

# User Manual

2016 v1.0

## SMARTRAIL X100-MID DIN Rail Smart Energy Meter for Single Phase Electrical Systems

### 1 Introduction

The Multifunction Energy Meter, SMARTRAIL X100-MID, is a new generation DIN rail mounted meter, used not only in the electricity transmission and power distribution system but also in power consumption measurement and analysis in high voltage intelligent power grid.

This document provides operating, maintenance and installation instructions for the SMARTRAIL X100-MID. The unit measures and displays the characteristics of single phase two wire supplies including voltage, frequency, current, power, active and reactive energy, imported or exported. Energy is measured in kWh and kVAh. Maximum demand power can be measured over preset periods of up to 60 minutes.

The SMARTRAIL X100-MID features two built-in pulsed outputs and RS485 Modbus RTU comms. Configuration is password protected.

#### 1.1 Unit Characteristics

The SMARTRAIL X100-MID can measure and display:

- Voltage
- Frequency
- Current
- Power, Maximum Demand Power and Power Factor
- Imported, Exported & Total Active Energy
- Imported, Exported & Total Reactive Energy

The unit has a Password-Protected set up menu for:

- Changing the Password
- Demand Interval Time
- Reset for Demand Measurements
- Pulse Output Duration

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

#### 1.2 RS485 Serial – Modbus RTU

This uses an RS485 serial port with Modbus RTU protocol to provide a means of remotely monitoring and controlling the SMARTRAIL X100-MID. Set-up screens are provided for setting up the RS485 port. See section 4.3

#### 1.3 Pulse output

This unit has 2 built-in pulsed outputs that record measured active and reactive energy. The constant for reactive energy is 5000imp/kVAh. 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 will display the set Modbus address.
	Finally the meter will display the configured baud rate.

\*After a short delay, the screen will display the total active energy measurement.

### 3 Buttons

The buttons operate as follows:



This is the button used to rotate through the different parameter options. This is also the button used to cycle through numbers when in selection mode. Holding this button when in selection mode will exit selection without saving.



This is the button that is held to enter an input, to confirm your selection change and to access the set up menu. This is also the button used to move right when in selection mode.

### 3.1 Measurements

Each successive press of the button selects a new parameter.

	Total active energy (Σ kWh).
	Imported active energy (kWh).
	Exported active energy (kWh).
	Partial active energy (Σ r kWh).
	Total reactive energy (Σ kVAh).
	Imported reactive energy (kVAh).
	Exported reactive energy (kVAh).
	Partial reactive energy (Σ r kVAh).
	Total Maximum Demand (W).
	Voltage Input (V).
	Current Input (A).
	Instantaneous Active Power (W).
	Instantaneous Reactive Power (VAr).
	Instantaneous Apparent Power (VA).
	Power Factor.
	Frequency (Hz)
	Pulse Constant
	Modbus Address (001-241)
	Modbus Baud Rate
	Hours Run (Σ h)

### 4 Set Up

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

	The set-up menu is password-protected so you must enter the correct password (default '1000') before proceeding.
	Use the  button to change the selected number, use the  button to move right.
	Once you have inputted the correct password hold the  button to confirm your selection.
	If the inputted password is correct, access will be granted to the set up menu. If an incorrect password is inputted an error screen will appear and you will be prompted to try again.

To exit the set-up menu, press & hold until the measurement screen is restored.

#### 4.1 Menu Option Selection

1. Use the button to scroll through to the required item in the menu. The menu scrolls through on a loop.
2. Once on the desired menu option, press & hold to confirm your selection.
3. If an item flashes, then it can be adjusted by the button. If not, there maybe a further layer.
4. Once you have changed the selection to the desired option, press & hold to confirm your selection. Once the option stops flashing it will set.
5. Having completed a parameter setting, press & hold the button to exit the set-up menu.

#### 4.2 Number Entry Procedure

When setting up the unit, some screens require the entering of a number. In particular, on entry to the set-up menu, 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 will start flashing and is set using the button.
2. Press to move right to the next digit.
3. After setting the last digit, press & hold the button to confirm the change.

#### 4.3 Set Modbus Address

This sets the Modbus address of the specific meter so that clients using a Modbus system can differentiate between meters. Available options are 001-241.

	Use the  button to choose the Modbus Address menu option.
	Press & hold the  button to edit the menu option. The Modbus address screen will appear with the first digit flashing.
	Use the  button to set the first digit and press  to move to the next digit.
	Press & hold the  button to confirm the change to the option you have selected.

To exit the set-up menu, press & hold until the measurement screen is restored.

#### 4.4 Set Baud Rate

The baud rate of a data communications system is the number of symbols per second transferred.

	Use the  button to choose the Baud Rate menu option.
	Press & hold the  button to edit the menu option. The baud rate option will appear flashing.
	Use the  button to cycle through the available options. Available options are 1200, 2400, 4800 & 9600.
	Press & hold the  button to confirm the change to the option you have selected.

To exit the set-up menu, press & hold until the measurement screen is restored.

### 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

#### 4.3 Set Parity

Available options are none (N), even (E) & odd (O).

	Use the  button to choose the Parity menu option.
	Press & hold the  button to edit the menu option. The parity option will appear flashing.
	Use the  button to cycle through the available options.
	Press & hold the  button to confirm the change to the option you have selected.

To exit the set-up menu, press & hold until the measurement screen is restored.

#### 4.6 Set Pulsed Output

The SMARTRAIL X100-MID comes with 2 built-in pulsed outputs. One of the pulsed outputs is settable by the user, the other pulsed output is fixed. Available options for editable pulsed outputs are kWh, kVAh, Import kWh, Export kWh, Import kVAh & Export kVAh.

