I NFORMATION
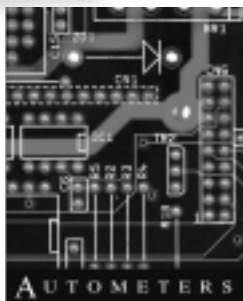# C ENTRES
IC870 SERIES

I NSTALLATION
AND OPERATING
MANUAL

```
         VOLTAGE
R-N 230 V    R-Y 400 V
Y-N 230 V    Y-B 400 V
B-N 230 V    B-R 400 V
```

IC 870

A UTOMETERS

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FIRST CHECK THE CONTENTS OF YOUR PACKAGE

It should contain:
1. Meter
2. Fixing brackets with screws inserted (Quantity 2)
3. Communications cassette if specified
4. Installation and operation manual

1 DESCRIPTION

OVERVIEW OF THE UNIT

The IC 870 Multi-Function meter is designed to display various types of power measurement information. An optional data communication module can be fitted to the IC870 meter. The modules can be fitted to the meters without being removed from site.

The IC 870 meter is fitted with one factory programmable relay, volt free normally open contacts. All the connections, including the communications when fitted, are screw terminals at the back of the meter. All the screws in the terminals are captive.

The front panel consists of a 20 character 4-line display and a set of readout selection buttons.

Generally speaking, the meter is factory programmed and provides a small range of functions which are programmable by the user. The standard meter is supplied with CT Ratio Setting and CT Polarity Check available for user programming. It is also available with additional controllability

(i.e. a greater range of programmable functions) to special order. The standard functions are described on pages 9-10.

PULSE OUTPUTS

One voltage free output relay is factory fitted in the meter which can be programmed to kWh, kVARh or kVAH. Pulse value and duration are factory set at 1kWh and 100ms. Function 60 enables the user to alter the value to suit individual requirements. The pulse status cycle (code 53) provides a visual indication for testing the meter from the front panel.

COMMUNICATION MODULE

An optional communication module is available for the IC870 Information Centre, enabling different methods of transferring data to computer systems.

Listed below are the four modules available:

1. 485 Module
2. Modbus Module
3. Volt free relay module (available 2000)
4. 4-20mA Module (available 1999)

Fully complies to
European
Electromagnetic
Compatibility

Conforms to IEC 1036
Section 4.6.1.
Accuracy Class 1.0

Certificate No. 0275

2 Iɴsᴛᴀʟʟᴀᴛɪᴏɴ

INSTALLATION OF THE METER

Mount the meter so that the front panel is vertical.
A typical panel would be a switchgear cabinet
door. The meter requires depth behind the panel of
100mm excluding wiring for a standard meter and
150mm excluding wiring if fitted with a
communications module. Prepare a single square
hole 92mm wide and 92mm high.

LOCATION

The IC870 meter should be mounted in a dry dirt
free environment away from heat sources and very
high electric fields. Temperatures should not
exceed 70°C or fall below -20°C.

MOUNTING METER WITH A CASSETTE MODULE

For the IC 870 with a communication
cassette; after cutting the clearance aperture,
remove the terminal cover from the meter.
Engage the cassette module if supplied as
a separate item by plugging the module
directly into the back of the meter.
Enter the meter into the aperture and secure
using the two fixing clamps provided.
Connect the current terminals first numbered
1-8 followed by the voltage terminals
numbered 9-11, the neutral terminal number
12 and finally the volt free relay terminals
numbered 13 and 14.

When connecting wires to the
communication module ensure that you
first thread the cable through the hole in
the terminal cover.

Re-fit the terminal cover.
The terminal cover can be sealed
for extra security.

