AUTOMETERS SYSTEMS

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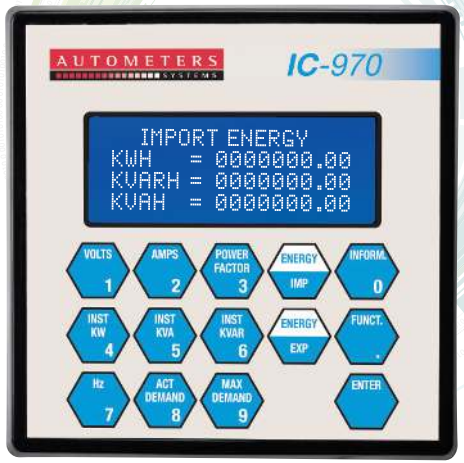
INSTALLATION & OPERATING MANUAL

IC 970



Overview of the meter

The IC 970 is the latest meter in the IC 900 series of Information Centres from Autometers Systems Ltd. With new advances in micro processors and new added features, the meters are user friendly, easy to install and simple to programme.

The IC 900 range of Information Centres are electronic meters and great care has been taken to ensure that they meet the stringent requirements of all the potential users and specifiers of the product, from the buyer who wants a competitively priced product, the installer who wants simple fitting with good connection terminals to the end user who wants a quick and easy means of obtaining information. The IC 900 range of meters meets these varied demands.

The IC 970 meter has been designed to communicate with other systems by means of either pulse outputs standard on all IC 900 meters or via a separate plug in communication module which is sold with the meters or can be retro fitted at a later date.

All the IC 900 range of meters have been designed to communicate with Autometers Systems Ltd Horizon range of data collection units, this enabling complete measurement and data collection systems to be built up.

A new feature to the IC 970 is the protocol set up information which can be viewed on the display when a communication module has been installed.

Pulse outputs

There are two optically isolated volt free relays outputs on the IC 970 and IC 990, one relay for kWh and the other for kVah. Both these relays are fully programmable to adjust the value of the pulse (4 settings) and the time of the contact closure. Both meters are factory set to 1 imp/kWh and 1 imp/kVah.

Communication module

An optional communication module can be fitted to the IC 970 and IC 990 meters offering a wider range of information which can be transferred to a BMS system.

AUTOMETERS SYSTEMS

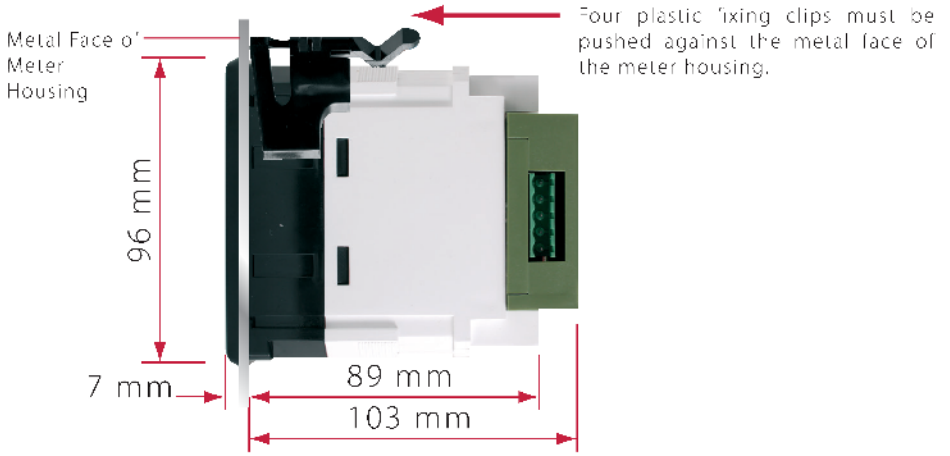
Installation of the meter

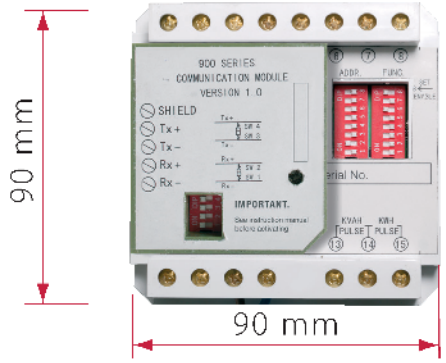
Location

The IC 900 series of meters should be mounted in a dry, dirt free environment away from heat sources and very high electric fields. Temperatures should not exceed 50°C or fall below -10°C.

