SATEC
Powerful Solutions

expertmeter™ PM180

PM180 Series
SUBSTATION AUTOMATION UNIT

INSTALLATION MANUAL

BG0521 Rev. A2

LIMITED WARRANTY

The manufacturer offers the customer a 24-month functional warranty on the instrument for faulty workmanship or parts from date of dispatch from the distributor. In all cases, this warranty is valid for 36 months from the date of production. This warranty is on a return to factory basis.

The manufacturer does not accept liability for any damage caused by instrument malfunction. The manufacturer accepts no responsibility for the suitability of the instrument to the application for which it was purchased.

Failure to install, set up or operate the instrument according to the instructions herein will void the warranty.

Your instrument may be opened only by a duly authorized representative of the manufacturer. The unit should only be opened in a fully anti-static environment. Failure to do so may damage the electronic components and will void the warranty.

NOTE

The greatest care has been taken to manufacture and calibrate your instrument. However, these instructions do not cover all possible contingencies that may arise during installation, operation or maintenance, and all details and variations of this equipment are not covered by these instructions.

For additional information regarding installation, operation or maintenance of this instrument, contact the manufacturer or your local representative or distributor.

IMPORTANT

Please read the instructions in this manual before performing installation, and take note of the following precautions:

1. Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Failure to do so may result in <u>serious or even fatal injury</u> and/or equipment damage.

2. Before connecting the instrument to the power source, check the labels on the side of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages, currents, analog output and communication protocol for your application

3. Do not connect the instrument to a power source if it is damaged.

4. Do not expose the instrument to rain or moisture.

5. The secondary of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even <u>serious or fatal injury</u>. Ensure that the current transformer wiring is made through shorting switches and is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.

6. Setup procedures must be performed only by qualified personnel familiar with the instrument and its associated electrical equipment

7. Do NOT open the instrument under any circumstances.

☞**Read this manual thoroughly before connecting the meter to the current carrying circuits. During operation of the meter, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.**

October 2012

Table of Contents

Chapter 1 Introduction

1.1 About This Manual

This manual is intended to assist the user in the installation of the *PM180 Series (expertmeter™ PM180) Substation Automation Unit*. The term '*PM180*' is used herein to refer to all models in the series.

This chapter gives an overview of this manual and an introduction to the *PM180.*

Chapter 2, *Installation*, provides instructions for mechanical and electrical installation.

Chapter 3, *Communications*, provides drawings for communications connections and instructions.

Chapter 4, Technical Specifications for the *PM180* are found in the *Appendix*.

1.2 About The *PM180*

The *PM180* series is a group of advanced multi-microprocessor-based digital instruments that incorporate the capabilities of a power quality analyzer, energy meter, fault and data recorder and programmable controller, oriented for substation automation. These instruments provide three-phase measurements of electrical quantities in power distribution systems, monitoring external events, operating external equipment via relay contacts, fast and long-term on-board recording of measured quantities, faults with currents up to 100A and events, harmonic network analysis and disturbance recording.

Features

The PM180 combines in a single enclosure:

- Digital Fault Recorder (onboard fault detector - programmable fault thresholds and hysteresis, up to 100 Amps fault currents, zero-sequence currents and volts, current and volt unbalance; up to 48 external digital triggers from tripping protection relays; ready-for-use fault reports - fault currents magnitude and duration, coincident volts magnitude, fault waveforms and RMS trace)

- Precise Sequence-of-Events Recorder (up to 48 digital inputs at 1-ms resolution, fault events and relay operations)

- Power Quality Recorder (EN 50160, onboard PQ analyzer; programmable thresholds and hysteresis; ready-for-use reports; transients, impulses, sags/swells, interruptions, harmonics, inter-harmonics, frequency variations, volts unbalance)

- Event Recorder for logging internal diagnostics events, control events and I/O operations

- Eight fast Waveform Recorders (simultaneous 8-channel AC, VDC and 16-channel digital inputs recording in a single plot; selectable AC sampling rate of 32, 64, 128 or 256 samples per cycle; 20 pre-fault cycles, 1-ms resolution for digital inputs; up to 3 hours of continuous recording with a 250-Mbyte onboard memory at a rate of 32 samples per cycle)

- Sixteen fast Data Recorders (from 1/2 cycle RMS to 2-hour RMS envelopes; up to 20 pre-fault cycles; programmable data logs on a periodic basis and on any internal and external trigger)

- Programmable Controller (64 control setpoints, OR/AND logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording)

- High-Class 3-phase Power meter (true RMS, volts, amps, powers, power factors, unbalance, neutral current)

- Demand Meter (amps, volts, harmonic demands)

- Precise Energy and Power Demand Meter (TOU, 16 Summary energy and demand registers for substation energy management, accumulation of energy pulses from external watt-meters, block and sliding demands, up to 64 energy sources)

- Harmonic Analyzer (to 63rd harmonic volts and amps, directional power harmonics and power factor, phasors, symmetrical components)

- 32 digital counters for counting pulses from external sources and numerous internal events

- 16 programmable timers from 1/2 cycle to 24 hours for periodic recording and triggering operations on a time basis

- 1-ms satellite-synchronized clock (IRIG-B time-code input)

- Second backup power supply unit

1.2.1   AC/DC Inputs

The PM180 is provided with a set of fully isolated AC/DC inputs for a connection to the AC feeders and station battery:

Three isolated AC voltage inputs (up to 690VAC direct line-to-line input voltage)

Four standard isolated AC current inputs with an extended input range up to 2000% overload (20A up to 100 Amps input currents - fault currents)

Optional up to two sets of four isolated current inputs up to 100 Amps, external CT, fault currents detector

AC/DC voltage input (up to 400V AC/DC) for monitoring fourth AC voltage or DC of the station battery

1.2.2   Digital and Analog I/O Options

The PM180 has three I/O expansion slots for removable "hot-swap" plug-in I/O modules:

DI - Digital inputs (16 optically isolated inputs per module, up to 3 modules per device; options for dry contacts, 24-250VDC wet inputs; programmable de-bounce time from 1 ms to 1 sec; free linkage to Sequence-of-Events Recorder, Fault Recorder, control setpoints, pulse counters and Energy/TOU subsystem)

RO - Relay outputs (8 relays per module, up to 3 modules per device; unlatched, latched and pulse operations, failsafe operation for alarm notifications; programmable pulse width; direct remote relay control through communications)

AI/AO - Mixed analog input/output modules (four optically isolated AI and four AO with internal power supplies per module, up to 2 modules per device; options for 0-1mA, ±1mA, 0-20mA and 4-20mA inputs and outputs; 200% overload current for 0-1mA and ±1mA AI/AO)

1.2.3   Communications Options

The PM180 has extensive communications capabilities:

Three independent universal serial communications ports (RS-232, RS-422/RS-485, up to 115,200 bps, Modbus RTU/ASCII and DNP3.0 protocols)

Infrared port (MODBUS RTU/ASCII and DNP3.0 protocols)

Embedded 56K modem for communications through public telephone lines (MODBUS RTU/ASCII and DNP3.0 protocols)

Ethernet 10/100Base-T port (MODBUS/TCP or DNP3.0/TCP protocols, up to five non-intrusive simultaneous connections, Telnet service port)

USB 1.1 port (MODBUS RTU protocol, 12 Mbps) for fast local communications and data retrieving

1.2.4   Remote Displays

The PM180 can be ordered with an optional LED Remote Display Module (RDM180) or LCD Remote Graphical Module (RGM180). Both have a fast RS-485 port and communicate with the PM180 through the MODBUS RTU protocol. Remote displays can be located at distances of up to 0.5 km from the device. The RGM180 can also be ordered with an Ethernet 10/100Base-T port and can communicate with the PM180 through a local network.

The RDM180 has 3-row (2x4 characters + 1x6 characters) bright red LEDs well suited for dark areas. It allows the user to view real-time RMS and harmonics measurements, status indication parameters, and perform basic setup operations when installing and servicing the device.

The RGM180 is equipped with a color graphics LCD display with Touch Panel and has extensive dialog capabilities, allowing the user to view different fault and power quality information in a graphical form, such as waveforms, harmonic spectrum, phasors and data trends, review latest fault and power quality reports for fast fault analysis, and much more.

1.2.5   Upgradeable Firmware

The PM180 uses flash memory for storing device firmware that allows future upgrading of the device without replacing any hardware component. The new features can be easily added to your device by simply replacing the firmware through a local RS-232/485 port, USB port or Ethernet port.

