AUTOMETERS SYSTEMS

HORIZON
Energy Monitoring and Invoicing

HORIZON SYSTEM METER HT-400

Multi Function , Multi Tariff , MID Approved. Autometers Modbus V6.

Introduction

This document provides operating, maintenance and installation instructions.These units measure and display 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),import, export and total Energy (kWh/kVarh).The units can also measure Maximum demand current and power, this is measured over preset periods of up to 60 minutes.

The HT-400 range of meters are 100 amp maximum direct connected meters and can be supplied in two versions, with the mains supply entering at the top of the meter or the mains supply entering at the bottom of the meter (see page 14).

The new HT-400 meter is supplied with an RS 485 Modbus protocol and 2 pulse outputs.

The Modbus output is defaulted to work directly with the Horizon data monitoring and invoicing system


SGS

EU Type Examination Certificate Number: 0120/SGS0350

Autometers Systems Ltd

4B Albany Road
Manchester
M21 0AW
United Kingdom

Instrument identification:
A-400 Series
Polyphase, Active Import/ Export (kWh), Indoor, Electricity Meter
HT-400
Polyphase, Active Import/ Export (kWh), Indoor, Multi-Tariff, Electricity Meter

Instrument Traceable Number:
0120/SGS0350

has been assessed and certified as meeting the requirements of

EU Directive 2014/32/EU
on Measuring Instruments Annex II, Module B

It is certified that the manufacturer's technical design and specimen for the above instrument has been examined and, based on the evidence submitted, it is considered that the instrument conforms to the requirements of Annex V of EU Directive 2014/32/EU.

This certificate must be used in conjunction with a certificate covering the product verification as required in Annex II, Module D or Annex II, Module F.

This certificate is valid until 5th January 2025
Issue 2

Certification is based on report number(s): SHES13080032150 1 dated 26th December 2014
EMA198276/1 dated 26th December 2014
EMA198276/2 dated 21st June 2018
EMA198306

Authorised Signature

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SGS

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EU Type Examination Cert.
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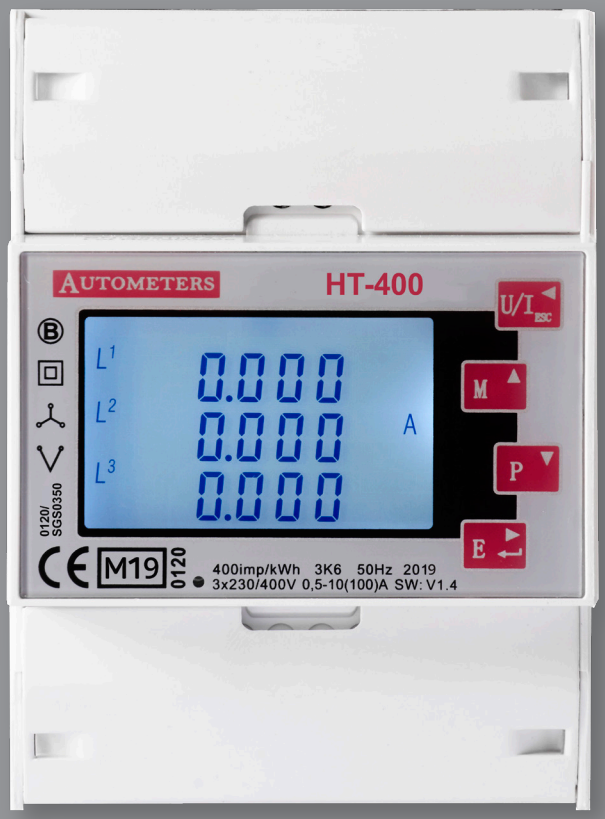


Declaration of Conformity

We, Autometers Systems Ltd, 4B Albany Road, Manchester, M21 0AW, UK ensure and declare that apparatus: Energy Meter HT-400 with the measurement range 3x230/400V 0,5-10 (100)A 50Hz are in conformity with the type as described in the EU-type examination certificate 0120/SGS0350 with Serial number in format of XXXXXXXX, Batch format: xxxxxx and satisfy the appropriate requirements of the Directive 2014/32/EU with the following standards: EN 50470-1: 2006, Electricity metering equipment (AC) Part 1: General requirements, tests and test conditions. Metering equipment (class indexes A, B and C) and EN 50470-3: 2006, Electricity metering equipment (AC) Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

I. Unit Characteristics

1.1 Unit Characteristics

- MID Approved (SGS.UK) Appendix B and D
- Multi-tariff with internal time clock
- Measures kWh, KVArh, KVar,PF,Hz, Max demand
- RS 485 Modbus (Autometers V6 protocol)
- Two Pulse Outputs
- BI- Directional Measurement for Import and Export
- Back light LCD for full viewing Angles
- Available as 1 Phase 2 Wire, 3 Phase 3 Wire and 3 Phase 4 Wire

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

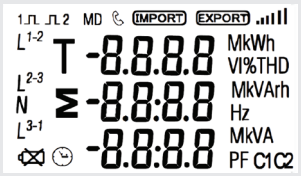
1.2 RS485 Serial-Modbus RTU

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

1.3 Pulse output

The HT-400 has two pulse outputs which measure energy. Number 1 pulse output is fully programmable, number 2 pulse output is fixed at 400 imp/kWh, 100ms pulse width.