Installation

The IC 970 meter should be installed by a competent qualified electrician. The IC 970 meter is a panel mounted meter and therefore must be fitted into a panel where all the terminals are concealed. A typical panel would be a switchgear cabinet door where access to the terminals can only be gained by the use of a tool.





Please note.
An aperture of 92mm x 92mm must be cut into the metal face of meter housing for the meter to be mounted.

Wiring information

Power Supply

Standard 3 phase 4 wire (IC 900 series) meters are powered by 230 volts AC (47-66 Hz) internally on terminal 11 (L3) and terminal 12 (neutral).

Wiring

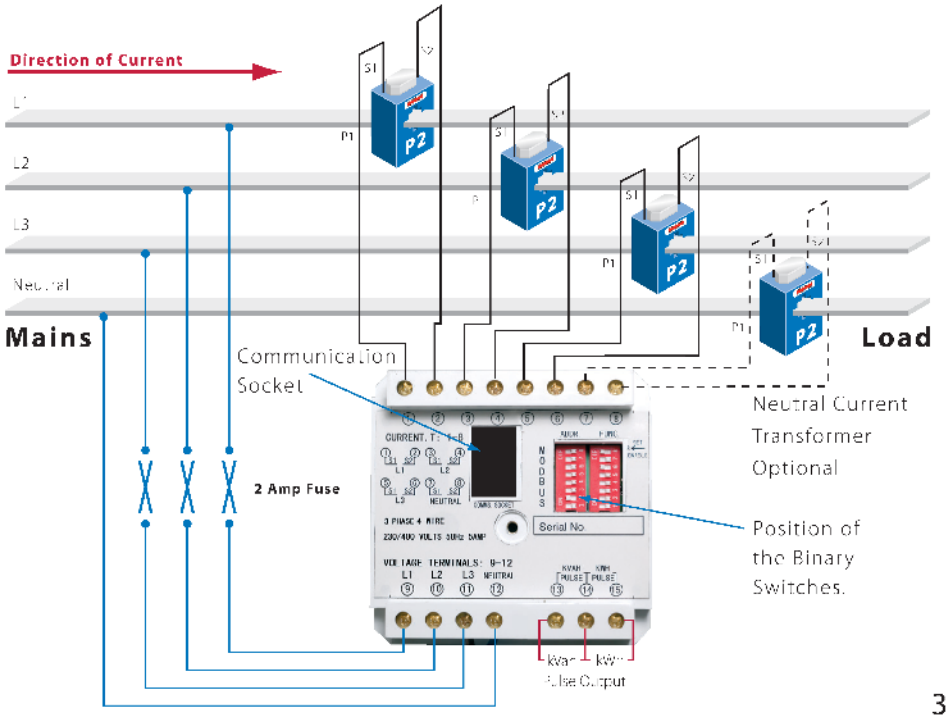
Electrical and communication connections are made directly to the back of the meter.
The main electrical connections are made to terminals 1-12 low voltage connections pulse outputs connections are made to terminals 13-15.

Electrical Connections

2.5mm flexible stranded cable is recommended for all main electrical connections. For the low voltage communication connections we recommend a twisted shielded cable Belden (2 wire Belder 9841) (4 wire Belden 9842) or equivalent.

Phasing and polarity of the AC current and voltage inputs and their relationship is critical to the correct operation of all the IC 900 series meters.

Connection details ic 970



Programming the meter

When you receive the meter there will be at least one value that you must programme into the meter. This is the current transformer ratio. If you want to monitor the neutral current then the neutral current transformer ratio will also need to be programmed.

If the meter has been purchased with the communication module you may need to alter the standard protocol set up. See page 17 & 18 For communication module set up.

Programming the CT Ratio

First you must locate the two red binary switches on the back of the meter.
See connection details page 3.

