

User Manual

2016 v1.0

SMART X835

MULTIFUNCTION POWER MONITOR

1 Introduction

The multifunction panel meter SMART X835 is a top new-generation intelligent panel meter, used not only in the electricity transmission and power distribution system but also in the power consumption measurement and analysis in high voltage intelligent power grid.

This document provides operating, maintenance and installation instructions for the SMART X835. The unit measures and displays the characteristics of single phase two wires and three phase four wires supplies, including voltage, frequency, current, power and active and reactive energy, imported or exported. Energy is measured in terms of kWh, kVarh. Maximum demand current can be measured over preset periods of up to 60minutes. In order to measure energy, the unit requires voltage and current inputs in addition to the supply required to power the product. The requisite current input(s) are obtained via current transformers (CT).

The SMART X835 can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interfaces provide pulse and RS485 Modbus RTU outputs. Configuration is password protected.

1.1 Unit Characteristics

The SMART X835 can measure and display:

- Line voltage and THD% (total harmonic distortion) of all phases
- Line Frequency
- Currents, Current demands and current THD% of all phases
- Power, maximum power demand and power factor
- Active energy imported and exported
- Reactive energy imported and exported

The unit has password-protected set-up screens for:

- Changing password
- Supply system selection 1phase2wire, 3phase 4wires
- CT Ratio and secondary current
- PT Ratio and secondary voltage
- Demand Interval time
- Reset for demand measurements
- Pulse output duration

A pulse output indicates real-time energy measurement. An RS485 output allows remote monitoring from another display or a computer.

1.2 Current Transformer Current ratio

The unit can be configured to operate with CT ratio between primary and secondary current is 1 and 2000. Maximum CT primary current corresponds to a maximum input current to the unit of 1/5A.

1.3 RS485 Serial – Modbus RTU

This uses an RS485 serial port with Modbus RTU protocol to provide a means of remotely monitoring and controlling the SMART X835. Set-up screens are provided for setting up the RS485 port. See section 4.8

1.4 Pulse output

This provides 2 pulse outputs those clocks up measured active and reactive energy. The constant for reactive energy is 5000imp/kVarh. The pulse width for active energy can be set from the Set-up menu.

2 Start Up Screens

	The first screen lights all display segments and can be used as a display check
	The second screen indicates the firmware installed in the unit and its build number.
	Next the unit performs a self-test and indicates if the test passes.

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

3 Measurements

The buttons operate as follows:

	Selects the Voltage and Current display screens. In Set-up Mode, this is the "Left" or "Back" button.
	Select the Frequency and Power factor display screens. In Set-up Mode, this is the "Up" button.
	Select the Power display screens. In Set-up Mode, this is the "Down" button.
	Select the Energy display screens. In Set-up mode, this is the "Enter" or "Right" button.

3.1 Voltage and Current

Each successive press of the **UI** button selects a new parameter.

	Phase to neutral voltages.
	Current on each phase.
	Phase to neutral voltage THD%.
	Current THD% for each phase.

3.2 Frequency and Power Factor and Demand

Each successive press of the **M** button selects a new range:

	Total kW Frequency Power factor (total)
	Power factor of each phase
	Maximum Power Demand.
	Maximum Current Demand.

3.3 Power

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

	Instantaneous active power (kW)
	Instantaneous reactive power (kVar)
	Instantaneous Volt-amps (KVA)
	Total kW, kVarh, kVA

3.4 Energy Measurements

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

	Imported active energy in kWh.
	Exported active energy in kWh.
	Imported reactive energy in kVarh.
	Exported reactive energy in kVarh.
	Total active energy in kWh.
	Total reactive energy in kVarh.

4 Set Up

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

	Setting up is password-protected so you must enter the correct password (default '1000') before processing.
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Setting up is password-protected so you must enter the correct password (default '1000') before processing. If an incorrect password is entered, the display will show: PASS Err

To exit setting-up mode, press **UI** repeatedly until the measurement screen is restored.

4.1 Set-up Menu Structure

	Change password nnnn 4-digit number – default '1000'
	Set the ratio of the CT nnnn 4-digit number 0001–2000.
	Set the ratio of PT Nnnn 4-digit number 0001–2000.

DIT(Demand Integration Time). This is the period in minutes over which the current and power readings are integrated for maximum demand measurement. Options are: off, 5, 10, 15, 30 and 60minutes.

4.2 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 menu options.

