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# Installation and Operating Manual
# QUADRATIC INTEGRA 2000


Crompton INSTRUMENTS

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## Overview

The Crompton INTEGRA 2000 is a panel mounted instrument for the communication and display of electrical parameters. It combines High Accuracy measurement technology with the ease of use of a menu driven graphical display.

Measures, displays and communicates all these parameters and more: V, A, Hz, W, VA, VAr, PF, KWHr, KVA, min/max etc.

Benefits of the INTEGRA 2000:

- True RMS measurement for accurate measurement of distorted waveforms.
- Excellent harmonic handling for true power measurement.
- Standard electrical connection to 3Ø Systems.
- High accuracies maintained over a wide measuring range.
- 96x96mm DIN one piece self-contained package.
- IP54 front of panel.
- Heavy screw clamp terminals for current and voltage inputs ensure easy installation of cable up to $3mm^2$ x 2.
- Clear indication via LCD Graphic Display Module.
- LED Back lighting for viewing in low ambient light.
- Large characters in standard fonts for easy viewing.
- Tactile feedback keypad for positive user interface.
- User friendly Interface via on screen prompts.
- The user is taken through the menu structure with ease and simplicity.
- Analogue outputs.
- RS485 serial communication output via two part, screw clamp connector.
- Uses industry standard "Modbus" Network Protocol.
- Metasys compatible for Johnson Controls N2 Bus - building management system.
- Compatible with all leading BMS systems.
- Pulsed output for Hours related functions via relay with volt free contacts.
- Designed to meet world-wide Industry standard approvals. (Safety, Performance, EMC, etc.)

## Contents

## Installation

### General

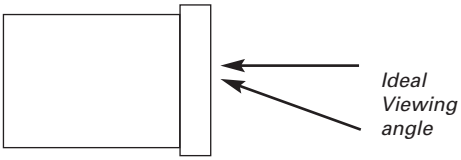
The INTEGRA 2000 may be mounted in a panel of any thickness up to a maximum of 5mm. Mounting is by two corner clamps and thumb screws. Consideration should be given to the space required behind the unit to allow for bends in the connection cables.

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

INTEGRA 2000 should be mounted in a reasonably stable ambient temperature and in any event where the operating temperature is within the range 0-50°C.

INTEGRA 2000 should not be mounted where it will be subjected to excessive direct sunlight. Vibration should be kept to a minimum.

For optimum viewing INTEGRA 2000 should be mounted so that the operator views the display as shown below.




Side labels show full connection information and data. It is good EMC practice to suppress differential surges (caused by contactors, tap changes, sensitive switching, etc.) to 2.2kV at the source.

### 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.
4. The current inputs of these products are designed for connection into systems via current transformers only.

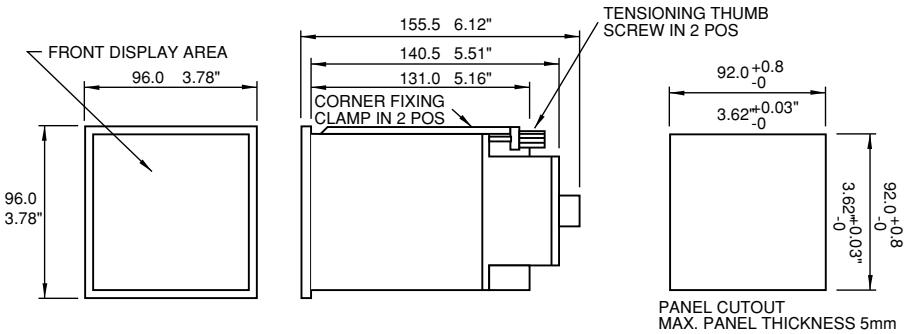
## EMC Installation Requirements

This product range 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. Screen 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 2.2kV pk. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances the auxiliary supply may have to be momentarily disconnected to restore correct operation.
4. ESD precautions must be taken at all times when handling this product.

For assistance on protection requirements, please contact your local sales office.

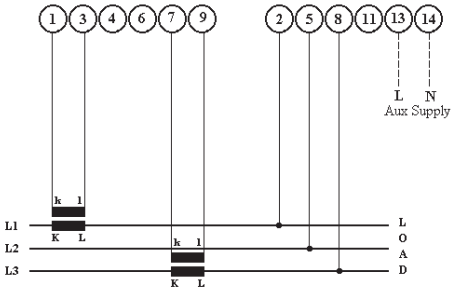
## Case Dimension and Panel Cutout



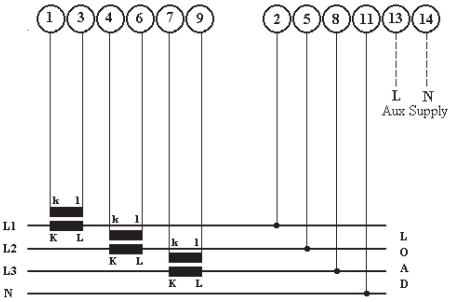
## Connection Diagrams

### Connection Detail

**3 Ø 3 W Unbalanced load (2 element)**




**3 Ø 4W Unbalanced load (3 element)**




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

**Auxiliary Supply** - INTEGRA 2000 ideally should be powered by a dedicated supply, however it may be powered by 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 according to local codes of practice.

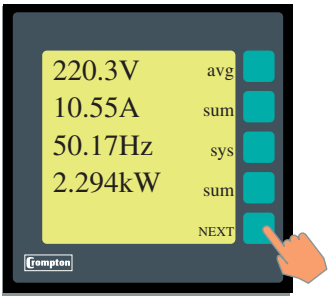
**Import/Export Connections** - The connections shown assume an import power configuration and therefore power factor is shown as import (IMP). Current will flow towards the load, if current flows away from the load, in an export power situation, then the power factor indication will change to export (EXP). This negates the need for separate export connections, because Integra serves the full four conditions of power factor.

# Operating Instructions

**Power measurement made easy with INTEGRA 2000**

On power up and in normal operation the INTEGRA 2000 displays the initial screen. This screen is factory set to display "Volts", "Amps", "Frequency" and "Watt". It may be changed to display any four parameters. See the customisation section later in this guide.

### The INTEGRA 2000 screen




The standard viewing screen has four active readings indicated.

By **character size** and one key soft prompt.

**1st size** Largest characters - the active readings. Four digits with dynamic scaling.

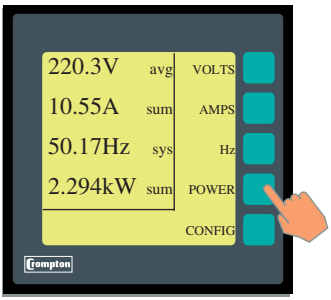
**2nd size** The parameters for active readings with dynamic scaling to reflect Kilo, Mega etc.

**3rd size** Indicate the relationship of the active reading to the measured system, e.g. L-L, sum etc.

**4th size** Smallest characters - offers the key legends which guide the user through the menus of the instrument.

"Next" is the only available key function on this screen.

Press the "**NEXT**" key.

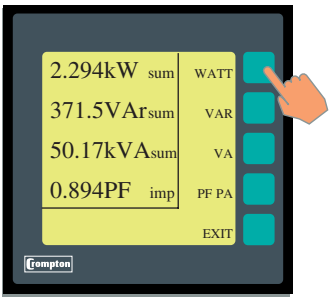



The default screen now reduces in size to reveal the first level of key legends, all readings are still active.

Each key now takes the user down to a new level of the menu structure.

This can be demonstrated by pressing "Power"

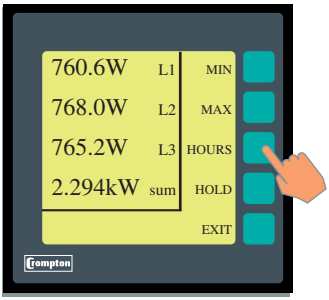
Press "**POWER**"




The first level power screen by default shows active readings of W, VAr, VA and PF PA.

(From this level down exiting all screens is easily done by a single keystroke "**Exit**".)

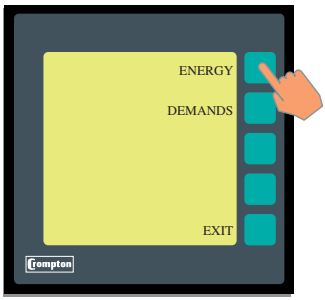
Next example press the "**WATT**" button.



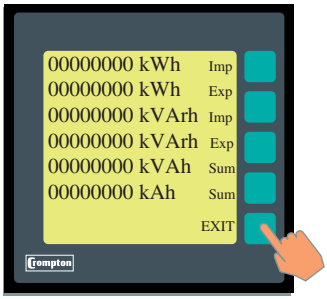

This screen now displays active reading of Watt by Line and Sum

The soft prompts keys now available are "**MIN**", "**MAX**", "**HOURS**" and "**HOLD**".

Press "**HOURS**"

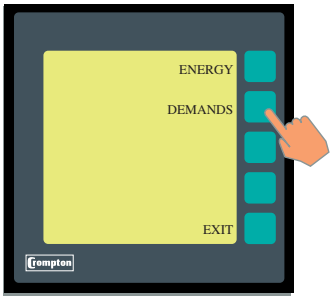



Press "**ENERGY**"

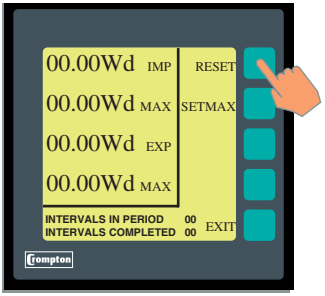



This screen displays all Hour related functions, both import and export where appropriate.

Press "**EXIT**" and this will revert to the previous screen.



