POWERTRAK POWER MONITORING INTERFACE

PT-9000 SERIES

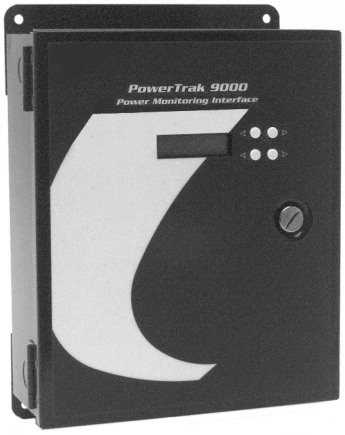
DESCRIPTION

The **PT-9000 Series PowerTrak Power Monitoring Interface** monitors numerous power system parameters for local display and/or remote connection to a BAS or other data acquisition equipment. Any three- or single-phase 50/60 Hz electrical system from 120-600V can be monitored by the **PT-9000 Series** without the need for potential transformers. Higher voltage systems such as 5 kV or 15 kV services can also be monitored using potential transformers. The **PT-9000 Series** is available for use with 1A, 5A, or 0.333V current transformers. Options include a current transformer shorting assembly and a digital LCD display.

Furnished in a NEMA 1 hinged cover enclosure with external mounting feet and conduit knockouts on all sides, the **PT-9000 Series** is simple to install. Setup of the **PT-9000 Series** is easily accomplished with a selector switch and DIP switches. A truly unique feature of the **PT-9000 Series** is its ability to identify and electronically correct wiring problems such as reversed CT polarities or improper phasing of voltages with CTs.

FEATURES

- ***Auto-corrects for wiring errors***
- ***Three-phase (Wye or Delta) or single-phase systems***
- ***Voltage selector switch (120-600V)***
- ***Accepts 1A, 5A, or 0.333V CTs***
- ***Low voltage alarm contact***
- ***Two 4-20 mA outputs***
- ***Pulse output for KWH with selectable pulse rate***
- ***Optional two-line LCD display***
- ***Optional unique CT shorting assembly***
- ***Easily installed enclosure with external mounting feet***
- ***Optional LonWorks, Modbus, and Metasys communications***



Shown with optional display

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APPLICATION

Remote (Outputs) & Local (Display) Monitoring

KWH	***Total KW***
Window KW	***Peak window KW***
Total KVA	***Total power factor (PF)***
True RMS voltage	***True RMS current***

Local (Display) Monitoring - Each Phase

True RMS voltage
True RMS current
KW (Wye systems)
KVA (Wye systems)
Power factor (Wye systems)

SPECIFICATIONS

Inputs

System type	Three-phase (Wye or Delta), single-phase
Input voltage	120-600 VAC
Frequency	50/60 Hz
Input current	0-5A, 0-1A, or 0-0.333V
CT burden	0.75 VA max (1A or 5A inputs)
CT primary	5, 50, 75, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2500, 3000, 3500, 4000, 5000, or 6000
PT burden	4.8 VA max
Internal fusing	0.5A, 600V (**KLK-0.5**)

Outputs

Pulse output	Pulsed contact closure for KWH solid-state relay, 50 VAC/DC max, 100 mA max
Pulse rate	Four selectable KWH per pulse rates, 50% duty cycle
Max pulse rate	Five pulses per second
Contact output	Maintained contact closure for low voltage alarm 50 VAC/DC, 100 mA max
Analog outputs	Two externally powered 4-20 mA signals selectable for total KW, window KW, peak window KW, total power factor, total KVA, RMS current*, or RMS voltage*
Max load	725Ω each output @ 24 VDC
Power	External 24 VDC @ 60 mA max
Accuracy	0.75% of F.S. (kW, kVA, V, A) ± 0.03 PF (40% to 100% F.S. power)
Operating temp	32° to 122°F (0° to 50°C)
Humidity	5% to 95% noncondensing
Display option**	LCD, two lines, 16 characters/line
Dimensions	12"H x 10"W x 4"D (30.5 x 25.4 x 10.2 cm)
NEMA 3R	20" H x 16"W x 6"D (50.8 x 40.6 x 15.2 cm)
Weight	12 lb (5.5 kg), NEMA 3R:43 lb (20 kg)
Approvals	UL and cULus listed, File #E161500 Certified to LonMark Interoperability Guidelines version 3.1

* Voltage and current outputs are the average of the three-phase true RMS values.

**When using potential transformers for voltages above 600V, some displayed values must be multiplied by the PT ratio.

INSTALLATION

PowerTrak Installation

Using the external mounting feet, secure the **PowerTrak** to a wall surface using the proper mounting hardware for the type of wall construction involved. Pull the conduit and wiring runs through any of the eight 1/2" knock-outs into the enclosure and tag (identify) per job drawings. To avoid electrical noise and interference, the signal output wiring should be kept separated from the line voltage and current transformer wiring.

Current Transformer (CT) Installation

All CT's should be installed with the side of the transformer labeled "H1" facing the incoming power to maintain proper CT polarity. Connect the CT wiring to the CT INPUTS terminal block as shown in the **PowerTrak** wiring diagrams (Figures 1 & 2). If the **PowerTrak** is equipped with the CT shorting Assembly Option, see instructions below. A pair of wires for each CT is required as shown in the wiring diagrams or a common CT return wire can be used with 1 amp or 5 amp CT's. When using the SCT Series of current transformers with the PT-9300, recommended wiring is a twisted shielded pair for each CT to avoid noise pick-up. Ground the shield wire at the PT-9300 ground lug only. The output from each CT should be wired to be in phase with its respective voltage. For example, the CT installed on Phase-A is connected to the Phase-A CT input terminals X1 and X2, and the system voltage connection from Phase-A should be to terminal L1.

