AUTOMETERS SYSTEMS

ic⁹

**installation and
operation manual
IC7-C and IC9-C**

AUTOMETERS SYSTEMS

ic⁹

VOLTAGE
L1=231.0 L1-L2=397.5
L2=228.0 L2-L3=399.2
L3=233.0 L3-L1=401.8

VOLTS	AMPS	POWER FACTOR	FUNCT.
DEMAND	ENERGY	H	ENTER
INST KW	INST KVAR	INST KVA	kWh/imp

HORIZON
range

The fusion of land based metering and
ether based monitoring

The Information Centre *ic⁷*-C and *ic⁹*-C

Check Contents

Package should contain:

1. Black locking bezel
2. Main meter case
3. Top terminal cover
4. Lower terminal cover

Overview

The IC7-C and IC9-C meter is 230/400 volt 50 Hz, 5 amp current transformer operated meter designed for measuring 3 phases in a 4 wire star configured system and is capable of transmitting kWh and KVAh by means of the volt free outputs which are standard on the basic model. The model IC9-C is supplied with fully programmable RS485-Modbus communication output and is capable of transmitting all of the data the meter monitors.

Installation

Orientation
The meters are designed to be fitted into a panel, normally a switchgear cabinet. It is therefore recommended that the front of
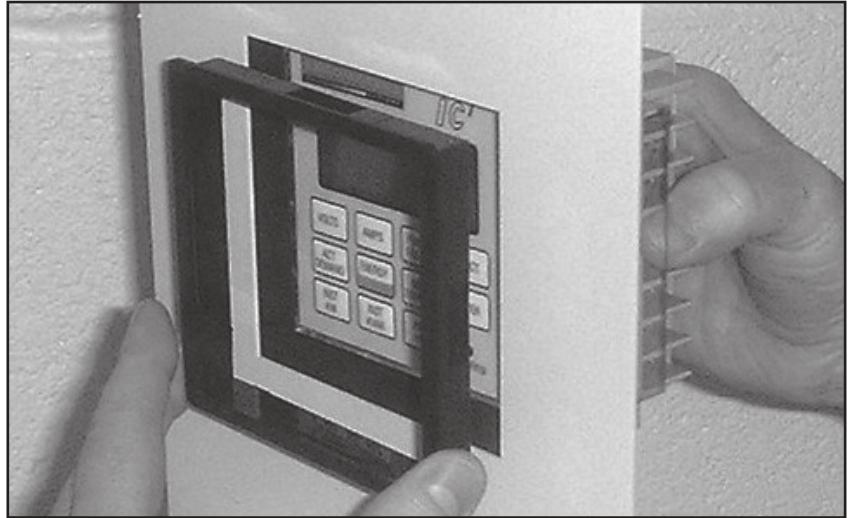

Diagram 1. Meter Installation

the meter is positioned vertically with adequate space around and at the back for connections.

Location
The meters should be mounted in a dry dirt free environment away from all heat sources and very high electric fields. Temperatures should not exceed 70°C or fall below -20°C.

Installing the meter.
First remove the meter from the packaging and check for any damage. The meter should be in two pieces, a Front Bezel and the

back of the meter. (See diagram 1 above) The aperture required to fit the meter is 92 mm x 92 mm.

Holding the back of the meter in one hand and the bezel in the other hand, present to the opening. Slide the back of the meter first through the opening on the rear side of the door and then push the bezel from the front side over the protruding clear plastic and push fully home until it locks firmly. Please note it is extremely difficult to remove when fitted. Please see diagram 1.
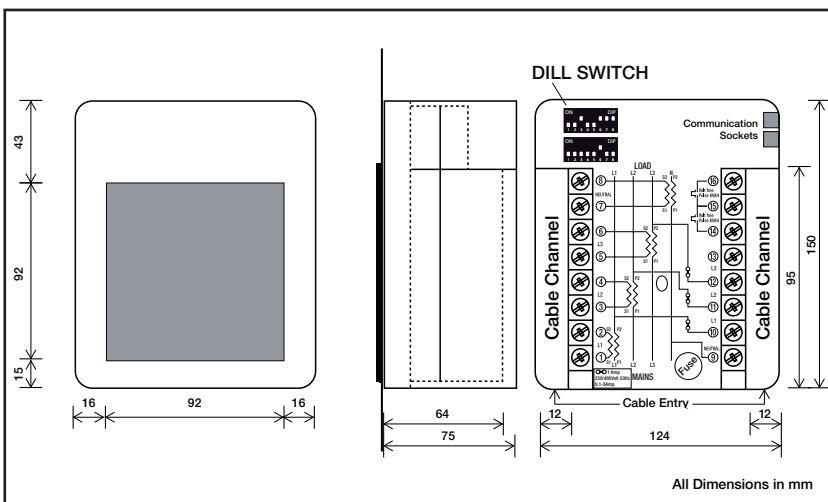

