

Installation and Operating Instructions QUADRATIC INTEGRA 1000



**Crompton Quadratic
INTEGRA 1000
Power Measurement, Display and Communication**

Installation & Operating Instructions

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1. Introduction

The Crompton INTEGRA 1000 is a panel mounted 96x96mm DIN Digital Metering System, for the measurement, display and communication of up to 23 electrical parameters, integrating high accuracy measurement technology with the simplicity and visibility of 7 segment LED displays.

All voltage and current measurements are True RMS for accurate measurement of distorted waveforms over a wide measuring range. The INTEGRA 1000 has excellent harmonic handling for true power measurement.

Available in the following system configurations:-

Single Phase

3 Phase 3 Wire Unbalanced

3 Phase 4 Wire Unbalanced

The INTEGRA 1000 front panel has two push buttons and offers a quick reference to the displayed parameters. The two keys take the User through the menu structure with ease and simplicity, to display and configure to their individual requirements. The parameters available are:-



Measured Quantity	Displayed Parameter	Units of measurement
System Voltage	U.SyS	(Volts), see note 3
System Current (Average)	i.SyS	(Amps), see note 3
Voltage L-N (4 wire only)	L1,2,3 - n	(Volts)
Voltage L-L (calculated in 4 wire, not available on single phase unit)	L1-2,L2-3,L3-1	(Volts)
Current in 3 phases (not available on single phase unit)	i1,i2,i3	(Amps)
Current Neutral (4 wire only)	in	(Amps)
Frequency	Fr	(Hz)
Power Factor	PF	
Active Power	P	(kW), see note 1
Reactive Power	rP	(kVAr), see note 1
Apparent Power	AP	(kVA)
Active Energy	Ph	(kW.h)
Reactive Energy	Prh	(kVAr.h)
Total System Current Demand	Ad	(Admd), see note 2
Total System Active Power Demand	Pd	(kWdmd)
Maximum Total System Current Demand	Hi Ad	(Admd), see note 2
Maximum Total System Active Power Demand	Hi Pd	(kWdmd)

Note 1. All power related measurements are importing only.

Note 2. With a full scale current setting of greater than or equal to 2700 amps the parameter display for the current demand screen will change to show an "E3" on the bottom line. This is to indicate that the current demand readings should be interpreted as kiloamps.

Note 3. In a single phase system L-N voltage and current will be displayed as U.SyS and i.SyS. L-L voltage is not displayed.

A pulsed relay output, representing kWhr, with selectable pulse width, and an RS485 Modbus™ output (see section 4) are available as optional features. Connections for both are via two part screw clamp connectors.

2. Display Screens

The following screens indicate the parameter displays which are used to indicate the value which will be displayed on the corresponding line of the display when the "parameter display" is replaced with the "values display".

The screens may be scrolled through by pressing the ">> Next" key. The "parameter display" will be shown briefly after each operation of the ">> Next" key. The screens will only advance to the next display if the ">> Next" key is pressed whilst the parameters are being displayed.

The display will alternate between the "parameter display" and the "values display" at the rate selected by the User.(See Sections 3.3.2. & 3.3.3.).

Screens 8 and 9 will not alternate between the "parameter display" and the "values display".

Screen 1 - User Defined Screen

See Section 3.2 for programming procedure. If this screen has been set up then this will be displayed at switch on, if not then Screen 2 - System Screen, below, is displayed.

Screen 2 - System Screen

To view screen two, press the ">> Next" key. (only necessary if screen 1 has been set)



Average Voltage (Volts) {Line to Line for 3 wire systems, Line to neutral for single phase and 4 wire systems}

Average Line Current (Amps)

Active Power (kW)

Note: In Single phase mode pressing the ">> Next" key will advance to Screen 6. In 3phase 3wire mode pressing the ">> Next" key will advance to Screen 4.



Screen 3 - Line to Neutral Voltages

To view screen three, press ">> Next" key. (4 wire systems only)

Voltage Line 1 to neutral (Volts)

Voltage Line 2 to neutral (Volts)

Voltage Line 3 to neutral (Volts)



Screen 4 - Line to Line Voltages

To view screen four, press the ">> Next" key. (Not selectable for single phase)

Voltage Line 1 to Line 2 (Volts)

Voltage Line 2 to Line 3 (Volts)

Voltage Line 3 to Line 1 (Volts)



Screen 5 - Line Currents

To view screen five, press the ">> Next" key. (Not selectable for single phase)

Current Line 1 (Amps)

Current Line 2 (Amps)

Current Line 3 (Amps)



Screen 6 - Neutral Current, Frequency, Power Factor

To view screen, six, press the ">> Next" key.

Neutral Current (Amps). (4 wire system only)

Frequency (Hz)

Power Factor (0 to 1)

Note: In single phase and 3 wire systems the Neutral Current will be blank



Screen 7 - Power

To view screen seven, press the ">> Next" key.

Active Power (kW)

Reactive Power (kVAr)

Apparent Power (kVA)



Screen 8 - Active Energy (kW.h)

To view screen eight, press the ">> Next" key.

Active Energy (kW.h)

This screen displays both the parameter and values simultaneously

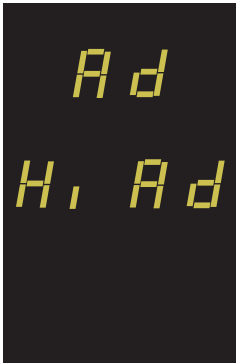


Screen 9 - Reactive Energy (kVAR.h)

To view screen nine, press the ">> Next" key.

Reactive Energy (kVAR.h)

This screen displays both the parameter and values simultaneously



Screen 10 - Amp Demands

To view screen ten, press the ">> Next" key.

The following screen will be shown for a full scale current selection of less than 2700 amps

System Total Current Demand (Admd)

Maximum System Total Current Demand (Ad)

The following screen will be shown for a full scale selection of greater than or equal to 2700 amps



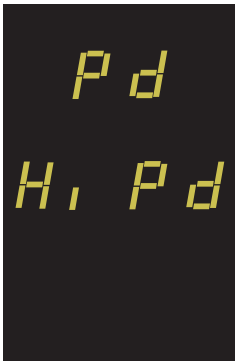
System Total Current Demand (kAdmd)

Maximum System Total Current Demand (kAd)

Read values as kA

Screen 11 - Power Demands

To view screen eleven, press the ">> Next" key.