Current Transformer (CT) Shorting Assembly Option

The CT Shorting Assembly Option provides a simple and convenient means of shorting 1 amp or 5 amp current transformer secondaries should there be a requirement to take the **PowerTrak** out of service. This option is installed by securing the Shorting Assembly pins to the **PowerTrak** CT INPUTS terminal block, and securing the Shorting Assembly board to the stand-offs on the **PowerTrak** circuit board. All CT wiring connections should be made to the terminal strip on the Shorting Assembly Option board. A pair of wires for each CT is required as shown in the wiring diagrams or a common CT return wire can be used. The current from each CT should be wired to be in phase with its respective voltage. For example, the CT installed on Phase-A is connected to the Phase-A CT input terminals X1 and X2, and the system voltage connection from Phase-A should be to terminal L1. *With the shorting assembly jumper plugs in the SHORT position, the corresponding CT secondary is shorted. With the jumper plugs in the NORM position, the CT secondary can be read by the **PowerTrak**. The jumper plugs should be placed in the SHORT position before the shorting assembly is disconnected from the **PowerTrak**.*

Current Transformer (CT) Installation Note: When using current transformers with small burden (load) capability (typically CT's with ratios below 200:5), the CT secondary wiring can add significantly to the burden that must be supported by the CT. For these applications, consideration should be given to the distance between the PowerTrak and the current transformers as well as to the gauge of the CT wiring. Refer to the Technical Reference section in the Kele catalog for more information on burden or call Kele.

Summing Current Transformers: When wiring summing CT's, proper CT polarity and phasing with voltages must be observed. The PowerTrak Auto-Configuration and Manual Configuration functions cannot be used with summing current transformers.

CAUTION: Open circuiting the secondary leads of a 1 amp or 5 amp secondary current transformer under load can cause hazardous voltages which can injure personnel or damage equipment. Maintain a shorted circuit across the secondary leads whenever the current transformer is not connected to the PowerTrak transducer. The PowerTrak shorting assembly option or an externally mounted U3889 switch is recommended.

System Voltage Connections

The system voltage connections are made to the **PowerTrak** terminal strip labeled SYSTEM VOLTAGE CONNECTIONS. System voltages up to 600 volts can be connected directly to this terminal strip. For system voltages greater than 600 volts, potential transformers can be used. The system voltage terminal strip is pluggable allowing for easier wiring installation and/or removal of the **PowerTrak** from service. For three-phase systems refer to Figure 1 for wiring details. Three-phase wye systems should have the neutral line connected to the **PowerTrak**. For single-phase systems refer to Figure 2 for wiring details. Each system voltage connection should be wired to be in phase with its respective CT input.

Input Wiring Installation Note

For safety reasons, the electrical system should be de-energized before installing current transformers and making voltage connections. Care should be taken when wiring the CT and system voltage inputs to the **PowerTrak** in order to maintain proper CT polarity and proper phasing between the CTs and system voltage connections. In the event of inadvertent wiring errors such as reversed polarity CTs or incorrect phasing of voltages with CTs, the **PowerTrak** auto-configuring system is used to electronically "correct" the errors and provide accurate output data. The auto-configuring system eliminates the time consuming troubleshooting and the trial and error wire swapping required with other power monitors.

INSTALLATION - Continued

Output Connections

Analog (4-20mA) Outputs
The **PowerTrak** provides two separate 4-20 mA analog signal outputs. Each output can individually be set by DIP switches to represent a different parameter. Both 4-20 mA output loops require an external 24 VDC power supply and polarity should be observed. See Figures 1 and 2 for wiring diagrams. The “LOOP 1 UP” and “LOOP 2 UP” LED's will vary in intensity with the signal when a valid current loop is connected in series with these outputs. If these LED's are "OFF" there is an open circuit in the current loop.

Digital Outputs
The **PowerTrak** provides a KWH pulse output and a low voltage alarm output. Both outputs are solid state relays rated for 50 VAC/DC 100 mA maximum. See Figures 1 and 2 for wiring diagrams. When driving a DC relay coil, a reverse connection protection diode (like 1N4004) is recommended across the relay coil. If driving an AC relay coil, a varistor across the relay coil is recommended (like V39ZA1). The ”KWH PULSE“ LED is “ON” when the KWH pulse contact is closed and “OFF” when the contact is open. The ”SYS VOLTS OK“ LED is “ON” when all phase voltages are above the low voltage alarm settings. The LED is ”OFF“ when any phase voltage drops below the low voltage alarm setting.

PowerTrak Communications
The **PowerTrak** can be supplied with an optional communications module allowing access to all of the monitored parameters. Refer to the data sheet supplied with the communications module for information on wiring, protocols, etc.

POWERTRAK LCD DISPLAY OPTION

The **PowerTrak** may be ordered with an optional two line, 16 character, alpha-numeric LCD display for local monitoring of power parameters. Each line of the display can be manually scrolled with the yellow, cover mounted buttons to view up to 23 different displayed parameters. No calibration of the display is required. When using potential transformers on systems greater than 600V, multiply KW, KWH, KVA and VOLT displayed values by the PT ratio to get the correct parameter value. PT ratio=Primary/Secondary. Example: 4800V/120V=40

