



# User Manual

2019 v2.0

## 871-8308 MID DIN Rail 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 wires (1p2w), three phase three wires (3p3w,) and three phase four wires (3p4w) networks. The measuring parameters include voltage (V), frequency (Hz), current (A), power (kW/Kva/Kvar), imported, exported and total Energy (kWh/kVarh). The unit also measures Maximum demand current and power, this is measured over preset 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. Built-in pulse and RS485 Modbus RTU outputs. Configuration is password protected.

This unit can be powered from a separate auxiliary (AC or DC) supply. Alternatively it can be powered from the monitored supply by linking the voltage reference and neutral reference in to terminals 5 + 6 (Please refer to wiring diagram).

#### 1. Unit Characteristics

The Unit 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 1p2w, 3p3w,3p4w
- Demand interval time
- Reset for demand measurements
- Pulse output duration

#### 1.2 Current Transformer Primary Current

This unit has to be configured to operate with a CT, The optional secondary currents or 1A or 5A, it is programmed by inputting the ratio (Please see section 4.5).It can be used on primary currents up to 6000A.

Please also be aware on the MID version you can only program the ratio once.

#### 1.3 RS485 Serial – Modbus RTU

RS485 serial port with Modbus RTU protocol to provide a means of remotely monitoring and controlling the Unit. Set-up screens are provided for setting up the RS485 port. Refers to section 4.8.

#### 1.4 Pulse output

Two pulsed outputs that can be set for active(kWh) or reactive (kVarh) energy. Terminals 11 & 12 have a fixed output of 3200imp/kWh. The settable pulse output is terminals 9 & 10.

## 2 Start Up Screens

|  |  |
|--|--|
|  | The first screen lights up 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. |
|  | 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:

|  |   |
|--|---|
|  | 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 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 button selects a new range:

|  |                                     |
|--|-------------------------------------|
|  | Frequency and Power Factor (total). |
|  | Power Factor of each phase.         |
|  | Maximum Power Demand.               |
|  | Maximum Current Demand.             |

### 3.3 Power

Each successive press of the button select a new range:

|  |                                       |
|--|---------------------------------------|
|  | Instantaneous Active Power in kW.     |
|  | Instantaneous Reactive Power in kVAR. |
|  | Instantaneous Volt-Amps in kVA.       |
|  | Total kW, kVarh, kVA.                 |

### 3.4 Energy Measurements

Each successive press of the 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.    |

Please note the register is 9999999.9 display over two lines.

## 4 Set Up

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

|  |   |
|--|---|
|  | 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: <b>PASS Err</b>                                 |

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

### 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 menu options.

#### 4.1.1 Menu Option Selection

1. Use the and buttons to scroll through the different options of the set up menu.
2. Press to confirm your selection
3. If an item flashes, then it can be adjusted by the and buttons.
4. Having selected an option from the current layer, press to confirm your selection. The SET indicator will appear.
5. Having completed a parameter setting, press to return to a higher menu level. The SET indicator will be removed and you will be able to use the and buttons for further menu selection.
6. On completion of all setting-up, press repeatedly until the measurement screen is restored.

#### 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 and buttons
2. Press confirm each digit setting. The SET indicator appears after the last digit has been set.
3. After setting the last digit, press to exit the number setting routine. The SET indicator will be removed.

### 4.2 Change Password

|  |   |
|--|---|
|  | Use the  and  to choose the change password option.   |
|  | Press the  to enter the change password routine. The new password screen will appear with the first digit flashing. |
|  | Use  and  to set the first digit and press  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 to exit the number setting routine and return to the Set-up menu. SET will be removed

### 4.3 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  and  buttons to select the DIT option. The screen will show the currently selected integration time. |
|  | Press  to enter the selection routine. The current time interval will flash.  |
|  | Use  and  buttons to select the time required.  |
|  | Press  to confirm the selection. SET indicator will appear.   |

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

### 4.4 Supply System

The unit has a default setting of 3Phase 4wire (3P4). Use this section to set the type of electrical system.

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

Press & hold confirm your adjustment, you can then move to the next parameter setting or press & hold to exit the set-up menu.

