SATEC
Powerful Solutions

EM920

expertmeter™

POWER QUALITY AND REVENUE METER

Installation Manual

DANGER

This symbol indicates the presence of dangerous voltage within and outside the product enclosure that may constitute a risk of electric shock, serious injury or death to persons if proper precautions are not followed.

CAUTION

This symbol alerts the user to the presence of hazards that may cause minor or moderate injury to persons, damage to property or damage to the device itself, if proper precautions are not followed.

NOTE

☞   This symbol directs the user's attention to important installation, operating and maintenance instructions.

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.

Only a duly authorized representative of the manufacturer may open your instrument. 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.

⚡ **DANGER**

Failure to observe the following instructions may result in severe injury or death.
Read the instructions in this manual before performing installation, and take note of the following precautions:

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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 front of the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages and currents 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. **Only qualified personnel familiar with the instrument and its associated electrical equipment must perform setup procedures**.
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.**

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Chapter 1 Introduction

About This Manual

This manual is intended to assist the user in the installation of the *eXpert**meter**™* **EM920** *POWER QUALITY REVENUE METER Unit*. The term '*EM920"* is used herein to refer to all models in the series.

This chapter gives an overview of this manual and an introduction to the *EM920.*

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

Chapter 3, *Communications*, provides drawings for communications connections and instructions for printing electrical parameter readings.

Technical Specifications for the *EM920* are found in the *Appendix*.

About The EM920

The *EM920* series is a of state-of-art multi-microprocessor-based digital instrument, socket meter base, that incorporate the capabilities of a power quality analyzer, energy meter, fault and data recorder and programmable controller, oriented for substation, industrial and commercial areas. 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, transient voltages measurements up to 2KV, fault recording of currents up to 50A, harmonic analysis and disturbance recording. The *EM920 has current classes of 10 A and 20 A and* offers precise active and reactive energy metering in 4 quadrants, Power Quality Analyzer according to EN50160 Standard, all the basic metering, control, and fault and event recording capabilities

The *EM920* socket meter is designed to fit into S-Base meter sockets and A-to-S Base adapters. The meter supports form factors 9S/9A.

Features

The *EM920* combines in a single enclosure:

- Precise Class 0.2 Active Energy and Power Demand Meter and better, Multiple Tariffs & Time-Of-Use (TOU, 16 Summary energy and demand registers for substation energy management, accumulation of energy pulses from external watt-meters, block and sliding demands), transformer and line losses, unique anti-tampering and self-test functions
- State of the art Power Quality Recorder (onboard PQ analyzer according to EN50160; programmable thresholds with hysteresis; ready-for-use reports; sags/swells, interruptions, frequency variations; flicker, temporary overvoltages, transient overvoltages, voltage unbalance, harmonic and interharmonics voltages)
- Digital Fault Recorder (onboard fault detector - programmable fault, up to 50 Amps fault currents, zero-sequence currents and volts, current and volt unbalance; under-voltage, neutral current;
- Event Recorder for logging internal diagnostics events, control events and I/O operations
- Four fast Waveform Recorders; selectable AC sampling rate of 32 - 1024 samples per cycle; 20 pre-fault cycles, 1-ms resolution for digital inputs monitoring; up to 3 min of continuous recording with an 8 M-byte onboard memory at a rate of 32 samples per cycle, expandable up to 16 M-byte at meter shop
- Sixteen fast Data Recorders (from ½ 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 (32 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 of volts and amps, powers, power factors, neutral current)
- Demand Meter (amps, volts, harmonic demands)
- Harmonic Analyzer (to 128'Th harmonic volts and amps, power harmonics and power factor, phasor, symmetrical components)
- 16 programmable timers from ½ cycle to 24 hours for periodic recording and triggering operations on a time basis
- Isolated Three-Phase Power Supply unit from the measured voltage inputs, according to the voltage measurement input range:
  - Low Range measurement input nominal rating – "U" Model: 57.7V AC to 120V AC (L-N)

– High Range measurement input nominal rating – standard Model: 120V AC to 277V AC (L-N)
- On board 2 Digital optically isolated Fast Inputs and 1 KYZ relay output.
- Auxiliary power supply option – AC/DC and Low DC options are available in "U" model only
- High resolution 4' Graphic LCD display
- Four slots for option modules

AC/DC Inputs

- Three AC voltage inputs - up to 480VAC direct line-to-line input voltage, for feeding and measurement; high impedance input (>10MΩ)
- Four AC voltage inputs - up to 2KV peak direct line-to-ground and neutral-to-ground input voltage
- Three standard isolated AC current inputs (FORM 9) and optional fourth current input, 5A nominal input currents and up to 50 A fault overload current
- Optional isolated AC/DC power supply input – up to 4KV AC insulation withstanding
- Optional isolated low DC power supply input – up to 4KV AC insulation withstanding

Input/Outputs

The *EM920* is equipped with two fast digital inputs (DI), in the basic instrument, eight digital inputs (8DI module) and six digital outputs (6RO module) optional modules

- DI (basic) – 2 Digital inputs – optically isolated input; dry contact, programmable de-bounce time from 1 ms to 1 sec; free linkage to Sequence-of-Events Recorder, Fault Recorder, control setpoints, pulse counters for Energy/TOU subsystem)
- 8DI (optional module)– 8 Digital inputs – optically isolated input; dry contact, programmable sampling rate from ½ cycle to 1 sec; control setpoints, pulse counters for Energy/TOU subsystem)
- KYZ relay output (basic)
- 6RO (optional module) – 2 relay types: 2 x Electromechanic Relays – EMR FORM A and 4 x Solid State Relays – SSR Form C, unlatched, latched and pulse operations, failsafe operation for alarm notifications; programmable pulse width; direct remote relay control through communications
- 4AO (optional module), 4 Analog Outputs with 5 basic current options (0-20mA, 4-20mA, 0-1mA and ± 1mA)
- TRM (optional module), analyzing transient voltage between phase and ground, up to 2 kV and sampling rate up to 1024 samples per cycle

Communications

The *EM920* has extensive communications capabilities:

- On-board Infrared port, isolated RS-485 port and USB Device port (MODBUS RTU/ASCII and DNP3.0 protocols)
- ETH (optional module), including:
  – Versatile RS-232/485 universal serial communications port (up to 115,200 bps, MODBUS RTU/ASCII and DNP3.0 protocols)
  – Ethernet 10/100 Base-T port (MODBUS/TCP or DNP3.0/TCP protocols, up to five non-intrusive simultaneous connections, Telnet service port)
  – 1-ms satellite-synchronized clock - IRIG-B format time-code input
- Cellular GPRS modem (MODBUS/TCP or DNP3.0/TCP protocols)
- Dial Up MODEM (optional module), including:
  – Versatile RS-232/485 universal serial communications port (up to 115,200 bps, MODBUS RTU/ASCII and DNP3.0 protocols)
  – PSTN MODEM port (MODBUS/RTU, MODBUS/TCP or DNP3.0, DNP3.0/TCP protocols, up to five non-intrusive simultaneous connections, Telnet service port)
  – 1-ms satellite-synchronized clock - IRIG-B format time-code input

Upgradeable Firmware

The *EM920* 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/RS-485, USB port or Ethernet port.

Socket Meter Overview

FM – FORM designation
CL – Current Class
CA – Accuracy Class
Kh – Watthour meter constant
V – Rated Voltage
W – Wiring configuration
Freq. – Working Frequency
TA – Test amperes

WATT – watthour pulse LED

VAR – varhour pulse LED

IR - Optical Port

LCD GRAPHIC Display

DEMAND RESET sealed button

User Navigator buttons

VTR – Voltage Transformer Ratio

kWh constant

CTR – Current Transformer Ratio

TEST Button under cover

Replaceable Battery area

FM 9S
CL 20
CA 0.2
Kh 0.25
V~ 57-120
W 4WY
Freq 50/60Hz
TA 2.5

EM920
S/N 123456789

CTR :5   VTR :1
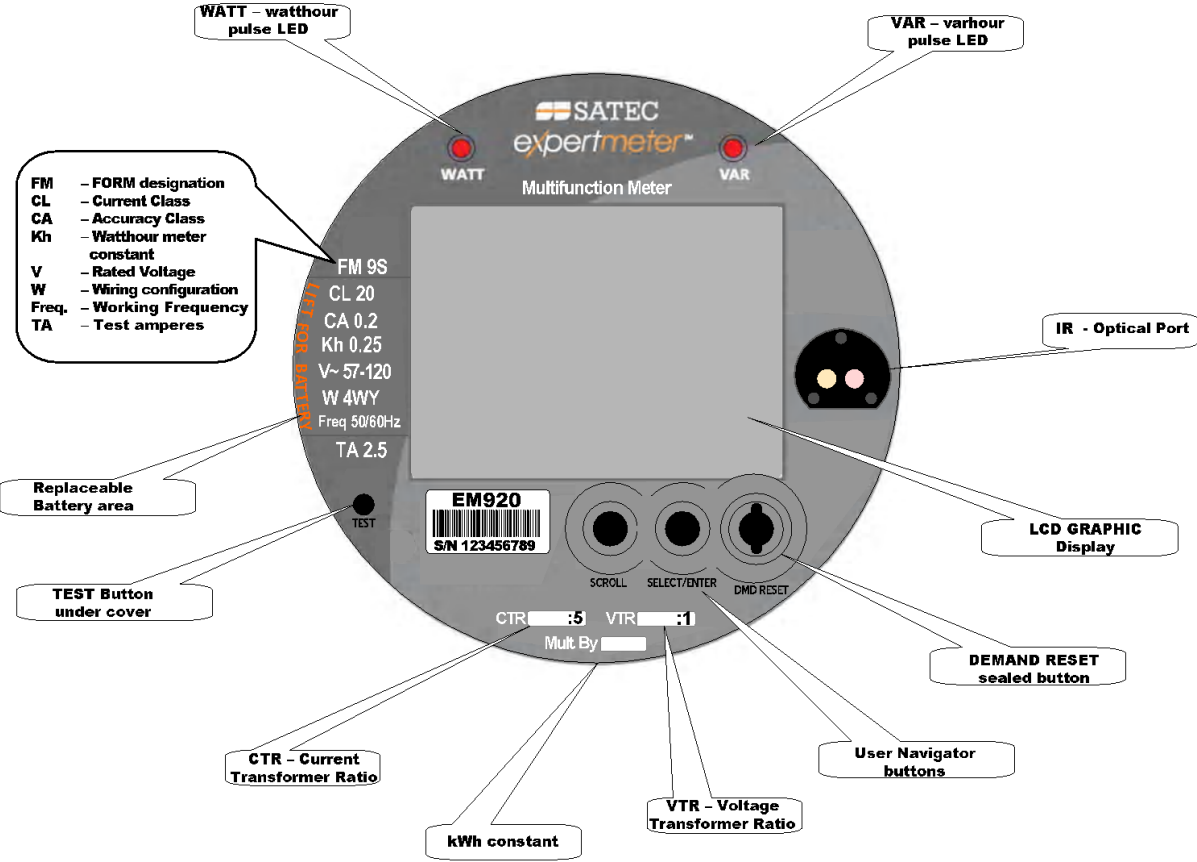Mult By

SCROLL   SELECT/ENTER   DMD RESET

Figure 1: Front view - Nameplate description

Chapter 2 Installation

The *eXpertmeter*™ **EM920** Socket meter is designed to mount into a standard meter socket. Follow the Installation summary below, to ensure that the unit is installed securely. The *EM920* series can be mounted outside or in an enclosed and protected environment, such as in a switchgear cabinet. You may install a switch or circuit breaker nearby and label it clearly as the monitor's disconnecting mechanism.

Preliminary installation

Examine the labels to verify that the meter you are installing is the correct form factor and service type. Make sure that the socket and meter current class ratings are compatible.

