

Continuous metering of feeders, transformers, capacitor banks, generators and motors.



DESCRIPTION

The PQM is an ideal choice when continuous monitoring of a three phase system is required. It provides metering for current, voltage, real and reactive power, energy use, cost of power, power factor and frequency. Programmable setpoints and 4 assignable output relays allow control functions to be added for specific applications. This includes basic alarm on over/under current or voltage, unbalance, demand based load shedding, and capacitor power factor correction control. More complex control is possible using the 4 switch inputs which also can be used for status such as breaker open/closed, flow information etc.

The PQM may be used as a data gathering device for a plant automation system that integrates process, instrument and electrical requirements. All monitored values are available via two digital RS485 communication ports running the ModBus® protocol. If analog values are required for direct interface to a PLC, any of the monitored values can be output to one of 4 isolated analog

outputs. A process variable can be measured using an analog input. A front panel RS232 communication port can be connected to a PC for simultaneous access of information by other plant personnel.

The quality of the power system is important with increasing use of electronic loads such as computers, ballasts or variable frequency drives. With the PQM's power analysis option, any phase current or voltage can be displayed and the harmonic content calculated. By knowing the harmonic distribution, action can be taken to prevent overheated transformers, motors, capacitors, neutral wires and nuisance breaker trips. Redistribution of system loading can also be determined. Waveform and chart recorder printouts available from the PQM assist in problem diagnosis.

Economical system monitoring or control is possible by selecting the non-display chassis model as a system component and adding required options to obtain the desired level of functionality.

PQM

Power Quality Meter

Applications

- Metering of distribution feeders, transformers, generators, capacitor banks and motors
- Medium and low voltage systems
- Commercial, industrial, utility
- Flexible control for demand load shedding, power factor, etc.
- Power quality analysis

Metering/Control

- A V W var VA varh Wh PF Hz unbalance
- A W var VA demand
- Load shedding
- Power factor control
- Pulse input totalizing
- Pulse output based on kWh, kvarh or kVAh

Monitoring

- Harmonic analysis through 63rd with THD and TIF
- Event recorder
- Waveform capture
- Data logger
- Triggered trace memory

Communication

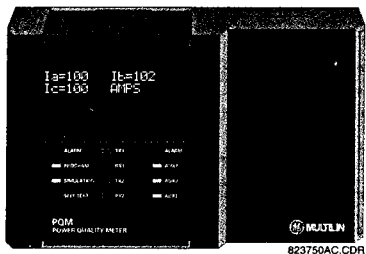
- Ports: RS232 front, dual RS485 rear
- ModBus® RTU protocol
- Mini RTU: digital 4 in / 4 out
- Analog 1 in / 4 out
- Local/remote display of all values
- Communicate with GE Multilin 269/565 (MOD 508)



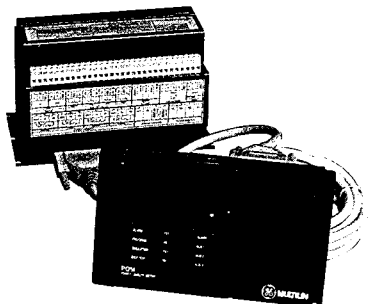
STANDARD FEATURES

Select the panel mount with display version for easy local interface or for maximum economy select the chassis mount configuration. Both models offer RS485 ModBus® communications for programming and monitoring. Replace expensive additional devices by adding the CONTROL, TRANSDUCER and POWER ANALYSIS options as required.

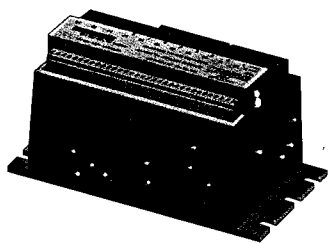
Panel mount with display for local/remote programming and monitoring



Keep 600 volt wiring off a panel with reduced depth by using the detachable face plate (MOD 505); cable is 6 ft (2 meters) in length

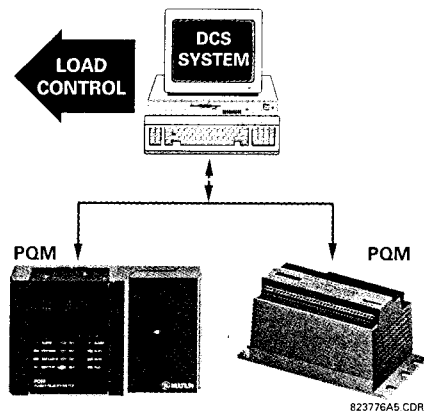


Chassis mount without a display as a system component for lowest cost



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Expensive peak demand penalties can be avoided using demand monitoring for load scheduling



184

Metering

Each voltage and current is sampled 64 times per cycle for 0.2% accuracy true RMS measured values.

- $I_a I_b I_c I_n$
- $V_a V_b V_c V_{ab} V_{bc} V_{ca}$
- VI unbalance
- true PF crest & K factor
- Hz W var VA
- Wh varh VAh W cost
- demand: A W var VA

A keypad and illuminated 40 character display are used for programming setpoints and monitoring values and status.

Select up to 10 different messages for automatic scanning of important information



823763A7.CDR

Alarms

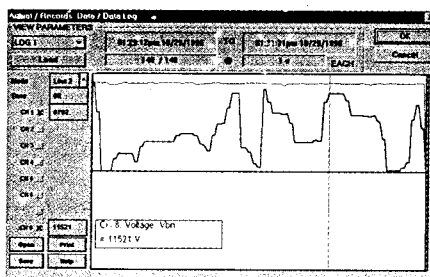
Any of the assignable output relays may be used to trigger an alarm for specific applications. Alarm messages are in clear English for easy interpretation.

CONDITION	APPLICATION
overcurrent	motors/transformers
undercurrent	pumps/compressors
neutral current	leakage/unbalance
current unbalance	motors
overvoltage	equipment protection
undervoltage	motors/load transfer
phase sequence	pumps/equipment
overfrequency	generators
underfrequency	load shedding
power factor	capacitor banks
switch input	process control

Data Logger (Trending)

Trending is useful as a troubleshooting aid when a problem is detected. Measured values can be selected and plotted with a programmable sampling rate to suit the time interval of interest. The generated chart recorder screen can be printed or exported to other programs for report writing.

