User Manual
2019 v2

MPA-3-668
DIN Rail Smart Energy Meter for Single & 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 (kW/KVA/KVAr), Power Factor (PF), 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.

It also comes with a complete comms capability with built in Pulse and RS485 Modbus RTU outputs, configuration is password protected.

This unit is 10(100)A direct connected. Configuration is password protected.

1.1 Unit Characteristics

The MPA-3-668 can measure and display:
- Phase to Neutral Voltage and THD% (Total Harmonic Distortion) of all Phases
- Line Frequency
- Current, Maximum Demand Current and Current THD% of all Phases
- Power, Maximum Power Demand 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
- System Configuration - 1P2W, 3P3W, 3P4W.
- Demand Interval Time
- Reset for Demand Measurements
- Pulsed Output Duration

1.2 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.

1.3 Pulse output

Two pulsed outputs that can be set for active(kWh) or reactive (kVArh) energy.

2 Start Up Screens

	The first screen lights up all display segments and can be used as a display check.
SoFt 13.00 2013	The second screen indicates the firmware installed in 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:

V/A ESC	Selects the Voltage and Current display screens. In Set-up Mode, this is the "Left" or "Back" 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 "Enter" or "Right" button.

3.1 Voltage and Current

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

L¹ 000.0 V L² 000.0 L³ 000.0	Phase to neutral voltages.
L¹ 0.000 A L² 0.000 L³ 0.000	Current on each phase.
L¹ 00.00 V %THD L² 00.00 L³ 00.00	Phase to neutral voltage THD%.
L¹ 00.00 I%THD L² 00.00 L³ 00.00	Current THD% for each phase.

3.2 Frequency and Power Factor and Demand

Each successive press of the [MD PF Hz] button selects a new range:

M 00.00 Hz 0.999 PF	Frequency and Power Factor (total).
L¹ 0.999 L² 0.999 L³ 0.999 PF	Power Factor of each phase.
MD 0.000 kW M	Maximum Power Demand.
MD L¹ 0.000 L² 0.000 L³ 0.000 A	Maximum Current Demand.

3.3 Power

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

L¹ 0.000 kW L² 0.000 L³ 0.000	Instantaneous Active Power in kW.
L¹ 0.000 kVAr L² 0.000 L³ 0.000	Instantaneous Reactive Power in kVAr.
L¹ 0.000 L² 0.000 L³ 0.000 kVA	Instantaneous Volt-Amps in KVA.
M 0.000 kW 0.000 kVAr 0.000 kVA	Total kW, kVArh, kVA.

3.4 Energy Measurements

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

IMPORT kWh 0000 0.314	Imported active energy in kWh.
EXPORT kWh 0000 00.0	Exported active energy in kWh.
IMPORT 0000 00.0 kVArh	Imported reactive energy in kVArh.
EXPORT 0000 00.0 kVArh	Exported reactive energy in kVArh.
kWh 0000 M 031.4	Total active energy in kWh.
kVArh 0000 M 00.0	Total reactive energy in kVArh.

Please note the register is 9999999.9 display over two lines.

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4 Set Up

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

PASS 0000	Setting up is password-protected so you must enter the correct password (default '1000') before processing.
PASS Err	If an incorrect password is entered, the display will show: PASS Err

To exit setting-up mode, press [V/A] 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 [MD PF Hz] and [P] buttons to scroll through the different options of the set up menu.
2. Press [E] to confirm your selection
3. If an item flashes, then it can be adjusted by the [MD PF Hz] and [P] buttons.
4. Having selected an option from the current layer, press [E] to confirm your selection. The SET indicator will appear.
5. Having completed a parameter setting, press [V/A] to return to a higher menu level. The SET indicator will be removed and you will be able to use the [MD PF Hz] and [P] buttons for further menu selection.
6. On completion of all setting-up, press [V/A] 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 [MD PF Hz] and [P] buttons
2. Press [E] to confirm each digit setting. The SET indicator appears after the last digit has been set.
3. After setting the last digit, press [V/A] to exit the number setting routine. The SET indicator will be removed.

4.2 Change Password

SET PASS 1000	Use the [MD PF Hz] and [P] to choose the change password option.
SET PASS 1000	Press the [E] to enter the change password routine. The new password screen will appear with the first digit flashing.
SET PASS 1000	Use [MD PF Hz] and [P] to set the first digit and press [E] to confirm your selection. The next digit will flash.
SET PASS 1100	Repeat the procedure for the remaining three digits.
SET PASS 1100	After setting the last digit, SET will show.

Press [V/A] 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.

SET dIt 10	From the set-up menu, use [MD PF Hz] and [P] buttons to select the DIT option. The screen will show the currently selected integration time.
SET dIt 10	Press [E] to enter the selection routine. The current time interval will flash.
SET dIt	Use [MD PF Hz] and [P] buttons to select the time required.
SET dIt 20	Press [E] to confirm the selection. SET indicator will appear.

Press [V/A] 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

4.4 Supply System

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

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

Press [V/A] 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.

4.5 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

SET rLY kWh	From the set-up menu, use [MD PF Hz] and [P] buttons to select the Pulse output option.
SET rLY kWh	Press [E] to enter the selection routine. The unit symbol will flash.
SET rLY kVArh	Use [MD PF Hz] and [P] buttons to choose kWh or kVArh.

On completion of the entry procedure, press [E] to confirm the setting and press [V/A] to return to the main set up menu.

4.5.1 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.

