IC-5 Technical Manual

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1. Overview MID Approved (Annex B, Annex D)

The IC-5, a new and innovative meter designed by Autometers Systems Ltd, is specifically designed to cut down the engineer's installation and wiring time.

The IC-5 breaks new grounds in its design, not only in enabling the meter to be unplugged from the meter base allowing for any future updates, but also in the design of the meter base, where current shorting terminals and in line voltage protection fuses have been built in as standard.

Twin Modbus communication channels, two volt free pulsed outputs, one programmable, ensure simple accurate remote monitoring of data, particularly when used in conjunction with the Autometers Horizon system.

The twin Modbus channels enable the use of the new remote register the IC-U and the IC-S which have been designed to plug into the meter by using patch leads on channel 1 and enabling channel 2 to be connected to a remote BMS system.

The large display - with new blue back light - enables clarity of reading and the facility to show more information on any one page. The three main keys allow simple and speedy programming and scrolling to the desired page. The Din rail fixing and the new surface enclosure, the MX-5, make the meter the ideal meter for all installations.

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Α U T O M E T E R S

Technical Description

The IC-5 has been designed to monitor power in 1 phase 2 wire or 3 phase 4 wire in 230, 230/400 volt 50 Hz networks. The meter has a maximum current capacity of 6 amp and is designed for use with current transformers with secondary ratio of 5 amp. The current transformer ratio can be programmed only in the factory by Autometers Systems Ltd.

The IC-5 is available in two models: **IC-5-7** which will display Harmonic THD values only and the **IC-5-9** which will display full Harmonics to the 63rd Inst. All the other details are the same.

2. Functionality

The IC-5 displays the following pages:

Import Energy	kWh, kVArh, kVAh
Export Energy	kWh, kVArh
Volts	Line to Neutral, Line to Line
Current	Line to Neutral
Power Factor	L1, L2, L3
Instantaneous kW	L1, L2, L3 and Total
Instantaneous kVAr	L1, L2, L3 and Total
Instantaneous kVA	L1, L2, L3 and Total
Rising Demand	kW, kVAr, kVA. Minutes into period
Maximum Demand	kW, kVAr, kVA. Peak with Time and Date
Harmonics	Voltage THD, Current THD, Neutral THD: IC-5-7, IC-5-9
Voltage to 63rd Inst	L1, L2, L3: IC-5-9
Current to 63rd Inst	L1, L2, L3: IC-5-9
Neutral Current to 63rd Inst	L1,L2, L3: IC-5-9
System Frequency	Hz
Hours Run	Hours, Minutes and Seconds
Configuration of Meter	Current Transformer Ratio setting
Output Pulse Values	Pulse Output Values. 1, 10, 100imp/kWh
Meter Information	Model, Serial Number, Software
Contact Details	Autometers company details
Modbus Set Up	Address, Baud Rate, Parity, Terminator, F.P. Format for connection

Display Information

IMPORT	ENERGY	ntille	Terminator Resistor icon
KWH	13.88	E	RS 485 Modbus icon
KVARH KVAH	0.83 13.90	I1 I2 I3 In	Current Input icons
L1 L2 L3 I1 I2	BIA Z 👄	L1 L2 L3	Voltage input icons

Voltage Icons

The voltage icons L1, L2 and L3 will illuminate when the voltage is above 50 volt ac.

Current Icons

The current icons I1, I2, I3, In will illuminate when the meter is in accordance with Directive 2004/22/EC for Annex B and Annex D.

The icons will turn black as an indication when the current in any measuring phase falls below 0.2% of primary current.

WARNING

The meter is supplied with 230 volt at the Auxiliary terminal (13 and 15) which supplies power to the display. Should the display go blank it does **not** mean voltage is not present at the meter.

Modbus Icon

The telephone icon will illuminate, indicating that the Modbus channel 1 (wired terminals 19, 20 and 21) and Modbus channel 2 (J45 socket for external display) are active.

Terminator Resistor Icon

The Resistor Icon will be illuminated when the Resistor has been switched on in the meter. This icon should be illuminated only when the meter is the last one in the Lan.