2. Start up screens



The first screen lights all LED segments and can be used as a display LED check

The second screen indicates the software version of the unit.
(the above picture is just for reference)

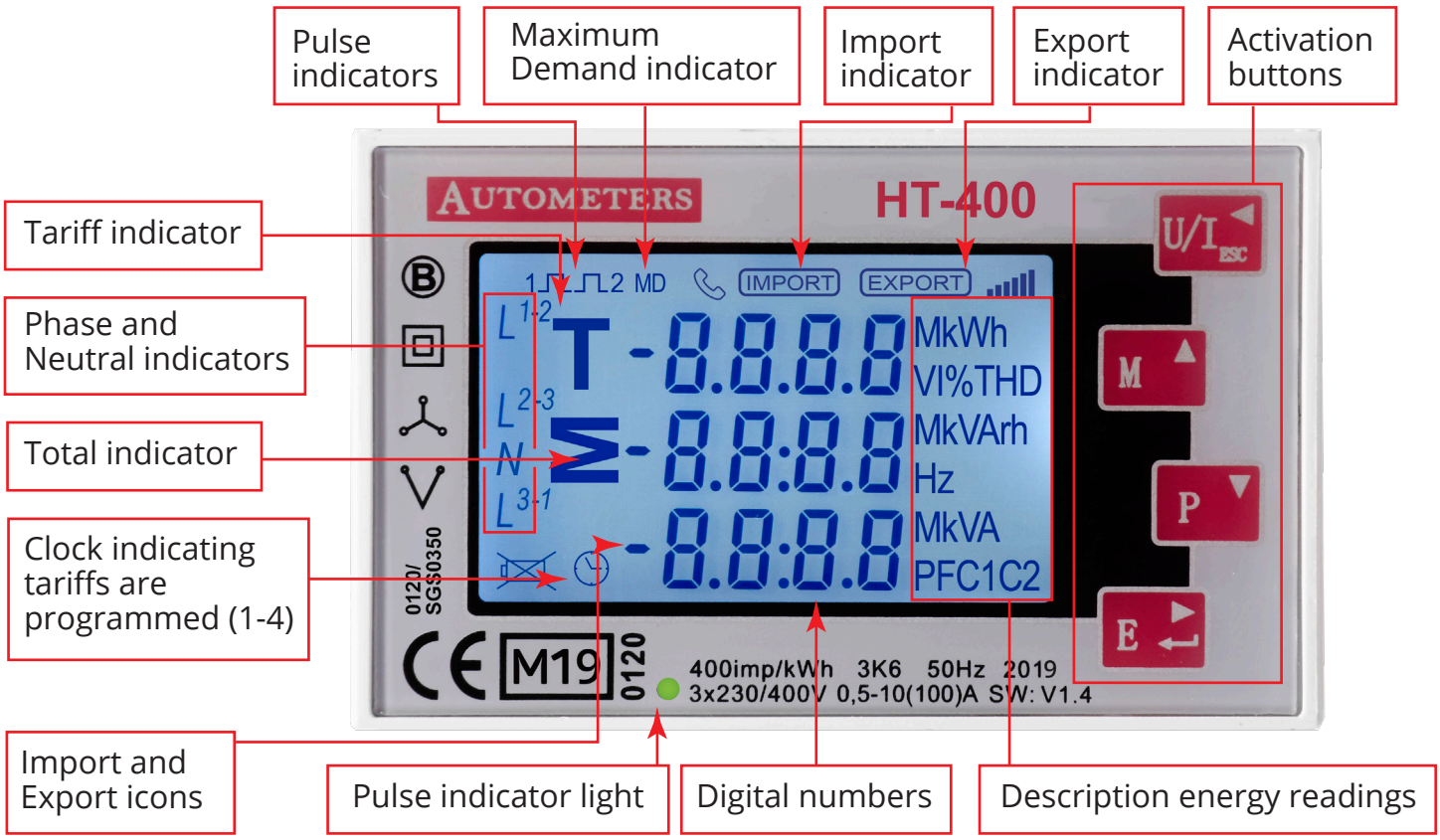
After a short delay, the screen will display active energy measurements.

2.1 Reading an 8 digit kWh register number

The top line shows the first four digits in the register number. The bottom line shows the next four digits.

In the example, the 8 digit kWh register number is 000003.14

3. Keys and Displays



3.1 Button Functions

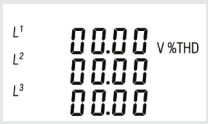
Button	Click
V/A ESC	■ Selects the Voltage and Current display screens. ■ In Set-up Mode, this is the “Left” or “Back” button.
MD/ PF/HZ	■ Select the Frequency and Power factor display screens. ■ In Set-up Mode, this is the “Up” button.
P	■ Select the Power display screens. ■ In Set-up Mode, this is the “Down” button. ■ Modbus Id ■ Baud rate ■ Parity ■ ID, Serial number
E	■ Select the Energy display screens. ■ In Set-up mode, this is the “Enter”, “Right” or “Confirm” button.