System Total Active Power Demand (kWdmd)

Maximum System Total Active Power Demand (kWd)

Display Value Range

The displayed values must be in the range -999 to 9999.

Whilst operating within the specified range the displayed value will not overrange for positive values.

Whilst displaying negative values the display will overflow for values more negative than -999, this situation will be indicated by displaying four bars in the appropriate display line:



Value on middle line has overflowed

kWh and kVArh Display Range

The kWh and kVArh display range is limited to 9999999k. If the unit is allowed to increment beyond this value the count will continue to be updated in the measurement unit but the display will change to seven bars.



The value will continue to be available via the Modbus output.

3. Programming

The following sections comprise of step by step procedures for configuring the INTEGRA 1000 for the individual user requirements.

To access the set-up screens press and hold the “↑↓ Adjust” and “>> Next” Key simultaneously for 5 seconds. This will take the User into the Password Protection Entry Stage.(See Section 3.1). To return to the display screens at anytime during these procedures, press the “↑↓ Adjust” and “>> Next” Key simultaneously for 5 seconds.

3.1. Password Protection

Password protection can be enabled to prevent unauthorised access to set-up screens, by default password protection is not enabled.

Password protection is enabled by selecting a four digit number other than 0000, setting a password of 0000 disables the password protection.



Enter Password, prompt for first digit. (*decimal point indicates that this will be flashing.)

Press the “↑↓ Adjust” key to scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the “>> Next” key to advance to the next digit.

In the special case where the Password is “0000” pressing the “>> Next” key when prompted for the first digit will advance to the “Password Confirmed” screen.

Note: If a password has not been set, pressing the “>> Next” key, the 4 ‘question marks’ displayed will allow the User to access the set-up screens, i.e. Set-Up Screen (See Section 3.1.1)



Enter Password, first digit entered, prompt for second digit. (*decimal point indicates that this point will be flashing.)

Press the “↑↓ Adjust” key to scroll the value of the second digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the “>> Next” key to advance to the next digit.



Enter Password, second digit entered, prompt for third digit.
(*decimal point indicates that this will be flashing.)

Use the "↑↓ Adjust" key to scroll the value of the third digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the ">> Next" key to advance to the next digit.



Enter Password, third digit entered, prompt for fourth digit. (*decimal point indicates that this will be flashing.)

Use the "↑↓ Adjust" key to scroll the value of the fourth digit from 0 through to 9, the value will wrap from 9 round to 0.

Press the ">> Next" key to advance to verification of the Password.



Enter Password, fourth digit entered, awaiting confirmation of the Password



Password Confirmed

Pressing "↑↓ Adjust" key will advance to the "New/Change Password" entry stage.

Pressing the ">> Next" key will advance to the "Set-Up" Screen.(See Section 3.1.1.)



Password Incorrect

The unit has not accepted the Password entered.

Pressing the "↑↓ Adjust" key will return to the "Enter Password" stage.

Pressing the ">> Next" key exits the set-up menus and returns operation to the normal display mode.



New/Change Password.

(* decimal point indicates that this will be flashing.)

Pressing the "↑↓ Adjust" key will scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0.

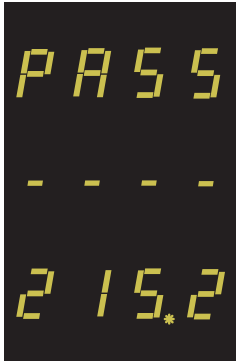
Pressing the ">> Next" key advances the operation to the next digit and sets the first digit, in this case to "2".



New/Change Password, first digit entered, prompting for second digit. (*decimal point indicates that this will be flashing)

Pressing the “↑↓ Adjust” key will scroll the value of the second digit from 0 through to 9, the value will wrap from 9 round to 0.

Pressing the “>> Next” key advances the operation to the next digit and sets the second digit, in this case to “1”.



New/Change Password, second digit entered, prompting for third digit. (*decimal point indicates that this will be flashing)

Pressing the “↑↓ Adjust” key will scroll the value of the third digit from 0 through to 9, the value will wrap from 9 round to 0.

Pressing the “>> Next” key advances the operation to the next digit and sets the third digit, in this case to “5”.



New/Change Password, third digit entered, prompting for fourth digit. (* decimal point indicates that this will be flashing.)

Pressing the “↑↓ Adjust” key will scroll the value of the fourth digit from 0 through to 9, the value will wrap from 9 round to 0.

Pressing the “>> Next” key advances the operation to the New Password Confirmation stage and sets the fourth digit, in this case to “3”.



New Password Confirmed.

Pressing "↑↓ Adjust" key will return to the "Change Password".
Pressing the ">> Next" key will advance to the "Set-Up" screen.
(See Section 3.1.1)



3.1.1. Set Up Screen

Pressing the "↑↓ Adjust" key will scroll between 'Set Up' and 'User Def'.

Pressing the ">> Next" key with 'Set Up' displayed will advance to the "Full Scale Current" screen. (See Section 3.3.1)

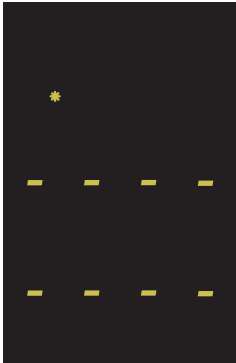


Pressing the ">> Next" key with 'User Def' displayed will advance to the User Defined Screen configuration. (See Section 3.2)

3.2. Configuring the User Defined Screen.

This screen is available for the User to select the parameters that are required to be displayed on one screen. The parameters available are dependant on the system configuration, See Section 1 for system dependant parameters.

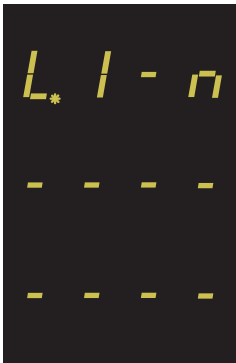
Note: Only one of Active Energy or Reactive Energy may be selected for the user defined screen.



