EUROTHERM
CONTROLS

Engineers Handbook

Model 900 EPC

Doc. No. HA024689
Issue 1

RESTON, VIRGINIA, USA

900 EPC

Engineers Handbook

Printed in England 0193 Part No. HA024689 Issue 1

CONTENTS

Chapter 1	INSTALLATION
Chapter 2	HARDWARE TECHNICAL DATA
Chapter 3	FIELD CALIBRATION PROCEDURE
Chapter 5	PASSWORDS
Chapter 6	MEMORY LIFETIME
Chapter 7	INSTRUMENT REPAIRS
Chapter 8	INSTRUMENT DISMANTLING AND RE-ASSEMBLY
Appendix A	900 EPC CONFIGURATION SHEETS

Chapter 1

INSTALLATION

Edition 1

Contents

Dimensional details 1-1
Instrument sealing 1-1
Rear terminal cover 1-1
Connections and wiring 1-2
Instrument labels 1-2
Instrument layout 1-2
Rear terminal connections 1-3
Power Supply 1-3
    Suppression earth 1-4
Inputs 1-4
    Thermocouple 1-4
    Pyrometer 1-4
    DC signals 1-5
    Remote inputs 1-5
    Quad logic inputs 1-5
    Digital inputs 1-5
Outputs 1-6
    Relay outputs 1-6
    Triac outputs 1-6
    DC control, logic outputs 1-6
    Triple logic outputs 1-7
    Quad logic outputs 1-7
    DC retransmission 1-7
Valve positioner 1-7
    Relays 1-7
    Triacs 1-7
Valve positioner potentiometer input 1-8
Digital communications 1-8
    Digital communications - RS422 (485) 1-8
    Digital communications - RS232 1-8
Transducer power supply 1-8
Caution notes 1-9

Chapter 1 INSTALLATION

If the instrument is to be panel mounted a DIN-size 92mm by 92mm cut-out is required as illustrated.

Should the instrument be required to be sealed to the panel surface, up to IP65, follow the instructions detailed in 'Instrument Sealing'.

Insert the instrument through the cutout via the front of the panel. Install the mounting clamps, one on the top and the other below the instrument. These clamps are located from the rear. Ensure that the four feet are firmly seated in the slots in the case, as shown in figure 1-1.

Tighten the screws firmly with a screwdriver from the rear of the mounting panel; a torque limiter in each clamp prevents over-tightening.

The instrument is supplied with a terminal cover which provides electrical safety.

Figure 1-1 Instrument mounting

Dimensional details

The instrument is of 1/4DIN size and has a rear terminal protection cover. Check that the correct dimensions are used when fitting a gasket for IP65 sealing.

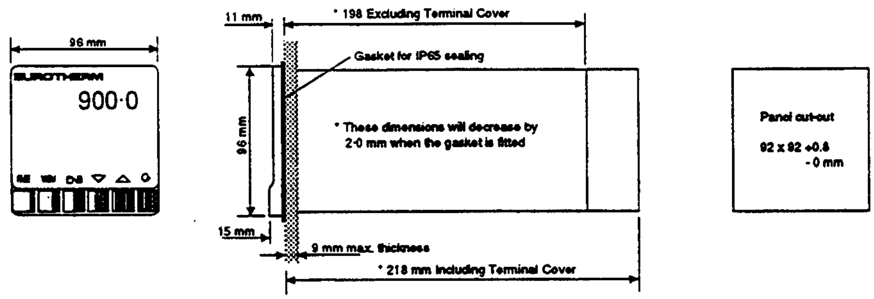


Figure 1-2 Physical size

Instrument sealing

Supplied within the packaging of the instrument, in a separate polythene bag, is a rubber seal. When this seal is correctly placed between the sleeve and the panel surface it will provide protection to the IP65 standard.

If protection of the instrument is not required this seal need not be fitted and only the installation instructions need be followed.

Fitting the seal should be carried out as soon as the instrument is removed from the packing. Place the seal over the front of the instrument so that it sits as shown in figure1-3, against the back of the bezel. The instrument can now be mounted into the panel cut-out and assembly continued as described in the installation instructions.