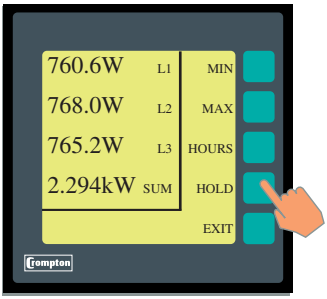

Press "**DEMANDS**"



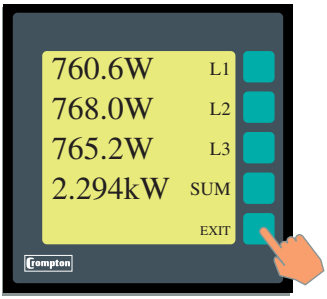

Press "**SETMAX**" to return the maximum demand to the present demand value.

Press "**RESET**" to begin or re-start the demand period

Press "**EXIT**" twice

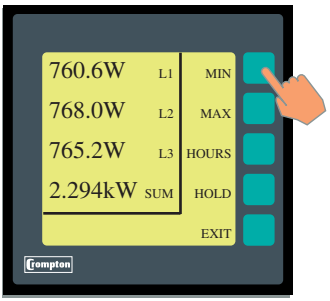



Press "**HOLD**"




This will expand the active screen to full size. This screen remains until deactivated by pressing "**EXIT**" where it will return to the reduced active screen.

Press "**EXIT**"




The minimum and maximum values are stored for each reading.

The minimum and maximum values can be reset at the customisation screen.

Press "**MIN**"

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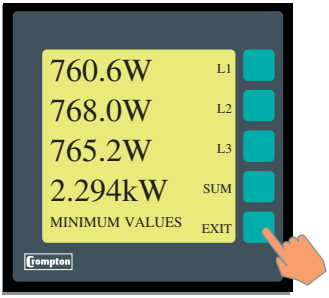


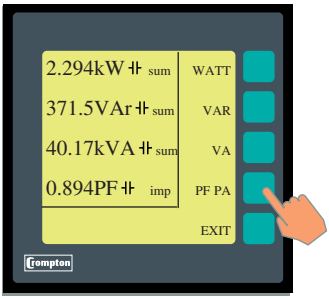

The minimum values are shown.

Press "**EXIT**"

Press "**MAX**" shows the maximum values.

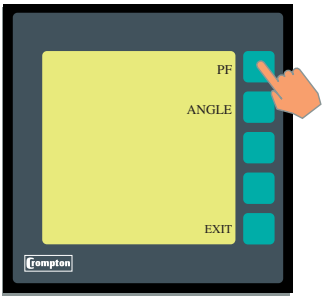
Press "**EXIT**"

Press "**EXIT**" again




All the screen stages for "**WATT**" are repeated for "**VAR**" and "**VA**".

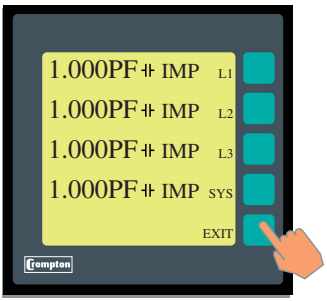
Press "**PF PA**"




On pressing "**PF PA**" the display offers two choices for displaying the phase relationships: Power Factor ("**PF**") and Phase Angle ("**ANGLE**").

Either choice will give the same information, displayed in the chosen way.

Press "**PF**"



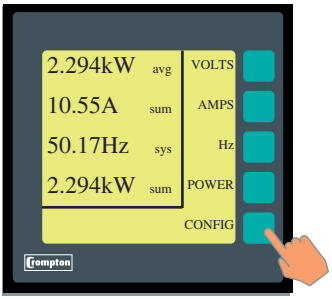

The power factor for each phase, and the sum, is displayed.

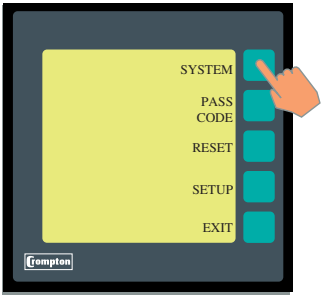
Two pieces of information are shown to indicate the Quadrant in which the load is operating:

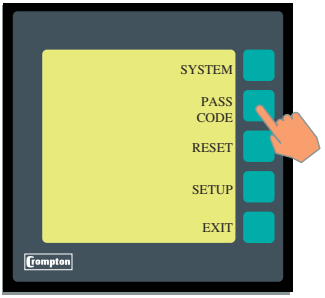
A symbol is used to indicate a Capacitive (⫪) or Inductive (⊔) load. The direction is shown as "**IMP**" for Importing and "**EXP**" Exporting.

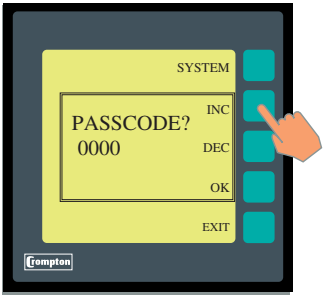
The only soft prompt available is "**EXIT**" which will take you to the previous screen.

The "**EXIT**" button is pressed as many times as necessary to return to the first menu screen. Note that if a key is not pressed for approximately one minute the display will automatically revert to the initial screen. This will not occur if a screen has been held by using the "**HOLD**" button.




## Customisation

Press "**NEXT**"

Press "**CONFIG**"

This enters into the customising area of the menu structure. All critical functions request confirmation. Pressing "**EXIT**" again allows easy escape without change.

The unit will revert to the initial screen approximately one minute after the last keypress. This means it cannot be left in a configuration menu. Any partially completed changes will be discarded.

There are four main options:

"**SYSTEM**" Gives status information for field service personnel.

"**PASSCODE**" Allows the user to change the protection passcode

"**RESET**" Allows the user to clear the hours related counters, the Minimum and Maximum values and the Demand values.

"**SETUP**" Allows the user to customise the Scaling, Demand period and Output options if fitted.

Press "**SYSTEM**"

The "**SYSTEM**" screen provides the following information:

- Firmware version.
- Communications speed, number of data bits, number of stop bits, parity and address.
- Protocol installed
- Electrical system configuration.

Press "**EXIT**"

## Passcode

Press "**PASSCODE**"

All settings that alter the operation of the unit are passcode protected. The user must enter the correct code before access to the configuration menu is allowed.

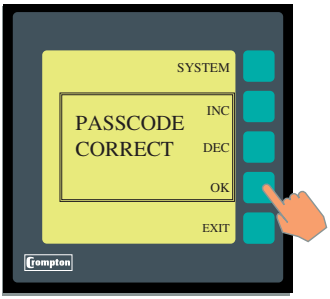
*NOTE: The factory default setting is "0000"*

Once this passcode has been entered, it remains valid for all menus. If the keys are not pressed for a one minute period the unit exits the configuration menu and returns to the default screen. The passcode will have to be re-entered for any further configuration.

The passcode is a number between 0000 and 9999. It can be changed by the user to any number. The factory default is 0000.

Pressing "**OK**" with the factory default password will allow access to the customisation.

*NOTE: To secure system settings, countries and configuration a password should always be used.*

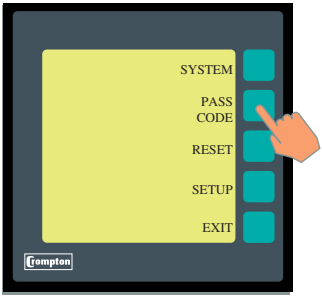



To select the passcode, the "**INC**" and "**DEC**" keys are used to increment and decrement the displayed number. Pressing the "**DEC**" key with 0000 displayed will change the number to 9999.

The number will automatically increment and decrement if the "**INC**" or "**DEC**" key is held depressed. The longer the key is held, the faster the numbers will change.

Once the correct number is displayed, press the "**OK**" button.

If the displayed passcode matches the correct value, the screen will show "**PASSCODE CORRECT**" and return to the previous screen.

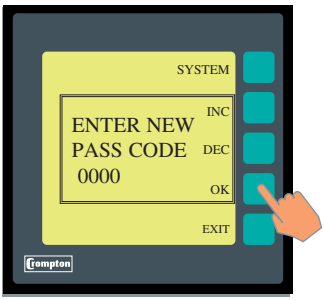



## Changing the Passcode

*NOTE: If the current passcode has not been entered during this configuration session the user will be prompted to enter it at this stage.*

Press "**EXIT**"

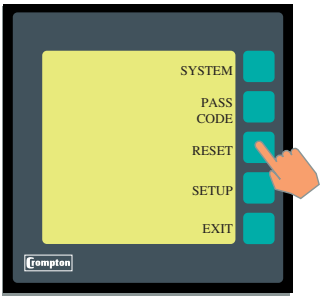
Press "**PASSCODE**"




To select the new passcode, the "**INC**" and "**DEC**" keys are used to increment and decrement the displayed number. Pressing the "**DEC**" key with 0000 displayed will change the number to 9999.

The number will automatically increment and decrement if the "**INC**" or "**DEC**" key is held depressed. The longer the key is held, the faster the numbers will change.

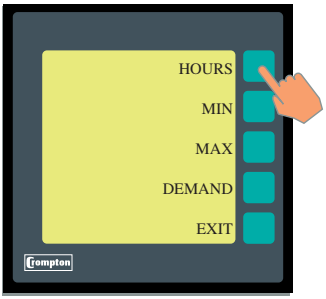
Once the desired number is displayed, press the "**OK**" button.