You will see two sets of RED binary switches with numbers 1-8 on each of them.
SELECT the binary switch with the word "func" above and switch number 8 to the "on" position.
This puts the meter into programming mode.

Important.
When you have completed programming the meter you must switch number 8 to the "off" position.

To reset maximum demand - code 12 (view)

Please follow these instructions precisely.

1. Press Function Key

The display will change to:

You will notice the cursor is flashing at the first digit on the left of the two digits. Press the key with 1 on it, the cursor will now move to the next digit, now press 2.

2.Press Enter.

The display will change to.

Press Enter. This will RESET **The Maximum Demand** and take you back to the default register.

To check you have reset the max demand press the **"Max demand"** key all numbers should have reset to zero.

To enter the C.T. Ratio code 13 (switch 8 on)

Your Current Transformer Ratio requires to be programmed into this meter. Please follow these instructions precisely.

1. Press Function Key

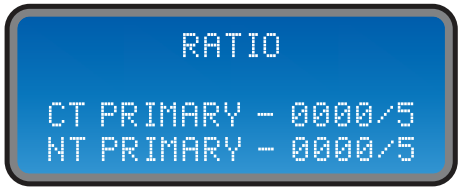
The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **1** on it, the cursor will now move to the next digit, now press **3.**

3. Press Enter.

The display will change to.



Enter the current transformer value by pressing the numbers which are on the front of the key pad. The cursor will automatically move to the right as you enter the numbers. The cursor will drop down to the NT primary, repeat the previous steps.

When you have completed inputting the value of the current transformers.

Press Enter.

This will programme the meter and take you back to the default register.

To check you have programmed the correct value press the Information key continuously until you reach the correct screen.

Please Note.
When setting the C.T or N.T ratios and you have only three digits you must enter "0" as the first digit. E.g. 100/5 would be entered as 0100/5.

To change the pulse output value Code 21 (switch 8 on)

Please follow these instructions precisely.

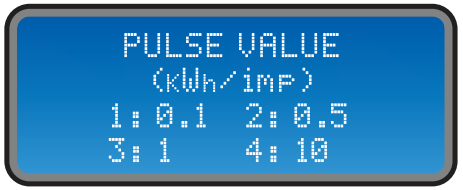
1. Press Function Key

The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits. Press the key with **2** on it, the cursor will now move to the next digit, now press **1.**

2. Press Enter

The display will change to.



You will notice the cursor is flashing at the first digit on the left TO ALTER THE OUTPUT VALUE (kWh)

Select the value you require by pressing the keys numbered 1, 2, 3 or 4. When you press one of these keys the meter will automatically update & return you back to the default display.

The kVah pulse output will automatically be set to the same value.

To change the pulse closure time Code 22 (switch 8 on)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **2** on it, the cursor will now move to the next digit, now press **2.**

Press Enter.

The display will change to.

You will notice the cursor is flashing at the first digit on the left TO ALTER THE time

Select the number and press the key, the cursor will now move to the next digit to the right.

When finished

Important.
The pulse time can be set from 20ms to 300ms. If it is above 300ms, the default time is 100ms.

Press Enter.

The meter will automatically take you back to the default display.

The kVah pulse output will automatically be set to the same value.

To change the display contrast Code 30 (switch 8 on)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with 3 on it, the cursor will now move to the next digit, now press 0.

Press Enter.

The display will change to.

You will notice the cursor is flashing at the first digit on the left (+)
To Increase Contrast Press The Key "Energy Imp" The contrast will start to go darker.
Keep pressing until you have reached your desired setting

(-) Press the **"Energy Exp"** key to lighten the display.

When finished

Press Enter.

The meter will automatically take you back to the default display.

To change the time the back light is on Code 31 (switch 8 on)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **3** on it, the cursor will now move to the next digit, now press **1.**

Press Enter.

The display will change to.

You will notice the cursor is flashing at the first digit on the left, TO ALTER the time the back light remains on; enter a new digit by pressing the desired number on the key pad.

When you have selected your first digit press enter and the cursor will move to the second number, repeat above. The maximum time the backlight will remain on is 99 minutes.

When finished

Press Enter.