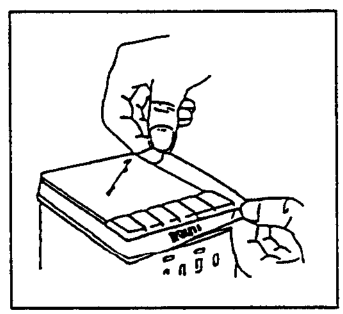


Figure 1-3 Fitting the seal

Note. It is important that the panel cut out dimensions are adhered to for IP65 to be effective. There must be no sharp or burred edges.

Rear terminal cover

To remove the rear terminal protection cover four catches have to be released, two at the top and two at the bottom. Insert the tool supplied to release each pair of catches.

Refit the cover so that the four catches engage in their respective slots.

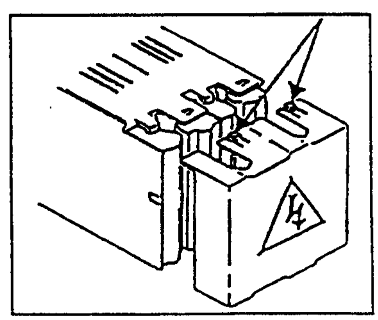


Figure 1-4 Rear terminal cover

Connections and wiring

Electrical connections are made via individual screw terminal blocks on the rear of the instrument. All connections are low current and a 16/0.20 wire size is adequate.

WARNING !

The maximum limit of one type 14 AWG (2.1mm²) or two 17 AWG (1.0mm²) cables into any individual screw terminal block must not be exceeded.Excessive force is not required when tightening screws onto the wires. Do not over tighten.

Wires, once connected to the instrument, can be run up/down the trough as shown in figure 1-5 and optionally secured by ties.

The instrument supply should be fused externally, in accordance with local wiring regulations.

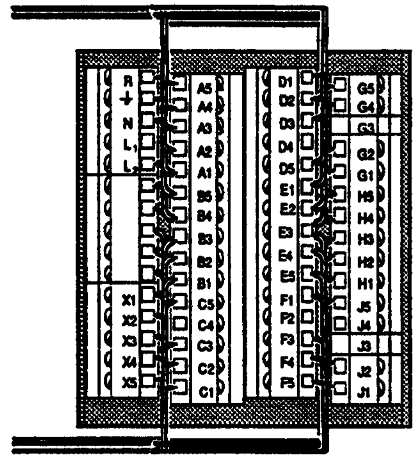
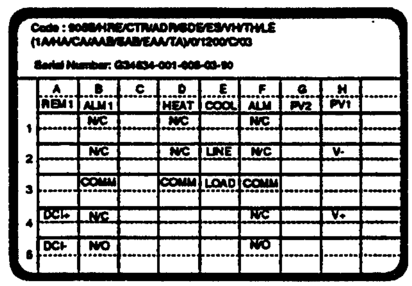


Figure 1-5 Correct cabling position

Instrument labels

Labels on the instrument and case indicate the specific configuration and terminal number connections for the instrument.

This label is found on the sleeve of the instrument and indicates the rear terminal connections for the instrument ordered.



	A	B	C	D	E	F	G	H	
	REM 1	ALM 1		HEAT	COOL	ALM	PV2	PV1	
1		N/C		N/C		N/C			
2		N/C		N/C	LINE	N/C		V-	
3		COMM		COMM	LOAD	COMM			
4	DCI+	N/C				N/C		V+	
5	DCI-	N/O				N/O			

Figure 1-6 Sleeve label

This label is found on the rear of the instrument and indicates the ordering code, serial no. etc.

Code: 905S/HRE/CTR/ADR/SOE/ES/VH/TH/LE
(1A/HA/CA/AAB/SAB/EAA/TA)/0/1200/C/03//

SN : G34534-001-008-03-90
SW VER : 2.11 Service Tel : 0273 91919191 EI

Figure 1-7 Instrument label

Instrument layout

The 900 series of instruments can easily be configured to most customer requirements on site. The microprocessor, power supply and display boards are standard to all 900 series instruments, see figure 8-2. Various plug-in hardware modules can then be fitted to provide the different functions as in figure 1-8. These modules can be allocated to one or two options boards as required. Each option board contains three slots which are pin related to the rear terminals as shown in figure 1-9.