External dimensions 91 x 91
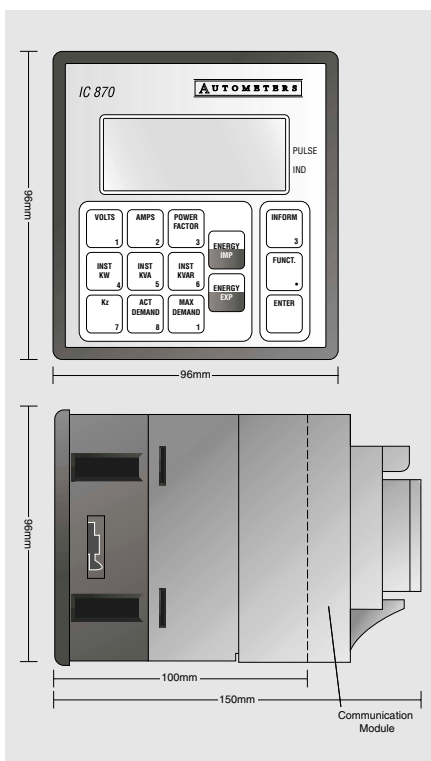Clearance aperture required 92 x 92 mm

Figure 1. Installation details

3

3 W I R I N G I N F O R M A T I O N

POWER SUPPLY

The standard 3 phase 4 wire IC870 meter is powered by 230 Volts AC (47 to 66 Hz) at 0.2 Amps.
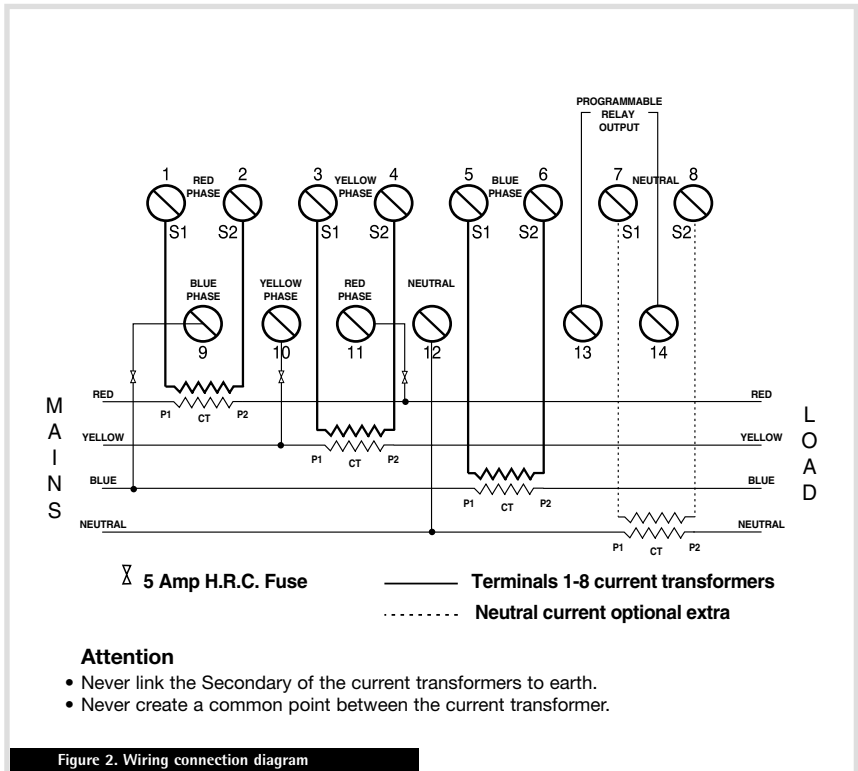
WIRING

Electrical and communications connections are made directly to the back of the meter. Electrical connections are made to terminals 1-12, pulse output relay numbered 13-14, and the RS485 communications directly to the communications cassette (optional extra).

ELECTRICAL CONNECTIONS

2.5 sq.mm wire is recommended for all electrical connections, subject to the distance between the meter and the current transformer.

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

Attention
- Never link the Secondary of the current transformers to earth.
- Never create a common point between the current transformer.