DISPLAYED PARAMETERS BY SYSTEM TYPE

3-Phase Delta	3-Phase Wye	1-Phase, 2-Wire	1-Phase, 3-Wire
TOTAL KW	TOTAL KW	TOTAL KW	TOTAL KW
WINDOW KW	WINDOW KW	WINDOW KW	WINDOW KW
WIN PK KW (Peak)	WIN PK KW (Peak)	WIN PK KW (Peak)	WIN PK KW (Peak)
KWH	KWH	KWH	KWH
L-L AVG V*	“A” KW	L1-N VOLT	“A” KW
L1L2 VOLT	“B” KW	“A” AMPS	“B” KW
L2L3 VOLT	“C” KW	TOTAL KVA	L-N AVG V*
L3L1 VOLT	L-N AVG V*	TOTAL PF	L1-N VOLT
AVG AMPS*	L1-N VOLT		L2-N VOLT
“A” AMPS	L2-N VOLT		AVG AMPS*
“B” AMPS	L3-N VOLT		“A” AMPS
“C” AMPS	AVG AMPS*		“B” AMPS
TOTAL KVA	“A” AMPS		TOTAL KVA
TOTAL PF	“B” AMPS		“A” KVA
	“C” AMPS		“B” KVA
	TOTAL KVA		TOTAL PF
	“A” KVA		“A” PF
	“B” KVA		“B” PF
	“C” KVA		
	TOTAL PF		
	“A” PF		
	“B” PF		
	“C” PF		

* Voltage and amps displayed values are the average of the true RMS phase values.

KWH and Peak Window KW Reset
The KWH display value can be reset to zero by pressing the CLEAR KWH COUNT button inside of the **PowerTrak**. The peak window KW value can be reset to zero by pressing the CLEAR PEAK KW button inside of the **PowerTrak** or by momentarily interrupting power to the current loop connected to MA OUT 2 terminals.

POWERTRAK CONFIGURATION

DIP Switches

Setting the DIP switches according to system requirements is suggested before applying power to the **PT-9000 Series**. However, it is not necessary to remove power from the **PT-9000 Series** in order to make changes to the DIP switch settings.

A1 - A2: Define the power system type. Set these switches to match the type of system that is to be monitored. Select from three-phase Wye or Delta and single-phase two- or three-wire systems.

A3 - A8: Define the low voltage alarm threshold. Select an appropriate value for the system voltage that is monitored. For Delta systems, low voltage is measured line-to-line. For Wye and single-phase systems, low voltage is measured line-to-neutral. Select from alarm threshold values ranging from 51-540V.

B1 - B2: Define the KWH per pulse value. Set these switches to obtain an optimum pulse rate that can be read by the BAS controller or data acquisition equipment. Select from 10, 1, 0.1, and 0.01 KWH per pulse values.

B3 - B5: Define mA loop #2 signal type. Set these switches for the power parameter to be represented by this 4-20 mA output. Select from seven different parameters: Total KW, Window KW, Peak Window KW, Total KVA, Total Power Factor, True RMS Voltage*, True RMS Current*.

B6 - B8: Define mA loop #1 signal type. Set these switches for the power parameter to be represented by this 4-20 mA output. Select from seven different parameters: Total KW, Window KW, Peak Window KW, Total KVA, Total Power Factor, True RMS Voltage*, True RMS Current*.

C1 - C5: Define the current transformer ratio. Set switches to match the primary current rating of the current transformers connected to the **PT-9000 Series.** Select from CT primaries ranging from 50 to 6000.

* Voltage and current outputs are the average of the three-phase true RMS values.

System Voltage Select Switch

Set the SYSTEM VOLTAGE SELECT switch to the correct line-to-line system voltage (or potential transformer secondary voltage, if used) connected to the **PT-9000 Series.** If the actual system voltage is greater than the selector switch setting, the over voltage LED will flash, and the **PT-9000 Series** will cycle on and off to protect itself from over voltage. If this occurs, turn the selector switch to the correct system voltage setting.

Auto-Configuration

After all wiring connections are completed, the DIP switches are set correctly, the voltage selector switch is set to the correct system voltage, and the electrical system is energized, the **PT-9000 Series** can be auto-configured. To initiate the auto-configuring system, press the AUTO-CONFIG button. The **PT-9000 Series** will examine the current and voltage waveforms for correct phasing and CT polarity. During the auto-configuring process, the Volts/Amps phasing LEDs and CT reverse polarity LEDs will light in sequence. When the process is completed only one of the Volts/Amps phasing LEDs will be lighted, indicating the actual phasing between the voltage and current inputs to the **PT-9000 Series**. A lighted CT polarity LED indicates that the corresponding CT is installed or wired backwards giving a reverse polarity. A correctly wired **PT-9000 Series** will be indicated by all CT polarity LEDs extinguished and the left most Volts/Amps phasing LED lighted. Should any of the other phasing or CT polarity LEDs be lighted, the **PT-9000 Series** will electronically fix the wiring errors and provide correct and accurate outputs. No time consuming troubleshooting or wire swapping is required.

Note: The Auto-Configuration and Manual Configuration functions cannot be used with summing current tranformers. Proper wiring of CT's and voltages must be observed when using summing CT's.

If the auto-configuring system is unable to determine the correct wiring configuration, the **PowerTrak** will enter the manual configuration mode and the manual config yellow LED will light. If this occurs, try initiating the auto-configuring system again, by pressing the Auto-config button. If the manual config yellow LED lights again then check the following:

1. Verify all switch settings on the **PowerTrak** are correct for the monitored electrical system.
2. Verify all phase voltages are present at the SYSTEM VOLTAGE terminal block using a voltmeter and/or the **PowerTrak** display option.
3. Verify all Current Transformer inputs are present at the CT INPUTS terminal block using a clamp on ammeter and/or the **PowerTrak** display option. Current transfomer secondary wires (X1 & X2) should be connected to the **PowerTrak** in pairs.