Top Line Entry

Pressing the “↑↓ Adjust” key will scroll through the parameters available. The top line may contain any of the following (subject to system type): L(1,2,3)-n, I(1,2,3), U.SyS, i.SyS, P, AP, rP, P.F., Fr, Ph, Prh, Pd, Hi Pd L(1,2,3)-L(2,3,1), in and blank, wrapping back L1-n, I1 or USyS depending on system type. (*decimal point indicates that this will be flashing).

Note: If already configured, the previously selected parameter will be displayed, pressing the “>> Next” key will keep this parameter and advance to Middle Line Entry Screen.



Top Line Entry

User has scrolled through to 'L1-n' voltage parameter. (*decimal point indicates that this will be flashing).

Pressing the “↑↓ Adjust” key will continue to scroll through the parameters.

Pressing the “>> Next” key will select the displayed parameter for the top line and advance to the Middle Line Entry Stage.

Note: If either Active or Reactive Energy is selected for the top line it will not be possible to put a parameter on the middle line and this will be forced blank. Pressing the “>> Next” key with these parameters selected will advance to the Bottom Line Entry Stage.



Middle Line Entry

(* decimal point indicates that this will be flashing)

Pressing the “↑↓ Adjust” key will scroll through the parameters available. The top line may contain any of the following (subject to system type): L(1,2,3)-n, I(1,2,3), U.SyS, i.SyS, P, AP, rP, P.F., Fr, Ph, Prh, Pd, Hi Pd L(1,2,3)-L(2,3,1), in and blank, wrapping back L1-n, I1 or USyS depending on system type.

Note: If already configured, the previously selected parameter will be displayed, pressing the “>> Next” key will keep this parameter and advance to the Bottom Line Entry Stage



Middle Line Entry

User has scrolled through to the 'i1' current parameter. (*decimal point indicates that this will be flashing).

Pressing the “↑↓ Adjust” key will continue to scroll through the parameters.

Pressing the “>> Next” key will select the displayed parameter for the middle line and advance to the Bottom Line Entry Stage.

Note: If either Active or Reactive Energy is selected for the middle line it will not be possible to put a parameter on the bottom line and will be forced blank. Pressing the “>> Next” key with these parameters displayed will advance to the User Defined Confirmation Screen.



Bottom Line Entry

(* decimal point indicates that this will be flashing)

Pressing the "↑↓ Adjust" key will scroll through the parameters available. The bottom line of the display may contain: L(1,2,3)-n, l(1,2,3), U.SyS, i.SyS, P, AP, rP, P.F., Fr, Pd, Hi Pd L(1,2,3)-L(2,3,1), in and blank, wrapping back to L1-n, l1 or USyS depending on system type.

Note: If already configured, the previously selected parameter will be displayed, pressing the ">> Next" key will keep this parameter and advance to the Bottom Line Confirmation Screen.



Bottom Line Entry

User has scrolled through to 'Fr' frequency parameter. (*decimal point indicates that this will be flashing).

Pressing the "↑↓ Adjust" key will continue to scroll through the parameters.

Pressing the ">> Next" key will select the displayed parameters for the Bottom Line and advance to the User Defined Confirmation Screen



User Defined Confirmation

Pressing the "↑↓ Adjust" key will return the operation to the Top Line Entry Stage.

Pressing the ">> Next" key will return to the display screens.

Note: If the blank line is selected for each of the three display lines the unit will not show the User Defined Screen when in Display mode.

The display will wrap from Screen 11 to Screen 2 on operation of the ">> Next" key and the system screen (screen 2) will be shown at power-up.

3.3 Set Up Screens

Note: The Screens in sections 3.3.6 to 3.3.10 will be displayed in all units but will have no effect on the operation of those units that do not have these options fitted.

3.3.1 Full Scale Current

Nominal Full Scale Current that will be displayed as the Line Currents. This screen enables the user to display the Line currents inclusive of any transformer ratios, the values displayed represent the Current in Amps.

Pressing the ">> Next" key accepts the present value and advances to the "Value Visible Time" menu. (See Section 3.3.2)



Pressing the "↑ Adjust" key will enter the "Full Scale Current Edit" mode. This will scroll the value of the most significant digit from 0 through to 4, the value will wrap from 4 round to 0. (0 to 9 for lesser significant digits)

Pressing the ">> Next" key will advance to the next less significant digit. (* decimal point indicates that this will be flashing.)

When the least significant digit has been set, pressing the ">> Next" key will advance to the "Full Scale Current Confirmation" stage.

Note: When the most significant digit is set to 4 the lesser significant digits are all forced to zero.

The minimum value allowed is 1, the value will be forced to 1 if the display contains zero when the ">> Next" key is pressed



Full Scale Current Confirmation

This screen will only appear following an edit of the full scale current.

If the scaling is not correct, pressing the "↑ Adjust" key will return to the "Full Scale Current Edit" stage with the least significant digit highlighted (associated decimal point flashing) and the bottom line of the display will be blanked.

Pressing the ">> Next" key sets the displayed value and will advance to the "Value Visible Time" menu. (See Section 3.3.2)

3.3.2. Display Mode, Value Visible Time.

This screen allows the User to set the length of time that the values (readings) will be displayed. These values represent the time in seconds.



Display Mode, Value Visible Time

Pressing the ">> Next" key accepts the present value and advances to the "Parameter Visible Time" menu. (See Section 3.3.3)

Pressing the "↑↓ Adjust" key will enter the "Value Visible Time Edit" mode and scroll the value through the values 2, 5 and 10 wrapping back to 2.

Pressing the ">> Next" key will advance to the "Value Visible Time Confirmation" stage.



Display Mode, Value Visible Time Confirmation.

This screen will only appear following an edit of Display Mode, Value Visible time.

Pressing the "↑↓ Adjust" key will return the operation to the "Value Visible Time Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance to the "Parameter Visible Time" menu.

(See Section 3.3.3)

3.3.3. Display Mode, Parameter Visible Time

This screen allows the User to set the length of time that the parameters will be displayed. These values represent the time in seconds.



