

MODEL 64-5

Power Factor Regulator

- High accuracy phase-angle sensing
- Adjustable limits
- Automatic/manual modes
- Activated steps indicators
- 2"x 8" Backlit LCD Display

DESCRIPTION

The **Model 64-5 Power Factor Regulator** is a monitoring and power factor control system. It is designed to help obtain an improved power factor, with a minimum of added capacitors. This device uses a unique phase-angle sensing circuit to monitor the power factor of a 3-phase power line.

The Model 64-5 automatically responds to changing power factor by closing or opening the internal relays, which add or subtract capacitor banks on the line. Although intended for 115VAC 50/60Hz systems, other voltage or frequency models may be available (check jumper on PC board for 50Hz operation).

SPECIFICATIONS

Model	64-5
Input voltage	115VAC, 50/60Hz
Input current	Min: 0.5A Max: 5A continuous
Output contacts	10A at 240VAC resistive
Expected relay life	Mech: 10 million operations Elec: 100,000 at rated load
Adjustment	0.90 to 1.00PF
Time delay	Adjustable 1 to 60 seconds in 0.5 second increments.
Enclosure material	ABS Plastic/Stainless Steel
Weight	2.15 lbs.
Mounting	Panel Mounted

OPERATION

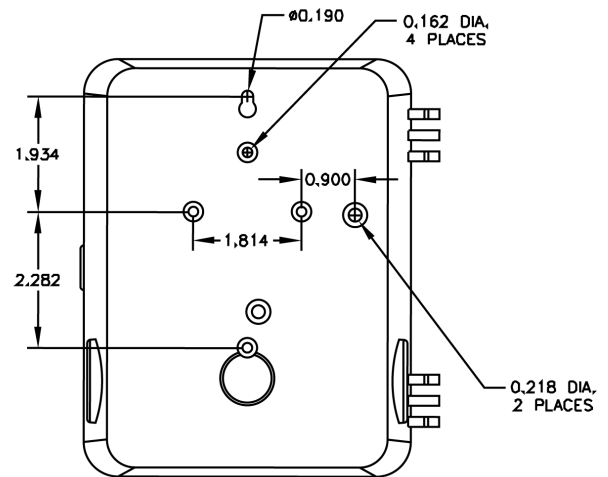
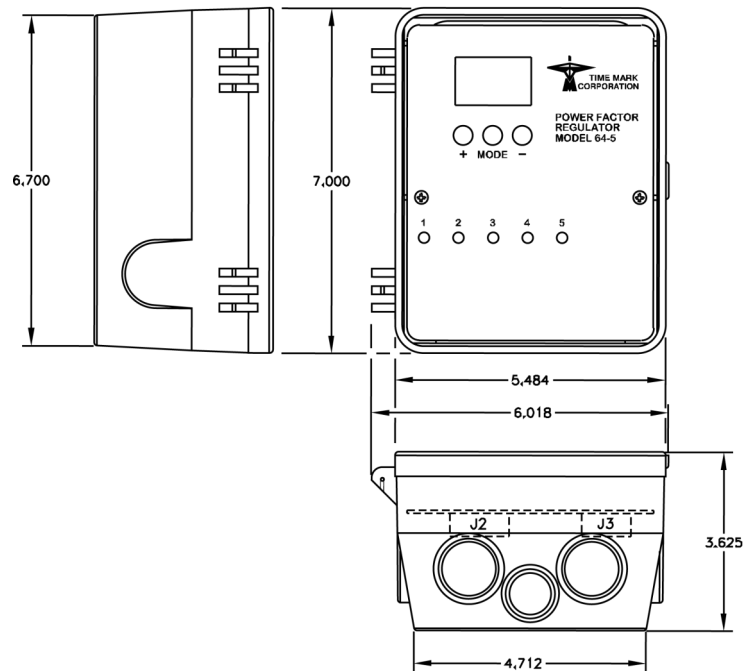
The **Model 64-5** has a POWER FACTOR control, adjustable between 0.90 and 1.00. If the power factor drops below this setting, the unit will begin adding capacitor stages every 30.0 seconds unless the user changes the response time, until the high PF set point is 1.00, or a user selected high set point is reached.

The Model 64-5 will drop out one stage of capacitors every 30.0 seconds, or user set time, if the power factor becomes capacitive (or leading). This continues until the power factor is again inductive (lagging).

The manual mode allows capacitance to be removed or added at the push of a button.