- Make sure that all communication and auxiliary power wiring is accessible in case disconnection is required for any reason.
- Before applying power to the meter, install batteries if not installed at the factory and check the connections if they are installed. **POWER MUST BE OFF TO INSTALL THE INTERNAL BATTERY!**
    See Replacing Battery paragraph to install the Internal Battery
- Before inserting or unplugging meter to/from socket POWER must be denergized.
- Insert the meter into the socket, making sure that the unit blades are firmly within the jaws of the socket.
- The meter installation must be installed far enough (at least 3ft) from the high power line busses

Mechanical Installation

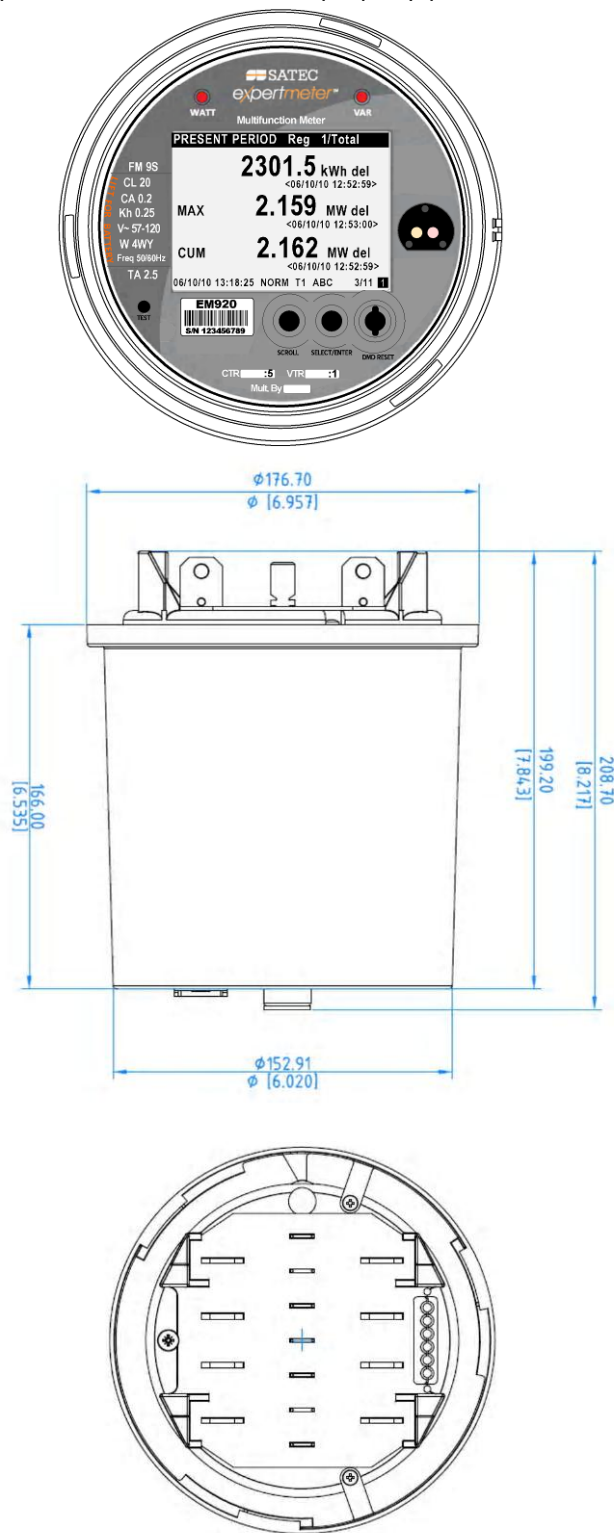Refer to the figures provided in this section to properly perform the mechanical installation.

Figure 2: EM920 - FORM 9S Dimensions

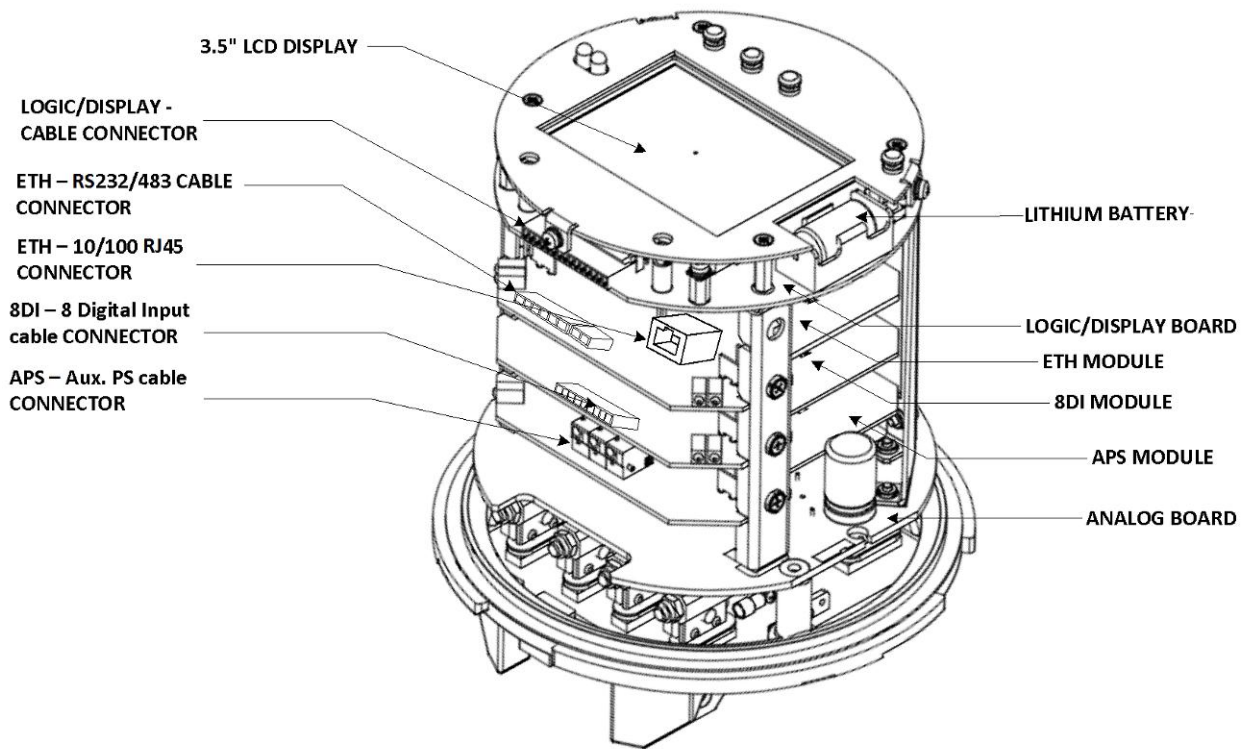# Physical Description

Device Structure

Figure 3: EM920 internal structure

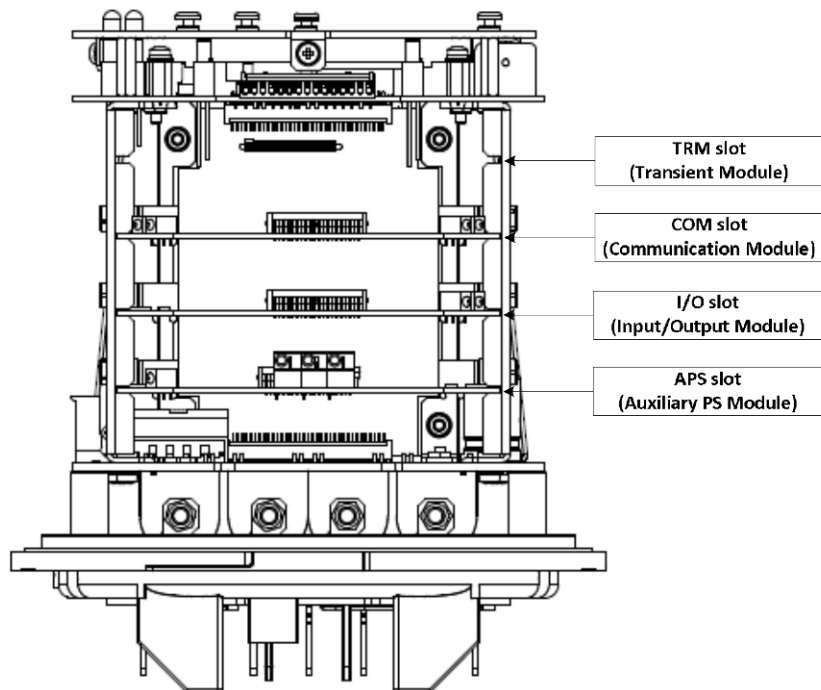## Optional Modules location

Figure 4: EM920 internal structure
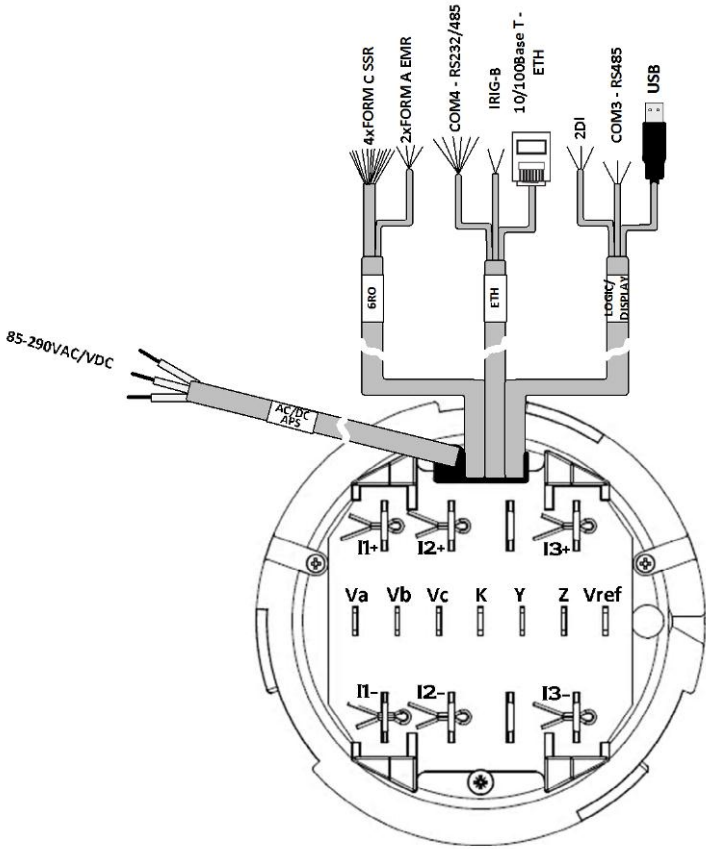
Meter External connections

Figure 5:Meter Base – rear view

Electrical Installation

⚠️ Before installing, ensure that all incoming power sources are shut OFF. Failure to observe this practice can result in serious or even fatal injury and damage to equipment.

Voltage Inputs

There are 3 AC Y-connected voltage inputs of 100-480 VAC (phase-to-phase) and neutral, via socket meter blades.
The *EM920* Power Supply Inputs are the same as the Voltages Inputs

Current Inputs

There are 4 current inputs up to 50A, connected to external CT's via socket meter blades.

Ground Input

Make sure the *EM920* socket is properly connected to ground

Typical Installation

⚠️ Before installing, ensure that all incoming power sources are shut OFF and are protected with a slow blow fuse of 2A (SW1 and SW3), and short the current inputs (SW2)
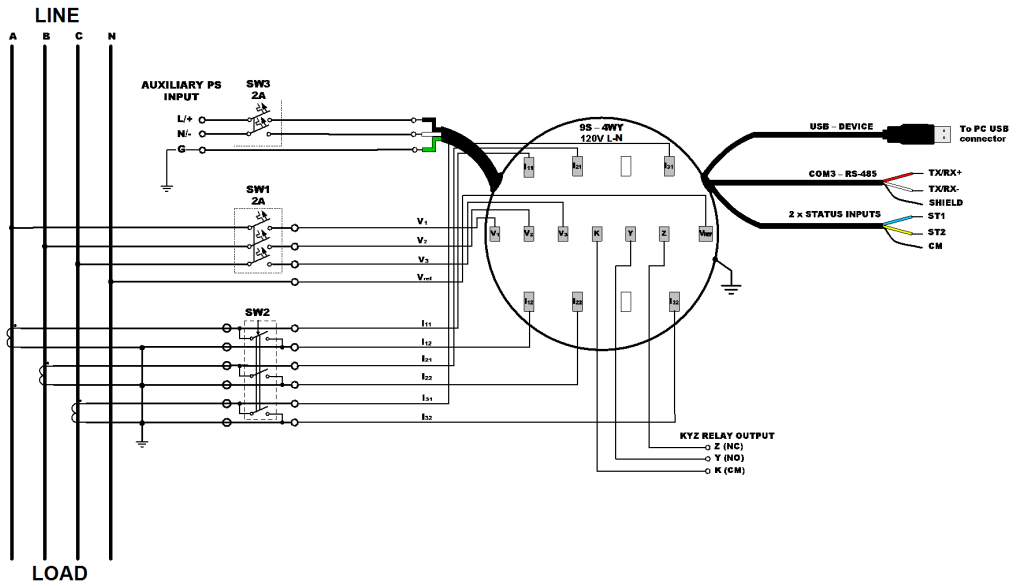

Figure 6: FORM 9 Typical Electrical Installation

FORM 5/35/6/36/9 Wiring Configurations

Available wiring modes are listed in the following table, See parameter setup instructions in the Operation Manual.
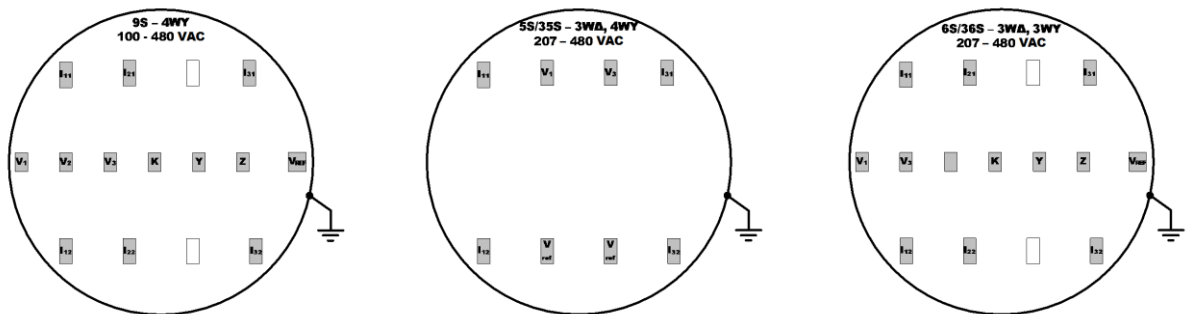

