smartprocess
control & instrumentation

User Manual
2017 v1.0

SMARTPANEL X835-MID
96mm² Smart Energy Meter for Single and Three Phase Electrical Systems

1 Introduction

This document provides operating, maintenance and installation instructions. This unit measures and displays the characteristics of Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W,) and Three Phase Four Wire (3P4W) networks.

The measuring parameters include Voltage (V), Current (A), Frequency (Hz), Power Factor (PF), Active, Reactive & Apparent Power (kW/kVA/kVAr), Imported, Exported and Total Active Energy (kWh), Imported, Exported and Total Reactive Energy (kVArh).

The unit also measures Maximum Demand Current & Maximum Demand Power, this is measured over preset time periods of up to 60 minutes.

This unit is a 1A or 5A Current Transformer operated and can be configured to work with a wide range of CTs. The unit can also be configured to work with a Voltage Transformer.

Unlike other alternatives, our 96mm² panel meter has built-in Pulsed outputs and RS485 Modbus RTU communications; no separate modules are required to add comms to this device.

Instead of programming the meter through modbus, we have incorporated a password protected set-up menu within the meters software, allowing configuration without having to interrogate through comms.

This unit does not require a separate auxiliary supply for power. The self-supplied auxiliary comes from any Phase that is connected to the voltage inputs, meaning should one of the Phases fail, the unit will power itself from another Phase, ensuring the meter continues to measure usage.

The SMARTPANEL X835-MID meter comes with sealable terminal covers to ensure that the installation is safe and tamper-proof.

2 Start Up Screens

	The first screen lights up all display segments and can be used as a display check.
SOFT 01 01.02	The second screen indicates the firmware installed on the unit and its build number.
INST TEST PASS	The interface performs a self-test and indicates the result if the test passes.

*After a short delay, the screen will display active energy measurements.

3 Measurements

The buttons operate as follows:

Ph S ESC	Selects the Phase Summary display screens. In Set-up Mode, this is the "Escape" button.
V/A	Selects the Voltage and Current display screens. In Set-up Mode, this is the "Left" button.
MD PF Hz	Select the Frequency and Power factor display screens. In Set-up Mode, this is the "Up" button.
P	Select the Power display screens. In Set-up Mode, this is the "Down" button.
E	Select the Energy display screens. In Set-up mode, this is the "Right" or "Enter" button.

3.1 Phase Sequence

Toggle through the V/A screens to check your Phase Sequence connections are aligned:

PSEq U 123 I 123	U (Voltage) sequence I (Current) sequence

3.2 Phase Summary

Each press of the **Ph S** ESC button selects a new parameter:

L1 230.0 W / V / A / kWh	Phase 1 Summary: Active Power Live to Neutral Voltage Current Total kWh
L2 230.0 W / V / A / kWh	Phase 2 Summary: Active Power Live to Neutral Voltage Current Total kWh
L3 230.0 W / V / A / kWh	Phase 3 Summary: Active Power Live to Neutral Voltage Current Total kWh
L1 230.0 W / V / A / kVArh	Phase 1 Summary: Active Power Live to Neutral Voltage Current Total kVArh
L2 230.0 W / V / A / kVArh	Phase 2 Summary: Active Power Live to Neutral Voltage Current Total kVArh
L3 230.0 W / V / A / kVArh	Phase 3 Summary: Active Power Live to Neutral Voltage Current Total kVArh

3.3 Voltage and Current

Each press of the V/A button selects a new parameter:

L1 230.0 L2 230.0 L3 230.0 V	Phase to Neutral Voltage
L1-2 415.0 L2-3 415.0 L3-1 415.0 V	Phase to Phase Voltage
L1 0.00 L2 0.00 L3 0.00 N 0.00 A	Current per Phase
L1 0.00 L2 0.00 L3 0.00 U THD%	Voltage Total (1st)Harmonic Distortion Percentage. To view 2nd-63rd THD%, hold the V/A button for 2 seconds and use the up and down arrows.
L1 0.00 L2 0.00 L3 0.00 I THD%	Current Total (1st)Harmonic Distortion Percentage. To view 2nd-63rd THD%, hold the MD PF Hz button for 2 seconds and use the up and down arrows.