NOTE: For the auto-configuring system to function properly, these four conditions should be met:

1. Load amperage must be above 5% of the CT primary rating.
2. The system power factor must be greater than 0.64 lagging.
3. The power factor should not be leading.
4. The power system waveform does not have severe harmonic distortion.

After checking these items and making any corrections, press the AUTO-CONFIG button again. If the **PowerTrak** is still unable to determine the correct wiring configuration, Manual Configuration will be required.

Manual Configuration

If the auto-configuring system is unable to determine the correct wiring configuration, the **PT-9000 Series** will enter the manual configuration mode and the manual config yellow LED will light. If this occurs, try initiating the auto-configuring system again, otherwise proceed with manual configuration. The electrical system load should be relatively constant during the manual configuration procedure. To manually configure the **PT-9000 Series,** set the DIP switches so that one of the 4-20 mA outputs represents Total KW. Connect a meter set to read DC milliamps to this output, or if the **PT-9000 Series** has the LCD display option, set one of the display lines to read Total KW. Next, press the manual config CT polarity button (CT POL) to scan through the different CT polarity combinations. Each time record the reading of the Total KW display or mA output. Allow the reading to stabilize before recording it. After reviewing all of the CT polarity combinations, press the manual config V-A MATCH button and repeat the process of scanning through the CT polarity combinations. After trying all possible combinations of V-A match and CT polarity, the correct configuration is the one producing the highest value of kW on the display or the highest mA reading on the meter. Manually set the **PT-9000 Series** to the correct configuration using the CT POL & VA MATCH push buttons.

MANUAL CONFIGURATION WORKSHEET

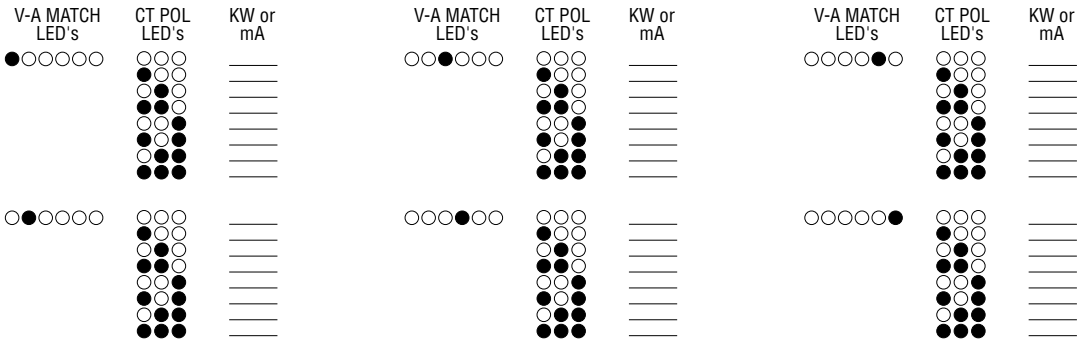


TABLE 1. POWER SYSTEM TYPE

POWER SYSTEM TYPE	SWITCH A1	SWITCH A2
3-Phase Delta	Off	Off
3-Phase Wye	Off	On
1-Phase 2-Wire	On	Off
1-Phase 3-Wire	On	On

TABLE 2. LOW VOLTS ALARM THRESHOLD

Note: For Wye and single phase systems, low voltage is measured line-to-neutral. For Delta systems, low voltage is measured line-to-line.

LOW VOLTS THRESHOLD	SWITCH A3	SWITCH A4	SWITCH A5	SWITCH A6	SWITCH A7	SWITCH A8
51	Off	Off	Off	Off	Off	Off
54	Off	Off	Off	Off	Off	On
55	Off	Off	Off	Off	On	Off
57	Off	Off	Off	Off	On	On
59	Off	Off	Off	On	Off	Off
62	Off	Off	Off	On	Off	On
66	Off	Off	Off	On	On	Off
88	Off	Off	Off	On	On	On
92	Off	Off	On	Off	Off	Off
94	Off	Off	On	Off	Off	On
96	Off	Of	On	Off	On	Off
98	Off	Off	On	Off	On	On
99	Off	Off	On	On	Off	Off
102	Off	Off	On	On	Off	On
104	Off	Off	On	On	On	Off
106	Off	Off	On	On	On	On
108	Off	On	Off	Off	Off	Off
111	Off	On	Off	Off	Off	On
113	Off	On	Off	Off	On	Off
114	Off	On	Off	Off	On	On
116	Off	On	Off	On	Off	Off
118	Off	On	Off	On	Off	On
123	Off	On	Off	On	On	Off
125	Off	On	Off	On	On	On
130	Off	On	On	Off	Off	Off
160	Off	On	On	Off	Off	On
170	Off	On	On	Off	On	Off
176	Off	On	On	Off	On	On
180	Off	On	On	On	Off	Off
184	Off	On	On	On	Off	On
185	Off	On	On	On	On	Off
187	Off	On	On	On	On	On
192	On	Off	Off	Off	Off	Off
197	On	Off	Off	Off	Off	On
200	On	Off	Off	Off	On	Off
204	On	Off	Off	Off	On	On
207	On	Off	Off	On	Off	Off
213	On	Off	Off	On	Off	On
216	On	Off	Off	On	On	Off
222	On	Off	Off	On	On	On
225	On	Off	On	Off	Off	Off
229	On	Off	On	Off	Off	On
236	On	Off	On	Off	On	Off
249	On	Off	On	Off	On	On
277	On	Off	On	On	Off	Off