Record trends of measured parameters over time

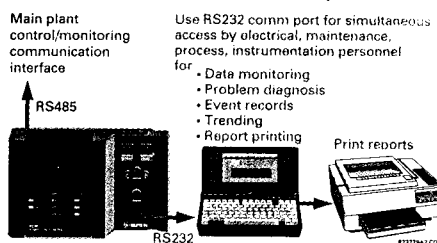


Communication

Integrate process, instrumentation and electrical requirements in a plant automation system by connecting PQM meters together to a DCS or SCADA system. A PC running PQMPC can change system setpoints, monitor values, status and alarms. Continuous monitoring minimizes process downtime by immediately identifying potential problems due to faults or changes from growth.

- RS485 ModBus® 1,200 - 19,200 bps
- mini RTU SCADA system component
- measure actual values
- read status
- issue control commands
- load all setpoints from a file
- change individual setpoints

The display version PQM comes complete with a front RS232 port. The RS232 port can be used for data collection, printing reports or problem analysis without disturbing the main communication interface to rear RS485 port.



Future Expansion

Flash Memory is used for firmware storage within the PQM. This allows future product upgrades to be loaded via the serial port.

Initially PQM meters can be used as stand-alone units. Open architecture allows connection to other Multilin or Modbus® compatible devices on the same communication link. These can be integrated in a complete plant wide system for overall process monitoring and control.

Download the latest product enhancements via the serial port

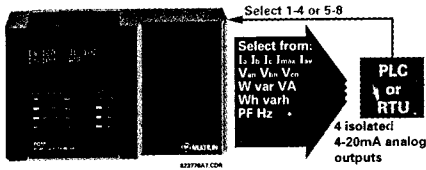


OPTIONS

Transducer

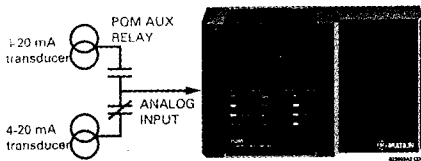
4 ANALOG OUTPUTS: 4 isolated analog outputs can be used to replace 8 analog transducers. Output signals can be selected from any of the measured parameters for direct interface to a PLC.

Replace 8 transducers with the PQM's direct PLC 4-20 mA analog interface



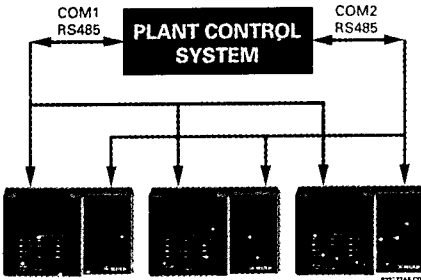
ANALOG INPUT: With the analog input and an output relay for selection, two transducers (such as temperature or water level) can be monitored and used for control.

Connect two 4-20 mA transducers for process variable measurement and control



2ND REAR COMM PORT: An additional rear RS485 comm port is provided for simultaneous monitoring by process, instrument, electrical or maintenance personnel.

Redundancy in high security systems is provided by the 2nd RS485 comm port

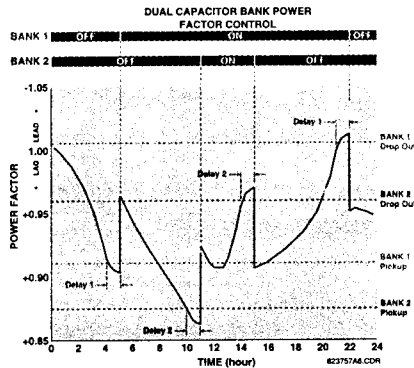


Control

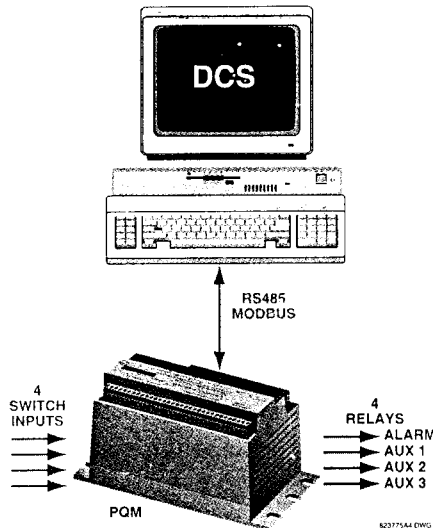
3 OUTPUT RELAYS/4 INPUTS: Measured parameters from the standard PQM can be combined with setpoints and input/outputs for control applications. With the control option, 3 output relays and 4 switch inputs are added along with programmable setpoints to make a mini RTU. Output relays can also be controlled via the communication port or assigned to different setpoints for custom programming to accommodate many situations. Possibilities include:

- undercurrent alarm for pumps
- over/undervoltage for generators
- unbalance alarm for rotating machines
- dual level power factor for capacitor bank switching
- underfrequency/demand output for load shedding resulting in power cost savings
- kWh, kvarh and kVAh pulse output for PLC interface

Power factor setpoints and 2 output relays can be used for 2 level capacitor bank switching



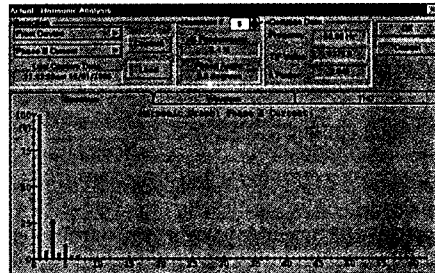
Use the PQM as a "Mini RTU" for monitoring and control with addressable output relays and switch inputs



Power Analysis

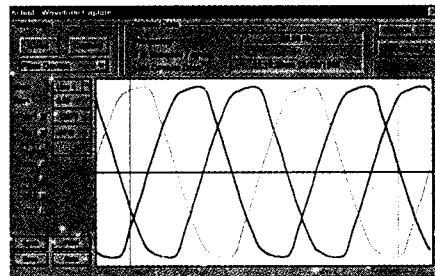
HARMONIC ANALYSIS: Non linear loads such as variable speed drives, computers and electronic ballasts can cause harmonics which may lead to problems such as nuisance breaker tripping, telephone interference, transformer, capacitor or motor overheating. For fault diagnosis such as detecting undersized neutral wiring, need for a harmonic rated transformer, or effectiveness of harmonic filters, details of the harmonic spectrum are useful and available with the power analysis option.