3.4 Frequency and Power Factor and Demand

Each press of the **MD PF Hz** button selects a new range:

1.00 PF 50.00 Hz	Total Frequency Total Power Factor
1.00 1.00 1.00 PF	Power Factor per Phase
L1 MAX 0.00 L2 DMD 0.00 L3 DMD 0.00 A	Maximum Current Demand per Phase
MAX 0.00 W MAX 0.00 VAr DMD 0.00 VA Σ	Max Demand Active Power Max Demand Reactive Power Max Demand Apparent Power

3.5 Power

Each press of the **P** button select a new range:

P L1 0.00 L2 0.00 L3 0.00 W	Active Power per Phase
Q L1 0.00 L2 0.00 L3 0.00 VAr	Reactive Power per Phase
S L1 0.00 L2 0.00 L3 0.00 VA	Apparent Power per Phase
0.00 W 0.00 VAr 0.00 VA Σ	Total Active Power Total Reactive Power Total Apparent Power

3.6 Energy Measurements

Each press of the **E** button selects a new range:

Total 0000000.0 kWh	Total Reactive Energy
Total 0000000.0 kVArh	Total Active Energy
Imp 0000000.0 kWh	Imported Active Energy
Exp 0000000.0 kWh	Exported Active Energy
Imp 0000000.0 kVArh	Imported Reactive Energy
Exp 0000000.0 kVArh	Exported Reactive Energy

4 Set Up

To enter set-up mode, hold the **E** button for 3 seconds, until the password screen appears.

PASS 0000	Set up is password-protected so you must enter the correct password (default '1000') before proceeding.
PASS 1000	Use the **MD PF Hz** and **P** buttons to adjust the flashing number. Press the **E** button to move to the next number. Hold the **E** button to continue.
PASS ERR	If an incorrect password is entered, the display will show: "PASS Err" If a correct password is entered, you will see the first setup screen: "Set Comms"

To exit setting-up mode, press the **Ph S** button and you will return to a parameter screen.

4.1 Set-up Entry Methods

Some menu items, such as password and CT, require a four-digit number entry while others, such as supply system, require selection from a number of options.

4.1.1 Menu Option Selection

1. Use the **MD PF Hz** and **P** buttons to scroll through the different options of the set up menu.

2. Hold the **E** button to confirm your selection.

3. If an item flashes, then it can be adjusted by using the **MD PF Hz** and **P** buttons.

5. Once you have adjusted the option appropriately, you will need to save the change by holding the **E** button. The word **"Good"** should appear briefly, then the menu option will stop flashing.

6. On completion of all setting-up, press the **Ph S** ESC button and you will return to a parameter screen.

4.1.2 Number Entry Procedure

When Setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right. The procedure is as follows:

1. The current digit to be set flashes and then can be adjusted using the **MD PF Hz** and **P** buttons.

2. To move to the next digit, press the **E** button.

3. Save the change by holding the **E** button. The word **"Good"** should appear briefly, then the menu option will stop flashing.

4.2 Communication

There is a RS485 port that can be used for communication using Modbus RTU protocol. For Modbus RTU, parameters are programmed through the set-up menu.

SEt COnS	Configure Comms Settings *contains sub-menu options*
SEt Addr 001	Set Meter Modbus Address (ID) Numerical: **001**-247
SEt bAud 9600	Set Baud Rate Options: 2400, 4800, **9600**, 19200, 38400.
SEt PAr1 nOnE	Set Parity Options: **none**, even, odd.
SEt StOP 1	Set Stop Bits Options: **1**, 2.

On completion of the entry procedure, press the **Ph S** button and you will return to a parameter screen.

4.3 Current Transformer (CT)

This unit is CT Operated, the primary (CT1) and secondary (CT2) of the current transformer need to be programmed correctly for the meter to scale the inputs accordingly.

SEt Ct	Configure CT Settings *contains sub-menu options*
SEt Ct2 5 A	CT Secondary (CT2) Options: 1A, **5A**.
SEt Ct1 0005	CT Primary (CT1) Numerical: 0001-9999A. **0005A default**

Please note as this is a MID approved device, you will only have one opportunity to set CT Primary/Secondary.

4.4 Voltage Transformer (PT)

This unit can be used with voltage (potential) transformers, the primary (PT1) and secondary (PT2) of the voltage transformer need to be programmed correctly for the meter to scale the inputs accordingly.

