Installation and Operating Instructions

Integra 1560 and 1580
Digital Metering and Transducer Systems

TE *ENERGY*
connectivity

Contents   Page

Important safety information is contained in the Installation and Maintenance section. Users must familiarise themselves with this information before attempting installation or other procedures.

Contents   Page

1. Introduction

The Crompton Integra 1560/1580 is a measuring and communication instrument available with digital, analogue or LED display interfaces. Typically, it is used in conjunction with an Integra display unit. When a permanent display is not required, the display can be temporarily connected for set up and system commissioning, and then disconnected. The Integra configuration software tool running on a Windows platform may also be used for set-up. RS485 communications ports can be connected to a display or to a Modbus master. One RS485 communications port also supports Johnson Controls N2 protocol. Options include LonWorks and Profibus interfaces.

The Integra 1560/1580 will measure and communicate many electrical parameters, including THD values. All voltage and current measurements are RMS calculated for accurate measurement of non sinusoidal waveforms. An option is available for metered neutral current.

Not all configurations and options described in this manual may be immediately available. Contact your supplier for details of availability.

The Integra is available with either DIN rail or surface mounting options.

System	DIN Rail Mounting Model No.	Surface Mounting Model No.
Single Phase 2 Wire	INT-1561	INT-1581
Single Phase 3 Wire	INT-1562	INT-1582
3 Phase 3 Wire	INT-1563	INT-1583
3 Phase 4 Wire	INT-1564	INT-1584
3 Phase 4 Wire with metered neutral	INT-1565	INT-1585

The set up of the Integra 1560/1580 may be carried out by using the Crompton Integra display unit or Integra configuration software – the relevant user documentation gives more information on :

    Configuring for use with installed current transformers
    Setting Potential Transformer / Voltage Transformer ratios, where required
    Demand Integration Time
    Resetting demand and energy
    Pulsed output set up
    Communications (RS485) set up
    Analogue output set up
    Password protection of set up screens to prevent accidental modification

If required, most set up parameters may also be manipulated directly via the Modbus interface.

If required, set up parameters may be manipulated directly via the Modbus interface. The Integra can be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. Versions are available to suit 100-250V 50-60 Hz a.c./d.c. and 12-48V d.c supplies.

Some models have a black top cover. These products omit some features available on models with red translucent top cover. Where appropriate, these features will be indicated in this document with an ¬ symbol. The 1565/1585 is always configured with a red top cover. When powered, a low power red light source will be visible through the back cover.

Modbus, Lonworks and Profibus are trademarks of their respective owners. All trademarks are acknowledged.

Interfaces include:

- Display or RS485 Modbus RTU Port (standard)
- Second Modbus or Display Port (optional)
- One or two Energy Pulse Relays representing kWh and kvarh (optional)
- One Analogue Output Channel (optional)
- Second Analogue Output Channel (optional)
- LonWorks free topology twisted pair network interface
- Profibus interface

The Analogue outputs provide a current output that indicates the value of a chosen parameter. Not all options may be fitted to the same unit. Pre sales literature indicates valid option combinations and ordering codes.

Connections for all interfaces are via detachable two-part screw clamp connectors, except Profibus which provides a conventional 9 pin interface.

1.1 Measurement Capabilities

The 1560/1580 can measure the following:

System voltage (average of all phases)
System current (average of all phases)
Voltage and Current Total Harmonic Distortion
System frequency (Hz)
Voltage line to neutral for each phase (not 3 phase 3 wire systems)
Voltage line to line for each phase
Current in each line.
Neutral current (calculated, or metered with 4th CT option R)
Power Factor
Active Power (kW)
Reactive Power (kvar)
Apparent Power (kVA)
Active Energy (kWh) Import and Export
Reactive Energy (kvarh) Import and Export
Total System Current Demand (AD)
Total System Active Power Demand (kWD)
Maximum Total System Current Demand (Max AD)
Maximum Total System Active Power Demand (Max kWD)

1.2 Maximum Power

The 1560/1580 is limited to a maximum power of 360 MW. During set-up, primary voltage and current setting are checked and the unit will not accept entries that breach the 360 MW limit. This is covered in more detail in the sections that show primary voltage and current set-up. The Maximum Power restriction of 360 MW refer to 120% of nominal current and 120% of nominal voltage, i.e. 250 MW nominal system power.

1.3 Secondary Voltage

The 1560/1580 allows the user to specify, within a range, the secondary voltage of the potential transformer (PT) with which it is to be used. In this document the term Potential Transformer and Voltage Transformer are equivalent.

1.4 Demand Calculation

The maximum power consumption of an installation is often important, as power utilities base some of their charges on it. Many utilities use a thermal maximum demand indicator (MDI) to measure this peak power consumption and the Integra digitally models this thermal response.

Demand Integration Times can be set to 8, 15, 20, 30 or (R only) 60 minutes.

<u>Maximum</u> Demand is the maximum power or current demand that has occurred since the unit was last reset.

1.5 RS485 Serial Option

This option provides an RS485 serial port with Modbus or JC N2 protocol to provide a means of remotely monitoring and controlling the Integra unit. Both protocols are supplied in the same unit, but only on one of the serial ports. The second port is limited to Modbus or display communications. Communications automatically configure according to the protocol that is recognized when the master sends a message. The controlling and monitoring unit may also be a remote display.

Where a free port is available, it can be connected to a PC for control and monitoring purposes.

When used in Modbus systems, baud rate and data format can be user configured.

1.6 Pulse Output Option

This option provides one or two relay pulse output indications of measured active energy (kWh) and reactive energy consumed (kvarh). The unit can produce one pulse for every 1, 10,100 or 1000kWh/kvarh of energy consumed. The pulse divisor and pulse width (duration) can be user configured. When two pulse outputs are fitted, they share a common divisor value and pulse width.

1.7 Analogue Output Option (R)

This option provides an analogue current output that indicates the value of a chosen parameter. The parameter and active range can be user configured. Units fitted with analogue output option include an extended top cover.

1.8 Lonworks Option

The Lonworks option provides a standard free topology FTT10A transceiver. Lonworks implementations include a Modbus port. This Modbus port is used when a local Integra display is required or for setting up the unit from Crompton configuration software.

1.9 Profibus Option

The Profibus option provides an RS485 interface capable of operating at up to 10Mb/s. Profibus implementations include Modbus port. This Modbus port is used when a local Integra display is required or for setting up the unit from Crompton configuration software.

2 Communications set up

2.1 Introduction

Modbus, JC N2, LonWorks and Profibus communication options all require specific set up of the internal communication parameters.

The table summarises these settings

Protocol	Baud Rate (k baud)	Parity and stop bits	Address	Notes
Modbus	Match network *	Match Network *	1-247	
JCN2	9.6	No 1	1-247	
LonWorks	19.2	No 2	1	
Profibus	Do Not Change	Do Not Change	1-125	
Integra Display	Automatic	Automatic	Automatic	See Section 4.3

* These parameters should be set to match the communications parameters of the associated network.

2.2 RS485 Baud Rate

The RS485 Baud Rate option only sets the Baud Rate for an RS485 port that is not communicating with a display unit. The port characteristics for communication with a display are preset.

If the JC N2 protocol is to be used, the baud rate must be set to 9.6. If the Lonworks option is fitted, this setting must be set to 19.2.

If a display is detected on an RS485 port at start-up, any user settings for that port will be ignored. If the Profibus option is fitted, the user set baud rate is ignored at start up. It is recommended that the baud rate is not changed by the user when a Profibus option is fitted is fitted as this will disable the Profibus interface. Normal operation may be resumed by power cycling the Integra.

2.3 RS485 Parity / stop bits Selection

If the Lonworks option is fitted, this setting must be set to no parity two stop bits.

The RS485 Parity Selection option only sets the parity for a port that is not communicating with a display unit. The port characteristics for communication with a display are preset. If the JC N2 protocol is to be used, this parameter must be set to No parity and One stop bit. If the Profibus option is fitted, the user set parity and stop bits are ignored at start up. It is recommended that the baud rate is not changed by the user when a Profibus option is fitted as this will disable the Profibus interface. Normal operation may be resumed by power cycling the Integra.

2.3.1 RS485 Modbus , JC N2 or Profibus Address

If the Lonworks option is fitted, this setting must be set to 1.

