

② For NEMA Type 12/IP54, two PP01068 internal fans are needed.

525–690V, Frames FR10–FR12

Frame	10			11			12			Delivery	
hp (I_H):	200	250	300	400	450	500	550	600	700	Code	Catalog Number
	Component Boards										
	1	1	1	1	1	1	1	1	1	W	**VB00561** ①
	1	1	1	1	1	1	2	2	2	FC	**VB00451**
	6									FC	**VB00545**
		6								FC	**VB00510**
			6				12	12	12	FC	**VB00511**
	1	1	1				2	2	2	FC	**VB00330**
	1	1	1				2	2	2	FC	**VB00487**
				3	3	3				FC	**VB00489**
				9						FC	**VB00546**
					9					FC	**VB00547**
						9				FC	**VB00512**
							2	2	2	FC	**VB00448**
							1	1	1	FC	**VB00336**
	Power Modules										
	1	1	1	2	2	2	2	2	2	FC	**FR10821** ②
	2	2	2							FC	**FR10829**
	1									FC	**FR10-200-5-ANS** ③
		1								FC	**FR10-250-5-ANS** ③
			1				2	2	2	FC	**FR10-300-5-ANS** ③
				3						FC	**FR11–400-5-ANS** ③
					3					FC	**FR11-450-5-ANS** ③
						3				FC	**FR11-500-5-ANS** ③
	Electrolytic Capacitors										
	2	2	2	3	3	3	4	4	4	FC	**PP00060**
	12	12	12	18	18	18	24	24	24	FC	**PP01099**
	Fuses										
	1	1	1	1	1	1	2	2	2	FC	**PP01094**
	2	2	2	2	2	2	4	4	4	FC	**PP01095**
	Cooling Fans and Isolation Transformers										
	2	2	2	3	3	3	4	4	4	FC	**VB00299**
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ④
	2	2	2				4	4	4	FC	**PP01068**
	1	1	1	1	1	1	2	2	2	FC	**PP01096**
	1	1	1				2	2	2	FC	**FR10844**
	1	1	1	3	3	3	2	2	2	FC	**FR10845**
	1	1	1				2	2	2	FC	**FR10846**
	1	1	1	3	3	3	2	2	2	FC	**FR10847**
	Fan Power Supply										
							1	1	1	FC	**VB00299**
	Rectifying Boards										
	1	1	1	2	2	2	2	2	2	FC	**VB00460**

Notes

① SPX9000 drives only (FR10 and larger).
② Rectifying board not included.
③ See **Page V6-T2-18** for details.
④ PP00060 capacitor not included in main fan; please order separately.

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Technical Data and Specifications

SVX9000 Drives

Description	Specification
Input Ratings	
Input voltage (V_{in})	+10%/–15%
Input frequency (f_{in})	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
High withstand rating	100 kAIC
Output Ratings	
Output voltage	0 to V_{in}
Continuous output current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload current (I_H/I_L)	150% I_H, 110% I_L for 1 min.
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current (I_H)	250% for 2 seconds
Control Characteristics	
Control method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: SPX9000 drives only
Switching frequency Frame 4–6 Frame 7–12	Adjustable with parameter 2.6.9 1–16 kHz; default 10 kHz 1–10 kHz; default 3.6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy ±1% V/Hz Panel reference: Resolution 0.01 Hz
Field weakening point	30–320 Hz
Acceleration time	0–3000 sec.
Deceleration time	0–3000 sec.
Braking torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient operating temperature	14°F (–10°C), no frost to 122°F (50°C) I_H (FR4–FR9) 14°F (–10°C), no frost to 104°F (40°C) I_H (FR10 and up) 14°F (–10°C), no frost to 104°F (40°C) I_L (all frames)
Storage temperature	–40° to 158°F (–40° to 70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 9842 ft (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	NEMA 1/IP21 or NEMA 12/IP54, open chassis/IP20

Description	Specification
Control Connections	
Analog input voltage	0 to 10V, R = 200 kohms (–10 to 10V joystick control) resolution 0.1%; accuracy ±1%
Analog input current	0(4) to 20 mA; R_i—250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24V ±15%, max. 250 mA
Output reference voltage	+10V +3%, max. load 10 mA
Analog output	0(4) to 20 mA; R_L max. 500 ohms; resolution 10 bit; accuracy ±2%
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	Two programmable Form C relay outputs switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A
Protections	
Overcurrent protection	Trip limit 4.0 x I_H instantaneously
Overvoltage protection	Yes
Undervoltage protection	Yes
Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input phase supervision	Trips if any of the input phases are missing
Motor phase supervision	Trips if any of the output phases are missing
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection	Yes (+24V and +10V reference voltages)

Standard I/O Specifications

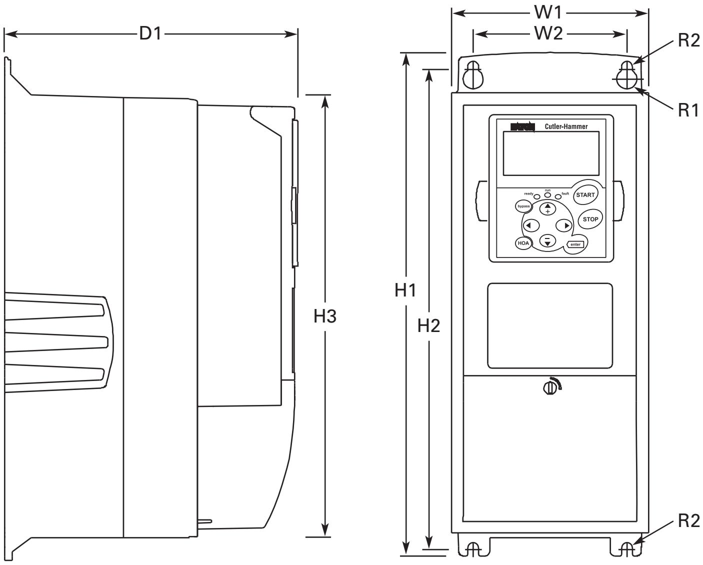
Description	Specification
Six–digital input programmable	24V: "0" ≤10V, "1" ≥18V,R_i >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10V, R_i >200 kohms Current: 0 (4)–20 mA, R_i = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R_L max. 500 ohms 10 bits ±2%
One digital output programmable	Open collector 48 Vdc 50 mA

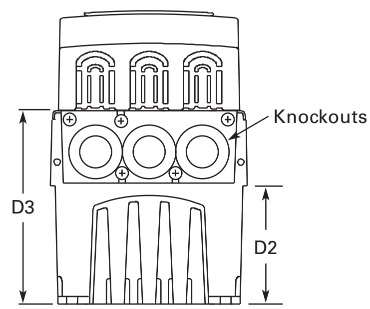
Dimensions

Approximate Dimensions in Inches (mm)

9000X Open Drives

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR4, FR5 and FR6

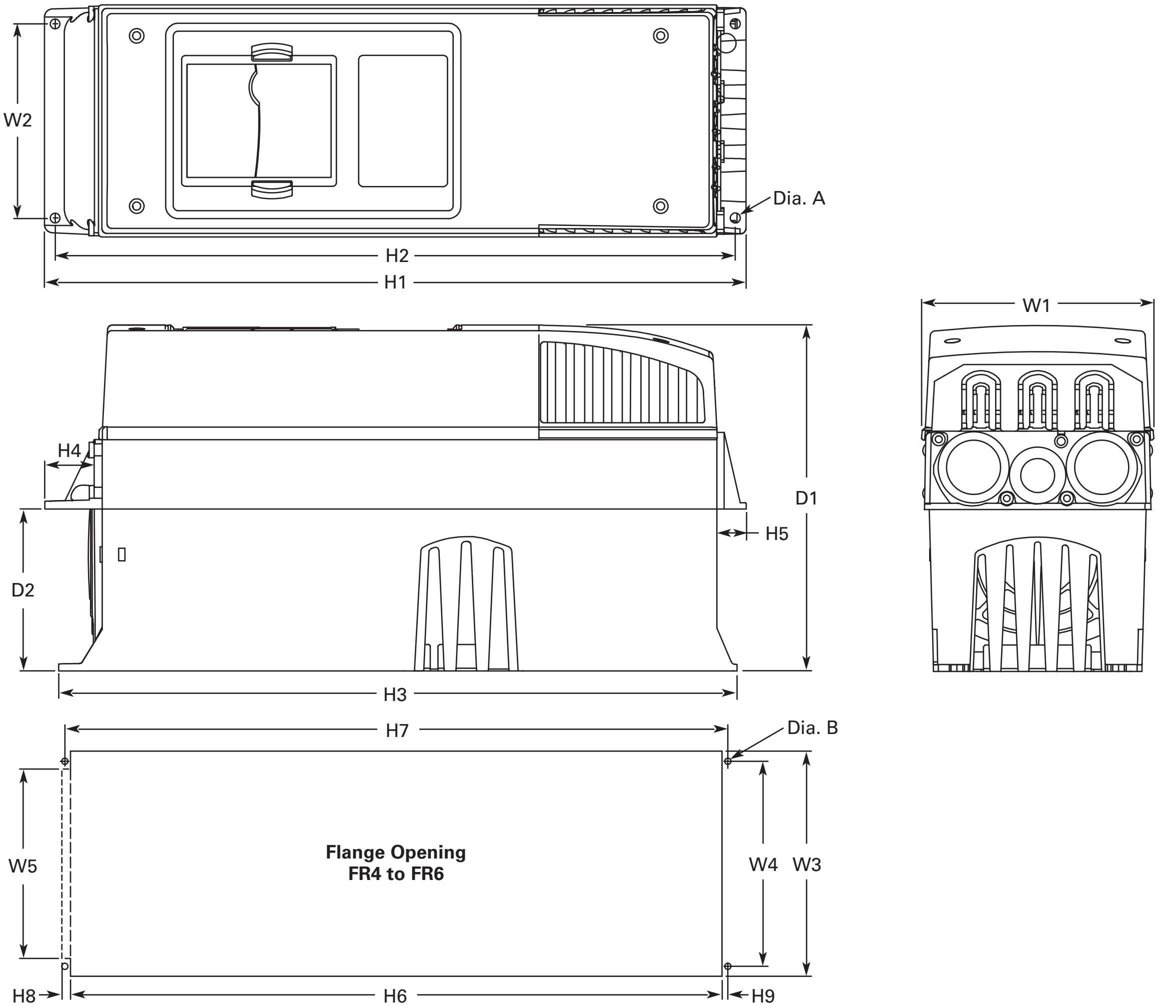




Voltage	hp (I_H)	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
FR4													
230V	3/4–3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	4.9 (126)	5.0 (128)	3.9 (100)	0.5 (13)	0.3 (7)	11.0 (5)	3 @ 1.1 (28)
480V	1–5												
FR5													
230V	5–7-1/2	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	0.5 (13)	0.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
480V	7-1/2–15												
FR6													
230V	10–15	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	0.6 (15.5)	0.4 (9)	40.8 (19)	3 @ 1.5 (37)
480V	20–30												
575V	2–25												

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54 with Flange Kit, FR4, FR5 and FR6



FR4, FR5 and FR6 with Flange Kit

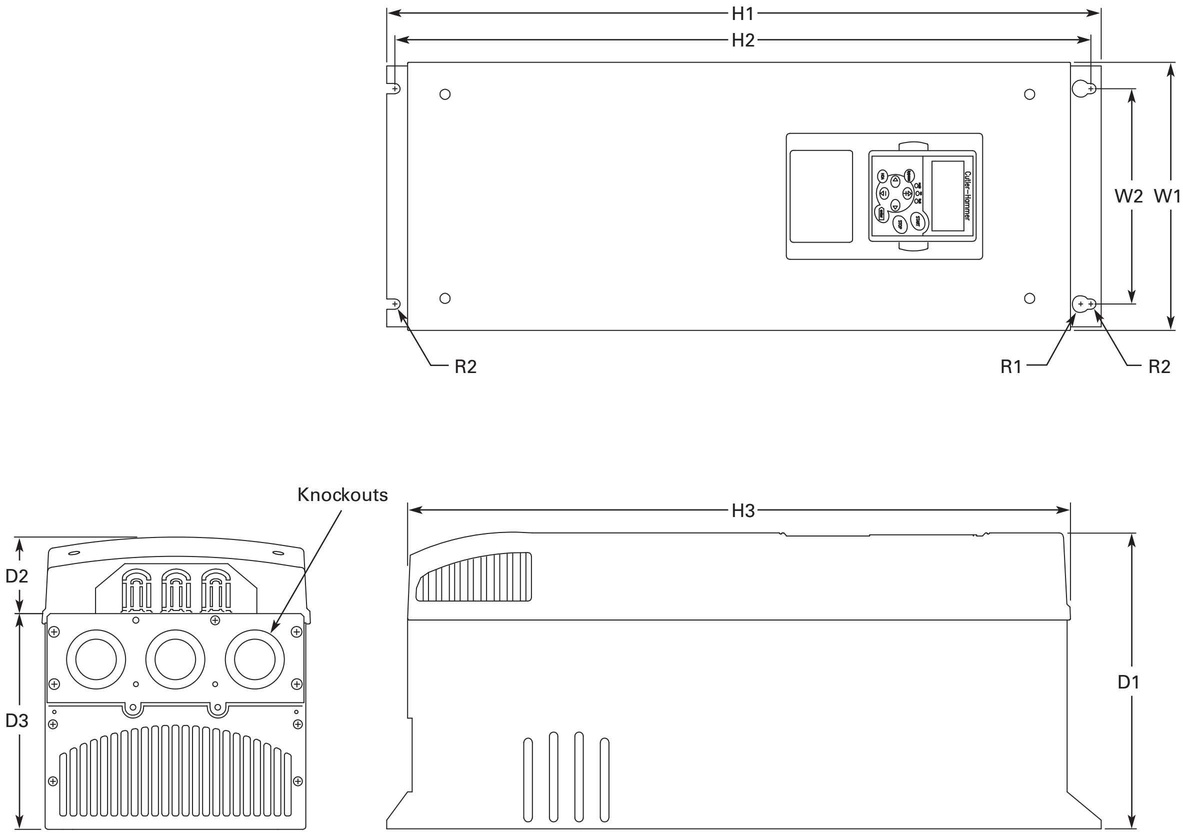
W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4									
5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	0.9 (22)	7.5 (190)	3.0 (77)	0.3 (7)
FR5									
5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	0.7 (18)	8.4 (214)	3.9 (100)	0.3 (7)
FR6									
7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	0.8 (20)	9.3 (237)	4.2 (106)	0.3 (7)

Flange Opening, FR4 to FR6

W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4							
4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	0.2 (5)	0.3 (7)
FR5							
5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	0.2 (5)	0.3 (7)
FR6							
7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	0.3 (7)	0.2 (5)	0.3 (7)

Approximate Dimensions in Inches (mm)

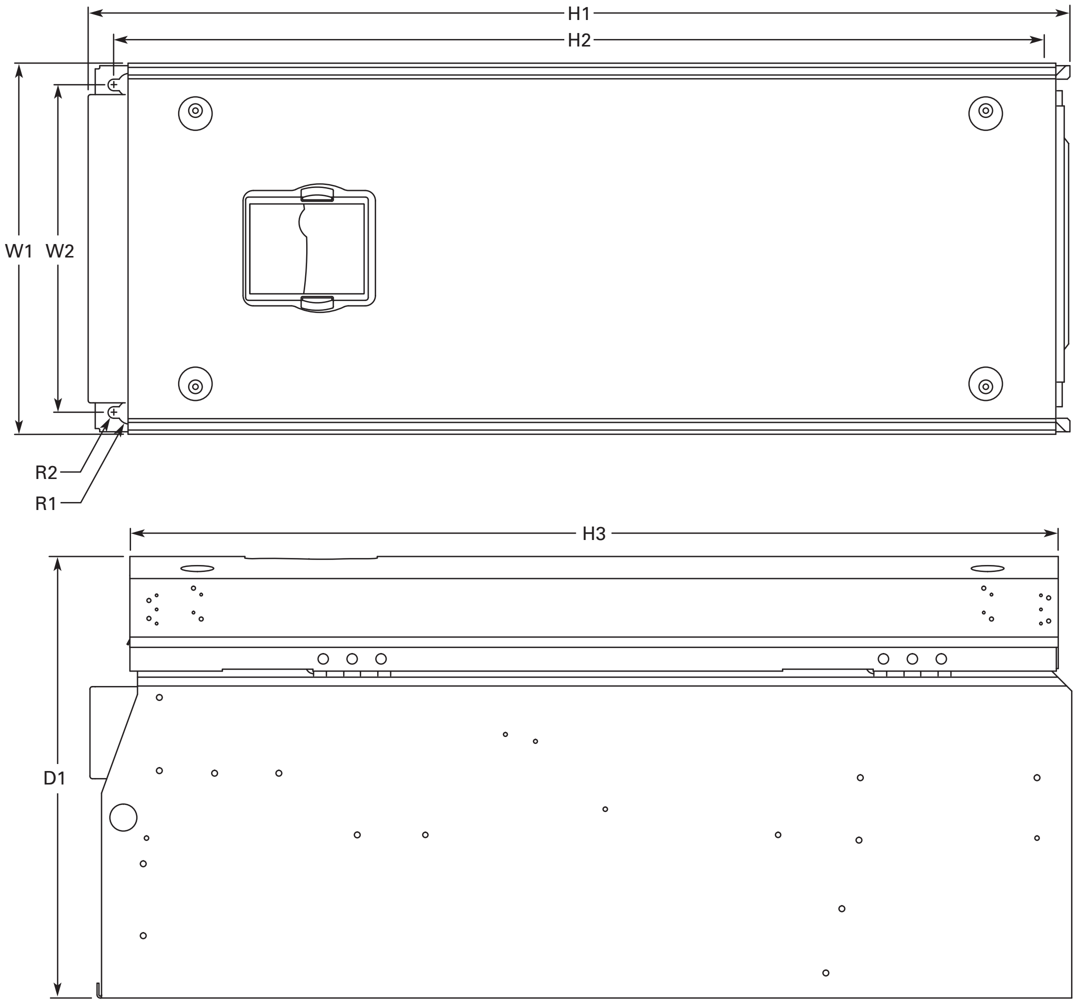
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR7



Voltage	hp (I_H)	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
230V	20–30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	0.7 (18)	0.4 (9)	77.2 (35)	3 at 1.5 (37)
480V	40–60												
575V	30–40												

Approximate Dimensions in Inches (mm)

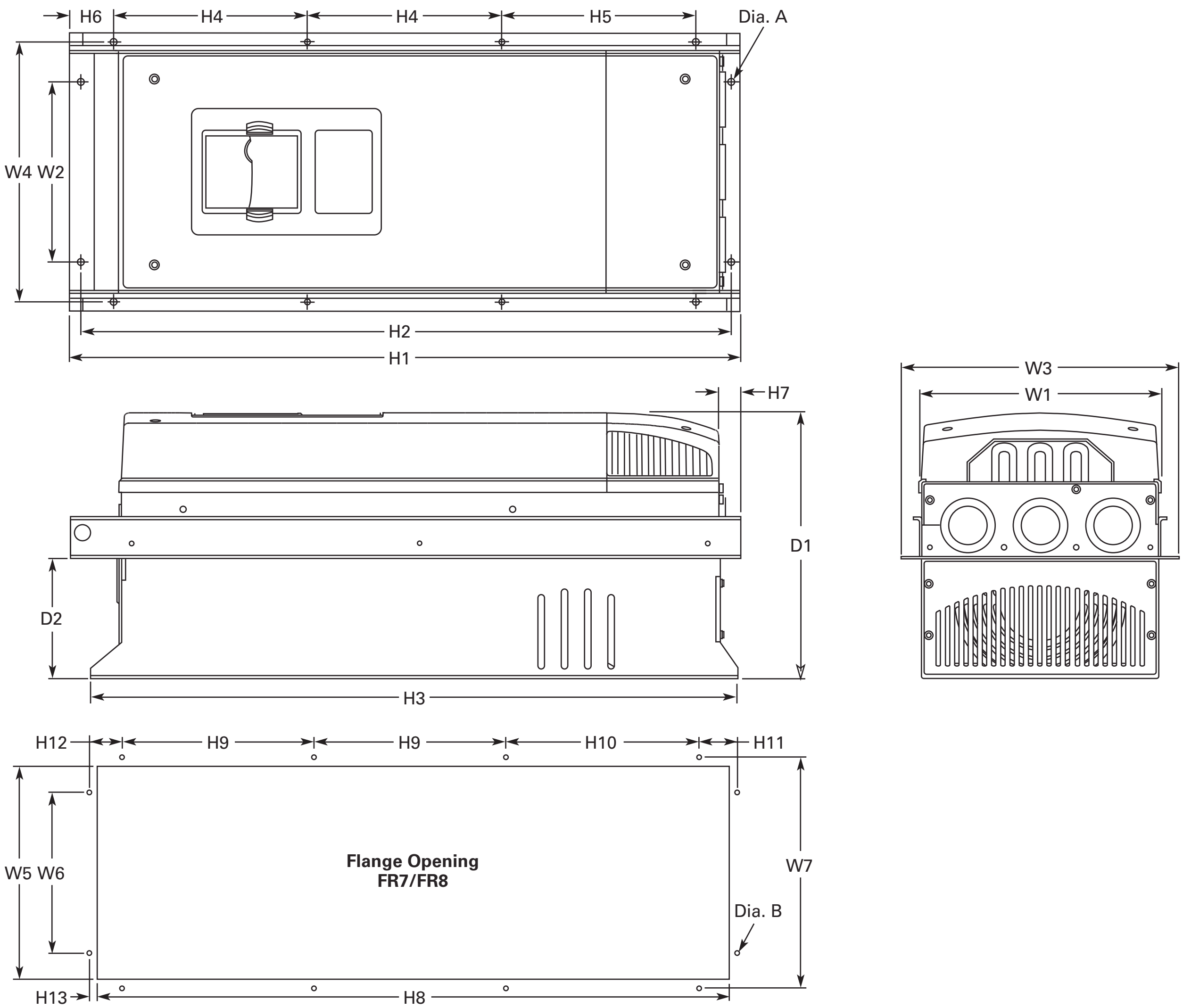
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR8



Voltage	hp (I_H)	D1	H1	H2	H3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230V	40–60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	0.7 (18)	0.4 (9)	127 (58)
480V	75–125									
575V	50–75									

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, with Flange Kit, FR7 and FR8



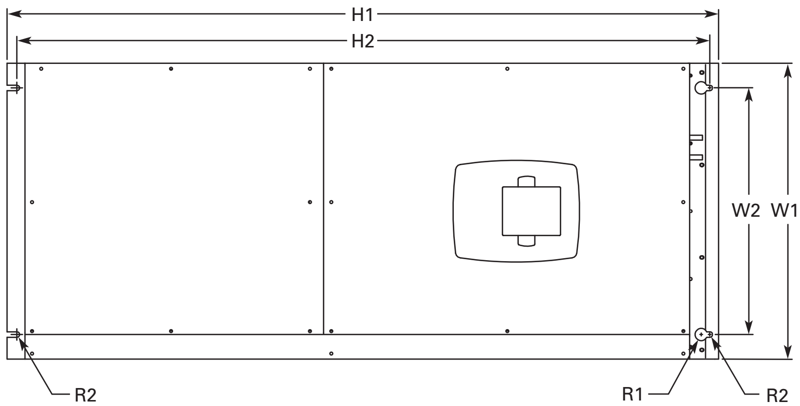
W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7													
9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	24.9 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	0.9 (23)	0.8 (20)	10.1 (257)	4.6 (117)	0.3 (6)
FR8													
11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	0.4 (9)

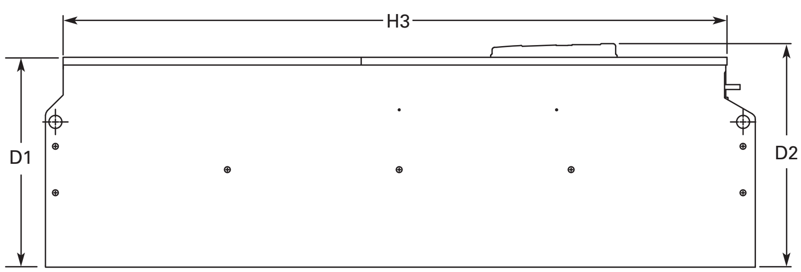
Flange Opening, FR7 and FR8

W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7									
9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	0.3 (6)
FR8									
11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	0.4 (9)

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9

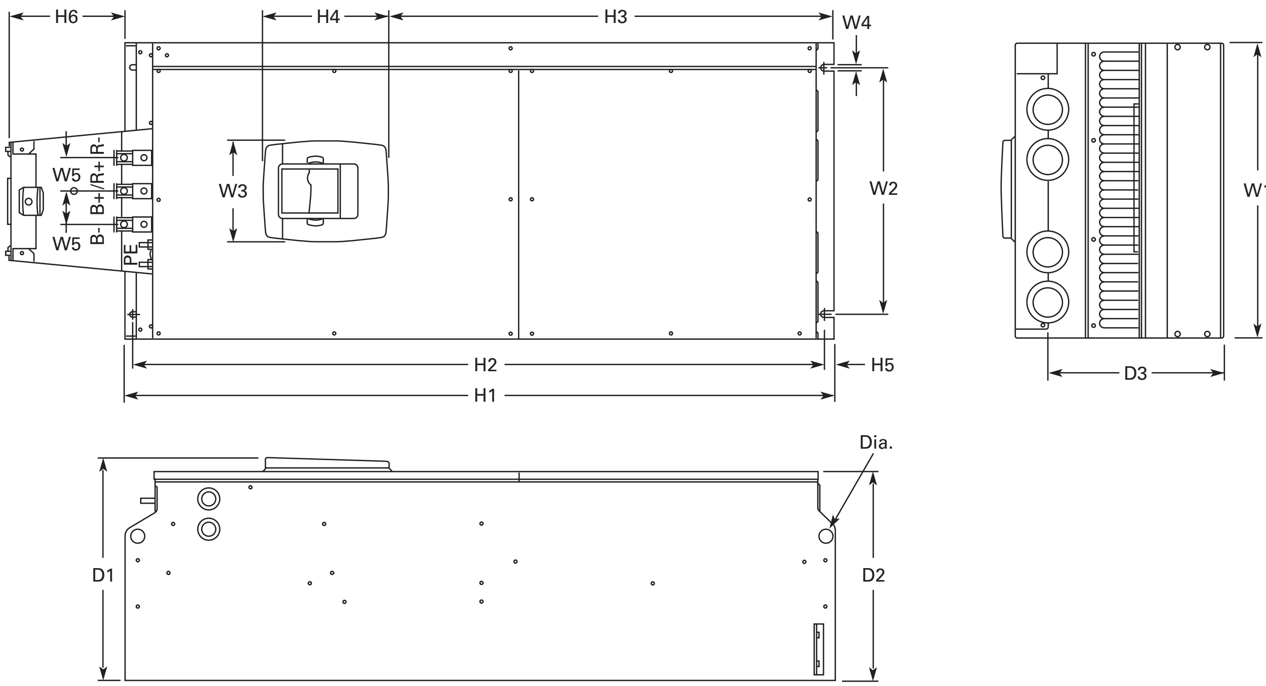




Voltage	hp (I_H)	H1	H2	H3	D1	D2	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230V	75–100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	0.8 (20)	0.4 (9)	321.9 (146)
480V	150–200										
575V	100–175										

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54 FR9, continued



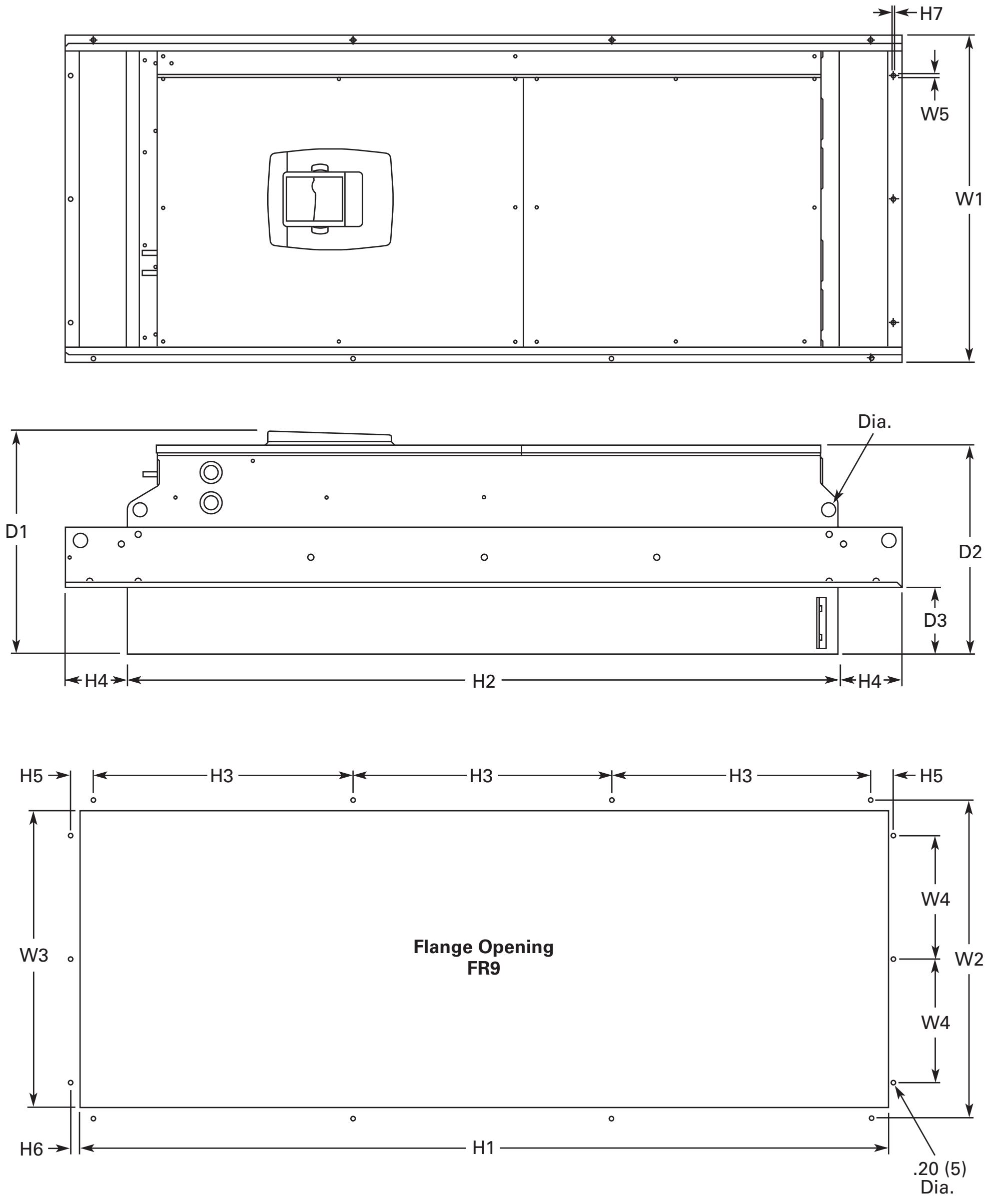
W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
18.9 (480)	15.7 (400)	6.5 (165)	0.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	0.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	0.8 (21)

Note

① Brake resistor terminal box (H6) included when brake chopper ordered.

Approximate Dimensions in Inches (mm)

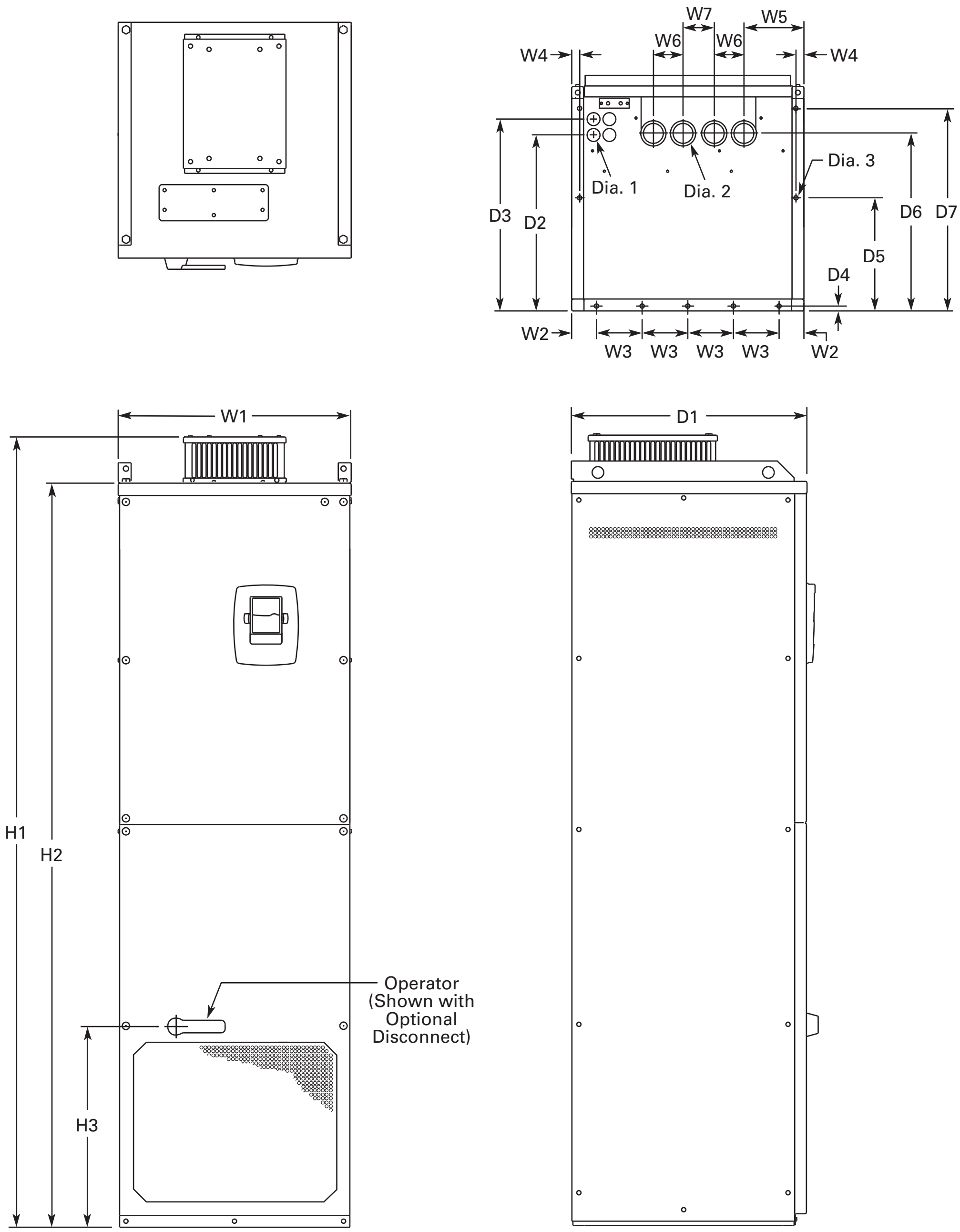
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9 with Flange Kit



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	0.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	0.4 (9)	0.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	0.8 (21)

Approximate Dimensions in Inches (mm)

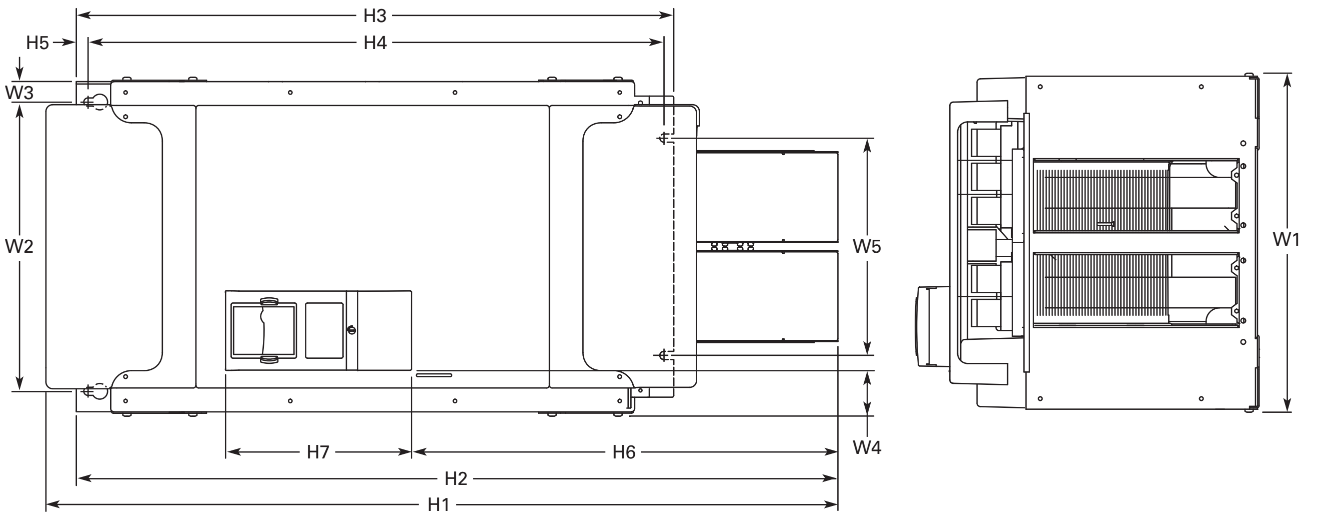
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR10 Freestanding

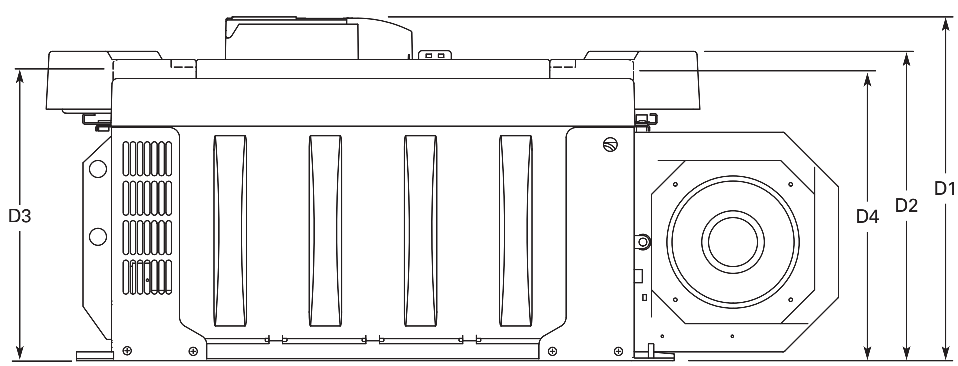


W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
23.43 (595)	2.46 (62.5)	4.53 (115)	0.79 (20)	5.95 (151)	2.95 (75)	30.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	0.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	0.83 (21)	1.89 (48)	0.43 (11)	857 (389)

Approximate Dimensions in Inches (mm)

FR10 Open Chassis ①





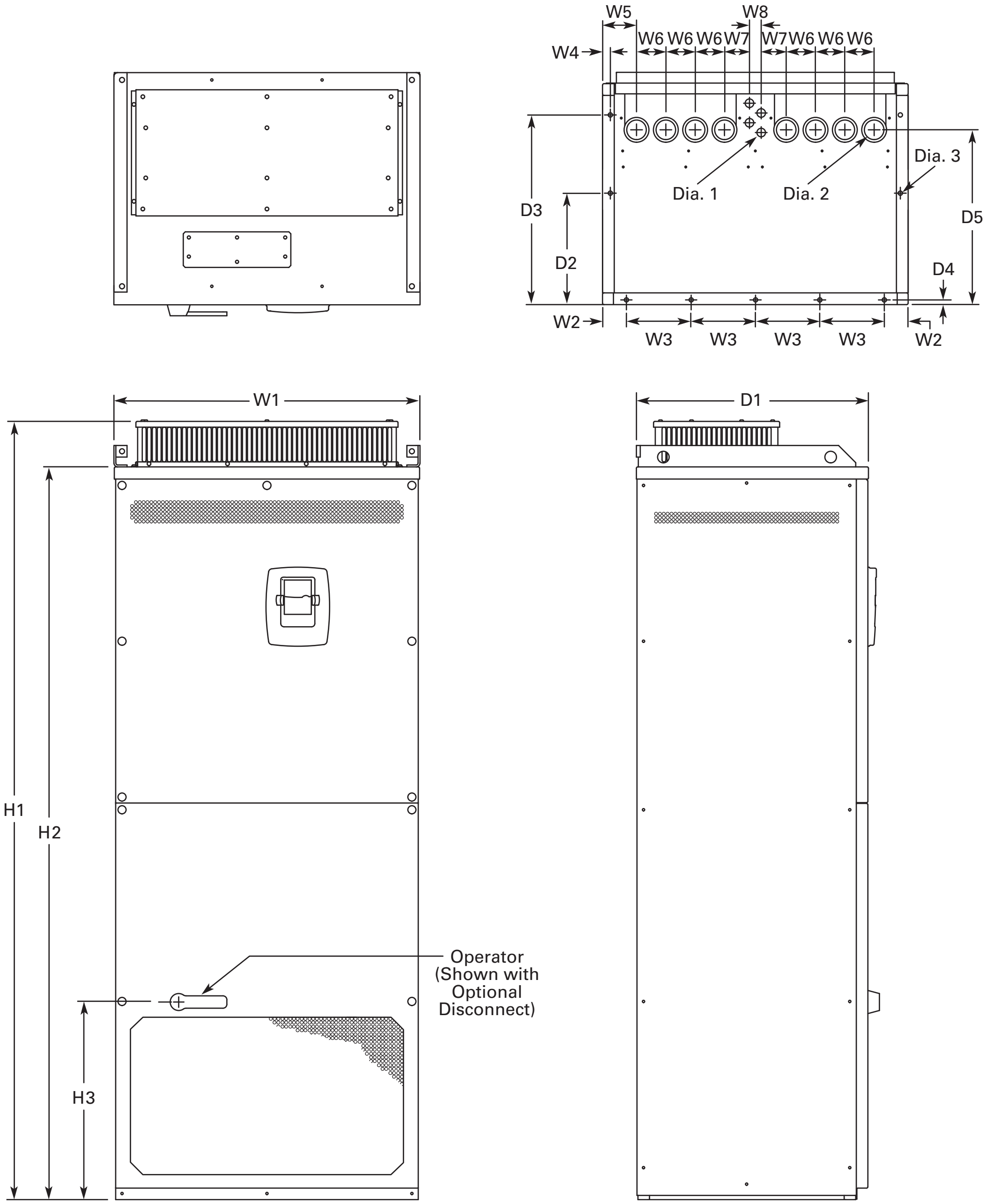
Voltage	hp (I_H)	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	Weight Lbs (kg)
480V	250–350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	0.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
575V	200–300																	

Note

① 9000X FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

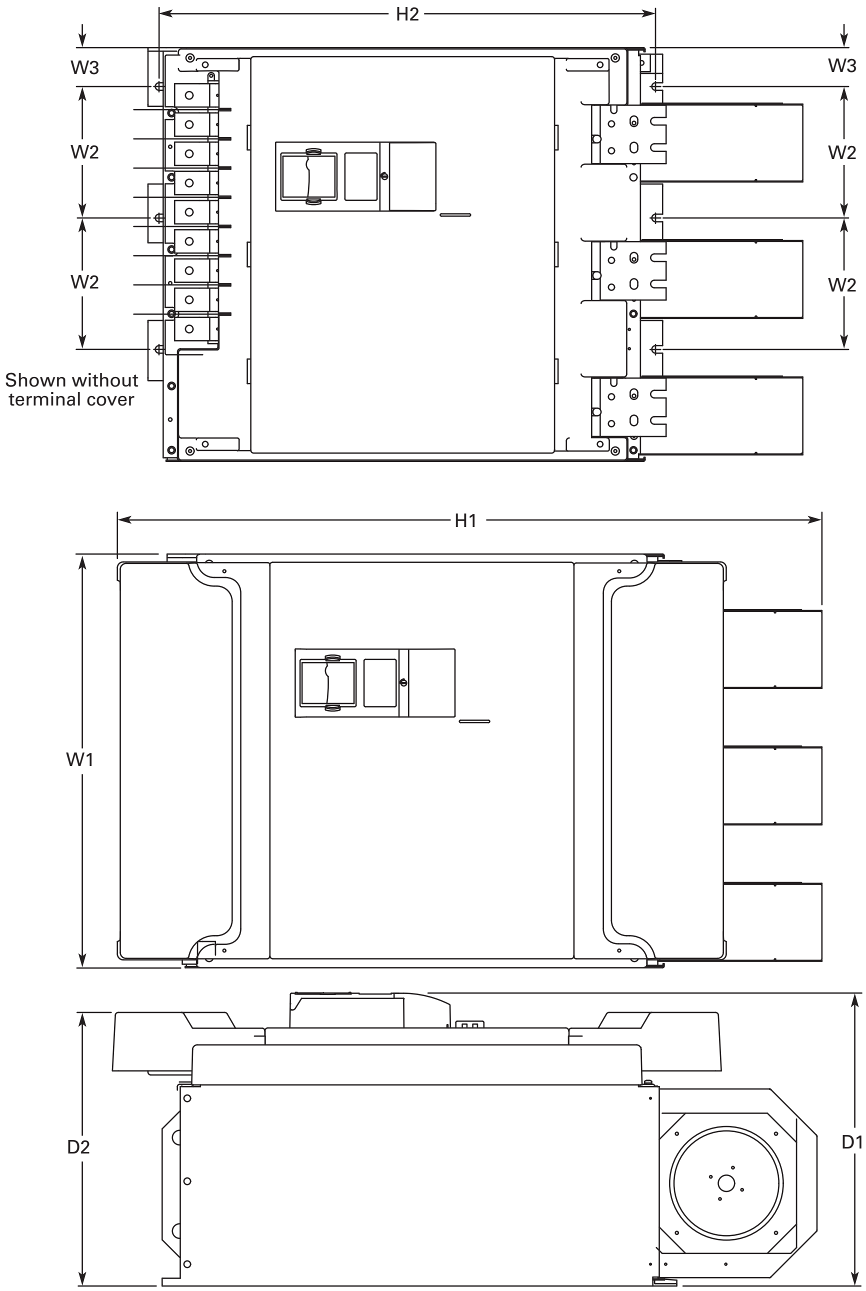
NEMA Type 1/IP21, FR11 Freestanding Drive



Voltage	hp (I_H)	W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480	400–550	31.26 (794)	2.40 (61)	6.50 (165)	0.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	0.47 (12)	17.60 (447)	0.83 (21)	1.89 (48)	0.35 x 0.43 (9 x 11)	526 (239)

Approximate Dimensions in Inches (mm)

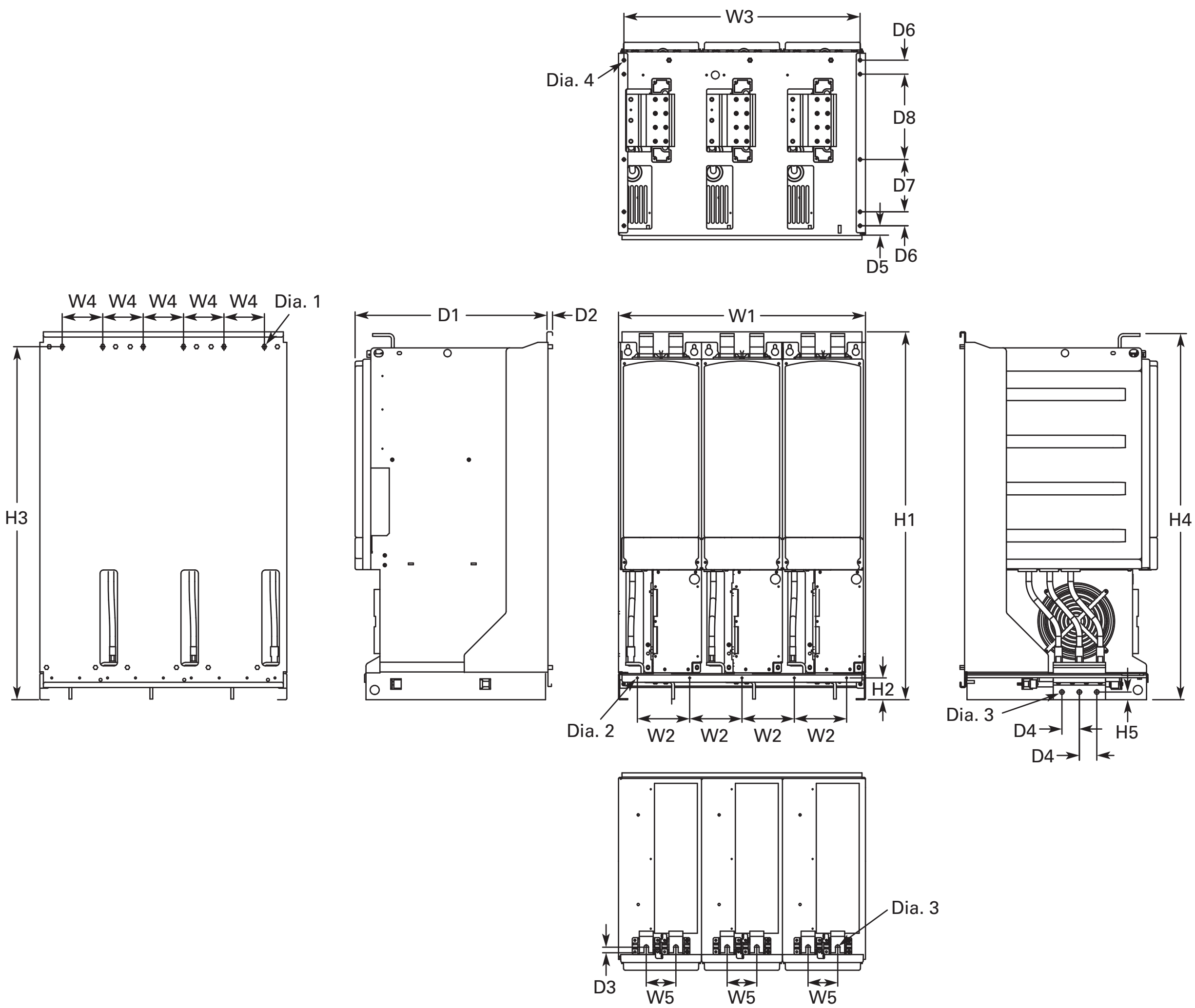
FR11 Open Chassis



Voltage	hp (I_H)	W1	W2	W3	H1	H2	D1	D2	Weight Lbs (kg)
480V	400–550	27.9 (709)	8.86 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
575V	400–500								

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Inverter



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.79 (20)	21.77 (553)	0.51 (13)	0.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	683 (310)

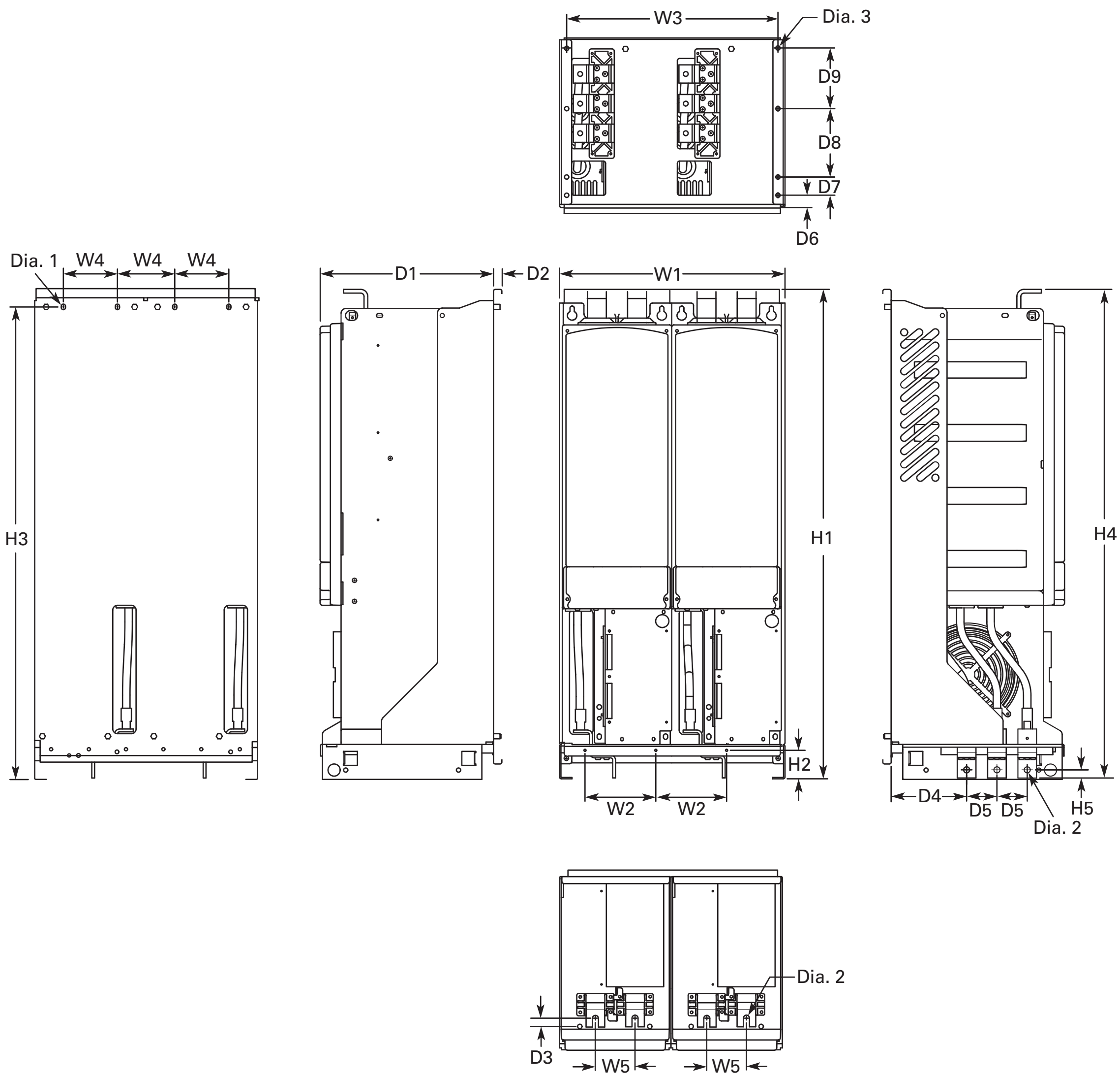
Notes

9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

FR13 is built from an inverter module and a converter module. Please refer to SPX9000 installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Converter



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.51 (13)	0.37 (9.5)	295 (134)

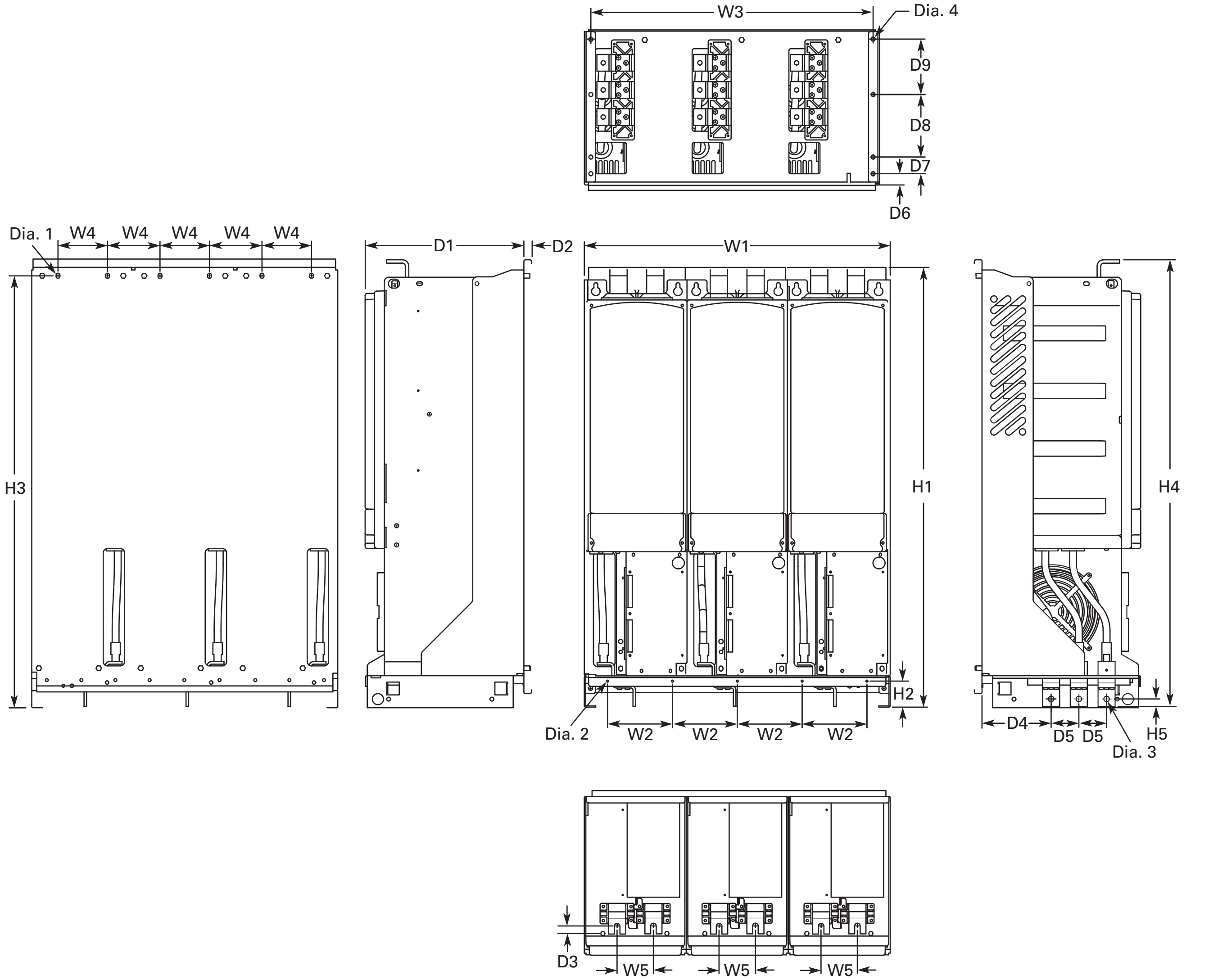
Number of Input Units

480V Catalog Number	hp	Input Modules
SPX800A0-4A2N1	800	2

690V Catalog Number	hp	Input Modules
SPX800A0-5A2N1	800	2
SPX900A0-5A2N1	900	2
SPXH10A0-5A2N1	1000	2

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Converter—900/1000 hp 480V



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	443 (201)

Number of Input Units

480V Catalog Number	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Approximate Dimensions in Inches (mm)

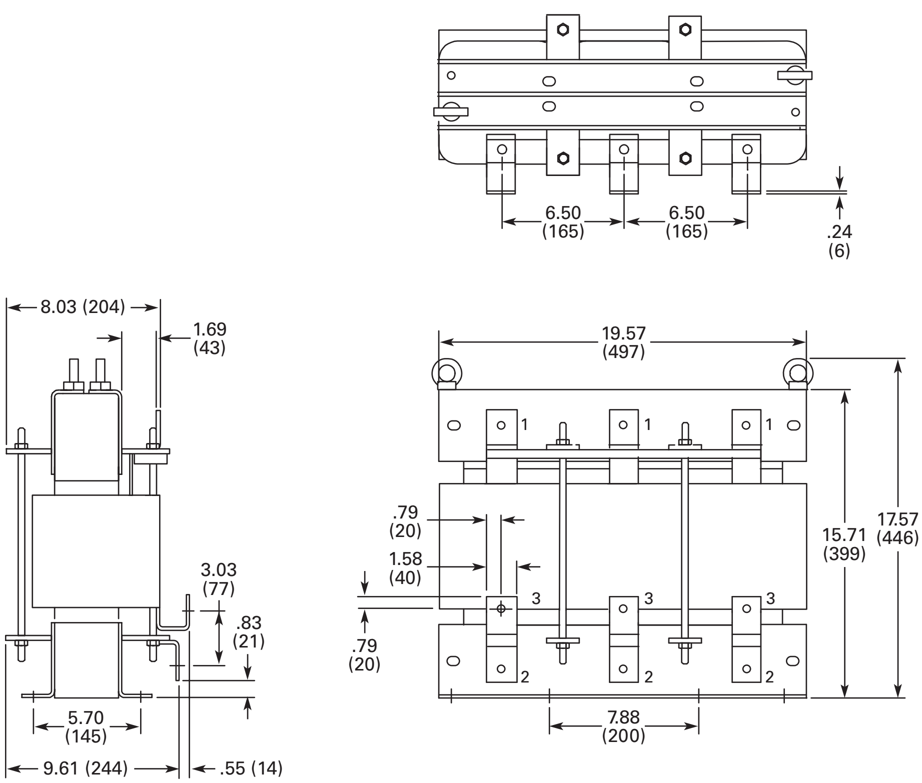
AC Choke Dimensions

Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380–500V		
SPX 250 4	FR10	CHK0400
SPX 300 4		CHK0520
SPX 350 4		CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4		2 x CHK0400
SPX 550 4		2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4		2 x CHK0520
SPX 700 4		2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4		3 x CHK0520
SPX H10 4		3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4		6 x CHK0400

Catalog Number	Frame Size	Choke Type ①
Voltage Range 525–690V		
SPX 200 5	FR10	CHK0261
SPX 250 5		CHK0400
SPX 300 5		CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5		CHK0520
SPX 500 5		2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5		2 x CHK0400
SPX 700 5		2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5		2 x CHK0400
SPX H10 5		2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5		6 x CHK0400

CHK0520

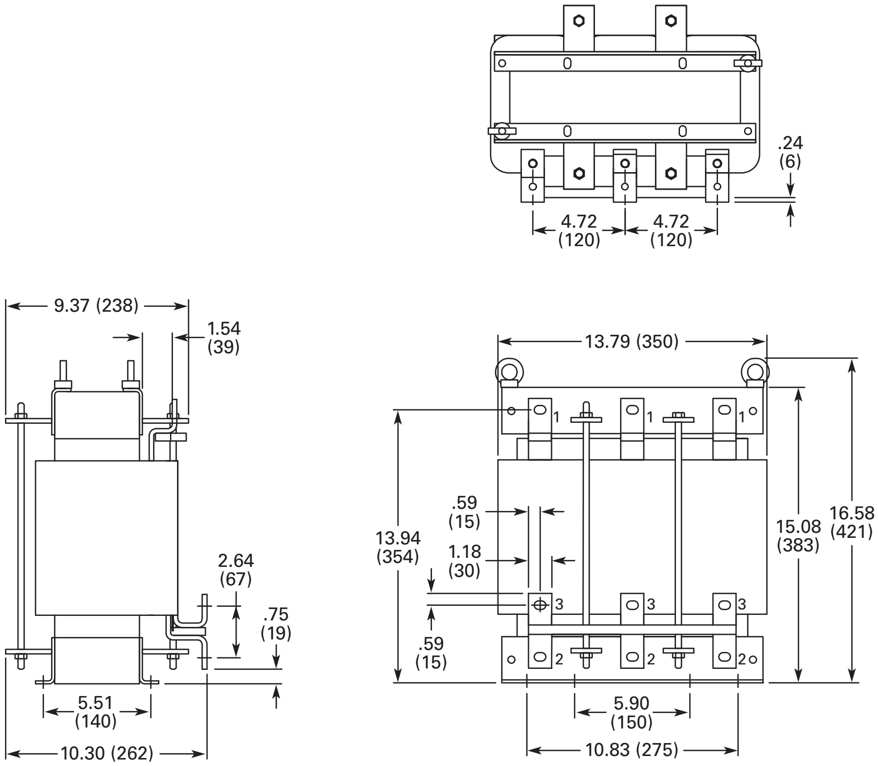


Note

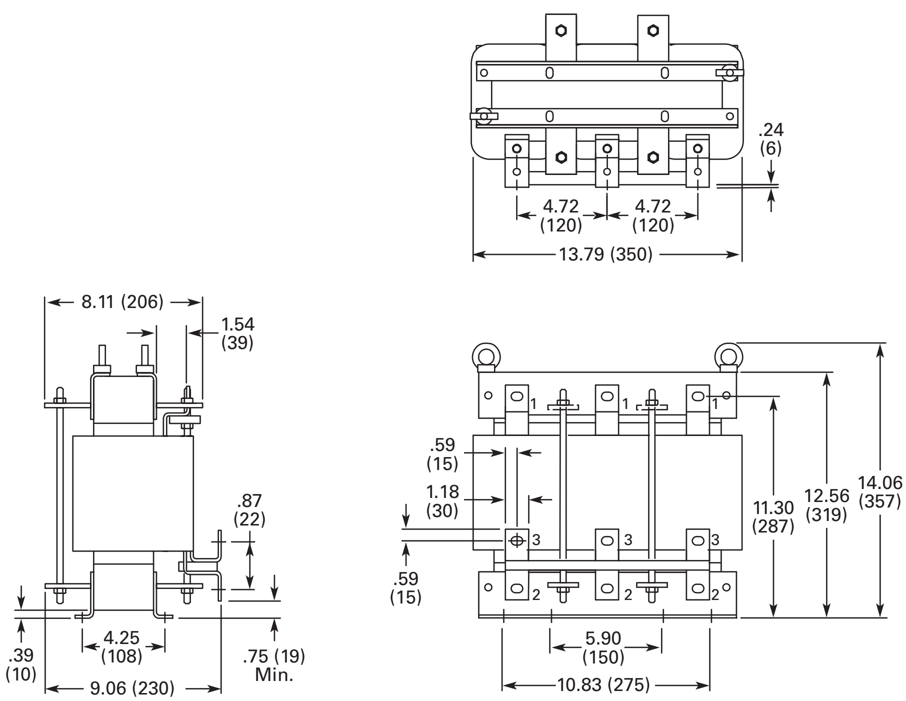
① Chokes are provided with all FR10–FR14 drives.

Approximate Dimensions in Inches (mm)

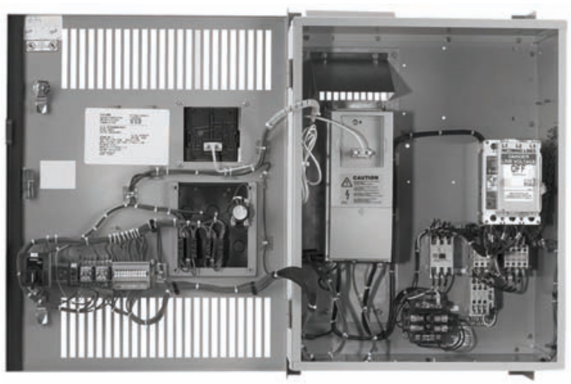
CHK0400



CHK0261



SVX9000 Enclosed Drives



Contents

SVX9000 Enclosed Drives

Product Description

- **Standard Enclosed—** covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed**—applies to specific customer requirements that vary from the standard enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered**—for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 1/IP21 or NEMA Type 12/IP54 enclosures
- Input voltage: 208V, 230V, 480V and 575V (consult factory)
- Complete range of control, network and power options
- Horsepower range:
  - 208V—3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 230V—3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 480V—1 to 700 hp I_H; 1-1/2 to 800 hp I_L
- HMCP padlockable

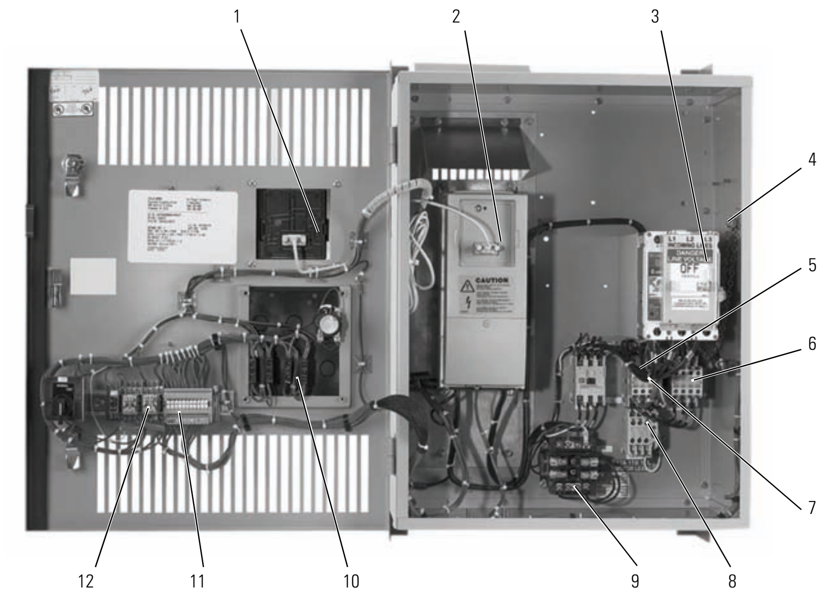
Standards and Certifications

- UL Listed
- cUL Listed

Listed   Listed

Product Identification

Enclosed 9000X Series Drive



1 Door mounted keypad (included as standard with bypass option)

2 SVX9000 variable frequency drive

3 Input disconnect (HMCP)
- Option P1

4 Input line fuses
- Option P3

5 Input contactor (included as standard with bypass option)

6 Output contactor
- Option PE (included as standard with bypass option)

7 Bypass contactor
- Option RB
- Option RA

8 Overload relay
- Option PH
- Option PI

9 115V control transformer
- Option KB

10 Bypass pilot lights and selector switches
- Option RB
- Option RA
- Option L2
- Option KF

11 Customer control and signal connection terminal block

12 Control relay

2

Catalog Number Selection

SVX9000 Enclosed NEMA Type 1/IP21 and NEMA Type 12/IP54 Drives

SVX F07 1 4 A A _ _ _ _ _ _ _ _ _ _ (Build Alphabetically and Numerically)

Product Family
SVX = Enclosed drives

Horsepower Rating		
F07 = 3/4 hp	**025** = 25 hp	**250** = 250 hp
001 = 1 hp	**030** = 30 hp	**300** = 300 hp
F15 = 1-1/2 hp	**040** = 40 hp	**350** = 350 hp
002 = 2 hp	**050** = 50 hp	**400** = 400 hp
003 = 3 hp	**060** = 60 hp	**500** = 500 hp
005 = 5 hp	**075** = 75 hp	**550** = 550 hp
007 = 7-1/2 hp	**100** = 100 hp	**600** = 600 hp
010 = 10 hp	**125** = 125 hp	**650** = 650 hp
015 = 15 hp	**150** = 150 hp	**700** = 700 hp
020 = 20 hp	**200** = 200 hp	**800** = 800 hp

Enclosure Rating
1 = NEMA Type 1/IP21
2 = NEMA Type 12/IP54
6 = NEMA Type 12/IP54 filtered

Voltage Rating
1 = 208V
2 = 230V
4 = 480V

Application—Torque/Braking ②
A = I_L/no brake chopper
B = I_L/internal brake chopper
D = I_H/no brake chopper
E = I_H/internal brake chopper

Enclosed Style
A = Enclosed drive

	Enclosed Options ①④⑤	Type
K1	Door-mounted speed potentiometer ③	Control
K2	Door-mounted speed potentiometer with HOA selector switch ③	Control
K3	3–15 psig follower	Control
K4	HAND/OFF/AUTO switch (22 mm)	Control
K5	MANUAL/AUTO ref switch (22 mm)	Control
K6	START/STOP pushbuttons (22 mm)	Control
KB	115V control transformer (550 VA)	Control
KF	Bypass test switch for RA and RB	Addl. bypass
KO	Standard elapsed time meter	Control
L1	Power on and fault pilot lights	Light
L2	Bypass pilot lights for RA, RB bypass options	Addl. bypass
LA	Green RUN light (22 mm)	Light
LD	Green STOP light (22 mm)	Light
LE	Red RUN light	Light
LF	Red STOP light (22 mm)	Light
LJ	White power on light (22 mm)	Light
LU	Misc. light (22 mm)	Light
P1	Input disconnect (HMCP) 100 kAIC	Input
P2	Disconnect switch ⑦	Input
P3	Input line fuses (200 kAIC)	Input
P7	Input power surge protection	Input
PE	Output contactor	Output
PF	Output filter	Output
PG	MotoRx (up to 600 ft) 1000 V/μS DV/DT filter	Output
PH	Single overload relay	Output
PI	Dual overload relays	Output
PN	Dual overloads for bypass	Addl. bypass
RA	Manual HOA bypass controller	Bypass
RB	Manual IOB bypass controller	Bypass
RC	Auto transfer HOA bypass controller	Bypass
RD	Auto transfer IOB bypass controller	Bypass
S5	Floor stand 22 in	Enclosure
S6	Floor stand 12 in	Enclosure
S7	10 in expansion	Enclosure
S8	20 in expansion	Enclosure
S9	Space heater	Enclosure

Communication Options ⑥		
C2 = Modbus	**C6** = CanOpen (slave)	**CA** = Johnson Controls N2
C3 = Profibus DP	**C7** = DeviceNet	**CI** = Modbus TCP
C4 = LonWorks	**C8** = Modbus (D9 type connector)	**CJ** = BACnet
C5 = Profibus DP (D9 connector)		**CK** = Ethernet IP
		C3 = RS-232 with D9 connection

Control Options	
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc	**B5** = 3 RO (NO)
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm	**B8** = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	**B9** = 1 RO (NO), 5 DI 42–240 Vac input

	Engineered Options
HT	High temperature rating for 50°C (FR10 and above) ⑧
VB	Varnished boards

Notes

① Local/remote keypad is included as the standard control panel.
② Brake chopper is a factory installed option only, see drive options on **Page V6-T2-18**. External dynamic braking resistors not included. Consult factory.
③ Includes local/remote speed reference switch.
④ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
⑤ See **Pages V6-T2-61** and **V6-T2-62** for descriptions.
⑥ See **Pages V6-T2-59** and **V6-T2-60** for complete descriptions.
⑦ Applicable only with FR10 and FR11 freestanding designs.
⑧ Consult Eaton for availability.

Product Selection

When Ordering

- Select a base catalog number that meets the application requirements—nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted local/remote keypad and enclosure.
- If dynamic brake chopper or control/communication option is desired, change the appropriate code in the base catalog number.
- Select enclosed options. Add the codes as suffixes to the base catalog number in alphabetical and numeric order.
- **Read all footnotes**.

208V Drives

SVX9000 Enclosed Drives

Input Base Drives

Enclosure Size ①	hp	Current (A)	NEMA Type 1/IP21 Frame Size	NEMA Type 1/IP21 Base Catalog Number ②	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②
High Overload Drive and Enclosure						
0	3/4	3.7	4	**SVXF0711EA**	4	**SVXF0721EA**
	1	4.8		**SVX00111EA**		**SVX00121EA**
	1-1/2	6.6		**SVXF1511EA**		**SVXF1521EA**
	2	7.8		**SVX00211EA**		**SVX00221EA**
	3	11		**SVX00311EA**		**SVX00321EA**
0	5	17.5	5	**SVX00511EA**	5	**SVX00521EA**
	7-1/2	25		**SVX00711EA**		**SVX00721EA**
1	10	31	6	**SVX01011EA**	6	**SVX01021EA**
	15	48		**SVX01511EA**		**SVX01521EA**
2	20	61	7	**SVX02011DA**	7	**SVX02021DA**
	25	75		**SVX02511DA**		**SVX02521DA**
	30	88		**SVX03011DA**		**SVX03021DA**
3	40	114	8	**SVX04011DA**	8	**SVX04021DA**
4	50	143	8	**SVX05011DA**	8	**SVX05021DA**
5	60	170	8	**SVX06011DA**	8	**SVX06021DA**
	75	211	9	**SVX07511DA**	9	**SVX07521DA**
	100	273		**SVX10011DA**		**SVX10021DA**
Low Overload Drive and Enclosure						
0	1	4.8	4	**SVX00111BA**	4	**SVX00121BA**
	1-1/2	6.6		**SVXF1511BA**		**SVXF1521BA**
	2	7.8		**SVX00211BA**		**SVX00221BA**
	3	11		**SVX00311BA**		**SVX00321BA**
	5	17.5	5	**SVX00511BA**	5	**SVX00521BA**
	7-1/2	25		**SVX00711BA**		**SVX00721BA**
	10	31		**SVX01011BA**		**SVX01021BA**
1	15	48	6	**SVX01511BA**	6	**SVX01521BA**
	20	61		**SVX02011BA**		**SVX02021BA**
2	25	75	7	**SVX02511AA**	7	**SVX02521AA**
	30	88		**SVX03011AA**		**SVX03021AA**
	40	114		**SVX04011AA**		**SVX04021AA**
3	50	—	8	**SVX05011AA**	8	**SVX05021AA**
4	60	170	8	**SVX06011AA**	8	**SVX06021AA**
5	③	205 ③	8	**SVX07511AA**	8	**SVX07521AA**
	③	261 ③	9	**SVX10011AA**	9	**SVX10021AA**

Notes

For brake chopper options, see **Page V6-T2-63**.

① See enclosure dimensions starting on **Page V6-T2-67**.

② Includes drive, local/remote keypad and enclosure.

③ These units are current rated (75 I_L hp 205 amps, 100 I_L hp 261 amps). They are not hp rated.

2

230V Drives

SVX9000 Enclosed Drives

Input Base Drives

Enclosure Size ①	hp	Current (A)	NEMA Type 1/IP21 Frame Size	NEMA Type 1/IP21 Base Catalog Number ②	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②
High Overload Drive and Enclosure						
0	3/4	3.7	4	**SVXF0712EA**	4	**SVXF0722EA**
	1	4.8		**SVX00112EA**		**SVX00122EA**
	1-1/2	6.6		**SVXF1512EA**		**SVXF1522EA**
	2	7.8		**SVX00212EA**		**SVX00222EA**
	3	11		**SVX00312EA**		**SVX00322EA**
	5	17.5	5	**SVX00512EA**	5	**SVX00522EA**
	7-1/2	25		**SVX00712EA**		**SVX00722EA**
1	10	31	6	**SVX01012EA**	6	**SVX01022EA**
	15	48		**SVX01512EA**		**SVX01522EA**
2	20	61	7	**SVX02012DA**	7	**SVX02022DA**
	25	75		**SVX02512DA**		**SVX02522DA**
	30	88		**SVX03012DA**		**SVX03022DA**
3	40	114	8	**SVX04012DA**	8	**SVX04022DA**
4	50	140	8	**SVX05012DA**	8	**SVX05022DA**
5	60	170	8	**SVX06012DA**	8	**SVX06022DA**
	75	205	9	**SVX07512DA**	9	**SVX07522DA**
	100	261		**SVX10012DA**		**SVX10022DA**
Low Overload Drive and Enclosure						
0	1	4.8	4	**SVX00112BA**	4	**SVX00122BA**
	1-1/2	6.6		**SVXF1512BA**		**SVXF1522BA**
	2	7.8		**SVX00212BA**		**SVX00222BA**
	3	11		**SVX00312BA**		**SVX00322BA**
	5	17.5	5	**SVX00512BA**	5	**SVX00522BA**
	7-1/2	25		**SVX00712BA**		**SVX00722BA**
	10	31		**SVX01012BA**		**SVX01022BA**
1	15	48	6	**SVX01512BA**	6	**SVX01522BA**
	20	61		**SVX02012BA**		**SVX02022BA**
2	25	75	7	**SVX02512AA**	7	**SVX02522AA**
	30	88		**SVX03012AA**		**SVX03022AA**
	40	114		**SVX04012AA**		**SVX04022AA**
3	50	140	8	**SVX05012AA**	8	**SVX05022AA**
4	60	170	8	**SVX06012AA**	8	**SVX06022AA**
5	75	205	8	**SVX07512AA**	8	**SVX07522AA**
	③	261 ③	9	**SVX10012AA**	9	**SVX10022AA**

Notes

For brake chopper options, see **Page V6-T2-63**.