### 4.5 CT

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

|  |  |
|--|--|
|  | From the set-up menu, use  and  buttons to select the CT option.                                       |
|  | <b>Secondary CT setting</b><br>Press  enter the CT secondary current selection routine.:5A/1A          |
|  | <b>Set CT Ratio value</b><br>Press  enter the CT Ratio setting screen. The range is from 0001 to 9999. |

For example, if using a 100/5A current transformer you will enter 0020, as you need to divide the primary by the secondary to get the ratio (CT rate).

Please note as this is a MID approved device, you will only have one opportunity to set the ratio.

#### 4.5.1 CT Reversal

If the CT connections are incorrectly wired, they can be reversed through the Set System Continued menu:

|  |  |
|--|--|
|  | From the set-up menu, use  and  buttons to select the "Set Sys Cont" option. Press  to enter the sub-menu. |
|  | This screen will display, you can change "Forward" to "Reverse" on each individual CT connection.          |
|  | Press & Hold  confirm your adjustment. You can then move on to IB or IC.                                   |

### 4.6 PT

The PT option sets the secondary voltage (PT2 100 to 500V) of the voltage transformer (PT) that may be connected to the meter.

|  |  |
|--|--|
|  | From the set-up menu, use  and  buttons to select the PT option. The screen will show the voltage PT secondary voltage value. The default value is 400V. |
|  | <b>Secondary PT setting</b><br>Press  enter the PT secondary voltage selection routine. The range is from 100 to 500V.                                   |
|  | <b>Set PT ratios value</b><br>Press  enter the PT ratio screen. The range is from 0001 to 9999.  |

For example, if set the ratio to be 100,it means the primary voltage equals secondary voltage x100.

### 4.7 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  and  buttons to select the Pulse output option. |
|  | Press  enter the selection routine. The unit symbol will flash.            |
|  | Use  and  buttons to choose kWh or kVarh.                                  |

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

#### 4.7.1 Pulse rate

You can configure the pulse output to relate to a defined amount of imported or exported energy. This can also be set to use with active energy (kWh) or reactive energy (kVarh).

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.

For example, If the CT is set to 500/5A on a single phase network this would generate (500Ax230V=115,000 / 1000) 115kWh which is 31W per second. A setting of 10imp/kWh (10 pulses per kWh) would generate 3 pulses per second. This will exceed the 2 pulse per second limitation.

Pulse settings: 1 pulse per 0.01(10W) / 0.1(100W) / 1 (1kWh) / 10(10kWh) / 100(100kWh) /1000 (1000kWh)

#### 4.7.2 Pulse Duration

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

Use 'MOR' and 'P' buttons to choose pulse width. On completion of the entry procedure press 'E' to confirm the setting and press 'VA ESC' to return to the main set up menu.

#### 4.8 Communication

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

##### 4.8.1 RS485 Address

On completion of the entry procedure, press 'E' to confirm the setting and press 'VA ESC' button to return the main set-up menu.

##### 4.8.2 Baud Rate

On completion of the entry procedure, press 'E' to confirm the setting and press 'VA ESC' to return to the main set up menu.

#### 4.8.3 Parity

On completion of the entry procedure, press 'E' to confirm the setting and press 'VA ESC' to return to the main set up menu.

##### 4.8.4 Stop bits

On completion of the entry procedure, press 'E' to confirm the setting and press 'VA ESC' to return to the main set up menu.

#### 4.9 CLR

The meter provides a function to reset the maximum demand value of current and power.

Press 'E' to confirm the setting and press 'VA ESC' to return to the main set up menu.

### 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.

##### 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 THD% for each phase

##### 2. Power factor and Frequency and Max. Demand

- Frequency in Hz
- Instantaneous power:
- Power 0 to 3600MW
- Reactive power 0 to 3600 MVAR
- Volt-amps 0 to 3600 MVA
- Maximum demanded power since last Demand reset Power factor
- Maximum neutral demand current, since the last Demand reset (for three 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 2.5mm<sup>2</sup> 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 2.5mm<sup>2</sup> 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) ±1% of range maximum
- Apparent power (VA) ±1% of range maximum
- Active energy (Wh) Class 1 IEC 62053-21
- Reactive energy (VARh) ±1% of range maximum
- Total harmonic distortion 1% up to 31st harmonic
- Response time to step input 1s, typical, to >99% of final reading, at 50 Hz.