The screen will return to the previous menu

*NOTE : If the password is changed and subsequently forgotten, please contact your nearest sales and service centre for assistance. A list of telephone numbers and addresses is printed on the rear cover of this manual.*

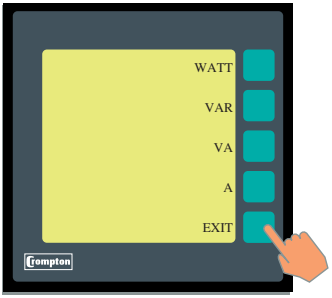
Press "**RESET**"




## Resetting Stored Values

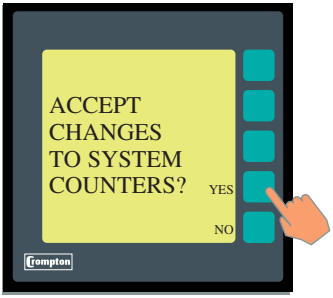
This menu allows the user to reset any of the stored values. These include all the hours related parameters ( W.h, VAr.h, VA.h, A.h), the Minimum values, the Maximum values and the Demand values.

Press "**HOURS**"




Press "**WATT**" to zero accumulated W.h. "**RESET**" will appear to the left indicating this choice has been made. A similar function is performed by the "**VAR**", "**VA**" and "**A**" keys.

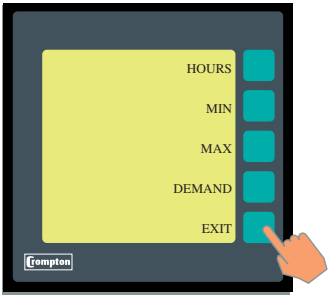
Press "**EXIT**"




The screen now asks the operator to confirm changes.

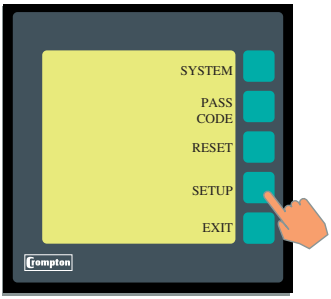
"**YES**" will implement the changes and take the user back to the reset screen.

"**NO**" will not implement the changes, but will also take the user back to the reset screen.



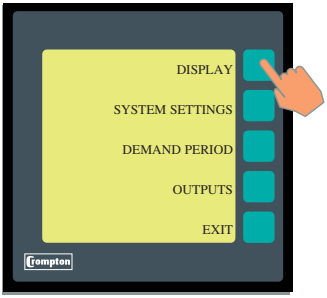

The "**MIN**", "**MAX**" and "**DEMAND**" keys perform a similar function to the stored minimum, maximum and demand values.

Press "**EXIT**"




## Setting up the INTEGRA 2000 display

Press "**SETUP**"




This screen offers four options:

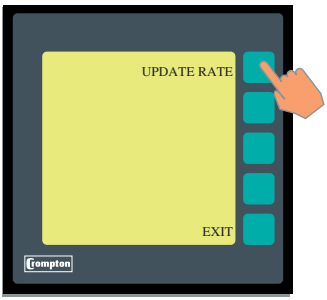
"**DISPLAY**" allows the user to adjust the display update time.

"**SYSTEM SETTINGS**" allows the user to enter CT and VT ratios. The unit will then display all parameters scaled to the primary values.

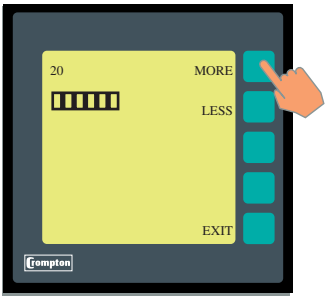
"**DEMAND PERIOD**" allows the user to change the integration period of the Maximum Demand functions. The same interval is used for all parameters.

"**OUTPUTS**" allows the configuration of the optional output modules.

Press "**DISPLAY**"




Press "**UPDATE RATE**". This screen allows the screen update time to be modified. The standard update time is approximately 100ms but users can progamme the Integra 2000 to override up to 20 updates thereby avoiding digit roll. Analogue and digital outputs are not affected by this feature. The bar flashes at the selected rate to assist selection.

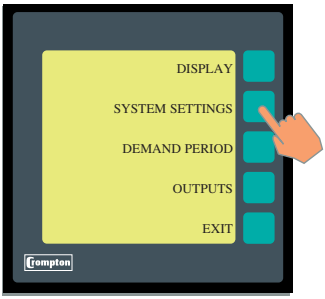



Press and hold the "**MORE**" or "**LESS**" buttons, this will increment the number on the far left or the screen.

The higher the number, ("**MORE**") the higher the number of updates missed.

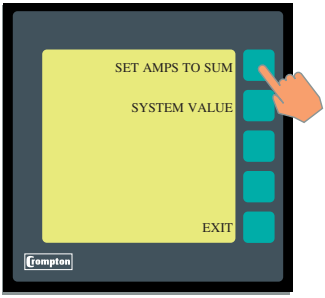
The lower the number, ("**LESS**") the lower the number of updates missed.

Press "**EXIT**" twice to return to the set-up screen.




## System Settings

Press "**SYSTEM SETTINGS**"




By pressing "**SET AMPS TO SUM**" you answer a question.

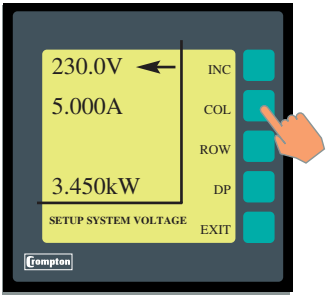
"**SET AMPS TO SUM**" or "**SET AMPS TO AVERAGE**"

This screen if the sum on the average of the three phases of current are displayed on the default screen.

Press "**SYSTEM VALUES**"

This screen is used to set up the primary system voltage and current values. The values entered here should be the primary values of the system CT's and VT's.

e.g. if a 40/5 CT is used, the current setting should read 40.



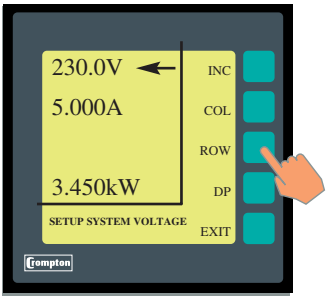

For a 4 wire system, the voltage value is the Line to Neutral (L-N) voltage.

For a 3 wire system, the voltage value is the Line to Line (L-L) voltage.

"**INC**" increments the selected character over its available range

e.g. numbers = 0 to 9
parameters = V, kV, etc.

- If 6.8kV/110V VT is used, the voltage setting should read 6.800kV. The VT secondary voltage must be the same as the product voltage given on the label.
- If no VT is used, the voltage setting must be the same as the product voltage given on the label.

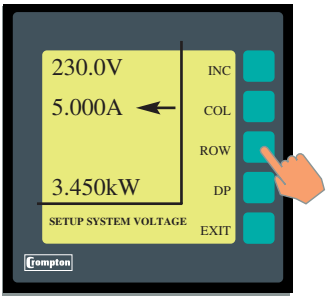



"**COL**" selects the column to be chaned by the "**INC**" button. The digit to be changed goes in to inverse mode.

"**DP**" (Decimal Point) Selects the correct decimal point position.

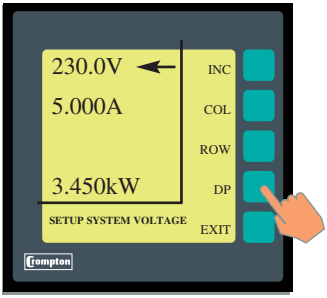
Change the voltage value to match the system primary value. When this has been done, press the "**ROW**" button.

Crompton INSTRUMENTS

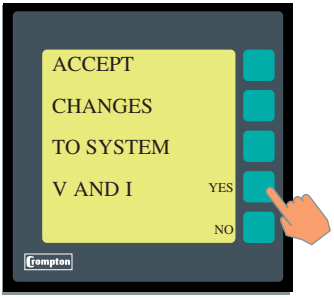



Change the current value to match the system primary value.

*Note: The watt reading will update automatically.*




Press "**EXIT**"

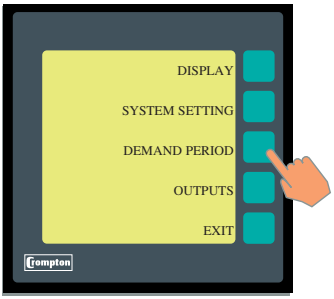



This screen now asks the operator to confirm changes.

"**YES**" will implement the changes and take the user back to the "**SETUP**" screen.

"**NO**" will not implement the changes but will also take the user back to the "**SETUP**" screen

Press "**EXIT**"




## Demand Period

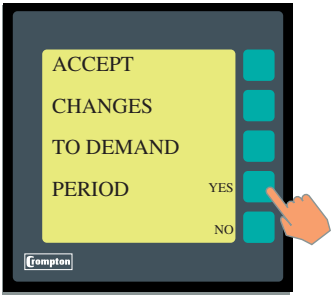
Press "**DEMAND PERIOD**"

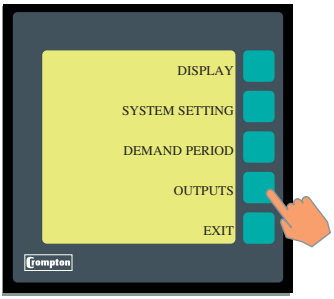
This screen sets up the two parameters that define the averaging response. Refer to Appendix A for further information. This uses the same procedure as the previous set up screen.

The SUB INTERVAL LENGTH can be any value between 1 and 30 minutes. The NUMBER OF SUB INTERVALS can be any value between 1 and 30.

On completion, press "**EXIT**"

Accept or ignore changes here.