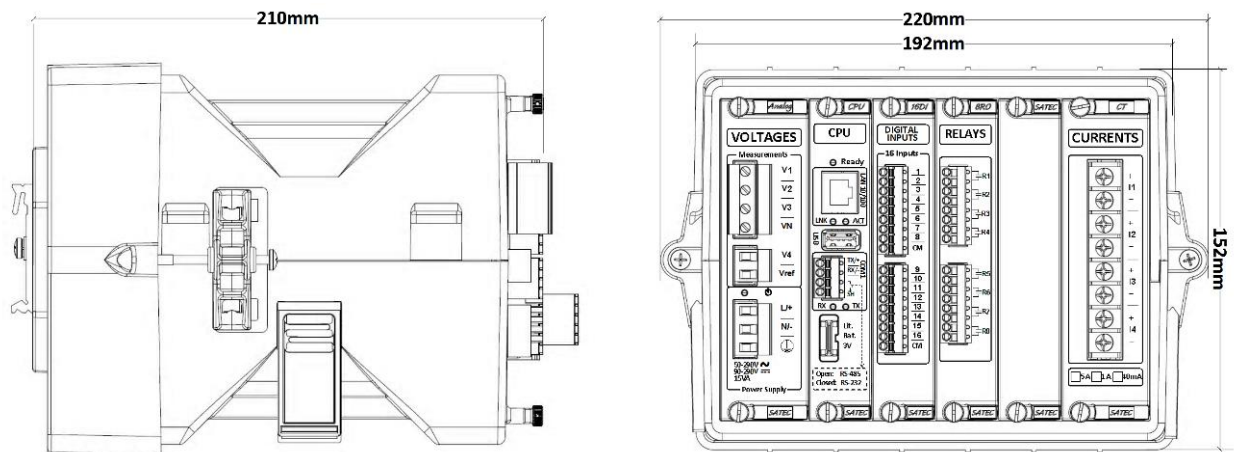# Chapter 2 Installation

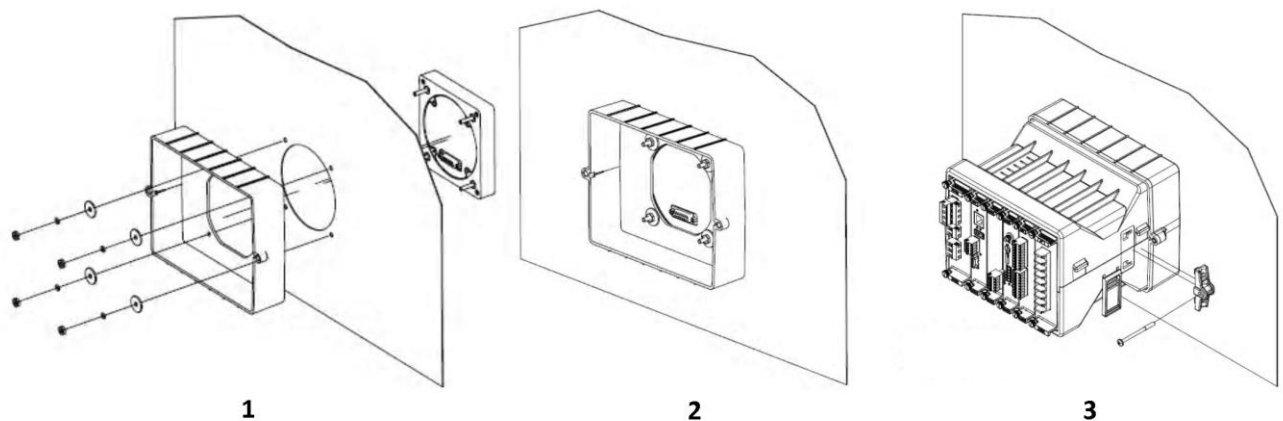## 2.1 Mechanical Installation

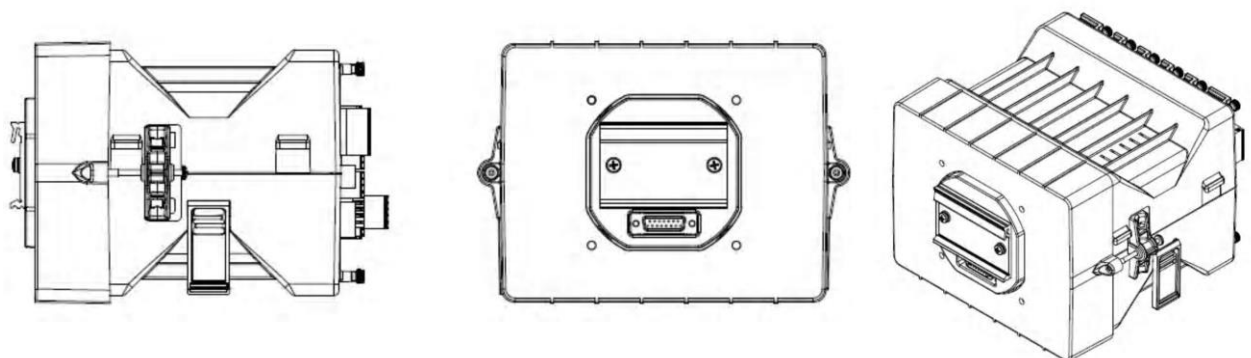*Figure 2-1a Dimensions*

Figure 2-1b Panel Mounting

Figure 2-1c DIN Rail Mounting

2.2 Electrical Installation

2.2.1   Power Source Connection

The PM180 unit has two independent power supplies: main and auxiliary backup power supply. The standard power supply may be connected to an 50-290V AC or 90-290V DC power source. Lower voltage DC power supply options are also available (see *Appendix: Technical Specifications*).

The main power supply connections are:

- AC power: line to VOLTAGES board terminal "L/+"; neutral to VOLTAGES board terminal "N/-".

- DC power: positive to VOLTAGES board terminal "L/+"; negative to VOLTAGES board terminal "N/-".

The auxiliary backup power supply connections:

- AC power: line to AUX. P.S. AC/DC board terminal "L/+"; neutral to AUX. P.S. AC/DC board terminal "N/-"

- DC power: positive to AUX. P.S. AC/DC board terminal "L/+"; negative to AUX. P.S. AC/DC board terminal "N/-".

Copper wiring 1.5-2.5 mm^2 (15 -13 AWG) should be used.

2.2.2   Current Inputs

PM180 has 4 current inputs up to 100A, connected to Relay Protection CT's via CURRENTS board terminal. Copper wiring 2.5 – 6 mm^2 (10 AWG) should be used.

2.2.3   Ground

Connect the chassis ground of the *PM180* to the switchgear earth ground using dedicated wire greater than 2 mm^2/14 AWG.

2.2.4   Voltage Inputs

PM180 models have 3 AC Y-connected voltage inputs of 690V (phase-to-phase) and neutral, and one separate isolated AC/DC voltage input of 400V.

2.2.5   Wiring Configurations

Use any of the seven wiring configurations shown in Figures 2-3, 2-4, 2-5, 2-6, 2-7, 2-8 or 2-9.

| Wiring Configuration		
(See parameter setup instructions in Section 4.1)	Code for Setup	See Figure:
3-wire direct connection using 2 CTs (2-element)	3dir2	2-3
4-wire WYE direct connection using 4 CTs (3-element)	4Ln3 or 4LL3	2-4
4-wire WYE connection using 3 PTs, 3 CTs (3-element)	4Ln3 or 4LL3	2-5
3-wire open delta connection using 2 PTs, 2 CTs (2-element)	3OP2	2-6
4-wire WYE connection using 2 PTs, 3 CTs (2½-element)	3Ln3 or3LL3	2-7
3-wire open delta connection using 2 PTs, 3 CTs (2½ - element)	3OP3	2-8
4-wire delta direct connection using 3 CTs (3-element)	4Ln3 or 4LL3	2-9
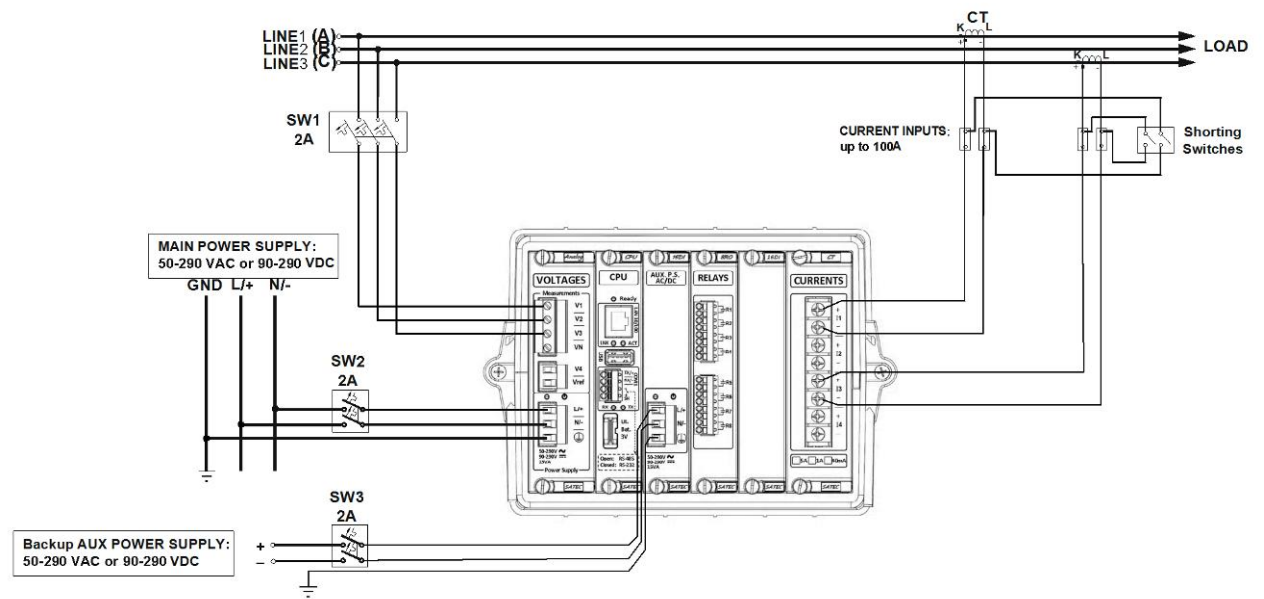
Figure 2-3 Three Wire Direct Connection Using 2 CTs (2-element)
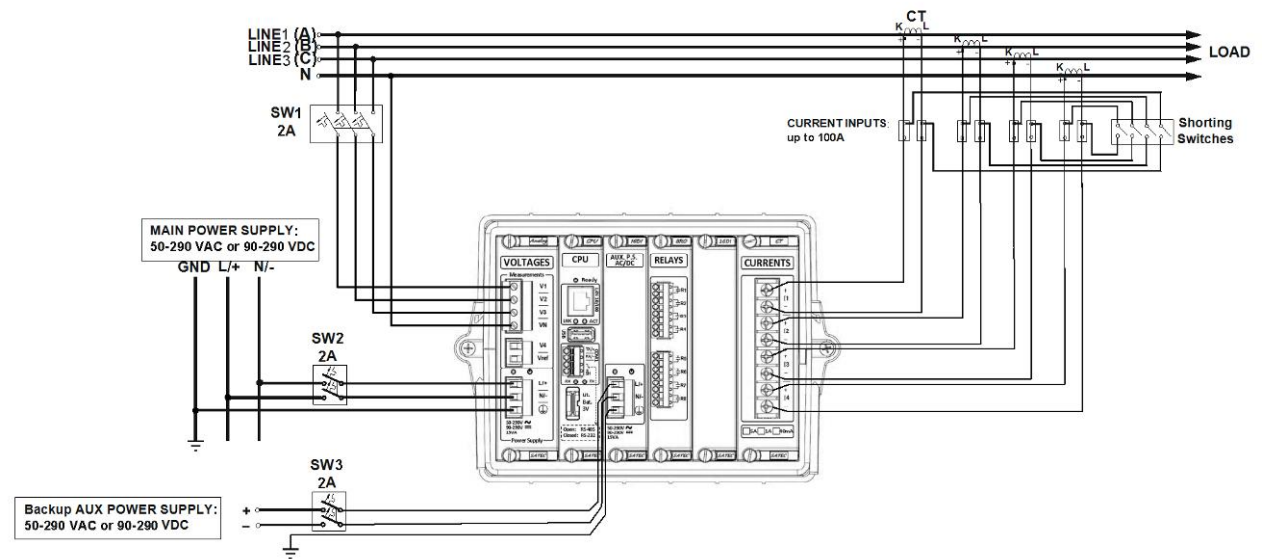
Wiring Mode = **3dir2**