Figure 2. Wiring connection diagram

4

4 Pʀᴏɢʀᴀᴍᴍɪɴɢ ᴛʜᴇ Mᴇᴛᴇʀ

PROGRAMME THE CT RATIO CODE 013

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

1. Press function, then 0, then1, then 3.
Enter the code where the asterisk is indicated,
three asterisks indicates it requires three numbers
entering.

```
ENTER THE NUMBER OF
    THE REQUIRED
     FUNCTION
       ***
```
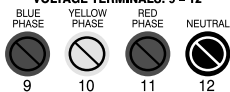
2. Enter Password.
(The Serial Number is on the reverse side of
your meter) - six digits, starting from the left
hand side.

```
   ENTER PASSWORD
      ******
```

Serial Number 800001 ◄—Password

VOLTAGE TERMINALS: 9 – 12
BLUE PHASE YELLOW PHASE RED PHASE NEUTRAL
9   10   11   12

3. Enter the CT Ratio
Type in the number with the first digit on the
left e.g. 2500/5. Type 2 then 5 then 0 then 0.
If the CT Ratio is required with less than four
digits (e.g. 300/5 Amp), start first left hand digit
with 0 e.g. enter CT ratio- 0300.

```
 ENTER NEW CT RATIO
OLD RATIO 0005:5
NEW RATIO 0300
```
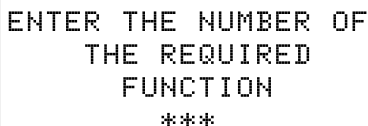
```
   MEMORY UPDATED
```
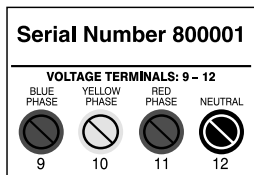
PROGRAMME THE NEUTRAL CURRENT RATIO CODE 015

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

1. Press function then 0, then1, then 5. Enter the code where the asterisk is indicated, three asterisks indicates it requires three numbers entering.

```
ENTER THE NUMBER OF
    THE REQUIRED
      FUNCTION
        ***
```

2. Enter Password.
(The Serial Number is on the reverse side of your meter) - six digits, starting from the left hand side.

```
  ENTER PASSWORD
    ******
```

Serial Number 800001 ◀—Password

VOLTAGE TERMINALS: 9 – 12
BLUE PHASE · YELLOW PHASE · RED PHASE · NEUTRAL
9   10   11   12

3. Enter the NT Ratio
Type in the number with the first digit on the left e.g. 2500/5. Type 2 then 5 then 0 then 0. If the NT Ratio is required with less than four digits (e.g. 300/5 Amp), start first left hand digit with 0 e.g. enter NT ratio- 0300/5.

```
  ENTER NT RATIO
OLD RATIO 0005:5
NEW RATIO ****
```

```
 MEMORY UPDATED
```

PROGRAMMING THE PULSE VALUE CODE 060

1. Press function, then 0, then 6, then 0.
Enter the code where the asterisk is indicated,
three asterisks indicates it requires three
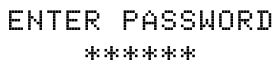numbers entering.

```
ENTER THE NUMBER OF
    THE REQUIRED
     FUNCTION
       ***
```

2. Enter Password.
(The Serial Number is on the
reverse side of your meter) -
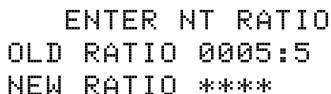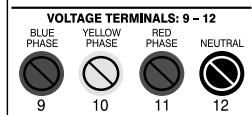six digits, starting from the left hand side.

```
ENTER PASSWORD
   ******
```

Serial Number 800001 ←—Password

VOLTAGE TERMINALS: 9 – 12
BLUE PHASE   YELLOW PHASE   RED PHASE   NEUTRAL
9   10   11   12

3. The display will show the factory setting.
Type in the new required value using the function
button as the decimal point.
If for example the Pulse Value is required to be
programmed to 10 kWh per pulse, enter 1,
then 0, then decimal point, (function), then 0,
then 0. important. There are 6 digits available to
programme the Pulse Value. It is imperative that
the decimal point is inserted into the new value
e.g. 1.0000 kWh, 10.000 kWh and 100.00 kWh.

```
 ENTER PULSE VALUE
OLD VALUE 1.000KWH
NEW VALUE *****KWH
```

