MotorSaver® Plus
THREE-PHASE ELECTRIC MOTOR PROTECTOR

INSTALLATION INSTRUCTIONS FOR THE MODEL 601-CS-P1 (601-CS-D-P1)

ELECTRONIC POWER MONITOR

BE SURE POWER IS DISCONNECTED PRIOR TO INSTALLATION!
FOLLOW NATIONAL, STATE AND LOCAL CODES.
READ THESE INSTRUCTIONS ENTIRELY BEFORE INSTALLATION.

601-CS-X-P1 Three Phase Power Monitor is a fully programmable electronic power monitor designed to monitor three phase systems. The 601-CS-X-P1 has a single relay that can be configured as a general purpose network output or to trip on ground faults. The 601-CS-X-P monitors ground fault current, phase currents, phase voltages, power factor and frequency. The RS485MS-2W communications module allows the 601-CS-X-P to communicate using the Modbus RTU protocol. The Modbus connection can be used to monitor power parameters, setup the device, or control the fault relay. A DeviceNet communications module and DeviceNet Communications I/O module are available as well.

DANGER!

HAZARDOUS VOLTAGES MAY BE PRESENT DURING INSTALLATION.
Electrical shock can cause death or serious injury.
Installation should be done by qualified personnel following all national, state and local electrical codes.

CONNECTIONS

1. Disconnect power and verify power is off.
2. Using the four corner tabs or the DIN rail mount, install the 601-CS-X-P1 directly above or below the contactor. To use the DIN rail mount, hook the top clip first then apply downward pressure until the lower clip snaps onto the rail.
3. A) For amperages from 1-175 amps, insert the motor conductors through the holes marked A, B, and C. Make certain the conductor through each hole corresponds to the right motor conductor, i.e. the A phase conductor should go through the A round hole. See Figure 1 for a typical wiring diagram.

   C) For amperages greater than 175 amps, external CTs (current transformers) are required. SymCom recommends using CTs with terminals for ease of installation. See Figure 2 for a typical wiring diagram using external CTs.
   NOTE: Pay close attention to this diagram to eliminate any power factor errors, when communicating with the device.
4. Connect the 3-phase power from the line side of the contactor to L1, L2, and L3 terminals using 12-18 AWG copper wire. These should be tightened to no more than 7 inch lbs.
5. Connect the control circuit wires to the appropriate terminals.
6. Connect a zero sequence CT to the connector on the underside of the unit.
7. Insert all three motor conductors through the zero sequence CT.

II-601CS-B

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Table 1-Wiring configuration based on motor load amps			
Recommended Full Load Amps	**# of Passes through each Window**	**Recommended CT**	**Mul/Div Parameters**
1-175	1	--	1/1
176-220	1	200:5	40/1
220-320	1	300:5	60/1
320-420	1	400:5	80/1
400-520	1	500:5	100/1
480-600	1	600:5	120/1
540-700	1	700:5	140/1
560-800	1	800:5	160/1

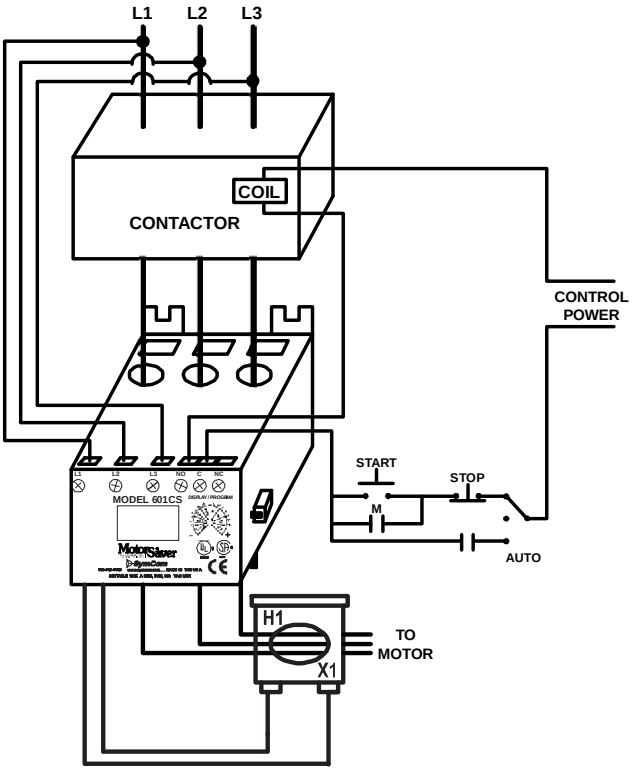

Figure 1: Typical Wiring Diagram for FLA of 1-175A

Note: All CTs must face the same direction and all CT secondaries must be wired identically, i.e. all X1 terminals enter the main (round) window and returns to H1 terminal after exiting the loop conductor window (rectangle).