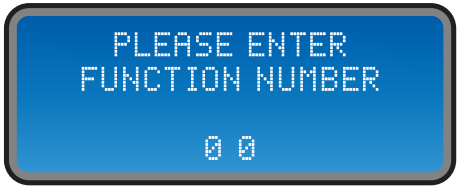
The meter will automatically take you back to the default display.

To check the connections on the meter Code 50 (view)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

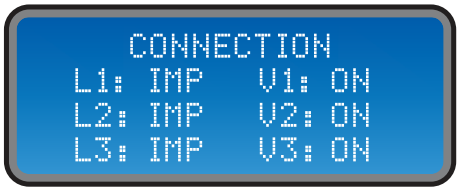


You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **5** on it, the cursor will now move to the next digit, now press **0.**

Press Enter.

The display will change to.



The display will indicate what the meter is sensing.

If you have connected the meter correctly you should see above display.

If you see **L1, L2 or L3 SHOWING "EXP"** this indicates that one or more current transformers are not connected correctly. This must be corrected to ensure accurate meter readings.

If you see **V1,V2 or V3** showing **"LOW"** check your voltage connections and the actual voltage on the terminals. This must be corrected to ensure accurate meter readings.

Press Enter.

The meter will automatically take you back to the default display.

Relay test mode code 51 (switch 8 on)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **5** on it, the cursor will now move to the next digit now, press **1.**

Press Enter.

The display will change to.

When you see above display the relay output will open and close once every second. This will test if the relay is functioning correctly.

When finished

Press Enter.

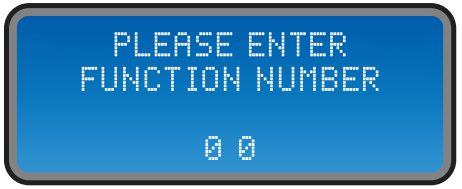
The meter will automatically take you back to the default display.

Indication of binary switch settings Code 52 (view)

Please follow these instructions precisely.

1. Press Function Key

The display will change to.

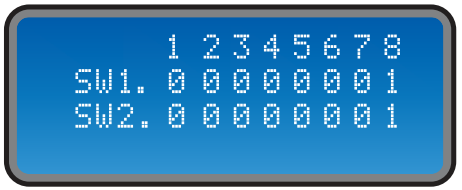


You will notice the cursor is flashing at the first digit on the left of the two digits

Press the key with **5** on it, the cursor will now move to the next digit, now press **2.**

Press Enter.

The display will change to.



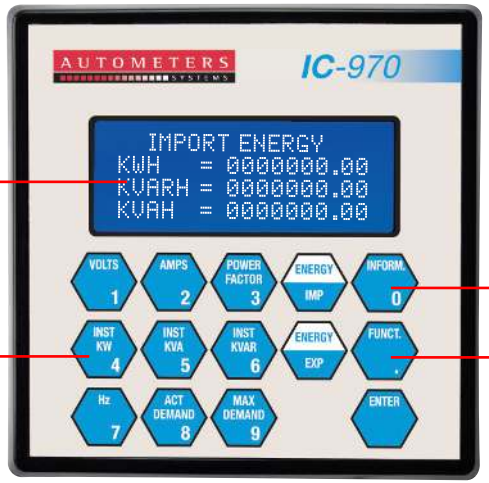
The above display indicates the individual switches which have been switched to the "on" position on the binary switch.

"0" indicates the switch is in the "OFF" position
"1" indicates the switch is in the "ON" position.

Press Enter.

The meter will automatically take you back to the default display.

Key functions



Display *of 4 lines with 20 characters per line.*

Membrane ***Keypad*** *with 15 sealed keys.*

The ***Information Key*** *indicates how the meter has been programmed.*

The ***Function Key*** *to select special functions.*

Voltage Display

```
VOLTAGE
L1= 230.0 L1-L2=400.0
L2= 230.0 L2-L3=400.0
L3= 230.0 L3-L1=400.0
```

