**Installation and Operating Instructions
SWITCHBOARD INTEGRA 1000**

Crompton Switchboard
INTEGRA 1000
Power Measurements and Display Made Easy

Installation & Operating Instructions
Models 077-IJ, 077-DK and 85-IJ

Contents

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INSTRUMENTS

1. Introduction

The Crompton Switchboard INTEGRA 1000 is available in three formats:-

- A panel mounted self contained measuring, display and communication device (model 077-IJ)
- A separate display (Model 077-DKB) and measuring communication module (model 85K-IJ)
- Measuring and communication module (model 85K-IJ) available for RS485 output only.

This system will measure display and communicate 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 configuration:-
Single Phase
3 Phase 3 Wire Unbalanced
3 Phase 4 Wire Unbalanced
The INTEGRA 1000 front panel has two push buttons. 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:-
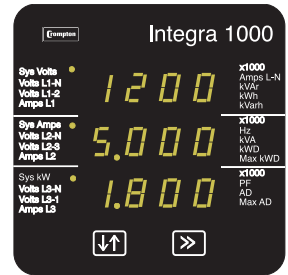
Adjust Key   Next Key

Measured Quantity	Units of measurement
System Voltage	(Volts), *see note 2*
System Current (Average)	(Amps), *see note 2*
Voltage L-N (4 wire only)	(Volts)
Voltage L-L (calculated in 4 wire, not available on single phase unit)	(Volts)
Current in 3 phases (not available on single phase unit)	(Amps)
Neutral Current (4 wire only)	(Amps)
Frequency	(Hz)
Power Factor	
Active Power	(kW), *see note 1*
Reactive Power	(kVAr), *see note 1*
Apparent Power	(kVA)
Active Energy	(kW.h)
Reactive Energy	(kVAr.h)
Total System Current Demand	(Admd)
Total System Active Power Demand	(kWdmd)
Maximum Total System Current Demand	(Admd)
Maximum Total System Active Power Demand	(kWdmd)

Note 1. All power related measurements are importing only unless connected as exporting unit.
Note 2. In a single phase system L-N voltage and current will be displayed, 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. Installation

2.1 Display

The Switchboard INTEGRA 1000 (display only for combined measure and display units) may be mounted in a panel of any thickness up to a maximum of 0.47". Mounting is by four $^1/_4$ 2 8 U N F corner studs and nuts. 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.
Switchboard INTEGRA 1000 should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range -20 to +70°C. Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

2.2 Transducer

Units should be installed in a dry position, not in direct sunlight and where the ambient temperature is reasonably stable and will not be outside the range –20 to +70°C. The preferred mounting orientation is flange down, however other positions will not affect operation. Fixing should be by screws through the holes provided. Vibration should be kept to a minimum.

Caution

1. In the interest of safety and functionality these products <u>must</u> be installed by a qualified engineer, abiding by any local regulations.
2. Voltages dangerous to human life are present at some of the terminal connections of these units. Ensure that all supplies are de-energised before attempting any connection or disconnection. External installations must be sufficient to protect human life and equipment under fault conditions.
3. These products do not have internal fuses therefore external fuses must be used for protection for safety under fault conditions.

2.3 EMC Installation Requirements

These products have 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.
5. The current inputs of these products are designed for connection into systems via current transformers only.
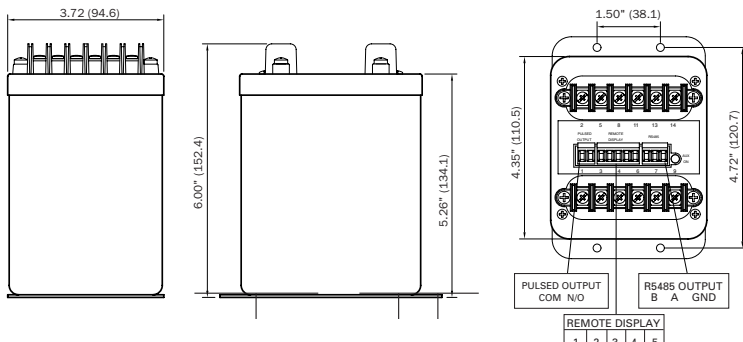
2.4 Case Dimension and Panel Cut-out

2.4.1 Model 077-IJ
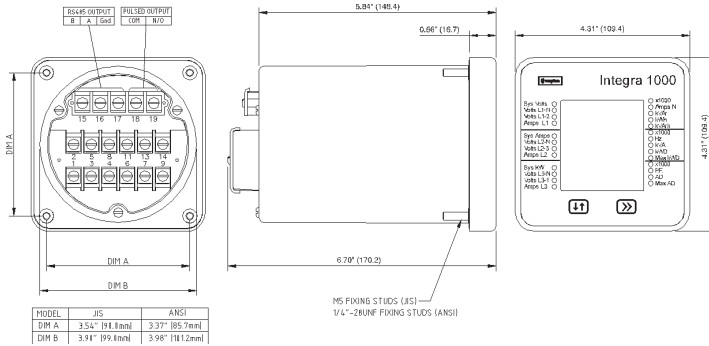

2.4.2 Model 077-DK

2.4.3 Model 85K-IJ

3
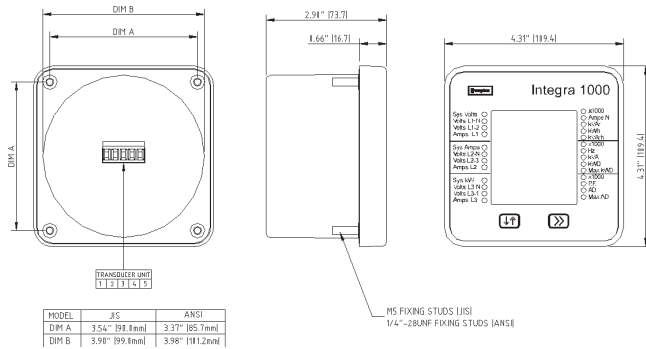
2.5 Wiring

Input connections are made to screw clamp terminals. Choice of cable should meet local regulations. Terminals for both current and voltage inputs will accept up to 3mm 2 x 2 diameter cables or ring lugs suitable for 6-32 screws.