Display Mode, Parameter Visible Time

Pressing the ">> Next" key accepts the present value and advances to the "Demand Integration Time" menu. See Section 3.3.4)

Pressing the "↑↓ Adjust" key will enter the "Parameter Visible Time Edit" mode and scroll the value through the values 0, 1, 2 and 5 wrapping back to 0.

Pressing the ">> Next" button will advance to the "Parameter Visible Time Confirmation" stage.

Note: If 0 (zero) is selected the display will not alternate between the value and parameter display but will stay on the value display. In this mode pressing the ">> Next" key will display the currently displayed parameter briefly and will not advance the display page until the ">> Next" key is pressed with the parameter display on screen.



Display Mode, Parameter Visible Time Confirmation

This screen will only appear following an edit of Display Mode, value visible time.

Pressing the "↑↓ Adjust" key will return the operation to the "Value Visible Time Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance to the "Demand Integration Time" menu. (See Section 3.3.4).

3.3.4. Demand Integration Time

This screen is used to set the time taken for the Maximum Demand readings, the value displayed represent time in minutes.



Demand Integration Time Edit

Pressing the ">> Next" key accepts the present value and advances to the "Reset" menu. (See Section 3.3.5.)

Pressing the "↑↓ Adjust" key will enter the "Demand Integration Time Edit" mode and scroll the value through the values 8, 15, 20 and 30 wrapping back to 8.

Pressing the ">> Next" key advances to the "Demand Integration Time Confirmation" menu.

As the unit advances to the next screen the unit demands are reset.



Demand Integration Time Confirmation

This screen will only appear following an edit of the Demand Integration Time.

If the time shown is not correct, pressing the "↑↓ Adjust" key will return to the "Demand Integration Time Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance to the "Reset Selection" menu. (See Section 3.3.5)

3.3.5. Resets.

The following screens allow the User to reset the Active Energy, Demand and Maximum Demand readings individually or altogether.

Note: Resetting the Demand will automatically reset the Maximum Demands (HiAd and HiPd)



Reset (None)

Pressing the ">> Next" key advances to the "Pulse Duration" menu. (See Section 3.3.6)

Pressing the "↑↓ Adjust" key will enter the "Reset Parameter Select" mode and scroll the "value" through the parameters None, All, h, and d wrapping back to None.

Pressing the ">> Next" key will not reset any variables and will advance to the "Pulse Duration Edit" menu. (See Section 3.3.6)



Reset Parameter Select, (Reset All)

The User has scrolled through to the "ALL" value.

Pressing the ">> Next" key will select the value and advance to the "Reset All Confirmation" Mode.



Reset All Confirmation.

Pressing the "↑↓ Adjust" key will re-enter the "Reset Parameter Select" mode.

Pressing the ">> Next" key resets the Energy, Demand and Maximum Demand readings and will advance to the "Pulse Duration Edit" mode. (See Section 3.3.6)



Reset Parameter Select, (Reset Energy Variables)

The User has scrolled through to the "h"(Active Energy) value.

Pressing the ">> Next" key will select the value and advance to the "Reset Active Energy Confirmation" Mode.



Reset Active Energy Variables Confirmation

Pressing the "↑↓ Adjust" key will re-enter the "Reset Parameter Select" mode.

Pressing the ">> Next" key resets the Active Energy readings and will advance to the "Pulse Duration Edit" menu. (See Section 3.3.6)



Reset Parameter Select, (Reset Demands)

The User has scrolled through to the "d"(Demands) value.

Pressing the ">> Next" key will select the value and advance to the "Reset Demands Confirmation" Mode.



Reset Demands Confirmation

Pressing the “↑↓ Adjust” key will re-enter the “Reset Parameter Select” mode.

Pressing the “>> Next” key resets the Demand readings and will advance to the “Pulse Duration Edit” menu. (See Section 3.3.6)

3.3.6. Pulsed Output, Pulse Duration

This screen allows the User to set the duration that the relay pulsed output will be on.(closed), the value displayed represents the duration in milliseconds (ms).



Pulse Duration Edit.

Pressing the ">> Next" key accepts the present value and advances to the "Pulse Rate" menu.(See Section 3.3.7).

Pressing the "↑↓ Adjust" key will enter the "Pulse Duration Edit" mode and scroll the value through the values 60, 100 and 200 wrapping back to 60.

Pressing the ">> Next" key selects the value shown and advances to the "Pulse Duration Confirmation" screen.



Pulse Duration Confirmation

This screen will only appear following an edit of the pulse duration. In this case the duration has been changed to 100.

If the duration shown is not correct, pressing the "↑↓ Adjust" key will return to the "Pulse Duration Edit" stage and will blank the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance to the "Pulse Rate" menu. (See Section 3.3.7).

3.3.7. Pulse Rate (Relay Pulsed Output Option Only)

This screen is available for the User to set the kW.h. pulse rate divisor.



Pulse Rate Divisor Edit

Pressing the ">> Next" key accepts the present value and advances to the "RS485 Baud Rate Edit" menu. (See Section 3.3.8.)

Pressing the "↑ Adjust" key will enter the "Pulse Rate Divisor Edit" mode and scroll the value through the values 1, 10, 100, wrapping back to 1.

Pressing the ">> Next" key advances to the "Pulse Rate Divisor Confirmation" screen.



Pulse Rate Divisor Confirmation

This screen will only appear following an edit of the Pulse Rate Divisor.

If the divisor shown is not correct, pressing "↑ Adjust" key will return the operation to the "Pulse Rate Divisor Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance to "RS485 Baud Rate Edit" menu. (See Section 3.3.8.).

3.3.8. RS485 Baud Rate. (RS485 Output Option Only)

This screen allows the User to set the Baud Rate of the RS485 Modbus output. The values displayed are in kbaud.



RS485 Baud Rate Edit

Pressing the ">> Next" key accepts the present value and advances to the "RS485 Parity Selection" menu. (See Section 3.3.9.).

Pressing the "↑↓ Adjust" key will enter the "RS485 Baud Rate Edit" mode and scroll the value through the values 2.4, 4.8, 9.6 and 19.2 wrapping back to 2.4.

