

## MODEL APLI - APOLLO CURRENT METERS & MODEL APLV - APOLLO VOLTMETERS



- **FOUR MULTI-RANGE UNITS COVER:**  
 199.9  $\mu$ A to 1.999 A, 199.9 mV \* (A.C. or D.C.)  
 1.999 V to 300 V (A.C. or D.C.)
- **3 1/2-DIGIT, 0.56" (14.2 mm) HIGH LED DISPLAY W/POLARITY**
- **BUILT-IN SCALING PROVISIONS**
- **SELECTABLE DECIMAL POINT LOCATION**
- **AUTO ZEROING CIRCUITS**
- **FRONT PANEL CALIBRATION ADJUSTMENT**
- **OVER-RANGE INDICATION**
- **NEMA 4/IP65 SEALED FRONT METAL BEZEL**



\* Accessory Shunts Available For Higher Current Ranges.

### DESCRIPTION

Apollo Volt and Current Meters are premium quality instruments designed for tough industrial applications. With multi-range capability, built-in provision for scaling, and DIP switch selectable decimal points, these units offer the ultimate in application flexibility. Just four basic models, off-the-shelf, from your local distributor, cover your voltage and current indicator needs, as well as your requirements for direct readout from pressure, speed or flow transducers, or any other variable that can be translated to voltage or current.

The attractive die-cast metal bezel of the Apollo not only enhances the appearance of any panel, it can also be sealed in the front panel for use in wash-down areas and tough, dirty industrial environments. The 3 1/2-digit bi-polar display (minus sign displayed when current or voltage is negative) features 0.56" (14.2 mm) high, 7-segment LED's for easy reading. Also featured are removable terminal blocks on the rear that facilitate installation wiring and change-outs.

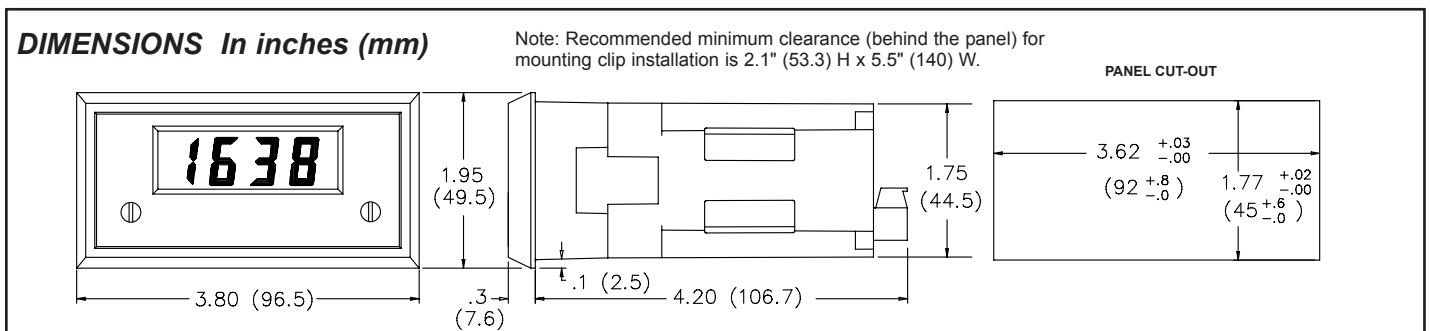
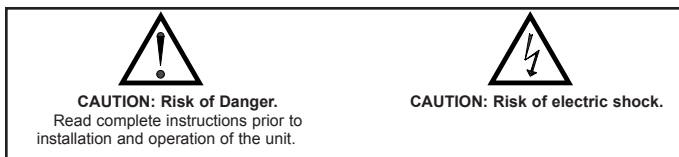
### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

### SPECIFICATIONS

1. **DISPLAY:** 3 1/2-digit, 0.56" (14.2 mm) high, 7-segment LED, (-) minus sign displayed when current or voltage is negative. Decimal points inserted before 1st, 2nd, or 3rd least significant digits by DIP switch selection.
2. **POWER:** Available in either 115 VAC or 230 VAC versions. Allowable power line variation  $\pm 10\%$ , 50/60 Hz, 6 VA.  
**Isolation:** 2300 Vrms for 1 min. between input and supply (300 V working voltage).
3. **INPUT RANGES:** (Selectable by input and jumper connections.)
 