Frequency

```
FREQUENCY

50.00 HZ
```

Amps Display

```
AMPS
L1= 400.0
L2= 387.0   T= 1187.0
L3= 400.0   N=  200.0
```

Actual Demand

```
ACT DEMAND
KW   = 0.00
KVAR = 0.00
KVA  = 0.00  MIN = 16
```

Power Factor

```
POWER FACTOR
L1= 0.999
L2= 0.999   T= 0.999
L3= 0.999
```

Maximum Demand

```
MAX DEMAND
PEAK KW   = 0.00
PEAK KVAR = 0.00
PEAK KVA  = 0.00
```


Instantaneous KVA

```
INST KVA
L1= 0.0000
L2= 0.0000  T= 0.0000
L3= 0.0000
```

Energy IMP (Default Screen)

```
IMPORT ENERGY
KWH   = 0000187.24
KVARH = 0000005.08
KVAH  = 0000200.22
```

Instantaneous KW

```
INST KW
L1= 0.0000
L2= 0.0000  T= 0.0000
L3= 0.0000
```

Energy EXP

```
EXPORT ENERGY

KWH   = 0000187.24
KVARH = 0000005.08
```

Instantaneous KVAR

```
INST KVAR
L1= 0.0000
L2= 0.0000  T= 0.0000
L3= 0.0000
```

To View Minimum and Maximum Values Press: Volts (FUNC 60), Amps (FUNC 61) and Neutral Amps (FUNC 62).

Maximum and Minimum Volts

```
(MAX) VOLTAGE (MIN)
L1= 250     L1= 218
L1= 248     L1= 219
L1= 248     L1= 218
```

Maximum and Minimum Amps

```
(MAX) AMPS (MIN)
L1= 165     L1= 60
L1= 145     L1= 45
L1= 158     L1= 38
```

Maximum and Minimum Neutral Amps

```
(MAX) NEUTRAL (MIN)
AMP
N= 35.5     N= 10.0
```

To reset minimum and maximum values above press: Function Key 09 (Volts), 10 (Amps) or 11 (Neutral Amps). E.g. Amps: Press 'Function Key', Enter Function Number 10, Press 'Enter Key' to reset phase amps, this returns you back to default screen.

Information key

When you press the information key and the communication module is fitted the following displays will appear. To move on to the displays shown below press the "INFORM" key repeatedly until the required display is shown.

1

```
        IC970

COMM. MODULE : ONLINE
PULSE MODULE : ONLINE
```

2

```
        IC970
FP. FORMAT   :HIGH 1st
DATA FORMAT  :FLOAT
WIRE MODE    :2 WIRE
```

3

```
        IC970
BAUD RATE    :  9600
PARITY TYPE  :  EVEN
MODBUS TYPE  :  RTU
```

4

```
   AUTOMETERS LTD
    IC 970  VER 3.0
SERIAL NO  : 0700003
ADDRESS    : 001
```

5

```
        IC970
3P4W  230/400V  50 HZ
 CT  RATIO     0500.5
 NT  RATIO     0500.5
```

6

```
     PULSE DETAILS

PULSE VALUE  =0.5KWH
PULSE TIME   =100 MS
```

7

```
RESET VOLTS  FUNC - 09
RESET AMPS   FUNC - 10
RESET NAMP   FUNC - 11
RESET MD     FUNC - 12
```

8

```
RATIO        FUNC - 13
PULSE VALUE  FUNC - 21
PULSE TIME   FUNC - 22
CONTRAST     FUNC - 30
```

9

```
BACKLIGHT    FUNC - 31
CONNECTION   FUNC - 50
PULSE TEST   FUNC - 51
DILL SWITCH  FUNC - 52
```

10

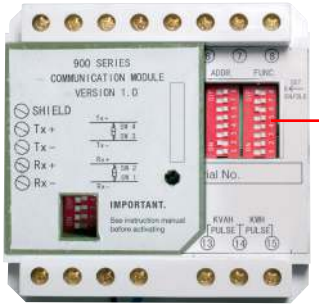
```
VOLTS MAX/MIN  =   60
AMPS MAX/MIN   =   61
NAMP MAX/MIN   =   62
```

Please Note.

If there is no communication module fitted, you will only see displays 1, 4, 5, 6, 7, 8, 9 & 10.

