

Integra Ci3 digital metering system

1. Features and options

The Integra Ci3 meter is designed for accurate measurement and display of all major electrical and power quality parameters. It has easy programming, mounting and navigation. It has been designed, developed and manufactured in the UK, by Crompton Instruments. It is programmable to suit single-phase, three-phase three-wire and three-phase four-wire system configurations.

The product features a DIN 96 panel mounted enclosure, backlit LCD display and user programmable CT ratios, all accessible via an intuitive user interface. Integra Ci3 measures 17 electrical parameters including total harmonic distortion (THD) measurement up to the 31st harmonic.

Integra Ci3 offers two optional output ports at the rear of the product. This allows to fit either two isolated pulsed output relays or a RS-485 communication module such as Modbus® or Johnson Controls communication output. These are selectable via internal configuration settings.

Pre sales literature indicates valid option combinations and ordering codes.

Modbus® is a registered trademark of AEG Schneider Automation Inc. All trademarks are acknowledged.

1.1 Power Supplies

The Integra Ci3 must be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. The input range of the auxiliary is 110-400V AC or 120-350V DC. All connections are made to screw clamp terminals. Terminals will accept one stranded 0.05 - 2.5mm² cable or one 0.05 - 4mm² cable. Terminal screws are fully tightened for shipment and must be undone before wire insertion. Terminal screws should be tightened to 0.8Nm or 0.6 ft/lbf only.

1.2 Modbus® RS485 module Option

An optional Modbus™ RS485 module is available for purchase. Where a Modbus® RS485 module is available, it can be connected to a PC for control and monitoring purposes. A maximum of one Modbus® RS485 module can be fitted to an Integra Ci3.

1.3 Pulse Relay Module Option

An optional Pulsed Relay module is available for purchase. Pulse relays are user programmable for corresponding energy type, pulse divisor (one pulse for every 1, 10,100 or 1000kWh/kvarh for example) and pulse width (duration). A maximum of two Pulsed Relay modules can be fitted to an Integra Ci3. When two Pulsed Relay modules are fitted, they share a common divisor value and pulse width.

1.4 Display Screen

The display screen is used in two main modes: display of measured values and parameter setup.

1.5 Front Display Buttons

The front of the product has four buttons that select different electrical parameters and are also used for system configuration.



is used to select the Voltage and Frequency parameter screens.
In set-up mode this is the “Back” button.



is used to select the Current parameter screens.
In set-up mode this is the “Up” button.



is used to select the Power and Power Factor parameter screens. In set-up mode this is the “Down” button.



is used to select the Energy parameter screens. In set-up mode this is the “Enter” button.

1.6 Display Mode

The parameters are viewed on a backlit LCD display. The 15 screens are accessible via 4 buttons on the front panel allowing the user to scroll between various screens.

1.7 Set up mode,

The top row shows an abbreviation of the parameter name, the middle row shows the parameter value being set and the bottom row is used to confirm the input has been “set” to the desired value. In general, the and buttons change a parameter value and the key enters the value and progresses the set-up procedure to the next screen.

1.8 Start Up Screens

When power is initially applied to the Integra Ci3, it progresses through a series of three start-up screens. The first screen lights all the LCD segments and acts as a LCD display check. The second indicates the firmware installed in the unit, and the third displays the instrument start-up self test result. If this self test is successful, the unit then switches to the default “System” screen.

2. Display mode screen sequence (4 wire)

Button	Screen No.	Description
	1	Volts L1 – N Volts L2 - N Volts L3 - N
	2	Volts L1 -L2 Volts L2 - L3 Volts L3 - L1
	3	Frequency
	4	Volts L1 - N THD% Volts L2 - N THD% Volts L3 - N THD%
	5	Volts L1 -L2 THD% Volts L2 - L3 THD% Volts L3 - L1 THD%
	1	Current L1 Current L2 Current L3
	2	Neutral Current
	3	L1 Current Max Demand L2 Current Max Demand L3 Current Max Demand
	4	Neutral Current Max Demand
	5	Current L1 THD%






		Current L2 THD%
		Current L3 THD%
P/PF	1	kW kVAr kVA
	2	kW Max Demand
	3	Power Factor
E	1	kWh
	2	kVArh

For 3 phase 3 wire operation no neutral related values will be available





For 1 phase 2 wire operation only L1 values will be available.