Figure 7: Applicable FORMS

Wiring Configuration	Wiring Setup	FORM factor
4-wire WYE 3-element using 3 CTs	4Ln3	9S
4-wire WYE 3-element connection using 3 PTs, 3 CTs	4Ln3	9S
4-wire 3-element delta using 3 CTs	4LL3	9S
4-wire 3-element delta connection using 3 PTs, 3 CTs	4LL3	9S
3-wire 2½-element Open Delta connection using 3 CTs	3OP3	5S/35S
3-wire 2½-element Open Delta connection using 2 PTs, 3 CTs	3OP3	5S/35S
3-wire 2-element Open Delta using 2 CTs	3OP2	
4-wire WYE 2½-element connection using 3 CTs	3Ln3	6S/36S
4-wire WYE 2½-element connection using 2 PTs, 3 CTs	3Ln3	6S/36S
4-wire 2½-element delta connection using 2 PTs, 3 CTs	3LL3	

Table 1: Wiring Configuration

☞ **NOTE**

In 4LN3 and 3LN3 wiring modes, the voltage readings for volt demands represent line-to-neutral voltages; otherwise, they will be line-to-line voltages. The voltage waveforms and harmonics in 4LN3 and 3LN3 wiring modes represent line-to-neutral voltages; otherwise, they will be line-to-line voltages
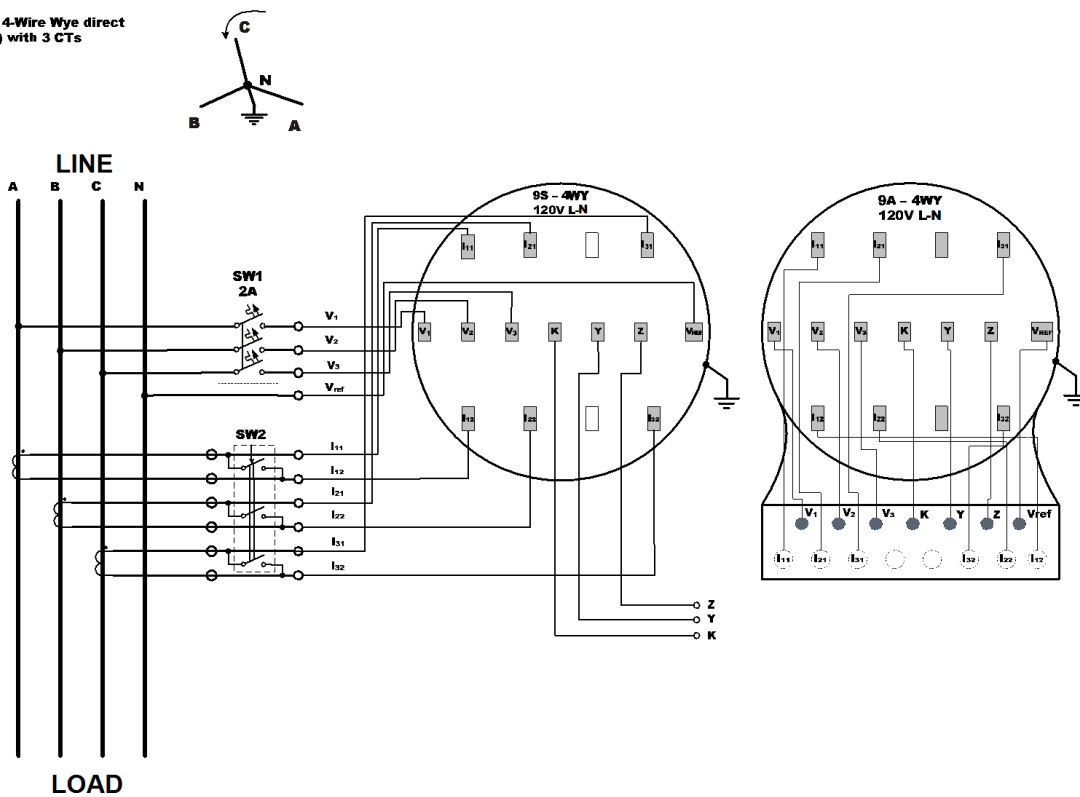
Figure 8: Four Wire WYE Connection No PTs Using 3CTs - Wiring Setup: 4Ln3

Figure 9:Four Wire WYE Connection Using 3 PTs and 3(4) CTs - Wiring Setup: 4Ln3
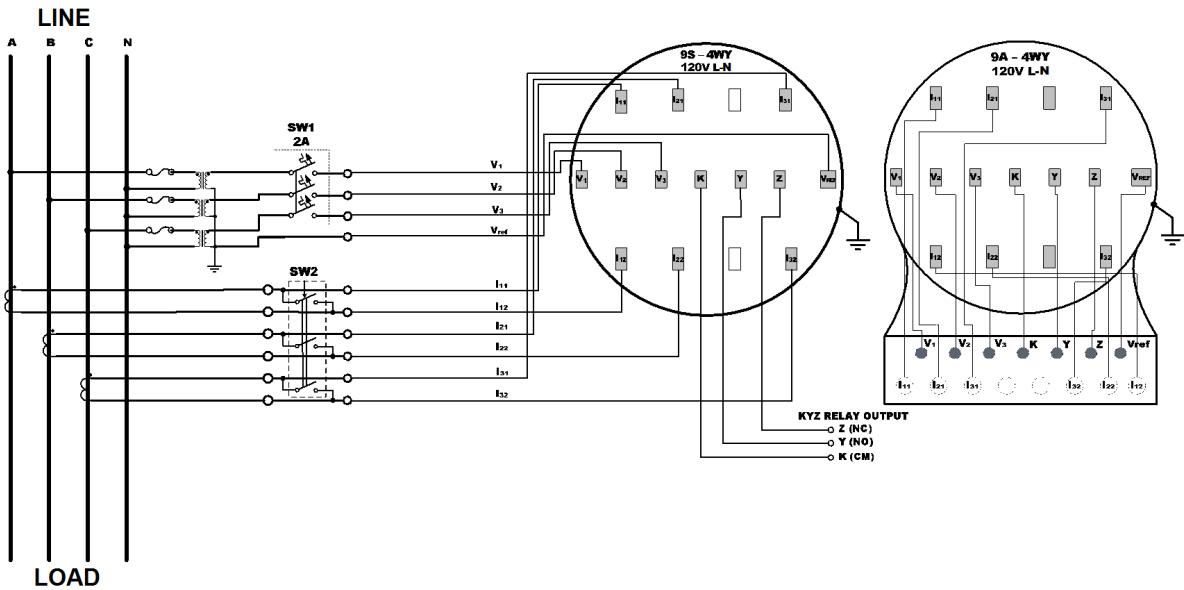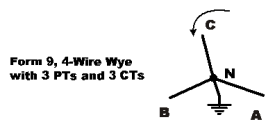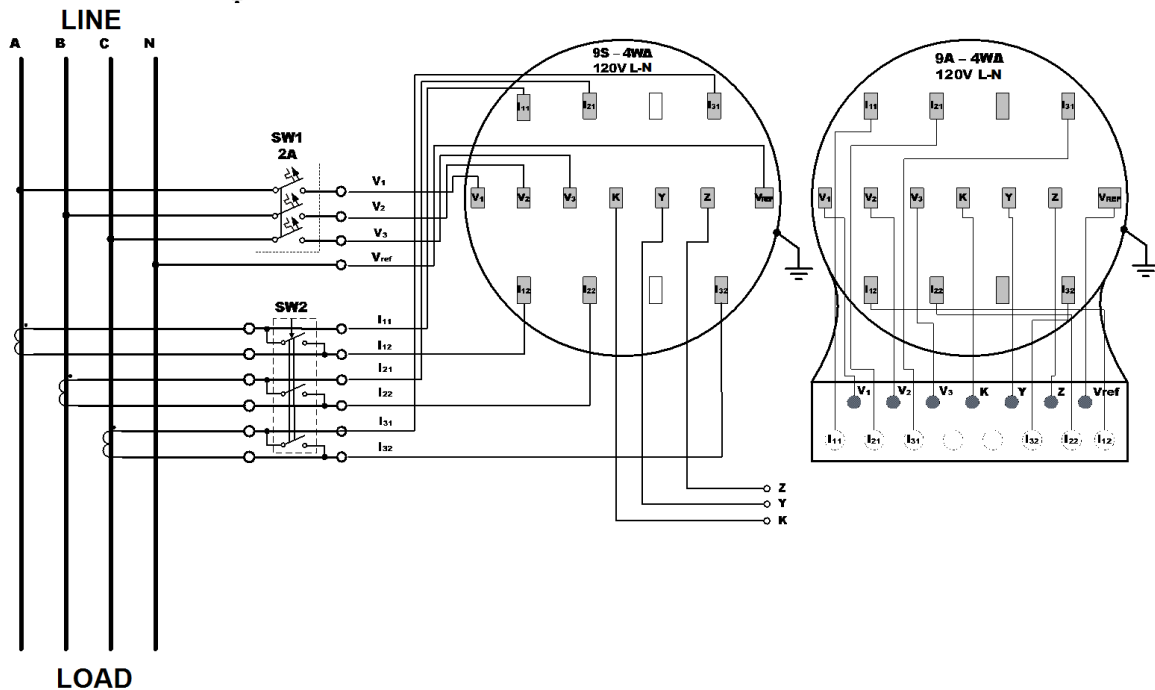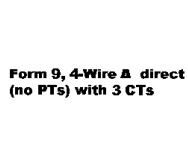

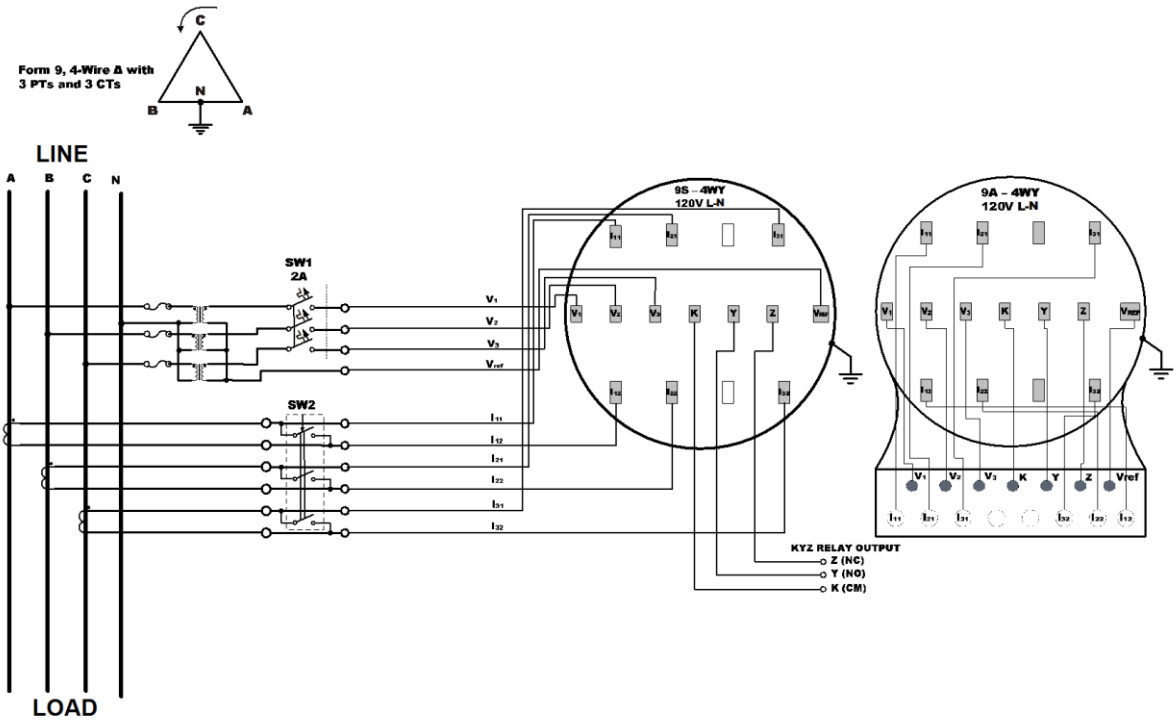*Figure 10: Four Wire DELTA Connection Using no PTs and 3(4) CTs - Wiring Setup: 4LL3*