3.2 Voltage and Current

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

Phase to neutral voltages.

Current on each phase.

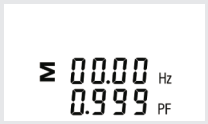


Phase to neutral voltage THD% of 2nd to 19th.

Each phase Current THD% of 2nd to 19th.

3.3 Frequency and Power Factor and Demand

Each successive press of the MD/ PF/HZ button selects a new range:



Frequency and Power Factor (total).

Power Factor of each phase.

Maximum Current Demand.

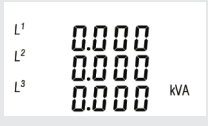
Maximum Power Demand.

3.4 Power

Each successive press of the P button selects a new range:

Instantaneous Active Power in kW.

Instantaneous Reactive Power in kVAr.



Instantaneous Volt-Amps in KVA.

Total kW, kVArh, kVA.

3.5 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.

Tariff 1 active energy
Tariff 2 active energy
Tariff 3 active energy
Tariff 4 active energy
("T x run" shows tariff running)

Date
Year/month/day.
(Factory programmed)

Time
Hour/minute/second
Example:00:02: 16
(Factory programmed)

4. Set Up

To enter set-up mode, press the E 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.

If an incorrect password is entered, the display will show:

PASS Err

To exit set-up mode, press the V/A ESC button 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

Use the MD/PF/HZ and P buttons to scroll through the different options of the set-up menu.
Press E to confirm your selection.
If an item flashes, then it can be adjusted by the MD/PF/HZ and P buttons.
Having selected an option from the current layer, press E to confirm your selection. The SET indicator will appear.
Having completed a parameter setting, press V/A ESC 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.
On completion of all setting-up, press V/A ESC 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:
The current digit to be set flashes and is set using the MD/PF/HZ and P buttons.
Press E to confirm each digit setting. The SET indicator appears after the last digit has been set.
After setting the last digit, press V/A ESC to exit the number setting routine. The SET indicator will be removed.

4.2 Communication

Where the meter has been supplied with a RS 485 protocol output the individual parameters are set by using the front key panel.

4.2.1 Modbus RS 485 Address

(The range is from 001 to 247)
From the set-up menu, use MD/PF/HZ and P buttons to select the address ID.

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

Use MD/PF/HZ and P 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 ESC button to return the main set-up menu.

4.2.2 Baud Rate

From the set-up menu, use MD/ PF/HZ and P buttons to select the Baud Rate option.

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

Use MD/ PF/HZ 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 V/A ESC to return to the main set up menu.

4.2.3 Parity

From the set-up menu, use MD/ PF/HZ and P buttons to select the Parity option.

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

Use MD/ PF/HZ and P buttons to choose parity (EVEN / ODD / NONE (default is EVEN)).
On completion of the entry procedure, press E to confirm the setting and press V/A ESC to return to the main set up menu.

4.3 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 pulse output—Units: total kWh/kVArh, import kWh/kVArh, export kWh/kVArh

From the set-up menu, use MD/ PF/HZ and P buttons to select the Pulse Output option.

Press E to enter the selection routine. The unit symbol will flash.

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 ESC to return to the main set up menu.

4.3.1 Pulse Rate

Use this to set the energy represented by each pulse. Rate can be set to 1 pulse per 0.01kWh / 0.1kWh / 1kWh / 10kWh / 100kWh.

(It shows 1 impulse = 10kWh/kVArh)

From the set-up menu, use MD/PF/HZ and P buttons to select the Pulse Rate option.

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 ESC to return to the main set up menu.

4.3.2 Pulse Duration

The pulse width can be selected as 200, 100 (default) or 60ms.

(It shows pulse width of 200ms)

From the set-up menu, use MD/PF/HZ and P buttons to select the Pulse width option.

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

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 ESC to return to the main set up menu.

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: 0, 5, 8,10,15, 20, 30, 60 minutes.

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.

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

Use MD/PF/HZ and P buttons to select the time required.

Press E to confirm the selection. SET indicator will appear.

Press V/A ESC to exit the DIT selection routine and return to the menu.

4.5 Backlit Set-up

The meter provides a function to set the blue backlit lasting time (0/5/10/30/60/120 minutes). Option 0 means the backlit always on here.

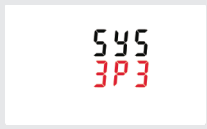
Default:60
If it's set to 5,the backlit will be off in 5minutes.

Use MD/PF/HZ and P buttons to choose the time
Press E to confirm the setting and press V/A ESC to return to the main set up menu.

4.6 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 MD/PF/HZ and P buttons to select the system option. The screen will show the currently selected power supply.