3. Set up

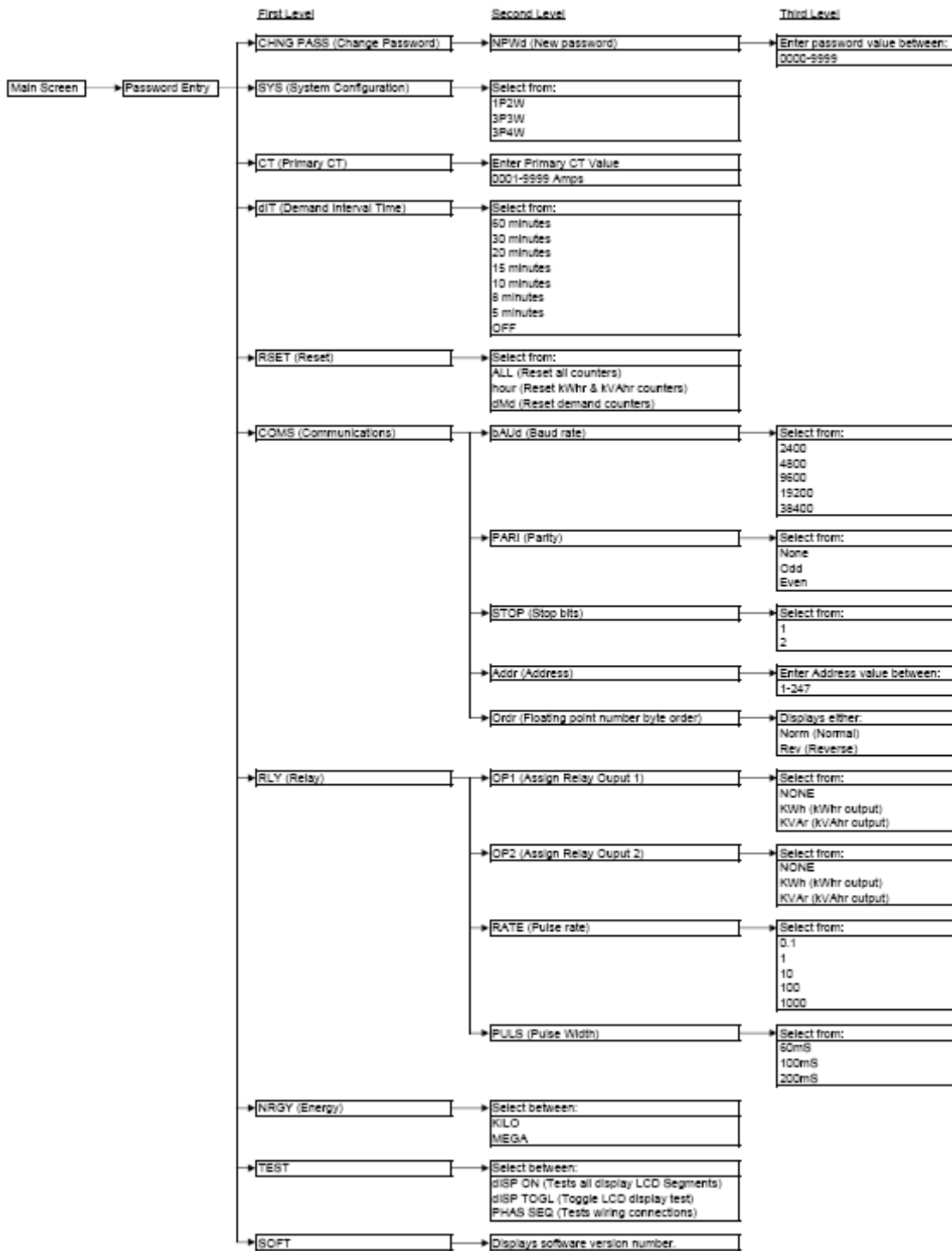
Set up of the Integra Ci3 may be carried out by using the display or Integra Ci3 configurator software. Integra configurator software has its own on-line guide. If required, set up parameters may be manipulated directly via the Modbus[®] interface. The following sections give step by step procedures for configuring the Integra using the display.

To access the Set-up screens, press and hold the  and the  buttons simultaneously for five seconds. This displays the password entry screen. Password protection is enabled to prevent unauthorised access to Set-up screens. Password is normally set to 0000 when a product is shipped. The unit can be protected if the password is set to any four digit number other than 0000. When exiting Set-up mode, the instrument returns to the last selected Display screen. To return to the Display screens at any time during the set up procedures, press the  and the  buttons simultaneously for five seconds, or keep pressing the back button . Any set up changes that have already been made will be retained.

3.1 Number Entry Procedure


When setting up the unit, many screens require the setting up of a number, usually on the middle row of digits. For example, on entry to the setting up section, a password may be required. The procedure is as follows: In general, press the  and  buttons to change up or down the digit value that is flashing on the screen. Pressing the  button confirms the selection and moves the flashing to the next digit in the sequence. The digits are set one at a time, from left to right until all four digits are set. At any time during this operation it is possible to press the  button to move back to the previous digit in the sequence.

4. Menu Structure





Menu navigation

Once the correct password has been entered the user can access the first level menu structure. The user can use the **A** and **↓** buttons to navigate up and down this level until the desired parameter is reached. The user then presses the **↵** button to select the desired parameter and enter the second level menu structure. For some parameters such as COMS there is an additional third level menu structure. Once the user has made all the


necessary selections and entered the required settings the user should press the  to return to the first level menu structure.