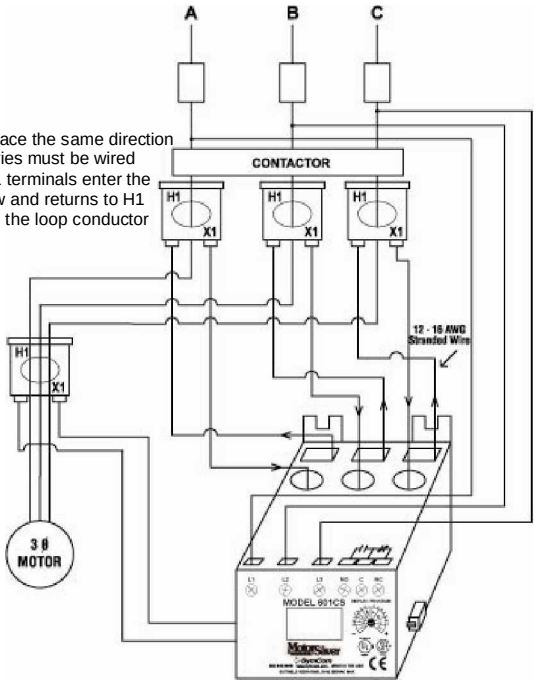

Figure 2: Typical Wiring Diagram Using External CTs.

SYSTEM DISPLAY

For models equipped with a display (601-CS-D-P1) the unit is capable of displaying nine measured parameters, see table below.

Table 2 – Display Parameters		
Parameter	**Description**	**Units**
L1-L2	Measured line voltage from L1-L2	Volts
L2-L3	Measured line voltage from L2-L3	Volts
L3-L1	Measured line voltage from L3-L1	Volts
VUB	Measured voltage unbalance	%
A	Measured phase A current	Amps
B	Measured phase B current	Amps
C	Measured phase C current	Amps
CUB	Measured current unbalance	%
GF	Measured ground fault current	Amps

PROGRAMMABLE PARAMETERS (601-CS-D-P1 only)

The 601-CS-D-P1 has 15 programmable parameters that will control the operation of the device.

GFCT – Ground Fault CT Ratio (1-950, 1.0) Default=500

This setting sets the CT ratio of the external zero-sequence CT. For example if the external CT that is being used has a ratio of 500:1, set this setting to 500. If the CT being used has a ratio of 100:5 set this setting to 20. If CT is 1000:1 set this setting to 1.00. If this setting reads 1.xx then the CT ratio set is 1.xx*1000.

Table 3 - Ground Fault CT Ratio

Setting	CT Ratio	Setting	CT Ratio
1	1:1	160	160:1 or 800:5
8	8:1	165	165:1
10	10:1 or 50:5	170	170:1
15	15:1 or 75:5	175	175:1
20	20:1 or 100:5	180	180:1
25	25:1	185	185:1
30	30:1	190	190:1
35	35:1	200	200:1 or 1000:5
40	40:1 or 200:5	250	250:1
50	50:1	300	300:1
60	60:1 or 300:5	350	350:1
70	70:1	400	400:1
80	80:1 or 400:5	450	450:1
90	90:1	500	500:1
100	100:1 or 500:5	550	550:1
110	110:1	600	600:1
120	120:1 or 600:5	650	650:1
125	125:1	700	700:1
130	130:1	750	750:1
135	135:1	800	800:1
140	140:1 or 700:5	850	850:1
145	145:1	900	900:1
150	150:1	950	950:1
155	155:1	1.0	1000:1

MUL – Multiplier (1-255) Default=1

The current measured through the round windows is multiplied by this setting for proper display. If using a 50:5 CT set this to 10.

