Installation Safety Requirements

Various symbols used on the instrument are described below:

Caution (refer to the accompanying documents) | Functional (ground) earth terminal | Protective earth terminal

INSTALLATION CATEGORY AND POLLUTION DEGREE

This unit has been designed to conform to BS EN61010 installation category II and pollution degree 2. These are defined as follows:

- **Installation category II.** The rated impulse voltage for equipment on nominal 230V ac mains is 2500V.
- **Pollution degree 2.** Normally, only non-conductive pollution occurs. However, a temporary conductivity caused by condensation must be expected.

PERSONNEL

Installation MUST only be carried out by qualified personnel.

ENCLOSURE OF LIVE PARTS

To prevent hands or metal tools touching parts that may be electrically live, the unit must be installed in an enclosure.

WIRING

It is important to connect the unit in accordance with the data on this sheet, ensuring the protective Earth connection is ALWAYS fitted first and disconnected last. Wiring MUST comply with all local wiring regulations, i.e. UK, the latest IEE wiring regulations (BS7671), and USA, NEC Class 1 wiring methods. Only use copper conductors for connections. Terminal tightening torque 0.4Nm (3.5lbin) max.

Caution

Do not connect AC supply to low voltage sensor input or low level inputs and outputs.

POWER ISOLATION

The installation must include a power isolating switch or circuit breaker. This should be in close proximity (1 meter) to the unit, in easy reach of the operator and marked as the disconnecting device for the unit.

OVERCURRENT PROTECTION

It is recommended that the power supply to the system is fused appropriately to protect the cabling to the unit.

CONDUCTIVE POLLUTION

Electrically conductive pollution, i.e. carbon dust, MUST be excluded from the enclosure in which the unit is installed. To secure a suitable atmosphere in conditions of conductive pollution, fit an air filter to the air intake of the enclosure. Where condensation is likely, include a thermostatically controlled heater in the enclosure.

OVER-TEMPERATURE PROTECTION

When designing a contol system it is essential to consider the consequences should any part of the system fail. In temperature control applications the primary danger is the heating will remain constantly on. This could spoil the product, but more seriously damage the process machinery being controlled, or even cause a fire.

This may occur if the,

- temperature sensor is detached from the process
- thermocouple wiring has short circuited
- unit fails with the heating output constantly on
- external valve or contactor is sticking in the heating condition
- unit setpoint is set to high

Where damage or injury can occur, it is recommended that a separate over-temperature protection unit, and independant temperature sensor, to isolate the heating circuit, is fitted.

Note. Alarm relays within the unit will not indicate all failure conditions.

INSTALLATION REQUIREMENTS FOR EMC

To comply with European EMC directive certain installation precautions are necessary:

- General guidance. Refer to *EMC Installation Guide*, Part no. HA025464.
- Relay outputs. It may be necessary to fit a suitable filter to suppress conducted emissions. Filter requirements depend on the type of load.
- Table top installation. If using a standard power socket, compliance to commercial and light industrial emissions standard is usually required. To comply with conducted emissions standard, a suitable mains filter must be installed.

General

This unit is intended for Industrial Temperature and Process Control applications, within the requirements of the European Directives on Safety and EMC.

Warning

The Safety and EMC protection provided can be seriously impaired, if the unit is not used in the manner specified. The Installer MUST ensure the Safety and EMC of the installation.

UNPACKING AND STORAGE

If on receipt, the packaging or unit are damaged, do NOT install, but contact the supplier. If being stored before use, protect from humitity and dust in an ambient temperature range of -30°C to +75°C.

Caution: Electrostatic discharge

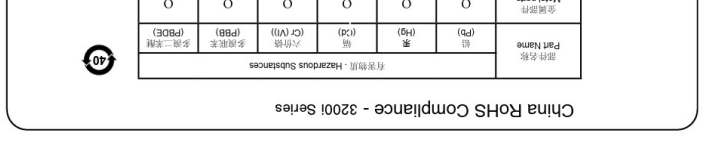
Always observe all electrostatic precautions, before handling the unit.

SERVICE AND REPAIR

The unit has no servicable parts. Contact the supplier for repair.

CLEANING

Use Isopropyl Alcohol to clean label. Labels will become illegible if water or water based products are used. Use a mild soap solution to clean other exterior surfaces.