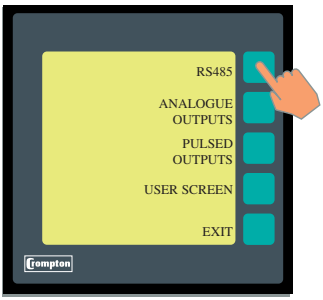





## Outputs

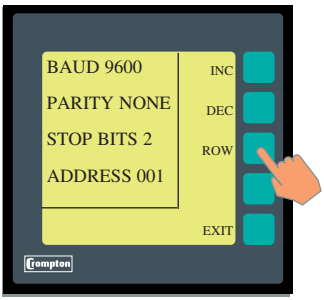
Press "**OUTPUTS**"

This screen lists the available output options supported by the unit. Note that although the software can be configured, additional hardware output modules may be required. Contact your local sales and service centre for assistance.




## Setting up the INTEGRA 2000 RS485 output

Press "**RS485**"

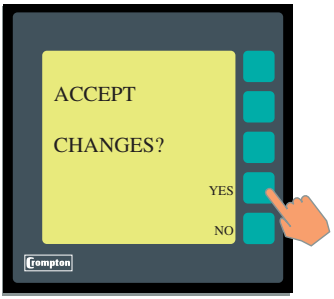



This screen allows the user to configure the parameters for the RS485 port. *NOTE: Communicatios settings for Johnsons Controls are fixed and pre set.* A pointer is shown next to the value being changed. The "**INC**" and "**DEC**" keys are used to increment and decrement the displayed value. The "**ROW**" key is user to move the pointer to the next parameter.

The Baud rate is selectable to 2400, 4800, 9600 and 19,200. The Parity can be set to EVEN, ODD or NONE.
The Stop Bits are adjusted automatically, depending on the Parity setting.

The address can be set to any value between 001 and 247. Address 0 (Broadcast mode) is not supported.

Press "**EXIT**" when the values have been amended correctly

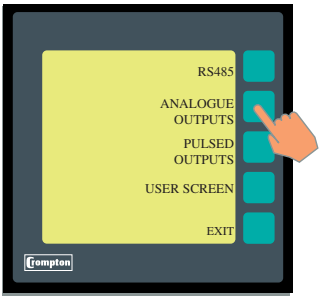


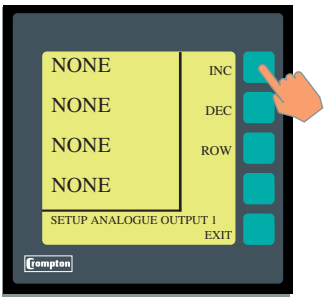

The screen now asks the operator to confirm changes.

"**YES**" will implement the changes

"**NO**" will discard the changes.

Pressing either key will take the user back to the output screen.




## Analogue Outputs

Press "**ANALOGUE OUTPUTS**"

This screen assigns a parameter to each of the four analogue outputs.

"**INC**" cycles the selected parameter forward through the list.

"**DEC**" cycles the selected parameter backwards through the list.

"**ROW**" moves the pointer to the next output channel.

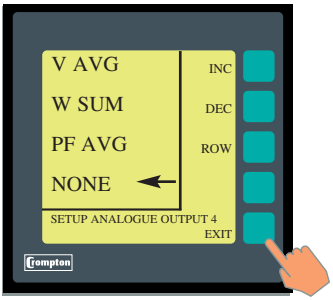
All of the keys will auto-repeat if held down.

| Parameter | Description | Scaling |
|---|---|---|
| NONE | No assigned value | Zero |
| V 1 | Volts 1 | 0-100% |
| V 2 | Volts 2 | 0-100% |
| V 3 | Volts 3 | 0-100% |
| V AVG | Volts Average | 0-100% |
| V L1/L2 | Volts L1-L2 | 0-100%** |
| V L2/L3 | Volts L2-L3 | 0-100%** |
| V L3/L1 | Volts L3-L1 | 0-100%** |
| V L/L AVG | Volts L-L Average | 0-100%** |
| I 1 | Current 1 | 0-100% |
| I 2 | Current 2 | 0-100% |
| I 3 | Current 3 | 0-100% |
| I SUM | Current Sum | 0-100% |
| I AVG | Current Average | 0-100% * |
| I NEUTRAL | Neutral Current | 0-100% * |
| W 1 IMP | Watts 1 Import | 0-100% * |
| W 2 IMP | Watts 2 Import | 0-100% * |
| W 3 IMP | Watts 3 Import | 0-100% * |
| W SUM IMP | Watts Sum Import | 0-100% * |
| W 1 EXP | Watts 1 Export | 0-100% * |
| W 2 EXP | Watts 2 Export | 0-100% * |
| W 3 EXP | Watts 3 Export | 0-100% * |
| W SUM EXP | Watts Sum Export | 0-100% * |
| VAR 1 IMP | VAr 1 Import | 0-100% * |
| VAR 2 IMP | VAr 2 Import | 0-100% * |
| VAR 3 IMP | VAr 3 Import | 0-100% * |
| VAR SUM IMP | VAr Sum Import | 0-100% * |
| VAR 1 EXP | VAr 1 Export | 0-100% * |
| VAR 2 EXP | VAr 2 Export | 0-100% * |
| VAR 3 EXP | VAr 3 Export | 0-100% * |
| VAR SUM EXP | VAr Sum Export | 0-100% * |
| VA 1 | VA 1 | 0-100% |
| VA 2 | VA 2 | 0-100% |
| VA 3 | VA 3 | 0-100% |
| VA SUM | VA Sum | 0-100% |
| HZ | Frequency | 45-65 Hz |
| PHANGLE 1 | Phase Angle 1 | +180° / 0 / -180° |
| PHANGLE 2 | Phase Angle 2 | +180° / 0 / -180° |
| PHANGLE 3 | Phase Angle 3 | +180° / 0 / -180° |
| ANGLE AVG | Phase Angle Average | +180° / 0 / -180° |
| PF 1 | Power Factor 1 | +180° / 0 / -180° |
| PF 2 | Power Factor 2 | +180° / 0 / -180° |
| PF 3 | Power Factor 3 | +180° / 0 / -180° |
| PF AVG | Power Factor AVG | +180° / 0 / -180° |

* = For Watts and Vars, the output is positive for both Import and Export directions.

** = 3 phase 4 wire mode only.

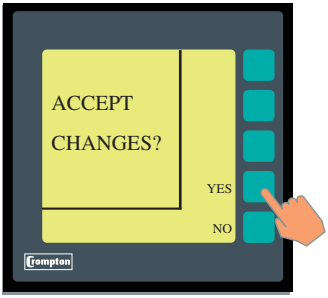
Crompton INSTRUMENTS




If any output is assigned to be "**NONE**", a zero value will be transmitted.

The same value may be assigned to more than one output if necessary.

Once all four outputs have been assigned, press "**EXIT**"

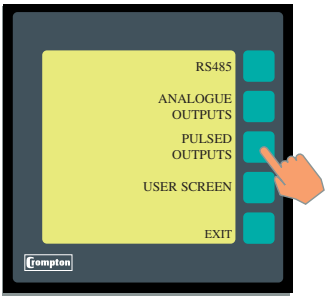



The screen now asks the operator to confirm changes.

"**YES**" will implement the changes

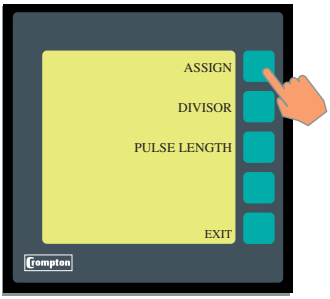
"**NO**" will discard the changes

Pressing either key will take the user back to the output screen.




## Pulsed Outputs

Press "**PULSED OUTPUTS**"



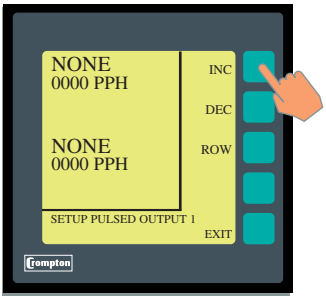

This menu has three options:

"**ASSIGN**" assigns a parameter to each output

"**DIVISOR**" enables a divide ratio of 10, 100 or 1000

"**PULSE LENGTH**" sets the duration of the pulse length from 20mS to 200mS

Press "**ASSIGN**"




This screen assigns a parameter to each of the pulsed outputs.

"**INC**" cycles the selected parameter forward through the list.

"**DEC**" cycles the selected parameter backwards through the list.

"**ROW**" moves the pointer to the other output channel.

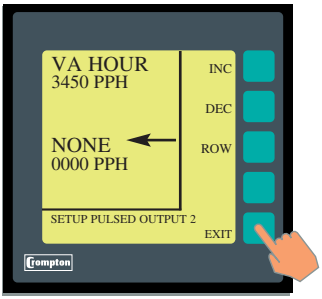
All of the keys will autorepeat if held down.

The line reading "**0000 PPH**" indicates how many pulses per hour will be output for that parameter at full scale power. This number is automatically determined by the unit from the VT and CT ratio settings made in the main setup menu. The number of pulses may be divided down using the "**DIVISOR**" option, described later.

*NOTE: The maximum pulse rate is 3600 pulses per hour. Suitable for systems up to 3.6 MW (3,600 kW). If greater than 3.6 MW pulses autorange to 1 pulse per MW.h.*

The list of parameters is as follows:

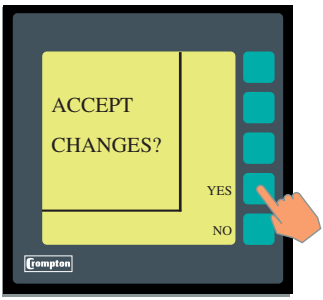
| Parameter | Description |
|---|---|
| NONE | No assigned value |
| IMP WATT HR | Import Watt Hours |
| EXP WATT HR | Export Watt Hours |
| IMP VAR HR | Import VAr Hours |
| EXP VAR HR | Export VAr Hours |
| VA HOUR | VA Hours |
| AMP HOUR | Amp Hours |




If any output is assigned to be "**NONE**", no pulses will be transmitted.