① See enclosure dimensions starting on **Page V6-T2-67**.

② Includes drive, local/remote keypad and enclosure.

③ This unit is current rated (100 I_L hp 100 amps, 261 I_L hp). It is not hp rated.

480V Drives

SVX9000 Enclosed Drives

Input Base Drives

Enclosure Size ①	hp	Current (A)	NEMA Type 1/IP21 Frame Size	NEMA Type 1/IP21 Base Catalog Number ②	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②
High Overload Drive and Enclosure						
0	1	2.2	4	**SVX00114EA**	4	**SVX00124EA**
	1-1/2	3.3		**SVXF1514EA**		**SVXF1524EA**
	2	4.3		**SVX00214EA**		**SVX00224EA**
	3	5.6		**SVX00314EA**		**SVX00324EA**
	5	7.6		**SVX00514EA**		**SVX00524EA**
	7-1/2	12	5	**SVX00714EA**	5	**SVX00724EA**
	10	16		**SVX01014EA**		**SVX01024EA**
	15	23		**SVX01514EA**		**SVX01524EA**
1	20	31	6	**SVX02014EA**	6	**SVX02024EA**
	25	38		**SVX02514EA**		**SVX02524EA**
	30	46		**SVX03014EA**		**SVX03024EA**
2	40	61	7	**SVX04014DA**	7	**SVX04024DA**
	50	72		**SVX05014DA**		**SVX05024DA**
	60	87		**SVX06014DA**		**SVX06024DA**
3	75	105	8	**SVX07514DA**	8	**SVX07524DA**
	100	140		**SVX10014DA**		**SVX10024DA**
4	125	170	8	**SVX12514DA**	8	**SVX12524DA**
5	150	205	9	**SVX15014DA**	9	**SVX15024DA**
	200	245		**SVX20014DA**		**SVX20024DA**
6, 8 ③④	250	300	10	**SVX25014DA**	10	**SVX25064DA**
	300	385		**SVX30014DA**		**SVX30064DA**
	350	460		**SVX35014DA**		**SVX35064DA**
8, 9 ④⑤	400	520	11	**SVX40014DA**	11	**SVX40064DA**
	500	590		**SVX50014DA**		**SVX50064DA**
	550	650		**SVX55014DA**		**SVX55064DA**
⑥	600	730	12	**SVX60014DA**	12	**SVX60064DA**
	650	820		**SVX65014DA**		**SVX65064DA**
	700	920		**SVX70014DA**		**SVX70064DA**

Notes

For brake chopper options, see **Page V6-T2-63**.
① See enclosure dimensions starting on **Page V6-T2-67**.
② Includes drive, local/remote keypad and enclosure.
③ The smaller enclosure Size 6 accommodates only power options, input disconnect (P1) and input line fuses (P3). Bypass and other options require Size 8. Adding any standard control option will not require the larger enclosure.
④ For other options, consult factory.
⑤ The smaller enclosure Size 8 accommodates only power options, input disconnect (P1) and input line fuses (P3). Bypass and other options require Size 9. Adding any standard control option will not require the larger enclosure.
⑥ Consult Eaton.

2

SVX9000 Enclosed Drives

Input Base Drives, continued

Enclosure Size [1]	hp	Current (A)	NEMA Type 1/IP21 Frame Size	NEMA Type 1/IP21 Base Catalog Number [2]	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number [2]
Low Overload Drive and Enclosure						
0	1-1/2	3.3	4	**SVXF1514BA**	4	**SVXF1524BA**
	2	4.3		**SVX00214BA**		**SVX00224BA**
	3	5.6		**SVX00314BA**		**SVX00324BA**
	5	7.6		**SVX00514BA**		**SVX00524BA**
	7-1/2	12		**SVX00714BA**		**SVX00724BA**
	10	16	5	**SVX01014BA**	5	**SVX01024BA**
	15	23		**SVX01514BA**		**SVX01524BA**
	20	31		**SVX02014BA**		**SVX02024BA**
1	25	38	6	**SVX02514BA**	6	**SVX02524BA**
	30	46		**SVX03014BA**		**SVX03024BA**
	40	61		**SVX04014BA**		**SVX04024BA**
2	50	72	7	**SVX05014AA**	7	**SVX05024AA**
	60	87		**SVX06014AA**		**SVX06024AA**
	75	105		**SVX07514AA**		**SVX07524AA**
3	100	140	8	**SVX10014AA**	8	**SVX10024AA**
4	125	170	8	**SVX12514AA**	8	**SVX12524AA**
	150	205		**SVX15014AA**		**SVX15024AA**
5	200	261	9	**SVX20014AA**	9	**SVX20024AA**
	250	300		**SVX25014AA**		**SVX25024AA**
6, 8 [3][4]	300	385	10	**SVX30014AA**	10	**SVX30064AA**
	350	460		**SVX35014AA**		**SVX35064AA**
	400	520		**SVX40014AA**		**SVX40064AA**
8, 9 [4][5]	500	590	11	**SVX50014AA**	11	**SVX50064AA**
	550	650		**SVX55014AA**		**SVX55064AA**
	600	730		**SVX60014AA**		**SVX60064AA**
[6]	650	820	12	**SVX65014AA**	12	**SVX65064AA**
	700	920		**SVX70014AA**		**SVX70064AA**
	800	1030		**SVX80014AA**		**SVX80064AA**

Notes

For brake chopper options, see **Page V6-T2-63**.

[1] See enclosure dimensions starting on **Page V6-T2-67**.

[2] Includes drive, local/remote keypad and enclosure.

[3] The smaller enclosure Size 6 accommodates only power options, input disconnect (P1) and input line fuses (P3). Bypass and other options require Size 8. Adding any standard control option will not require the larger enclosure.

[4] For other options, consult factory.

[5] The smaller enclosure Size 8 accommodates only power options, input disconnect (P1) and input line fuses (P3). Bypass and other options require Size 9. Adding any standard control option will not require the larger enclosure.

[6] Consult Eaton.

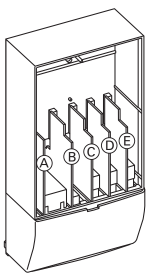
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description [1]	Allowed Slot Locations [2]	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
2 RO, therm—SPX only	B	**OPTA3**	**A3**	—	■	■	■	■	■	■
Encoder low volt +5V/15V/24V—SPX only	C	**OPTA4**	**A4**	—	■	■	■	■	■	■
Encoder high volt +15V/24V—SPX only	C	**OPTA5**	**A5**	—	■	■	■	■	■	■
Double encoder—SPX only	C	**OPTA7**	**A7**	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO—SPX only	A	**OPTA8**	**A8**	—	■	■	■	■	■	■
3 DI (encoder 10–24V), out +15V/+24V, 2 DO (pulse+direction)—SPX only	C	**OPTAE**	**AE**	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	■	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
Communication Cards [3]										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD1**	**D1**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD2**	**D2**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series local/remote keypad	—	**KEYPAD-LOC/REM**	—	—	—	—	—	—	—	—
9000X Series remote mount keypad kit (keypad not included)	—	**OPTRMT-KIT-9000X**	—	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	**PP00104**	—	—	—	—	—	—	—	—

Notes

[1] AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

[2] Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

[3] OPTC2 is a multi-protocol option card.

2

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/ Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

SVX Conversion Kit

Frame 4–7 ①

Frame Size	Enclosure Size	Delivery Code	Catalog Number
FR4	0	FB10	**OPTCON-SVXFR4-SZ00**
	1		**OPTCON-SVXFR4-SZ01**
FR5	0	FB10	**OPTCON-SVXFR5-SZ00**
	1		**OPTCON-SVXFR5-SZ01**
FR6	1	FB10	**OPTCON-SVXFR6-SZ01**
	2		**OPTCON-SVXFR6-SZ02**
FR7	2	FB10	**OPTCON-SVXFR7-SZ02**

Note

① The kit consists of a flange kit, adapter plate(s), hardware, remote keypad kit and SVX9000 decal.

Control/Communication Option Descriptions

For availability, see Product Selection for base drive voltage required.

Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer**—Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch—**Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K3	**3–15 PSIG Follower**—Provides a pneumatic transducer which converts a 3–15 psig pneumatic signal to either 0–8 Vdc or a 1–9 Vdc signal interface with the SVX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft (1.8m) of flexible tubing and a 1/4 in (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-Bypass Configurations**—Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to k (keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.	Control
K5	**MANUAL/AUTO Speed Reference Switch**—Provides a door-mounted selector switch for MANUAL/AUTO speed reference.	Control
K6	**START/STOP Pushbuttons**—Provide door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KB	**115V Control Transformer, 550 VA**—Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
KF	**Bypass Test Switch for RB and RA**—Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The test switch is mounted on the inside of the enclosure door.	Addl. bypass
KO	**Standard Elapsed Time Meter**—Provides a door-mounted elapsed run time meter.	Control
L1	**Power On and Fault Pilot Lights**—Provide a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options**—A green light indicates when the motor is running in inverter mode and an amber light that indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. bypass
LA	**Green RUN Light (22 mm)**—Provides a green run light that indicates the drive is running.	Light
LD	**Green STOP Light (22 mm)**—Provides a green light that indicates the drive is stopped.	Light
LE	**Red RUN Pilot Light (22 mm)**—Provides a red run pilot light that indicates the drive is running.	Light
LF	**Red STOP Light (22 mm)**—Provides a red stop light that indicates the drive is stopped.	Light
LJ	**White Power On Light (22 mm)**—The 22 mm white light that illuminates when the drive assembly is powered.	Light
LU	**Misc. Light (22 mm)**—Provides a misc. "user defined" pilot light. User to define light function and color.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC**—High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P2	**Disconnect Switch**—Disconnect switch option is applicable only with NEMA Type 1/IP21 and NEMA Type 12/IP54 freestanding drives. Allows a convenient means of disconnecting the SVX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC**—Provides high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor**—Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
PE	**Output Contactor**—Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600 Vac are provided for customer use. Bypass options **RB** and **RA** include an output contactor as standard. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter**—Used to reduce the transient voltage (DV/DT) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30m) with a drive of 3 hp and above, for cable lengths of 33 ft (10m) with a drive of 2 hp and below, or for a drive rated at 525–690V. This option is mounted in the enclosure, and may be used in conjunction with a brake chopper circuit.	Output
PG	**MotoRx (300–600 ft) 1000 V/µS DV/DT Filter**—Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the output filter (See option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300–600 ft (91–183m). *This option can not be used with the brake chopper circuit. The output filter (option **PF**) should be investigated as an alternative.*	Output
PH	**Single Overload Relay**—Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the bypass configurations for overload current protection in the bypass mode. The overload relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output

For availability, see Product Selection for base drive voltage required.

Available Control/Communications Options, continued

Option	Description	Option Type
PI	**Dual Overload Relays**—This option is recommended when a single drive is operating two motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass**—This option is recommended when a single drive is operating two motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. bypass
RA	**Manual HOA Bypass Controller**—The manual HAND/OFF/AUTO (HOA)—3-contactor—bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page V6-T2-66**).	Bypass
RB	**Manual IOB Bypass Controller**—The manual INVERTER/OFF/BYPASS (IOB)—3-contactor—bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page V6-T2-66**).	Bypass
RC	**Auto Transfer HOA Bypass Controller**—The manual HAND/OFF/AUTO (HOA)—3-contactor—bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to "across the line" operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page V6-T2-66**). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller**—The auto INVERTER/OFF/BYPASS (IOB)—3-contactor—bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to "across the line" operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page V6-T2-66**). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
S5	**Floor Stand 22 in**—Converts a Size 1 or 2, normally wall mounted enclosure to a floor standing enclosure with a height of 22 in (558.8 mm).	Enclosure
S6	**Floor Stand 12 in**—Converts a Size 2, normally wall mounted enclosure to a floor standing enclosure with a height of 12 in (304.8 mm).	Enclosure
S7	**10 in Expansion**—In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. **NOTE:** Enclosure expansion rated NEMA Type 1/IP21 only.	Enclosure
S8	**20 in Expansion**—In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. When the output filter (option **PF**) is selected for a drive using a Size 5 enclosure, this expansion box is required and included in the option pricing. Enclosure expansion rated NEMA Type 1/IP21 only.	Enclosure
S9	**Space Heater**—Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures 0 and 1, and a 400W heater is installed in enclosures 2–5. Requires a customer supplied 115V remote supply source.	Enclosure

Enclosed Drive Options

Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

For brake chopper circuit selection and adder—NEMA Type 1/IP21, NEMA Type 12/ IP54, consult the factory.

Conformal (Varnished) Coating ②

Chassis Frame	Delivery Code
FR4	FP
FR5	FP
FR6	FP
FR7	FP
FR8	FP
FR9	FP
FR10	FP
FR11	FP
FR12	FP
FR13	FP
FR14	FP

208V and 230V Control Options—3/4–100 hp ③

Description	Catalog Number Suffix
Door-mounted speed potentiometer	**K1**
Door-mounted speed potentiometer with HOA selector switch	**K2**
3–15 psig follower	**K3**
HAND/OFF/AUTO switch (22 mm)	**K4**
MANUAL/AUTO ref switch (22 mm)	**K5**
START/STOP pushbuttons (22 mm)	**K6**
115 Volt control transformer 550 VA	**KB**
Standard elapsed time meter	**KO**

480V Control Options—1–800 hp ③

Description	Catalog Number Suffix
Door-mounted speed potentiometer	**K1**
Door-mounted speed potentiometer with HOA selector switch	**K2**
3–15 psig follower	**K3**
HAND/OFF/AUTO switch (22 mm)	**K4**
MANUAL/AUTO ref switch (22 mm)	**K5**
START/STOP pushbuttons (22 mm)	**K6**
115 Volt control transformer 550 VA	**KB**
Standard elapsed time meter	**KO**

208V and 230V Light Options—3/4–100 hp ③

Description	Catalog Number Suffix
Power on/fault pilot lights (22 mm)	**L1**
Green RUN light (22 mm)	**LA**
Green STOP light (22 mm)	**LD**
Red RUN light (22 mm)	**LE**
Red STOP light (22 mm)	**LF**
Power on light (22 mm)	**LJ**
Misc. light (22 mm)	**LU**

480V Light Options—1–800 hp ③

Description	Catalog Number Suffix
Power on/fault pilot lights (22 mm)	**L1**
Green RUN light (22 mm)	**LA**
Green STOP light (22 mm)	**LD**
Red RUN light (22 mm)	**LE**
Red STOP light (22 mm)	**LF**
Power on light (22 mm)	**LJ**
Misc. light (22 mm)	**LU**

Notes

① External dynamic braking resistors not included. Consult factory.
② See Product Selection on **Pages V6-T2-55** to **V6-T2-58**, 208V, 230V and 480V. Consult the factory for adder.
③ Consult factory for adder information.

208V and 230V Bypass Options, 3/4–100 hp ①②

Description	Catalog Number Suffix
Bypass test switch for RA, RB (and RC, RD—230V)	**KF**
Bypass pilot lights for RA, RB options	**L2**
Dual overloads for bypass	**PN**
Manual HOA bypass controller	**RA**
Manual IOB bypass controller	**RB**
Auto transfer HOA bypass controller	**RC**
Auto transfer IOB bypass controller	**RD**

480V Bypass Options, 1–800 hp ①②

Description	Catalog Number Suffix
Bypass test switch for RA, RB, RC, RD	**KF**
Bypass pilot lights for RA, RB options	**L2**
Dual overloads for bypass	**PN**
Manual HOA bypass controller	**RA**
Manual IOB bypass controller	**RB**
Auto transfer HOA bypass controller	**RC**
Auto transfer IOB bypass controller	**RD**

208V and 230V Enclosure Options, Sizes 0–5 ②

Description	Catalog Number Suffix
Floor stand 22 in (558.8 mm)	**S5**
Floor stand 12 in (304.8 mm)	**S6**
10 in (254 mm) expansion ③	**S7**
20 in (508 mm) expansion	**S8**
Space heater ④	**S9**

480V Enclosure Options, Sizes 0–9 ②

Description	Catalog Number Suffix
Floor stand 22 in (558.8 mm)	**S5**
Floor stand 12 in (304.8 mm)	**S6**
10 in (254 mm) expansion ③	**S7**
20 in (508 mm) expansion	**S8**
Space heater ④	**S9**

208V and 230V Power Options, 3/4–100 hp ②

Description	Catalog Number Suffix
Input	
Input disconnect (HMCP) 100 kAIC	**P1**
Input line fuses 200 kAIC	**P3**
Input power surge protection	**P7**
Output	
Output contactor	**PE**
Output filter ⑤⑥	**PF**
MotoRx (300–600 ft) 1000 V/µs DV/DT filter ⑥	**PG**
Single overload relay ⑦	**PH**
Dual overload relays ⑦	**PI**

480V Power Options, 1–800 hp ②

Description	Catalog Number Suffix
Input	
Input disconnect (HMCP) 100 kAIC	**P1**
Input line fuses 200 kAIC	**P3**
Input power surge protection	**P7**
Output	
Output contactor	**PE**
Output filter ⑤⑥	**PF**
MotoRx (300–600 ft) 1000 V/µs DV/DT filter ⑥	**PG**
Single overload relay ⑦	**PH**
Dual overload relays ⑦	**PI**

Input Options, 250–550 hp ②

Description	Catalog Number Suffix
480V Only	
Load switch	**P2** ⑧

Notes

① See **Page V6-T2-62** for details.
② Consult factory for adder information.
③ See **Page V6-T2-67** for dimensions.
④ Requires customer supplied 115 Vac supply.
⑤ Not required for 208V and 230V applications.
⑥ Output filter may be required whenever the distance from the drive to the motor exceeds 100 ft (30m). Refer to **Page V6-T2-61**, option **PF** for further details.".
⑦ Heater packs not included.
⑧ Applicable with FR10 and FR11 freestanding designs only.

Technical Data and Specifications

9000X Enclosed Drives

Description	NEMA Type 1/IP21 or NEMA Type 12/IP54 Specification
Primary Design Features	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input voltage base
Output frequency range	0–320 Hz
Initial output current (I_H)	250% for 2 seconds
Overload (1 minute [I_H/I_L])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL
Protection Features	
Incoming line fuses	Optional
AC input circuit disconnect	Optional
Line reactors	Standard
Phase rotation insensitive	Standard
EMI filter	Standard
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard

Description	NEMA Type 1/IP21 or NEMA Type 12/IP54 Specification
Input/Output Interface Features	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA Isolated	Configurable
4–20 mA Differential	Configurable
3–15 psig	Optional
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Optional
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	1 (2 relays Form C)
Open collector outputs	1
Additional discrete outputs	Optional
Communications	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional

9000X Enclosed Drives, continued

Description	NEMA Type 1/IP21 or NEMA Type 12/IP54 Specification
Performance Features	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional ①
DC braking	Standard
PID setpoint controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Carrier frequency adjustment	1–16 kHz
Standard Conditions for Application and Service	
Operating ambient temperature	0 to 40°C
Storage temperature	–40 to 60°C
Humidity (maximum), non-condensing	95%
Altitude (maximum without derate)	3300 ft (1000m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>96%
Power factor (displacement)	>0.94

Standard I/O Specifications

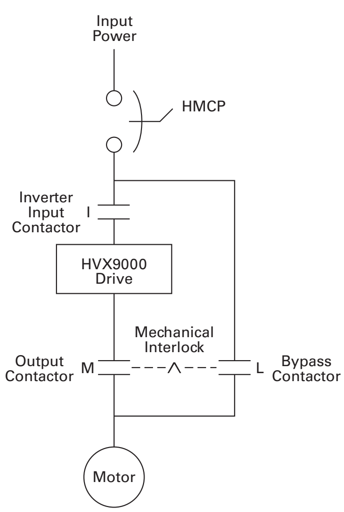
Description	Specification
Six–digital input programmable	24V: "0" ≤10V, "1" ≥18V,R_i >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10V, R_i >200 kohms Current: 0 (4)–20 mA, R_i = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R_L max. 500 ohms 10 bits ±2%
One digital output programmable	Open collector 48 Vdc 50 mA

I/O Specifications for Control/Communication Options

Description	Specification
Analog voltage, input	0–±10V, R_i ≥200 kohms
Analog current, input	0 (4)–20 mA, R_i = 250 ohms
Digital input	24V: "0" ≤10V, "1" ≥18V, R_i >5 kohms
Auxiliary voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R_L = 500 kohms resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10V, R_L ≥1 kohms, resolution 10 bit, accuracy ≤±2%
Relay output	
Maximum switching voltage	300 Vdc, 250 Vac
Maximum switching load	8A/24 Vdc, 0.4A/300 Vdc, 2 kVA/250 Vac
Maximum continuous load	2A rms
Thermistor input	R_{trip} = 4.7 kohms
Encoder input	24V: "0" ≤10V, "1" ≥18V, R_i = 2.2 kohms 5V: "0" ≤2V, "1" ≥3V, R_i = 330 ohms

Wiring Diagram

Power Diagram for Bypass Options RB and RA



Note

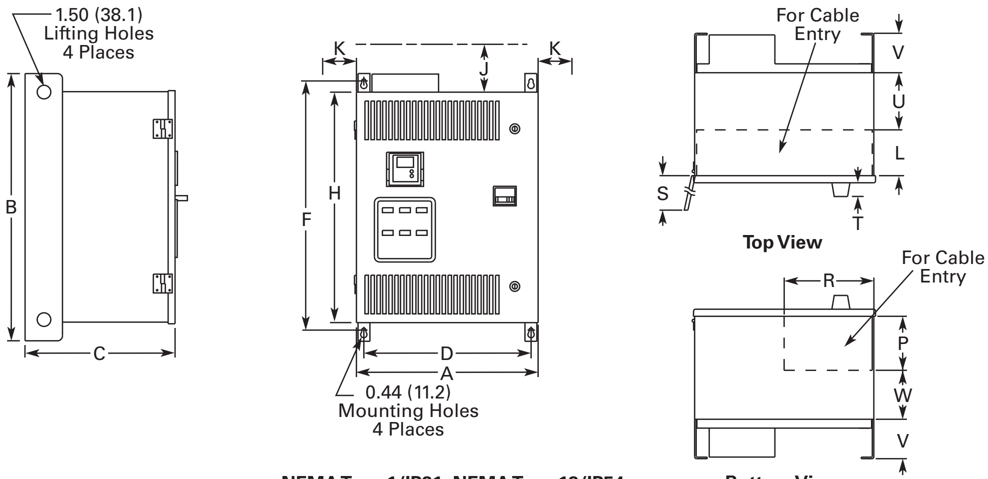
① Some horsepower units include dynamic braking chopper as standard—refer to individual drive sections.

Dimensions

Approximate Dimensions in Inches (mm)

9000X Enclosed Drives

Size 0



NEMA Type 1/IP21, NEMA Type 12/IP54
NEMA Type 12/IP54 Includes Cover Plates Over Louvers

Bottom View

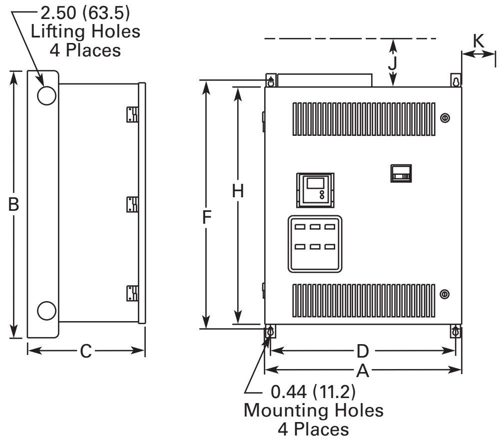
For reference only, dimensions are subject to change.

Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
19.9 (504)	29.0 (737)	16.4 (416)	18.3 (465)	—	—	—	27.4 (695)	—	—	25.4 (644)	4.0 (102)	3.0 (76)

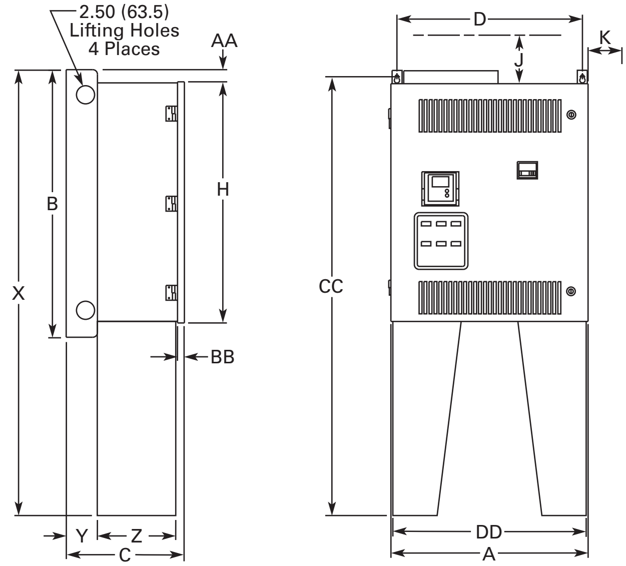
Cable Entry L	M	N	P	R	Door Clearance S	CB Handle T	U	V	W	Max. Approx. Shipping Weight Lbs (kg)
5.0 (127)	—	—	6.0 (152)	9.6 (245)	26.4 (669)	1.5 (38)	6.3 (160)	4.3 (108)	5.3 (134)	200 (91)

Approximate Dimensions in Inches (mm)

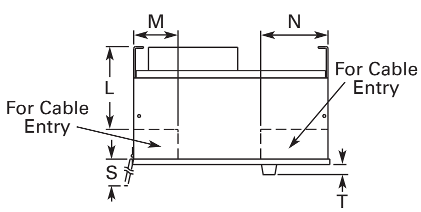
Size 1



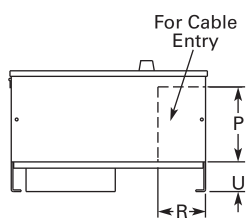
NEMA Type 1/IP21, NEMA Type 12/IP54
NEMA Type 12/IP54 Includes Cover Plates Over Louvers



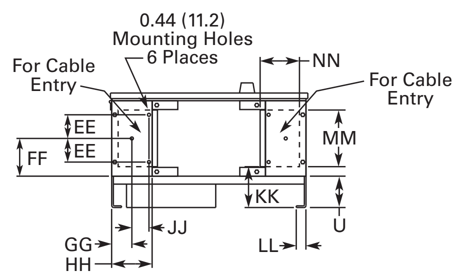
NEMA Type 1/IP21, NEMA Type 12/IP54
with Floor Stand



Top View



Bottom View



Bottom View
NEMA Type 1/IP21, NEMA Type 12/IP54
with Floor Stand

For reference only, dimensions are subject to change.

Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
26.4 (669)	36 (914)	16.3 (414)	24.8 (630)	—	—	—	34.0 (864)	—	—	32.4 (822)	4.0 (102)	3.0 (76)

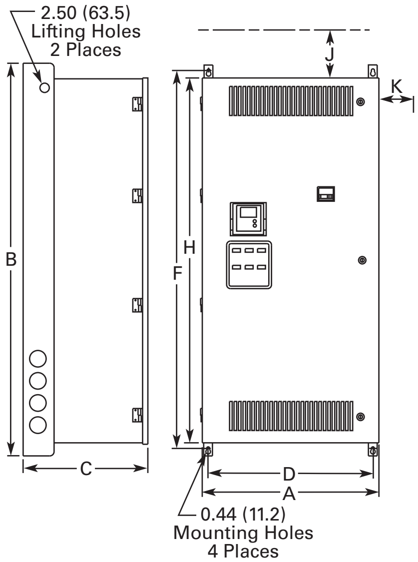
Cable Entry L	M	N	P	R	Door Clearance S	CB Handle T	U	V	W	Max. Approx. Shipping Weight Lbs (kg)
11.0 (279)	6.0 (152)	9.0 (229)	10.0 (254)	6.5 (165)	26.4 (669)	1.5 (38)	4.3 (108)	—	—	230 (104)

Floor Stand

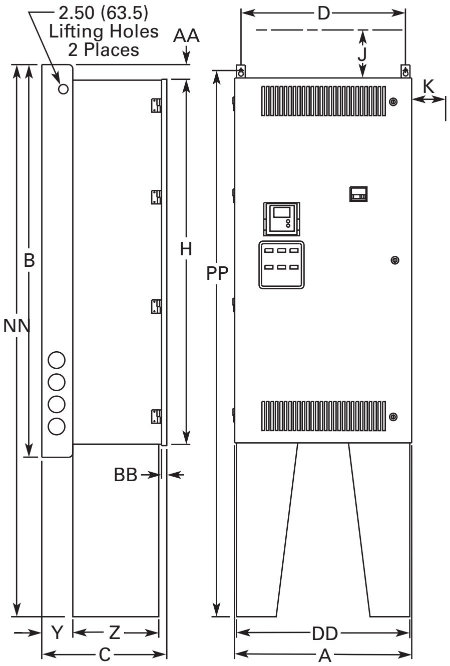
X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	RR	SS	TT	UU	VV
56.0 (1422)	4.3 (108)	11.1 (281)	1.8 (46)	0.8 (19)	55.2 (1402)	26.0 (660)	3.5 (90)	5.5 (141)	3.0 (76)	6.0 (152)	2.0 (51)	5.4 (136)	1.1 (28)	8.8 (224)	5.4 (137)	—	—	—	—	—	—

Approximate Dimensions in Inches (mm)

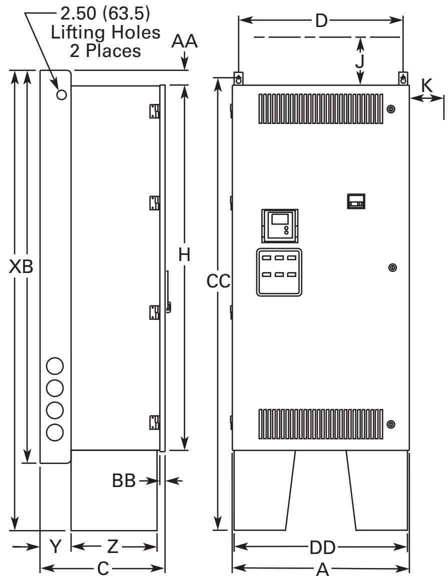
Size 2



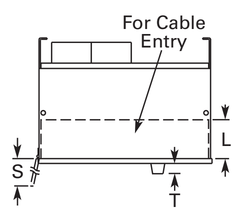
NEMA Type 1/IP21, NEMA Type 12/IP54
NEMA Type 12/IP54 Includes
Cover Plates Over Louvers



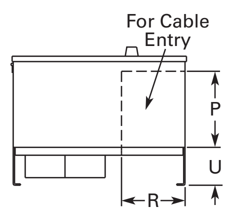
NEMA Type 1/IP21, NEMA Type 12/IP54
with 22 in Floor Stand



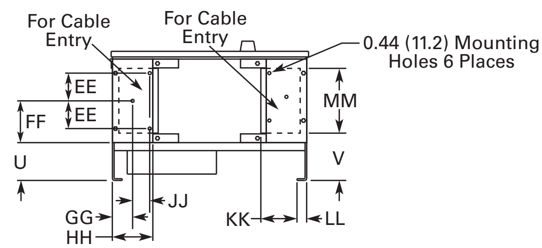
NEMA Type 1/IP21, NEMA Type 12/IP54
with 12 in Floor Stand



Top View



Bottom View



Bottom View
NEMA Type 1/IP21, NEMA Type 12/IP54
with Floor Stand

For reference only, dimensions are subject to change.

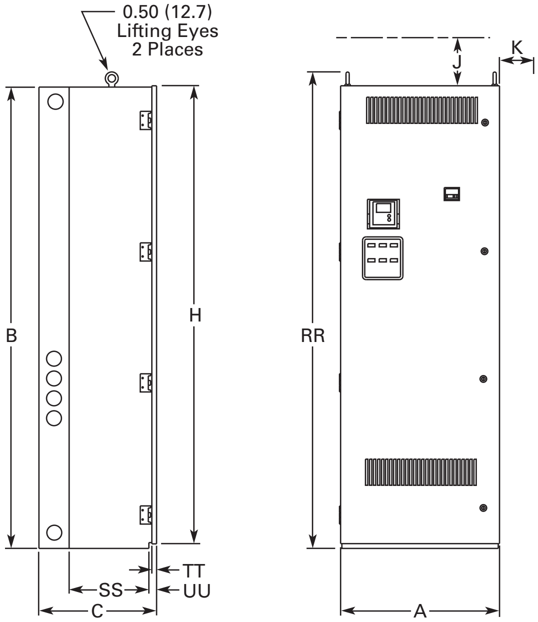
Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	**B**	**C**	**D**	**D1**	**E**	**E1**	**F**	**G**	**G1**	**H**	**J**	**K**
26.4 (669)	59.0 (1499)	19.4 (492)	24.8 (630)	—	—	—	57.0 (1448)	—	—	55.4 (1406)	4.0 (102)	3.0 (76)

Cable Entry L	M	N	P	R	Door Clearance S	CB Handle T	U	V	W	Max. Approx. Shipping Weight Lbs (kg)
5.9 (149)	—	—	12.4 (315)	9.5 (241)	26.4 (669)	1.5 (38)	4.8 (121)	5.9 (151)	—	380 (173)

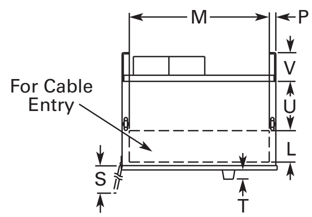
Floor Stand X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	RR	SS	TT	UU	VV
69.0 (1753)	4.8 (121)	13.6 (344)	1.8 (46)	0.8 (19)	68.2 (1732)	26.0 (660)	4.8 (121)	6.8 (172)	3.0 (76)	6.0 (152)	2.0 (51)	5.0 (127)	1.1 (28)	11.3 (288)	79.0 (2007)	78.2 (1986)	—	—	—	—	—

Approximate Dimensions in Inches (mm)

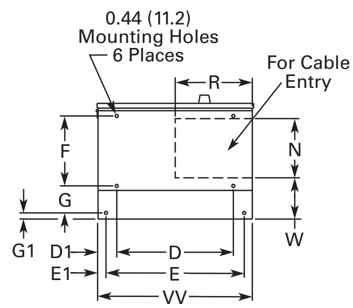
Size 3



NEMA Type 1/IP21, NEMA Type 12/IP54
NEMA Type 12/IP54 Includes Cover Plates Over Louvers



Top View



Bottom View

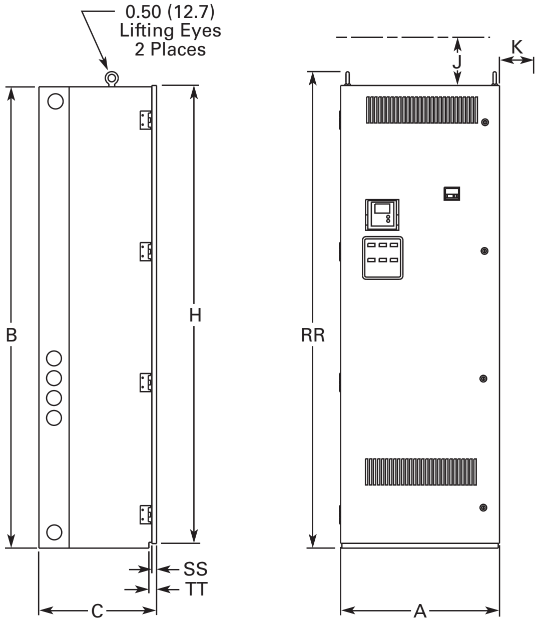
For reference only, dimensions are subject to change.

Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
26.4 (671)	77.0 (1956)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140)	0.9 (24)	76.4 (1939)	4.0 (102)	3.0 (76)

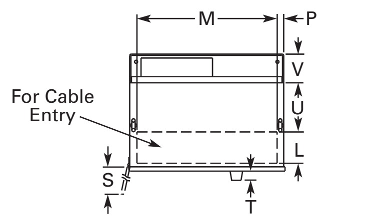
Cable Entry L	M	N	P	R	Door Clearance S	CB Handle T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
5.3 (133)	23.4 (594)	10.0 (254)	1.3 (32)	12.9 (328)	26.4 (669)	1.5 (38)	8.0 (203)	4.8 (121)	6.8 (173)	79.5 (2018)	13.40 (340)	0.8 (19)	1.3 (32)	26.0 (660)	690 (313)

Approximate Dimensions in Inches (mm)

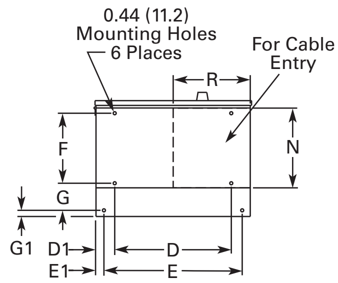
Size 4



NEMA Type 1/IP21, NEMA Type 12/IP54
NEMA Type 12/IP54 Includes Cover Plates Over Louvers



Top View



Bottom View

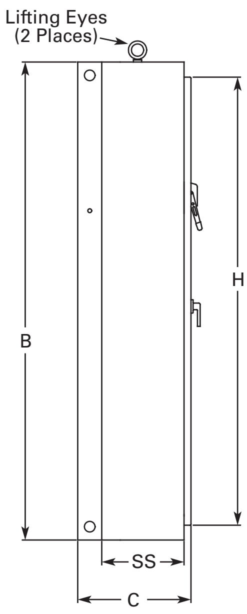
For reference only, dimensions are subject to change.

Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	**B**	**C**	**D**	**D1**	**E**	**E1**	**F**	**G**	**G1**	**H**	**J**	**K**
26.4 (671)	90.0 (2286)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140)	0.9 (24)	89.4 (2270)	4.0 (102)	3.0 (76)

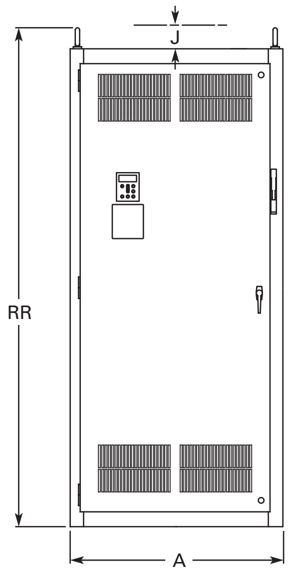
Cable Entry					Door Clearance	CB Handle									Max. Approx. Shipping Weight
L	**M**	**N**	**P**	**R**	**S**	**T**	**U**	**V**	**W**	**RR**	**SS**	**TT**	**UU**	**VV**	**Lbs (kg)**
5.3 (133)	23.4 (594)	13.8 (351)	1.0 (25)	11.2 (286)	26.4 (669)	1.5 (38)	8.0 (204)	4.8 (121)	—	92.5 (2349)	0.8 (19)	1.3 (32)	—	—	825 (375)

Approximate Dimensions in Inches (mm)

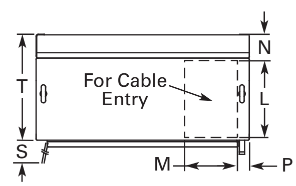
Size 5



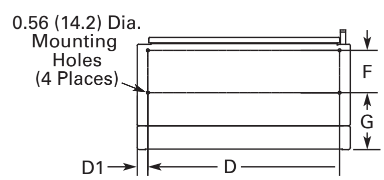
Side View



Front View
NEMA Type 1/IP21

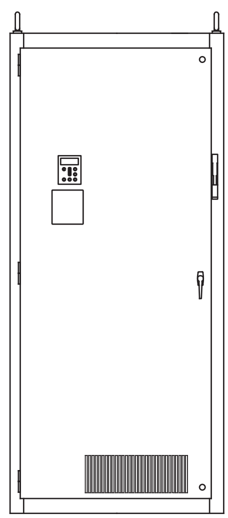


Top View



Bottom View

	I_L hp
208/230V	75 100
480V	200 250


Front View
NEMA Type 12/IP54

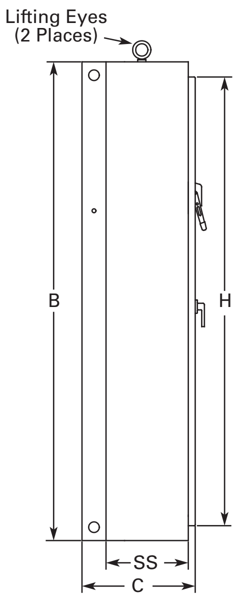
For reference only, dimensions are subject to change.

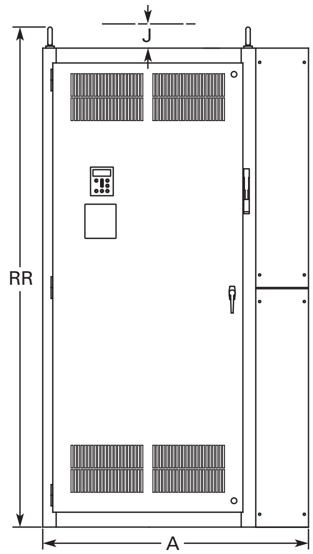
Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
40.0 (1016)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Cable Entry L	M	N	P	R	Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
15.0 (381)	10.0 (254)	4.8 (122)	2.0 (51)	—	36.3 (921)	20.0 (508)	—	—	—	94.0 (2387)	15.5 (394)	—	—	—	1275 (579)

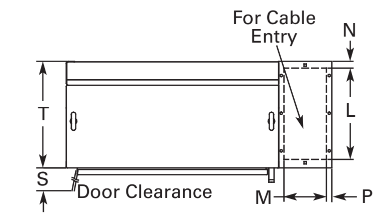
Approximate Dimensions in Inches (mm)

Size 5-1P

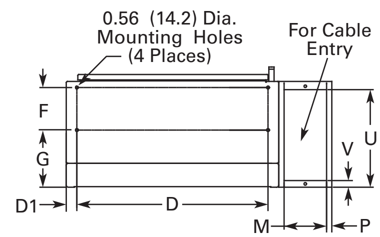




Front View
NEMA Type 1/IP21

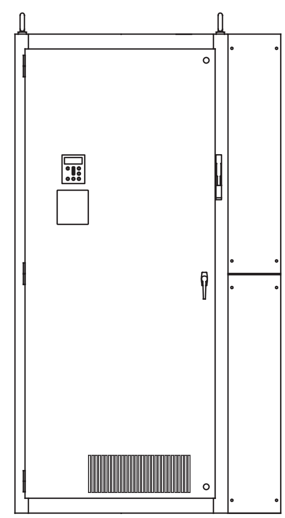


Top View



Bottom View

	I_L hp
208/230V	75 100
480V	200 250



Front View
NEMA Type 12/IP54

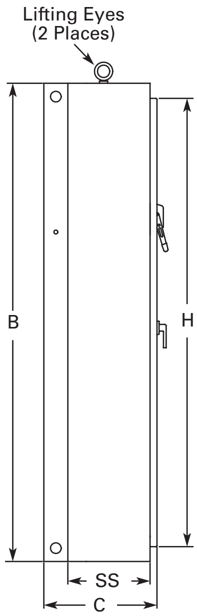
For reference only, dimensions are subject to change.

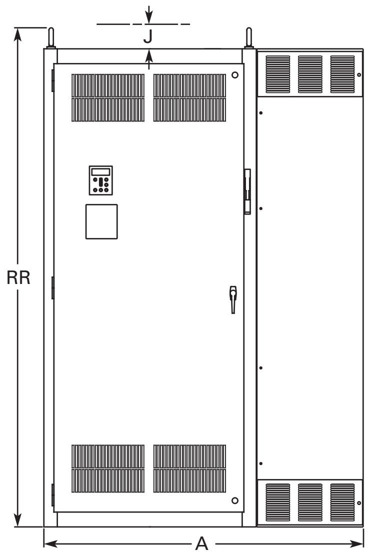
Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
50.0 (1270)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Cable Entry L	M	N	P	R	Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
17.1 (435)	8.0 (203)	1.3 (33)	1.0 (25)	—	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1375 (624)

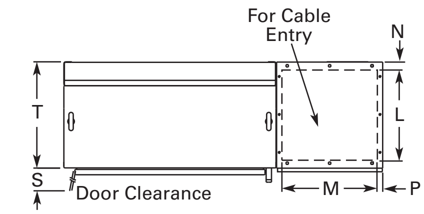
Approximate Dimensions in Inches (mm)

Size 5-2P

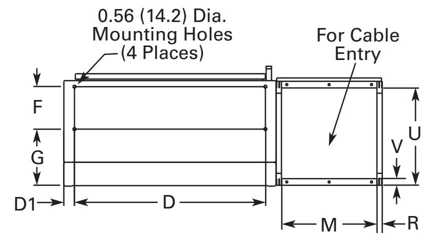




Front View
NEMA Type 1/IP21

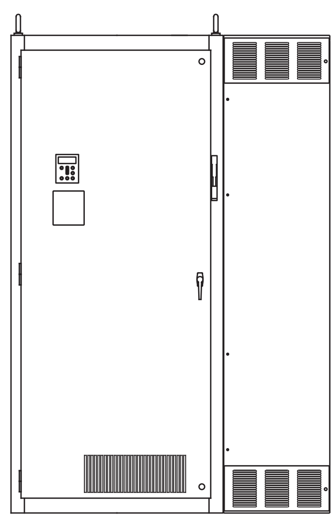


Top View



Bottom View

	I_L hp
208/230V	75 100
480V	200 250



Front View
NEMA Type 12/IP54

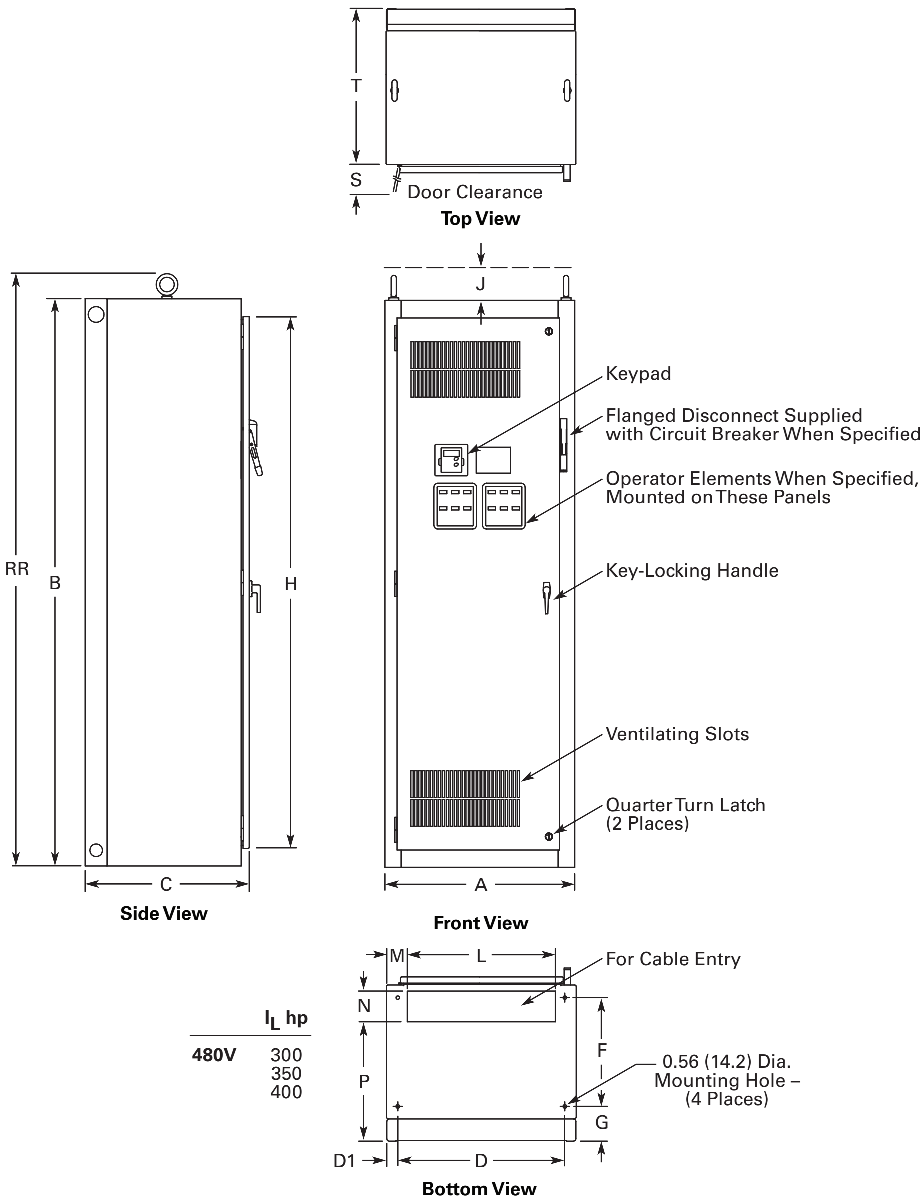
For reference only, dimensions are subject to change.

Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
Enclosure Size 5-2P												
60.0 (1524)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Cable Entry L	M	N	P	R	Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
17.0 (432)	18.0 (457)	1.5 (38)	1.0 (25)	0.9 (23)	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1585 (720)

Approximate Dimensions in Inches (mm)

Size 6



	I_L hp
480V	300 350 400

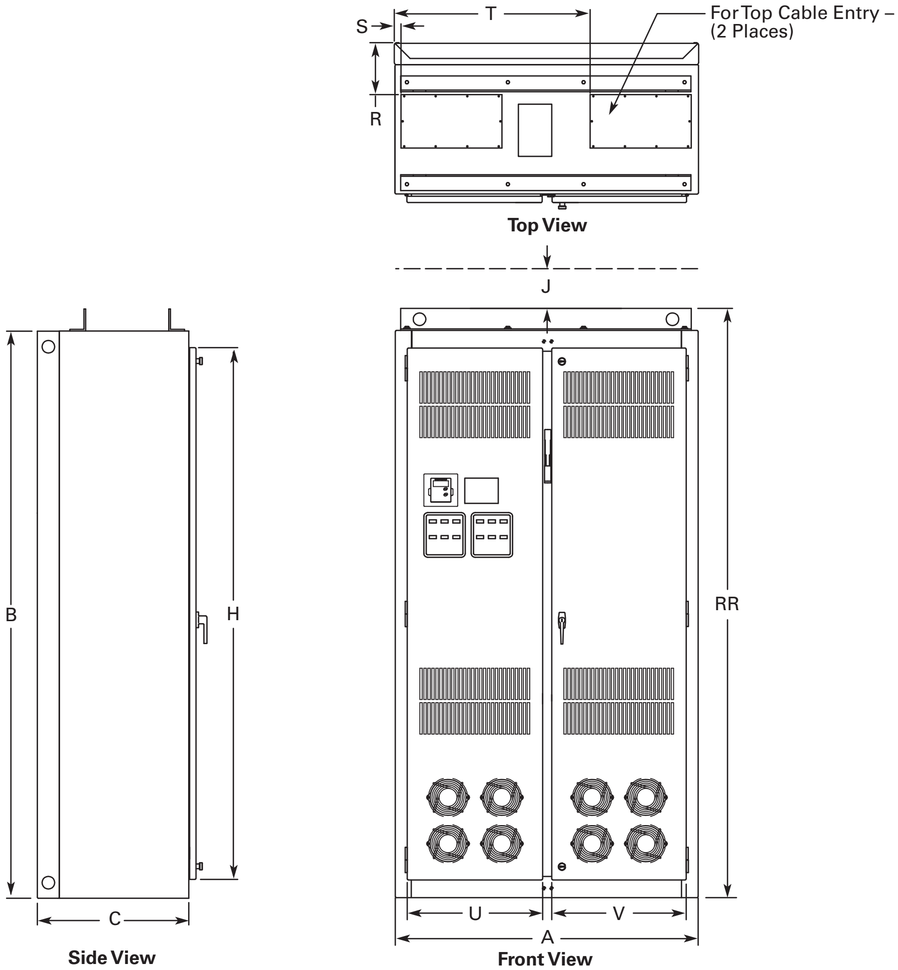
For reference only, dimensions are subject to change. See **Page V6-T2-57**, notes 3 and 5 for enclosure and option selection.

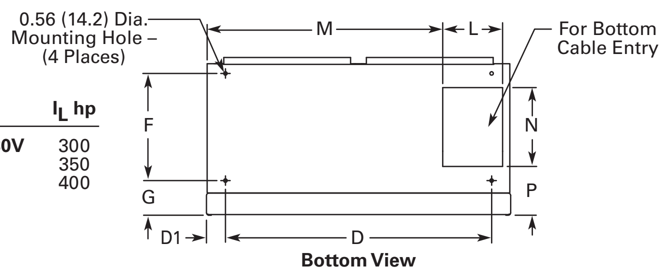
Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
30.0 (762)	90.0 (2286)	26.0 (660)	26.5 (673)	1.8 (46)	—	—	17.3 (438)	5.5 (140)	—	84.4 (2143)	4.0 (102)	—

Cable Entry L	M	N	P	R	Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
23.5 (597)	3.3 (84)	4.5 (114)	19.3 (490)	—	26.2 (667)	24.8 (629)	—	—	—	93.9 (2386)	—	—	—	—	1500 (681)

Approximate Dimensions in Inches (mm)

Size 8





	I_L hp
480V	300
	350
	400

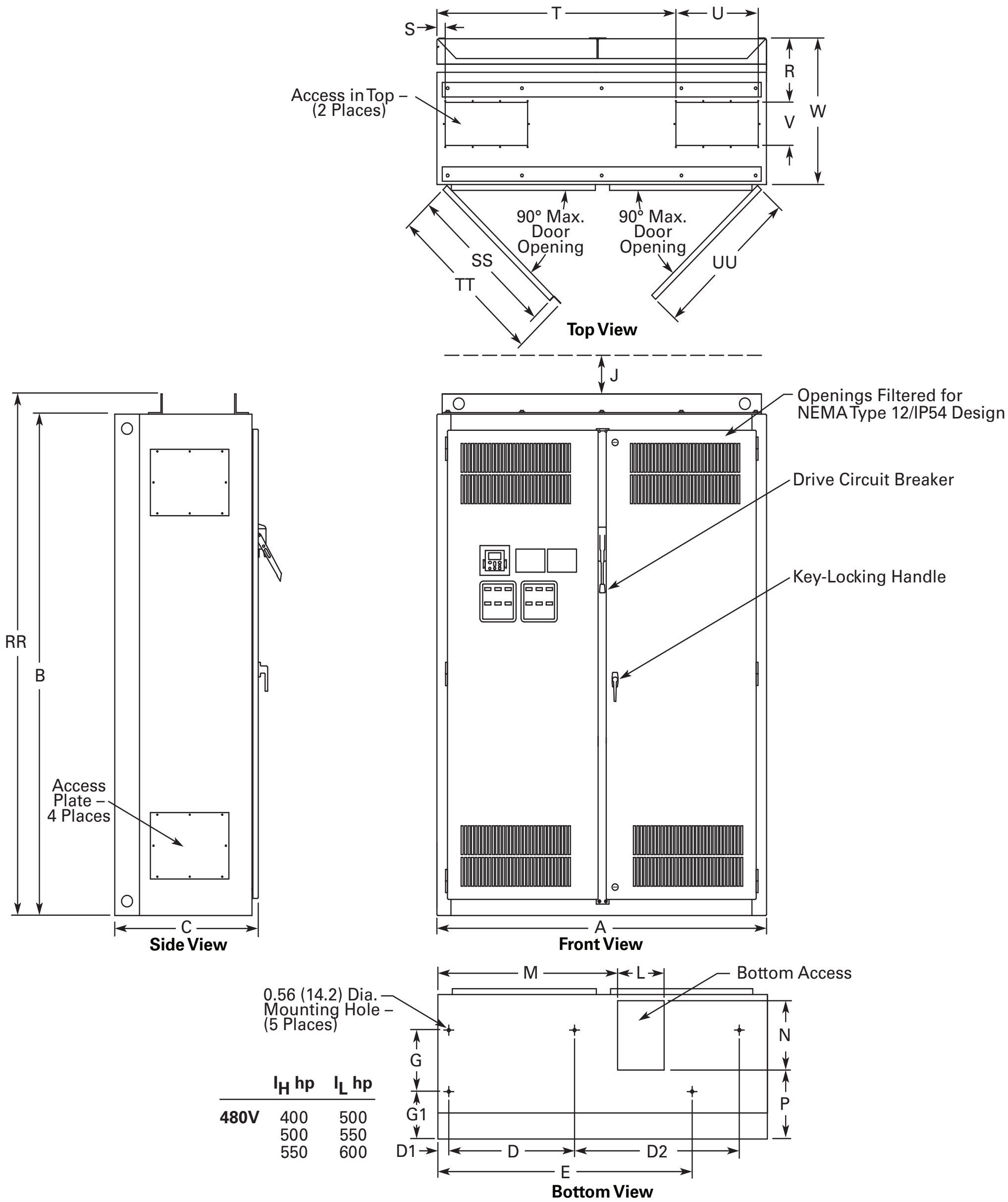
For reference only, dimensions are subject to change. See **Page V6-T2-57**, notes 3 and 5 for enclosure and option selection.

Wide A	High B	Deep C	Mounting D	D1	E	E1	F	G	G1	Door Height H	Min. Air Space J	K
48.0 (1219)	90.0 (2286)	24.0 (610)	42.2 (1072)	3.0 (77)	—	—	—	5.5 (139)	—	84.4 (2143)	4.0 (102)	—

Cable Entry L	M	N	P	R	S	T	U	V	W	RR	SS	TT	UU	VV	Max. Approx. Shipping Weight Lbs (kg)
9.5 (241)	37.5 (952)	12.5 (318)	7.7 (196)	8.3 (210)	1.3 (32)	31.0 (787)	21.5 (545)	21.3 (541)	—	93.5 (2375)	—	—	—	—	2000 (908)

Approximate Dimensions in Inches (mm)

Size 9



For reference only, dimensions are subject to change. See **Page V6-T2-57**, notes 3 and 5 for enclosure and option selection.

Wide	High	Deep	Mounting							Door Height	Min. Air Space	
A	**B**	**C**	**D**	**D1**	**E**	**E1**	**F**	**G**	**G1**	**H**	**J**	**K**
60.0 (1524)	90.0 (2286)	260.1 (664)	22.9 (582)	2.0 (51)	30.0 (762)	44.3 (1125)	10.6 (270)	10.6 (270)	8.2 (208)	—	4.0 (102)	—

Cable Entry															Max. Approx. Shipping Weight
L	**M**	**N**	**P**	**R**	**S**	**T**	**U**	**V**	**W**	**RR**	**SS**	**TT**	**UU**	**VV**	**Lbs (kg)**
8.5 (216)	32.7 (831)	12.0 (305)	11.9 (303)	9.8 (249)	1.5 (38)	43.5 (1105)	15.0 (381)	7.5 (191)	25.0 (635)	93.5 (2375)	27.4 (696)	290.1 (738)	270.1 (687)	—	2500 (1135)

SVX9000 VFD Pump Panels

Contents

SVX9000 VFD Pump Panels

Product Description

- **Standard Enclosed**—covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed**—applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered**—for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 12/IP54 or NEMA Type 3R enclosures
- Input voltage: 208V, 230V, 480V and 575V (consult factory)
- Complete range of control, network and power options
- Horsepower range:
  - 208V—3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 230V—3/4 to 100 hp I_H; 1 to 100 hp I_L
  - 480V—1 to 350 hp I_H; 1-1/2 to 400 hp I_L
- HMCP padlockable
- Single-phase input available—consult factory

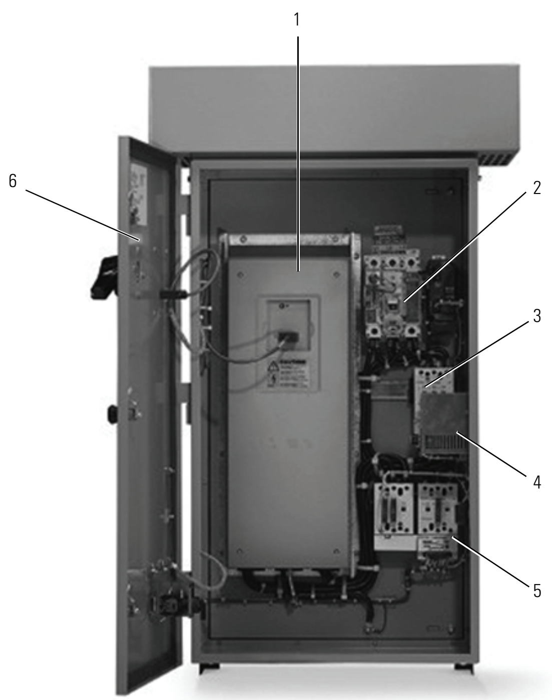
Standards and Certifications

- UL Listed
- cUL Listed

Listed Listed

Product Identification

SVX9000 Pump Application



1 SVX9000 variable frequency drive
2 Input disconnect (HMCP) Option P1
3 Input contactor (included as standard with bypass option)
4 Space heater Option S9
5 Bypass contactor Option RA/RB
6 Door-mounted keypad (included as standard)

Catalog Number Selection

SVX9000 Enclosed NEMA Type 12/IP54/3R Drive

SVX 010 2 4 E P _ _ _ _ _ _ _ _ _ _

Build Alphabetically and Numerically

Product Family
SVX = Enclosed drives

Horsepower Rating		
F07 = 3/4 hp	**010** = 10 hp	**060** = 60 hp
001 = 1 hp	**015** = 15 hp	**075** = 75 hp
F15 = 1-1/2 hp	**020** = 20 hp	**100** = 100 hp
002 = 2 hp	**025** = 25 hp	**125** = 125 hp
003 = 3 hp	**030** = 30 hp	**150** = 150 hp
005 = 5 hp	**040** = 40 hp	**200** = 200 hp
007 = 7-1/2 hp	**050** = 50 hp	
Consult factory ①		
250 = 250 hp	**350** = 350 hp	
300 = 300 hp	**400** = 400 hp	

Enclosure Rating
2 = NEMA Type 12/IP54
3 = NEMA Type 3R

Voltage Rating	
Three-phase	Single-phase
1 = 208V	**J** = 230V
2 = 230V	**K** = 480V
4 = 480V	

Application—Torque/Braking ③
A = I_L/no brake chopper
B = I_L/internal brake chopper
D = I_H/no brake chopper
E = I_H/internal brake chopper

Enclosed Style
P = Pumping application

	Enclosed Options ②⑤⑥	Type
K1	Door-mounted speed potentiometer ④	Control
K2	Door-mounted speed potentiometer with HOA selector switch ④	Control
K5	MANUAL/AUTO reference switch (22 mm)	Control
K6	START and STOP pushbuttons (22 mm)	Control
K9	(2) Factory installed auxiliary contacts	Power
L1	Power on and fault pilot lights	Light
L2	Bypass pilot lights for RA bypass option ⑧	Addl. bypass
LD	Green STOP light	Light
LE	Red RUN light	Light
LU	Light (22 mm)	Light
LW	PTT light (22 mm)	Light
LY	Adder for LED each	Light
P1	Input disconnect (HMCP) 100 kAIC	Input
P3	Input line fuses (200 kAIC)	Input
P7	Input power surge protection	Input
P8	TVSS transient voltage surge suppressor	Input
PE	Output contactor	Output
RA	Manual HOA bypass controller ⑧	Bypass
S5	Floor stand 22 in	Enclosure
S9	Space heater w/out CPT	Enclosure
SA	Space heater w/CPT	Enclosure
SB	Socket type control relay	Enclosure
SE	On-delay timer	Enclosure
SF	Off-delay timer	Enclosure

Communication Options ⑦
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 connector)
C6 = CanOpen (slave)
C7 = DeviceNet
C8 = Modbus (D9 type connector)
CA = Johnson Controls N2
CI = Modbus TCP
CJ = BACnet
CK = Ethernet IP
D3 = RS-232 with D9 connection

Control Options
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input

Notes

① Consult factory.
② Local/remote keypad is included as the standard control panel.
③ Brake chopper is a factory installed option only, see drive options on **Page V6-T2-18**. External dynamic braking resistors not included. Consult factory.
④ Includes local/remote speed reference switch.
⑤ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
⑥ See **Page V6-T2-87** for descriptions.
⑦ See **Pages V6-T2-85** and **V6-T2-86** for complete descriptions.
⑧ Bypass options applicable only in the pump panel three-phase design.

Product Selection

When Ordering

- Select a base catalog number that meets the application requirements—nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted local/remote keypad and enclosure.
- If dynamic brake chopper or control/communication option is desired, change the appropriate code in the base catalog number.
- Select enclosed options. Add the codes as suffixes to the base catalog number in alphabetical and numeric order.
- **Read all footnotes**.

208V Drives

SVX9000 Enclosed Drives

Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②
High Overload Drive and Enclosure					
A	3/4	4	**SVXF0721EP**	4	**SVXF0731EP**
	1		**SVX00121EP**		**SVX00131EP**
	1-1/2		**SVXF1521EP**		**SVXF1531EP**
	2		**SVX00221EP**		**SVX00231EP**
	3	5	**SVX00321EP**	5	**SVX00331EP**
	5		**SVX00521EP**		**SVX00531EP**
	7-1/2		**SVX00721EP**		**SVX00731EP**
	10	6	**SVX01021EP**	6	**SVX01031EP**
B	15		**SVX01521EP**		**SVX01531EP**
	20	7	**SVX02021DP**	7	**SVX02031DP**
	25		**SVX02521DP**		**SVX02531DP**
C	30		**SVX03021DP**		**SVX03031DP**
	40	8	**SVX04021DP**	8	**SVX04031DP**
	50		**SVX05021DP**		**SVX05031DP**
D	60		**SVX06021DP**		**SVX06031DP**
	75	9	**SVX07521DP**	9	**SVX07531DP**
	100		**SVX10021DP**		**SVX10031DP**
Low Overload Drive and Enclosure					
A	1	4	**SVX00121BP**	4	**SVX00131BP**
	1-1/2		**SVXF1521BP**		**SVXF1531BP**
	2		**SVX00221BP**		**SVX00231BP**
	3		**SVX00321BP**		**SVX00331BP**
	5	5	**SVX00521BP**	5	**SVX00531BP**
	7-1/2		**SVX00721BP**		**SVX00731BP**
	10		**SVX01021BP**		**SVX01031BP**
	15	6	**SVX01521BP**	6	**SVX01531BP**
B	20		**SVX02021BP**		**SVX02031BP**
	25	7	**SVX02521AP**	7	**SVX02531AP**
	30		**SVX03021AP**		**SVX03031AP**
C	40		**SVX04021AP**		**SVX04031AP**
	50	8	**SVX05021AP**	8	**SVX05031AP**
	60		**SVX06021AP**		**SVX06031AP**
D	75		**SVX07521AP**		**SVX07531AP**
	100	9	**SVX10021AP**	9	**SVX10031AP**

Notes

① Enclosure dimensions starting on **Page V6-T2-92**.

② Includes drive, local/remote keypad and enclosure.

230V Drives

SVX9000 Enclosed Drives

Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②
High Overload Drive and Enclosure					
A	3/4	4	SVXF0722EP	4	SVXF0732EP
	1		SVX00122EP		SVX00132EP
	1-1/2		SVXF1522EP		SVXF1532EP
	2		SVX00222EP		SVX00232EP
	3	5	SVX00322EP	5	SVX00332EP
	5		SVX00522EP		SVX00532EP
	7-1/2		SVX00722EP		SVX00732EP
	10	6	SVX01022EP	6	SVX01032EP
B	15		SVX01522EP		SVX01532EP
	20	7	SVX02022DP	7	SVX02032DP
	25		SVX02522DP		SVX02532DP
C	30		SVX03022DP		SVX03032DP
	40	8	SVX04022DP	8	SVX04032DP
	50		SVX05022DP		SVX05032DP
D	60		SVX06022DP		SVX06032DP
	75	9	SVX07522DP	9	SVX07532DP
	100		SVX10022DP		SVX10032DP
Low Overload Drive and Enclosure					
A	1	4	SVX00122BP	4	SVX00132BP
	1-1/2		SVXF1522BP		SVXF1532BP
	2		SVX00222BP		SVX00232BP
	3		SVX00322BP		SVX00332BP
	5	5	SVX00522BP	5	SVX00532BP
	7-1/2		SVX00722BP		SVX00732BP
	10		SVX01022BP		SVX01032BP
	15	6	SVX01522BP	6	SVX01532BP
B	20		SVX02022BP		SVX02032BP
	25	7	SVX02522AP	7	SVX02532AP
	30		SVX03022AP		SVX03032AP
C	40		SVX04022AP		SVX04032AP
	50	8	SVX05022AP	8	SVX05032AP
	60		SVX06022AP		SVX06032AP
D	75		SVX07522AP		SVX07532AP
	100	9	SVX10022AP	9	SVX10032AP

Notes

① Enclosure dimensions starting on **Page V6-T2-92**.

② Includes drive, local/remote keypad and enclosure.

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SVX9000 Enclosed Drives

Pump Panel Style (Single-Phase)

Enclosure Size ①	hp	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②
Low Overload Drive and Enclosure					
A	3/4	4	**SVXF072JBP**	4	**SVXF073JBP**
	1		**SVX0012JBP**		**SVX0013JBP**
	2	5	**SVX0022JBP**	5	**SVX0023JBP**
	3		**SVX0032JBP**		**SVX0033JBP**
	5		**SVX0052JBP**		**SVX0053JBP**
	7-1/2	6	**SVX0072JBP**	6	**SVX0073JBP**
	10		**SVX0102JBP**		**SVX0103JBP**
B	15	7	**SVX0152JBP**	7	**SVX0153JBP**
	20		**SVX0202JAP**		**SVX0203JAP**
C	25	8	**SVX0252JAP**	8	**SVX0253JAP**
	30		**SVX0302JAP**		**SVX0303JAP**
	40		**SVX0402JAP**		**SVX0403JAP**

Notes

① Enclosure dimensions starting on **Page V6-T2-92**.

② Includes drive, local/remote keypad and enclosure.

480V Drives

SVX9000 Enclosed Drives

Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②
High Overload Drive and Enclosure					
A	1	4	**SVX00124EP**	4	**SVX00134EP**
	1-1/2		**SVXF1524EP**		**SVXF1534EP**
	2		**SVX00224EP**		**SVX00234EP**
	3		**SVX00324EP**		**SVX00334EP**
	5		**SVX00524EP**		**SVX00534EP**
	7-1/2	5	**SVX00724EP**	5	**SVX00734EP**
	10		**SVX01024EP**		**SVX01034EP**
	15		**SVX01524EP**		**SVX01534EP**
	20	6	**SVX02024EP**	6	**SVX02034EP**
	25		**SVX02524EP**		**SVX02534EP**
B	30	7	**SVX03024EP**	7	**SVX03034EP**
	40		**SVX04024DP**		**SVX04034DP**
	50		**SVX05024DP**		**SVX05034DP**
	60		**SVX06024DP**		**SVX06034DP**
C	75	8	**SVX07524DP**	8	**SVX07534DP**
	100		**SVX10024DP**		**SVX10034DP**
	125		**SVX12524DP**		**SVX12534DP**
D	150	9	**SVX15024DP**	9	**SVX15034DP**
	200		**SVX20024DP**		**SVX20034DP**
Consult factory	250	10	**SVX25024DP**	10	**SVX25034DP**
	300		**SVX30024DP**		**SVX30034DP**
	350		**SVX35024DP**		**SVX35034DP**
Low Overload Drive and Enclosure					
A	1-1/2	4	**SVXF1524BP**	4	**SVXF1534BP**
	2		**SVX00224BP**		**SVX00234BP**
	3		**SVX00324BP**		**SVX00334BP**
	5		**SVX00524BP**		**SVX00534BP**
	7-1/2		**SVX00724BP**		**SVX00734BP**
	10	5	**SVX01024BP**	5	**SVX01034BP**
	15		**SVX01524BP**		**SVX01534BP**
	20		**SVX02024BP**		**SVX02034BP**
	25	6	**SVX02524BP**	6	**SVX02534BP**
	30		**SVX03024BP**		**SVX03034BP**
B	40	7	**SVX04024BP**	7	**SVX04034BP**
	50		**SVX05024AP**		**SVX05034AP**
	60		**SVX06024AP**		**SVX06034AP**
	75		**SVX07524AP**		**SVX07534AP**
C	100	8	**SVX10024AP**	8	**SVX10034AP**
	125		**SVX12524AP**		**SVX12534AP**
	150		**SVX15024AP**		**SVX15034AP**
D	200	9	**SVX20024AP**	9	**SVX20034AP**
	250		**SVX25024AP**		**SVX25034AP**
Consult factory	300	10	**SVX30024AP**	10	**SVX30034AP**
	400		**SVX40024AP**		**SVX40034AP**

Notes

① Enclosure dimensions starting on **Page V6-T2-92**.

② Includes drive, local/remote keypad and enclosure.

SVX9000 Enclosed Drives

2

Pump Panel Style (Single-Phase)

Enclosure Size ①	hp	NEMA Type 12/IP54 Frame Size	NEMA Type 12/IP54 Base Catalog Number ②	NEMA Type 3R Frame Size	NEMA Type 3R Base Catalog Number ②
Low Overload Drive and Enclosure					
A	3/4	4	**SVXF072KBP**	4	**SVXF073KBP**
	1		**SVX0012KBP**		**SVX0013KBP**
	2		**SVX0022KBP**		**SVX0023KBP**
	3		**SVX0032KBP**		**SVX0033KBP**
	5	5	**SVX0052KBP**	5	**SVX0053KBP**
	7-1/2		**SVX0072KBP**		**SVX0073KBP**
	10		**SVX0102KBP**		**SVX0103KBP**
	15	6	**SVX0152KBP**	6	**SVX0153KBP**
	20		**SVX0202KBP**		**SVX0203KBP**
B	25	7	**SVX0252KAP**	7	**SVX0253KAP**
	30		**SVX0302KAP**		**SVX0303KAP**
C	40	8	**SVX0402KAP**	8	**SVX0403KAP**
	50		**SVX0502KAP**		**SVX0503KAP**
	60		**SVX0602KAP**		**SVX0603KAP**

Notes

① Enclosure dimensions starting on **Page V6-T2-92**.

② Includes drive, local/remote keypad and enclosure.

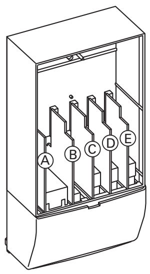
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	■	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series local/remote keypad	—	**KEYPAD-LOC/REM**	—	—	—	—	—	—	—	—
9000X Series remote mount keypad kit	—	**OPTRMT-KIT-9000X**	—	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	**PP00104**	—	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/ Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Control/Communication Option Descriptions

For availability, see Product Selection for base drive voltage required.

Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer—**Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch—**Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K5	**MANUAL/AUTO Speed Reference Switch**—Provides a door-mounted selector switch for MANUAL/AUTO speed reference.	Control
K6	**START and STOP Pushbuttons (22 mm)**—START (green) STOP (red). Provide door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
K9	**(2) Factory Installed Auxiliary Contacts**—Provide two NO/NC auxiliary contacts.	Power
L1	**Power On and Fault Pilot Lights**—Provide a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options**—A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LD	**Green STOP Light (22 mm)**—Provides a green light that indicates the drive is stopped.	Light
LE	**Red RUN Pilot Light (22 mm)**—Provides a red run pilot light that indicates the drive is running.	Light
LU	**Misc. Light (22 mm)**—Provides a misc. “user defined” pilot light. User to define light function and color.	Light
LW	**PTT (Push-To-Test) Light (22 mm)**—Provides misc. “user defined” PTT pilot light. User to define light function and color.	Light
LY	**Adder for LED Each**—Changes light packages from standard incandescent bulb to LED style bulb.	Light
P1	**Input Disconnect Assembly Rated to 100 kAIC**—High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	**Input Line Fuses Rated to 200 kAIC**—Provide high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor**—Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	**TVSS Transient Voltage Surge Suppressor**—Provides transient voltage surge suppression of the unit. Consult factory for ratings.	Input
PE	**Output Contactor**—Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive’s run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600 Vac are provided for customer use. Bypass option **RA** includes an output contactor as standard. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.	Output
RA	**Manual HOA Bypass Controller**—The Manual HAND/OFF/AUTO (HOA)—3-contactor—bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on **Page V6-T2-91**).	Bypass
S5	**Floor Stand 22 in**—Converts a Size A or B, normally wall mounted enclosure to a floor standing enclosure with a height of 22 in (558.8 mm).	Enclosure
S9	**Space Heater without CPT**—Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C and D. Requires a customer supplied 115V remote supply source.	Enclosure
SA	**Space Heater with CPT**— Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C and D. Provided with CPT connected to load side of input disconnect.	Enclosure
SB	**Ice Cube Style Control Relay**—Provides misc. “user defined” 4PDT control relay. Requires user to define functionality.	Enclosure
SE	**On-Delay Timer (Delay on Make)**—Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure
SF	**Off-Delay Timer (Delay on Break)**—Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure

2

VFD Pump Panel Options

Brake Chopper Options ①

208V and 230V: NEMA Type 12/IP54/3R, I_H hp 3/4 to 100; I_L hp 1 to 100
480V: NEMA Type 12/IP54/3R, I_H hp 1 to 400; I_L hp 1-1/2 to 400

208V and 230V Control Options, 3/4–100 hp ②

Description	Catalog Number Suffix
Door-mounted speed potentiometer	K1
Door-mounted speed potentiometer with HOA selector switch	K2
Manual/auto reference switch (22 mm)	K5
START and STOP pushbuttons (22 mm)	K6

480V Control Options, 1–800 hp ②

Description	Catalog Number Suffix
Door-mounted speed potentiometer	K1
Door-mounted speed potentiometer with HOA selector switch	K2
Manual/auto reference switch (22 mm)	K5
START and STOP pushbuttons (22 mm)	K6

208V and 230V Light Options, 3/4–100 hp ②

Description	Catalog Number Suffix
Power on/fault pilot lights (22 mm)	L1
Green STOP light (22 mm)	LD
Red RUN light (22 mm)	LE
Misc. light (22 mm)	LU
PTT light (22 mm)	LW
LED	LY

480V Light Options, 1–800 hp ②

Description	Catalog Number Suffix
Power on/fault pilot lights (22 mm)	L1
Green STOP light (22 mm)	LD
Red RUN light (22 mm)	LE
Misc. light (22 mm)	LU
PTT light (22 mm)	LW
LED	LY

Notes

① External dynamic braking resistors not included. Consult factory.
② Consult factory for adder information.
③ See **Page V6-T2-87** for details.
④ Bypass options applicable only in the pump panel three-phase design.