The following example shows how to set the CT primary.




- Press and hold the two outermost buttons  and  simultaneously for five seconds until the password screen is displayed.









- Press  four times to enter the default password of “0000”.



- The system setup screen will be displayed on the screen. Press the  button to scroll down the menu until you see the CT primary setting screen.






- Press the  button to enter the CT primary setting screen. The first digit should start flashing.
- Use the  and  buttons to set the digit to the required level then press  to confirm.
- Repeat this process until all four digits have been set to the desired CT primary value. (e.g. 100A = 0100A, 1000A = 1000A)
- The word “SET” should be displayed after the fourth digit has been entered to confirm that the primary CT value has been set.
- Press  to return to the first level menu structure. At this point it is possible to scroll up and down the first level menu structure so that the user can adjust another parameter. (e.g. system configuration, or comms etc)
- If no other setting are required then press  to exit set-up mode and return to measurement mode.

5. Set-up screens

5.1 CHNG PASS (Change password)

Selecting this screen takes the user to the new password screen. The user can enter any password between the values of 0000 and 9999.

Use the  and  buttons to set the digit to the desired number then press  to confirm. Repeat this process four times until the desired 4 digit password has been set.

5.2 SYS (System configuration)

This screen is used to set the wiring configuration used for the instrument.

Use the  and  buttons to scroll through the following options:

- 1P2W (Single phase)
- 3P3W (3 Phase 3 Wire)
- 3P4W (3 Phase 4 Wire)

Once the desired system configuration has been found press  to confirm.

5.3 CT (CT Primary)

This screen is used to set the value of the CT primary to be used with the Integra Ci3. E.g. setting this screen to 0100 (100A) will tell the product that a 100/5A ct is being used on the current input and the product will use this value to correctly calculate all Current and Power measurements etc.

Use the **▲** and **▼** buttons to set the digit to the desired number then press **▶** to confirm.
Repeat this process four times until the desired CT primary value has been set.

5.4 dIT (Demand Integration Time)

This screen is used to set the period over which the current and power readings are integrated for maximum demand measurement. The values displayed are in minutes.

Use the **▲** and **▼** buttons to scroll through the following options:

- 60 (60 minutes)
- 30 (30 minutes)
- 20 (20 minutes)
- 15 (15 minutes)
- 10 (10 minutes)
- 8 (8 minutes)
- 5 (5 minutes)
- OFF (No demand integration time)

Once the desired demand integration time has been found, press **▶** to confirm.

5.5 RSET (Reset)

This screen allows the user to reset Energy and Demand readings either individually or all together.

Resetting the Energy (hour) readings resets the kWhr and kVAhr readings.

Resetting the Demand (dMd) readings resets the Current Demand readings.

Use the **▲** and **▼** buttons to scroll through the following options:

- ALL (Resets all counters)
- hour (Resets kWhr and kVAhr counters)
- dMd (Resets demand counters)

Once the desired reset has been found press **▶** to confirm.

5.6 COMS (Communications)

This screen allows the user to adjust all parameters that are required for the Modbus[®] RS485 module Option (if fitted)

Selecting this screen opens a sub menu of communication parameters:

5.6.1 bAUd (Baud rate)

This screen sets the Baud rate of the Modbus[®] RS485 module Option.

Use the **▲** and **▼** buttons to scroll through the following options:

- 2400
- 4800
- 9600
- 19200
- 38400

Once the desired baud rate has been found press **▶** to confirm.

5.6.2 PARI (Parity)

This screen allows the setting of the parity for the Modbus[®] RS485 module Option.

Use the **▲** and **▼** buttons to scroll through the following options:

- None
- Odd
- Even

Once the required parity has been found press **▶** to confirm.


5.6.3 STOP (Stop Bits)*

This screen allows the user to adjust the number of stop bits for the Modbus[®] RS485 module Option.

*Note: This function is only enabled if Parity (5.6.2) is set to "None".




Use the **▲** and **▼** buttons to scroll through the following options:

- None
- Odd
- Even

Once the required stop bits have been selected press  to confirm.

5.6.4 Addr (Modbus Address)

This screen allows the setting of the Modbus® RS485 module Option device address. The instrument will only allow valid Modbus® addresses in the range of 1-247 to be entered.

Use the  and  buttons to set the digit to the desired number then press  to confirm.

Repeat this process three times until the desired 3 digit address has been set.

5.6.5 Ordr (Floating Point Byte Order)*

This screen displays the floating point number byte order, either Norm (Normal) or Rev (Reverse).

*Note: No adjustment of this parameter is allowed via the front of the Integra Ci3. Changes to the floating point number byte order are made on the Modbus® system; please refer to the Integra Communications Guide for information on how to adjust this setting.


