

INSTALLATION INSTRUCTIONS

Original Issue Date: **5/05**

Model: **Transfer Switches Equipped with Series 1000 Controls**

Market: **ATS**

Subject: **Digital Power Meters**

Introduction

The digital three-phase power meter displays voltage, current, frequency, and power on both sources. See Figure 1. The meter also provides programmable visual alarms for high and low voltage and high current conditions. Programming menus are password-protected.

The meter kit includes a 3-position selector switch. Use the switch to select the source to be monitored by the meter, Normal or Emergency.

The meters are available factory-installed on transfer switches equipped with Series 1000 transfer switch controllers. See Figure 2.

These instructions explain normal operation, setting alarms, and other meter programming procedures. The wiring diagram is included for troubleshooting purposes. Meter kits are factory-installed and should not require field-connection. Follow the safety precautions if opening the transfer switch enclosure.

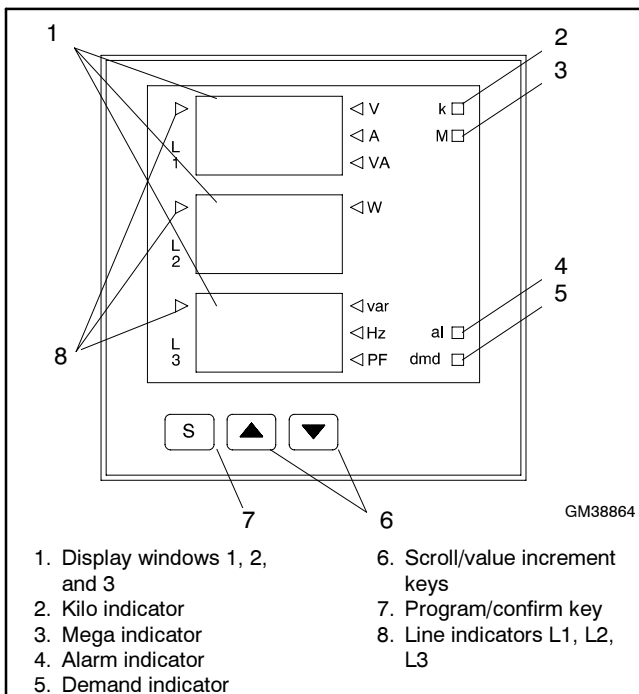


Figure 1 Power Meter Front Panel

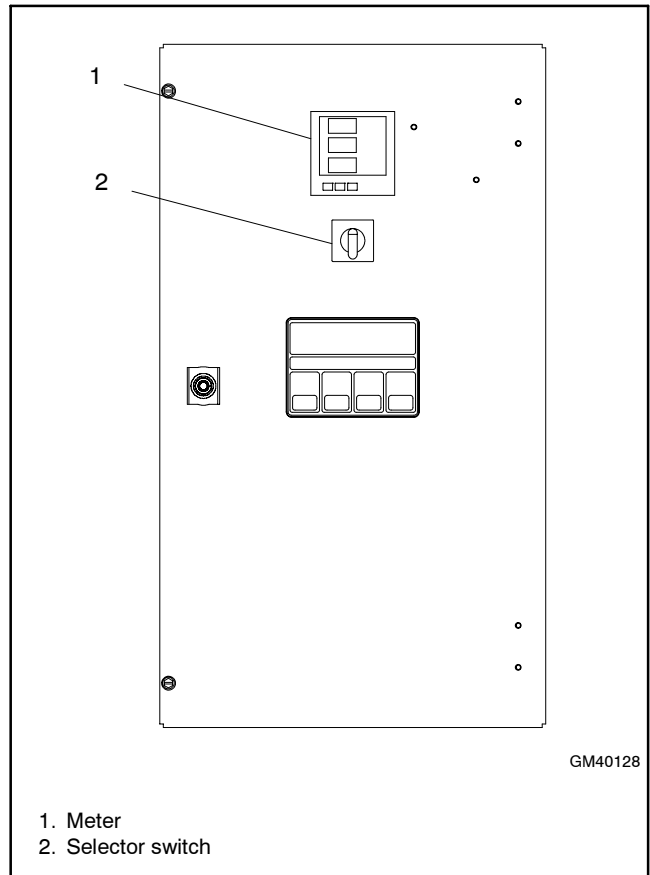
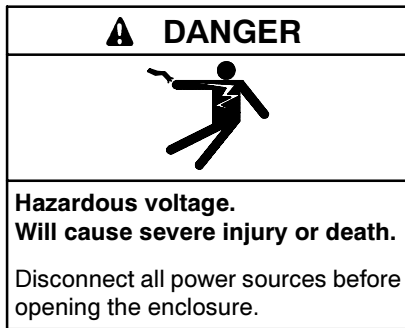