Figure 11: Four Wire DELTA Connection Using 3 PTs and 3 CTs - Wiring Setup: 4LL3
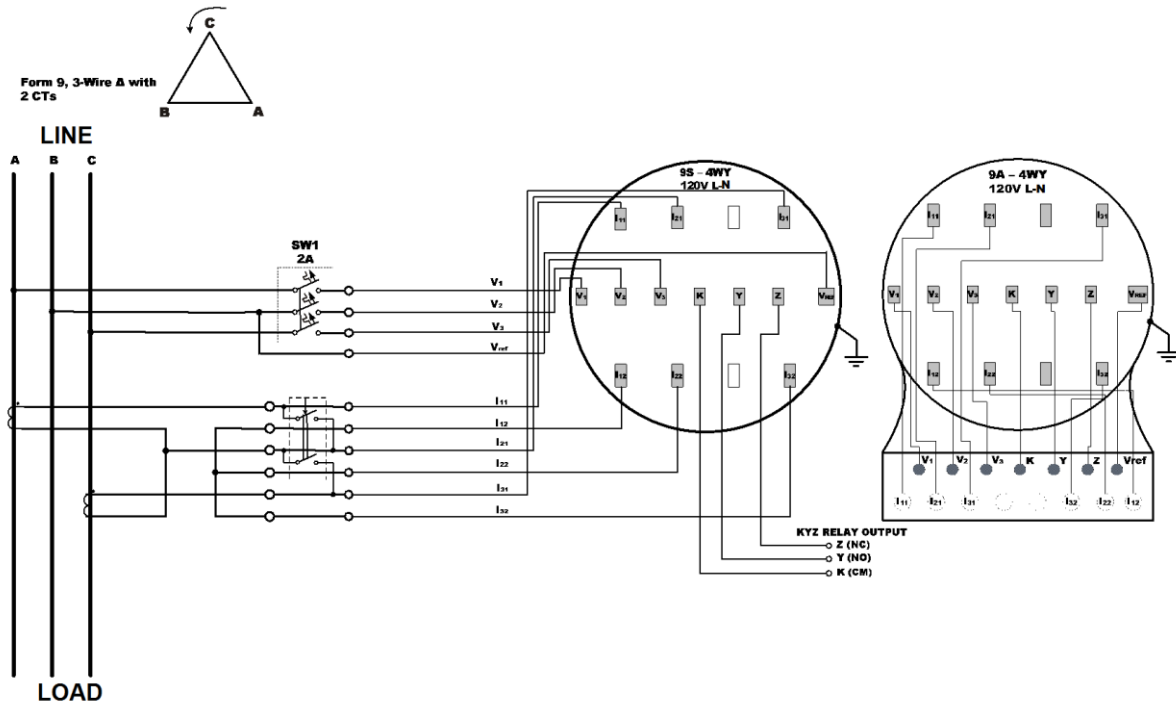
Figure 12: Three Wire DELTA Connection Using no PTs and 2 CTs - Wiring Setup: 3OP3
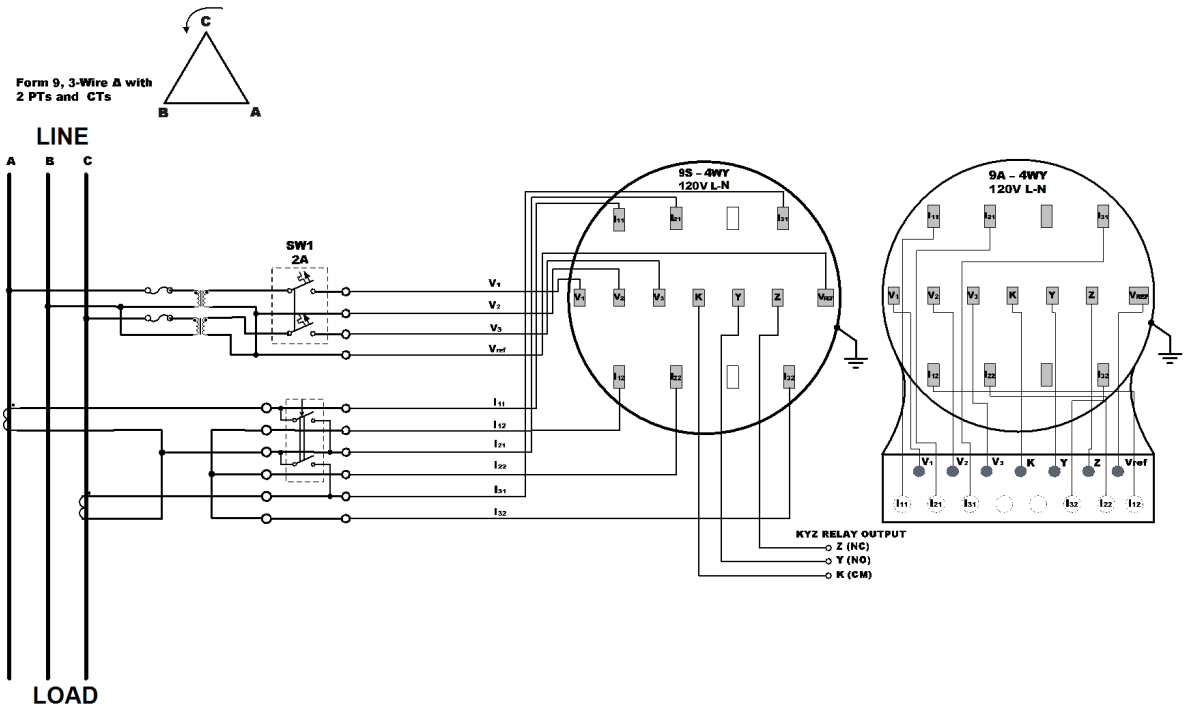
Figure 13: Three Wire DELTA Connection Using 2 PTs and 2 CTs - Wiring Setup: 3OP3

Input / Output ports options

⚠	Before I/O Module installation ensure that all incoming power sources are shut OFF. Failure to observe this practice can result in serious or even fatal injury and damage to equipment.

On board I/O ports

LOGIC/DISPLAY

The *EM920* LOGIC/DISPLAY board is equipped with two fast Dry contact detector – Digital Inputs *2DI* unit, providing wet contact voltage of 24VDC, RS-485 communication port COM3 and USB device port.

Figure 14:LOGIC/DISPLAY Cable

2DI

Two On Board optically isolated digital inputs are provided for status monitoring and external synchronization of power demand period and time. Dry contacts may be connected to these inputs, as shown in *Figures 15*

For ratings, see *Appendix: Technical Specifications*.
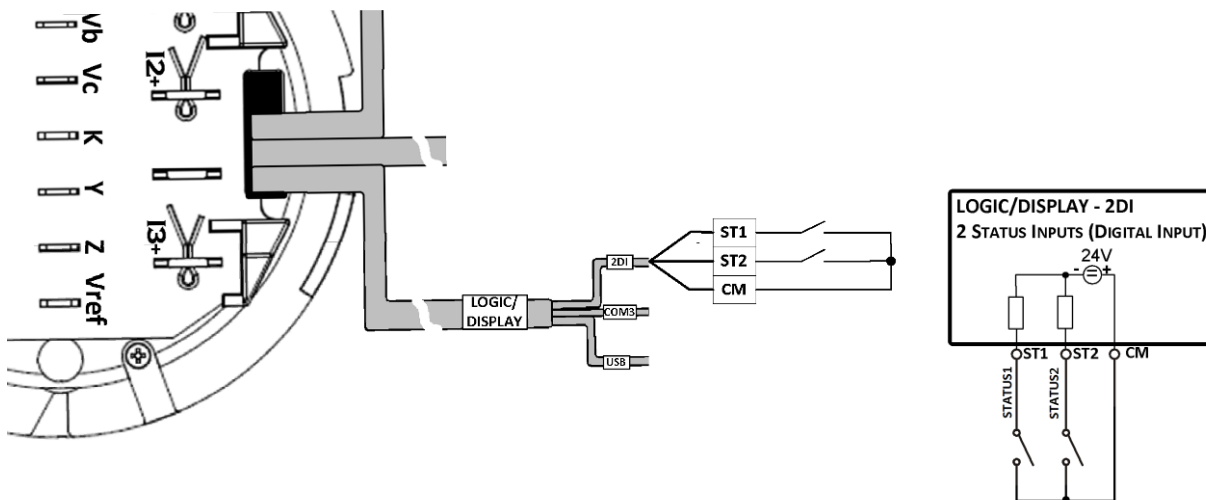
Figure 15: 2DI LOGIC/DISPLAY STATUS Input Connection

KYZ relay

The meter includes one Form C relayl output. It can be used to send KYZ pulsing information to third party system equipment, accessible from meter base blades contacts.

For ratings, see *Appendix: Technical Specifications*

Optional I/O modules

8DI

The *8DI* module consists of eight status inputs detection.

To install the *8DI* module follow instructions:

1) Remove the plastic cover
2) Remove the body shield
3) Plug-in the module in the I/O slot and attach it to bracket using the two screws
4) Connect the *8DI* cable and pass it through the device base window cables
5) Mount back the body shield
6) Mount back the plastic cover

The *8DI* module is factory or Meter Shop plugged-in at the I/O slot

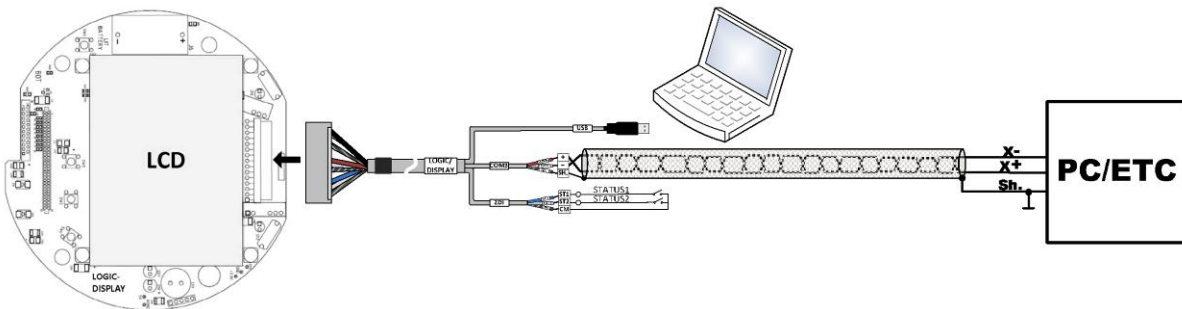*Figure 16: 8DI Cable*

Eight optically isolated digital inputs are provided for status monitoring and external synchronization of power demand period and time. Dry contacts may be connected to these inputs, as shown in *Figures 17*

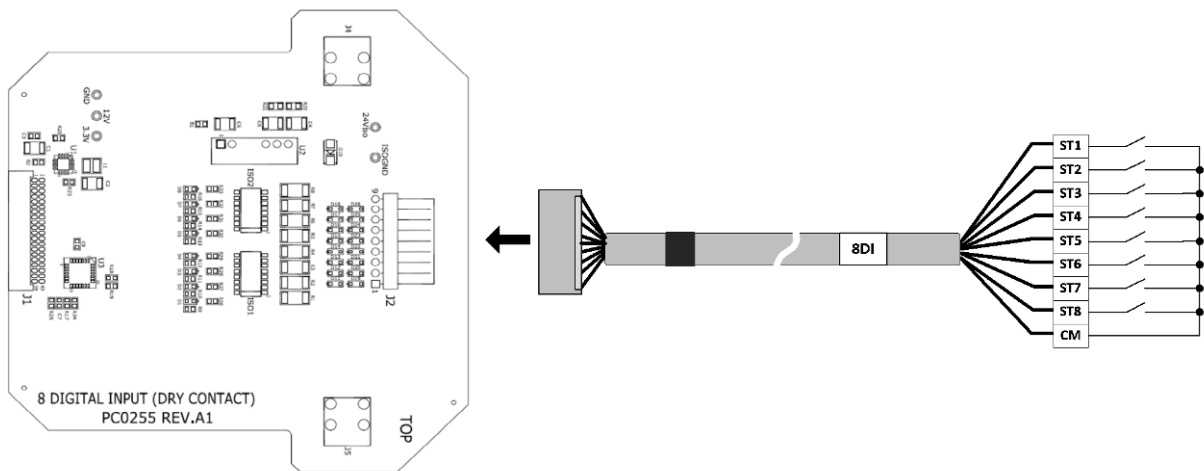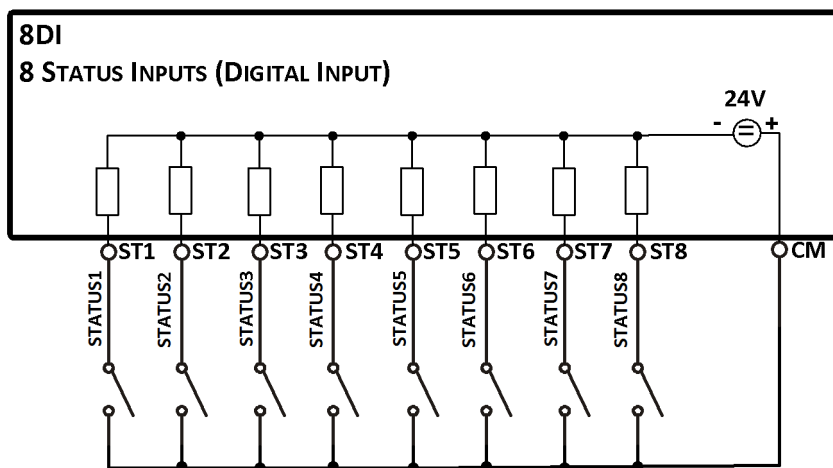For ratings, see *Appendix: Technical Specifications*.