Pressing the ">> Next" key advances to the "RS485 Baud Rate Confirmation" menu.



RS485 Baud Rate Confirmation

This screen will only appear following an edit of the Baud Rate.

If the rate shown is not correct, pressing the "↑↓ Adjust" key will return to the "RS485 Baud Rate Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the displayed value and will advance operation to "RS485 Parity Selection" menu. (See Section 3.3.9.).

3.3.9. RS485 Parity Selection. (RS485 Output Option Only).

This screen allows the User to set the parity of the RS485 Modbus Output.



RS485 Parity Selection

Pressing the ">> Next" key accepts the present value and advances to the "RS485 Modbus Address" menu. (See Section 3.3.10).

Pressing the "↑ Adjust" key will enter the "RS485 Parity Selection Edit" mode and scroll the value through the values odd, E (even) and no (none) wrapping back to odd.

Pressing the ">> Next" key advances to the "RS485 Parity Confirmation" menu.



RS485 Parity Confirmation

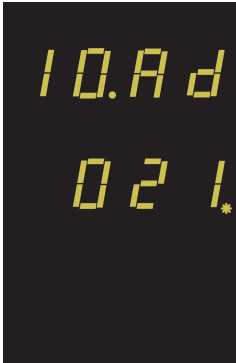
This screen will only appear following an edit of the Parity Selection.

If the value shown is not correct, pressing the "↑ Adjust" key will return to the "RS485 Parity Edit" stage by blanking the bottom line of the display.

Pressing the ">> Next" key sets the value shown and will advance to the "RS485 Modbus Address" menu. (See Section 3.3.10).

3.3.10. RS485 Modbus Address (RS485 Output Option Only).

This screen allows the User to set the Modbus address, for the instrument, which will be used by the Modbus protocol.



RS485 Modbus Address

Pressing the ">> Next" key accepts the present value and will return to the Display Mode.

Pressing the "↑↓ Adjust" key will enter the "RS485 Modbus Address Edit" mode and scroll the value of the most significant digit from 0 through to 2, the value will wrap from 2 round to 0. (0 to 9 for lesser significant digits) Pressing the ">> Next" key advances to the next less significant digit. (bright decimal point indicates that this will be flashing.)

When the least significant figure has been set, Pressing the ">> Next" key will advance to the "RS485 Modbus Address Confirmation" stage.

Note: When the most significant digit is set to 2 the lesser significant digits must be less than or equal to 47, the digits will scroll through from 0 to 4 and 0 to 7 respectively. The range of the allowable addresses is 1 to 247.



RS485 Modbus Address Confirmation

This screen will only appear following an edit of the Modbus Address.

If the address shown is not correct, pressing the "↑↓ Adjust" key will return to the "RS485 Modbus Address Edit" stage with the least significant digit highlighted (associated decimal point flashing).

Pressing the ">> Next" key sets the value shown and will return to the Display Mode.

4. Outputs

4.1 MODBUS® , Implementation

INTEGRA 1000 offers the option of a RS485 communication module for direct connection to SCADA systems using the MODBUS® RTU protocol. The MODBUS® protocol establishes the format for the master's query by placing into it the device address, a function code defining the requested action, any data to be sent, and an error checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned, and an error checking field. If an error occurred in receipt of the message, or if the slave is unable to perform the requested action, the slave will construct an error message and send it as its response.

The electrical interface is 2-wire RS485, via a 3 way 2 part connector. Connection should be made using twisted pair screened cable (Typically 22 gauge Belden 8761 or equivalent). All "A" and "B" connections are daisy chained together. The screens should also be connected to the "Gnd" terminal. To avoid the possibility of loop currents, an Earth connection should be made at one point on the network. See the connection diagram for details.

Line topology may or may not require terminating loads depending on the type and length of cable used. Loop (ring) topology does not require any termination load.

The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The load should be made up of a resistor and capacitor in series across the 'A' and 'B' terminals. Either the manufacturer of the cable or the consultant for the system management controller should be able to specify the impedance that is required for a given 485 network.

A total maximum length of 1200M is allowed for the RS485 network. A maximum of 32 electrical nodes can be connected, including the controller.

The address of each INTEGRA 1000 can be set to any value between 1 and 247. Broadcast mode (address 0) is not supported.

The maximum latency time of an INTEGRA 1000 is 400ms i.e. this is the amount of time that can pass before the first response character is output. The supervisory programme must allow this period of time to elapse before assuming that the INTEGRA 1000 is not going to respond.

The format for each byte in RTU mode is:

Coding System:	8-bit binary, hexadecimal 0-9, A-F 2 hexadecimal characters contained in each 8-bit field of the message
Data Format:	4 bytes (32 bits) per parameter. Floating point format (to IEEE 754)
Bits per Byte:	1 start bit 8 data bits, least significant bit sent first 1 bit for even/odd parity; no bit for no parity 1 stop bit if parity is used; 2 bits if no parity

Error Check Field: Cyclical Redundancy Check (CRC)

Data Transmission speed is selectable between 2400, 4800, 9600, 19200 bps

All settings are user configurable via the set-up screens.

Register Addresses

Each parameter is held in one register address. The following table details these addresses. A tick ✓ in the column indicates that the parameter is valid for that wiring system. Any parameter with a cross (X) will return the value Zero (0000h).

Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters.

Each request for data must be restricted to 20 registers or less. Violating this requirement will impact the performance of the instrument.

Address	Parameter	4-wire	3-wire	2-wire
1	Volts 1	✓	✓	✓
2	Volts 2	✓	✓	X
3	Volts 3	✓	✓	X
4	Current 1	✓	✓	✓
5	Current 2	✓	✓	X
6	Current 3	✓	✓	X
22	Volts Ave	✓	✓	✓
24	Current Ave	✓	✓	✓
27	Watts Sum	✓	✓	✓
29	VA Sum	✓	✓	✓
31	VAr Sum	✓	✓	✓
32	Power Factor Ave	✓	✓	✓
36	Frequency	✓	✓	✓
37	W.hr Import	✓	✓	✓
39	VAr.hr Import	✓	✓	✓
43	W Demand Import	✓	✓	✓
44	W Max. Demand Import	✓	✓	✓
53	A Demand	✓	✓	✓
54	A Max. Demand	✓	✓	✓
101	V L1-L2 (calculated)	✓	X	X
102	V L2-L3 (calculated)	✓	X	X
103	V L3-L1 (calculated)	✓	X	X
113	Neutral Current	✓	X	X

The demand parameters may be viewed or changed using the Modbus protocol. Each parameter is held in the 4X registers. Modbus code 03 is used to read the parameter and code 16 is used to write.