Output connections are made directly to a two part, detachable screw clamp style connector. The choice of cable should satisfy local regulations. See section 6 for more detail.
The connection between display and transducer for the two-part configuration is via a 4-way conductor +screen, screened cable. Connection at both ends of the cable can be terminated with the two-part screw clamp style connector supplied. The umbilical can be shortened or lengthened as required to a maximum of 3,900 feet provided that each conductor of the cable is less than 2 ohms dc resistance.
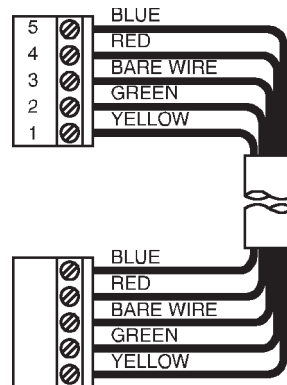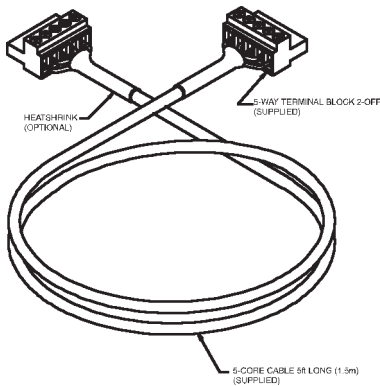
Pin1:   RS485 "A" connection
Pin2:   RS485 "B" connection
Pin3:   RS485 Screen connection
Pin4:   Unit Power + connection
Pin5:   Unit Power – connection

The pin order on the units is as follows:
077-DK: Left to Right = Pin1 to Pin 5 as viewed from rear of display.
85K-IJ: Left to Right = Pin1 down to Pin5 as viewed from the front of the product.

2.6 Auxiliary Supply

Switchboard 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.
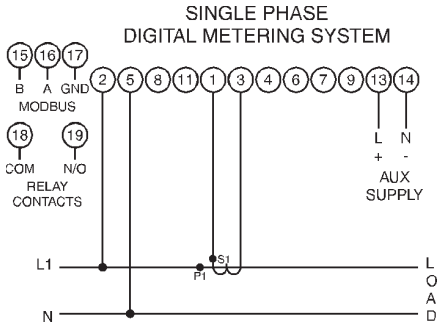
2.7 Fusing

It is recommended that all voltage lines are fitted with 1 amp HRC fuses.
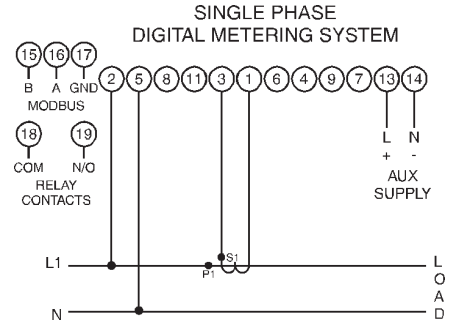
2.8 Earth/Ground Connections

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

3. Connection Diagrams

Importing Connections   **Exporting Connections**
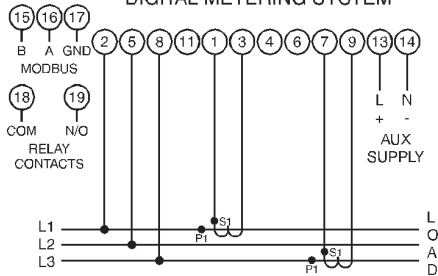
SINGLE PHASE
DIGITAL METERING SYSTEM

SINGLE PHASE
DIGITAL METERING SYSTEM
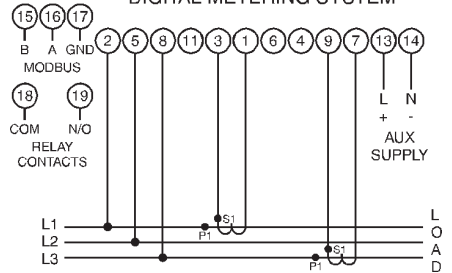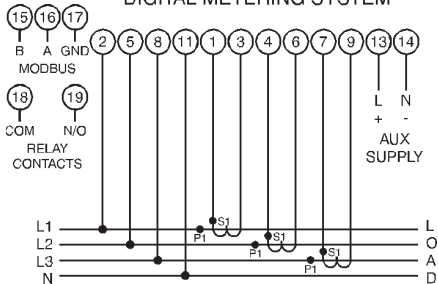

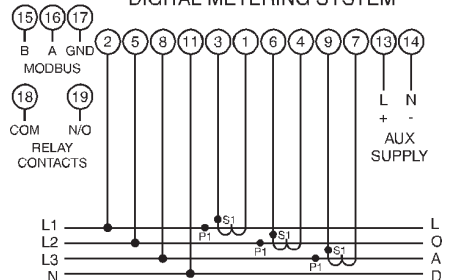3-PHASE 3-WIRE UNBALANCED LOAD
DIGITAL METERING SYSTEM

3-PHASE 3-WIRE UNBALANCED LOAD
DIGITAL METERING SYSTEM

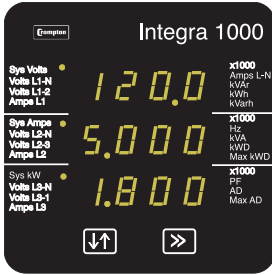3-PHASE 4-WIRE UNBALANCED LOAD
DIGITAL METERING SYSTEM

3-PHASE 4-WIRE UNBALANCED LOAD
DIGITAL METERING SYSTEM

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INSTRUMENTS

4. Display Screens

The screens may be scrolled through by pressing "\>\>Next" key. The screens will advance to the next display if the "\>\>Next" key is pressed.