5.7 RLY (Relay)

This screen allows the user to adjust all parameters that are required for the Pulse Relay Module Options (if fitted).


Selecting this screen opens a sub menu of relay parameters:

5.7.1 OP1 (Relay Output 1)

This screen allows the user to assign Pulse Relay Output 1 to measure either None, kWhr or kVAhr.



Use the  and  buttons to scroll through the following options:

- None (No output selected)
- kWh (kWhr pulsed output)
- KVAr (kVAhr pulsed output)


Once the required pulsed output setting has been selected press  to confirm.

5.7.2 OP2 (Relay Output 2)

This screen allows the user to assign Pulse Relay Output 2 to measure either None, kWhr or kVAhr.



Use the  and  buttons to scroll through the following options:

- None (No output selected)
- kWh (kWhr pulsed output)
- KVAr (kVAhr pulsed output)


Once the required pulsed output setting has been selected press  to confirm.

5.7.3 RATE (Pulsed Output Rate)

This screen allows the user to adjust the number of kWhr or kVAhr's per output pulse:

Use the  and  buttons to scroll through the following options:

- 0.1 (1 pulse per 0.1 kWhr/kVAhr)
- 1 (1 pulse per 1 kWhr/kVAhr)
- 10 (1 pulse per 10 kWhr/kVAhr)
- 100 (1 pulse per 100 kWhr/kVAhr)
- 1000 (1 pulse per 1000 kWhr/kVAhr)

Once the desired pulse rate has been set press  to confirm.

5.7.4 PULS (Pulse Width)

This screen allows the user to adjust the duration of the relay output pulse. The values displayed are in milliseconds (ms).

Use the  and  buttons to scroll through the following options:

- 60 (60ms)
- 100 (100ms)
- 200 (200ms)

Once the desired pulse rate has been set press  to confirm.

5.8 NRGY (Energy)

This screen allows the user to change the Energy readings from kWhr/kVAhr to MWhr/MVAhr and vice versa.

Use the  and  buttons to scroll through the following options:

- KILO
- MEGA

Once the desired energy setting has been set press **F** to confirm.

5.9 TEST (Product Self Tests)

This screen allows the user to select a number of self diagnostic test routines.

Use the **A** and **PIPF** buttons to scroll through the following options:

- **DISP ON** This test illuminates all the LCD segments on the display to identify any display errors.
- **DISP TOGL** This test toggles half the LCD segments on the display on and off. This test helps to determine if any display segments are permanently illuminated.
- **PHAS SEQ** This test determines if the Voltage and Current connections to the Ci3 are correct. If all the connections are correct the product will display V 123 and I 123. For example, if the product displayed V 132 and I 123 this would indicate that the Voltage connections are incorrect and need to be corrected.

Once the desired self test has been selected, press **F** to confirm.

5.10 SOFT (Software Version Number)

This screen displays the software version number installed in the Ci3.

6. Basis of measurement and calculations

6.1 Phase to Phase voltages on 4 wire products

Phase to Phase voltages are measured directly and calculated as RMS values. Situations where the phases are not spaced 120 degrees apart (e.g. 4 wire open delta) are indicated correctly.

6.2 Reactive and Apparent Power

Active powers are calculated directly by multiplication of voltage and current. Reactive powers are calculated using frequency corrected quarter phase time delay method. Apparent power is calculated as the square root of sum of squares of active and reactive powers.

6.3 Energy resolution

Cumulative energy counts are reported using the standard IEEE floating point format. Reported energy values in excess of 16MWh may show a small non cumulative error due to the limitations of the number format. Internally the count is maintained with greater precision. The reporting error is less than 1 part per million and will be automatically corrected when the count increases.

6.4 Power Factor

The magnitude of Per Phase Power Factor is derived from the per phase active power and per phase reactive power. The power factor value sign is set to negative for an inductive load and positive for a capacitive load.

The magnitude of the System Power Factor is derived from the sum of the per phase active power and per phase reactive power. Individual phases whose apparent power is less than 2% of nominal are not included in power factor determinations. The system power factor value sign is set to negative for an inductive load and positive for a capacitive load. The load type, capacitive or inductive, is determined from the signs of the sums of the relevant active powers and reactive powers. If both signs are the same, then the load is inductive, if the signs are different then the load is capacitive. The magnitude of the phase angle is the ArcCos of the power factor. Its sign is taken as the opposite of the VAR's sign.

6.5 Maximum Demand

The maximum power consumption of an installation is provided as power utilities often levy related charges. Many utilities use a thermal maximum demand indicator (MDI) to measure this peak power consumption. An MDI averages the power consumed over a number of minutes, reflecting the thermal load that the demand places on the supply system. Integra uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand period being updated every minute. Demand Integration Times can be set to 5, 8, 15, 20, 30 or 60 minutes. Maximum Demand is the maximum power or current demand that has occurred since the unit was last reset. This is maintained as a continuous record of the highest demand value that has been reached. Note: During the initial period when the "sliding window" does not yet contain a full set of readings (i.e. the elapsed time since the demands were last reset or the elapsed time

since Integra was switched on is less than the selected demand period) then maximum demands may not be true due to the absence of immediate historical data.