本表格依据SJ/T 11364的规定编制。

O: 表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。

X: 表示该有害物质至少在该部件的均质材料中的含量超出GB/T 26572规定的限量要求。

This table is made according to SJ/T 11364

O: Indicates that the concentration of hazardous substance in all of the homogeneous materials for this part is below the limit as stipulated in GB/T 26572

X: Indicates that concentration of hazardous substance in at least one of the homogeneous materials used for this part is above the limit as stipulated in GB/T 26572

WARNING: This product can expose you to chemicals including lead and lead compounds which are known to the State of California to cause cancer and birth defects or other reproductive harm.
For more information go to: https://www.P65Warnings.ca.gov

Manufacturing Address
Eurotherm Limited (Head Office)
Faraday Close
Durrington
Worthing, West Sussex
BN13 3PL U.K
Tel. (+44) 1903 263333

Eurotherm Automation SAS
6 Chemin des Jonces - CS 20214
Dardilly cedex
Lyon, 69574
France

https://www.eurotherm.com

HA029465ENG/5 05/2025

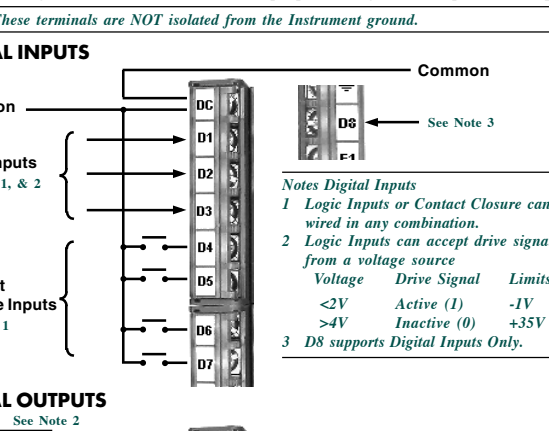
2604/2704 HIGH PERFORMANCE CONTROLLER/PROGRAMMER

Eurotherm® by Watlow

INSTALLATION AND WIRING INSTRUCTIONS

These instruments are modular, fully configurable, high accuracy, high stability temperature and process controllers, available in a single, dual or three loop format. Each unit is supplied as a specific hardware configuration, e.g. there are five 'slots' that contain specific plug in modules, identified by a hardware code printed on the label on the side of the controller at time of ordering. The unit can also be supplied with pre-configured software for some simple applications according to an optional Configuration Code, or configured via the front panel or iTools Engineering Studio.

The 2604 has a dual 7-segment display of process value and setpoint with a LCD panel for display of information and user defined messages. The user interface is menu driven via the display and seven front panel keys.



The 2704 has a 120 x 160 pixel electroluminescent display of all process value and setpoint information and user defined messages. The user interface is menu driven via the display and seven front panel keys.

FEATURES INCLUDE:

- Advanced ramp/dwell programmer with storage of up to 50 programs for the 2604 and 60 programs for the 2704.
- Application specific controllers (including Handbook), i.e. Vacuum Furnace, Carbon Potential, Humidity, Boiler (TDS) and Melt Pressure.
- A wide variety of configurable inputs, including thermocouples, Pt100 resistance thermometers (PRT) and high level process inputs.
- Loop configuration as PID, On/Off or motorised valve position, with control of strategies including single, cascade, override and ratio control.
- PID control outputs can be relay, logic, triac or dc with motorised valve position outputs being relay triac or logic.
- Simplified commissioning and optimised process available via Auto Tuning and PID gain scheduling.

Note. Refer to the Engineering Handbook for Operation and Configuration details, available on the enclosed CD (Part No. LA029175) or via the website.

WARNING

This instrument is fitted with a back up battery which should be changed at regular intervals.

It is important to maintain a record of instrument configuration or, preferably, a clone file which can be re-loaded after a battery change or any other maintenance.

The battery is not serviceable, contact your local service centre to make suitable arrangements. For further information see the User Manuals a https://www.eurotherm.com

Power Supply

Note. Labels may differ between communication protocol variants.

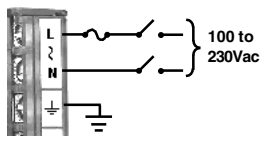
High Voltage Supply		Low Voltage Supply	
Legend	Supply	Legend	Supply
L	Line	24	24V ac/dc
N	Neutral	24	24V ac/dc
⏚	Earth	⏚	Earth

POWER SUPPLY SPECIFICATION

VH SUPPLY VOLTAGE OPTION

This is suitable for connection to a power supply of between 100 and 230Vac ±15%, 48 to 62 Hz, 20W maximum.

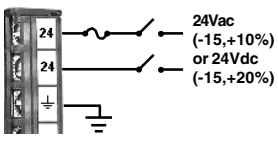
Note. This MUST be fused using a T type fuse (EN60127 time-lag type) rated at 1A.