3. Technical Features



4. Installation and Wiring Requirements

Important

The meter is intended to be installed in a Mechanical Environment "M1", with Shock and Vibrations of low significance, as per 2004/22 EC Directive. The meter is intended to be installed in Electromagnetic Environment "E2", as per 2004/22/EC Directive.

The meter is intended to be used indoors in a non condensing humidity atmosphere.

Location

The IC-5 series of meters should be fitted in a dry, dirt-free environment away from heat sources and very high electric fields. Temperatures should not fall below -25C and not exceed +55C.

Installation

The IC-5 should be installed only by a competent and qualified electrician who is fully aware of the latest electricity regulations on installing a meter. The meter should be fitted securely and in a position which makes it easy to use.

The meter can be fitted in two ways:

- 1. Din rail mounting (35mm)
- 2. Conventional three fixing direct to a board.

For Din rail see fig 1. This shows the positional height of the Din rail bracket on the back of the meter and the spring clips used to hold the meter on the rail.



fig 1

If you are fitting the meter direct to the wall please see fig 2 (page 5), indicating the position of the three fixing points and their dimensions.



Cable information

For distances up to 2 metres and using current transformers with a minimum of 2.5 va, we recommend for all electrical connections 2.5sq mm cable for pulse outputs and for Modbus outputs we recommend Beldon 9841 or equivalent. If you are using the J45 socket to Autometers remote display, we recommend the patch lead as supplied by Autometers.

Wiring information

The IC-5 has been designed to measure current and voltage in a 1 phase 2 wire or 3 phase 4 wire 230/400 volt ac network. The meter has a maximum current rating of 6 amps and its primary use is to be used with current transformers with a secondary of 5 amps. The meter has an auxiliary 230 volt set of terminals which are located in the small terminal chamber number 13 and 15. These must be connected to power up the meter.

Power supply

The IC-5 has an Auxiliary power supply which must be connected to 230 volt ac. Terminals 13 and 15 in the small terminal chamber. **Failure to connect this supply will mean the display will not switch on.**

WARNING

The meter is supplied with 230 volt at the Auxiliary terminals (13 and 15) which supplies power to the display. Should the display go blank it does **not** mean voltage is not present at the meter.

Electrical connections

The current terminals 1 and 3, 4 and 6, 7 and 9, 10 and 12 have current shorting links which can short out the individual phase current terminals. The voltage terminals number 2, 5, and 8 have independent in line fuses. **It is imperative** when the meter has been fully connected, that the fuses are in place and the current shorting terminals are in the open position (see diagram, page 6).

Current Transformer Operated Meter IC-5

Wiring details for the 3 phase 4 wire meter showing the optional Neutral Current Transformer.



Removing the Meter from the Base



fig 1



fig 2



fig 4



fig 5



fig 6

Isolate the meter, check with appropriate test meter and make sure there is no voltage present at the meter terminals before proceeding.

To remove the meter from the base you must first remove the terminal cover and disconnect any wires connected to terminals 13-21 and any cable pushed into the J45 socket on the meter.

Then remove the screw which holds the meter to the base picture (fig 1).

With the screw removed, take hold of the sides of the meter and push upward (fig 2, fig 3). This will unplug the pins of the meter from the socket in the meter base.

With the meter now removed, pull down the cover plate marked X in fig 4, fig 5. This will cover the exposed holes in the meter base and secure the terminal cover on the base, this will now insulate all terminals.



fig 3

To fit the meter back into the base, remove terminal cover and lift the cover plate back into the base position so it is flat against the base. Now carefully present the meter to the base ensuring that the plastic guides slide down the slide rail and push fully home until the pins enter the socket, then secure the fixing screw. The meter is ready to be connected.

To release meter from Din rail, it might be necessary to remove the meter from the base. Please see arrows (fig 6) indicating release clips to remove from the Din rail.

Shorting the Current Terminals



fig 7



fig 8

In fig 7, above, the meter is set up for the normal working conditions. The red bars are all horizontal, just above the terminal fixing screws, thus ensuring that the brass sliding bars are not making contact with the top fixing screws, in fig 8.