DIV – Divisor (1-255) Default=1

The current measured through the round windows is divided by this setting for proper display. If the motor conductors make 10 passes through the round windows set this to 10.

GFWE – Ground Fault Warning Enable (Off, On) Default=Off

When this setting is set to On, the device will indicate a warning condition via the network, when the measure GF is ≥ the GF warning setpoint.

GFWD – Ground Fault Warning Delay (0-127.5 seconds in ½ second increments) Default=0

This setting is the delay before the GF warning status changes. For example setting this to 020 would be a warning delay of 10 seconds.

GFWS – Ground Fault Warning Setpoint (0-20 Amps) Default=1

When the measured GF ≥ this setting, the device will indicate a warning condition.

GFTE – Ground Fault Trip Enable (Off, On) Default=Off

When this setting is set to On, the unit will open the fault relay if the measured GF is ≥ the GF trip setpoint.

MBWD – Modbus Watchdog Enable (Off,On) Default=Off

When this setting is set to On, the device will open the fault relay after 10 seconds of no communication via the Modbus network.

TG – Tamper Guard Enable (Off, On, Clr) Default=Off

When this setting is set to On, no other settings can be changed via the front panel. If the user set this setting to Clr, the last fault will be cleared.

GFME – Ground Fault Motor Acceleration Enable (Off, On) Default=Off

When this setting is set to On, the motor acceleration trip delay will apply to the ground fault trip.

MATD – Motor Acceleration Trip Delay (0-127.5 second in ½ seconds increments) Default=0

If the Ground Fault Motor Acceleration Enable setpoint is set to On this trip delay will prevent tripping on ground fault from the time 3-phase motor current is present, until this delay expires. For example setting this to 020 will be a trip delay of 10 seconds.

ADDR – Modbus Communication Address (1-255) Default=1

This setting determines the address, which the device will communicate via Modbus.

COMM – Communication Parameters (C01-C07) Default=C03

This setting sets the communication parameters that the 601-CS-D-P1 will use to communicate via the RS-485 link.

Table 4 – Comm. Parameters	
C01	9600,0,1
C02	9600,N,1
C03	9600,E,1
C04	19200,N,1
C05	19200,0,1
C06	19200,N,1
C07	19200,E,1

GFTD – Ground Fault Trip Delay (0-251) Default=16

This setting determines how long it will take the fault relay to open when a ground fault is present. To calculate the GF trip delay use the following equation.

Xfact = Measured GF current/GFTS

If Xfact ≤ 4
    GF Trip Time (seconds) = (GFTD/Xfact)*.5
If Xfact > 4
    GF Trip Time (seconds) = (GFTD/4)*.5

GFTS – Ground Fault Trip Setpoint (0.1-20 Amps, Off) Default=Off

This setting sets the amount of ground fault current that must be measured before the device will trip on a ground fault condition. This setting can be set to Off which will disable the ground fault trip feature.

Programming Example 1

The 601-CS-D-P1 is setup on the following system: 3-phase high resistance grounded motor. The FLA of this motor is 50A and the ground fault current that can flow is limited to 10A. The design of the system allows for 1-2A of ground fault current to flow without shutting down the process. The 601-CS-D-P1 is setup as follows:

GFCT - A 500:1 zero-sequence CT is connected to the 601-CS-D-P1, set this parameter to 500

MUL - By looking at table 1 for a motor of 50A, set this parameter to 1.

DIV - By looking at table 1 for a motor of 50A, set this parameter to 1.

GFWE – We want to send a warning to the PLC if the ground fault current exceeds 2A, set this parameter to On.

GFWD – We want the warning to be indicated immediately, when there is a ground fault of 2A present, set this parameter to 0.

GFWS – We want the warning to occur when 2A of ground fault is flowing, set this parameter to 2.00.

GFTE – If 10A of ground fault flow we want to shut down the whole system, set this parameter to On.

MBWD – Because the network is only being used to monitor for a warning condition, and we don't want loss of network communication to shut down our process, set this parameter to Off.

GFME – Motor acceleration delays don't apply to this application, set this parameter to Off.

MATD - Motor acceleration delays don't apply to this application, set this parameter to 0.

