Tyco Electronics

Integra 1630
Operation and Set up

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Caution: Risk of Danger
These instructions contain important safety information: Read before starting installation or servicing of the equipment

Caution: Risk of Electric Shock

1 Features and Options

An Ethernet port, RS485 communications port, 1 or 2 solid state relays or Profibus port are available as optional extras. Not all options may be fitted to the same unit. Pre sales literature indicates valid option combinations and ordering codes. Not all options are available in all territories – contact your sales office for availability information. Modbus and Profibus are trademarks of their respective owners. All trademarks are acknowledged

1.1 Power Supplies

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. The auxiliary supply range is marked on the rear label.

1.2 Ethernet Option

The Ethernet port supports Modbus TCP or Bacnet IP protocol. The protocol choice is fixed at manufacture.

1.3 RS485 Serial Option

This optional port can be used as an RS485 Modbus RTU port, as a Johnson Controls N2 protocol slave or connected to a remote Integra display unit. 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.
Where a port is available, it can be connected to a PC for control and monitoring purposes.

1.4 Profibus DP

When fitted with Profibus option, this unit provides the standard RS485 9-way D-type Connector. Up to 12Mbit Baud Rate is supported.
The Profibus GSD file is available from the website:
http://www.crompton-instruments.com/INTEGRA.GSD

1.5 Communications protocol details

Refer to the separate Integra 1630 communications guide (available online at www.crompton-instruments.com) for information on Modbus and other protocol implementation details and register allocation

1.6 Pulse Relays

Pulse relays are user programmable for corresponding energy type, pulse divisor (one pulse for every 1, 10,100 or 1000kWh/kvarh for example) and pulse width (duration). When two pulse outputs are fitted, they share a common divisor value and pulse width.

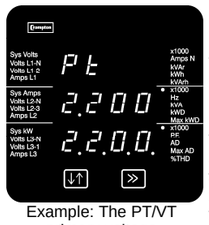
1.7 Display Screen

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

Example: Voltage display

1.8 Display Mode

Three measured values can be shown, one on each row. For each row, the LED indicators show the parameter being indicated and the units.
The >> button selects display screens in sequence.



Example: The PT/VT primary voltage confirmation screen.

1.9 Set up mode,

The top row shows an abbreviation of the parameter name, the middle row shows the parameter value being set and the bottom row is used for confirmation of the entered value. In general, the ↓↑ key changes a parameter value and the >> key confirms a value and moves on to the next screen.

1.10 Start Up Screens

Initially, when power is applied to the Integra, start up screens are shown. The first screen lights all the LED's and is used as a display LED check. The second screen indicates the firmware installed in the display unit – this is replaced by the default "System" screen.

2 Display mode screen sequence

(FuLL) mode only, please refer to section **4.2**

Screen	Upper Line	Middle Line	Lower Line
System (Default display – Shown on power up)	System Average Voltage (Line to Line for 3 wire systems, Line to Neutral for 4 wire and single phase systems.	System Average Line Current	System Total Active Power
System %THD Screen	Average % Total Harmonic Distortion for System Voltages.	Average % Total Harmonic Distortion for System Currents.	
Line to Neutral Voltages **3 phase, 4 wire only.**	Voltage Line 1 to Neutral	Voltage Line 2 to Neutral	Voltage Line 3 to Neutral
Line to Neutral Voltage %THD **3phase, 4 wire only.**	%THD of Line 1 Voltage to Neutral.	%THD of Line 2 Voltage to Neutral	%THD of Line 3 Voltage to Neutral.
Line to Line Voltages	Voltage Line 1 to Line 2	Voltage Line 2 to Line 3	Voltage Line 3 to Line 1
Line to Line Voltages %THD **3 phase, 3 wire only.**	Line 1 to Line 2 Voltage %THD.	Line 2 to Line 3 Voltage %THD.	Line 3 to Line 1 Voltage %THD.
Line Currents	Line 1 Current	Line 2 Current	Line 3 Current
Line Currents %THD	Line 1 Current %THD	Line 2 Current %THD	Line 3 Current %THD.
Neutral Current, Frequency and Power Factor	Neutral Current (Amps). (4wire and single phase only).	Frequency (Hz).	Power Factor (0 to 1, C = Capacitive and L = Inductive).
Power	Reactive Power (kvar).	Apparent Power (kVA).	Active Power (kW).