DIMENSIONS



REAR VIEW

Telephone: Main - (918) 438-1220
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MODEL 64-5 Power Factor Regulator

READ ALL INSTRUCTIONS BEFORE INSTALLING, OPERATING OR SERVICING THIS DEVICE.
KEEP THIS DATA SHEET FOR FUTURE REFERENCE

GENERAL SAFETY

POTENTIALLY HAZARDOUS VOLTAGES ARE PRESENT AT THE TERMINALS OF THE MODEL 64-5.
ALL ELECTRICAL POWER SHOULD BE REMOVED WHEN CONNECTING OR DISCONNECTING WIRING.
THIS DEVICE SHOULD BE INSTALLED AND SERVICED BY QUALIFIED PERSONNEL.

Installation Instructions

OPERATION (cont'd)

If the operating voltage is lost or the input current is too low, all relays will drop out.

The display of the Model 64-5 will show if the power factor is inductive or capacitive. Output lights show relay status. Normally, the unit is in "auto" mode (the letter "A" is shown in the display).

Press the MODE button to cycle through the following options:

Mode	Use +/- buttons to:
Manual (M)	Add or remove capacitor banks
Relay Operation	Select Sequence or Binary
# of Steps	Select based on Relay Operation <i>Sequence: Values are 1 to 5.</i> <i>Binary: Values are 1 to 31.</i>
High Set	Set the power factor High set point
Low Set	Set the power factor Low set point
Delay Set (<i>Dly Set</i>)	Set the delay between relay operations

Note: If the display is in any mode other than AUTO, and no buttons have been pressed for 30 seconds, the unit will automatically return to the AUTO mode. If the current is below the minimum of 0.5A, the display will show "Low Curr" and all relays will drop out.

POWER FACTOR DEFINED

The Power Factor, or PF, is stated as a decimal number between 0 and 1, and is the cosine of the angle between the voltage and current waveforms. In AC circuits, power (in watts) is defined as voltage \times current \times power factor. From this, you can see that with a power factor of 0 there can be no power, regardless of how large the voltage or current may be. A normal inductive motor will have a power factor between 0.30 and 0.90, depending on how the motor is loaded.

HOW TO SELECT CAPACITORS

Power factor correcting capacitors and capacitor banks are normally rated in KVARs. There are three basic steps to

properly size the capacitors to a given application:

1. Determine present load, measured in KW
2. Determine present power factor
3. Determine desired power factor

Using **Chart 2** on page 4, locate the original (present) power factor in the vertical left-hand margin. Locate the desired (corrected) power factor across the top of the chart.

The correction factor (a three place decimal number) is denoted at the intersection of the row and column of these two figures.

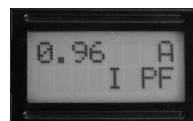
The correction factor is next multiplied by the present KW load. The result is the required capacitor size, stated in KVAR. Correcting to a power factor of 0.95 is generally considered optimum; correcting to a leading, or capacitive, condition should not be attempted.

When the total KVAR requirement is determined, it can be divided among the five stages of the Model 64-5, to provide five-step power factor correction. **When installing capacitors, consult the manufacturer's literature for fusing and contactor requirements.**

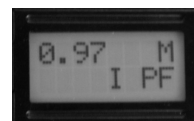
In addition to the capacitors and contactors, a properly sized current transformer with a minimum burden rating of 2 VA and a 5 Amp secondary is required. You will also need a power transformer with an 115VAC secondary with a 50 VA minimum. Proper phasing of CT and the PT are essential. If correction stages work in reverse, disconnect power and reverse the CT secondary leads.

SCREEN SHOTS OF THE 64-5

AUTO MODE



MANUAL MODE



AUTO-LOW CURR



TROUBLESHOOTING

Should this regulator fail to operate properly, check that all voltages are present and of the correct level. Check to see if all wiring is correct. If problems persist, contact the manufacturer at 800-862-2875; Monday thru Friday, 8 a.m. to 5 p.m. CST.