Programming the communication module

You will notice in the picture below two red vertical rows of switches 1 - 8. Above each row the letters "ADDR" and "FUNC" are printed. These individual switches will have to be selected to programme the correct protocol in the meter. *See below.*



Binary Switches

You will notice two red binary switches next to each other, one is marked **"ADDR"** and the other switch is marked **"FUNC".**

"ADDR" Binary Switch

The binary switch on the left is marked **"ADDR"** and is for setting the meters address number. Each meter in the Modbus system must have its own unique number.

ADDR.

The binary switch has 8 switches numbered 1-8.
The number sequence is as follow.

1 = 1	3= 4	5= 16	7 = 64
2= 2	4= 8	6= 32	8 = 128

E.G. by moving the number 1 switch to the "on" position you have numbered this meter as 1.
By switching numbers 1 and 4 to the "on" position this becomes number 9.
The highest number which you can allocate to a meter is 128.

"FUNC" Binary Switch

This switch is for setting the individual parameters for the Modbus settings.

FUNC.

Switches 1 and 2: Baud Rate Setting.

Off -	off	=	9600
On -	off	=	19200
Off -	or	=	38400
On -	or	=	1200

Switch 3: Wire Mode

OFF	=	2 wire.
ON	=	4 wire.

Switch 4: Modbus Type

OFF	=	RTU.
ON	=	ASCI.

Switch 5: Parity Type

OFF	=	Even.
ON	=	Odd.

Switch 6: Data Format

OFF	=	ASCII String.
ON	=	Floating Point.

Switch 7: Floating Point Format

OFF	=	High word first.
ON	=	Low word first.

Switch 8: Special Switch For Programming The Functions Into The Meter

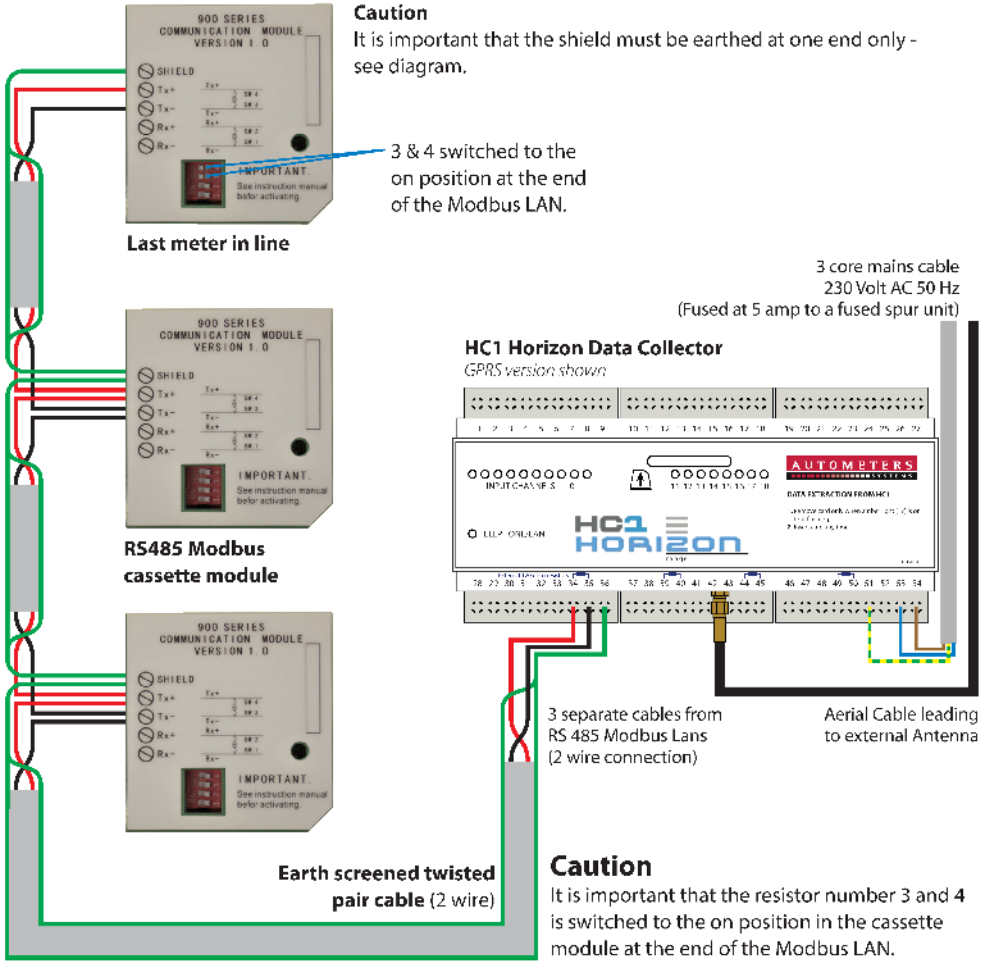
ON	=	Programming function on.
OFF	=	kWh impulse with output relay.