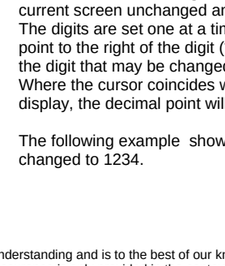
Energy Screens All readings are cumulative since last reset and stored during power down	Upper 2 lines: Show 7 digit reading split across 2 lines	Low line
Active Import Energy (kWh)	Show 7 digit reading across 2 lines	
Reactive Import Energy (kvarh)	Show 7 digit reading across 2 lines	
Active Export Energy (kWh)	Show 7 digit reading across 2 lines	**E**
Reactive Export Energy (kvarh)	Show 7 digit reading across 2 lines	**E**

Screen	Middle Line	Lower Line
Demand (Import power and the import current integrated over the defined period.	Total Active Import Power Demand (kWD)	Total Import Current Demand (AD)
Maximum Demand (The highest values reached for import power demand and the import current demand that have been recorded since the unit was last reset)	Maximum Active Import Power Demand (kWD)	Maximum Total current Demand (AD)

Screen	Upper Line	Middle Line	Lower Line
Hours Run	Hours run in whole hours and 1/100 hours		**hrn**

At the end of the display sequence, key >> returns to the start with the System Screen

2.1 Special screens



The displayed values must be in the range –999 x 1000 to 9999 x 1000. Any parameter value outside this range will cause the display to show four bars in the appropriate line. For example, here, the value on the middle line is over range.

An "Err1" represents a transient internal malfunction. If "Err1" persists, disconnect the auxiliary supply for 10 seconds.

3 Setting up

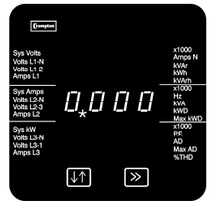
Set up of the Integra may be carried out by using the display or Integra configurator software. Integra configurator software has it's own on line guide.
If required, set up parameters may be manipulated directly via the Modbus interface. Profibus models may be temporarily manually switched to Modbus mode for setting up.
The following sections give step by step procedures for configuring the Integra using the display.
To access the Set-up screens, press and hold the ↓↑ (Adjust) key and the **>>** (Next) keys simultaneously for five seconds. This displays the password entry screen.
Password protection can be enabled to prevent unauthorised access to Set-up screens. Password protection is not normally enabled when a product is shipped. The unit is protected if the password is set to any four digit number other than 0000. Setting a password of 0000 disables the password protection.

On completion of the last Set-up screen, the program exits Set-up mode and returns to the last selected Display screen. To return to the Display screens at any time during the set up procedures, press the ↓↑ and the >> keys simultaneously for five seconds. Any set up changes that have already been made will be retained.

3.1 Number Entry Procedure

When setting up the unit, many screens require the setting up of a number, usually on the middle row of digits. For example, on entry to the setting up section, a password may be required. The procedure is as follows:
In general, press the ↓↑ (adjust) key to change something on the current screen. Pressing the >> (next) key normally leaves the current screen unchanged and brings up the next screen.
The digits are set one at a time, from left to right. The decimal point to the right of the digit (* in the picture) flashes to indicate the digit that may be changed currently. It thus acts as a cursor. Where the cursor coincides with a genuine decimal point on the display, the decimal point will flash.

The following example shows how the number 0000 can be changed to 1234.



First digit
Press the ↓↑ key to scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0. For this example, set it to '1'.
Press the >> key to confirm the setting and advance to the next digit.
On some screens, the digit range may be restricted to prevent out of range entries.

Second digit
Use the ↓↑ key to set the second digit to the required value.
Press the >> key to confirm the selection and advance to the next digit. Repeat for the 3rd and 4th digits. Press the >> key to confirm the selection. If the unit accepts the entry, the Confirmation screen will appear.

Confirmation
The Confirmation screen shows the entered number on the bottom row with all decimal points showing.
If the unit does not accept the entry, e.g. an incorrect password, a rejection screen will appear, with dashes on the bottom line.

If the displayed number is correct, press the >> key to move to the next Set-up screen.
If not, press the ↓↑ key to return to restart the number entry. The first digit entry screen will appear. If the password is accepted, the ↓↑ key selects "change password" instead of restarting number entry.

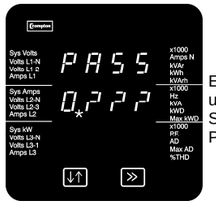
3.2 Access without Password Protection

Password introduction
Press >> from the Password Introduction screen. The 0000 password confirmation screen will appear.