4.2.1 Menu Option Selection

1. Use the **M** and **P** buttons to select the required item from the menu shown in section 4.1. selection does not roll over between bottom and top of list
2. Press **ESC** to confirm your selection
3. If an item flashes, then it can be adjusted by the **M** and **P** buttons. If not, there maybe a further layer.
4. Having selected an option from the current layer, press **ESC** to confirm your selection. The SET indicator will appear.
5. Having completed a parameter setting, press **UI** to return to a higher menu level. The SET indicator will be removed and you will be able to use the **M** and **P** buttons for further menu selection.
6. On completion of all setting-up, press **UI** repeatedly until the measurement screen is restored.

4.2.2 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 is set using the **M** and **P** buttons
2. Press **ESC** to confirm each digit setting. The SET indicator appears after the last digit has been set.
3. After setting the last digit, press **UI** to exit the number setting routine. The SET indicator will be removed.

4.3 Change Password

	Use the M and P to choose the change password option.
	Press the ESC to enter the change password routine. The new password screen will appear with the first digit flashing.
	Use M and P to set the first digit and press ESC to confirm your selection. The next digit will flash.
	Repeat the procedure for the remaining three digits.
	After setting the last digit, SET will show.

Press **UI** to exit the number setting routine and return to the Set-up menu. SET will be removed

4.4 DIT Demand Integration Time

This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: off, 5, 10,15 30,60 minutes.

	From the set-up menu, use M and P buttons to select the DIT option. The screen will show the currently selected integration time.
	Press ESC to enter the selection routine. The current time interval will flash.
	Use M and P buttons to select the time required.
	Press ESC to confirm the selection. SET indicator will appear.

Press **UI** to exit the DIT selection routine and return to the menu.

Warnings

Important Safety Information is contained in the Maintenance section. Familiarize yourself with this information before attempting installation or other procedures. **Symbols used in this document:**

- Risk of Danger:** These instructions contain important safety information. Read them before starting installation or servicing of the equipment.
- Caution:** Risk of Electric Shock

4.5 Supply System

Use this section to set the type of power supply being monitored.

	From the set-up menu, use M and P buttons to select the system option. The screen will show the currently selected power supply.
	Press ESC to enter the selection routine. The current selection will flash.
	Use M and P buttons to select the required system option: 1P2(W),3P3(W) ,3P4(W).
	Press ESC to confirm the selection. SET indicator will appear.

Press **UI** to exit the system selection routine and return to the menu. SET will disappear and you will be returned to the main set-up Menu.

4.6 CT

The CT option sets the current ratio (1–2000) and secondary current (CT2 1A or 5A) of the current transformer (CT) that wires to the meter.

	From the set-up menu, use M and P buttons to select the CT option. The screen will show the current CT primary current value.
	Secondary CT setting Press ESC to enter the CT secondary current selection routine. 5A/1A
	Primary CT setting Press ESC to enter the CT primary current selection routine.

4.7 PT

The PT option sets the primary voltage (PTRatio100–50000V) and secondary voltage (PT2 100–500V) of the Voltage transformer (PT) that wires to the meter. The default value is 230V for both primary and secondary voltage.

	From the set-up menu, use M and P buttons to select the PT option. The screen will show the voltage PT primary voltage value.
	Secondary PT setting The setting method is same as Primary voltage setting PT1 Max. PT2 value is 500V
	Primary PT setting Press ESC to enter the PT primary voltage selection routine.

Press **UI** to exit the system selection routine and return to the menu. SET will disappear and you will be returned to the main set-up Menu.

4.8 Pulse Output

This option allows you to configure the pulse output. The output can be set to provide a pulse for a defined amount of energy active or reactive. Use this section to set up the relay pulse output—Units: kWh, kVarh

	From the set-up menu, use M and P buttons to select the Pulse output option.
	Press ESC to enter the selection routine. The unit symbol will flash.
	Use M and P buttons to choose kWh or kVarh.

On completion of the entry procedure, press **ESC** to confirm the setting and press **UI** to return to the main set up menu.

4.8.1 Pulse rate

Use this to set the energy represented by each pulse. Rate

can be set to 1 pulse per 0.001Wh/0.01kWh/0.1kWh/1kWh/10 kWh/100kWh. (It shows 1 impulse = 1Wh/kVarh)

	From the set-up menu, use M+ and P+ buttons to select the Pulse Rate option.
	Press E to enter the selection routine. The current setting will flash.

Use **M+** and **P+** buttons to choose pulse rate. 0.001/0.01/0.1/1/10/100kWh/kVarh per pulse. On completion of the entry procedure, press **E** to confirm the setting and press **W** to return to the main set up menu.