A.C. Voltmeters	A.C. Current Meters	D.C. Voltmeters	D.C. Current Meters
0-1.999 Volts (basic range)	0-199.9 $\mu$ A (microamps)	$\pm 1.999$ Volts (basic range)	$\pm 199.9$ $\mu$ A (microamps)
0-19.99 Volts	0-19.99 mA (milliamps)	$\pm 19.99$ Volts	$\pm 1.999$ mA (milliamps)
0-199.9 Volts	0-199.9 mA	$\pm 199.9$ Volts	$\pm 199.9$ mA
0-300 Volts	0-1.999 amps	$\pm 300$ Volts	$\pm 1.999$ amps
	0-199.9 mV (basic range)		$\pm 199.9$ mV (basic range)
4. **ACCURACY:**
  - DC Volts** -  $\pm(0.1\%$  of Reading + 1 digit)
  - AC Volts** -  $\pm(0.1\%$  of Reading + 2 digits) (45-500 Hz)
  - DC Current**
    - 199.9  $\mu$ A, 1.999 mA, 19.99 mA:**  $\pm(0.1\%$  of Reading + 1 digit)
    - 199.9 mA:**  $\pm(0.15\%$  of Reading + 1 digit)
    - 1.999 A:**  $\pm(0.5\%$  of Reading + 1 digit)
  - AC Current (45-500 Hz)**
    - 199.9  $\mu$ A, 1.999 mA, 19.99 mA:**  $\pm(0.1\%$  of Reading + 2 digits)
    - 199.9 mA:**  $\pm(0.15\%$  of Reading + 2 digits)
    - 1 A:**  $\pm(0.5\%$  of Reading + 2 digits)
5. **OVER-RANGE INDICATION:** on all modes is indicated by blanking 3 least significant digits.
6. **MAX. VOLTAGE ON BASIC RANGE INPUTS:** 75 VAC or DC (Term. 8 to 3 on voltmeters, Term. 9 to 3 on current meters).
7. **MAX. VOLTAGE ON TERMINAL BLOCK:** 300 VAC or DC (Both voltmeters and current meters).



8. **MAX. SHUNT CURRENTS (ON CURRENT METERS):**

**199.9 µA through 19.99 mA:** 10 x max. range current

**199.9 mA:** 1 amp

**1.999 amp:** 3 amps

*Caution: In circuits where fault currents can exceed the maximum shunt current, a fast-blow fuse should be installed in series with the input signal.*

*Otherwise, a slow blow 10 amp fuse is recommended that will allow for start-up over current situations, while still protecting the instrument.*

9. **TEMPERATURE COEFFICIENTS:**

<b>Current meters</b>	<b>Voltmeters</b>
D.C.: ±100 PPM/°C	D.C.: ±75 PPM/°C
A.C.: ±200 PPM/°C	A.C.: ±150 PPM/°C

10. **ENVIRONMENTAL CONDITIONS:**

**Operating Temperature :** 0° to 60°C

**Storage Temperature :** -40° to 80°C

**Operating and Storage Humidity:** 85% max. relative humidity (non-condensing) from 0°C to 50°C.

**Altitude:** Up to 2000 meters

11. **RESPONSE TIME TO STEP CHANGE INPUT:** 1 sec. nominal

12. **READING RATE:** 2.5 readings/sec., nominal

13. **NORMAL MODE REJECTION:** 50 dB 50/60 Hz (D.C. units only)

14. **COMMON MODE REJECTION:** 110 dB D.C. or 50/60 Hz (D.C. units only)

15. **COMMON MODE VOLTAGE (COMM. TO EARTH):** 350 volt peak

16. **CERTIFICATIONS AND COMPLIANCES:**

**SAFETY**

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4 Enclosure rating (Face only), UL50

**ELECTROMAGNETIC COMPATIBILITY:**

**Immunity to EN 50082-2**

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m <sup>1</sup> 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms <sup>2</sup> 150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m
Simulation of cordless telephone	ENV 50204	Level 3; 10 V/m 900 MHz ± 5 MHz 200 Hz, 50% duty cycle

**Emissions to EN 50081-2**

RF interference	EN 55011	Enclosure class A Power mains class A
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*Notes:*

1. *Self-recoverable loss of performance during EMI disturbance at 10 V/m: Process signal may deviate during EMI disturbances.*

*For operation without loss of performance:*

*Unit is mounted in a grounded metal enclosure (Buckeye SM7013-0 or equivalent)*

*I/O and power cables are routed in metal conduit connected to earth ground.*

2. *Self-recoverable loss of performance during EMI disturbance at 10 V/rms: Process signal may deviate during EMI disturbances.*

*For operation without loss of performance:*

*Install power line filter, RLC#LFIL0000 or equivalent*

*Refer to the EMC Installation Guidelines section of this bulletin for additional information.*

17. **CONSTRUCTION:** Metal die-cast front bezel with black, high impact plastic insert case. This unit is rated for NEMA 4/IP65 indoor use when properly installed (panel gasket and mounting clips included). Installation Category II, Pollution Degree 2.