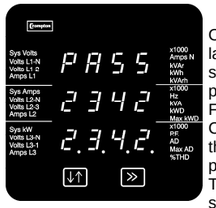
0000 Password Confirmation
Press >> again to proceed to the first Set-up screen.

3.3 Access with Password Protection

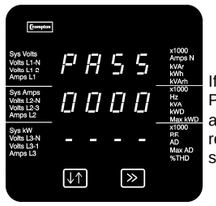
Password Introduction
Press ↓↑ from the Password Introduction screen. The Password first digit entry screen will appear.



First digit
Enter the four-digit password using the method described in Section 3.1 : Number Entry Procedure.



Password Confirmation
On pressing >> to confirm the last digit, the Confirmation screen will appear, provided the password is correct.
From the Password Confirmation screen, there is the option of changing the password, as described below. To proceed to the first Set-up screen, press >>.

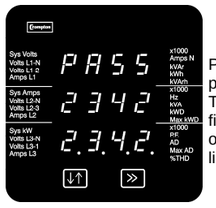


If the password is incorrect, the Password Rejected screen will appear. Press ↓↑ to start a retry or >> to exit to the Display screens.

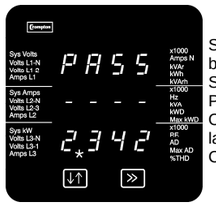
Password Rejected

3.4 Setting or Changing the Password

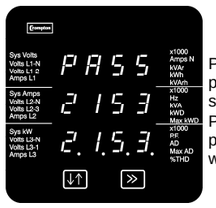
The option to change the password is only available from the Password Confirmation screen.



Password Confirmation
Press ↓↑ to start changing the password.
The password screen for the first digit will appear, with the old password on the bottom line.



First new password digit
Set up the new password on the bottom line, as described in Section 3.1 : Number Entry Procedure.
On pressing >> to confirm the last digit, the Password Confirmation screen will appear.



New password confirmation
Press >> to confirm the new password. The first Set-up screen will appear.
Press ↓↑ to re-edit the password. The first digit screen will appear again.

Date: Jun-09
Reference : INT-1630-INSTAL-OP Iss 6.doc

3.5 Secondary Voltage and Maximum Power

The 1630 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.
The 1630 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*. If the system type is changed (e.g. from single phase to 3 phase) and that change would result in exceeding the maximum power, the Integra display will not show metered values and settings must be revised manually to restore normal operation. *Always check the FSC, PT and pulse rate divisor settings after changing system type.* *The Maximum Power restriction of 360 Megawatts refers to 120% of nominal current and 120% of nominal voltage, i.e. 250 Megawatts nominal system power.

4 Set up screen sequence

4.1 SyS

This screen is used to set the wiring configuration. **Unless it is desired to change the wiring configuration, press the >> key to move to the diSP screen.**
Press the ↓↑ key to change the system configuration.
Use the ↓↑ key to scroll through the available values.

- 3P4u (3 phase 4 wire)
- 3P3u (3 phase 3 wire)
- 1P2 (Single phase 2 wire)

Select the value required and press >> to confirm the selection.
Integra will restart if a change to the wiring configuration is made.
After a restart wait for about 5 seconds until the normal system display screen is shown and then re-enter set up mode.

4.2 diSP

This screen allows the user to select the range of displayed parameters. If a selection is changed the Integra will restart after 5 seconds into the selected mode.
Use the ↓↑ key to scroll through the available values.

- FuLL, All parameters indicated by the display mask
- volt, Voltages only
  Phase to phase, 3 phase 3 wire (3P3u)
  Phase to phase & phase to neutral, 3 phase 4 wire (3P4u)
- Curr, current per phase only (3P3u & 3P4u)

4.3 FrE

This screen allows the selection of the default frequency. The default frequency is the system frequency assumed if no voltage signals are present or applied.

- 50 (Hz)
- 60 (Hz)

If a selection is changed the Integra will restart after 5 seconds into the chosen frequency.

4.4 FSC

This parameter is the value of nominal Full Scale Current (usually the associated CT primary current rating) that will be displayed as the Line Current. This screen enables the user to display the Line Currents inclusive of any transformer ratios.
The values displayed indicate the current in amps. For example setting 800 on this screen will cause the display to indicate 800 amps when the nominal maximum (typically 5A or factory build option of 1A) current flows through the Integra current inputs.
The allowable range is 1 to 9999A. .