Harmonic spectrum analysis helps to identify problems and that implemented changes work correctly



WAVEFORM CAPTURE: Voltage and current waveforms can be captured and displayed on a PC using the PQMPC program supplied with the PQM or using third party software. Distorted peaks or notches from SCR switching provide clues for taking corrective action.

Voltage and current waveforms provide valuable insights into system problems



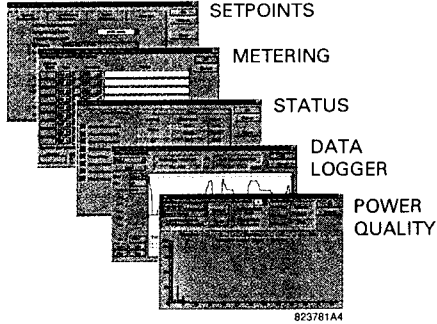
EVENT RECORDER: Alarms, setpoint triggers, input and output events can be stored in a 40 event record and time/date stamped by the internal clock. This is useful for diagnosing problems and system activity. Minimum and maximum values are also continuously updated and time stamped.

TRACE MEMORY: The PQM can be configured to record maximum of 36 cycles of data on all voltage and current inputs based on undervoltage, overvoltage, overcurrent or switch input state change.

PQMPC

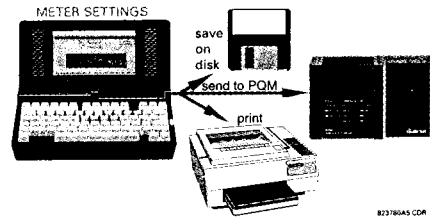
The PQMPC is a Windows based program the PQM. It can be used to enter setpoints, read metered values, monitor status and evaluate power quality. All data continuously gathered by the PQM can be transferred to a third party software program for display, control or analysis via the communications interface.

Use the free PQMPC software to program/monitor from a PC under Windows®



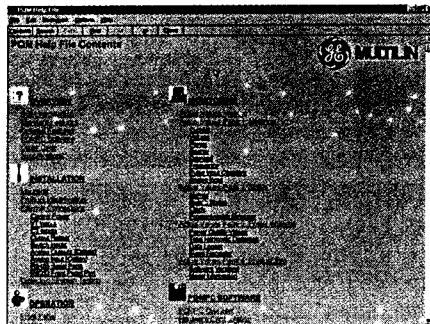
Once all setpoints have been entered they can be downloaded into any PQM or stored in a file with a tag name for later reference.

Program setpoints then download to the PQM, save to a file or print for later reference

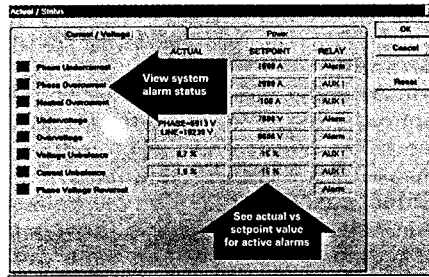


27 To speed up learning, the full instruction manual is available on line.

Click on any topic for on-line help or print any topic including illustrations



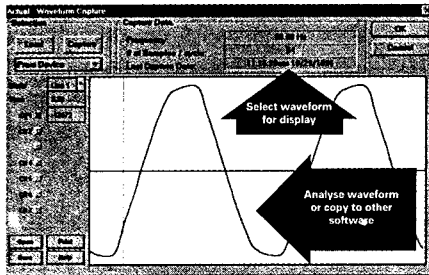
Monitor any measured value or status for fast fault diagnosis and correction



Screens are available for monitoring all measured values such as current, voltage, or power. Status of alarms and control settings can also be displayed.

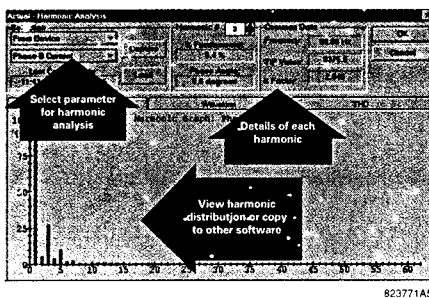
Voltage and current waveshape can give important information about what is happening on a system. For example, non linear loads such as computers or variable speed drives may introduce distortion that indicates filtering is required.

Gain useful system information using voltage/current waveform capture



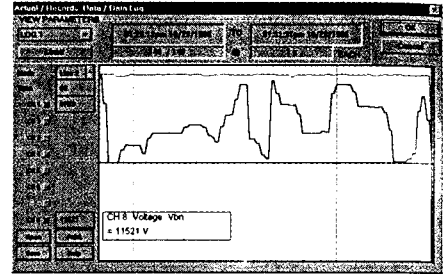
Harmonic analysis may reveal excessive harmonic content requiring a derated transformer or larger neutral wire. Early warning of these problems can prevent equipment damage or nuisance breaker tripping.

Use the power analysis option to identify harmonics for sizing transformers, neutral wiring and preventing equipment overheating



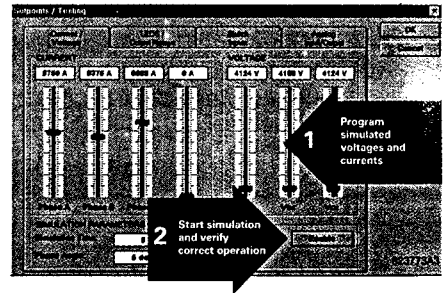
When justifying equipment purchases or analyzing problems such as phase unbalance from a power utility, a print-out can be useful. PQMPC enables waveform capture information to be transferred to other programs for inclusion in reports. Routine event logs of demand or sampled voltage can also be created and printed out.

Print data logger records or demand profile trending

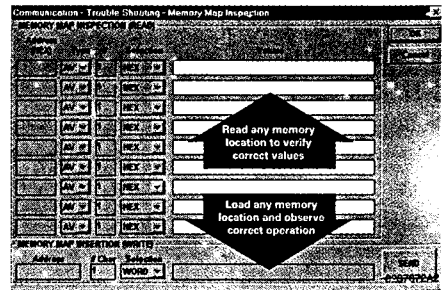


To verify correct installation, the simulation mode substitutes programmed currents and voltages for real ones. This powerful tool is also an excellent training aid for plant personnel.