Diagram 2. External Dimension

Phasing and polarity of the AC current and voltage inputs and their relationship is critical to the correct operation of this meter.

The connection diagram shows a current transformer fitted to the Neutral.

If you do not want to monitor the neutral current it is not necessary to connect to terminals 7 and 8.

Terminal 9 is the Neutral supply

Terminals 10,11,and 12 are the three phase line voltages (230 volt). Terminals 14,15, and 16 are the low voltage pulse output. (volt free)

Wiring information

Power supply
The standard IC9 requires a 230 volt 50 Hz supply. This is powered from the L3 phase and Neutral internally.

Wiring
Electrical and communication connections are made directly to the back of the meter.

The main electrical connections are made to terminals 1-16 at the lower half of the meter, Communication Modbus 485 connections are made via the two sockets at the top of the meter on the side. Please see dia 2.

Programming the CT Ratio '13'

To programme the CT Ratio the dill switch number "8" on the lower dill switch block must be in the "On" position

See diagram 6 for position of dill switches.

Connect power to the meter.

To programme, press the function key on the front of the meter, which will then take you into the display sequences for programming the CT Ratios.

You should now see the screen below

```
   PLEASE  ENTER
  FUNCTION  NUMBER


        **
```
Diagram 3: Programming Screen

(a) You will notice the cursor flashing on the first "zero", by pressing the "Energy" key the zero will change to 1, if you press the "Energy" key again it will change to 2 and so on.

(b) If you go past your number continue going through the numbers until the number you require reappears. Stop at your correct number '1'.

(c) Press the "Enter" key and the flashing cursor will move to the right. Stop at number '3'. Press function.

Diagram 4 : CT Setting Screens

```
      RATIO

  CT  PRIMARY=****/5
  NT  PRIMARY=****/5
```

(d) Repeat steps (a) to (c) to enter the correct programming details for your chosen CT ratios.

(e) When the process is complete press the "Function" key to take you back to the default screen.

Note: When setting CT ratios and if you have only three digits you must enter "0" as the first digit. e.g. 100/5 would be entered as 0100/5.

When you have programmed the meter, disconnect the power to the meter and ensure dill switches are set to the 'OFF' position.

Operating information

Power on
After you have programmed the meter and you have put power onto the meter, the first screen to appear will indicate details of the meter and your programmed parameter values. After 10 seconds will revert to normal default screen. "b"

a) Power On:

```
         IC⁹
  3P4W  230/400V  50HZ
   CT Ratio   ****:5
   NT Ratio   ****:5
```

b) Normal Default Display

```
   IMPORT ENERGY
  KWH   = 000000.00
  KVAH  = 000000.00
  KVARH = 000000.00
```

Test Mode Display
At this stage it is advisable to check the connection to the meter, to do this please see page 6 function 50. This will enable you to see if the current transformers have been connected correctly and the three voltages are present.

Diagram 5: Connection Check Screen

```
     CONNECTION
  L1 import   V1 ON
  L2 import   V2 ON
  L3 import   V3 ON
```

The diagram above is showing that the current transformers are correct and the three phase voltages are correct.

If the current transformers are correct but the voltage on each phase is missing or below 200 volts, then the screen will look as in the diagram below:

```
     CONNECTION
  L1 import   V1 OFF
  L2 import   V2 OFF
  L3 import   V3 OFF
```

Screen Definitions

Below are the available screens, which can be seen by pressing the various keys on the front of the meter. After 10 seconds the meter will revert to the "IMPORT ENERGY" screen.