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

Use MD/PF/HZ and P buttons to select the required system option: 1P2(W),3P3(W) ,3P4(W).

Press E to confirm the selection. SET indicator will appear.
Press V/A ESC 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.

4.7 Maximum Demand Reset

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

Use MD/PF/HZ and P buttons to select the reset option.

Press E to enter the selection routine. The dIt will flash
Press E to confirm the setting and press V/A ESC to return to the main set up menu.

4.8 Change Password

Use MD/ PF/HZ and P to choose the change password option.

Press the E button to enter the change password routine. The new password screen will appear with the first digit flashing.

Use MD/ PF/HZ 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 V/A ESC to exit the number setting routine and return to the set-up menu. SET will be removed.

4.9 Tariffs

Four tariff and eight segments. Factory configured. Contact Autometers Ltd for details.

4.9.1 Set System RTC & Time

RTC and time are factory configured. Only required when using tariffs.

5. Specification

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 four phase four wire(3p4w) system.

5.1.1 Voltage and Current

Phase to neutral voltages 100 to 276V a.c. (not for 3p3w supplies).
Voltages between phases 173 to 480V a.c.
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 Maximum Demand

Frequency in Hz
Instantaneous power:
Power 0 to 96000 W
Reactive power 0 to 96000 VAr
Volt-amps 0 to 96000 VA
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 999999.99 kWh
Imported/Exported reactive energy..... 0 to 999999.99 kVArh
Total active energy..... 0 to 999999.99 kWh
Total reactive energy..... 0 to 999999.99 kVArh

5.2 Measured Inputs

2 Voltage inputs through 4-way fixed connector with 25mm^2 stranded wire capacity. single phase two wire (1 p2w), three phase three wire (3p3w) or three phase four wire (3p4w) unbalanced. Line frequency measured from L 1 voltage or L3 voltage.

5.3 Interfaces for External Monitoring

Three interfaces are provided:
- RS 485 communication channel that can be programmed for Modbus RTU protocol
- Pulse output 1 indicating real-time measured energy (configurable)
- Pulse output 2 400imp/kWh (not configurable)

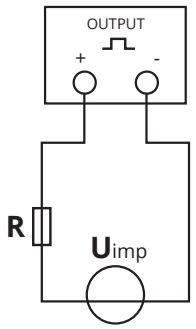
The Modbus configuration (baud rate etc.) and the pulse relay output assignments (kW/kVArh, import/export etc.) are configured through the set-up screens.

5.3.1 Pulse Output

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

Contact range 5-27V DC Max. current Input: 27mA DC



Pulse output circuit diagram

The test pulse output is a polarity dependent, passive transistor output requiring an external voltage source for correct operation. For this external voltage source, the voltage (Ui) should be 5-27V DC, and the maximum input current (Imax) should be 27mA DC. To connect the impulse output, connect 5-27V DC to connector 7 (anode), and the signal wire(s) to connector 6 (cathode). The meter pulse is indicated on the front panel.

Attention: Pulse output must be fed as shown in the wiring diagram above. Scrupulously respect polarities and the connection mode. Opto-coupler with potential-free SPST-NO contact.

5.3.2 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, 001 to 247

Please contact us if your require the Modbus/Mbus protocol document.

5.4 Accuracy

Voltage	0.5% of range maximum
Current	0.5% of nominal
Frequency	0.2% of mid-frequncy
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 EN50470-1/3
Reactive energy (VARh)	±1% of range maximum
THD	1% up to 31st harmonic
Response time to step input	1s, typical, to >99% of final reading, at 50 Hz

5.5 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 ± 2°C
Input waveform	50 Hz(MID) 50 or 60Hz ±2%(non-MID)
Input waveform	Sinusoidal (distortion factor < 0.005)

5.6 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.

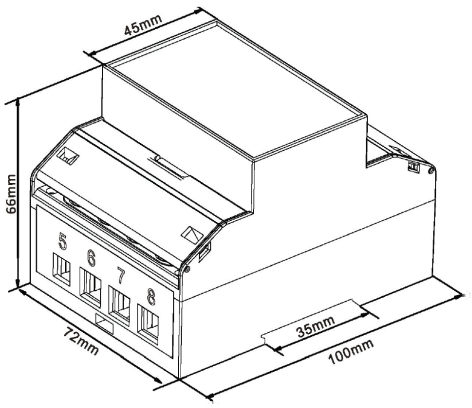
5.7 Mechanics

DIN rail dimensions	72 x 100 mm (WxH) per DIN 43880
Mounting	DIN rail (DIN 43880)
Sealing	Ip51 (indoor)
Material	Self-extinguishing Ul94 V-0

6. Dimensions

The meter is a four module DIN rail mounted meter.
Dimensions are 72mm width x 100mm height x 66mm deep

The cut out hole for the front of the enclosure is 73mm x 46mm



WARNING

Important Safety Information is contained in sections 7-8. 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

7. Maintenance

In normal use, little maintenance is needed. As appropriate for service conditions, isolate electrical power, inspect the unit and remove any dust or other foreign material present. Periodically check all connections for freedom from corrosion and screw tightness, particularly if vibration is present.