6.6 Total Harmonic Distortion

The calculation used for the Total Harmonic Distortion is: $THD = ((RMS \text{ of total waveform} - RMS \text{ of fundamental}) / RMS \text{ of total waveform}) \times 100$ this is often referred to as THD – R, and lies in the range 0 to 100%. THD measurement is subject to the 'range of use' limits. Integra may give erratic or incorrect readings where the THD is very high and the fundamental is essentially absent. For low signal levels the noise contributions from the signal may represent a significant portion of the “RMS of total waveform” and may thus generate unexpectedly high values of THD. To avoid indicating large figures of THD for low signal levels the product will produce a display of 0 (zero). Typically, display of THD will only produce the 0 (zero) value when the THD calculation has been suppressed due to a low signal level being detected. It should also be noted that spurious signals (for example, switching spikes) may be included in the “RMS of the total waveform” and will be used in the calculation of THD. The display of THD may be seen to fluctuate under these conditions.

7. Installation and Maintenance

Warning

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. If this equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired. 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. Never open circuit the secondary winding of an energised current transformer. Auxiliary circuits are separated from metering inputs by at least basic insulation in accordance with IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Measurement category III, pollution degree 2, for rated voltage. 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.

7.1 Checks and Cleaning

The front of the case should be gently wiped with a dry cloth only. Do not apply any pressure over the central rectangular display viewing window areas. 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 accidentally be contaminated with water, the unit must be thoroughly dried before further service. Should it be suspected that water or other contaminants might have entered the unit, factory inspection and refurbishment is recommended. 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 display window also acts as an insulating barrier. It is not possible to touch, by hand, any live part, even if the window is completely missing, but if the window is perforated or significantly damaged in any other way, repair is required. In the unlikely event of a repair being necessary, it is recommended that the unit be returned to factory.

7.2 Location and mounting

Units should be installed in a dry position, where the ambient temperature is reasonably stable and will not be outside the range -10 to +55°C. Vibration should be kept to a minimum. Preferably, mount the Integra Ci3 so that the display contrast is not reduced by direct sunlight or other high intensity lighting. The Integra may be mounted in a standard DIN 96 panel up to a maximum thickness of 5 mm. Mounting is by four integral retention clips.

Consideration should be given to the space required above and below the instrument to allow for associated cables. If IP54 ingress protection is required, a panel gasket must be used. The terminals at the rear of the product must be protected from liquids or other contamination. These units are intended for indoor use only at an altitude of less than 2000m.

7.3 Electromagnetic Compatibility

This unit has been designed to provide protection against EM (electro-magnetic) interference in line with requirements of EU and other regulations. 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, surges and 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 and small signal 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.

7.4 Terminals

All connections are made to screw clamp terminals. Terminals will accept one stranded 0.05 - 2.5mm² cable or one 0.05 - 4mm² cable. Terminal screws are fully tightened for shipment and must be undone before wire insertion. Terminal screws should be tightened to 0.8Nm or 0.6 ft/lbf only.

7.5 Metered Supply Wiring

7.5.1 Input wiring and fusing

The product must be used with external CTs. Choice of cable should meet local regulations for the operating voltage and current. This unit must be fitted with external fuses in voltage and auxiliary supply lines. Voltage input lines must be fused with a quick blow AC fuse 1A maximum. Auxiliary supply lines must be fused with a slow blow fuse rated 1A maximum. Choose fuses of a type and with a breaking capacity appropriate to the supply and in accordance with local regulations. CT secondaries must be grounded in accordance with local regulations. It is desirable to make provision for shorting links to be made across CTs. This permits easy replacement of a unit should this ever be necessary. A switch or circuit breaker allowing isolation of supplies to the unit must be provided.

7.5.2 Additional considerations for three wire systems

If this product is used in a system with an a.c. auxiliary where the frequency of the auxiliary may be different to the frequency of the signals being measured it will be necessary to connect the neutral terminal either to the system neutral connection or to an earth (ground) connection in order to achieve the published specifications.

8. Auxiliary and Output Connections

8.1 Auxiliary Supply

The auxiliary supply is rated at 100-400V AC, 120-350 DC. The Integra should ideally be powered from a dedicated supply, however it may be powered from the signal source, providing the source remains within tolerance of the voltage auxiliary range.