ADDR – The PLC will communicate with this device using address 5, so set this parameter to 5.

COMM – The PLC uses 19200,E,1 communication, so set this to C07.

GFTD – Based on the formula for this setting, we want to trip in 2 seconds for a ground fault 4 times the ground fault setpoint, set this parameter to 16.

GFTS – We want to shut down the system if the ground fault current exceeds 10A, set this parameter to 10.0.

TG – To prevent any un-authorized changes to the parameters of this device, set this parameter to On.

PROGRAMMING (601-CS-D-P1 Only)

1. Rotate the MODE SELECT switch to the parameter to be programmed.
2. Press and hold the RESET/PROGRAM button.
3. Rotate the DISPLAY/PROGRAM knob until the proper setting for the parameter that is being programmed is displayed.
4. Release the RESET/PROGRAM button. This stores the new parameter in the nonvolatile memory. If the number changes back to what it was before programming, then the tamper guard is on and will need to be unlocked before programming can be completed
5. Continue steps 1-4 until all parameters are programmed.

OPERATION

The relay operation of the Model 601-CS-X-P1 is designed to be fail safe. This means that when a ground fault trip condition occurs, the relay will open its NO contacts, if ground fault tripping is enabled. When the display shows GrF, the unit has opened the fault relay, because of a ground fault event. The relay can be reset by pressing the reset button (601-CS-D-P1 only).

CLEARING LAST FAULT (601-CS-D-P1 only)

The last fault stored can be cleared on the MotorSaver®Plus following these steps:

1. Rotate the MODE SELECT switch to TG.
2. Press and hold the RESET/PROGRAM button. Adjust the DISPLAY/PROGRAM adjustment until “cLr” appears on the display. Release the RESET/PROGRAM button.

To verify the last fault was cleared, place the MODE SELECT switch in the RUN position. Then press and hold the RESET/PROGRAM button; “cLr” should be on the display.

MODEL 601-CS-X-P1 SPECIFICATIONS	
ELECTRICAL	
3-Phase Input Voltage	200–480VAC
Frequency	50–60Hz
Motor Full Load Amp Range	0.5–175A, 3-phase (direct) 176–800A, 3-phase (external CTs required)
Input Ground Fault Current	0.5-10A
Power Consumption	10 Watts (max.)
Output Contact Rating SPDT (Form C)	Pilot duty rating: 480VA @ 240VAC General purpose: 10A @ 240VAC
Expected Life	
Mechanical	1 x 10^6 operations
Electrical	1 x 10^5 operations at rated load
Accuracy at 25° C (77° F)	
Voltage	±1%
Current	±3%(<175A Direct)
GF Current	±3%
Repeatability	
Voltage	±0.5% of nominal voltage
Current	±1% (<175A direct)
Safety Marks	
UL	UL508
CE	IEC 60947-1, IEC 60947-5-1
Standards Passed	
Electrostatic Discharge (ESD) Radio Frequency Immunity (RFI), Conducted Radio Frequency Immunity (RFI), Radiated	IEC 1000-4-2, Level 3, 6kV contact, 8kV air IEC 1000-4-6, Level 3 10V IEC 1000-4-3, Level 3 10V/m
Fast Transient Burst	IEC 1000-4-4, Level 3, 3.5 kV input power
Surge	
IEC	1000-4-5 Level 3, 2kV line-to-line; Level 4, 4kV line-to-ground
ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Short Circuit Rating	100KA RMS, SYM, 600 VAC MAX
Vibration	IEC 68-2-6, 10-55Hz, 1mm peak-to-peak, 2 hours, 3 axis
Shock	IEC 68-2-27, 30g, 3 axis, 11ms duration, half-sine pulse
Mechanical	
Dimensions	3.0"H x 5.1"D x 3.6"W
Terminal Torque	7 in.-lbs.
Enclosure Material	Polycarbonate
Weight	1.2 lbs
Max. Conductor Size Through 601-CS-X-P1	0.65" with insulation
Environmental	
Temperature Range	Ambient Operating: -20° to 70° C (-4° to 158°F) Ambient Storage: -40° to 80° C (-40° to 176°F)
Pollution Degree	3
Class of Protection	IP20, NEMA 1
Relative Humidity	10–95%, non-condensing per IEC 68-2-3