The front of the case should be wiped with a dry cloth only. Use minimal pressure, especially over the viewing window area. If necessary wipe the rear case with a dry cloth. If a cleaning agent is necessary, isopropyl alcohol is the only recommended agent and should be used sparingly. Water should not be used. If the rear case exterior or terminals should be contaminated accidentally with water, the unit must be returned to Autometers Systems Ltd for inspection and testing.

8. Installation

The meter is designed to be fitted on a DIN rail in a suitable enclosure. The unit is intended for use in a reasonably stable ambient temperature within the range -25°C to +55°C. Do not fit the meter where there is excessive vibration or in excessive direct sunlight.
Please note terminal covers should be fitted and sealed.
See connection diagrams pages 14-15.

8.1 Safety

The unit is designed in accordance with IEC 61010-1:2010 – Permanently connected use, Normal condition. Installation category III, pollution degree 2, basic insulation for rated voltage.

9. Electrician.

The HT-400 DIN rail meter should only be installed by a fully qualified electrician who has knowledge of electricity meters connected with current transformers.

It is the installer who is fully responsible for the safe installation of this meter. It must be installed to meet the current electrical regulations concerning installation of electricity meters.

10. EMC Installation Requirements

Whilst this unit complies with all relevant EU EMC (electro-magnetic compatibility) regulations, any additional precautions necessary to provide proper operation of this and adjacent equipment will be installation dependent and so the following can only be general guidance:
Avoid routing wiring to this unit alongside cables and products that are, or could be, a source of interference.

The auxiliary supply to the unit should not be subject to excessive interference. In some cases, a supply line filter may be required.

To protect the product against incorrect operation or permanent damage, surge transients must be controlled. It is good EMC practice to suppress transients and surges at the source. The unit has been designed to automatically recover from typical transients; however in extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 10 seconds to restore correct operation.
Screened communication leads are recommended and may be required. These and other connecting leads may require the fitting of RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems.

It is good practice to install sensitive electronic instruments that are performing critical functions in EMC enclosures that protect against electrical interference causing a disturbance in function.

II. Wiring Diagrams

11.1 Mains/Load Connections

The HT-400 can be supplied with two wiring configurations: Mains entering at the top, load at the bottom - see fig.A; or mains entering at the bottom, load at the top - see fig.B.