208V, 230V and 480V Enclosure Options, Sizes A–D ②

Description	Catalog Number Suffix
Floor stand 22 in (558.8 mm)	S5
Space heater without CPT	S9
Space heater with CPT	SA
Socket type control relay	SB
On-delay timer	SE
Off-delay timer	SF

208 and 230V Power Options, 3/4–100 hp ②

Description	Catalog Number Suffix
Two auxiliary contacts installed	K9
Input disconnect (HMCP) 100 kAIC	P1
Input line fuses 200 kAIC	P3
Input power surge protection	P7
TVSS transient voltage surge suppressor	P8
Output contactor	PE

480V Power Options, 1–400 hp ②

Description	Catalog Number Suffix
Two auxiliary contacts installed	K9
Input disconnect (HMCP) 100 kAIC	P1
Input line fuses 200 kAIC	P3
Input power surge protection	P7
TVSS transient voltage surge suppressor	P8
Output contactor	PE

208 and 230V Bypass Options, 3/4–100 hp ②③

Description	Catalog Number Suffix
Bypass pilot lights for RA option	L2 ④
Manual HOA bypass controller	RA ④

480V Bypass Options, 1–400 hp ②③

Description	Catalog Number Suffix
Bypass pilot lights for RA option	L2 ④
Manual HOA bypass controller	RA ④

Technical Data and Specifications

9000X VFD Pump Panels

Description	NEMA Type 12/IP54 or NEMA Type 3R Specification
Primary Design Features	
45–66 Hz input frequency	Standard
Output (AC volts maximum)	Input voltage base
Output frequency range	0–320 Hz
Initial output current (I_H)	250% for 2 seconds
Overload (1 minute [I_H/I_L])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL
Protection Features	
Incoming line fuses	Optional
AC input circuit disconnect	Optional
Line reactors	Standard
Phase rotation insensitive	Standard
EMI filter	Standard—Thru Frame 9
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard

Description	NEMA Type 12/IP54 or NEMA Type 3R Specification
Input/Output Interface Features	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA isolated	Configurable
4–20 mA differential	Configurable
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Optional
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	1 (2 relays Form C)
Open collector outputs	1
Additional discrete outputs	Optional
Communications	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional

2

9000X VFD Pump Panels, continued

Description	NEMA Type 12/IP54 or NEMA Type 3R Specification
Performance Features	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional ①
DC braking	Standard
PID setpoint controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Carrier frequency adjustment	1–16 kHz
Standard Conditions for Application and Service	
Operating ambient temperature	0 to 40°C
Storage temperature	–40 to 60°C
Humidity (maximum), non-condensing	95%
Altitude (maximum without derate)	3300 ft (1000m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>96%
Power factor (displacement)	0.96

Standard I/O Specifications

Description	Specification
Six–digital input programmable	24V: "0" ≤10V, "1" ≥18V,R_i >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10V, R_i >200 kohms Current: 0 (4)–20 mA, R_i = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R_L max. 500 ohms 10 bits ±2%
One digital output programmable	Open collector 48 Vdc 50 mA

I/O Specifications for Control/Communication Options

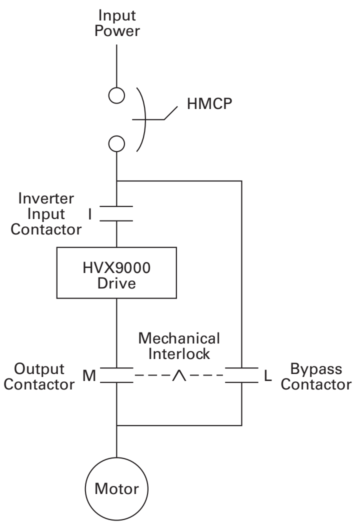
Description	Specification
Analog voltage, input	0–±10V, R_i ≥200 kohms
Analog current, input	0 (4)–20 mA, R_i = 250 ohms
Digital input	24V: "0" ≤10V, "1" ≥18V, R_i >5 kohms
Auxiliary voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R_L = 500 kohms, resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10V, R_L ≥1 k kohms, resolution 10 bit, accuracy ≤±2%
Relay output	
Maximum switching voltage	300 Vdc, 250 Vac
Maximum switching load	8A/24 Vdc, 0.4A/300 Vdc, 2 kVA/250 Vac
Maximum continuous load	2A rms
Thermistor input	R_{trip} = 4.7 kohms

Note

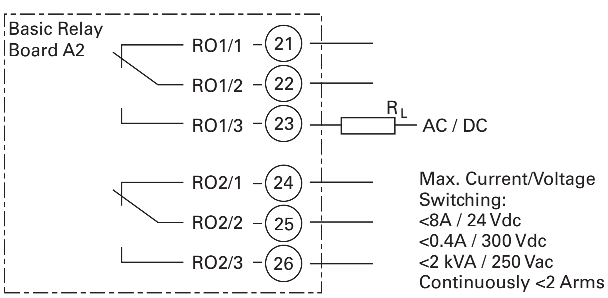
① Some horsepower units include dynamic braking chopper as standard—refer to individual drive sections.

Wiring Diagrams

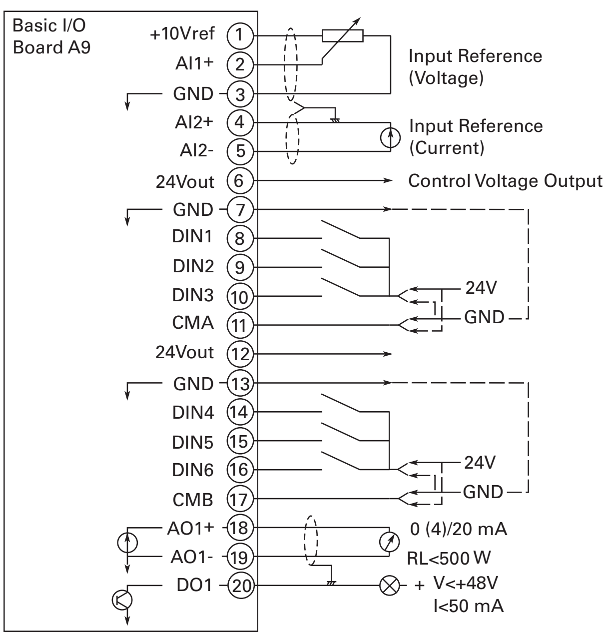
Power Diagram for Bypass Option RA



A2 Board Control Wiring

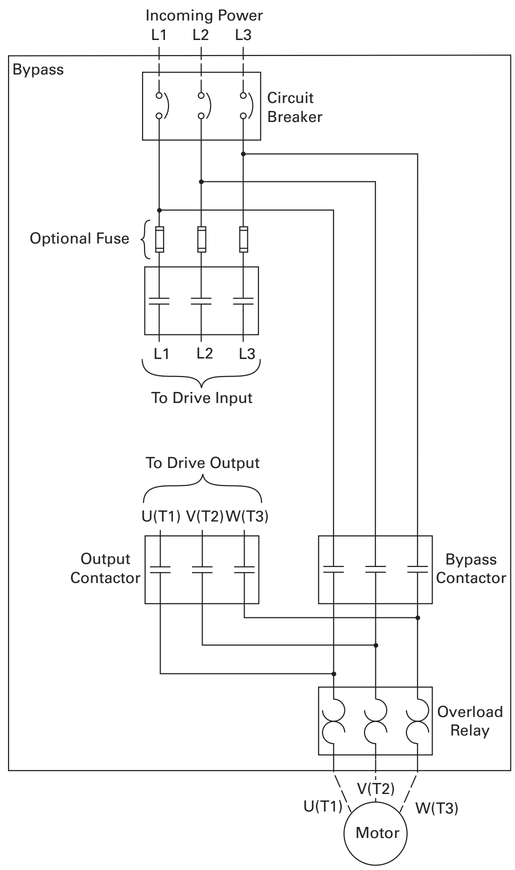


A9 Board Control Wiring

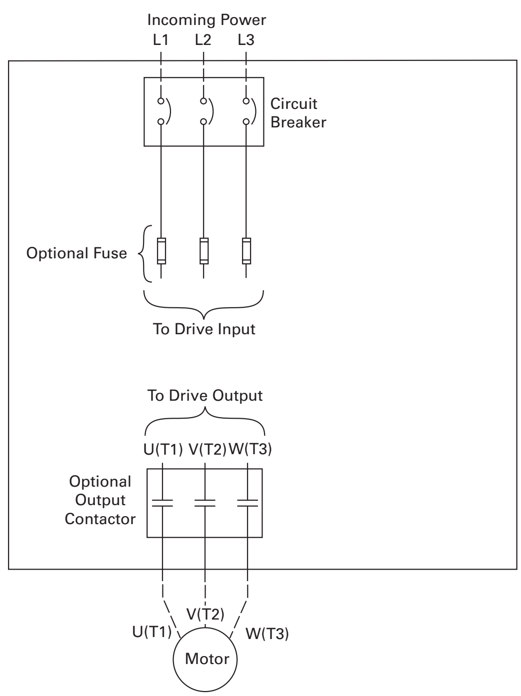


—— Indicates Connections for Inverted Signals

SVX9000 Pump Panel Bypass Power Wiring



SVX9000 Pump Panel Disconnect Power Wiring

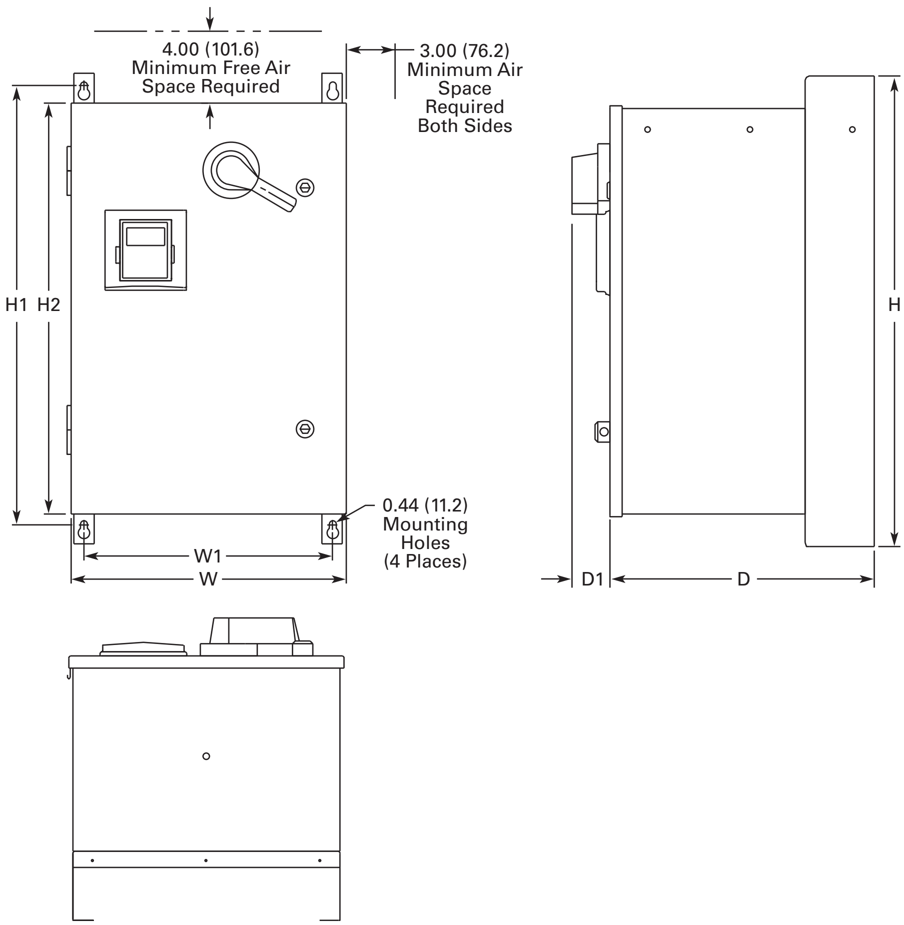


Dimensions

Approximate Dimensions in Inches (mm)

SVX9000 Pump Application Drives

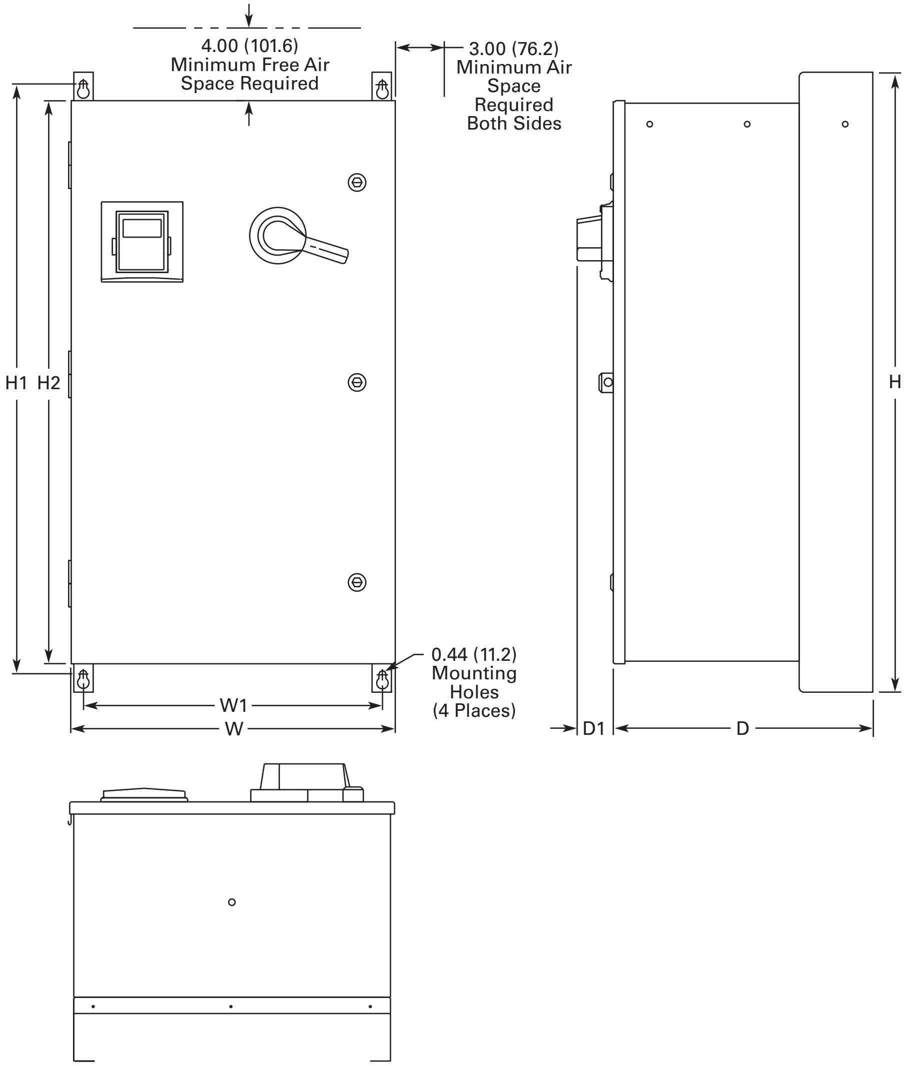
Enclosure Box A NEMA Type 12/IP54



Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	W	W1	D	D1	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
Three-Phase											
208V	3/4–10	1–15	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
230V	3/4–10	1–15									
480V	1–25	1–30									
Single-Phase											
230V	—	3/4–10	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
480V	—	3/4–20									

Approximate Dimensions in Inches (mm)

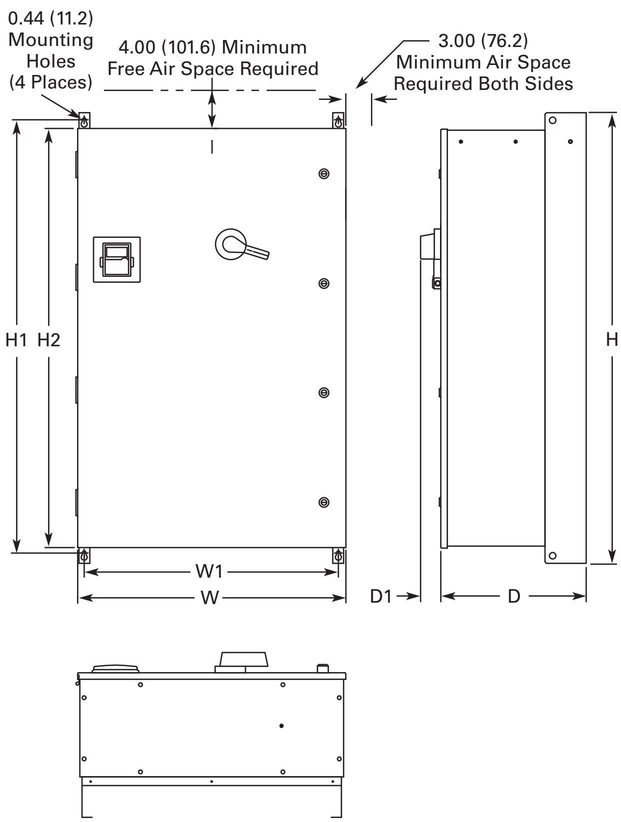
Enclosure Box B NEMA Type 12/IP54

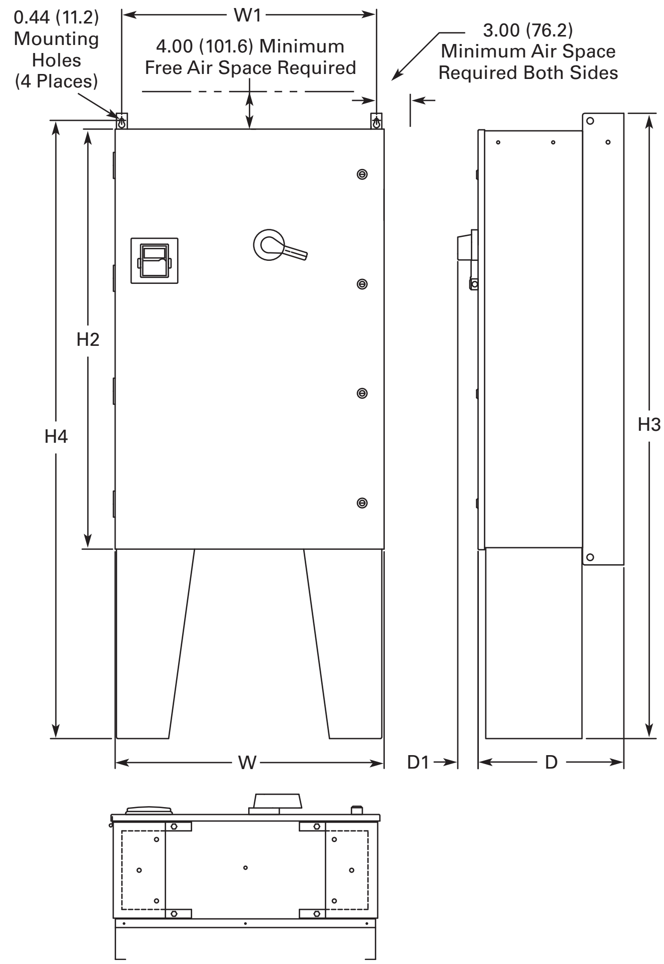


Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	W	W1	D	D1	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
Three-Phase											
208V	15–25	20–30	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
230V	15–25	20–30									
480V	30–60	40–75									
Single-Phase											
230V	—	15–20	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
480V	—	25–30									

Approximate Dimensions in Inches (mm)

Enclosure Box C NEMA Type 12/IP54





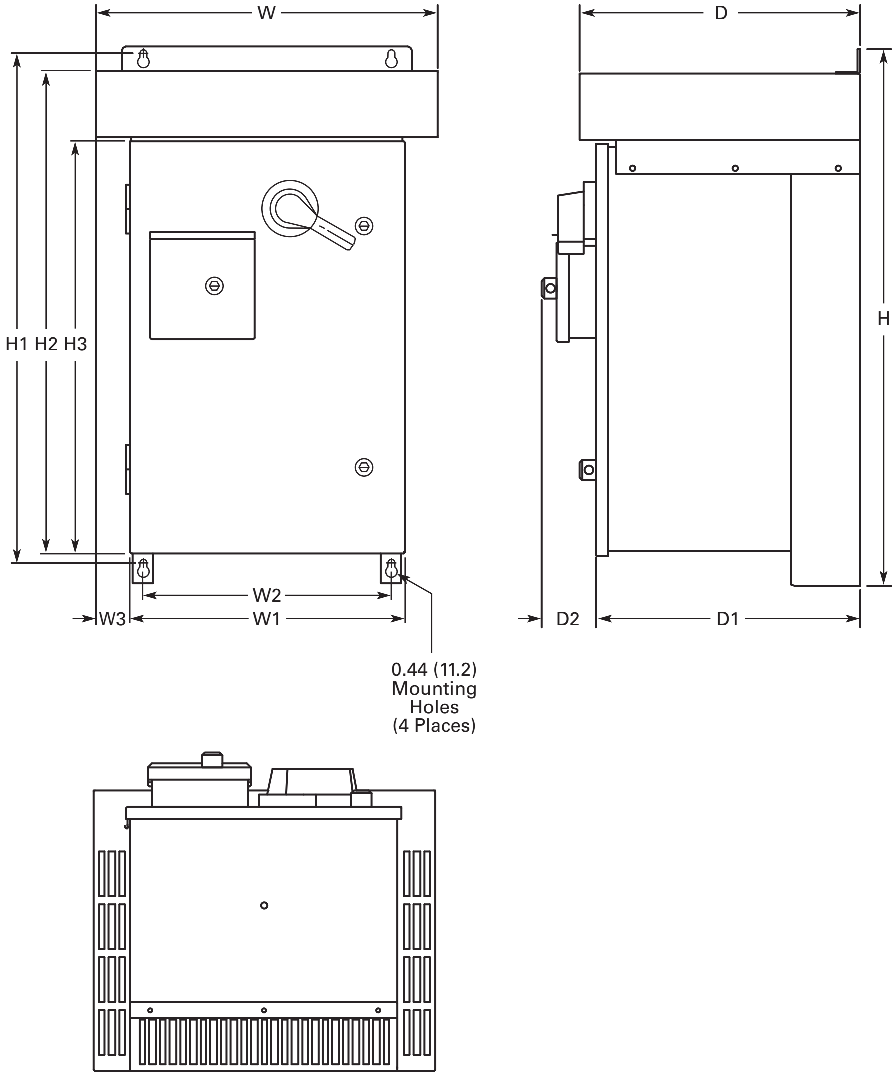
Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	H3	H4	W	W1	D	D1	Approx. Shipping Weight Lbs (kg)
Three-Phase												
208V	30–50	40–60	52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	①
230V	30–50	40–60										
480V	75–125	100–150										
Single-Phase												
230V	—	25–40	52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	①
480V	—	40–60										

Note

① Consult factory.

Approximate Dimensions in Inches (mm)

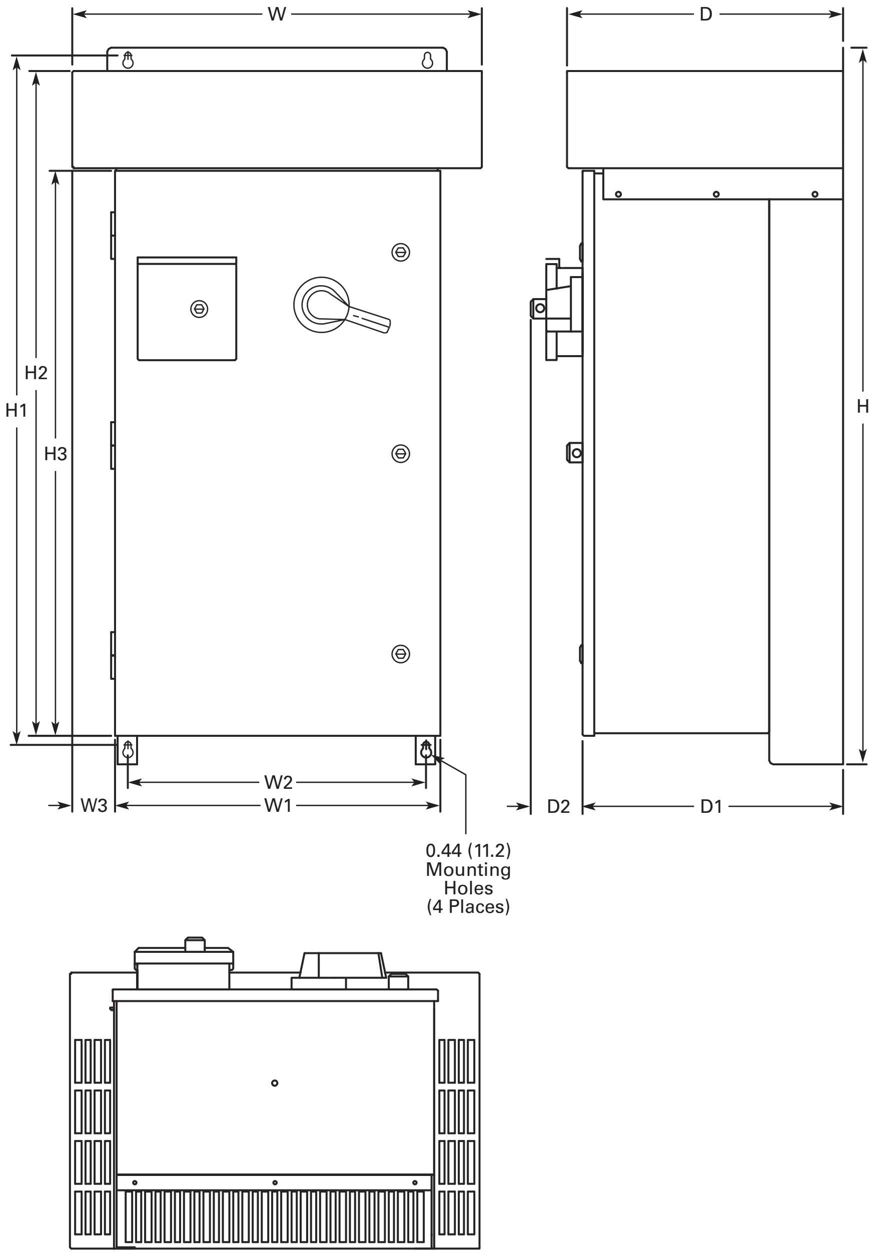
Enclosure Box A NEMA Type 3R



Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
Three-Phase															
208V	3/4–10	1–15	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (840.1)	170 (77)	215 (98)
230V	3/4–10	1–15													
480V	1–25	1–30													
Single-Phase															
230V	—	3/4–10	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (840.1)	170 (77)	215 (98)
480V	—	3/4–20													

Approximate Dimensions in Inches (mm)

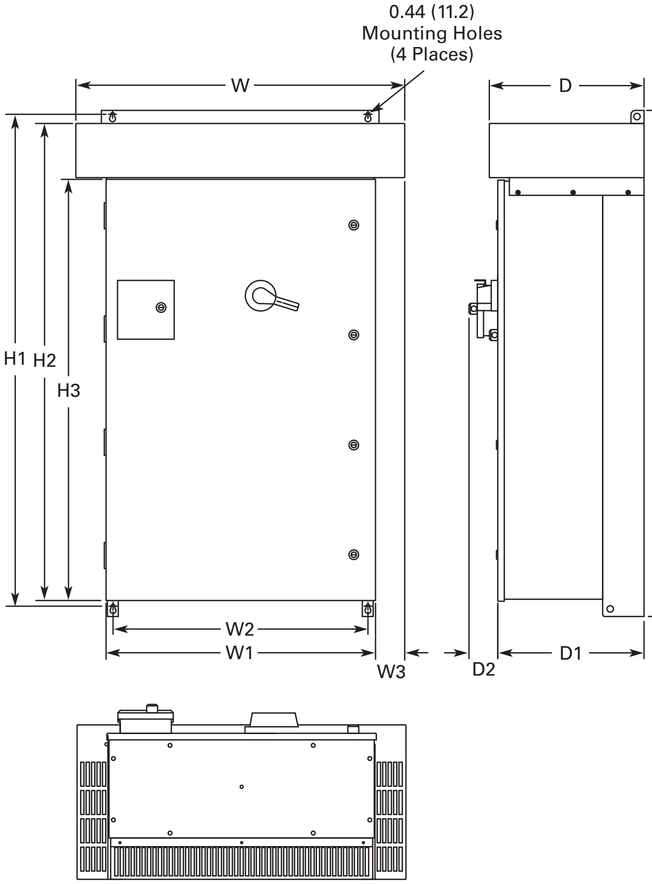
Enclosure Box B NEMA Type 3R

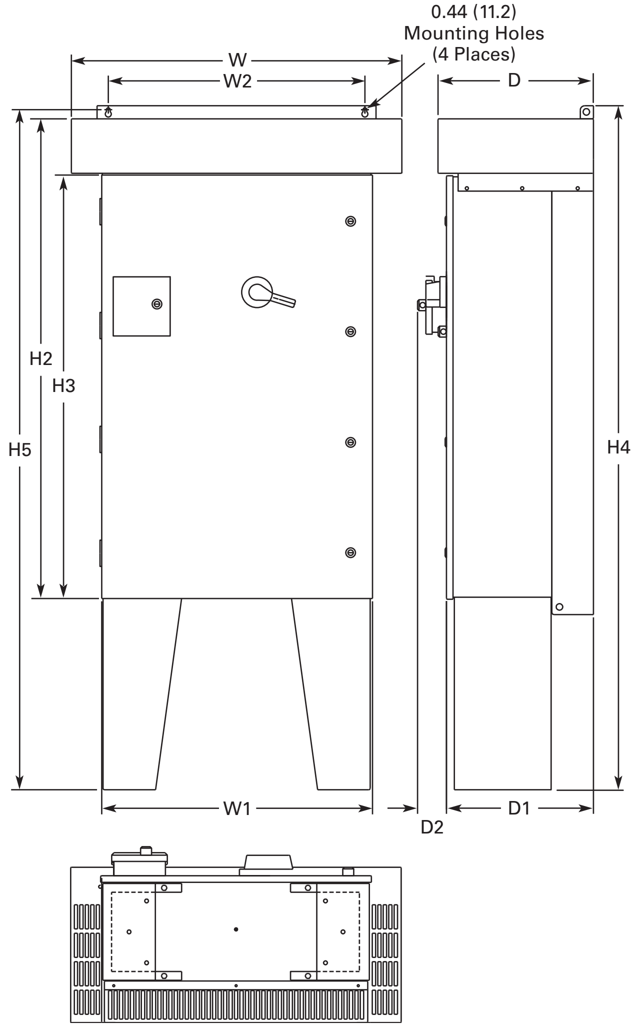


Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)	Approx. Shipping Weight Lbs (kg)
Three-Phase															
208V	15–25	20–30	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (840.1)	235 (107)	290 (132)
230V	15–25	20–30													
480V	30–60	40–75													
Single-Phase															
230V	—	15–20	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (840.1)	235 (107)	290 (132)
480V	—	25–30													

Approximate Dimensions in Inches (mm)

Enclosure Box C NEMA Type 3R





Voltage AC	hp (I_H)	hp (I_L)	H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	Approx. Weight Lbs (kg)
Three-Phase																
208	30–50	40–60	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (840.1)	①
230	30–50	40–60														
480	75–125	100–150														
Single-Phase																
230V	—	25–40	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (840.1)	①
480V	—	40–60														

Note

① Consult factory.

SPX9000 Drives

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Product Description

The SPX9000 Series Adjustable Frequency Drives from Eaton's electrical sector are specifically designed for high performance applications. Equipped with high processing power, the SPX9000 can use information from an encoder or a resolver in order to provide very precise motor control. Sensorless vector and simple frequency control are also supported. Typical applications requiring high performance are: master-slave drives, positioning applications, winder tension control and synchronization.

The core of the SPX9000 is a fast microprocessor, providing high dynamic performance for applications where good motor handling and reliability are required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The SPX9000 supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Simultaneous fast monitoring of several drives can be done by using the 9000Xdrive tool and CAN communication. In applications where reliability and quality are essential for high-performance, the SPX9000 is the logical choice.

The Eaton family of drives includes HVX9000, H-Max, M-Max, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features and Benefits

- Speed error <0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5V (RS-422), 15V or 24V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy <2%; <5% down to zero speed
- Starting torque >200%, depending on motor and drive sizing
- Integrated datalogger for system analysis
- Fast multiple drive monitoring with PC
- Full capability for master/slave configurations
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7200 Hz) possible
- Robust design—proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- Line reactor is included but is separated from chassis
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12/IP54 keypad on all drives
- Hand-held auxiliary 240 power supply allows programming/monitoring of control module without applying full power to the drive
- The SPX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" precision application programs consisting of:
  - Basic
  - Standard
  - Local/remote
  - Multi-step speed control
  - PID control
  - Multi-purpose control
  - Pump and fan control with auto change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake chopper standard from: 1–30 hp/380–500V 3/4–15 hp/208–230V
- NEMA Type 1/IP21 enclosures available Frame Sizes FR4–FR11, NEMA Type 12/IP54 enclosures available Frame Sizes FR4–FR10 (FR10 and FR11 freestanding drives)
- Open chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Standards and Certifications

Product

- IEC 61800-2

Safety

- UL 508C

EMC (at default settings)

- Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

- UL Listed

Catalog Number Selection

SPX9000 Adjustable Frequency Drives

SPX 010 A 1 – 4 A 1 B 1 _ _ _ _ _ _

Product Family
SPX = Open drives

Horsepower Rating	
F07 =3/4	**125** =125
001 = 1	**150** =150
F15 =1-1/2	**250** =250
002 = 2	**300** =300
003 = 3	**350** =350
004 =5 (I_L)	**400** =400
005 = 5	**500** =500
006 =7-1/2 (I_L)	**550** =550
007 =7-1/2	**600** =600
010 =10	**650** =650
015 =15	**700** =700
020 =20	**800** =800
025 =25	**900** =900
030 =30	**H10** =1000
040 =40	**H12** =1200
050 =50	**H13** =1350
060 =60	**H15** =1500
075 =75	**H16** =1600
100 =100	**H20** =2000

AFD Software Series
A = Standard software

Enclosure ③
0 = Chassis
1 = NEMA Type 1/IP21
2 = NEMA Type 12/IP54

Voltage Rating
2 = 230 (208–240) V
4 = 480 (380–500) V
5 = 575 (525–690) V

Keypad
A = Alphanumeric

Input Options ①
1 = Three-phase, EMC H
2 = Three-phase, EMC N
4 = Three-phase, EMC L

Brake Chopper Options ②
N = No brake chopper circuit
B = Internal brake chopper circuit

Board Modifications
1 = Standard boards
2 = Conformal (varnished) coating ④

Options
Options appear in alphabetical order.
Extended I/O Card Options
A3 = 2 RO, Therm
A4 = Encoder low volt +5V/15V24V
A5 = Encoder high volt +15V/24V
A7 = Double Encoder
A8 = 6 DI, 1 DO, 2 AI, 1AO
AE = 3 DI (Encoder 10–24V), Out +15V/+24V 2 DO (pulse + direction)
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT + 24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input
BB = SPI, absolute encoder

Communication Cards	
CA = Johnson Controls N2	**C5** = Profibus DP (D9 connector)
CI = Modbus TCP	**C6** = CANopen (slave)
CJ = BACnet	**C7** = DeviceNet
CK = Ethernet IP	**C8** = Modbus (D9 type connector)
C2 = Modbus	**D1** = Adapter—SPX only
C3 = Profibus DP	**D2** = Adapter—SPX only
C4 = LonWorks	**D3** = RS-232 with D9 connection

Power Module

FR10 – 000 – 4 – A N S

Frame Code

Horsepower
Example: **150** = 150 hp
(See chart above)

Voltage
4 = 380–500V
5 = 525–690V

Cooling Type
A = Air

Brake Option
N = No brake chopper
B = Brake chopper

Varnishing	
S = Standard	**V** = Varnished

Notes

① All 230V drives and 480V drives up to 200 hp (I_H) are only available with input option **1** (EMC level H)**.** 480V drives 250 hp (I_H) or larger are available with input option **2** (EMC level N). 575V drives 200 hp (I_H) or larger are available with input option **2**. 575V drives up to 150 hp (I_H) are available with input option **4** (EMC level L). 480V and 600V freestanding drives are available with input option **4** (EMC level L).

② 480V drives up to 30 hp (I_H) are only available with brake chopper option **B**. 480V drives 40 hp (I_H) or larger come standard with brake chopper option **N**. 230V drives up to 15 hp (I_H) are only available with brake chopper option **B**. 230V drives 20 hp and larger come standard with brake chopper option **N**. All 575V drives come standard without brake chopper option (**N**). **N** = **No** brake chopper.

③ 480V drives 250–350 hp (I_H) and 690V drives 200–300 hp (I_H) are available with enclosure style **0** (chassis). 480V and 690V FR10 freestanding drives are available with **1** (NEMA Type 1/IP21) or **2** (NEMA Type 12/IP54). FR11 freestanding drives are only available with enclosure style **1** (NEMA Type 1/IP21).

④ Factory promise delivery. Consult sales office for availability.

Product Selection

230V Drives

SPX9000 Open Drives

208–240V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	FP	3/4	3.7	1	4.8	**SPXF07A1-2A1B1**
		1	4.8	1-1/2	6.6	**SPX001A1-2A1B1**
		1-1/2	6.6	2	7.8	**SPXF15A1-2A1B1**
		2	7.8	3	11	**SPX002A1-2A1B1**
		3	11	—	12.5	**SPX003A1-2A1B1**
FR5	FP	—	12.5	5	17.5	**SPX004A1-2A1B1**
		5	17.5	7-1/2	25	**SPX005A1-2A1B1**
		7-1/2	25	10	31	**SPX007A1-2A1B1**
FR6	FP	10	31	15	48	**SPX010A1-2A1B1**
		15	48	20	61	**SPX015A1-2A1B1**
FR7	FP	20	61	25	75	**SPX020A1-2A1N1**
		25	75	30	88	**SPX025A1-2A1N1**
		30	88	40	114	**SPX030A1-2A1N1**
FR8	FP	40	114	50	140	**SPX040A1-2A1N1**
		50	140	60	170	**SPX050A1-2A1N1**
		60	170	75	205	**SPX060A1-2A1N1**
FR9	FP	75	205	100	261	**SPX075A1-2A1N1**
		100	261	—	—	**SPX100A1-2A1N1**

208–240V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	FP	3/4	3.7	1	4.8	**SPXF07A2-2A1B1**
		1	4.8	1-1/2	6.6	**SPX001A2-2A1B1**
		1-1/2	6.6	2	7.8	**SPXF15A2-2A1B1**
		2	7.8	3	11	**SPX002A2-2A1B1**
		3	11	—	12.5	**SPX003A2-2A1B1**
FR5	FP	—	12.5	5	17.5	**SPX004A2-2A1B1**
		5	17.5	7-1/2	25	**SPX005A2-2A1B1**
		7-1/2	25	10	31	**SPX007A2-2A1B1**
FR6	FP	10	31	15	48	**SPX010A2-2A1B1**
		15	48	20	61	**SPX015A2-2A1B1**
FR7	FP	20	61	25	75	**SPX020A2-2A1N1**
		25	75	30	88	**SPX025A2-2A1N1**
		30	88	40	114	**SPX030A2-2A1N1**
FR8	FP	40	114	50	140	**SPX040A2-2A1N1**
		50	140	60	170	**SPX050A2-2A1N1**
		60	170	75	205	**SPX060A2-2A1N1**
FR9	FP	75	205	100	261	**SPX075A2-2A1N1**
		100	261	—	—	**SPX100A2-2A1N1**

480V Drives

SPX9000 Open Drives

380–500V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	W	1	2.2	1-1/2	3.3	**SPX001A1-4A1B1**
	FP	1-1/2	3.3	2	4.3	**SPXF15A1-4A1B1**
	FP	2	4.3	3	5.6	**SPX002A1-4A1B1**
	W	3	5.6	5	7.6	**SPX003A1-4A1B1**
	W	5	7.6	—	9	**SPX005A1-4A1B1**
	FP	—	9	7-1/2	12	**SPX006A1-4A1B1**
FR5	W	7-1/2	12	10	16	**SPX007A1-4A1B1**
		10	16	15	23	**SPX010A1-4A1B1**
		15	23	20	31	**SPX015A1-4A1B1**
FR6	W	20	31	25	38	**SPX020A1-4A1B1**
		25	38	30	46	**SPX025A1-4A1B1**
		30	46	40	61	**SPX030A1-4A1B1**
FR7	FP	40	61	50	72	**SPX040A1-4A1N1**
	W	50	72	60	87	**SPX050A1-4A1N1**
	W	60	87	75	105	**SPX060A1-4A1N1**
FR8	FP	75	105	100	140	**SPX075A1-4A1N1**
	W	100	140	125	170	**SPX100A1-4A1N1**
	W	125	170	150	205	**SPX125A1-4A1N1**
FR9	W	150	205	200	261	**SPX150A1-4A1N1**
		200	245	250	300	**SPX200A1-4A1N1**

380–500V, NEMA Type 1/IP21 Freestanding Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	W	250	330	300	385	**SPX250A1-4A4N1**
	FP	300	385	350	460	**SPX300A1-4A4N1**
	W	350	460	400	520	**SPX350A1-4A4N1**
FR11	FP	400	520	500	590	**SPX400A1-4A4N1**
	FP	500	590	550	650	**SPX500A1-4A4N1**
	FP	550	650	600	730	**SPX550A1-4A4N1**

Note

Integrated fuses as standard. Limited option selection available; 115V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), Disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-111**.

SPX9000 Open Drives

380–500V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR4	W	1	2.2	1-1/2	3.3	**SPX001A2-4A1B1**
	FP	1-1/2	3.3	2	4.3	**SPXF15A2-4A1B1**
	FP	2	4.3	3	5.6	**SPX002A2-4A1B1**
	W	3	5.6	5	7.6	**SPX003A2-4A1B1**
	W	5	7.6	—	9	**SPX005A2-4A1B1**
	FP	—	9	7-1/2	12	**SPX006A2-4A1B1**
FR5	W	7-1/2	12	10	16	**SPX007A2-4A1B1**
		10	16	15	23	**SPX010A2-4A1B1**
		15	23	20	31	**SPX015A2-4A1B1**
FR6	W	20	31	25	38	**SPX020A2-4A1B1**
		25	38	30	46	**SPX025A2-4A1B1**
		30	46	40	61	**SPX030A2-4A1B1**
FR7	FP	40	61	50	72	**SPX040A2-4A1N1**
		50	72	60	87	**SPX050A2-4A1N1**
		60	87	75	105	**SPX060A2-4A1N1**
FR8	FP	75	105	100	140	**SPX075A2-4A2N1**
		100	140	125	170	**SPX100A2-4A1N1**
		125	170	150	205	**SPX125A2-4A1N1**
FR9	FP	150	205	200	261	**SPX150A2-4A1N1**
		200	245	250	300	**SPX200A2-4A1N1**

380–500V, NEMA Type 12/IP54 Freestanding Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	FP	250	330	300	385	**SPX250A2-4A4N1**
	FP	300	385	350	460	**SPX300A2-4A4N1**
	FP	350	460	400	520	**SPX350A2-4A4N1**

380–500V, Open Chassis Drives

Frame Size ①	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	W	250	330	300	385	**SPX250A0-4A2N1**
		300	385	—	460	**SPX300A0-4A2N1**
		350	460	400	520	**SPX350A0-4A2N1**
FR11	FP	400	520	500	590	**SPX400A0-4A2N1**
		500	590	—	650	**SPX500A0-4A2N1**
		—	650	600	730	**SPX550A0-4A2N1**
FR12	FP	600	730	—	820	**SPX600A0-4A2N1**
		—	820	700	920	**SPX650A0-4A2N1**
		700	920	800	1030	**SPX700A0-4A2N1**
FR13	FP	800	1030	900	1150	**SPX800A0-4A2N1**
		900	1150	1000	1300	**SPX900A0-4A2N1**
		1000	1300	1200	1450	**SPXH10A0-4A2N1**
FR14	FP	1200	1600	1500	1770	**SPXH12A0-4A2N1**
		1600	1940	1800	2150	**SPXH16A0-4A2N1**

Notes

Integrated fuses as standard. Limited option selection available; 115V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-111**.

① FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

575V Drives

SPX9000 Open Drives

525–690V, NEMA Type 1/IP21 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR6	W	2	3.3	3	4.5	**SPX002A1-5A4N1**
		3	4.5	—	5.5	**SPX003A1-5A4N1**
		—	5.5	5	7.5	**SPX004A1-5A4N1**
		5	7.5	7-1/2	10	**SPX005A1-5A4N1**
		7-1/2	10	10	13.5	**SPX007A1-5A4N1**
		10	13.5	15	18	**SPX010A1-5A4N1**
		15	18	20	22	**SPX015A1-5A4N1**
		20	22	25	27	**SPX020A1-5A4N1**
		25	27	30	34	**SPX025A1-5A4N1**
FR7	W	30	34	40	41	**SPX030A1-5A4N1**
		40	41	50	52	**SPX040A1-5A4N1**
FR8	W	50	52	60	62	**SPX050A1-5A4N1**
		60	62	75	80	**SPX060A1-5A4N1**
		75	80	100	100	**SPX075A1-5A4N1**
FR9	W	100	100	125	125	**SPX100A1-5A4N1**
		125	125	150	144	**SPX125A1-5A4N1**
		150	144	—	170	**SPX150A1-5A4N1**
		—	170	200	208	**SPX175A1-5A4N1**

525–690V, NEMA Type 1/IP21 Freestanding Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	FP	200	208	250	261	**SPX200A1-5A4N1**
		250	261	300	325	**SPX250A1-5A4N1**
		300	325	400	385	**SPX300A1-5A4N1**
FR11	FP	400	385	450	460	**SPX400A1-5A4N1**
		450	460	500	502	**SPX450A1-5A4N1**
		500	502	550	590	**SPX500A1-5A4N1**

Note

Integrated fuses as standard. Limited option selection available; 115V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-111**.

SPX9000 Open Drives

525–690V, NEMA Type 12/IP54 Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR6	F1	2	3.3	3	4.5	**SPX002A2-5A4N1**
		3	4.5	—	5.5	**SPX003A2-5A4N1**
		—	5.5	5	7.5	**SPX004A2-5A4N1**
		5	7.5	7-1/2	10	**SPX005A2-5A4N1**
		7-1/2	10	10	13.5	**SPX007A2-5A4N1**
		10	13.5	15	18	**SPX010A2-5A4N1**
		15	18	20	22	**SPX015A2-5A4N1**
		20	22	25	27	**SPX020A2-5A4N1**
		25	27	30	34	**SPX025A2-5A4N1**
FR7	FP	30	34	40	41	**SPX030A2-5A4N1**
		40	41	50	52	**SPX040A2-5A4N1**
FR8	FP	50	52	60	62	**SPX050A2-5A4N1**
		60	62	75	80	**SPX060A2-5A4N1**
		75	80	100	100	**SPX075A2-5A4N1**
FR9	FP	100	100	125	125	**SPX100A2-5A4N1**
		125	125	150	144	**SPX125A2-5A4N1**
		150	144	—	170	**SPX150A2-5A4N1**
		—	170	200	208	**SPX175A2-5A4N1**

525–690V, NEMA Type 12/IP54 Freestanding Drives

Frame Size	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	FP	200	208	250	261	**SPX200A2-5A4N1**
		250	261	300	325	**SPX250A2-5A4N1**
		300	325	400	385	**SPX300A2-5A4N1**

525–690V, Open Chassis Drives

Frame Size ①	Delivery Code	hp (I_H)	Current (I_H)	hp (I_L)	Current (I_L)	Catalog Number
FR10	FP	200	208	250	261	**SPX200A0-5A2N1**
		250	261	300	325	**SPX250A0-5A2N1**
		300	325	400	385	**SPX300A0-5A2N1**
FR11	FP	400	385	450	460	**SPX400A0-5A2N1**
		450	460	500	502	**SPX450A0-5A2N1**
		500	502	—	590	**SPX500A0-5A2N1**
FR12	FP	—	590	600	650	**SPX550A0-5A2N1**
		600	650	700	750	**SPX600A0-5A2N1**
		700	750	800	820	**SPX700A0-5A2N1**
FR13	FP	800	820	900	920	**SPX800A0-5A2N1**
		900	920	1000	1030	**SPX900A0-5A2N1**
		1000	1030	1250	1180	**SPXH10A0-5A2N1**
FR14	FP	1350	1300	1500	1500	**SPXH13A0-5A2N1**
		1500	1500	2000	1900	**SPXH15A0-5A2N1**
		2000	1900	2300	2250	**SPXH20A0-5A2N1**

Notes

Integrated fuses as standard. Limited option selection available; 115V transformer (KB), light kit (L1), HOA (K4), speed potentiometer w/HOA (K2), disconnect switch (P2). See Freestanding Option selection on **Page V6-T2-111**.

① FR10–FR14 includes 3% line reactor, but it is not integral to chassis.

Accessories

Demo Drive and Power Supply

Demo Drive and Power Supply

Description	Catalog Number
9000X demo drive	**9000XDEMO**
Hand-held 24V auxiliary power supply—Used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**

NEMA Type 12/IP54 Conversion Kit

The NEMA Type 12/IP54 kit option is used to convert a NEMA Type 1/IP21 to a NEMA Type 12/IP54 drive. The NEMA Type 12/IP54 kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

NEMA Type 12/IP54 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm) Length	Width	Height	Approximate Weight Lb (kg)	Catalog Number
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	**OPTN12FR4**
FR5		16 (406)	8 (203)	7 (178)	5 (2.3)	**OPTN12FR5**
FR6		21 (533)	10 (254)	5 (127)	7 (3.2)	**OPTN12FR6**

Flange Kits

Flange Kit NEMA Type 12/IP54

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12/IP54 fan components. Metal shroud not included.

Flange kits for NEMA Type 12/IP54 enclosure drive rating are determined by rating of drive.

Flange Kit NEMA Type 12/IP54— Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number
FR4	W	**OPTTHRFR4**
FR5		**OPTTHRFR5**
FR6		**OPTTHRFR6**

Flange Kit NEMA Type 12/IP54—Frames 4–9 ①

Frame Size	Delivery Code	Catalog Number
FR4	FP	**OPTTHR4**
FR5		**OPTTHR5**
FR6		**OPTTHR6**
FR7		**OPTTHR7**
FR8		**OPTTHR8**
FR9		**OPTTHR9**

Flange Kit NEMA Type 1/IP21

Flange kits for NEMA Type 1/IP21 enclosure drive rating are determined by rating of drive.

Flange Kit NEMA Type 1/IP21—Frames 4–9 ①

Frame Size	Delivery Code	Catalog Number
FR4	FP	**OPTTHR4**
FR5		**OPTTHR5**
FR6		**OPTTHR6**
FR7		**OPTTHR7**
FR8		**OPTTHR8**
FR9		**OPTTHR9**

Note

① For installation of an SPX9000 NEMA Type 1/IP21 drive into a NEMA Type 12/IP54 oversized enclosure.

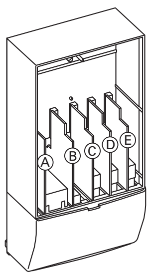
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

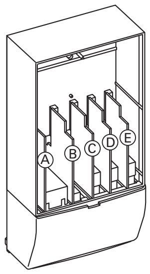
Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
2 RO, therm	B	**OPTA3**	**A3**	—	■	■	■	■	■	■
Encoder low volt +5V/15V/24V	C	**OPTA4**	**A4**	—	■	■	■	■	■	■
Encoder high volt +15V/24V	C	**OPTA5**	**A5**	—	■	■	■	■	■	■
Double encoder—SPX only	C	**OPTA7**	**A7**	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**	**A8**	—	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA1**	—	■	■	■	■	■	■	■
3 DI (encoder 10–24V), out +15V/+24V, 2 DO (pulse+direction)—SPX only	C	**OPTAE**	**AE**	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTAFA1**	—	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	—	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
SPI, absolute encoder	C	**OPTBB**	**BB**	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

Option Boards



2

Option Board Kits, continued

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD1**	**D1**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD2**	**D2**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series local/remote keypad (replacement keypad)	—	**KEYPAD-LOC/REM**	**—**	—	—	—	—	—	—	■
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**	**—**	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	**PP00104**	**—**	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohms line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/ Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1–127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Control Panel Options

Factory Options

Description	Factory Installed Option Code	Field Installed NEMA Type 1/IP21 Catalog Number
Local/Remote Keypad SVX9000 Control Panel—This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	**A**	**KEYPAD-LOC/REM**
Keypad Remote Mounting Kit—This option is used to remote mount the SVX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft cable, keypad holder and mounting hardware.	—	**OPTRMT-KIT-9000X**
Keypad Blank—9000X Series select keypad for use with special and custom applications.	—	**KEYPAD-BLANK**

Miscellaneous Options

Description	Catalog Number
9000XDrive—A PC-based tool for controlling and monitoring of the SVX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDrivecable must be used.	**9000XDRIVE**
SVDrivecable—6 ft (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000XDrive option to avoid damage to the SVX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	**SVDRIVECABLE**
External Dynamic Braking Resistors—Used with the dynamic braking chopper circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into standard duty and heavy-duty. Standard duty is defined as 20% duty or less with 100% braking torque, while heavy-duty is defined as 50% duty or less with 150% braking torque.	①

SPX9000 Drive Options

Brake Chopper Options

The brake chopper circuit option is used for applications that require dynamic braking. Dynamic braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

For brake chopper circuit selection and adder—NEMA Type 1/IP21, NEMA Type 12/IP54, Chassis, consult the factory. Delivery code is FP.

Conformal (Varnished) Coating ②

Chassis Frame	Delivery Code
FR4	FP
FR5	FP
FR6	FP
FR7	FP
FR8	FP
FR9	FP
FR10	FP
FR11	FP
FR12	FP
FR13	FP
FR14	FP

Conformal Coated Board Kits ③

Field Installed Catalog Number	Factory Installed Option Designator
OPT_V ④	⑤

Notes

① Consult factory.

② See Product Selection on **Pages V6-T2-101** to **V6-T2-105**, 208–240V, 380–500V, 525–690V. Consult the factory for adder

③ See option catalog numbers on **Page V6-T2-107**.

④ Replace "__" with the correct catalog number from **Page V6-T2-107**. Example: OPT**C2**V.

⑤ Construct catalog numbers for factory installed per Catalog Number Selection on **Page V6-T2-100**.

Control/Communication Options

Available Control/Communications Options

Option	Description	Option Type
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch**—Provides the SPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K4	**HAND/OFF/AUTO Switch for Non-Bypass Configurations**—Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.	Control
KB	**115V Control Transformer, 550 VA**—Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
L1	**Power On and Fault Pilot Lights**—Provide a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
P2	**Disconnect Switch**—Disconnect switch option is applicable only with NEMA Type 1/IP21 and NEMA Type 12/IP54 Freestanding drives. Allows a convenient means of disconnecting the SPX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

SPX Freestanding Options

480V and 690V Control Options, 200–550 hp ①

Description	Catalog Number Suffix
Door-mounted speed potentiometer with HOA selector switch	**K2**
HAND/OFF/AUTO switch (22 mm)	**K4**
115 volt control transformer 550 VA	**KB**

480V and 690V Light Options, 200–550 hp ①

Description	Catalog Number Suffix
Power on/fault pilot lights	**L1**

Input Options, 200–550 hp ①

Description	Catalog Number Suffix
Disconnect switch	**P2** ②

Notes

① Consult factory for adder information.

② Applicable with FR10 and FR11 freestanding designs only.

Replacement Parts

SPX9000 Drives Spare Units

208–690V, Frames 4–12

Description	Catalog Number
Control unit–Includes the control board, blue base housing, installed SVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See **Page V6-T2-107** for standard and option boards and keypad.	**CSBS0000000000**

SPX9000 Drives Replacement Parts

208–240V, Frames FR4–FR8

Frame	4					5			6		7			8			Delivery Code	Catalog Number
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60		
Control Board																		
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00561**
Power Boards																		
	1																FB	**VB00308-0004-2**
		1															FB	**VB00308-0007-2**
			1														FB	**VB00308-0008-2**
				1													FB	**VB00310-0011-2**
					1												FB	**VB00310-0012-2**
						1											FB	**VB00313-0017-2**
							1										FB	**VB00313-0025-2**
								1									FB	**VB00313-0031-2**
									1								FB	**VB00316-0048-2**
										1							FB	**VB00316-0061-2**
											1						FB	**VB00319-0075-2**
												1					FB	**VB00319-0088-2**
													1				FB	**VB00319-0114-2**
														1			FB	**VB00322-0140-2**
															1		FB	**VB00322-0170-2**
																1	FB	**VB00322-0205-2**
Electrolytic Capacitors																		
	2	2	2														W	**PP01000**
				2	2												W	**PP01001**
						2	2										W	**PP01002**
								2									W	**PP01003**
									2	2							W	**PP01004**
											2	2	2	4	4		W	**PP01005**
																4	W	**PP01099**

Note

① I_L only; has no corresponding I_H rated hp rating.

208–240V, Frames FR4–FR8, continued

Frame	4					5			6		7			8			Delivery	
hp (I_H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	Code	Catalog Number
Cooling Fans																		
	1	1	1	1	1												W	**PP01060**
						1	1	1									W	**PP01061**
									1	1							W	**PP01062**
											1	1	1				W	**PP01063**
														1	1	1	FC	**PP01123** ②
	1	1	1	1	1												W	**PP01086**
						1	1	1	1	1							FC	**PP01088**
											1	1	1				W	**PP01049**
														1	2	2	FC	**CP01180**
														1	1	1	FC	**PP08037**
IGBT Modules																		
	1	1															W	**CP01304**
			1														W	**CP01305**
				1	1	1											W	**CP01306**
							1										W	**CP01307**
								1									W	**CP01308**
									1								W	**PP01022**
										1							W	**PP01023**
											1						W	**PP01024**
												1					W	**PP01025**
													1				W	**PP01029**
														1			W	**PP01026**
															1	1	W	**PP01027**
Choppers/Rectifiers																		
									1								W	**CP01367**
										1							W	**CP01368**
Diode/Thyristor Modules																		
											3	3	3				W	**PP01035**
														3	3	3	W	**CP01268**
Rectifying Boards																		
											1	1	1				W	**VB00242**
														1	1	1	W	**VB00227**

Note

② PP00061 capacitor not included in main fan; please order separately.

380–500V, Frames FR4–FR9

Frame	4					5			6			7			8			9		Delivery Code	Catalog Number
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200		
Control Board																						
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	**VB00252**
Power Boards																						
	1																				FB	**VB00208-0003-5**
		1																			FB	**VB00208-0004-5**
			1																		FB	**VB00208-0005-5**
				1																	FB	**VB00208-0007-5**
					1																FB	**VB00208-0009-5**
						1															FB	**VB00210-0012-5**
							1														FB	**VB00213-0016-5**
								1													FB	**VB00213-0022-5**
									1												FB	**VB00213-0031-5**
										1											FB	**VB00216-0038-5**
											1										FB	**VB00216-0045-5**
												1									FB	**VB00216-0061-5**
													1								FB	**VB00219-0072-5**
														1							FB	**VB00219-0087-5**
															1						FB	**VB00219-0105-5**
																1					FB	**VB00236-0140-5**
																	1				FB	**VB00236-0168-5**
																		1			FB	**VB00236-0205-5**
Electrolytic Capacitors																						
	2	2	2	2																	W	**PP01000**
					2	2															W	**PP01001**
							2	2													W	**PP01002**
									2												W	**PP01003**
										2	2	2									W	**PP01004**
													2	2	2	4	4	4	8	8	W	**PP01005**
Cooling Fans																						
	1	1	1	1	1	1															W	**PP01060**
							1	1	1												W	**PP01061**
										1	1	1									W	**PP01062**
													1	1	1						W	**PP01063**
																1	1	1			FC	**PP01123** ②
																			1	1	FC	**PP01080** ③
	1	1	1	1	1	1															W	**PP01086**
							1	1	1												FC	**PP01088**
										1	1	1	1	1	1						W	**PP01049**
																1	1	1			FC	**CP01180**
																			1 ④	2	W	**PP01068**
																			1	1	FC	**PP09051**

Notes

① I_L only; has no corresponding I_H rated hp rating.
② PP00061 capacitor not included in main fan; please order separately.
③ PP00011 capacitor not included in main fan; please order separately.
④ For FR9 NEMA Type 12/IP54 you need two PP01068 internal fans.

380–500V, Frames FR4–FR9, continued

Frame	4						5			6			7			8			9			
hp (I_H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	Delivery Code	Catalog Number
IGBT Modules																						
	1	1	1																		W	**CP01304**
				1	1																W	**CP01305**
						1	1														W	**CP01306**
								1													W	**CP01307**
									1												W	**CP01308**
										1	1										W	**PP01022**
												1									W	**PP01023**
													1								W	**PP01024**
														1							W	**PP01025**
															1						W	**PP01029**
																1					W	**PP01026**
																	1	1			W	**PP01027**
Chopper/Rectifiers																						
										1	1										W	**CP01367**
												1									W	**CP01368**
Diode/Thyristor Modules																						
													3	3	3						W	**PP01035**
																3	3	3			W	**CP01268**
																			3	3	W	**PP01037**
Rectifying Boards																						
													1	1	1						W	**VB00242**
																1	1	1			W	**VB00227**
																			1	1	W	**VB00459**
Rectifying Module Sub-assembly																						
																			1	1	W	**FR09810**
Power Module Sub-assemblies																						
																			1		W	**FR09-150-4-ANS** ②
																				1	W	**FR09-200-4-ANS** ②

Notes

① I_L only; has no corresponding I_H rated hp rating.

② See **Page V6-T2-100** for details.

380–500V, Frames FR10–FR12

Frame	10			11			12			Delivery	
hp (I_H):	250	300	350	400	500	550	600	650	700	Code	Catalog Number
Control Board											
	1	1	1	1	1	1	1	1	1	W	**VB00561**
Shunt Boards											
	6									FC	**VB00537**
		6								FC	**VB00497**
			6				12	12	12	FC	**VB00498**
				9						FC	**VB00538**
					9					FC	**VB00513**
						9				FC	**VB00514**
Driver Boards											
				3	3	3				FC	**VB00489**
	1	1	1				2	2	2	FC	**VB00487**
Driver Adapter Board											
	1	1	1				2	2	2	FC	**VB00330**
ASIC Board											
	1	1	1	1	1	1	2	2	2	FC	**VB00451**
Feedback Interface Board											
							2	2	2	FC	**VB00448**
Star Coupler Board											
							1	1	1	FC	**VB00336**
Power Modules											
	1	1	1	2	2	2	2	2	2	FC	**FR10820** ①
	2	2	2							FC	**FR10828**
	1									FC	**FR10-250-4-ANS** ②
		1								FC	**FR10-300-4-ANS** ②
			1				2	2	2	FC	**FR10-350-4-ANS** ②
				3						FC	**FR11–400-4-ANS** ②
					3					FC	**FR11-500-4-ANS** ②
						3				FC	**FR11-550-4-ANS** ②
Electrolytic Capacitors											
	2	2	2	3	3	3	4	4	4	FC	**PP00060**
	12	12	12	18	18	18	24	24	24	FC	**PP01005**
Fuses											
	1	1	1	1	1	1	2	2	2	FC	**PP01094**
	2	2	2	2	2	2	4	4	4	FC	**PP01095**
Cooling Fans and Isolation Transformers											
	2	2	2	3	3	3	4	4	4	FC	**VB00299**
	2	2	2	3	3	3	4	4	4	FC	**PP01080** ③
	2	2	2				4	4	4	FC	**PP01068**
	1	1	1	1	1	1	2	2	2	FC	**PP01096**
	1	1	1				2	2	2	FC	**FR10844**
	1	1	1	3	3	3	2	2	2	FC	**FR10845**
	1	1	1				2	2	2	FC	**FR10846**
	1	1	1	3	3	3	2	2	2	FC	**FR10847**
Rectifying Board											
	1	1	1	2	2	2	2	2	2	FC	**VB00459**

Notes

① Rectifying board not included.

② See **Page V6-T2-100** for details.

③ PP00060 capacitor not included in main fan; please order separately.

525–690V, Frames FR6–FR9

Frame	6									7		8			9				Delivery	
hp (I_H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①	Code	Catalog Number
Control Board																				
	1	1	1	1	1	1	1	1	1	1	1					1	1	1	W	**VB00561**
Driver Boards																				
	1																		FB	**VB00404-0004-6**
		1																	FB	**VB00404-0005-6**
			1																FB	**VB00404-0007-6**
				1															FB	**VB00404-0010-6**
					1														FB	**VB00404-0013-6**
						1													FB	**VB00404-0018-6**
							1												FB	**VB00404-0022-6**
								1											FB	**VB00404-0027-6**
									1										FB	**VB00404-0034-6**
Power Boards																				
	1	1	1	1	1	1	1	1	1										FB	**VB00414**
										1									FB	**VB00419-0041-6**
											1								FB	**VB00419-0052-6**
												1							FB	**VB00422-0062-6**
													1						FB	**VB00422-0080-6**
														1					FB	**VB00422-0100-6**
Power Modules																				
															1				FC	**FR09-100-5-ANS** ②
																1			FC	**FR09-125-5-ANS** ②
																	1		FC	**FR09-150-5-ANS** ②
																		1	FC	**FR09-175-5-ANS** ②
Electrolytic Capacitors																				
	2	2	2	2	2	2	2	2	2										FC	**PP01093**
										2	2	4	4		8	8	8	8	FC	**PP01041**
														4					FC	**PP01040**
Fuses																				
												1	1	1	1	1	1	1	W	**PP01094**
												2	2	2	2	2	2	2	W	**PP01095**

Notes

① I_L only; has no corresponding I_H rated hp rating.

② See **Page V6-T2-100** for details.

525–690V, Frames FR6–FR9, continued

Frame	6									7		8			9				Delivery	
hp (I_H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①	Code	Catalog Number
Cooling Fans																				
	1	1	1	1	1														W	**PP01061**
						1	1	1	1										W	**PP01062**
										1	1								W	**PP01063**
												1	1	1					FC	**PP01123**
	1	1	1	1	1	1	1	1	1	1	1								W	**PP01049**
												1	1	1					FC	**CP01180**
															1	1	1	1 ②	W	**PP01068**
															1	1	1	1	FC	**PP01080**
Fan Power Supply																				
																1	1	1	FC	**VB00299**
IGBT Modules																				
	3	3	3	3	3	3	3	3	3										FC	**PP01091**
										1	1								FC	**PP01089**
												1	1	1					FC	**PP01127**
IGBT/Diode (Brake)																				
	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	FC	**PP01040**
Diode Module																				
	1	1	1	1	1	1	1	1	1										FC	**PP01092**
Diode/Thyristor Modules																				
										3	3								FC	**PP01071**
															3	3	3	3	FC	**PP01072**
Rectifying Boards																				
										1	1								FC	**VB00442**
															1	1	1	1	FC	**VB00460**
Rectifying Module Sub-Assemblies																				
																1	1	1	W	**FR09810**
																1	1	1	FC	**FR09811**

Notes

① I_L only; has no corresponding I_H rated hp rating.

② For NEMA Type 12/IP54, two PP01068 internal fans are needed.

525–690V, Frames FR10–FR12

Frame	10			11			12				
hp (I_H):	250	300	350	400	500	550	600	650	700	Delivery Code	Catalog Number
Component Boards											
	1	1	1	1	1	1	1	1	1	W	**VB00561**
	1	1	1	1	1	1	2	2	2	FC	**VB00451**
	6									FC	**VB00545**
		6								FC	**VB00510**
			6				12	12	12	FC	**VB00511**
	1	1	1				2	2	2	FC	**VB00330**
	1	1	1				2	2	2	FC	**VB00487**
				3	3	3				FC	**VB00489**
				9						FC	**VB00546**
					9					FC	**VB00547**
						9				FC	**VB00512**
							2	2	2	FC	**VB00448**
							1	1	1	FC	**VB00336**
Power Modules											
	1	1	1	2	2	2	2	2	2	FC	**FR10821** [1]
	2	2	2							FC	**FR10829**
	1									FC	**FR10-200-5-ANS** [2]
		1								FC	**FR10-250-5-ANS** [2]
			1				2	2	2	FC	**FR10-300-5-ANS** [2]
				3						FC	**FR11–400-5-ANS** [2]
					3					FC	**FR11-450-5-ANS** [2]
						3				FC	**FR11-500-5-ANS** [2]
Electrolytic Capacitors											
	2	2	2	3	3	3	4	4	4	FC	**PP00060**
	12	12	12	18	18	18	24	24	24	FC	**PP01099**
Fuses											
	1	1	1	1	1	1	2	2	2	FC	**PP01094**
	2	2	2	2	2	2	4	4	4	FC	**PP01095**
Cooling Fans and Isolation Transformers											
	2	2	2	3	3	3	4	4	4	FC	**VB00299**
	2	2	2	3	3	3	4	4	4	FC	**PP01080** [3]
	2	2	2				4	4	4	FC	**PP01068**
	1	1	1	1	1	1	2	2	2	FC	**PP01096**
	1	1	1				2	2	2	FC	**FR10844**
	1	1	1	3	3	3	2	2	2	FC	**FR10845**
	1	1	1				2	2	2	FC	**FR10846**
	1	1	1	3	3	3	2	2	2	FC	**FR10847**
Fan Power Supply											
							1	1	1	FC	**VB00299**
Rectifying Boards											
	1	1	1	2	2	2	2	2	2	FC	**VB00460**

Notes

[1] Rectifying board not included.

[2] See **Page V6-T2-100** for details.

[3] PP00060 capacitor not included in main fan; please order separately.