If the JC N2 protocol is to be used, the address may not be set higher than 247.

If the Profibus option is fitted, this address must not be set higher than 125, and an address of 0 (zero) is not available. The Profibus interface checks this setting on power up only. If it is necessary to change the Profibus address then the Integra should be power cycled after setting the new address.

The Address option only sets the address for a port that is not communicating with a display unit. The port characteristics for communication with a display are preset.

3 Analogue Output Set Up

3.1.1 Introduction

The user may choose what measurement an analogue output is to represent and the span and offset of input range that the output will indicate.

For each analogue output fitted, provision is made for five values to be user selected. These are:

A1r - Parameter, from Table 3.1.6. This is the measured electrical parameter that is to be represented by the analogue output, for example, Watts or Frequency.

A1rt - Reading Top. This is the value of the electrical parameter that will cause the analogue output to produce maximum (output top)

A1rb - Reading Bottom. This is the value of the electrical parameter that will cause the analogue output to produce minimum (output bottom)

A1ot - Output Top. This is the value of output that will be reached when the measured electrical parameter is at the reading top value.

A1ob - Output Bottom. This is the value of output that will be reached when the measured electrical parameter is at the reading bottom value.

To illustrate, a simple example is shown in Section 3.1.3.

3.1.1.1 Setting up via LED display

When setting the unit up via the LED display, user selectable values are abbreviated as follows:

	For channel 1	For Channel 2
Parameter	A1r	A2r
Reading Top	A1rt	A2rt
Reading Bottom	A1rb	A2rb
Output Top	A1ot	A2ot
Output Bottom	A1ob	A2ob

The example shows the set-up for the first analogue channel. Set-up of the second analogue output is identical except that the screens indications are as above. At the end of the set up for the second analogue output pressing >> will exit the set up system and enter A2rb - Reading Bottom.

It is recommended that a 3 or 4 output unit be set up with Integra configuration software, however setting up can be performed with a display unit only, with some limitations. Only channels 1 and 2 may be directly set, and channels 3 and 4 are automatically configured as detailed in the autoconfiguration section below.

3.1.1.2 Autoconfiguration on 3 channel analogue output 1563 and 1564

For a 3 output unit, if the "lead channel" is set to phase 1 of a measurement that is available for all three phases, the "follower channels" are set up identically, including reading top, reading bottom, output top and output bottom, their outputs corresponding to phase 2 and 3 of that parameter. For a 3 output Integra, channel 1 is the lead channel and 2 and 3 follow.

For 1564

If channel 1 set to	Then 2 is set to	and channel 3 is set to
V1	V2	V3
I1	I2	I3
kW1	kW2	kW3
kVA1	kVA2	kVA3
kvar1	kvar2	kvar3
Power Factor 1	Power Factor 2	Power Factor 3
Phase Angle 1	Phase Angle 2	Phase Angle 3
VL1-2	VL2-3	VL3-1
THD V1	THD V2	THD V3
THD I1	THD I2	THD I3
Anything else	kW, 0 to max kW range	Kvar, 0 to max kvar range

For 1563

If channel 1 set to	Then 2 is set to	and channel 3 is set to
I1	I2	I3
VL1-2	VL2-3	VL3-1
THD V1	THD V2	THD V3
THD I1	THD I2	THD I3
Anything else	kW, 0 to max kW range	Kvar, 0 to max kvar range

For example, if channel 1 is set to I1, reading bottom to 200A and reading top to 300A, channels 2 and 3 will be set to represent current phases 2 and 3 respectively with the same span and offset as channel 1.

3.1.1.3 Autoconfiguration on 4 channel analogue output 1563 and 1564

For a 4 output unit, if the "lead channel" is set to phase 1 of a measurement that is available for all three phases, the "follower channels" are set up identically, including reading top, reading bottom, output top and output bottom, their outputs corresponding to phase 2 and 3 of that parameter. For a 4 output Integra, channel 2 is the lead channel and 3 and 4 follow.

For 1564

If channel 2 set to	Then channel 3 is set to	and channel 4 is set to
V1	V2	V3
I1	I2	I3
kW1	kW2	kW3
kVA1	kVA2	kVA3
kvar1	kvar2	kvar3
Power Factor 1	Power Factor 2	Power Factor 3
Phase Angle 1	Phase Angle 2	Phase Angle 3
VL1-2	VL2-3	VL3-1
THD V1	THD V2	THD V3
THD I1	THD I2	THD I3
Anything else	kW, 0 to max kW range	Kvar, 0 to max kvar range

For 1563

If channel 2 set to	Then channel 3 is set to	and channel 4 is set to
I1	I2	I3
VL1-2	VL2-3	VL3-1
THD V1	THD V2	THD V3
THD I1	THD I2	THD I3
Anything else	kW, 0 to max kW range	Kvar, 0 to max kvar range

For example, if channel 2 is set to I1, reading bottom to 200A and reading top to 300A, channels 3 and 4 will be set to represent current phases 2 and 3 respectively with the same span and offset as channel 1.

3.1.1.4 Manual override of autoconfigure operation

If autoconfiguration is not required, then set up the lead channel completely first, and then set follower channels manually to the desired option. Changing the lead channel to Phase 1 of a per phase parameter will automatically overwrite any manual settings made for the follower channels. Reading top, reading bottom, output top and output bottom changes made on the lead channel are also reflected on the follower channels,but only when the lead and follower channels indicate, in order, the 3 phases of one measurement. If the lead channel is changed to other than Phase 1 of a per phase parameter, then the following two channels are automatically set to kW, zero offset and span equal to full range, and to kvar, zero offset and span equal to full range. Autoconfiguration is disabled on 1561 and 1562.

3.1.2 Analogue set up features

3.1.2.1 Reverse Operation

It is possible to set reading top below reading bottom. In the example of Section 3.1.3, setting reading top parameter to 195 volts and reading bottom to 245 volts would cause the output current to decrease from 20mA to 4mA as the measured voltage increases from 195 to 245 volts.

3.1.2.2 Reduced output range

Note that if the output values are adjusted to reduce output range, accuracy may be degraded. For example, if a 0-20mA capable output is set to operate over 0-1mA, then the specified accuracy will be degraded by a factor of 20.

3.1.2.3 Fixed output value

By setting output top to equal output bottom, the output current will be set to that value irrespective of the level of the associated input parameter. This may be useful to check the operation of other systems using the analogue signal as an input.

3.1.3 Analogue Output Scaling Example

In this example, the Integra has an output current range of 4 to 20 mA and it is required that this output range represents an 'Average Volts' reading range of 195 to 245V. When set, output will be 4 mA when the measured voltage is 195 volts, 12 mA at 220 volts and 20 mA at 245 volts.

Note that when entering values via the Integra display, rounding of the desired values may occur as only 3 significant digits are available. Rounding of the desired values may be made very small by using the Integra configuration software which has more significant digits available.

3.1.3.1 Reading (A1r or A2r)

The measured electrical parameter that the analogue output will represent.

Example: Volts Ave (Average Voltage) - Parameter 22 in table 3.1.6

As shown in the table, any continuously variable parameter (volts, amps, power etc) can be selected for output as an analogue value. The table also shows those values that may be signed (where the value may go negative). Do not attempt to select values not shown in the table. Either the value will be rejected, or the analogue output will show unpredictable results. Normal operation can be restored by selecting a value shown in the table.

3.1.3.2 Reading Top (A1rt or A2rt)

This is the value of the electrical parameter that will cause the analogue output to produce 'Output Top'. Example: **245 volts.**

This value may be set to any value between zero and approximately 120% of nominal. (Or between –120% and +120% of values that may be signed for example var). Depending on the precise value chosen, range may be limited to about 119% of nominal. If the Integra will not accept a value of exactly 120% of nominal, lower the selected value slightly.

3.1.3.3 Reading Bottom (A1rb or A2 rb)

This is the value of the electrical parameter that will cause the analogue output to produce 'Output Bottom'.

Example: **195 volts.**

This value may be set to any value between zero and approximately 120% of nominal. (Or between –120% and +120% of values that may be signed for example var)

3.1.3.4 Output

The two output values specify the analogue current outputs that will represent the top and bottom reading values. They are included to allow a 0-20mA output to be converted to 4-20mA and to permit additional versatility where particular requirements prevail. However it is suggested that, in most cases, these values should be set to the limits that the hardware can cover. The range of the analogue output(s) for a particular unit is marked on the product label.