VL SUPPLY VOLTAGE OPTION

This is suitable for connection to a power supply of 24Vac -15,+10% 48-62Hz or 24Vdc -15,+20%, 20W maximum.

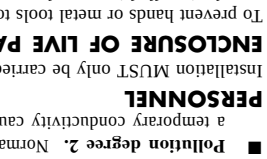
Note. This MUST be fused using a T type fuse (EN60127 time-lag type) rated at 4A.



I/O Expander Terminals (see Note)

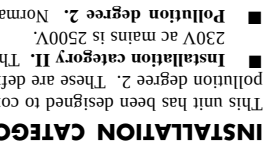
DATA TRANSFER

The primary use of the I/O Expander terminals (E1 and E2) is to connect an I/O Expander Module (Model No 2000IO). This adds a further 20 digital inputs and 20 digital outputs to this instrument. Data transfer is performed serially via a two wire interface from instrument to expander.



DIGITAL INPUT

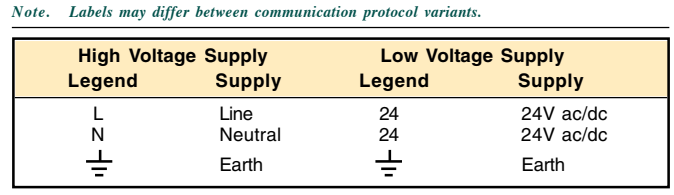
These terminals can only be used as a secondary digital input if the I/O Expander is not fitted. If used in this way simply connect a 2K2, ¼W limiting resistor in series with the input.



Analogue Input Terminals

The Analogue Input Terminals (BA and BB) accept volts, e.g. 0-10Vdc, or Milliamp, e.g. 4-20mA, signals. The signals can be used for remote setpoint input, remote setpoint trim or as a high level PV input to a control loop and can be characterised to match a particular curve from a transmitter.

Note. The terminals are NOT isolated from the Digital I/O and do NOT support direct input from a Thermocouple.



Notes
1 *Use earth screened cables, connect the screen at supply end.*
2 *To earth screened cables, connect the screen to terminal BC.*

Caution

Ensure that mains supplies are connected to the power supply terminals (100 to 230Vac only), the fixed relay terminals or to relay or triac modules. Under no circumstances should mains supplies be connected to any other terminals.
A protective Earth connection is required. ALWAYS ensure that the protective Earth is fitted first and disconnected last.

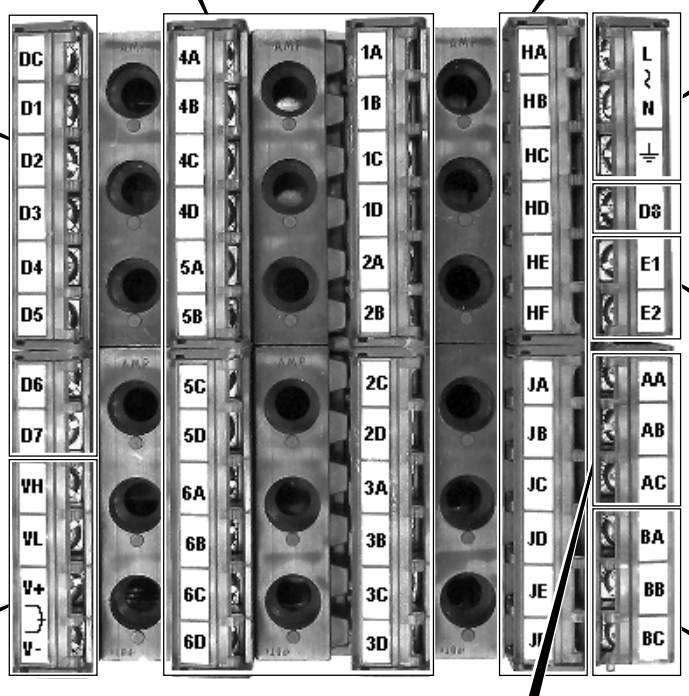
MODULES

SEE PLUG-IN I/O MODULES

Note. Module position 2 is for future expansion.

COMMUNICATIONS

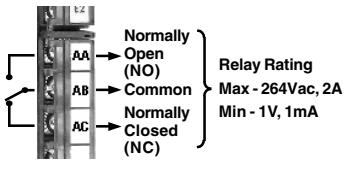
SEE COMMUNICATIONS - DEVICENET™, MODBUS/TCP, MODBUS AND EI-BISYNCH, AND PROFIBUS™



Relay Terminals

These terminals can be configured as a control output, an alarm, or event output. A single changeover relay is provided as standard.