4.1 Screen 1 – System Screen

The system screen is the default display. When the unit is energised this is the first screen to appear.

System Total Active Power (kW)

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

System Average Line Current (Amps)

Note: In Single phase mode pressing the "\>\>Next" key will advance to Screen 5. In 3 phase 3 wire mode pressing "\>\>Next" key will advance to Screen 3.
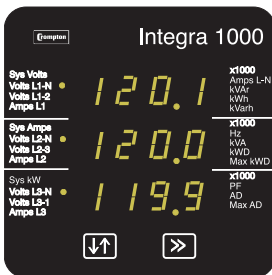
4.2 Screen 2 – Line to Neutral Voltages

To view screen two, 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)
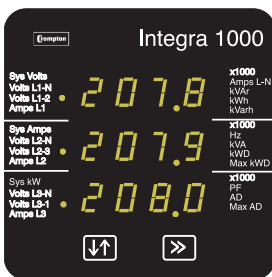
4.3 Screen 3 – Line to Line Voltages

To view screen three, 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)

4.4 Screen 4 – Line Currents

To view screen four, press the ">>Next" key. (Not selectable for single phase)
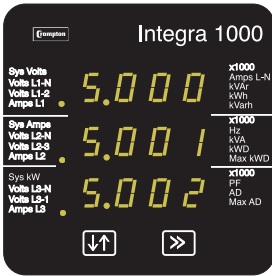
Current Line 3 (Amps)

Current Line 2 (Amps)

Current Line 1 (Amps)

4.5 Screen 5 – Neutral current, Frequency and Power Factor

To view screen five, press the ">>Next" key.
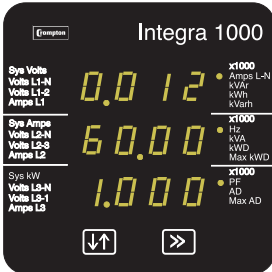
Neutral Current (Amps). (4-wire system only)

Frequency (Hz)

Power Factor (0 to 1)

4.6 Screen 6 – Power

To view screen six, press the ">>Next" key.
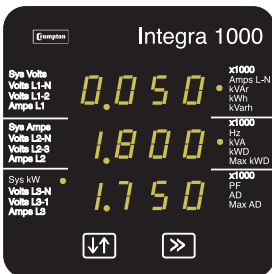
Reactive Power (kVAr)

Apparent Power (kVA)

Active Power (kW)
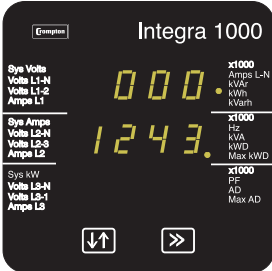
4.7 Screen 7 – Active Energy (kW.h)

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

Active Energy (kW.h)

7 digit reading i.e. 0001243
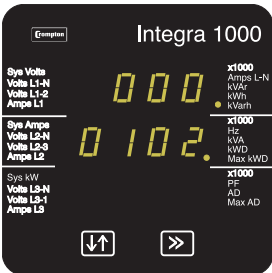
4.8 Screen 8 – Reactive Energy (kVAr.h)

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

Reactive Energy (kVAr.h)
7 digit reading i.e. 0000102
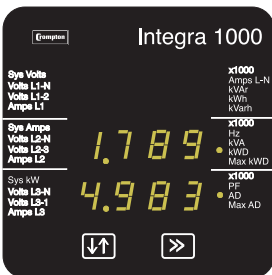
4.9 Screen 9 – Active Power & Current Demands

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

System Total Active Power Demand (kWD)

System Total Current Demand (AD)
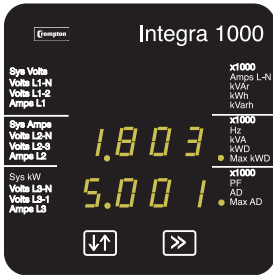
4.10 Screen 10 – Active Power & Current Maximum Demands

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

Maximum System Total Active Power Demand (kWd)

Maximum System Total current Demand (AD)
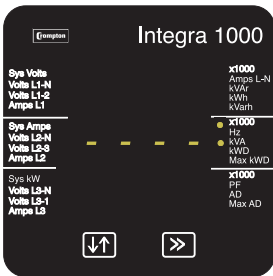
4.11 Over Range

The displayed values must be in the range –999 x 1000 to 9999 x 1000.

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

Whilst displaying negative values the display will overflow for values more negative than –999 x 1000, this situation will be indicated by displaying four bars in the appropriate line:

Value on middle line has overflowed
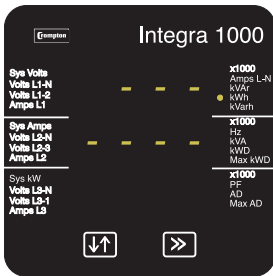
kWh and kVArh Display Range

The kWh and kVArh display range is limited to 9999999. 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 counter will register from a count of 1 kWh kVArh to a maximum of 9,999,999.

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

5. Programming

The following sections comprise of step by step procedures for configuring the Switchboard 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 5.1).
To return to the display screens at anytime during these procedures, press the "↑↓ Adjust" and ">> Next" Key simultaneously for 5 seconds.
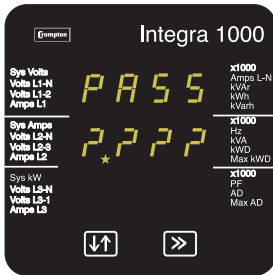
5.1 Password Protection

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.

(* Denotes that decimal point 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.

Enter Password, first digit entered, prompt for second digit.

(* Denotes that decimal 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.