Figure 2 Installed Meter and Selector Switch

Safety Precautions



Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Operation

Use the selector switch to choose the source to be monitored by the meter, Normal or Emergency. See Figure 3. Then press the up arrow key  to step through the display screens in the order shown in Figure 4. Press the down arrow key  to return to the previously displayed screen.

When the phase-to-phase voltage is displayed or W-var are generated, the decimal point on the right of the display blinks.

The Formulas Used section after Figure 4 shows the equations used for calculated values.

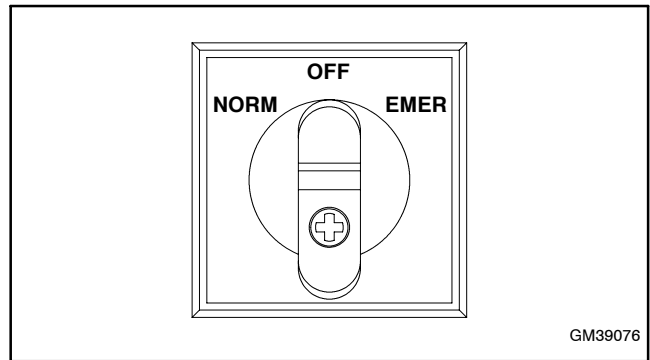


Figure 3 Three-Position Selector Switch

Screen	Window			Note
	1	2	3	
1	V L1	V L2	V L3	Voltage, line-neutral
2	V L12	V L13	V L31	Voltage, line-line. Decimal point blinking on the right of the display.
3	A L1	A L2	A L3	Amps (current)
4	An	AL.n		AL.n if neutral current alarm is active
5	W L1	W L2	W L3	Decimal point blinking on the right of the display if generated power
6	PF L1	PF L2	PF L3	Power factor (L=inductive, C=capacitive)
7	VAR L1	VAR L2	VAR L3	Decimal point blinking on the right of the display if generated power
8	VA L1	VA L2	VA L3	Volt-Amps
9	VA system	W system	VAR system	
10	VA dmd (system)	W dmd (system)	Hz (system)	dmd = demand (integration time selectable from 1 to 30 minutes)
11		W dmd MAX		Maximum sys power demand
12	V LN dmd	AL.U	PF system	AL.U= is activated only if one of VLN is not within the set limits
13	A MAX			max. current among the three phases

Figure 4 Displays for 3-Phase Systems (in a 3-phase system with neutral)

Formulas Used

Phase Variables

Instantaneous effective voltage:

$$V_{IN} = \sqrt{\frac{1}{n} \cdot \sum_1^n (V_{IN})_I^2}$$

Instantaneous active power:

$$W_1 = \frac{1}{n} \cdot \sum_1^n (V_{IN})_I \cdot (A_1)_I$$

Instantaneous power factor:

$$\cos \phi_1 = \frac{W_1}{(VA_1)}$$

Instantaneous effective current:

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_1^n (A_1)_I^2}$$

Instantaneous apparent power:

$$VA_1 = V_{IN} \cdot A_1$$

Instantaneous reactive power:

$$VAr_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

System Variables

Equivalent 3-phase voltage:

$$V_{\Sigma} = \frac{V_1 + V_2 + V_3}{3} * \sqrt{3}$$

3-phase reactive power:

$$VAr_{\Sigma} = VAr_1 + VAr_2 + VAr_3$$

3-phase active power:

$$W_{\Sigma} = W_1 + W_2 + W_3$$

3-phase apparent power:

$$VA_{\Sigma} = \sqrt{W_{\Sigma}^2 + VAr_{\Sigma}^2}$$

3-phase power factor:

