



INTEGRA Ci1

Digital Energy Meter for Single- and Three-phase Electrical Systems

Model Type: CI1-01

Installation and Operating Instructions

Introduction

The Integra Ci1 digital meter is designed for accurate measurement and display of imported and exported real and reactive energy, since it was last reset, in terms of Wh, kWh, MWh, VARh, kVARh and MVARh for single phase, three-phase 3- or 4-wire supplies.

This manual provides all the necessary instructions to safely install and operate the instrument. However, for more in-depth operating instructions please refer to the full manual on the Crompton Instruments website, www.crompton-instruments.com.

Measurement

In measurement mode, the buttons control the displayed measurement as follows:

		<p>Displays the maximum current that can be monitored. This reading is set on installation according to the current transformer in use. The small 'A' on the bottom line indicates that the display is showing Amps.</p>
		<p>Displays active energy measured since the unit was last reset. The display alternates between Imported and Exported energy each time the button is pressed. The bottom line of the display shows the import/export mode and the Wh, kWh or MWh range. The and/or symbol on the top line flashes each time an output pulse is generated.</p>
		<p>Displays reactive energy measured since the unit was last reset. The display alternates between Imported and Exported reactive energy each time the button is pressed. The bottom line of the display shows the import/export mode and the VARh, kVARh or MVARh range. The and/or symbol on the top line flashes each time an output pulse is generated.</p>
		<p>This display indicates the phase sequences of the measured voltages and currents, allowing a check that they are connected correctly. The sequence can be 123 or 132 but voltage (V) and current (I) sequences must be the same. A 'V1--' or 'I--' display indicates a phase error of voltage or current, respectively.</p>

Setting-up

To enter set-up mode, firmly press the and buttons simultaneously and hold for about 5 seconds until the password screen appears. Setting-up is password-protected so you must enter the correct password (default '0000') before proceeding. If an incorrect password is entered, the display reverts to measurement mode.

To exit setting-up mode, press repeatedly until the measurement screen is restored or hold CT and TEST buttons simultaneously for 5 seconds.

Setup Menu Structure

Change password

nnnn – 4-digit number, default '0000'

Supply systems

3-phase 3- or 4-wire, Single phase

CT Set maximum current that can be monitored according to CT in use. *nnnn* – 4-digit number 0001 to 9999

Reset Resets cumulative energy measurement to zero

Communication parameters for RS485 interface (optional)

Modbus™ protocol

Baud rate 2400/4800/9600/19200/38400

Parity none/odd/even

Stop bits 1 (1 or 2 if parity is None)

RS485 network address *nnn* – 3-digit number 1 to 247

Order – Norm/Rev indicates if Modbus™ word order is normal or reversed

Johnson Controls (JC) N2 protocol

RS485 network address *nnn* – 3-digit number 1 to 255

Relay pulse outputs (optional)

OP1 kWh/kVARh (Active/reactive)

Import or Export from output module 1

OP2 kWh/kVARh (Active/reactive)

Import or Export from output module 2

Rate 0.001/0.01/0.1/1/10/100/1000/10,000 kWh or

kVARh per pulse

Pulse width 200/100/60 ms

Energy Unit/kilo/Mega

1% limit on/off

Test Phase sequence

Display on – all elements on to check display

Display toggle - Each element is turned on and off

SFS Build number

SFH Firmware version

Menu Option Selection

- Use the (up) and (down) keys to select the required item from the menu. Selection does not roll over from bottom to top of list or vice versa.
- Press to confirm selection.
- If an item flashes, then it can be adjusted by the and keys. If not, there may be a further layer, e.g. Comms - Baud rate, before adjustment is possible. Press to select the lower layer.
- Having selected an option from the current layer, press to confirm your selection. The SET indicator will come on.
- Having completed a parameter setting, press to return to a higher menu level. The SET indicator will go off and you will be able to use the and keys for further menu selection.

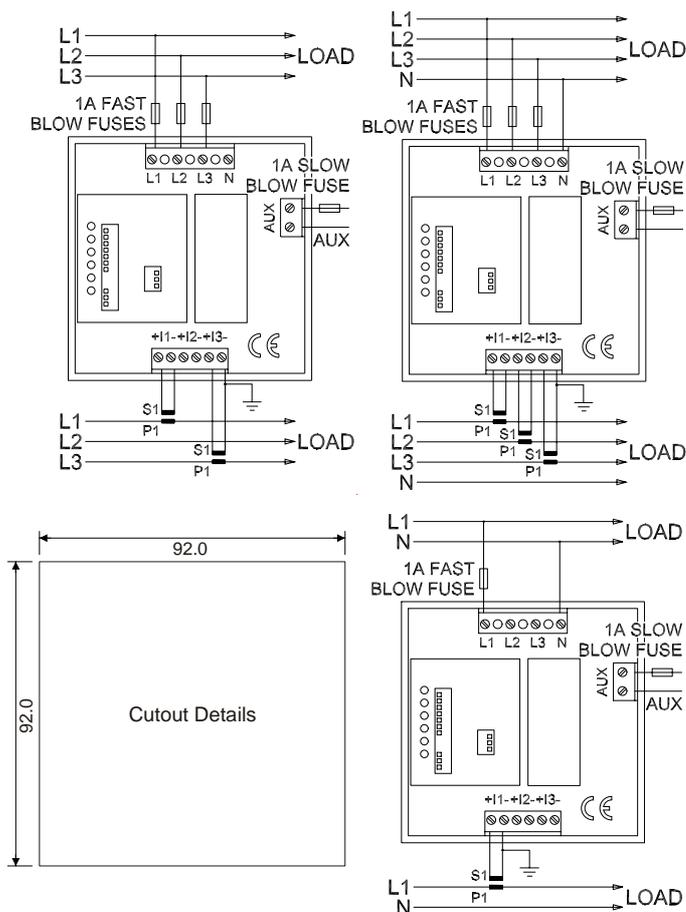
- On completion of all setting-up, press **CT** repeatedly until the measurement screen is restored.