4.5 PT

If there is no potential transformer (PT) associated with the Integra, i.e. the voltage terminals are connected directly to the metered voltage, leave this value unchanged and skip this set up step.
This value is the nominal full scale voltage which will be displayed as L1-N, L2-N and L3-N for a four wire system, L1-2, L2-3 and L3-1 in a three wire system or system volts for single phase. This screen enables the user to display the line to neutral or line to line voltages inclusive of any transformer ratios, maximum 400kV. The values displayed represent the voltage in kilovolts (note the x1000 indicator). For example, on a 2.2kV system with 110V potential transformer secondary, set 2.200 at this screen**.**
If the PT primary and secondary values are changed and it is desired to revert to a set-up with no PT, then set both PT primary and secondary values to the nominal maximum voltage for the Integra

4.6 SU

If there is no PT associated with the Integra, leave this value unchanged and skip this step.
This value must be set to the nominal full scale secondary voltage which will be obtained from the transformer when the potential transformer (PT) primary is supplied with the voltage defined above. This defines the actual full scale voltage that will be obtained from the PT secondary and measured by the unit. The ratio of the full scale primary to full scale secondary voltage is the transformer ratio. Given full scale primary and secondary voltages, the unit calculates the primary voltage to display for any given measured secondary voltage.
The secondary voltage displayed is in volts. Following the previous example, on a 2.2 kV system with 110V PT secondary, set this screen to 110.0. The secondary value may only be set to values within the range defined by the factory voltage build option. These nominal rms input voltages are shown in the specification

4.7 d.i.t.

This screen is used to set the period over which current and power readings are integrated. The value displayed represents time in minutes. To change the Demand Integration Time, use the ↓↑ key to scroll through the available values.

4.8 rSEt

The reset screens allow resetting of the Energy and Demand readings individually or all together.
Resetting the cumulative Energy (h) resets Active and Reactive Energy import and export registers.
Resetting Demand (d) resets Active Import Power Demand;
Current Demand;
Maximum Active Import Power Demand and
Maximum Current Demand
To reset one or more readings use the ↓↑ key to scroll through the available options:-
h Active and reactive energy
d Demands and maximum demands :
Active Import Power Demand,
Current Demand,
Maximum Active Import Power Demand and
Maximum Current Demand)
hrn – hours run
None – no reset
All – Energy, Demands and Hours Run combined.
Select the option required and press >> to confirm the selection.
The appropriate confirmation screen will appear.
The confirmation screen will not appear if "None" has been selected.

4.9 PULS

This applies to the Relay Pulsed Output option only. Units with this option provide pulses to indicate power consumption (kWh, and kvarh where two outputs are available).
This screen allows the user to set the duration of the relay output pulse. The value displayed represents the pulse duration in milliseconds (ms).
Use the ↓↑ key to scroll through the available values. Select the value required and press >> to confirm the selection. The confirmation screen will appear.

4.10 rAtE

This applies to the Relay Pulsed Output option only. Units with this option provide pulses to indicate power consumption (kWh, and kvarh where two outputs are available).
This screen allows setting of the pulse rate divisor. By default, the unit produces one pulse per kWh/kvarh. Changing this divisor changes the output pulse rate, as follows:

Divisor	One pulse per:
1	1 kWh/kvarh
10	10 kWh/kvarh
100	100 kWh/kvarh
1000	1000 kWh/kvarh

Use the ↓↑ key to scroll through the available values. If the maximum power is greater than 3.6 megawatts, the range of divisors will be restricted to limit the number of pulses/hour to 7200 maximum at full power. Select the required divisor and press >> to confirm the selection.

4.11 bAUd

Use this screen to set the Baud Rate of the RS485 Modbus/JC N2 port. The values displayed are in kbaud. Use the ↓↑ key to scroll through the available values. Select the required baud rate and press >> to confirm the selection

Protocol/Option	Valid Rates
Modbus RTU	4.8, 9.6, 19.2, 38.4(to match Master)
Ethernet	38.4 only
JC N2	9.6 only
Profibus	Auto*
Remote Display	Auto*

* If the Profibus option is fitted, any user communications settings are ignored at start up. When a Profibus option is fitted the communications parameters should not changed by the user as this will disable the Profibus interface. (Normal operation may be resumed by power cycling the Integra.) If a display is detected on an RS485 port at start-up, any user settings for that port will be ignored, and the port automatically configured for use with the display.

4.12 PAri

This screen allows setting of the parity and number of stop bits of the RS485 Modbus/JC N2 port. Use the ↓↑ key to scroll through the available values:
E – even parity with one stop bit
odd – odd parity with one stop bit
no 1 - no parity one stop bit,
no 2 - no parity two stop bits.
Select the required setting and press >> to confirm the selection.