18. **WEIGHT:** 1.2 lbs. (0.54 Kg)

**EMC INSTALLATION GUIDELINES**

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The unit should be mounted in a metal enclosure, that is properly connected to protective earth.

2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.

a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).

b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.

c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

4. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VB3

Corcom #1VR3

*Note: Reference manufacturer's instructions when installing a line filter.*

6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

**WIRING CONNECTIONS**

As depicted in the drawing of the Apollo Unit, all connections are made to a removable terminal block for ease of installation.

All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker.

To remove the block, pull from the back of the block until it slides clear of the terminal block shroud. **Caution:** Terminal block should **NOT** be removed with power applied to the unit.

**POWER WIRING**

Primary AC power is connected to Terminals 1 and 2 (*Marked A.C. Power; located on the left-hand side of the terminal block*). For best results, the AC power should be relatively "Clean" and within the specified ±10% variation limit. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

**SIGNAL WIRING**

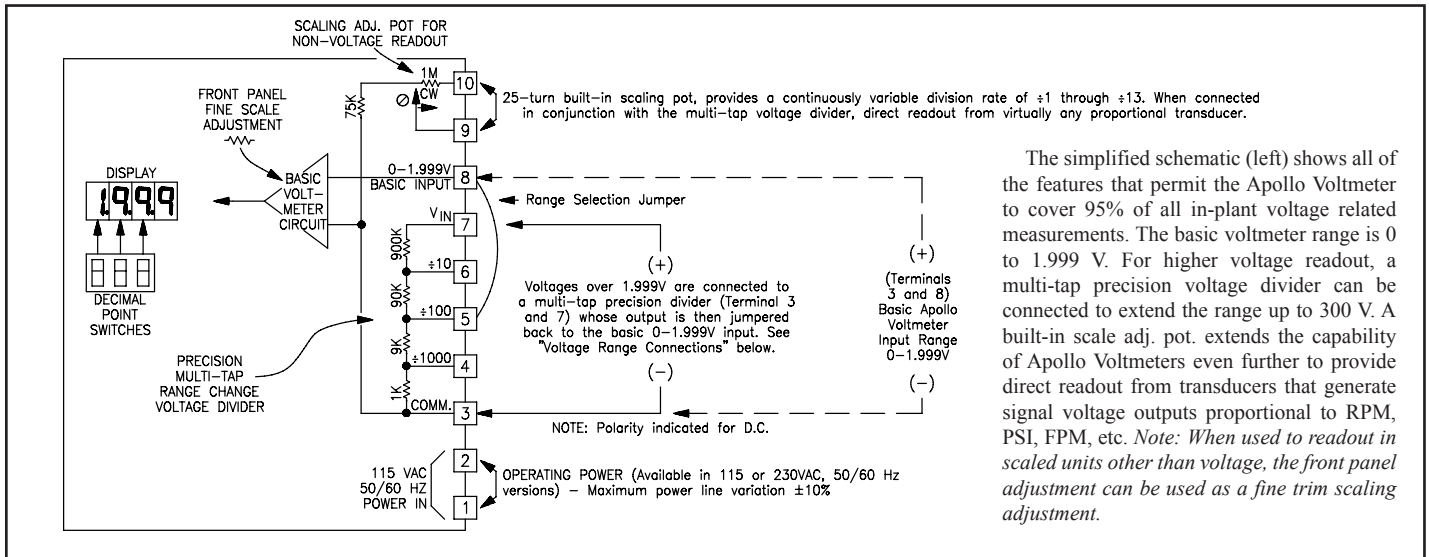
Input connections and range configuration jumpers are made on Terminals 3 through 10 or 11. If AC signal current greater than 5 amps is going to be applied, the appropriate size slow blow fuse should be installed.