Number Entry Procedure

When setting-up the unit, some screens require the setting-up 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 **Wh** and **VArh** keys.
- Press **TEST** to confirm each digit setting. The SET indicator comes on after the last digit has been set.
- After setting the last digit, press **CT** to exit the number setting routine. The SET indicator will go off.

Installation



The unit may be mounted in a panel of any thickness up to a maximum of 6 mm (0.25in). Leave enough space behind the instrument to allow for bends in the connection cables. As the front of panel enclosure conforms to IP52, it is protected from dripping water. The unit is intended for use in a reasonably stable ambient temperature within the range -10 to +55°C. Do not mount the unit where there is excessive vibration or in excessive direct sunlight.

Safety

The unit was designed in accordance with BS EN 61010-1:2001 (IEC 61010-1:2001) – Permanently connected use, Normal condition. Installation category III, pollution degree 2, basic insulation for rated voltage. Measurement Category III.

Warnings

Caution: Risk of Electric Shock

- During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.
- Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.
- This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.
- The unit does not have internal fuses therefore external fuses must be used for protection and safety under fault conditions.
- Never open-circuit the secondary winding of an energized current transformer.
- If this equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.
- Auxiliary circuits (communication & relay outputs) are separated from metering inputs and 110-400V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

EMC Installation Requirements

Whilst this unit complies with all relevant EU EMC (electromagnetic 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.

Wiring

Input connections are made to screw clamp terminals. Choice of cable should meet local regulations for the operating voltage and current. **The current inputs of this product are designed for connection into systems via current transformers only.**

Instrument transformers used for connection to the meter must be of approved type and compliant with ANSI/IEEE C57.13 or IEC 60044-1, selected and sized appropriate to the supply network being monitored. All negative current inputs are commoned inside the unit and grounding should be at one point only. To minimise measurement errors, the CTs should be grounded as shown in the wiring diagram. CT secondaries must be grounded in accordance with local regulations. It is desirable to make provision for shorting links to be made across CTs to permit easy replacement of a unit should this ever be necessary.

All connections are made to screw clamp terminals. Terminals are suitable for copper wires only and will accept one 0.05 – 2.5mm² (30 – 21AWG) stranded or solid core cable. Instruments are intended for panel mounting. Terminals must be enclosed within the panel. Use wire rated at 600V for main terminals, 60°C minimum temperature. Terminal screws are fully tightened for shipment and must be undone before wire insertion. Terminal screws should be tightened to 0.5Nm (4.4 lbf in) only.

Additional considerations for three wire systems

The neutral terminal (terminal N) is indirectly connected to the voltage input terminals (terminals L1, L2, L3). When connected to a three wire system the neutral terminal will adopt a potential somewhere between the remaining lines. If external wiring is connected to the neutral terminal it must be connected to either the neutral line or earth (ground) to avoid the possibility of electric shock from the neutral terminal.

Fusing

This unit must be fitted with external fuses in voltage and auxiliary supply lines. Voltage input lines must be fused with a fast blow fuse 1A maximum. Auxiliary supply lines must be fused with a slow blow fuse rated 1A maximum (if product is powered line-to-line, ensure both lines are fused). Choose fuses of a type and with a breaking capacity appropriate to the supply and in accordance with local regulations.

A suitable switch or circuit breaker conforming to the relevant parts of IEC 60947-1 and IEC 60947-3 should be included in the installation. It should be positioned so as to be easy to operate, in close proximity to the equipment, and clearly identified as the disconnecting device.

Earth/Ground Connections

For safety reasons, current transformer secondary connections should be grounded in accordance with local regulations. Under no circumstances should the product be operated without an Earth connection.

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 thoroughly dried before further service. Should it be suspected that water might have entered the unit, factory inspection and refurbishment is recommended.

In the unlikely event of a repair being necessary, it is recommended that the unit be returned to the factory or nearest Crompton Instruments / TE Connectivity service centre.

Specification

Measurement Inputs

Imported and exported energies are recorded.