Important
The power must be switched off when fitting a communication module to the meter.

Communication connections

RS 485 Connection

This connection should be made using the appropriate screened twisted pair cable (Belden 9841, 2 wire or 9842 if using 4 wires or equivalent). It is imperative that the terminals are wired as per the diagrams below.



AUTOMETERS SYSTEMS

Transformer selection

Current Transformer Selection

For accurate monitoring, correct selection of current transformers are critical. The following paragraphs provide the information required to choose these transformers.

The 900 range of meters use current transformers (CT) to sense the current in each phase of the power feed. The selection of the CTs is important because it directly affects accuracy.

The CT secondary rating depends on the current input option installed. The standard IC 900 current rating is 5 amps.

The CT primary rating is normally selected to be equal to the current rating of the power feed protection device. However, if the peak anticipated load is much less than the rated system capacity then improved accuracy and resolution can be obtained by selecting a lower rated CT. In this case the CT size should be the maximum expected peak current +25%, rounded up to the nearest standard CT size.

Other factors may affect CT accuracy. The length of the CT cabling should be minimised. Also the CT burden rating must exceed the combined burden of the IC 900, plus cabling, together with any other connected devices.

Overall accuracy is dependent on the combined accuracies of the IC 900 METER and the current transformers.

Performance and data

Measurements

The unit is designed for measuring 3 phase in a 4 wire star configuration.

Technical Parameters

Meter standard	BS EN 61036		
Accuracy	Active 1.0, reactive 2.0	Range of voltage	200v – 250 v
Reference Voltage	3 x 230/400 volt	Operation temperature	- 10ºC + 50ºC
Basic Current	5 amp	Storage temperature	- 10ºC + 60ºC
Maximum Current	6 amp	Humidity	<=95%
Frequency	50/60 Hz	Power consumption	0.01VA @5A; 1.5W
Pulse Constant	5000 imp/kWh,		10VA @230 volt
	5000 imp/kVarh	Pulse output	BS EN 62053 -31

Outputs

There are two optically isolated volt free relays on the IC 970.

Pulse duration: Programmable.	Pulse Value: Programmable.
Default 100 ms	Default 1 kWh, 1 kVah

Relay contacts maximum switching voltage 230 volt 100 Ma
Maximum switching current 0.75 Amp (switching power 30 va)

Communication Module

Fully programmable 485 Modbus Default.

Baud Rate:	9600	Parity Type:	EVEN
Wire Mode:	2 WIRE	Data Format:	FLOATING POINT
Modbus Type:	RTU	FP. Format:	HIGH WORD 1st

Definitions

Measurement Category CATIII

Measurement category III is for measurements performed in the building installation. Note 2 examples are measurements on distribution boards, circuit breakers, wiring, including cables, bus-bars, junction boxes socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example, stationary motors with permanent connection to the fixed installation.

 **Double Insulation Symbol**

 **Caution, risk of electric shock**

Table 1 symbol 11, IEC 60417-5172
Defined as: Insulation comprising both basic insulation and supplementary insulation.