Note: To remove the instrument from the sleeve refer to Chapter 8 "Instrument Dismantling and Re-assembly".

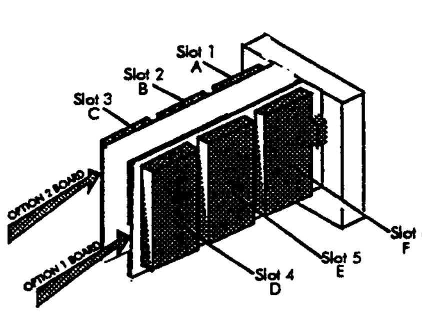
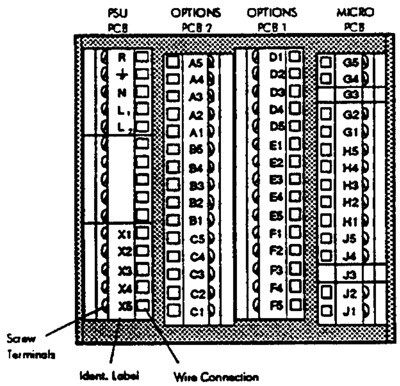


Figure 1-8 Module position

Rear terminal connections



The relationship between the slot numbers given in the diagram on the right and the application of the ordered module installed in that slot are given in Table A.

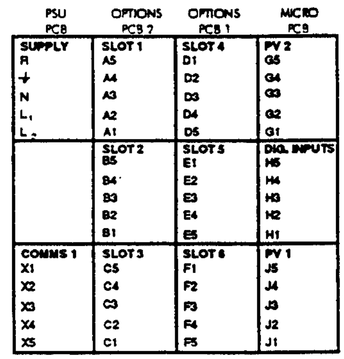


Figure 1-9 Rear terminal layout

Single Loop Instruments (Except Cascade)			Cascade Instruments (911S, 912S, 944S & 945S)			Dual Loop Instruments		
Heat/Process Option	Slot 4	Terminals D1-D5	Heat/Process Option	Slot 3	Terminals C1-C5	Loop 1		
Option A	Slot 5	Terminals E1-E5	Option A	Slot 2	Terminals B1-B5	Heat/Process Option	Slot 4	Terminals D1-D5
Option B	Slot 6	Terminals F1-F5	Option B	Slot 1	Terminals A1-A5	Option AA	Slot 5	Terminals E1-E5
Option C	Slot 3	Terminals C1-C5	Option C	Slot 4	Terminals D1-D5	Option BB	Slot 6	Terminals F1-F5
Option D	Slot 2	Terminals B1-B5	Option D	Slot 5	Terminals E1-E5	Loop 2		
Option E	Slot 1	Terminals A1-A5	Option E	Slot 6	Terminals F1-F5	Heat/Process Option	Slot 3	Terminals C1-C5
						Option AA	Slot 2	Terminals B1-B5
						Option BB	Slot 1	Terminals A1-A5

Table A

Using the above table together with information in the remainder of this section will enable the user to ascertain the rear terminal configuration at the time of ordering an instrument.

Power supply

Two versions of the power supply are available. The power supply can be 85V to 264Vac or a low level ac/dc supply of 20-30Vac / 17.5 - 30Vdc. The two versions of the power supply use different terminals as shown in figure 1-10.

For detailed information on supply specification refer to the environmental section, in chapter 2.

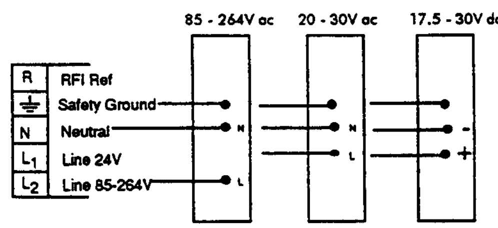


Figure 1-10 Mains connections

Suppression earth

Terminal R is the radio frequency interference reference for the instrument.

When despatched from the factory, terminals R and ⏚ are connected together by a link (R152) on the power supply board. In most cases it is acceptable to leave the internal connection and connect just ⏚ to the supply earth.