Technical Data and Specifications

SPX9000 Drives

Description	Specification
Input Ratings	
Input voltage (V_{in})	+10%/–15%
Input frequency (f_{in})	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
High withstand rating	100 kAIC
Output Ratings	
Output voltage	0 to V_{in}
Continuous output current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload current (I_H/I_L)	150% I_H, 110% I_L for 1 min.
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current (I_H)	250% for 2 seconds
Control Characteristics	
Control method	Frequency control (V/f) Open loop: sensorless vector control Closed loop: frequency control Closed loop: vector control
Switching frequency	Adjustable with parameter 2.6.9
Frame 4–6	1 to 16 kHz; default 10 kHz
Frame 7–12	1 to 10 kHz; default 3.6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy ±1% V/Hz Panel reference: Resolution 0.01 Hz
Field weakening point	30 to 320 Hz
Acceleration time	0 to 3000 sec.
Deceleration time	0 to 3000 sec.
Braking torque	DC brake: 30% x T_n (without brake option)
Ambient Conditions	
Ambient operating temperature	14°F (–10°C), no frost to 122°F (50°C) I_H (FR4–FR9) 14°F (–10°C), no frost to 104°F (40°C) I_L (FR10 and up) 14°F (–10°C), no frost to 104°F (40°C) I_L (all frames)
Storage temperature	–40° to 158°F (–40° to 70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 9842 ft (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	NEMA 1/IP21 or NEMA 12/IP54, open chassis/IP20

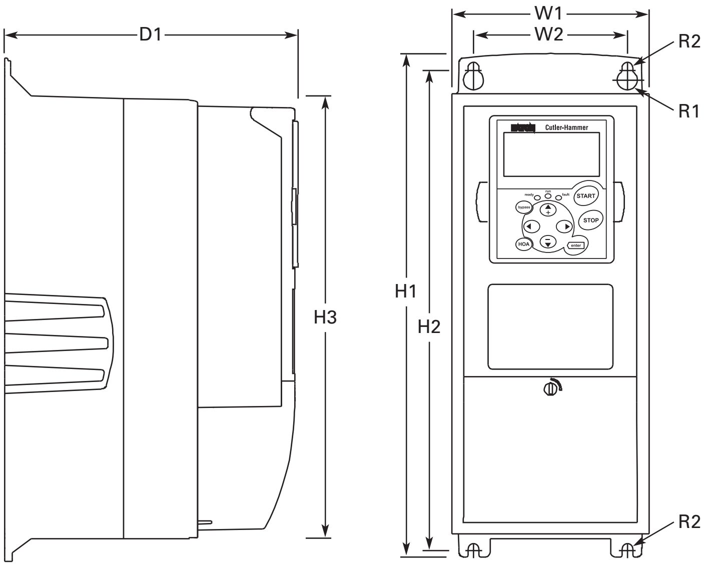
Description	Specification
Control Connections	
Analog input voltage	0 to 10V, R = 200 kohms (–10 to 10V joystick control) resolution 0.1%; accuracy ±1%
Analog input current	0(4) to 20 mA; R_i—250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24V ±15%, max. 250 mA
Output reference voltage	+10V +3%, max. load 10 mA
Analog output	0(4) to 20 mA; R_L max. 500 ohms; resolution 10 bit; Accuracy ±2%
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	2 programmable Form C relay outputs switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A
Protections	
Overcurrent protection	Trip limit 4.0 x I_H instantaneously
Overvoltage protection	Yes
Undervoltage protection	Yes
Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input phase supervision	Trips if any of the input phases are missing
Motor phase supervision	Trips if any of the output phases are missing
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection	Yes (+24V and +10V reference voltages)
High Performance Features	
Speed error	<0.01%, depending on the encoder
Encoder support	Incremental or absolute
Encoder voltages	5V (RS-422), 15V or 24V, depending on the option card
Torque control	Full torque control at all speeds, including zero
Torque accuracy	<2%; <5% down to zero speed
Starting torque	>200%, depending on motor and drive sizing
Master/slave configurations	Full capability
System analysis	Integrated data logger
PC communication	Fast multiple drive monitoring with PC
Inter-drive communication	High-speed bus (12 Mbits/s)
High-speed applications	Up to 7200 Hz

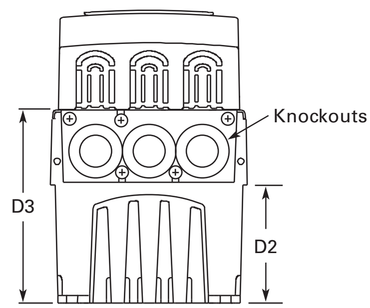
Dimensions

Approximate Dimensions in Inches (mm)

9000X Drives

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR4, FR5 and FR6

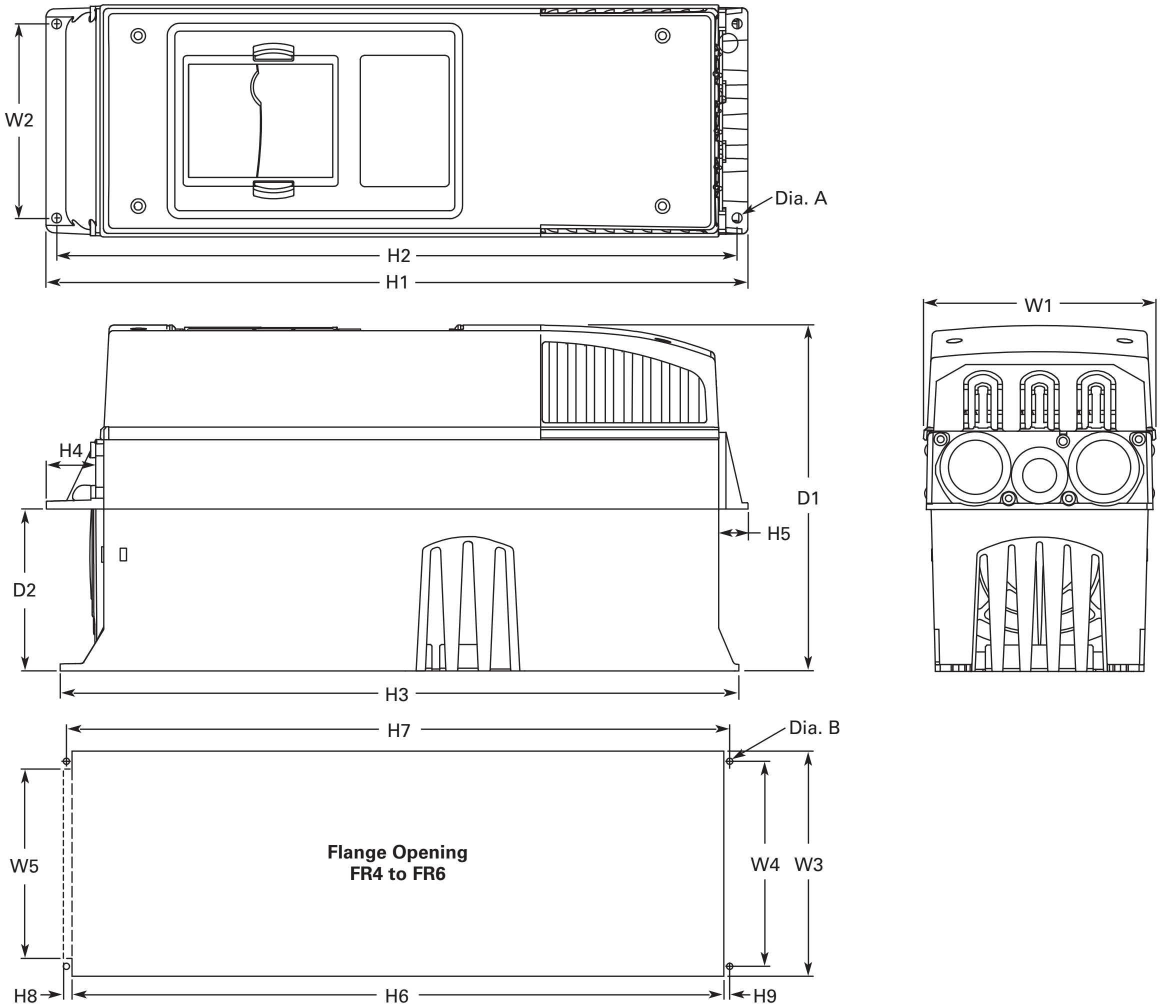




Voltage	hp (I_H)	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
FR4													
230V	3/4–3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.04 (128)	3.9 (100)	0.5 (13)	0.3 (7)	11.0 (5)	3 at 10.1 (28)
480V	1–5												
FR5													
230V	5–7-1/2	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.7 (144)	3.9 (100)	0.5 (13)	0.3 (7)	17.9 (8)	2 at 1.5 (37) 1 at 10.1 (28)
480V	7-1/2–15												
FR6													
230V	10–15	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.7 (195)	5.8 (148)	0.6 (15.5)	0.4 (9)	40.8 (19)	3 at 1.5 (37)
480V	20–30												
575V	2–25												

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54 with Flange Kit, FR4, FR5 and FR6



FR4, FR5 and FR6 with Flange Kit

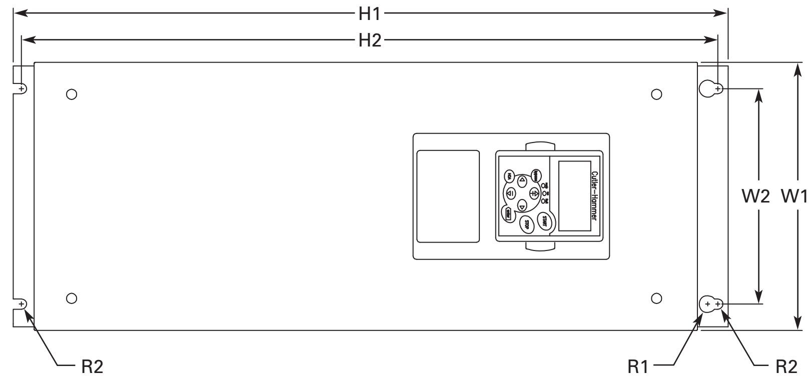
W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4									
5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	0.9 (22)	7.5 (190)	3.0 (77)	0.3 (7)
FR5									
5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	0.7 (18)	8.4 (214)	3.9 (100)	0.3 (7)
FR6									
7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	0.8 (20)	9.3 (237)	4.2 (106)	0.3 (7)

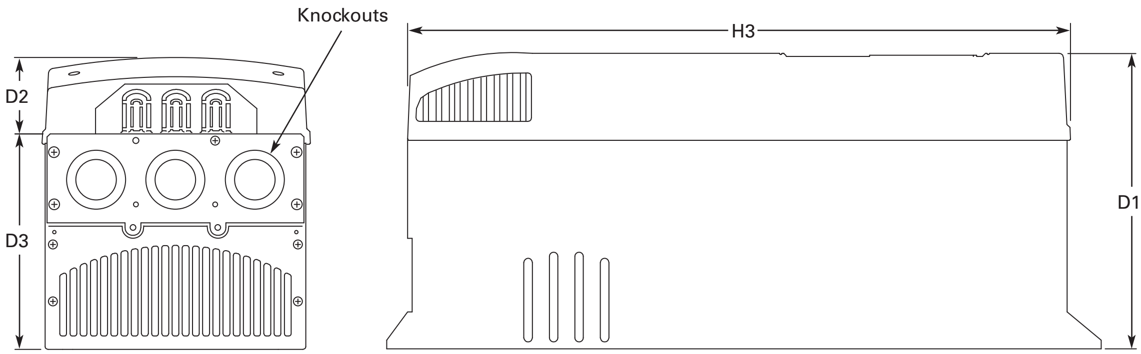
Flange Opening, FR4 to FR6

W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4							
4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	0.2 (5)	0.3 (7)
FR5							
5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	0.2 (5)	0.3 (7)
FR6							
7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	0.3 (7)	0.2 (5)	0.3 (7)

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR7

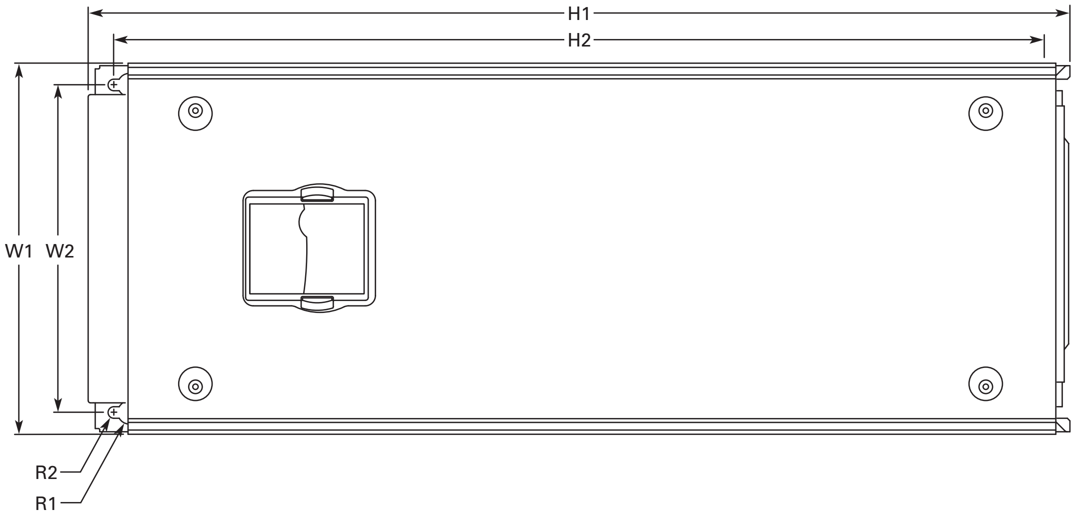


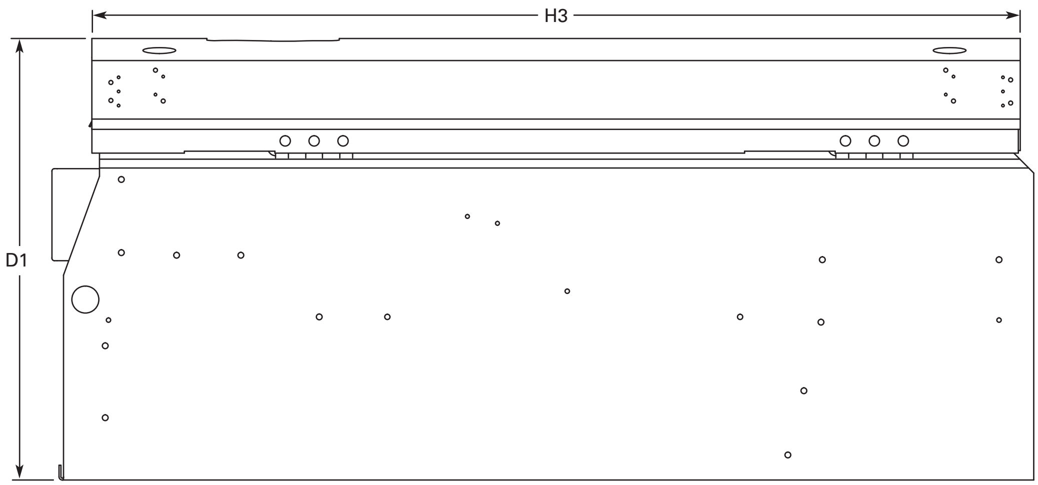


Voltage	hp (I_H)	H1	H2	H3	D1	D2	D3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)	Knockouts at Inches (mm) N1 (O.D.)
230V	20–30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	0.7 (18)	0.4 (9)	77.2 (35)	3 at 1.5 (37)
480V	40–60												
575V	30–40												

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR8

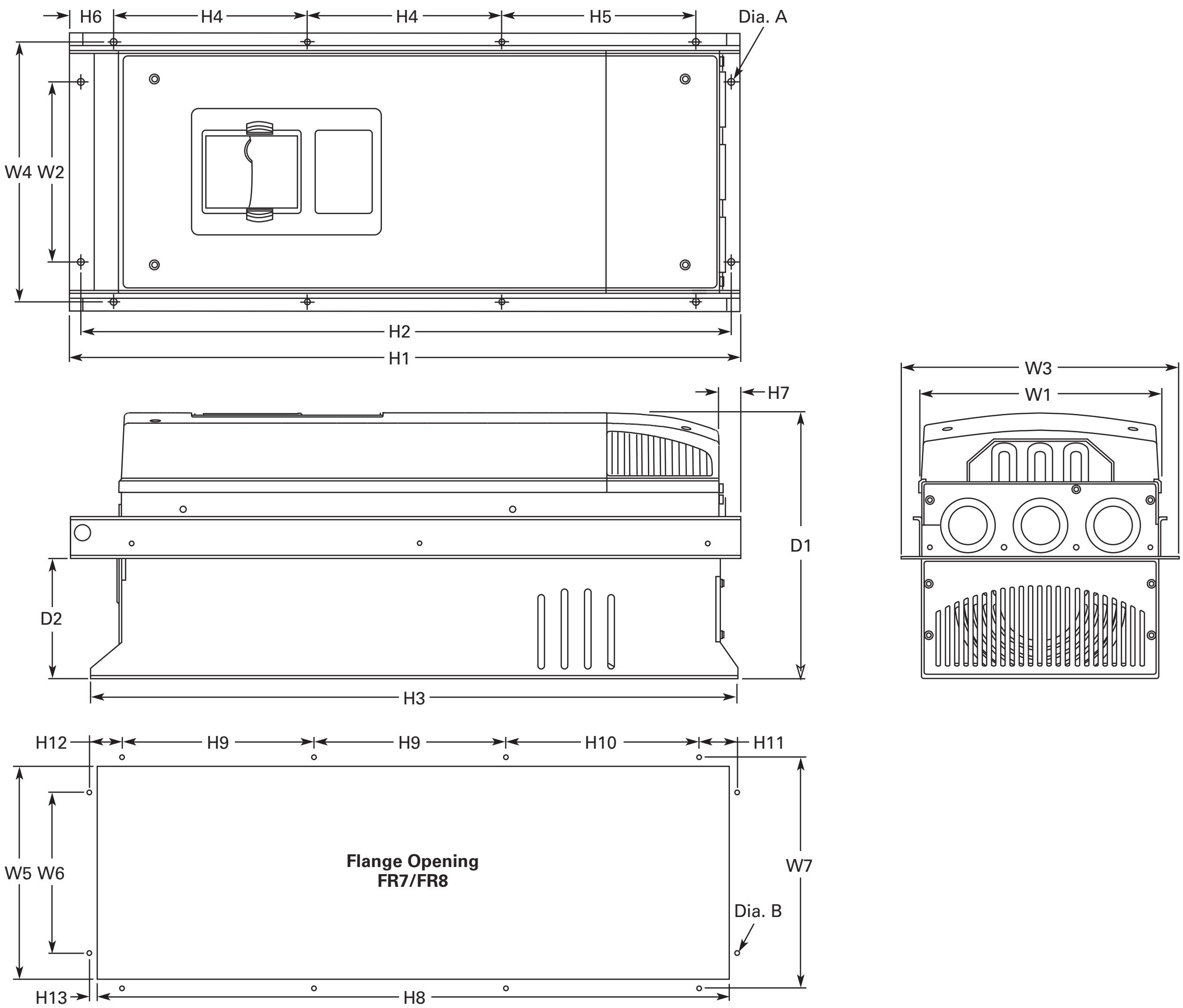




Voltage	hp (I_H)	D1	H1	H2	H3	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230V	40–60	13.5 (344)	300.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	0.7 (18)	0.4 (9)	127 (58)
480V	75–125									
575V	50–75									

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, with Flange Kit, FR7 and FR8



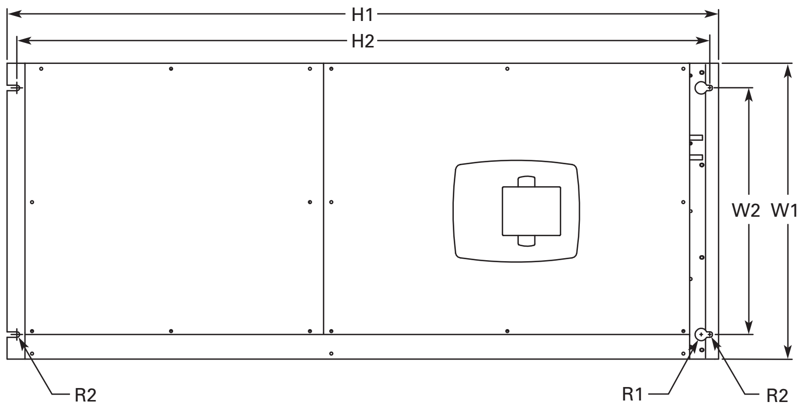
W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7													
9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.9 (632)	24.8 (630)	7.4 (189)	7.4 (189)	0.9 (23)	0.8 (20)	10.1 (257)	4.6 (117)	0.3 (6)
FR8													
11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	0.4 (9)

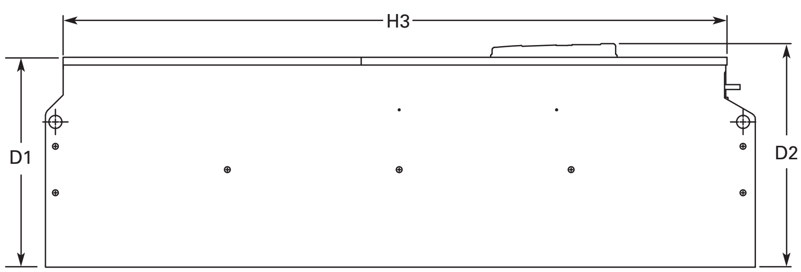
Flange Opening, FR7 and FR8

W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7									
9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	0.3 (6)
FR8									
11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	0.4 (9)

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9

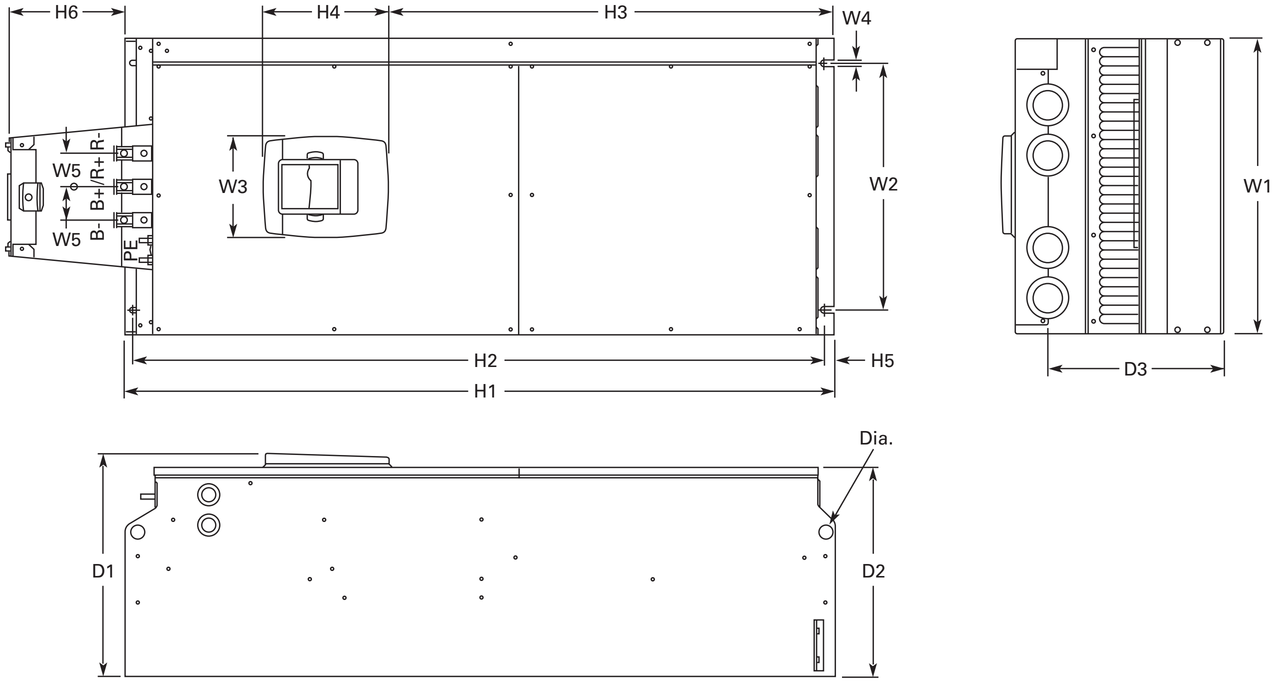




Voltage	hp (I_H)	H1	H2	H3	D1	D2	W1	W2	R1 Dia.	R2 Dia.	Weight Lbs (kg)
230V	75–100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	0.8 (20)	0.4 (9)	322 (146)
480V	150–200										
575V	100–175										

Approximate Dimensions in Inches (mm)

NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9, continued



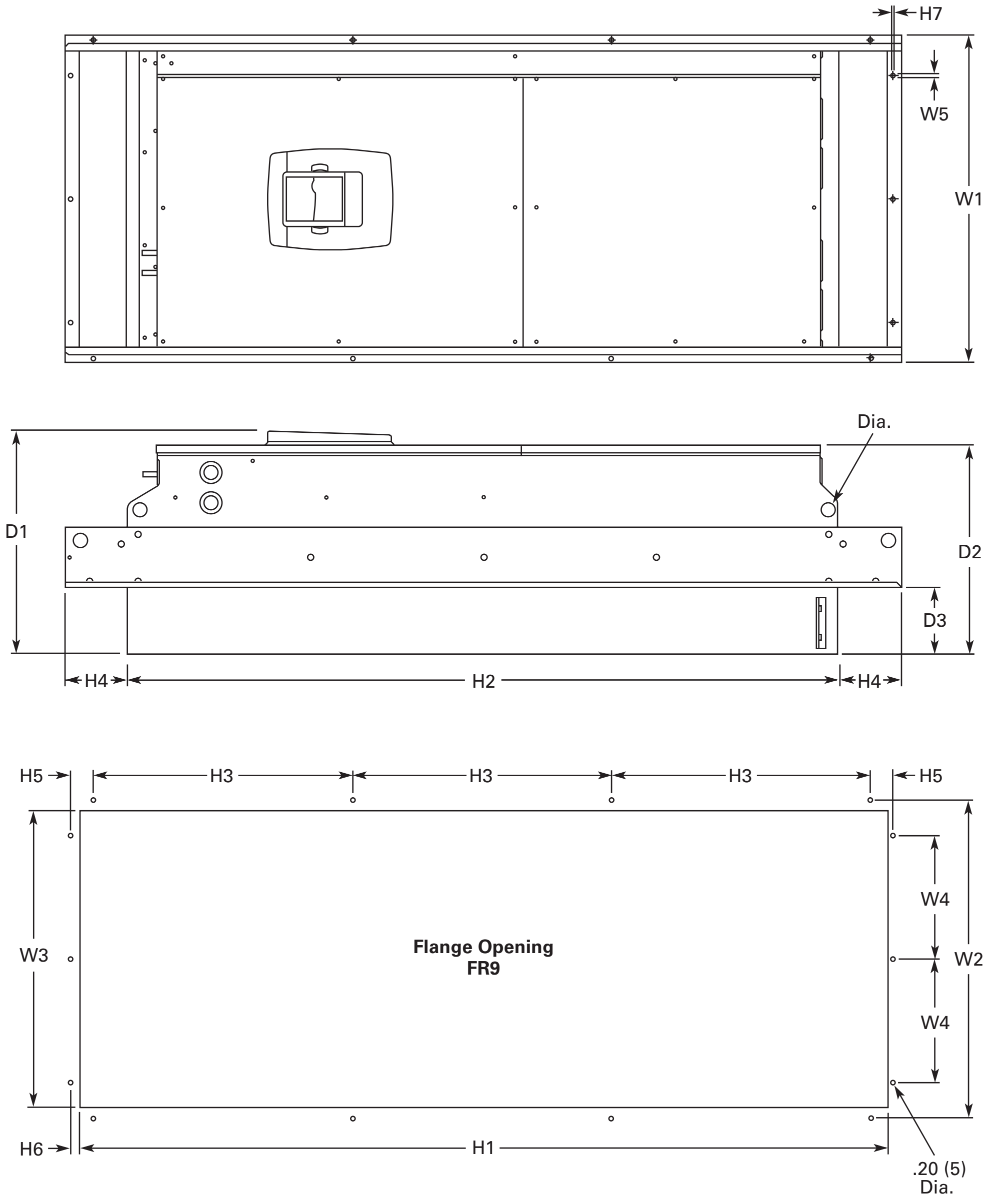
W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
18.9 (480)	15.7 (400)	6.5 (165)	0.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	0.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	0.8 (21)

Note

① Brake resistor terminal box (H6) included when brake chopper ordered.

Approximate Dimensions in Inches (mm)

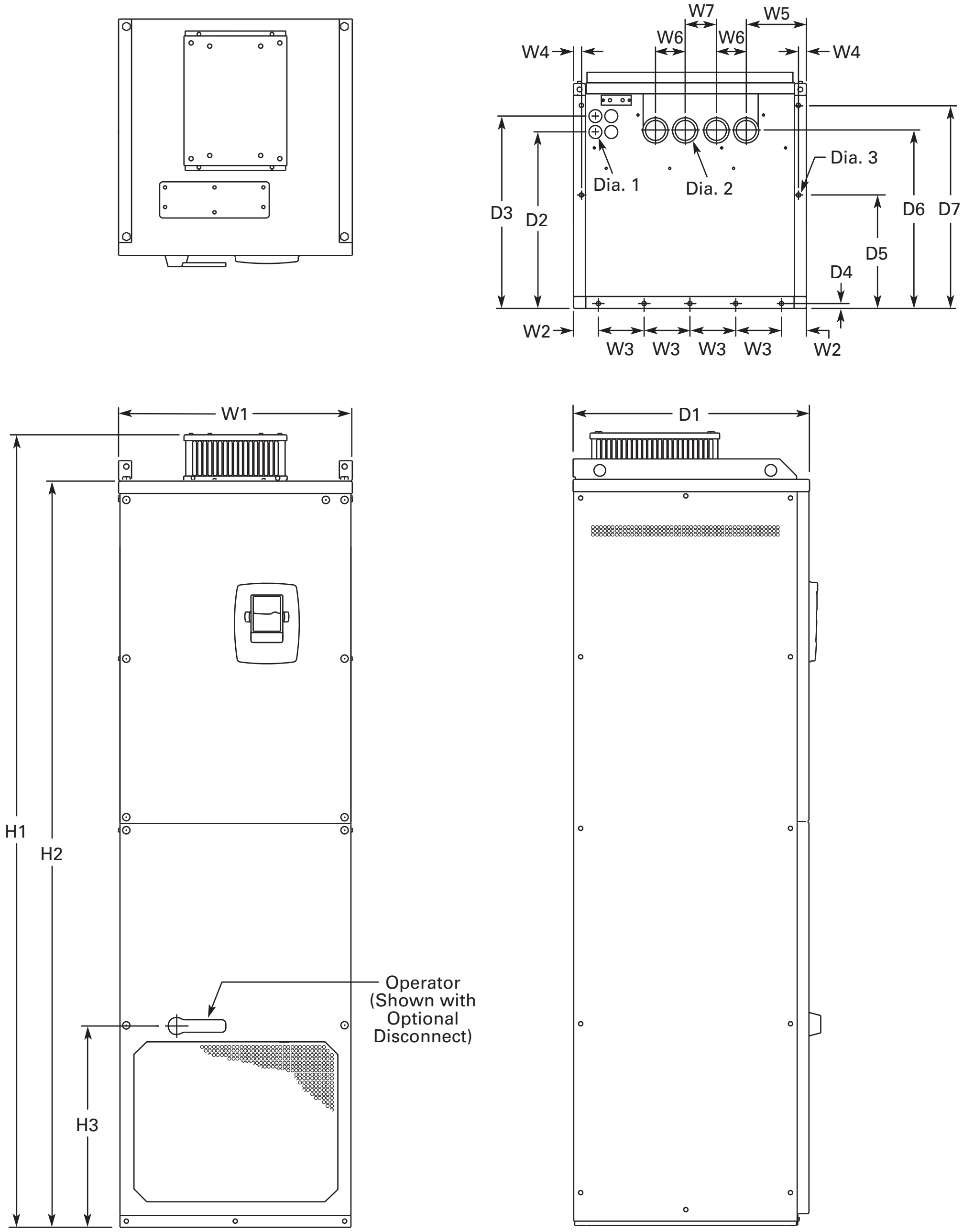
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR9 with Flange Kit



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	0.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	0.4 (9)	0.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	0.8 (21)

Approximate Dimensions in Inches (mm)

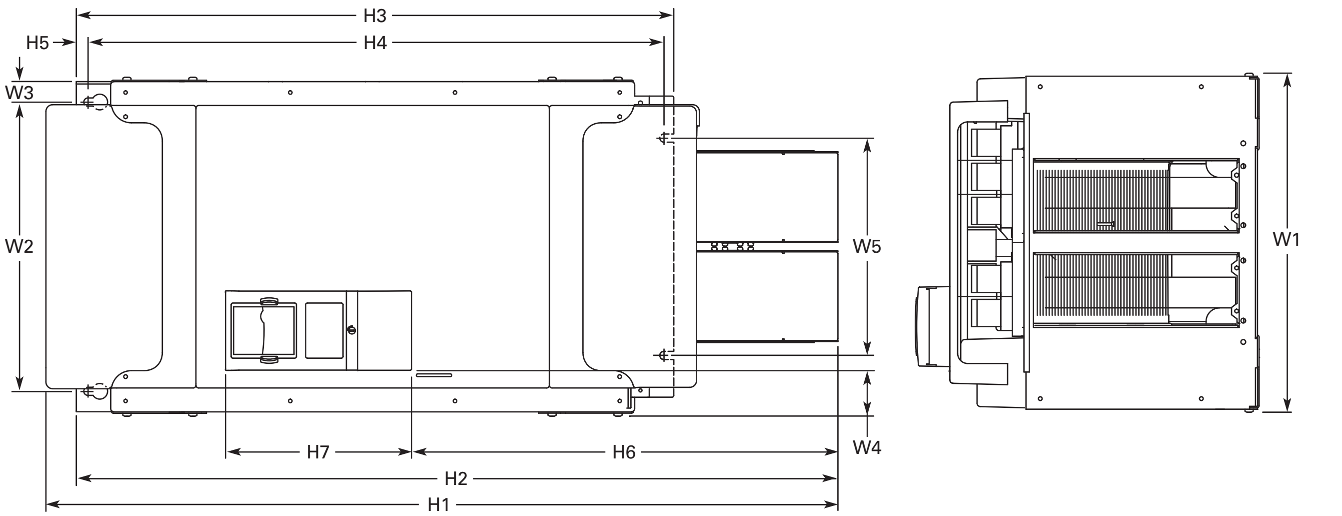
NEMA Type 1/IP21 and NEMA Type 12/IP54, FR10 Freestanding

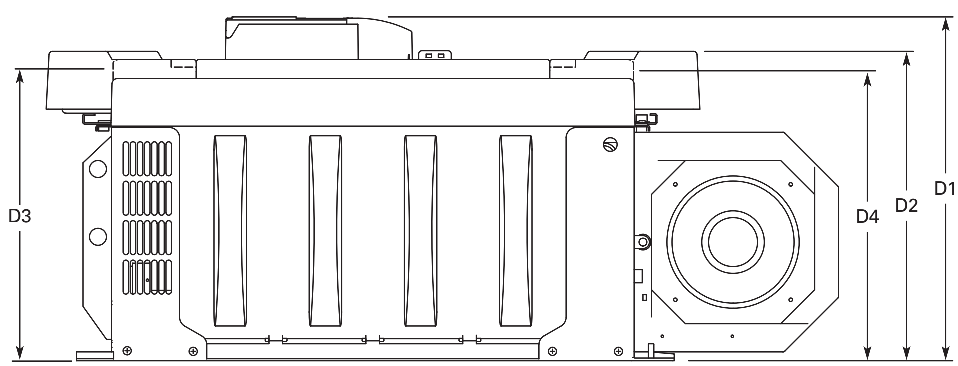


Volts	hp (I_H)	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480V	250–350	23.43 (595)	2.46 (62.5)	4.53 (115)	0.79 (20)	5.95 (151)	2.95 (75)	30.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	0.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	0.83 (21)	1.89 (48)	0.43 (11)	875 (389)
690V	200–300																					

Approximate Dimensions in Inches (mm)

FR10 Open Chassis ①





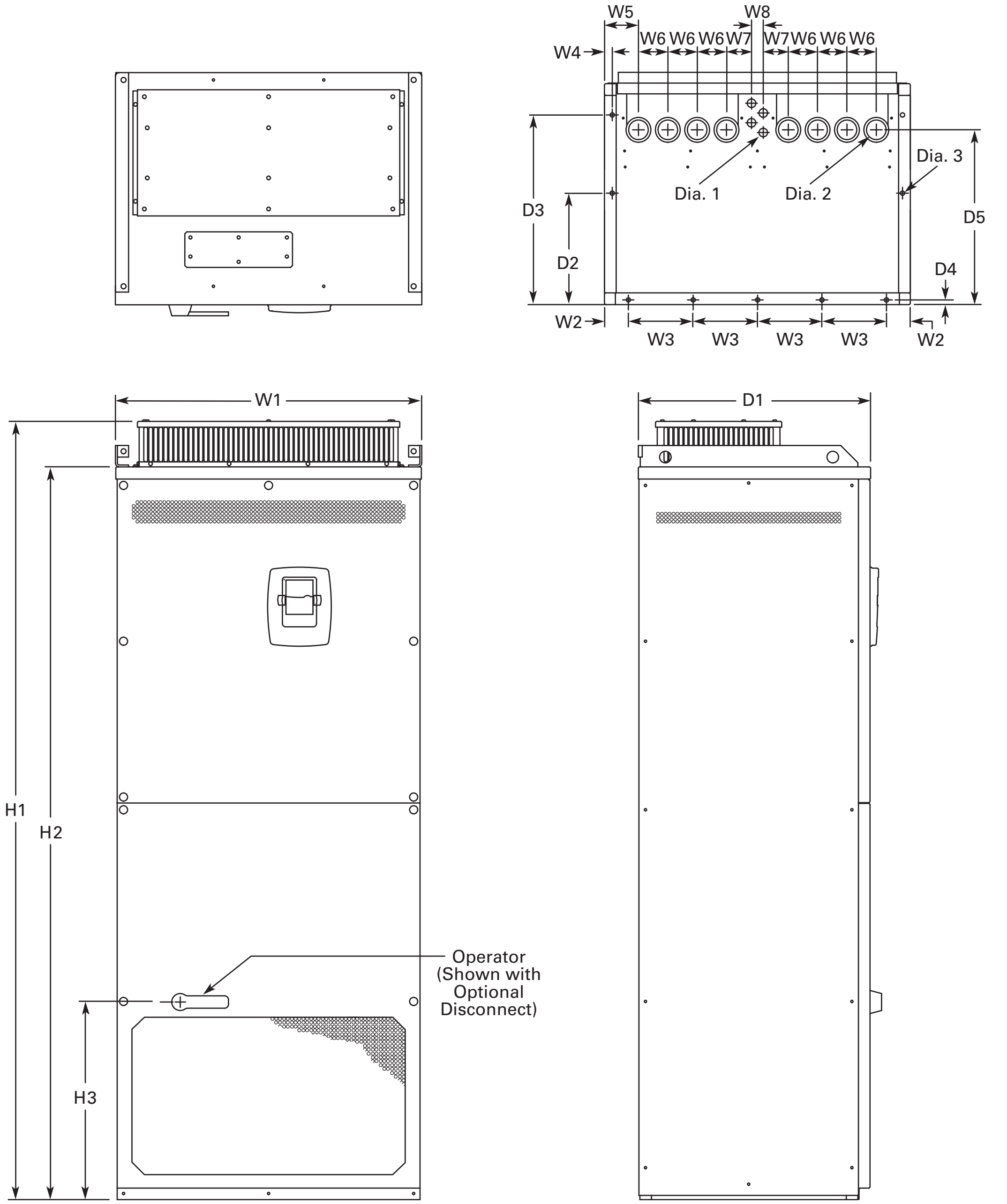
Voltage	hp (I_H)	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	Weight Lbs (kg)
480V	250–350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	0.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
575V	200–300																	

Note

① SPX9000X FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

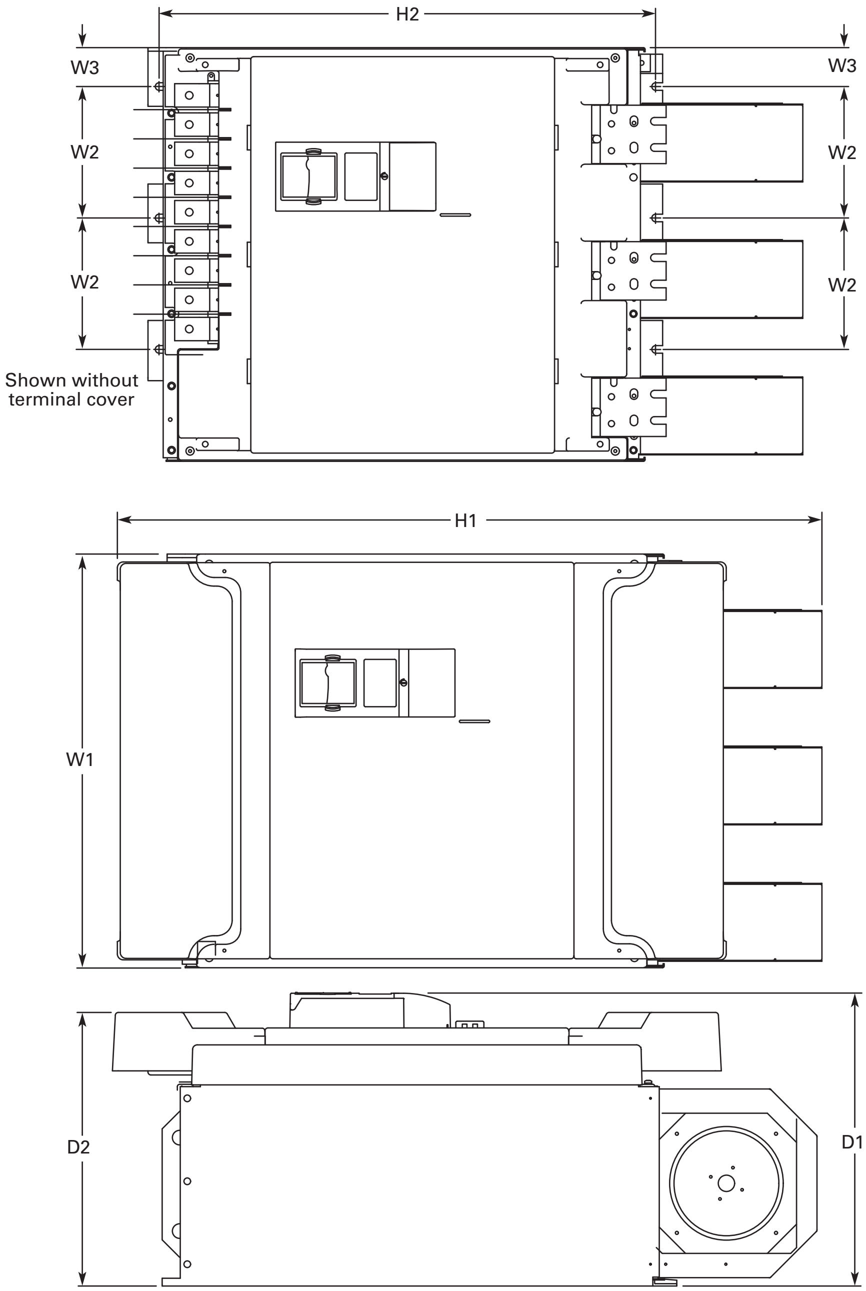
NEMA Type 1/IP21, FR11 Freestanding Drive



Voltage	hp (I_H)	W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
480V	400–550	31.26 (794)	2.40 (61)	6.50 (165)	0.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	0.47 (12)	17.60 (447)	0.83 (21)	1.89 (48)	0.35 x 0.43 (9 x 11)	526 (239)
690V	400–500																				

Approximate Dimensions in Inches (mm)

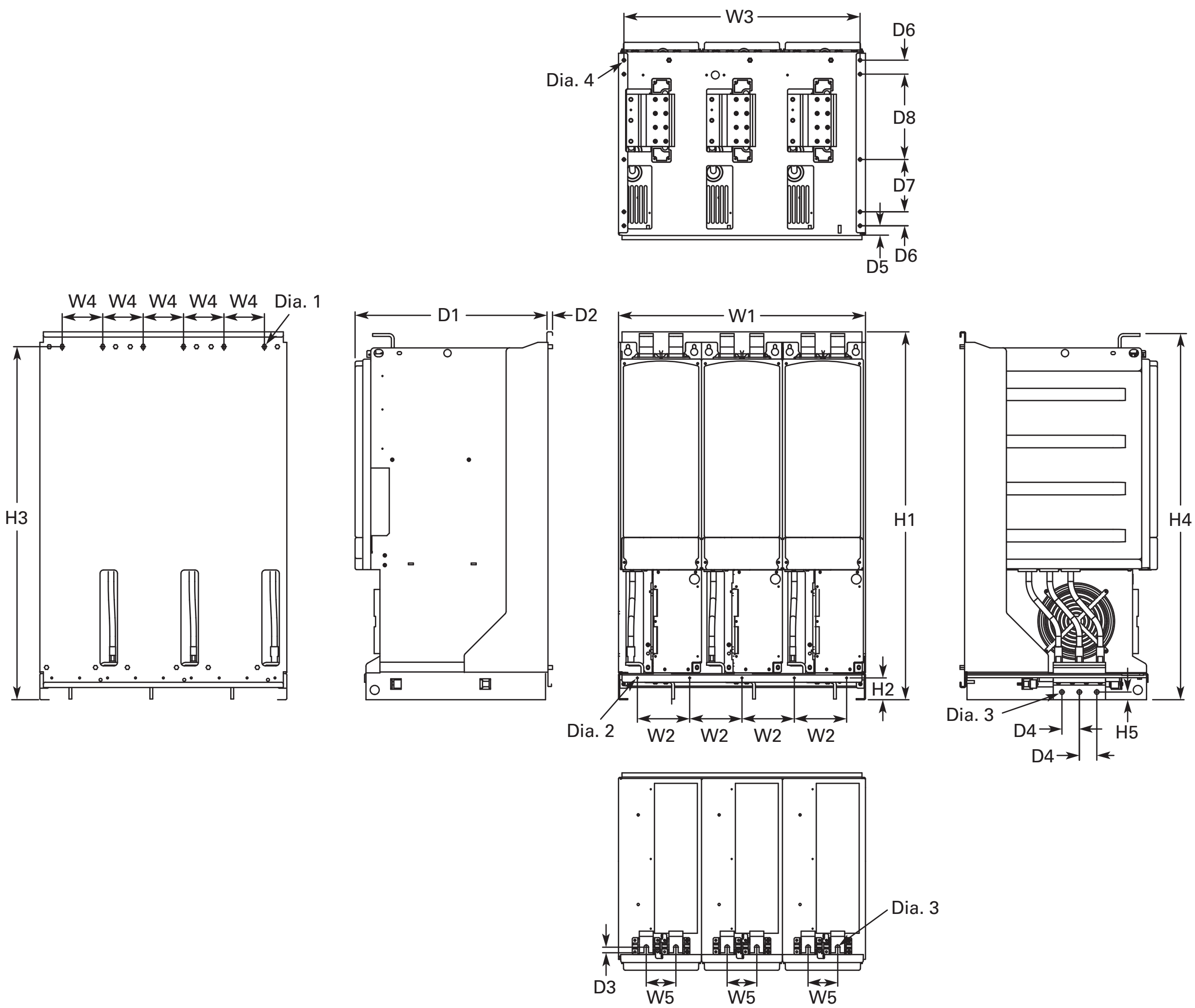
FR11 Open Chassis



Voltage	hp (I_H)	W1	W2	W3	H1	H2	D1	D2	Weight Lbs (kg)
480V	400–550	27.9 (709)	8.6 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)
575V	400–500								

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Inverter



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.79 (20)	21.77 (553)	0.51 (13)	0.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	683 (310)

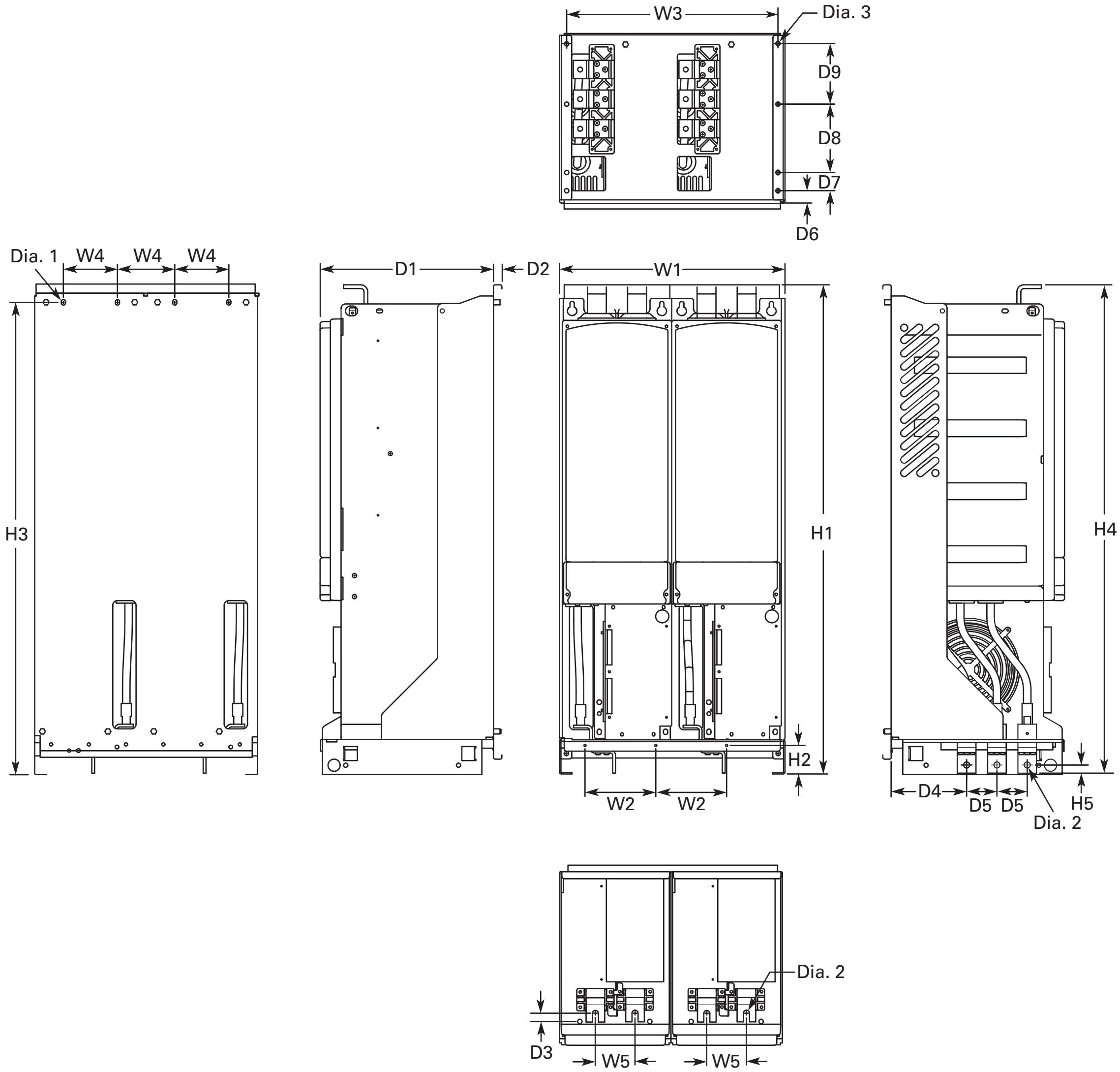
Notes

9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

FR13 is built from an inverter module and a converter module. Please refer to SPX9000 installation manual for mounting instructions.

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Converter



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Weight Lbs (kg)
18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.51 (13)	0.37 (9.5)	295 (134)

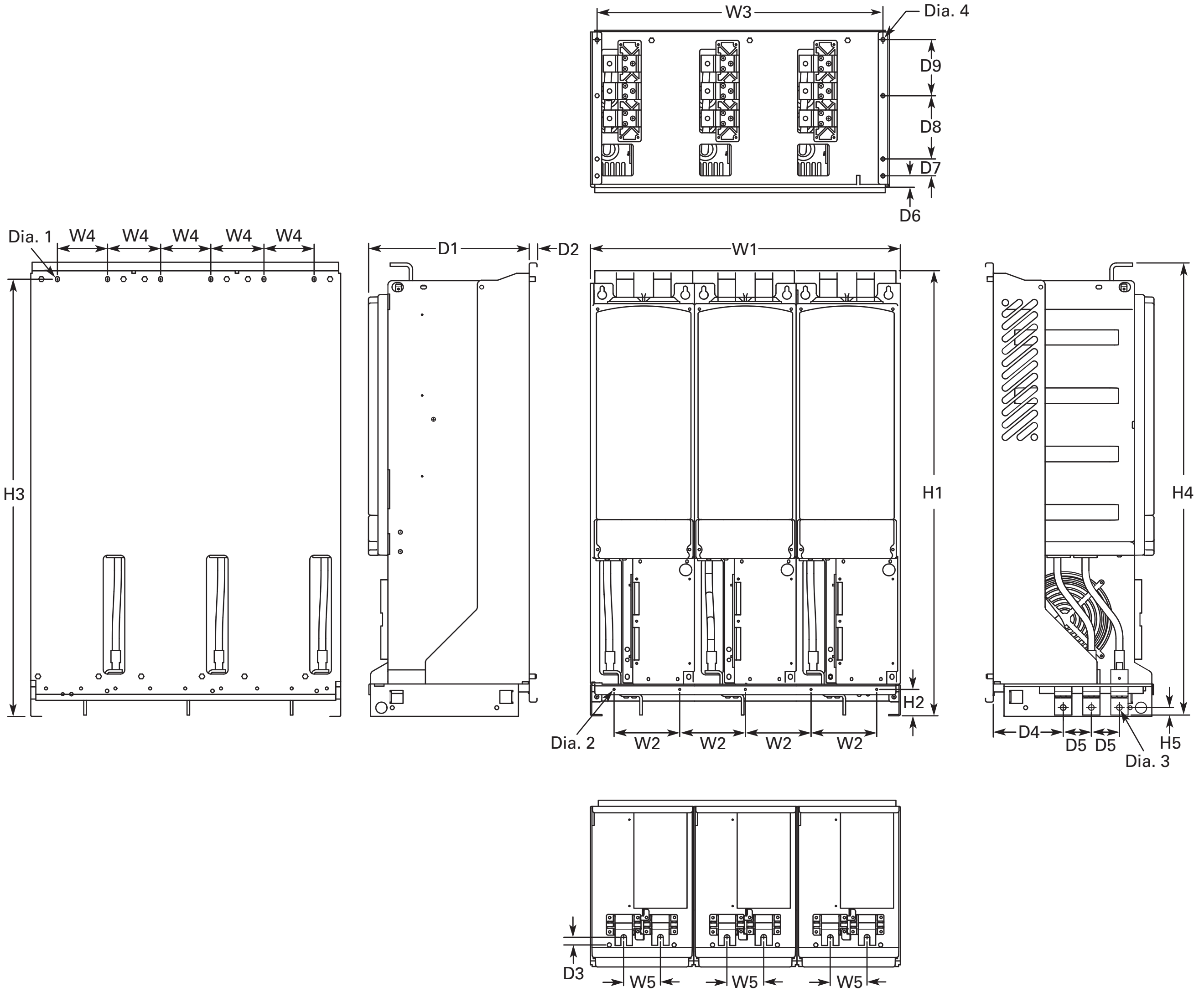
Number of Input Units

480V Catalog Number	hp	Input Modules
SPX800A0-4A2N1	800	2

690V Catalog Number	hp	Input Modules
SPX800A0-5A2N1	800	2
SPX900A0-5A2N1	900	2
SPXH10A0-5A2N1	1000	2

Approximate Dimensions in Inches (mm)

FR13, Open Chassis Converter—900/1000 hp 480V



W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Weight Lbs (kg)
27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	0.69 (17.5)	14.69 (373)	0.51 (13)	0.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	0.35x0.59 (9x15)	0.18 (4.6)	0.51 (13)	0.37 (9.5)	443 (201)

Number of Input Units

480V Catalog Number	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Approximate Dimensions in Inches (mm)

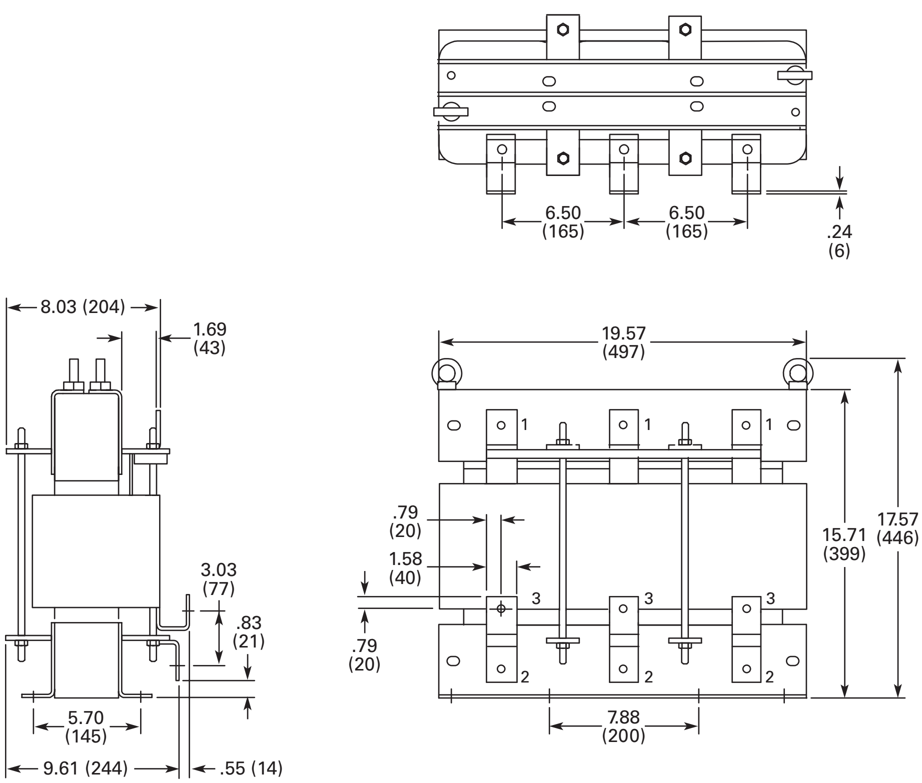
AC Choke Dimensions

Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380–500V		
SPX 250 4	FR10	CHK0400
SPX 300 4		CHK0520
SPX 350 4		CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4		2 x CHK0400
SPX 550 4		2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4		2 x CHK0520
SPX 700 4		2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4		3 x CHK0520
SPX H10 4		3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4		6 x CHK0400

Catalog Number	Frame Size	Choke Type ①
Voltage Range 525–690V		
SPX 200 5	FR10	CHK0261
SPX 250 5		CHK0400
SPX 300 5		CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5		CHK0520
SPX 500 5		2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5		2 x CHK0400
SPX 700 5		2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5		2 x CHK0400
SPX H10 5		2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5		6 x CHK0400

CHK0520

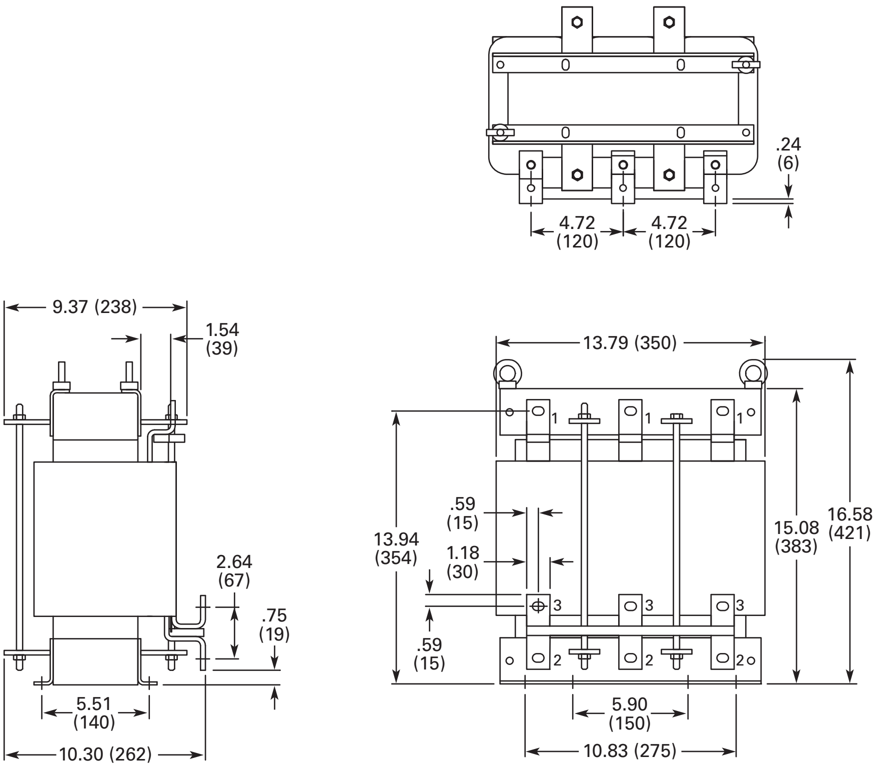


Note

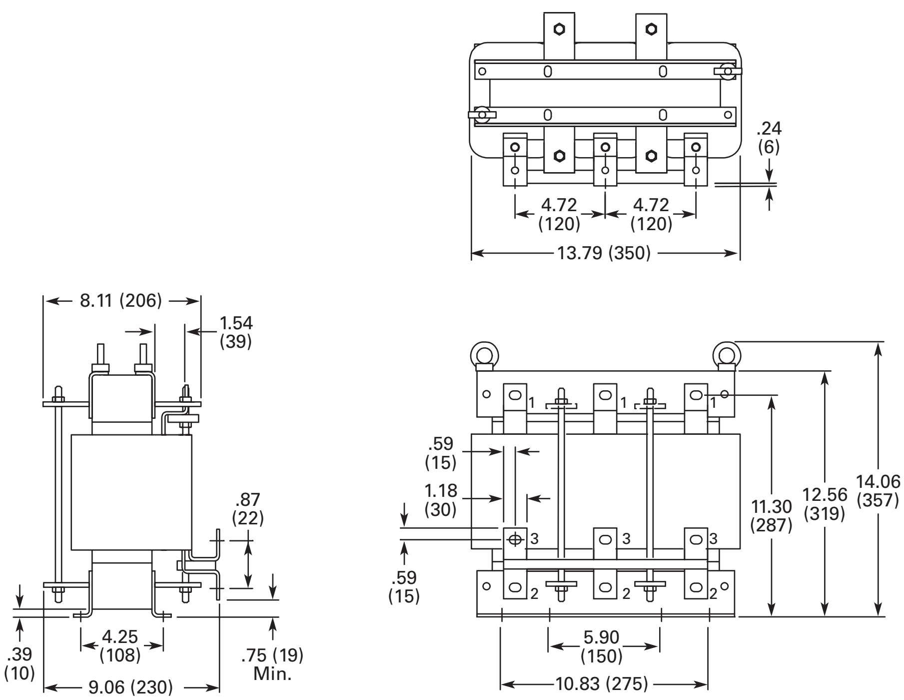
① Chokes are provided with all FR10–FR14 drives.

Approximate Dimensions in Inches (mm)

CHK0400



CHK0261



H-Max Series Drives

Contents

Description	*Page*

Product Overview

H-Max Family Introduction

Eaton's H-Max™ Series VFD is the next generation of drives specifically engineered for HVAC pump and fluid control applications. The H-Max family of products boasts industry leading energy efficiency algorithms for your applications. Not only are the drives ultra-efficient—they contain software that minimizes motor winding energy loses in your applications. Designed for easy installation, simple startup, and long life; the H-Max Series drive family provides exceptional value to our customers,

Product Range

Open Style Drives:

- 0.75–125 hp at 230 Vac
- 1.5–250 hp at 480 Vac

Note: Available in NEMA 1 or NEMA 12 designs.

IntelliPass/IntelliDisconnect Drives:

- 1–30 hp at 208 Vac
- 1–30 hp at 230 Vac
- 1–75 hp at 480 Vac

Note: Available in NEMA 1, NEMA 12, or NEMA 3R enclosures.

Application Description

The H-Max Series drive was designed specifically for HVAC pump and fluid control applications. It is intended to be used on variable torque loads with the intent of moving air or liquids. With this in mind, the H-Max drive has onboard I/O pre-programmed to meet the common needs for these applications. The H-Max drive supports items such as standard speed control, PID functionality, as well as multi-motor applications. The drive easily supports interlock, second motor parameter set, as well as fire mode functionality.

Key Feature

Active Energy Control Algorithm

Eaton's H-Max Series drives have been designed to provide industry leading energy saving solutions. Not only is the drive ultra-efficient, the drive seeks the most efficient operating point of the motor, minimizing energy loss in the windings per the given load requirements. This is an Eaton protected control algorithm exclusive to H-Max drives.

H-Max Drives

Contents

H-Max Drives

Product Description

Eaton's H-Max Series VFD has software and hardware designed specifically for the HVAC, pump industry. The ultra-efficient DC capacitor and power structure allows the drive to consume less energy, lowering greenhouse gases.

The I/O configuration is designed with wiring ergonomics in mind by including removable terminal blocks. The main, easily removable, control board used for all drive frames with six digital IN, two analog IN, one analog OUT, three relay OUT accepts two additional I/O or communication board. In addition, the control board has built-in RS-485 and Ethernet communication.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

In addition to the Active Energy Control Algorithm to maximize motor efficiency, the drive boasts an ultra-efficient DC capacitor and power structure to allow less energy consumption, lowering greenhouse gases.

Features and Benefits

Hardware

- Thin metal capacitor design—ultra-efficient drive operation and extended self life (up to five years without reforming)
- Integrated 5% DC link choke with Input surge protection—protects against voltage spikes and provides a clean wave form to the motor
- EMI/RFI filters standard on all drives—meets EMC Category 2 for commercial applications
- Real-time clock—supports calendaring and PLC functionality
- Graphic LCD display and keypad—supports simple menu navigation as well as on-screen diagnostics and troubleshooting
- HAND-OFF-AUTO and drive-bypass selector on keypad—simplifies control
- Standard I/O: 6DI, 2AI, 1AO, 2 Form C RO (NO/NC), 1 Form A RO (NO)—supports requirements for most installations
- Onboard RS 485: Modbus, N2, BACnet—meets needs of most communication requirements
- Onboard Ethernet: BACnet/IP, Modbus/TCP—meets needs of most communication requirements
- Two expansion slots—intended to support additional I/O or communication protocols as necessary
- Quick disconnect terminals for I/O connections—supports fast easy installation

Software

- Active energy control—minimizes energy losses in your motor resulting in industry leading energy efficiency for your application
- Quick Start Wizard upon initial power up—supports fast easy installation
- Copy/paste functionality on drive keypad—allows for fast setup of multiple drives
- Pre-programmed I/O—supports fast easy installation for most applications

Standards and Certifications

Product

- IEC 61800-5-1
- CE
- cUL

Safety

- UL 508C
- EN 61800-5-1
- CE
- cUL

- C-Tick Mark

Catalog Number Selection

H-Max Series Drives

HMX 3 4 A G 3D4 2 1 - N

Product	
HMX =	HVAC drive

Phase	
3 =	Three-phase

Voltage	
2 =	200–240V
4 =	380–480V

Software Series
A–Z

Keypad	
G =	Graphical panel

Amperes			
200–240 Volts		**380–480 Volts**	
3D7 = 3.7A–0.75 hp, 0.55 kW	**062** = 62A–20 hp, 15 kW	**3D4** = 3.4A–1.5 hp, 1.1 kW	**046** = 46A–30 hp, 22 kW
4D8 = 4.8A–1 hp, 0.75 kW	**075** = 75A–25 hp, 18.5 kW	**4D8** = 4.8–2 hp, 1.5 kW	**061** = 61A–40 hp, 30 kW
6D6 = 6.6A–1.5 hp, 1.1 kW	**088** = 88A–30 hp, 22 kW	**5D6** = 5.6A–3 hp, 2.2 kW	**072** = 72A–50 hp, 37 kW
8D0 = 8A–2 hp, 1.5 kW	**105** = 105A–40 hp, 30 kW	**8D0** = 8A–4 hp, 3 kW	**087** = 87A–60 hp, 45 kW
011 = 11A–3 hp, 2.2 kW	**140** = 140A–50 hp, 37 kW	**9D6** = 9.6A–5 hp, 4 kW	**105** = 105A–75 hp, 55 kW
012 = 12A–4 hp, 3 kW	**170** = 170A–60 hp, 45 kW	**012** = 12A–7.5 hp, 5.5 kW	**140** = 140A–100 hp, 75 kW
018 = 18A–5 hp, 4 kW	**205** = 205A–75 hp, 55 kW	**016** = 16A–10 hp, 7.5 kW	**170** = 170A–125 hp, 90 kW
024 = 24A–7.5 hp, 5.5 kW	**261** = 261A–100 hp, 75 kW	**023** = 23A–15 hp, 11 kW	**205** = 205A–150 hp, 110 kW
031 = 31A–10 hp, 7.5 kW	**310** = 310A–125 hp, 90 kW	**031** = 31A–20 hp, 15 kW	**261** = 261A–200 hp, 132 kW
048 = 48A–15 hp, 11 kW		**038** = 38A–25 hp, 18.5 kW	**310** = 310A–250 hp, 160 kW

Input Options Frame and Voltage Specific	
2 =	EMC C2

Enclosure	
1 =	Open NEMA Type 1 IP21
2 =	Open NEMA Type 12 IP54

Braking/Application	
N =	No brake chopper (low overload)

Notes

All boards are varnished (conformed coated). Corrosion resistant.

Battery included in all drives for real-time clock.

Keypad kit includes HOA bypass.

Keypad kit includes HOA, back reset for Europe application.

EMI/RFI filters included.

DC link choke included.

Product Selection

H-Max Series Drives—230 Vac

NEMA Type 1

NEMA Type 1/IP21

FS Frame Size	Drive Output Current Low Overload Full Load Amps at 40°C	Horsepower	Assigned Motor Ratings Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	Catalog Number
4	3.7	0.75	0.55	3.2	2.6	**HMX32AG3D721-N**
	4.8	1	0.75	4.2	3.7	**HMX32AG4D821-N**
	6.6	1.5	1.1	6.6	4.8	**HMX32AG6D621-N**
	8	2	1.5	6.8	6.6	**HMX32AG8D021-N**
	11	3	2.2	9.6	8	**HMX32AG01121-N**
	12.5	4	3	N/A	11	**HMX32AG01221-N**
5	18	5	4	15.2	12.5	**HMX32AG01821-N**
	24	7.5	5.5	22	18	**HMX32AG02421-N**
	31	10	7.5	28	24	**HMX32AG03121-N**
6	48	15	11	42	31	**HMX32AG04821-N**
	62	20	15	54	48	**HMX32AG06221-N**
7	75	25	18.5	68	62	**HMX32AG07521-N**
	88	30	22	80	75	**HMX32AG08821-N**
	105	40	30	104	88	**HMX32AG10521-N**
8	140	50	37	130	105	**HMX32AG14021-N**
	170	60	45	154	140	**HMX32AG17021-N**
	205	75	55	192	170	**HMX32AG20521-N**
9	261	100	75	248	205	**HMX32AG26121-N**
	310	125	90	N/A	261	**HMX32AG31021-N**

NEMA Type 12

NEMA Type 12/IP54

FS Frame Size	Drive Output Current Low Overload Full Load Amps at 40°C	Horsepower	Assigned Motor Ratings Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	Catalog Number
4	3.7	0.75	0.55	3.2	2.6	**HMX32AG3D722-N**
	4.8	1	0.75	4.2	3.7	**HMX32AG4D822-N**
	6.6	1.5	1.1	6.6	4.8	**HMX32AG6D622-N**
	8	2	1.5	6.8	6.6	**HMX32AG8D022-N**
	11	3	2.2	9.6	8	**HMX32AG01122-N**
	12.5	4	3	N/A	11	**HMX32AG01222-N**
5	18	5	4	15.2	12	**HMX32AG01822-N**
	24	7.5	5.5	22	18	**HMX32AG02422-N**
	31	10	7.5	28	24	**HMX32AG03122-N**
6	48	15	11	42	31	**HMX32AG04822-N**
	62	20	15	54	48	**HMX32AG06222-N**
7	75	25	18.5	68	62	**HMX32AG07522-N**
	88	30	22	80	75	**HMX32AG08822-N**
	105	40	30	104	88	**HMX32AG10522-N**
8	140	50	37	130	105	**HMX32AG14022-N**
	170	60	45	154	140	**HMX32AG17022-N**
	205	75	55	192	170	**HMX32AG20522-N**
9	261	100	75	248	205	**HMX32AG26122-N**
	310	125	90	N/A	261	**HMX32AG31022-N**

Note

① For sizing reference.

2

H-Max Series Drives—480 Vac

NEMA Type 1

NEMA Type 1/IP21

FS Frame Size	Drive Output Current Low Overload Full Load Amps at 40°C	Horsepower	Assigned Motor Ratings Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	Catalog Number
4	3.4	1.5	1.1	2.1	2.6	**HMX34AG3D421-N**
	4.8	2	1.5	3.4	3.4	**HMX34AG4D821-N**
	5.6	3	2.2	5.6	4.8	**HMX34AG5D621-N**
	8.0	4	3.0	N/A	5.6	**HMX34AG8D021-N**
	9.6	5	4	7.6	8	**HMX34AG9D621-N**
	12	7.5	5.5	11	9.6	**HMX34AG01221-N**
5	16	10	7.5	14	12	**HMX34AG01621-N**
	23	15	11	21	16	**HMX34AG02321-N**
	31	20	15	27	23	**HMX34AG03121-N**
6	38	25	18.5	34	31	**HMX34AG03821-N**
	46	30	22	40	38	**HMX34AG04621-N**
	61	40	30	52	46	**HMX34AG06121-N**
7	72	50	37	65	61	**HMX34AG07221-N**
	87	60	45	77	72	**HMX34AG08721-N**
	105	75	55	96	87	**HMX34AG10521-N**
8	140	100	75	124	105	**HMX34AG14021-N**
	170	125	90	156	140	**HMX34AG17021-N**
	205	150	110	180	170	**HMX34AG20521-N**
9	261	200	132	240	205	**HMX34AG26121-N**
	310	250	160	302	261	**HMX34AG31021-N**

NEMA Type 12

NEMA Type 12/IP54

FS Frame Size	Drive Output Current Low Overload Full Load Amps at 40°C	Horsepower	Assigned Motor Ratings Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	Catalog Number
4	3.4	1.5	1.1	2.1	2.6	**HMX34AG3D422-N**
	4.8	2	1.5	3.4	3.4	**HMX34AG4D822-N**
	5.6	3	2.2	5.6	4.8	**HMX34AG5D622-N**
	8.0	4	3.0	N/A	5.6	**HMX34AG8D022-N**
	9.6	5	4	7.6	8	**HMX34AG9D622-N**
	12	7.5	5.5	11	9.6	**HMX34AG01222-N**
5	16	10	7.5	14	12	**HMX34AG01622-N**
	23	15	11	21	16	**HMX34AG02322-N**
	31	20	15	27	23	**HMX34AG03122-N**
6	38	25	18.5	34	31	**HMX34AG03822-N**
	46	30	22	40	38	**HMX34AG04622-N**
	61	40	30	52	46	**HMX34AG06122-N**
7	72	50	37	65	61	**HMX34AG07222-N**
	87	60	45	77	72	**HMX34AG08722-N**
	105	75	55	96	87	**HMX34AG10522-N**
8	140	100	75	124	105	**HMX34AG14022-N**
	170	125	90	156	140	**HMX34AG17022-N**
	205	150	110	180	170	**HMX34AG20522-N**
9	261	200	132	240	205	**HMX34AG26122-N**
	310	250	160	302	261	**HMX34AG31022-N**

Note

① For sizing reference.

Onboard Network Communications

Johnson Controls Metasys N2

H-Max Series provides communication between the drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. N2 can be selected and programmed by the drive keypad.

BACnet

H-Max Series provides communication to BACnet networks. Data transfer is master-slave/token passing (MS/TP) RS-485.

BACnet IP

100 base T interface.

Modbus TCP

Ethernet based protocol.

Modbus RTU

H-Max Series provides communication to Modbus RTU RS-485 as a slave on a Modbus network. Other communication parameters include an address range from 1–247; a parity of None, Odd or Even; and the stop bit is 1.

H-Max Series Option Board Kits Available for Slot B

The factory issued relay option board can be replaced with the following option boards to customize the drive for your application needs.

The standard board provides 2 Form C RO (NO/NC) and 1 Form A RO (NO).

Option Boards Mounted in Slot B

Option Kit Description	Option Kit Catalog Number
I/O expander card, 2 RO and thermistor input	**Relay Board 2**

H-Max Series Option Board Kits Available for Slots D and E

The H-Max Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards.

The H-Max Series factory-installed standard board configuration includes an I/O board and a relay output board.

Option Boards Mounted in Slots D and E

Option Kit Description	Option Kit Catalog Number
6 x DI /DO, each digital input can be individually programmed as digital output	**XMX-IO-B1-A**
1RO Form C (NO/NC), 1RO Form A (NO), 1 thermistor	**XMX-IO-B2-A**
1 x AI, 2 x AO (isolated)	**XMX-IO-B4-A**
3 x RO Form A (NO)	**XMX-IO-B5-A**
1RO Form A (NO), 5DI 42–240 Vac input	**XMX-IO-B9-A**
1 x AO, 1 x DO, 1 x RO	**XMX-IO-BF-A**
LonWorks®	**XMX-COM-C4-A**

NEMA Type 1 to NEMA Type 12/IP54 Conversion Kit

The NEMA Type 12/IP54 option kit is used to convert a NEMA Type 1 to a NEMA Type 12 drive.

Kit consists of a drive cover, fan kit and plugs.

NEMA Type 12/IP54 Cover

Option Kit Description	Option Kit Catalog Number
FS4-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS4-N12KIT**
FS5-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS5-N12KIT**
FS6-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS6-N12KIT**

Accessories

Flange Kits

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure.

Flange Kit NEMA Type 1/IP21

Includes flange, mounting brackets, and screws.

Flange Kit NEMA Type 12/IP54

Includes flange, mounting brackets, NEMA Type 12 fan components, air shroud screws and plugs.

Frames FS4–FS9 ①②

Description	Catalog Number
NEMA Type 12/IP54	
FS4 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	**FS4-Flange-N12KIT**
FS5 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	**FS5-Flange-N12KIT**
FS6 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	**FS6-Flange-N12KIT**
FS7 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	**FS7-Flange-N12KIT**

Keypad Accessories

Remote Mounting Keypad Kit

Frames FS4–FS9

Description	Catalog Number
Remote mounting keypad kit—bezel and cable	**OPTRMT-BP-HMAX**

Drive Demo

H-Max Series Drive Demo

Demos and Power Supply

Description	Catalog Number
H-Max Series drive demo	**H-MAX-DEMO**
H-Max Series bypass demo	**H-MAX-BYPASS-DEMO**
Hand-held 24V auxiliary power supply—used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	**9000XAUX24V**

Notes

① For installation of a NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.
② Frame size 8 and 9 must be ordered from the factory as a flange mount unit.

Replacement Parts

Control Board/Keypad

Description	Current Catalog Number
H-Max Series graphic bypass, HOA	**KeypadbypassHOA**
H-Max Series graphic back, HOA	**KeypadbackHOA**

PC Cable

Description	Catalog Number
Remote download USB to RJ-45 cable with software driver disk	**REM-USB-Down**

Replacement Relay Board in Slot B

Description	Catalog Number
Replacement relay board qty 2 Form C relay, qty 1 Form A relay	**Relay board 1**

Main Fan

Description	Catalog Number
FS4 main fan	**FS4-Main Fan**
FS5 main fan	**FS5-Main Fan**
FS6 main fan	**FS6-Main Fan**
FS7 main fan	**FS7-Main Fan**

Internal Fan

Description	Catalog Number
FS4 internal fan (IP54/NEMA 12)	**FS4-Internal Fan**
FS5 internal fan (IP54/NEMA 12)	**FS5-Internal Fan**
FS6 internal fan (IP54/NEMA 12)	**FS6-Internal Fan**
FS7 internal fan (IP54/NEMA 12)	**FS7-Internal Fan**

Technical Data and Specifications

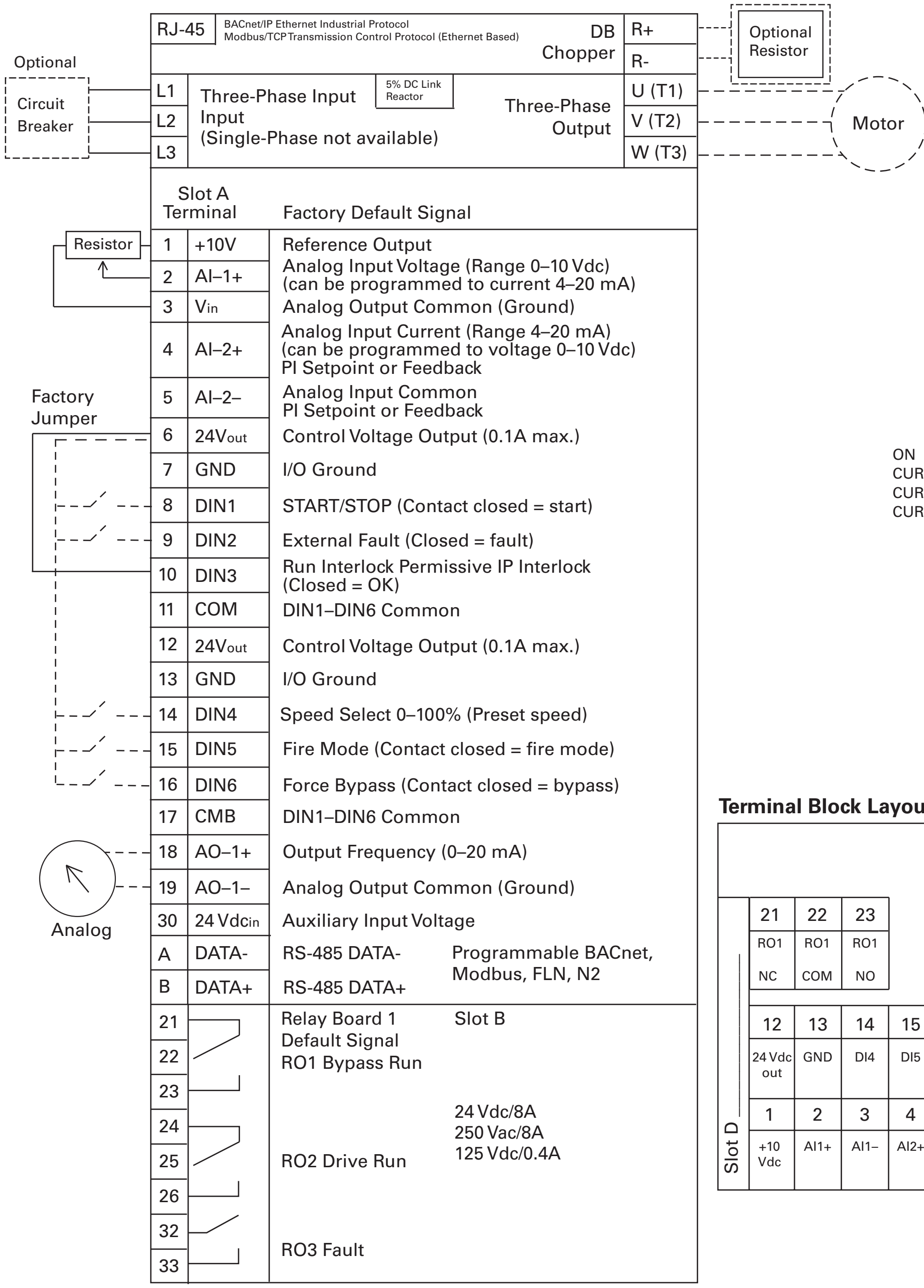
H-Max Series Drives

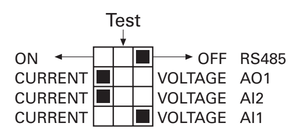
Description	Specification
Input Ratings	
Input voltage (V_{in})	200–240 Vac, 380–480 Vac, –10%/+10%
Input frequency (f_{in})	50/60 Hz (variation up to 47–66 Hz)
Connection to power	Once per minute or less (typical operation)
Short circuit withstand rating	100 kAIC
Output Ratings	
Output voltage	0 to V_{in}/U_{in} line voltage in
Continuous output current	Ambient temperature max. 104°F (40°C)
I_L overload	1.1 x I_L (1 min./10 min.)
Overload current	110% (1 min./10 min.)
Initial output current	150% for two seconds
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Control Characteristics	
Control method	Frequency control (V/f) open loop sensorless vector control
Switching frequency	1–310 amps FS4–9: default 6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy ±1% Panel reference: Resolution 0.01 Hz
Field weakening point	8 to 320 Hz
Acceleration time	0.1 to 3000 seconds
Deceleration time	0.1 to 3000 seconds
Braking torque	DC brake: 30% x T_n
Ambient Conditions	
Ambient operating temperature	FS4–FS9: 14°F (–10°C), no frost to 104°F (40°C) (Drive can operate at 122°F (50°C), see **Pages V6-T2-141** and **V6-T2-142**)
Storage temperature	–40° to 158°F (–40° to 70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 60721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 60721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 9842 ft (3000m); 380–480V
Vibration	FS4–FS9: EN 61800-5-1, EN 60068-2-6; 5 to 150 Hz, displacement amplitude 1 mm (peak) at 5 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 61800-5-1, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	NEMA Type 1/IP21 or NEMA Type 12/IP54 (keypad required for IP54/Type 12)
Standards	
EMC	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H (EMC C2)
Emissions	EMC level dependent— +EMC 2: EN61800-3 (2004) Category C2 Delivered with Class C2 EMC filtering as default.