AUTOMETERS SYSTEMS

Functions

Supplied	Function 09	-	Min/Max Volts	Reset to Zero
As Standard	Function 10	-	Min/Max Amps	Reset to Zero
	Function 11	-	Min Max Neutral Amps	Reset to Zero
	Function 12	-	Peak Maximum Demand	Reset to Zero
	Function 13	-	C.T and N.T current transformer setting	Programmable
	Function 21	-	Pulse value	Programmable
	Function 22	-	Pulse Duration	Programmable
	Function 30	-	Display contrast	Programmable
	Function 31	-	Back light Duration	Programmable
	Function 50	-	Connection details	View only
	Function 51	-	Relay test mode	View only
	Function 52	-	Binary switch positions	View only

Physical

Dimensions (mm)

W96mm x H96mm x D 89mm (with comms module 103mm). Weight with communication module and fixing clips: 0.64 kilos. Packing weight individually boxed in polyfoam box: 0.65 kilos

Maintenance and service

Field Service Considerations

In the unlikely event that a unit 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.

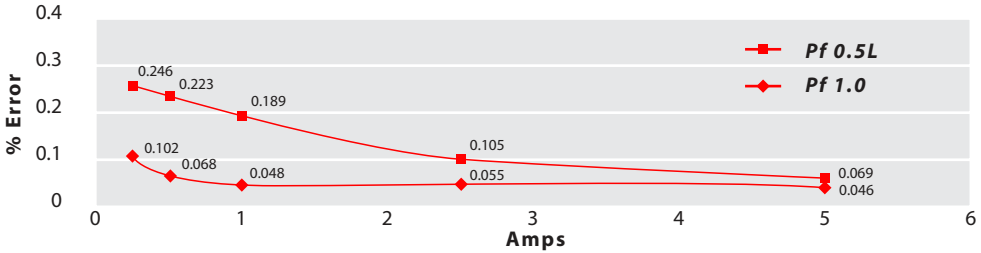
1. It is good practice that a current transformer shorting block is fitted, this enables the meter to be disconnected without open circuiting the current transformers. The shorting block should be wired so that the protective relays are not affected.

2. All wiring should be routed to allow easy removal of the connection to the terminals.

Disconnect From Supply

A suitable isolator for both voltage and current terminals shall be included in the wiring installation, close to the meter with easy access and marked as the meters disconnect device. If the equipment is used in a manner not specified by the manufacturer the protection provided by the equipment may be impaired. Current measuring terminals are not intended to be connected to voltages to earth above 50Vac.

Performance Characteristics - Typical load curve with balanced load at 50 Hz



Dedicated customer service

Customer care is the cornerstone of the company's success. A positive service policy is observed throughout every specialist area of operation.

The personal involvement of all the directors at every level, a highly trained and motivated staff, fully computerised systems and in depth stockholding combine to provide a level of service which has earned the appreciation of customers across the spectrum of the UK and overseas markets. Computerised distribution systems are geared to a consistent 24 hour despatch of products, with 20 minute despatch being possible in response to urgent demand for small orders.

Product range

Metering and monitoring equipment ranges from single phase and Polyphase kWh electromechanical meters to a sophisticated range of fully programmable information centres. Also available are Electronic Meters, Panel Mounted Meters, Maximum Demand Meters, DIN Rail Meters and Current Transformers.

CE Approval.

The IC 970 has been fully examined and tested in accordance with the standards listed and meets the specified requirements defined in BS EN 61326:1997 inc A1, A2, A3 - Electrical equipment for measurement, control and laboratory use - EMC requirements.

1.	BS EN 61326:1997 inc. A1, A2 & A3	Conducted Emissions
2.	BS EN 61326:1997 inc. A1, A2 & A3	Radiated Electricity Field Emissions
3.	BS EN 61000-4-2:1995 inc. A1 & A2	Electromagnetic Compatibility
4.	BS EN 61000-4-3:2002 inc. A1 & A2	Electromagnetic Compatibility
5.	BS EN 61000-4-4:1995 inc. A1 & A3	Electromagnetic Compatibility

Safety Standards: BS EN 61010-1:2001

Important.

The attention of the specifier, purchaser, installer or user is drawn to special measures and limitations to use which must be observed when these products are taken into service to maintain compliance with the CE directives. Details of these special measures and limitations of use are available from HMSO.
REF: IEC 1000-5-1(BS195/210788DC) IEC 1000-5-2 (BS 195/214642DC)
IEC 10000-5-6 (BS 195/210789DC).

WARNING DO NOT MEGGAR TEST