The same value may be assigned to more than one output if necessary.

Once both outputs have been assigned, press "**EXIT**"

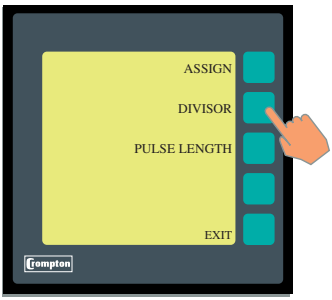



The screen now asks the operator to confirm changes.

"**YES**" will implement the changes

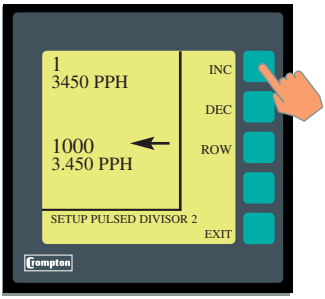
"**NO**" will discard the changes

Pressing either key will take the user back to the pulsed output screen.




The "**DIVISOR**" screen enables a divide ratio of 10, 100 or 1000. This allows the user to program the unit to output a lower number of pulses according to the system requirements. For example, setting the divisor to 1000 will output kilowatt hour pulses, and setting the divisor to 1 will output Watt hour pulses.

Press "**DIVISOR**"




This screen assigns a divisor value to each of the pulsed outputs.

"**INC**" cycles the value between 1, 10, 100 and 1000.

"**DEC**" cycles the value backwards through the list.

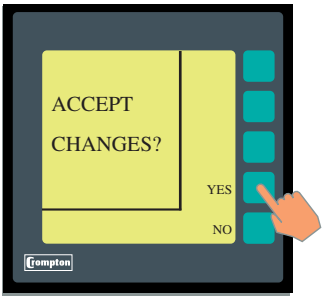
"**ROW**"moves the pointer to the other output channel.

All of the keys will autorepeat if held down.

Note that the Pulses per hour (PPH) figure is automatically calculated to show the number of pulses that will be transmitted at full-scale power.

NOTE: If the system power is scaled in kW then the default pulse rate is 1 pulser perkWh (up to 3,600 kW system). If the system power (see system settings) is over 3.6 MW then the pulse rates adjust accordingly to 1 pulse per MWh.

Crompton INSTRUMENTS

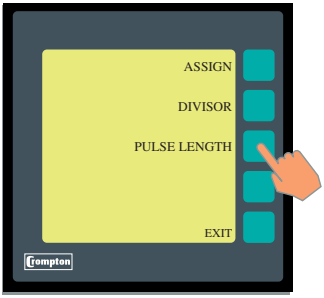



The screen now asks the operator to confirm changes.

"**YES**" will implement the changes

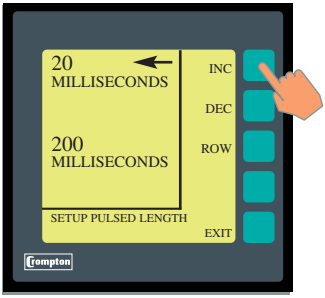
"**NO**" will discard the changes

Pressing either key will take the user back to the pulsed output screen.




The "**PULSE LENGTH**" screen enables the width of each output pulse to be adjusted in 20mS increments between 20 and 200mS.

Press "**PULSE LENGTH**"

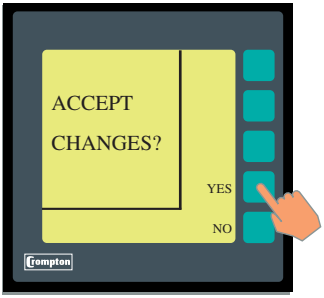



"**INC**" increases the value in 20mS increments up to a maximum of 200mS

"**DEC**" decreases the value in 20mS increments down to a minimum of 20mS

"**ROW**" moves the pointer to the other output channel.

All of the keys will autorepeat if held down.




The screen now asks the operator to confirm changes.

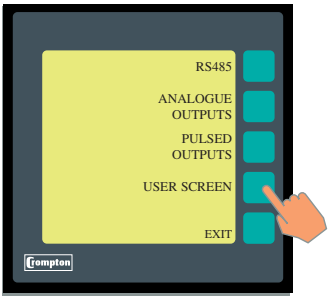
"**YES**" will implement the changes

"**NO**" will discard the changes

Pressing either key will take the user back to the pulsed output screen.

Press "**EXIT**" again to return to the output screen

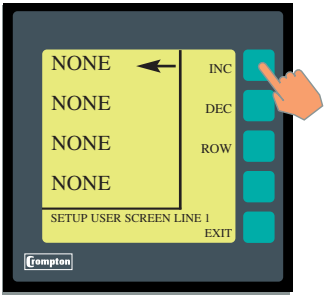
Crompton INSTRUMENTS




## Setting up the INTEGRA 2000 user screen

The unit defaults to an initial screen after a period of one minute from the last button press. This initial screen may be changed to display particular parameters of interest. The factory default setting of Vavg, Asum, Hz and Wsum is shown if a user screen is not programmed, or if all choices are set to NONE.

Press "**USER SCREEN**"




This screen assigns a parameter to each of the four screen lines.

"**INC**" cycles the selected parameter forward through the list.

"**DEC**" cycles the selected parameter backwards through the list.

"**ROW**"moves the pointer to the next zone.

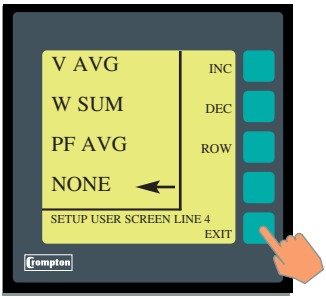
All of the keys will autorepeat if held down.

The list of parameters is as follows:

| Parameter | Description |
|---|---|
| NONE | No assigned value |
| V 1 | Volts 1 |
| V 2 | Volts 2 |
| V 3 | Volts 3 |
| V AVG | Volts Average |
| V L1/L2 | Volts L1-L2* |
| V L2/L3 | Volts L2-L3* |
| V L3/L1 | Volts L3-L1* |
| V L/L AVG | Volts L-L Average* |
| I 1 | Current 1 |
| I 2 | Current 2 |
| I 3 | Current 3 |
| I SUM | Current Sum |
| I AVG | Current Average |
| I NEUTRAL | Neutral Current |
| W 1 | Watts 1 |
| W 2 | Watts 2 |
| W 3 | Watts 3 |
| W SUM | Watts Sum |
| VAR 1 | VAr 1 |
| VAR 2 | VAr 2 |
| VAR 3 | VAr 3 |
| VAR SUM | VAr Sum |

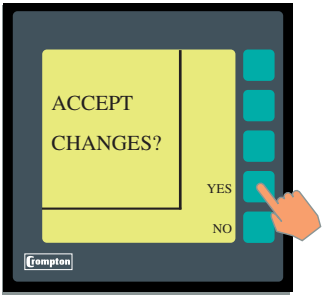
| Parameter | Description |
|---|---|
| VA 1 | VA 1 |
| VA 2 | VA 2 |
| VA 3 | VA 3 |
| VA SUM | VA Sum |
| HZ | Frequency |
| PHANGLE 1 | Phase Angle 1 |
| PHANGLE 2 | Phase Angle 2 |
| PHANGLE 3 | Phase Angle 3 |
| ANGLE AVG | Phase Angle Average |
| PF1 | Power Factor 1 |
| PF2 | Power Factor 2 |
| PF3 | Power Factor 3 |
| PF AVG | Power Factor Average |
| IMP WATT HR | Import Watt Hours |
| EXP WATT HR | Export Watt Hours |
| IMP VAR HR | Import Var Hours |
| EXP VAR HR | Export Var Hours |
| VA HOUR | VA Hours |
| AMP HOUR | Amp Hours |

* = 3 phase 4 wire mode only




If any line is assigned to be "**NONE**", a blank space will be shown. If all four lines are assigned "**NONE**" the factory default screen of Vavg, Asum, Hz and Wsum is shown.

Once all four lines have been assigned, press "**EXIT**"

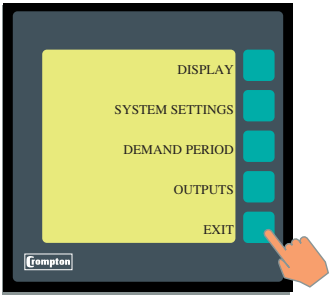



The screen now asks the operator to confirm changes.

"**YES**" will implement the changes

"**NO**" will discard the changes

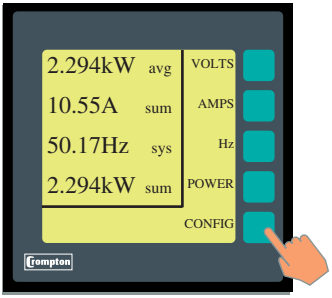
Pressing either key will take the user back to the output screen.




Press "**EXIT**" once again to return to the setup screen.

Press "**EXIT**" to return to the configuration screen.

Press "**EXIT**" to return to the measurement screen.

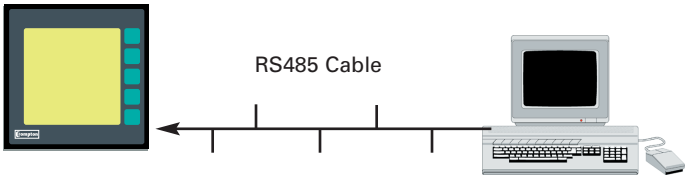



The user is returned to the first menu screen.

If no user screen has been defined the soft prompts will disappear after a short time and will return to the large character active reading screen.

If a user screen has been defined this will be shown immediately.

Normally the characters will retain their usual size, i.e. voltage being the largest size and energy the second size. However, if one of the lines selected is normally the second size then all lines will also be the second size.