Protocol/Option	Valid Settings
Modbus RTU	Any (to match Master)
Ethernet	No parity, 1 stop bit
JC N2	No parity, 1 stop bit
Profibus	Auto*
Remote Display	Auto*

* See notes about Auto in section 4.11

4.13 Addr

This screen allows setting of the Modbus/JC N2 or Profibus device address for the instrument. Set the three-digit address using the method described above in section 3.1 : Number Entry Procedure. The range of selectable digits is restricted so that no higher number can be set.
Press **>>** to confirm the selection. The Confirmation screen will appear.

Protocol/Option	Valid Settings
Modbus RTU	000-247
Ethernet	001 only
JC N2	000-247 only
Profibus	001-125 only
Remote Display	Auto*

* See notes about Auto in section 4.11

This is the end of the set up sequence and the display returns to the last selected measured values Display screen.

4.14 Remote Display auto detect

A remote Integra display can be connected to the RS485 port to enable display of more parameters simultaneously or for observations at a remote location. For about five seconds after power on the instrument will attempt to determine if a display is attached to the RS485 port. If it detects an Integra display unit is powered up and attached, the port is automatically configured for display operation until the instrument is powered down.
If the display detection period expires without a display unit being detected, the Integra will configure the port to use the communication parameters previously set for that port. If a display is subsequently connected to the port, it may not function correctly. Power cycle the Integra to restore correct display operation. Ideally the Integra and any associated display should share a common auxiliary supply so that the detection mechanism can function properly. If this is not possible, then either the display auxiliary should start first, or the port communications parameters should be set to 9600 baud, two stop bits, no parity, address 1.

4.15 Remote Communications Parameter Set Up

Communications parameter options set from the Integra configurator software or another Modbus master affect the port on which the Modbus master is connected. Changes take effect only when the Integra 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 , the acknowledgement and any subsequent communications are at 9600 baud. After the Integra has been power cycled, communications will be at 4800 baud.
Communications parameters may be checked from the Integra front panel display
Communications parameter options (baud rate, stop bits, parity, address) changed from a remote Integra display unit will have no effect.
Further information is contained in the RS485 communication guide for the Integra 1630. This document is available on the Crompton Instruments website (www.crompton-instruments.com). E-mail support for specific issues is available, however, 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.

4.16 Relay outputs

One or two pulsed outputs are optionally available. These relays output pulses at a rate proportional to the user selected energy parameter (eg kWh or kvarh)
The pulse width and pulse rate are user definable from the display or where a Modbus communications option is available from Integra configurator software or other Modbus master.
Pulse energy parameter selection is settable by Modbus only.
Default options ex factory are Relay 1: kWh import, Relay 2: kvarh import. The rear label has space to mark pulse function if changed from default.
The solid state output relays provide fully isolated, volt free connections via screw clamp terminals.

4.17 Setting up the Ethernet option

The IP address of the INTEGRA 1630 must be appropriate for the network to which it is attached. The address to use will depend upon the local network and should be determined by the network administrator. The INTEGRA 1630 Ethernet option module supports static IP address assignment only.

The INTEGRA 1630 IP address is factory set to **192.168.1.100**.
If attaching two or more INTEGRA 1630 meters to the same network the IP addresses must be changed so that each meter is assigned to an unique address. It is best to change the IP address before the Integra is connected to the network, and one to one connection can be assured. The IP address is changed using the RUINET utility. More details are available in the Integra 1630 Communications guide available from the website www.crompton-instruments.com. If connecting the Integra directly to a PC, an Ethernet crossover cable will be required.

5 Basis of measurement and calculations

5.1 Phase to Phase voltages on 4 wire products

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

5.2 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.

5.3 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.

5.4 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.

5.5 Maximum Demand

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

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

6 Maintenance

Warning
During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.
Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.
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 and relay,) 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.

6.1 Checks and Cleaning

The front of the case should be gently wiped with a dry cloth only. Do not apply any pressure over the central rectangular display viewing window areas. If necessary wipe the rear case with a dry cloth. If a cleaning agent is necessary, isopropyl alcohol is the only recommended agent and should be used sparingly. Water should not be used. If the rear case exterior or terminals should accidentally be contaminated with water, the unit must be thoroughly dried before further service. Should it be suspected that water or other contaminants might have entered the unit, factory inspection and refurbishment is recommended.
In normal use, little maintenance is needed. As appropriate for service conditions, isolate electrical power, inspect the unit and remove any dust or other foreign material present. Periodically check all connections for freedom from corrosion and screw tightness, particularly if vibration is present.
The front display window also acts as an insulating barrier. It is not possible to touch, by hand, any live part, even if the window is completely missing, but if the window is perforated or significantly damaged in any other way, repair is required.
In the unlikely event of a repair being necessary, it is recommended that the unit be returned to the factory or nearest Crompton service centre.