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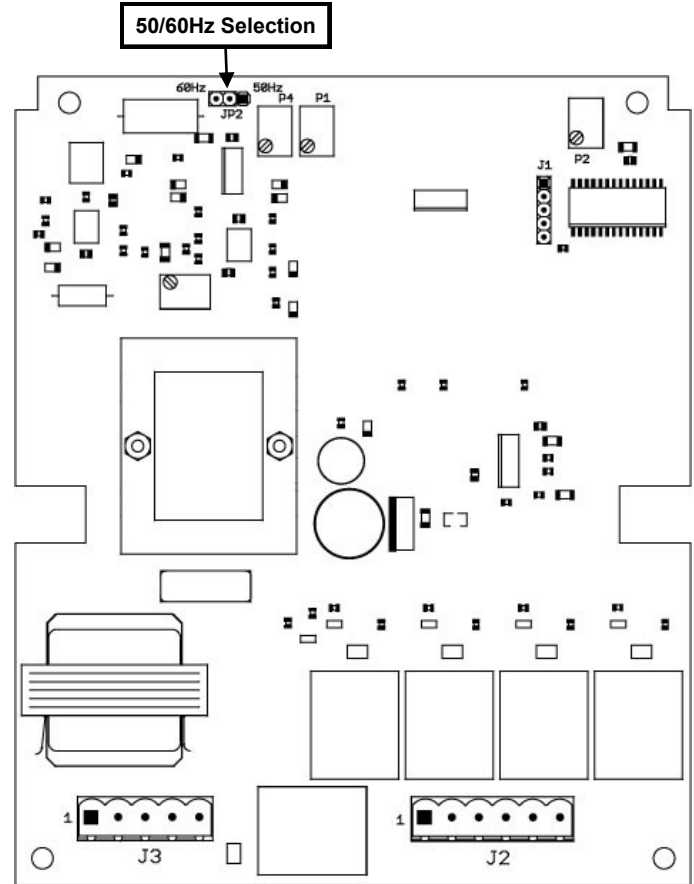
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WARRANTY

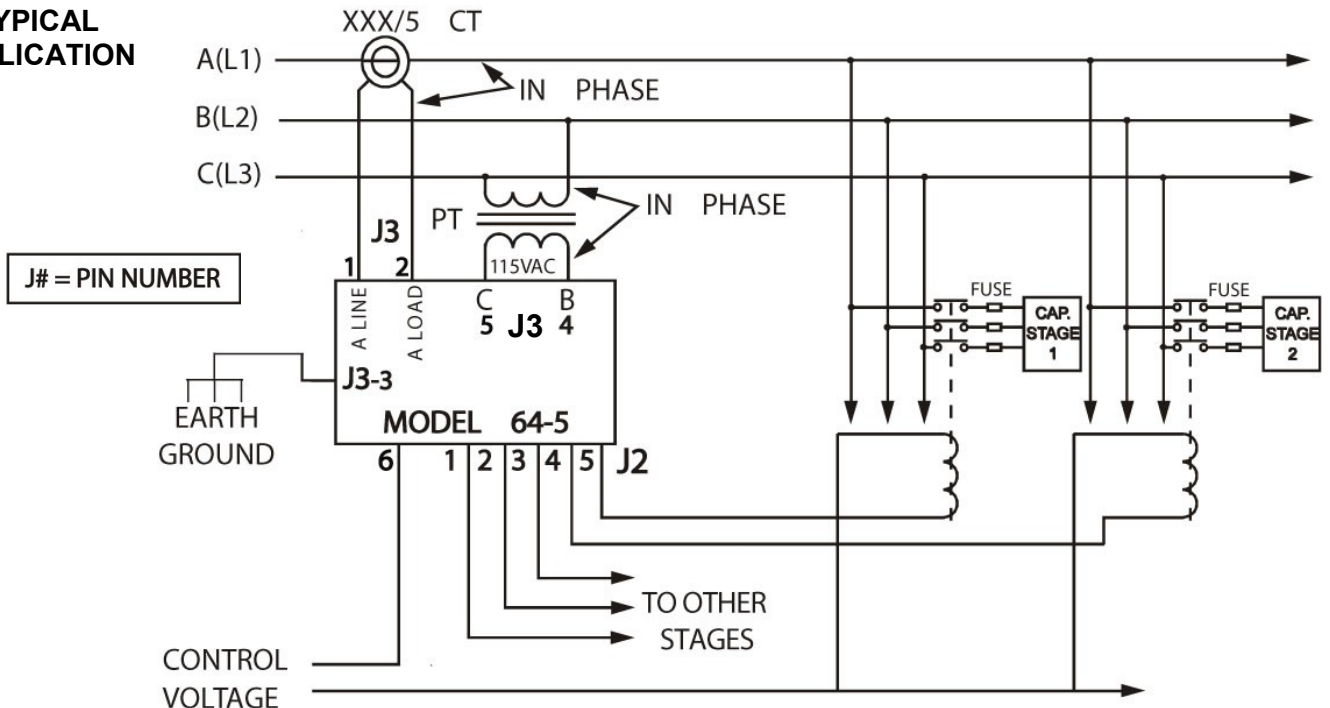
This product is warranted to be free from defects in materials and workmanship for one year. Should this device fail to operate, we will repair it for one year from the date of manufacture. For complete warranty details, see the *Terms and Conditions of Sales* page in the front section of the Time Mark catalog or contact Time Mark at 1-800-862-2875.