## Option 1 - RS485 Digital Outputs

### MODBUS® Implementation

INTEGRA 2000 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 (half duplex), 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.

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 cable should be terminated with a resistor at each end.

The address of each Integra 2000 can be set to any value between 1 and 247. Broadcast mode (address 0) is not supported.

The maximum latency time of an Integra 2000 is 200mS (Average 50mS) 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 2000 is not going to respond.

The format for each byte in RTU mode is:

| | |
|---|---|
| Coding System: | 8-bit binary, hexadecimal 0-9, A-F<br>Two hexadecimal characters contained in each 8-bit field of the message. |
| Data Format: | 4 bytes (32 bits) per parameter.<br>Floating point format ( to IEEE 754)<br>Most significant byte first.<br>Reversed format available upon request. |
| Bits per Byte: | 1 start bit<br>8 data bits, least significant bit sent first<br>1 bit for even/odd parity; no bit for no parity<br>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, 19200bps

All settings are user configurable via the setup screens.

The Crompton Instruments “Guide to RS485 communications” and “The Modbus® protocol - a detailed guide” can be viewed from the CD catalogue or website.

See the customisation section for details.

## Register Addresses

Each parameter is held in a consecutive word address as defined in the Modbus Protocol. 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 (0h).

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 |
| | | N° of words | = | 02 |
| | Volts 2 | Start address | = | 02 |
| | | N° 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 | Wire | | |
|---|---|---|---|---|
| | | 4 | 3 | 2 |
| 1 | Demand Time | √ | √ | √ |
| 2 | Number of Sub-Intervals | √ | √ | √ |
| 3 | Sub-Interval Length | √ | √ | √ |

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 these parameters and code 16 to write to them.

The Demand Time (Address 1) is used to reset the demand period. A value of zero (0) must be written to this register to accomplish this. Writing any other value will cause an error to be returned.

The value written in to addresses 2 and 3 must be in the range 1 to 30, otherwise an error will be returned.

See Appendix A for further information on the Demand Parameters.

## Modbus® Register Addresses

| Parameter No | Modbus Start Address | | Parameter | Integra 2000 Configuration (No of Wires) | | |
|---|---|---|---|---|---|---|
| | High Byte | Low Byte | | 4 | 3 | 2 |
| 1 | 00 | 00 | Volts 1 | ✓ | ✓ | ✓ |
| 2 | 00 | 02 | Volts 2 | ✓ | ✓ | x |
| 3 | 00 | 04 | Volts 3 | ✓ | ✓ | x |
| 4 | 00 | 06 | Current 1 | ✓ | ✓ | ✓ |
| 5 | 00 | 08 | Current 2 | ✓ | ✓ | x |
| 6 | 00 | 0A | Current 3 | ✓ | ✓ | x |
| 7 | 00 | 0C | Watts 1 | ✓ | x | ✓ |
| 8 | 00 | 0E | Watts 2 | ✓ | x | x |
| 9 | 00 | 10 | Watts 3 | ✓ | x | x |
| 10 | 00 | 12 | VA 1 | ✓ | x | ✓ |
| 11 | 00 | 14 | VA 2 | ✓ | x | x |
| 12 | 00 | 16 | VA 3 | ✓ | x | x |
| 13 | 00 | 18 | VAr 1 | ✓ | x | ✓ |
| 14 | 00 | 1A | VAr 2 | ✓ | x | x |
| 15 | 00 | 1C | VAr 3 | ✓ | x | x |
| 16 | 00 | 1E | Power Factor 1 | ✓ | x | ✓ |
| 17 | 00 | 20 | Power Factor 2 | ✓ | x | x |
| 18 | 00 | 22 | Power Factor 3 | ✓ | x | x |
| 19 | 00 | 24 | Phase Angle 1 | ✓ | x | ✓ |
| 20 | 00 | 26 | Phase Angle 2 | ✓ | x | x |
| 21 | 00 | 28 | Phase Angle 3 | ✓ | x | x |
| 22 | 00 | 2A | Volts Ave | ✓ | ✓ | ✓ |
| 23 | 00 | 2C | Reserved | | | |
| 24 | 00 | 2E | Current Ave | ✓ | ✓ | ✓ |
| 25 | 00 | 30 | Current Sum | ✓ | ✓ | ✓ |
| 26 | 00 | 32 | Reserved | | | |
| 27 | 00 | 34 | Watts Sum | ✓ | ✓ | ✓ |
| 28 | 00 | 36 | Reserved | | | |
| 29 | 00 | 38 | VA Sum | ✓ | ✓ | ✓ |
| 30 | 00 | 3A | Reserved | | | |
| 31 | 00 | 3C | VAr Sum | ✓ | ✓ | ✓ |
| 32 | 00 | 3E | Power Factor Ave | ✓ | ✓ | ✓ |
| 33 | 00 | 40 | Reserved | | | |
| 34 | 00 | 42 | Phase Angle Ave | ✓ | ✓ | ✓ |
| 35 | 00 | 44 | Reserved | | | |
| 36 | 00 | 46 | Frequency | ✓ | ✓ | ✓ |
| 37 | 00 | 48 | W.hr Import | ✓ | ✓ | ✓ |
| 38 | 00 | 4A | W.hr Export | ✓ | ✓ | ✓ |
| 39 | 00 | 4C | VAr.h Import | ✓ | ✓ | ✓ |
| 40 | 00 | 4E | VAr.h Export | ✓ | ✓ | ✓ |
| 41 | 00 | 50 | VA.h | ✓ | ✓ | ✓ |
| 42 | 00 | 52 | A.h | ✓ | ✓ | ✓ |
| 43 | 00 | 54 | W Demand Import | ✓ | ✓ | ✓ |
| 44 | 00 | 56 | W Max. Demand Import | ✓ | ✓ | ✓ |
| 45 | 00 | 58 | W Demand Export | ✓ | ✓ | ✓ |
| 46 | 00 | 5A | W Max. Demand Export | ✓ | ✓ | ✓ |
| 47 | 00 | 5C | VAr Demand Import | ✓ | ✓ | ✓ |
| 48 | 00 | 5E | VAr Max Demand Import | ✓ | ✓ | ✓ |
| 49 | 00 | 60 | VAr Demand Export | ✓ | ✓ | ✓ |
| 50 | 00 | 62 | VAr Demand Export | ✓ | ✓ | ✓ |
| 51 | 00 | 64 | VA Demand | ✓ | ✓ | ✓ |
| 52 | 00 | 66 | VA Max. Demand | ✓ | ✓ | ✓ |
| 53 | 00 | 68 | A Demand | ✓ | ✓ | ✓ |
| 54 | 00 | 6A | A Max. Demand | ✓ | ✓ | ✓ |
| 55 | 00 | 6C | Volts 1 Max. | ✓ | ✓ | ✓ |

| Parameter No | Modbus Start Address | | Parameter | Integra 2000 Configuration (No of Wires) | | |
|---|---|---|---|---|---|---|
| | High Byte | Low Byte | | 4 | 3 | 2 |
| 56 | 00 | 6E | Volts 1 Min. | ✓ | ✓ | ✓ |
| 57 | 00 | 70 | Volts 2 Max. | ✓ | ✓ | x |
| 58 | 00 | 72 | Volts 2 Min. | ✓ | ✓ | x |
| 59 | 00 | 74 | Volts 3 Max. | ✓ | ✓ | x |
| 60 | 00 | 76 | Volts 3 Min. | ✓ | ✓ | x |
| 61 | 00 | 78 | Current 1 Max. | ✓ | ✓ | ✓ |
| 62 | 00 | 7A | Current 1 Min. | ✓ | ✓ | ✓ |
| 63 | 00 | 7C | Current 2 Max. | ✓ | ✓ | x |
| 64 | 00 | 7E | Current 2 Min. | ✓ | ✓ | x |
| 65 | 00 | 80 | Current 3 Max. | ✓ | ✓ | x |
| 66 | 00 | 82 | Current 3 Min. | ✓ | ✓ | x |
| 67 | 00 | 84 | Volts Average Max. | ✓ | ✓ | ✓ |
| 68 | 00 | 86 | Volts Average Min. | ✓ | ✓ | ✓ |
| 69 | 00 | 88 | Reserved | | | |
| 70 | 00 | 8A | Volts Sum Min. | x | x | x |
| 71 | 00 | 8C | Reserved | | | |
| 72 | 00 | 8E | Reserved | | | |
| 73 | 00 | 90 | Current Sum Max. | ✓ | ✓ | ✓ |
| 74 | 00 | 92 | Current Sum Min. | ✓ | ✓ | ✓ |
| 75 | 00 | 94 | Watt 1 Max. | ✓ | x | ✓ |
| 76 | 00 | 96 | Watt 1 Min. | ✓ | x | ✓ |
| 77 | 00 | 98 | Watt 2 Max. | ✓ | x | x |
| 78 | 00 | 9A | Watt 2 Min. | ✓ | x | x |
| 79 | 00 | 9C | Watt 3 Max. | ✓ | x | x |
| 80 | 00 | 9E | Watt 3 Min. | ✓ | x | x |
| 81 | 00 | A0 | Watt Sum Max. | ✓ | ✓ | ✓ |
| 82 | 00 | A2 | Watt Sum Min. | ✓ | ✓ | ✓ |
| 83 | 00 | A4 | VAr 1 Max. | ✓ | x | ✓ |
| 84 | 00 | A6 | VAr 1 Min. | ✓ | x | ✓ |
| 85 | 00 | A8 | VAr 2 Max. | ✓ | x | x |
| 86 | 00 | AA | VAr 2 Min. | ✓ | x | x |
| 87 | 00 | AC | VAr 3 Max. | ✓ | x | x |
| 88 | 00 | AE | VAr 3 Min. | ✓ | x | x |
| 89 | 00 | B0 | VAr Sum Max. | ✓ | ✓ | ✓ |
| 90 | 00 | B2 | VAr Sum Min. | ✓ | ✓ | ✓ |
| 91 | 00 | B4 | VA1 Max. | ✓ | x | ✓ |
| 92 | 00 | B6 | VA 1 Min. | ✓ | x | ✓ |
| 93 | 00 | B8 | VA 2 Max. | ✓ | x | x |
| 94 | 00 | BA | VA 2 Min. | ✓ | x | x |
| 95 | 00 | BC | VA3 Max. | ✓ | x | x |
| 96 | 00 | BE | VA3 Min. | ✓ | x | x |
| 97 | 00 | C0 | VA Sum Max. | ✓ | ✓ | ✓ |
| 98 | 00 | C2 | VA Sum Min. | ✓ | ✓ | ✓ |
| 99 | 00 | C4 | Frequency Max. | ✓ | ✓ | ✓ |
| 100 | 00 | C6 | Frequency Min. | ✓ | ✓ | ✓ |
| 101 | 00 | C8 | V L1-L2 | ✓ | x | x |
| 102 | 00 | CA | V L2-L3 | ✓ | x | x |
| 103 | 00 | CC | V L3-L1 | ✓ | x | x |
| 104 | 00 | CE | V L-L Ave | ✓ | x | x |
| 105 | 00 | D0 | V L1-L2 Max | ✓ | x | x |
| 106 | 00 | D2 | V L1-L2 Min | ✓ | x | x |
| 107 | 00 | D4 | V L2-L3 Max | ✓ | x | x |
| 108 | 00 | D6 | V L2-L3 Min | ✓ | x | x |
| 109 | 00 | D8 | V L3-L1 Max | ✓ | x | x |
| 110 | 00 | DA | V L3-L1Min | ✓ | x | x |
| 111 | 00 | DC | V L-L Ave Max | ✓ | x | x |
| 112 | 00 | DE | V L-L Ave Min | ✓ | x | x |
| 113 | 00 | E0 | I Neutral | ✓ | x | x |