Integra 1630

Installation guide and Specification

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Caution: Risk of Danger
These instructions contain important safety information: Read before starting installation or servicing of the equipment

Caution: Risk of Electric Shock

Warning
During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.
Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions. If this equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.
This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.
Never open circuit the secondary winding of an energised current transformer.
Auxiliary circuits (12-48V auxiliary, communications and relay) are separated from metering inputs and 100-250V auxiliary circuits by at least basic insulation in accordance with IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Measurement category III, pollution degree 2, for rated voltage. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

7 Installation and Maintenance

7.1 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. Preferably, mount the Integra so that the display contrast is not reduced by direct sunlight or other high intensity lighting.
The Integra may be mounted in a standard DIN 96 panel up to a maximum thickness of 5 mm. Mounting is by 4 screw clamps. Undo the screws so that the plastic mountings may be inserted in the extreme left and right slots in top and bottom of the case. Tighten the screws just sufficiently to hold the unit in place. Typically this requires one to two turns after the screw point engages with the rear of the mounting panel. It is easy to cause damage with excessive torque when using a larger screwdriver, as the screw thread can easily exert sufficient force to damage the plastic mountings. It is also possible to mark the front surface of the mounting panel if this is made of very thin material and the mounting screws are excessively tightened.
Consideration should be given to the space required above and below the instrument to allow for associated cables. If minimum depth behind the panel is required then the optional mounting collar may be used. Use of this collar increases the front of panel protrusion by 12mm, and decreases the rear depth by a similar amount. If IP54 ingress protection is required, a panel gasket must be used. If the mounting collar is used, a second gasket, or other means must be used to ensure both front and rear edges of the mounting collar are sealed.
The terminals at the rear of the product must be protected from liquids or other contamination.
These units are intended for indoor use only at an altitude of less than 2000m.

7.2 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, surges and transients must be controlled. It is good EMC practice to suppress transients and surges at the source. The unit has been designed to automatically recover from typical transients, however in extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 10 seconds to restore correct operation.
- Screened communication and small signal leads are recommended and may be required. These and other connecting leads may require the fitting of RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems.
- It is good practice to install sensitive electronic instruments that are performing critical functions in EMC enclosures that protect against electrical interference causing a disturbance in function.

7.3 Terminals

All connections (except Ethernet and Profibus ports) are made to screw clamp terminals. Terminals will accept one stranded 0.05 - 2.5mm^2 cable or one 0.05 - 4mm^2 cable. Terminal screws are fully tightened for shipment and must be undone before wire insertion. Terminal screws should be tightened to 0.8Nm or 0.6 ft/lbf only.

7.4 Metered Supply Wiring

7.4.1 Input wiring and fusing

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

7.4.2 Additional considerations for three wire systems

If this product is used in a system with an a.c. auxiliary where the frequency of the auxiliary may be different to the frequency of the signals being measured it will be necessary to connect the neutral terminal (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.

7.5 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.

7.5.1 Wire type

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

7.5.2 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.

8 Auxiliary and Output Connections

8.1 Auxiliary Supply

There are two auxiliary supply alternatives available as factory build options. The auxiliary supply is marked on the rear 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 13 and 14. For 100-250 V, connections are polarity insensitive. For 12-48 V auxiliary, connect to centre and right hand (as viewed from instrument rear) terminals marked – (13) and + (14). Polarity reversal will not cause damage but the instrument will not function.

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 *Operation and Setup guide* section *Remote 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.

8.2 Output Connections

8.2.1 Ethernet

The INTEGRA 1630 Ethernet option module supports 10/100Base-T Ethernet communication. Connection is via an Ethernet switch that supports the IEEE 802.3 standard at 10/100Mbps. The meter is fitted with a socket suitable for an RJ45 connector. Use a CAT5 or CAT6 patch cord to connect the meter to an Ethernet switch or hub. Conventional networking technology is appropriate for the Integra, however, Ethernet is sensitive to electrical interference which may arise in an industrial location. Care should be taken to ensure that Ethernet cables are protected from such interference, and where appropriate, industrial grade Ethernet switches, hubs and other components are used.