By pressing the following keys the display will show:

a) Volts

```
      VOLTAGE
L1=000.0 L1-L2=000.0
L2=000.0 L2-L3=000.0
L3=000.0 L3-L1=000.0
```
Press the key twice to view Page 2

```
      FREQUENCY

      50.00Hz
```

b) Amps

```
        AMPS
 L1=000.0
 L2=000.0   T=000.0
 L3=000.0   N=000.0
```

c) Power Factor

```
      POWER FACTOR
 L1=0.000
 L2=0.000   T=0.000
 L3=0.000
```

d) Actual Demand

```
      ACT DEMAND
KW  =00.0000
KVAR=00.0000
KVA =00.0000 MIN=00
```

e) Energy

```
    IMPORT ENERGY
 KWH   = 000000.00
 KVAH  = 000000.00
 KVARH = 000000.00
```
Press the key twice to view Page 2

```
    EXPORT ENERGY

 KWH   = 000000.00
 KVARH = 000000.00
```

f) Harmonic
Press 'H' key, the dislay change as below:
1. HARMONIC L1V (%)
2. HARMONIC L2V (%)
3. HARMONIC L2V (%)
4. HARMONIC L1A (%)
5. HARMONIC L2A (%)
6. HARMONIC L3A (%)
7. HARMONIC NA (%)

When it enter any harmonic display, press 'ENTER', it will display one kind of harmonic data.

Page 1

```
   HARMONIC *** (%)
 THD=0.00   9th=0.00
 3th=0.00  11st=0.00
 5th=0.00  13th=0.00
```

Page 2

```
   HARMONIC *** (%)
 7th=0.00  15th=0.00
17th=0.00  25th=0.00
19th=0.00  27th=0.00
```

Page 3

```
   HARMONIC *** (%)
21st=0.00  29th=0.00
23th=0.00  31st=0.00
33th=0.00  41st=0.00
```

Page 4

```
   HARMONIC *** (%)
35th= 0.00  43th=0.00
37th=0.00  45th=0.00
39th=0.00  47th=0.00
```

Page 5

```
   HARMONIC *** (%)
49th=0.00  55th=0.00
51st=0.00  57th=0.00
53th=0.00  59th=0.00
```

Page 6

```
   HARMONIC *** (%)
61st=0.00  63th=0.00
```

g) Instantaneous KW

```
      INST KW
L1=00.0000
L2=00.0000  T=00.0000
L3=00.0000
```

h) Instantaneous KVAR

```
      INST KVAR
L1=00.0000
L2=00.0000  T=00.0000
L3=00.0000
```

i) Instantaneous KVA

```
      INST KVA
L1=00.0000
L2=00.0000  T=00.0000
L3=00.0000
```

Page 2 Max Demand

```
      MAX DEMMAND
KW  =00.0000
KVAR=00.0000
KVA =00.0000
```

viii. Press 'ENTER' Key

To see meter information continually press to scroll down pages.

Page 1

```
   AUTOMETERS LTD
        IC9
 SERIAL No: 9000001
    ADDRESS: 00
```

Page 2

```
  METER DESCRIPTION

 3 PHASE 4 WIRE
 230/400V 5A 50Hz
```

Page 3

```
       RATIOS
 VT 230.0:230.0
 CT 5:5
 NT 5:5
```

Page 4

```
   PULSES DETAILS

 PULSE VALUE  =1kWh
 PULSE PERIOD =100ms
```

Page 5

```
 RESET M D   FUNC-012
 RATIO       FUNC-013
 CONTRAST    FUNC-016
 CONNECTION FUNC-050
```

Page 6

```
 PULSE TEST FUNC-060
```

2) Function operating display:

Press 'FUNCT' key. Display will change to below.

```
    PLEASE ENTER
   FUNCTION NUMBER

         **
```