Notes
1 *Connect the Power Supply last to avoid electrical damage.*
2 *Use copper conductors only.*
3 *Do NOT run power and signal cables together.*



Notes **Wiring Specifics.** *All electrical connections made to screw terminals protected by a clear plastic hinged cover, used to prevent accidental contact with live wires. The terminals accept wire sizes from 0.5 to 1.5mm2 (16 to 22 AWG) and should be tightened to a torque of 0.4Nm (3.5lbin). If using crimp connectors, the correct size is AMP, part number 349262-1.*

I/O Expander is not supported beyond products with a product status level (PSL) equal to 'A6' (2604) 'B5' (2704) and above. The status level is specified on the serial number.

Digital I/O Terminals

The eight digital I/O connections provided can be individually configured as,

- **Input.** Inputs are Logic (-1 to 35Vdc) or Contact Closure, and can be configured for Manual, Remote, Run, Hold, Reset, etc,
- **Output.** Outputs are open collector requiring an external power supply, and can be configured as event Alarms, Time proportioning or valve position outputs.

Note. These terminals are NOT isolated from the Instrument ground.

DIGITAL INPUTS

Notes Digital Inputs
1 *Logic Inputs or Contact Closure can be wired in any combination.*
2 *Logic Inputs can accept drive signals from a voltage source*

Voltage	Drive Signal	Limits
<2V	Active (1)	-1V
>4V	Inactive (0)	+35V

3 *D8 supports Digital Inputs Only.*

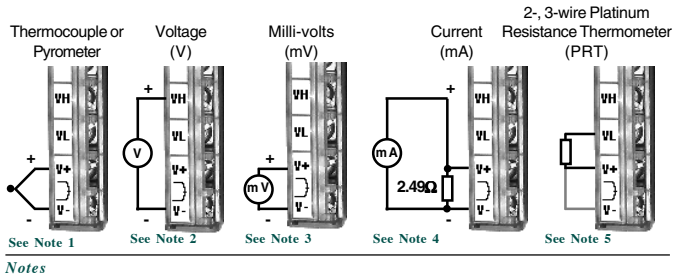
DIGITAL OUTPUTS

Notes Digital Outputs
1 *Relay, Thyristor or Solid State Relay (SSR) Drive can be wired in any combination.*
2 *Digital Outputs support 10 to 35Vdc External Power Supply Unit (PSU)*
3 *Each output is current limited to 40mA.*

Process Variable (PV) Input Terminals

The fixed Process Variable (PV) input terminals can be configured for Thermocouple, PRT (Pt100), Pyrometer, Voltage (e.g. 0-10Vdc) or Milliamp (e.g. 4-20mA) and vacuum - log10 signals. These sensors are used to provide inputs to Control Loop 1.

Note. The terminals are isolated from the Digital I/O. If using shielded cables, only ground one end to avoid ground loop currents.



Notes
1 *Use appropriate compensating cable when configuring and extending a Thermocouple input.*
2 *Operating range between 0V to 10V or 0V to 2V.*
3 *Operating range up to 80mV.*
4 *Operating range between 0 to 20mA or 4 to 20mA.*
5 *A link MUST be fitted between V+ and V- if using a 2-wire PRT. The resistance of each wire in a 3-wire PRT must be the same.*
6 *Do NOT run power and signal cables together.*

The Unit

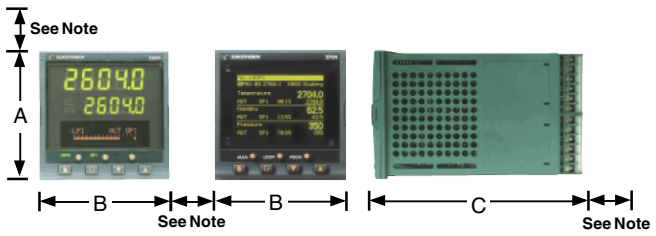
Before installing the unit check the packaging contains the Unit, mounting components, and a CD, and the Hardware code and Configuration code to ensure that it is suitable for the process specified.

TO MOUNT THE UNIT

The Unit is supplied as two parts, the controller and the sleeve, but is intended to be mounted together through a cut out in the front panel of an electrical control cabinet. It is held in position using the panel retaining clips supplied.

The Unit can be mounted vertically or on a sloping panel of maximum thickness 15mm (0.6 inches). Adequate access space must be available at the rear of the instrument panel for wiring and servicing purposes.