8.2.2 RS485 or additional display

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 usually be satisfactory. As the remote device to Integra communication uses RS485, cable length (transmission distance) can be up to 1200 metres in good conditions. Electrical interference or other adverse conditions may reduce the maximum cable length possible for reliable operation.

8.2.3 Profibus option

When using the Profibus option, a straight (i.e. cable conductors parallel to D type pins) connector is arranged to hang down vertically, providing good support for the weight of the connector and associated cable. A 6.25mm tag is provided adjacent to the Profibus connector to give a low impedance signal decoupling earth connection, if required by the Profibus network.
The slide switch on top of the unit allows serial communications to be switched to the Modbus port for setup purposes, if desired. Only one communications port (i.e. Modbus *or* Profibus) can be active at any one time.

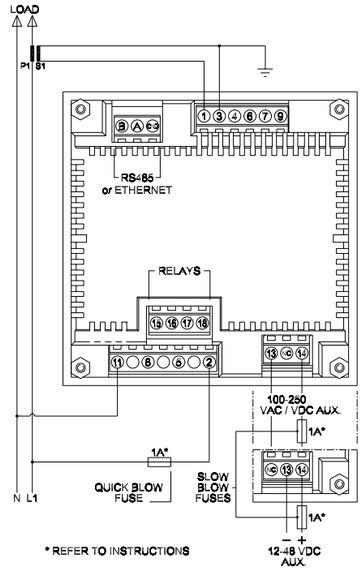
8.2.4 Pulse relays

Up to 2 solid state relays can be fitted. Relay rating is 250V, 50mA, maximum. Lines connected to these terminals must be either short or filtered where appropriate to limit transients and surges to under 1kV (IEC 61326)

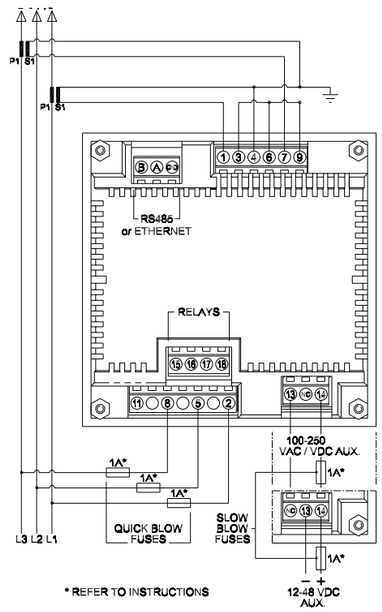
8.3 Metered Supply Connection Diagrams

Connections assume active energy import – for export applications reverse CT phasing

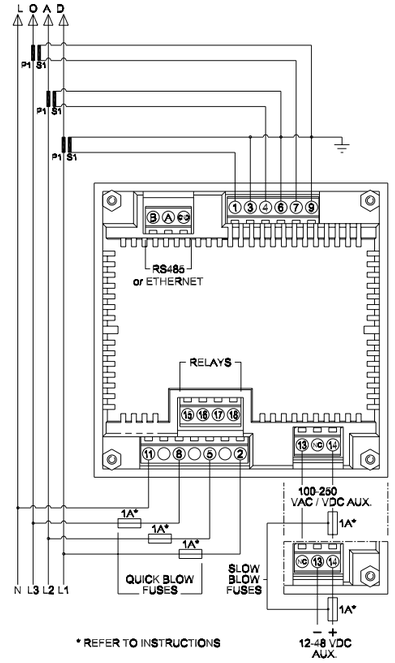
8.3.1 SINGLE PHASE - 2 WIRE



8.3.2 3-PHASE - 3 WIRE UNBALANCED LOAD

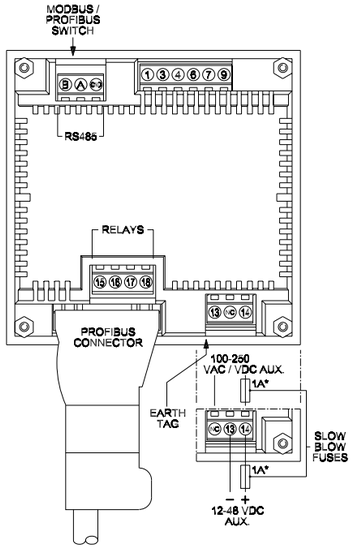


8.3.3 3-PHASE - 4 WIRE UNBALANCED LOAD



8.3.4 Profibus Connections

(metering connections as above)



Date: Jun-09
Reference : INT-1630-INSTAL-OP Iss 6.doc

9 Specification

9.1 Inputs

Nominal rated input voltage

	Voltage range L	Voltage range M
Single phase two wire	57 - 139V L-N	140 - 277V L-N
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 10s 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

9.2 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
Optional auxiliary d.c.supply	12 - 48V DC. nominal +25%, -15%(10.2 – 60VDC absolute limits)
Supply burden	3W / 6 VA (AC or DC supply)

9.3 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.