## Appendix B: Instrument Holding Registers

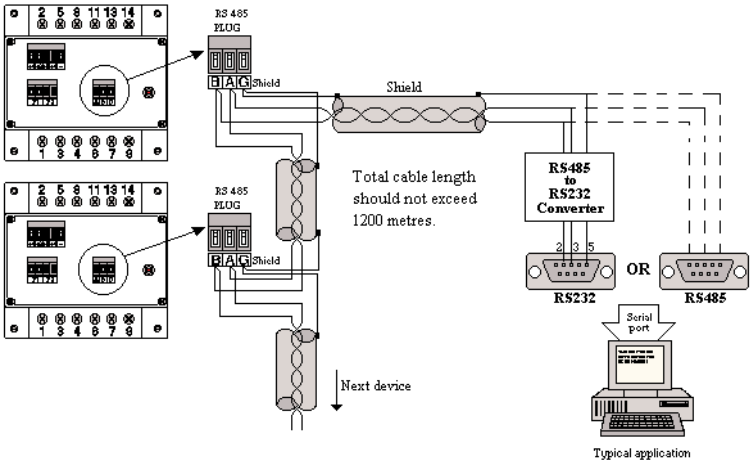
In the table the "System Configuration" is defined by the number of wires, 4 represents a 3 phase 4 wire system, 3 represents a 3 phase 3 wire system and 2 represents a single phase system.

| Parameter No | Modbus Start Address | | Parameter |
|---|---|---|---|
| | High Byte | Low Byte | |
| 1 | 00 | 00 | Demand Time |
| 2 | 00 | 02 | Demand Period |
| 3 | 00 | 04 | Demand Interval |
| 4 | 00 | 06 | System Volts |
| 5 | 00 | 08 | System Current |
| 6 | 00 | 0A | System Type |
| 7 | 00 | 0C | Relay Pulse Width |
| 8 | 00 | 0E | Energy Reset |
| 12 | 00 | 16 | Pulse Width Divisor |

**Important Note: Energy counters**

The front panel display has an 8-digit capability for 'kilowatt-hour' and 'kVAr-hour' values, and this count will automatically roll-over to zero once the 8-digit value exceeds 99,999,999. The associated Modbus registers are scaled in 'Watt-hour' and 'VAr-hour' and will automatically roll-over to zero once a numerical value of 4,294,967,296 has been accumulated. The Modbus and display values are in-step until the energy count exceeds 4,294,967 kwh, after which the Modbus count starts again from zero, but the display count continues to increment. The display and Modbus counters can be re-synchronised by resetting the energy counters to zero, easily done through the Integra front panel or via Modbus by writing to a holding register.

## Output Connection Diagram




### Notes

### Line Topology

Each end of the cable should be terminated with a resistor. A typical value is 600Ω. Consult the cable manufacturers data or the system interogator for the exact value. Depending on the cable used and the length of the cable run may not require any termination loading. The impedance of the termination load should match the impedance of the cable being used and should be at both ends of the line. The load should be made up of a resistor and a capacitor in series across the 'A' and 'B' terminals.

### Loop Line Topology

A loop ring topology may be used if preferred. In this case no termination resistors are required.

### Full Duplex/Half Duplex

Integra is half duplex (2 wire) i.e. transmits and receives on the same pair of wires. If the master has 4 connections (2 receive and 2 transmit i.e. full duplex) then common +(A)'s together and also common both -(B)'s. However make sure PLC is RS485 (4 wire) and not RS422. Also check data synchronisation i.e. half or full duplex. The PLC must be operating at the same baud rate as Integra and also half duplex.

## Option 2 - 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 2000 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 from:**
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

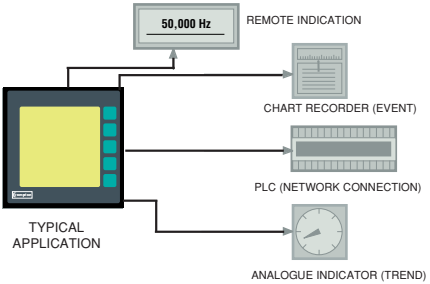
When integrating the Crompton equipment into a Metasys Network, keep the following considerations in mind.

- 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 |

| NPT | NPA | Description | Units |
|---|---|---|---|
| ADF | 1 | V1 | Volts |
| ADF | 2 | V2 | Volts |
| ADF | 3 | V3 | Volts |
| ADF | 4 | I1 | Amps |
| ADF | 5 | I2 | Amps |
| ADF | 6 | I3 | Amps |
| ADF | 7 | Watts Line 1 | KWatts |
| ADF | 8 | Watts Line 2 | KWatts |
| ADF | 9 | Watts Line 3 | KWatts |
| ADF | 10 | VA Line 1 | KVA |
| ADF | 11 | VA Line 2 | KVA |
| ADF | 12 | VA Line 3 | KVA |
| ADF | 13 | VAR Line 1 | KVAr |
| ADF | 14 | VAR Line 2 | KVAr |
| ADF | 15 | VAR Line 3 | KVAr |
| ADF | 16 | PF Line 1 | |
| ADF | 17 | PF Line 2 | |
| ADF | 18 | PF Line 3 | |
| ADF | 19 | Phase Angle Line 1 | • |
| ADF | 20 | Phase Angle Line 2 | • |
| ADF | 21 | Phase Angle Line 3 | • |
| ADF | 22 | System V Average | Volts |
| ADF | 23 | System I Sum | Amps |
| ADF | 24 | System W Sum | KW |
| ADF | 25 | System VA Sum | KVA |
| ADF | 26 | System VAr Sum | KVAr |
| ADF | 27 | System PF Average | |
| ADF | 28 | System Phase Angle Average | • |
| ADF | 29 | System Frequency | Hz |
| ADF | 30 | Import Watt Hour Register | KWhr |
| ADF | 31 | Export Watt Hour Register | KWhr |
| ADF | 32 | System Import VAr Hour Register | KVArhr |
| ADF | 33 | System Export VAr Hour Register | KVArhr |
| ADF | 34 | System VA Hour Register | KVAhr |
| ADF | 35 | System A Hour Register | Ahr |
| ADF | 36 | Demand (Import W) | KW |
| ADF | 37 | MAX Demand (Import W) | KW |
| ADF | 38 | Demand (Export W) | KW |
| ADF | 39 | MAX Demand (Export W) | KW |
| ADF | 40 | Demand (Import VAr) | KVAr |
| ADF | 41 | MAX Demand (Import VAr) | KVAr |
| ADF | 42 | Demand (Export VAr) | KVAr |
| ADF | 43 | MAX Demand (Export VAr) | KVAr |
| ADF | 44 | Demand (VA) | KVA |
| ADF | 45 | MAX Demand (VA) | KVA |
| ADF | 46 | Demand (I) | Amps |
| ADF | 47 | MAX Demand (I) | Amps |
| ADF | 48 | V1 Max | Volts |
| ADF | 49 | V1 Min | Volts |
| ADF | 50 | V2 Max | Volts |