*(For detailed information, see "Inputs and Applications".)*

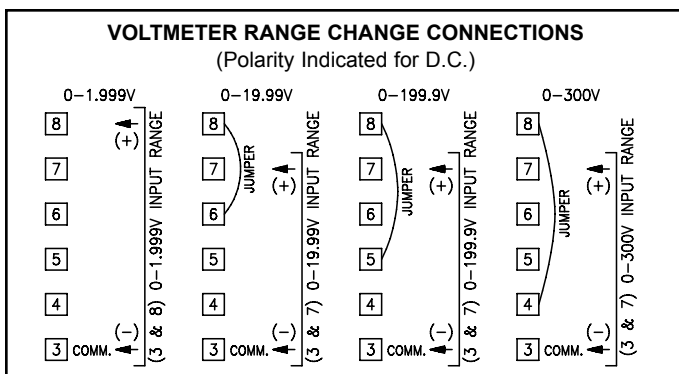
**DECIMAL POINT SELECTION**

The Apollo Volt and Current meters have DIP switches located on the side of the unit for the selection of 1 of 3 decimal points for display.

# APOLLO VOLTMETER INPUTS & CONFIGURATIONS (Applies to both Apollo A.C. & D.C. voltmeters)



The simplified schematic (left) shows all of the features that permit the Apollo Voltmeter to cover 95% of all in-plant voltage related measurements. The basic voltmeter range is 0 to 1.999 V. For higher voltage readout, a multi-tap precision voltage divider can be connected to extend the range up to 300 V. A built-in scale adj. pot. extends the capability of Apollo Voltmeters even further to provide direct readout from transducers that generate signal voltage outputs proportional to RPM, PSI, FPM, etc. Note: When used to readout in scaled units other than voltage, the front panel adjustment can be used as a fine trim scaling adjustment.



## WHERE:

- VT = Maximum Transducer Output
- D.D.P. = Display Decimal Point
- D.R. = Desired Reading
- D.F. = Division Factor

**D.D.P.**

0.000	= 1	The Display Decimal Point
00.00	= 10	(D.D.P.) is determined by
000.0	= 100	the desired decimal point
0000	= 1000	placement in the readout.

Then we connect the divider and pot. to obtain the adjustable division range we need to bracket the proper division factor (See "Scaling Connection Diagrams" below).

**EXAMPLE 1:** A pressure transducer delivers a 5.5 V signal @ 120.0 PSI maximum.

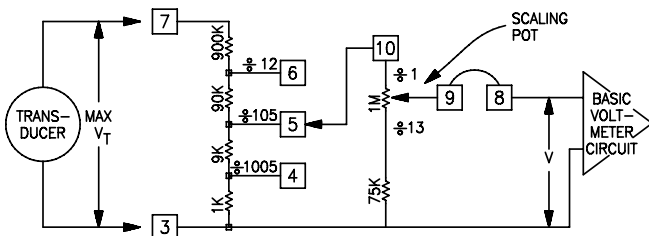
$$\frac{VT \times D.D.P.}{D.R.} = \frac{5.5 \times 100}{120.0} = 4.58 \text{ D.F.}$$

This division factor falls between 1 and 12, so connect per "Diagram A" below. Calibrate by adjusting the scaling pot. to get the proper readout at a known pressure.

## SCALING FOR DIRECT READOUT OF OTHER VARIABLES

In many industrial applications, a voltage sensing instrument is required to display a reading in terms of PSI, RPM, or some other variable. The signal voltage being measured is normally generated by a transducer which senses the variable and delivers a linearly proportional output voltage.

The multi-tap divider and the scale adj. pot. of the Apollo Voltmeters can be connected in tandem (series) to scale (divide) virtually any signal voltage up to 300 V max. down to the basic 0 to 1.999 V input range to get the desired reading. The multi-tap voltage divider provides coarse ranges of division and the scaling pot. provides continuous selection of division factors between the taps.

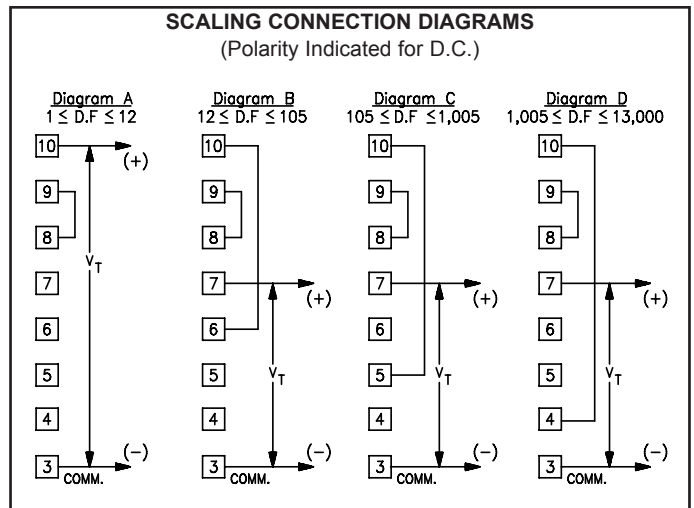


Note: The normal decade division factors ( $\div 10$ ,  $\div 100$ , and  $\div 1000$ ) have been adjusted in this schematic to account for parallel connection of the scale pot. resistance which increases these factors as shown.