(* Denotes that decimal point 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
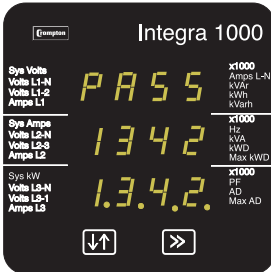
Password Confirmed

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 5.1.1.)
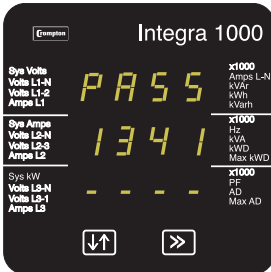
Password Incorrect

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.

Integra 1000

Sye Volts
Volts L1-N
Volts L1-2
Amps L1

Sys Ampe
Volts L2-N
Volts L2-3
Amps L2

Sys kW
Volts L3-N
Volts L3-1
Amps L3

x1000 / Amps L-N / kVAr / kWh / kVarh
x1000 / Hz / kVA / kWD / Max kWD
x1000 / PF / AD / Max AD
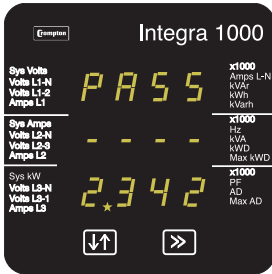
P A S S
- - - - -
2.3 4 2

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".

Integra 1000
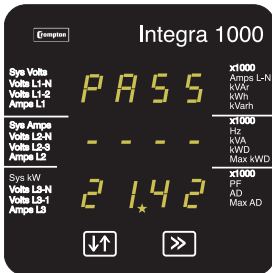
P A S S
- - - - -
2 1.4 2

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".

Integra 1000
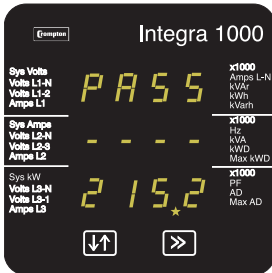
P A S S
- - - - -
2 1 5.2

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".

Integra 1000

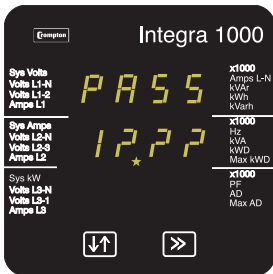P A S S
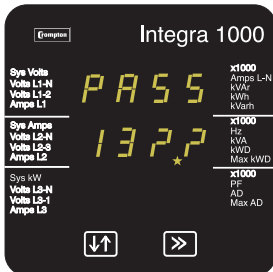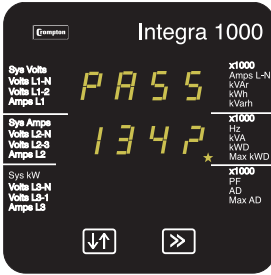- - - - -
2 1 5 3.

New/Change Password, third digit entered, prompting for fourth digit. (* Denotes that decimal point 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.
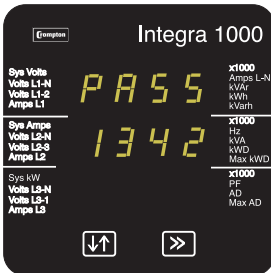
Crompton
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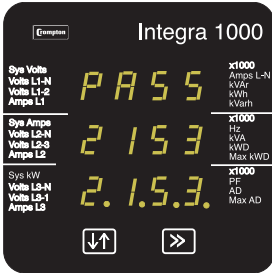
New Password Confirmed.

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

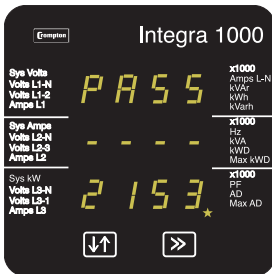Pressing the ">> Next" key will advance to the "Full Scale Current" screen. (See Section 5.2.1)

5.2 Set Up Screens

Note: The Screens in sections 5.2.5 to 5.2.9 will be displayed in all units but will have no effect on the operation of those units that do not have these options fitted

5.2.1 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.
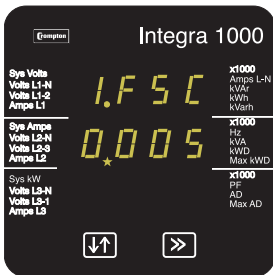
Pressing the ">> Next" key accepts the present value and advances to the potential transformer ratio menu. (See Section 5.2.2)

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 9, unless the presently displayed current transformer ratio together with the full scale voltage value results in a maximum power of greater than 360 Megawatts in which case the digit range will be restricted, 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. (* Denotes that decimal point will be flashing).

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

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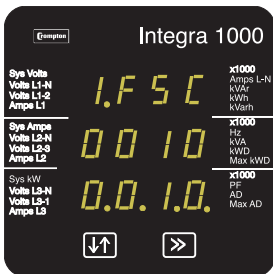
Full Scale Current Confirmation

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 most 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 "Potential Transformer Ratio" menu. (See Section 5.2.2)

5.2.2 Potential Transformer Ratio

The nominal full scale voltage which will be displayed as the L1-N, L2-N and L3-N for a four wire system or as L1-2, L2-3 and L3-1 in a three wire system. This screen enables the user to display the line to neutral and line to line voltages inclusive of any transformer ratios, the values displayed represent the voltage in kilovolts (note the x1000 enunciator).
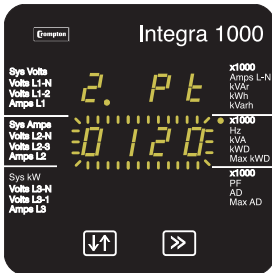
Pressing the ">> Next" key accepts the present value and advances to the "Demand Integration Time" menu. (See section 5.2.3)

Pressing the "↑↓ Adjust" key will enter the "Potential Transformer Ratio Edit" mode.
Initially all the digits of the current value will be flashing and the decimal point position will be illuminated. This is to indicate that initially the "multiplier" must be selected, pressing the "↑↓ Adjust" key will move the decimal point position to the right until it reaches ###.# after which it will return to #.###

Pressing the ">> Next" key will accept the present multiplier (decimal point position) stop the digits flashing and advances to the "Potential Transformer Digit Edit" mode.