On the screen above, you will see two asterix, one flashing.
Type in the first number of the required function you wish to see by pressing the 'ENERGY' key continually until you have reached the correct number, then press 'ENTER' key. Repeat for the second asterix.
When both numbers have been entered, press the "FUNCT" key. This will take you to the desired screen.
To return to the normal screen press 'FUNCTION' key again.
If you enter an incorrect number or a function which is not available on this model you will see the screen below.

```
   FUNCTION SELECTED
   IS NOT  AVAILABLE
```

List of function code as below:

Function Number	Option		Number
12	Demand reset		
13	Ratio	CT ratio	Primary
16	Display contrast	+ or -	Primary
50	Connection test		
60	Pulse test		

RESET MAXIMUM DEMAND
Function 12.

```
   PRESS ENTER KEY
     TO RESET MD
```

To reset maximum demand enter
Function 12
(page 5 function operation
display)
press "enter" key.
Press "Funct" key to return to
normal display.

SETTING CURRENT TRANSFORMER RATIO.
Function 13.

```
  RATIO

 CT PRIMARY=****/5
 NT PRIMARY=****/5
```

To set C.T. ratio see page 3.

DISPLAY CONTRAST.
Function 16.

```
  DISPLAY CONTRAST

     +        -
```

To alter the display enter function
16.
(See Page 5 function operation
display)
The curser will flash on one of the
two signs.
To increase contrast press "enter"
key to move the curser to the
flashing "+" sign,
Display will change, press the
"Enter "key to step the contrast.
Press "Funct" key to return to
normal display.

CURRENT TRANSFORMER AND VOLTAGE CONNECTION SETTINGS
Function 50

```
      CONNECTION
 L1 import   V1 OFF
 L2 import   V2 OFF
 L3 import   V3 OFF
```

To check connections enter
function 50.
(See Page 5 function operation
display)
Press "Funct" key to see
connections.
Press "Funct" key to return to
normal display.

PULSE TEST
Function 60

```
  RELAY PULSE TEST
 PULSE EVERY SECOND

 PRESS ENTER TO EXIT
```

To test the relay output enter
function 60
(See Page 5 function operation
display)
Press "enter key"
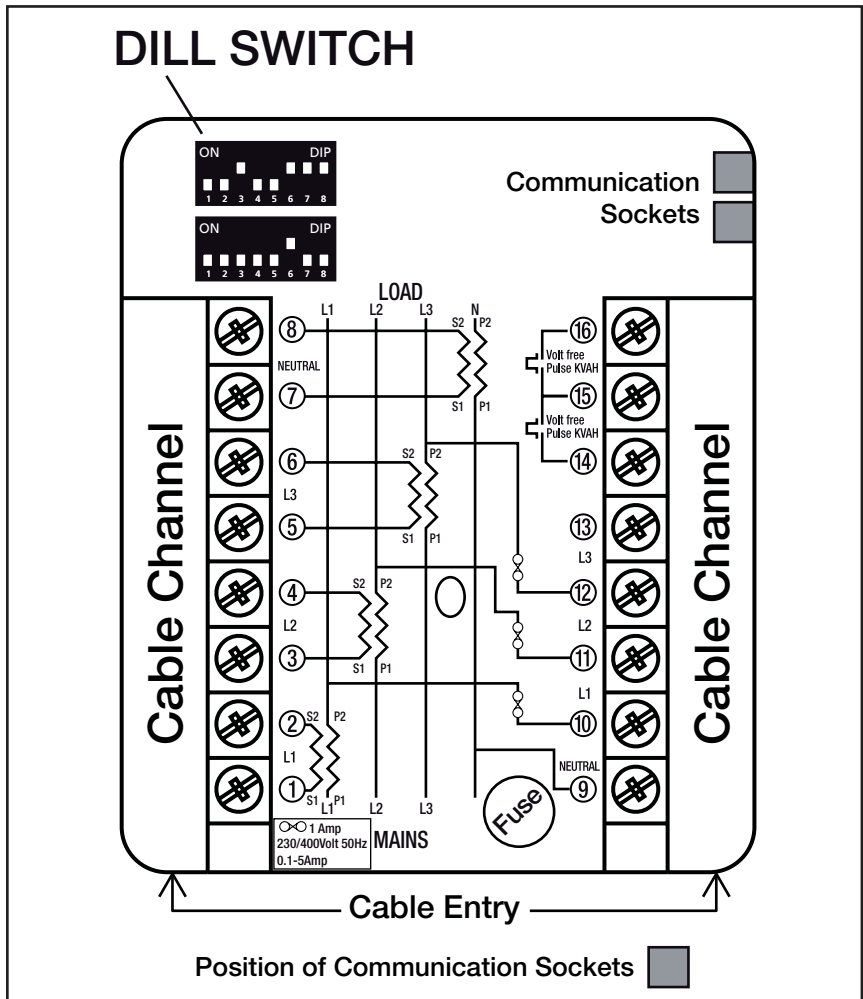Press "Funct" key to return to
normal display.