In order to determine the jumper wiring configuration of the Apollo for a scaled application, we must first determine the division factor required to provide the desired display.

## USING THE FORMULA:

$$\frac{VT \times D.D.P.}{D.R.} = D.F.$$

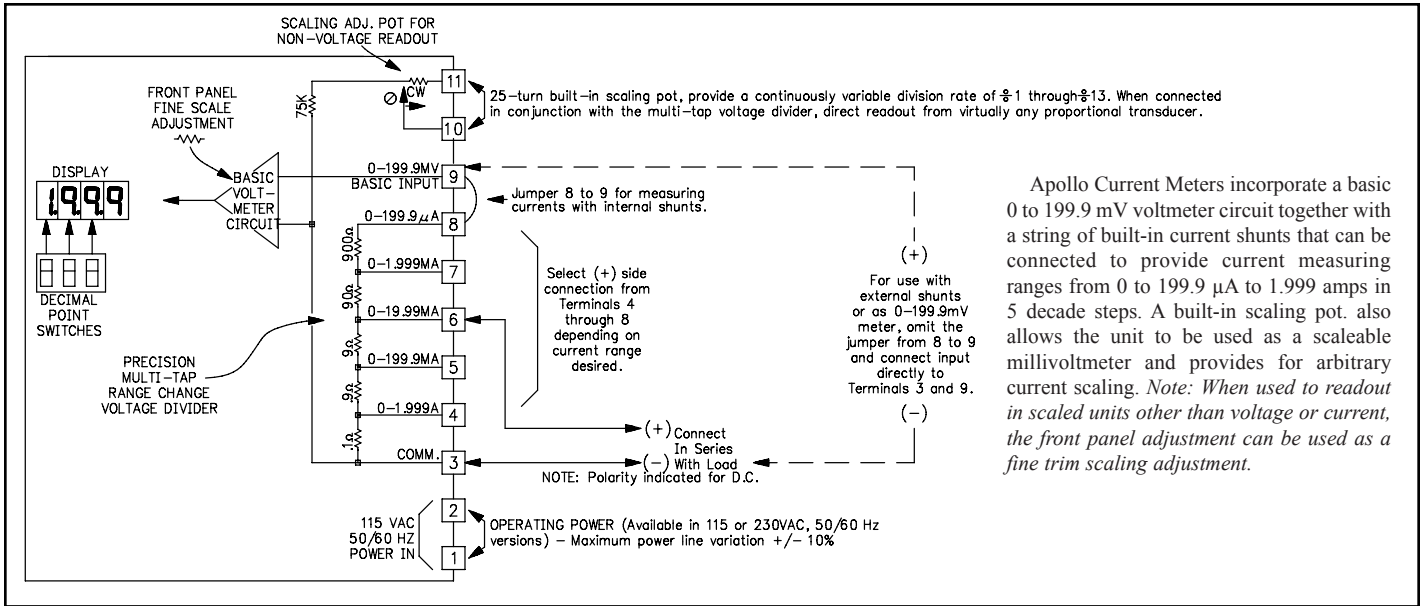


**EXAMPLE 2:** A D.C. tachometer generator delivers 210 V at maximum machine speed which is to be indicated as 575 FPM on an Apollo Voltmeter.

$$\frac{210 \text{ V (Max. from tach. gen.)} \times 1000 \text{ (D.P.P.)}}{575 \text{ (Desired Readout)}} = 365 \text{ (D.F.)}$$