In simulation mode, voltage and current can be "injected" without a test set to verify correct control operation or for training

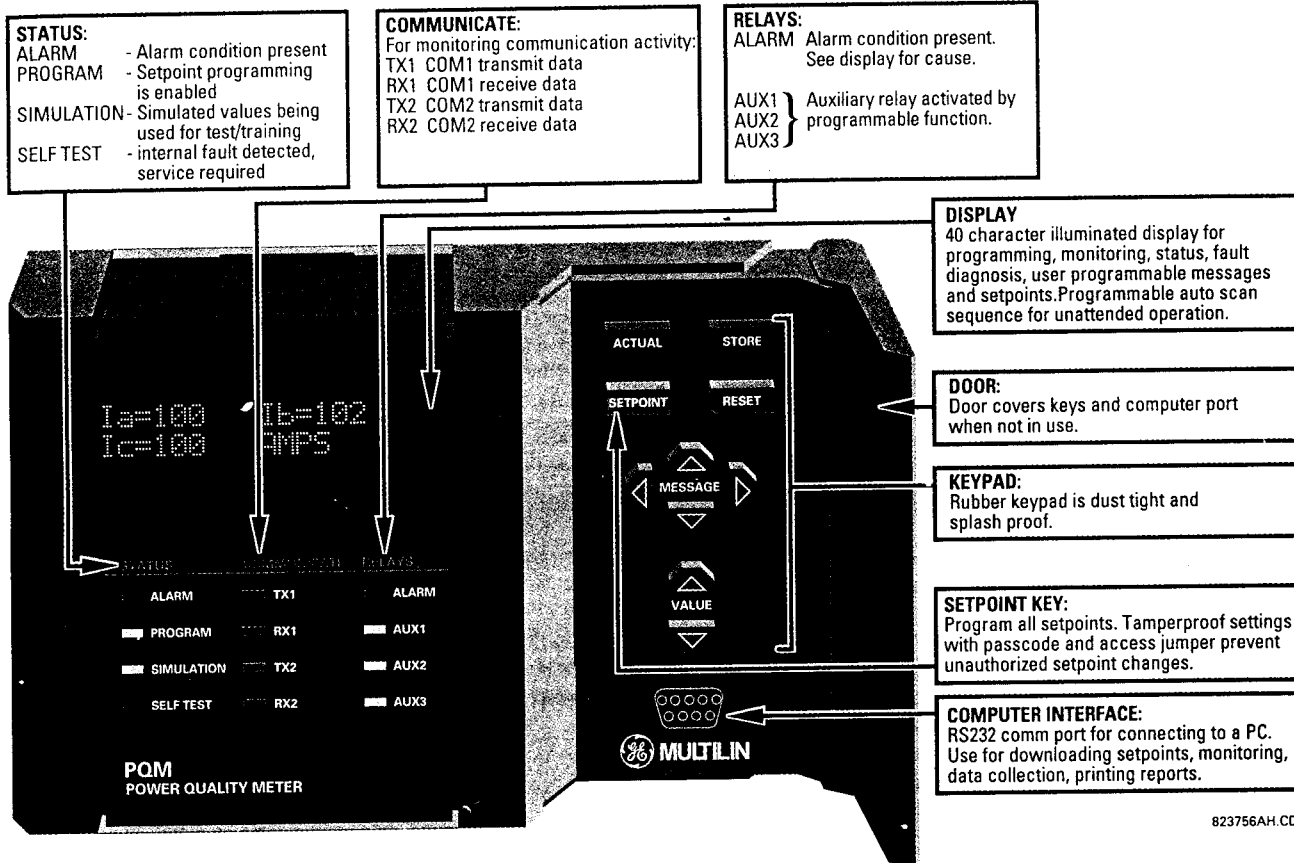


A built in communications debugging tool assists in troubleshooting when developing communication interfaces