Three current inputs (six physical terminals) with 2.5mm² stranded wire capacity for connection of external CTs. Voltage inputs through 4-way fixed connector with 2.5mm² stranded wire capacity. 3-Phase 3- and 4-wire and Single-phase 2-wire unbalanced. Line frequency measured from L1 voltage or L3 voltage.

Direct measurement of 173 to 500Vac L-L (100 to 289Vac L-N).

Range of Use

Values of measured quantities, components of measured quantities, and quantities which affect measurement errors to some degree, for which the product gives meaningful readings:

Voltage 5 ... 120% of Range Maximum
(below 5% of Range Maximum voltage, current indication may only be approximate)

Current 1 ... 120% of nominal

Active power 1 ... 144% of nominal, 360MW maximum

Apparent power 1 ... 144% of nominal, 360MVA maximum

Power is only registered when voltage and current are within their respective range of use.

Accuracy

Active energy (Wh) Class 1 IEC 62053-21 section 4.6

Reactive energy (VARh) ±1% of range maximum

Temperature co-efficient Active energy = 0.018%/°C, typical

Error change due to variation of an influence quantity in the manner described in Section 6 of IEC 688:1992 2 × error allowed for the reference condition applied in the test. Error due to temperature variation as above.

Error in measurement when a measurand is within its measuring range, but outside its reference range 2 × error allowed at the end of the reference range adjacent to the section of the measuring range, where the measurand is currently operating / being tested.

Auxiliary Supply

The unit is powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply, through a two-way fixed connector with 2.5mm² stranded wire capacity.

Operating range

110 to 400V AC nominal ±10% (99-440V AC absolute limits)

120 to 350V DC nominal ±20% (96-420V DC absolute limits)

Frequency Range 45 to 66 Hz

Burden 5VA nominal

Option Modules

Pulsed output relays	1 per module (maximum 2 modules fitted per meter)
Contact rating	50mA max at 250V AC for general switching applications
Type	Solid state relay
RS485 output module	1 channel per module (maximum 1 module fitted per meter)
Type	2-wire half duplex
Baud rate	2400, 4800, 9600, 19200, 38400

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 ±1°C
Input waveform	50 or 60Hz ±2%
Input waveform	Sinusoidal (distortion factor <0.005)
Auxiliary supply voltage	Nominal ±1%
Auxiliary supply frequency	Nominal ±1%
Auxiliary supply waveform (if AC)	Sinusoidal (distortion factor <0.05)
Magnetic field of external origin	Terrestrial flux

Environment

Operating temperature	-10°C to +55°C*
Storage temperature	-20°C to +70°C*
*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.	
Relative humidity	0 to 90%, non-condensing
Altitude	Up to 2000m
Warm up time	1 minute
Vibration	10Hz to 50Hz, IEC 60068-2-6, 2g
Shock	30g in 3 planes
Dielectric voltage withstand test	2.2kV rms 50Hz for 1 minute between Measuring Voltage Inputs to RS485 and Relay, and between Auxiliary to RS485 and Relay.

 Front Face Only

Mechanics

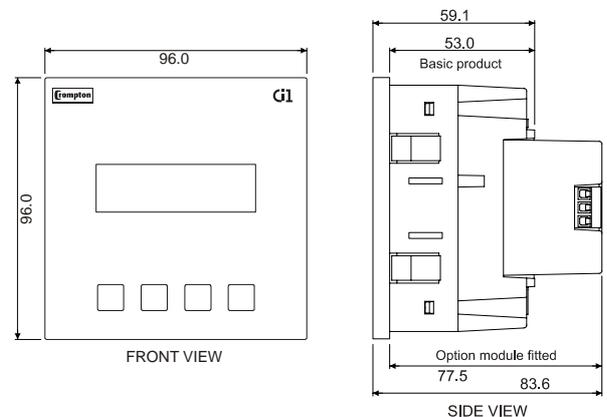
Dimensions	96 × 96 mm (L×W)
Depth (behind panel)	53 mm, 77.5 mm with option module(s)
Case protrusion (in front of panel)	7 mm maximum
Sealing	IP52 (front panel), IP30 (case) (minimum)
Mounting	DIN 96 panel mounting

Approval, Certification, and Standards Compliance

EMC, Emissions	BS EN 61326, Class A (Industrial)
EMC, Immunity	BS EN 61326, Class A (Industrial)
Safety	BS EN 61010-1:2001

Specification Input

Nominal input voltage	100 to 289V AC L-N (173 to 500V AC L-L)
Max. continuous input overload voltage	120% of nominal (Maximum 600V AC L-L)
Max. short duration input voltage	2 x range maximum (1 second application repeated 5 times at 5 minute intervals)
Nominal input voltage burden	< 0.2VA per phase
Nominal input current	5A AC rms
Max. continuous input overload current	120% of nominal
Max. short duration input current	10 x nominal (1 second application repeated 5 times at 5 minute intervals)
Frequency	45 to 66Hz



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