3.1.3.5 Output Top (A1ot or A2ot)

This is the value of output that will be reached when the measured electrical parameter is at the reading top value. Example: **20mA.**

3.1.3.6 Output Bottom (A1ob or A2ob)

This is the value of output that will be reached when the measured electrical parameter is at the reading bottom value. Example: **4mA.**
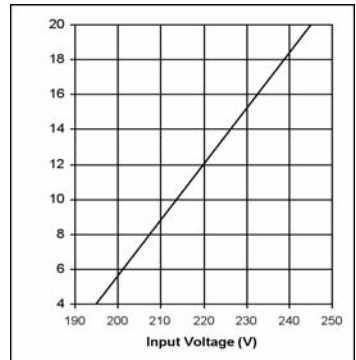
3.1.4 Power Factor

When analogue output current is used to represent power factor, it can indicate the power factor for an inductive or capacitive load on imported or exported power. This can be shown in two dimensions as follows:
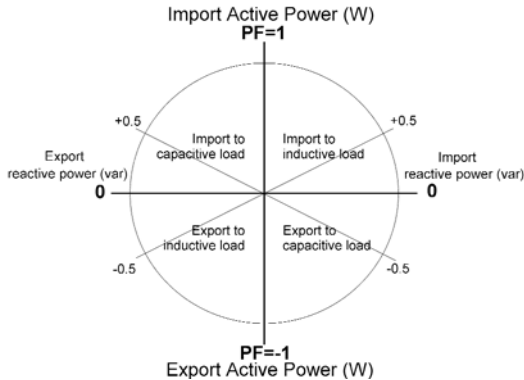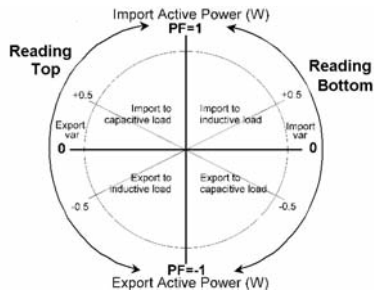

Power factor

The polarity of the power factor reading in the diagram above indicates the direction of active power flow:

Positive   PF relates to imported active power

Negative PF relates to exported active power.

When setting up the analogue output for a power factor reading, the Reading Top value must be in one of the left-hand quadrants and the Reading Bottom value must be in one of the right-hand quadrants. The analogue output range will always include unity PF (=1).


Hence, if the Reading Top value is set to –0.5, this will be a power factor of 0.5 for power exported to an **inductive** load (bottom **left-hand** quadrant). If a Reading Bottom value of –0.5 is specified, this will represent a power factor of 0.5 for power exported to a **capacitive** load (bottom **right-hand** quadrant). As a power factor of +1 (for true power imported to a resistive load) is always included in the analogue output range, the output would span –0.5 export inductive to –0.5 export capacitive.

In specifying the Output Top and Output Bottom values, there are two conventions – one for European areas of influence and one for North American areas. The two conventions are:

Europe   Output Top greater or more positive than Output Bottom.

USA   Output Top less or more negative than Output Bottom.

The examples below show cases where power is only imported and the load may be either capacitive or inductive. The Reading Top and Reading Bottom values of zero ensure that the whole range of possible (import) power factor readings is covered. The unit in the left-hand example has an analogue output range of +1 to –1 mA and, since the Output Top value (+1 mA) is more positive than the Output Bottom value (-1 mA), this arrangement complies with the European convention. The right-hand example shows the North American convention.
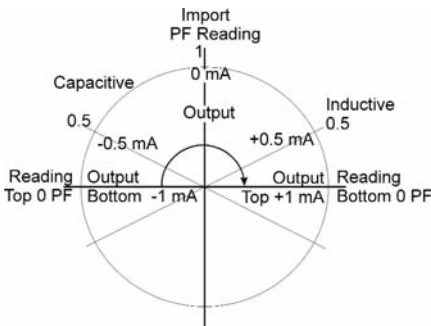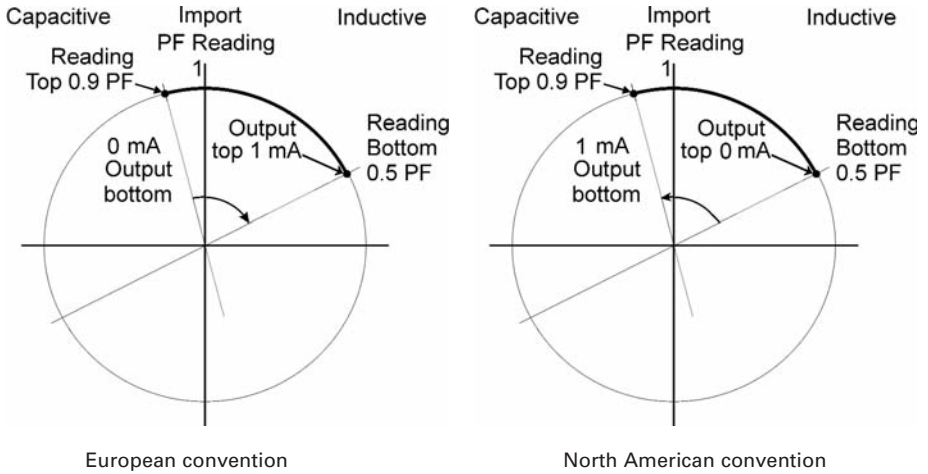

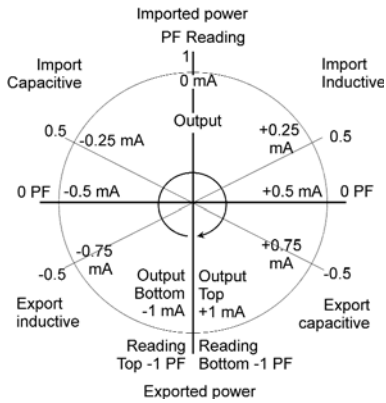European convention   North American convention
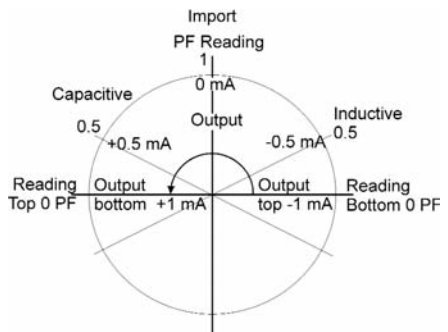
Symmetrical full-range, import only,

In the above symmetrical arrangement, 0 mA corresponds to unity power factor. This is not the case with the following asymmetrical arrangement.

European convention

North American convention

Asymmetrical, import only, mainly inductive

In the example above, the unit has an analogue output range of 0 to 1 mA, all power is imported and the load is inductive. The 1 mA Output range covers a reading power factor range of 0.6, from 0.9 capacitive to 0.5 inductive. The Output to Reading correlation is as follows:

| Reading	European convention Output	North American convention Output
0.9 Pf cap.	0 mA	1 mA
1 Pf	0.167 mA	0.833 mA
0.9 Pf ind.	0.333 mA	0.667 mA
0.8 Pf ind.	0.500 mA	0.500 mA
0.7 Pf ind.	0.667 mA	0.333 mA
0.6 Pf ind.	0.833 mA	0.167 mA
0.5 Pf ind.	1 mA	0 mA

| European convention | North American convention |
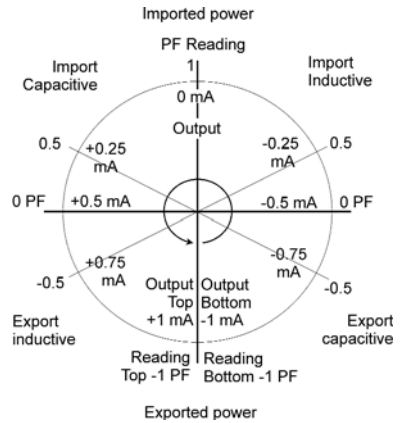
Symmetrical full-range import/export

In this example, the unit represents the full range of inductive and capacitive loads on imported and exported power. The unit has an analogue output range of −1 to +1 mA. Both Reading Top and Reading Bottom are set to −1 power factor.