$$\cos \phi_{\Sigma} = \frac{W_{\Sigma}}{VA_{\Sigma}}$$

Measured Waveforms

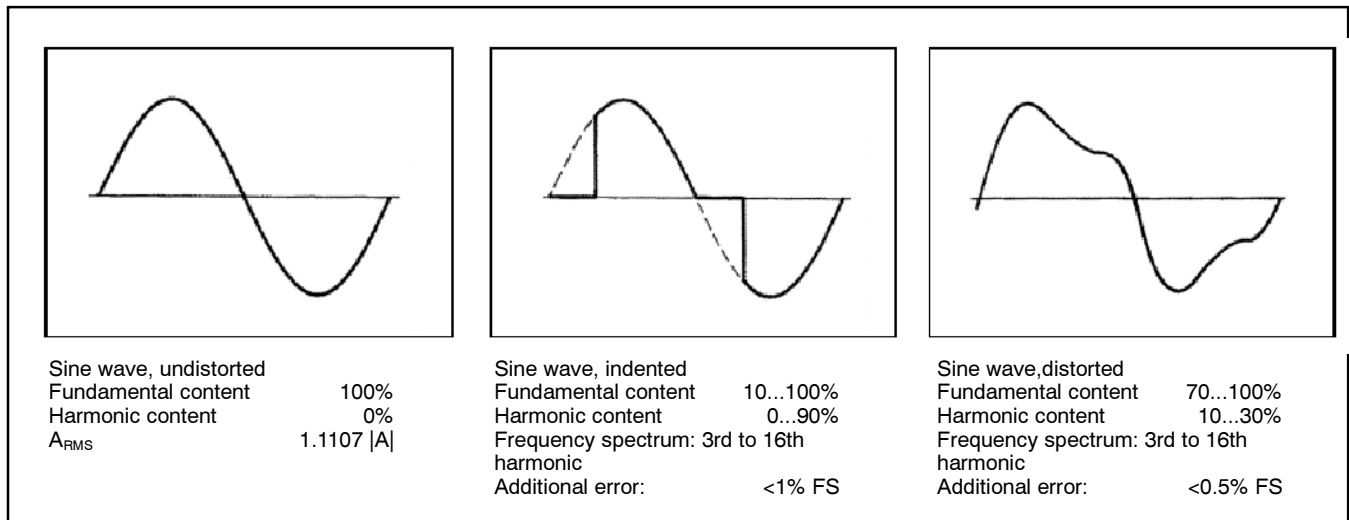


Figure 5 Waveforms of Signals That Can Be Measured

Setting Alarms and Programming

The meters are factory-set for the voltage and current of the transfer switch and should not require field-adjustment.

Alarms are not factory-set. Refer to Figure 6 and the following instructions to set the visual alarms, change the password, and program other parameters if required.

Note: The programming mode times out if no keys are pressed for approximately 30 seconds.

KEY PAD functions

S Access to the programming phase and value confirmation.

▲ In measuring mode: scroll to the next displayed system variable. In programming mode: scroll to the next function or parameter value increase.

▼ In measuring mode: scroll to the previously displayed system variable. In programming mode: scroll to the previous function or parameter value decrease.

Reset and access to the main menu

A.rE: Reset the alarms.

P.rE: Reset the displayed MAX current value and Wdmd.

PAS: Enter the correct password to access the main menu. The default password is 0.

The password can be changed using the n_P function, if desired.

Main menu functions

n_P: New password, change password function.

SYS: Electrical system selection, choose the correct electrical system:

- **3P.n:** 3-phase with neutral
- **3P.A:** 3-phase ARON
- **3P:** 3-phase without neutral
- **2P:** 2-phase
- **1P:** 1-phase

Ct.r: Current transformer ratio: select the needed value from 0 to 999. **Example:** if the primary of the CT being connected is 300A and the secondary is 5A, the CT ratio corresponds to 60 (obtained from the calculation: $300/5$).

Note: The current inputs can be connected to the lines ONLY through current transformers. Direct connection is not allowed.

Note: When the CTs are connected to earth, a leakage current from 0 to 1.8mA max is generated to earth, whose value depends on the input impedance value, the type of connection and the line voltage measured from the instrument.

Ut.r: Voltage transformer ratio: select the needed value from 1.0 to 99.9. **Example:** if the primary of the VT being connected is 5kV and the secondary is 100V, the VT ratio will be 50 (given by $5000/100$).