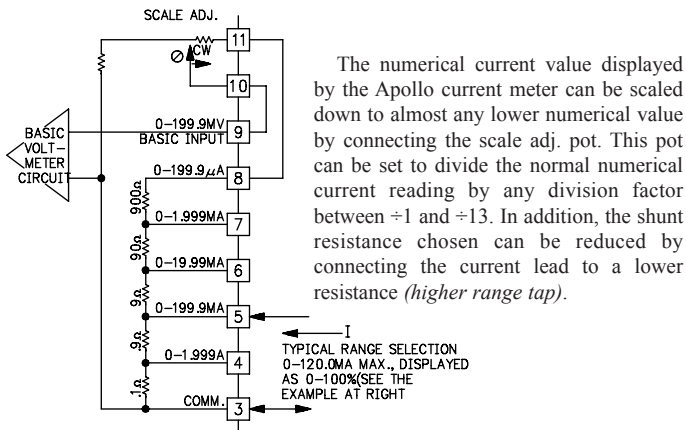
This division factor falls between 105 and 1005, so connect per "Diagram C" above. Calibrate by adjusting the scaling pot. to get the proper readout at a known speed.

# APOLLO CURRENT METER INPUTS & CONFIGURATIONS (Applies to both Apollo A.C. & D.C. current meters)



Apollo Current Meters incorporate a basic 0 to 199.9 mV voltmeter circuit together with a string of built-in current shunts that can be connected to provide current measuring ranges from 0 to 199.9 μA to 1.999 amps in 5 decade steps. A built-in scaling pot. also allows the unit to be used as a scaleable millivoltmeter and provides for arbitrary current scaling. *Note: When used to readout in scaled units other than voltage or current, the front panel adjustment can be used as a fine trim scaling adjustment.*

## CURRENT METER SCALING



## EXAMPLE

In the diagram (left), the Apollo Current Meter has been connected to measure a circuit current to 120.0 mA maximum. However, in this application, the readout is to be in percent of load current, with 120.0 mA being equivalent to 100.0% readout. The scale adj. pot. connected as shown can be adjusted to reduce the normal 120.0 mA display to the 100.0% display desired. The input current leads could also be connected to 4 and 3 instead of 5 and 3 as shown, and this would yield a readout to 100% and allow the decimal point and least significant digit (0.1%) to be dropped.

Scaling to obtain a numerical readout higher than the numerical value of the current can also be done in most cases by simply feeding the current input into a lower range. However, at the higher current range (1.999 A) and with external shunts, care should be taken to avoid exceeding maximum shunt current.

For example, if the unit is measuring a maximum current of 1.3 amps (current flowing between terminals 3 and 4), the numerical current value will be 1.300 displayed. Here, it is impossible to increase the numerical scaled value to say 1.500 by connecting to the next sensitivity (199.9 mA) since the 1.3 amp actual current exceeds the maximum current rating of this range (See "Specifications" for maximum current.)

## INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

## Installation

The unit meets NEMA 4/IP65 requirements for indoor use when properly installed. The units are intended to be mounted into an enclosed panel.

Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8".)

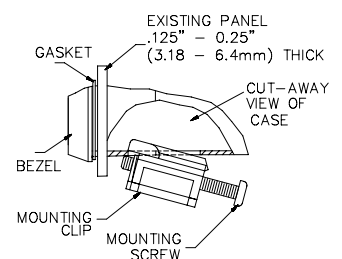
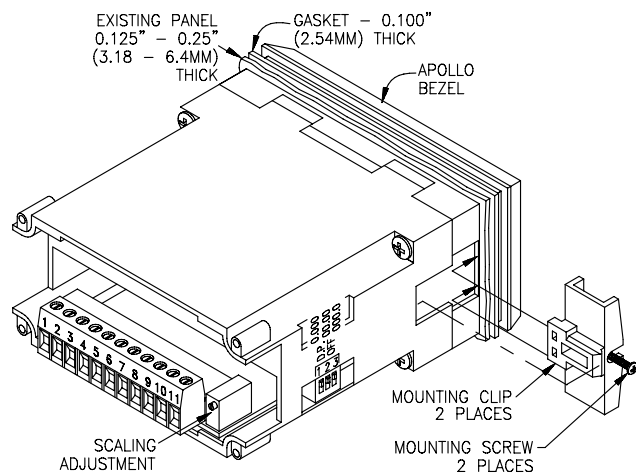
After the panel cut-out has been completed and deburred, carefully slide the gasket over the rear of the unit to the panel. Insert the unit into the panel.

As depicted in the drawing, install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side.

Install each of the mounting clips by inserting the wide lip of the clips into the wide end of the hole, located on either side of the case. Then snap the clip onto the case.