4. When last digit entered, screen displays

```
MEMORY UPDATED
```

PROGRAMMING THE PULSE DURATION (TIME) CODE 061
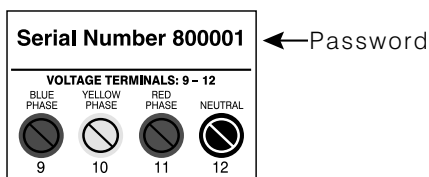
1. Press the function 0, then 6, then 1. Enter the code where the asterisk is indicated. Three asterisks indicates it requires a three numbers entering.

```
ENTER THE NUMBER OF
    THE REQUIRED
      FUNCTION
        ***
```

2. Enter Password (the serial number is on the reverse side of your meter) - 6 digits starting from the left hand side.

```
ENTER PASSWORD
    ******
```

Serial Number 800001 ◄—Password

VOLTAGE TERMINALS: 9 – 12

BLUE PHASE	YELLOW PHASE	RED PHASE	NEUTRAL
9	10	11	12

3. The display will show the factory setting (100ms). Type in the new required value using the function button as the decimal point. If for example the pulse duration is required to be programed to 200ms, enter 0, 2, 00

```
ENTER PULSE DURATION
  OLD VALUE 100 ms
  NEW VALUE **** ms
```

4. When last digit entered, screen display

```
MEMORY UPDATED
```

5 I N F O R M A T I O N

CHECK CT POLARITY

1. Press function.
Enter the code where the asterisk indicated.
Three asterisks indicates it requires three numbers entering.

```
ENTER THE NUMBER OF
     THE REQUIRED
       FUNCTION
         ***
```

2. Enter code '050'
Display will show - The Plus mark '+'
indicates the CT is correctly connected.
If a negative mark '-' sign is displayed, this
indicates the CT connection is incorrect.
N.B. This is only available if power is flowing

```
CT POLARITY TEST
RED   :+
YELLOW:+
BLUE  :+
```

RESET MAXIMUM DEMANDS

1. Press function.
Enter the code where the asterisk is indicated.
Three asterisks indicates it requires three
numbers entering.

```
ENTER THE NUMBER OF
     THE REQUIRED
       FUNCTION
         ***
```

2. Enter Code. '012'.
Display will show -

3. Press enter to reset Maximum Demand.

4. The display will show MEMORY UPDATED

```
   PRESS ENTER KEY
   TO RESET MDs
```

```
   MEMORY UPDATED
```

PULSE STATUS CHECK

1. Press function.

Enter the code where the asterisk is indicated. Three asterisks indicates it requires three numbers entering.

2. Enter Code '053'.

3. Display will show

Please note this display is common for all IC870 Meters. Three digits equal the relay count (resets to zero after 999)

```
┌─────────────────────────┐
│  ENTER THE NUMBER OF     │
│     THE REQUIRED         │
│       FUNCTION           │
│         ***              │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│   NUMBER OF RELAY        │
│  PULSES SINCE LAST       │
│     POWER DOWN           │
│        000               │
└─────────────────────────┘
```

6 OPERATION

Once the meter is installed and the functions have been set (see below) the only operation is that of taking readings from the front panel readout. If the data is collected using the RS485 network, no operation is required at all.

INFORMATION

When you press the information button the display cycles through a sequence giving information about the meter as shown below.