#### 5.4 Auxiliary Supply

Two-way fixed connector with 2.5mm<sup>2</sup> stranded wire capacity. 85 to 275V a.c. 50/60Hz ±10% or 120V to 380V d.c. ±20%. Consumption <2W 10VA.

#### 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 Pulse Output

Opto-coupler with potential free SPST-NO Contact (Contact range 5-27VDC / Max current input: Imin 2mA and Imax 27mA DC). The pulse output can be set to generate pulses to represent kWh or kVarh.

Rate can be set to generate 1 pulse per:  
 0.01 = 10Wh/VArh  
 0.1 = 100 Wh/VArh  
 1 = 1 kWh/kVarh  
 10 = 10 kWh/kVarh  
 100 = 100 kWh/kVarh

Pulse width 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) / 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 95%, non-condensing
- Altitude Up to 3000m
- 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 Mechanics

- DIN rail dimensions 72 x 94.5 mm (WxH) per DIN 43880
- Mounting DIN rail (DIN 43880)
- Sealing IP51 indoor
- Material Self-extinguishing UL 94 V-0

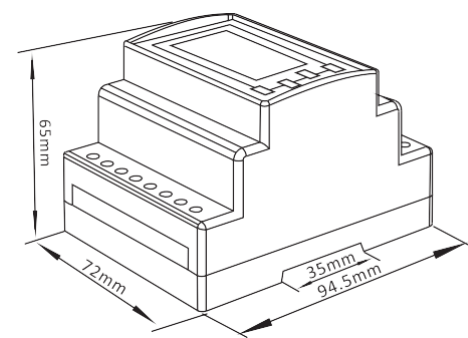
#### 5.9 Declaration of Conformity

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We, RS Components Ltd, Birchington Road, Corby, Northants, NN17 9RS, United Kingdom, declare that the fulfilment of the essential requirements of the Directive 2014/32/EU, set out in Annex I and in the relevant instrument-specific Annexes has been demonstrated. This declaration of conformity is issued under our sole responsibility as the manufacturer. The poly phase multifunction electrical energy meter type 871-8308 corresponds to the production model described in the EC-type examination certificate 0120/SGS0177 issued by SGS UK Ltd, Notified Body number 0120. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation.

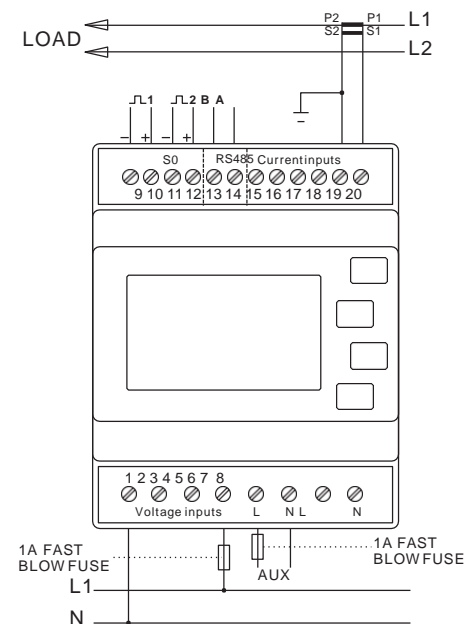
Signed James Milne RS Components date: 15th Jan 2019

### 6 Dimensions

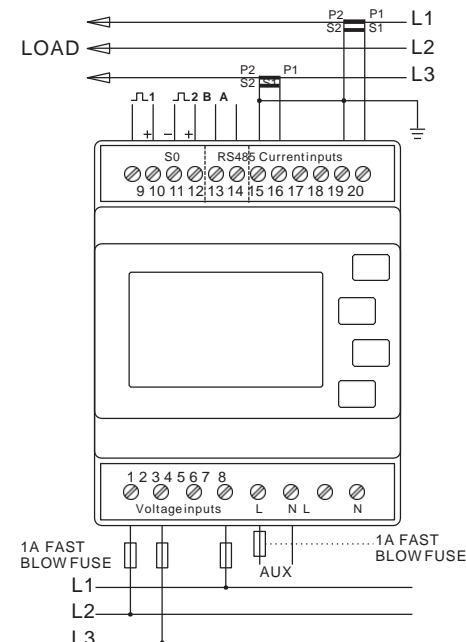


### 7 Installation

#### 7.1 Single phase two wires



#### 7.2 Three phase three wires



#### 7.3 Three phase four wires