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

SET rATE 10	From the set-up menu, use [MD PF Hz] and [P] buttons to select the Pulse Rate option.
SET rATE 10	Press [E] to enter the selection routine. The current setting will flash. 0.01/0.1/1/10/100kWh/ kVArh per pulse.

Use [MD PF Hz] and [P] buttons to choose pulse rate. On completion of the entry procedure, press [E] to confirm the setting and press [V/A] to return to the main set up menu.

4.5.2 Pulse Duration

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

SET PULS 200	From the set-up menu, use [MD PF Hz] and [P] buttons to select the Pulse width option.
SET PULS 200	Press [E] to enter the selection routine. The current setting will flash.

Use [MD PF Hz] and [P] buttons to choose pulse width. On completion of the entry procedure press [E] to confirm the setting and press [V/A] to return to the main set up menu.

4.6 Communication

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

4.6.1 RS485 Address

From the set-up menu, use ▲ and ▼ buttons to select the address ID.

Press E button to enter the selection routine. The current setting will be flashing.

Use ▲ and ▼ buttons to choose Modbus address (001 to 247).

On completion of the entry procedure, press E button to confirm the setting and press V/A button to return the main set-up menu.

4.6.2 Baud Rate

From the set-up menu, use ▲ and ▼ buttons to select the Baud Rate option.

Press E to enter the selection routine. The current setting will flash.

Use ▲ and ▼ 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 V/A to return to the main set up menu.

4.6.3 Parity

From the set-up menu, use ▲ and ▼ buttons to select the parity option.

Press E to enter the selection routine. The current setting will flash.

Use ▲ and ▼ buttons to choose parity (EVEN / ODD / NONE (default)).

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

4.6.4 Stop bits

From the set-up menu, use ▲ and ▼ buttons to select the stop bit option.

Press E to enter the selection routine. The current setting will flash.

Use ▲ and ▼ buttons to choose stop bit (2 or 1)

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

4.7 CLR

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

From the set-up menu, use ▲ and ▼ 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 V/A to return to the main set up menu.

4.8 Backlight Set-up

Our high-definition backlight display can be set to a duration that suits the end-customer best.

From the set-up menu, use ▲ and ▼ buttons to select the reset option.

Press E to enter the selection routine. The dlt will flash. The options are 0/5/10/30/60/120 minutes.

Press E to confirm the setting and press V/A 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.

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 THD% for each phase

5.1.2 Power factor and Frequency and Max. Demand

- Frequency in Hz
- Instantaneous power:
- Power 0 to 3600 MW
- 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 25mm^2 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.

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.

5.5 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 400imp/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 = 10 Wh/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)
• Short Circuit Capacity	10kA
• Over Voltage Category	Cat III (4kV)
• 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	76 x 100 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

We, Janitza Electronics UK Ltd, declare under our sole responsibility as the manufacturer that the poly phase multifunction electrical energy meter "MPA-3-668" correspond to the production model described in the EC-type examination certificate and to the requirements of the Directive 2014/32/EC EC type examination certificate number 0120/SGS0257. Identifcation number of the NB 0120.
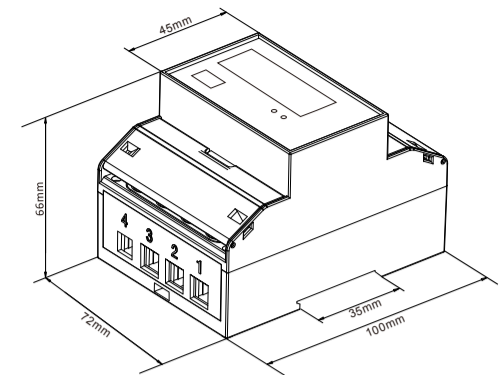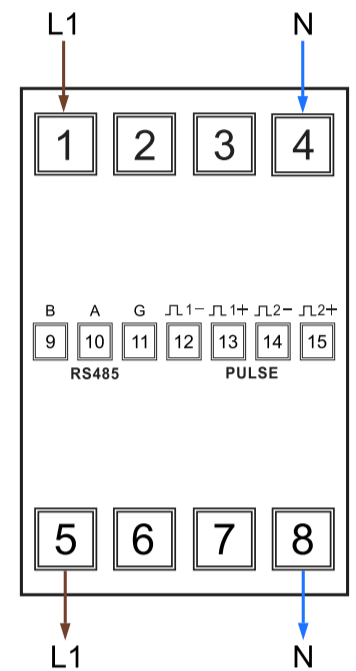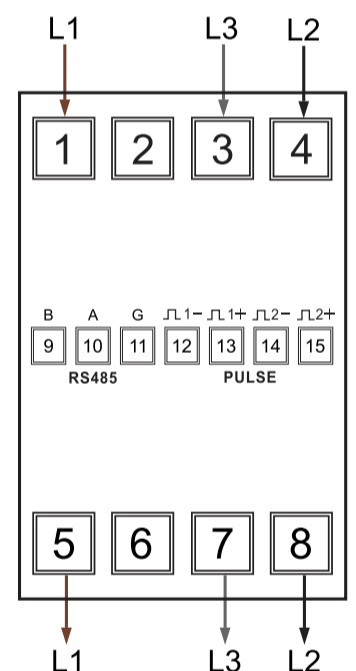
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6.1 Nameplate

7 Dimensions

8 Installation

8.1 Single phase two wires

8.2 Three phase three wires

8.3 Three phase four wires