Accuracy

Voltage	0.17 % of Range Maximum
Current	0.17 % of nominal
Neutral current (calculated)	0.95 % 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 IEC1036 Sect 4.6
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% 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 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.
Error change due to variation of an influence quantity (except temperature) by varying one influence quantity within range of use, whilst keeping all other influence quantities at their nominal value is less than twice the error allowed for the reference condition applied in the test. (This definition is applied to limit the number of combinations to be applied during type tests)
Error due to temperature variation is as above.
Error in measurement when a measurand is within its measuring range, but outside its reference range is less than twice the 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.

9.5 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

9.6 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 (current THD 0-100%)

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

9.7 Standards

EMC Emissions	EN61326 – Emission class A (Industrial)
EMC Immunity	EN61326 – Immunity Annex A (Industrial) – Radiated and conducted immunity: performance criterion A Fast transient and surge: performance criterion B
Safety	IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category III, pollution degree 2, Basic Insulation, for rated voltage.

9.8 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
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.

9.9 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 .. 18 Hz, 1.5mm amplitude peak to peak, 18Hz 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.

9.10 Enclosure

Sealing	IP 54, front face only, when used with panel gasket.
Mounting	DIN 96 panel mounting, plastic moulded case. Optional front of panel collar to reduce depth behind panel.

9.11 Ethernet Option

The INTEGRA 1630 Ethernet option is suitable for connection to SCADA systems using the MODBUS®TCP or Bacnet IP protocol. The Integra 1630 communications guide includes more details.
The Ethernet port supports 10/100Mbs in accordance with IEEE802.11 via an RJ45 socket

9.12 Serial Communications Option

Protocol	Profibus DP, Modbus (RS485) or Johnson Controls N2 Ver A 1996
Modbus Baud rate	38400, 19200, 9600 or 4800 (programmable)
Modbus Parity	None, Odd or Even, with 1 stop bit, or None with 1 or 2 stop bits.

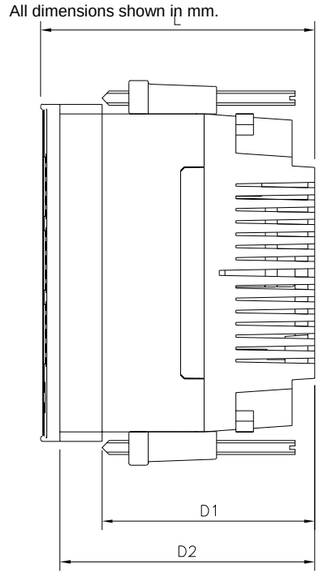
(Note Johnson Controls N2 specifies fixed baud rate and parity)
Programmable Modbus word order at user option.

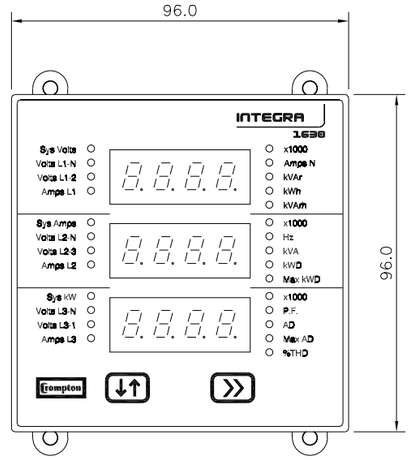
9.13 Active Energy Pulsed Output Option

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	7200 Pulses per Hour max
Relay Rating	240V, 50mA max. Solid state relay contacts to be protected from transients and other EMC by keeping connecting leads short or by adding filtering to keep transients under 1kV.

10 Dimensions

All dimensions shown in mm.





	D1: Depth behind panel front face when using optional mounting collar	D2: Depth behind panel front face without using optional mounting collar	L: Overall product depth
Standard product (RS485/Ethernet)	61 mm	73 mm	79 mm
Extended Product (Profibus)	81 mm	92 mm	98 mm