Figure 2-4 Four Wire WYE Direct Connection Using 4 CTs (3-element)

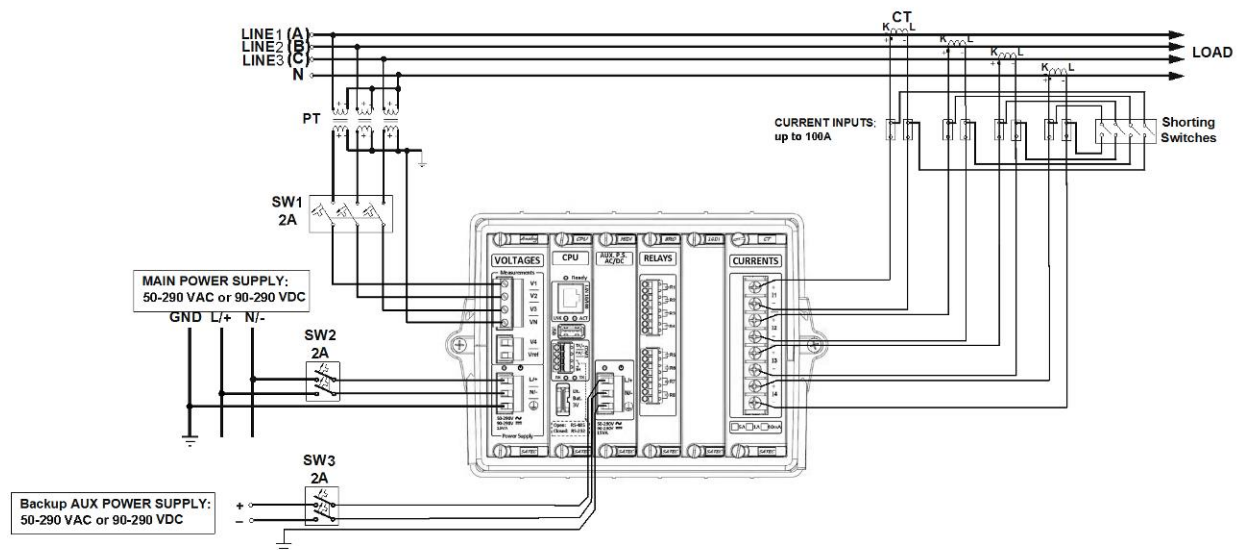Wiring Mode = **4LL3** or **4Ln3**

Figure 2-5 Four Wire WYE Connection Using 3 PTs, 4 CTs (3-element)

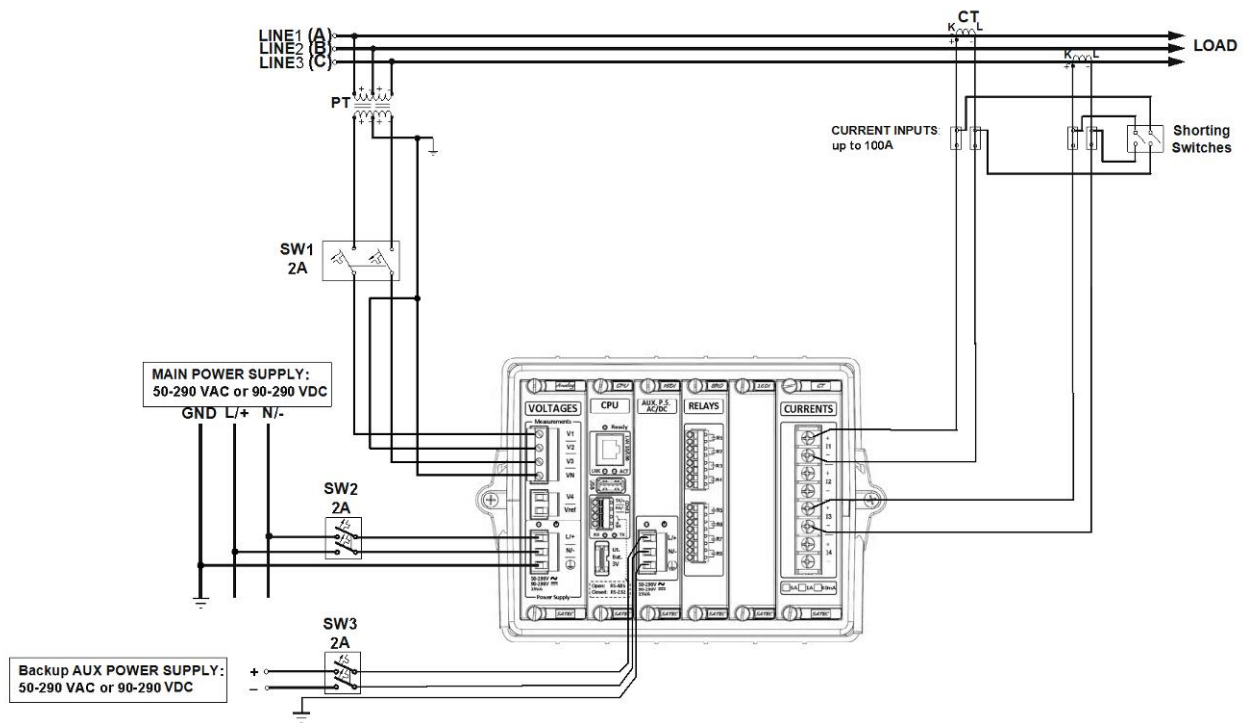Wiring Mode = **4LL3** or **4Ln3**

Figure 2-6 Three Wire Open Delta Connection Using 2 PTs, 2 CTs (2-element)
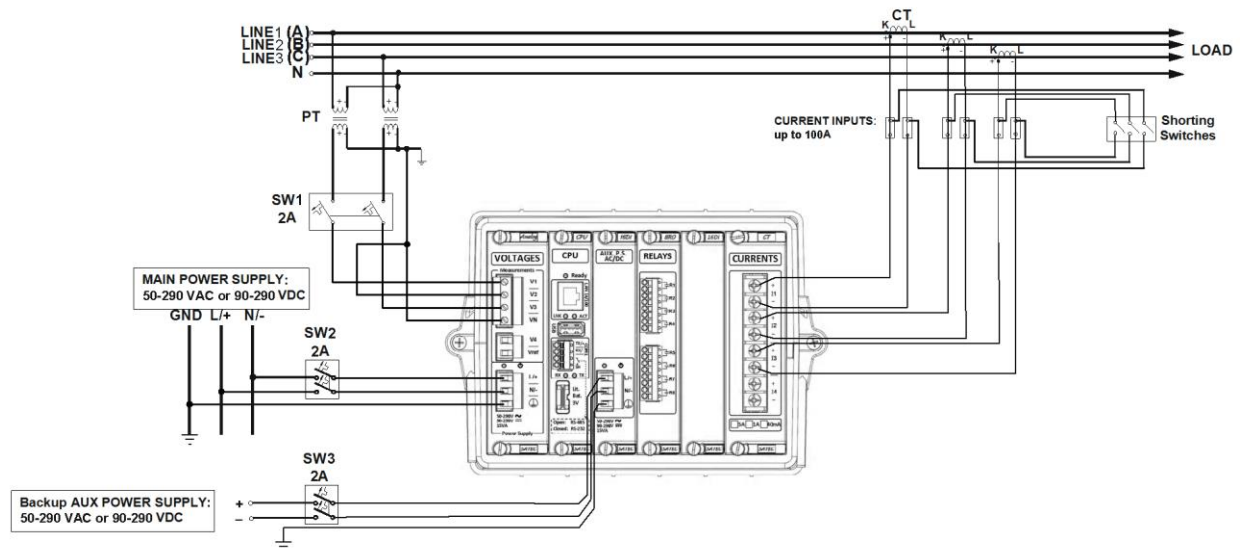
Wiring Mode = **3OP2**