Note. Once mounted, the Controller may be removed from the sleeve at any time.

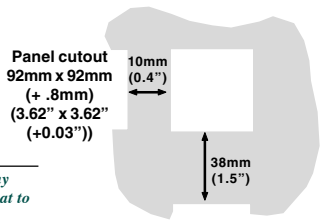


Note. Always allow sufficient clearance for ventilation and connections.

Dimension	Measurement
A	96 mm (3.78 Inches)
B	96 mm (3.78 Inches)
C	150 mm (5.91 Inches)

DIRECT PANEL MOUNTING

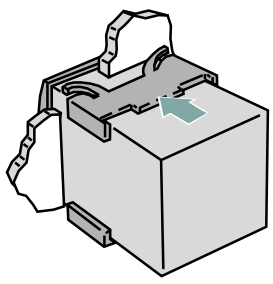
1. Check that the mounting panel is not thicker than 15mm (0.6 inches) (typically for wood or plastic) and not thinner than 2mm (0.08") (for steel).
2. In the mounting panel, cut an aperture 92mm x 92mm (+ .8mm).



Note. Ensure the Unit is not mounted close to any device that is likely to produce enough heat to affect the performance.

3. Insert the Unit through the panel cut out.
4. Spring the upper and lower panel retaining clips into place. Secure the unit by holding it level and pushing both retaining clips forward.

   Once fitted this unit is IP65 rated.



Note. If removing the retaining clips, unhook the side using fingers or a screwdriver, and extract (slide) the unit from the mounting panel.

REMOVING THE CONTROLLER

The controller can be removed from the sleeve by easing the latching ears on either side of the sleeve outwards and pulling the controller forward. When fitting the controller back into the sleeve, ensure the latching ears click into place.

Warning

For safety reasons and to prevent premature wear on the connectors the Power to the Unit MUST be isolated before removing the Controller.

Environmental Requirements	Minimum	Maximum
Temperature	0ºC	50ºC
Humidity (Relative - RH)	5% RH	95% RH
Altitude		2000m

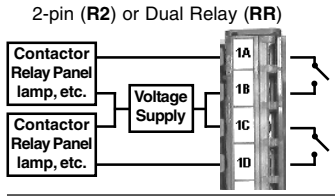
Plug-in I/O Modules

Use 4-terminal I/O modules at Module 1, 3, 4, 5, and 6 only, except where stated.

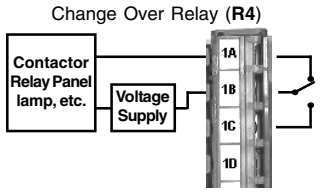
Note. Check the order code on the side of the unit, to learn what modules are fitted, and use 'View Config' level to inspect each Module position. Any changes to the Modules Position should be recorded on the side of the unit.

OUTPUT TYPES

2-pin (**R2**) or Dual Relay (**RR**)

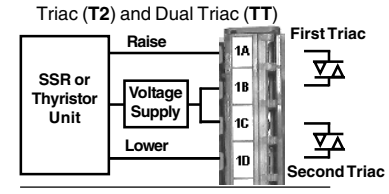


Change Over Relay (**R4**)



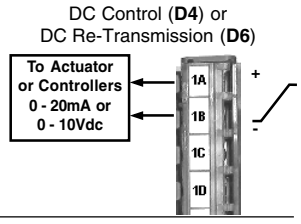
Note. Both Relays support 264Vac , 2A max, 12V, 10mA min.

Triac (**T2**) and Dual Triac (**TT**)



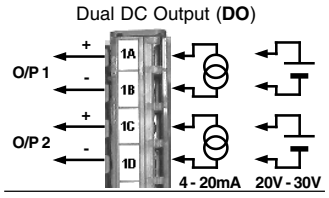
Notes Triac and Dual Triac
1 The combined current rating for the Dual Triacs must not exceed 0.7A, 30 - 264Vac.
2 Dual Relay modules can be configured to offer the same control as the Dual Triac.

DC Control (**D4**) or DC Re-Transmission (**D6**)



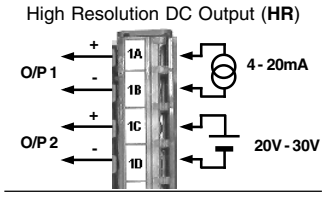
Note. Wire to Actuators for DC Control, and to Controllers for DC Re-Transmission.