| NPT | NPA | Description | Units |
|---|---|---|---|
| ADF | 51 | V2 Min | Volts |
| ADF | 52 | V3 Max | Volts |
| ADF | 53 | V3 Min | Volts |
| ADF | 54 | I1 Max | Amps |
| ADF | 55 | I1 Min | Amps |
| ADF | 56 | I2 Max | Amps |
| ADF | 57 | I2 Min | Amps |
| ADF | 58 | I3 Max | Amps |
| ADF | 59 | I3 Min | Amps |
| ADF | 60 | System V Average Max | Volts |
| ADF | 61 | System V Average Min | Volts |
| ADF | 62 | System I Max | Amps |
| ADF | 63 | System I Min | Amps |
| ADF | 64 | W1 Max | KWatts |
| ADF | 65 | W1 Min | KWatts |
| ADF | 66 | W2 Max | KWatts |
| ADF | 67 | W2 Min | KWatts |
| ADF | 68 | W3 Max | KWatts |
| ADF | 69 | W3 Min | KWatts |
| ADF | 70 | System W Max | KWatts |
| ADF | 71 | System W Min | KWatts |
| ADF | 72 | VAr 1 Max | KVAr |
| ADF | 73 | VAr 1 Min | KVAr |
| ADF | 74 | VAr 2 Max | KVAr |
| ADF | 75 | VAr 2 Min | KVAr |
| ADF | 76 | VAr 3 Max | KVAr |
| ADF | 77 | VAr 3 Min | KVAr |
| ADF | 78 | System VAr Max | KVAr |
| ADF | 79 | System VAr Min | KVAr |
| ADF | 80 | VA 1 Max | KVA |
| ADF | 81 | VA 1 Min | KVA |
| ADF | 82 | VA 2 Max | KVA |
| ADF | 83 | VA 2 Min | KVA |
| ADF | 84 | VA 3 Max | KVA |
| ADF | 85 | VA 3 Min | KVA |
| ADF | 86 | System VA Max | KVA |
| ADF | 87 | System VA Min | KVA |
| ADF | 88 | Hz Max | Hz |
| ADF | 89 | Hz Min | Hz |
| ADF | 90 | VL1L2 | Volts |
| ADF | 91 | VL2L3 | Volts |
| ADF | 92 | VL3L1 | Volts |
| ADF | 93 | System VLL Average | Volts |
| ADF | 94 | VL1L2 Max | Volts |
| ADF | 95 | VL1L2 Min | Volts |
| ADF | 96 | VL2L3 Max | Volts |
| ADF | 97 | VL2L3 Min | Volts |
| ADF | 98 | VL3L1 Max | Volts |
| ADF | 99 | VL3L1 Min | Volts |
| ADF | 100 | System VLL Average Max | Volts |
| ADF | 101 | System VLL Average Min | Volts |




## Option 3 - Analogue Outputs

This module provides four d.c. isolated outputs.

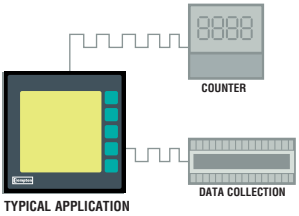
The 4-20mA output module must be powered from an external 24V d.c. source.

Pin 16a = 0V
Pin 16b = +24V

The output signals are presented on pins 15a to 15d.

See the output connection details for further clarification.

These outputs can be individually assigned to represent any one of the measured and displayed parameters.
All settings are user configurable via the user interface screens. See the customisation section for details.




## Option 4 - Pulsed Outputs

These modules supply pulses proportional to measured power.

INTEGRA 2000 can be configured via options to two pulsed outputs. Outputs are relays which are fully isolated, volt free contacts.

Both relays are user definable to any of the hours related energy parameters e.g. Wh, VArh, VAh and Ah.

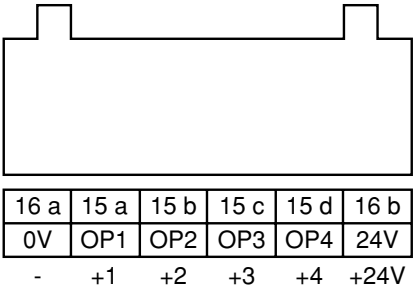
The pulse width and rate are both user definable via the user interface screens.

See the customisation section for details.

Connection is made via a port screw clamp connector capable at accepting 2.5mm$^2$ cable.

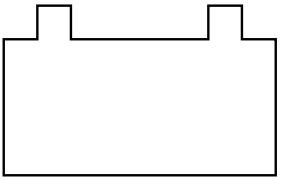
## Output Connection Details

**Analogue Outputs - 4-20mA**



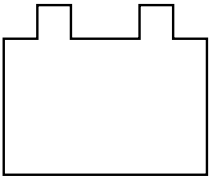
| 16 a | 15 a | 15 b | 15 c | 15 d | 16 b |
|---|---|---|---|---|---|
| 0V | OP1 | OP2 | OP3 | OP4 | 24V |
| - | +1 | +2 | +3 | +4 | +24V |

**Relay**



| 21 | 24 | 25 | 28 |
|---|---|---|---|
| Com | N/O | Com | N/O |
| RLA2 | | RLA1 | |

**RS485**



| 31 | 32 | 33 |
|---|---|---|
| B | A | Gnd |

# Appendix A

## 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 2000 uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument. As many different time constants are in use by the different power utilities, Integra 2000 can be configured to conform to any desired demand response.

The demand period is made up of a number of sub-intervals. Each sub-interval can be between 1 and 30 minutes duration. There can be between 1 and 30 sub-intervals in one demand period.

For example, a 15 minute demand period may be represented as 1x15 minutes,

3 x 5 minutes or 5 x 3 minutes. For each of these cases, the demand value will be updated every 15, 5 or 3 minutes respectively.

When the demand period is reset, the values in the Demand and Maximum Demand registers are set to zero. The Demand screen will show “TIMING” during the first demand period, as the values are misleading until the sliding window has been filled with valid readings. The display shows how many sub-intervals have been selected, and how many have elapsed. Once valid readings are being shown, the display counts through each sub-interval in Seconds.

The length of each sub-interval and the number of them may be altered via the RS485 port using the MODBUS protocol. The demand period can also be reset, which allows synchronisation to other equipment.

## Neutral Current Calculation

The neutral current value is calculated from the sum of the three vector currents and is provided as an indication of the neutral current load and has a worst case accuracy tolerance of ±4% of end scale.

# Appendix B

## Product Specification

### INPUTS

| | | | |
|---|---|---|---|
| Voltage | V maximum.<br>Measuring Range 10 - 100%<br>Range of use 5 - 120% | | |
| Current | 5 amps (1A optional).<br>Measuring Range 10 - 100%<br>Range of use 5 - 120% | | |
| Frequency | 45 to 66Hz | | |
| Power Factor | Range of use -1 / 0 / 1 / 0 /-1 | | |
| Overloads | Voltage<br>2x overload, applied 10 times for 1 second at 10 second intervals.<br>Max terminal voltage 600V<br>Current 20x overload, applied 5 times for 1 secondat 5 minute intervals.<br>Max continuous terminal current 6A | | |
| Burden | Voltage Each phase 0.02VA<br>Current Each phase 0.6VA | | |

### OUTPUTS

| | | | |
|---|---|---|---|
| Digital | Ports | | |
| | 1 off - | RS485 | |
| | | Protocol | Modbus® RTU |
| | | Style | 3 way 2 part screw clamp |
| Analogue | 4 off - | Linear | 4-20mA dc into 0-500Ω<br>Uni-directional<br>Externally powered.<br>24V d.c. (16V -27V) |
| | | Style - | 6 way 2 part screw clamp |
| Pulsed | Type | | |
| | | Relay | SPNO |
| | | Switching. | 100V dc 0.5A. |
| | | Style | 2 part screw clamp. |

### ISOLATION

| | |
|---|---|
| Input to Digital O/P. Fibre | = Infinite. |
| RS485 | = 2.2kV. |
| Input to Analogue O/P. | = 2.2kV |
| Input to Pulsed O/P. | = 2.2kV |
| Digital O/P to Analogue O/P | = Not Isolated. |

## MAXIMUM OPERATING VOLTAGE (W.R.T. GROUND)

| | |
|---|---|
| Voltage inputs: | 346V |
| Current inputs: | 24V |
| Digital / Analogue outputs: | 100V |
| Pulsed outputs: | 100V |

## ACCURACY CLASS

| | |
|---|---|
| Voltage | 0.5% of reading ±4 Digits |
| Current | 0.5% of reading ±4 Digits |
| Power | 1.0% of reading ±4 Digits |
| Frequency | 0.1% of mid freq. ±2 Digits |
| Phase Angle/ Power Factor | 1.0% of reading ±4 Digits |

Note: The accuracy of calculated line-line voltages in 4 wire units is dependant upon the phase angle between the voltages.

| | |
|---|---|
| Display update | 1 per second. 80mS approx. |
| Analogue O/P | 1.5% of ES. |
| Analogue update | 1 per second. |
| RS485 O/P | As accuracies above. |
| RS232 O/P | As accuracies above. |
| RS232 O/P | Update 50ms Average, 200mS Maximum |

## CLIMATIC

| | | |
|---|---|---|
| Temperature: | operating | 0 / 50°C |
| | storage | -20 /+65°C |
| | calibration | 23°C |
| Temperature Coefficent: | | ±0.013%/°C |
| Humidity: | | 95% RH non condensing |
| Enclosure Code: | | IP54 |

## AUXILIARY SUPPLY

100 - 250 V AC/DC

12 - 48 V DC (option)

| | |
|---|---|
| Burden | 6VA |
| Analogue output supply: | 24V d.c. (16-27V), clean (transients limited to 20V peak) cable to be screened. |

## STANDARDS AND APPROVALS

Complies with the relevent parts of the following standards.

Consult factory for approvals listing.

| | |
|---|---|
| Safety | IEC 1010/BSEN 61010-1, UL1244, CSA 22-2 (General electrical and mechanical safety requirement) IEC 664, VDE 0110, PD 6499 (insulation on low voltage systems) |
| Enclosure | EN60529, IEC 529, BS5490, (IP ratings & Fixings) DIN 43700 (Housing) |
| EMC | Emmisions BS EN 50081/1 Immunity BS EN 50082/2 |
| Test | Measuring circuit BSEN 60688, IEC 688 |
| Method | Performance BS4889, IEC 359 BSEN 61036, IEC 1036 (kWh functionality) |

## Notes

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