Fig.A Mains at the top

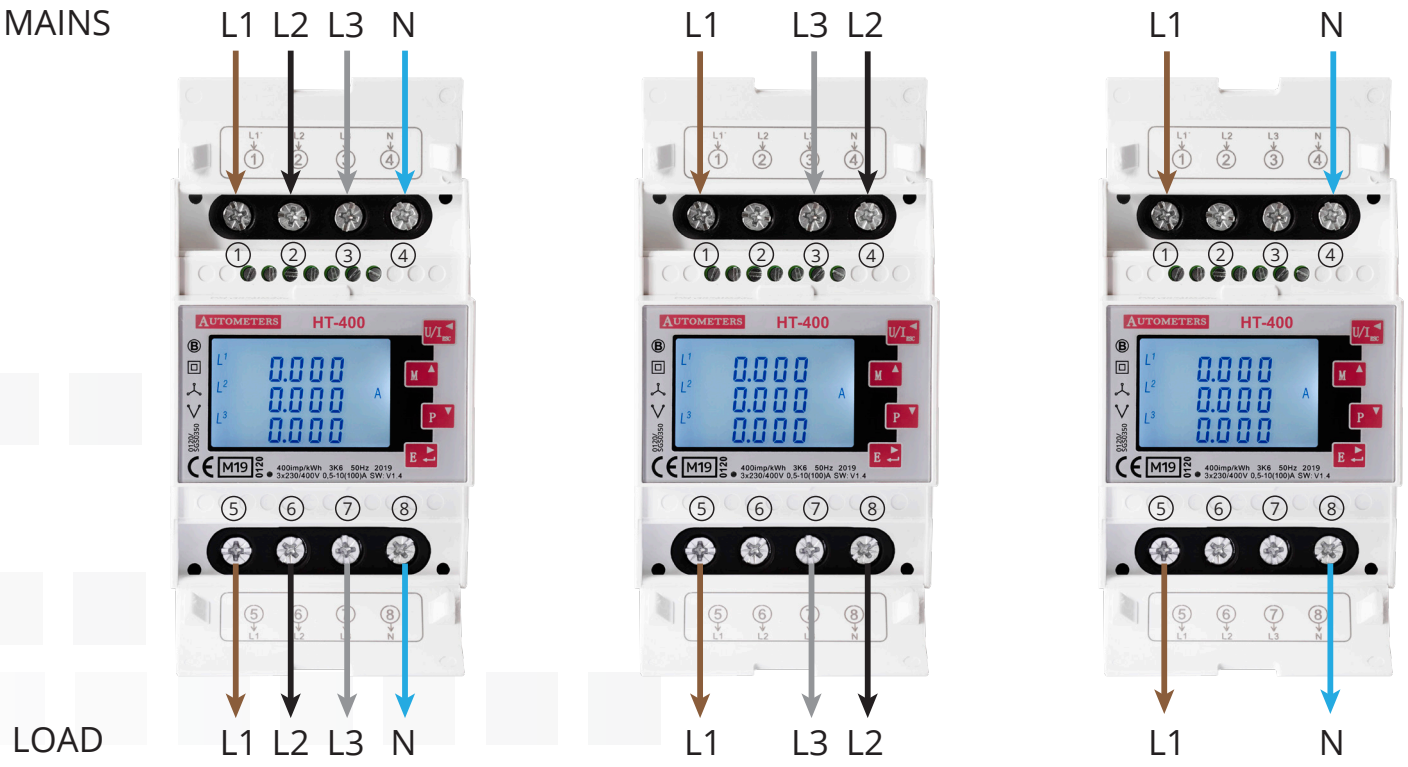
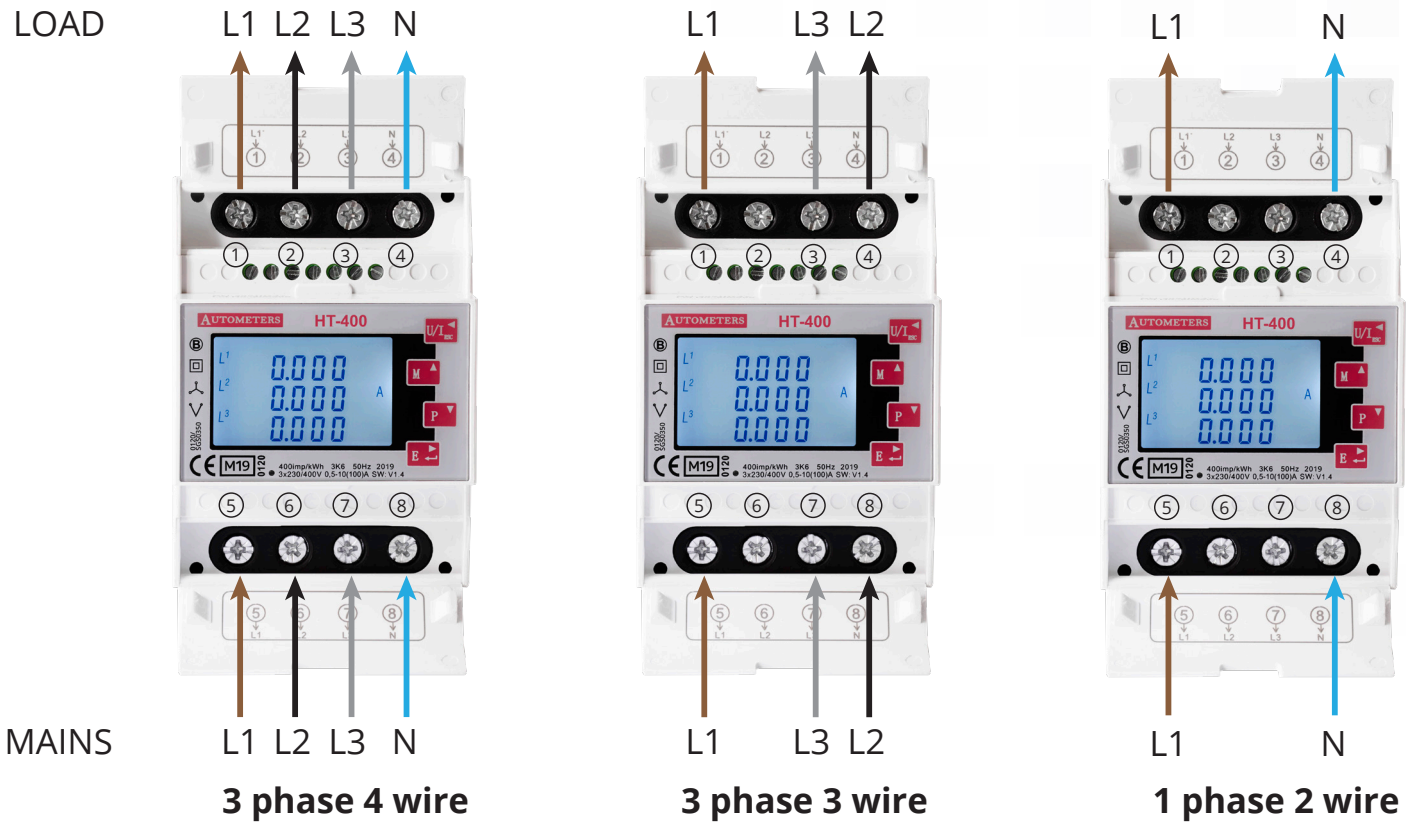
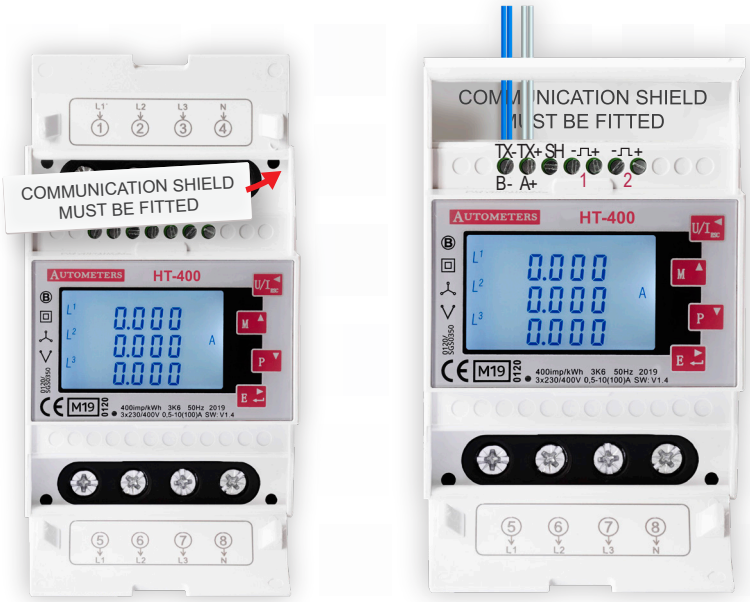