TABLE 2. CONTINUED

LOW VOLTS THRESHOLD	SWITCH A3	SWITCH A4	SWITCH A5	SWITCH A6	SWITCH A7	SWITCH A8
294	On	Off	On	On	Off	On
304	On	Off	On	On	On	Off
312	On	Off	On	On	On	On
321	On	On	Off	Off	Off	Off
332	On	On	Off	Off	Off	On
341	On	On	Off	Off	On	Off
353	On	On	Off	Off	On	On
360	On	On	Off	On	Off	Off
374	On	On	Off	On	Off	On
384	On	On	Off	On	On	Off
396	On	On	Off	On	On	On
408	On	On	On	Off	Off	Off
432	On	On	On	Off	Off	On
480	On	On	On	Off	On	Off
510	On	On	On	Off	On	On
540	On	On	On	On	Off	Off

TABLE 3. KWH PER PULSE

KWH PER PULSE	SWITCH B1	SWITCH B2
0.01	Off	Off
0.1	Off	On
1	On	Off
10	On	On

TABLE 4. mA OUTPUT SIGNAL SELECTIONS

SIGNAL SELECTED for mA OUTPUT	mA OUTPUT #2			mA OUTPUT #1		
	Switch B3	Switch B4	Switch B5	Switch B6	Switch B7	Switch B8
Total KW	Off	Off	Off	Off	Off	Off
15 minute Sliding Window KW	Off	Off	On	Off	Off	On
Peak Sliding Window KW	Off	On	Off	Off	On	Off
Total KVA	Off	On	On	Off	On	On
Total Power Factor	On	Off	Off	On	Off	Off
RMS Current	On	Off	On	On	Off	On
RMS Voltage	On	On	Off	On	On	Off

TABLE 5. CT RATIO SELECTIONS (5 Amp or 1 Amp or 0.333 Volt CTs)

CT PRIMARY	SWITCH C1	SWITCH C2	SWITCH C3	SWITCH C4	SWITCH C5
5	Off	Off	Off	Off	Off
50	Off	Off	Off	Off	On
75	Off	Off	Off	On	Off
100	Off	Off	Off	On	On
150	Off	Off	On	Off	Off
200	Off	Off	On	Off	On
250	Off	Off	On	On	Off
300	Off	Off	On	On	On
400	Off	On	Off	Off	Off
500	Off	On	Off	Off	On
600	Off	On	Off	On	Off
750	Off	On	Off	On	On
800	Off	On	On	Off	Off
1000	Off	On	On	Off	On
1200	Off	On	On	On	Off
1500	Off	On	On	On	On
1600	On	Off	Off	Off	Off
2000	On	Off	Off	Off	On
2500	On	Off	Off	On	Off
3000	On	Off	Off	On	On
3500	On	Off	On	Off	Off
4000	On	Off	On	Off	On
5000	On	Off	On	On	Off
6000	On	Off	On	On	On

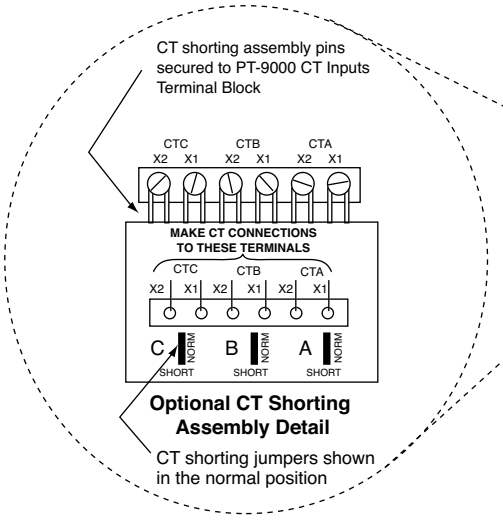
CAUTION:

CAUTION:

CAUTION:

FIGURE 1. WIRING - THREE-PHASE POWERTRAK APPLICATION

CAUTION: Lethal voltages may be present across the secondary terminals of all current transformers. Keep these terminals shorted or connected to the transducer.