SEt Pt	Configure PT Settings *contains sub-menu options*
SEt Pt2 230 L-n V	PT Secondary (PT2) Numerical: **230**V L-N.
SEt Pt1 00 0230 V	PT Primary (PT1) Numerical: 00110-99999V. **00230V default**

Please note as this is a MID approved device, you will only have one opportunity to set PT Primary/Secondary.

4.5 Pulse Settings

The SMARTPANEL X835-MID has two pulsed outputs. Pulse 1 is configurable; you can set the pulse rate and duration, as well as the parameter to pulse for. *Pulse 2 is factory set and cannot be modified.*

SEt PULS	Configure Pulse 1 *contains sub-menu options*

SEL PULS OUT 1	**Pulse 1 Output** Options: Import kWh, **Export kWh**, Total kWh, Import kVArh, Export kVArh, Total kVArh.
SEL PULS rALE 0001	**Pulse 1 Rate (pulses per kWh)** Options: **0.001**, 0.01, 0.1, 1, 10, 100, 1000.*
SEL PULS tl̄nE 200	**Pulse Time (duration)** Options: 60, 100, **200mS**.

* The Pulse Rate can be set as follows:
```
0.001  = 1 pulse per 1 Wh/VArh (1000 pulses per kWh/kVArh)
0.01   = 1 pulse per 10 Wh/VArh (100 pulses per kWh/kVArh)
0.1    = 1 pulse per 100 Wh/VArh (10 pulses per kWh/kVArh)
1      = 1 pulse per 1 kWh/kVArh
10     = 1 pulse per 10 kWh/kVArh
100    = 1 pulse per 100 kWh/kVArh
1000   = 1 pulse per 1000 kWh/kVArh
```

4.6 Maximum Demand

This sets the period of time (in minutes) in which the Current and Power readings are recorded for maximum demand measurements.

SEL d̄n̄d	**Configure Demand Settings** *contains sub-menu options*
SEL dl t 60	**Demand Integration Time (DIT)** Options: OFF, 5, 8, 10, 15, 20, 30, **60 minutes**.
SEL d̄n̄d n̄thd SLld	**Demand Method** Options: Fixed, **Sliding**.*

* The Demand Method can be configured as follows:
Sliding = 0~60 minutes, 1~61 minutes, 2~62 minutes etc
Fixed = 0~60 minutes, 60~120 minutes, 120~180 minutes etc

4.7 Time Settings

The time options of the meter are stored in this menu option.

SEL tl̄nE	**Configure Time Settings** *contains sub-menu options*
SEL bAcL LlL OFF	**Backlit Time Period** Options: **OFF**, 5, 10, 30, 60, 120 minutes. ***OFF keeps the backlight on permanently.***
SEL dl SP SCrL 5	**Display Auto-Scroll Time** Numerics: 001-255 seconds. **005 Seconds (default)**

4.8 System Settings

This menu option allows the parameters to be reset to 0.

SEL SYS	**Reset Meter Readings** *contains sub-menu options*
SEL SYS tYPE 3P4	**System Type** Options: 1P2, 3P3, **3P4**.
SEL SYS CnCL	**System Connection: CTs** You can adjust the flow of current on the meter if you have installed a CT incorrectly. *contains sub-menu options*
SYS CnCL Ph-1 Frd	**CT Phase 1 Direction** Options: **Forward**, Reverse.

SYS CnCL Ph-2 Frd	**CT Phase 2 Direction** Options: **Forward**, Reverse.
SYS CnCL Ph-3 Frd	**CT Phase 3 Direction** Options: **Forward**, Reverse.
SEL PASS yOrd 1000	**Set Password** Numeric: 0001-9999. **1000 (default)**
SEL AULO dl SP SCrL	**Enable Auto Display Scroll** Options: **ON**, OFF.

4.9 Reset Settings

This menu option allows the parameters to be reset to 0.

SEL rESL	**Reset Meter Readings** *contains sub-menu options*
SEL rESL EnGY	**Reset Energy Parameters** *This options is not available on the MID approved model.*
SEL rESL d̄n̄d	**Reset Demand Parameters**
SEL rESL ALL	**Reset All Parameters** *This options is not available on the MID approved model.*

5 Specifications

5.1 Measured Parameters

The unit can monitor and display the following parameters of a Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W) or Three Phase Four Wire (3P4W) system.