SEQUENCE OF INFORMATION READOUTS

```
┌─────────────────────────┐
│    AUTOMETERS LTD        │
│      IC 870-EP           │
│  METER NO: 000000        │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│     PULSE DETAILS        │
│                          │
│ VALUE = 1.0000 KWH       │
│ TIME  = 100ms            │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│  METER DESCRIPTION       │
│                          │
│  3PHASE 4WIRE            │
│  230/400v 50HZ           │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│  FUNCTION NUMBERS        │
│ RESET MD     FUNC-012    │
│ CT TEST      FUNC-050    │
│ PULSE TEST   FUNC-190    │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│       RATIOS             │
│ CT 200:5                 │
│ VT 230:230.0             │
│ NT 50:5                  │
└─────────────────────────┘
```

7 Fᴜɴᴄᴛɪᴏɴ Dɪsᴘʟᴀʏs

DISPLAY

The display is a negative image 20 x 4 characters.
Dimensions of the characters are 2.3mm
wide by 4.03mm high (5 x 8 dots).
Expected lifetime under normal operating
conditions is a minimum of 100,000 hours.

Note: Numbers in displays
are for example only.

SEQUENCE

The IC870 is a single key operation device,
to obtain information press appropriate key.

INST kVA

```
  APPARENT POWER KVA
R 190.000
Y 190.000    T570.000
B 190.000
```

VOLTS

```
        VOLTAGE
R-N 230 V   R-Y 400 V
Y-N 230 V   Y-B 400 V
B-N 230 V   B-R 400 V
```

INST kVAR

```
REACTIVE POWER KVAR
R 215.111
Y 40.1415   T263.406
B 8.15421
```

AMPS

```
        AMPS
R 800.06
Y 800.06    T 2400: A
B 800.06    N 10.000A
```

ENERGY IMPORT

```
   IMPORT ENERGY
KWH   = 1108.4125 >>
KVAH  = 1154.5011
KVARH = 88.9088
```

POWER FACTOR

```
   POWER FACTOR
R 0.000
Y 0.000    T 0.000
B 0.000
```

ENERGY EXPORT

```
   EXPORT ENERGY

KWH   = 5001.4111
kVARH = 90.4511
```

INST kW

```
   REAL POWER KW
R 184.00
Y 184.00    T 552.000
B 184.00
```

Hz

```
   FREQUENCY

   50.00 Hz
```

8 MAXIMUM DEMAND

To obtain the peak maximum demand or actual demand press the corresponding key.

ACT DEMAND

```
KW   = 120.000
KVA  = 140.001
KVAR = 80.1429
A    = 521.73 MIN=19
```

MAX DEMAND

```
PEAK KWH  = 0.0000
PEAK KVA  = 0.0000
PEAK KVAR = 0.0000
PEAK AMPS = 0.0000
```

Pulse Indicator
Display of pulse output is indicated by double chevron flashing on Import Energy display.

FUNCTION KEY

Function allows for resetting and checking of the various parameters as indicated by pressing the information key. To enter values which will define the meter parameters it will be necessary to enter a password. When entered and validated the meter can then be programmed.
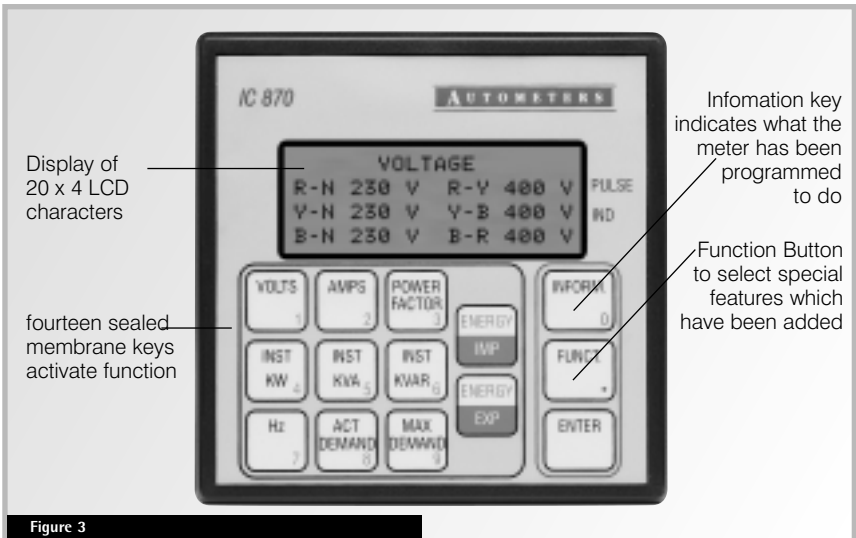
Display of 20 x 4 LCD characters