Diagram 6.

Wiring Information

Power Supply

The standard IC7-C and IC9-C requires a 230 volt, 50Hz supply. This is provided from the L3 phase and Neutral internally.

Wiring

Electrical and communication connections are made to terminals 1-6 at the lower half of the meter. Communication Modbus 485 connections are made via the two sockets at the top of the meter on the side. Please see diagram 3.

Programming the Meter

To program the meter the dill switch, number "8" on the lower dill switch block must be in the "on" position.

Programming the Modbus Meter Register

Each meter that is connected to a Local Area Network (LAN) must have a unique modbus register so that it can be identified by the computer processor. Allocating a meter modbus register is accomplished using the upper block of dill switches. The dill switches in this block each represent a number, in geometric progression starting with dill switch number "8". Thus switch number "8" represents register number "1", switch number "7" represents register number "2", switch number "6" represents register number "4", switch number "5" represents register number "8" and so on.

To allocate a meter register number the required dill switches must be switched into the "on" (up) position.

TOP SWITCH
MODBUS
ADDRESS

LOWER SWITCH
MODBUS
PARAMETERS

Thus: To allocate meter register number "1", only dill switch number "8" on the upper block of dill switches needs to be in the "on" position.

To allocate meter register number "14" dill switches numbers "5", "6" and "7" must be in the "on" position.

To allocate meter register number "39" dill switches numbers "3", "6", "7" and "8" must be in the "on" position. Etc.

Programming the Meter Functions.

The operating functions of the meter, such as baud rate, data format etc are programmed using the lower block of dill switches, as follows:

Baud Rate

Programming the Baud rate utilises dill switches numbered "1" and "2" on the lower dill switch block, as follows:

Baud Rate	Dill Switch 1	Dill Switch 2
9600	Off	Off
19200	On	Off
38400	Off	On
1200	On	On

Wire Mode

Programming wire mode utilises switch number "3", as follows:
Two wire mode: switch Off
 Four wire mode: switch On

Modbus Type

Programming the modbus type utilises switch number "4", as follows:
RTU: switch Off
ASCII: switch On

Parity Type

Programming the parity type utilises switch number "5", as follows:
Even: switch Off
Odd: switch On

Data Format

Programming data type utilises switch number "6", as follows:
ASCII string: Off
Floating point: On

Floating Point Format

Programming the floating point format utilises switch number "7", as follows:
High word first: switch Off
Low word first: switch On

LED Mode

Programming the LED mode and CT ratio utilises switch number "8", as follows:
Calibration 1000 impulses per Kwh: switch On
Kwh impulse with output relay: switch Off

Performance and data

Overview

The IC7-C and IC9-C meters are 230/400 volt 50 Hz, 5 amp current transformer operated meter designed for measuring 3 phases in a 4 wire star configured system and is capable of transmitting kWh and kVAH by means of the volt free outputs which are standard on the basic model. The model IC9-C is supplied with a fully programmable RS485-communication output and is capable of transmitting all of the data the meter monitors.