5.1.1 Voltage and Current

- Phase to Neutral Voltages 100 to 276V AC (not for 3P3W supplies).
- Phase to Phase Voltages 174 to 480V AC (3 Phase supplies only).
- Percentage total Voltage Harmonic Distortion (U THD%) for each Phase to N (not for 3P3W supplies).
- Percentage Voltage THD% between Phases (3 Phase supplies only).
- Percentage total Current Harmonic Distortion (I THD%) for each Phase.

5.1.2 Power factor and Frequency and Max. Demand

- Frequency in Hz (45~66Hz)
- Instantaneous power:
- Power 0 to 999MW
- Reactive power 0 to 999MVAr
- Volt-amps 0 to 999MVA
- Maximum demanded power since last Demand reset Power factor
- Maximum neutral demand current, since the last Demand reset (for 3 Phase supplies only)

5.1.3 Energy Measurements

- Imported/Exported Active Energy   0 to 9999999.9 kWh
- Imported/Exported Reactive Energy 0 to 9999999.9 kVArh
- Total Active Energy   0 to 9999999.9 kWh
- Total Reactive Energy   0 to 9999999.9 kVArh

5.2 Measured Inputs

Voltage inputs through 4-way fixed connector with 2.5mm² stranded wire capacity. Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W) or Three Phase Four Wire (3P4W) unbalanced. Line frequency measured from L1 Voltage or L3 Voltage. Three Current inputs (six physical terminals) with 2.5mm² stranded wire capacity for connection of external CTs. Nominal rated input Current 5A or 1A AC RMS.

5.3 Accuracy

• Voltage (L-N / L-L)	0·5% of range maximum
• Current	0·5% of nominal
• Frequency	0·2% of mid-frequency
• Power Factor	1% of unity (0.01)
• Active Power (W)	±1% of range maximum
• Reactive Power (VAr)	±1% of range maximum
• Apparent Power (VA)	±1% of range maximum
• Active Energy (Wh)	Class 1 IEC 62053-21 or Class 0.5 IEC 62053-22
• Reactive Energy (VArh)	Class 2 IEC 62053-23
• Total Harmonic Distortion	1% up to 63rd Harmonic

5.4 Auxiliary Supply

This unit does not require a separate auxiliary supply; the unit draws the necessary power from the voltage input connections. If a three phase supply is connected, and the phase that is powering the unit fails, it will change the phase supply to avoid shutting down.

5.5 Interfaces for External Monitoring

Three interfaces are provided:

- RS485 communication channel that can be programmed for Modbus RTU protocol
- Relay output indicating real-time measured energy. (configurable)
- Pulse output 3200imp/kWh (not configurable)

The Modbus configuration (baud rate etc.) and the pulse relay output assignments (kW/kVArh, import/export etc.) are configured through the set-up screens.

5.5.1 Pulsed Outputs

The pulsed outputs are "passive type" and comply with Class A IEC 62053-31. The pulse output can be set to generate pulses to represent kWh or kVArh.

The Pulse Rate can be set as follows:
```
0.001  = 1 pulse per 1 Wh/VArh (1000 pulses per kWh/kVArh)
0.01   = 1 pulse per 10 Wh/VArh (100 pulses per kWh/kVArh)
0.1    = 1 pulse per 100 Wh/VArh (10 pulses per kWh/kVArh)
1      = 1 pulse per 1 kWh/kVArh
10     = 1 pulse per 10 kWh/kVArh
100    = 1 pulse per 100 kWh/kVArh
1000   = 1 pulse per 1000 kWh/kVArh
```

The Pulse width can we set as 200/100/60 mS.

5.5.2 RS485 Output for Modbus RTU

For Modbus RTU, the following RS485 communication parameters can be configured from the set-up menu:

Baud rate 2400, 4800, 9600, 19200, 38400

Parity none (default) / even / odd

Stop bits 1 or 2

RS485 network address three digit number, 001 to 247

Response Time <100mS

5.6 Reference Conditions of Influence Quantities

Influence Quantities are variables that affect measurement errors to a minor degree. Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

• Ambient temperature	23°C ±1°C
• Input waveform	50 or 60Hz ±2%
• Input waveform	Sinusoidal (distortion factor < 0·005)
• Auxiliary supply voltage	Nominal ±1%
• Auxiliary supply frequency	Nominal ±1%
• Auxiliary supply waveform (if AC)	Sinusoidal (distortion factor < 0·05)
• Magnetic field of external origin	Terrestrial flux