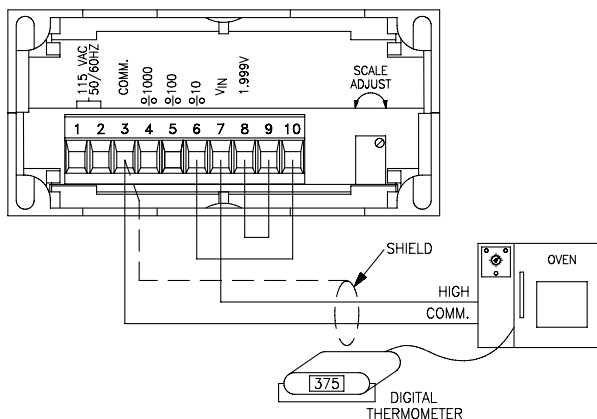
Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal.

**Caution:** Only minimum pressure is required to seal panel. Do NOT overtighten screws.



## TYPICAL VOLTAGE & CURRENT MEASUREMENT APPLICATIONS

### TEMPERATURE MONITORING IN A BISCUIT BAKING OPERATION



A biscuit baker has temperature controllers on his ovens that have a dial for setting the temperature of his ovens. He would like to have a digital display of his temperature for ease of monitoring. He has determined, by talking to the temperature controller manufacturer, there is a 0 to 10 VDC voltage available from the controller, that represents a temperature of approximately 0 to 600°F.

An Apollo DC voltage indicator is ideally suited to this application. It is apparent that a standard range will not satisfy this requirement; therefore, field

scaling is required. The first thing that must be done is to determine what division factor is required. Use the equation discussed in the text.

$$\text{Division Factor} = \frac{(\text{Maximum Output}) \times \text{D.P.P.}}{(\text{Desired Display})} = \frac{(10) \times 1000}{(600)} = 16.7 \text{ (D.F.)}$$

It can be seen that the division factor falls between 12 and 105 (See "Scaling Connection Diagrams"). This is accomplished by connecting a jumper between "+10" (Terminal 6) and Terminal 10 (the 1.999 V basic input), and a jumper between Terminal 9 and Terminal 8. Then, using 2 conductor shielded wire to minimize noise pickup, the common of the temperature controller output is connected to "COMM." (Terminal 3) and the "HIGH" side of the output of the temperature controller is connected to "VIN" (Terminal 7). The shield is also connected to "COMM." (Terminal 3).

The Apollo is now ready to be calibrated. The baker has access to a portable digital thermometer. So in this case, calibration will be accomplished by causing the Apollo indicator to agree with the portable digital thermometer. The baker sets his oven to his normal baking temperature of 375°F. He installs the temperature probe in the oven and waits for it to reach equilibrium. After the oven has stabilized, at its operating temperature, the baker simply adjusts the "coarse" scaling adjustment, located at the rear of the unit, until the display is close in value to that indicated on the digital thermometer. He then removes the "fine" scaling access plug and adjusts the "fine" scaling adjustment until the display agrees with the digital thermometer. He replaces the access plug to keep dust out of the Apollo. The Apollo voltmeter now indicates the oven temperature and the baker can monitor his temperature precisely.

### VOLUME INDICATION

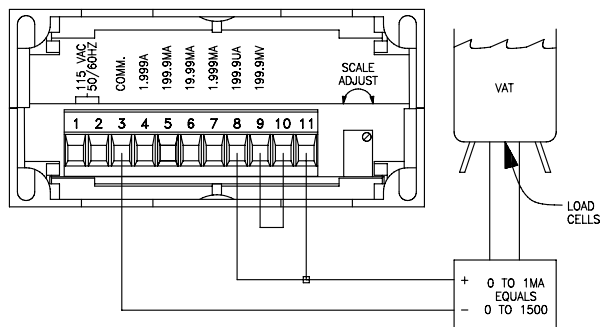
A manufacturer who uses vats of chemicals in his process has been using the output of load cells, connected to a circuit that in turn drives a 1 mA DC analog meter movement to display how full the vat is. The meter dial is calibrated 0 to 1500 gallons.

An Apollo DC current indicator is ideally suited to this application. It is apparent that a standard range will not satisfy this requirement and field scaling is required.

It can be seen that the 1 mA for 1500 gallons can not be accomplished using the 1.999 mA range; however, the maximum input of 1mA does not exceed the maximum input on the 199.9  $\mu$ A range, so this range is selected. This is accomplished by connecting the jumpers as described in the "Scaling" section [e.g. from "199.9  $\mu$ A" (Terminal 8) to Terminal 11 and a jumper between Terminal 10 and the "199.9 mV" basic input (Terminal 9)]. Then, the Apollo is connected in the circuit to replace the analog meter by connecting the "199.9  $\mu$ A" (Terminal 8) where the "+" terminal of the analog meter was connected, and connecting the "COMM." (Terminal 3) where the "-" terminal of the analog meter was connected.