Potential Transformer Digit Edit

Pressing the "↑↓ Adjust" key will scroll the value of the most significant digit from 0 through to 9 unless the presently displayed Potential Transformer ratio together with the full scale current value, previously set, would result in a maximum power of greater than 360 Megawatts in which case the digit range will be restricted.

Pressing the ">> Next" key accepts the present value at the cursor position and advances the cursor to the next less significant digit.

(* Denotes that decimal point will be flashing).

Note: the flashing decimal point indicates the cursor position, a steady decimal point will be present to identify the scaling of the number until the cursor position coincides with the steady decimal point position. At this stage the decimal point will flash.

When the least significant digit has been set pressing the ">> Next" key will advance to the "Potential Transformer Ratio Confirmation" stage.

Screen showing display of 0.120 kV i.e. 120 Volts indicating steady decimal point and cursor flashing at the "hundreds of volts" position.
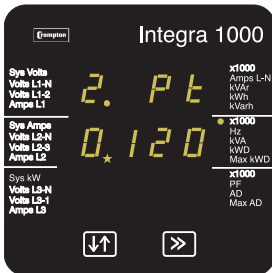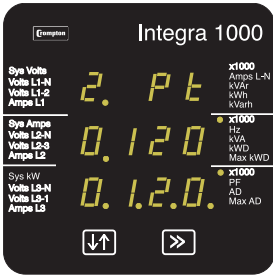
Potential Transformer Ratio Confirmation

This screen will only appear following an edit of the Potential Transformer ratio.

If the scaling is not correct, pressing the "↑↓ Adjust" key will return to the "Potential Transformer Ratio Edit" stage with the digits flashing indicating that the multiplier (decimal point position) should be selected.

Pressing the ">> Next" key sets the displayed value and will advance to the "Demand Integration Time" menu. (See Section 5.2.3)

5.2.3 Demand Integration Time Edit

This screen is used to set the time taken from maximum demand readings; the value displayed represents time in minutes.
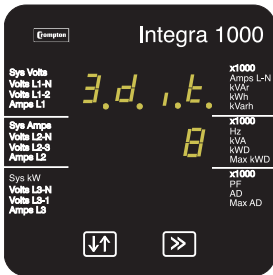
Pressing the ">> Next" key accepts the present value and advances to the "Reset" menu. (See Section 5.2.4)

Pressing the "↑↓ Adjust" key will enter the "Demand Integration Time Edit" mode and scroll the value through the values available.

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

At the unit advances to the next screen the unit demands are reset.
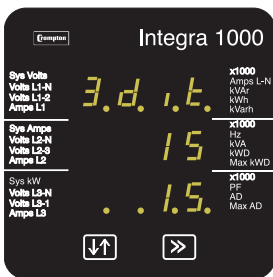
Demand Integration Time Confirmation.

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 5.2.4)

5.2.4. 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)
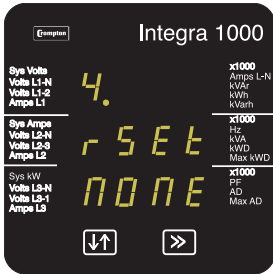
Reset (None)

Pressing the "≫ Next" key advances to the "Pulse Duration" menu. (See Section 5.2.5)

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 5.2.5)
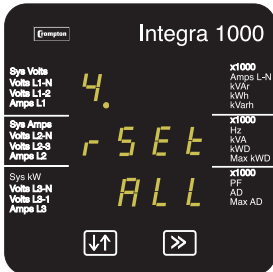
Reset Parameter Select, (Reset All)

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.
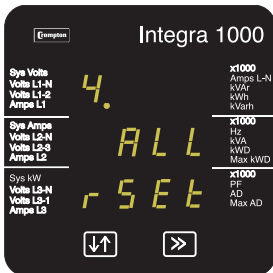
Reset All Confirmation.

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 5.2.5)
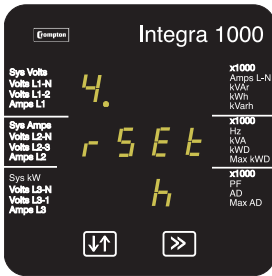
Reset parameter Select, (Reset Energy Variables)

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

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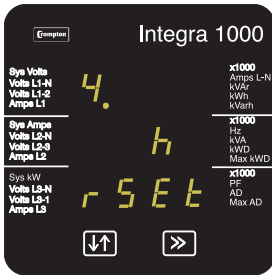
Reset Active Energy Variables Confirmation.

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 5.2.5)
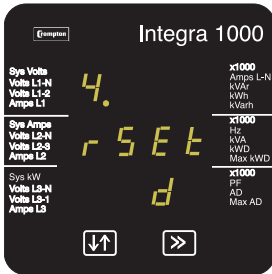
Reset Parameter Select, (Reset Demands).

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.
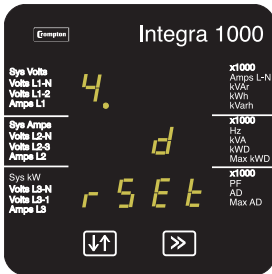
Reset Demands Confirmation.

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 5.2.5)

5.2.5 Pulsed output, Pulse duration (Relay Pulsed Output Option Only)

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).
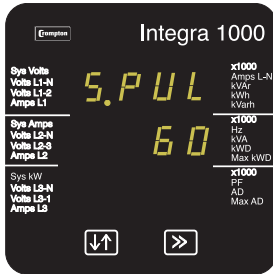

Pulse Duration Edit.