Technical Parameters

Meter Standard	BS EN 61036
Accuracy	Active 1.0, Reactive 2.0
Reference Voltage	3 x 230 /400 v
Basic Current	5 Amp
Maximum Current	6 Amp
Frequency	50/60 Hz
Pulse Constant (LED strobe)	1000 imp/kWh, 1000 imp/ kVAH
Range of Voltage	200- 250 volt
Operating Temperature	-30°C – +70°C
Storage Temperature	-30°C – +80°C
Power Consumption	0.01VA @5A; 0.8W, 8VA @230V
Pulse Output	IEC 62053-31
Red L.E.D.	Pulse Indication.
Display	20 x 4 character LCM with background light.
Output Details	2 – Opto isolated Mosfet devices: 400 ACV, 100ma KWh, KVAH
Pulse Duration	80-100 ms closure
Pulse Value	C.T. Value less than 1000/5A = 1 kWh/imp C.T. Value 1000/5A or more than = 10 kWh/imp

Current transformer selection

For accurate monitoring, correct selection of the current transformers is critical. Always select the current transformers suitable for the load you are actually monitoring. **DO NOT** automatically select current transformers to the breaker size in case the load is significantly lower.

Main Function

Measurement and Information available from Keypad.
1. Active, Reactive, Apparent import energy
2. Active, Reactive export energy

Real Variables

1. Voltage: 3 phase voltages, 3 line voltages
2. Current: 3 phase current and neutral current
3. Active instant (kW): 3 phase and total power
4. Reactive instant (KVAR): 3 phase and total power
5. Apparent (KVA): 3 phase and total power
6. Power factor: 3 phase and total power factor
7. Frequency

Demand (Demand period 30 minutes)

1. Current Demand: Active, Reactive, Apparent demand
2. Maximum demand: Active, Reactive, Apparent Maximum demand

Performance characteristics

Diagram 9: Typical load curve with balanced load at 50 Hz.

8
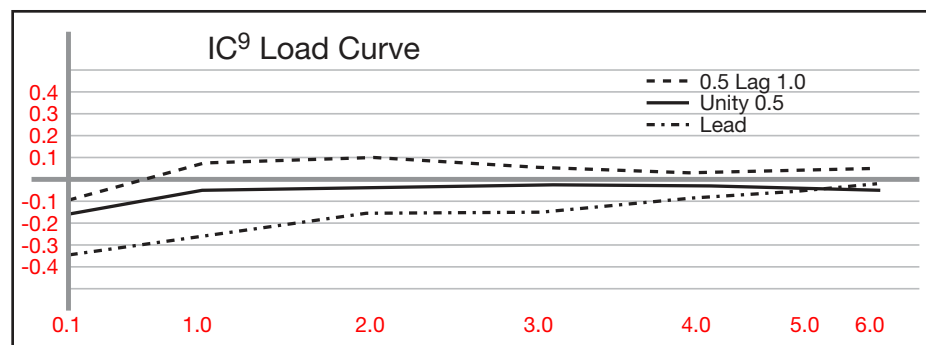
Important

The meter must be fitted by a competent person and must be fitted in accordance to the latest edition of electrical regulations concerning electricity meters.

The attention of the specifier, purchaser, installer and user is drawn to the special measures and limitations to use, which must be observed when this product is taken into service to maintain compliance with the CE directives currently in force. Details of these special measures and limitation to use are available from HMSO.

Ref: IEC1000-5-1 (BS195/210788DC), IEC1000-5-2 (BS195/214642DC), IEC1000-5-6 (BS195/210789DC).

Dedicated customer service

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

The personal involvement of the directors at every level, a highly trained and motivated staff, fully computerised systems and in depth stock holding, combine to provide a level of service which has earned the appreciation of customers across the spectrum of the UK and export markets.

Computerised distribution systems are geared to consistent 24-hour despatch of products, with 20-minute despatch being possible in respect to urgent demand for small orders.

Product range

Metering and monitoring equipment ranges from single and three phase kWh meters to a sophisticated range of fully programmable information centres. Also available are Electronic meters capable of monitoring over 400 individual parameters with full memory backup for in depth graphical analysis of power usage, together with a range of devices which enables data to be transferred utilising leading-edge telephone technology, thus enabling the information to be sent directly to the web and viewed via a PC, a laptop computer or even a mobile 'phone. The information can also be sent to a dedicated internal server if preferred.

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

AUTOMETERS
SYSTEMS