P.i.t.: Power integration time: select the needed value from 1 to 30 minutes.

Fis: Filtering range programming to set the operating range of the digital filter. The value is expressed as % of the full scale value.

Fic: Filtering coefficient programming to set the filtering coefficient of the instantaneous measurements. Increasing the value also increases the stability and the settling time of the measurements.

AL.⎯: Up alarm (V LN), it's the maximum value of the variable over which the alarm is activated.

AL.⎯: Down alarm (V LN), it's the minimum value of the variable below which the alarm is activated.

Note: Note: if the "AL up" and "AL down" values are the same the V LN alarm will be disabled. The alarm status is displayed by a blinking LED.

AL.n: Neutral current alarm, the value of the variable over which the alarm is activated. If the AL.n value is 0, the neutral current alarm control will be disabled. The alarm status is displayed by a blinking LED.

Adr: Instrument serial port adress: from 1 to 255. If the serial port communication is not present the Adr menu won't be displayed.

Note: Serial port communication is not provided on standard product.

End: To confirm the new selected values press the **S** key, or press **▲** or **▼** to return to the main menu functions.

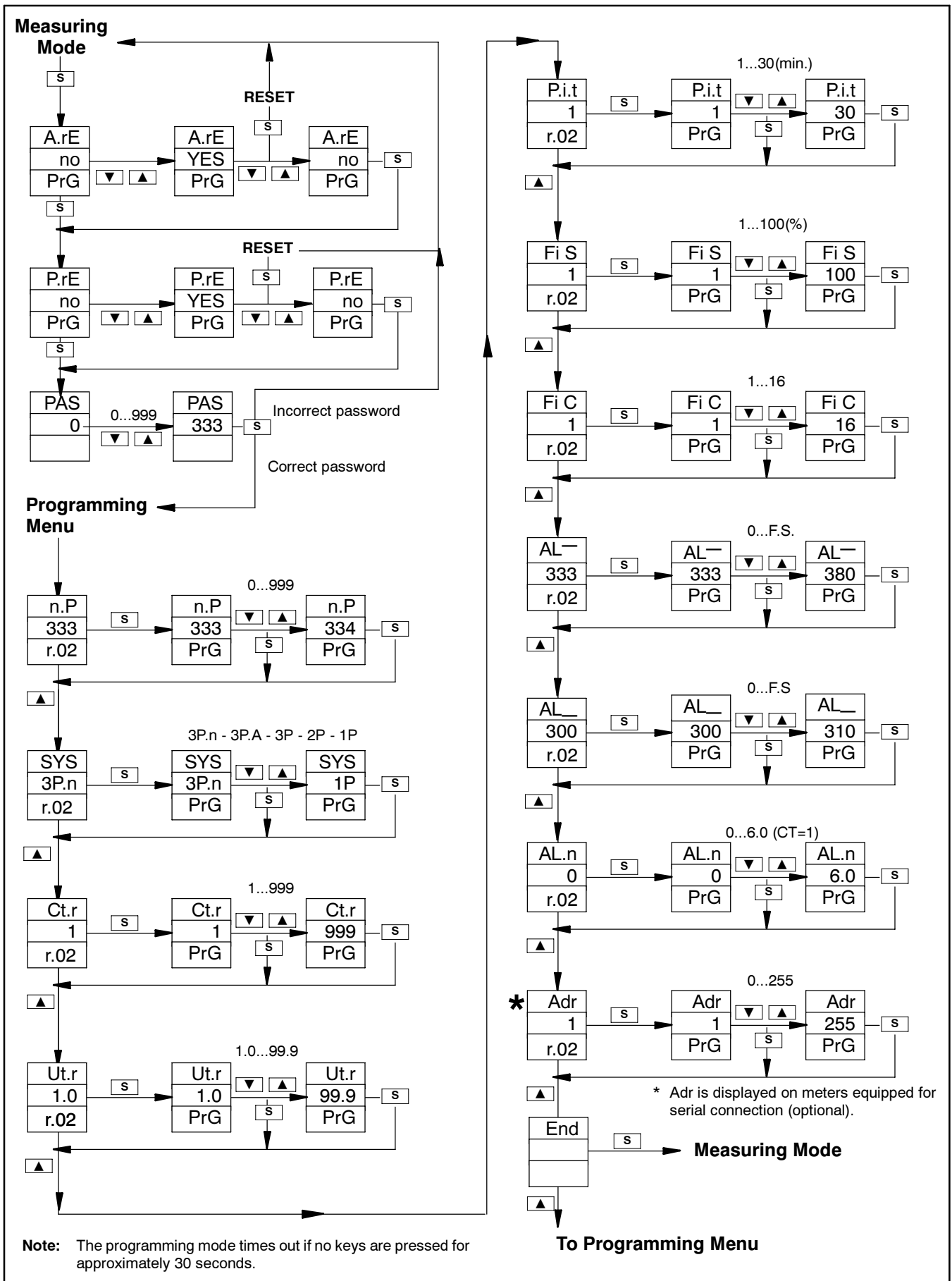


Figure 6 Programming

Software Functions

Alarms: Programmable, for the VLN and An (neutral current).