8.2 Output Connections

8.2.1 Modbus[®] RS485 module Option

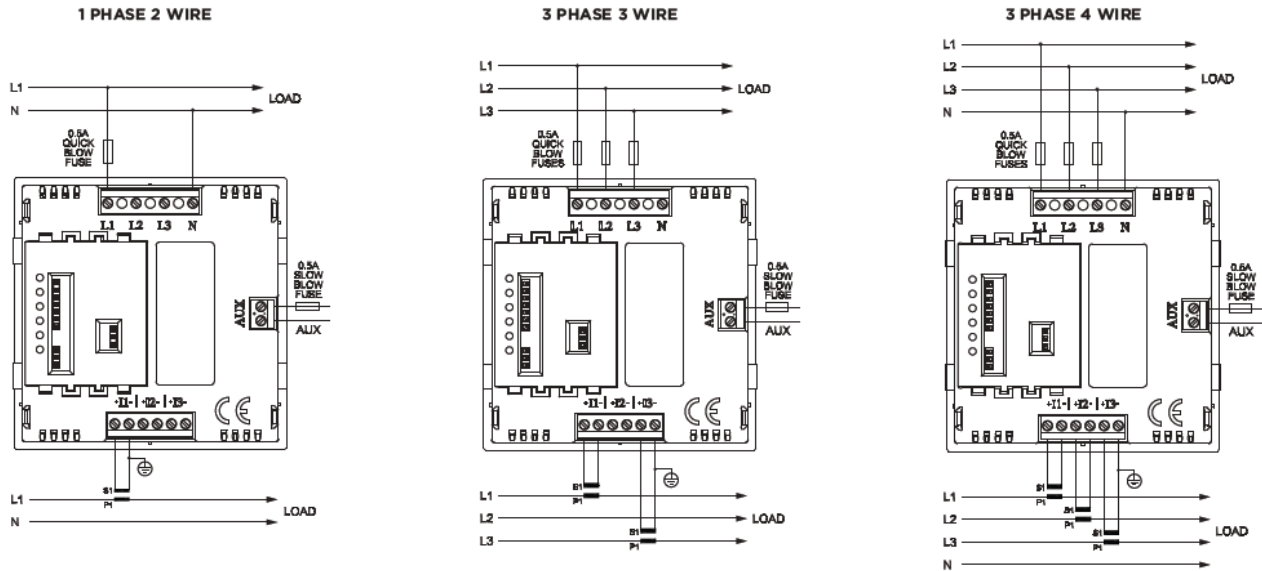
The recommended cable between the RS485 master and the Integra Ci3 is two core screened cable. Preferably select a cable specifically recommended for RS485 use (for example Belden 9860, 8761) although for shorter distances of a few metres most two core screened cables will usually be satisfactory. As the remote device to Integra communication uses RS485, cable length (transmission

distance) can be up to 1200 metres in good conditions. Electrical interference or other adverse conditions may reduce the maximum cable length possible for reliable operation.

8.2.2 Pulse Relay Module Option

Up to 2 solid state relays can be fitted. Relay rating is 250V, 50mA, maximum. Lines connected to these terminals must be either short in length or filtered where appropriate.

8.3 Connection Diagrams



9. Specification

Input

Nominal input voltage
 Max. continuous input overload voltage
 Max. short duration input voltage

Nominal input voltage burden
 Nominal input current
 Max. continuous input overload current
 Max. short duration input current

Frequency

Auxiliary

Operating range

Accuracy

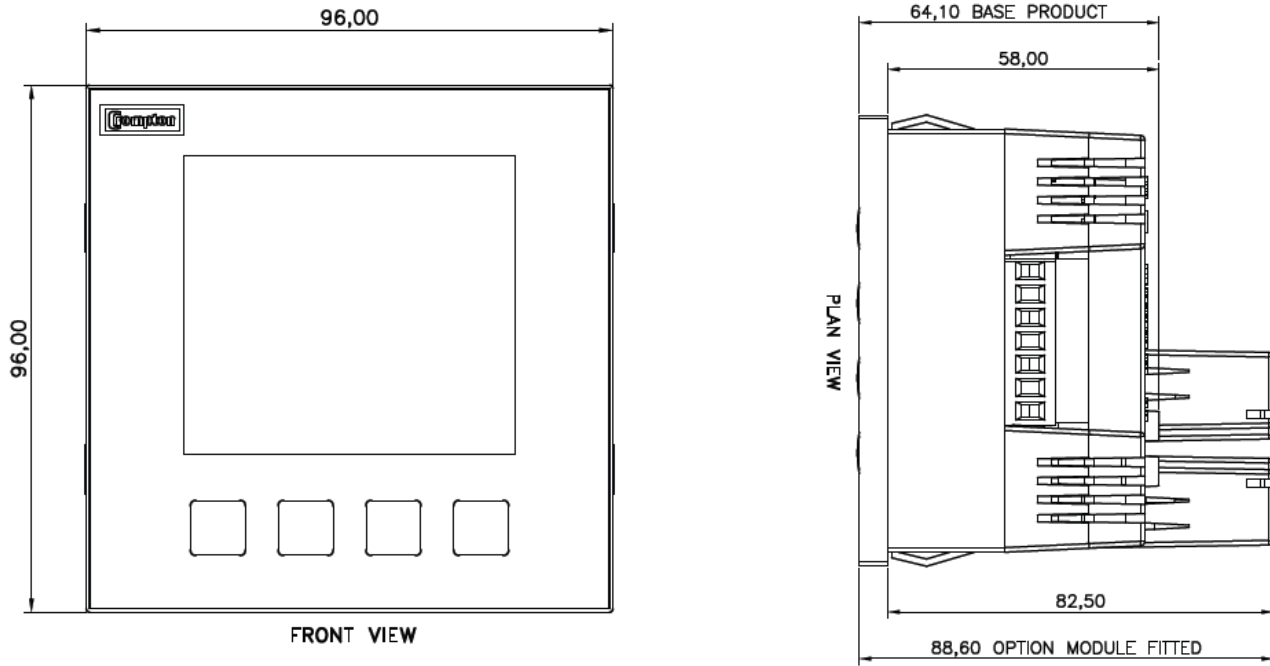
Voltage (V) 0.5%
 Current (A) 0.5%
 Neutral current calculated (A) 4%
 Frequency (Hz) 0.1 Hz
 Power factor (PF) 1% of unity
 Active power (W) +/- 1% of range
 Reactive power (VAR) +/- 1% of range
 Apparent power (VA) +/- 1% of range
 Active energy (kWh) Class 1 (IEC 62053-21)
 Reactive energy (kVArh) +/- 1% of range
 THD 1% up to 31st harmonic
 Response time 1sec