3.1.5 Phase Angle

The Phase Angle analogue outputs are treated in a similar manner to Power Factor, with values specified in degrees. The following figure shows the relationship between phase angle in degrees and power factor
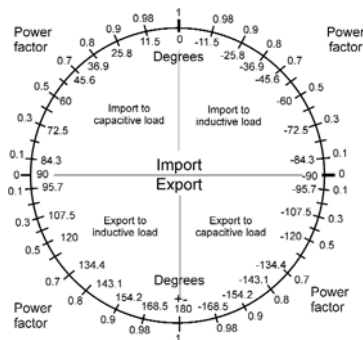
3.1.6 Parameters available for analogue outputs

Parameter Number	Parameter	3 Ø 4 wire	3 Ø 3 wire	1 Ø 3 wire	1 Ø 2 wire	+/-
1	Volts 1 (L1 – N or L1 – L2 3_3W)	✓	✓	✓	✓	
2	Volts 2 (L2 – N or L2 – L3 3_3W)	✓	✓	✓		
3	Volts 3 (L3 – N or L3 – L1 3_3W)	✓	✓			
4	Current 1	✓	✓	✓	✓	
5	Current 2	✓	✓	✓		
6	Current 3	✓	✓			
7	kW Phase 1	✓		✓	✓	✓
8	kW Phase 2	✓		✓		✓
9	kW Phase 3	✓				✓
10	kVA Phase 1	✓		✓	✓	
11	kVA Phase 2	✓		✓		
12	kVA Phase 3	✓				
13	kvar Phase 1	✓		✓	✓	✓
14	kvar Phase 2	✓		✓		✓
15	kvar Phase 3	✓				✓
16	Power Factor Phase 1	✓		✓	✓	✓
17	Power Factor Phase 2	✓		✓		✓
18	Power Factor Phase 3	✓				✓
19	Phase Angle Phase 1	✓		✓	✓	✓
20	Phase Angle Phase 2	✓		✓		✓
21	Phase Angle Phase 3	✓				✓
22	Volts Ave	✓	✓	✓	✓	
24	Current Ave	✓	✓	✓	✓	
25	Current Sum	✓	✓	✓	✓	
27	kWatts Sum	✓	✓	✓	✓	✓
29	kVA Sum	✓	✓	✓	✓	
31	kVAr Sum	✓	✓	✓	✓	✓
32	Power Factor Ave	✓	✓	✓	✓	✓
34	Average Phase Angle	✓	✓	✓	✓	✓
36	Frequency (range 40-70Hz)	✓	✓	✓	✓	
43	kW Demand Import	✓	✓	✓	✓	
44	kW Max. Demand Import	✓	✓	✓	✓	
53	A Demand	✓	✓	✓	✓	
54	A Max. Demand	✓	✓	✓	✓	
101	V L1-L2	✓		✓		
102	V L2-L3	✓				
103	V L3-L1	✓				
104	Average Line to Line Volts	✓		✓		
113	Neutral Current	✓		✓	✓	
118	THD Volts 1	✓	✓	✓	✓	
119	THD Volts 2	✓	✓	✓		
120	THD Volts 3	✓	✓			
121	THD Current 1	✓	✓	✓	✓	
122	THD Current 2	✓	✓	✓		
123	THD Current 3	✓	✓			
125	THD Voltage Mean	✓	✓	✓	✓	
126	THD Current Mean	✓	✓	✓	✓	

4 Serial Communications

4.1 Port 1 – Display, Modbus or JC N2

RS485 Integra 1560/1580 digital transducers have fitted as standard one communications port. This port can be used for either the Integra display unit, as an RS485 Modbus RTU port, or as a Johnson Controls N2 protocol slave. Choice of reply protocol is made by the Integra on the basis of the format of request, so that a Modbus request receives a Modbus reply, and an N2 protocol request receives an N2 protocol reply.

4.2 Port 2 Option – Display or Modbus

Integra 1560/1580 digital transducers can have an optional second RS485 communications port. This port can be used for either the Integra display unit or as an RS485 Modbus RTU port.

With the exception of JC N2 support, port 2 functions in the same way as port 1

4.3 Display auto detect

On power up the Integra 1560 and 1580 have a Display Auto Detect facility. For about five seconds the instrument will attempt to determine if a display is attached to a port. If it detects an Integra display unit is powered up and attached, the communication settings on that port will be fixed to display operation until the instrument is powered down.

If the display auto detect period expires without a display unit being detected, the Integra 1560/1580 will configure the port to use the communication parameters previously set for that port. If a display is subsequently connected to the port, it will generally not function correctly. Power cycle the Integra 1560/1580 to restore display correct operation. As recommended in the installation section, ideally the transducer and any associated displays should share a common auxiliary supply so that the auto detect mechanism can function properly. If this is not possible, then either the display auxiliary should start first, or the communications parameters for a port that is to be connected to a display should be set to 9600 baud, two stop bits, no parity and address 1.

4.4 Communications Parameter Set Up

If communications parameter options (baud rate, stop bits, parity, address) are set from an Integra display unit, the transducer modifies the communications settings of the other port. For example, any communications settings changes made on a display plugged into port 1 will affect port 2 only.

Communications parameter options set from the configuration program or another Modbus master affect the port on which the Modbus master is connected. Changes take effect only when the transducer is power cycled. For example, if the baud rate is currently set to 9600 baud and is then changed to 4800 baud, by a Modbus master on port 1, the acknowledgement and any subsequent communications are at 9600 baud. After the transducer has been power cycled, communications on port 1will be at 4800 baud. Communications parameters may be checked by connecting an Integra display to Port 2. Caution should be exercised with a single port transducer, as "lost" communications settings can only be recovered by trial and error, or return to factory.

4.5 More information

Further information is contained in the RS485 communication guide for the Integra. This document is available on the Crompton Instruments website (see back cover for address). E-mail support for specific issues is also available, however, this support is limited to integrating the Integra into a functional system. We are not able to provide more generalised support on communications systems that are better tackled by a local systems integrator.

4.6 LonWorks Interface

Integra is also available with an optional LonWorks interface for connection into twisted pair free topology networks. Lonworks option products also include an RS485 port. This port is primarily intended for an Integra LED display, but may also be used for Modbus interfaces, such as operation with the configuration program. This product is not intended to operate with both networks in constant use. Wiring connections are shown in section 10.2.5. Ensure that communications parameters configured from LED display or configuration program are set as recommended in section 2.2, 2.3 and 2.3.1. Further details of this interface are contained in the separate Integra Lonworks Communications guide available from the Crompton Instruments website. The Integra.xif file is also available from the website. The Neuron ID for the Integra is not externally recorded at manufacture – this information can only be determined using the service pin and a suitable software application.

E-mail support for specific issues is also available, however, this support is limited to integrating the Integra into a functional system. We are not able to provide more generalised support on communications systems that are better tackled by a local systems integrator.

4.7 Profibus Interface

Integra is also available with an optional Profibus interface. Profibus option products also include an RS485 port. This port is primarily intended for a LED display, but may also be used for Modbus interfaces, such as operation with the configuration program. This product is not intended to operate with both networks in constant use. Wiring connections are shown in section 10.2.6. Ensure that communications parameters configured from the Integra LED display or configuration program are set as recommended in section 2.2, 2.3 and 2.3.1. Further details of this interface are contained in the separate Integra Profibus Communications guide available from the Crompton Instruments website. E-mail support for specific issues is also available, however, this support is limited to integrating the Integra into a functional system. We are not able to provide more generalised support on communications systems that are better tackled by a local systems integrator.

5 Pulsed Output Option

One or two pulsed outputs are optionally available. (ℝ - Check with your distributor for availability)

These relays output pulses at a rate proportional to the measured Active import Energy (kWh) and Reactive import Energy (kvarh). When only one relay is fitted, it is configured for kWh.

When one relay is the only output option fitted, normally open contacts are available on the main terminal block, with terminal Identification 13 and 14.

On the 1565/1585, terminals 13 and 14 are used for connection of the 4th CT.

On the 1565/1585 if pulsing relays are fitted then change over contacts are available on detachable terminal connections.

The pulse width and pulse rate are both user definable from the display or where a Modbus communications option is available from Integra configurator software or other Modbus master.