Figure 2-7 Four Wire Wye Connection Using 2 PTs, 3 CTs (2½-element)
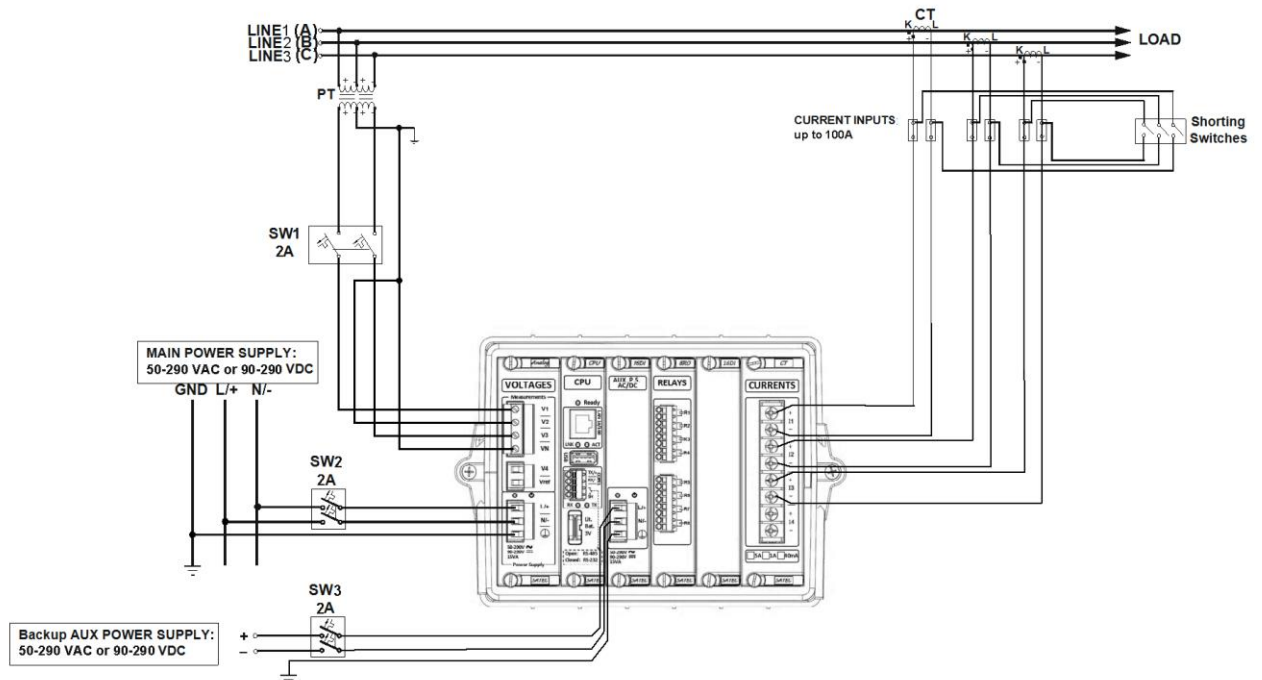
Wiring Mode = **3LL3** or **3Ln3**

Figure 2-8 Three Wire Open Delta Connection Using 2 PTs, 3 CTs (2½-element)
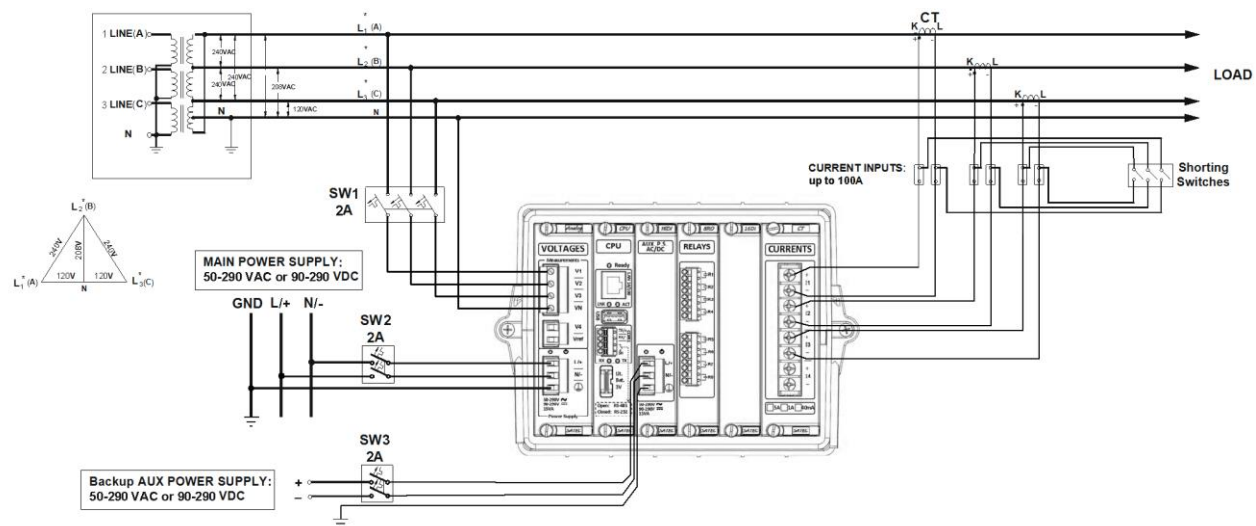
Wiring Mode = **3OP3**

Figure 2-9 Four Wire Delta Direct Connection Using 3 CTs (3 element)

Wiring Mode = 4LL3 or 4Ln3

2.2.6 Digital Inputs

16 optically isolated digital inputs in one digital input module are provided for status monitoring and external synchronization of power demand period and time. Dry or wet contacts may be connected to these inputs, as shown in *Figures 2-10* and *2-11*. All common terminals are internally connected together.
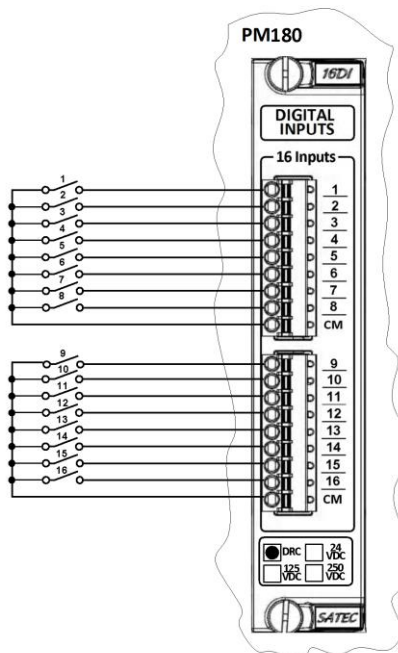
Dry Contacts

Figure 2-10 Digital Input Connection for Dry Contacts

Wet Contacts

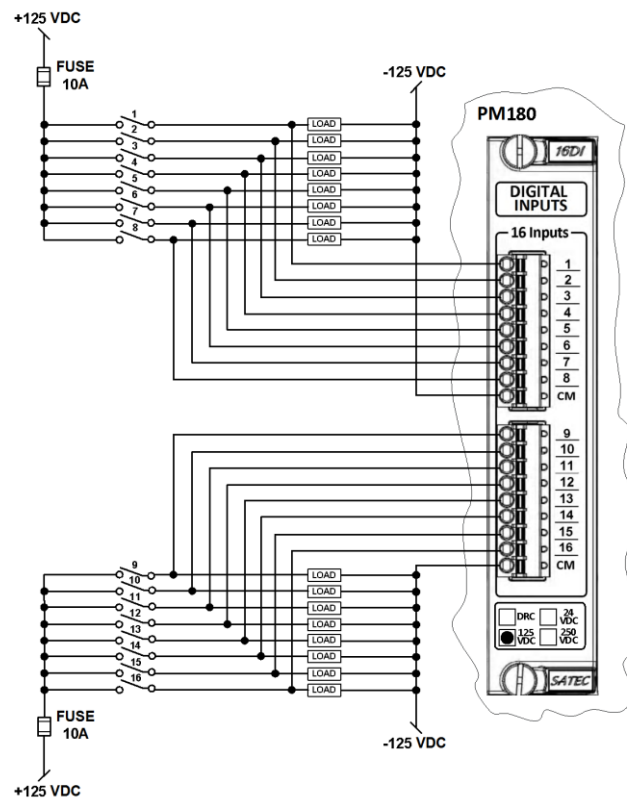Wet contact options are: 24V, 125V or 250V DC (voltage varies according to wet contact option).

Figure 2-11 Digital Input Connection for Wet Contacts

PM180 Substation Automation Unit **9**

2.2.7 Relays

8 relays in one Relay Output Module are provided for alarms, remote control or energy pulsing, as shown in *Figure 2-12*. For ratings, see *Appendix: Technical Specifications*.

Figure 2-12 Relays Connection
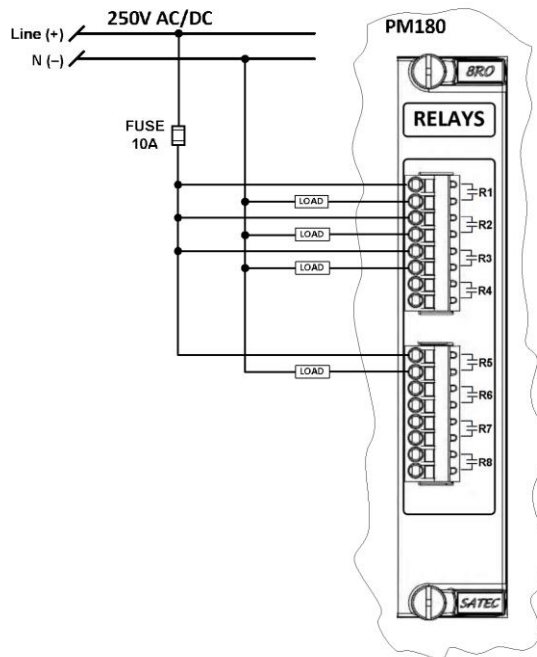
2.2.8 Digital Input/Output

4 optically isolated digital inputs and 2 relay outputs in module are provided for status monitoring and external synchronization of power demand period and time, and for alarms, remote control or energy pulsing, as shown in *Figures 2-12*. All common terminals are internally connected together.