Chart 1. METER READING vs. POWER FACTOR

Power Factor	Capacitive Output (in mA)	Inductive Output (in mA)
0.40	0.0571877	0.942812
0.45	0.0782908	0.921709
0.50	0.0999998	0.900000
0.55	0.122446	0.877554
0.60	0.145799	0.854201
0.65	0.170277	0.829723
0.70	0.196180	0.803820
0.75	0.223936	0.776064
0.80	0.254201	0.745799
0.85	0.288078	0.711922
0.90	0.327720	0.672280
0.95	0.378701	0.621299
1.00	0.500000	0.500000



TYPICAL APPLICATION



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CHART 2. KW multipliers to determine capacitor kilovars required for power factor correction.

ORIG PF	CORRECTED POWER FACTOR																				
	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00
0.50	0.982	1.008	1.034	1.060	1.086	1.112	1.139	1.165	1.192	1.220	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.589	1.732
0.51	0.937	0.962	0.989	1.015	1.041	1.067	1.094	1.120	1.147	1.175	1.203	1.231	1.261	1.292	1.324	1.358	1.395	1.436	1.484	1.544	1.687
0.52	0.893	0.919	0.945	0.971	0.997	1.023	1.050	1.076	1.103	1.131	1.159	1.187	1.217	1.248	1.280	1.331	1.351	1.392	1.440	1.500	1.643
0.53	0.850	0.876	0.902	0.928	0.954	0.980	1.007	1.033	1.060	1.088	1.116	1.144	1.174	1.205	1.237	1.277	1.308	1.349	1.397	1.457	1.600
0.54	0.809	0.835	0.861	0.887	0.913	0.939	0.966	0.992	1.019	1.047	1.075	1.103	1.133	1.154	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.55	0.769	0.795	0.821	0.847	0.873	0.899	0.926	0.952	0.979	1.007	1.035	1.063	1.093	1.124	1.156	1.190	1.227	1.268	1.316	1.376	1.519
0.56	0.730	0.756	0.782	0.808	0.834	0.860	0.887	0.913	0.940	0.968	0.996	1.024	1.054	1.085	1.117	1.151	1.188	1.229	1.277	1.337	1.480
0.57	0.692	0.718	0.744	0.770	0.796	0.822	0.849	0.875	0.902	0.930	0.958	0.986	1.016	1.047	1.079	1.113	1.150	1.191	1.239	1.299	1.442
0.58	0.655	0.681	0.707	0.733	0.759	0.785	0.812	0.838	0.865	0.893	0.921	0.949	0.979	1.010	1.042	1.076	1.113	1.154	1.202	1.262	1.405
0.59	0.619	0.645	0.671	0.697	0.723	0.749	0.776	0.802	0.829	0.857	0.885	0.913	0.943	0.974	1.006	1.040	1.077	1.118	1.166	1.226	1.369
0.60	0.583	0.609	0.635	0.661	0.687	0.713	0.740	0.766	0.793	0.821	0.849	0.877	0.907	0.938	0.970	1.004	1.041	1.082	1.130	1.190	1.333
0.61	0.549	0.575	0.601	0.627	0.653	0.679	0.706	0.732	0.759	0.787	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.156	1.299
0.62	0.516	0.542	0.568	0.594	0.620	0.646	0.673	0.699	0.726	0.754	0.782	0.810	0.840	0.871	0.903	0.937	0.974	1.015	1.063	1.123	1.266
0.63	0.483	0.509	0.535	0.561	0.587	0.613	0.640	0.666	0.693	0.721	0.749	0.777	0.807	0.838	0.870	0.904	0.941	0.982	1.030	1.090	1.233
0.64	0.451	0.474	0.503	0.529	0.555	0.581	0.608	0.634	0.661	0.689	0.717	0.745	0.775	0.806	0.838	0.872	0.909	0.950	0.998	1.068	1.201
0.65	0.419	0.445	0.471	0.497	0.523	0.549	0.576	0.602	0.629	0.657	0.685	0.713	0.743	0.774	0.806	0.840	0.877	0.918	0.966	1.026	1.169
0.66	0.388	0.414	0.440	0.466	0.492	0.518	0.545	0.571	0.598	0.626	0.654	0.682	0.712	0.743	0.775	0.808	0.846	0.887	0.935	0.995	1.138
0.67	0.358	0.384	0.410	0.436	0.462	0.488	0.515	0.541	0.568	0.596	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.965	1.108
0.68	0.328	0.354	0.380	0.406	0.432	0.458	0.485	0.511	0.538	0.566	0.594	0.622	0.652	0.683	0.715	0.749	0.786	0.827	0.875	0.935	1.078