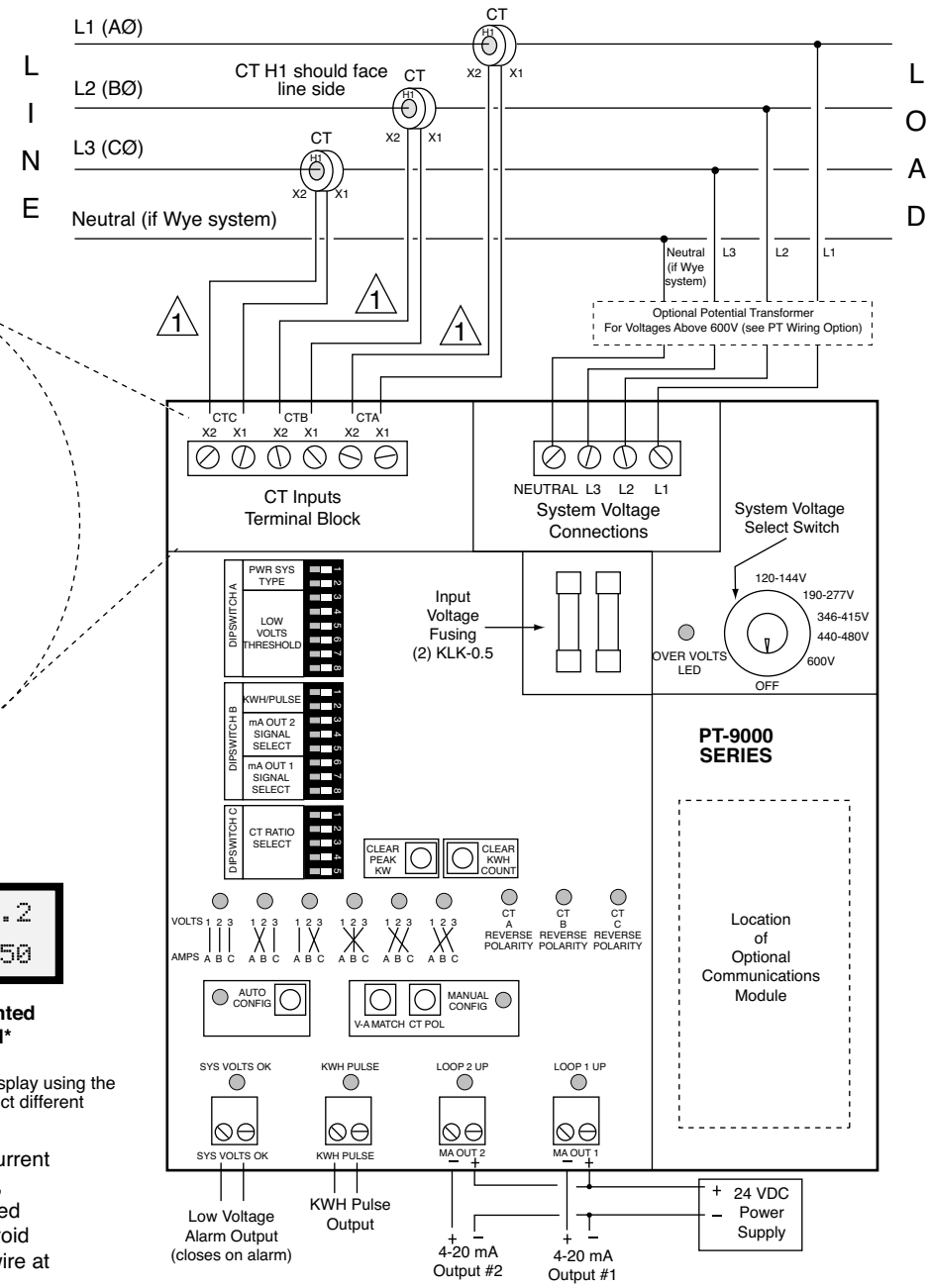


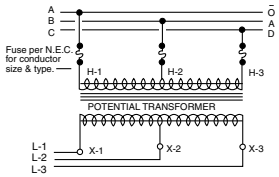
Optional CT Shorting Assembly Detail

Optional Cover-Mounted LCD Display Detail*

*Manually scroll individual lines of display using the cover-mounted push buttons, to select different power system parameters.

1 When using the **SCT Series** current transformers with the **PT-9300**, recommended wiring is a twisted shielded pair for each CT to avoid noise pick-up. Ground shield wire at **PT-9300** ground lug only.





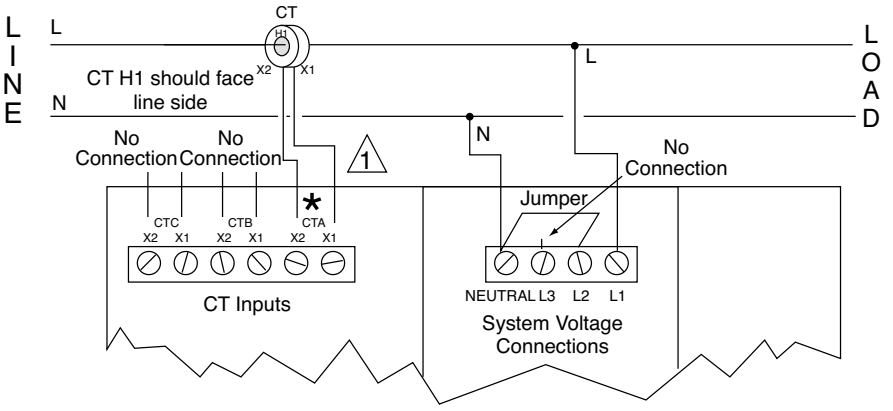
PT Wiring Option
(for systems greater than 600V)

Connection option using one open Delta 3PT3 three-phase potential transformer with 120 VAC secondary.

FIGURE 2. WIRING - SINGLE-PHASE POWERTRAK APPLICATIONS

1 When using the **SCT Series** current transformers with the **PT-9300**, recommended wiring is a twisted shielded pair for each CT to avoid noise pick-up. Ground shield wire at **PT-9300** ground lug only.

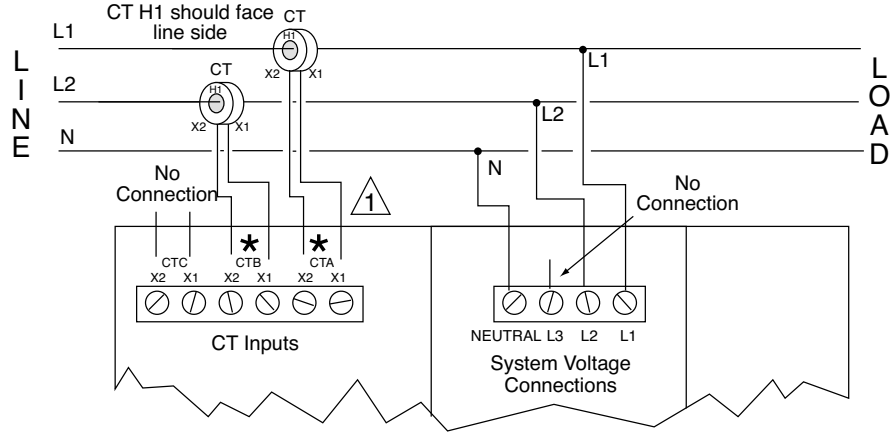
* Make CT connections to terminal strip on optional CT shorting assembly if present. See Wiring - Three-Phase PowerTrak Application.