Figure 2-12a Digital Inputs and Relays Connection
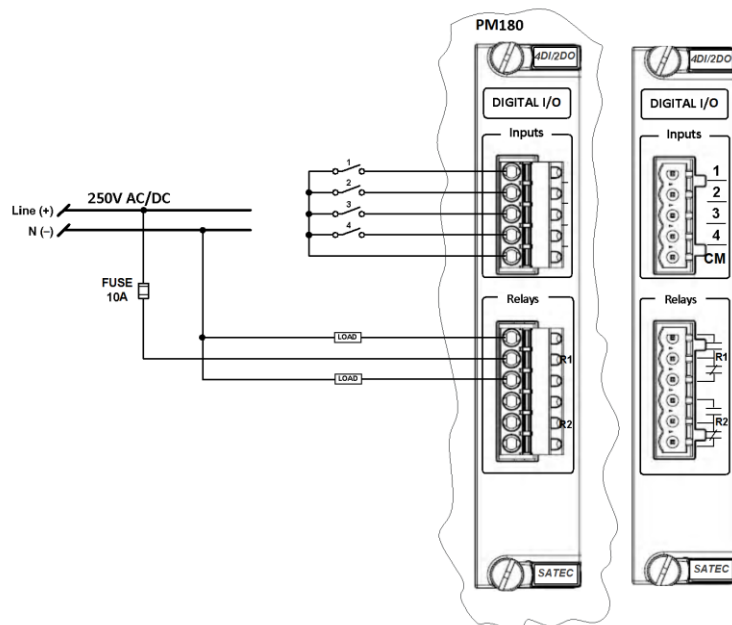
2.2.9   Analog Input/Output

The *PM180* provides 4 optically isolated analog inputs and 4 analog outputs with internal isolated power supply. Current input/output options are: 0-20 mA and 4-20 mA (current loop load of up to 500 Ohm), 0-1 mA and ±1 mA (current loop load of up to10 kOhm), as shown in *Figure 2-13*.
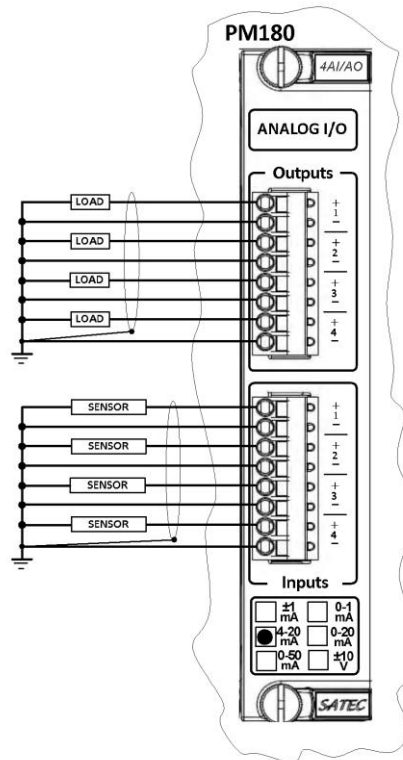
Figure 2-13 Analog Input/Output Connection
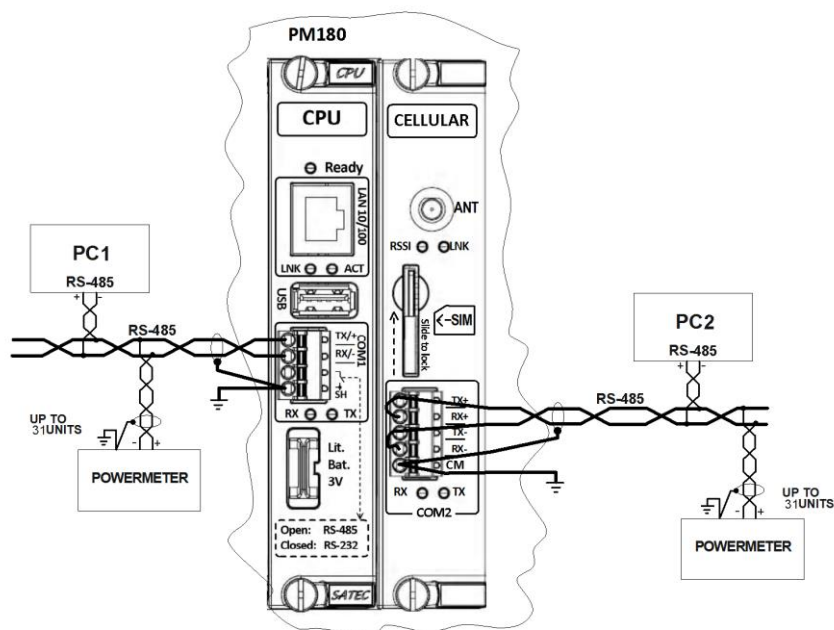
Figure 2-14 Communication Network Connection – RS-422/RS-485

2.3 Location of Modules

The PM180 provides a total of 6 modules slots: 3 fixed slots for ANALOG, CPU and CT factory installed modules and 3 general purpose field installable "hot swap" modules slots for input/output, measurement and communication optional modules. Any type of optional module can be installed in any slot
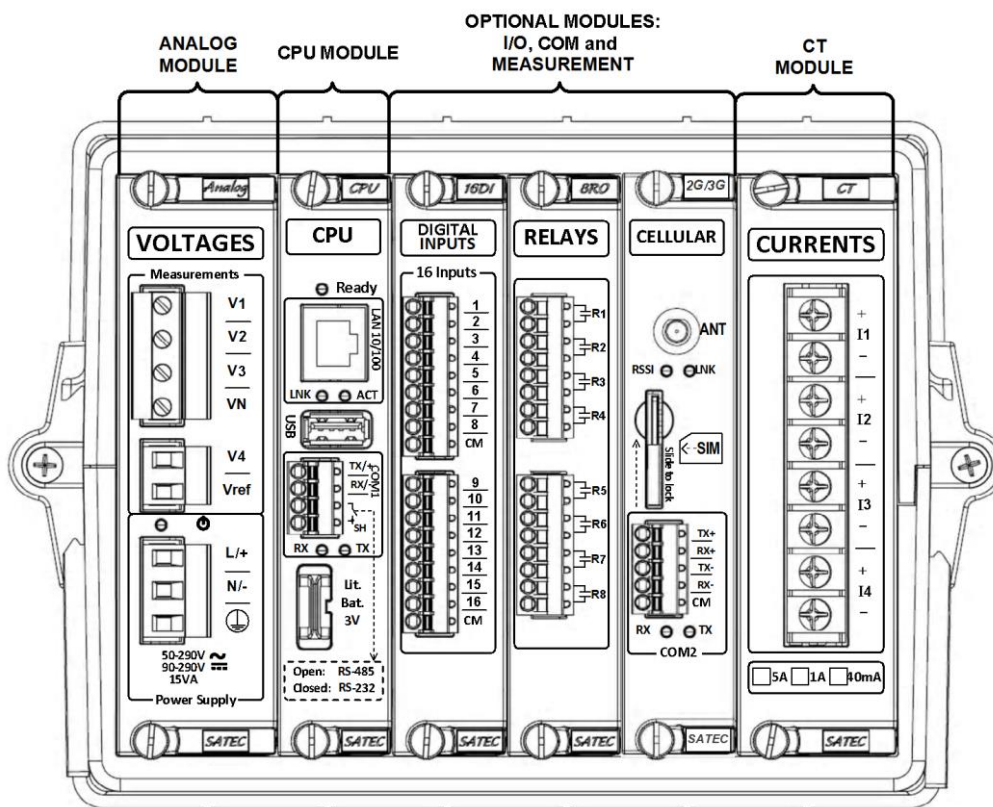
Figure 2-15 Location of Modules