More details of relay set-up are contained the Integra Modbus guide and the Integra configurator software user guide

The output relays provide fully isolated, volt free contacts and connection is made via screw clamp terminals.

6 Analogue Output Option

Integra optionally provides one or two d.c. isolated outputs. Where two or more outputs are fitted, they share a common return (0v) These outputs can be individually assigned to represent any one of the available continuously variable parameters.

Output range limits are factory set as one of the options in the table below. The mA range for both channels is the same.

Range	Load	Compliance Voltage
0/20mA	0Ω-500Ω	10V
-1/0/+1mA	0-10kΩ	10V

Parameters can be adjusted to suit the application and are not fixed to the system value. Top and bottom readings can be adjusted and a variety of outputs achieved, for example:-

Normal zero e.g. 0/1mA = 0/100kW
Inverse zero e.g. 1mA/0 = 0/100kW
Offset zero 0/1mA = 50/100kW
Live zero 4-20mA = 0-100kW or 4-12-20mA = -100/0/+100kW
Bipolar outputs, e.g. -1/0/+1mA = -100/0/+100kW

Example

Mode	0kW	50kW	100kW
Normal	0mA	0.5mA	1mA
Inverse	1mA	0.5mA	0
Offset	0	0	1mA
Live	4mA	12mA	20mA

More details of analogue output set-up are contained in section 3 of this document, the 1560/1580 Modbus guide and the Integra configurator software user guide.

7 Basis of measurement and calculations

7.1 Phase to Phase voltages on 4 wire and single phase 3 wire

Phase to phase voltages are calculated from Phase to Neutral voltages. The calculation makes the assumption that the Phases are 120 degrees apart (4 wire) or 180 degrees apart (single phase 3 wire). Errors will arise if the phase angle is significantly different from 120 degrees. (This description applies only to products with a black top cover)

R Phase to Phase voltages are measured directly and calculated as RMS values. Situations where the phases are not spaced 120 degrees apart (e.g. 4 wire open delta) are indicated correctly. (This description applies only to products with a red top cover)

7.2 Reactive and Apparent Power

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

7.3 Energy resolution

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

7.4 Power Factor

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

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

7.5 Maximum Demand

The maximum power consumption of an installation is provided as power utilities often levy related charges. Many utilities use a thermal maximum demand indicator (MDI) to measure this peak power consumption. An MDI averages the power consumed over a number of minutes, reflecting the thermal load that the demand places on the supply system.

Integra uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand period being updated every minute.

Time Integration Periods can be set to 8, 15, 20 or 30 minutes (¬ or 60 minutes)

Note: During the initial period when the "sliding window" does not yet contain a full set of readings (i.e. the elapsed time since the demands were last reset or the elapsed time since Integra was switched on is less than the selected demand period) then maximum demands may not be true due to the absence of immediate historical data.

The Time Integration Period can be user set either from the display or by using the communications option, where fitted.

Maximum Demand is the maximum power or current demand that has occurred since the unit was last reset. This is maintained as a continuous record of the highest demand value that has been reached.

7.6 Total Harmonic Distortion

The calculation used for the Total Harmonic Distortion is:

THD = ((RMS of total waveform – RMS of fundamental) / RMS of total waveform) x 100

This is often referred to as THD – R

The figure is limited to the range 0 to 100% and is subject to the 'range of use' limits. Integra may give erratic or incorrect readings where the THD is very high and the fundamental is essentially suppressed.

For low signal levels the noise contributions from the signal may represent a significant portion of the "RMS of total waveform" and may thus generate unexpectedly high values of THD. To avoid indicating large figures of THD for low signal levels the product will produce a display of 0 (zero). Typically, display of THD will only produce the 0 (zero) value when the THD calculation has been suppressed due to a low signal level being detected.

It should also be noted that spurious signals (for example, switching spikes) if coincident with the waveform sampling period will be included in the "RMS of the total waveform" and will be used in the calculation of THD. The display of THD may be seen to fluctuate under these conditions

8 Specification

8.1 Inputs

Nominal rated input voltage

	Voltage range L	Voltage range M
Single phase two wire	57 - 139V L-N	140 - 277V L-N
Single phase three wire	57 - 139V L-N (114 - 278V L-L)	140 - 240V L-N (279 - 480V L-L)
Three phase three wire	100 - 240V L-L	241 - 480V L-L
Three phase four wire	100 - 240V L-L (57 - 139V L-N)	241 - 480V L-L (140 - 277V L-N)

Voltages above are expressed as RMS values and relate to sinusoidal waveforms and corresponding instantaneous peak values. "Range Maximum" for a particular instrument refers to the upper end of the relevant voltage range.

Max continuous input voltage	120% of range maximum.
Max short duration input voltage	2* range maximum (1s application repeated 10 times at 0s intervals)
Nominal input voltage burden	0.2VA approx. per phase
Nominal input current	1 or 5A a.c. rms
System CT primary values	Integer values up to 9999A (1 or 5 Amp secondaries)
System VT ratios	Any value up to 400kV(subject to an overall power limit of 250 MW nominal, 360MW maximum and the 4 significant digit limitation of the display unit, where this is used for setup)
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

8.2 Auxiliary

Standard supply voltage	100 - 250V AC nominal ±15% (85 - 287V AC absolute limits) or 100V to 250V DC nominal +25%, -15% (85 - 312V DC absolute limits)
a.c. supply frequency range	45 to 66 Hz
a.c. supply burden	3W / 6VA
Optional auxiliary d.c.supply	12 - 48V DC. nominal +25%, -15%(10.2 – 60VDC absolute limits)
d.c. supply burden	3W / 6 VA

8.3 Measuring Ranges

Values of measured quantities for which accuracy is defined.

Voltage	80 .. 120% of nominal (any voltage within the specified range – eg 45.6V to 166.8V L-N 4 wire L range)
Current	5 .. 120% of nominal
Frequency	45 .. 66 Hz
Active power (Watt)	5 .. 120% of nominal, bi-directional, 360 MW Max
Reactive power (var)	5 .. 120% of nominal, bi-directional, 360 Mvar Max
Apparent power (VA)	5 .. 120% of nominal, 360 MVA Max
Power Factor	0.8 lagging .. 1 .. 0.8 leading,

Total Harmonic Distortion	Up to 31st Harmonic 0%-40%, with typical harmonic content distribution, defined to be less than 15% of fundamental amplitude in harmonics content above 15th

Voltage and current ranges assume that crest values are less than 168% of rms nominal.

8.4 Accuracy

Voltage	0.17 % of Range Maximum
Current	0.17 % of nominal
Neutral current (calculated)	0.95 % of nominal
Neutral current (1565/1585 only)	0.17 % of nominal
Frequency	0.15% of mid frequency
Power factor	1% of Unity (0.01)
Active power (W)	±0.2 % of Range Maximum
Reactive power (var)	±0.5 % of Range Maximum
Apparent power (VA)	±0.2% of Range Maximum
Active energy (Wh)	0.3% of Range Maximum* Exceeds class 1 (Sect 4.6 of IEC1036)
Reactive energy (varh)	0.6% of Range Maximum*
Total Harmonic Distortion	1%, up to 31st harmonic
Temperature coefficient	0.013%/°C V,I typical
0.018%/°C W, var, VA typical	
Response time to step input	0.5 seconds plus Modbus response time (to within twice accuracy specification of final value), at 50Hz. 60Hz response time is faster. This parameter is measured via the Modbus port)
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 due to temperature variation as above.
Error in measurement when a measurand is within its measuring range, but outside its reference range.	2 * Error allowed at the end of the reference range adjacent to the section of the measuring range where the measurand is currently operating / being tested.

*Error in energy readings is expressed as a percentage of the energy count that would result from applying range maximum voltage and nominal current for the same measurement period.

8.5 Reference conditions of influence quantities

Influence quantities are variables which affect measurement errors to a minor degree.
Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

Ambient temperature	23°±1°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 (if AC) waveform	Sinusoidal (distortion factor < 0.05)
Magnetic field of external origin	Terrestrial flux

8.6 Range of Use

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

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

Current	0.1 .. 120% of nominal
Frequency	45 .. 66 Hz
Power Factor	1 .. 0 leading or lagging
Active power (Watt)	1 .. 144% of nominal, 360MW Max
Reactive power (var)	1 .. 144% of nominal, 360Mvar Max
Apparent power (VA)	1 .. 144% of nominal, 360MVA Max
Harmonic distortion (voltage)	Max 40% THD up to 31st harmonic

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

Power Factor is only indicated when the measured VA is over 3% of Range Maximum.