Description	Specification
Control Connections	
Analog input voltage	0 to 10V, R = 200 kohms differential Resolution 0.1%; Accuracy ±1% Dip switch selection (voltage/current)
Analog input current	0(4) to 20 mA; R_i –250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24V ±10%, max. 250 mA
Output reference voltage	+10V +3%, max. load 10 mA
Analog output	0–10V, 0(4) to 20 mA; R_L max. 500 ohms; Resolution 10 bit; Accuracy ±2% Dip switch selection (voltage/current)
Relay outputs	3 programmable, 2 Form C, 1 Form A relay outputs Switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A
Hard wire jumper	Between terminal 6 and 10 factory default
Dip switch setting default	RS485 = off A01 = current A12 = current A11 = voltage
Protections	
Overcurrent protection	Yes
Overvoltage protection	Yes
DC bus regulation anti-trip	Yes (accelerates or decelerates the load)
Undervoltage protection	Yes
Earth fault protection	Yes (in case of earth fault in motor or motor cable, only the frequency converter is protected)
Input phase supervision	Yes (trips if any of the input phases are missing)
Motor phase supervision	Yes (trips if any of the output phases are missing)
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection	Yes
Surge protection	Yes (varistor input)
Conformed coated (varnished) boards	Yes (prevents corrosion)

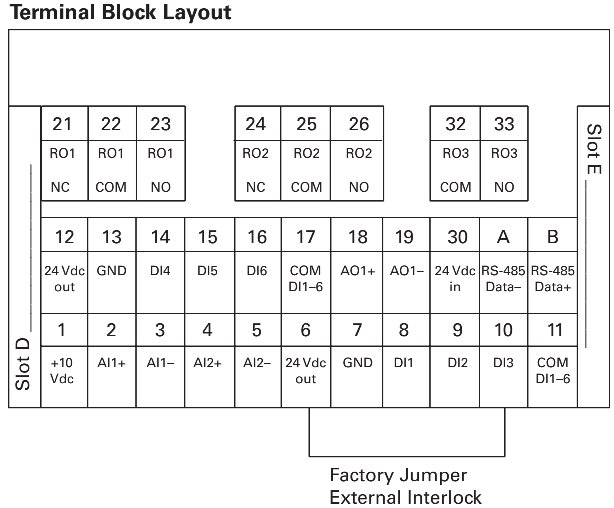
Wiring Diagram

Control Input/Output, PID Application





Terminal Block Layout



Standards

- Digital inputs D1–D6, relay out, analog in/out are freely programmed
- The user can assign a single input to multiple functions

Includes

- Six digital input
- Two analog input
- One analog output
- Three relay output
- RS-485
- Ethernet (BACnet and Modbus)

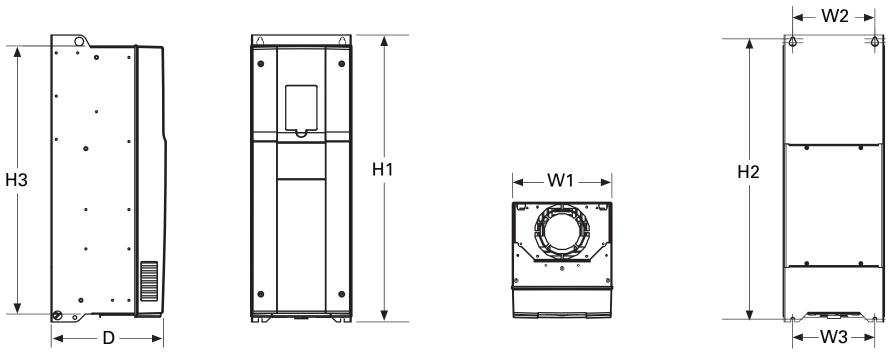
Reliability

- Pretested components
- Conformal coated (varnished) boards
- 40°C rated
- 110% overload for one minute
- Eaton Electrical Services & Systems national network of AF drive specialists

Dimensions

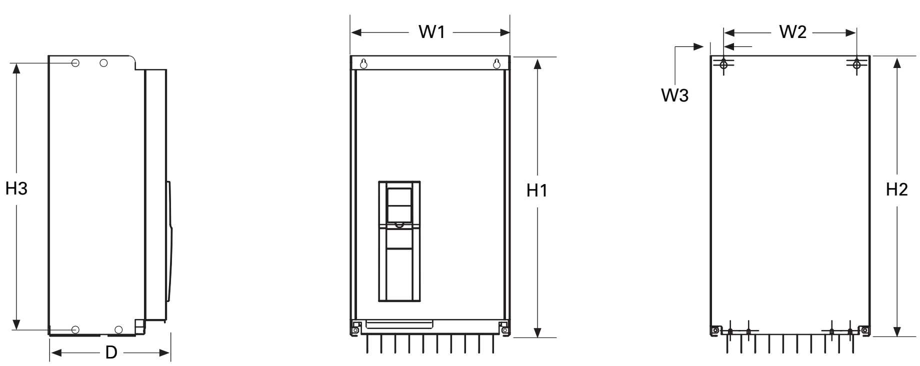
Approximate Dimensions in Inches (mm)

H-Max Series Frames FS4–FS7



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
FS4											
230 Vac	0.75–4	0.55–3.0	3.7–12.5	7.77 (197.3)	12.89 (327.5)	12.32 (313.0)	11.22 (285.0)	5.04 (128.0)	3.94 (100.0)	3.94 (100.0)	13.2 (6)
480 Vac	1.5–7.5	1.1–5.5	3.4–12								
FS5											
230 Vac	5–10	4–7.5	18–31	8.73 (221.6)	16.50 (419.0)	15.98 (406.0)	15.04 (382.0)	5.67 (144.0)	4.53 (115.0)	3.94 (100.0)	22.0 (10)
480 Vac	10–20	7.5–15	16–31								
FS6											
230 Vac	15–20	11–15	48–62	9.29 (236.0)	21.93 (557.0)	21.28 (540.5)	20.24 (514.0)	7.68 (195.0)	5.83 (148.0)	5.83 (148.0)	44.1 (20)
480 Vac	25–40	18.5–30	38–61								
FS7											
230 Vac	25–30	18.5–30	75–105	10.49 (266.5)	25.98 (660.0)	25.39 (645.0)	24.29 (617.0)	9.06 (230.0)	7.48 (190.0)	7.48 (190.0)	82.6 (37.5)
480 Vac	50–75	37–55	72–105								

H-Max Series Frames FS8 and FS9



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
FS8											
230 Vac	50–75	37–55	140–205	13.76 (349.6)	38.02 (965.7)	37.26 (946.4)	37.26 (946.4)	11.42 (290.1)	9.29 (236.0)	1.42 (36.0)	154.3 (70)
480 Vac	100–150	75–110									
FS9											
230 Vac	100–120	75–90	261–310	14.63 (371.6)	33.09 (890.4)	31.89 (810.0)	31.89 (810.0)	18.90 (480.0)	15.75 (400.0)	1.57 (40.0)	238.1 (108)
480 Vac	200–250	132–160									

Note: For flange dimension, please reference User Manual.

H-Max IntelliPass and IntelliDisconnect Drives

Contents

H-Max IntelliPass and IntelliDisconnect Drives

Product Description

The IntelliPass electronic bypass is a two or optional three contactor design using a 24 Vdc ***XT*** Series contactor with an optional manual override switch that allows the unit to run in bypass without the H-Max Series drive.

The IntelliPass software parameters utilize engineering units common to the HVAC industry. Onboard startup wizard guarantees flawless commissioning with plug-and-play screen entry. Available in NEMA Type 1 and 12 with optional pre-engineered operator devices to meet all customized specification requirements.

The IntelliPass construction features allow for easy installation, reliable operation and serviceability with additional onboard wire space and removable conduit plates with knockouts.

Features and Benefits

Industry leading energy saving solution—uses the Eaton H-Max drive with Active Energy Control algorithm.

Built to be as tough as the application—Eaton's robust design boasts an industrial grade enclosure and industry proven components.

- PSG Industrial Power Supply
- ***XT*** Contactors
- 22 mm Pilot Devices

Designed with Our Customers in Mind

- Removable top and bottom entry panels
- Door mounted graphic display and keypad
- Easily accessible connection terminals with removable I/O terminal connections

Engineered Product Solution

- The Eaton H-Max IntelliPass and IntelliDisconnect products are available with a variety of factory tested and certified options meeting or exceeding UL508C requirements

Standards and Certifications

Product

- IEC 61800-5-1
- CE
- cUL

Safety

- UL 508C
- EN 61800-5-1
- CE
- cUL

- Plenum Rated

2

Catalog Number Selection

H-Max Series IntelliPass and IntelliDisconnect Drives

HMX 011 3 4 N A _ _ _ _ _ _ _ _ _ _

Build options alphabetically and numerically.

Product
HMX = HVAC drive (VT) (low overload)

NEC Ampere Ratings	
208 Volts	**480 Volts**
4D5 = 4.5A—1 hp	**2D1** = 2.1A—1 hp
7D5 = 7.5A—2 hp	**3D4** = 3.4A—2 hp
011 = 11A—3 hp	**5D6** = 5.6A—3 hp
017 = 17A—5 hp	**9D6** = 9.6A—5 hp
025 = 25A—7.5 hp	**011** = 11A—7.5 hp
031 = 31A—10 hp	**014** = 14A—10 hp
047 = 47A—15 hp	**021** = 21A—15 hp
060 = 60A—20 hp	**027** = 27A—20 hp
075 = 75A—25 hp	**034** = 34A—25 hp
088 = 88A—30 hp	**040** = 40A—30 hp
230 Volts	**052** = 52A—40 hp
4D2 = 4.2A—1 hp	**065** = 65A—50 hp
7D5 = 7.5A—2 hp	**077** = 77A—60 hp
9D6 = 9.6A—3 hp	**096** = 96A—75 hp
016 = 16A—5 hp	
022 = 22A—7.5 hp	
028 = 28A—10 hp	
042 = 42A—15 hp	
054 = 54A—20 hp	
068 = 68A—25 hp	
080 = 80A—30 hp	

Enclosure Style
3 = IntelliPass NEMA Type 1
4 = IntelliPass NEMA Type 12
5 = IntelliPass NEMA Type 3R
A = IntelliDisconnect NEMA Type 1
B = IntelliDisconnect NEMA Type 12
C = IntelliDisconnect NEMA Type 3R

Voltage
1 = 208V
2 = 230V
4 = 480V

Braking/Application
N = No brake chopper (low overload)

Software Series
A–Z

Extended I/O Options in Slot D and E
B1 = 6 x DI /DO, Each digital input can be individually programmed as digital output
B2 = 1RO (NC/NO), 1RO (NO), 1 Thermistor
B4 = 1 x AI, 2 x AO (isolated)
B5 = 3 x RO
B9 = 1RO (NO), 5 DI 42–240 Vac input
BF = Expander IO, 1 AO, 1 DO, 1 RO

Optional Communications in Slot D and E
C4 = LonWorks®

EMC Upgrade Option
EMC C2 Standard

Keypad Options
None available

IntelliDisconnect Options
L3 = Pilot lights (Power ON, RUN, Fault)
P3 = Fused drive isolation (cannot be used with PE)
PE = Output contactor (cannot be used with P3)
SA = Space heater w/transformer (Type 3R only)

IntelliPass Bypass Options
L4 = Pilot lights (Power ON, RUN, Fault, Bypass)
P3 = Fused drive isolation (can not be used with P6)
P6 = Third contactor drive isolation (cannot be used with P3 or IS)
M1 = Manual bypass switch located on front door
SA = Space heater w/transformer (Type 3R only)
K9 = Auxiliary contacts
IS = Isolation switch (cannot be used with P6)

Standard Onboard Communications
RS-485 Communications
BACnet MS/TP = Master slave/token protocol (Universal BACnet) RS-485 **Modbus** RTU RS-485, ASCII or RTU, remote terminal unit 32 nodes **N2** = Johnson Controls Metasys N2 network
Onboard Ethernet-Based Communications (port left side of keypad)
BACnet/IP Ethernet industrial protocol **Modbus**/TCP Transmission control protocol (Ethernet-based)

Notes

IntelliPass—two contactor electronic bypass standard.

All boards are varnished. Corrosion resistant.

Battery included in all drives for real-time clock. Three year lifetime.

Keypad kit includes HOA bypass.

EMI/RFI filters included.

DC link choke included.

Product Selection

H-Max Series IntelliPass NEMA Type 1—Two Contactor Bypass Standard

HMX_

208 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	4.5	**HMX4D531BA**
	2	7.5	**HMX7D531BA**
	3	10.6	**HMX01131BA**
5	5	16.7	**HMX01731BA**
	7.5	24.2	**HMX02531BA**
	10	30.8	**HMX03131BA**
6	15	46.2	**HMX04731BA**
	20	59.4	**HMX06031BA**
7	25	74.9	**HMX07531NA**
	30	88	**HMX08831NA**

230 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	4.2	**HMX4D232BA**
	2	7.5	**HMX7D532BA**
	3	9.6	**HMX9D632BA**
5	5	15.2	**HMX01632BA**
	7.5	22	**HMX02232BA**
	10	28	**HMX02832BA**
6	15	42	**HMX04232BA**
	20	54	**HMX05432BA**
7	25	68	**HMX06832NA**
	30	80	**HMX08032NA**

480 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	2.1	**HMX2D134BA**
	2	3.4	**HMX3D434BA**
	3	5.6	**HMX5D634BA**
	5	9.6	**HMX9D634BA**
	7.5	11	**HMX01134BA**
5	10	14	**HMX01434BA**
	15	21	**HMX02134BA**
	20	27	**HMX02734BA**
6	25	34	**HMX03434BA**
	30	40	**HMX04034BA**
	40	52	**HMX05234BA**
7	50	65	**HMX06534NA**
	60	77	**HMX07734NA**
	75	96	**HMX09634NA**

Notes

For Wiring Diagrams, see **Page V6-T2-157**.
For NEMA 12 or 3R enclosures, see Catalog Number Selection on Page **V6-T2-150**.
Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

H-Max Series IntelliDisconnect NEMA Type 1—Main Disconnect Standard

HMX_

208 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	4.5	**HMX4D5A1BA**
	2	7.5	**HMX7D5A1BA**
	3	11	**HMX011A1BA**
5	5	17	**HMX017A1BA**
	7.5	25	**HMX025A1BA**
	10	31	**HMX031A1BA**
6	15	47	**HMX047A1BA**
	20	60	**HMX060A1BA**
7	25	75	**HMX075A1NA**
	30	88	**HMX088A1NA**

230 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	4.2	**HMX4D2A2BA**
	2	7.5	**HMX7D5A2BA**
	3	9.6	**HMX9D6A2BA**
5	5	15.2	**HMX016A2BA**
	7.5	22	**HMX022A2BA**
	10	28	**HMX028A2BA**
6	15	42	**HMX042A2BA**
	20	54	**HMX054A2BA**
7	25	68	**HMX068A2NA**
	30	80	**HMX080A2NA**

480 Vac

FS Frame Size	Horsepower	Drive Rated NEC Amps	Catalog Number
4	1	2.1	**HMX2D1A4BA**
	2	3.4	**HMX3D4A4BA**
	3	5.6	**HMX5D6A4BA**
	5	9.6	**HMX9D6A4BA**
	7.5	11	**HMX011A4BA**
5	10	14	**HMX014A4BA**
	15	21	**HMX021A4BA**
	20	27	**HMX027A4BA**
6	25	34	**HMX034A4BA**
	30	40	**HMX040A4BA**
	40	52	**HMX052A4BA**
7	50	65	**HMX065A4NA**
	60	77	**HMX077A4NA**
	75	96	**HMX096A4NA**

Notes

For Wiring Diagrams, see **Page V6-T2-157**.
For NEMA 12 or 3R enclosures, see Catalog Number Selection on **Page V6-T2-150**.
Call Technical Support for NEMA 3R specifics. Enclosure size and weight differ from NEMA 1 and 12 products.

Onboard Network Communications

Johnson Controls Metasys N2

H-Max Series provides communication between the drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. N2 can be selected and programmed by the drive keypad.

BACnet

H-Max Series provides communication to BACnet networks. Data transfer is master-slave/token passing (MS/TP) RS-485.

BACnet IP

100 base T interface.

Modbus TCP

Ethernet based protocol.

Modbus RTU

H-Max Series provides communication to Modbus RTU RS-485 as a slave on a Modbus network. Other communication parameters include an address range from 1–247; a parity of None, Odd or Even; and the stop bit is 1.

H-Max Series Option Board Kits Available for Slots D and E

The H-Max Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards.

The H-Max Series factory-installed standard board configuration includes an I/O board and a relay output board.

Option Boards Mounted in Slots D and E

Option Kit Description	Option Kit Catalog Number
6 x DI /DO, each digital input can be individually programmed as digital output	**XMX-IO-B1-A**
1RO Form C (NO/NC), 1RO Form A (NO), 1 thermistor	**XMX-IO-B2-A**
1 x AI, 2 x AO (isolated)	**XMX-IO-B4-A**
3 x RO Form A (NO)	**XMX-IO-B5-A**
1RO Form A (NO), 5DI 42–240 Vac input	**XMX-IO-B9-A**
LonWorks®	**XMX-COM-C4-A**
1 x AO, 1 x DO, 1 x RO	**XMX-IO-BF-A**

NEMA Type 12/IP54 Conversion Kit

The NEMA Type 12/IP54 option kit is used to convert a NEMA Type 1 to a NEMA Type 12 drive.

Kit consists of a drive cover, fan kit and plugs.

NEMA Type 12/IP54 Cover

Option Kit Description	Option Kit Catalog Number
FS4-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS4-N12KIT**
FS5-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS5-N12KIT**
FS6-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	**FS6-N12KIT**

Extended I/O Options in Slot D and E

Description	Suffix Number
6 x DI /DO, Each digital input can be individually programmed as digital output	B1
1RO (NC/NO), 1RO (NO), 1 Thermistor	B2
1 x AI, 2 x AO (isolated)	B4
3 x RO	B5
1RO (NO), 5 DI 42–240 Vac input	B9
Expander IO, 1 AO, 1 DO, 1 RO	BF

Optional Communications in Slot D and E

Description	Suffix Number
LonWorks®	C4

EMC Upgrade Option

Description	Suffix Number
Standard	EMC C2

Keypad Options

Description	Suffix Number
None available	—

IntelliDisconnect Options

Description	Suffix Number
Pilot lights (Power ON, RUN, Fault)	L3
Fused drive isolation (cannot be used with PE)	P3
Output contactor (cannot be used with P3)	PE
Space heater w/transformer (Type 3R only)	SA

IntelliPass Bypass Options

Description	Suffix Number
Pilot lights (Power ON, RUN, Fault)	L4
Fused drive isolation (can not be used with P6)	P3
Third contactor drive isolation (cannot be used with P3 or IS)	P6
Manual bypass switch located on front door	M1
Space heater w/transformer (Type 3R only)	SA
Auxiliary contacts	K9
Isolation switch	IS

Standard Onboard Communications

Description	Suffix Number
RS-485 Communications	
BACnet MS/TP = Master slave/token protocol (Universal BACnet) RS-485	BACnet
Modbus RTU RS-485, ASCII or RTU, remote terminal unit 32 nodes	Modbus
Johnson Controls Metasys N2 network	N2
Onboard Ethernet-Based Communications (port left side of keypad)	
BACnet/IP Ethernet industrial protocol	BACnet
Modbus/TCP Transmission control protocol (Ethernet-based)	Modbus

Technical Data and Specifications

Primary Design Features

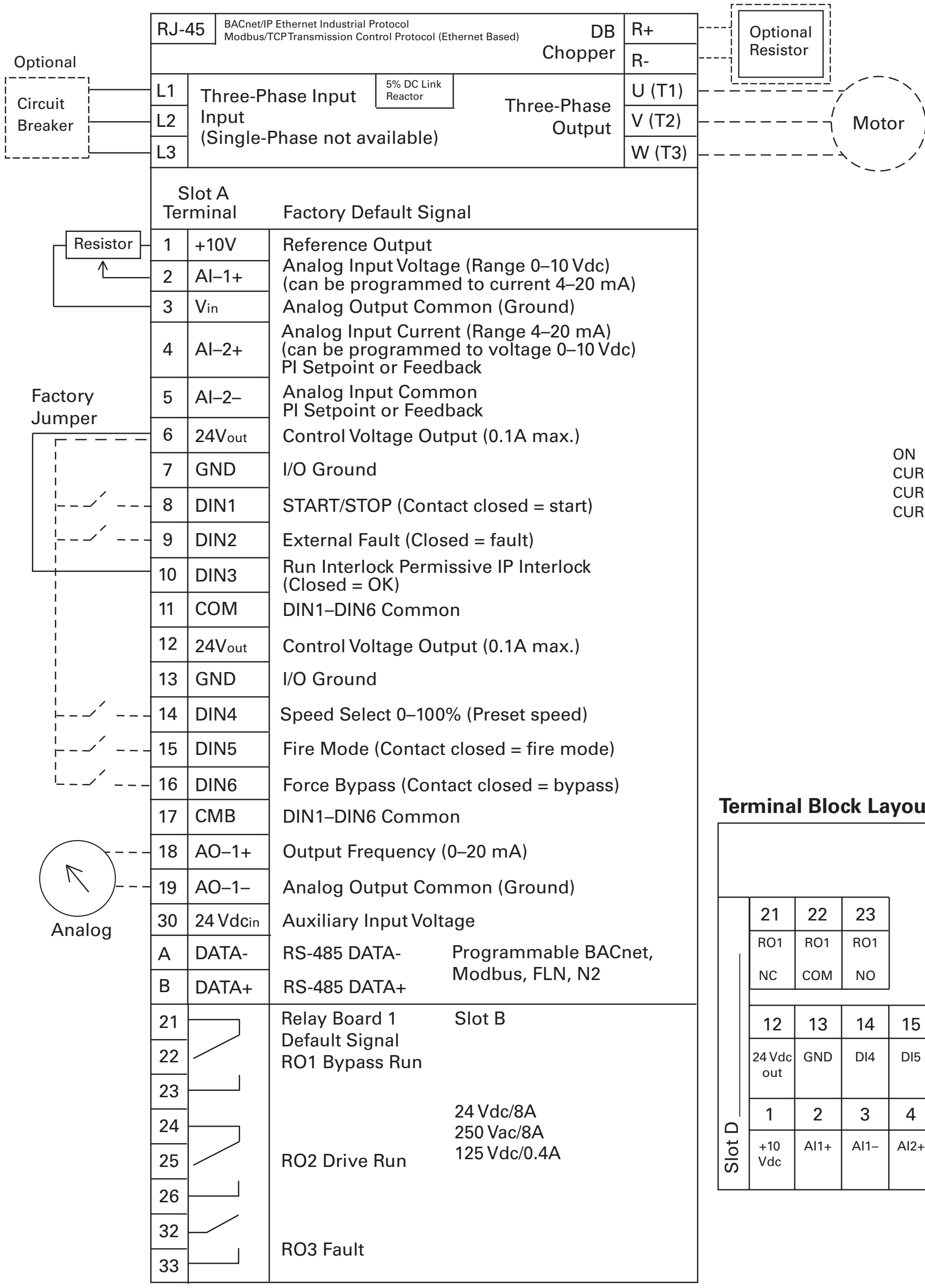
Description	IntelliPass	IntelliDisconnect
CB MMP	Standard	Standard
2 contactor bypass	Standard	N/A
Mechanical interlock	Standard	N/A
Electrical interlock	Standard	N/A
Third contactor (isolation)	Optional	N/A
Isolation switch	Optional	N/A
Top entry (power)	Standard	Standard
Bottom entry (power)	Standard	Standard
Output contactor	Standard	Optional

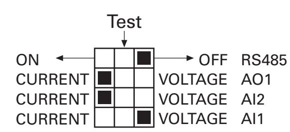
H-Max Series Drives

Description	Specification
Input Ratings	
Input voltage (V_{in})	208, 230, 480 Vac, –10%/+10%
Input frequency (f_{in})	50/60 Hz (variation up to 47–66 Hz)
Connection to power	Once per minute or less (typical operation)
Short circuit withstand rating	65 kAIC combination
Output Ratings	
Output voltage	0 to V_{in}/U_{in} line voltage in
Continuous output current	Ambient temperature max. 104°F (40°C)
I_L overload	1.1 x I_L (1 min./10 min.)
Overload current	110% (1 min./10 min.)
Initial output current	150% for two seconds
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Control Characteristics	
Control method	Frequency control (V/f) open loop sensorless vector control
Switching frequency	1–310 amps; adjustable with parameter 2.6.9 FS4–FS7: default 6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy ±1% Panel reference: Resolution 0.01 Hz
Field weakening point	8 to 320 Hz
Acceleration time	0.1 to 3000 seconds
Deceleration time	0.1 to 3000 seconds
Braking torque	DC brake: 30% x T_n
Ambient Conditions	
Ambient operating temperature	FS4–FS7: 14°F (–10°C), no frost to 104°F (40°C) (Drive can operate at 122°F (50°C)
Storage temperature	–40° to 158°F (–40° to 70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 60721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 60721-3-3, unit in operation, Class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 9842 ft (3000m); 380–480V
Vibration	FS4–FS7: EN 61800-5-1, EN 60068-2-6; 5 to 150 Hz, displacement amplitude 1 mm (peak) at 5 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 61800-5-1, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	NEMA Type 1/IP21 or NEMA Type 12/IP54 (keypad required for IP54/Type 12)
Standards	
EMC	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H (EMC C2)
Emissions	EMC level dependent— +EMC 2: EN61800-3 (2004) Category C2 Delivered with Class C2 EMC filtering as default.
Control Connections	
Analog input voltage	0 to 10V, R = 200 kohms differential Resolution 0.1%; Accuracy ±1% Dip switch selection (voltage/current)
Analog input current	0(4) to 20 mA; R_i –250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24V ±10%, max. 250 mA
Output reference voltage	+10V +3%, max. load 10 mA
Analog output	0–10V, 0(4) to 20 mA; R_L max. 500 ohms; Resolution 10 bit; Accuracy ±2%; Dip switch selection (voltage/current)
Relay outputs	3 programmable, 2 Form C, 1 Form A relay outputs Switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A
Hard wire jumper	Between terminal 6 and 10 factory default
Dip switch setting default	RS485 = off A01 = current A12 = current A11 = voltage
Protections	
Overcurrent protection	Yes
Overvoltage protection	Yes
DC bus regulation anti-trip	Yes (accelerates or decelerates the load)
Undervoltage protection	Yes
Earth fault protection	Yes (in case of earth fault in motor or motor cable, only the frequency converter is protected)
Input phase supervision	Yes (trips if any of the input phases are missing)
Motor phase supervision	Yes (trips if any of the output phases are missing)
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection	Yes
Surge protection	Yes (varistor input)
Conformed coated (varnished) board	Yes (prevents corrosion)

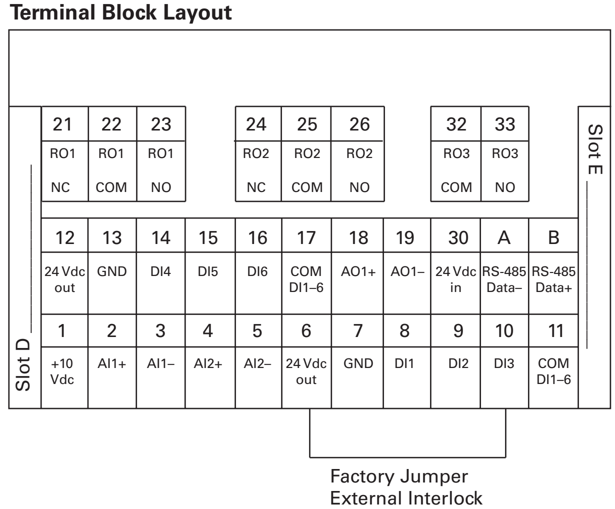
Wiring Diagrams

Control Input/Output, PID Application





Terminal Block Layout



Standards

- Digital inputs D1–D6, relay out, analog in/out are freely programmed
- The user can assign a single input to multiple functions

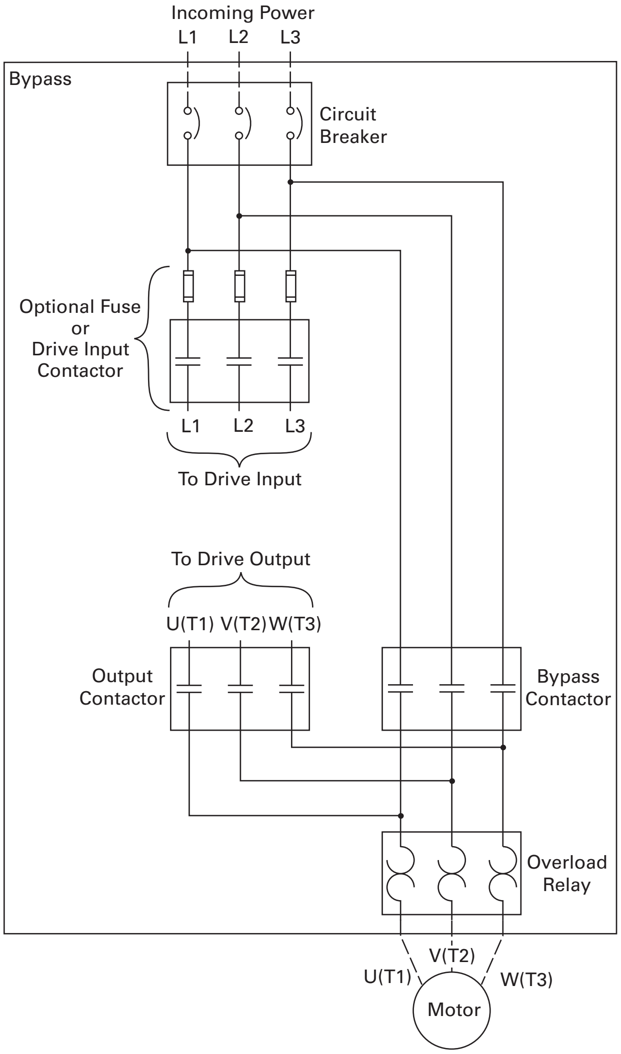
Includes

- Six digital input
- Two analog input
- One analog output
- Three relay output
- RS-485
- Ethernet

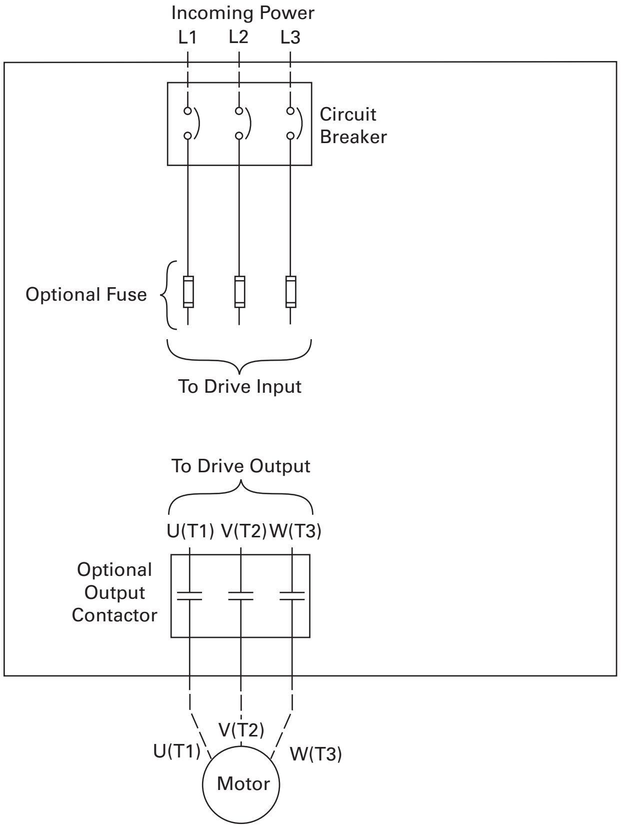
Reliability

- Pretested components
- Conformal coated (varnished) boards
- 40°C rated
- 110% overload for one minute
- Eaton Electrical Services & Systems national network of AF drive specialists

H-Max Series IntelliPass



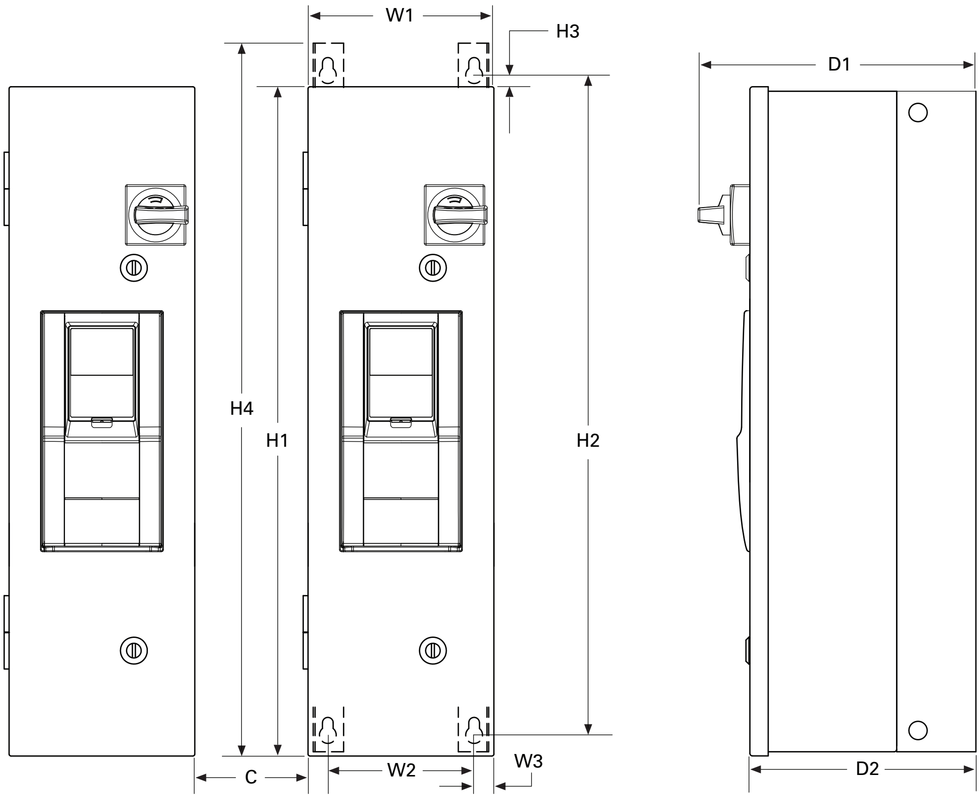
H-Max Series IntelliDisconnect Power Wiring



Dimensions

Approximate Dimensions in Inches (mm)

H-Max Series IntelliPass and IntelliDisconnect Drives



Consult factory or use manual for final dimensions.

Frame Size	Voltage	Horsepower (I_L)	H1	H2	H3	H4	C	W1	W2	W3	D1	D2	Weight in Lbs (kg)
FS4	208	1–3	29.69 (754.1)	37.12 (942.9)	0.25 (6.35)	31.00 (914.4)	3.00 (76.2)	7.88 (200.2)	6.33 (160.8)	0.75 (19.1)	11.40 (289.6)	9.27 (235.5)	45 (20.41)
	230	1–3											
	480	1–7.5											
FS5	208	5–10	37.00 (939.8)	34.47 (875.5)	0.25 (6.35)	38.31 (973.0)	3.00 (76.2)	9.40 (238.8)	7.75 (196.9)	0.75 (19.1)	15.30 (388.6)	13.17 (334.6)	57.5 (26.10)
	230	5–10											
	480	10–20											
FS6	208	15–20	45.08 (1145.0)	40.28 (1023.1)	0.25 (6.35)	46.4 (1178.6)	4.00 (101.6)	10.90 (276.9)	9.35 (327.5)	0.75 (19.1)	15.75 (400.0)	13.62 (346.0)	98.0 (44.45)
	230	15–20											
	480	25–40											
FS7	208	25–30	58.32 (1481.3)	56.30 (1430.0)	0.25 (6.35)	59.46 (1510.3)	5.00 (127.0)	13.98 (355.1)	12.35 (313.7)	0.75 (19.1)	15.50 (393.7)	13.55 (244.2)	165.0 (74.84)
	230	25–30											
	480	50–75											

Note: C distance is spacing required to mount multiple drives.

CFX9000 Enclosed Drives

Contents

Product Description

The CFX9000 Clean Power Drives from Eaton's electrical sector use tuned passive filters to significantly reduce line harmonics at the drive input terminals.

The CFX9000 drive also delivers True Power Factor—in addition to reducing harmonic distortion, the CFX9000 drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

The 9000X family of drives includes HVX9000, SVX9000, SLX9000, and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

CFX9000 Enclosed Products

- **Standard Enclosed**—covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages V6-T2-166** to **V6-T2-181**.
- **Modified Standard Enclosed**—applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered**—for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for assistance in pricing and lead time.*

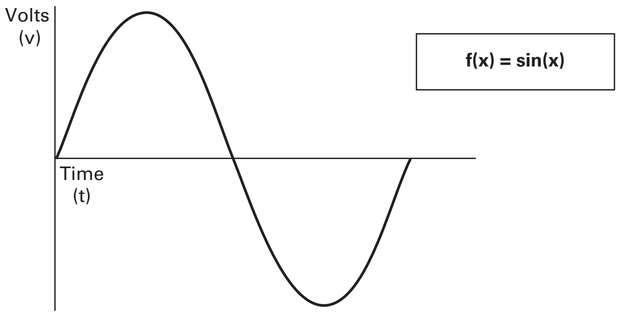
Application Description

Designed to meet the IEEE® 519-1992 requirements for harmonic distortion, the CFX9000 is an excellent choice for small and midsize drives applications where harmonics are a concern.

What Are Harmonics?

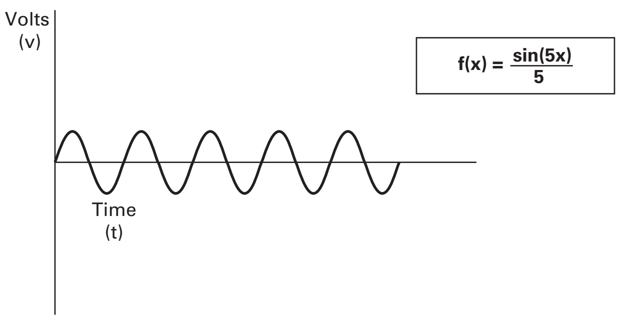
Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

Perfect Wave



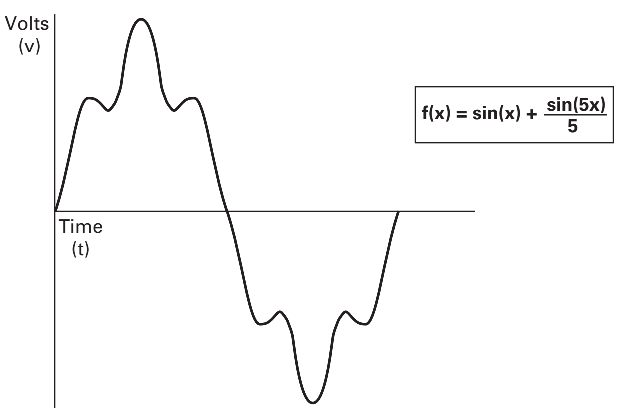
Add a second wave that is five times the fundamental frequency—300 Hz (typical of frequency added to the line by a fluorescent light).

Second Wave



Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

Resulting Supply



What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By applying drives from the Eaton Clean Power Drives Family; The HCX9000, CFX9000 and CPX9000.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

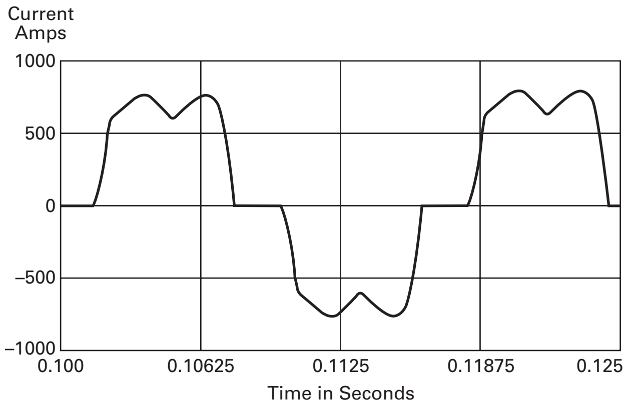
1. ***Installation and utility costs increase.*** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant (from 16.6–21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. ***Downtime and loss of productivity.*** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. ***Downtime and nuisance trips of drives and other equipment.*** Emergency generators have up to three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. ***Larger motors must be used.*** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. ***Higher installation costs.*** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

How Does a VFD Convert Three-Phase AC to a Variable Output Voltage and Frequency?

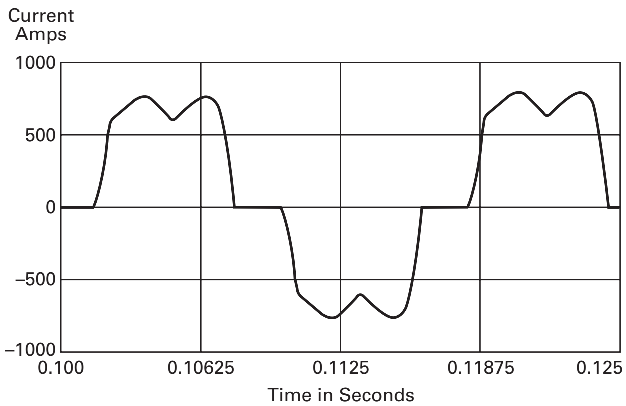
The six-pulse VFD: The majority of all conventional drives that are built consist of a six-pulse configuration. The figure below represents a six-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0–400 Hz.

The six-pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. The figure is a 100 hp drive with 45A of damaging harmonic current.

100 hp Six-Diode Rectifier Design



100 hp Six-Pulse Nonproductive Harmonic Current



Six-Pulse Nonproductive Harmonic Current

Six-Pulse Circuit		
Current harmonics		
I_1 = 100%	I_{11} = 6.10%	I_{19} = 1.77%
I_5 = 22.5%	I_{13} = 4.06%	I_{23} = 1.12%
I_7 = 9.38%	I_{17} = 2.26%	I_{25} = 0.86%
Power = 100 hp		
Harmonic current = 45 amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

	Harmonic Order (Odd Harmonics)					
Isc/I_L	h<11	11≤h<17	17≤h<23	23≤h<35	35≤h	TDD
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio Isc/I_L is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

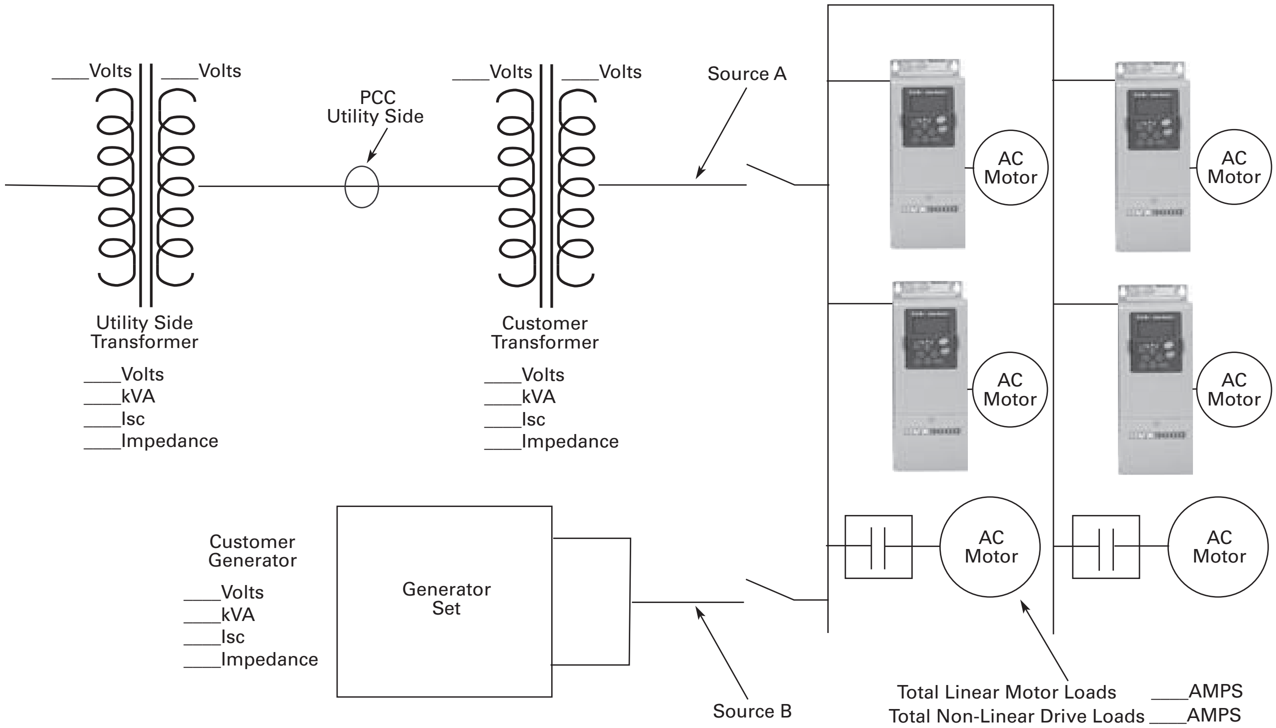
Notes

TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC. All of the limits are measured at a point of common coupling.

One-Line Diagram for Harmonic Analysis



The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The one line in this figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519
- POA (Point of Analysis) is defined as where the harmonic calculations are taken

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

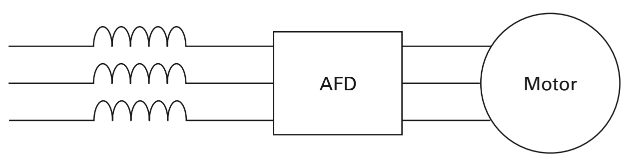
Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a three-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10–25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of percent impedance, most typically 1–1.5%, 3% and 5%.

Note: The 9000X drives come standard with a nominal 3% input impedance.

Line Reactor



Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of percent impedance
- Provides increased input protection for AFD and its semiconductors from line transients

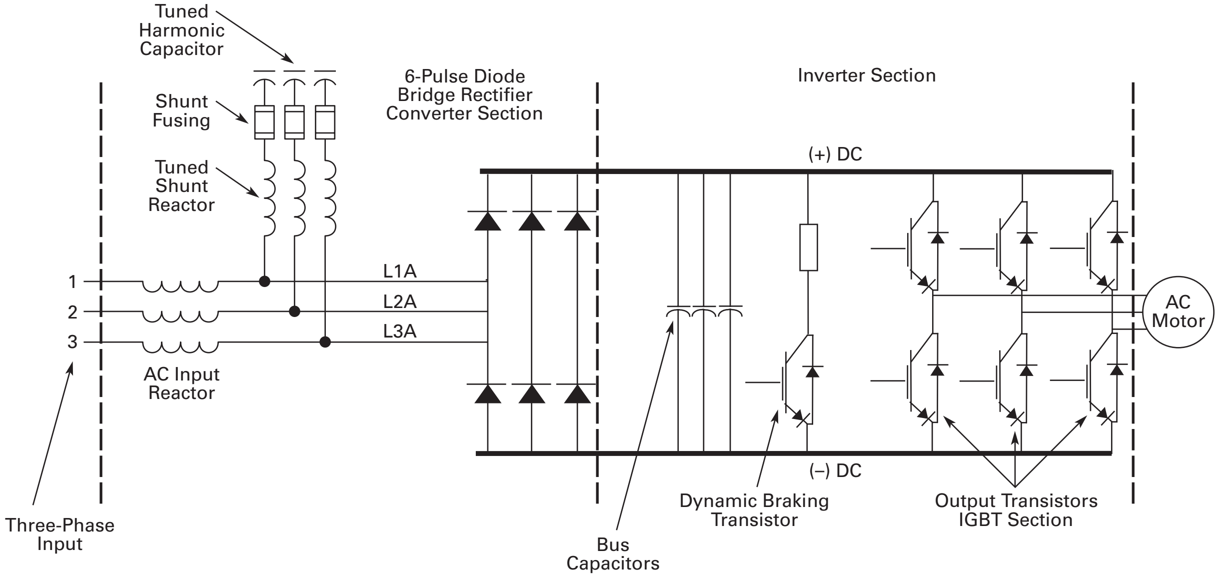
Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

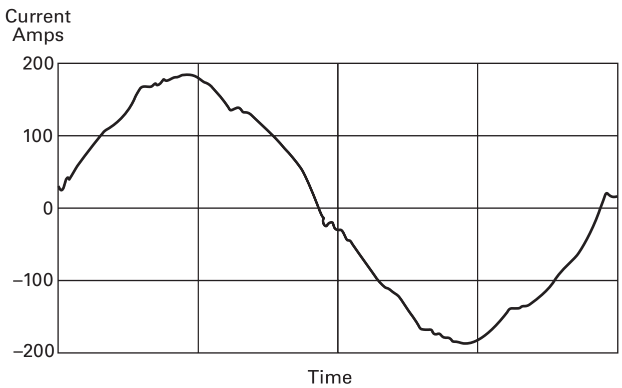
2. Passive Filters

Tuned harmonic filters involve the series connection of an inductor with the shunt connection of an inductor and capacitor to form a low impedance path to ground for a specific range of frequencies. This path presents an alternative to the flow of harmonic currents back into the utility source.

CFX9000 Drive with Integrated Passive Filter



100 hp CFX9000 480V Drive with Integrated Passive Filter



100 hp CFX9000 480V Drive with Integrated Passive Filter

Passive Filter		
Current harmonics		
I_1 = 100%	I_{11} = 0.24%	I_{19} = 0.50%
I_5 = 3.76%	I_{13} = 1.1%	I_{23} = 0.55%
I_7 = 1.65%	I_{17} = 0.80%	I_{25} = 0.80%
Power = 100 hp		
H_c = 8.6 Amps		

Advantages

- Low cost for smaller horsepower applications
- More effective harmonic attenuation than 12-pulse drives
- Provides increased input protection for AFD from line transients

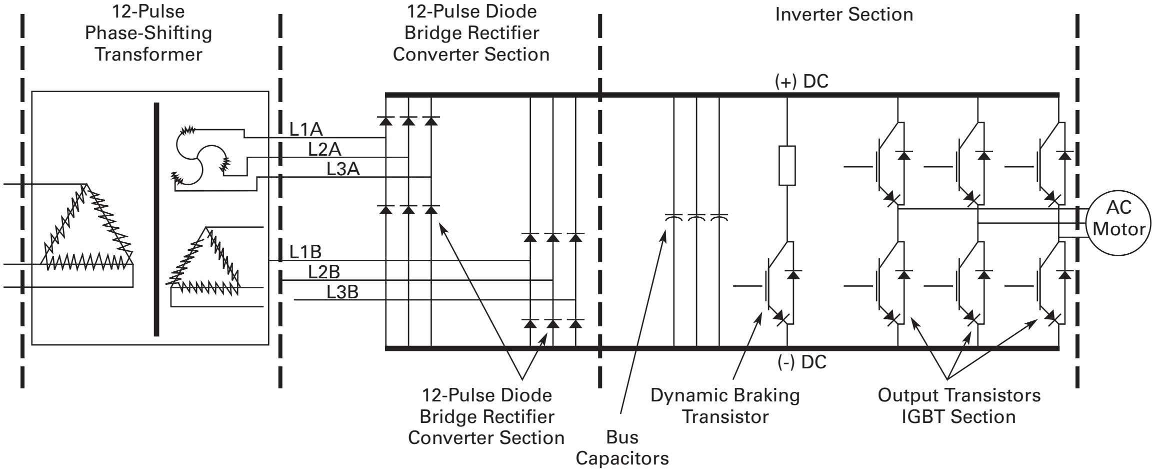
Disadvantages

- Capacitors age over time, unlike magnetics
- Not as effective as 18-pulse drives
- Challenging to retrofit with bypass applications

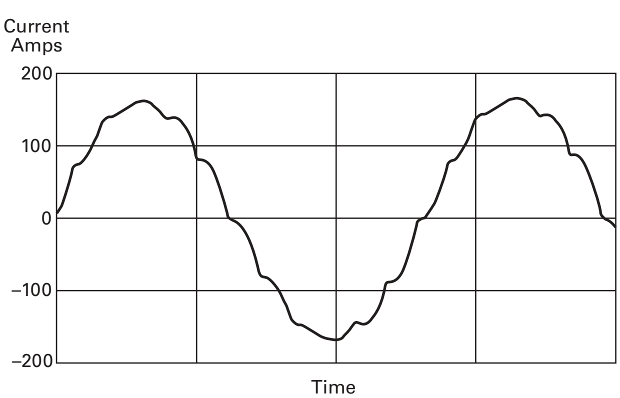
3. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately 85% reduction of harmonic current and voltage distortion may be achieved (over standard six-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

Basic 12-Pulse Rectifier with "Phase Shifting" Transformer



100 hp 480V Drive with 12-Pulse Rectifier



100 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit

Current harmonics		
I_1 = 100%	I_{11} = 4.19%	I_{19} = 0.06%
I_5 = 1.25%	I_{13} = 2.95%	I_{23} = 0.87%
I_7 = 0.48%	I_{17} = 0.21%	I_{25} = 0.73%
Power = 100 hp		
H_c = 20 Amps		

Advantages

- Reasonable cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

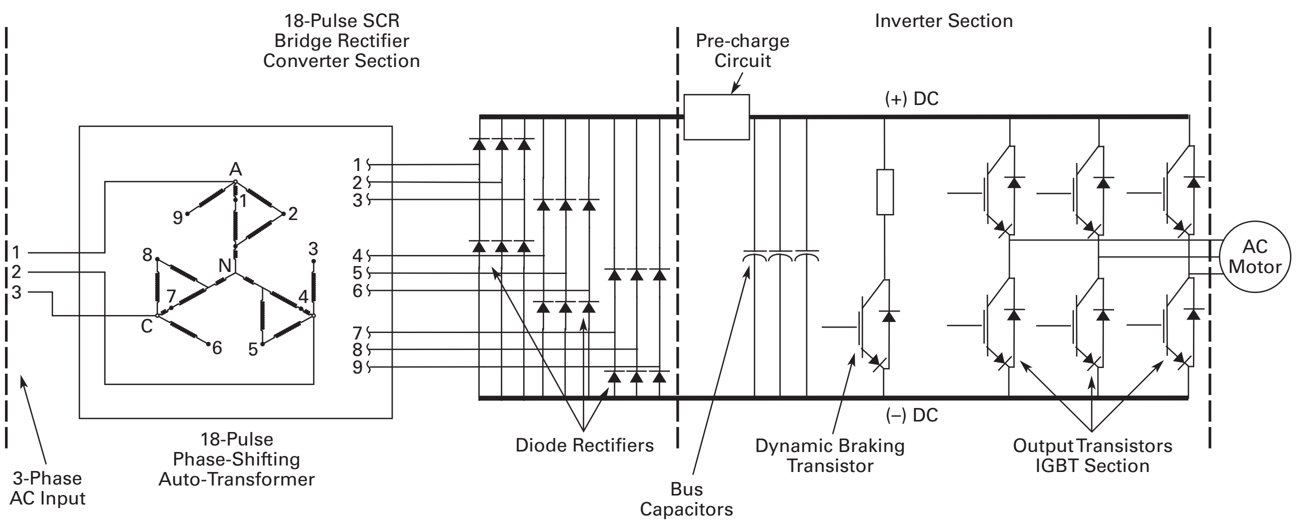
- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

4. Clean Power Drives

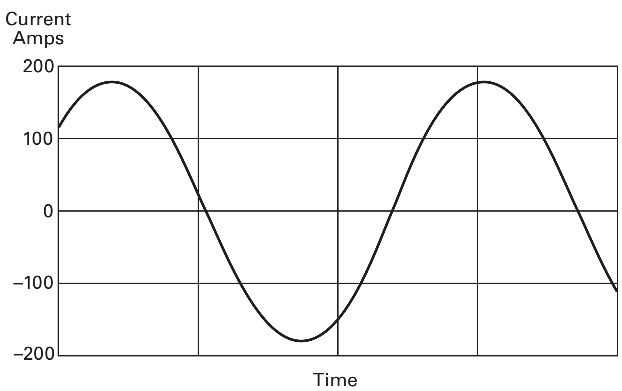
When the total load is comprised of non-linear load such as drives, and the ratio is I_{SC}/I_L, the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and "clean" such that system interference and additional losses are negligible. Eaton's CPX9000 clean power drive uses a phase-shifting auto-transformer with delta-connected winding that carries only the ampere-turns caused by the difference in load currents. This results in nine separate phases. In this type of configuration, the total kVA rating of the transformer magnetic system was only 48% that of the motor load. A traditional isolated transformer system, with multipulse windings, would require the full kVA rating to be supported, which is more common in an MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with six-pulse passive filter and 12-pulse systems are shown on **Pages V6-T2-161**, **V6-T2-163** and below.

Basic 18-Pulse Rectifier with Phase-Shifting Auto-Transformer



100 hp 480V Drive with 18-Pulse Rectifiers



100 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power

Current harmonics		
$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 1.00\%$
$I_5 = 0.16\%$	$I_{13} = 0.10\%$	$I_{23} = 0.01\%$
$I_7 = 0.03\%$	$I_{17} = 0.86\%$	$I_{25} = 0.01\%$
Power = 100 hp		
H_c = 5.9 Amps		

Advantages

- Effectively guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semiconductors from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter
- Minimizes ripple current in capacitors, doubling expected capacitor life

Disadvantages

- Not as cost effective as some other methods at small (<50) horsepower

Features and Benefits

New CFX9000 Integrated Filter Clean Power Drive features include (at 480V):

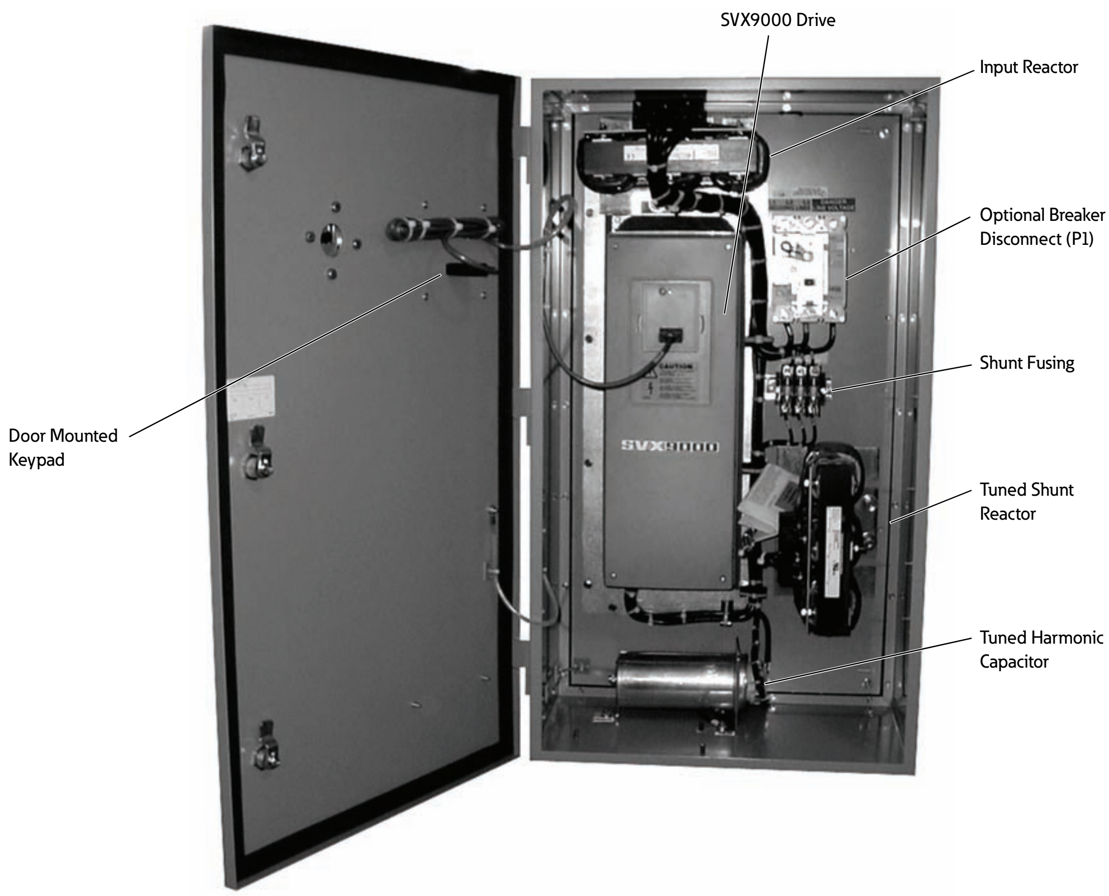
- UL Type 1, UL Type 12, UL Type 3R and NEMA 12 with gaskets and filters
- Input voltage: 480V, 230V, 575V
- Complete range of control, network and power options
- Horsepower range:
  - 480V, 7-1/2–400 hp I_L
  - 230V, 7-1/2–100 hp I_L; consult factory for details
  - 575V, 15–400 hp I_L; consult factory for details
- Single enclosure for both drive and filter reduces field wiring and enables convenient bypass installation
- Packaged solution ensures optimal coordination of drive and filter

Standards and Certifications

- UL
- cUL
- 508C

Product Identification

CFX9000 Drive—UL Type 12, 40 hp



Catalog Number Selection

CFX9000 Enclosed Drives

CFX 050 1 4 A A _ _ _ _ _ _ _ _ _ _

Build Alphabetically and Numerically

Product Family
CFX = Integrated filter clean power drive

Horsepower Rating		
007 = 7-1/2 hp	**040** = 40 hp	**150** = 150 hp
010 = 10 hp	**050** = 50 hp	**200** = 200 hp
015 = 15 hp	**060** = 60 hp	**250** = 250 hp
020 = 20 hp	**075** = 75 hp	**300** = 300 hp
025 = 25 hp	**100** = 100 hp	**350** = 350 hp
030 = 30 hp	**125** = 125 hp	**400** = 400 hp

Enclosure Rating
1 = UL Type 1
2 = UL Type 12
3 = UL Type 3R
6 = NEMA 12 filtered

Voltage Rating
1 = 208V
2 = 230V
4 = 480V
5 = 575V (575–600V)

Application—Torque/Braking [1]
A = I_L/no brake chopper
B = I_L/internal brake chopper
D = I_H/no brake chopper
E = I_H/internal brake chopper

Enclosed Style
A = Enclosed drive

Enclosed Options [2][3][4]		Type
K1	Door-mounted speed potentiometer [5]	Control
K2	Door-mounted speed potentiometer with HOA selector switch [5]	Control
K3	3–15 psig follower	Control
K4	HAND/OFF/AUTO switch (22 mm)	Control
K5	MANUAL/AUTO reference switch (22 mm)	Control
K6	START/STOP pushbuttons (22 mm)	Control
KF	Bypass test switch for RA and RB	Addl. bypass
KO	Standard elapsed time meter	Control
L1	Power, RUN and fault pilot lights	Light
L2	Bypass pilot lights for RA, RB, bypass options	Addl. bypass
LE	Red RUN light	Light
P1	Input circuit breaker	Input
P3	Input line fuses (200 kAIC)	Input
P7	Input power surge protection	Input
P8	TVSS surge protective device	Input
PE	Output contactor	Output
PF	Output filter	Output
PG	MotoRx (up to 600 ft) 1000 V/µS DV/DT filter	Output
PH	Single overload relay	Output
PI	Dual overload relays	Output
PN	Dual overloads for bypass	Addl. bypass
RA	Manual HOA bypass controller	Bypass
RB	Manual IOB bypass controller	Bypass
RC	Auto transfer HOA bypass controller	Bypass
RD	Auto transfer IOB bypass controller	Bypass
RG	Reduced voltage starter for bypass	Bypass
S4	Floor stand 6 in	Enclosure
S5	Floor stand 22 in	Enclosure
S6	Floor stand 12 in	Enclosure
S9	Space heater	Enclosure

Communication Options [6]	
C2 = Modbus	**C8** = Modbus (D9 type connector)
C3 = Profibus DP	**CA** = Johnson Controls N2
C4 = LonWorks	**CI** = Modbus TCP/Ethernet IP
C5 = Profibus DP (D9 Connector)	**CJ** = BACnet
C6 = CanOpen (Slave)	**D3** = RS-232 with D9 connection
C7 = DeviceNet	

Control Options
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input

Engineered Options	
HT	High temperature rating for 50°C [7]
VB	Varnished boards

Notes

[1] Brake chopper is standard in 208V, 230V and 480V drives up to FR6; optional in all other drives.
[2] Local/remote keypad is included as the standard control panel.
[3] Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
[4] See **Pages V6-T2-177** and **V6-T2-178** for complete descriptions.
[5] Includes local/remote speed reference switch.
[6] See **Pages V6-T2-175** and **V6-T2-176** for complete descriptions.
[7] Consult Eaton for availability.

Product Selection

When Ordering

- Select a base catalog number that meets the application requirements—nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.
- The CFX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating. The older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in the following table.

Ambient Temperature Ratings

Enclosure Size	I_H	I_L
B, C, 9 ①	40°C	40°C
7, 8	50°C	50°C

- If dynamic brake chopper or control/communication option is desired, change the appropriate code in the base catalog number.
- All of the programming is exactly the same as the standard SVX9000 drive.
- Select enclosed options. Add the codes as suffixes to the base catalog number in alphabetical and numeric order.

Note

① For high temperature rating, select HT option code and contact factory.

208V Drives

CFX9000 Drive

UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered

hp	NEC Current (A)	Chassis Frame	UL Type 1 Base Catalog Number	UL Type 12 and NEMA 12 Filtered Base Catalog Number	UL Type 3R Base Catalog Number
Low Overload Drive					
7-1/2	24.2	FR5	[1]	**CFX00721BA**	**CFX00731BA**
10	30.8	FR5	[1]	**CFX01021BA**	**CFX01031BA**
15	46.2	FR6	[1]	**CFX01521BA**	**CFX01531BA**
20	59.4	FR6	[1]	**CFX02021BA**	**CFX02031BA**
25	74.8	FR7	[1]	**CFX02521AA**	**CFX02531AA**
30	88	FR7	[1]	**CFX03021AA**	**CFX03031AA**
40	114	FR7	[1]	**CFX04021AA**	**CFX04031AA**
50	143	FR8	**CFX05011AA**	**CFX05061AA**	**CFX05031AA**
60	169	FR8	**CFX06011AA**	**CFX06061AA**	**CFX06031AA**
75	211	FR8	**CFX07511AA**	**CFX07561AA**	**CFX07531AA**
100	273	FR9	**CFX10011AA**	**CFX10061AA**	**CFX10031AA**
High Overload Drive					
7-1/2	24.2	FR5	[1]	**CFX00721EA**	**CFX00731EA**
10	30.8	FR6	[1]	**CFX01021EA**	**CFX01031EA**
15	46.2	FR6	[1]	**CFX01521EA**	**CFX01531EA**
20	59.4	FR7	[1]	**CFX02021DA**	**CFX02031DA**
25	74.8	FR7	[1]	**CFX02521DA**	**CFX02531DA**
30	88	FR7	[1]	**CFX03021DA**	**CFX03031DA**
40	114	FR8	**CFX04011DA**	**CFX04061DA**	**CFX04031DA**
50	143	FR8	**CFX05011DA**	**CFX05061DA**	**CFX05031DA**
60	169	FR8	**CFX06011DA**	**CFX06061DA**	**CFX06031DA**
75	211	FR9	**CFX07511DA**	**CFX07561DA**	**CFX07531DA**
100	273	FR9	**CFX10011DA**	**CFX10061DA**	**CFX10031DA**

CFX9000 Enclosure

Chassis Frame	UL Type 1 Disconnect Only	UL Type 1 With Power Options	UL Type 12 Disconnect Only	UL Type 12 With Power Options	UL Type 3R Disconnect Only	UL Type 3R With Power Options
FR4	N/A	N/A	B	C	B	C
FR5	N/A	N/A	B	C	B	C
FR6	N/A	N/A	B	C	B	C
FR7	N/A	7	C	7	C	D
FR8	7	7	7	7	F	F
FR9	8	8	8	8	F	F

Enclosure Dimension Drawings

Enclosure Size	UL Type 1 and UL Type 12	UL Type 3R
B	See **Page V6-T2-183**	See **Page V6-T2-185**
C	See **Page V6-T2-184**	See **Page V6-T2-186**
D	N/A	See **Page V6-T2-187**
F	N/A	See **Page V6-T2-188**
7 [2]	See **Page V6-T2-189**	[3]
8 [2]	See **Page V6-T2-190**	[3]
9	See **Page V6-T2-191**	[3]

Notes

[1] FR5–FR7 drives not available in UL Type 1.
[2] Enclosures 7 and 8 are NEMA 12 filtered.
[3] Not available for UL Type 3R.

230V Drives

CFX9000 Drive

UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered

hp	NEC Current (A)	Chassis Frame	UL Type 1 Base Catalog Number	UL Type 12 and NEMA 12 Filtered Base Catalog Number	UL Type 3R Base Catalog Number
Low Overload Drive					
7-1/2	22	FR5	①	**CFX00722BA**	**CFX00732BA**
10	28	FR5	①	**CFX01022BA**	**CFX01032BA**
15	42	FR6	①	**CFX01522BA**	**CFX01532BA**
20	54	FR6	①	**CFX02022BA**	**CFX02032BA**
25	68	FR7	①	**CFX02522AA**	**CFX02532AA**
30	80	FR7	①	**CFX03022AA**	**CFX03032AA**
40	104	FR7	①	**CFX04022AA**	**CFX04032AA**
50	130	FR8	**CFX05012AA**	**CFX05062AA**	**CFX05032AA**
60	154	FR8	**CFX06012AA**	**CFX06062AA**	**CFX06032AA**
75	192	FR8	**CFX07512AA**	**CFX07562AA**	**CFX07532AA**
100	248	FR9	**CFX10012AA**	**CFX10062AA**	**CFX10032AA**
High Overload Drive					
7-1/2	22	FR5	①	**CFX00722EA**	**CFX00732EA**
10	28	FR6	①	**CFX01022EA**	**CFX01032EA**
15	42	FR6	①	**CFX01522EA**	**CFX01532EA**
20	54	FR7	①	**CFX02022DA**	**CFX02032DA**
25	68	FR7	①	**CFX02522DA**	**CFX02532DA**
30	80	FR7	①	**CFX03022DA**	**CFX03032DA**
40	104	FR8	**CFX04012DA**	**CFX04062DA**	**CFX04032DA**
50	130	FR8	**CFX05012DA**	**CFX05062DA**	**CFX05032DA**
60	154	FR8	**CFX06012DA**	**CFX06062DA**	**CFX06032DA**
75	192	FR9	**CFX07512DA**	**CFX07562DA**	**CFX07532DA**
100	248	FR9	**CFX10012DA**	**CFX10062DA**	**CFX10032DA**

CFX9000 Enclosure

Chassis Frame	UL Type 1 Disconnect Only	UL Type 1 With Power Options	UL Type 12 Disconnect Only	UL Type 12 With Power Options	UL Type 3R Disconnect Only	UL Type 3R With Power Options
FR4	N/A	N/A	B	C	B	C
FR5	N/A	N/A	B	C	B	C
FR6	N/A	N/A	B	C	B	C
FR7	N/A	7	C	7	C	D
FR8	7	7	7	7	F	F
FR9	8	8	8	8	F	F

Enclosure Dimension Drawings

Enclosure Size	UL Type 1 and UL Type 12	UL Type 3R
B	See **Page V6-T2-183**	See **Page V6-T2-185**
C	See **Page V6-T2-184**	See **Page V6-T2-186**
D	N/A	See **Page V6-T2-187**
F	N/A	See **Page V6-T2-188**
7 ②	See **Page V6-T2-189**	③
8 ②	See **Page V6-T2-190**	③
9	See **Page V6-T2-191**	③

Notes

① FR5–FR7 drives not available in UL Type 1.

② Enclosures 7 and 8 are NEMA 12 filtered.

③ Not available for UL Type 3R.

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480V Drives

CFX9000 Drive

CFX9000 Base Drive

hp	NEC Current (A)	Chassis Frame	UL Type 1 Base Catalog Number ①	UL Type 12 and NEMA 12 Filtered Base Catalog Number ①	UL Type 3R Base Catalog Number ①
Low Overload Drive					
7-1/2	11	FR4	②	**CFX00724BA**	**CFX00734BA**
10	14	FR5	②	**CFX01024BA**	**CFX01034BA**
15	21	FR5	②	**CFX01524BA**	**CFX01534BA**
20	27	FR5	②	**CFX02024BA**	**CFX02034BA**
25	34	FR6	②	**CFX02524BA**	**CFX02534BA**
30	40	FR6	②	**CFX03024BA**	**CFX03034BA**
40	52	FR6	②	**CFX04024BA**	**CFX04034BA**
50	65	FR7	**CFX05014AA** ③	**CFX05024AA**	**CFX05034AA**
60	77	FR7	**CFX06014AA** ③	**CFX06024AA**	**CFX06034AA**
75	96	FR7	**CFX07514AA** ③	**CFX07524AA**	**CFX07534AA**
100	124	FR8	**CFX10014AA**	**CFX10064AA**	**CFX10034AA**
125	156	FR8	**CFX12514AA**	**CFX12564AA**	**CFX12534AA**
150	180	FR8	**CFX15014AA**	**CFX15064AA**	**CFX15034AA**
200	240	FR9	**CFX20014AA**	**CFX20064AA**	**CFX20034AA**
250	302	FR9	**CFX25014AA**	**CFX25064AA**	**CFX25034AA**
300	361	FR10	**CFX30014AA**	**CFX30064AA**	④
350	414	FR10	**CFX35014AA**	**CFX35064AA**	④
400	477	FR10	**CFX40014AA**	**CFX40064AA**	④
High Overload Drive					
7-1/2	11	FR5	②	**CFX00724EA**	**CFX00734EA**
10	14	FR5	②	**CFX01024EA**	**CFX01034EA**
15	21	FR5	②	**CFX01524EA**	**CFX01534EA**
20	27	FR6	②	**CFX02024EA**	**CFX02034EA**
25	34	FR6	②	**CFX02524EA**	**CFX02534EA**
30	40	FR6	②	**CFX03024EA**	**CFX03034EA**
40	52	FR7	**CFX04014DA** ③	**CFX04024DA**	**CFX04034DA**
50	65	FR7	**CFX05014DA** ③	**CFX05024DA**	**CFX05034DA**
60	77	FR7	**CFX06014DA** ③	**CFX06024DA**	**CFX06034DA**
75	96	FR8	**CFX07514DA**	**CFX07564DA**	**CFX07534DA**
100	124	FR8	**CFX10014DA**	**CFX10064DA**	**CFX10034DA**
125	156	FR8	**CFX12514DA**	**CFX12564DA**	**CFX12534DA**
150	180	FR9	**CFX15014DA**	**CFX15064DA**	**CFX15034DA**
200	240	FR9	**CFX20014DA**	**CFX20064DA**	**CFX20034DA**
250	302	FR10	**CFX25014DA**	**CFX25064DA**	④
300	361	FR10	**CFX30014DA**	**CFX30064DA**	④
350	414	FR10	**CFX35014DA**	**CFX35064DA**	④

Notes

① The integrated filter clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
② FR4–FR6 drives not available in UL Type 1.
③ This catalog number is used only with power options.
④ Consult factory.

CFX9000 Enclosure

Chassis Frame	UL Type 1 Disconnect Only	UL Type 1 With Power Options	UL Type 12 Disconnect Only	UL Type 12 With Power Options	UL Type 3R Disconnect Only	UL Type 3R With Power Options
FR4	N/A	N/A	B	C	B	C
FR5	N/A	N/A	B	C	B	C
FR6	N/A	N/A	B	C	B	C
FR7	N/A	7	C	7	C	D
FR8	7	7	7	7	F	F
FR9	8	8	8	8	F	F
FR10	9	9	9	9	①	①

Enclosure Dimension Drawings

Enclosure Size	UL Type 1 and UL Type 12	UL Type 3R
B	See **Page V6-T2-183**	See **Page V6-T2-185**
C	See **Page V6-T2-184**	See **Page V6-T2-186**
D	N/A	See **Page V6-T2-187**
F	N/A	See **Page V6-T2-188**
7 ②	See **Page V6-T2-189**	③
8 ②	See **Page V6-T2-190**	③
9	See **Page V6-T2-191**	③

Notes

① Consult factory.
② Enclosures 7 and 8 are NEMA 12 filtered.
③ Not available for UL Type 3R.

575V Drives

CFX9000 Drive

UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered

hp	NEC Current (A)	Chassis Frame	UL Type 1 Base Catalog Number	UL Type 12 and NEMA 12 Filtered Base Catalog Number	UL Type 3R Base Catalog Number
Low Overload Drive					
15	17	FR6	①	**CFX01525AA**	**CFX01535AA**
20	22	FR6	①	**CFX02025AA**	**CFX02035AA**
25	27	FR6	①	**CFX02525AA**	**CFX02535AA**
30	32	FR6	①	**CFX03025AA**	**CFX03035AA**
40	41	FR7	①	**CFX04025AA**	**CFX04035AA**
50	52	FR7	①	**CFX05025AA**	**CFX05035AA**
60	62	FR8	**CFX06015AA**	**CFX06065AA**	**CFX06035AA**
75	77	FR8	**CFX07515AA**	**CFX07565AA**	**CFX07535AA**
100	99	FR8	**CFX10015AA**	**CFX10065AA**	**CFX10035AA**
125	125	FR9	**CFX12515AA**	**CFX12565AA**	**CFX12535AA**
150	144	FR9	**CFX15015AA**	**CFX15065AA**	**CFX15035AA**
200	192	FR9	**CFX20015AA**	**CFX20065AA**	**CFX20035AA**
250	242	FR10	**CFX25015AA**	**CFX25065AA**	②
300	289	FR10	**CFX30015AA**	**CFX30065AA**	②
400	382	FR10	**CFX40015AA**	**CFX40065AA**	②
High Overload Drive					
10	14	FR6	①	**CFX01025DA**	**CFX01035DA**
15	17	FR6	①	**CFX01525DA**	**CFX01535DA**
20	22	FR6	①	**CFX02025DA**	**CFX02035DA**
25	27	FR6	①	**CFX02525DA**	**CFX02535DA**
30	32	FR7	①	**CFX03025DA**	**CFX03035DA**
40	41	FR7	①	**CFX04025DA**	**CFX04035DA**
50	52	FR8	**CFX05015DA**	**CFX05065DA**	**CFX05035DA**
60	62	FR8	**CFX06015DA**	**CFX06065DA**	**CFX06035DA**
75	77	FR8	**CFX07515DA**	**CFX07565DA**	**CFX07535DA**
100	99	FR9	**CFX10015DA**	**CFX10065DA**	**CFX10035DA**
125	125	FR9	**CFX12515DA**	**CFX12565DA**	**CFX12535DA**
150	144	FR9	**CFX15015DA**	**CFX15065DA**	**CFX15035DA**
200	192	FR10	**CFX20015DA**	**CFX20065DA**	②
250	242	FR10	**CFX25015DA**	**CFX25065DA**	②
300	289	FR10	**CFX30015DA**	**CFX30065DA**	②

Notes

① FR6–FR7 drives not available in UL Type 1.

② Consult factory.