Single-Phase Two-Wire Systems

1 When using the **SCT Series** current transformers with the **PT-9300**, recommended wiring is a twisted shielded pair for each CT to avoid noise pick-up. Ground shield wire at **PT-9300** ground lug only.

* Make CT connections to terminal strip on optional CT shorting assembly if present. See Wiring - Three-Phase PowerTrak Application.



Single-Phase Three-Wire Systems

EQUATIONS - ANALOG OUTPUTS

Analog (4-20 mA) Outputs

The **PowerTrak** provides two separate 4-20 mA analog signal outputs. Each output can individually be set by DIP switches to represent a different power parameter. Select from Total KW, Window KW, Peak Window KW, Total KVA, Total Power Factor, True RMS Voltage, and True RMS Current. See Table 4 for DIP switch settings. The "LOOP 1 UP" and "LOOP 2 UP" LED's will be "ON" when a valid current loop is connected in series with these outputs. If these LED's are "OFF" there is an open circuit in the current loop. Both 4-20mA output loops require an external 24 VDC power supply.

Total KW

The Total KW parameter is the total instantaneous KW demand for a three-phase or single phase electrical system.

Window KW

The Window KW parameter is a fifteen minute sliding window average of KW demand. The sliding window KW value is updated on thirty second intervals with the KW data from the oldest interval constantly being replaced by the KW data from the most recent interval.

Peak Window KW

The Peak Window KW parameter represents the highest (peak) sliding window KW value measured by the **PowerTrak**. The peak window KW value is updated on thirty second intervals and will change in value only if the current sliding window KW value is greater than the current peak window KW value.

EQUATIONS ANALOG - continued

KW Equations (Total, Window, or Peak Window)

Three-phase equation:

$$KW = \frac{E \times I \times 1.73 \times (mA\ out - 4)}{1000 \times 16}$$

Single-phase equation:

$$KW = \frac{E \times I \times (mA\ out - 4)}{1000 \times 16}$$

Where,
KW = Total, Window, or Peak Window KW value

E = 144 (SYSTEM VOLTAGE SELECT switch set to 120-144V)
= 277 (SYSTEM VOLTAGE SELECT switch set to 190-277V)
= 415 (SYSTEM VOLTAGE SELECT switch set to 346-415V)
= 480 (SYSTEM VOLTAGE SELECT switch set to 440-480V)
= 600 (SYSTEM VOLTAGE SELECT switch set to 600V)
= Primary value of potential transformer multiplied by 1.2 (for systems greater than 600 volts)

I = Primary value of the CT ratio selected with DIP switches C1-C5. (***Example:*** I = 500 for 500:5 ratio)

mA out = PowerTrak milliamp output value

Total KVA
The Total KVA parameter is the total instantaneous KVA demand for a three-phase or single phase electrical system.

Three-phase equation:

$$KVA = \frac{E \times I \times 1.73 \times (mA\ out - 4)}{1000 \times 16}$$

Single-phase equation:

$$KVA = \frac{E \times I \times (mA\ out - 4)}{1000 \times 16}$$

Where,
KVA = Total KVA value

E = 144 (SYSTEM VOLTAGE SELECT switch set to 120-144V)
= 277 (SYSTEM VOLTAGE SELECT switch set to 190-277V)
= 415 (SYSTEM VOLTAGE SELECT switch set to 346-415V)
= 480 (SYSTEM VOLTAGE SELECT switch set to 440-480V)
= 600 (SYSTEM VOLTAGE SELECT switch set to 600V)
= Primary value of potential transformer multiplied by 1.2 (for systems greater than 600 volts)

I = Primary value of the CT ratio selected with DIP switch C1-C5. (***Example:*** I = 500 for 500:5 ratio)

mA out = PowerTrak milliamp output value

Total Power Factor
The Total Power Factor parameter is a measure of the power factor (0 to 1) for a three-phase electrical system.

$$PF = \frac{1 \times (mA\ out - 4)}{16}$$

Where,
PF = Total Power Factor
mA out = PowerTrak milliamp output value

EQUATIONS ANALOG - continued

True RMS Voltage

The True RMS Voltage parameter is an average of the three true RMS phase to phase voltages for Delta systems. For Wye systems this parameter is an average of the three true RMS line to neutral voltages.

$$\text{Volts} = \frac{\text{Emax X (mA out -4)}}{16}$$

Where,
Volts = True RMS Voltage output

Emax = 170 (SYSTEM VOLTAGE SELECT switch set to 120-144V)
= 320 (SYSTEM VOLTAGE SELECT switch set to 190-277V)
= 470 (SYSTEM VOLTAGE SELECT switch set to 346-415V)
= 550 (SYSTEM VOLTAGE SELECT switch set to 440-480V)
= 700 (SYSTEM VOLTAGE SELECT switch set to 600V)
= Primary value of potential transformer multiplied by 1.42 (for systems greater than 600 volts)

mA out = PowerTrak milliamp output value for True RMS Voltage

True RMS Current

The True RMS Current parameter is an average of the three true RMS values of the three-phase currents.

$$\text{Current} = \frac{\text{CT Primary X (mA out - 4)}}{16}$$

Where,
Current = True RMS Current

CT Primary = Primary value of the CT ratio selected with DIP switch C1-C5.
(***Example:*** CT ratio = 500 for 500:5 ratio)

mA out = PowerTrak milliamp output value for True RMS Current

EQUATIONS DIGITAL OUTPUT

KWH Pulse Output

The PowerTrak provides a contact closure pulse output representing energy consumption (KWH). By setting the appropriate DIP switches (B1-B2, See Table 3) each pulse will represent either 10, 1, 0.1 or 0.01 KWH per pulse. The “10” KWH per pulse setting produces the slowest pulse rate and the “0.01” KWH per pulse setting produces the fastest pulse rate. Select a KWH per pulse setting that produces a pulse rate that can be read by the building automation controller (or other data acquisition equipment) and will not exceed five pulses per second at the maximum expected KW value. See KWH equations. The “KWH PULSE” LED is “ON” when the KWH pulse contact is closed and “OFF” when the contact is open.