Dual DC Output (**DO**)



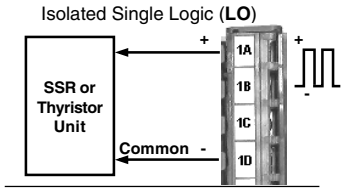
Notes Dual DC Output
1 Supports 4 - 20mA or 24Vdc power supply.
2 Fit in Module positions, 1, 4, and 5 only.

High Resolution DC Output (**HR**)



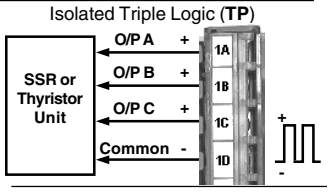
Notes High Resolution Dual DC Output
1 Supports one 15-bit 4 - 20mA and one 24Vdc power supply per channel.
2 Fit in Module positions, 1, 4, and 5 only.

Isolated Single Logic (**LO**)



Note. Isolated Single Logic Output supports 18Vdc, @ 24mA max, per channel.

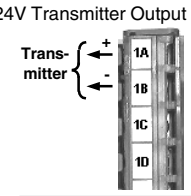
Isolated Triple Logic (**TP**)



Note. Isolated Triple Logic Output supports 18Vdc, @ 8mA max, per channel.

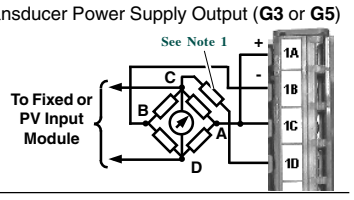
POWER

24V Transmitter Output (**MS**)



Note. 20mA to external transmitter.

Transducer Power Supply Output (**G3** or **G5**)

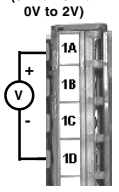


Notes
1 Fit an external calibration resistor if not already installed.
2 Use screened cable to reduce interference for Strain Gauge power supply connections
3 Uses 5 or 10Vdc to power Strain Gauge Transducer
4 Uses Shunt Contact for automatic calibration.

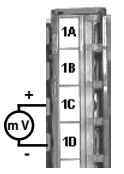
INPUT TYPES

These support both PV (**PV**), Module positions 3 and 6 only, and Analogue Input (**AM**) Modules, any position except Module position 5.

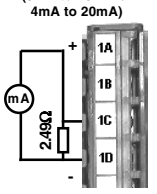
Voltage (V) (0V to 10V or 0V to 2V)



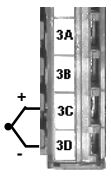
Milli-volts (mV) (up to 100mV)



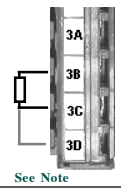
Current (mA) (0mA to 20mA or 4mA to 20mA)



Thermocouple or Pyrometer



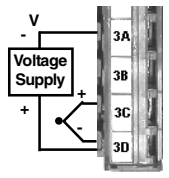
2-, 3-wire PRT



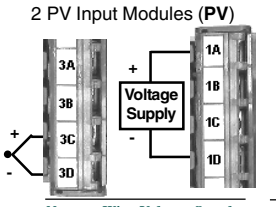
Note. If using 2-wire PRT, fit link between C and D.

These support PV Input (**PV**) Modules, restricted to Module positions 3 and 6.

Zirconia Probe Dual PV Input (**DP**)

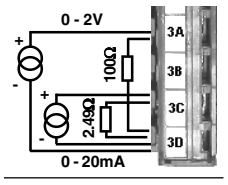


Zirconia Probe 2 PV Input Modules (**PV**)



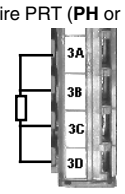
Note. Wire Voltage Supply to any Input.

Dual PV Input (**DP**) (Current source)



Note. Common connections to D, must be returned to D separately.

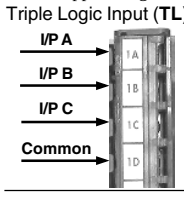
4-wire PRT (**PH** or **PL**)



Notes
1 If runs exceed 30 metres use screened cables.
2 Ensure the resistance of each wire is the same.
3 PH version uses 100Ω , PL version uses 25.5Ω .

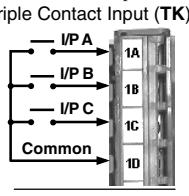
These support Digital and Potentiometer Input Modules fitted in any position.

Triple Logic Input (**TL**)



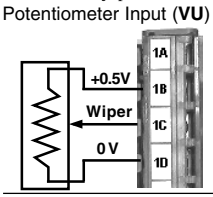
Note. <5V Off, >10.8V On. Limits: -3V, +30V.