Output modules (optional)

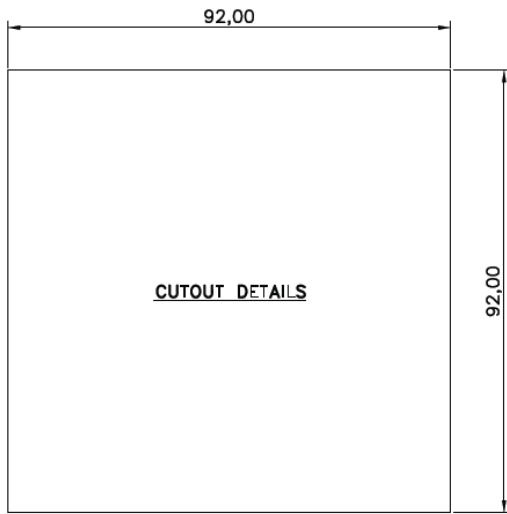
100-289V AC L-N (173-500V AC L-L)
 120% of nominal
 2 x range maximum (1 second application repeated 5 times at 5 minute intervals)
 < 0.2VA per phase
 5A AC rms
 120% of nominal
 10 x nominal (1 second application repeated 5 times at 5 minute intervals)
 45-66Hz
 110-400V AC nominal +/-10% (99-440V AC absolute limits) or
 120-350V DC +/-20% (96-420V DC absolute limits)

Pulsed output relays	1 per module (2 modules maximum fitted per Ci3)
Contact rating	50mA max at 250V AC
Type	Solid state relay
RS485 Modbus® output module	1 Modbus® channel per module (maximum of 1 module fitted per Ci3)
Type	2-wire half duplex
Baud rate	2400, 4800, 9600, 19200, 38400
Enclosure	
Enclosure style	DIN 96 panel mount
Dimensions	96x96x64.1mm (depth behind panel front without module 58mm, with module 82.5mm)
Panel cut-out	92x92mm
Panel thickness	1 to 5mm
Front protection rating	IP52
Case protection rating	IP30
Material	Polycarbonate to UL94V0
Weight	300g
Terminals	Shrouded screw-clamp 0.05 to 4mm wire
Environment	
Operating temperature	
-10°C to +55°C	
Storage temperature	-20°C to +70°C
Relative humidity	0-90% non-condensing
Shock	30g in 3 planes
Vibration	10Hz to 50Hz
Dielectric voltage Withstand test	3.25kV rms 50Hz for 1 minute between comms and measuring inputs, comms and aux, aux and measuring inputs