KWH equations:

Three phase and single phase equation:

KWH = N x KWH per pulse x PT Ratio (If used)

Where,
N = total number of pulses accumulated at the controller input

KWH per pulse = KWH per pulse setting at DIP switches B1-B2 (see Table 3).

PT Ratio=PT Primary/PT Secondary. Example: 4800V to 120V PT Ratio=4800/120=40

EQUATIONS DIGITAL - continued

Three-phase equation:

$$\text{PULSE/SECOND} = \frac{E \times I \times 1.73}{1000 \times 3600} \times \frac{1}{\text{KWH/pulse} \times \text{PT Ratio (If used)}}$$

Single-phase equation:

$$\text{PULSE/SECOND} = \frac{E \times I}{1000 \times 3600} \times \frac{1}{\text{KWH/pulse} \times \text{PT Ratio (If used)}}$$

Where,

PULSE/SECOND = Number of pulses per second the **PowerTrak** will produce at a given KWH/pulse setting and KW demand maximum value. If greater than five pulses per second select a larger value KWH per pulse setting with DIP switches B1-B2 (See Table 3).

E = 144 (SYSTEM VOLTAGE SELECT switch set to 120-144V)
= 277 (SYSTEM VOLTAGE SELECT switch set to 190-277V)
= 415 (SYSTEM VOLTAGE SELECT switch set to 346-415V)
= 480 (SYSTEM VOLTAGE SELECT switch set to 440-480V)
= 600 (SYSTEM VOLTAGE SELECT switch set to 600V)
= Primary value of potential transformer multiplied by 1.2 (for systems greater than 600 volts)

I = Primary value of the CT ratio selected with DIP switch C1-C5. (ex. I = 500 for 500:5 ratio)

KWH/pulse = KWH per pulse setting from DIP switches B1-B2 (See Table 3).

PT Ratio=PT Primary/PT Secondary. (***Example:*** 4800V to 120V PT Ratio=4800/120=40)

Low Voltage Alarm Contact (SYS VOLTS OK)

The Low Voltage Alarm Contact is a normally open contact that closes when any phase voltage drops below the low voltage alarm setting determined by DIP switches A3-A8 (see Table 2). Voltage is measured line-to-line on delta systems and line to neutral on wye systems and single-phase. There is an approximate 2-4 second time delay to prevent nuisance trips of the alarm contact. The “SYS VOLTS OK” LED is “ON” when all phase voltages are above the low voltage alarm setting. The LED is “OFF” when any phase voltage drops below the low voltage alarm setting.

Contact Open = All phase voltages above low-voltage alarm setting.
Contact Closed = Any phase voltages below the low-voltage alarm setting (or no power to the PT-9000).

AREA FOR CALCULATION / NOTES

POWERTRAK INSTALLATION CHECKLIST

____1. Mount the **PowerTrak** using the proper hardware for the type of wall construction involved. Pull the conduit and wiring to any of the eight 1/2" knockouts.

____2. With the electrical system de-energized, make all CT and voltage connections per instructions.

____3. Make wiring connections to the output signal terminals for the KWH pulse, low-voltage alarm contact, and both 4-20 mA signals (if used).

____4. If the shorting assembly option is installed on the **PowerTrak,** place the shorting jumpers in the NORM position.

____5. Set the SYSTEM VOLTAGE SELECT switch to the line-to-line voltage of the electrical system to be monitored.

____6. Set the Power System Type, DIP switches A1-A2.

____7. Set the Low Voltage Alarm Threshold, DIP switches A3-A8.

____8. Set the KWH/Pulse rate (if used), DIP switches B1-B2

____9. Set the mA output #2 for the desired parameter (if used), DIP switches B3-B5.

___10. Set the mA output #1 for the desired parameter (if used), DIP switches B6-B8.

___11. Set the CT ratio for the current transformer primary rating used. DIP switches C1-C5.

___12. With the electrical system energized and under load, press the AUTO-CONFIG button to auto-configure the **PowerTrak.** After scanning the electrical connections the auto-config LED's will display the actual electrical connections to the PowerTrak, electronically ”correct“ wiring errors, and provide accurate output signals. If the MANUAL CONFIG LED lights, follow instructions in this data sheet.

___13. If equipped with the display option, verify that all parameters display a value.

___14. Verify that all output signals used are working properly.

If you have any questions, call Kele at 901-937-4900, FAX 901-372-2531, or e-mail info@kele.com.

ORDERING INFORMATION

MODEL	DESCRIPTION	
PT-9500	PowerTrak power monitoring interface, 5A CT input	
PT-9300	PowerTrak power monitoring interface, 0.333V CT input	
	OPTIONS	
	D	LCD display, cover-mounted for local monitoring
	S	CT shorting assembly (not necessary for PT-9300)
	3R	PowerTrak mounted in a NEMA 3R enclosure

PT-9500 – **D** – **S**

Example: **PT-9500-D-S** PowerTrak with LCD display and CT shorting assembly

Related Products

PT-NTL-10	**LonWorks communications module**
PT-NT4-N2	**Metasys® communications module**
PT-NT4-BAC	**BACnet communications module**
AL12AR	**Cylinder lock Kit**
U3889-E	**Shorting/Disconnect assembly**