fourteen sealed membrane keys activate function

Infomation key indicates what the meter has been programmed to do

Function Button to select special features which have been added

Figure 3

12

9 TRANSFORMER SELECTION

CURRENT TRANSFORMER SELECTION

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

CT SELECTION

IC870 meters use current transformers (CTs) 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 IC870 current input 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 because long cabling will contribute to inaccuracy. Also, the CT burden rating must exceed the combined burden of the IC870, plus cabling, together with any other connected devices.

Overall accuracy is dependent on the combined accuracies of the IC870 meter and the CTs.

10 COMMUNICATIONS

ICS SOFTWARE

A host computer running ICS software may communicate with one or more IC 870 Series remote devices. These programs will display all data normally provided through the front panel display of each device.

SOFTWARE UPDATING VIA THE COMMUNICATIONS PORT

Future IC 870 Series software update, when made available by Autometers can be quickly performed via the RS485 port.

COMMUNICATIONS PROTOCOL

To communicate with SCADA or other software packages via the RS485 Communication Port, an IC 870 Series Protocol will be required.

COMMUNICATION CONNECTIONS

CAUTION

It is important that the shield of each leg of the RS485 cable be connected at one end only.

RS485 Communications Module
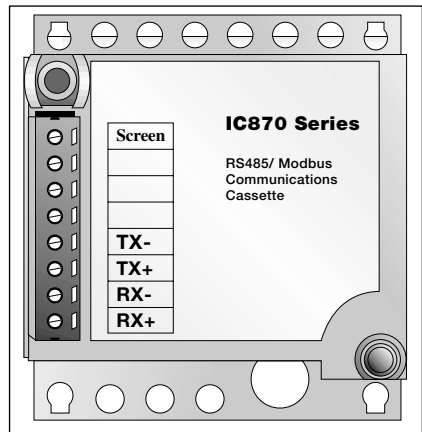
When wiring up the RS485 Network you should observe the following points

1. RS-485 Cable: 22 gauge shielded twisted pair (Belden 8761 or equivalent).
2. Each shield must be earthed at one end only.
3. Each Tx(+) terminal is connected to the Rx(+) terminal on the next device, and each Tx(-) terminal is connected to the Rx(-) terminal on the next device.
4. Up to 15 devices are allowed on the RS485 ring.
5. Use terminal 8 (NC) spare terminal for linking Earth Shields.

The IC 870 Series performs remote communications using the RS485 communications standard. If a computer is to be connected to the RS485 network to perform remote analysis, then the host computer requires an internal RS232c to RS485 converter board and Autometers communication protocol.
All field service work including running diagnosis, testing, software upgrades etc., are performed via the communication link.

4-20mA COMMUNICATION MODULE

CONNECTION DIAGRAM

RS485 communications are made via a 22 gauge shielded twisted pair cable.

4 Channel Programmable 4-20mA Module
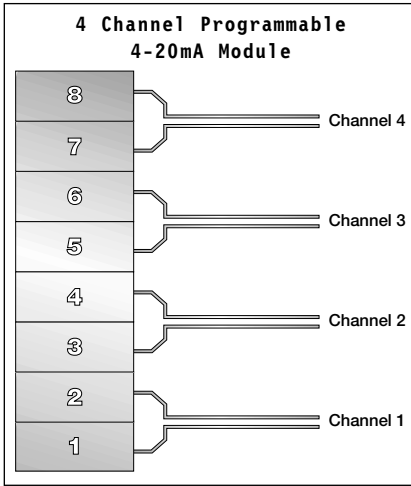
11 PERFORMANCE AND DATA

MEASUREMENTS

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

Volts
± 10% nominal voltage.