Triple Contact Input (**TK**)



Note. <100Ω On, >28KΩ V Off.

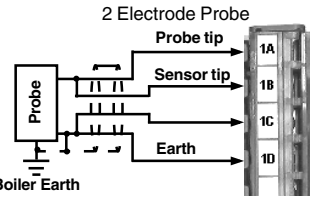
Potentiometer Input (**VU**)



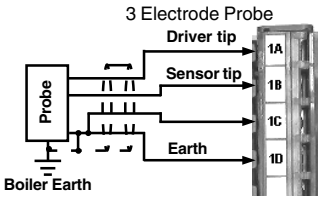
Note. 100Ω to 15KΩ range.

TDS MODULE (2704 ONLY)

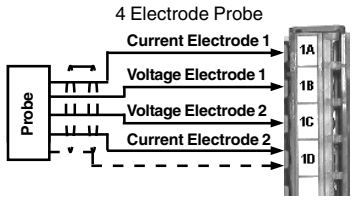
2 Electrode Probe



3 Electrode Probe



4 Electrode Probe



Note. Adhere to suppliers recommendations for grounding and screen connections.

Communications - DeviceNet™

Protocol is DeviceNet™ interface requiring each node to have a unique address on the DeviceNet™ network and must be set to the same Baud rate.

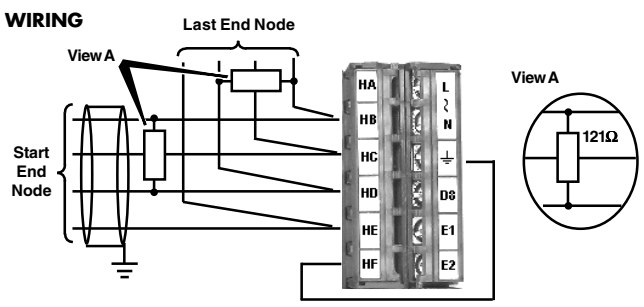
Note. Refer to DeviceNet™ Communications Handbook, Part No. HA027506ENG.

Legend	CAN Label	Chip Colour	Description
HA	V+	Red	DeviceNet™ network power positive terminal.
			Note. If the DeviceNet™ network does not supply the power, connect to the positive terminal of an external 11-25 Vdc power supply.
HB	CAN_H	White	DeviceNet™ CAN_H data bus terminal.
HC	DRAIN	None	Shield/Drain wire connection. To prevent ground loops, the DeviceNet™ network should be grounded in only one location.
HD	CAN_L	Blue	DeviceNet™ CAN_L data bus terminal.
HE	V-	Black	DeviceNet™ network power negative terminal.
			Note. If the DeviceNet™ network does not supply the power, connect to the negative terminal of an external 11-25 Vdc power supply.
HF	-		Connect to instrument earth.

Caution

Power Taps are recommended if connecting a DC power supply to the DeviceNet trunk line. To connect multiple Power supplies, fit a Schottky diode to the V+ of each Power Supply unit. Connect 2 fuses or Circuit Breakers to protect the Bus from excessive current, that may cause damage to the cables and connectors. Connect the Instrument Earth terminal, HF, to the main Power supply earth terminal.

WIRING



TERMINATION RESISTOR

A 121Ω Termination Resistor must not be fitted as any part of a master or slave if already internally installed.

WATLOW
Powered by Possibility

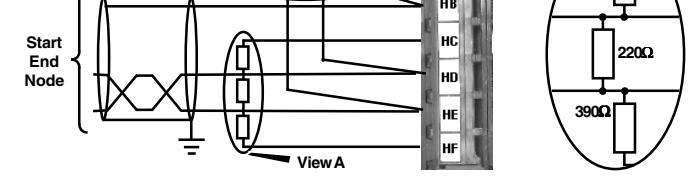
Communications - Profibus™

Protocol is Profibus DP requiring each node to have a unique address on the Profibus network and must be set to the same Baud rate.

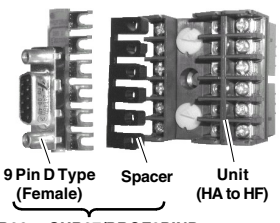
Note. Refer to Profibus™ Communications Handbook, Part No. HA026290.

Legend	Signal	9 Pin D Type	Description
HA			N/A
HB	Shield	1	Shield/Drain wire connection.
HC	VP (+5V)	6	5V supply
HD	Rx/Tx (+ve)	3	Profibus network power positive terminal.
HE	Rx/Tx (-ve)	8	Profibus network power negative terminal.
HF	Dig Grnd	5	Digital Ground.