Figure 17: 8DI module STATUS Input Connection

Relay Outputs (6RO – optional module)

The *6RO* module consists of: four FORM C (SSR) and two FORM A (EMR) relay outputs.

To install the *6RO* module follow instructions:

7) Remove the plastic cover
8) Remove the body shield
9) Plug-in the module in the I/O slot and attach it to bracket using the two screws
10) Connect the *6RO* cable and pass it through the device base window cables
11) Mount back the body shield
12) Mount back the plastic cover

The *6RO* module is factory or Meter Shop plugged-in at the I/O slot

External control loads can be connected to the contacts relay as shown in *Figures 18*.

For ratings, see *Appendix: Technical Specifications*
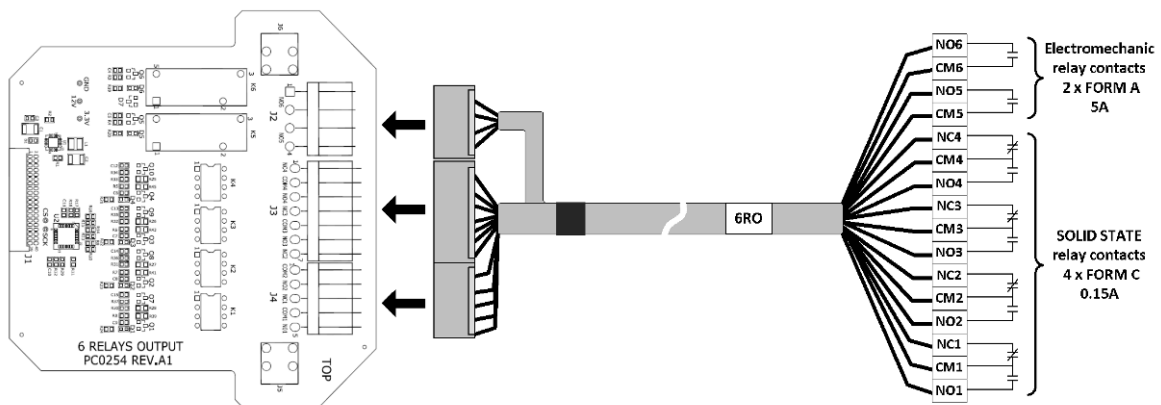
Figure 18: 6RO Connection

Analog Outputs (4AO – optional module)

The *EM920* analog output (AO) expansion module provides:

- 4 optically isolated analog outputs with an internal power supply;
- Options for 0-20mA, 4-20mA, 0-1mA, and ± 1mA output; 1-cycle update time.

To install the *4AO* module follow instructions:

1) Remove the plastic cover
2) Remove the body shield
3) Set SW1 and SW2 for the proper Analog Output current according to following table

Analog Output Current	SW1 setting		SW2 setting	
	1	2	1	2-5
± 1mA	ON	ON	OFF	OFF
0-20mA	OFF	ON	ON	ON
0-1mA	OFF	OFF	ON	OFF
4-20mA	ON	OFF	ON	ON

Table 2: 4AO – Output Curent setting

4) Plug-in the module in the I/O slot and attach it to bracket using the two screws
5) Connect the *4AO* cable and pass it through the device base window cables
6) Mount back the body shield
7) Mount back the plastic cover

The *4AO* module is factory or Meter Shop plugged-in at the I/O slot

For ratings, see Appendix: Technical Specifications
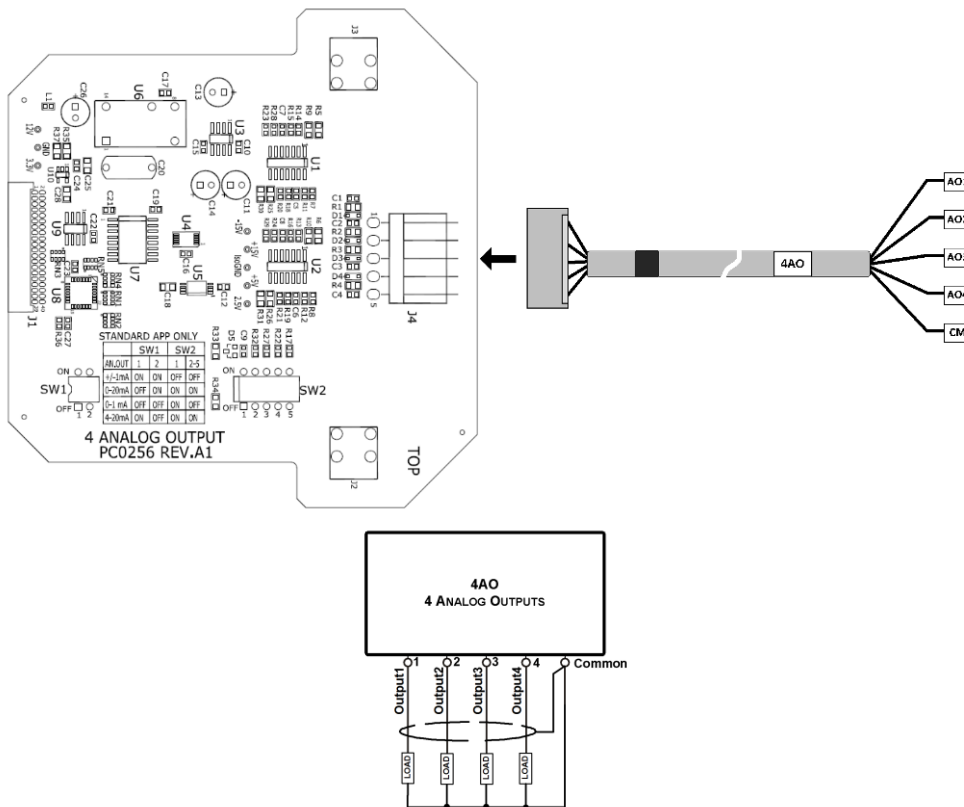
Figure 19: 4AO Connection

⚠ It is recommended to connect unused Analog output channels to Common terminal.

⇒ The 4AO module TERMINAL is for use only with equipment which has no live parts which are ACCESSIBLE

The RATING of the insulation of the external equipment for use with the 4AO module, shall comply according to Installation Category III for insulation to be suitable for SINGLE FAULT CONDITION

- The external equipment TERMINAL connection type is normally terminal block for wire size 14 AWG (up to 1.5 mm2)

The type of equipment that might be connected to the TERMINAL is:

Programmable Logic Controller for automation – PLC

Digital or Analog meter

Analog Inputs/Analog Outputs (4AI/4AO – optional module)

Future

Transients Recorder Module (TRM – optional module)

The *EM920* Transients Recorder module provides four input voltages transient measurement related to ground: V1 (L1-G), V2 (L2-G), V3 (L3-G) and VN (N-G)

To install the *TRM* module follow instructions:

1) Remove the plastic cover
2) Remove the body shield
3) Plug-in the module in the TRM slot and attach it to bracket using the two screws
4) Mount back the body shield
5) Mount back the plastic cover

The *TRM* module is factory or Meter Shop plugged-in at the TRM slot.

See parameter setup instructions in the Operation Manual.

For ratings, see *Appendix: Technical Specifications*
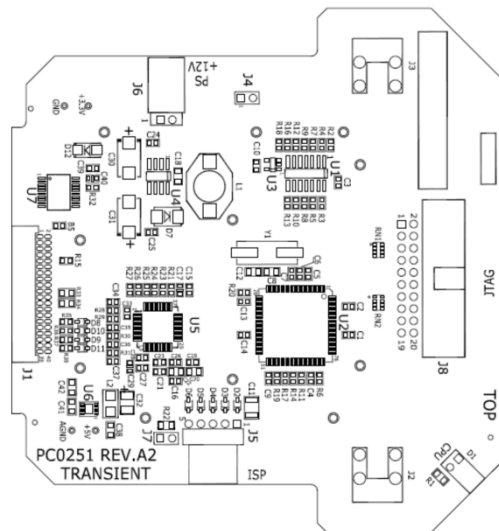
Figure 20: TRM module – Transient Recorder

Communications options

The *EM920* has several communication alternatives depending on your ordering preferences. All communications ports, of different type, can be used simultaneously.

The basic *EM920* is equipped with one standard optical communication port (COM1), an optically isolated RS-485 communication port (COM3) and an USB Device Type A.

Other *COM* ports are available as optional module.

On Board Communication port

Infrared Communication port (COM1)

Mount an optical probe cable (not included), at the instrument front panel, to communicate between the meter optical port and a PC serial port

Figure 21: Infrared Communication port – COM1

RS-485 Communication port (COM3 – on board)

The RS-485 Communication port – COM3 is provided by the LOGIC/DISPLAY board.

The RS-485 connection is provided by the LOGIC/DISPLAY cable with three wires as shown in figure 22
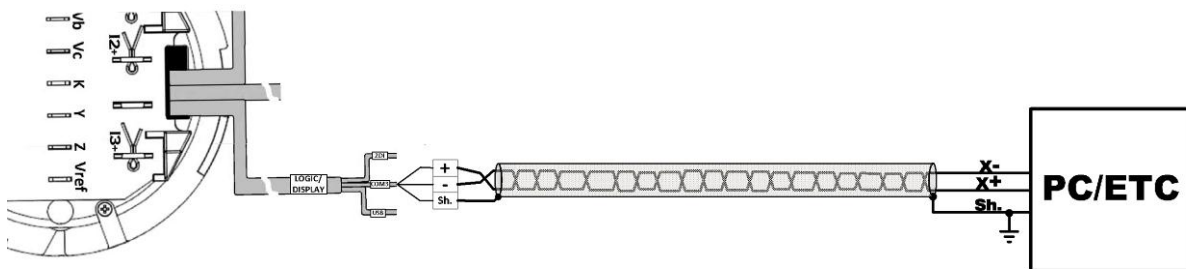
Figure 22: Serial Communication Network Connection – RS-485 COM3

USB Communication port (USB – on board)

The *EM920* provides a standard full speed USB DEVICE port.

The USB DEVICE port connection is provided by the LOGIC/DISPLAY cable terminated with a standard USB type A connector as shown in figure 23
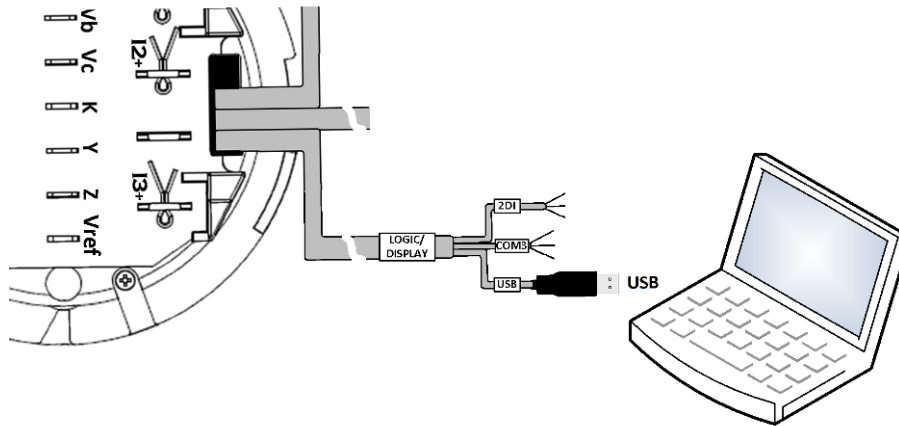
Figure 23: USB connection

Optional Communication ports

Wireless Communication port – GSM/GPRS module (COM2 – optional module)

The Wireless Communication port – COM2 is provided by optional module: GSM/GPRS module.

Before plugging-in the GSM/GPRS module to the meter, insert the SIM card into the SIM card carrier, then pull the slide to lock the SIM card as shown in figure 24.