Voltage THD is only indicated when the measured voltage is over 5% of Range Maximum, and full accuracy only when measured voltage >25% of Range Maximum.

Current THD is only registered when the measured current is over 5% of nominal, and full accuracy only when measured current is over 20% of nominal

8.7 Standards

Terms, Definitions and Test Methods	IEC688:1992 (BSEN 60688)
EMC Emissions	EN61326 – Emission class A (Industrial)
EMC Immunity	EN61326 – Immunity Annex A (Industrial)
Safety	IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category III, pollution degree 2, Basic Insulation, for rated voltage.

8.8 Insulation

CT primary to voltage circuits	2.2kV rms 50Hz for 1 minute
Relay contact to voltage circuits	2.2kV rms 50Hz for 1 minute
RS485 to voltage circuits	3.1kV DC for 1 minute
Analogue to voltage circuits	3.1kV DC for 1 minute
Auxiliary supply to voltage circuits	2.7kV rms 50Hz for 1 minute
CT primary to CT primary	CT circuits are galvanically isolated from each other, resistance typically in excess of 100k ohms tested with a nominal voltage of 10VDC.

8.9 Environmental

Operating temperature	-20 to +60°C *
Storage temperature	-30 to +80°C *
Relative humidity	0 .. 90% non condensing
Warm up time	1 minute
Shock	30g in 3 planes
Vibration	10 .. 15 Hz, 1.5mm amplitude peak to peak,
	15Hz to 150 Hz @ 1g

* Maximum operating and storage temperatures are in the context of typical daily and seasonal variation. This product is not designed for permanent operation or long term storage at maximum specified temperatures.

8.10 RS485 Serial Communications Option

Baud rate	19200, 9600, 4800 or 2400 (programmable)
Parity	None, Odd or Even, with 1 stop bit, or None with 1 or 2 stop bits.
Protocol	Modbus (RS485) or Johnson Controls N2 Ver A 1996

(Note Johnson Controls N2 specifies fixed baud rate and parity)

Programmable Modbus word order at user option.

8.11 Active Energy Pulsed Output Option

|	
Default pulse rate	1 per kWh/ kvarh
Pulse rate divisors	10 (yielding 1 pulse per 10 kWh/ kvarh)
	100 (yielding 1 pulse per 100 kWh/ kvarh)
	1000 (yielding 1 pulse per 1MWh/ Mvarh)
Pulse duration	60ms, 100ms or 200ms
Pulse rate	3600 Pulses per Hour max

8.12 Analogue Outputs Option

Range	0/20mA (user configurable as 4-20mA)
	or -1/-0/+1mA (user configurable as 0-1mA)
	For 2 channel option both ranges must be identical.
Accuracy	0.2% of full range
Temperature coefficient	0.018%/°C
Over range	On a two output product, with both channels loaded with maximum load, outputs will typically reach a minimum of 105% under input over range conditions. Over range on a single output product will be similar or better.
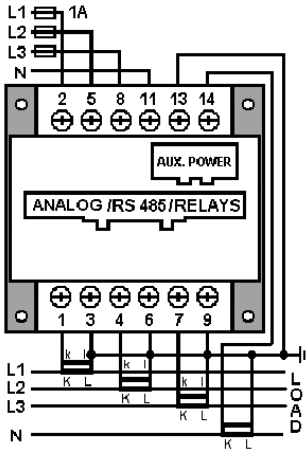
European Style   **USA Style**

3-PHASE - 4 WIRE UNBALANCED
LOAD with metered neutral

3-PHASE - 4 WIRE UNBALANCED
LOAD with metered neutral
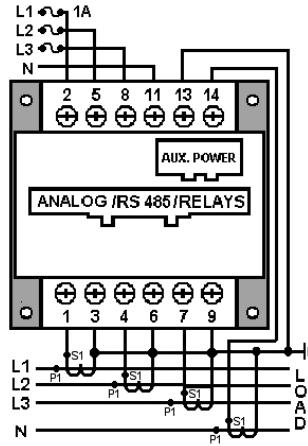
3-PHASE - 4 WIRE UNBALANCED LOAD
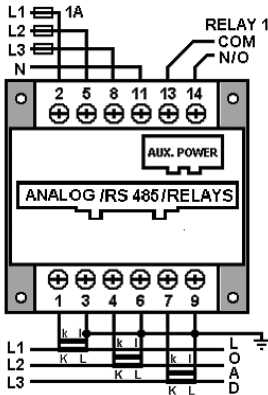
3-PHASE - 4 WIRE UNBALANCED LOAD
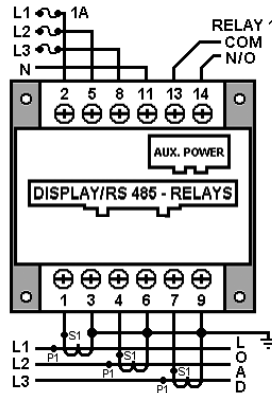
European Style

3-PHASE - 3 WIRE UNBALANCED LOAD
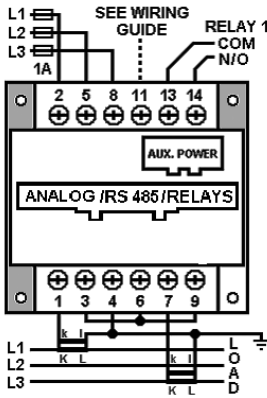
SINGLE-PHASE - 2 WIRE

USA Style

3-PHASE - 3 WIRE UNBALANCED LOAD
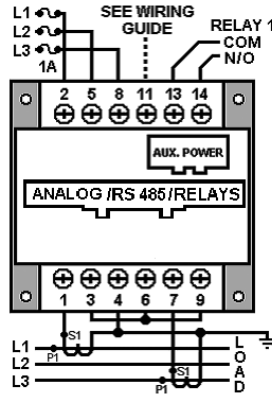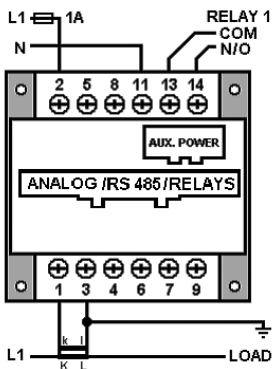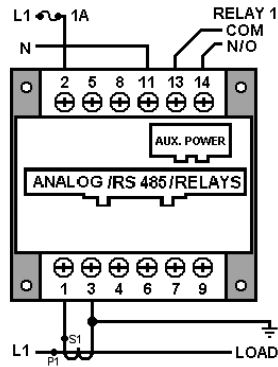
SINGLE-PHASE - 2 WIRE

European Style

SINGLE-PHASE - 3 WIRE
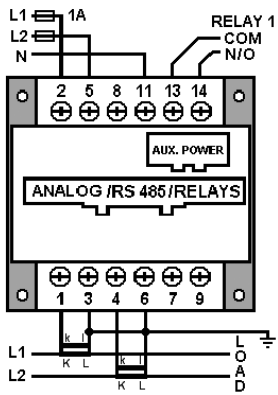
USA Style

SINGLE-PHASE - 3 WIRE
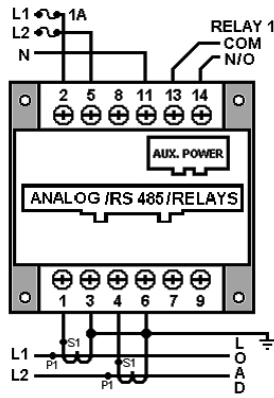
10 Auxiliary and Output Connections

10.1 Auxiliary Supply

There are two auxiliary supply alternatives available as factory build options. The auxiliary supply is marked on the unit rating label. The Integra should ideally be powered from a dedicated supply, however when the 100-250 V auxiliary option is fitted it may be powered from the signal source, providing the source remains within tolerance of the medium voltage auxiliary range.