For normal working conditions, where current and voltage are being monitored, **it is imperative** that the sliding bars do not touch the top screws, as in fig 8.

To short out the current terminals

Hold the red bar and loosen the current terminals you wish to short out, fig 9.

When they are loose, push the red bar fully up, making sure that the sliding brass bars are under the top screws, fig 9, then tighten. This phase has now been shorted out.

Repeat on all other phases you wish to short out.



fig 9

Maintenance and Service

Field considerations

In the unlikely event that a meter should fail, it will generally be serviced by exchanging the unit for a replacement unit. The initial installation should be done in a way which makes this as convenient as possible.

The meter has been designed so that no maintenance is required. Programming of the Modbus and viewing data are by the front three press switches located on the right hand side of the display.

Performance characteristics

Typical load curve with balanced load at 50 Hz.



Technical Specification for IC-5

Accuracy Class	1
Basic Current Ib	5A
Max Current Imax	6A
Min Current	0.02 lb
Starting Current	0.004 lb
Reference Voltage	Un, 3x230/400V
Voltage Range	0.8 Un > 1.15 Un
Reference Frequency	50Hz
Operating Temp. Range	-25C to +55C
Storage Temperature	-30C to +60C
Current Circuit Burden	<0.5VA
Voltage Circuit Burden	<0.5W / 5VA
Dielectric Strength	4KV, 50Hz, 1 Min
Impulse Voltage	5KV, 1.2/50us
Short Circuit Current	30 Imax
EMC	61000-4-4 (4kv)
S0-1 Default	ti = 80ms (10m to 160ms)
S0-2 Programmable	ti = 80ms (10m to 160ms)
Dimensions	Length: 169mm Height: 138mm Depth: 68mm
Weight	1.35kg Meter (unboxed)





Programming the Meter

- Press the key until you reach the page **INFORMATION** display.
 Press the key. This takes you into set up mode.
 Carry on pressing the key until you reach the page **MODBUS**.
- Press the event to programme the Modbus parameters.
 This automatically moves you over the first digit in the Modbus address. (100)
- 3. Press the 🔤 key if you want to increment this digit, this will now flash.
- 4. Press the 🔥 key to increment the number.
- 5. Press the 🔤 key to lock the number into memory.
- 6. Press the 🔥 key to move the cursor to the next position. (10)
- 7. Press the 🚥 key if you want to increment this digit, this will now flash.
- 8. Press the \Lambda key to increment the number.
- 9. Press the 🚥 key to lock the number into memory.
- 10. Press the 🚯 key to move the cursor to the next position. (1)
- 11. Press the 🚥 key if you want to increment this digit, this will now flash.
- 12. Press the 🕢 key to increment the number.
- 13. Press the 🚥 key to lock the number into memory.

Programming the Baud Rate

- 14. Press the \Lambda key to move down to the **BAUD RATE**.
- 15. Press the em key if you want to change the Baud Rate, this will now flash.
- 16. Press the \Lambda key to step through the choices.

setting into memory.	 MOD Address Baud Parity Terminator 	BUS E 011 19200 Odd ON	3
	FP. Format	Lowwd 1st	

Programming the Parity

- 18. Press the 🕢 key to move down to the **PARITY** setting.
- 19. Press the 🔤 key if you want to change the parity, this will now flash.
- 20. Press the \bigcirc key to step through the choices.
- 21. Press the 🚥 to lock the setting into memory.

Programming the Terminator

- 22. Press the () key to move down to the **TERMINATOR**.
- 23. Press the 🔤 key if you want to change the Terminator, this will now flash.
- 24. Press the \Lambda key to step through the choices.
- 25. Press the 🚥 to lock the setting into memory.

Programming the F.P. Format

- 26. Press the 🕔 key to move down to the **F.P. FORMAT**.
- 27. Press the 🚥 key if you want to change the F.P. Format. This will now flash.
- 28. Press the 🔥 key to step through the choices.
- 29. Press the 🚥 to lock the setting into memory.
- 30. Press the key the cursor will move to the "S" sign (top left hand corner of the display) and start flashing.
 You must press root to lock all your Modbus settings into memory.