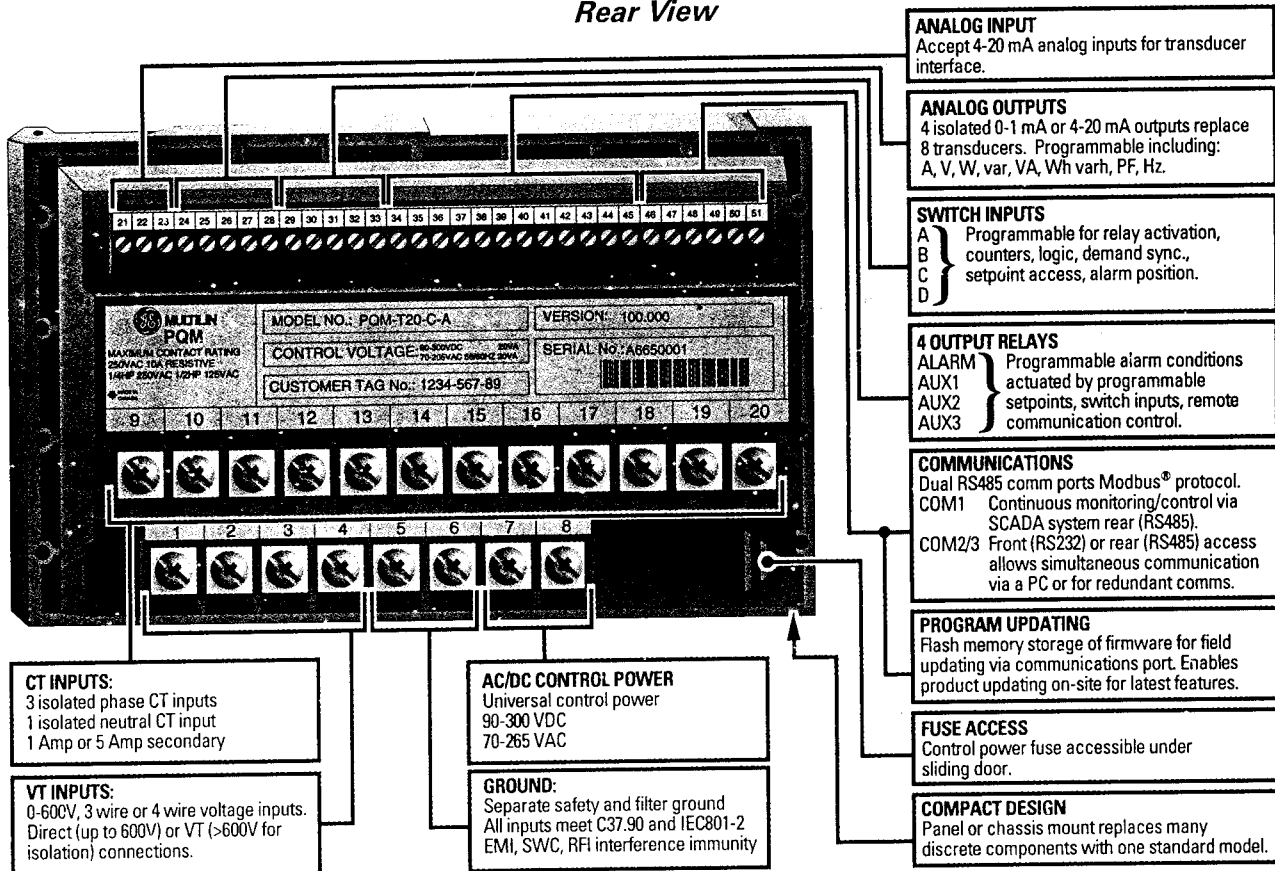


FEATURES

Front View



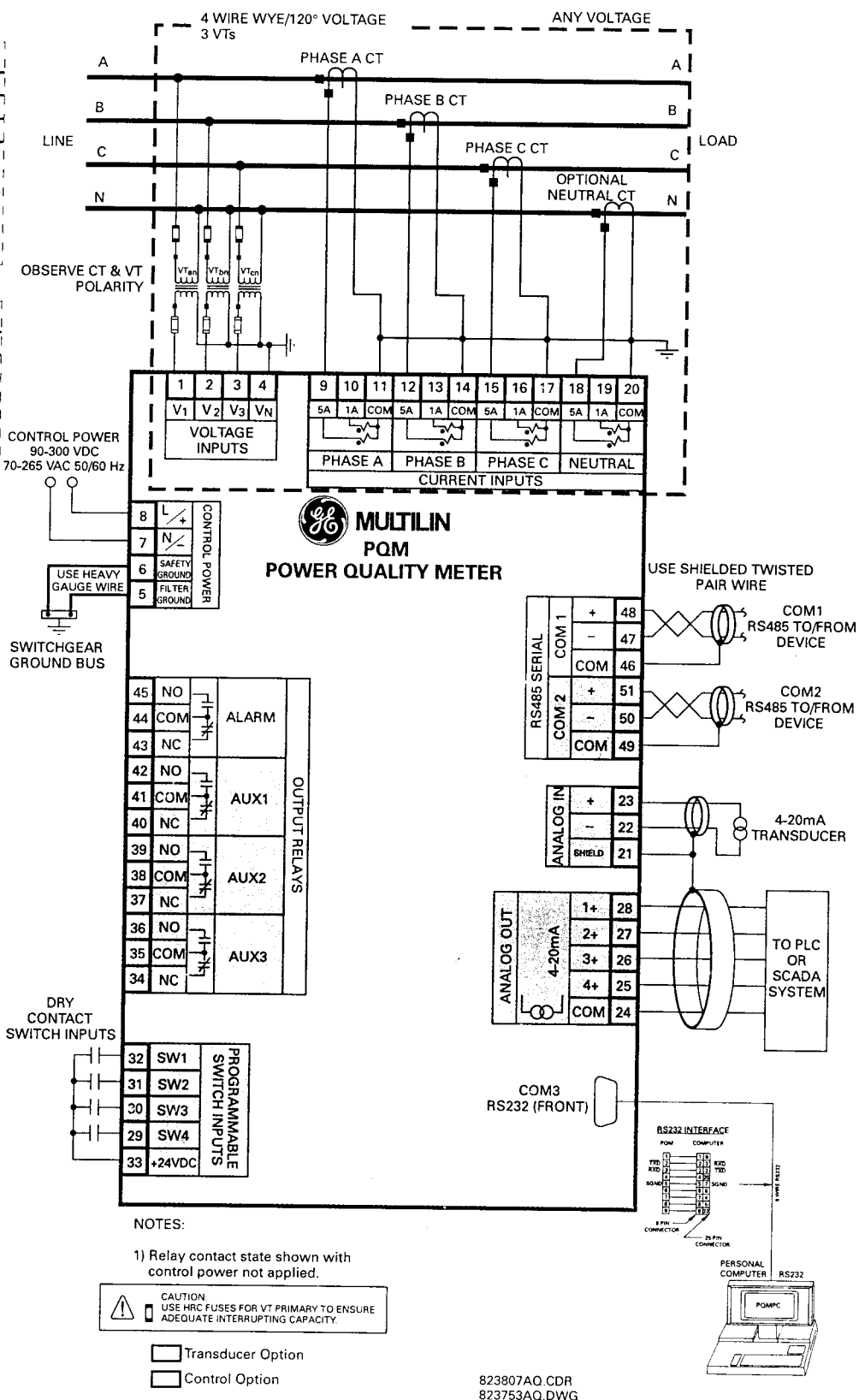
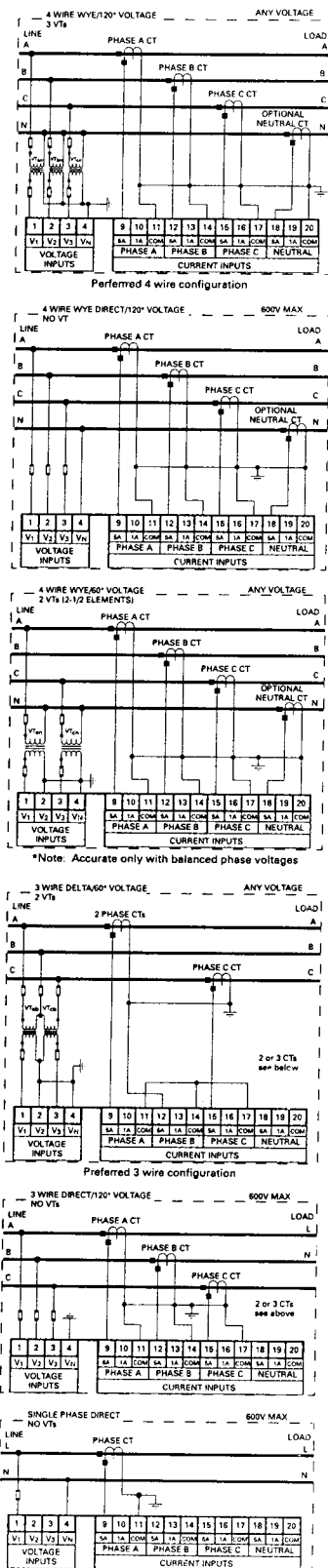
Rear View