The auxiliary supply connection has terminals for both medium voltage and low voltage auxiliary. Depending on the supply option fitted either the 12-48 pair or the 100-250v pair will be operational. For 100-250 V auxiliary, connect the supply to the outer two terminals marked L and N. For 100-250 V, connections are polarity insensitive. For 12-48 V auxiliary, connect to centre and right hand (as viewed from instrument top) terminals marked - and +. Polarity reversal will not cause damage but the instrument will not function.

100-250V AC or DC		100-250V AC or DC
N	-	L+
	12-48V negative	12-48V Positive

It is recommended that if used with a remote Integra display, a common auxiliary supply is used for both the display and Integra. If this arrangement is not implemented then the Integra communications parameters may be configured as detailed in the preceding section 4.3, Display auto detect. The Integra establishes contact with a remote display in the first 5 seconds after power up, and may not operate correctly with the display if the display is powered several seconds after the Integra is powered, unless the communications parameters are set appropriately.

10.2 Output Connections

Output connections are made directly to a two part, detachable screw clamp style connector. Detachable terminal connector screws should be tightened to 0.9Nm or 0.7 ft/lbf only. General guidance on cable selection and wiring practice is given in section 11.1.

10.2.1 RS 485 and relay outputs

This option has a flat top cover and is fitted when RS485, pulsing relays or both are required.

10.2.2 Relay connections

When the centre output connector is fitted, Relay 2 and Relay 3 provide output pulses with change over contacts. When only a single pulsing relay is specified, the 6 way Relay 2 / Relay 3 connector shown on the preceding diagram may not be fitted. On this variant, Relay 1 normally open contacts are available (except 1565/1585) on the main terminal block at terminals 13 and 14 as shown on the wiring diagrams in section 9.

10.2.3 RS485 or additional display

The connections between an Integra and RS485 master or optional display are made directly to a two-part detachable screw clamp style connector. The recommended cable between the RS485 master or display and Integra is two core screened cable. Preferably select a cable specifically recommended for RS485 use (for example Belden 9860, 8761) although for shorter distances of a few metres most two core screened cables will often be satisfactory. As the remote device to Integra communication uses RS485, cable length (transmission distance) can be up to 1200 metres in good conditions. Electrical interference or other adverse conditions may reduce the maximum cable length possible for reliable operation.

10.2.4 Analogue or Analogue and RS485 options
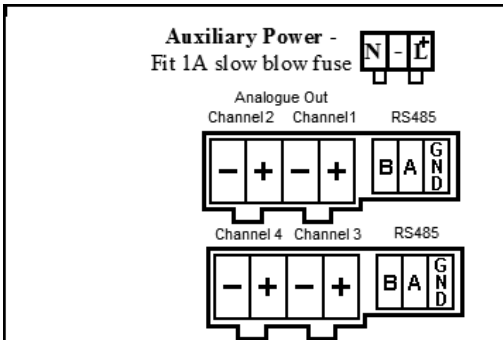
Note that the return(–ve) terminal for analogue outputs is common amongst all analogue channels. The analogue return is galvanically isolated from the RS485 ground.

The polarity indicated above is correct for positive designated currents. On –1 .. 0 .. +1 mA outputs, polarity will be reversed when the relevant parameter is below half scale. On purely positive going configured outputs (0..20mA), it is possible that a small reverse current may be registered when the input parameter is below reading bottom. If the application cannot tolerate such reverse currents, fitting of an external silicon diode is suggested.

10.2.5 LON option

Integra with LonWorks option has two ports. The LonWorks port is designed for connection into a LON twisted pair free topology network and is based around the FTT-10A interface. It is recommended that FTT-10 guidelines are followed in configuring the network. The detail of these guidelines is beyond the scope of this document.

The RS 485 port is intended for setting up the Integra using the configuration software, or for local display connection.

Both ports are electrically isolated from the metering circuits, but not from each other. It is recommended that the LON interface be temporarily disconnected when using a PC to set up the Integra to avoid problems with earth loops or minor earth potential differences. The Integra display is isolated from earth so earthing problems should not arise if LON and display are permanently connected.
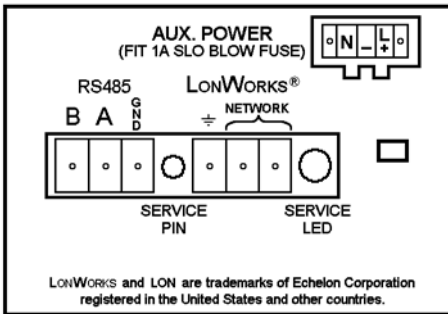
The service LED provides basic diagnostic information for the LON interface:

Continuously on	Probable hardware fault within the LON interface
Continuously off	Probable hardware fault within the LON interface, or no auxiliary power to the Integra.
Single 1 second flash, 2 seconds off and then continuously on after applying auxiliary power	Possible LON node memory corruption.
Repeated 1 second on followed by 2 second off	Probable hardware fault within the LON interface, or LON node memory corruption.

All of the above problems (with the exception of no auxiliary power) require service attention to the Integra LON interface.

|	
Repeated 1 second on, 1 second off flashing	Node unconfigured. Node must be reinstalled and commissioned before correct operation.
Brief flash on, off for 6 seconds, and then continuously on	Node configured and running normally

10.2.6 Profibus Interface

Integra with Profibus option has two ports.   The Profibus port is designed for connection into a Profibus network via 9 pin D connector.   The earth tag (fuseblade) is intended for local earth bonding if electrical interference may be an issue.

The RS 485 port is intended for setting up the Integra using the configuration software, or for local display connection.

Both ports are electrically isolated from the metering circuits, and from each other.
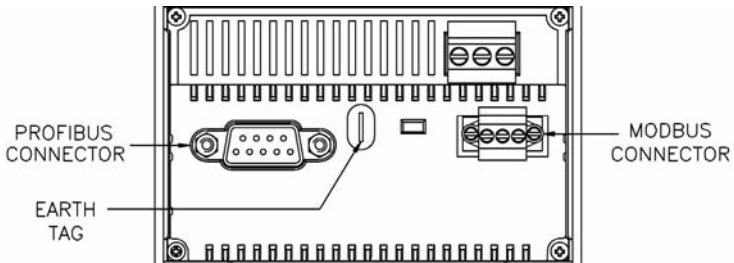
11 Installation and Maintenance

11.1 Location and mounting

Units should be installed in a dry position, where the ambient temperature is reasonably stable and will not be outside the range -20 to +60°C. Vibration should be kept to a minimum. Consideration should be given to the space adjacent to the instrument to allow for connectors and associated cables.

The terminals must be protected from liquids or other contamination.

These units are intended for indoor use only at an altitude of less than 2000m.

Warning

During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.

It is recommended adjustments be made with the supplies de-energised, but if this is not possible, then extreme caution should be exercised.

Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.

This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.

Never open circuit the secondary winding of an energised current transformer.

Auxiliary circuits (12-48V auxiliary, communications, relay and analogue outputs, where applicable) are separated from metering inputs and 100-250V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

This unit is not intended to provide safety rated isolation between the 12-48V auxiliary terminals and communications or analogue output circuits. Galvanic isolation is provided, but one of the 12-48V inputs should be at or near earth potential.

11.2 Electromagnetic Compatibility

This unit has been designed to provide protection against EM (electro-magnetic) interference in line with requirements of EU and other regulations. Precautions necessary to provide proper operation of this and adjacent equipment will be installation dependent and so the following can only be general guidance:-

- Avoid routing wiring to this unit alongside cables and products that are, or could be, a source of interference.
- The auxiliary supply to the unit should not be subject to excessive interference. In some cases, a supply line filter may be required.
- To protect the product against incorrect operation or permanent damage, surge transients must be controlled. It is good EMC practice to suppress differential surges to 2kV or less at the source. The unit has been designed to automatically recover from typical transients, however in extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.
- Screened communication and small signal leads are recommended and may be required. These and other connecting leads may require the fitting of RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems.

- It is good practice to install sensitive electronic instruments that are performing critical functions in EMC enclosures that protect against electrical interference causing a disturbance in function.

11.3 Metered Supply Wiring

11.3.1 Input wiring and fusing
Input connections are made to screw clamp terminals. Choice of cable should meet local regulations for the operating voltage and current. Terminals for both current and voltage inputs will accept one or two 3mm2 or less cross sectional area cables. This unit must be fitted with external fuses in voltage and auxiliary supply lines. Voltage input lines must be fused with a quick blow AC fuse 1A maximum. Auxiliary supply lines must be fused with a slow blow fuse rated 1A maximum. Choose fuses of a type and with a breaking capacity appropriate to the supply and in accordance with local regulations.