Note: Note: the alarm is only visual, by means of LED on the front of the instrument.

Reset: independent alarm (VLN, An). max: A, Wdmd

Password: Numeric code of max. 3 digits; 2 protection levels of the programming data

1st level Password "0", no protection

2nd level Password from 1 to 999, all data are protected

System selection:

- 3-phase with neutral
- 3-phase without neutral
- 3-phase ARON (not used)
- 2-phase
- Single phase

Transformer ratios:

- CT: 1 to 999
- VT: 1.0 to 99.9

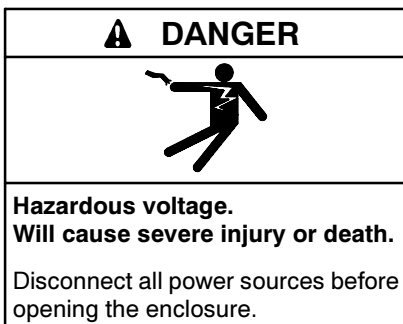
Filter:

- Operating range: 0 to 99.9% of the input electrical scale
- Filtering coefficient: 1 to 16
- Filter action: Measurements, alarms, serial output (fundamental variables: V, A, W and their derived ones).

Serial Connection (optional)

Meters with RS-485 communication connections are only available through special order. Contact the factory.

Follow the Safety Precautions when opening the transfer switch enclosure. See Figure 7 for serial connections on meters equipped with communications.



Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Output Specifications:

Serial port: RS485 (optional) 2 or 4 wiring

Communication protocol: MODBUS/ JBUS

Baud rate: 9600 baud

Parity: none

Line termination: by means of external jumper

Line bias: not available

Address: 1 to 255

Variable to be transmitted: all the displayed

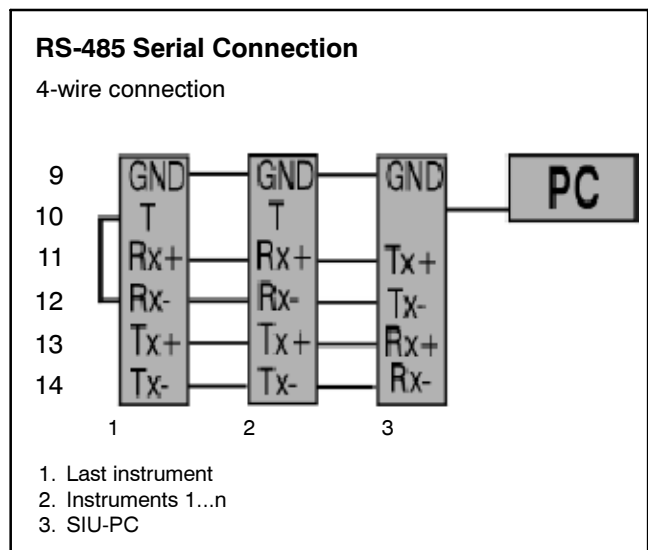


Figure 7 RS-485 Connection (available on special-order meters only)