0.69	0.299	0.325	0.351	0.377	0.403	0.429	0.456	0.482	0.509	0.537	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.906	1.049
0.70	0.270	0.296	0.322	0.348	0.374	0.400	0.427	0.453	0.480	0.508	0.536	0.564	0.594	0.625	0.657	0.691	0.728	0.769	0.817	0.877	1.020
0.71	0.242	0.268	0.294	0.320	0.346	0.372	0.399	0.425	0.452	0.480	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.72	0.214	0.240	0.266	0.292	0.318	0.344	0.371	0.397	0.424	0.452	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.73	0.186	0.212	0.238	0.264	0.290	0.316	0.343	0.369	0.396	0.424	0.452	0.480	0.510	0.541	0.573	0.607	0.644	0.685	0.733	0.793	0.936
0.74	0.159	0.185	0.211	0.237	0.263	0.289	0.316	0.342	0.369	0.397	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.75	0.132	0.158	0.184	0.210	0.236	0.262	0.289	0.315	0.342	0.370	0.398	0.426	0.456	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.76	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.288	0.315	0.343	0.371	0.399	0.429	0.460	0.492	0.526	0.563	0.604	0.652	0.712	0.855
0.77	0.079	0.105	0.131	0.157	0.183	0.209	0.236	0.262	0.289	0.317	0.345	0.373	0.403	0.434	0.466	0.500	0.537	0.578	0.626	0.685	0.829
0.78	0.052	0.078	0.104	0.130	0.156	0.182	0.209	0.235	0.262	0.290	0.318	0.346	0.376	0.407	0.439	0.473	0.510	0.551	0.599	0.659	0.802
0.79	0.026	0.052	0.078	0.104	0.130	0.156	0.183	0.209	0.236	0.264	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.633	0.776
0.80	0.000	0.026	0.052	0.078	0.104	0.130	0.157	0.183	0.210	0.238	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.499	0.547	0.609	0.750
0.81		0.000	0.026	0.052	0.078	0.104	0.131	0.157	0.184	0.212	0.240	0.268	0.298	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.82			0.000	0.026	0.052	0.078	0.105	0.131	0.158	0.186	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.495	0.555	0.698
0.83				0.000	0.026	0.052	0.079	0.105	0.132	0.160	0.188	0.216	0.246	0.277	0.309	0.343	0.380	0.421	0.469	0.529	0.672
0.84					0.000	0.026	0.053	0.079	0.106	0.134	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.85						0.000	0.027	0.053	0.080	0.108	0.136	0.164	0.194	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.86							0.000	0.026	0.053	0.081	0.109	0.137	0.167	0.198	0.230	0.264	0.301	0.342	0.390	0.450	0.593
0.87								0.000	0.027	0.055	0.083	0.111	0.141	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.88									0.000	0.028	0.056	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.89										0.000	0.028	0.056	0.086	0.117	0.149	0.183	0.220	0.261	0.309	0.369	0.512
0.90											0.000	0.028	0.058	0.089	0.121	0.155	0.192	0.233	0.281	0.341	0.484
0.91												0.000	0.030	0.061	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.92													0.000	0.031	0.063	0.097	0.134	0.175	0.223	0.283	0.426
0.93														0.000	0.023	0.066	0.103	0.144	0.192	0.252	0.395
0.94															0.000	0.034	0.071	0.112	0.160	0.220	0.363
0.95																0.000	0.037	0.079	0.126	0.186	0.329
0.96																	0.000	0.041	0.089	0.149	0.292
0.97																		0.000	0.048	0.108	0.251
0.98																			0.000	0.060	0.203
0.99																				0.000	0.143
1.00																					0.000

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