10. Dimensions



11 Panel cut-out



12 Modbus Input Registers

Input Parameter Number [MS]	Input Parameter Name	Input Parameter Units	Input Parameter Description
1 [1]	V1	Volts	Phase 1 line to neutral volts.
2 [3]	V2	Volts	Phase 2 line to neutral volts.
3 [5]	V3	Volts	Phase 3 line to neutral volts.
4 [7]	I1	Amps	Phase 1 current.
5 [9]	I2	Amps	Phase 2 current.
6 [11]	I3	Amps	Phase 3 current.
7 [13]	P1	Watts	Phase 1 power.
8 [15]	P2	Watts	Phase 2 power.
9 [17]	P3	Watts	Phase 3 power.
10 [19]	VA1	VoltAmps	Phase 1 volt amps.
11 [21]	VA2	VoltAmps	Phase 2 volt amps.
12 [23]	VA3	VoltAmps	Phase 3 volt amps.
13 [25]	VAr1	VAr	Phase 1 volt amps reactive.
14 [27]	VAr2	VAr	Phase 2 volt amps reactive.
15 [29]	VAr3	VAr	Phase 3 volt amps reactive.
16 [31]	PF1	None	Phase 1 power factor (1).
17 [33]	PF2	None	Phase 2 power factor (1).
18 [35]	PF3	None	Phase 3 power factor (1).
19 [37]	PA1	Degrees	Phase 1 phase angle.
20 [39]	PA2	Degrees	Phase 2 phase angle.
21 [41]	PA3	Degrees	Phase 3 phase angle.
22 [43]	VLNAvg	Volts	Average line to neutral volts.
23 [45]			
24 [47]	IAvg	Amps	Average line current.
25 [49]	ISum	Amps	Sum of line currents.
26 [51]			
27 [53]	PSum	Watts	Total system power.
28 [55]			
29 [57]	VASum	VA	Total system volt amps.
30 [59]			
31 [61]	VArSum	VAr	Total system VAr.
32 [63]	PFTot	None	Total system power factor (1).
33 [65]			
34 [67]	PATot	Degrees	Total system phase angle.
35 [69]			
36 [71]	Frq	Hz	Frequency of supply voltages.
37 [73]	WhImp	kWh/MWh	Import Wh since last reset (2).
38 [75]	WhExp	kWh/Mwh	Export Wh since last reset (2).
39 [77]	VArhImp	kVArh/MVArh	Import VArh since last reset (2).
40 [79]	VArhExp	kVArh/MVArh	Export VArh since last reset (2).
41 [81]	VAh	kVAh/MVAh	VAh since last reset (2).
42 [83]	Ah	Ah/kAh	Ah since last reset(3).
43 [85]	PSumDmd	Watts	Total system power demand (4).
44 [87]	PSumDmdMax	Watts	Maximum total system power demand (4).
45 [89]			
46 [91]			
47 [93]			
48 [95]			
49 [97]			
50 [99]			
51 [101]	VASumDmd	VA	Total system VA demand.
52 [103]	VASumDmdMax	VA	Maximum total system VA demand.
53 [105]	InDmd	Amps	Neutral current demand.
54 [107]	InDmdMax	Amps	Maximum neutral current demand.
55 [109]			
100 [199]			
101 [201]	V12	Volts	Line 1 to Line 2 volts.
102 [203]	V23	Volts	Line 2 to Line 3 volts.
103 [205]	V31	Volts	Line 3 to Line 1 volts.
104 [207]	VLLAvg	Volts	Average line to line volts.
105 [209]			
106 [211]			
107 [213]			
108 [215]			
109 [217]			

110 [219]			
111 [221]			
112 [223]			
113 [225]	In	Amps	Neutral current.
114 [227]			
115 [229]			
116 [231]			
117 [233]			
118 [235]	V1THD	%	V1 total harmonic distortion.
119 [237]	V2THD	%	V2 total harmonic distortion.
120 [239]	V3THD	%	V3 total harmonic distortion.
121 [241]	A1THD	%	A1 total harmonic distortion.
122 [243]	A2THD	%	A2 total harmonic distortion.
123 [245]	A3THD	%	A3 total harmonic distortion.
124 [247]			
125 [249]	VLNAvgTHD	%	Average line to neutral volts THD.
126 [251]	AAvgTHD	%	Average line current THD.
127 [253]			
128 [255]	-PFTot	Degrees -	Total system power factor (5).
129 [257]			
130 [259]	I1Dmd	Amps	Phase 1 current demand.
131 [261]	I2Dmd	Amps	Phase 2 current demand.
132 [263]	I3Dmd	Amps	Phase 3 current demand.
133 [265]	I1DmdMax	Amps	Maximum phase 1 current demand.
134 [267]	I2DmdMax	Amps	Maximum phase 2 current demand.
135 [269]	I3DmdMax	Amps	Maximum phase 3 current demand.
136 [271]			
167 [333]			
168 [335]	V12THD	%	Line 1 to line 2 volts THD.
169 [337]	V23THD	%	Line 2 to line 3 volts THD.
170 [339]	V31THD	%	Line 3 to line 1 volts THD.
171 [341]	VLLAvgTHD	%	Average line to line volts THD.

Notes:

- (1) The power factor has its sign adjusted to indicate the nature of the load. Positive for capacitive and negative for inductive.
- (2) There is a user option to select either k or M for the energy prefix.
- (3) The same user option as in (2) gives a prefix of none or k for Amphours.
- (4) The power sum demand calculation is for import power only.
- (5) The negative total system power factor is a sign inverted version of parameter 32, the magnitude is the same as parameter 32.

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