1) Push down the SIM carrier slide
2) Insert the SIM card into SIM carrier
3) Push up the SIM carrier slide to lock the SIM card
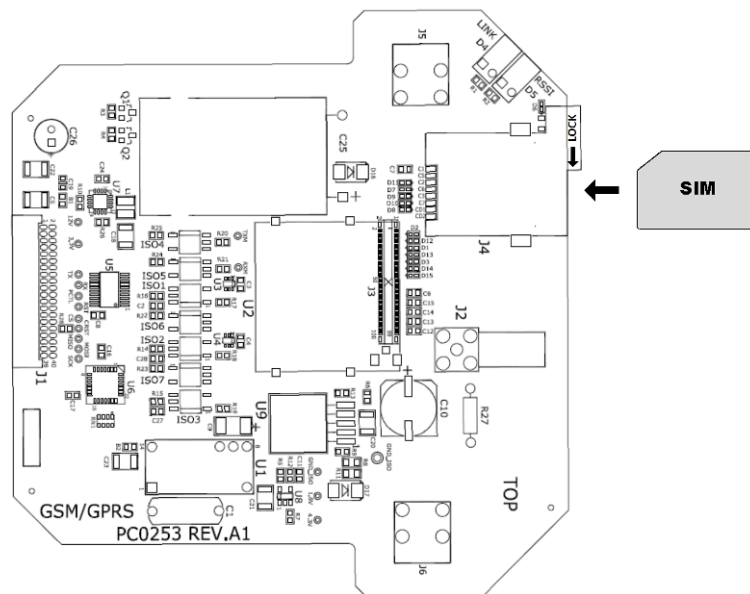
Figure 24: GSM/GPRS module – SIM card assembly

To install the *GSM/GPRS* module follow instructions:

1) Remove the plastic cover
2) Remove the body shield

3) Plug-in the module in the COM slot and attach it to bracket using the two screws

4) Connect the *GSM/GPRS* antenna cable expander and pass it through the device base window cables

5) Mount back the body shield

6) Mount back the plastic cover

The *GSM/GPRS* module is factory or Meter Shop plugged-in at the COM slot
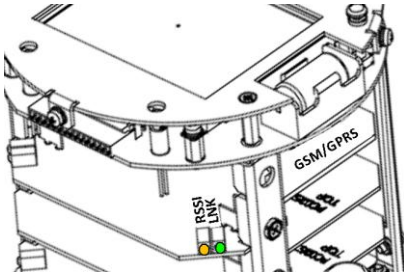
1) Apply power to the meter

2) After one minute the "LNK" GREEN LED is flashing until it lights "ON" continuously

3) The "RSSI" ORANGE LED will light "ON" or blinks, the flashing rate is proportional to the RF receive level (RSSI), if RF receive level is high then the led is "ON" continuously, if RF receive level is poor then the led is blinking

ETHERNET or MODEM optional module

The Communication port – COM4 and IRIG-B interface input are provided by optional modules: ETHERNET and MODEM.

To install the *ETHERNET* or MODEM module follow instructions:

1) Remove the plastic cover

2) Remove the body shield

3) Plug-in the module in the COM slot and attach it to bracket using the two screws

4) Connect the *ETH* or *MODEM* cable and pass it through the device base window cables

5) Mount back the body shield

6) Mount back the plastic cover

The *ETHERNET* or *MODEM* module is factory or Meter Shop plugged-in at the COM slot
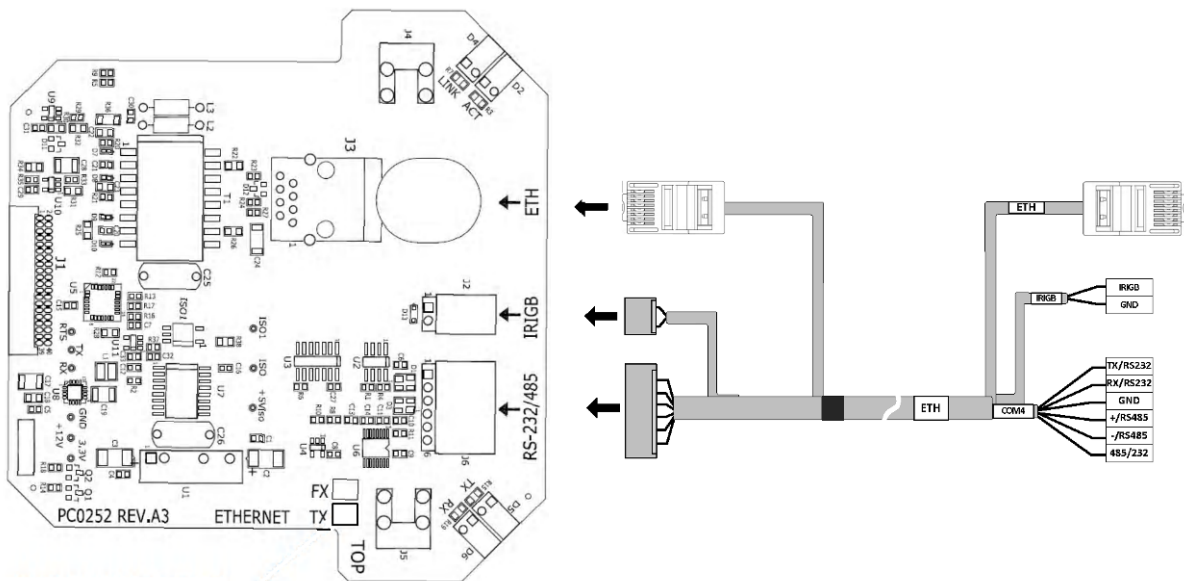
Figure 25: ETHERNET module
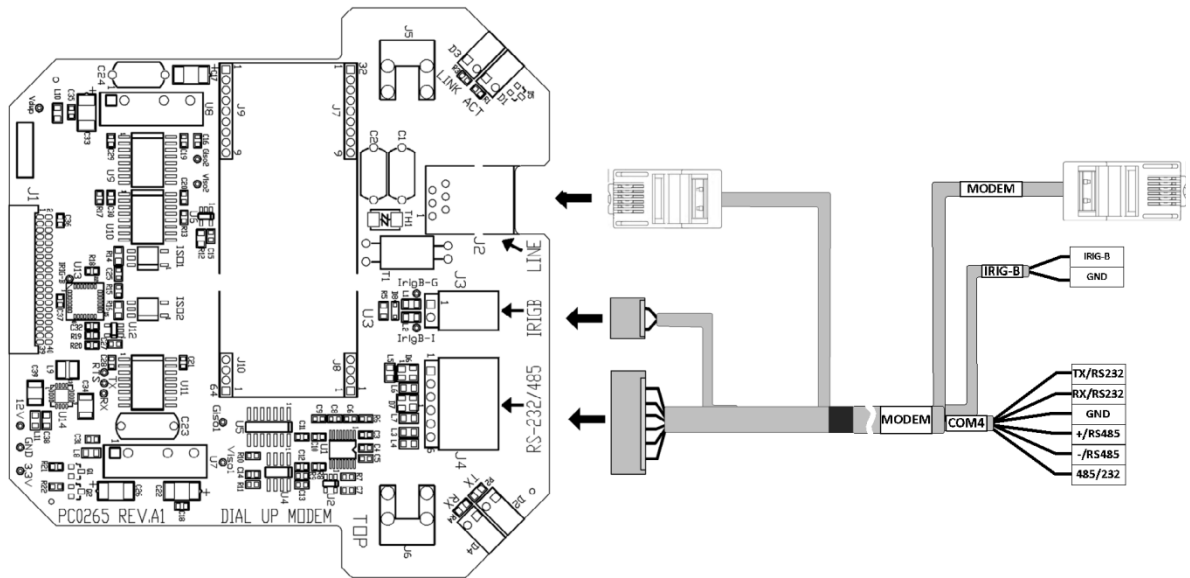
Figure 26: MODEM module

RS-485/232 Communication port (COM4 – ETH or MODEM optional modules)

The RS-485/232 Communication port – COM4 is provided by ETH optional module.
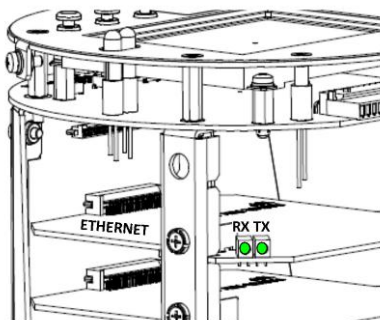
Each module with Communication port – COM4, provides two indication GREEN LEDS:

"RX" GREEN LED, blinking led shows receiving data at COM4

"TX" GREEN LED, blinking led shows sending data at COM4

RS-485 mode

In the RS-485 mode, the 485/232 wire must be left opened as shown in figure 27
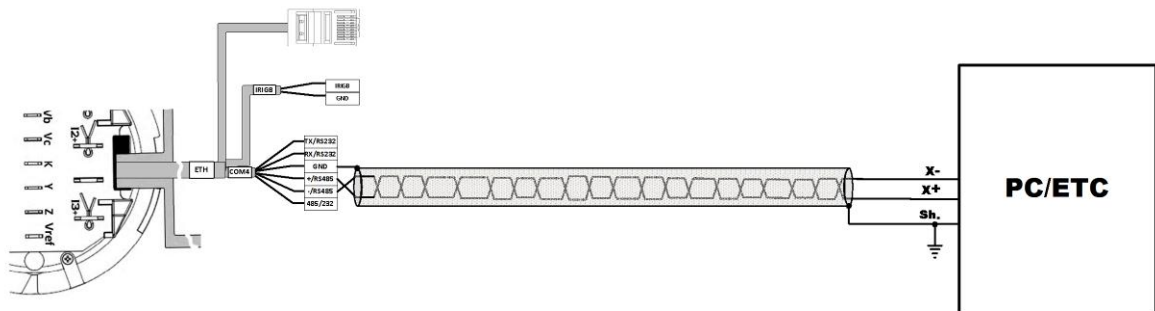
Figure 27: Serial Communication Network Connection – RS-485 COM4

RS-232 mode

In the RS-232 mode, the 485/232 wire must be tied to GND wire as shown in figure 28
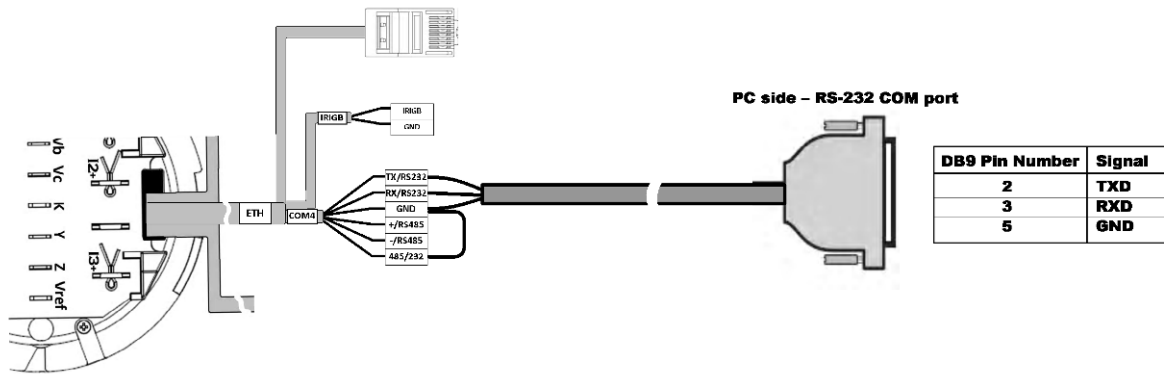
Figure 28: Serial Communication Connection – RS-232 COM4

IRIG-B

1-ms satellite-synchronized clock from a GPS satellite clock that has an IRIG-B time code output connected to the IRIG-B input port.
Connect the GPS receiver IRIG-B output to the IRIG-B/GND wires respectively.

ETHERNET Communication port (ETH – optional module)

The 10/100Base T Ethernet port – ETH is provided by optional module: ETHERNET module.

The ETHERNET Communication port is terminated with RJ45 connector, as shown in figure 29.
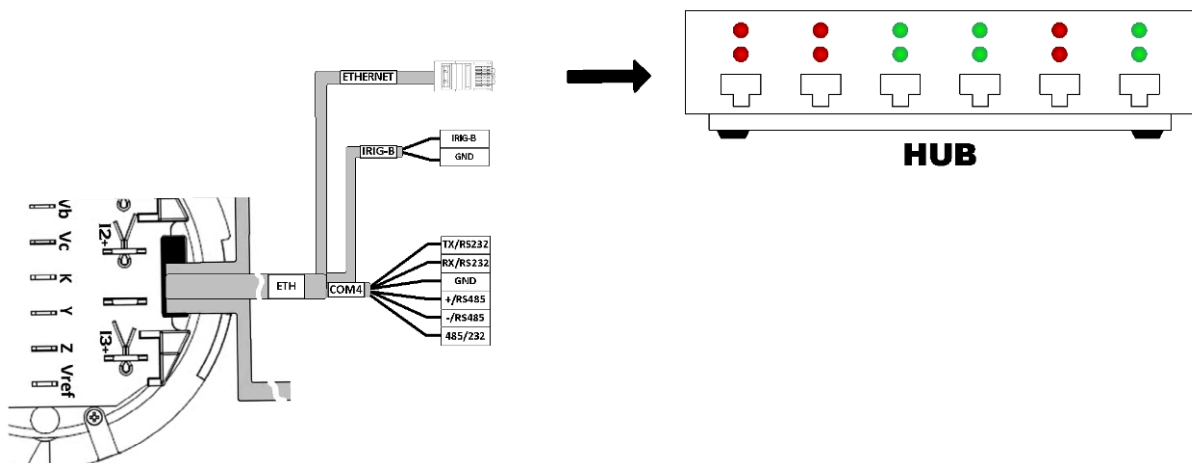
Figure 29: ETHERNET connection
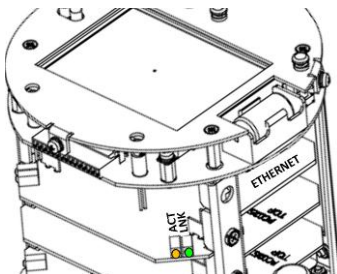
The *ETH* module provides additionally to COM4 indication GREEN LEDS, ETHERNET indication leds :

"LNK" GREEN LED/ "ACT" ORANGE LED, when "LNK" is "ON" continuously and "ACT" is blinking, it shows that the ETHERNET is active

MODEM Communication PSTN port (MODEM – optional module)

The Telephone Line MODEM PSTN port – MODEM is provided by optional module: MODEM module.