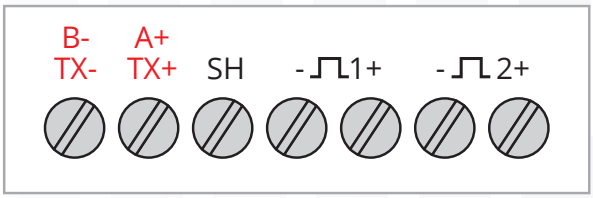
Fig.B Mains at the bottom



11.2 Communication Connections



The communications shield must be fitted before making the communication connections



12. The Horizon Energy Monitoring System With the New HT-400 Series

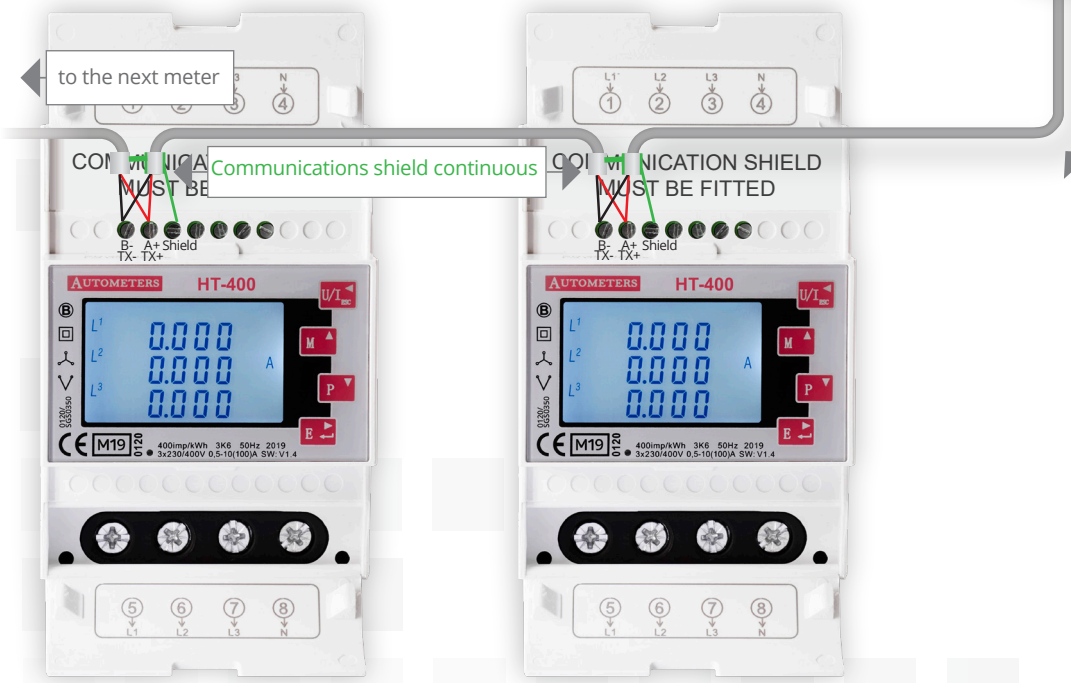
RS 485 Modbus Communication to enable full data retrieval of kWh for Graphic analysis and Billing

The HC2-P is a surface mounted GPRS enabled data collection device capable of storing information from up to 350 meters via 3 separate Lans

2 x Modbus – up to 127 meters on 1000 metres of Belden 9841 cable.

1 x M-bus – up to 100 devices on 1000 metres of Belcom 410P1824 cable.