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TYPICAL WIRING

ALTERNATIVE CT/VT CONNECTIONS



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823807AQ.CDR
823753AQ.DWG

TECHNICAL SPECIFICATIONS

CURRENT INPUTS Conversion: True rms, sample time 260 μ s CT Input: 1 A and 5 A secondary Burden: 0.2 VA Overload: 20 x CT for 1s 100 x CT for 0.2 sec Full Scale: 150% of CT Frequency: up to 32nd harmonic Accuracy: $\pm 0.2\%$ of full scale, true rms		MEASURED VALUES <table border="1"> <thead> <tr> <th>PARAMETER</th> <th>ACCURACY (% OF FULL SCALE)</th> <th>RESOLUTION</th> <th>RANGE</th> </tr> </thead> <tbody> <tr> <td>VOLTAGE</td> <td>$\pm 0.2\%$</td> <td>1 VOLT</td> <td>20% OF VT TO 100% OF VT</td> </tr> <tr> <td>CURRENT</td> <td>$\pm 0.2\%$</td> <td>1 A</td> <td>1% OF CT TO 150% OF CT</td> </tr> <tr> <td>VOLTAGE UNBALANCE</td> <td>$\pm 1\%$</td> <td>0.1%</td> <td>0 - 100.0%</td> </tr> <tr> <td>CURRENT UNBALANCE</td> <td>$\pm 1\%$</td> <td>0.1%</td> <td>0 - 100.0%</td> </tr> <tr> <td>kW</td> <td>$\pm 0.4\%$</td> <td>0.01 kW</td> <td>0 - 999,999.99 kW</td> </tr> <tr> <td>kvar</td> <td>$\pm 0.4\%$</td> <td>0.01 kvar</td> <td>0 - 999,999.99 kvar</td> </tr> <tr> <td>kVA</td> <td>$\pm 0.4\%$</td> <td>0.01 kVA</td> <td>0 - 999,999.99 kVA</td> </tr> <tr> <td>kWh</td> <td>$\pm 0.4\%$</td> <td>1 kWh</td> <td>0 - 999,999.99 kWh</td> </tr> <tr> <td>kvarh</td> <td>$\pm 0.4\%$</td> <td>1 kvarh</td> <td>0 - 999,999.99 kvarh</td> </tr> <tr> <td>kVAh</td> <td>$\pm 0.4\%$</td> <td>1 kVAh</td> <td>0 - 999,999.99 kVAh</td> </tr> <tr> <td>POWER FACTOR</td> <td>1%</td> <td>0.01</td> <td>$\pm 0.0 - 1.0$</td> </tr> <tr> <td>FREQUENCY</td> <td>0.02 Hz</td> <td>0.01 Hz</td> <td>20.00 - 70.00 Hz</td> </tr> <tr> <td>kW DEMAND</td> <td>$\pm 0.4\%$</td> <td>0.1 kW</td> <td>999,999.99 kW</td> </tr> <tr> <td>kvar DEMAND</td> <td>$\pm 0.4\%$</td> <td>0.1 kvar</td> <td>999,999.99 kvar</td> </tr> <tr> <td>kVA DEMAND</td> <td>$\pm 0.4\%$</td> <td>0.1 kVA</td> <td>999,999.99 kVA</td> </tr> <tr> <td>AMPS DEMAND</td> <td>$\pm 0.2\%$</td> <td>1 A</td> <td>0 - 7,500 A</td> </tr> <tr> <td>AMPS THD</td> <td>$\pm 2.0\%$</td> <td>0.1%</td> <td>0.0 - 100.0%</td> </tr> <tr> <td>VOLTS THD</td> <td>$\pm 2.0\%$</td> <td>0.1%</td> <td>0.0 - 100.0%</td> </tr> </tbody> </table>		PARAMETER	ACCURACY (% OF FULL SCALE)	RESOLUTION	RANGE	VOLTAGE	$\pm 0.2\%$	1 VOLT	20% OF VT TO 100% OF VT	CURRENT	$\pm 0.2\%$	1 A	1% OF CT TO 150% OF CT	VOLTAGE UNBALANCE	$\pm 1\%$	0.1%	0 - 100.0%	CURRENT UNBALANCE	$\pm 1\%$	0.1%	0 - 100.0%	kW	$\pm 0.4\%$	0.01 kW	0 - 999,999.99 kW	kvar	$\pm 0.4\%$	0.01 kvar	0 - 999,999.99 kvar	kVA	$\pm 0.4\%$	0.01 kVA	0 - 999,999.99 kVA	kWh	$\pm 0.4\%$	1 kWh	0 - 999,999.99 kWh	kvarh	$\pm 0.4\%$	1 kvarh	0 - 999,999.99 kvarh	kVAh	$\pm 0.4\%$	1 kVAh	0 - 999,999.99 kVAh	POWER FACTOR	1%	0.01	$\pm 0.0 - 1.0$	FREQUENCY	0.02 Hz	0.01 Hz	20.00 - 70.00 Hz	kW DEMAND	$\pm 0.4\%$	0.1 kW	999,999.99 kW	kvar DEMAND	$\pm 0.4\%$	0.1 kvar	999,999.99 kvar	kVA DEMAND	$\pm 0.4\%$	0.1 kVA	999,999.99 kVA	AMPS DEMAND	$\pm 0.2\%$	1 A	0 - 7,500 A	AMPS THD	$\pm 2.0\%$	0.1%	0.0 - 100.0%	VOLTS THD	$\pm 2.0\%$	0.1%	0.0 - 100.0%	DEMAND MONITORING Measured Values: Phase A/B/C/N Current (A) 3 ϕ Real Power (kW) 3 ϕ Reactive Power (kvar) 3 ϕ Apparent Power (kVA) Measurement Type: Thermal Exponential 90% response time (programmable): 5 - 60 min, steps of 1 min Block Interval/Rolling Demand time in interval (programmable): 5 - 60 min, steps of 1 min A: 10 to 7,500 in steps of 1 kW: 0.1 to 6,500.0 in steps of 0.1 kvar: 0.1 to 6,500.0 in steps of 0.1 kVA: 0.1 to 6,500.0 in steps of 0.1 Pickup Level:	