Where fitted, CT secondaries must be grounded in accordance with local regulations. It is desirable to make provision for shorting links to be made across CTs. This permits easy replacement of a unit should this ever be necessary.

A switch or circuit breaker allowing isolation of supplies to the unit must be provided.

Main terminal screws should be tightened to 1.35Nm or 1.0 ft/lbf only.

11.3.2 Neutral terminal on three phase, three wire systems
If this product is used in a system with an a.c. auxiliary where the frequency of the auxiliary may be different to the frequency of the signals being measured it will be necessary to connect the neutral terminal (terminal number 11) either to the system neutral connection or to an earth (ground) connection in order to achieve the published specifications.

The neutral terminal (terminal number 11) is indirectly connected to the voltage input terminals (terminals 2, 5 and 8). When connected to a three wire system where one of the lines has become disconnected the neutral terminal will adopt a potential somewhere between the remaining lines.

If external wiring is connected to the neutral terminal it must be connected to either the neutral line or earth (ground) to avoid the possibility of electric shock from the neutral terminal.

Standard CT wiring configurations for 3 wire systems include a commoning point. A maximum of two units, fed from a single set of CTs and with a single earth point may be wired in this way. If more units must be run from a single set of CTs then use 3 CTs and wire CT connections as for 4 wire systems. In this configuration, the number of units that may be connected is limited by the permissible CT burden.

11.4 Underwriters Laboratories (UL) Installation Requirements
The following points are mandatory in any installation where UL approval is required. They may be considered as good practice recommendations in other applications.

11.4.1 Wire type
Voltage and current measuring terminal blocks are suitable for use with copper wire only.

11.4.2 Wire size
Voltage and current measuring terminal blocks will accept one or two 3mm2 or less cross sectional area cables [up to 12 AWG]. Main terminal screws should be tightened to 1.35Nm or 1.0 ft/lbf only.

11.4.3 Mounting position

Instruments are intended for panel mounting. Terminals must be enclosed within the panel. Use National Electrical Code Handbook [NEC] Class 1 wiring, rated at 600 V for main terminals.

11.5 Maintenance

The case should be wiped with a dry cloth only. If a cleaning agent is necessary, isopropyl alcohol is the only recommended agent and should be used sparingly. Water should not be used. If the case exterior or terminals should accidentally be contaminated with water, the unit must be thoroughly dried before further service. Should it be suspected that water or other contaminants might have entered the unit, factory inspection and refurbishment is recommended.

In normal use, little maintenance is needed. As appropriate for service conditions, isolate electrical power, inspect the unit and remove any dust or other foreign material present. Periodically check all connections for freedom from corrosion and screw tightness, particularly if vibration is present.

The front display window also acts as an insulating barrier. It is not possible to touch, by hand, any live part, even if the window is completely missing, but if the window is perforated or significantly damaged in any other way, repair is required.

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

11.6 Outline Dimensions - Flat rear Cover

All dimensions below are in mm (inches) and relate to products with Modbus / RS485, pulsing relays or Lonworks interfaces.
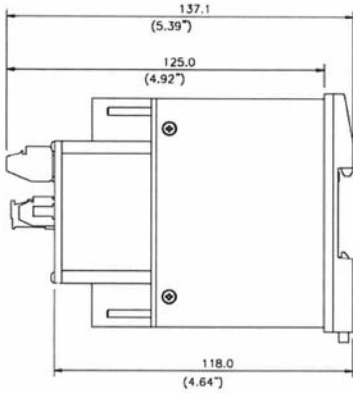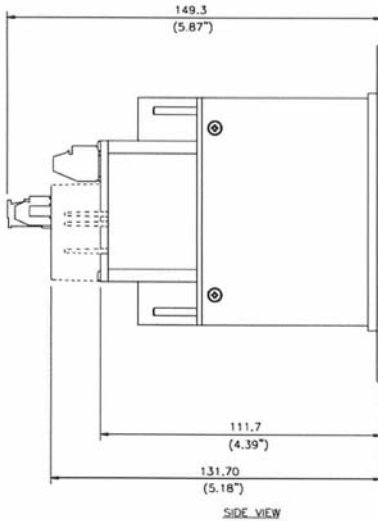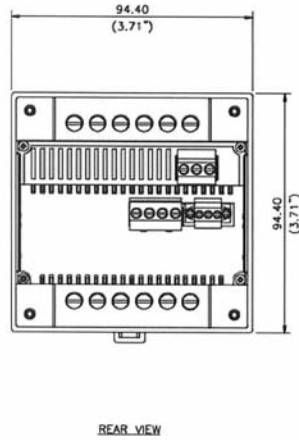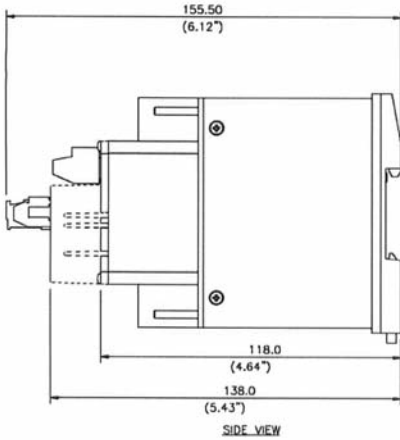

SIDE VIEW
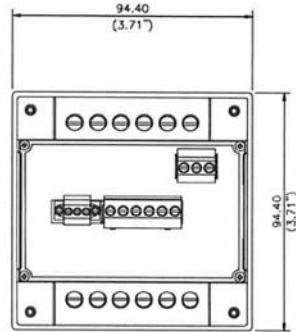
REAR VIEW
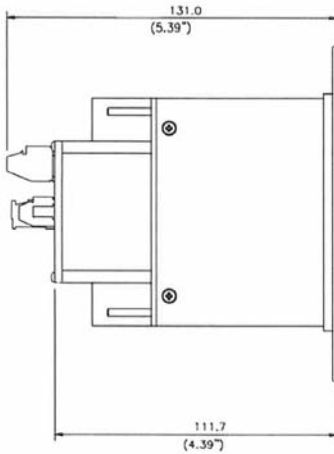
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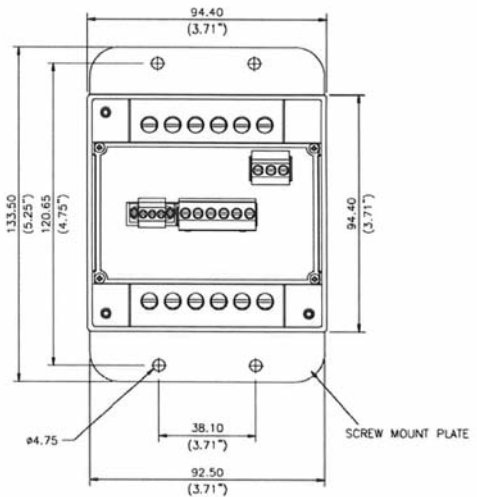
REAR VIEW

11.7 Outline Dimensions - Extended rear Cover

The dimensions below relate to products with Analogue and Analogue/RS485 and Profibus options

Note that the overall space required behind the panel for Profibus option models will depend on the (user supplied) Profibus connector chosen.
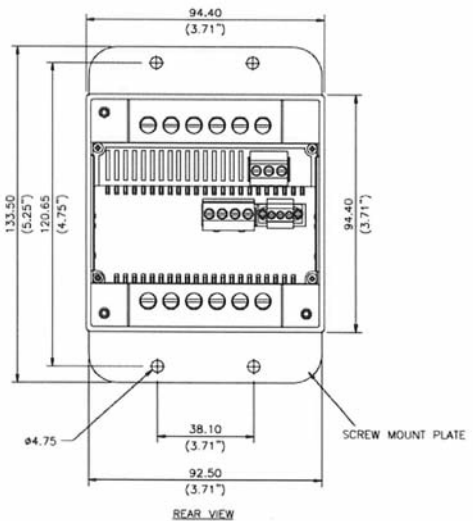
About TE Connectivity

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