Address	Parameter	4-wire	3-wire	2-wire	
1	Demand Time	√	√	√	r/w
2	Number of Sub-Intervals	√	√	√	r/w
3	Sub-Interval Length	√	√	√	r/w
4	System Voltage	√	√	√	ro
5	System Current	√	√	√	ro
6	System Type	√	√	√	ro
7	Relay Pulse Width	√	√	√	r/w
8	Energy Reset	√	√	√	wo
9	Used by Display				
10	Used by Display				
11	Node Address	√	√	√	ro
12	Pulse Divisor	√	√	√	r/w
13	Used by Display				
14	Used by Display				
15	Used by Display				
16	Used by Display				
17	Used by Display				
18	Used by Display				
19	System Power	√	√	√	r/o

r/w = read/write ro = read only wo = write only

The Demand Time (Address 1) is used to reset the demand period. A value of zero must be written to this register to accomplish this. Writing any other value will cause an error to be returned. Any valid value sent to this register will automatically reset the Maximum Demand registers.

The value written to addresses 2 must be one of the following 8,15, 20 or 30, otherwise an error will be returned.

Address 3 must always be set to 1.

The addresses 4, 5 and 6 are read only. The System type address will display either 1,2 or 3. 1 = Single phase, 2 = 3 Phase 3 Wire, 3 = 3 Phase 4 Wire.

Address 7, Relay Pulse Width, values of 3,5 or 10 can only be written to this register. Writing any other value will cause an error to be returned. 3 = 60 ms, 5=100 ms, 10=200 ms.

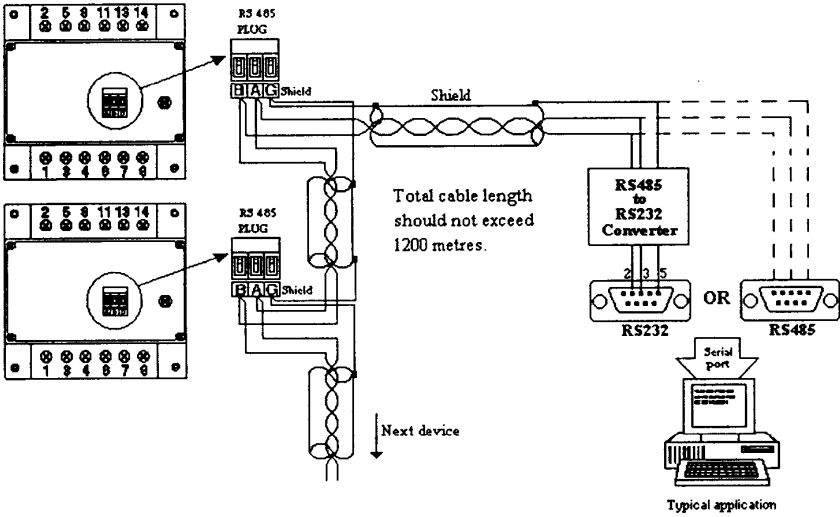
Address 8 is used to reset the Energy readings. A value of zero must be written to this register to accomplish this. Writing any other value will cause an error to be returned.

Addresses 9 & 10 are used by the display unit and cannot be accessed remotely.

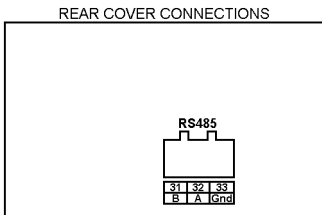
Address 11 is the Node Address for the instrument. Any value between 1 and 247 can be set.

Address 12, values of 1,10 or 100 should only be entered, writing any other value will cause an error to be returned.

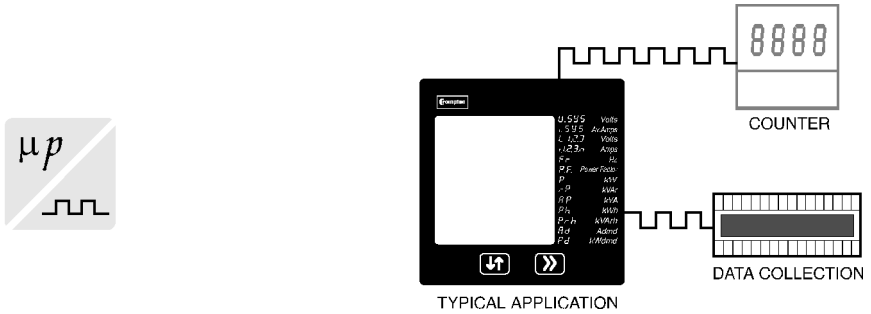
Addresses 13 - 18 are used by the display unit and cannot be accessed remotely.
 Address 19 is read only and displays the System Power.



Rear Cover Output Connections



4.2. Pulsed Output.

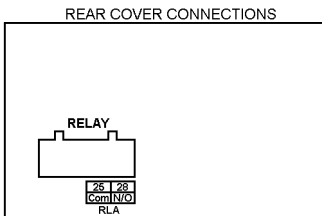


This module outputs pulses at a rate proportional to the measured Active Energy (kW.h).

The pulse width and pulse rate are both User definable via the set-up screens. See sections 3.3.6 and 3.3.7.

The output relay provides a fully isolated, volt free contact and connection is made via a screw clamp connector, which can accept cable up to 2.5 mm².

Rear Cover Output Connections



5. Maximum Demand Calculation.

The maximum power consumption of an installation is an important measurement as most power utilities base their charges on it. 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, such that short surges do not give an artificially high reading.

INTEGRA 1000 uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand period being updated on a minute by minute basis.

The demand period can be reset, which allows synchronisation to other equipment. When it is reset, the values in the Demand and Maximum Demand registers are set to zero.