CFX9000 Enclosure

Chassis Frame	UL Type 1 Disconnect Only	UL Type 1 With Power Options	UL Type 12 Disconnect Only	UL Type 12 With Power Options	UL Type 3R Disconnect Only	UL Type 3R With Power Options
FR6	N/A	N/A	B	C	B	C
FR7	N/A	7	C	7	C	D
FR8	7	7	7	7	F	F
FR9	8	8	8	8	F	F
FR10	9	9	9	9	①	①

Enclosure Dimension Drawings

Enclosure Size	UL Type 1 and UL Type 12	UL Type 3R
B	See **Page V6-T2-183**	See **Page V6-T2-185**
C	See **Page V6-T2-184**	See **Page V6-T2-186**
D	N/A	See **Page V6-T2-187**
F	N/A	See **Page V6-T2-188**
7 ②	See **Page V6-T2-189**	③
8 ②	See **Page V6-T2-190**	③
9	See **Page V6-T2-191**	③

Notes

① Consult factory.
② Enclosures 7 and 8 are NEMA 12 filtered.
③ Not available for UL Type 3R.

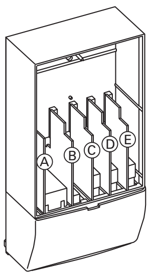
Options

CFX9000 Series Option Board Kits

The CFX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The CFX9000 Series factory-installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC/NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/ext +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
6 DI	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC/NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated)	B, C, **D**, E	**OPTB4**	**B4**	■	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
3 Pt100 RTD board	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	■	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	■	■	■	■	■	■	■
PROFIBUS DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CANopen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO® 11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 as/m. 120 ohm line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory-installed option and as a field-installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks using Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 to 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol," the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Control/Communication Option Descriptions

Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer**—Provides the drive with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch**—Provides the drive with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K3	**3–15 psig Follower**—Provides a pneumatic transducer which converts a 3–15 psig pneumatic signal to either 0–8 Vdc or a 1–9 Vdc signal interface with the drive. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft (1.8m) of flexible tubing and a 1/4 in (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-Bypass Configurations**—Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.	Control
K5	**MANUAL/AUTO Speed Reference Switch**—Provides door-mounted selector switch for MANUAL/AUTO speed reference.	Control
K6	**START/STOP Pushbuttons**—Provide door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	**Bypass Test Switch for RB and RA**—Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. bypass
KO	**Standard Elapsed Time Meter**—Provides a door-mounted elapsed run time meter.	Control
L1	**Power On, Run and Fault Lights**—Provide a white power on light that indicates power to the enclosed cabinets, a green run light and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options**—A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. bypass
LE	**Red Run Pilot Light (22 mm)**—Provides a red run pilot light that indicates the drive is running.	Light
P1	**Input Circuit Breaker**—High interrupting circuit breaker that provides a means of short-circuit protection for the power cables between it and the CPX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the CPX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure. Standard rating is 65 kAIC at 208/480V. 100 kAIC is available as an option.	Input
P3	**Input Line Fuses Rated to 200 kAIC**—Provide high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	**MOV Surge Suppressor**—Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	**TVSS Surge Protective Device with 50 kA Rating**—Provides transient voltage protection eliminating surges and spikes which can damage the diode bridge of the drive.	Input
PC	**Capacitor Contactor**—This option provides a contactor between the tuned reactor and capacitor to disconnect the capacitor from the circuit when desired, typically at light or no load conditions. This contactor is wired to a programmable relay output.	Input
PE	**Output Contactor**—Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NO auxiliary contacts rated at 10A, 600 Vac are provided for customer use. Bypass options **RB** and **RA** include an output contactor as standard. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter**—Used to reduce the transient voltage (DV/DT) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30m) or for a drive rated at 525–690V. This option is mounted in the enclosure, and may be used in conjunction with a brake chopper circuit.	Output
PG	**MotoRx (300–600 ft) 1000 V/µS DV/DT Filter**—Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the output filter (see option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300–600 ft (91–183m). *This option cannot be used with the brake chopper circuit. The output filter (option **PF**) should be investigated as an alternative.*	Output
PH	**Single Overload Relay**—Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the bypass configurations for overload current protection in the bypass mode. The overload relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	**Dual Overload Relays**—This option is recommended when a single drive is operating two motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass**—This option is recommended when a single drive is operating two motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. bypass

Available Control/Communications Options, continued

Option	Description	Option Type
RA	**Manual HOA Bypass Controller**—The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the CFX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-182**).	Bypass
RB	**Manual IOB Bypass Controller**—The manual INVERTER/OFF/BYPASS (IOB)—three-contactor—bypass option provides a means of bypassing the CFX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted IOB selector switch. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-182**).	Bypass
RC	**Auto Transfer HOA Bypass Controller** —The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the CFX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-182**). Door-mounted pilot lights are provided that indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller**—The auto INVERTER/OFF/BYPASS (IOB)—three-contactor—bypass option provides a means of bypassing the CFX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted IOB selector switch. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-182**). Door-mounted pilot lights are provided that indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	**Reduced Voltage Starter for Bypass**—Used in conjunction with bypass option RA, RB, RC or RD. This option adds ***IT.*** Series reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S4	**Floor Stand 6 in**—Raises “F” box off the ground 6 in (152.4 mm). Recommended when box is not installed on an appropriate concrete pad.	Enclosure
S5	**Floor Stand 22 in**—Converts a Size B or C, normally wall mounted enclosure to a floor standing enclosure with a height of 22 in (558.8 mm).	Enclosure
S6	**Floor Stand 12 in**—Converts a Size C or D, normally wall mounted enclosure to a floor standing enclosure with a height of 12 in (304.8 mm).	Enclosure
S9	**Space Heater**—Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. Heater requires a customer supplied 115V remote supply source.	Enclosure

Enclosed Drive Options

Conformal (Varnished) Coating ①

Chassis Frame	Delivery Code	Chassis Frame	Delivery Code
FR6	FP	FR9	FP
FR7	FP	FR10	FP
FR8	FP	FR11	FP
—	—	FR12	FP

Light Options

Description	Catalog Number Suffix
Power on, run, fault LED lights (22 mm)	**L1**
Power on, fault LED lights (22 mm)	**L3**
Green LED run light (22 mm)	**LA**
Green LED stop light (22 mm)	**LD**
Red LED run light (22 mm)	**LE**
Red LED stop light (22 mm)	**LF**
Red LED fault light (22 mm)	**LG**
Power on white LED light (22 mm)	**LJ**
Miscellaneous LED light (22 mm)	**LU**

Control Options

Description	Catalog Number Suffix
Door-mounted speed potentiometer	**K1**
Door-mounted speed potentiometer with HOA selector switch	**K2**
3–15 psig follower	**K3**
HOA selector switch	**K4**
MANUAL/AUTO reference switch	**K5**
START-STOP pushbuttons	**K6**
Type D2 control relay	**SD**
On-delay relay	**SE**
Off-delay relay	**SF**
Additional terminal blocks per 4 points	**SD**

Note

① See catalog number description to order.

Bypass Control Options

Description	Catalog Number Suffix
Bypass test switch used with RA and RB	KF
Inverter/bypass pilot lights	L2

Meter Options

Description	Catalog Number Suffix
Standard elapsed time meter	KO
Frequency meter	KS
MP-3000 relay with URTD	KV
MP-3000 relay with URTD and CTs	KU

Enclosure Options

Enclosure Size	Catalog Number Suffix
Space Heater ①	
7	S9
8	S9
9	S9
B	S9
C	S9
D	S9
F	S9
Plastic Nameplate	
All	SN
Floor Stand/Enclosure Size	
6 in floor stand, size F	S4
22 in floor stand, size B and C	S5
12 in floor stand, size C and D	S6

208V Power Options, 7-1/2–100 hp

Description	Catalog Number Suffix
Input breaker	P1
Input line fusing	P2
Input line fuses 200 kAIC	P3
Output contactor	PE
Single overload relay	PH
Dual overload relays	PI
MOV	P7
50 kA surge protective device	P8
100 kA surge protective device	P9

230V Power Options, 7-1/2–125 hp

Description	Catalog Number Suffix
Input breaker	P1
Input line fusing	P2
Input line fuses 200 kAIC	P3
Output contactor	PE
Single overload relay	PH
Dual overload relays	PI
MOV	P7
50 kA surge protective device	P8
100 kA surge protective device	P9

480 and 575V Power Options, 7-1/2–400 hp

Description	Catalog Number Suffix
Input breaker	P1
Input line fusing	P2
Input line fuses 200 kAIC	P3
Output contactor	PE
Output filter	PF
MotoRx (300–600 ft) DV/DT filter	PG
Single overload relay	PH
Dual overload relays	PI
Input MOV	P7
50 kA surge protective device	P8
100 kA surge protective device	P9

208V Bypass Options, 7-1/2–100 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	RA
IOB bypass controller	RB
Auto transfer HOA bypass controller	RC
Auto transfer IOB bypass controller	RD
Reduced voltage starter for bypass	RG
Dual overloads for bypass	PN

230V Bypass Options, 7-1/2–125 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	RA
IOB bypass controller	RB
Auto transfer HOA bypass controller	RC
Auto transfer IOB bypass controller	RD
Reduced voltage starter for bypass	RG
Dual overloads for bypass	PN

480 and 575V Bypass Options, 7-1/2–400 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	RA
IOB bypass controller	RB
Auto transfer HOA bypass controller	RC
Auto transfer IOB bypass controller	RD
Reduced voltage starter for bypass	RG
Dual overloads for bypass	PN

Note

① Requires customer-supplied 115 Vac supply.

Technical Data and Specifications

CFX9000 Drives

Description	Specification
Primary Design Features	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input Voltage Base
Output frequency range	0–320 Hz
Initial output current (I_H)	250% for 2 seconds
Overload (1 minute [I_H/I_L])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL, 508C
Protection Features	
Incoming line fuses	Optional
AC input circuit disconnect	Optional
Phase rotation insensitive	Standard
EMI filter	Standard—FR6 thru FR9 ①
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard
Surge protective device	Optional

Description	Specification
Input/Output Interface Features	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA isolated	Configurable
4–20 mA differential	Configurable
3–15 psig	Optional
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Optional
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	2 relays Form C
Open collector outputs	1
Additional discrete outputs	Optional
Communications	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Ethernet IP/Modbus TCP	Optional
BACnet	Optional

Note

① The EMI filter is optional in FR10.

CFX9000 Drives, continued

Description	Specification
Performance Features	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional
DC braking	Standard
PID setpoint controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Standard Conditions for Application and Service	
Maximum operating ambient temperature	0 to 40°C, contact factory for 50°C ①
Storage temperature	–40 to 60°C
Humidity (maximum), non-condensing	95%
Altitude	100% load capacity (no derating) up to 3280 ft (1000m); 1% derating for each 328 ft (100m) above 3280 ft (1000m); max. 9842 ft (3000m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>96%
Power factor (displacement)	0.99

Standard I/O Specifications

Description	Specification
Six–digital input programmable	24V: "0" ≤10V, "1" ≥18V,R_i >5 kohms
Two–analog input configurable w/ jumpers	Voltage: 0–±10V, R_i >200 kohms Current: 0 (4)–20 mA, R_i = 250 kohms
Two–digital output programmable	Form C relays 250 Vac or 30 Vdc 2 Amp resistive
One–digital output programmable	Open collector 48 Vdc 50 mA
One–analog output programmable configurable w/jumper	0–20 mA, R_L max. 500 ohms 10 bits ±2%

I/O Specifications for Control/Communication Options

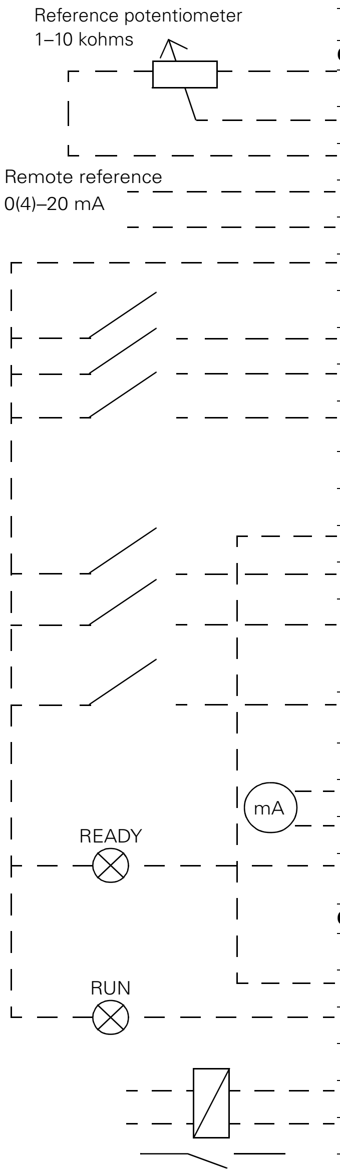
Description	Specification
Analog voltage, input	0–±10V, R_i ≥200 kilohms
Analog current, input	0 (4)–20 mA, R_i = 250 ohms
Digital input	24V: "0" ≤10V, "1" ≥18V, R_i >5 kilohms
Auxiliary voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R_L = 500 kilohms, resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10V, R_L ≥1 kohm, resolution 10 bit, accuracy ≤±2%
Relay output max. switching voltage	300 Vdc, 250 Vac
Relay output max. switching load	3A/24 Vdc, 300 Vdc, 250 Vac ②
Relay output max. continuous load	2A rms
Thermistor input	R_{trip} = 4.7 kohms

Notes

① Units FR10 rated 40°C.
② For applications above 3A consult instruction manual.

Wiring Diagram

Control Input/Output



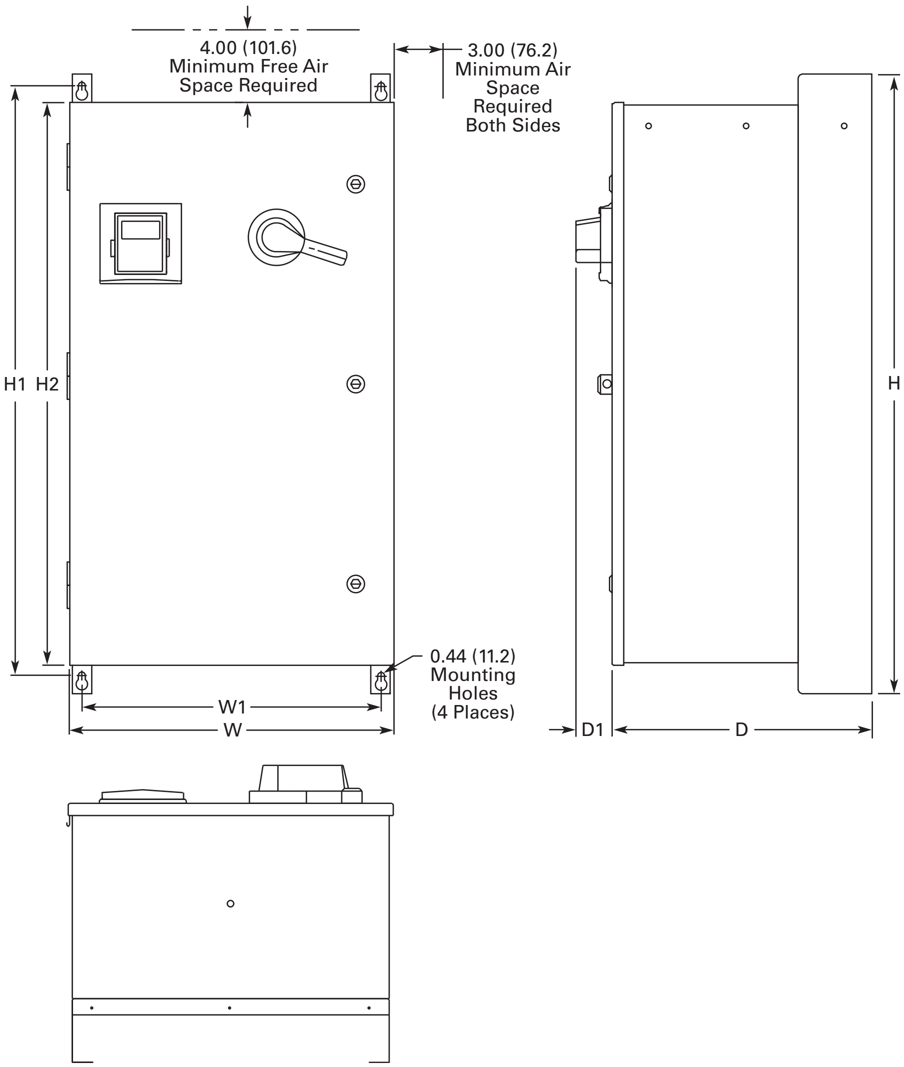
Basic Application Default I/O Configuration

Terminal		Signal	Description
OPTA9			
1	+10V$_{ref}$	Reference output	Voltage for potentiometer, etc.
2	AI1+	Analog input, voltage range 0–10 Vdc	Voltage input frequency reference
3	AI1–	I/O Ground	Ground for reference and controls
4	AI2+	Analog input, current range 0–20 mA	Current input frequency reference
5	AI2–		
6	+24V	Control voltage output	Voltage for switches, etc. max 0.1A
7	GND	I/O ground	Ground for reference and controls
8	DIN1	Start forward	Contact closed = start forward
9	DIN2	Start reverse	Contact closed = start reverse
10	DIN3	External fault input (programmable)	Contact open = no fault Contact closed = fault
11	CMA	Common for DIN 1–DIN 3	Connect to GND or +24V
12	+24V	Control voltage output	Voltage for switches (see terminal 6)
13	GND	I/O ground	Ground for reference and controls
14	DIN4	Multi-step speed select 1	**DIN4** / **DIN5** / **Frequency Ref.**
15	DIN5	Multi-step speed select 2	Open / Open / Ref.V$_{in}$ Closed / Open / Multi-step ref.1 Open / Closed / Multi-step ref.2 Closed / Closed / Ref$_{Max}$
16	DIN6	Fault reset	Contact open = no action Contact closed = fault reset
17	CMB	Common for DIN4–DIN6	Connect to GND or +24V
18	AO1+	Output frequency Analog output	Programmable Range 0–20 mA, R$_L$ max. 500 ohms
19	AO1–		
20	DO1	Digital output READY	Programmable Open collector, I ≤50 mA, V ≤48 Vdc
OPTA2			
21	RO1	Relay output 1 RUN	
22	RO1		
23	RO1		
24	RO2	Relay output 2 FAULT	
25	RO2		
26	RO2		

Dimensions

Approximate Dimensions in Inches (mm)

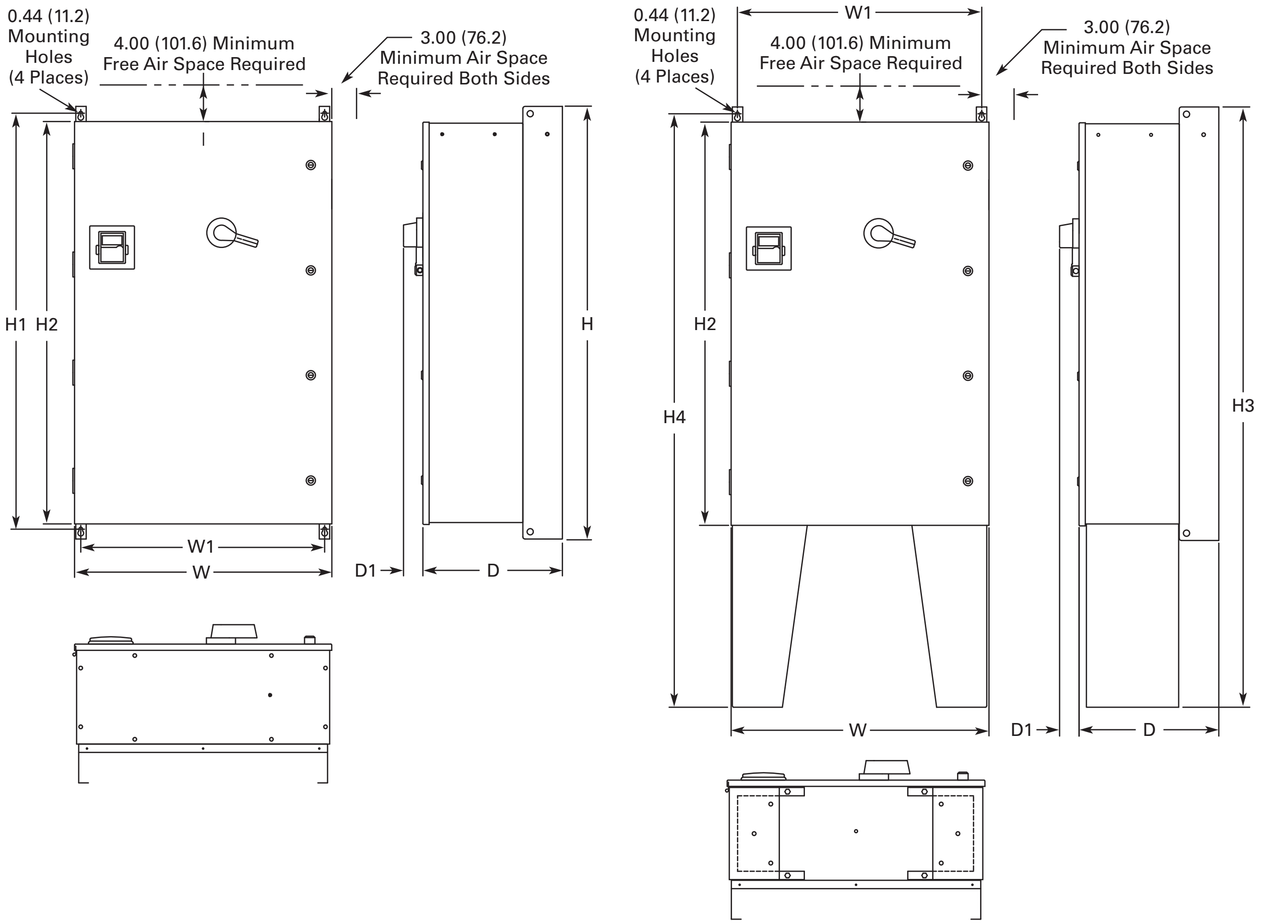
Enclosure Size B—UL Type 12



H	H1	H2	W	W1	D	D1	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)

Approximate Dimensions in Inches (mm)

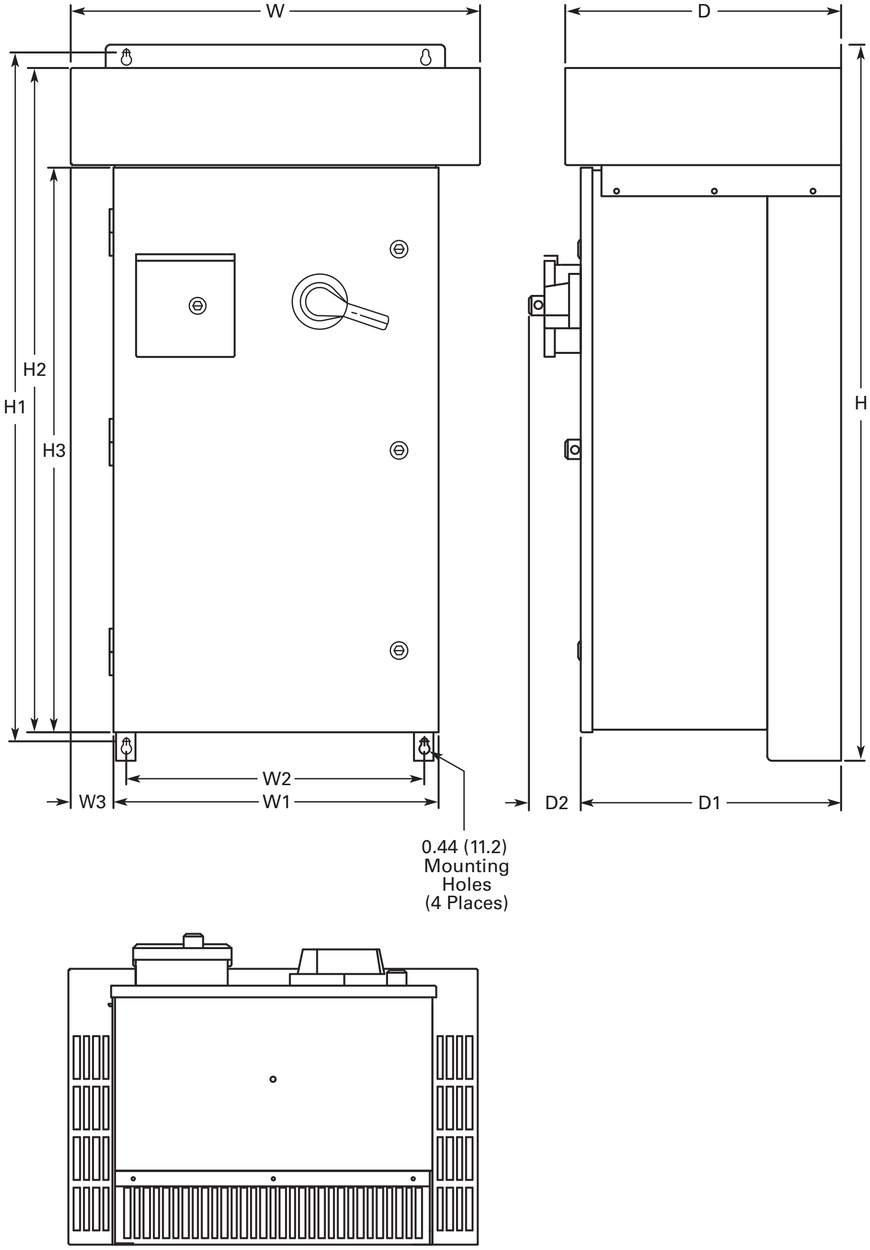
Enclosure Size C—UL Type 12



H	H1	H2	H3	H4	W	W1	D	D1	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	320 (145)	435 (197)

Approximate Dimensions in Inches (mm)

Enclosure Size B—UL Type 3R

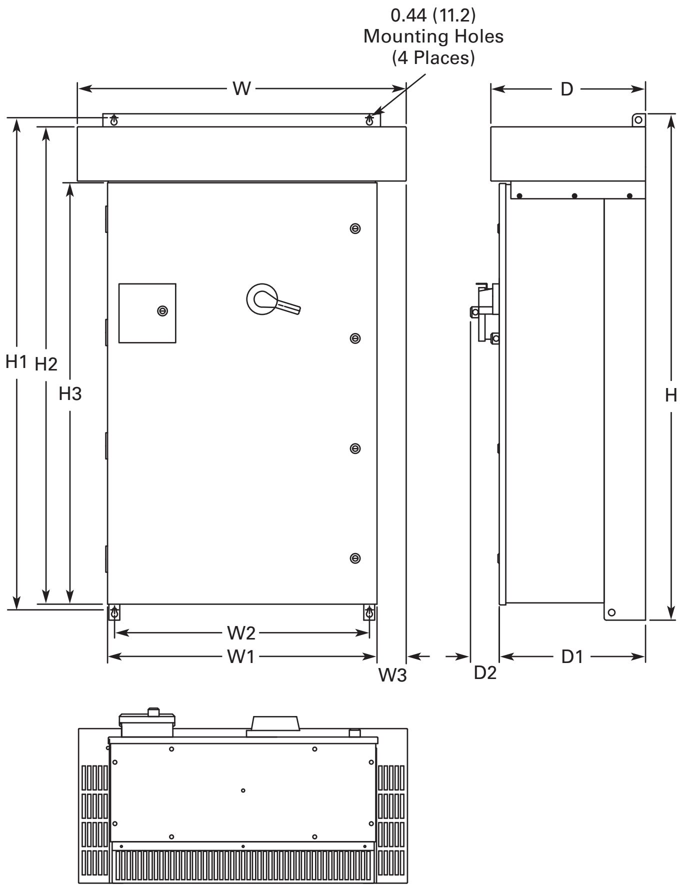


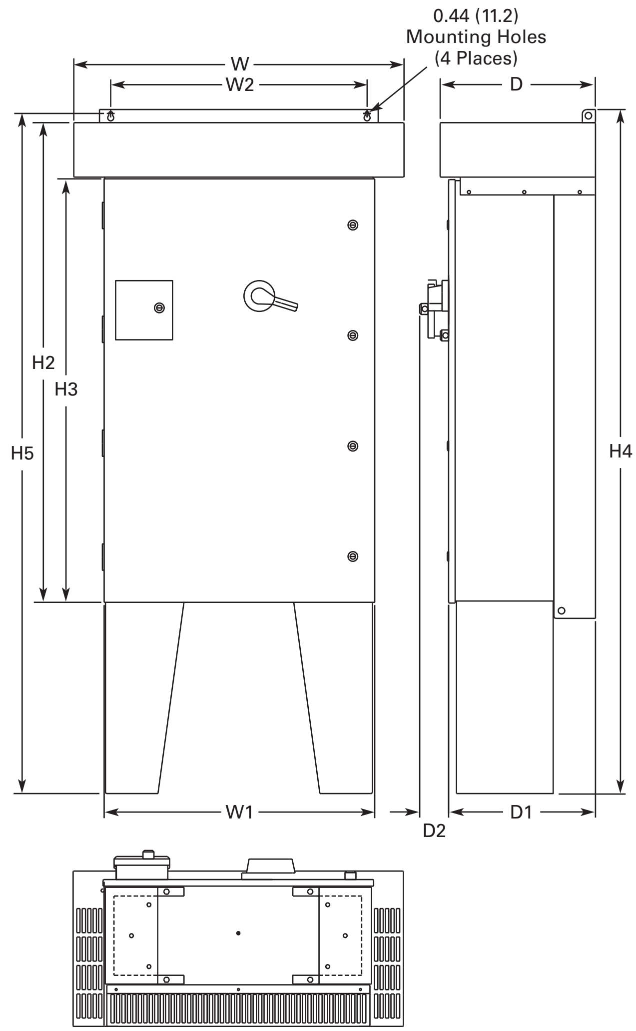
H	H1	H2	H3	W	W1	W2	W3	D	D1	D2	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (840.1)	235 (107)	290 (132)

2

Approximate Dimensions in Inches (mm)

Enclosure Size C—UL Type 3R

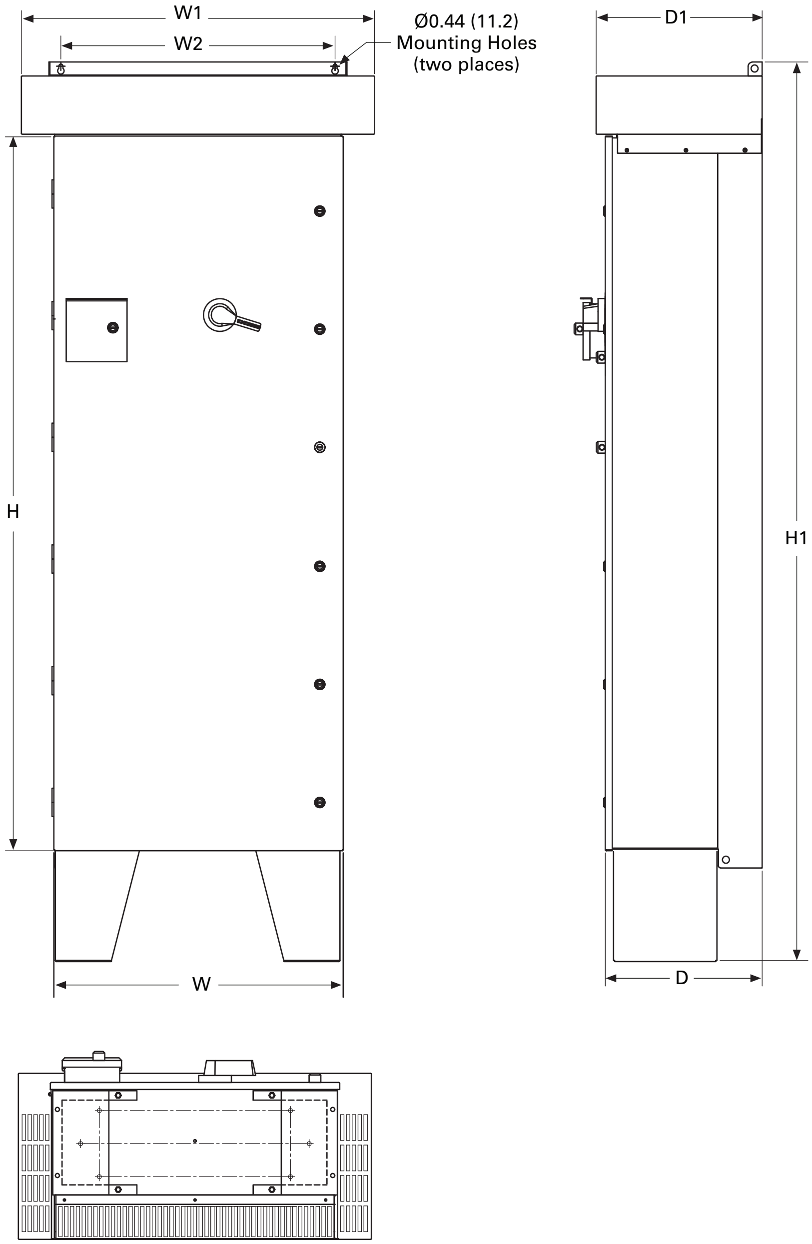




H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (840.1)	370 (168)	485 (220)

Approximate Dimensions in Inches (mm)

Enclosure Size D—UL Type 3R



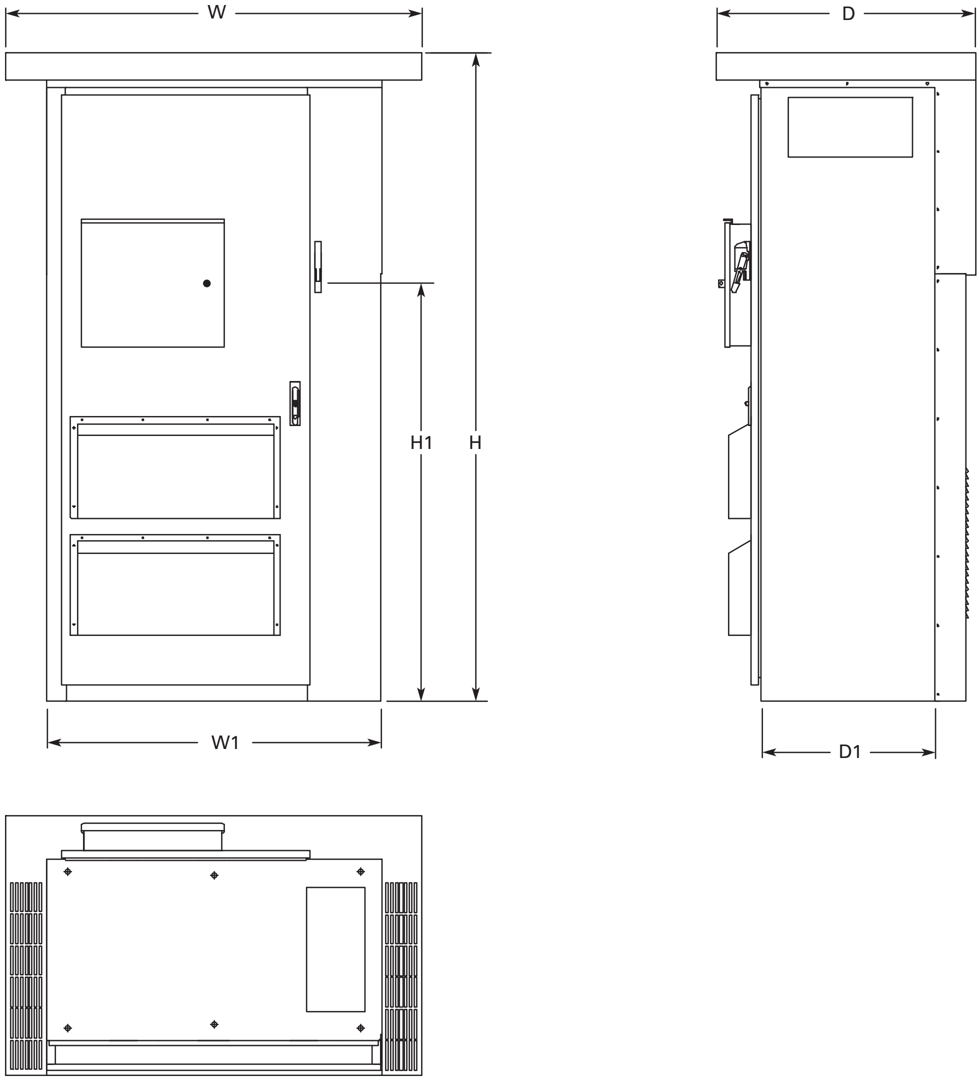
H	H1	W	W1	W2	D	D1	Approximate Shipping Weight Lbs (kg)
76.27 (1937.3)	96.00 (2438.4)	30.92 (784.4)	37.73 (958.3)	29.30 (744.2)	16.76 (424.7)	17.74 (450.6)	1000 (454)

Note

Shown with optional floor stands.

Approximate Dimensions in Inches (mm)

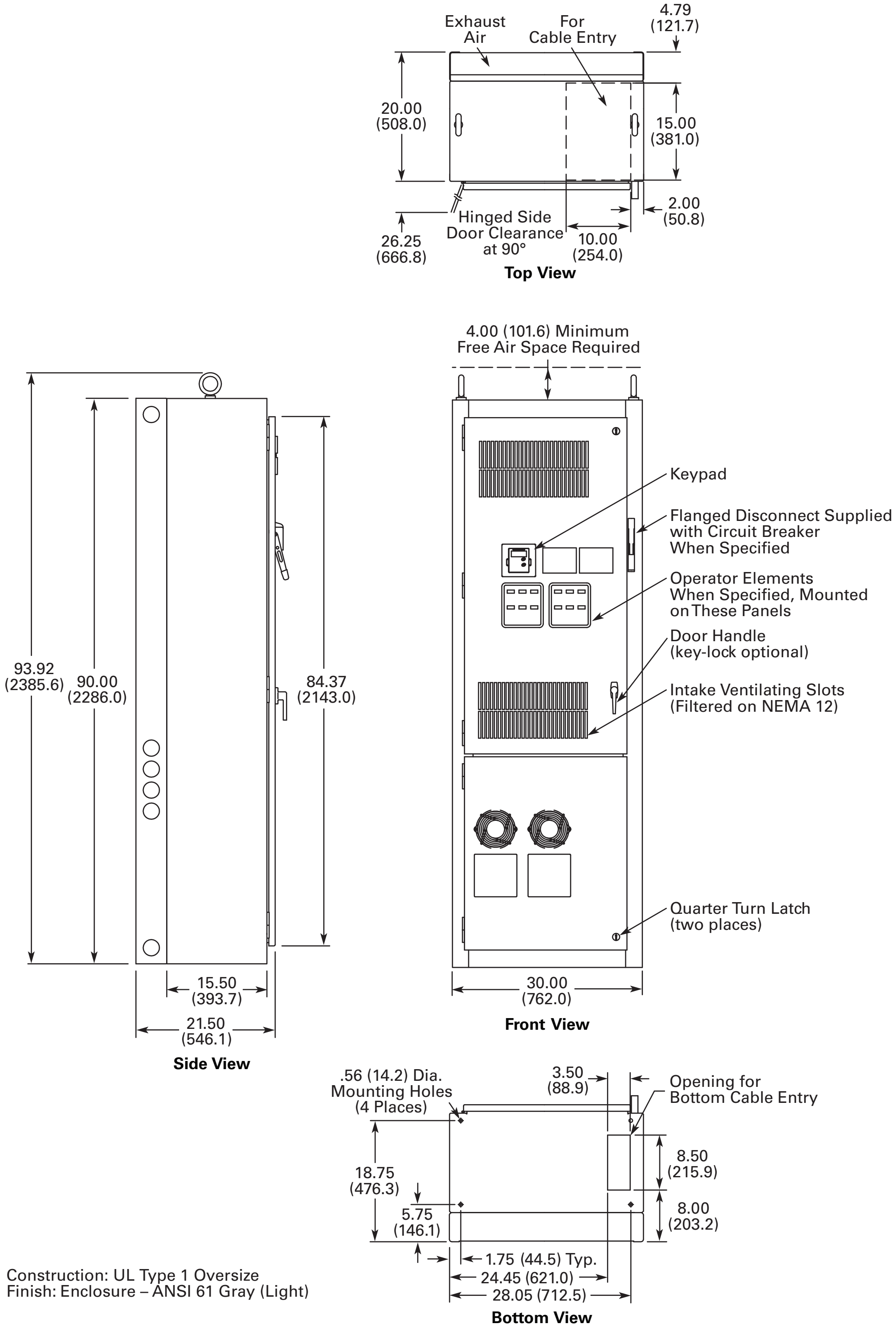
Enclosure Size F



H	H1	W	W1	D	D1	Approximate Weight Lbs (kg)	Approximate Shipping Weight Lbs (kg)
93.58 (2376.9)	69.51 (1765.60)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1700 (771)	1850 (839)

Approximate Dimensions in Inches (mm)

Enclosure Size 7

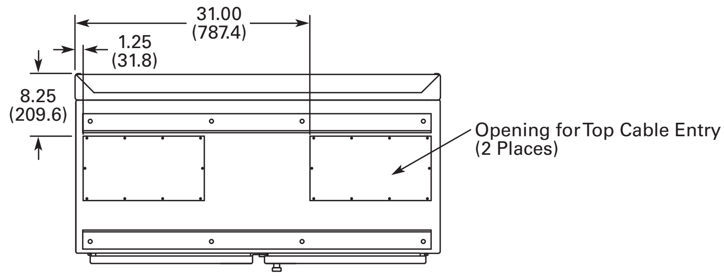


Construction: UL Type 1 Oversize
Finish: Enclosure – ANSI 61 Gray (Light)

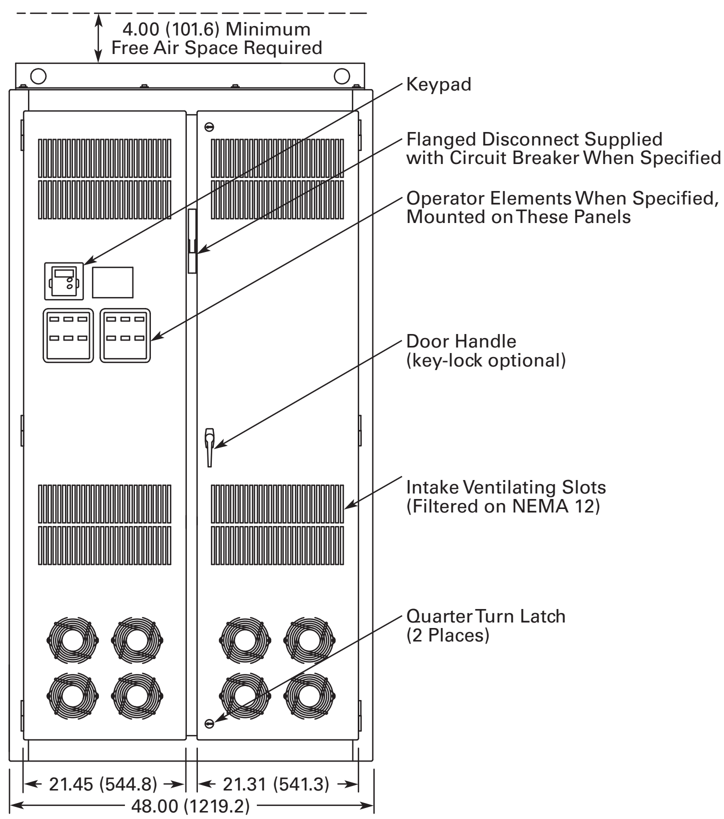
Approximate Shipping Weight Lbs (kg)
1000 (454)

Approximate Dimensions in Inches (mm)

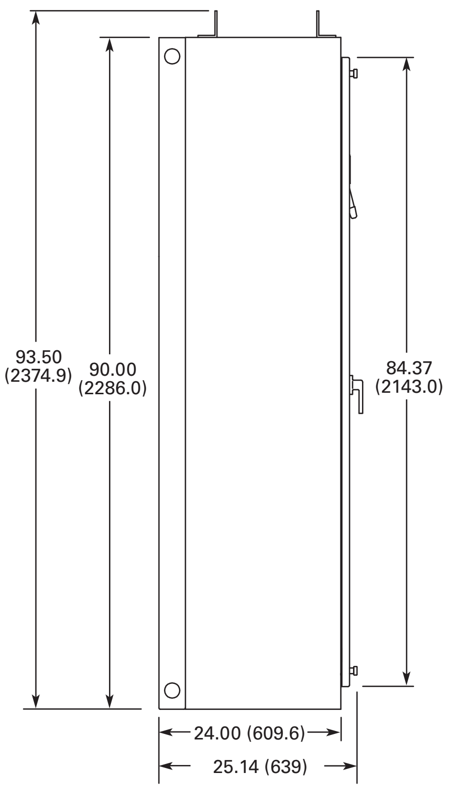
Enclosure Size 8



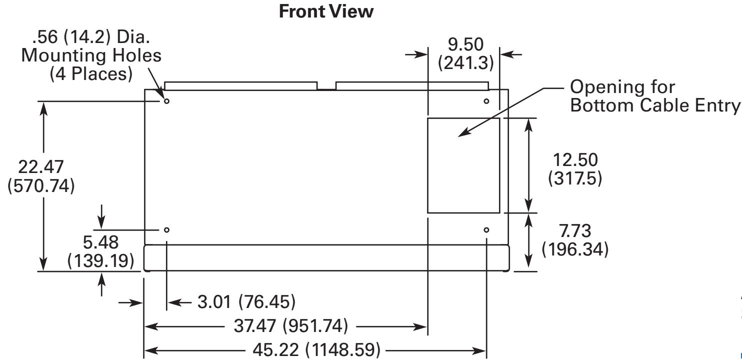
Top View



Front View



Side View



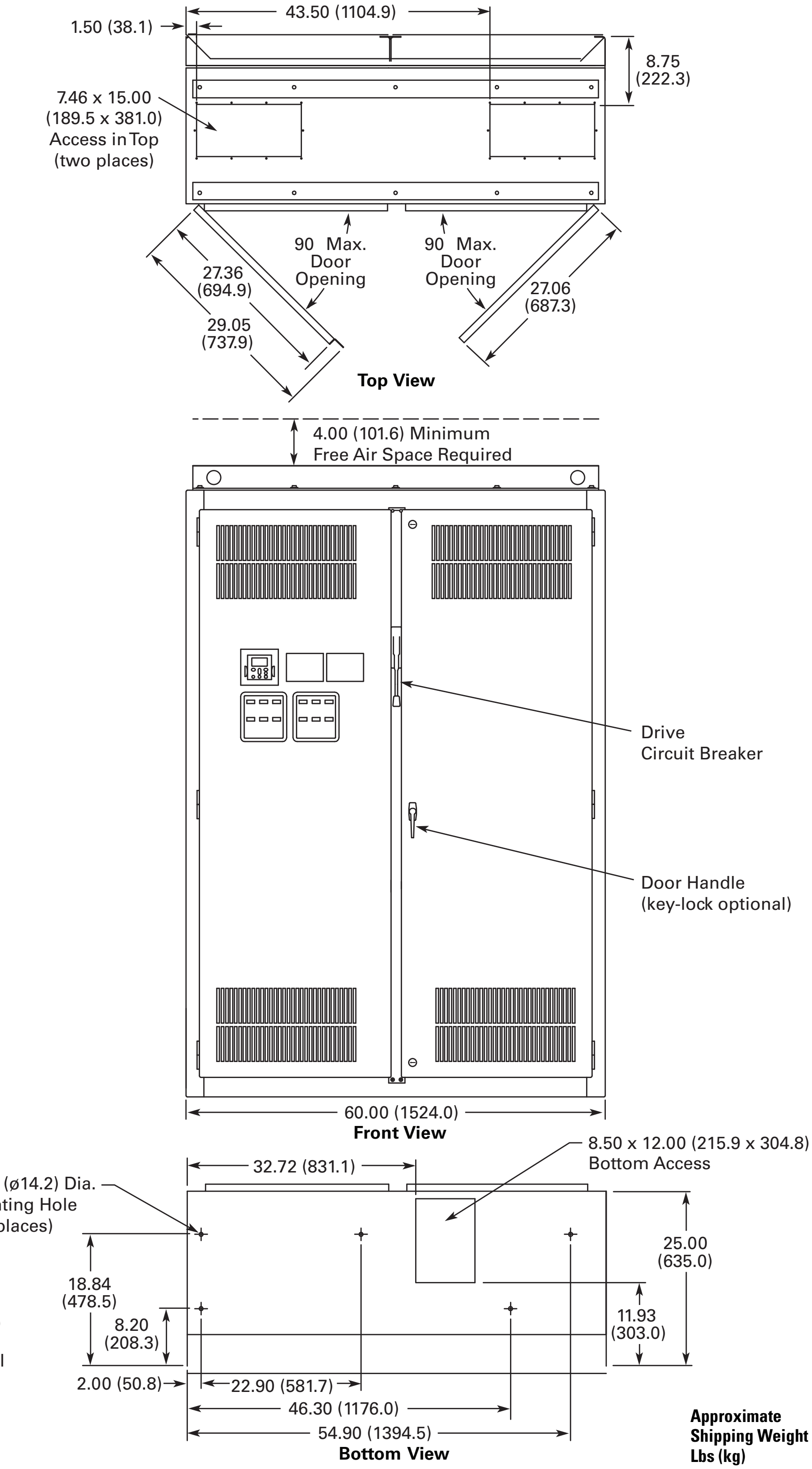
Bottom View

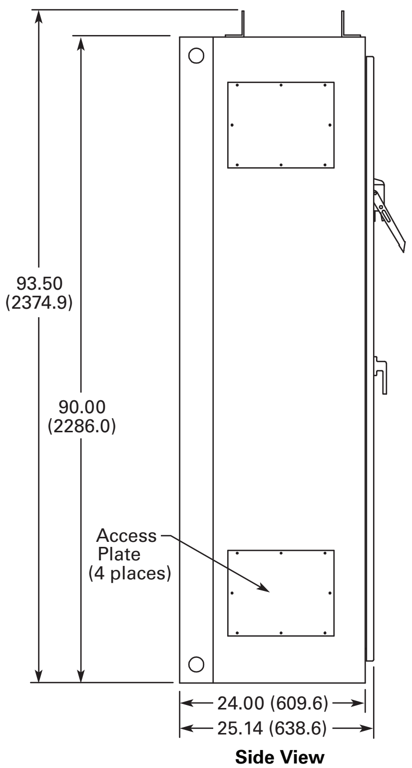
Construction: UL Type 1 Oversize
Finish: Enclosure – ANSI 61 Gray (Light)

Approximate Shipping Weight Lbs (kg)
1400 (636)

Approximate Dimensions in Inches (mm)

Enclosure Size 9





Finish: Enclosure—ANSI 61 Gray (light)
Material: Enclosure and Backplate—12 ga. = 0.1046 Cold Rolled Steel

Approximate Shipping Weight Lbs (kg)
1800 (817)

CPX9000 Enclosed Clean Power Drives

Contents

Product Description

Eaton's CPX9000 clean power drives use advanced 18-pulse clean power technology that significantly reduces line harmonics at the drive input terminals, resulting in one of the purest sinusoidal waveforms available.

The CPX9000 drive also delivers True Power Factor—in addition to reducing harmonic distortion, the CPX9000 drive prevents upstream transformer overheating and overloading of breakers and feeders, enabling the application of adjustable frequency drives on generators and other high impedance power systems.

All 9000X Series drives are constant torque rated and rated for either high overload (I_H) or low overload (I_L). I_H indicates 150% overload capacity for 1 minute out of 10 minutes. I_L indicates 110% overload capacity for 1 minute out of 10 minutes.

CPX9000 Enclosed Products

- **Standard Enclosed**—covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages V6-T2-199** and **V6-T2-208** to **V6-T2-213.**
- **Modified Standard Enclosed**—applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered**—for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for assistance in pricing and lead time.*

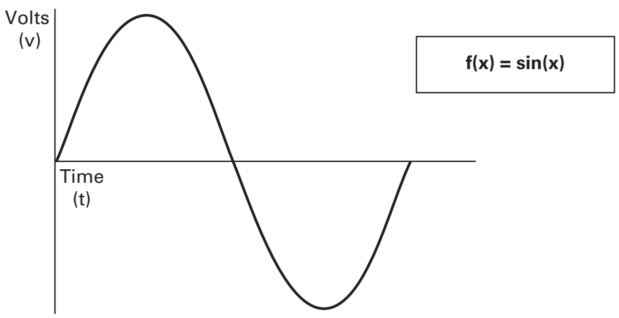
Application Description

Designed to exceed the IEEE® 519-1992 requirements for harmonic distortion, the CPX9000 is the clear choice for applications in the water, wastewater, HVAC, industrial and process industries where harmonics are a concern.

What Are Harmonics?

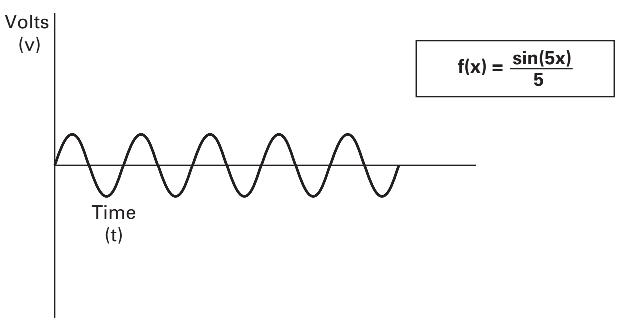
Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

Perfect Wave



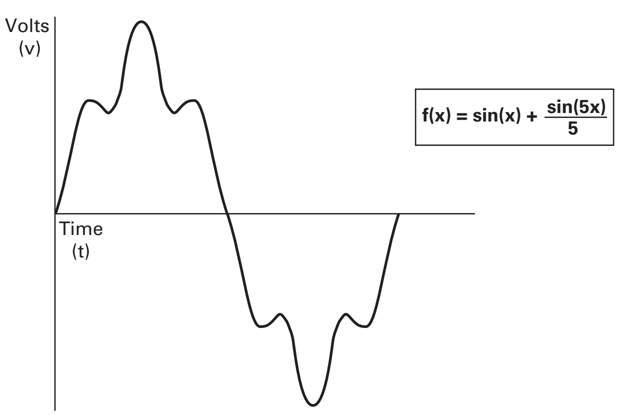
Add a second wave that is five times the fundamental frequency—300 Hz (typical of frequency added to the line by a fluorescent light).

Second Wave



Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

Resulting Supply



What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By purchasing Eaton's 18-pulse CPX9000 drive that is guaranteed to meet IEEE Std. 519-1992 Harmonic Distortion Limits.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications, there is a turn down valve used with the motor that will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

1. ***Installation and utility costs increase.*** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant and can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. ***Downtime and loss of productivity.*** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. ***Downtime and nuisance trips of drives and other equipment.*** Emergency generators have up to three times the impedance that is found in a conventional utility source. Thus the harmonic voltage distortion can be up to three times as large, causing risk of operation problems.
4. ***Larger motors must be used.*** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. ***Higher installation costs.*** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

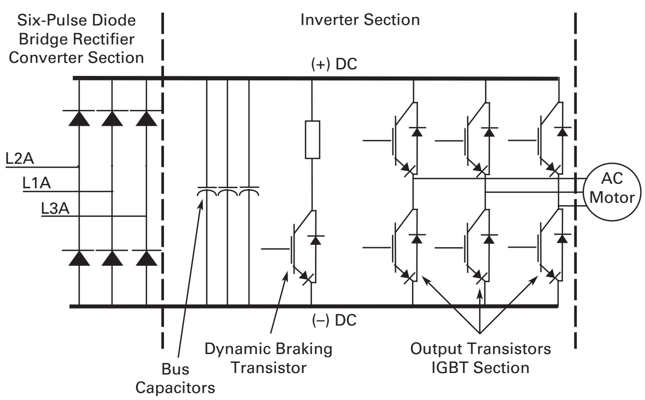
2

How Does a VFD Convert Three-Phase AC to a Variable Output Voltage and Frequency?

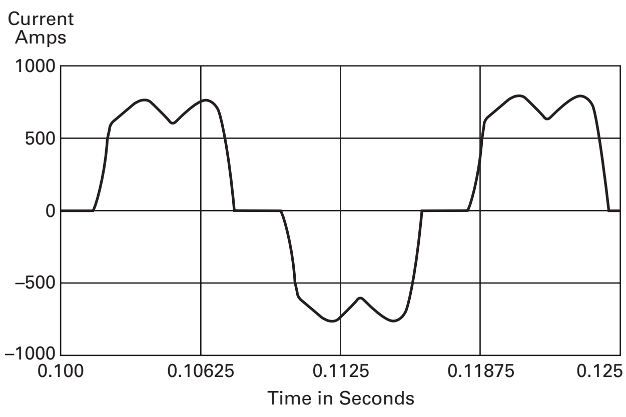
The six-pulse VFD: The majority of all conventional drives that are built consist of a six-pulse configuration. The figure below represents a six-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0–320 Hz.

The six-pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. See the curve below showing a 500 hp drive with 167A of damaging harmonic current.

Six-Diode Rectifier Design



500 hp Six-Pulse Nonproductive Harmonic Current



500 hp Six-Pulse Nonproductive Harmonic Current

Six-Pulse Circuit

Current harmonics		
I_1 = 100%	I_{11} = 6.10%	I_{19} = 1.77%
I_5 = 22.5%	I_{13} = 4.06%	I_{23} = 1.12%
I_7 = 9.38%	I_{17} = 2.26%	I_{25} = 0.86%
Power = 500 hp		
Harmonic current = 167 amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

	Harmonic Order (Odd Harmonics)					
I_{sc}/I_L	h<11	11≤h<17	17≤h<23	23≤h<35	35≤h	TDD
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio I_{sc}/I_L is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

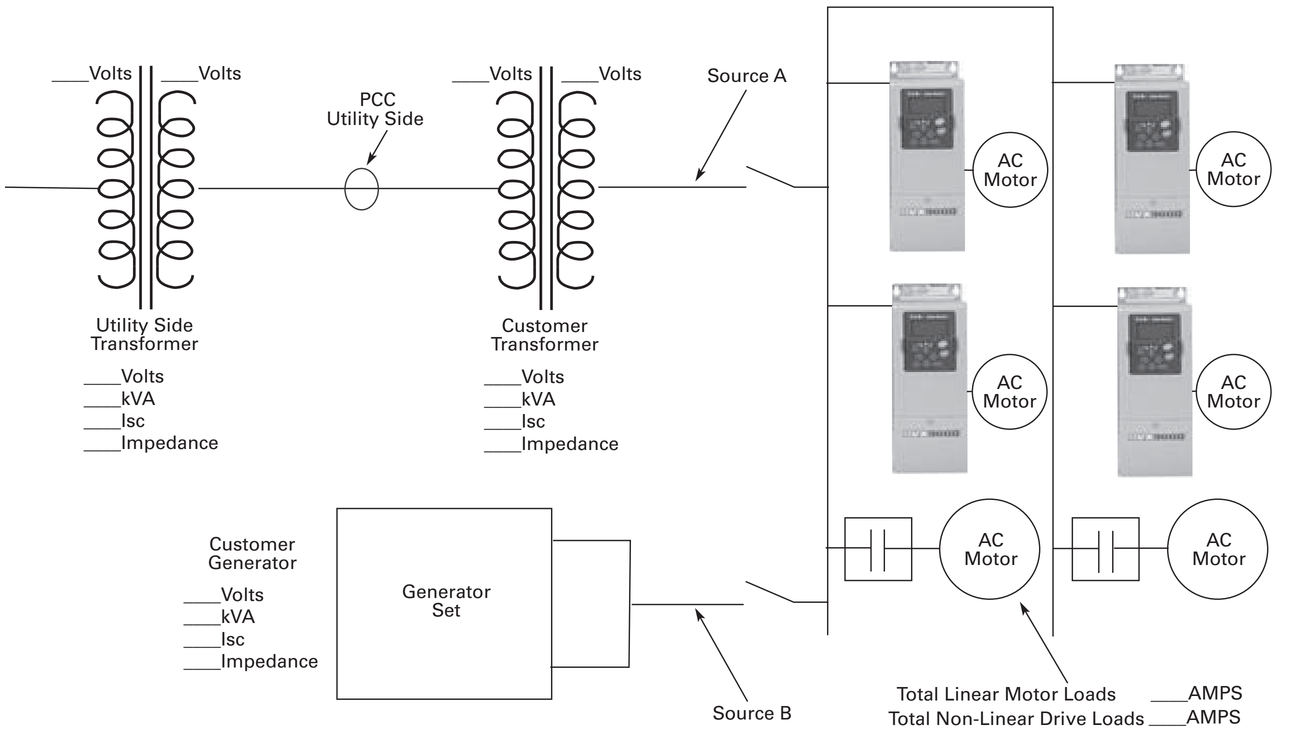
Notes

TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC. All of the limits are measured at a point of common coupling.

One-Line Diagram for Harmonic Analysis



The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The one-line in this figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519
- POA (Point of Analysis) is defined as where the harmonic calculations are taken

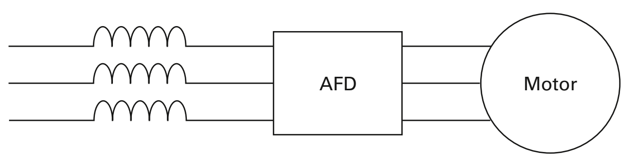
An oscilloscope can make all measurements at the PCC or POA do an on-site harmonic evaluation.

Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a three-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10–25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of impedance, most typically 1–1.5%, 3% and 5%.

Line Reactor



Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of impedance
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

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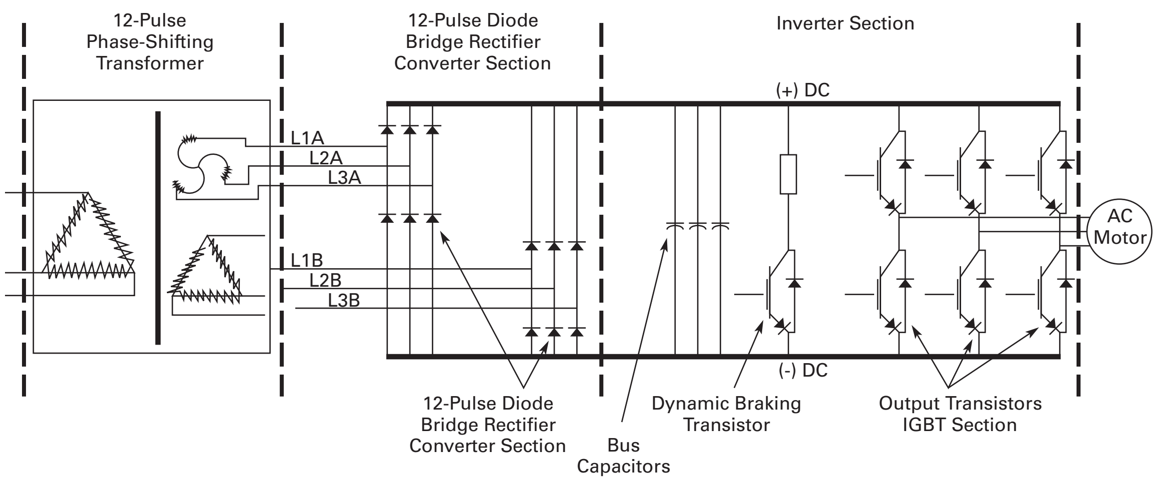
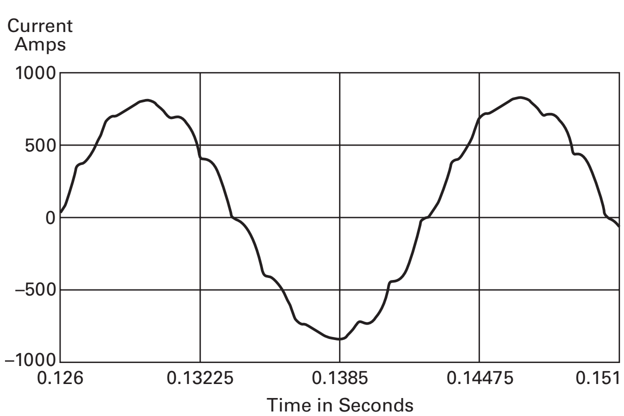
2. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately 85% reduction of harmonic current and voltage distortion may be achieved (over standard six-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

Basic 12-Pulse Rectifier with "Phase Shifting" Transformer



500 hp 480V Drive with 12-Pulse Rectifier



500 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit

Current harmonics		
I_1 = 100%	I_{11} = 4.19%	I_{19} = 0.06%
I_5 = 1.25%	I_{13} = 2.95%	I_{23} = 0.87%
I_7 = 0.48%	I_{17} = 0.21%	I_{25} = 0.73%
Power = 500 hp		
H_c = 66.2 amps		

Advantages

- Moderate cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

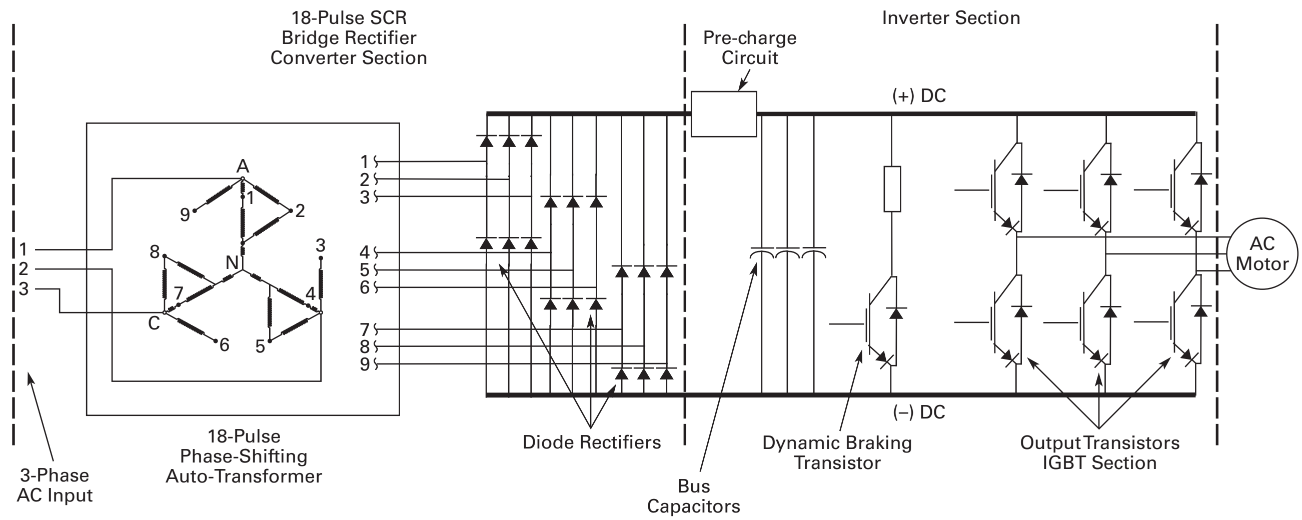
- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

3. Clean Power Drives

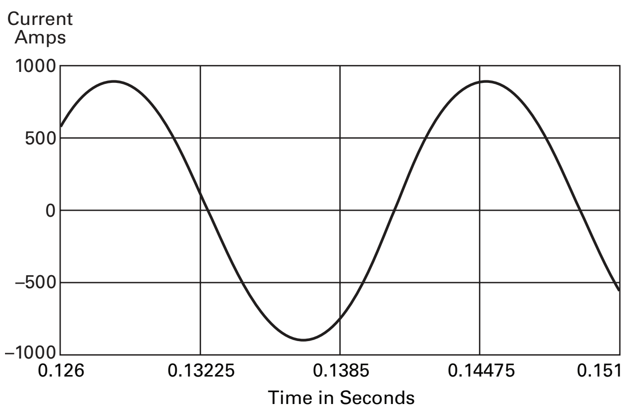
When the total load is of non-linear, the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and "clean" such that system interference and additional losses are negligible. Eaton's CPX9000 clean power drive uses a phase-shifting auto-transformer with delta-connected winding. Three of the output phases are advanced and three are retarded. The remaining three phases of this nine-phase supply are in phase with the incoming line. This results in nine separate phases. In this type of configuration, the total required kVA rating of the transformer is only 48% of a drive rate isolation transformer. A traditional isolated transformer system, with multipulse windings, would require the full kVA rating to be supported, which is more common in an MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with six-pulse and 12-pulse systems are shown, see **Pages V6-T2-194**, **V6-T2-196** and **V6-T2-197**.

Basic 18-Pulse Rectifier with Phase Shifting Transformer



500 hp 480V Drive with 18-Pulse Rectifiers



500 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power

Current harmonics		
$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 1.00\%$
$I_5 = 0.16\%$	$I_{13} = 0.10\%$	$I_{23} = 0.01\%$
$I_7 = 0.03\%$	$I_{17} = 0.86\%$	$I_{25} = 0.01\%$
Power = 500 hp		
H_c = 24 amps		

Advantages

- Virtually guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semiconductors from line transients
- Up to four times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter

Disadvantages

- Not as cost-effective as some other methods at small (<50) horsepower

Features and Benefits

CPX9000 clean power drive features include:

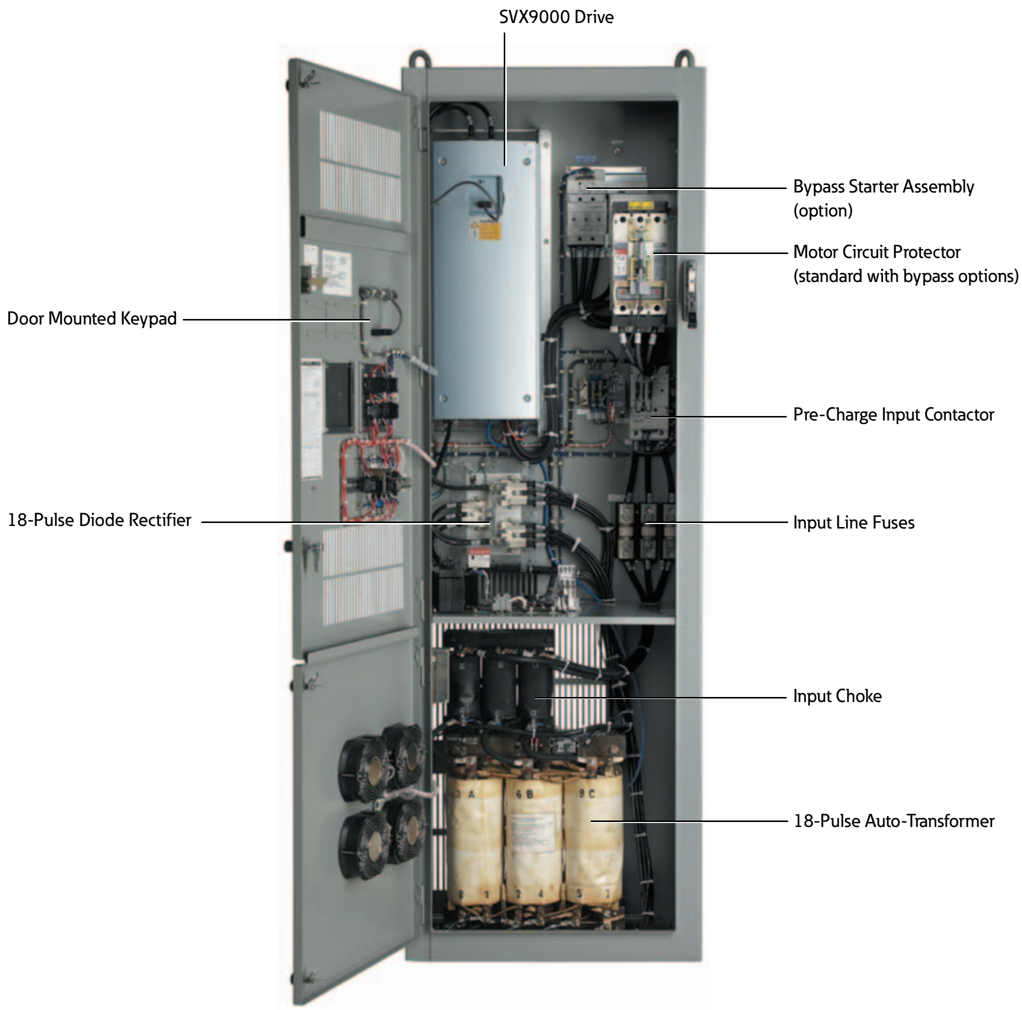
- Space optimized enclosure
- Simple layout for power options
- Type 1, NEMA 12 with gaskets and filters, Type 3R
- Input voltage: 480V, 208V, 575V
- Complete range of control, network and power options
- Horsepower range:
  - 480V, 25–800 hp (consult factory for larger sizes)
  - 208/230V, 25–200 hp
  - 575V, 25–800 hp (consult factory for larger sizes)
- Over 15 years of 18-pulse clean power experience
- 65 kAIC Standard at 480V and 208V
- 100 kAIC optional

Standards and Certifications

UL 508C tested, listed and approved.

Product Identification

Type 1, 25–150 hp (30 x 90 x 21.50)



Catalog Number Selection

CPX9000 Enclosed Drive

CPX 100 1 4 A A — Build options alphabetically and numerically.

Product Family

CPX = Clean power 18-pulse enclosed drives

Horsepower Rating

025 = 25 hp	**100** = 100 hp	**350** = 350 hp
030 = 30 hp	**125** = 125 hp	**400** = 400 hp
040 = 40 hp	**150** = 150 hp	**500** = 500 hp
050 = 50 hp	**200** = 200 hp	**600** = 600 hp
060 = 60 hp	**250** = 250 hp	**700** = 700 hp
075 = 75 hp	**300** = 300 hp	**800** = 800 hp

Enclosure Rating

1 = Type 1
3 = Type 3R
6 = Type 12 filtered

Voltage Rating

2 = 230V (208–240V)
4 = 480V
5 = 575V (575–600V)

Application—Torque/Braking ①

A = I_L/no brake chopper
B = I_L/internal brake chopper
D = I_H/no brake chopper
E = I_H/internal brake chopper

Enclosed Style

A = Enclosed drive

	Enclosed Options ②③④	Type
K1	Door-mounted speed potentiometer ⑤	Control
K2	Door-mounted speed potentiometer with HOA selector switch ⑤	Control
K3	3–15 psig follower	Control
K4	HAND/OFF/AUTO switch 0.87-inch (22 mm)	Control
K5	MANUAL/AUTO reference switch 0.87-inch (22 mm)	Control
K6	START/STOP pushbuttons 0.87-inch (22 mm)	Control
KF	Bypass test switch for RA and RB	Addl. bypass
KO	Standard elapsed time meter	Control
L1	Power, RUN and fault pilot lights	Light
L2	Bypass pilot lights for RA, RB, bypass options	Addl. bypass
LE	Red RUN light	Light
P1	Input disconnect	Input
P8	Surge protective device	Input
PE	Output contactor	Output
PF	Output filter	Output
PG	MotoRx (up to 600 ft [182.9m]) 1000 V/µS DV/DT filter	Output
PH	Single overload relay	Output
PI	Dual overload relays	Output
PN	Dual overloads for bypass	Addl. bypass
RA	Manual HOA bypass controller	Bypass
RB	Manual IOB bypass controller	Bypass
RC	Auto transfer HOA bypass controller	Bypass
RD	Auto transfer IOB bypass controller	Bypass
RG	Reduced voltage starter for bypass	Bypass
S7	10.00-inch (254.0 mm) expansion	Enclosure
S8	20.00-inch (508.0 mm) expansion	Enclosure
S9	Space heater	Enclosure

Communication Options ⑥

C2 = Modbus®	**CA** = Johnson Controls N2
C3 = PROFIBUS® DP	**CI** = Modbus TCP/Ethernet IP
C4 = LonWorks®	**CJ** = BACnet
C5 = Profibus DP (D9 connector)	**D3** = RS-232 with D9 connection
C6 = CANopen (slave)	
C7 = DeviceNet™	
C8 = Modbus (D9 Type connector)	

Control Options

B1 = 6 DI, 1 ext +24 Vdc/ext +24 Vdc
B2 = 1 RO (NC/NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/ext +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input

Engineered Options

HT	High temperature rating for 50°C (FR10 and above) ⑦
VB	Varnished boards

Notes

① Brake chopper is standard in drives up to 30 hp I_H or 40 hp I_L at 480V. It is optional in larger drives.
② Local/remote keypad is included as the standard control panel.
③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.
④ See **Pages V6-T2-210** and **V6-T2-211** for complete descriptions.
⑤ Includes local/remote speed reference switch.
⑥ See **Pages V6-T2-208** and **V6-T2-209** for complete descriptions.
⑦ Consult Eaton for availability.

2

Product Selection

When Ordering

- Select a base catalog number that meets the application requirements—nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base-enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.
- The CPX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating. The older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in the table below. Consult the factory for 50°C ratings of FR10 and above.

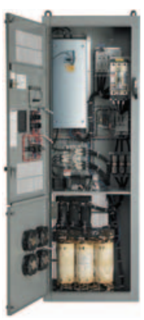
Ambient Temperature Ratings

Frame Size	I_H	I_L
FR4–FR9	50°C	50°C
FR10 and above	40°C	40°C

- If dynamic brake chopper or control/communication option is desired, change the appropriate code in the base catalog number.
- All of the programming is exactly the same as the standard SVX9000 drive.
- Select enclosed options. Add the codes as suffixes to the base catalog number in alphabetical and numeric order.