Wiring Diagram

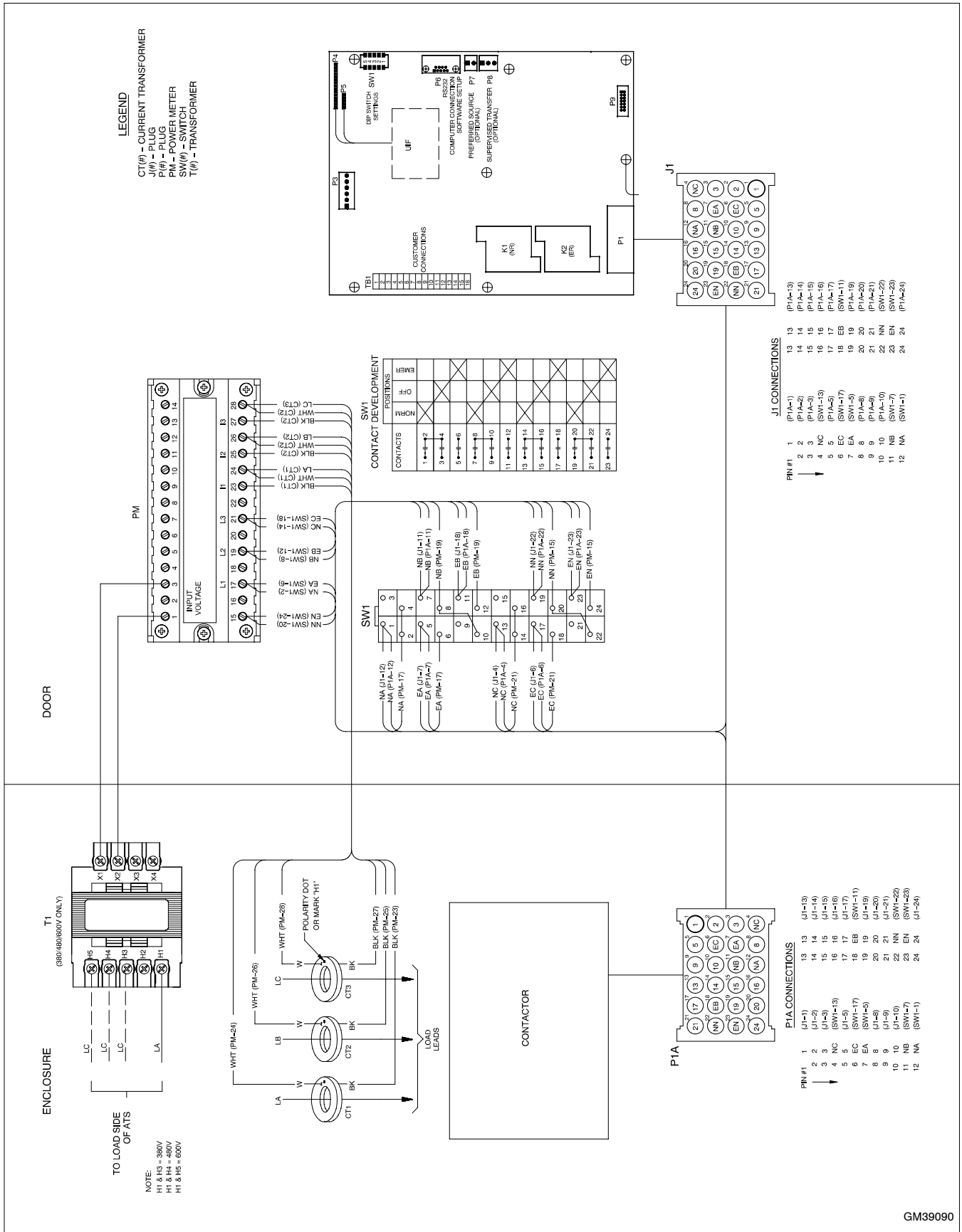


Figure 8 Wiring Diagram GM39090

Technical Specifications

Hardware: microprocessor based.

Keypad: 3 keys.

Type of electrical system: Selectable: 1-phase, 2-phase, 3-phase with neutral; 3-phase without neutral, 3-phase ARON.

Display: LED 3x3 DGT; digit height 14mm (96x96mm) or 9mm (DIN).

Sampling time: 700ms Rated input current: 5A

Max input current: 6A (on ext. C.T.)

Overload: 36A (6*I_{max}) for 500ms; Voltage: permanent
1.2 * max range function value

Rated input voltage: AV5: 660V L-L 5(6)A;
AV6: 208V L-L 5(6)A

Wave-form: sinusoidal or distorted wave.