The number of sub-intervals, i.e. the demand time in minutes, can be altered either by using the "Demand Integration Time" setup menu (see section 3.3.4) or via the RS485 port using the MODBUS® protocol.

Note: During the initial period when the "sliding window" does not yet contain a full set of readings (ie. the elapsed time since the demands were last reset or the elapsed time since INTEGRA 1000 was switched on is less than the selected demand time) the maximum demands (HiAd and HiPd) will remain at zero and not follow the instantaneous demands.

6. Installation

The INTEGRA 1000 may be mounted in a panel of any thickness up to a maximum of 5 mm. Mounting is by two corner clamps and thumb screws. Consideration should be given to the space required behind the instrument to allow for bends in the connection cables.

As the enclosure conforms to IP54 it is protected from water spray from all directions, additional protection to the panel may be obtained by the use of an optional panel gasket. The terminals at the rear of the product should be protected from liquids.

INTEGRA 1000 should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range 0-50°C. Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

Caution

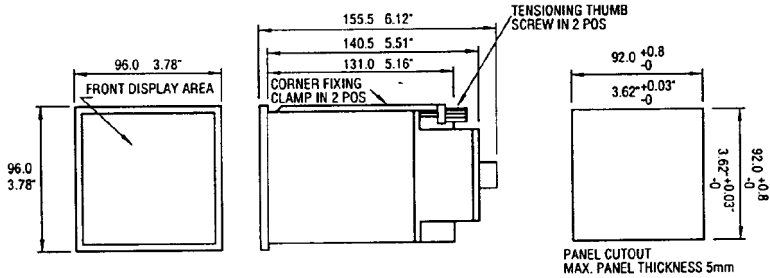
1. In the interest of safety and functionality this product must be installed by a qualified engineer.
2. Under normal or single fault conditions voltages dangerous to human life may be present at some of the terminal connections of this unit. Ensure that all supplies are de-energised before attempting any connection or disconnection.
3. These products do not have internal fuses therefore external fuses must be used for protection for safety under fault conditions.

EMC Installation Requirements

This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

1. Screened output and low signal input leads. Other connecting leads must be screened or have provision for fitting RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems. N.B. 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.
2. Avoid routing leads alongside cables and products that are, or could be, a source of interference.
3. To protect the product against permanent damage, surge transients must be limited to 2kV pk. It is good EMC practice to suppress differential surges to 2kV at the source. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.
4. ESD precautions must be taken at all times when handling this product.

Case Dimension and Panel Cutout



Wiring

Input connections are made directly to shrouded screw clamp terminal. Numbering is clearly marked in the plastic moulding. Choice of cable should meet local regulations. Terminals for both current and voltage inputs will accept up to 3mm² x 2 diameter cables.

Auxiliary Supply

INTEGRA 1000 should ideally be powered from a dedicated supply, however it may be powered from the signal source, providing the source remains within +/-10% of the chosen auxiliary voltage.

Fusing

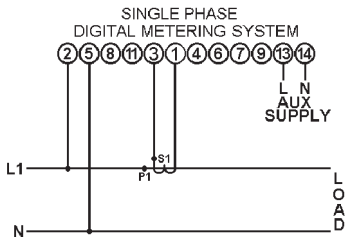
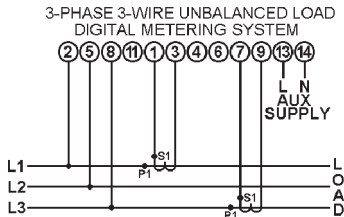
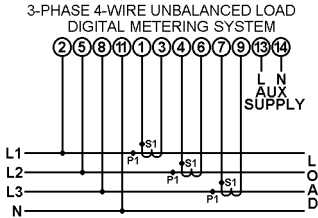
It is recommended that all voltage lines are fitted with 1 amp HRC fuses.

Earth/Ground Connections

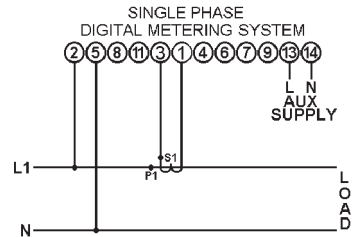
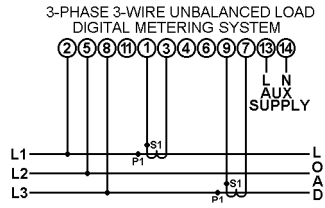
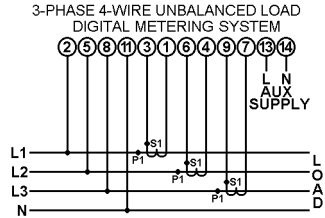
For safety reasons, CT secondary connections should be grounded in accordance with local regulations.

Connection Diagrams

Importing Connections



Exporting Connections



7. Specification

Inputs

Nominal input voltage (a.c. rms)	57.7 to 277V L-N 100 to 480V L-L
Max continuous input voltage	120% of nominal (up to 600V max.)
Max short duration input voltage	2*nominal (1s application repeated 10 times at 10s intervals)
Nominal input voltage burden	0.2VA approx. per phase
Nominal input current	1 or 5A a.c. rms
System CT primary values	Std. values up to 4kA (1 or 5 Amp secondaries)
Max continuous input current	120% of nominal
Max short duration current input	20*nominal (1s application repeated 5 times at 5 min intervals)
Nominal input current burden	0.6VA approx. per phase

Auxiliary

Standard nominal a.c.supply voltages	115 or 230V
Nominal a.c. supply voltage	57.7 .. 480V
a.c. supply voltage tolerance	±10% of nominal supply voltage
a.c. supply frequency range	45 to 65 Hz
a.c. supply burden	6VA
Optional nominal d.c.supply	24V
d.c. supply voltage tolerance	±15% of nominal supply voltage
d.c. supply input ripple limit	30% of nominal voltage (peak-peak, 45-130Hz)
d.c. supply burden	6VA

Measuring Ranges

Values of measured quantities for which errors are defined.