If the address is all you want to alter in the Modbus set up press the 🔥 key to step through the other parameters **AFTER** the F.P. Format.

The cursor will move to the "**S**" sign (top left hand corner of the display) and start flashing. You must press constrained to lock your settings into the meter.

When you have pressed me the two signs "S" and "E" will disappear from the display, this indicates the Modbus settings have been stored to memory in the meter.

To Reset the MAX Demands

- 1. Press the \Lambda key until you reach the page **INFORMATION**.
- 2. Press the ere key to reset Max Demands.

The display will reset to zero and return the default display.

To Reset the MIN and MAX Demands

- 1. Press the \Lambda key until you reach the page **INFORMATION**.
- 2. Press the \Lambda key to move to next window reset Min and Max Demands.
- 3. Press the 🔤 key to reset Max Demands.

The display will reset to zero and return the default display.

To Reset Hours Run Timer

- 1. Press the \Lambda key until you reach the page **INFORMATION**.
- 2. Press the \Lambda key to move to next window reset Min and Max Demands.
- 3. Press the 🕟 key again to move to next window reset Hours Run.
- 4. Press the ere key to reset Hours Run.

The display will reset to zero and return the default display.

To Adjust the Time

- 1. Press the 🚯 key until you reach the page **INFORMATION**.
- 2. Press the 🚥 key. This takes you into set up mode.

Carry on pressing the () key until you reach the page TIME.

3. Press the \bigcirc key until you reach the window which shows the Time.

E.g. 12/35/10... Hours, Minutes, Seconds.

- 4. Press the model key, you will notice that there now appears an asterisk next to the 12.
 E.g. 12*/35 /10. The asterisk indicates the number to the left (Hours) will be adjusted.
- 5. Press the 🔨 key to alter the 12 to the correct setting.

- 6. Press the ere key to lock the new hour setting into the memory.
- 7. You will notice the asterisk automatically moves to the right (Minutes). Repeat steps 5 and 6.
- You will notice the asterisk automatically moves to the right (Seconds). Repeat steps 5 and 6.

To Adjust the Date

- 1. Press the \Lambda key until you reach the page **INFORMATION**.
- Press the makey. This takes you into set up mode.
 Carry on pressing the key until you reach the page TIME.
- Press the key until you reach the window which shows the Date.
 E.g. 25/06/10. Day, Month, Year.
- 4. Press the end key you will notice that there now appears an asterisk next to the 25.
 E.g 25*/06 / 10. The asterisk indicates the number to the left (Hours) will be adjusted.
- 5. Press the \Lambda key to alter the 25 to the correct setting.
- 6. Press the 🚥 key to lock the new day setting into the memory.
- You will notice the asterisk automatically moves to the right (Months). Repeat steps 4 and 5.
- You will notice the asterisk automatically moves to the right (Year). Repeat steps 4 and 5.

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intelligent measurement monitoring accuracy

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Important: You will receive the meter programmed with the current transformer ratio as per your order. Other details might need to be programmed on site, such as the Modbus parameters. Please programme these as per the instructions on page 12.

Important: You will receive the meter in the factory default mode, which is suitable for 3 phase 4 wire network, 230/400 volt 50 Hz.

The current transformer ratio can only be set when you order the meter.

The RS 485 Modbus has been factory set to match the Autometers Protocol V6.

Baud Rate: 9600	Data Format: Floating point
Parity Type: Even	Modbus Type: RTU
Wire Mode: 2 Wire	F.P. : High word first

When using RS 485 Modbus it is vital that you understand what management system the meters will be connected to. Normally every meter must have a unique address and must not be duplicated. Also a terminator resistor of 120 ohms is fitted at the front end of the Lan and also at the last meter. The IC-5 has this built into the meter. Please see instructions how to turn on the terminator in the programming section, page 12.

Product development is continuous and Autometers Systems Ltd reserves the right to make alterations and manufacture without notice. Products as delivered may therefore differ from the descriptions and illustrations in this publication.

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