The MODEM Communication port is terminated with RJ11 connector, as shown in figure 30.
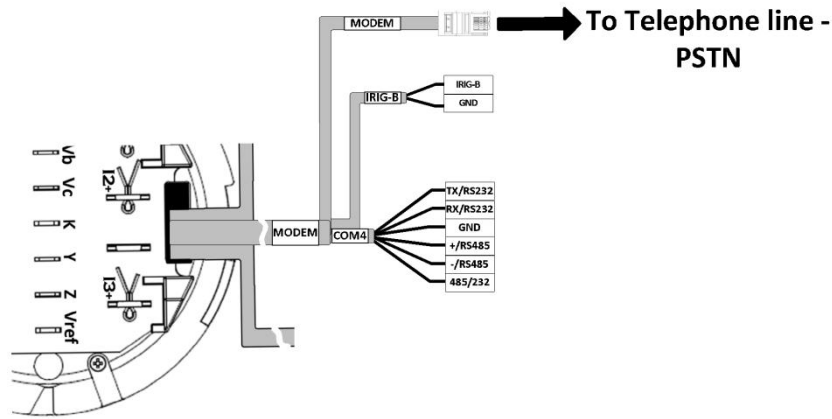
Figure 30: MODEM connection
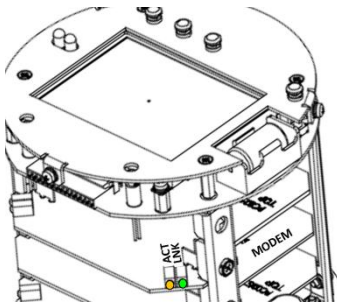
The *MODEM* module provides additionally to COM4 indication GREEN LEDS, MODEM indication leds :

"LNK" GREEN LED/ "ACT" ORANGE LED, when "LNK" is "ON" continuously and "ACT" is blinking, it shows that the MODEM is active

Auxiliary Power Supply

AC/DC Auxiliary Power Supply

The *EM920- 120V model only,* can be equipped with additional power supply to redundant the built-in power supply (Auxiliary Power Supply – *APS*).

To install the *APS* module follow instructions:

1) Remove the plastic cover
2) Remove the body shield
3) Plug-in the module in the APS slot and attach it to bracket using the two screws
4) Connect the *APS pigtail* cable and pass it through the device base window cables
5) Mount back the body shield
6) Mount back the plastic cover

The *APS* module is factory or Meter Shop plugged-in at the APS slot

The *APS* module is connected to an external AC/DC Voltage source with a three-wire pigtail cable as shown in figure 31, see *Appendix: Technical Specifications*
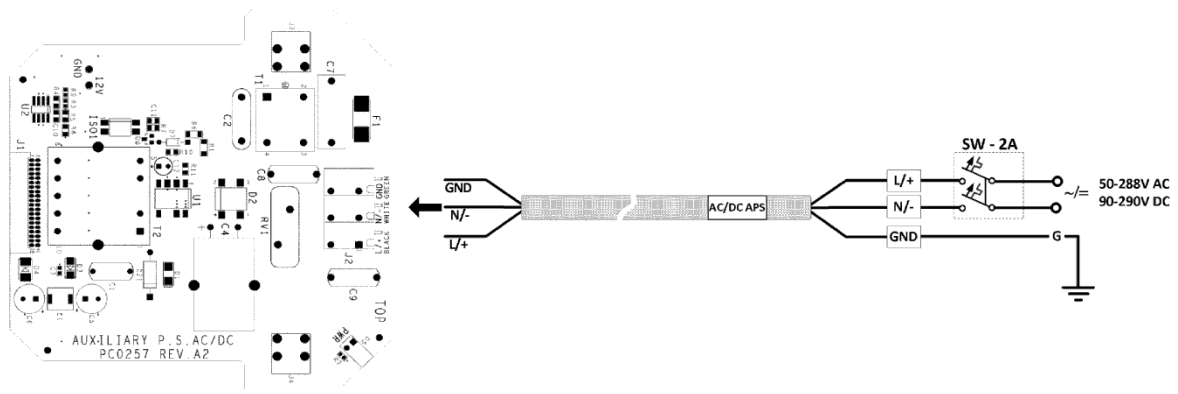
Figure 31: AC/DC APS module
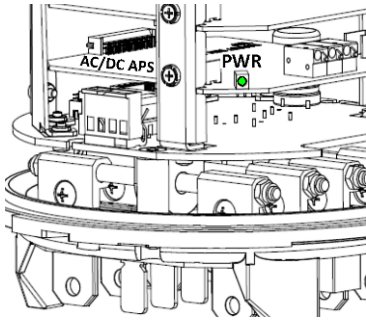
The AC/DC *APS* module provide one indication GREEN LED:

"PWR" GREEN LED:	is "OFF" if AC/DC APS cable is disconnected or no power source is applied to it
	is "ON" if power is applied to AC/DC APS cable

Chapter 2 Installation

Chapter 3 Communications

Computer Connections – RS-232
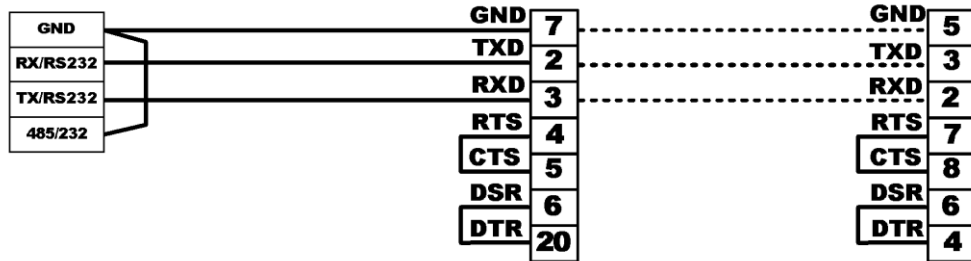
Figure 32: RS-232 Simple 3-wire Connection , 25-pin or 9-pin PC COM Port

Computer Connections – RS-485
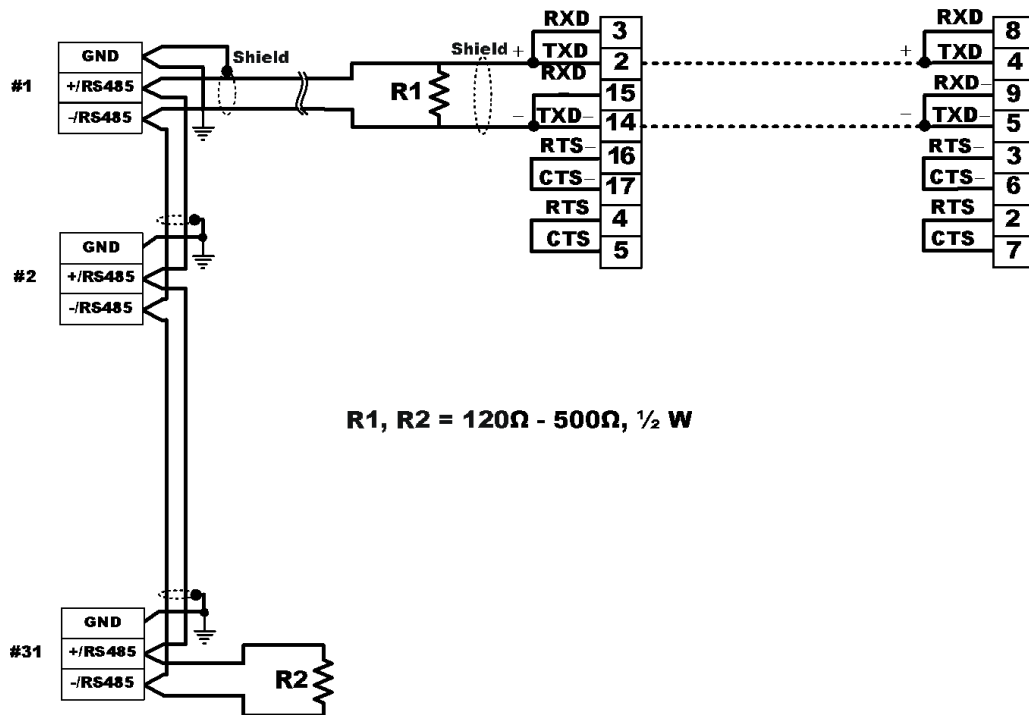
Figure 33: RS-485 Multidrop Connection, 25-pin or 9-pin PC COM Port

Chapter 4 Replacing the Battery

When the battery level drops below the minimum allowed threshold, the LCD graphic display, on the front of the device, shows: ⊠, indicating that the battery should be replaced.

Use the following procedure:

1) Remove the plastic cover
2) Lift the Name-plate where indicated, as shown in figure 28 below
3) Remove the battery by pulling the red ribbon and replace it, insure the proper polarity, (+) on the top
4) Leave the Name-plate back to cover the battery area
5) Mount back the plastic cover
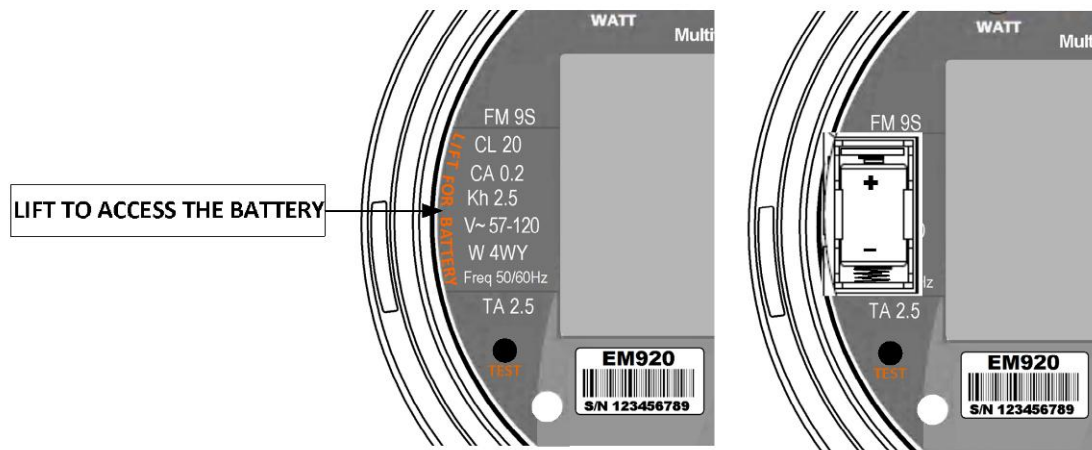
Figure 34: Memory Backup - Lithium Battery Replacement

IMPORTANT

- Use a ½AA lithium 3.6 volts battery.
- In order not to lose data stored in the memory, use PAS to upload data (see EM920 Operation Manual, Chapter 12) to a PC BEFORE changing the battery; OR, make sure you replace the battery while the power is ON. If you replace the battery while power is off, you will lose all data currently stored in the memory.

Appendix: Technical Specifications

Inputs Ratings

AC Voltage inputs	Va, Vb, Vc and Vref - 50/60Hz	High input impedance = 10MΩ
Reference voltage U_n 120V up to 277V L-N (direct) standard	Voltage rating: 120 up to 277 Volts (L-N), 207 to 480 Volts (L-L)	
	Voltage range Crest factor >2 [V_{L-N} x 1.2 x 2]	0 -332 V r.m.s, peak up 665V (for PQ)
	Maximum Line to Line voltage	1152 V r.m.s
	Temporary over voltage between live conductors and earth Transient over voltage between live conductors and earth (**TRM optional module**, from 15 µs up to ms)	1500 V r.m.s 6 kV peak, 2kV measurement
	Starting voltage	0.1%U_n
	Burden per phase	< 0.5 VA
	Overload withstand for 1 minute phase-to-ground (ANSI C12.1 & IEC 62053-22, protective class II)	4000V r.m.s
	Rated impulse voltage (ANSI C12.1 & IEC 62052-11, protective class II)	6000V peak
Reference voltage U_n 57.73V up to 120V L-N (via PT) optional	Voltage rating: 57.73 up to 120 Volts (L-N), 100 to 207 Volts (L-L)	
	Voltage range Crest factor >2 [V_{L-N} x 1.2 x 2]	0 -144 V r.m.s, peak up 288V (for PQ)
	Maximum Line to Line voltage	500 V r.m.s
	Temporary over voltage between live conductors and earth Transient over voltage between live conductors and earth (**TRM optional module**, from 15 µs up to ms)	240 V r.m.s 1.5 kV peak
	Starting voltage[1]	0.1%U_n
	Burden per phase	< 0.2 VA
	Overload withstand for 1 minute phase-to-ground (ANSI C12.1 & IEC 62053-22, protective class II)	4000V r.m.s
	Rated impulse voltage (ANSI C12.1 & IEC 62052-11, protective class II)	6000V peak
Voltage/Current inputs	Terminals for wires size	Blades (Socket meter standard – C12.10)
Ground input	Terminals for wires size	According to Socket meter standard – C12.10
AC Current inputs	**3 (4 optional) Galvanic isolated Inputs**	
Reference Current Basic model In = 5 A (TA = 2.5A)	Current class *Imax*	10A & 20A
	Maximum measurable short circuit current (*Isc)*	10 x I_n
	Burden per phase (*In* = 5 A)	< 0.2 VA
	Starting current (I1, I2, I3) – average Starting current (I1, I2, I3) – real time	0.2% I_n 1.0% I_n
	Over current withstand for 1 s non-recurring	50 x I_n
	Isolation	4000V r.m.s
	Terminals for wires size	Blades (Socket meter standard – C12.10)
	3 (4 optional) Galvanic isolated Inputs	FORM 9 (39 optional)