208/230V Drives

CPX9000 Drive



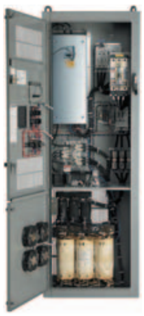
CPX9000 Base Drive Type 1

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	75	FR7	**CPX02512AA**
	30	88	FR7	**CPX03012AA**
	40	114	FR7	**CPX04012AA**
	50	140	FR8	**CPX05012AA**
	60	170	FR8	**CPX06012AA**
	75	205	FR8	**CPX07512AA**
8	100	300	FR9	**CPX10012AA**
9	125	340	FR8T	**CPX12512AA**
	150	410	FR8T	**CPX15012AA**
10	200	522	FR9T	**CPX20012AA**
High Overload Drive				
7	25	75	FR7	**CPX02512DA**
	30	88	FR7	**CPX03012DA**
	40	114	FR8	**CPX04012DA**
	50	140	FR8	**CPX05012DA**
	60	170	FR8	**CPX06012DA**
8	75	205	FR9	**CPX07512DA**
9	100	300	FR8T	**CPX10012DA**
	125	340	FR8T	**CPX12512DA**
10	150	410	FR9T	**CPX15012DA**
	200	522	FR9T	**CPX20012DA**

Notes

① See enclosure dimensions beginning on **Page V6-T2-217**.
② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

CPX9000 Drive



CPX9000 Base Drive NEMA 12 Filtered

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	75	FR7	**CPX02562AA**
	30	88	FR7	**CPX03062AA**
	40	114	FR7	**CPX04062AA**
	50	140	FR8	**CPX05062AA**
	60	170	FR8	**CPX06062AA**
	75	205	FR8	**CPX07562AA**
8	100	300	FR9	**CPX10062AA**
9	125	340	FR8T	**CPX12562AA**
	150	410	FR8T	**CPX15052AA**
10	200	522	FR9T	**CPX20062AA**
High Overload Drive				
7	25	75	FR7	**CPX02562DA**
	30	88	FR7	**CPX03062DA**
	40	114	FR8	**CPX04062DA**
	50	140	FR8	**CPX05062DA**
	60	170	FR8	**CPX06062DA**
8	75	205	FR9	**CPX07562DA**
9	100	300	FR8T	**CPX10062DA**
	125	340	FR8T	**CPX12562DA**
10	150	410	FR9T	**CPX15062DA**
	200	522	FR9T	**CPX20062DA**

CPX9000 Base Drive Type 3R ④

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	75	FR7	**CPX02532AA**
	30	88	FR7	**CPX03032AA**
	40	114	FR7	**CPX04032AA**
	50	140	FR8	**CPX05032AA**
	60	170	FR8	**CPX06032AA**
	75	205	FR8	**CPX07532AA**
8	100	300	FR9	**CPX10032AA**
9	125	340	FR8T	**CPX12532AA**
High Overload Drive				
7	25	75	FR7	**CPX02532DA**
	30	88	FR7	**CPX03032DA**
	40	114	FR8	**CPX04032DA**
	50	140	FR8	**CPX05032DA**
	60	170	FR8	**CPX06032DA**
8	75	205	FR9	**CPX07532DA**
9	100	300	FR8T	**CPX10032DA**

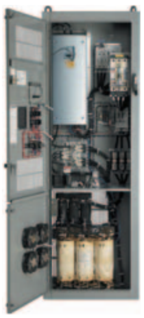
Notes

① See enclosure dimensions beginning on **Page V6-T2-217**.
② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.
④ All Type 3R drives use the Size F enclosure.

2

480V Drives

CPX9000 Drive



CPX9000 Base Drive Type 1

Enclosure Size [1]	hp [2]	Current (A)	Chassis Frame	Base Catalog Number [3]
Low Overload Drive				
7	25	38	FR6	**CPX02514BA**
	30	46	FR6	**CPX03014BA**
	40	61	FR6	**CPX04014BA**
	50	72	FR7	**CPX05014AA**
	60	87	FR7	**CPX06014AA**
	75	105	FR7	**CPX07514AA**
	100	140	FR8	**CPX10014AA**
	125	170	FR8	**CPX12514AA**
	150	205	FR8	**CPX15014AA**
8	200	261	FR9	**CPX20014AA**
	250	300	FR9	**CPX25014AA**
9	300	385	FR10	**CPX30014AA**
	350	460	FR10	**CPX35014AA**
	400	520	FR10	**CPX40014AA**
10	500	590	FR11	**CPX50014AA**
	550	650	FR11	**CPX55014AA**
	600	730	FR11	**CPX60014AA**
11	650	820	FR11	**CPX65014AA**
	700	920	FR12	**CPX70014AA**
	800	1030	FR12	**CPX80014AA**
High Overload Drive				
7	25	38	FR6	**CPX02514EA**
	30	46	FR6	**CPX03014EA**
	40	61	FR7	**CPX04014DA**
	50	72	FR7	**CPX05014DA**
	60	87	FR7	**CPX06014DA**
	75	105	FR8	**CPX07514DA**
	100	140	FR8	**CPX10014DA**
	125	170	FR8	**CPX12514DA**
8	150	205	FR9	**CPX15014DA**
	200	245	FR9	**CPX20014DA**
9	250	300	FR10	**CPX25014DA**
	300	385	FR10	**CPX30014DA**
	350	460	FR10	**CPX35014DA**
10	400	520	FR11	**CPX40014DA**
	500	590	FR11	**CPX50014DA**
	550	650	FR11	**CPX55014DA**
11	600	720	FR12	**CPX60014DA**
	650	820	FR12	**CPX65014DA**
	700	840	FR12	**CPX70014DA**

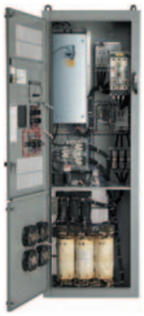
Notes

[1] See enclosure dimensions beginning on **Page V6-T2-217**.

[2] hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

[3] The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

CPX9000 Drive



CPX9000 Base Drive NEMA 12 Filtered

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	38	FR6	**CPX02564BA**
	30	46	FR6	**CPX03064BA**
	40	61	FR6	**CPX04064BA**
	50	72	FR7	**CPX05064AA**
	60	87	FR7	**CPX06064AA**
	75	105	FR7	**CPX07564AA**
	100	140	FR8	**CPX10064AA**
	125	170	FR8	**CPX12564AA**
	150	205	FR8	**CPX15064AA**
8	200	261	FR9	**CPX20064AA**
	250	300	FR9	**CPX25064AA**
9	300	385	FR10	**CPX30064AA**
	350	460	FR10	**CPX35064AA**
	400	520	FR10	**CPX40064AA**
10	500	590	FR11	**CPX50064AA**
	550	650	FR11	**CPX55064AA**
	600	730	FR11	**CPX60064AA**
11	650	820	FR11	**CPX65064AA**
	700	920	FR12	**CPX70064AA**
	800	1030	FR12	**CPX80064AA**
High Overload Drive				
7	25	38	FR6	**CPX02564EA**
	30	46	FR6	**CPX03064EA**
	40	61	FR7	**CPX04064DA**
	50	72	FR7	**CPX05064DA**
	60	87	FR7	**CPX06064DA**
	75	105	FR8	**CPX07564DA**
	100	140	FR8	**CPX10064DA**
	125	170	FR8	**CPX12564DA**
8	150	205	FR9	**CPX15064DA**
	200	245	FR9	**CPX20064DA**
9	250	300	FR10	**CPX25064DA**
	300	385	FR10	**CPX30064DA**
	350	460	FR10	**CPX35014DA**
10	400	520	FR11	**CPX40064DA**
	500	590	FR11	**CPX50064DA**
	550	650	FR11	**CPX55064DA**
11	600	720	FR12	**CPX60064DA**
	650	820	FR12	**CPX65064DA**
	700	840	FR12	**CPX70064DA**

Notes

① See enclosure dimensions beginning on **Page V6-T2-217**.
② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

CPX9000 Drive

CPX9000 Base Drive Type 3R ①

Enclosure Size ②	hp ③	Current (A)	Chassis Frame	Base Catalog Number ④
Low Overload Drive				
7	25	38	FR6	**CPX02534AA**
	30	46	FR6	**CPX03034AA**
	40	61	FR6	**CPX04034AA**
	50	72	FR7	**CPX05034AA**
	60	87	FR7	**CPX06034AA**
	75	105	FR7	**CPX07534AA**
	100	140	FR8	**CPX10034AA**
	125	170	FR8	**CPX12534AA**
	150	205	FR8	**CPX15034AA**
8	200	261	FR9	**CPX20034AA**
	250	300	FR9	**CPX25034AA**
High Overload Drive				
7	25	38	FR6	**CPX02534DA**
	30	46	FR6	**CPX03034DA**
	40	61	FR7	**CPX04034DA**
	50	72	FR7	**CPX05034DA**
	60	87	FR7	**CPX06034DA**
	75	105	FR8	**CPX07534DA**
	100	140	FR8	**CPX10034DA**
	125	170	FR8	**CPX12534DA**
8	150	205	FR9	**CPX15034DA**
	200	245	FR9	**CPX20034DA**

Notes

① All Type 3R drives use the Size F enclosure.

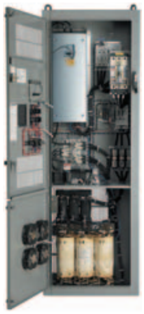
② See enclosure dimensions beginning on **Page V6-T2-217**.

③ hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.

④ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

575V Drives

CPX9000 Drive



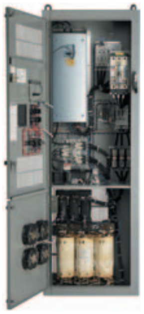
CPX9000 Base Drive Type 1

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	27	FR6	**CPX02515AA**
	30	34	FR6	**CPX03015AA**
	40	41	FR7	**CPX04015AA**
	50	52	FR7	**CPX05015AA**
	60	62	FR8	**CPX06015AA**
	75	80	FR8	**CPX07515AA**
	100	100	FR8	**CPX10015AA**
8	125	125	FR9	**CPX12515AA**
	150	144	FR9	**CPX15015AA**
	200	208	FR9	**CPX20015AA**
9	250	261	FR10	**CPX25015AA**
	300	325	FR10	**CPX30015AA**
	400	385	FR10	**CPX40015AA**
10	500	502	FR11	**CPX50015AA**
	600	590	FR11	**CPX60015AA**
11	650	650	FR12	**CPX65015AA**
	700	750	FR12	**CPX70015AA**
	800	820	FR12	**CPX80015AA**
High Overload Drive				
7	25	27	FR6	**CPX02515DA**
	30	34	FR7	**CPX03015DA**
	40	41	FR7	**CPX04015DA**
	50	52	FR8	**CPX05015DA**
	60	62	FR8	**CPX06015DA**
	75	80	FR8	**CPX07515DA**
8	100	100	FR9	**CPX10015DA**
	125	125	FR9	**CPX12515DA**
	150	144	FR9	**CPX15015DA**
9	200	208	FR10	**CPX20015DA**
	250	261	FR10	**CPX25015DA**
	300	325	FR10	**CPX30015DA**
10	400	385	FR11	**CPX40015DA**
	450	460	FR11	**CPX45015DA**
	500	502	FR11	**CPX50015DA**
11	600	590	FR12	**CPX60015DA**
	650	650	FR12	**CPX65015DA**
	700	750	FR12	**CPX70015DA**

Notes

① See enclosure dimensions beginning on **Page V6-T2-217**.
② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

CPX9000 Drive



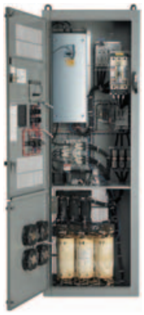
CPX9000 Base Drive NEMA 12 Filtered

Enclosure Size ①	hp ②	Current (A)	Chassis Frame	Base Catalog Number ③
Low Overload Drive				
7	25	27	FR6	**CPX02565AA**
	30	34	FR6	**CPX03065AA**
	40	41	FR7	**CPX04065AA**
	50	52	FR7	**CPX05065AA**
	60	62	FR8	**CPX06065AA**
	75	80	FR8	**CPX07565AA**
	100	100	FR8	**CPX10065AA**
8	125	125	FR9	**CPX12565AA**
	150	144	FR9	**CPX15065AA**
	200	208	FR9	**CPX20065AA**
9	250	261	FR10	**CPX25065AA**
	300	325	FR10	**CPX30065AA**
	400	385	FR10	**CPX40065AA**
10	500	502	FR11	**CPX50065AA**
	600	590	FR11	**CPX60065AA**
11	650	650	FR12	**CPX65065AA**
	700	750	FR12	**CPX70065AA**
	800	820	FR12	**CPX80065AA**
High Overload Drive				
7	25	27	FR6	**CPX02565DA**
	30	34	FR7	**CPX03065DA**
	40	41	FR7	**CPX04065DA**
	50	52	FR8	**CPX05065DA**
	60	62	FR8	**CPX06065DA**
	75	80	FR8	**CPX07565DA**
8	100	100	FR9	**CPX10065DA**
	125	125	FR9	**CPX12565DA**
	150	144	FR9	**CPX15065DA**
9	200	208	FR10	**CPX20065DA**
	250	261	FR10	**CPX25065DA**
	300	325	FR10	**CPX30065DA**
10	400	385	FR11	**CPX40065DA**
	450	460	FR11	**CPX45065DA**
	500	502	FR11	**CPX50065DA**
11	600	590	FR12	**CPX60065DA**
	650	650	FR12	**CPX65065DA**
	700	750	FR12	**CPX70065DA**

Notes

① See enclosure dimensions beginning on **Page V6-T2-217**.
② hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
③ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

CPX9000 Drive



CPX9000 Base Drive Type 3R ①

Enclosure Size ②	hp ③	Current (A)	Chassis Frame	Base Catalog Number ④
Low Overload Drive				
7	25	27	FR6	**CPX02535AA**
	30	34	FR6	**CPX03035AA**
	40	41	FR7	**CPX04035AA**
	50	52	FR7	**CPX05035AA**
	60	62	FR8	**CPX06035AA**
	75	80	FR8	**CPX07535AA**
	100	100	FR8	**CPX10035AA**
8	125	125	FR9	**CPX12535AA**
	150	144	FR9	**CPX15035AA**
	200	208	FR9	**CPX20035AA**
High Overload Drive				
7	25	27	FR6	**CPX02535DA**
	30	34	FR7	**CPX03035DA**
	40	41	FR7	**CPX04035DA**
	50	52	FR8	**CPX05035DA**
	60	62	FR8	**CPX06035DA**
	75	80	FR8	**CPX07535DA**
8	100	100	FR9	**CPX10035DA**
	125	125	FR9	**CPX12535DA**
	150	144	FR9	**CPX15035DA**

Notes

① All Type 3R drives use the Size F enclosure.
② See enclosure dimensions beginning on **Page V6-T2-217**.
③ hp ratings are provided as a guideline. Drives should be sized per motor nameplate FLA.
④ The 18-pulse clean power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

Options

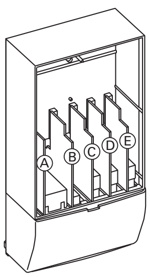
CPX9000 Series Option Board Kits

The CPX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see figure below).

The CPX9000 Series factory- installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

9000X Series Option Board Kits

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC/NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/ext +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
6 DI	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC/NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated)	B, C, **D**, E	**OPTB4**	**B4**	■	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
3 Pt100 RTD board	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	■	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	■	■	■	■	■	■	■
PROFIBUS DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
PROFIBUS DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CANopen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output
② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.
③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19,200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

PROFIBUS Network Communications

The PROFIBUS Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a PROFIBUS-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CANopen (Slave) Communications

The CANopen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO® 11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120 ohms, and specific line delay of nominal 5 nS/m. 120 ohm line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a two-wire twisted shielded cable with two-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory-installed option and as a field-installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks using Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/ Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 to 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol," the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Control/Communication Option Descriptions

For availability, see Product Selection for base drive voltage required.

Available Control/Communications Options

Option	Description	Option Type
K1	**Door-Mounted Speed Potentiometer**—Provides the CPX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.	Control
K2	**Door-Mounted Speed Potentiometer with HOA Selector Switch**—Provides the CPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer-supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4–20 mA signal.	Control
K3	**3–15 psig Follower**—Provides a pneumatic transducer that converts a 3–15 psig pneumatic signal to either 0–8 Vdc or a 1–9 Vdc signal interface with the CPX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	**HAND/OFF/AUTO Switch for Non-Bypass Configurations**—Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.	Control
K5	**MANUAL/AUTO Speed Reference Switch**—Provides door-mounted selector switch for MANUAL/AUTO speed reference.	Control
K6	**START/STOP Pushbuttons**—Provide door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	**Bypass Test Switch for RB and RA**—Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. bypass
KO	**Standard Elapsed Time Meter**—Provides a door-mounted elapsed run-time meter.	Control
L1	**Power On and Fault Power Lights**—Provide a white Power On light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	**Bypass Pilot Lights for RB, RA Bypass Options**—A green light indicates when the motor is running in Inverter mode and an amber light indicates when the motor is running in Bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. bypass
LE	**Red Run Pilot Light 0.87-Inch (22 mm)**—Provides a red Run pilot light that indicates the drive is running.	Light
P1	**Input Circuit Breaker**—High interrupting circuit breaker that provides a means of short-circuit protection for the power cables between it and the CPX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the CPX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure. Standard rating is 65 kAIC at 208/480V. 100 kAIC is available as an option.	Input
PE	**Output Contactor**—Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600 Vac are provided for customer use. Bypass options **RB** and **RA** include an output contactor as standard. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.	Output
PF	**Output Filter**—Used to reduce the transient voltage (DV/DT) at the motor terminals. The output filter is recommended for cable lengths exceeding 100 ft (30.5m) with a drive of 3 hp and above, for cable lengths of 33 ft (10.1m) with a drive of 2 hp and below, or for a drive rated at 525–690V. This option is mounted in the enclosure.	Output
PG	**MotoRx (300–600 Ft) 1000 V/µS DV/DT Filter**—Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the output filter (see option **PF**), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300–600 ft (91.4–182.9m).	Output
PH	**Single Overload Relay**—Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the bypass configurations for overload current protection in the bypass mode. The overload relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	**Dual Overload Relays**—This option is recommended when a single drive is operating two motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	**Dual Overloads for Bypass**—This option is recommended when a single drive is operating two motors in the Bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. bypass

For availability, see Product Selection for base drive voltage required.

Available Control/Communications Options, continued

Option	Description	Option Type
RA	**Manual HOA Bypass Controller**—The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-216**).	Bypass
RB	**Manual IOB Bypass Controller**—The manual INVERTER/OFF/BYPASS (IOB)—three-contactor—bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted IOB selector switch. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-216**).	Bypass
RC	**Auto Transfer HOA Bypass Controller** —The manual HAND/OFF/AUTO (HOA)—three-contactor—bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-216**). Door-mounted pilot lights are provided that indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	**Auto Transfer IOB Bypass Controller**—The auto INVERTER/OFF/BYPASS (IOB)—three-contactor—bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input HMCP, a fused control power transformer, and a full voltage bypass starter with a door-mounted IOB selector switch. IEC type input, bypass and input contactors are provided. The contactors are mechanically and electrically interlocked (see wiring diagram on **Page V6-T2-216**). Door-mounted pilot lights are provided that indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. **WARNING**: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	**Reduced Voltage Starter for Bypass**—Used in conjunction with bypass option RA, RB, RC or RD. This option adds reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S7	**10.00-Inch (254.0 mm) Expansion**—Expansion cabinet allows for special components, customer-supplied components or oversized cables. **NOTE:** Enclosure expansion rated Type 1 only.	Enclosure
S8	**20.00-Inch (508.0 mm) Expansion**—Expansion cabinet allows for special components, customer-supplied components or oversized cables. **NOTE:** Enclosure expansion rated Type 1 only.	Enclosure
S9	**Space Heater**—Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. The heater requires a customer-supplied 115V remote supply source.	Enclosure

Dissipated Watt Losses

Horsepower	40	50	60	75	100	125	150	200	250	300	350	400	450	500	600	700	800
Watts	1844	2170	2540	3040	4011	4940	5730	8020	9383	11600	13600	15700	16250	17976	20393	27200	31400

Conformal (Varnished) Coating ①

Chassis Frame	Delivery Code	Chassis Frame	Delivery Code
FR6	FP	FR9	FP
FR7	FP	FR10	FP
FR8	FP	FR11	FP
—	—	FR12	FP

480V Input Disconnect Selection ②

Horsepower	P1 Input Breaker	Bypass Motor Circuit Protector (RA, RB, RC, RD)
25	HFD3050	HMCP050K2C
30	HFD3060	HMCP100R3C
40	HFD3080	HMCP100R3C
50	HFD3100	HMCP100R3C
60	HFD3100	HMCP150T4C
75	HFD3125	HMCP150T4C
100	HFD3150	HMCP150U4C
125	HFD3200	HMCP250W5C
150	HFD3225	HMCP250W5C
200	HKD3300	HMCP400X5C
250	HKD3400	HMCP400X5C
300–400	HLD3600	HMCP600L6W
500–600	HND3800	HMCP800X7W
650–800	HND312	③

Notes

① See catalog number description to order.
② Contact factory for 208V and 575V applications.
③ Contact factory.

Enclosed Drive Options

Light Options

Description	Catalog Number Suffix
Power on, run, fault LED lights (22 mm)	**L1**
Power on, fault LED lights (22 mm)	**L3**
Green LED run light (22 mm)	**LA**
Green LED stop light (22 mm)	**LD**
Red LED run light (22 mm)	**LE**
Red LED stop light (22 mm)	**LF**
Red LED fault light (22 mm)	**LG**
Power on white LED light (22 mm)	**LJ**
Miscellaneous LED light (22 mm)	**LU**

Control Options

Description	Catalog Number Suffix
Door-mounted speed potentiometer	**K1**
Door-mounted speed potentiometer with HOA selector switch	**K2**
3–15 psig follower	**K3**
HOA selector switch	**K4**
MANUAL/AUTO reference switch	**K5**
START-STOP pushbuttons	**K6**
Type D2 control relay	**SD**
On-delay relay	**SE**
Off-delay relay	**SF**
Additional terminal blocks per 4 points	**SD**

Bypass Control Options

Description	Catalog Number Suffix
Bypass test switch used with RA and RB	**KF**
Inverter/bypass pilot lights	**L2**

Meter Options

Description	Catalog Number Suffix
Standard elapsed time meter	**KO**
Frequency meter	**KS**
MP-3000 relay with URTD	**KV**
MP-3000 relay with URTD and CTs	**KU**

Enclosure Options

Enclosure Size	Catalog Number Suffix
10.00 Inch (254.0 mm) Expansion	
7	**S7**
8	**S7**
9	**S7**
10	**S7**
11	**S7**
20.00 Inch (508.0 mm) Expansion	
7	**S8**
8	**S8**
9	**S8**
10	**S8**
11	**S8**
Space Heater ①	
7	**S9**
8	**S9**
9	**S9**
10	**S9**
11	**S9**
Plastic Nameplate	
7	**SN**
8	**SN**
9	**SN**
10	**SN**
11	**SN**

Note

① Requires customer-supplied 115 Vac supply.

208V and 230V Power Options, 25–200 hp

Description	Catalog Number Suffix
Input breaker	**P1**
Output contactor	**PE**
Single overload relay	**PH**
Dual overload relays	**PI**
MOV	**P7**
50 kA surge protective device	**P8**
100 kA surge protective device	**P9**

480 and 575V Power Options, 25–800 hp

Description	Catalog Number Suffix
Input breaker	**P1**
Output contactor	**PE**
Output filter	**PF**
MotoRx (300–600 Ft) DV/DT filter	**PG**
Single overload relay	**PH**
Dual overload relays	**PI**
Input MOV	**P7**
50 kA surge protective device	**P8**
100 kA surge protective device	**P8**

208V and 230V Bypass Options, 25–200 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	**RA**
IOB bypass controller	**RB**
Auto transfer HOA bypass controller	**RC**
Auto transfer IOB bypass controller	**RD**
Reduced voltage starter for bypass	**RG**
Dual overloads for bypass	**PN**

480 and 575V Bypass Options, 25–800 hp

Description	Catalog Number Suffix
Manual HOA bypass controller	**RA**
IOB bypass controller	**RB**
Auto transfer HOA bypass controller	**RC**
Auto transfer IOB bypass controller	**RD**
Reduced voltage starter for bypass	**RG**
Dual overloads for bypass	**PN**

Technical Data and Specifications

CPX9000 Drives

Description	Specification
Primary Design Features	
45–66 Hz input frequency	Standard
Output: AC volts maximum	Input voltage base
Output frequency range	0–320 Hz
Initial output current (I_H)	250% for 2 seconds
Overload (1 minute [I_H/I_L])	150%/110%
Enclosure space heater	Optional
Oversize enclosure	Standard
Output contactor	Optional
Bypass motor starter	Optional
Listings	UL, cUL, 508C
Protection Features	
Incoming line fuses	Standard 200 kAIC rating
AC input circuit disconnect	Optional
Phase rotation insensitive	Standard
EMI filter	Standard FR6 thru FR9 ①
Input phase loss protection	Standard
Input overvoltage protection	Standard
Line surge protection	Standard
Output short-circuit protection	Standard
Output ground fault protection	Standard
Output phase protection	Standard
Overtemperature protection	Standard
DC overvoltage protection	Standard
Drive overload protection	Standard
Motor overload protection	Standard
Programmer software	Optional
Local/remote keypad	Standard
Keypad lockout	Standard
Fault alarm output	Standard
Built-in diagnostics	Standard
Surge protective device	Optional

Description	Specification
Input/Output Interface Features	
Setup adjustment provisions	
Remote keypad/display	Standard
Personal computer	Standard
Operator control provisions	
Drive mounted keypad/display	Standard
Remote keypad/display	Standard
Conventional control elements	Standard
Serial communications	Optional
115 Vac control circuit	Optional
Speed setting inputs	
Keypad	Standard
0–10 Vdc potentiometer/voltage signal	Standard
4–20 mA isolated	Configurable
4–20 mA differential	Configurable
3–15 psig	Optional
Analog outputs	
Speed/frequency	Standard
Torque/load/current	Programmable
Motor voltage	Programmable
Kilowatts	Programmable
0–10 Vdc signals	Configurable w/jumpers
4–20 mA DC signals	Standard
Isolated signals	Standard
Discrete outputs	
Fault alarm	Standard
Drive running	Standard
Drive at set speed	Programmable
Optional parameters	14
Dry contacts	2 Form C contacts available
Additional discrete outputs	Optional
Communications	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (slave)	Optional
Profibus-DP	Optional
LonWorks	Optional
Johnson Controls Metasys N2	Optional
Ethernet IP/Modbus TCP	Optional
BACnet	Optional

Note

① The EMI filter is optional in FR10 and larger.

CPX9000 Drives

Description	Specification
Performance Features	
Sensorless vector control	Standard
Volts/hertz control	Standard
IR and slip compensation	Standard
Electronic reversing	Standard
Dynamic braking	Optional
DC braking	Standard
PID set point controller	Programmable
Critical speed lockout	Standard
Current (torque) limit	Standard
Adjustable acceleration/deceleration	Standard
Linear or S curve accel/decel	Standard
Jog at preset speed	Standard
Thread/preset speeds	7
Automatic restart	Selectable
Coasting motor start	Standard
Coast or ramp stop selection	Standard
Elapsed time meter	Optional
Carrier frequency adjustment	1–16 kHz
Standard Conditions for Application and Service	
Maximum operating ambient temperature	0–50°C up to FR9 0–40°C FR10 and larger, consult factory for 50°C rating above FR9
Storage temperature	–40 to 60°C
Humidity (maximum), noncondensing	95%
Altitude (maximum without derate)	3300 ft (1000m)
Line voltage variation	+10/–15%
Line frequency variation	45–66 Hz
Efficiency	>95%
Power factor (displacement)	0.99+
Power factor (apparent)	0.99

Standard I/O Specifications

Description	Specification
Six–digital input programmable	24V: "0" ≤10V, "1" ≥18V,R_i >5 kohms
Two–analog input configurable w/jumpers	Voltage: 0–±10V, R_i >200 kohms Current: 0 (4)–20 mA, R_i = 250 ohms
Two–digital output programmable	Form C relays 250 Vac 30 Vdc 2 amp resistive
One–analog output programmable configurable w/jumper	0–20 mA, R_L max. 500 ohms 10 bits ±2%

I/O Specifications for Control/Communication Options

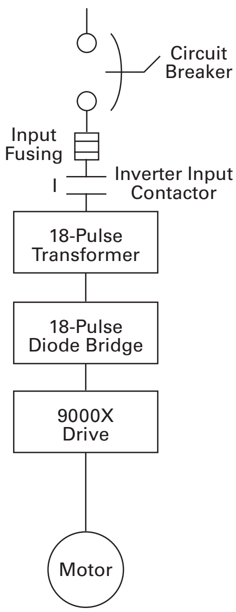
Description	Specification
Analog voltage, input	0–±10V, R_i ≥200 kilohms
Analog current, input	0 (4)–20 mA, R_i = 250 ohms
Digital input	24V: "0" ≤10V, "1" ≥18V, R_i >5 kilohms
Auxiliary voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4)–20 mA, R_L = 500 kilohms, resolution 10 bit, accuracy ≤±2%
Analog voltage, output	0 (2)–10V, R_L ≥1 kilohm, resolution 10 bit, accuracy ≤±2%
Relay output max. switching voltage	300 Vdc, 250 Vac
Relay output max. switching load	3A/24 Vdc, 300 Vdc, 250 Vac ①
Relay output max. continuous load	2A rms
Thermistor input	R_{trip} = 4.7 kohms

Note

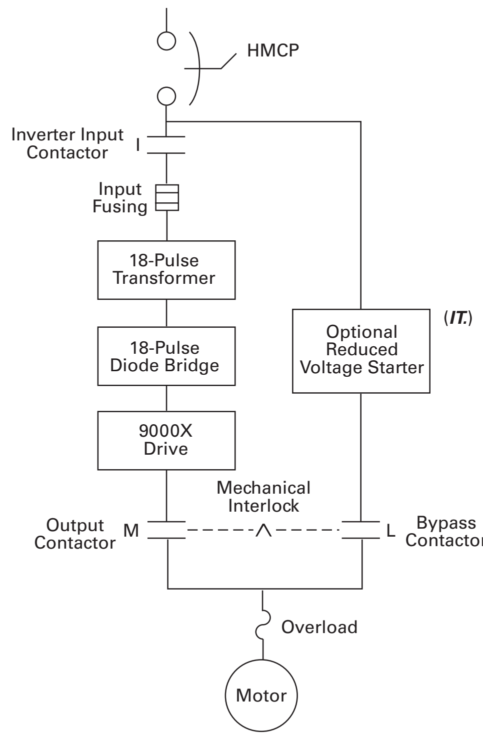
① For applications above 3A consult instruction manual.

Wiring Diagrams

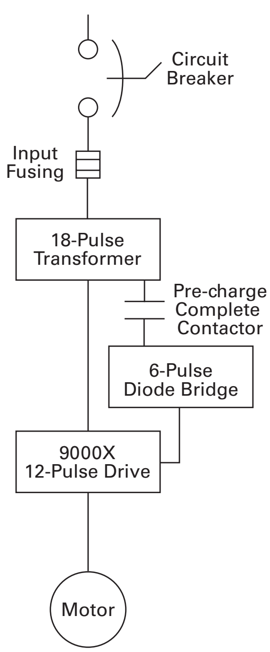
Power Diagram Up to FR9



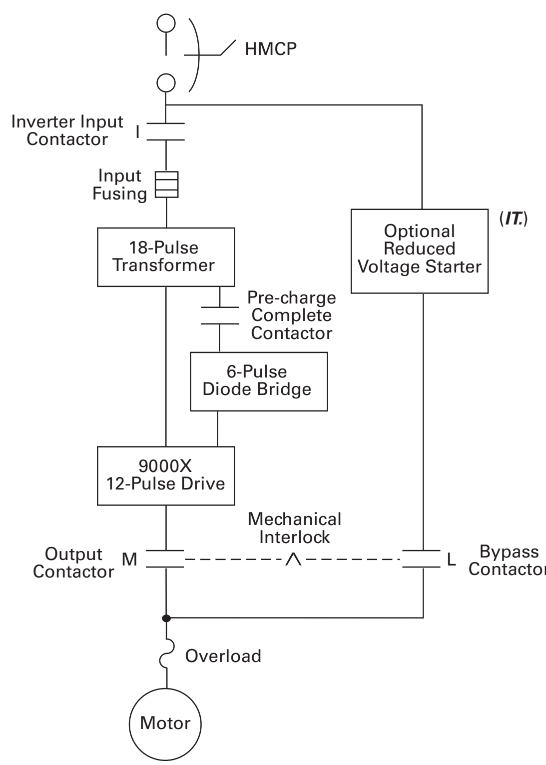
Power Diagram Up to FR9 with Bypass



Power Diagram FR10 and Larger



Power Diagram FR10 and Larger with Bypass

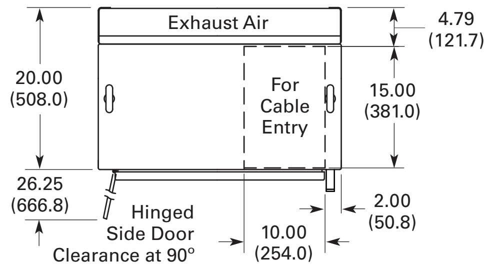


Dimensions

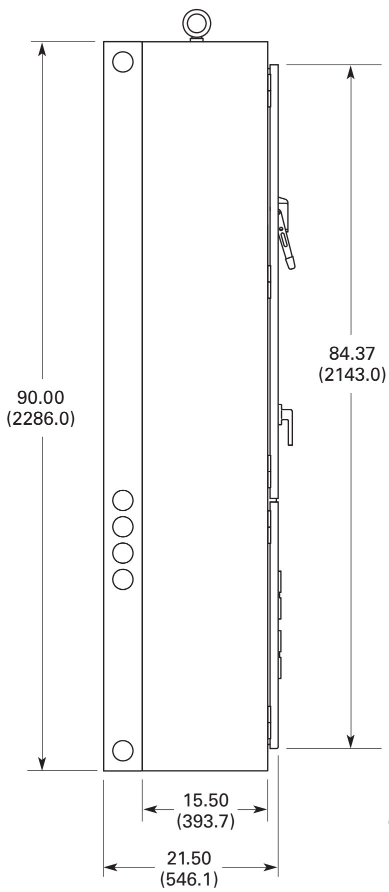
Approximate Dimensions in Inches (mm)

Enclosure Size 7

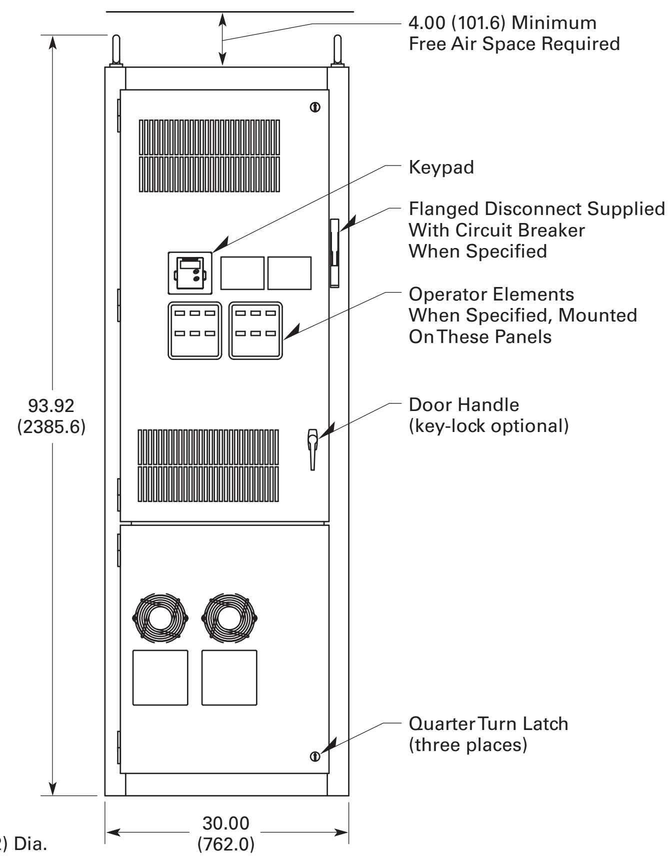
25–150 hp I_L and 25–125 hp I_H 480V—25–100 hp I_L and 25–75 hp I_H 575V

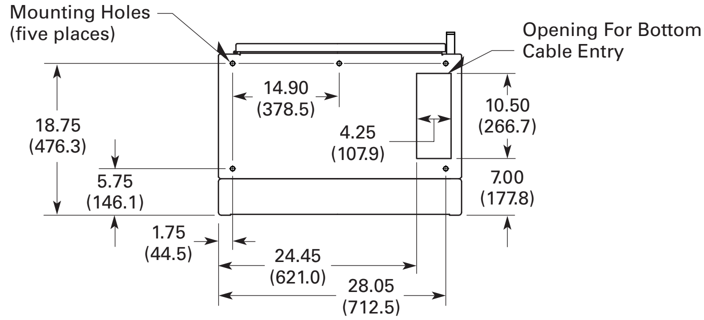


Top View



Side View





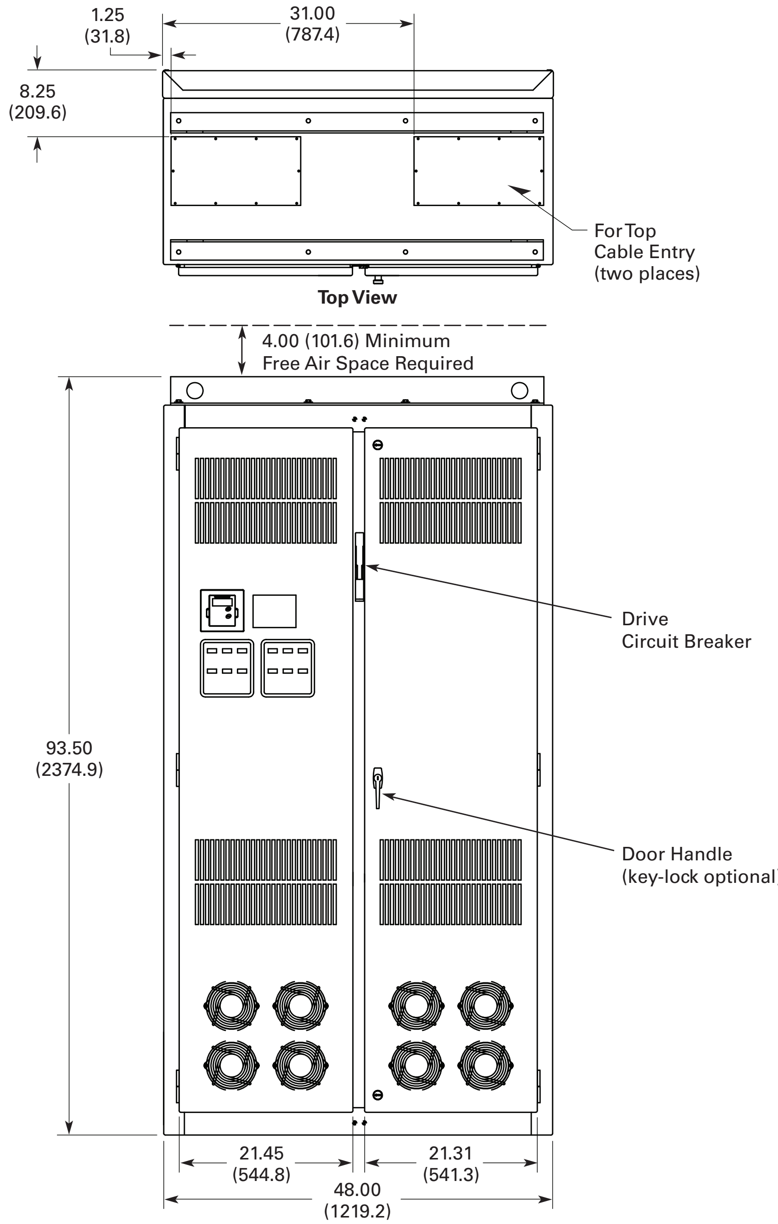
Bottom View

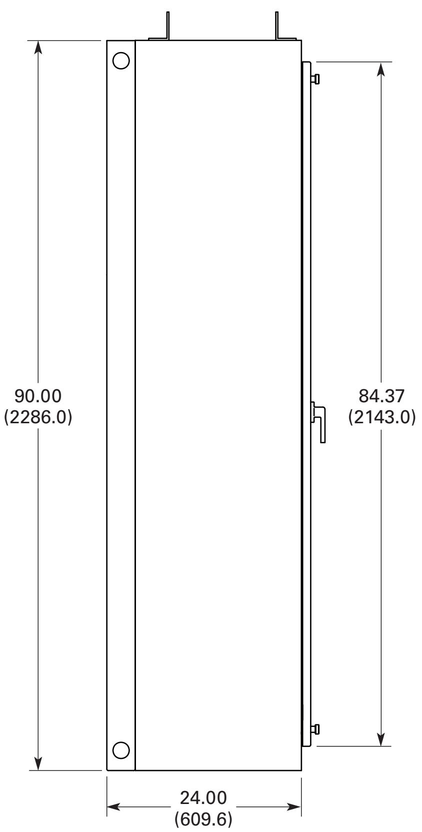
Finish: Enclosure—ANSI 61 Gray (light)
Material: Enclosure and Backplate—
12 ga. = 0.1046 Cold Rolled Steel

Approximate Dimensions in Inches (mm)

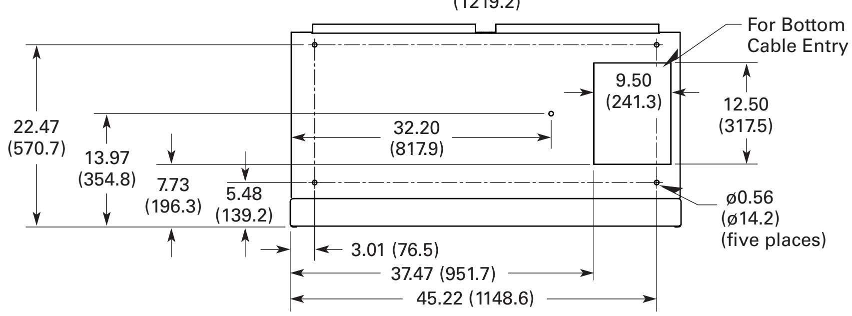
Enclosure Size 8

200–250 hp I_L and 150–200 hp I_H 480V—125–200 hp I_L and 100–150 hp I_H 575V





Side View



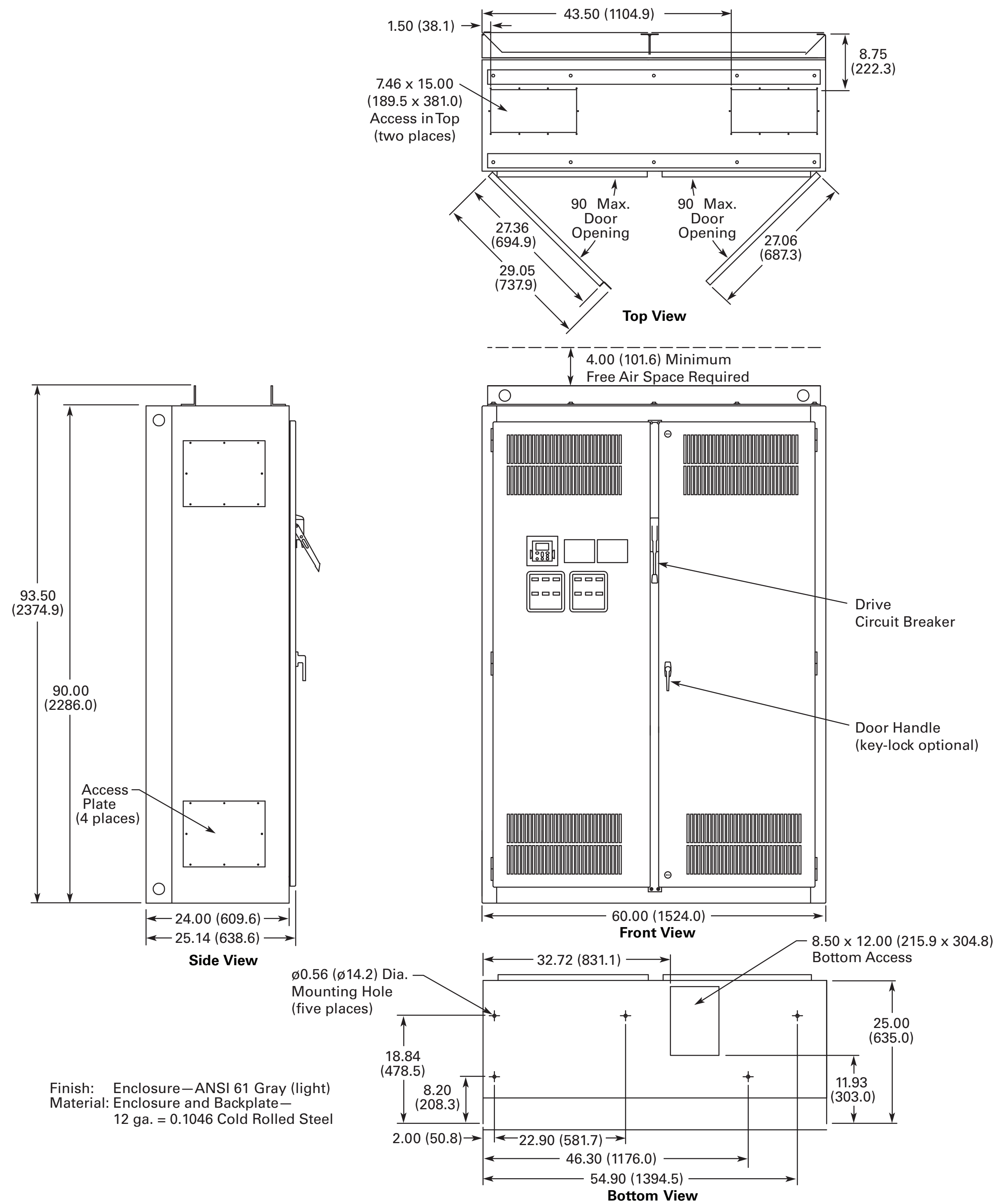
Bottom View

Finish: Enclosure—ANSI 61 Gray (light)
Material: Enclosure and Backplate—
12 ga. = 0.1046 Cold Rolled Steel

Approximate Dimensions in Inches (mm)

Enclosure Size 9

300–400 hp I_L and 250–350 hp I_H 480V—250–400 hp I_L and 200–300 hp I_H 575V

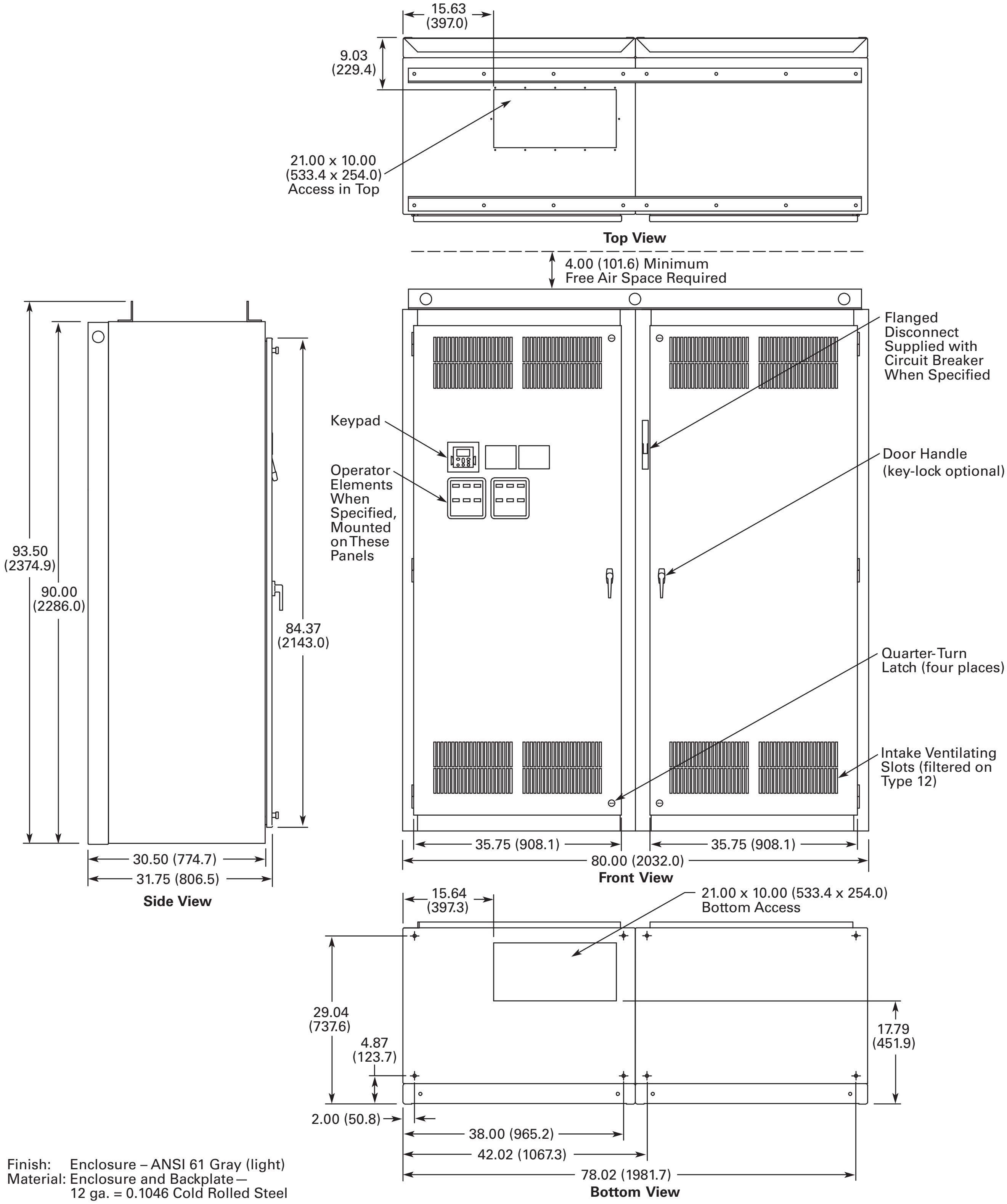


Finish: Enclosure—ANSI 61 Gray (light)
Material: Enclosure and Backplate—12 ga. = 0.1046 Cold Rolled Steel

Approximate Dimensions in Inches (mm)

Enclosure Size 10

500–600 hp I_L and 400–500 hp I_H 480V—500–600 hp I_L and 400–500 hp I_H 575V

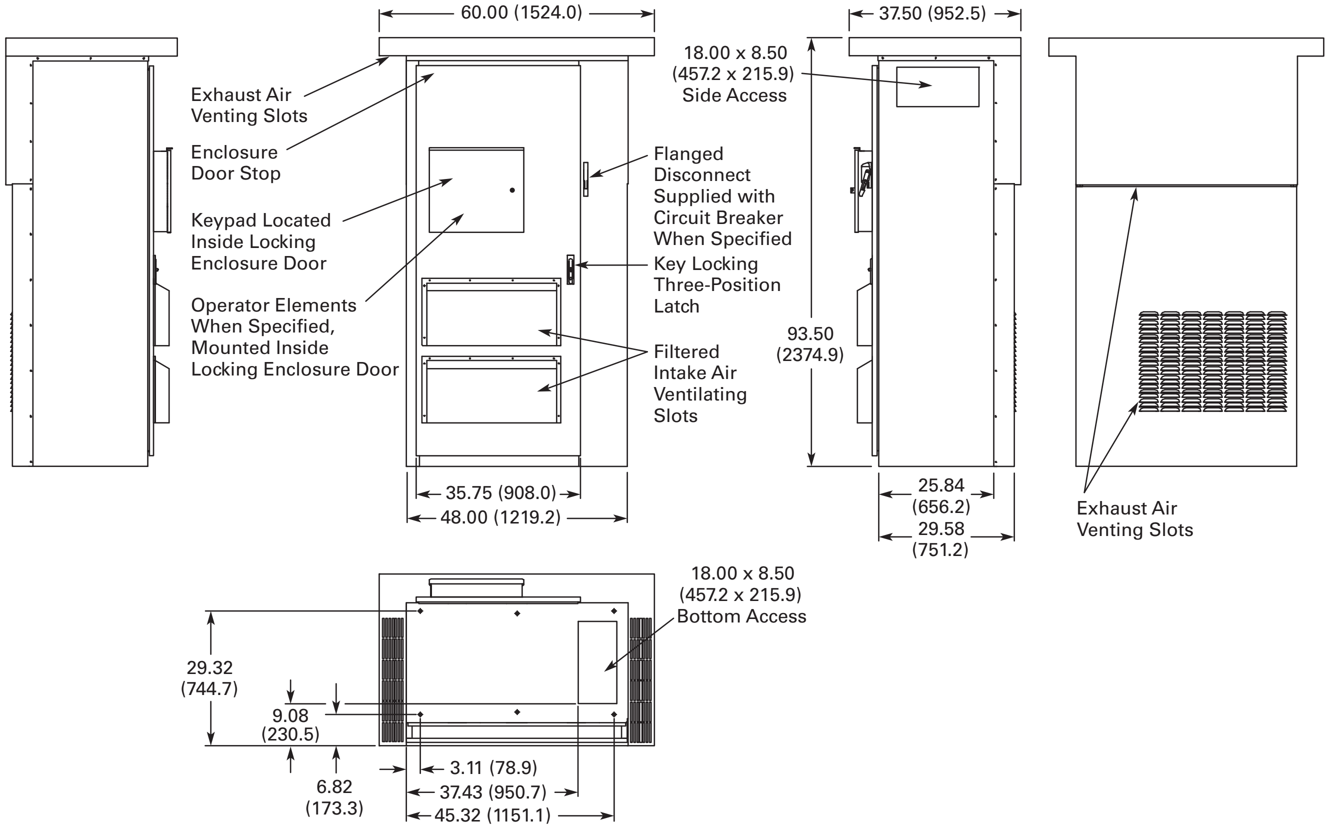


Finish: Enclosure – ANSI 61 Gray (light)
Material: Enclosure and Backplate—
12 ga. = 0.1046 Cold Rolled Steel

Approximate Dimensions in Inches (mm)

Enclosure Size F Type 3R Drives

25–250 hp I_L and 25–200 hp I_H 480V—25–200 hp I_L and 25–150 hp I_H 575V Type 3R Drives



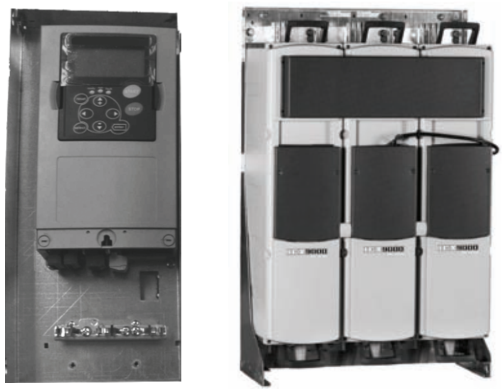
CPX9000 Enclosure Dimensions

Enclosure Size ①	Width	Height	Depth	Approx. Shipping Weight in Lbs (kg)
7	30.00 (762.0)	90.00 (2286.0)	21.50 (546.1)	1000 (454)
8	48.00 (1219.2)	90.00 (2286.0)	26.14 (664.0)	1400 (636)
9	60.00 (1524.0)	90.00 (2286.0)	25.74 (653.8)	1800 (817)
10	80.00 (2032.0)	90.00 (2286.0)	31.75 (806.5)	2100 (953)
11 ②③	120.00 (3048.0)	90.00 (2286.0)	25.74 (653.8)	2500 (1,135)
F ④	60.00 (1524.0)	93.50 (2374.9)	37.50 (952.5)	2500 (1,135)

Notes

① Enclosure sizes accommodate drive and options, including bypass and disconnect. For other power options, consult your Eaton representative.
② Consult factory. Limited power options available.
③ Enclosure size 11 consists of two of the enclosure size 9.
④ All Type 3R drives use the Size F enclosure.

LCX9000 Liquid Cooled Adjustable Frequency Drives



Contents

Description — *Page*

Product Description

The LCX9000 Liquid Cooled Drive family continues Eaton's tradition of providing state-of-the-industry products, by taking advantage of liquid cooling technology in lieu of air-cooling techniques.

The LCX9000 drives are liquid-cooled products that utilize potable water or a water-glycol mixture as a cooling medium.

Features and Benefits

- Compact size and low heat transfer rates allow enclosure size to be greatly reduced, which is especially beneficial in UL Type 4X applications
- Design is modular, with control and power modules independent of each other. Connection between power and control modules can be direct or extended via a fiber optic cable
- Same reliable control module and operating system as the SPX9000 air-cooled drives
- CE mark ensures compliance with the Electromagnetic Compatibility Directive (EMC) and the Low Voltage Directive (LVD)
- Reliable drive with over 500,000 hours MTBF based on MIL 217
- Currently supports DeviceNet, PROFIBUS-DP, Modbus RTU and Modbus TCP communication protocols
- Separately mounted line reactor included with AC fed models

Standards and Certifications

- CE

Catalog Number Selection

LCX9000 Liquid Cooled Adjustable Frequency Drives

LCX 016 A 0 – 4 A 3 B 2 _ _ _ _ _ _

Product Family
LCX = High performance, liquid-cooled drive

Current Rating	
480V	
016 = 16A	**385** = 385A
022 = 22A	**460** = 460A
031 = 31A	**520** = 520A
038 = 38A	**590** = 590A
045 = 45A	**650** = 650A
061 = 61A	**730** = 730A
072 = 72A	**820** = 820A
087 = 87A	**920** = 920A
105 = 105A	**H10** = 1030A
140 = 140A	**H11** = 1150A
168 = 168A	**H13** = 1370A
205 = 205A	**H16** = 1640A
261 = 261A	**H20** = 2060A
300 = 300A	**H23** = 2300A
690V	
170 = 170A	**590** = 590A
208 = 208A	**650** = 650A
261 = 261A	**750** = 750A
325 = 325A	**820** = 820A
385 = 385A	**H10** = 1030A
416 = 416A	**H11** = 1180A
460 = 460A	**H13** = 1300A
502 = 502A	**H15** = 1500A

Software Series
A = Standard

Enclosure Rating
0 = Open chassis

Voltage Rating
4 = 380–500V
5 = 520–690V

Keypad
A = Alphanumeric

Input Options
3 = Three-phase, EMC T
7 = DC Input

Options
List options in alphabetical order.
Extended I/O Card Options
A3 = 2 RO, therm
A4 = Encoder low volt +5V/15V/24V
A5 = Encoder high volt +15V/24V
A7 = Dual encoder +15V/24V
A8 = 6 DI, 1 DO, 2 AI, 1AO
AE = Encoder with 2 DOs
B1 = 6 DI, 1 ext +24 Vdc/EXT +24 Vdc
B2 = 1 RO (NC-NO), 1 RO (NO), 1 therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT + 24 Vdc
B5 = 3 RO (NO)
B8 = 1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100
B9 = 1 RO (NO), 5 DI 42–240 Vac input
BB = SPI, absolute encoder
Communication Cards
CA = Johnson Controls N2
CI = Modbus TCP
C2 = Modbus
C3 = Profibus DP
C4 = LonWorks
C5 = Profibus DP (D9 Connector)
C6 = CANopen (Slave)
C7 = DeviceNet
C8 = Modbus (D9 Type Connector)
D1 = Adapter
D2 = Adapter
D3 = RS-232 with D9 Connection

Board Modifications
2 = Varnished boards

Brake Chopper Options ①
N = No brake chopper circuit
B = Internal brake chopper

Note

① Brake chopper is only available in 480V CH3 drives.

Product Selection

LCX9000 Liquid Cooled Drives

380–500 Vac Liquid Cooled Drives

Motor Output Current Thermal, I_{th} (A)	I_L (A)	I_H (A)	kW	Chassis	Catalog Number
16	15	11	7.5	CH3	**LCX016A0-4A3N2**
22	20	15	11	CH3	**LCX022A0-4A3N2**
31	28	21	15	CH3	**LCX031A0-4A3N2**
38	35	25	18.5	CH3	**LCX038A0-4A3N2**
45	41	30	22	CH3	**LCX045A0-4A3N2**
61	55	41	30	CH3	**LCX061A0-4A3N2**
72	65	48	37	CH4	**LCX072A0-4A3N2**
87	79	58	45	CH4	**LCX087A0-4A3N2**
105	95	70	55	CH4	**LCX105A0-4A3N2**
140	127	93	75	CH4	**LCX140A0-4A3N2**
168	153	112	90	CH5	**LCX168A0-4A3N2**
205	186	137	110	CH5	**LCX205A0-4A3N2**
261	237	174	132	CH5	**LCX261A0-4A3N2**
300	273	200	160	CH61	**LCX300A0-4A3N2**
385	350	257	200	CH61	**LCX385A0-4A3N2**
460	418	307	250	CH72	**LCX460A0-4A3N2**
520	473	347	250	CH72	**LCX520A0-4A3N2**
590	536	393	315	CH72	**LCX590A0-4A3N2**
650	591	433	355	CH72	**LCX650A0-4A3N2**
730	664	487	400	CH72	**LCX730A0-4A3N2**
820	745	547	450	CH63	**LCX820A0-4A3N2**
920	836	613	500	CH63	**LCX920A0-4A3N2**
1030	936	687	560	CH63	**LCXH10A0-4A3N2**
1150	1045	766	600	CH63	**LCXH11A0-4A3N2**
1370	1245	913	700	CH74	**LCXH13A0-4A3N2**
1640	1491	1093	900	CH74	**LCXH16A0-4A3N2**
2060	1873	1373	1100	CH74	**LCXH20A0-4A3N2**
2300	2091	1533	1200	CH74	**LCXH23A0-4A3N2**

LCX9000 Liquid Cooled Drives

525–690 Vac Liquid Cooled Drives

Motor Output Current Thermal, I_{th} (A)	I_L (A)	I_H (A)	kW	Chassis	Catalog Number
170	155	113	110	CH61	**LCX170A0-5A3N2**
208	189	139	132	CH61	**LCX208A0-5A3N2**
261	237	174	160	CH72	**LCX261A0-5A3N2**
325	295	217	200	CH72	**LCX325A0-5A3N2**
385	350	257	250	CH72	**LCX385A0-5A3N2**
416	378	277	250	CH72	**LCX416A0-5A3N2**
460	418	307	300	CH72	**LCX460A0-5A3N2**
502	456	335	355	CH72	**LCX502A0-5A3N2**
590	536	393	400	CH63	**LCX590A0-5A3N2**
650	591	433	450	CH63	**LCX650A0-5A3N2**
750	682	500	500	CH63	**LCX750A0-5A3N2**
820	745	547	560	CH74	**LCX820A0-5A3N2**
920	836	613	650	CH74	**LCX920A0-5A3N2**
1030	936	687	700	CH74	**LCXH10A0-5A3N2**
1180	1073	787	800	CH74	**LCXH11A0-5A3N2**
1300	1182	867	900	CH74	**LCXH13A0-5A3N2**
1500	1364	1000	1000	CH74	**LCXH15A0-5A3N2**

540–675 Vdc Liquid Cooled Inverter Units

Drive Output Current			Motor Output Power				
Thermal I_{th} (A)	Rated Cont. I_L (A)	Rated Cont. I_H (A)	Optimum Motor at I_{th} 400V (kW)	Optimum Motor at I_{th} 500V (kW)	Power Loss c/a/T (kW)	Chassis	Catalog Number
16	15	11	7.5	11	0.4/0.2/**0.6**	CH3	**LCX016A0-4A7B2**
22	20	15	11	15	0.5/0.2/**0.7**	CH3	**LCX022A0-4A7B2**
31	28	21	15	18.5	0.7/0.2/**0.9**	CH3	**LCX031A0-4A7B2**
38	35	25	18.5	22	0.8/0.2/**1.0**	CH3	**LCX038A0-4A7B2**
45	41	30	22	30	1.0/0.3/**1.3**	CH3	**LCX045A0-4A7B2**
61	55	41	30	37	1.3/0.3/**1.5**	CH3	**LCX061A0-4A7B2**
72	65	48	37	45	1.2/0.3/**1.5**	CH4	**LCX072A0-4A7N2**
87	79	58	45	55	1.5/0.3/**1.8**	CH4	**LCX087A0-4A7N2**
105	95	70	55	75	1.8/0.3/**2.1**	CH4	**LCX105A0-4A7N2**
140	127	93	75	90	2.3/0.3/**2.6**	CH4	**LCX140A0-4A7N2**
168	153	112	90	110	2.5/0.3/**2.8**	CH5	**LCX168A0-4A7N2**
205	186	137	110	132	3.0/0.4/**3.4**	CH5	**LCX205A0-4A7N2**
261	237	174	132	160	4.0/0.4/**4.4**	CH5	**LCX261A0-4A7N2**
300	273	200	160	200	4.5/0.4/**4.9**	CH61	**LCX300A0-4A7N2**
385	350	257	200	250	5.5/0.5/**6.0**	CH61	**LCX385A0-4A7N2**
460	418	307	250	315	5.5/0.5/**6.0**	CH62	**LCX460A0-4A7N2**
520	473	347	250	355	6.5/0.5/**7.0**	CH62	**LCX520A0-4A7N2**
590	536	393	315	400	7.5/0.6/**8.1**	CH62	**LCX590A0-4A7N2**

LCX9000 Liquid Cooled Drives

540–675 Vdc Liquid Cooled Inverter Units, continued

Drive Output Current Thermal I_{th} (A)	Rated Cont. I_L (A)	Rated Cont. I_H (A)	Motor Output Power Optimum Motor at I_{th} 400V (kW)	Optimum Motor at I_{th} 500V (kW)	Power Loss c/a/T (kW)	Chassis	Catalog Number
650	591	433	355	450	8.5/0.6/**9.1**	CH62	**LCX650A0-4A7N2**
730	664	487	400	500	10.0/0.7/**10.7**	CH62	**LCX730A0-4A7N2**
820	745	547	450	560	12.5/0.8/**13.3**	CH63	**LCX820A0-4A7N2**
920	836	613	500	600	14.4/0.9/**15.3**	CH63	**LCX920A0-4A7N2**
1030	936	687	560	700	16.5/1.0/**17.5**	CH63	**LCXH10A0-4A7N2**
1150	1045	766	600	750	18.4/10.1/**19.5**	CH63	**LCXH11A0-4A7N2**
1370	1245	913	700	900	15.5/1.0/**16.5**	CH64	**LCXH13A0-4A7N2**
1640	1491	1093	900	1100	19.5/1.2/**20.7**	CH64	**LCXH16A0-4A7N2**
2060	1873	1373	1100	1400	26.5/1.5/**28.0**	CH64	**LCXH20A0-4A7N2**
2300	2091	1533	1250	1500	29.6/1.7/**31.3**	CH64	**LCXH23A0-4A7N2**
2470	2245	1647	1300	1600	36.0/2.0/**38.0**	2*CH64	**LCXH24A0-4A7N2**
2950	2681	1967	1550	1950	39.0/2.4/**41.4**	2*CH64	**LCXH29A0-4A7N2**
3710	3372	2473	1950	2450	48.0/2.7/**50.7**	2*CH64	**LCXH37A0-4A7N2**
4140	3763	2760	2150	2700	53.0/3.0/**66.0**	2*CH64	**LCXH41A0-4A7N2**

710–930 Vdc Liquid Cooled Inverter Unit

Drive Output Current Thermal I_{th} (A)	Rated Cont. I_L (A)	Rated Cont. I_H (A)	Motor Output Power Optimum Motor at I_{th} 400V (kW)	Optimum Motor at I_{th} 500V (kW)	Power Loss c/a/T (kW)	Chassis	Catalog Number
170	155	113	110	160	4.5/0.2/**4.7**	CH61	**LCX170A0-5A7N2**
208	189	139	132	200	5.5/0.3/**5.8**	CH61	**LCX208A0-5A7N2**
261	237	174	160	250	5.5/0.3/**5.8**	CH61	**LCX261A0-5A7N2**
325	295	217	200	300	6.5/0.3/**6.8**	CH62	**LCX325A0-5A7N2**
385	350	257	250	355	7.5/0.4/**7.9**	CH62	**LCX385A0-5A7N2**
416	378	277	250	355	8.0/0.4/**8.4**	CH62	**LCX416A0-5A7N2**
460	418	307	300	400	8.5/0.4/**8.9**	CH62	**LCX460A0-5A7N2**
502	456	335	355	450	10.0/0.5/**10.5**	CH62	**LCX502A0-5A7N2**
590	536	393	400	560	10.0/0.5/**10.5**	CH63	**LCX590A0-5A7N2**
650	591	433	450	600	13.5/0.7/**14.2**	CH63	**LCX650A0-5A7N2**
750	682	500	500	700	16.0/0.8/**16.8**	CH63	**LCX750A0-5A7N2**
820	745	547	560	800	16.0/0.8/**16.8**	CH64	**LCX820A0-5A7N2**
920	836	613	650	850	18.0/0.9/**18.9**	CH64	**LCX920A0-5A7N2**
1030	936	687	700	1000	19.0/1.0/**20.0**	CH64	**LCXH10A0-5A7N2**
1180	1073	787	800	1100	21.0/10.1/**20.1**	CH64	**LCXH11A0-5A7N2**
1300	1182	867	900	1200	27.0/1.4/**28.4**	CH64	**LCXH13A0-5A7N2**
1500	1364	1000	1050	1400	32.0/1.6/**33.6**	CH64	**LCXH15A0-5A7N2**
1700	1545	1133	1150	1550	N/A	CH64	**LCXH17A0-5A7N2**
1850	1682	1233	1250	1650	34.2/1.8/**36.0**	2*CH64	**LCXH18A0-5A7N2**
2120	1927	1413	1450	1900	37.8/2.0/**39.8**	2*CH64	**LCXH21A0-5A7N2**
2340	2127	1560	1600	2100	48.6/2.5/**51.1**	2*CH64	**LCXH23A0-5A7N2**
2700	2455	1800	1850	2450	57.6/3.0/**60.6**	2*CH64	**LCXH27A0-5A7N2**
3100	2818	2066	2150	2800	N/A	2*CH64	**LCXH31A0-5A7N2**

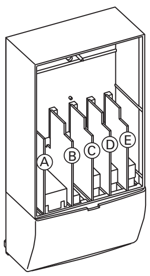
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
2 RO, therm	B	**OPTA3**	**A3**	—	■	■	■	■	■	■
Encoder low Volt +5V/15V/24V	C	**OPTA4**	**A4**	—	■	■	■	■	■	■
Encoder high Volt +15V/24V	C	**OPTA5**	**A5**	—	■	■	■	■	■	■
Dual encoder +15V/24V	C	**OPTA7**	**A7**	—	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**	**A8**	—	■	■	■	■	■	■
3 DI (encoder 10–24V), out +15V/+24V, 2 DO (pulse+direction)—SPX only	C	**OPTAE**	**AE**	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	—	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
SPI, absolute encoder	C	**OPTBB**	**BB**	—	—	—	—	—	—	—
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 Type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD1**	**D1**	■	■	■	■	■	■	■
Adapter—SPX only	D, **E**	**OPTD2**	**D2**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series standard keypad	—	**KEYPAD-STD**	—	—	—	—	—	—	—	■
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**	—	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

Line Reactors

The line reactor carries out several functions in the liquid cooled drive. Connection of the line reactor is necessary except if you have a component in your system that performs the same tasks (e.g. a transformer). The line reactor is needed as an essential component for motor control, to protect the input and DC-link components against abrupt changes of current and voltage as well as to function as a protection against harmonics. The line reactors are included in the standard delivery of liquid-cooled drives (not inverters). However, you can also order your drive without a line reactor.

Line Reactor Specifications

Drive Rating 480V	Drive Rating 690V	Thermal Current (A)	Nominal Inductance (µH) A/B ①	Calculated Loss (W)	Choke Catalog Number (690 Vac)
16 to 22A	12 to 23A	23	1900	145	**CHK0023N6A0**
31 to 38A	31 to 38A	38	1100	170	**CHK0038N6A0**
45 to 61A	46 to 62A	62	700	210	**CHK0062N6A0**
72 to 87A	72 to 87A	87	480	250	**CHK0087N6A0**
105 to 140A	105 to 140A	145	290	380	**CHK0145N6A0**
168 to 261A	170 to 261A	261	139/187	460	**CHK0261N6A0**
300 to 385A	325 to 385A 820 to 1180A ②	400	90/126	570	**CHK0400N6A0**
460 to 520A 1370A ②	416 to 502A 1300 to 1500A ②	520	65/95	610	**CHK0520N6A0**
590 to 650A 1640A ②	590 to 650A	650	51/71	840	**CHK0650N6A0**
730A 2060A ②	—	730	45/61	850	**CHK0730N6A0**
820A 2300A ②	750A	N/A	N/A	N/A	**CHK0820N6A0**
920 to 1030A	—	1000	30/41	950	**CHK1030N6A0**
1150A	—	1150	26/36	1000	**CHK1150N6A0**

Dimensions, see **Page V6-T2-232**.

Notes

① Inductances for different supply voltages: A = 400–480 Vac; B = 500–690 Vac.

② Drives require three chokes of the designated catalog number with six-pulse supply.

Technical Data and Specifications

LCX9000 Products

Description	Specification
General Specifications	
Line voltage	400 to 500 Vac; 525 to 690 Vac; (–10% to 10%) 465 to 800 Vdc; 640 to 1100 Vdc; (–0 to 0%)
Frequency	50/60 Hz
Line voltage variation	–10% to 10%
Input frequency variation	45–66 Hz
Continuous output current	Rated current at incoming cooling liquid temperature of 30°C
Output frequency	0–320 Hz
Drive efficiency	>95%
Power factor (displacement)	0.96
Liquid coolant pressure	87 psi (6 bar) maximum
Liquid coolant flow rate	1.3 to 7.9 gal./min. (5 to 30 liter/min.) minimum depending on drive size
Liquid coolant fittings	Standard quick connect, NPT
Operating ambient temperature	–10/50°C
Storage temperature	–40/70°C
Humidity	95% maximum (non-condensing)
Altitude	3300 ft (1000 m) maximum without derating
Enclosure	IP00
Warranty	Standard terms, 3 years with certified start-up
Mains Connection	
Input voltage (V_{in})	400–500 Vac; 525–690 Vac; (–10%–10%) 465–800 Vdc; 640–1100 Vdc; (–0–0%)
Input frequency (f_{in})	45–66Hz
Connection to mains	Once per minute or less (normal case)
Motor Connection	
Output voltage	0–V_{in}
Continuous output current	Rated current at nominal inflow cooling water temperature of 30°C; Overload 2 sec./20 sec.
Starting current	Rated current at 2 sec./20 sec. if output frequency <30 Hz and temperature of heatsink <149°F (65°C)
Output frequency	0–320 Hz (standard); 7200 Hz (special software)
Frequency resolution	Application dependent
Control Characteristics	
Control method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: Frequency control Closed loop: Vector control
Switching frequency	Adjustable with parameter 2.6.9
480V ①	Up to and including 61-Amp size: 1–16 kHz (factory default, 10 kHz) From 72-Amp size: 1–12 kHz (factory default, 3.6 kHz)
575V ①	1–6kHz (factory default, 1.5kHz)
Frequency reference	Analog input: resolution 0.1% (10 bits); accuracy ±1% Panel reference: resolution 0.01 Hz
Field weakening point	30–320 Hz
Acceleration time	0.1–3000 seconds
Deceleration time	0.1–3000 seconds
Braking torque	DC brake: 30% x T_n (without brake option)

Description	Specification
Ambient Conditions	
Ambient operating temperature	14°F (–10°C), no frost to 122°F (50°C) at I_{th} 122 to 158°F (50 to 70°C), derating required
Storage temperature	–40°F to 158°F (–40 to 70°C) No liquid in heatsink under 32°F (0°C)
Relative humidity	5–96% RH, noncondensing, no dripping water
Air quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2 Mechanical particles: IEC 721-3-3, unit in operation, class 3S2 (no conductive dust allowed); No corrosive gases
Altitude	Up to 1,000m: 100% load capacity (no derating) Above 1,000m: Derating of 1% per each 100m required
Vibration	EN 50178, EN 60068-2-6; 5–150 Hz Displacement amplitude: 0.25 mm (peak) at 3–31 Hz Max. acceleration amplitude: 1G at 31–150 Hz
Shock	EN 50178, EN 60068-2-27, UPS drop test (for applicable UPS weights) Storage and shipping: Max. 15G, 11 ms (in package)
Enclosure class	IP00 open frame standard in entire kW/hp range
EMC	
Immunity	Fulfils all EMC immunity requirements
Emissions	EMC level N; EMC level T for IT networks
Safety	
Approvals	EN 50178, EN 60204-1, CE, UL, CUL, FI, GOST R, IEC 61800-5 (See unit nameplate for more detailed approvals.)
Control Connections	
Analog input voltage	0 to +10V, R_i = 200 kohm (–10V to +10V joystick control) Resolution 0.1%; accuracy ±1%
Analog input current	0(4)–20 mA, R_i = 250 ohm differential
Digital inputs	6 positive or negative logic; 18–24 Vdc
Auxiliary voltage	+24V, ±15%, max. 250 mA
Output reference voltage	+10V, +3%, max. load 10 mA
Analog output	0(4)–20 mA, R_L max. 500 ohm Resolution 10 bits; accuracy ±2%
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	Two programmable change-over relay outputs Switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A Min. switching load: 5V/10 mA

Note

① Derating required if higher switching frequency than the default is used.