Chapter 3 Communications
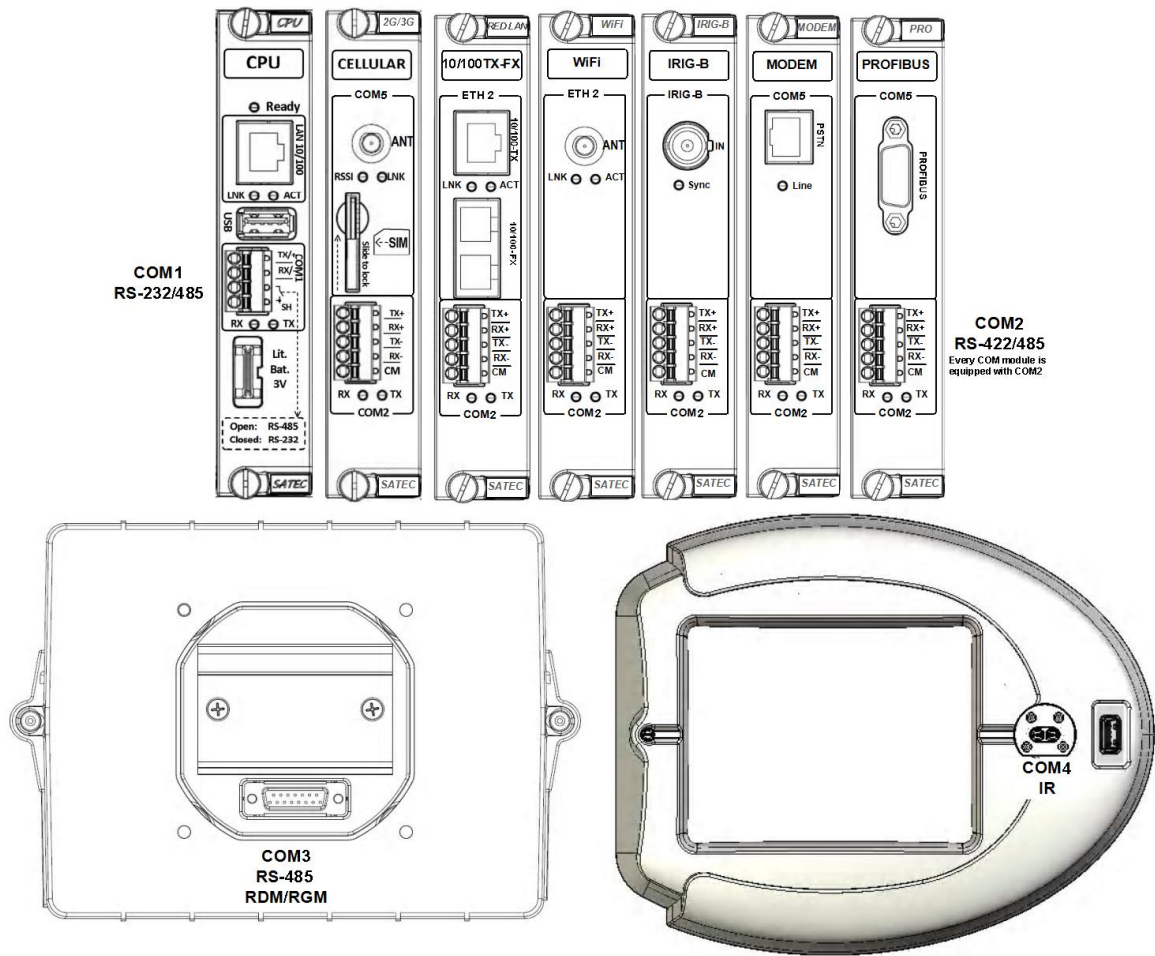
Figure 3-1 RS-232/RS-422/RS-485 Terminal Blocks

COM1, RS-232/485 versatile port is provided CPU module.

COM2, RS-422/485 port is provided by a number of Communication modules: CELLULAR, FIBER, WiFi, PROFIBUS and IRIG-B.

COM3, RS-485 port communicates with any SATEC remote display: RGM180 or RDM.

COM4, IR port is provided in the RGM180 when directly attached to the PM180.

COM5, RS-232 to communicate with modules to activate following communication ports: MODEM port, PROFIBUS port and CELLULAR port.

Computer Connections – RS-232
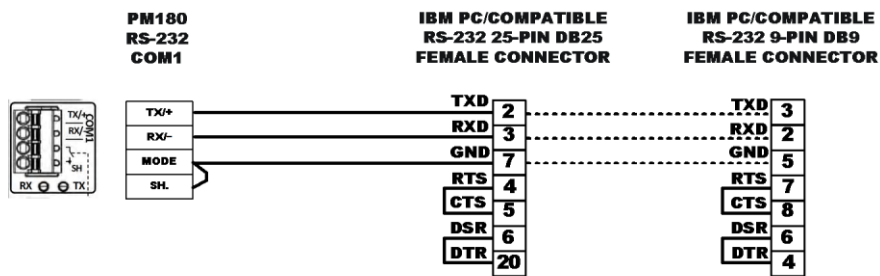
Figure 3-2 RS-232 Simple 3-wire Connection, 9-pin and 25-pin female

External Modem Connections
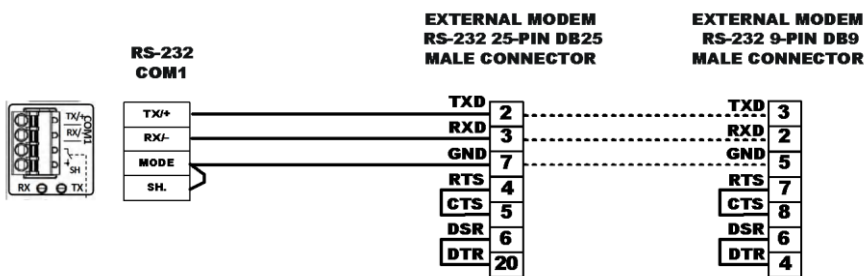
Figure 3-3 RS-232 Simple 3-wire Connection, 9-pin and 25-pin female

Initialization String: ATS0=1&D0&K0&W0

Computer Connections – RS-422/RS-485
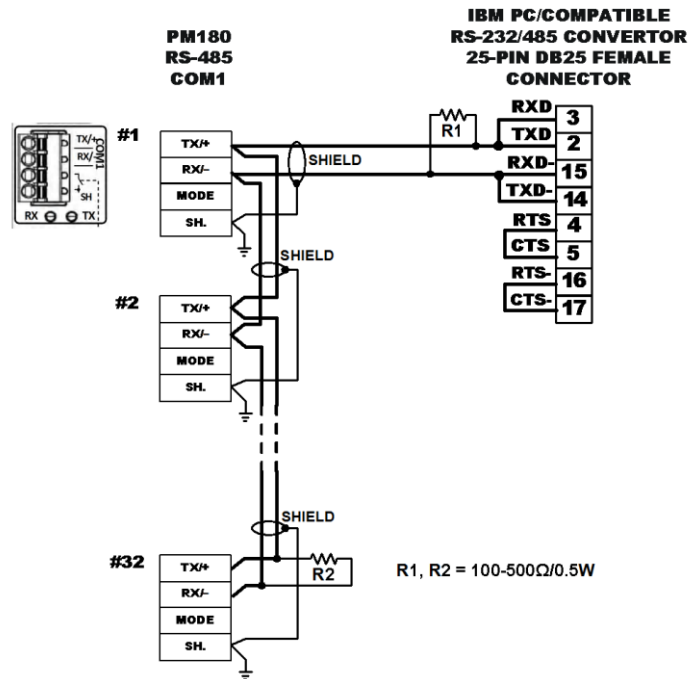
Figure 3-4 RS-485 Multidrop COM1 Connection, 25-pin PC Port
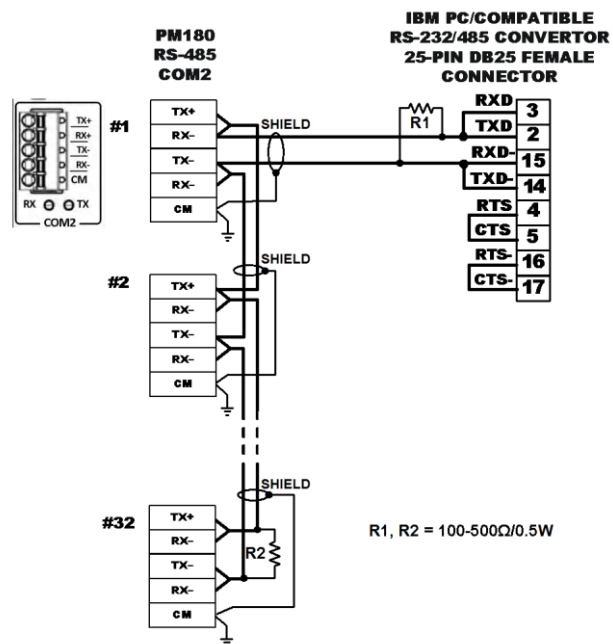
Figure 3-5 RS-485 Multidrop COM2 Connection, 25-pin PC Port
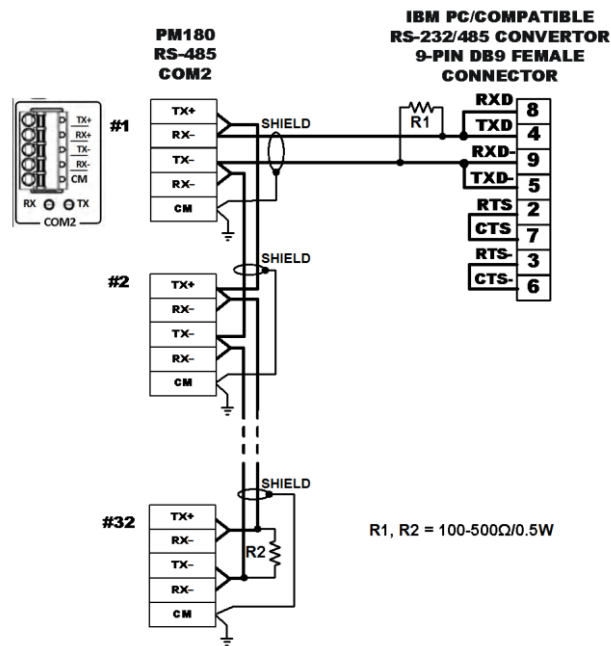
Figure 3-5a RS-485 Multidrop COM2 Connection, 9-pin PC Port
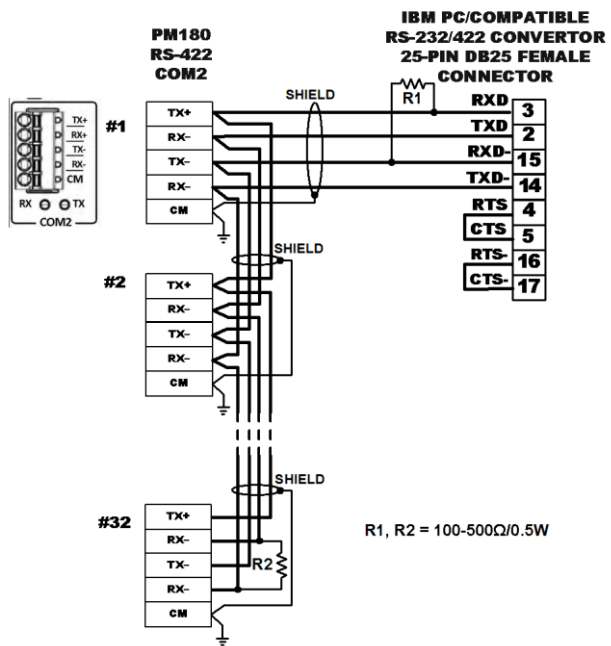
Figure 3-6 RS-422 Multidrop COM2 Connection, 25-pin PC Port
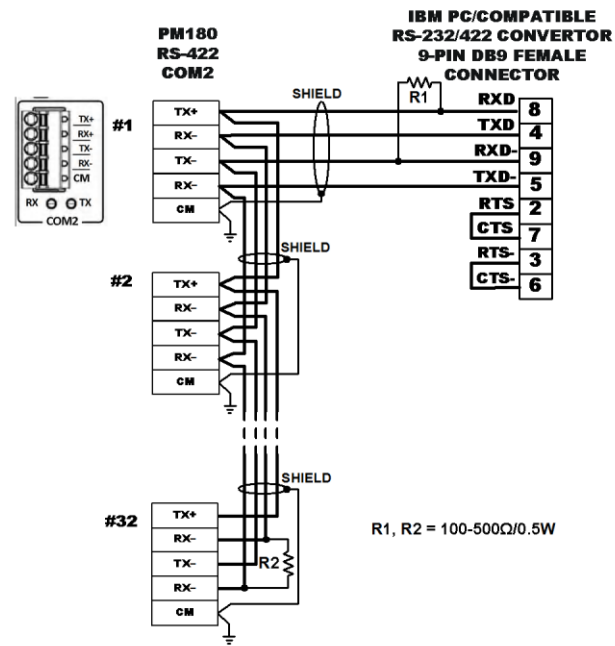
Figure 3-7 RS-422 Multidrop COM2 Connection, 9-pin PC Port