Pressing the "≫ Next" key accepts the present value and advances to the "Pulse Rate" menu. (See Section 5.2.6)

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.
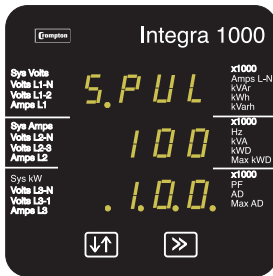
Pulse Duration Confirmation

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 5.2.6)

5.2.6 Pulse Rate (Relay Pulsed Output Option Only)

This screen is available for the User to set the kW.h. pulse rate divisor.
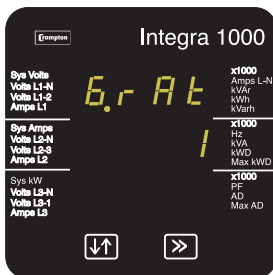
Pulse Rate Divisor Edit.

Pressing the "≫ Next" key accepts the present value and advances to the "RS 485 Baud Rate Edit" menu. (See Section 5.2.7.)

Pressing the "↑↓ Adjust" key will enter the "Pulse Rate Divisor Edit" mode and scroll the value through the values 1, 10, 100, 1,000 wrapping back to 1 unless the maximum power is greater than 3.6 megawatts in which case the range of divisors will be restricted to force an upper limit to the number of pulses/hr.

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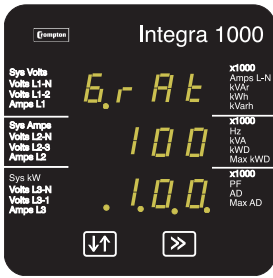
Pulse Rate Divisor Confirmation.

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 "RS 485 Baud Rate Edit" menu. (See Section 5.2.7.)

5.2.7 RS 485 Baud Rate (RS 485 Output Option Only)

This screen allows the User to set the Baud Rate of the RS 485 Modbus output. The values displayed are in kbaud.

RS 485 Baud Rate Edit.

Pressing the ">> Next" key accepts the present value and advances to the "RS 485 Parity Selection" menu. (See Section 5.2.8.)

Pressing the "↑↓ Adjust" key will enter the "RS 485 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 "RS 485 Baud Rate Confirmation" menu.
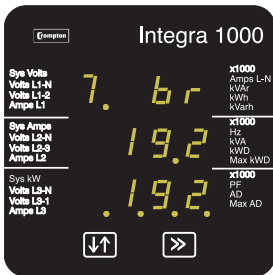
RS 485 Baud Rate Confirmation.

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 "RS 485 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 "RS 485 Parity Selection" menu. (See Section 5.2.8.)

5.2.8 RS 485 Parity Selection (RS 485 Output Option Only)

This screen allows the User to set the parity of the RS 485 Modbus Output.

Integra 1000
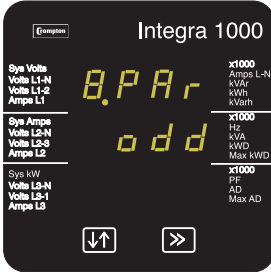
RS 485 Parity Selection

Pressing the "≫ Next" key accepts the present value and advances to the "RS 485 Modbus Address" menu. (See Section 5.2.9)

Pressing the "↑↓ Adjust" key will enter the "RS 485 Parity Selection Edit" mode and scroll the value through the values **odd**, E (even), and **no 1** (no parity one stop bit), **no 2** (no parity two stop bits), wrapping back to odd.

Pressing the "≫ Next" key advances to the "RS 485 Parity Confirmation" menu.

Integra 1000
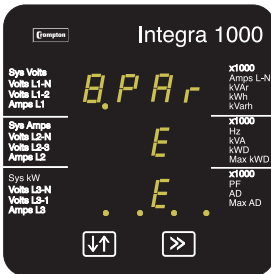
RS 485 Parity Confirmation.

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 "RS 485 Parity Edit" stage by blanking the bottom line of the display.

Pressing the "≫ Next" key sets the value shown and will advance to the "RS 485 Modbus Address" menu. (See Section 5.2.9)

5.2.9   RS 485 Modbus Address (RS 485 Output Option Only)

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

Integra 1000
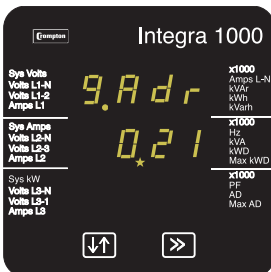
RS 485 Modbus Address

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

Pressing the "↑↓ Adjust" key will enter the "RS 485 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. (*decimal point indicates that this will be flashing.)

When the least significant figure has been set, Pressing the "≫ Next" key will advance to the "RS 485 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.
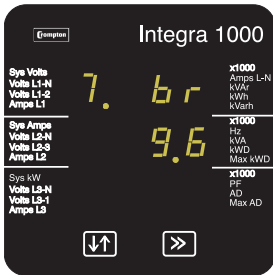
21
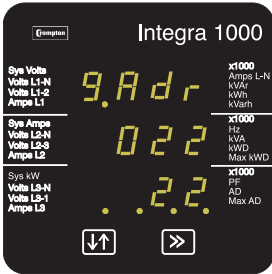
RS 485 Modbus Address Confirmation.

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 "RS 485 Modbus Address Edit" stage with the least significant digit highlighted (associated decimal point flashing).

Press the ">> Next" key sets the value shown and will return to the display mode.

6. Outputs

6.1 a MODBUS® , Implementation

INTEGRA 1000 offers the option of a RS 485 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 RS 485, 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 with a 120 ohm (0.25W min.) resistor.

A total maximum length of 3900 feet is allowed for the RS 485 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 150ms (400ms JIS version) 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) Most significant byte first
Bits per Byte:	1 start bit 8 data bits, least significant bit sent first 1 bit for even/odd parity 1 stop bit if parity is used; 1 or 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.