4.8.2 Pulse Duration

The energy monitored can be active or reactive and the pulse width can be selected as 200, 100 or 60ms. (It shows pulse width of 200ms)

	From the set-up menu, use M+ and P+ buttons to select the Pulse width option.
	Press E to enter the selection routine. The current setting will flash.

Use **M+** and **P+** buttons to choose pulse width (200/100/60ms). On completion of the entry procedure press **E** to confirm the setting and press **W** to return to the main set up menu.

4.9 Communication

There is a RS485 port can be used for communication using Modbus RTU protocol. For Modbus RTU, parameters are selected from Front panel.

4.9.2 Baud Rate

	From the set-up menu, use M+ and P+ buttons to select the Baud Rate option.
	Press E to enter the selection routine. The current setting will flash.
	Use M+ and P+ buttons to choose Baud rate 2.4k, 4.8k, 9.6k, 19.2k, 38.4k

On completion of the entry procedure, press **E** to confirm the setting and press **W** to return to the main set up menu.

4.9.3 Parity

	From the set-up menu, use M+ and P+ buttons to select the parity option.
	Press E to enter the selection routine. The current setting will flash.
	Use M+ and P+ buttons to choose parity (EVEN / ODD / NONE)

On completion of the entry procedure, press **E** to confirm the setting and press **W** to return to the main set up menu.

4.9.4 Stop bits

	From the set-up menu, use M+ and P+ buttons to select the stop bit option.
	Press E to enter the selection routine. The current setting will flash.
	Use M+ and P+ buttons to choose stop bit (2 or 1)

On completion of the entry procedure, press **E** to confirm the setting and press **W** to return to the main set up menu.

4.10.1 CLR kWh

	From the set-up menu, use M+ and P+ buttons to select the reset option.
	Press E to enter the selection routine. The dlt will flash.

Press **E** to confirm the setting and press **W** to return to the main set up menu.

4.10.2 CLR KVarh

	From the set-up menu, use M+ and P+ buttons to select the reset option.
	Press E to enter the selection routine. The dlt will flash.

Press **E** to confirm the setting and press **W** to return to the main set up menu.

4.10.2 CLR Max Demand

	From the set-up menu, use M+ and P+ buttons to select the reset option.
	Press E to enter the selection routine. The dlt will flash.

Press **E** to confirm the setting and press **W** to return to the main set up menu.

4.11 Reverse Connected Current Inputs Correction Setting

	From the set-up menu, use M+ and P+ buttons to select page "SET sys cont"
	Press E to enter Phase A, the default is frd (forward)
	Use M+ and P+ buttons to Phase B or C setting pages

4.11.2 How To Operate If Phase A Is Reversely Connected

	Go to phase A setting page
	Press E to enter the selection routine. The Frd will flash. Use P+ button to change Frd to rEV.

On Completion of the entry procedure, press **E** to confirm the setting and press **W** to return to the main set up menu.

4.12 Setting Auto Scroll Display Interval

	Use the M+ and P+ to choose the change Round of the significant time option
	Press the E to enter the change password routine. The new Round of the significant time screen will appear with the first digit flashing.
	Use M+ and P+ to set the first digit and press E to confirm your selection. The next digit will flash.
	Repeat the procedure for the remaining three digits.
	After setting the last digit, SET will show.

Press **W** to exit the number setting routine and return to the Set-up menu. SET will be removed

After setting, you still need to activate the auto scroll display function by keep pressing the button ESC. If you want exit from auto scroll display mode, you can pressing the ESC button to get out.

5 Specifications

5.1 Measured Parameters

The unit can monitor and display the following parameters of a single phase, 3-phase 3-wire or 3-phase 4-wire supply.

5.1.1 Voltage and Current

- Phase to neutral voltages 100 to 289V a.c. (not for 3p3w supplies)
- Voltages between phases 173 to 500V a.c. (3p supplies only)
- Percentage total voltage harmonic distortion (THD%) for each phase to N (not for 3p3w supplies)
- Percentage voltage THD% between phases (three phase supplies only)
- Current on each phase – 1 to 9999A range, set by external current transformer(s) (CTs)
- Current THD% for each phase

5.1.2 Power factor and Frequency and Max. Demand

- Frequency in Hz
- Instantaneous power:
- Power 0 to 999MW
- Reactive Power 0 to 999MVA
- Volt-amps 0 to 999 MVA
- Maximum demanded power since last Demand reset
- Power factor
- Maximum neutral demand current, since the last Demand reset (three phase supplies only)

5.1.3 Energy Measurements

- Imported active energy 0 to 9999999.9 kWh
- Exported active energy 0 to 9999999.9 kWh
- Imported reactive energy 0 to 9999999.9 kVAh
- Exported reactive energy 0 to 9999999.9 kVAh
- Total active energy 0 to 9999999.9 kWh
- Total reactive energy 0 to 9999999.9 kVAh

5.2 Measured Inputs

Voltage inputs through 4-way fixed connector with 2.5mm2 stranded wire capacity. 3-Phase 3-and 4-wire and Single-phase 2-wire 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 a.c.Rms.