Voltage	5 .. 120% of nominal
Current	5 .. 120% of nominal
Frequency	45 .. 66 Hz
Active power (Watt)	5 .. 120% of nominal, importing
Reactive power (VAr)	5 .. 120% of nominal, importing
Apparent power (VA)	5 .. 120% of nominal
Power Factor	0.5 lagging .. 1 .. 0.8 leading, importing

Accuracy

Voltage	0.4% of reading ±0.1% of range
Current	0.4% of reading ±0.1% of range
Neutral current	4% of range
Frequency	0.15% of mid frequency
Power factor	1% of Unity
Active power (W)	0.9% of reading ±0.1% of range
Reactive power (VAr)	1.9% of reading ±0.1% of range
Apparent power (VA)	0.9% of reading ±0.1% of range
Active energy (W.h)	1% (IEC 1036)
Reactive energy (VAr.h)	Active P.F. 0.8.. 1 ..0.8 importing 2% (IEC 1036) Reactive P.F. 0.8.. 1 ..0.8 importing
Temperature coefficient	0.013%/°C typical
Response time to step input	1.5 seconds. approx.

Error change due to variation of an influence quantity in the manner described in section 6 of IEC688:1992

2 * Error allowed for the reference condition applied in the test.

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.

Reference conditions of measurands and, where applicable, components of the measurand

Values of measured quantities, and of components of measured quantities, where the intrinsic (headline) errors for the measured quantities apply.

Voltage	10 .. 100% of nominal
Current	10 .. 100% of nominal
Frequency	Nominal $\pm 10\%$
Active power (Watt)	10 .. 100% of nominal
Voltage	Nominal $\pm 2\%$
Current	10 .. 100% of nominal
Active power factor	1 .. 0.8 leading or lagging
Reactive power (VAr)	10 .. 100% of nominal
Voltage	Nominal $\pm 2\%$
Current	10 .. 100% of nominal
Reactive power factor	1 .. 0.8 leading or lagging
Apparent Power (VA)	10 .. 100% of nominal
Voltage	Nominal $\pm 2\%$
Current	10 .. 100% of nominal
Power factor	1 .. 0.8 leading or lagging
Voltage	Nominal $\pm 2\%$
Current	40 .. 100% of nominal

Reference conditions of influence quantities

Values that quantities which affect measurement errors to a minor degree have to be for the intrinsic (headline) errors for measured quantities to apply.

Ambient temperature	23°C
Input frequency	50 or 60 Hz $\pm 2\%$
Input waveform	Sinusoidal (distortion factor 0.005)
Auxiliary supply voltage	Nominal $\pm 1\%$
Auxiliary supply frequency	Nominal $\pm 1\%$
Auxiliary supply distortion factor	0.05
Magnetic field of external origin	Terrestrial flux

Nominal range of use of influence quantities for measurands

Values of quantities which affect measurement errors to a minor degree for which the magnitude of the measurement error is defined in this specification.

Voltage	5 .. 120% of nominal
Current	5 .. 120% of nominal
Frequency	Nominal $\pm 10\%$
Power factor (active/reactive as appropriate)	0.5 lagging .. 1 .. 0.8 leading, importing
Temperature	0 .. 50°C
Input waveform distortion	20% 3rd Harmonic distortion
Auxiliary supply voltage	Nominal $\pm 10\%$
Auxiliary supply frequency	Nominal $\pm 10\%$
Magnetic field of external origin	400A/m

Functional ranges of measurands, and of influence quantities for measurands

Values of measured quantities, components of measured quantities, and quantities which affect measurement errors to a minor degree, for which the product gives meaningful readings.

Voltage	1 .. 120% of nominal
Current	0 .. 120% of nominal (2 .. 120% of nominal for Power Factor)
Frequency	45 .. 66 Hz

Functional ranges of measurands, and of influence quantities for measurands (Continued)

Power Factor (active/reactive as appropriate)	1 .. 0 leading or lagging, importing
Temperature	0 .. 50°C
Active power (Watt)	0 .. 120% of nominal
Reactive power (VAr)	0 .. 120% of nominal
Apparent power (VA)	0 .. 120% of nominal

Screen

Update	0.5 seconds. approx.
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Standards

Terms, Definitions and Test Methods	IEC688:1992 (BSEN 60688)
EMC Emissions	BSEN 500081/2
Immunity	BSEN 50082/2 1V/m min - External measures identified to achieve 10V/m IEC255-4 2kV peak on all measuring inputs.
Safety	IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category II, pollution degree 2, Basic Insulation 600V RMS

WARNING: All terminals are for use only with equipment which has no live parts WHICH ARE ACCESSIBLE and the insulation for external circuits is to be suitable for SINGLE FAULT CONDITIONS.



EU Directives

EMC and LVD

Insulation

Dielectric voltage withstand test 2.2kV RMS 50Hz for 1 minute between all electrical circuits

Environmental

Operating temperature 0 .. +50°C
 Storage temperature -20 .. +70°C
 Relative humidity 0 .. 95% non condensing
 Warm up time 1 minute
 Shock 30g in 3 planes
 Vibration 10 .. 55 Hz, 0.15mm amplitude
 Enclosure code (front) IP54
 Harmonic distortion up to 8th harmonic (10% THD)

Enclosure

Style 96mm x 96mm DIN
 Material UL94V-0/V-2
 Terminals M3.5 captive screw clamp
 Length 140mm std case
 Weight 1 kg

Serial Communications Option

Protocol MODBUS (RS485)
 Baud rate 19200, 9600, 4800 or 2400 (programmable)
 Parity Odd or Even, with 1 stop bit, or None with 2 stop bits.

Active Energy Pulsed Output Option

Default pulse rate 1 per kWhr
 Pulse rate divisors 1
 10 (yielding 1 pulse per 10 kWhr)
 100 (yielding 1 pulse per 100 kWhr)
 Pulse duration 60 ms, 100 ms or 200 ms

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, Tyco Electronics has no control over the field conditions which influence product installation.

It is the user's responsibility to determine the suitability of the installation method in the user's field conditions. Tyco Electronics' only obligations are those in Tyco Electronics' standard Conditions of Sale for this product and in no case will Tyco Electronics be liable for any other incidental, indirect or consequential damages arising from the use or misuse of the products. Crompton is a trade mark.



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