Chapter 4 Replacing the Battery

IMPORTANT

Use CR1225 lithium 3.0 volt battery.

The battery can be replaced while the PM180 is in operation; in PM180 Power Supply is "OFF" the battery can be replaced in the coming 30 minutes from turning OFF the Power Supply without loosing any data. The data may be uploaded and restored in a PC using PAS (see PM180 Operation Manual, Chapter 12) to avoid loosing data.

When the battery level drops below the minimum allowed threshold, the "BATTERY LOW" flag is set and an event is generated in the "Event Log" memory, indicating that the battery should be replaced. Use the following procedure:

1. Use a flat screwdriver to pull the battery holder out from the CPU Panel.

2. Pull the battery from the battery holder

3. Insert the new battery with the correct polarity

Battery polarity (+)

4. Insert the battery holder with the new battery in the CPU panel battery compartment

5. Push the battery holder until a click is heard

Appendix: Technical Specifications

5.1 Environmental Conditions

Operating Temperature: -30°C to 70°C (-22°F to 158°F)

Storage Temperature: -40°C to 85°C (-40°F to 185°F)

Humidity: 0 to 95% non-condensing

Altitude $\leq$ 2000m

5.2 Construction

Overall Dimensions
Width: 220.00 mm (8.66 Inches)

Height: 152 mm (5.98 Inches)

Depth: 210.00 mm (8.26 Inches)

Weight: 2.5kg (5.51 Lb)

Materials
Enclosure: Polycarbonate

Panels: Polycarbonate

PCB. : FR4 (UL94-V0)

Terminals: PBT (UL94-V0)

Connectors-Plug-in type: Polyamide PA6.6 (UL94-V0)

Packaging Case: Carton and Stratocell (Polyethylene Foam) Brackets

Labels: Polyester film (UL94-V0)

5.3 Power Supply

Isolation: 4kV AC @ 1mn

Rated input: 50-290VAC 50/60 Hz, 90-290VDC, Burden 15W

12 VDC Option: Rated input 9.6-19 VDC

24 VDC Option: Rated input 19-37 VDC

48 VDC Option: Rated input 37- 72 VDC

5.4 Input Ratings

AC Voltage Inputs: V1, V2, V3, VN
Operating Range: 690VAC line-to-line, 400VAC line-to-neutral

Direct input and input via PT (up to 828VAC line-to-line, up to 480VAC line-to-neutral)

Input Impedance: 1 MOhm

Burden for 400V: < 0.16 VA

Burden for 120V: < 0.015 VA

Overvoltage Withstand: 1000VAC continuous, 2500VAC for 1 second

Galvanic Isolation: 4kV AC @ 1mn

Wire Size: up to 10 AWG (up to 6 mm^2)

Terminals Pitch 7.5 mm

AC/DC Voltage Input: V4, Vref

Operating Range: 400VAC

Direct input and input via PT (up to 480VAC) or Battery input

Input Impedance: > 10MOhm

Burden for 400V: << 0.01 VA

Burden for 120V: << 0.01 VA

Overvoltage Withstand: 1000VAC continuous, 2500VAC for 1 second

Galvanic Isolation: 4kV AC @ 1mn

Wire Size: 10 AWG (up to 6 mm^2)

Terminals Pitch: 7.5 mm

Standard AC Current Inputs: I1, I2, I3, I4

Input via CT with 5A secondary

Operating range: maximum continuous 10A/20A RMS (ANSI C12.20 and IEC 62053-22)

Fault Currents: up to 100A RMS (20x)

Burden: < 0.15 VA

Overload Withstand: 20A RMS continuous, 250A for 1 second

Wire Size: 10 AWG (2.5 to 6 mm^2)

Terminals Pitch: 9.5 mm

Input via CT with 1A secondary

Operating Range: continuous 4A RMS (ANSI C12.20) or 2A RMS (IEC 62053-22)

Fault Currents: up to 20A RMS

Burden: < 0.02 VA

Overload Withstand: 4A RMS continuous, 50A for 1 second

Wire Size: 10 AWG (2.5 to 6 mm^2)

Terminals Pitch: 13 mm

5.5 Plug-In I/O Ratings

Digital Inputs (up to 3 I/O Modules)

Scan time: 1 ms @ 60Hz, 1.25 ms @ 50Hz.

16 optically isolated, dry contact sensing (voltage-free):

Internal power supply 24 VDC

Sensitivity: open @ input resistance >16kOhm, closed @ input resistance <10kOhm

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 3.81 mm

16 optically isolated, wet contact sensing:

External Power Supply: 24 VDC

Sensitivity: open @ input resistance >16kOhm, closed @ input resistance <10kOhm

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 3.81 mm

16 optically isolated, wet contact sensing:

External Power Supply: 125 VDC

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 3.81 mm

16 optically isolated, wet contact sensing:

External Power Supply: 250 VDC

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 3.81 mm

Relay Outputs (up to 3 I/O Modules)

8 relays SPST Form A

Contact rating:

> 10A @ 250V AC, 5A @ 30V DC
>
> 0.25A @ 250V DC (sw. Volt.)
>
> 5A 250V DC (sw. Cur.)

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 3.81 mm

Update time: 1/2 cycle

Analog Inputs/Outputs (up to 2 I/O Modules)

4 Analog Inputs:

Ranges (upon order):

> $\pm$1 mA (100% overload)
>
> 0-20 mA
>
> 4-20 mA
>
> 0-1 mA (100% overload)

Accuracy: 0.5% FS

Scan time: 2 cycles

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 5 mm

4 Analog Outputs:

Ranges (upon order):

> $\pm$1 mA, maximum load 10 kΩ (100% overload)
>
> 0-20 mA, maximum load 510 Ω
>
> 4-20 mA, maximum load 510 Ω
>
> 0-1 mA, maximum load 10 k Ω (100% overload)

Accuracy: 0.5% FS

Update time: 2 cycles

Wire Size: 12 AWG (up to 2.5 mm^2)

Terminals Pitch: 5 mm

5.6 Communication Ports

COM1

Serial EIA RS-232/485 optically isolated port

Withstanding Insulation: 4kV AC @ 1 mn

Connector Type: removable, captured-wire, 4 terminals.

Wire Size: up to 12 AWG (up to 2.5 mm^2).

Baud Rate: up to 115,200 bps.

Supported Protocols: MODBUS RTU/ASCII, DNP 3.0

COM2

Serial EIA RS-422/RS-485 optically isolated port

Withstanding Insulation: 4kV AC @ 1 mn

Connector type: removable, captured-wire, 5 terminals.

Wire Size: up to 12 AWG (up to 2.5 mm^2).

Baud Rate: up to 115,200 bps.

Supported Protocols: MODBUS RTU/ASCII, DNP 3.0

COM3

Serial EIA RS-485 optically isolated port for the RDM.

Withstanding Insulation: 2.5kV AC @ 1 mn

Connector Type: DB15.

Baud Rate: up to 115,200 bps.

Supported Protocols: MODBUS RTU/ASCII, DNP 3.0

USB Port

Isolated USB 1.1 port.