Please note there are limitations that need to be factored in when setting the pulsed output. This is based upon the relay output only being able to pulse 2 times in one second.

	Use the  button to choose the Pulsed Output menu option.
	Press & hold the  button to edit the menu option. The Pulsed output option will appear flashing.
	Use the  button to cycle through the available options.
	Press & hold the  button to confirm the change to the option you have selected.

To exit the set-up menu, press & hold until the measurement screen is restored.

#### 4.7 Set Pulse Constant

The Pulse Constant is the menu setting that allows you to set how many times the meter will pulse to produce 1 pulsed output. Available options are 1, 10, 100 & 1000. For example, if you have set the Pulsed Output (see 4.4) to kWh, and the Pulse Constant is set to 10, the meter will pulse 10 times per kWh pulsed output.

	Use the  button to choose the Pulse Constant menu option.
	Press & hold the  button to edit the menu option. The Pulse constant option will appear flashing.
	Use the  button to cycle through the available options.
	Press & hold the  button to confirm the change to the option you have selected.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.8 Set Pulse Duration

The Pulse Duration option that allows you to set how long the contact of the pulse is open for per pulse. Available options are 60, 100 & 200ms.

Navigation steps for setting pulse duration: PLS t, PLS t 200, PLS t 100, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.9 DIT - Demand Integration Time

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

Navigation steps for setting DIT: dit SET, dit 15, dit 30, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.10 Automatic Scroll Time Interval

Use this section to set the time interval for the meter to scroll through the different parameters.

Navigation steps for setting scroll time interval: ScrL t, t 00 S, t 30 S, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.11 LP - Light Period

This sets the period in minutes over which the backlight on the meter stays on for. The options are: off, 5, 10, 15, 30, 60 minutes. The option OFF means that the backlight stays on continuously.

Navigation steps for setting light period: LP SET, LP OFF, LP 60, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.12 Reset (Clr)

Within this menu option, you can clear the Maximum Demand Power (W), you can reset the Partial Active Energy (Σ kWh) and the Partial Reactive Energy (Σ kVArh).

Navigation steps for resetting: clr, MD, Σ r, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

4.13 Change Password

Navigation steps for changing password: SETPASS, PAS 1000, PAS 1000, PAS 1234, Good.

To exit the set-up menu, press & hold until the measurement screen is restored.

5 Specifications

The SMARTTRAIL X100-MID can monitor and display the following parameters of a single phase supply:

- 5.1.1 Voltage and Current
5.1.2 Power factor and Frequency and Max. Demand
5.1.3 Energy Measurements

5.2 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.

5.3 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/kVArh, 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 kVArh.

- Rate can be set to generate 1 pulse per:
1 = 1 kWh/kVArh
10 = 10 kWh/kVArh
100 = 100 kWh/kVArh
1000 = 1000 kWh/kVArh

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 1200, 2400, 4800, 9600,

Parity none / odd / even

RS485 network address 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)
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

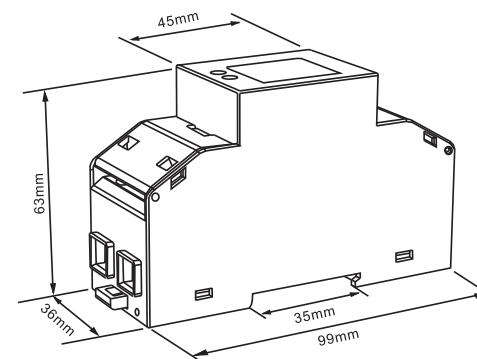
\*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

5.8 Declaration of Conformity

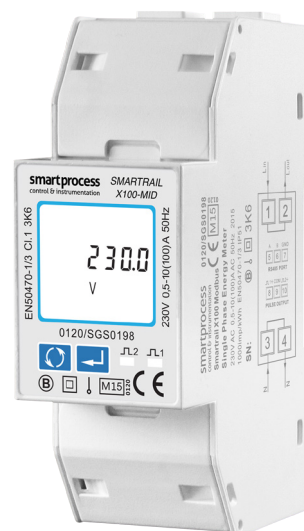
We, Smart Process & Control LTD, declare under our sole responsibility as the manufacturer that the single phase multifunction electrical energy meter "SMARTTRAIL X100", corresponds to the production model described in the EC-type examination certificate and to the requirements of the Directive 2004/22/EC EC type examination certificate number 0120/SGS0198. Identification number of the NB 0120.

6 Meter

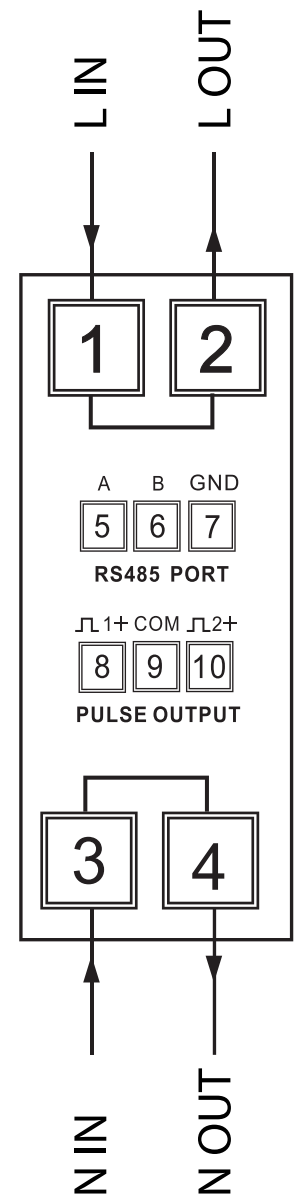
6.1 Dimensions



6.2 Appearance



7 Wiring Diagram



8 Notes

Blank lines for notes.