5.7 Environment

• Operating temperature	-25°C to +55°C*
• Storage temperature	-40°C to +70°C*
• Relative humidity	0 to 95%, non-condensing
• Altitude	<2000m
• Warm up time	1 minute
• Vibration	10Hz to 50Hz, IEC 60068-2-6, 2g
• Pollution Degree	II

*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

5.8 Mechanics

|	
• Dimensions	96mm x 96mm x 74mm (W x H x D)
• Mounting	92mm² Panel Cutout
• Sealing	IP51 indoor
• Material	Self-extinguishing UL 94 V-0

5.9 Declaration of Conformity

We, Smart Process & Control LTD, declare under our sole responsibility as the manufacturer that the poly Phase multifunction electrical energy meter "SMARTPANEL X835-MID" correspond to the production model described in the EC-type examination certificate and to the requirements of the Directive 2014/32/EU EC type examination certificate number 0120/SGS****. Identifcation of the NB 0120.

Manufacturer Details:

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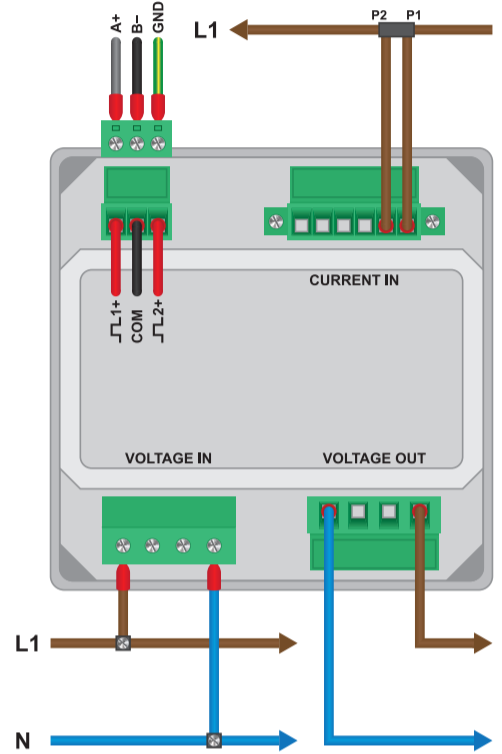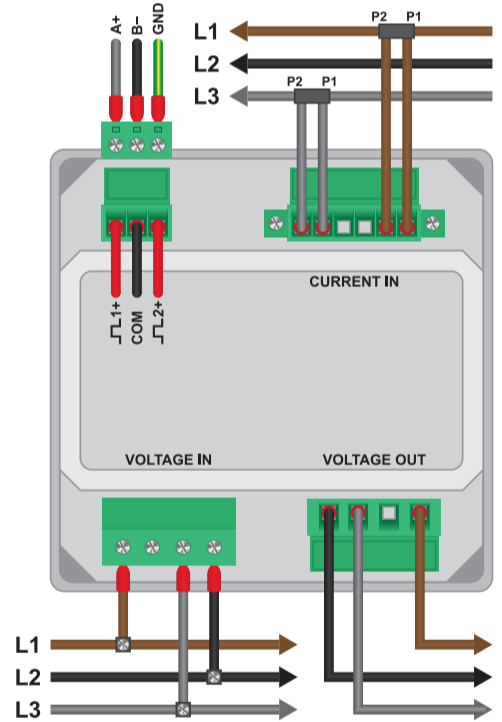Specifications are subject to change without notice

6 Dimensions
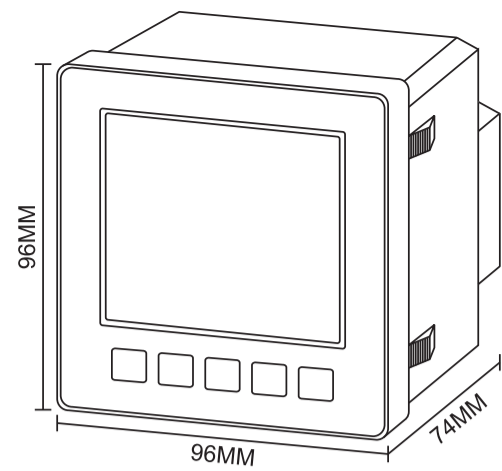
The panel meter fits in a 92mm x 92mm cutout.

96MM
96MM
74MM

7 Installation

7.1 Single Phase two wires

7.2 Three Phase three wires

7.3 Three Phase four wires