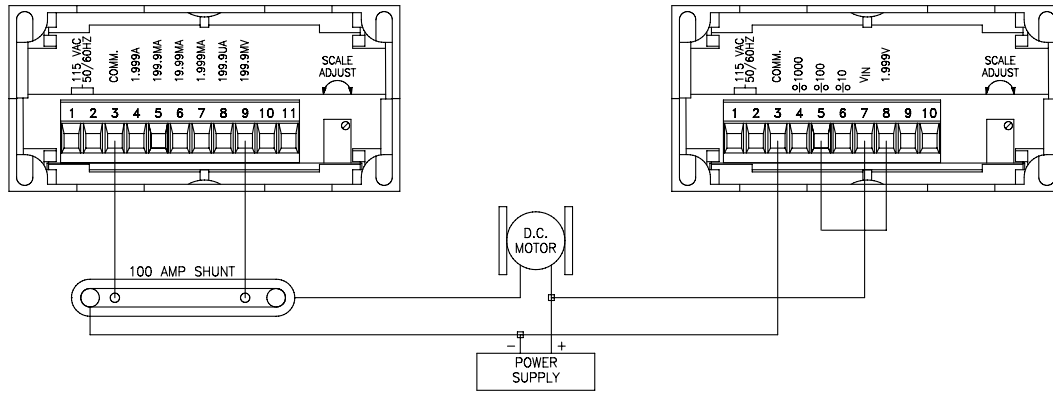
The Apollo is now ready to be calibrated. The operator fills the vat until it is completely full and he knows he has 1500 gallons. He then adjusts the

coarse scaling adjustment on the rear of the Apollo indicator until the display reads approximately 1500. He then removes the "fine" scaling adjustment access plug and adjusts the "fine" scaling adjustment until the display reads exactly 1500. He replaces the access plug to keep dust and water out of the Apollo. The Apollo current meter now indicates the exact number of gallons in the vat. No decimal point is selected because the resolution is 1 gallon.



## TYPICAL VOLTAGE & CURRENT MEASUREMENT APPLICATIONS (Cont'd)

### VOLTAGE & CURRENT MONITORING OF A DC MOTOR †



It is desired to monitor the power supply voltage and load current of a 120 volt DC motor. The maximum load current is 100 amps.

The Apollo DC Voltmeter, Model APLVD, is configured for the 199.9 V calibrated range by connecting the “+100” (Terminal 5) to the 1.999 V basic input (Terminal 8). The “COMM.” (Terminal 3) is connected to the negative terminal of the power supply and the “V<sub>IN</sub>” input (Terminal 7) is connected to the positive terminal of the power supply. The resolution of the display is 0.1 V, therefore “D.P.1” is selected.

The Apollo DC Current Meter, Model APLID, is configured by simply connecting the “COMM.” (Terminal 3) and the “199.9 mV” basic input (Terminal 9) to the sense terminals of the external 100 amp current shunt (AP-SCM-100). The external shunt is then connected in series with the negative terminal of the power supply. The resolution of the display is 0.1 amp, therefore “D.P.1” is selected.

The Apollo volt and current meters will now indicate the power supply voltage and load current of the DC motor precisely.

† Note: For high AC currents, it is recommended that the Model APLIT be used with a current transformer.

## TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS	
		230 VAC	115 VAC
**APLVD	Apollo DC Voltmeter	APLVD410	APLVD400
**APLVA	Apollo AC Voltmeter	APLVA410	APLVA400
**APLID	Apollo DC Current Meter	APLID410	APLID400
**APLIA	Apollo AC Current Meter	APLIA410	APLIA400
-	*10 amp Current Shunt	APSCM010	
-	*100 amp Current Shunt	APSCM100	

For more information on Pricing, Enclosures, & Panel Mount Kits, refer to the RLC Catalog or contact your local RLC distributor.

\* Voltage drop at full current = 100.0 mV maximum. Continuous current should not exceed 115% of rating.

\*\* Units are shipped calibrated to the following readings:

MODEL NO.	DISPLAY @ INPUT
APLVD	1999 @ 1.999 VDC
APLVA	1999 @ 1.999 VAC
APLID	1999 @ 199.9 mVDC
APLIA	1999 @ 199.9 mVAC

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### **LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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