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SAMPLING MODES <table border="1"> <thead> <tr> <th></th> <th>SAMPLES/ CYCLE</th> <th>INPUTS SAMPLED AT A TIME</th> <th>DURATION (CYCLES)</th> </tr> </thead> <tbody> <tr> <td>METERED VALUES</td> <td>64</td> <td>ALL</td> <td>2</td> </tr> <tr> <td>TRACE MEMORY</td> <td>16</td> <td>ALL</td> <td>CONTINUOUS</td> </tr> <tr> <td>HARMONIC SPECTRUM</td> <td>256</td> <td>1</td> <td>1</td> </tr> </tbody> </table>			SAMPLES/ CYCLE	INPUTS SAMPLED AT A TIME	DURATION (CYCLES)	METERED VALUES	64	ALL	2	TRACE MEMORY	16	ALL	CONTINUOUS	HARMONIC SPECTRUM	256	1	1	PULSE INPUT Max Inputs: 4 Min Pulse Width: 150 ms Min Off Time: 200 ms																																																															
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SWITCH INPUTS Type: Dry contact Resistance: 1,000 Ohm max ON resistance Voltage: 24 VDC @ 2 mA Duration: 100 ms minimum		COMMUNICATIONS COM1/COM2 Type: RS485 2 wire, half duplex, isolated COM3 Type: RS232, 9PIN Baud Rate: 1,200 to 19,200 Protocol: ModBus [®] RTU Functions: Read/write setpoints Read actual values Execute commands																																																																															
ANALOG OUTPUTS Accuracy: $\pm 2\%$ of full scale <table border="1"> <thead> <tr> <th></th> <th colspan="2">OUTPUT</th> </tr> <tr> <th></th> <th>0-1 mA (T1 Option)</th> <th>0-20 mA & 4-20 mA (T20 Option)</th> </tr> </thead> <tbody> <tr> <td>Max Load</td> <td>2400 Ω</td> <td>600 Ω</td> </tr> <tr> <td>Max Output</td> <td>1.1 mA</td> <td>21 mA</td> </tr> </tbody> </table> Isolation: 50 V isolated, active source			OUTPUT			0-1 mA (T1 Option)	0-20 mA & 4-20 mA (T20 Option)	Max Load	2400 Ω	600 Ω	Max Output	1.1 mA	21 mA	CONTROL POWER Input: 90 - 300 VDC 70 - 265 VAC 50/60 Hz Power: 10 VA nominal Holdup: 100 ms typical @ 120 VAC/VDC																																																																			
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ANALOG INPUT Range: 4 - 20 mA Accuracy: $\pm 1\%$ of full scale Relay Output: Programmable 4 - 20 mA Internal Burden Resistance: 250 Ohms		TYPE TESTS Dielectric Strength: 20 kV for 1 min to relays, CTs, VTs, power supply Insulation Resistance: IEC255 - 5 500 VDC Transients: ANSI C37.90.1 Oscillatory 2.5 kV/1 MHz ANSI C37.90.1 Fast Rise 5 kV/10 ns Ontario Hydro A-28M-82 IEC255-4 Impulse / High Frequency Disturbance Class III Level Impulse Test: IEC 255-5 0.5 Joule 5 kV RFI: 50 MHz/15w Transmitter EMI: C37.90.2 Electromagnetic Interference @ 150 MHz and 450 MHz, 10 V/m Static: IEC 801-2 Static Discharge Humidity: 95% non-condensing Temperature: -10°C to +60°C ambient Environment: IEC 68-2-38 Temperature/Humidity Cycle																																																																															
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OVERVOLTAGE ALARM/CONTROL Pickup Level: 1.01 to 1.25 in steps of 0.01 x VT Dropout Level: 97% of pickup Time Delay: 0.5 to 600.0 in steps of 0.5 sec Phases: Any One/Any Two/All Three (programmable) phases have to exceed pickup to operate Per voltage input Level Accuracy: Timing Accuracy: -0/+1 sec		UNDERFREQUENCY ALARM/CONTROL Required Voltage: 20 V applied Pickup Level: 20 - 70.00 in steps of 0.01 Hz Dropout Level: Pickup + 0.03 Hz Time Delay: 0.1 to 10.0 in steps of 0.1 sec Level Accuracy: ± 0.02 Hz Timing Accuracy: ± 3 cycles																																																																															
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PACKAGING Shipping Box: 8 1/2" x 6" x 6" (LxHxD) 215mm x 152mm x 152mm (LxHxD) Ship Weight: 5 lbs / 2.3 kg		CERTIFICATION ISO: Manufactured to an ISO9002 registered program UL: Recognized under E83849 CSA: Recognized under LR41286																																																																															