Measurement method: TRMS type

Accuracy:

W-VA: ±(1% FS + 1DGT) from 0.25A to 6A,
±(1% FS + 7 DGT) from 0.03 to 0.24A;
var: ±(2% FS +1DGT) from 0.25 to 6A,
±(2% FS +5 DGT) from 0.03 to 0.24A

V LL: ±(1.5% FS+1 DGT);

VL-N: (0.5%FS +1 DGT);

A: ±(0.5% FS +1 DGT) from 0.25 to 6A,
±(0.5% FS +7 DGT) from 0.03 to 0.25A;

An: ±(1.5% FS +1 DGT) from 0.25 to 6A,
±(1.5% FS +7 DGT) from 0.03 to 0.25A

Voltage/An control: Alarm: two set points

Peak factor: <3 (10A peak max)

Temperature drift: ≤200ppm/°C

Current transformer: prog. ratio from1 to 999

Voltage transformer: prog. ratio from1.0 to 99.9

Input impedance:

400/660VL-L: 1MΩ (phase-neutral input)

100/208VL-L: 453kΩ (phase-neutral input)

Power demand: Prog. integration time: 1 to 30 min.

Digital filter:

Filtering range: from 0 to 100;

Filtering coefficient: from 1 to 16

EMC:

Emissions: EN50084-1 (class A, residential environment, commerce and light industry)

Immunity: EN61000-6-2 (class A, industrial environment)

Power supply: CT-VT: 230V, 115V, 24V, 48VAC -15/+10%
50-60Hz; 24 to 48VDC ±20%

Operating temperature: from 0 to +50°C

Storage temperature: from -10 to +60°C

Relative humidity : 0-90% @40°C (non condensing)

Installation category (IEC 664): Cat. III

Insulation: AC power supply, 4kV for 60s between measuring input and power supply and between power supply and RS485, 500V for 60s between measuring input and RS485. DC power supply, 500V between meas. input and power supply and between power supply and RS485.

Dielectric strength: 4kV for 60s.

Standards: safety IEC-664.

Approvals: CE

Connections: screw type; Max. cable cross sect.: 2.5mm²

Protection degree: Front: IP50; Terminal blocks: IP20.

Mounting: DIN-rail mounting. Flush mounting.

Housing material: ABS, self-extinguishing: UL94 V-0

Dimensions: see Figure 9.

Weight: about 400g (packing included).