LCX9000 Products, continued

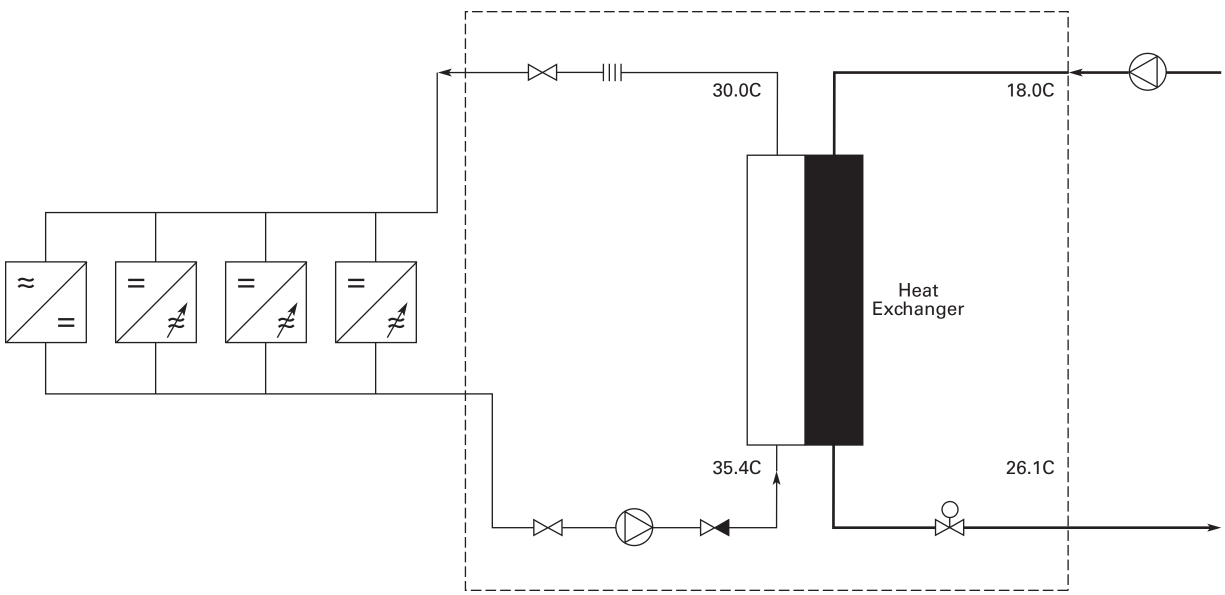
Description	Specification
Protections	
Overvoltage protection	
480V	911V
575V	1200V
Undervoltage protection	
480V	333V
575V	461V
Ground fault protection	In case of ground fault in motor or motor cable, only the drive is protected
Mains supervision	Trips if any of the input phases are missing (drives only)
Motor phase supervision	Trips if any of the output phases are missing
Unit overtemperature protection	
Alarm limit	149°F (65°C) for heatsink, 158°F (70°C) for circuit boards
Trip limit	158°F (70°C) for heatsink, 185°F (85°C) for circuit boards

Description	Specification
Protections, continued	
Overcurrent protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short-circuit protection	Yes (+24V and +10V reference voltages)
Liquid Cooling	
Allowed cooling agents	Drinking water Water-glycol mixture
Temperature of cooling agent	32 to 86°F (0 to 30°C) at I_{th} for input; 86 to 149°F (30 to 65°C) Max. temperature rise during circulation: 9°F (5°C), no condensation allowed
System max. working pressure	87 psi (6 bar)
System max. peak pressure	580 psi (40 bar)
Pressure loss (at nominal flow)	Varies according to size

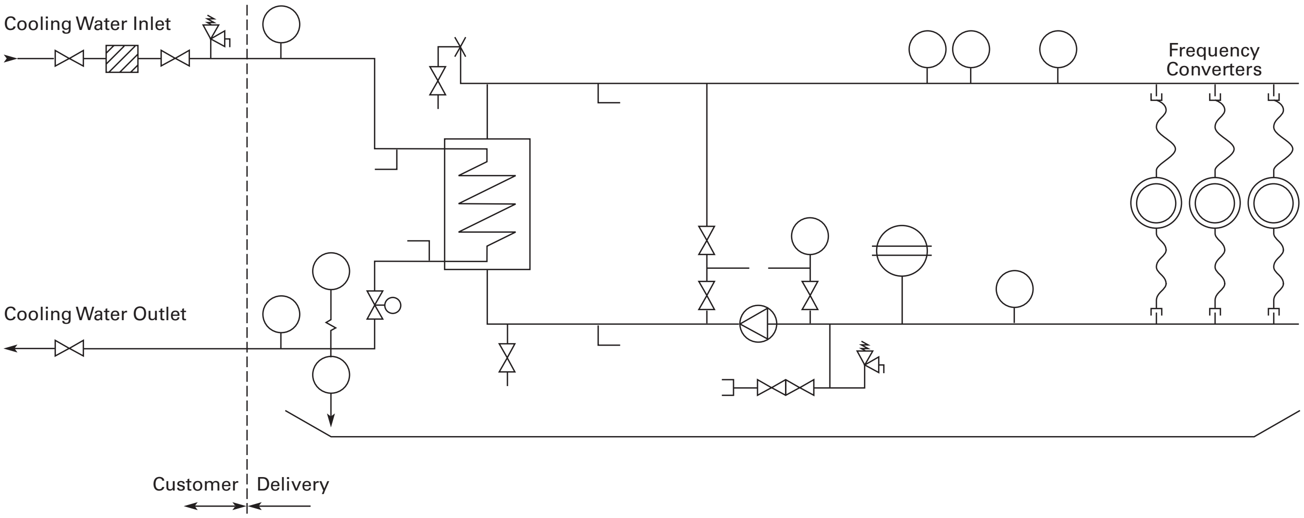
Wiring Diagrams

Cooling System Diagrams

Example of a Typical Cooling System

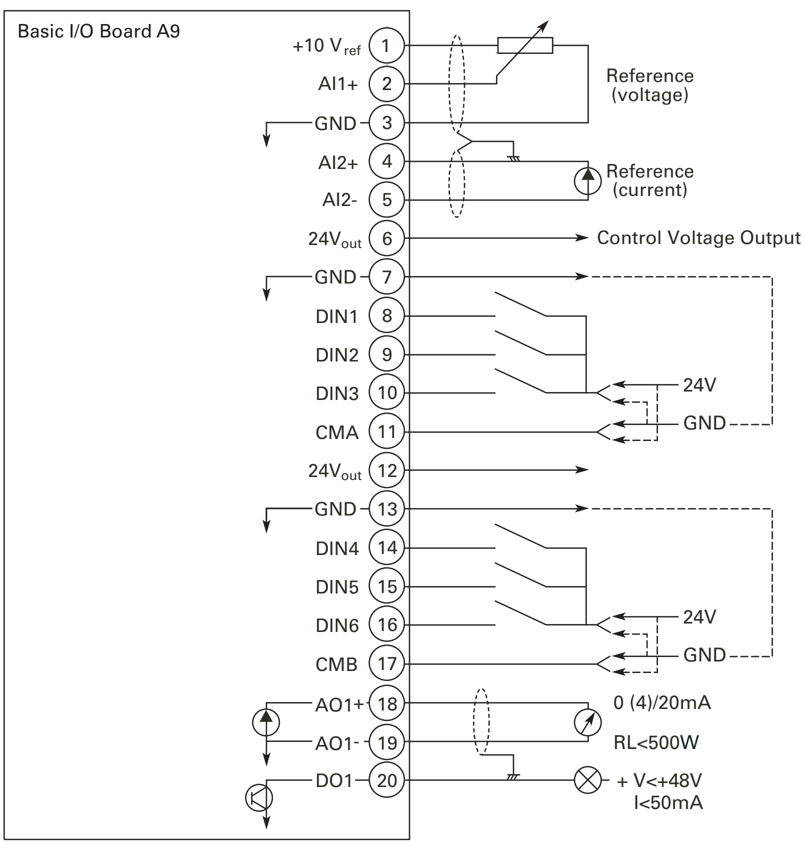


Example PI-Diagram of a Typical Cooling System and Connections



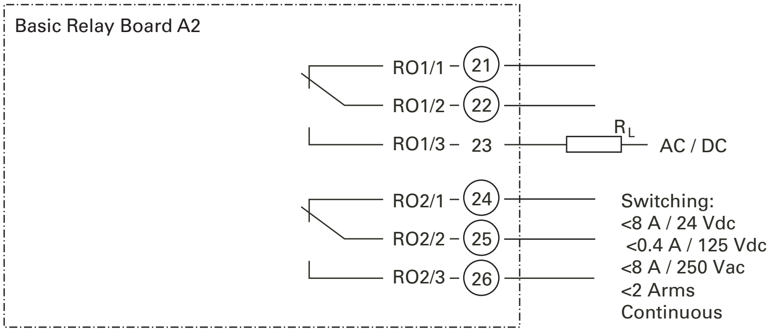
I/O Board Diagrams

A9 Option Board Control Wiring



Dotted lines indicate the connections for inverted signals

A2 Option Board Wiring

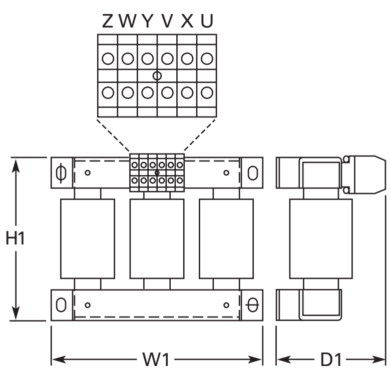


Dimensions

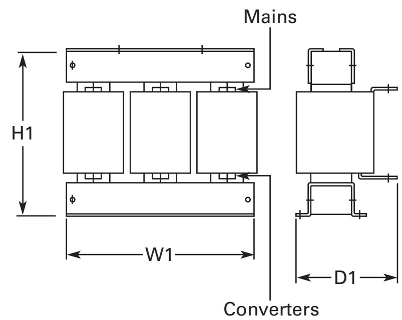
Approximate Dimensions in Inches (mm)

Line Reactors

Sizes Up To 61A



Sizes Larger Than 61A

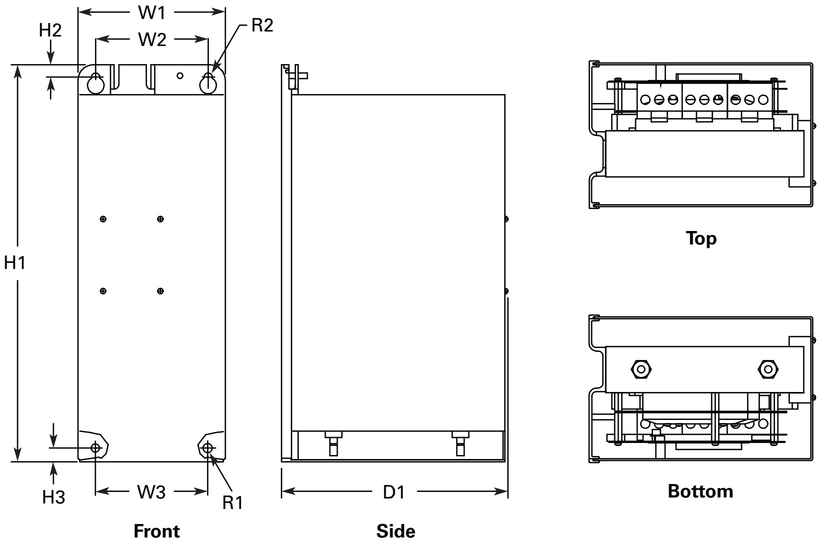


Catalog Number	H1	W1	D1	Weight Lbs (kg)
CHK0023N6A0	7.01 (178)	9.06 (230)	4.76 (121)	22 (10)
CHK0038N6A0	8.23 (209)	10.63 (270)	5.71 (145)	33 (15)
CHK0062N6A0	8.39 (213)	11.81 (300)	6.30 (160)	44 (20)
CHK0087N6A0	9.13 (232)	11.81 (300)	6.69 (170)	57 (26)
CHK0145N6A0	11.50 (292)	11.81 (300)	7.28 (185)	82 (37)
CHK0220N6A0	12.05 (306)	13.86 (352)	7.28 (185)	119 (54)
CHK0325N6A0	13.66 (347)	13.86 (352)	7.28 (185)	132 (60)
CHK0460N6A0	16.54 (423)	13.70 (348)	9.41 (239)	203 (92)
CHK0520N6A0	17.60 (447)	15.51 (394)	10.71 (272)	231 (105)
CHK0590N6A0	20.43 (519)	15.51 (394)	10.71 (272)	276 (125)
CHK0650N6A0	20.51 (521)	15.51 (394)	10.71 (272)	276 (125)
CHK0750N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK0820N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK1000N6A0	22.68 (576)	19.57 (497)	11.85 (301)	441 (200)
CHK1150N6A0	22.83 (580)	19.57 (497)	11.85 (301)	441 (200)

Approximate Dimensions in Inches (mm)

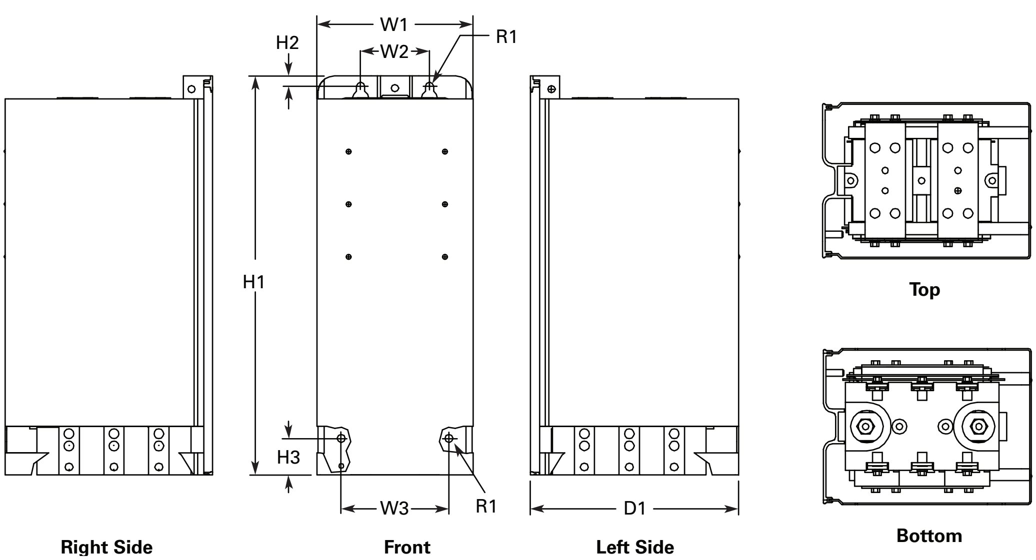
LCX9000 Drives

Chassis Size, CH3



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	16–61	16.97 (431.0)	0.53 (13.5)	0.59 (15.0)	9.69 (246.0)	6.30 (160.0)	4.80 (122.0)	4.80 (122.0)	0.39 (10.0)	0.35 (9.0)	66 (30)

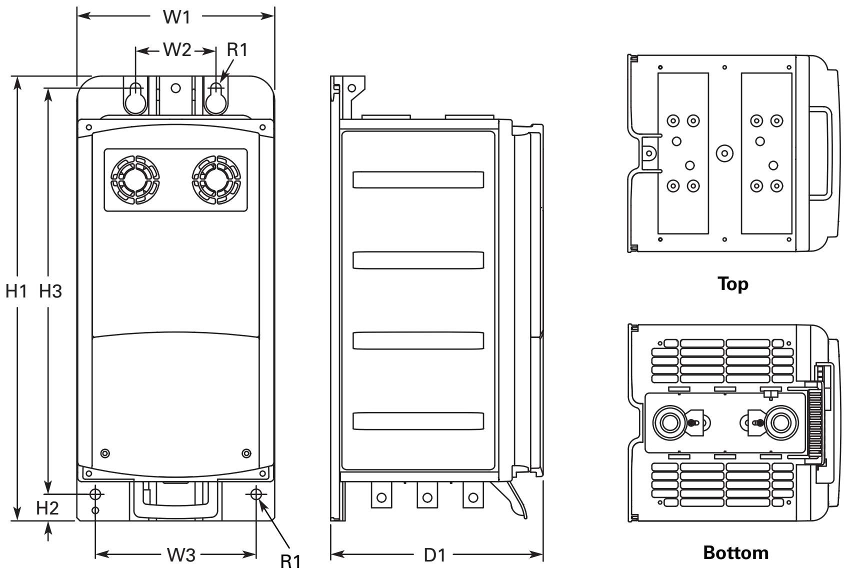
Chassis Size, CH4



Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	72–140	19.41 (493.0)	0.49 (12.5)	1.77 (45.0)	10.14 (257.5)	7.60 (193.0)	3.35 (85.0)	5.24 (133.0)	0.39 (10.0)	—	77 (35)

Approximate Dimensions in Inches (mm)

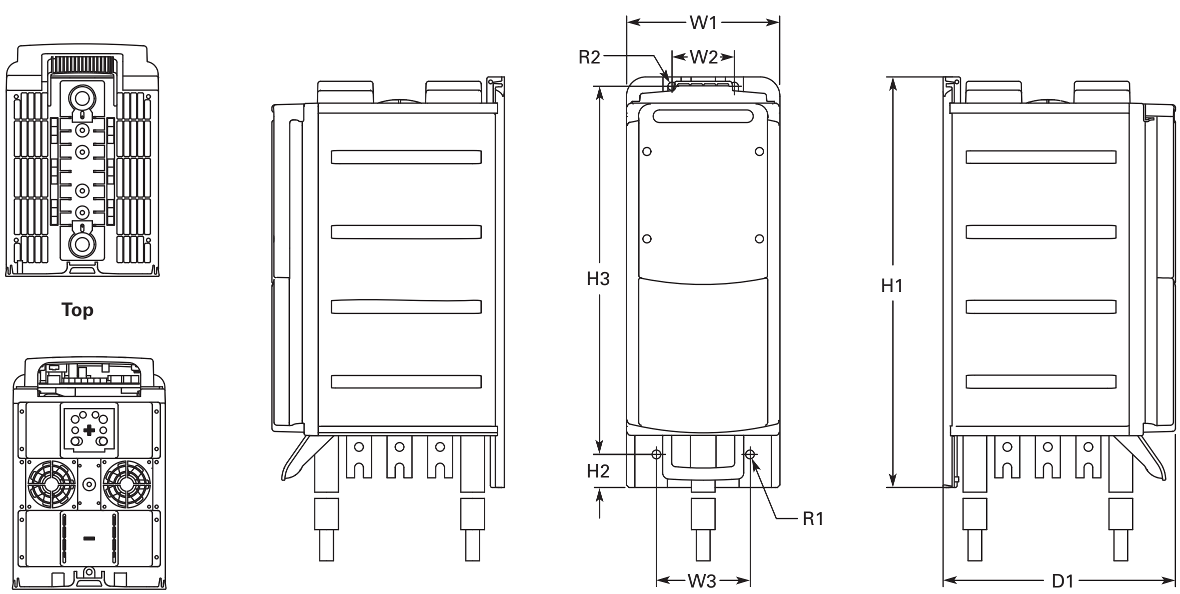
Chassis Size, CH5



Front Side

Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	168–261	21.77 (553.0)	1.30 (33.0)	19.88 (505.0)	10.39 (264.0)	9.69 (246)	3.94 (100.0)	7.87 (200.0)	0.51 (13.0)	—	88 (40)

Chassis Size, CH61

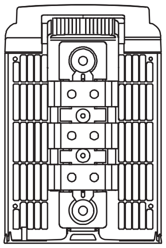


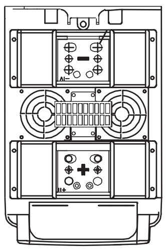
Bottom Right Side Front Left Side

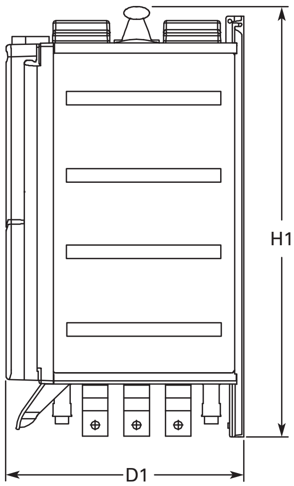
Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	300–385	25.91 (658.0)	2.09 (53.0)	23.23 (590.0)	14.69 (373.0)	9.69 (246.0)	3.94 (100.0)	5.91 (150.0)	0.55 (14.0)	0.51 (13.0)	121 (55)
525–690 Vac	170–208										

Approximate Dimensions in Inches (mm)

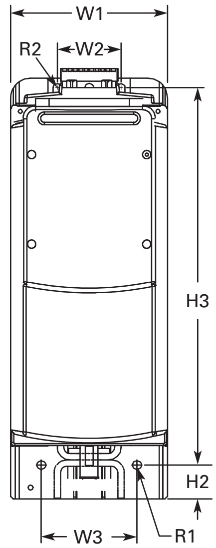
Liquid-Cooled Inverter—Chassis Size, CH62


Top


Bottom



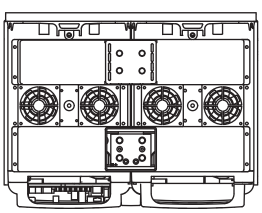
Side

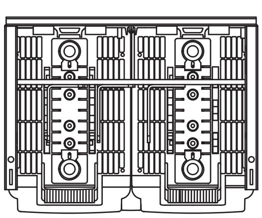


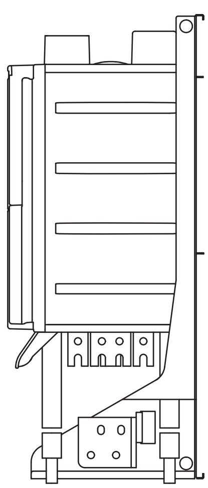
Front

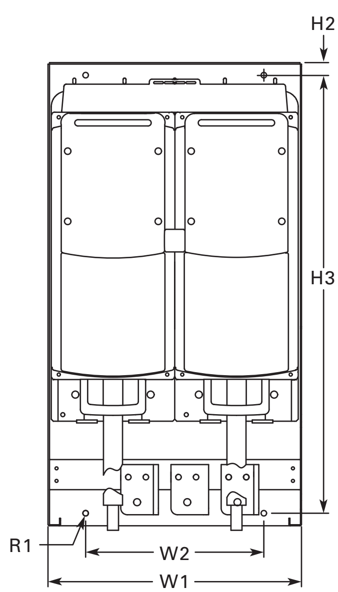
Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	R1 Dia.	R2 Dia.
540–675 Vdc	460–730	26.50 (673)	2.0 (53)	23.23 (590)	14.69 (373)	9.69 (246)	3.94 (100)	5.91 (150)	0.55 (14)	0.51 (13)
710–930 Vdc	325–502									

Chassis Size, CH63

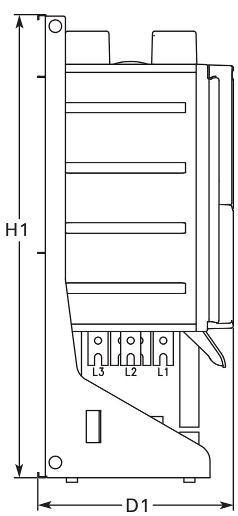

Top


Bottom


Right Side



Front

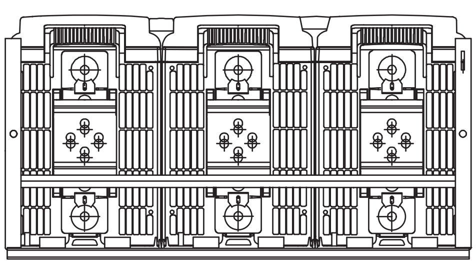


Left Side

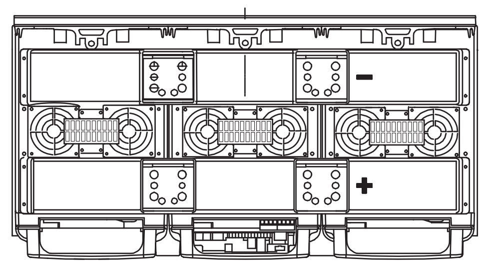
Voltage	Amps	H1	H2	H3	D1	W1	W2	R1 Dia.	Weight Lbs (kg)
380–500 Vac	820–1030	36.36 (923.5)	0.91 (23.0)	34.39 (873.5)	15.35 (390.0)	19.88 (505.0)	13.98 (355.0)	0.43 (11.0)	264 (120)
525–690 Vac	590–750								

Approximate Dimensions in Inches (mm)

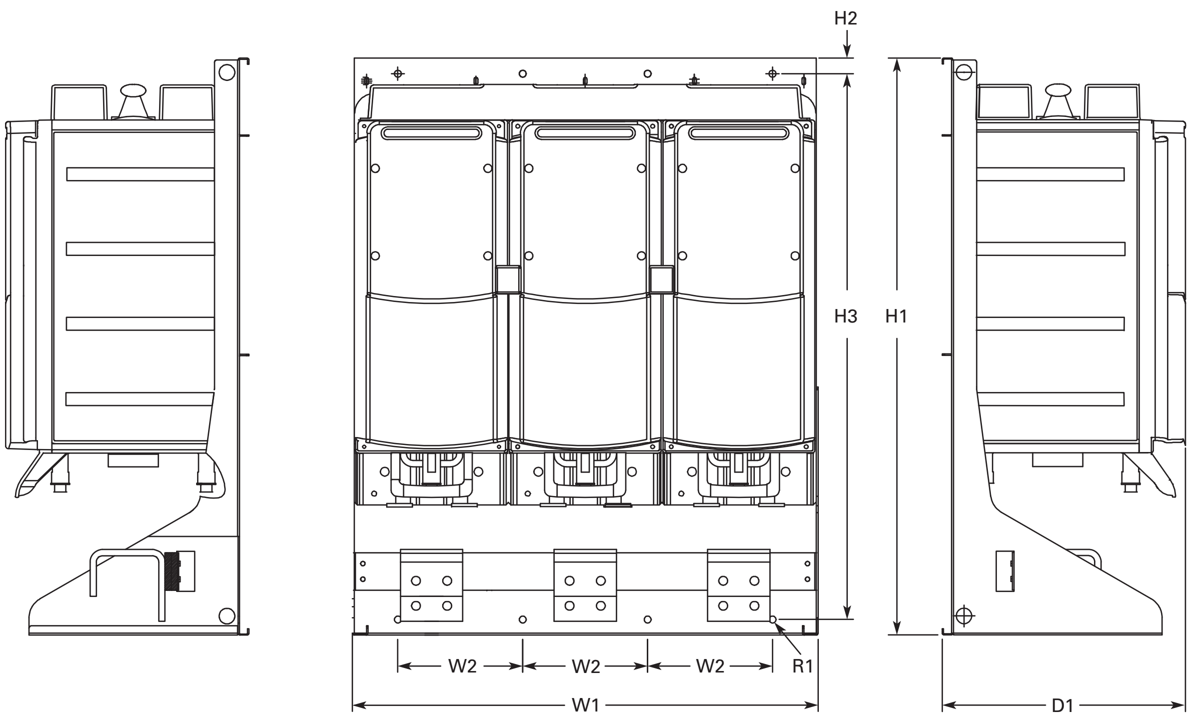
Liquid-Cooled Inverter with Mounting Bracket, Chassis Size CH64, IP90



Bottom



Top

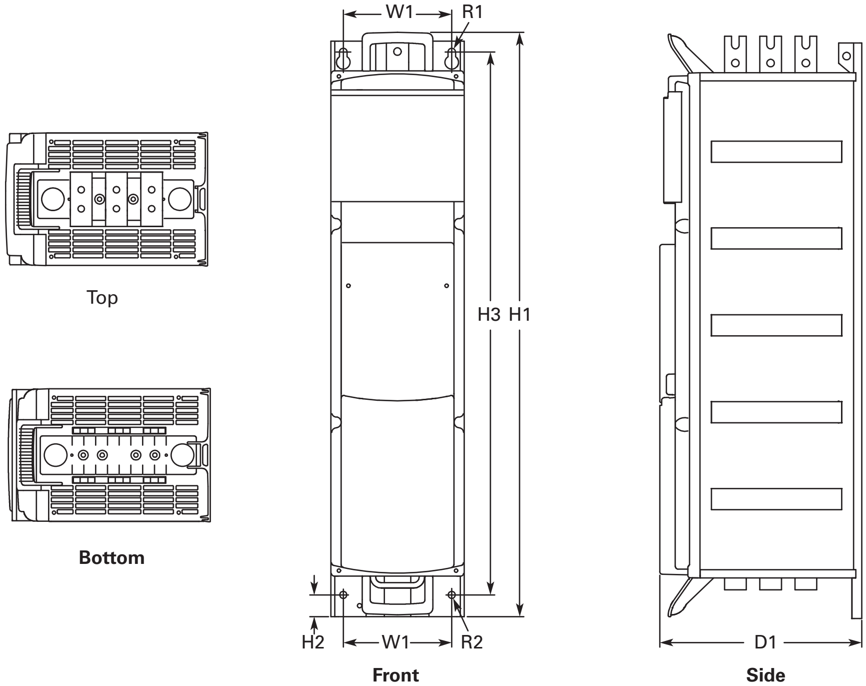


Right Side
Front
Left Side

Voltage	Amps	H1	H2	H3	D1	W1	W2	R1 Dia.
540–675 Vdc	1370–4140	36.38 (924)	1.03 (26)	34.37 (873)	15.35 (390)	29.37 (746)	7.87 (200)	0.43 (11)
710–930 Vdc	820–3100							

Approximate Dimensions in Inches (mm)

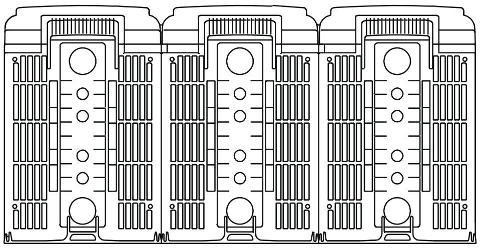
Chassis Size, CH72



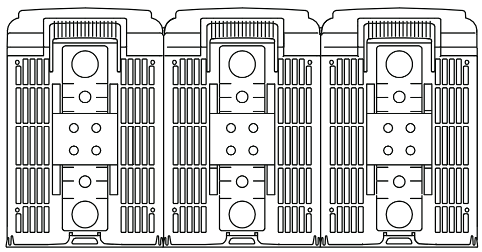
Voltage	Amps	H1	H2	H3	D1	W1	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	460–730	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	7.87 (200.0)	0.55 (14.0)	0.51 (13.0)	198 (90)
525–690 Vac	261–502								

Approximate Dimensions in Inches (mm)

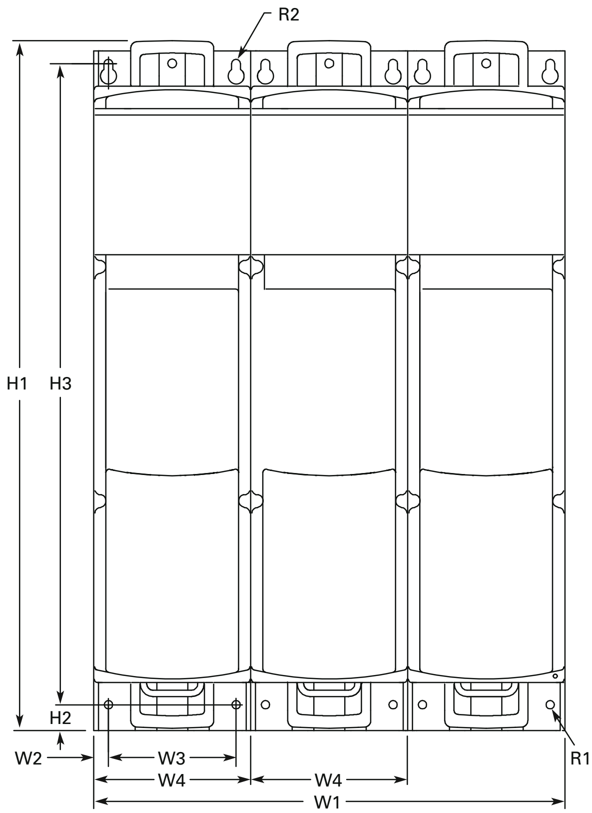
Chassis Size, CH74



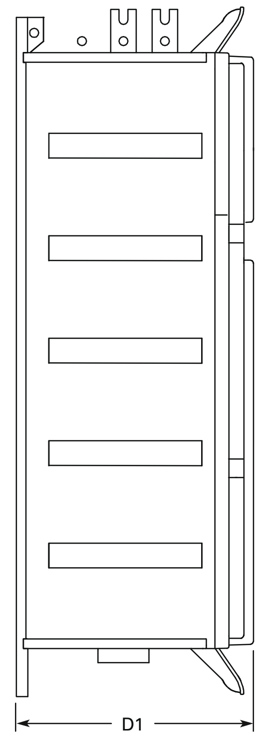
Top



Bottom



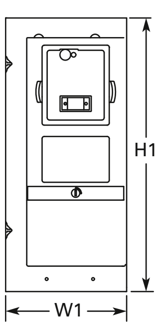
Front



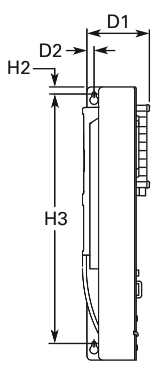
Side

Voltage	Amps	H1	H2	H3	D1	W1	W2	W3	W4	R1 Dia.	R2 Dia.	Weight Lbs (kg)
380–500 Vac	1370–2300	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	29.06 (738.0)	0.91 (23.0)	7.87 (200.0)	9.69 (246)	0.51 (13.0)	0.55 (14.0)	617 (280)
525–690 Vac	820–1500											

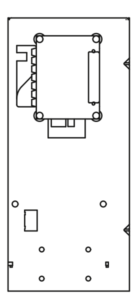
Control Unit



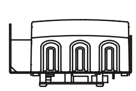
Front



Side



Back



Bottom

H1	H2	H3	D1	D2	W1
12.93 (328.5)	0.33 (8.5)	11.81 (300.0)	2.95 (75.0)	0.33 (8.5)	5.75 (146.0)

SPA9000/SPN9000/SPI9000 Common DC Bus Drive Products

Contents

Description — *Page*

Product Description

Eaton offers a comprehensive range of common DC bus drive products. The product family covers a number of front-end units and inverter units in the entire power range from 1-1/2 to 2000 horsepower at 460V and 690V. The drive components are built on the SPX9000 technology.

Front-End Units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus (and, in certain cases, vice versa).

The SPA (active front-end) unit is a bidirectional (regenerative) power converter for the front end of a common DC bus drive line up. An external LCL filter is used at the input. This unit is suitable in applications where low mains harmonics are required.

The SPN (non-regenerative front-end) unit is a uni-directional (motoring) power converter for the front-end of a common DC bus drive line-up. The device operates as a diode bridge using diode/thyristor components. A dedicated external choke is used at the input. The unit has the capacity to charge a common DC bus. This unit is suitable as a rectifying device when a "normal" level of harmonics is accepted and no regeneration to the mains is required.

Inverter Unit

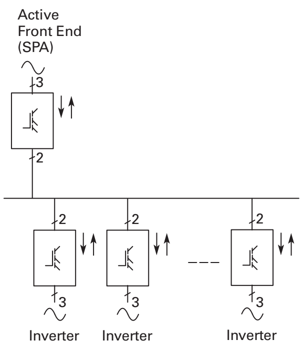
The SPI9000 Inverter Unit is a bidirectional DC-fed power inverter for the supply and control of AC motors. The inverter is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC side charging circuit is integrated up to 75 kW (FR4–FR8) and external for higher power ratings (FI9–FI14).

Application Description

The common DC bus product portfolio fulfills all solution demands with a flexible architecture.

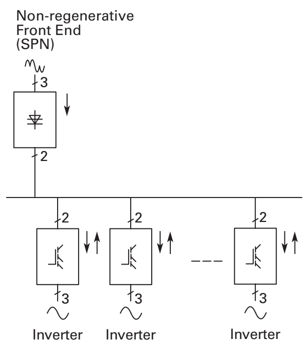
Front end units are selected according to the level of harmonics and power requirements. Typical drive system configurations are illustrated the following figures.

SPA + Inverters



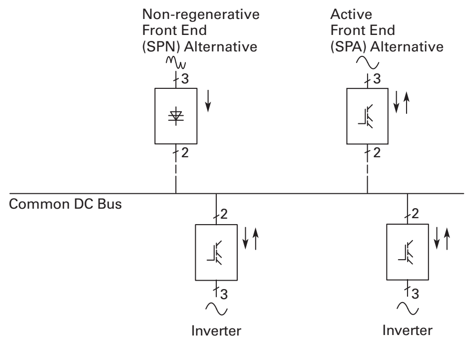
- Low harmonics, $-P_{mains} \approx +P_{mains}/P_{mains} \le \Sigma P_{INU}$
- Suitable for almost every application

SPN + Inverters



- Low total mains power, $P_{mains} \le \Sigma P_{INU}$
- Suitable e.g. for small processing line with un- and recoiler, em-stop coasting

Combination Configuration



Common DC bus components are used in a multitude of combinations. Drives which are braking can transfer the energy directly to the drives in motoring mode.

Product Comparison

Advantages over Conventional Front Ends

Eaton Front Ends vs. Conventional

	Non-Regenerative Front End	Active Front End	Conventional Regenerative Front End ①
Input device	Choke (L)	Filter (LCL)	Choke or auto-transformer (L)
Bridge type	Diode/thyristor bridge	IGBT bridge, two-level type	Anti-parallel connected thyristor bridge
Type of operation	Controlled half-bridge	High frequency modulation (1.5 to 3.6 kHz)	Firing angle controlled
Direction of power	Motoring	Motoring and regenerating	Motoring and regenerating
Charging	Constant current	External required	Usually internal
DC voltage	Nominal (approx. 1.35 alternative U_N)	Stable at +10% of nominal (approx. 110% of 1.35 alternative U_N)	Lowered DC voltage for commutation margin (e.g. 17% fi approx. 83% of 1.35 alternative U_N) or autotransformer on regenerative bridge
THD	Similar to six-pulse bridge normal <40%	Very low	Similar to six-pulse bridge or worse

Note

① Conventional regenerative front end (a.k.a. "anti-parallel thyristor bridge") is not available from Eaton.

Features

Standard Features

Feature	SPI9000 FR4, 6, 7	FR8	FI9–FI14	SPA FI9–FI14	SPN FI9
IP00	—	■	■	■	■
IP21	■	—	—	—	—
Air cooling	■	■	■	■	■
Standard board	■	■	■	■	
Varnished board	—	—	—	—	—
Alphanumeric keypad	■	■	■	■	—
EMC class T (EN 61800-3 for IT networks)	■	■	■	■	■
Safety CE/UL	■	■	■	■	■
Input choke	—	—	—	—	■
LCL filter	—	—	—	■	—
No integrated charging	—	—	■	■	—
Integrated charging (DC side)	■	■	—	—	■
Diode/thyristor rectifier	—	—	—	—	■
IGBT	■	■	■	■	—

Standards and Certifications

- CE
- UL
- cUL
- EN 61800-5-1 (2003)

Catalog Number Selection

Active Front End

SPA 205 A 0 – 4 A 3 N 1

Product Family
SPA = Active Front End

Current Rating	
480V	**575V**
205 = 205A	**125** = 125A
385 = 385A	**325** = 325A
H10 = 1150A	**920** = 920A

Software Series
A = Standard

Enclosure Rating
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = *IT* network

Brake Chopper Options
N = No brake chopper circuit

Board Modifications
1 = Standard boards
2 = Varnished boards

Non-Regenerative Front End

SPN 510 A 0 – 4 A 3 N 1

Product Family
SPN = Non-regenerative front end

Current Rating
480V/575V
510 = 510A

Software Series
A = Standard

Enclosure Rating
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = *IT* network

Brake Chopper Options
N = No brake chopper circuit

Board Modifications
1 = Standard boards
2 = Varnished boards

SPI9000 Inverter Unit

SPI 016 A 1 – 4 A 3 N 1

Product Family
SPI = Inverter unit

Current Rating

480V (FR4–FR8)		575V (FR6–FR8)	
003 = 3.3A	**031** = 31A	**003** = 3.2A	**022** = 22A
007 = 7.6A	**038** = 38A	**004** = 4.5A	**027** = 27A
009 = 9A	**061** = 61A	**005** = 5.5A	**034** = 34A
012 = 12A	**071** = 72A	**007** = 7.5A	**041** = 41A
016 = 16A	**087** = 87A	**010** = 10A	**052** = 52A
023 = 23A	**105** = 105A	**013** = 13.5A	**062** = 62A
		018 = 18A	**080** = 80A
480V (FI9–FI13)		**575V (FI9–FI14)**	
140 = 140A	**730** = 730A	**100** = 100A	**502** = 502A
170 = 170A	**820** = 820A	**125** = 125A	**590** = 590A
205 = 205A	**920** = 920A	**144** = 144A	**650** = 650A
245 = 245A	**H10** = 1030A	**170** = 170A	**820** = 820A
300 = 300A	**H11** = 1150A	**208** = 207A	**920** = 920A
385 = 385A	**H13** = 1300A	**261** = 261A	**H10** = 1030A
460 = 460A	**H16** = 1600A	**325** = 325A	**H13** = 1300A
520 = 520A	**H19** = 1940A	**385** = 385A	**H15** = 1500A
590 = 590A	**H23** = 2300A	**460** = 460A	**H19** = 1900A
650 = 650A			

Software Series
A = Standard

Enclosure Rating
1 = NEMA Type 1/IP21
0 = Chassis

Voltage Rating
4 = 480V
5 = 575V

Keypad
A = Alphanumeric

EMC Level
3 = *IT* network

Brake Chopper Options
N = No brake chopper circuit

Board Modifications
1 = Standard boards
2 = Varnished boards

Product Selection

Common DC Bus Drive Products

SPA9000 Active Front End 480V

	Low Overload (AC Current)		High Overload (AC Current)		Imax	
Frame	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)	Catalog Number
FI9	261	287	205	308	349	**SPA205A0-4A3N1**
FI10	460	506	385	578	693	**SPA385A0-4A3N1**
FI13	1300	1430	1150	1725	2070	**SPAH11A0-4A3N1**

SPN9000 Non-Regenerative Front End 480V

	Low Overload (AC Current)		High Overload (AC Current)		Imax	
Frame	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)	Catalog Number
FI9	520	572	460	690	828	**SPN460A0-4A3N1**

SPI9000 Inverter Unit 480V

	Low Overload (AC Current)		High Overload (AC Current)		Imax	
Frame	$I_{L\text{-}cont}$ (A)	I_{1min} (A)	$I_{H\text{-}cont}$ (A)	I_{1min} (A)	I_{2s} (A)	Catalog Number
FR4	4.3	4.7	3.3	5	6.2	**SPI003A1-4A3N1**
	9	9.9	7.6	11.4	14	**SPI007A1-4A3N1**
	12	13.2	9	13.5	18	**SPI009A1-4A3N1**
FR6	16	17.6	12	18	24	**SPI012A1-4A3N1**
	23	25.3	16	24	32	**SPI016A1-4A3N1**
	31	34	23	35	46	**SPI023A1-4A3N1**
	38	42	31	47	62	**SPI031A1-4A3N1**
	46	51	38	57	76	**SPI038A1-4A3N1**
FR7	72	79	61	92	122	**SPI061A1-4A3N1**
	87	96	72	108	144	**SPI072A1-4A3N1**
	105	116	87	131	174	**SPI087A1-4A3N1**
FR8	140	154	105	158	210	**SPI105A0-4A3N1**
FI9	170	187	140	210	280	**SPI140A0-4A3N1**
	205	226	170	255	336	**SPI170A0-4A3N1**
	261	287	205	308	349	**SPI205A0-4A3N1**
	300	330	245	379	444	**SPI245A0-4A3N1**
FI10	385	424	300	450	540	**SPI300A0-4A3N1**
	460	506	385	578	693	**SPI385A0-4A3N1**
	520	572	460	690	828	**SPI460A0-4A3N1**
FI12	590	649	520	780	936	**SPI520A0-4A3N1**
	650	715	590	885	1062	**SPI590A0-4A3N1**
	730	803	650	975	1170	**SPI650A0-4A3N1**
	820	902	730	1095	1314	**SPI730A0-4A3N1**
	920	1012	820	1230	1476	**SPI820A0-4A3N1**
	1030	1133	920	1380	1656	**SPI920A0-4A3N1**
FI13	1150	1265	1030	1545	1854	**SPIH10A0-4A3N1**
	1300	1430	1150	1720	2070	**SPIH11A0-4A3N1**
	1450	1595	1300	1950	2340	**SPIH13A0-4A3N1**
FI14	1770	1947	1600	2400	2880	**SPIH16A0-4A3N1**
	2150	2365	1940	2910	3492	**SPIH19A0-4A3N1**

Note

For filter and line reactor information, see **Page V6-T2-245**.

Common DC Bus Drive Products

SPA9000 Active Front End 575V

Frame	Low Overload (AC Current) $I_{L\text{-}cont}$ (A)	Low Overload (AC Current) I_{1min} (A)	High Overload (AC Current) $I_{H\text{-}cont}$ (A)	High Overload (AC Current) I_{1min} (A)	Imax I_{2s} (A)	Catalog Number
FI9	144	158	125	188	213	**SPA125A0-5A3N1**
FI10	385	424	325	488	585	**SPA325A0-5A3N1**
FI13	1030	1133	920	1380	1656	**SPA920A0-5A3N1**

SPN9000 Non-Regenerative Front End 575V

Frame	Low Overload (AC Current) $I_{L\text{-}cont}$ (A)	Low Overload (AC Current) I_{1min} (A)	High Overload (AC Current) $I_{H\text{-}cont}$ (A)	High Overload (AC Current) I_{1min} (A)	Imax I_{2s} (A)	Catalog Number
FI9	600	660	510	732	888	**SPN510A0-5A3N1**

SPI9000 Inverter Unit 575V

Frame	Low Overload (AC Current) $I_{L\text{-}cont}$ (A)	Low Overload (AC Current) I_{1min} (A)	High Overload (AC Current) $I_{H\text{-}cont}$ (A)	High Overload (AC Current) I_{1min} (A)	Imax I_{2s} (A)	Catalog Number
FR6	4.5	5	3.2	5	6.4	**SPI003A1-5A3N1**
	5.5	6	4.5	7	9	**SPI004A1-5A3N1**
	7.5	8	5.5	8	11	**SPI005A1-5A3N1**
	10	11	7.5	11	15	**SPI007A1-5A3N1**
	13.5	15	10	15	20	**SPI010A1-5A3N1**
	18	20	13.5	20	27	**SPI013A1-5A3N1**
	22	24	18	27	36	**SPI018A1-5A3N1**
	27	30	22	33	44	**SPI022A1-5A3N1**
	34	37	27	41	54	**SPI027A1-5A3N1**
FR7	41	45	34	51	68	**SPI034A1-5A3N1**
	52	57	41	62	82	**SPI041A1-5A3N1**
FR8	62	68	52	78	104	**SPI052A0-5A3N1**
	80	88	62	93	124	**SPI062A0-5A3N1**
	100	110	80	120	160	**SPI080A0-5A3N1**
FI9	125	138	100	150	200	**SPI100A0-5A3N1**
	144	158	125	188	213	**SPI125A0-5A3N1**
	170	187	144	216	245	**SPI144A0-5A3N1**
	208	229	170	255	289	**SPI170A0-5A3N1**
FI10	261	287	208	312	375	**SPI208A0-5A3N1**
	325	358	261	392	470	**SPI261A0-5A3N1**
	385	424	325	488	585	**SPI325A0-5A3N1**
FI12	460	506	385	578	693	**SPI385A0-5A3N1**
	502	552	460	690	828	**SPI460A0-5A3N1**
	590	649	502	753	904	**SPI502A0-5A3N1**
	650	715	590	885	1062	**SPI590A0-5A3N1**
	750	825	650	975	1170	**SPI650A0-5A3N1**
FI13	920	1012	820	1230	1476	**SPI820A0-5A3N1**
	1030	1133	920	1380	1656	**SPI920A0-5A3N1**
	1180	1298	1030	1464	1755	**SPIH10A0-5A3N1**
FI14	1500	1650	1300	1950	2340	**SPIH13A0-5A3N1**
	1900	2090	1500	2250	2700	**SPIH15A0-5A3N1**
	2250	2475	1900	2782	3335	**SPIH19A0-5A3N1**

Note

For filter and line reactor information, see **Page V6-T2-245**.

LCL Filters

LCL Filters for Active Front End (480V)

Amps	Catalog Number	Amps	Catalog Number
10	**REG 10 5 0**	270	**REG 270 5 0**
18	**REG 18 5 0**	410	**REG 410 5 0**
32	**REG 32 5 0**	580	**REG 580 5 0**
48	**REG 48 5 0**	840	**REG 840 5 0**
75	**REG 75 5 0**	1160	**REG 1160 5 0**
110	**REG 110 5 0**	1480	**REG 1480 5 0**
180	**REG 180 5 0**		

LCL Filters for Active Front End (690V)

Amps	Catalog Number	Amps	Catalog Number
14	**REG 14 6 0**	287	**REG 287 6 0**
23	**REG 23 6 0**	390	**REG 390 6 0**
35	**REG 35 6 0**	460	**REG 460 6 0**
52	**REG 52 6 0**	620	**REG 620 6 0**
85	**REG 85 6 0**	780	**REG 780 6 0**
122	**REG 122 6 0**	920	**REG 920 6 0**
185	**REG 185 6 0**	1180	**REG 1180 6 0**

Line Reactor

Line Reactor for Non-Regenerative Front End (480/575VV)

Amps	Watts Losses	Catalog Number
600	493	**CHK600**

2

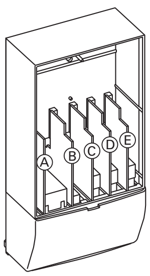
Options

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards.

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

Option Boards



Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Field Installed Catalog Number	Factory Installed Option Designator	SVX Ready Programs Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards										
2 RO (NC-NO)	B	**OPTA2**	—	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1AO, 1 +10 Vdc ref, 2 ext +24 Vdc/EXT +24 Vdc	A	**OPTA9**	—	■	■	■	■	■	■	■
Extended I/O Cards										
2 RO, therm	B	**OPTA3**	**A3**	—	■	■	■	■	■	■
Encoder low volt +5V/15V24V	C	**OPTA4**	**A4**	—	■	■	■	■	■	■
Encoder high volt +15V/24V	C	**OPTA5**	**A5**	—	■	■	■	■	■	■
Double encoder	C	**OPTA7**	**A7**	■	■	■	■	■	■	■
6 DI, 1 DO, 2 AI, 1 AO	A	**OPTA8**	**A8**	—	■	■	■	■	■	■
3 DI (encoder 10–24V), out +15V/+24V, 2 DO (pulse+direction)	C	**OPTAE**	**AE**	■	■	■	■	■	■	■
6 DI, 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB1**	**B1**	—	—	—	—	—	■	■
1 RO (NC-NO), 1 RO (NO), 1 therm	B, C, **D**, E	**OPTB2**	**B2**	—	—	—	—	—	■	■
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24 Vdc/EXT +24 Vdc	B, C, **D**, E	**OPTB4**	**B4**	—	■	■	■	■	■	■
3 RO (NO)	B, C, **D**, E	**OPTB5**	**B5**	—	—	—	—	—	■	■
1 ext +24 Vdc/EXT +24 Vdc, 3 Pt100	B, C, **D**, E	**OPTB8**	**B8**	—	—	—	—	—	—	—
1 RO (NO), 5 DI 42–240 Vac input	B, C, **D**, E	**OPTB9**	**B9**	—	—	—	—	—	■	■
SPI, absolute encoder	C	**OPTBB**	**BB**	—	—	—	—	—	—	—
Communication Cards ③										
Modbus	D, **E**	**OPTC2**	**C2**	■	■	■	■	■	■	■
Johnson Controls N2	D, **E**	**OPTC2**	**CA**	—	—	—	—	—	—	—
Modbus TCP	D, **E**	**OPTCI**	**CI**	■	■	■	■	■	■	■
BACnet	D, **E**	**OPTCJ**	**CJ**	■	■	■	■	■	■	■
Ethernet IP	D, **E**	**OPTCK**	**CK**	■	■	■	■	■	■	■
Profibus DP	D, **E**	**OPTC3**	**C3**	■	■	■	■	■	■	■
LonWorks	D, **E**	**OPTC4**	**C4**	■	■	■	■	■	■	■
Profibus DP (D9 connector)	D, **E**	**OPTC5**	**C5**	■	■	■	■	■	■	■
CanOpen (slave)	D, **E**	**OPTC6**	**C6**	■	■	■	■	■	■	■
DeviceNet	D, **E**	**OPTC7**	**C7**	■	■	■	■	■	■	■
Modbus (D9 type connector)	D, **E**	**OPTC8**	**C8**	■	■	■	■	■	■	■
Adapter	D, **E**	**OPTD1**	**D1**	■	■	■	■	■	■	■
Adapter	D, **E**	**OPTD2**	**D2**	■	■	■	■	■	■	■
RS-232 with D9 connection	D, **E**	**OPTD3**	**D3**	■	■	■	■	■	■	■
Keypad										
9000X Series local/remote keypad (replacement keypad)	—	**KEYPAD-LOC/REM**	—	—	—	—	—	—	—	■
9000X Series remote mount keypad unit (keypad not included, includes 10 ft cable, keypad holder, mounting hardware)	—	**OPTRMT-KIT-9000X**	—	—	—	—	—	—	—	—
9000X Series RS-232 cable, 13 ft	—	**PP00104**	—	—	—	—	—	—	—	—

Notes

① AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

③ OPTC2 is a multi-protocol option card.

Technical Data and Specifications

SPA9000/SPN9000/SPI9000

Description	Specification
Supply Connection	
Input voltage U_{in} (AC) front end modules	380–500 Vac/525–690 Vac –10% to 10%
Input voltage U_{in} (DC) inverter	465–800 Vdc/640–1100 Vdc –0% to 0%, the waviness of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50V peak-to-peak
Output voltage U_{out} (AC) inverter	3 ~ 0–U_{in}/1.4
Output voltage U_{out} (DC) active front end module	10.10 x 1.35 x U_{in} (factory default)
Output voltage U_{out} (DC) non-regenerative front end module	1.35 x U_{in}
Ambient Conditions	
Ambient operating temperature	14 (no frost) to 122°F (–10 to 50°C): I_H 14 (no frost) to 104°F (–10 to 40°C): I_L
Storage temperature	–40 to 158°F (–40 to 70°C)
Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
Air quality	
Chemical vapors	IEC 721-3-3, unit in operation, class 3C2
Mechanical particles	IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 1000m 1% derating for each 100m above 1000m; max. 3000m
Vibration	5–150 Hz
EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3–15.8 Hz Max acceleration amplitude 1G at 15.8–150 Hz
Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15G, 11 ms (in package)
Cooling capacity required	Approximately 2%
Cooling air required	FR4 41 cfm, FR6 250 cfm, FR7 250 cfm, FR8 383 cfm FI9 677 cfm, FI10 824 cfm, FI12 1648 cfm, FI13 2472 cfm
Unit enclosure class	FR4–FR7 NEMA Type 1/IP21; FR8, FI9–FI14 chassis (IP00)
EMC (at fault settings)	
Immunity	Fulfill all EMC immunity requirements
Safety	
Approvals	CE, UL, cUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
Control Connections	
Analog input voltage	0–10V, R_i = 200 kohms, (–10V to 10V joystick control) Resolution 0.1%, accuracy ±1%
Analog input current	0(4)–20 mA, R_i = 250 ohms differential
Digital inputs	6, positive or negative logic; 18–30 Vdc
Auxiliary voltage	+24V, ±15%, max. 250 mA
Output reference voltage	+10V, +3%, max. load 10 mA
Analog output	0(4)–20 mA; RL max. 500 ohms; resolution 10 bits Accuracy ±2%
Digital outputs	Open collector output, 50 mA/48V
Relay outputs	2 programmable change-over relay outputs Switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A Min. switching load: 5V/10 mA

SPA9000/SPN9000/SPI9000, continued

Description	Specification
Protections	
Overvoltage protection	480V/911 Vdc, 575V/1200 Vdc
Undervoltage protection	480V/333 Vdc, 575V/460 Vdc
Ground fault protection	In case of ground fault in motor or motor cable, only the inverter is protected
Motor phase supervision	Trips if any of the output phases is missing
Overcurrent protection	Yes
Unit overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection of 24V and 10V reference voltages	Yes

Input Fuses

SHT fuses can be assembled into same-size DIN fuse base.

SPA9000/SPN9000/SPI9000

Module Component	Frame	Bussman Fuse Type (aR)	Size	U_N (V)	I_N (A)	Qty.
Inverter Units						
SPI003A1-4	FR4	170M1560	0	690	20	2
SPI007A1-4	FR4	170M1562	0	690	63	2
SPI009A1-4	FR4	170M1562	0	690	63	2
SPI012A1-4	FR6	170M1565	0	690	63	2
SPI016A1-4	FR6	170M1565	0	690	63	2
SPI023A1-4	FR6	170M1565	0	690	63	2
SPI031A1-4	FR6	170M1567	0	690	100	2
SPI038A1-4	FR6	170M1567	0	690	100	2
SPI061A1-4	FR7	170M1570	0	690	200	2
SPI072A1-4	FR7	170M1570	0	690	200	2
SPI087A1-4	FR7	170M1571	0	690	250	2
SPI105A0-4	FR8	170M3819	DIN1	690	400	2
SPI140A0-4	FR8	170M3819	DIN1	690	400	2
SPI170A0-4	FR8	170M3819	DIN1	690	400	2
SPI205A0-4	FI9	170M6812	DIN3	690	800	2
SPI245A0-4	FI9	170M6812	DIN3	690	800	2
SPI300A0-4	FI10	170M8547	3SHT	690	1250	2
SPI385A0-4	FI10	170M8547	3SHT	690	1250	2
SPI460A0-4	FI10	170M8547	3SHT	690	1250	2
SPI520A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI590A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI650A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI730A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI820A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI920A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPIH10A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH11A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH13A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH16A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH19A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH23A0-4	FI14	170M8547	3SHT	690	1250	2 x 6

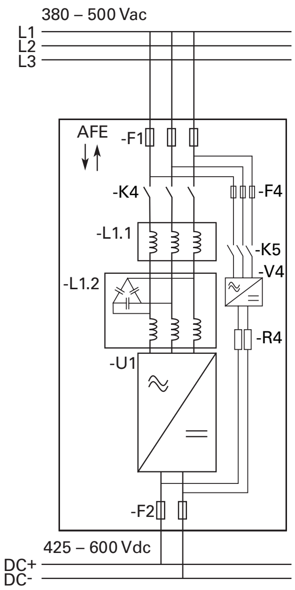
SHT fuses can be assembled into same-size DIN fuse base.

SPA9000/SPN9000/SPI9000, continued

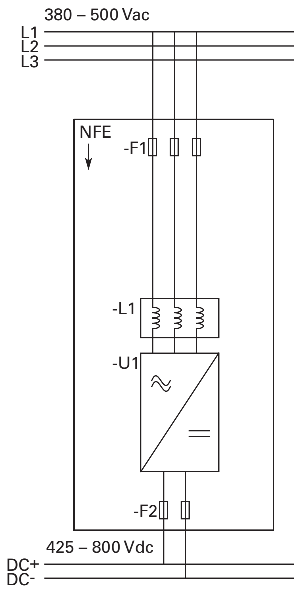
Module Component	Frame	Bussman Fuse Type (aR)	Size	U_N (V)	I_N (A)	Qty.
Active Front Ends						
SPA205A0-4	FI9	170M6202	3SHT	1250	500	3
SPA385A0-4	FI10	170M6277	3SHT	1250	1000	3
SPAH10A0-4	FI13	170M6277	3SHT	1250	1000	3 x 3
Non-Regenerative Front Ends						
SPN468A0-4	FI9	170M8547	3SHT	690	1250	3

Wiring Diagrams

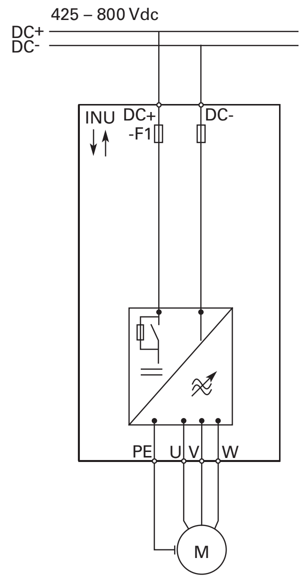
SPA9000—Active Front End



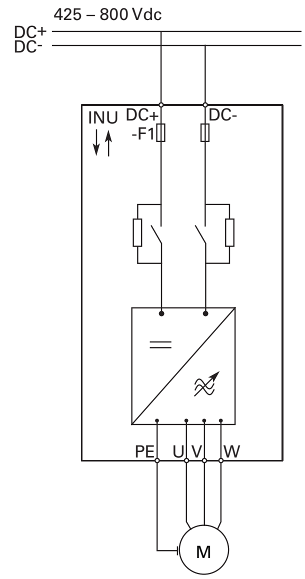
SPN9000—Non-Regenerative Front End



SPI9000—Inverter Unit (FR4–FR8)



SPI9000—Inverter Unit (FI9–FI14)



Dimensions

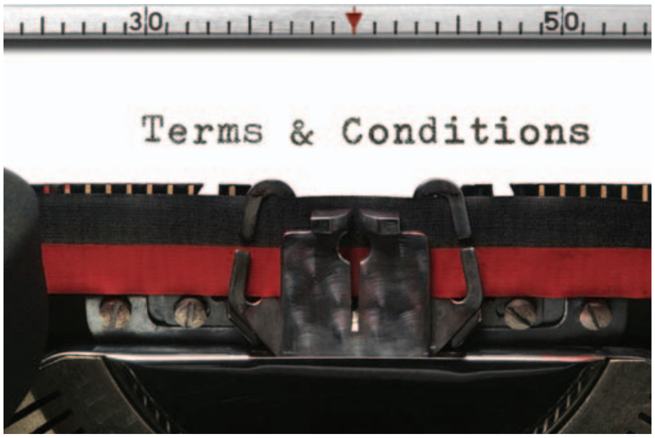
Approximate Dimensions in Inches (mm)

SPA9000/SPN9000/SPI9000

Frame	Height	Width	Depth	Weight Lbs (kg)
Active Front Ends				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)
Non-Regenerative Front Ends				
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
Inverter Units				
FR4	11.5 (292)	5.0 (128)	7.5 (190)	11 (5)
FR6	20.4 (519)	7.7 (195)	9.3 (237)	35 (16)
FR7	23.3 (591)	9.3 (237)	10.1 (257)	64 (29)
FR8	29.8 (758)	11.4 (289)	13.5 (344)	106 (48)
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)

Effective Date: November 1, 2008

Eaton Terms & Conditions



Contents

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Selling Policy (Supersedes Selling Policy 25-000, dated February 20, 2006)

Terms and Conditions of Sale

The Terms and Conditions of Sale set forth herein, and any supplements which may be attached hereto, constitute the full and final expression of the contract for the sale of products or services (hereinafter referred to as Product(s) or Services by Eaton Corporation (hereinafter referred to as Seller) to the Buyer, and supersedes all prior quotations, purchase orders, correspondence or communications whether written or oral between the Seller and the Buyer. Notwithstanding any contrary language in the Buyer's purchase order, correspondence or other form of acknowledgment, Buyer shall be bound by these Terms and Conditions of Sale when it sends a purchase order or otherwise indicates acceptance of this contract, or when it accepts delivery from Seller of the Products or Services.

THE CONTRACT FOR SALE OF THE PRODUCTS OR SERVICES IS EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS OF SALE STATED HEREIN. ANY ADDITIONAL OR DIFFERENT TERMS PROPOSED BY BUYER ARE REJECTED UNLESS EXPRESSLY AGREED TO IN WRITING BY SELLER. No contract shall exist except as herein provided.

Complete Agreement

No amendment or modification hereto nor any statement, representation or warranty not contained herein shall be binding on the Seller unless made in writing by an authorized representative of the Seller. Prior dealings, usage of the trade or a course of performance shall not be relevant to determine the meaning of this contract even though the accepting or acquiescing party had knowledge of the nature of the performance and opportunity for objection.

Quotations

Written quotations are valid for 30 days from its date unless otherwise stated in the quotation or terminated sooner by notice.

Verbal quotations, unless accepted, expire the same day they are made.

A complete signed order must be received by Seller within 20 calendar days of notification of award, otherwise the price and shipment will be subject to re-negotiation.

Termination and Cancellation

Any order may be terminated by the Buyer only by written notice and upon payment of reasonable termination charges, including all costs plus profit.

Seller shall have the right to cancel any order at any time by written notice if Buyer breaches any of the terms hereof, becomes the subject of any proceeding under state or federal law for the relief of debtors, or otherwise becomes insolvent or bankrupt, generally does not pay its debts as they become due or makes an assignment for the benefit of creditors.

Effective Date: November 1, 2008

Prices

All prices are subject to change without notice. In the event of a price change, the effective date of the change will be the date of the new price or discount sheet, letter or telegram. All quotations made or orders accepted after the effective date will be on the new basis. For existing orders, the price of the unshipped portion of an order will be the price in effect at time of shipment.

Price Policy—Products and Services

When prices are quoted as firm for quoted shipment, they are firm provided the following conditions are met:

1. The order is released with complete engineering details.
2. Shipment of Products are made, and Services purchased are provided within the quoted lead time.
3. When drawings for approval are required for any Products, the drawings applicable to those Products must be returned within 30* calendar days from the date of the original mailing of the drawings by Seller. The return drawings must be released for manufacture and shipment and must be marked "APPROVED" or "APPROVED AS NOTED." Drawing re-submittals which are required for any other reason than to correct Seller errors will not extend the 30-day period.

   * 60 days for orders through contractors to allow time for their review and approval before and after transmitting them to their customers.

If the Buyer initiates or in any way causes delays in shipment, provision of Services or return of approval drawings beyond the periods stated above, the price of the Products or Services will be increased 1% per month or fraction thereof up to a maximum of 18 months from the date of the Buyer's order. For delays resulting in shipment or provision of Services beyond 18 months from the date of the Buyer's order, the price must be renegotiated.

Price Policy—BLS

Refer to Price Policy 25-050.

Minimum Billing

Orders less than $1,000 will be assessed a shipping and handling charge of 5% of the price of the order, with a minimum charge of $25.00 unless noted differently on Product discount sheets.

Taxes

The price does not include any taxes. Buyer shall be responsible for the payment of all taxes applicable to, or arising from the transaction, the Products, its sale, value, or use, or any Services performed in connection therewith regardless of the person or entity actually taxed.

Terms of Payment

Products

Acceptance of all orders is subject to the Buyer meeting Seller's credit requirements. Terms of payment are subject to change for failure to meet such requirements. Seller reserves the right at any time to demand full or partial payment before proceeding with a contract of sale as a result of changes in the financial condition of the Buyer. Terms of Payment are either Net 30 days from the date of invoice of each shipment or carry a cash discount based on Product type. Specific payment terms for Products are outlined in the applicable Product discount schedules.

Services

Terms of payment are net within 30 days from date of invoice for orders amounting to less than $50,000.00.

Terms of payment for orders exceeding $50,000.00 shall be made according to the following:

1. Twenty percent (20%) of order value with the purchase order payable 30 days from date of invoice.
2. Eighty percent (80%) of order value in equal monthly payments over the performance period payable 30 days from date of invoice.

Except for work performed (i) under a firm fixed price basis or (ii) pursuant to terms of a previously priced existing contract between Seller and Buyer, invoices for work performed by Seller shall have added and noted on each invoice a charge of 3% (over and above the price of the work) which is related to Seller compliance with present and proposed environmental, health, and safety regulations associated with prescribed requirements covering hazardous materials management and employee training, communications, personal protective equipment, documentation and record keeping associated therewith.

Adequate Assurances

If, in the judgment of Seller, the financial condition of the Buyer, at any time during the period of the contract, does not justify the terms of payment specified, Seller may require full or partial payment in advance.

Delayed Payment

If payments are not made in accordance with these terms, a service charge will, without prejudice to the right of Seller to immediate payment, be added in an amount equal to the lower of 1.5% per month or fraction thereof or the highest legal rate on the unpaid balance.

Freight

Freight policy will be listed on the Product discount sheets, or at option of Seller one of the following freight terms will be quoted.

F.O.B.—P/S—Frt./Ppd. and Invoiced

Products are sold F.O.B. point of shipment freight prepaid and invoiced to the Buyer.

F.O.B.—P/S—Frt./Ppd. and Allowed

Products sold are delivered F.O.B. point of shipment, freight prepaid and included in the price.

F.O.B. Destination—Frt./Ppd. and Allowed

At Buyer's option, Seller will deliver the Products F.O.B. destination freight prepaid and 2% will be added to the net price.

The term "freight prepaid" means that freight charges will be prepaid to the accessible common carrier delivery point nearest the destination for shipments within the United States and Puerto Rico unless noted differently on the Product discount sheets. For any other destination contact Seller's representative.

Shipment and Routing

Seller shall select the point of origin of shipment, the method of transportation, the type of carrier equipment and the routing of the shipment.

If the Buyer specifies a special method of transportation, type of carrier equipment, routing, or delivery requirement, Buyer shall pay all special freight and handling charges.

When freight is included in the price, no allowance will be made in lieu of transportation if the Buyer accepts shipment at factory, warehouse, or freight station or otherwise supplies its own transportation.

Risk of Loss

Risk of loss or damage to the Products shall pass to Buyer at the F.O.B. point.

Concealed Damage

Except in the event of F.O.B. destination shipments, Seller will not participate in any settlement of claims for concealed damage.

When shipment has been made on an F.O.B. destination basis, the Buyer must unpack immediately and, if damage is discovered must:

1. Not move the Products from the point of examination.
2. Retain shipping container and packing material.
3. Notify the carrier in writing of any apparent damage.
4. Notify Seller representative within 72 hours of delivery.
5. Send Seller a copy of the carrier's inspection report.

Witness Tests/Customer Inspection

Standard factory tests may be witnessed by the Buyer at Seller's factory for an additional charge calculated at the rate of $2,500 per day (not to exceed eight (8) hours) per Product type. Buyer may final inspect Products at the Seller's factory for $500 per day per Product type.

Witness tests will add one (1) week to the scheduled shipping date. Seller will notify Buyer fourteen (14) calendar days prior to scheduled witness testing or inspection. In the event Buyer is unable to attend, the Parties shall mutually agree on a rescheduled date. However, Seller reserves the right to deem the witness tests waived with the right to ship and invoice Products.

Held Orders

For any order held, delayed or rescheduled at the request of the Buyer, Seller may, at its sole option (1) require payment to be based on any reasonable basis, including but not limited to the contract price, and any additional expenses, or cost resulting from such a delay; (2) store Products at the sole cost and risk of loss of the Buyer; and/or (3) charge to the Buyer those prices under the applicable price policy. Payment for such price, expenses and costs, in any such event, shall be due by Buyer within thirty (30) days from date of Seller's invoice. Any order so held delayed or rescheduled beyond six (6) months will be treated as a Buyer termination.

Drawing Approval

Seller will design the Products in line with, in Seller's judgment, good commercial practice. If at drawing approval Buyer makes changes outside of the design as covered in their specifications, Seller will then be paid reasonable charges and allowed a commensurate delay in shipping date based on the changes made.

Drawing Re-Submittal

When Seller agrees to do so in its quotation, Seller shall provide Buyer with the first set of factory customer approval drawing(s) at Seller's expense. The customer approval drawing(s) will be delivered at the quoted delivery date. If Buyer requests drawing changes or additions after the initial factory customer approval drawing(s) have been submitted by Seller, the Seller, at its option, may assess Buyer drawing charges. Factory customer approval drawing changes required due to misinterpretation by Seller will be at Seller's expense. Approval drawings generated by Bid Manager are excluded from this provision.

Warranty

Warranty for Products

Seller warrants that the Products manufactured by it will conform to Seller's applicable specifications and be free from failure due to defects in workmanship and material for one (1) year from the date of installation of the Product or eighteen (18) months from the date of shipment of the Product, whichever occurs first.

In the event any Product fails to comply with the foregoing warranty Seller will, at its option, either (a) repair or replace the defective Product, or defective part or component thereof, F.O.B. Seller's facility freight prepaid, or (b) credit Buyer for the purchase price of the Product. All warranty claims shall be made in writing.

Seller requires all non-conforming Products be returned at Seller's expense for evaluation unless specifically stated otherwise in writing by Seller.

This warranty does not cover failure or damage due to storage, installation, operation or maintenance not in conformance with Seller's recommendations and industry standard practice or due to accident, misuse, abuse or negligence. This warranty does not cover reimbursement for labor, gaining access, removal, installation, temporary power or any other expenses, which may be incurred in connection with repair or replacement.

This warranty does not apply to equipment not manufactured by Seller. Seller limits itself to extending the same warranty it receives from the supplier.

Extended Warranty for Products

If requested by the Buyer and specifically accepted in writing by Seller, the foregoing standard warranty for Products will be extended from the date of shipment for the period and price indicated below:

- 24 months—2% of Contract Price
- 30 months—3% of Contract Price
- 36 months—4% of Contract Price

Special Warranty (In and Out) for Products

If requested by the Buyer and specifically accepted in writing by Seller, Seller will, during the warranty period for Products, at an additional cost of 2% of the contract price, be responsible for the direct cost of:

1. Removing the Product from the installed location.
2. Transportation to the repair facility and return to the site.
3. Reinstallation on site.

The total liability of Seller for this Special Warranty for Products is limited to 50% of the contract price of the particular Product being repaired and excludes expenses for removing adjacent apparatus, walls, piping, structures, temporary service, etc.

Warranty for Services

Seller warrants that the Services performed by it hereunder will be performed in accordance with generally accepted professional standards.

The Services, which do not so conform, shall be corrected by Seller upon notification in writing by the Buyer within one (1) year after completion of the Services.

Unless otherwise agreed to in writing by Seller, Seller assumes no responsibility with respect to the suitability of the Buyer's, or its customer's, equipment or with respect to any latent defects in equipment not supplied by Seller. This warranty does not cover damage to Buyer's, or its customer's, equipment, components or parts resulting in whole or in part from improper maintenance or operation or from their deteriorated condition. Buyer will, at its cost, provide Seller with unobstructed access to the defective Services, as well as adequate free working space in the immediate vicinity of the defective Services and such facilities and systems, including, without limitation, docks, cranes and utility disconnects and connects, as may be necessary in order that Seller may perform its warranty obligations. The conducting of any tests shall be mutually agreed upon and Seller shall be notified of, and may be present at, all tests that may be made.

Warranty for Power Systems Studies

Seller warrants that any power systems studies performed by it will conform to generally accepted professional standards. Any portion of the study, which does not so conform, shall be corrected by Seller upon notification in writing by the Buyer within six (6) months after completion of the study. All warranty work shall be performed in a single shift straight time basis Monday through Friday. In the event that the study requires correction of warranty items on an overtime schedule, the premium portion of such overtime shall be for the Buyer's account.

Limitation on Warranties for Products, Services and Power Systems Studies

THE FOREGOING WARRANTIES ARE EXCLUSIVE EXCEPT FOR WARRANTY OF TITLE. SELLER DISCLAIMS ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

CORRECTION OF NON-CONFORMITIES IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE SELLER'S SOLE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR FAILURE OF SELLER TO MEET ITS WARRANTY OBLIGATIONS, WHETHER CLAIMS OF THE BUYER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE.

Asbestos

Federal Law requires that building or facility owners identify the presence, location and quantity of asbestos containing material (hereinafter "ACM") at work sites. Seller is not licensed to abate ACM. Accordingly, for any contract which includes the provision of Services, prior to (i) commencement of work at any site under a specific Purchase Order, (ii) a change in the work scope of any Purchase Order, the Buyer will certify that the work area associated with the Seller's scope of work includes the handling of Class II ACM, including but not limited to generator wedges and high temperature gaskets which include asbestos materials. The Buyer shall, at its expense, conduct abatement should the removal, handling, modification or reinstallation, or some or all of them, of said Class II ACM be likely to generate airborne asbestos fibers; and should such abatement affect the cost of or time of performance of the work then Seller shall be entitled to an equitable adjustment in the schedule, price and other pertinent affected provisions of the contract.

Compliance with Nuclear Regulation

Seller's Products are sold as commercial grade Products not intended for application in facilities or activities licensed by the United States Nuclear Regulatory Commission for atomic purposes. Further certification will be required for use of the Products in any safety-related application in any nuclear facility licensed by the U.S. Nuclear Regulatory Commission.

Returning Products

Authorization and shipping instructions for the return of any Products must be obtained from Seller before returning the Products.

When return is occasioned due to Seller error, full credit including all transportation charges will be allowed.

Product Notices

Buyer shall provide the user (including its employees) of the Products with all Seller supplied Product notices, warnings, instructions, recommendations, and similar materials.

Force Majeure

Seller shall not be liable for failure to perform or delay in performance due to fire, flood, strike or other labor difficulty, act of God, act of any governmental authority or of the Buyer, riot, embargo, fuel or energy shortage, car shortage, wrecks or delays in transportation, or due to any other cause beyond Seller's reasonable control. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be extended by a period of time reasonably necessary to overcome the effect of such delay.

Liquidated Damages

Contracts which include liquidated damage clauses for failure to meet shipping or job completion promises are not acceptable or binding on Seller, unless such clauses are specifically accepted in writing by an authorized representative of the Seller at its headquarters office.

Patent Infringement

Seller will defend or, at its option, settle any suit or proceeding brought against Buyer, or Buyer's customers, to the extent it is based upon a claim that any Product or part thereof, manufactured by Seller or its subsidiaries and furnished hereunder, infringes any United States patent, other than a claim of infringement based upon use of a Product or part thereof in a process, provided Seller is notified in reasonable time and given authority, information and assistance (at Seller's expense) for the defense of same. Seller shall pay all legal and court costs and expenses and court-assessed damages awarded therein against Buyer resulting from or incident to such suit or proceeding. In addition to the foregoing, if at any time Seller determines there is a substantial question of infringement of any United States patent, and the use of such Product is or may be enjoined, Seller may, at its option and expense: either (a) procure for Buyer the right to continue using and selling the Product; (b) replace the Product with non-infringing apparatus; (c) modify the Product so it becomes non-infringing; or (d) as a last resort, remove the Product and refund the purchase price, equitably adjusted for use and obsolescence. In no case does Seller agree to pay any recovery based upon its Buyer's savings or profit through use of Seller's Products whether the use be special or ordinary. The foregoing states the entire liability of Seller for patent infringement.

The preceding paragraph does not apply to any claim of infringement based upon: (a) any modification made to a Product other than by Seller; (b) any design and/or specifications of Buyer to which a Product was manufactured; or (c) the use or combination of Product with other products where the Product does not itself infringe. As to the above-identified claim situations where the preceding paragraph does not apply, Buyer shall defend and hold Seller harmless in the same manner and to the extent as Seller's obligations described in the preceding paragraph. Buyer shall be responsible for obtaining (at Buyer's expense) all license rights required for Seller to be able to use software products in the possession of Buyer where such use is required in order to perform any Service for Buyer.

With respect to a Product or part thereof not manufactured by Seller or its subsidiaries, Seller will attempt to obtain for Buyer, from the supplier(s), the patent indemnification protection normally provided by the supplier(s) to customers.

Compliance with OSHA

Seller offers no warranty and makes no representation that its Products comply with the provisions or standards of the Occupational Safety and Health Act of 1970, or any regulation issued thereunder. In no event shall Seller be liable for any loss, damage, fines, penalty or expenses arising under said Act.

Limitation of Liability

THE REMEDIES OF THE BUYER SET FORTH IN THIS CONTRACT ARE EXCLUSIVE AND ARE ITS SOLE REMEDIES FOR ANY FAILURE OF SELLER TO COMPLY WITH ITS OBLIGATIONS HEREUNDER.

NOTWITHSTANDING ANY PROVISION IN THIS CONTRACT TO THE CONTRARY, IN NO EVENT SHALL SELLER BE LIABLE IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE FOR DAMAGE TO PROPERTY OR EQUIPMENT OTHER THAN PRODUCTS SOLD HEREUNDER, LOSS OF PROFITS OR REVENUE, LOSS OF USE OF PRODUCTS, COST OF

CAPITAL, CLAIMS OF CUSTOMERS OF THE BUYER OR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, REGARDLESS OF WHETHER SUCH POTENTIAL DAMAGES ARE FORESEEABLE OR IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THE TOTAL CUMULATIVE LIABILITY OF SELLER ARISING FROM OR RELATED TO THIS CONTRACT WHETHER THE CLAIMS ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, SHALL NOT EXCEED THE PRICE OF THE PRODUCT OR SERVICES ON WHICH SUCH LIABILITY IS BASED.

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