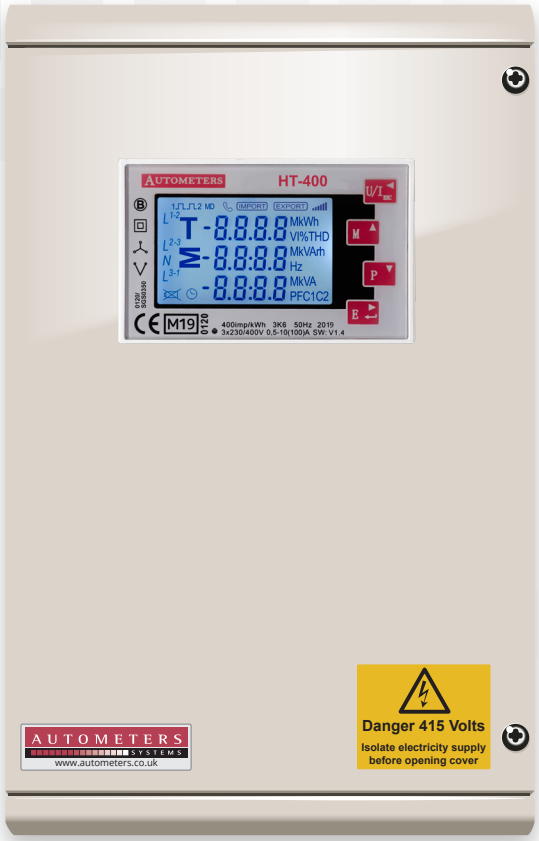
HC2-P is powered from either the HS-PS7 or PS13



Belden 9841 or Equal Cable Screened Twisted pair with full Coax shielding for RS 485 Modbus connection.

Red.....TX+ , Black...TX- , Green...Shield

13. Metal Enclosures for the HT-400 Series

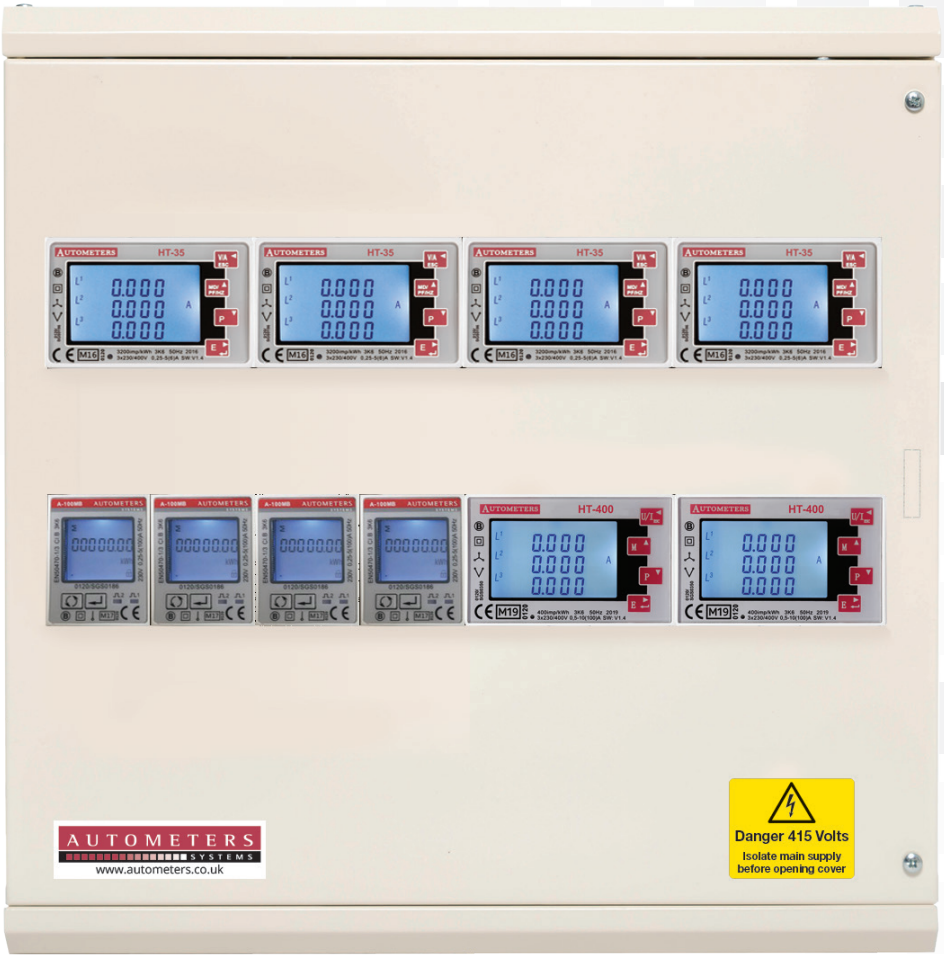


UE-1

Autometers manufacture a number of metal enclosures compatible with the full range of meters it supplies.

The new UE-1 is the latest design for the range of panel meters.

The enclosure consists of a fuse and shorting terminal arrangement, pre-wired to the meter inside the enclosure.



UE-32

The UE-32 enclosure can accommodate up to 16 meters.

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Ref. HT-400.05.2023