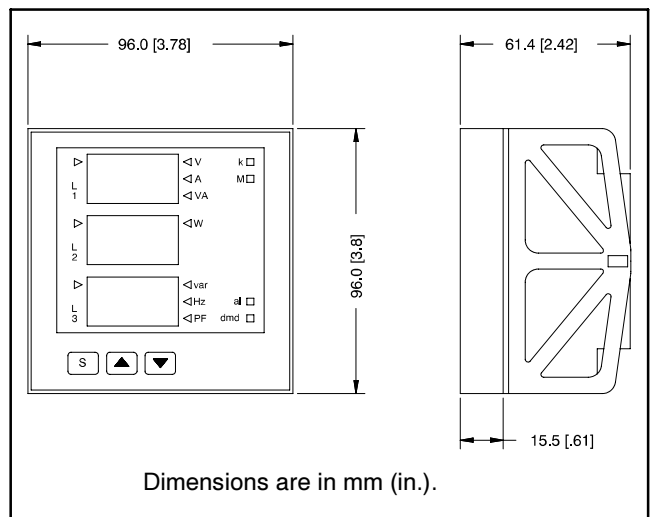


Figure 9 Dimensions

Parts Lists

208-240 Volt Meter Kit Unique Parts

Kit Number	Kit Description	Current Transformers		Door
		Qty.	Part Number	
GM39070-KA3	Meter, Digital 30-200A, 208-240V, 1Ph	2	246886	GM39086
GM39070-KA4	Meter, Digital 30-200A, 208-240V, 3Ph	3	246886	GM39086
GM39071-KA3	Meter, Digital 230-400A, 208-240V, 1Ph	2	248874	GM39080
GM39071-KA4	Meter, Digital 230-400A, 208-240V, 3Ph	3	248874	GM39080
GM39072-KA3	Meter, Dig. 600-1000A, 208-240V, 1Ph	2	291546	GM39081
GM39072-KA4	Meter, Dig. 600-1000A, 208-240V, 3Ph	3	291546	GM39081
GM40069-KA2	Meter, Digital 1200A, 208-240V, 3Ph,	3	291547	GM39082
GM39073-KA2	Meter, Dig.1600-2000A, 208-240V, 3Ph	3	291548	GM39082
GM39074-KA2	Meter, Dig.2600-3000A, 208-240V, 3Ph	3	297675	GM39082
GM39075-KA2	Meter, Digital 4000A, 208-240V, 3Ph	3	297676	GM39084
GM39077-KA3	Meter, Digital 150A, 208-240V, 1Ph	2	246886	GM39085
GM39077-KA4	Meter, Digital 150A, 208-240V, 3Ph	3	246886	GM39085
GM39078-KA3	Meter, Dig.225-400A, 208-240V, 1Ph	2	248874	GM39085
GM39078-KA4	Meter, Dig.225-400A, 208-240V, 3Ph	3	248874	GM39085
GM39088-KA3	Meter, Digital 150A, 208-240V, 1Ph	2	246886	GM39081
GM39088-KA4	Meter, Digital 150A, 208-240V, 3Ph	3	246886	GM39081
GM39089-KA3	Meter, Dig. 225-400A, 208-240V, 1Ph	2	248874	GM39081
GM39089-KA4	Meter, Dig. 225-400A, 208-240V, 3Ph	3	248874	GM39081

208-240 Volt Meter Kit Common Parts

Kit: See above		
Qty.	Description	Part Number
1	Meter, Power Three Phase	GM38864
1	Harness, Wiring	GM39069
1	Switch, 3 Position Selector	GM39076

380-600 Volt Meter Kit Unique Parts

Kit Number	Kit Description	Current Transformers		Door
		Qty.	Part Number	
GM39070-KA1	Meter, Digital 30-200A, 380-600V, 1Ph	2	246886	GM39086
GM39070-KA2	Meter, Digital 30-200A, 380-600V, 3Ph	3	246886	GM39086
GM39071-KA1	Meter, Digital 230-400A, 380-600V, 1Ph	2	248874	GM39080
GM39071-KA2	Meter, Digital 230-400A, 380-600V, 3Ph	3	248874	GM39080
GM39072-KA1	Meter, Dig. 600-1000A, 380-600V, 1Ph	2	291546	GM39081
GM39072-KA2	Meter, Dig. 600-1000A, 380-600V, 3Ph	3	291546	GM39081
GM40069-KA1	Meter, Digital 1200A, 380-600V, 3Ph	3	291547	GM39082
GM39073-KA1	Meter, Dig.1600-2000A, 380-600V, 3Ph	3	291548	GM39082
GM39074-KA1	Meter, Dig.2600-3000A, 380-600V, 3Ph	3	297675	GM39082
GM39075-KA1	Meter, Digital 4000A, 380-600V, 3Ph	3	297676	GM39084
GM39077-KA1	Meter, Digital 150A, 380-600V, 1Ph	2	246886	GM39085
GM39077-KA2	Meter, Digital 150A, 380-600V, 3Ph	3	246886	GM39085
GM39078-KA1	Meter, Dig.225-400A, 380-600V, 1Ph	2	248874	GM39085
GM39078-KA2	Meter, Dig.225-400A, 380-600V, 3Ph	3	248874	GM39085
GM39088-KA1	Meter, Digital 150A, 380-600V, 1Ph	2	246886	GM39081
GM39088-KA2	Meter, Digital 150A, 380-600V, 3Ph	3	246886	GM39081
GM39089-KA1	Meter, Dig. 225-400A, 380-600V, 1Ph	2	248874	GM39081
GM39089-KA2	Meter, Dig. 225-400A, 380-600V, 3Ph	3	248874	GM39081

380-600 Volt Meter Kit Common Parts

Kit: See above		
Qty.	Description	Part Number
2	Guard, Terminal	GM26856
1	Harness, Wiring	GM39069
1	Switch, 3 Position Selector	GM39076
1	Meter, Digital	GM40070
1	Transformer	GM40071

Notes

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