Withstanding Insulation: 4kV AC @ 1 mn

Connector Type A male, standard USB cable, max. length 2 meters

Supported protocols: MODBUS RTU

Ethernet Port (standard)

Transformer-isolated 10/100Base-T port

Withstanding Insulation: 4kV AC @ 1 mn

Connector Type: RJ45 modular.

Supported Protocols: MODBUS TCP (Port 502), DNP 3.0/TCP (Port 20000), IEC 61850

Number of simultaneous connections (sockets): 5.

Ethernet Port (backup - optional)

Transformer-isolated 10/100Base-T port

Optical-isolated 100Base FX

Wireless IEEE 802.11b/g

Withstanding Insulation: 4kV AC @ 1 mn

Connector Type TX port: RJ45 modular

Connector Type FX port: SC

Connector Type WiFi port: SMA

Supported Protocols: MODBUS TCP (Port 502), DNP 3.0/TCP (Port 20000), IEC 61850

Number of simultaneous connections (sockets): 5.

Modem Port

Transformer-isolated internal 56K modem.

Withstanding Insulation: 2.5kV AC @ 1 mn

Connector Type: RJ11.

Supported Protocols: MODBUS RTU/ASCII, DNP 3.0

Infrared Port

Optional optical IEC/ANSII head

Baud Rate: up to 115,200 bps.

Supported Protocols: MODBUS RTU/ASCII, DNP 3.0

5.7 Real-time Clock

Accuracy: maximum error 5 seconds per month @ 25°C

5.8 IRIG-B Port

Optically isolated IRIG-B port

Withstanding Insulation: 4kV AC @ 1 mn

Time code signal: non-modulated (pulse-width coded).

Level: unbalanced 5V.

Connector Type: BNC.

Recommended cable: 51Ohm low loss - RG58A/U (Belden 8219 or equivalent), TNC connector

Recommended GPS time code generator: Masterclock GPS-200A

5.9 Log Memory

Standard onboard memory: 250 Mbytes.

5.10 Remote Display Module

RDM

Display: high-brightness seven-segment digital LEDs, two 4-digit windows and one 6-digit windows

Keypad: 6 push buttons

Communication: EIA RS-485 port with 12V supply voltage

Connector Type: DB15

Wires Size: up to 12 AWG (up to 2.5 mm^2)

Distance: up to 1000m (4000 feet)

RGM180

5.7 Inch Touch-Panel LCD graphic TFT display

Resolution: 320 x 240

Communication:

EIA RS-485 port with 12V supply voltage

Connector Type: DB15

Wires Size: up to 12 AWG (up to 2.5 mm^2)

Distance: up to 1000m (4000 feet)

10/100Base T ETHERNET port with 12 V supply voltage and PoE (Power over ETHERNET)

Connector Type: RJ-45 and DB15

Operating temperature: -20°C - +70 °C

5.11 Standards Compliance

Directive complied with: EMC: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC

LVD: 72/23/EEC as amended by 93/68/EEC and 93/465/EEC

Harmonized standards to which conformity is declared: EN55011:1991; EN50082-1:1992; EN61010-1:1993; A2/1995

ANSI C37.90.1 1989 Surge Withstand Capability (SWC)

EN50081-2 Generic Emission Standard - Industrial Environment

EN50082-2 Generic Immunity Standard - Industrial Environment

EN55022: 1994 Class A

EN61000-4-2

ENV50140: 1983

ENV50204: 1995 (900MHz)

ENV50141: 1993

EN61000-4-4:1995

EN61000-4-8: 1993

Accuracy

Active Energy, IEC/AS 62053-22, class 0.2S

Reactive Energy, class 0.5S (under conditions as per IEC 62053-22:2003 @ 0$\leq$ |PF| $\leq$ 0.9)

Power Quality

Harmonics and inter-harmonics measurement

Flicker measurement

Power quality measurement methods A/S

Real time clock backup and accuracy

EMC Immunity:

IEC61000-4-2: Electrostatic discharge, 15kV/8kV – air/contact

IEC61000-4-3: Electromagnetic RF Fields, 10V/m and 30V/m @ 80Mhz – 1000MHz

IEC61000-4-4: Fast Transients burst, 4KV on current and voltage circuits and 2 KV for auxiliary circuits

IEC61000-4-5: Surge 6KV on current and voltage circuits and 1 KV for auxiliary circuits

IEEE C62.41.2-2002: high voltage line surges,

- 100 kHz ring wave – 6kV @ 0.5kA
- 1.2/50 microsecond – 8/20 microsecond Combination Wave – 6kV @ 3kA

IEC61000-4-6: Conducted Radio-frequency, 10V @ 0.15Mhz – 80MHz

IEC61000-4-8: Power Frequency Magnetic Field

IEC61000-4-12: Damped oscillatory waves, CMM 2.5KV and DFM 1KV @ 100KHz and 1MHz

EMC Immunity Protection Relays standard – IEC 60255-22:

IEC 60255-22-1: High frequency burst, 1MHz, 400 pulses/sec, common mode 2.5kV 1MHz, 400 pulses/sec, differential mode 1kV

IEC 60255-22-2: Electrostatic Discharge, 6KV (contact) / 8KV (Air)

IEC 60255-22-3: RF radiated electromagnetic field, 10V/m @ 80MHz to 1000MHz

IEC 60255-22-4: Fast transient, Mains and Measuring inputs: 5/50ns, 50 Ω 4kV, other inputs: 5/50ns, 50 Ω 2kV

IEC 60255-22-5: Surge, Common mode: 1.2/50 µs, 12 Ω 2kV, Differential mode: 1.2/50 µs, 12 Ω 1kV

Emission (radiated/conducted)

EN55022: 1994 Class A (CISPR 22)

FCC p.15 Class A

Construction

Safety

IEC/EN 61010-1

UL 61010-1

Insulation

IEC 62052-11 and NMI stds: Insulation impulse 12KV/40Ω @ 1.2/50 µs

IEC 62053-22 and NMI stds: AC voltage tests related to ground, 4 KV AC @ 1mn

Atmospheric Environment

Operational ambient temperature range: –30°C to +70 °C

Long-term damp heat withstand according to IEC 68-2-3 <95%, +40 °C

Transport and storage temperature range: –40°C to +85 °C

Vibration

IEC 60068-2-6

Shock

IEC 60068-2-27

Panel protection

IEC 60529: IP54 (NEMA type 13)

5.12 Measurement Specifications

Parameter	Full Scale @ Input Range	Accuracy			Range
		% Reading	% FS	Conditions	
Voltage V1-V4	120VxPT @ 120V 400VxPT @ 690V	0.2	0.01	10% to 120% FS	0 to 999,000 V

Line current I1- I4	CT	
		0.2
		0.2
		
		0.2
			
			0.01
			
			0.01
				For ANSI C12.20:
				  1% - 120% FS
				  120% - 400% FS
				For IEC 62053-22:
				  1% - 200% FS
					0 to 9999 A

Fault current I1- I4	CT	2.0		400% - 2000% FS	0 to 9999 A
DC Voltage	125V/220V		0.3	10% - 120%FS	0 to 290VDC
Active power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	 0.2	0.002 0.002	$|PF| \geq 0.5$ and ①	-2,000,000 to +2,000,000 kW
Reactive power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	 0.3	0.002 0.002	$|PF| \leq 0.9$ and ①	-2,000,000 to +2,000,000 kvar
Apparent power	0.36×PT×CT @ 120V 1.2×PT×CT @ 690V	 0.2	0.002 0.002	$|PF| \geq 0.5$ and ①	0 to 2,000,000 kVA
Power factor	1.000		0.35	$|PF| \geq 0.5$, $I \geq 2\%$ FSI	-0.999 to +1.000
Frequency		0.02			40.00 Hz to 70.00 Hz
Total Harmonic Distortion, THD V (I), %Vf (%If)	999.9	1.5	0.2	THD $\geq 1\%$ FS, V (I) $\geq 10\%$ FSV (FSI)	0 to 999.9
Total Demand Distortion, TDD, %	100		1.5	TDD $\geq 1\%$ FS, $I \geq 10\%$ FSI	0 to 100
Active energy Import & Export		Class 0.2 ANSI C12.20-2002 Current class 20 Class 0.2S (IEC 62053-22)			0 to 999,999.999 MWh
Reactive energy Import & Export		Class 0.2 under conditions as per ANSI C12.20-2002 Class 0.2 under conditions as per IEC 62053-22			0 to 999,999.999 Mvarh
Apparent energy		Class 0.2 under conditions as per ANSI C12.20-2002 Class 0.2 under conditions as per IEC 62053-22			0 to 999,999.999 MVAh

Parameter	Full Scale @ Input Range	Accuracy			Range
		% Reading	% FS	Conditions	
Volt-hours		Class 0.2		20% - 120% FS	0 to 999,999.999 kVh
Ampere-hours		Class 0.2		10% - 200% FS	0 to 999,999.999 kAh
Symmetrical components	Voltage FS	1		10% - 120% FS	
	Current FS	1		10% - 200% FS	
	Current FS	3		200% - 2000%FS	
Phasor angles		1 degree			

Key: PT - external potential transformer ratio   ① @ 80% to 120% of voltage FS and 1% to 200% of current FS

CT - primary current rating of external current transformer

FSV - voltage full scale;   FSI - current full scale

V_f- fundamental voltage; I_f - fundamental current

Notes

1. Accuracy is expressed as ± (percentage of reading + percentage of full scale) ± 1 digit. This does not include inaccuracies introduced by the user's potential and current transformers. Accuracy calculated at 1 second average.

2. Specifications assume: voltage and current waveforms with THD ≤ 5% for kvar, kVA and PF; reference operating temperature: 20°C - 26°C.

3. Measurement error is typically less than the maximum error indicated here.