WIRING



Use standard ProfiBus cables, 'Line A' and 'Line B', with special 9 pin D Type male connector headers, allowing one or two cables to be fitted. A termination load is built in with an ON/OFF switch, set to ON at the two ends of the line. When using 9 pin D Type connections a further assembly is required.



TERMINATION RESISTOR

The Profibus specification states that the Termination Resistor must be fitted to the last nodes in the line.

Communications - Modbus/TCP

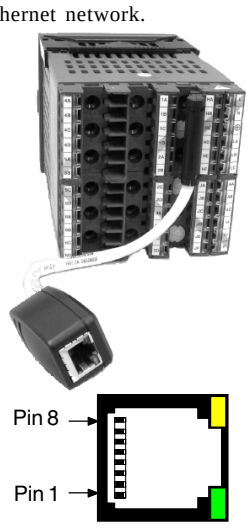
Protocol is Modbus/TCP, 10 Base T on an Ethernet network.

Note. Supported by the 2704 Unit only.

This requires an additional connector, Part no. SUB27/EA. It connects to the HA to HF terminals and allows communications via standard CAT5 cables directly to a Computer or Ethernet Switching unit/Hub.

Note. A cross-over cable MUST be used if connecting directly to a Computer operating as a Network master.

RJ45 Pin	Colour	Signal
8	Brown	N/A
7	Brown/White	N/A
6	Green	Rx-
5	Blue/White	N/A
4	Blue	N/A
3	Green/White	Rx+
2	Orange	Tx-
1	Orange/White	Tx+
	Plug shroud to Cable screen	



Communications - Modbus

Protocol is Modbus RTU, EIA232, EIA485 3-wire or 5-wire.

Note. Refer to 2000 Series Communications Manual, Part No. HA026230.

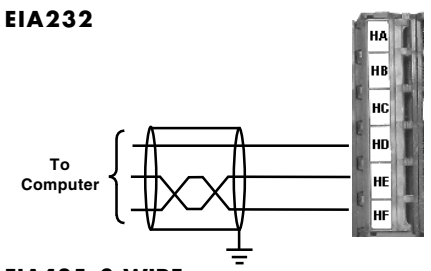
The Modbus network connection is via the HA to HF and JA to JF terminal connections. Units MUST be connected in a daisy-chain method using twisted pair cable.

Note. The Screen from each cable should be connected through and grounded at one point only.

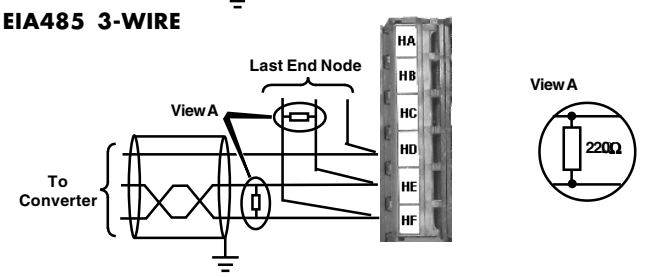
Legend	EIA232	EIA485 3-wire	EIA485 5-wire
HA (JA)	N/A	N/A	N/A
HB (JB)	N/A	N/A	Rx+
HC (JC)	N/A	N/A	Rx-
HD (JD)	Com	Com	Com
HE (JE)	Rx	A	Tx+
HF (JF)	Tx	B	Tx-

Note. Alternatively, use the JA to JF terminals.

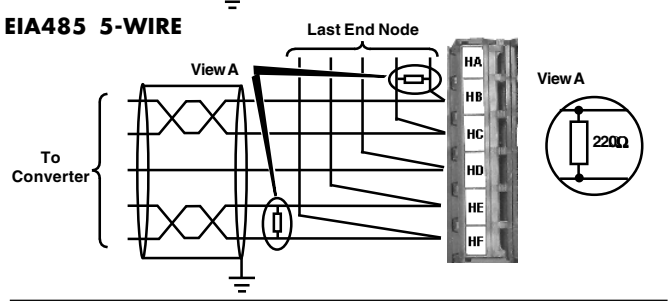
EIA232



EIA485 3-WIRE



EIA485 5-WIRE



Notes EIA485
1 Use twisted pair cable throughout.
2 An EIA232 to EIA485 converter is required when connecting directly to a Computer.

TERMINATION RESISTOR

A 220 Ω Termination Resistor MUST be fitted across the Receiver signals (Rx+ and Rx-) at each end of a maximum 32 communicating instruments.