---

[1] Starting voltage, interruptions and dips measurement applicable only with installed APS

Power Supply

Power supply	Supplied from Monitored Voltage inputs	
480V model standard (direct)	Three Phase PS, Rated Inputs (L-N) 50/60 Hz	120 – 277V AC ± 20%
	Operating voltage range	96 – 550V AC
	Insulation Dielectric withstand	2500V AC @ 1mn
	Operating Temperature range	-40ºC to + 75ºC
	Output voltage	+12V DC ± 5%
	Burden per phase	6VA
120 V model optional (via PT)	Three Phase PS, Rated Inputs 50/60 Hz	57.73 – 120V AC ± 20%
	Operating voltage range	47 – 250V AC
	Insulation Dielectric withstand	2500V AC @ 1mn
	Operating Temperature range	-40ºC to + 75ºC
	Output voltage	+12V DC ± 5%
	Burden per phase (w/o AUX. PS) Burden per phase (w. AUX. PS)	6VA <0.1VA
Auxiliary AC/DC Power supply[1]		
AC/DC Optional module	Operating Temperature range	-40ºC to + 75ºC
	Rated Input, 0-400 Hz	50-288V AC, 90-290V DC
	Isolation	2500V AC @ 1mn
	Output voltage	+12V DC ± 5%
	Burden	6VA
	Terminals for wires size	3 x 2.5 mm^2 pig-tail cable
Battery for RTC and SRAM	Minimum operation reserve 48 h. – if no use of battery (According to AS 1284.7/IEC 1038)	
	Total reserve capacity shall be not less than 2000h – with use of battery. (According to AS 1284.7/IEC 1038)	Up to 3 years
	More than 10 years service battery life (According to AS 1284.7/IEC 1038)	

Input/Output ports

Fast Status input	Digital Input optically isolated	
2DI basic **8DI** Optional module[2]	Dry contacts, internally wetted	24V DC
	Resistance of open contact sensing	> 1Mohm
	Resistance of closed contact sensing	< 100 Ohm
	Sampling rate	1 ms
	Insulation Dielectric withstand	2500V AC @ 1mn
	Terminals for wires size	10 x 2.5 mm^2 cable
RELAY OUTPUT		
Relay Output - KYZ basic	Digital output – SSR optically isolated	1
	1 relay (Form C)	0.5A @ 250V AC/DC
	Operation time Release time	1 ms 1 ms
	Insulation Dielectric withstand	2500V AC @ 1mn

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[1] Available in 120V model option only

[2] Factory/Meter shop installable

Appendix: Technical Specifications

	Terminals for wires size	Blades (Socket meter standard – C12.10)
Relay Output	Digital output – combined SSR + EMR	4 x FORM C + 2 x FORM A
6RO Optional module[1]	SSR – 4 relays (FORM C)	0.15A @ 250V AC/DC
	Operation time Release time	1 ms 1 ms
	Insulation Dielectric withstand	2500V AC @ 1mn
	EMR – 2 relays (FORM A), ½ cycle operation	5A @ 250V AC
	Operation time Release time	5-7 ms + ½ cycle 5-7 ms + ½ cycle
	Insulation resistance of open contacts	> 2 MΩ or 1000V @ 1mn
	Insulation Dielectric withstand	2500V AC @ 1mn
	Terminals for wires size	16 x 2.5 mm^2 cable
Analog Outputs	**Analog output galvanic isolated**	**4**
4AO Optional module[1]	Type of Outputs	4-20 mA default
		0-20 mA option
		0-1 mA (2mA max.) option
		± 1 mA (±2mA max.)option
	Non-linearity	0.2%
	Load for 20 mA	<510 Ω
	Accuracy	0.5%
	Power supply	Internal
	Insulation Dielectric withstand	2500V AC @ 1mn
	Terminals for wires size	5 x 2.5 mm^2 cable

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[1] Factory/Meter shop installable

Communication ports

COM1	Built-in Infra Red communication port	DISPLAY unit
IR port Basic	RS232 communication, TTL level, max baud rate	19.2 kb/s
	Protocols	MODBUS RTU/ASCII and DNP3.0
	Optically isolated	2500V AC @ 1mn
	Optical port per ANSI C12.18	Type 2
COM2	**Plug-in modules isolated communication port**	
GSM/GPRS MODEM Optional module[1]	RS232 communication, TTL level, max baud rate	115.2 kb/s
	Isolation	2500V AC @ 1mn
	GSM/GPRS module	Quad Band GPRS class10
	Antenna connection	Coax cable terminated with SMA connector
	Protocols	MODBUS/TCP or DNP3.0/TCP
	MODEM module	Telephone Line according to FCCp.68 and TBR21
	Line connection	RJ11
	Protocols	MODBUS/RTU, MODBUS/TCP or DNP3.0, DNP3.0/TCP
COM3	**Built-in serial communication port**	
basic	RS-485 isolated	115.2 kb/s
	Isolation	2500V AC @ 1mn
	Protocols	MASTER/SLAVE MODBUS RTU/ASCII and DNP3.0
	Terminals for wires size	2 x 2.5 mm^2 shielded twisted cable
COM4 ETH-TX MODEM Optional module[1]	**Plug-in modules isolated communication port**	
	Versatile RS-232/RS-485	
	Max. Baud rate	115.2 kb/s
	Isolation	2500V AC @ 1mn
	Protocols	MODBUS RTU/ASCII and DNP3.0
	Terminals for wires size	5 x 2.5 mm^2 shielded twisted cable
10/100Base-T ETH-TX Optional module[1]	**Plug-in modules network communication port**	
	Wired LAN communication port with auto-negotiation	IEEE 802.3
	Ethernet port Baud rate	10/100 Mb/s
	Protocols	MODBUS/TCP or DNP3.0/TCP protocols and IEC 61850-8-1, up to five non-intrusive simultaneous connections, Telnet service port
	ETH port Isolation	2500V AC @ 1mn
	ETH connector	ETH cable terminated with Standard RJ-45 connector
USB – FS device basic	**Communication port**	**Basic**
	USB communication port	Full speed Device
	USB port Baud rate	12 Mb/s
	Protocols	MODBUS RTU/ASCII and DNP3.0
	USB connector	Cable terminated with USB type A

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[1] Factory/Meter shop installable

IRIG-B ETH-TX MODEM Optional module[1]	Input Isolation	2500V AC @ 1mn
	Time code signal	Demodulated (pulse-width coded)
	Signal Level	Unbalanced 5V
	Terminals for wires size	2 x 2.5 mm^2 twisted cable
	Recommended cable	51Ohm low loss - RG58A/U (Belden 8219 or equivalent), TNC connector
	Recommended GPS time code generator	Masterclock GPS-200A

Console Display Unit

Display Panel		
Display	LCD graphic bright display	Multiple screens display
	Resolution	340 x 220 dots
	Size	4'
	Operational temperature	-20°C to + 70°C
	Backlit LCD display screen	Timeout operation
LEDs	Energy LED Pulsing	2 x RED (WATT & VAR)
Communication	IR port, COM1	ANSI C12.18
Navigator buttons	Accessible Buttons – SCROLL, SELECT/ENTER	2
	Sealed Button – DEMAND RESET	1
	Under cover Button – TEST mode	1

Real Time Clock

	5 ppm Accuracy @ 25°C	2.7 minute / year
	RTC backup data retention	5 years

Log Memory

Non-volatile memory (20years Data retention)	For energy and tariff registers logging, EV-PQ-DATA-WV log	16 MB

Environmental Conditions

	Operational temperature	-40 ºC to 75 ºC
	Optional LCD Operational temperature	-20 ºC to 70 ºC
	Storage temperature	-40 ºC to 85 ºC
	Humidity	0 to 95% non-condensing

Construction

Enclosure With sealing cover	Socket Meter base enclosure	ANSI C12.10 for electronic meter
	Size:	∅ 6" x L 7" x base ∅ 7"
	Weight	4 lb
	Mounting	ANSI C12.10 – FORM 9S/9A

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[1] Factory/Meter shop installable

Standards Compliance

EMC	ANSI C12.1	Reference: IEC 61000
Immunity	Surge – IEEE C62.41.2-2002 100kHz ring wave 1.2/50 µs – 8/20 µs	6kV / 0.5kA 6kV / 3kA
	Magnetic field – ANSI C12.1	
	FTB – IEC 61000-4-4, level 4	4kV – measuring inputs 2kV – I/O and com.
	SWC – IEEE C37.90.1	2.5kV – measuring inputs, I/O an com.
	Electromagnetic RF Fields – ANSI C12.1	20V/m @ 200kHz – 10GHz
	ESD - IEC61000-4-2	15KV – air
Emission	Radiated / Conducted - FCC/CFR 47 p.15	Class B
Safety	ANSI C12.1	
	Insulation, ANSI C12.1	2.5 KV r.m.s. @ 1mn
Environment	Mechanical Shock - IEC 60068-2-27 :1987 / ANSI C12.1: 2008	15g @ 11ms
	Mechanical Vibration - IEC 60068-2-6 :1987 / ANSI C12.1: 2008	0.5g @ 30-350 Hz
	Transportation drop and vibration – ISTA 1A / ANSI C12.1	
	Operational temperature – ANSI C12.1	-40 ºC to 75 ºC
	Storage temperature – ANSI C12.1	-40 ºC to 85 ºC
	Humidity – ANSI C12.1	
Measurements and Accuracy	ANSI C12.1 Active Energy measurement - ANSI C12.20 class 10/20	Class 0.2S
Power Quality	PQ methods – IEC 61000-4-30	Class A
	Harmonics & Interharmonics measurements – IEC 61000-4-7	Class I
	Flicker measurements – IEC 61000-4-15	Class I
	Report – EN50160	

Measurement Specifications

Parameter	Full Scale @ Input Range	Accuracy			Range
		% Reading	% FS	Conditions	
Voltage V1-V3 (L-n)	277 x PT ratio @ 277V	±0.05	±0.1	1% up to 120%	0 up to 999,000 V
Voltage V1-V3 (L-n)	120 x PT ratio @ 120V	±0.05	±0.1	1% up to 140%	0 up to 999,000 V
Voltage V1-V3 (L-n)	69 x PT ratio	±0.05	±0.1	1% up to 140%	0 up to 999,000 V
Line current I1- I3	CT primary current	±0.06	±0.06	1% up to 200%In	0 up to 20,000 A
Line current I1- I3	CT primary current	±0.1	±0.06	200% up to 400%	0 up to 20,000 A
Line Fault current I1- I3	CT primary current	±1.0	-	400%- 1000% In	0 up to 100,000 A
Active power	3xV FS×CT/1000	±0.2	±0.02	|PF| ≥ 0.5 *	-10,000,000 kW to +10,000,000 kW
Reactive power	3xV FS×CT/1000	±0.3	±0.04	|PF| ≤ 0.9 *	-10,000,000 kvar to +10,000,000 kvar
Apparent power	3xV FS×CT/1000	±0.2	±0.02	|PF| ≥ 0.5 *	0 to 10,000,000 kVA
Power factor	1.000		±0.2	|PF| ≥ 0.5, I ≥ 2% FSI	-0.999 to +1.000
Frequency	50 Hz	-	±0.02	40-65 Hz	40.00 up to 64.99 Hz
	60 Hz	-	±0.02	45- 70 Hz	45.00 up to 69.99 Hz
Total Harmonic Distortion, THD V (I), %V_f (%I_f)	999.9	±1.5	±0.1	THD ≥ 1%, V (I) ≥ 10% FSV (FSI)	0 to 999.9
Total Demand Distortion, TDD, %	100		±1.5	TDD ≥ 1%, I ≥ 10% FSI	0 to 100
Active energy Import & Export		ANSI C12.20, Class 10/20, Acc. Class 0.2			0 to 999,999.999 MWh
Reactive energy Import & Export		Class 0.5Sunder conditions as per IEC 62053-23:2003			0 to 999,999.999 Mvarh
Apparent energy		Class 0.2 under conditions as per IEC 62053-22:2003			0 to 999,999.999 MVAh
Symmetrical components	Voltage FS Current FS Current FS	±1.0 ±1.0 ±3.0		10% - 120% FS 10% - 400% FS 200% - 1000%FS	
Phasor angles		±1 degree			

* @ 80% to 120% of voltage FS, 2% to 200% of current FS, and frequency 50/60 Hz

PT - external potential transformer ratio

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 1second average.

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

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