5.3 Accuracy

- Voltage 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) ±2% of range maximum
- Apparent power (VA) ±1% of range maximum
- Active energy (Wh) Class 1 IEC 62053-21
- Reactive energy (VARh) ±2% of range maximum
- Total harmonic distortion 1% up to 31st harmonic
- Temperature co-efficient Voltage and current = 0.013%/°C typical = 0.018%/°C, typical
- Active energy 1s, typical, to >99% of final reading, at 50 Hz.
- Response time to step input

5.4 Auxiliary Supply

Two-way fixed connector with 2.5mm2 stranded wire capacity. 85 to 275V a.c. 50/60Hz ±10% or 120V to 380V d.c. ±20%. Consumption <10W.

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 5000imp/kWh (not configurable)

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

5.5.1 Pulse Relay Output

The pulse relay output can be set to generate pulses to represent kWh or kVAh.

Rate can be set to generate 1 pulse per:

- 0.001=1Wh/VArh
- 0.01 = 10 Wh/VArh
- 0.1 = 100 Wh/VArh
- 1 = 1 kWh/kVAh
- 10 = 10 kWh/kVAh
- 100 = 100 kWh/kVAh

Pulse width 200/100/60 ms. Relay Rating 240V ac 50mA

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 / odd / even

Stop bits 1 or 2

RS485 network address nnn – 3-digit number, 1 to 247

Modbus™ Word order Hi/Lo byte order is set automatically to normal or reverse. It cannot be configured from the set-up menu.

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.

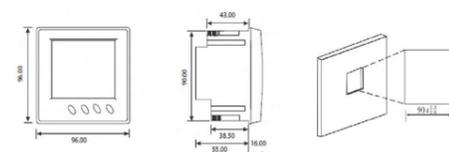
- Ambient temperature 23°C ±1°C
- Input waveform 50 or 60Hz ±2%
- Input waveform Sinusoidal (distortion factor < 0.005)
- Auxiliary supply voltage Nominal ±1%
- Auxiliary supply frequency Nominal ±1%
- Auxiliary supply waveform (if AC) Sinusoidal (distortion factor < 0.05)
- Magnetic field of external origin Terrestrial flux

5.7 Environment

- Operating temperature -25°C to +55°C*
- Storage temperature -40°C to +70°C*
- Relative humidity 0 to 90%, non-condensing
- Altitude Up to 2000m
- Warm up time 1 minute
- Vibration 10Hz to 50Hz, IEC 60068-2-6, 2g
- Shock 30g in 3 planes

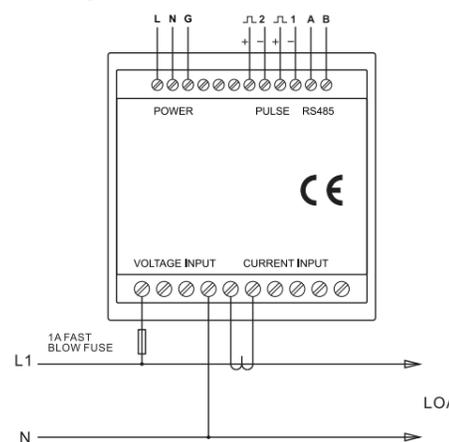
*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

6 Dimensions

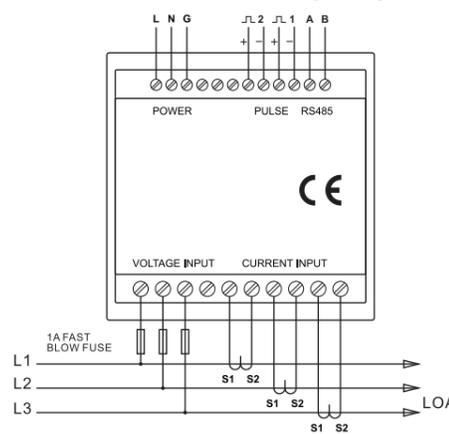


7 Wiring Diagram

7.1 Single Phase Two Wire (1P2W)



7.1 Three Phase Three Wire (3P3W)



7.1 Three Phase Four Wire (3P4W)