Accuracy
All energy measurements comply to IEC 1036 section 4.6.1 Class 1.0.

Burden
Current burden less than 1 VA.

Drift
Negligible, self-compensating circuit.

Display
IC870 series
LCD display 4 X 20 characters negative image wide temperature band

Temperatures
Operating temperatures: -20°C to +70°C
Storage temperatures: - 30°C to + 80°C

Membrane switch
Operating force 100-500 crs. Switch life 8-10 million operations (IP65 sealed).

OUTPUTS

One volt free relay is available factory set to kWh, kVARH or kVAH output
Pulse width: Programmable. Factory set 100ms
Pulse value: Programmable. Factory set 1kWh
Relay contacts:
Maximum switching voltage 600 volt AC/DC
Maximum switching current 100mA
Resistance 50 ohms
Optically isolated MOSFET switch

RS485 communications port (if fitted)
Factory set to 9600 Baud.
User programmable to 19,200 or 38,400 if required. The RS485 communication module uses a dedicated communication processor.

FUNCTIONS

Supplied as Standard
Function 012 - Peak maximum demand reset
Function 013 - Programmes CT setting
Function 015 - Programmes N.T. setting
Function 050 - CT polarity check
Function 053 - Pulse status check
Function 060 - Programme details of pulse value
Function 061 - Programme details of pulse time

PHYSICAL

Dimensions (mm): W96 x H96 x D100
Panel with communications module fitted,
W96 X H96 X D145
Cutout: 92 x 92mm
Weight: 1.25kg, excluding any external transformers.

# 12 M a i n t e n a n c e   A n d   S e r v i c e

MAINTENANCE

The IC870 Series Meter contain E^2 PROM for memory back up. The minimum life expectancy is 10 years. The IC870 meter does not require any regular maintenance.

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. A CT shorting block should be provided so that the meter current inputs can be disconnected without open circuiting the CTs. The shorting block should be wired so that protective relays are not affected.

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

P e r f o r m a n c e   c h a r a c t e r i s t i c s
TYPICAL LOAD CURVE WITH BALANCED LOAD AT 50 HZ

Load curve with balanced load
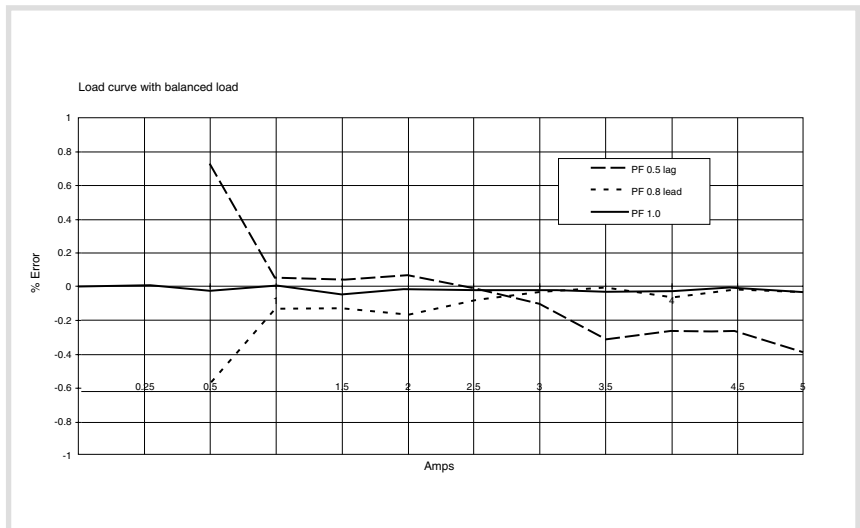
IMPORTANT

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

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 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 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.

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

AUTOMETERS

T HE METERING AND
MONITORING SPECIALIST