Crompton
INSTRUMENTS

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.

e.g. to request	Volts 1	Start address	= 00
	No of words		= 02
	Volts 2	Start address	= 02
	No of words		= 02

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

Address	Parameter	Modbus Start Address Hex		4-wire	3-wire	2-wire
		High Byte	Low Byte			
1	Volts 1 (L1 – N 4W or L1 – L2 3W)	00	00	√	√	√
2	Volts 2 (L2 – N 4W or L2 – L3 3W)	00	02	√	√	X
3	Volts 3 (L3 – N 4W or L3 – L1 3W)	00	04	√	√	X
4	Current 1	00	06	√	√	√
5	Current 2	00	08	√	√	X
6	Current 3	00	0A	√	√	X
22	Volts Ave	00	2A	√	√	√
24	Current Ave	00	2E	√	√	√
27	Watts Sum	00	34	√	√	√
29	VA Sum	00	38	√	√	√
31	VAr Sum	00	3C	√	√	√
32	Power Factor Ave	00	3E	√	√	√
36	Frequency	00	46	√	√	√
37	W.hr Import	00	48	√	√	√
39	VAr.hr Import	00	4C	√	√	√
43	W Demand Import	00	54	√	√	√
44	W Max. Demand Import	00	56	√	√	√
53	A Demand	00	68	√	√	√
54	A Max. Demand	00	6A	√	√	√
101	V L1 – L2 (calculated)	00	C8	√	X	X
102	V L2 – L3 (calculated)	00	CA	√	X	X
103	V L3 – L1 (calculated)	00	CC	√	X	X
113	Neutral Current	00	E0	√	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	Wire			
		4	3	2	
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 register.

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.

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INSTRUMENTS

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.
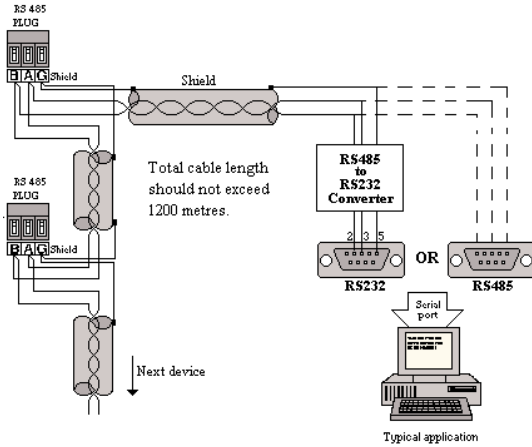
Transducer Output Connections
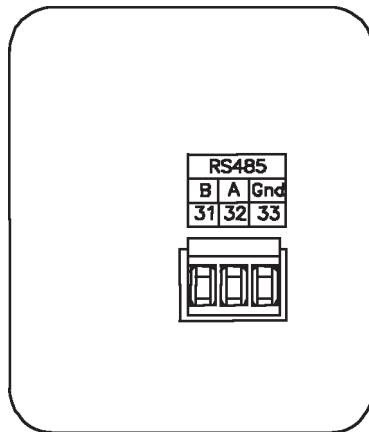
6.1.B RS485 Implementation for Johnson Controls Metasys

These notes explain Metasys and Crompton Instruments INTEGRA 1000 integration. Use these notes with the Metasys Technical Manual, which provides information on installing and commissioning Metasys N2 Vendor devices.

Application details
The INTEGRA 1000 is a N2 Vendor device which connects directly with the Metasys N2 Bus. Each Metasys N2 Bus port can connect up to 70 units. Each Crompton device can be accessed by the full complement of Metasys Facility Management System (FMS) features, including Change-of-state (COS) monitoring, alarm notification, scheduling, trend and totalisation.

Components requirements
• INTEGRA 1000 with RS485 card and Metasys protocol activated.
• N2 Bus cable.

Metasys release requirements
• Metasys OWS software release 7.0 or higher.
• Metasys NCM311. NCM360.

Support for Metasys Integration
Johnson Control Systems
System House, Randalls Research Park,
Randalls Way, Leatherhead,
Surrey, KT22 7TS
England

Support for Crompton INTEGRA operation
See back cover for local sales and service centre.

Design considerations
When integrating the Crompton equipment into a Metasys Network, keep the following considerations in mind.
• Make sure all Crompton equipment is set up, started and running properly before attempting to integrate with the Metasys Network.
• A maximum of 70 devices can be connected to any one NCM N2 Bus.

Vendor Address   1-255 (as N2 Bus)
Port Set-up
Baud Rate   9600
Duplex   Full
Word Length   8
Stop Bits   1
Parity   None
Interface   RS485

METASYS N2 application

Integra 1000 Point Mapping table

Address	Parameter Description	Units
1	Voltage 1	Volts
2	Voltage 2	Volts
3	Voltage 3	Volts
4	Current 1	Amps
5	Current 2	Amps
6	Current 3	Amps
7	Voltage average	Volts
8	Current average	Amps
9	Power (Watts) Sum	Kwatts
10	VA Sum	KVA
11	VAr Sum	KVAr
12	Power Factor average	
13	Frequency	Hz
14	Watt-Hours (Import)	KWhr
15	VAr-Hours (Import)	KVArhr
16	Watts Demand (Import)	KWatts
17	Maximum Watts Demand (Import)	KWatts
18	Amps Demand	Amps
19	Maximum Amps Demand	Amps
20	Voltage L1-L2 (calculated)	Volts
21	Voltage L2-L3 (calculated)	Volts
22	Voltage L3-L1 (calculated)	Volts
23	Neutral Current	Amps

6.2 Pulsed Output
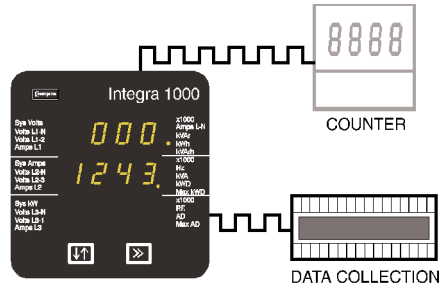
TYPICAL APPLICATION

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 5.2.5 and 5.2.6.

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 mm^2.

Transducer Output Connections

7. 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.