GUIDEFORM SPECIFICATIONS

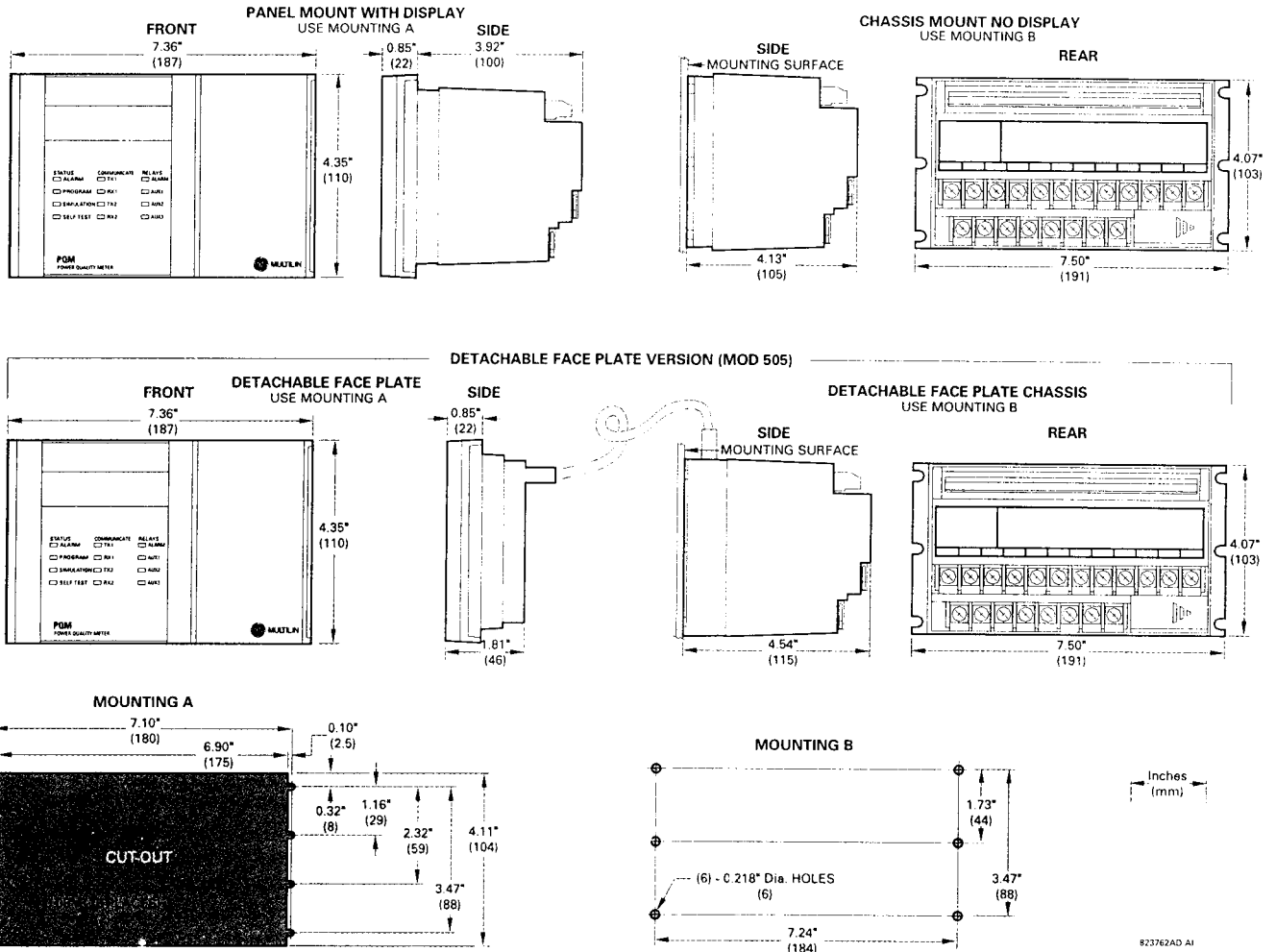
Three phase metering and power quality analysis shall be provided by a power quality meter. Metering shall include A, V, W, Wh, Wcost, var, varh, VA, VAh, Hz, and PF. Power analysis features shall include an event recorder, waveform capture, harmonic spectrum display (through the 62nd harmonic with total harmonic distortion) and a data logger function.

Four switch inputs shall be provided which can be programmed for relay activation, counters, logic, demand sync, reset and alarms. Four output relays shall be provided which can be

programmed to activate on alarms, setpoints, switch inputs, kWh pulse or communications control. These output relays shall also be able to use demand metering values of A, var, W and VA to control load shedding. PLC interface shall be provided via four isolated 4-20 mA outputs programmable from measured parameters. Transducer monitoring shall be provided via a 4-20 mA input. Preprogrammed logic shall allow capacitor bank control for power factor correction. Current inputs shall be via 1 amp or 5 amp CTs and no VTs shall be required for voltages up to 600V. Control power can be AC or DC.

Local user interface shall include a keypad and display for entering all setpoints and reading all measured values, and LED indicators for output relays, communication status and alarm status. An RS232 computer interface port shall be located on the front panel. Two RS485 and one RS232 communication ports shall be provided for simultaneous access using ModBus RTU protocol. Windows based software shall be provided to enable setpoint programming.

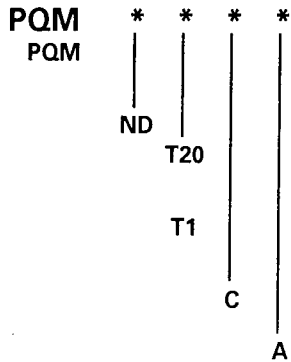
DIMENSIONS



27

ORDERING

To order select the basic model and the desired features from the Selection Guide below.



- Basic unit with display, all current/voltage/power measurements, 1 RS485 comm port, 1 RS232 port, alarm output relay
- Standard meter, no display, no RS232 port, chassis mount
- Transducer option; 4 isolated analog outputs 0-20 mA and 4-20 mA, assignable to all measured parameters, 4-20 mA analog input, 2nd RS485 comm port
- Transducer option; 4 isolated analog outputs 0-1 mA, assignable to all measured parameters, 4-20 mA analog input, 2nd RS485 comm port
- Control option; 3 additional programmable output relays (total of 4), 4 programmable switch inputs
- Power analysis option; harmonic analysis, triggered trace memory, waveform capture, event record, data logger

Order code for all options in a panel mount version with display: PQM-T20-C-A

Modifications:

- MOD 501: 20-60 VDC / 20-48 VAC Control Power
- MOD 504: Removable Terminal Blocks
- MOD 505: Detachable faceplate version
- 6 ft. length cable
- MOD 508: Communication with 269/565

Accessories:

- PQMPC supplied free
- RS232 to RS485 convertor
- 2.25" Collar for limited depth mounting
- MTM Plus Replacement Mounting Plate

Control Power:

- 90-300 VDC / 70 - 265 VAC standard
- 20-60 VDC / 20-48 VAC (MOD 501)

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