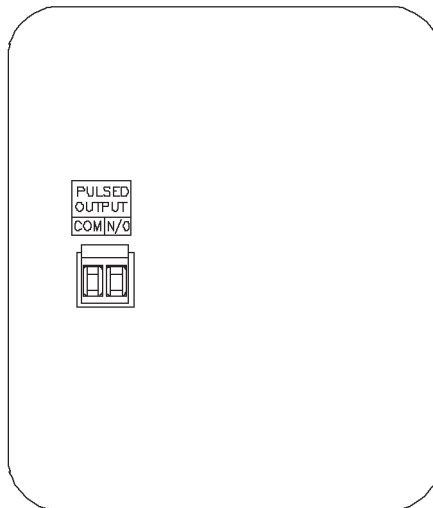ANSI INTEGRA 1000 uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand period being updated on a minute by minute basis.

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.

Time Integration Periods
ANSI   8, 15, 20 and 30 minutes
JIS   2, 10, 15 and 30 minutes.

The number of sub-intervals, i.e. the demand time in minutes, can be altered either by using the "Demand Integration Time" set-up menu (see section 5.2.3) or via the RS 485 port using the MODBUS®, protocol.

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 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.

JIS INTEGRA 1000 uses an expotential calculation in order to simulate a thermal MDI. This simulated demand measurement is updated each second.

The Time Integration Period can be altered either by using the "Demand Integration Time" set-up menu (see section 5.2.3) or via the RS 485 port using the MODBUS®, protocol.

8. Specification

Inputs

Nominal input voltage (a.c. rms)	57.7 to 600V L-N (single phase) 100 to 600V L-L (3 wire) 57.7 to 346V L-N (4 wire)
Max continuous input voltage	120% of nominal (up to 720V 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

Optional a.c. supply voltages	120 or 230V
Nominal a.c. supply voltage	57.7 .. 600V
a.c. supply voltage tolerance	±10% of nominal supply voltage
a.c. supply frequency range	45 to 66 Hz
a.c. supply burden	6VA
Standard universal supply	
3 Builds	12V to 48V d.c. (+25%, -15%), 24V to 48V a.c. (±20%) 100V to 250V d.c. (+25%, -15%), a.c. (±20%)
d.c. supply input ripple limit	30% of nominal voltage (peak-peak, 45-130Hz)
d.c. supply burden	4VA

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, 360MW Max.
Reactive power (VAr)	5 .. 120% of nominal, importing, 360 MVAr Max.
Apparent power (VA)	5 .. 120% of nominal, 360 MVA Max.
Power Factor	0.5 lagging .. 1 .. 0.8 leading, importing

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INSTRUMENTS

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, Active PF 0.8-1-0.8 importing)
Reactive energy (VAr.h)	2% (IEC 1036, Reactive PF 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 ±10%
Active power (Watt)	10 .. 100% of nominal
Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Active power factor	1 .. 0.8 leading or lagging
Reactive power (VAr)	10 .. 100% of nominal
Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Reactive power factor	1 .. 0.8 leading or lagging
Apparent Power (VA)	10 .. 100% of nominal

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INSTRUMENTS

Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Power factor	1 .. 0.8 leading or lagging
Voltage	Nominal ±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 ±2%
Input waveform	Sinusoidal (distortion factor 0.005)
Auxiliary supply voltage	Nominal ±1%
Auxiliary supply frequency	Nominal ±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 ±10%
Power factor (active/reactive as appropriate)	0.5 lagging .. 1 .. 0.8 leading ,importing
Temperature	-20°C to +70°C
Input waveform distortion	20% 3rd Harmonic distortion
Auxiliary supply voltage	Nominal ±10%
Auxiliary supply frequency	Nominal ±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
Power Factor (active/reactive as appropriate)	1 .. 0 leading or lagging, importing
Temperature	-20°C to +70°C
Active power (Watt)	0 .. 120% of nominal, 360 MW Max.
Reactive power (VAr)	0 .. 120% of nominal, 360 MVAr Max.
Apparent power (VA)	0 .. 120% of nominal, 360 MVA Max.

Screen

Update	0.5 second approx.

Standards

Terms, Definitions and Test Methods	IEC688 (BSEN 60688) IEC1036 (BSEN 61036)
EMC	Emissions - BSEN 500081/2 Immunity - BSEN 50082/2 10 V/m minimum
IEC255-4: 2kV peak on all measuring inputs	
Safety	IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition, Installation category III, pollution degree 2, Basic Insulation, 720V RMS

EU Directives

EMC and LVD

Insulation

Dielectric voltage withstand test

Up to 150V max terminal voltage	1.35kV RMS 50Hz for 1 minute between signal/aux lines.
Up to 300V max terminal voltage	2.2kV RMS 50Hz for 1 minute between signal/aux lines.
Up to 600V max terminal voltage	3.25kV RMS 50Hz for 1 minute between signal/aux lines.
Up to 720V max terminal voltage	4.35kV RMS 50Hz for 1 minute between signal/aux lines.
Comms lines	2.2kV

Crompton INSTRUMENTS

Environmental

Operating temperature	-20°C to +70°C
Storage temperature	-20°C to +80°C
Relative humidity	0 .. 95% non condensing
Warm up time	1 minute
Shock	30g in 3 planes
Vibration	10 to 15Hz @ 0.15mm amplitude 15 to 150Hz @ 1.0G
Enclosure code (front)	IP54
Harmonic distortion	up to 8th harmonic (10% THD)
Compliant with	UL 140 758 and EC1010 / BSEN 61010-1

Enclosure

Style	ANSI C39.1 or JIS C-1102
Material	Polycarbonate Front, Steel case
Terminals	6-32 UNC slotted barrier style.
Weight	1.3kg

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

Rated	SPNO, 100V dc, 0.5A Max.
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	60ms, 100ms or 200ms 3600 Pulses per hour max