In a particularly noisy environment it may be advantageous to separate the RFI from the safety earth by cutting link R152 shown in figure 1-11. Now connect terminal R to a clean earth reference and terminal ⏚ to the supply earth.

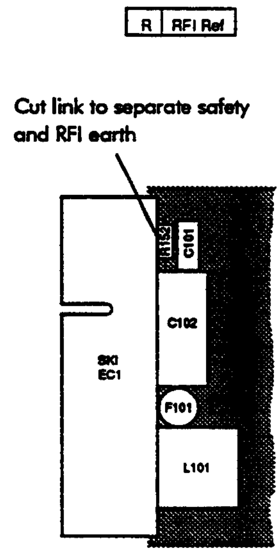


Figure 1-11 RFI connections

Inputs

One or two inputs are provided on the microprocessor board, the number installed on a particular instrument is dependant on the ordering code. Each of these inputs can be low or high level, thermocouple or RTD and will have been factory set to satisfy the ordering code requirements. Figures 1-12 to 1-18 show the connections for the various inputs.

Thermocouple

When the instrument has been configured for internal cold junction compensation (CJC), compensation cable of the correct type for the thermocouple used or the thermocouple itself must be wired to these terminals. Copper wire must NOT be used.

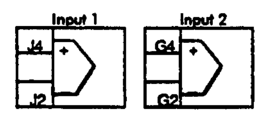


Figure 1-12 T/C connections

If an external cold junction (oven/ice reference) is to be used then copper wires must be used between the rear terminals of the instrument and the cold junction reference.

Resistance thermometer

Only when three conductors between the bulb and the rear terminals have identical resistance's will the lead resistance error be minimised. If a two wire system is used the lead resistance will give errors. When a four wire RTD is used the fourth wire is insulated from all other connections.

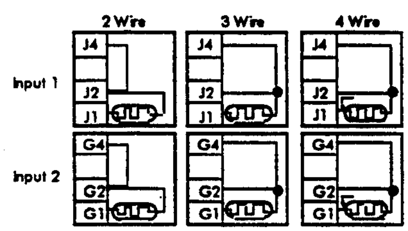


Figure 1-13 RT connections

Pyrometer

For pyrometers requiring a resistive load a burden resistor assembly will be supplied. This burden resistor must be connected across terminals 2 and 4 (polarity is not important) together with the external wiring. An area on the top of the burden resistor assembly is colour coded to indicate the value of the resistor:- YELLOW - 500Ω for Pyrometer Inputs.

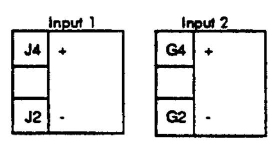


Figure 1-14 Pyrometer connections

DC signals

For inputs less than 100mV use terminals 2 and 4, polarity as shown.

For inputs from 100mV to 10V use terminals 2 and 5, polarity as shown.

For mA inputs a burden resistor assembly will be supplied.

This burden resistor must be connected across terminals 2 and 4 (polarity is not important) together with the external wiring, so that the resistor terminates the incoming control signal.

An area on the top of the burden resistor assembly is colour coded to indicate the value of the resistor:- RED - 5Ω for Process Value mA inputs.

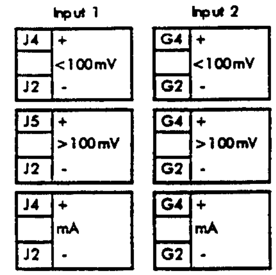


Figure 1-15 DC connections

Remote inputs

One or two remote inputs are available for voltage inputs of -10V to +10V. For current inputs a burden resistor must be connected across terminals 3 and 5 together with the external wiring.

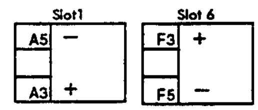


Figure 1-16 Remote connections

50Ω and 500Ω burden resistors are available, distinguished by Brown and Yellow colour markings respectively. 500Ω burden resistors are normally provided, but if the source of the current signal is unable to provide 10V then we recommend using 50Ω and reconfiguring the remote input range to a maximum of 1V. Remote inputs can be fitted in any slot but there is a maximum of one remote input per control loop. Remote inputs are fitted in slots 1/6 on standard products.

Quad logic inputs

To activate any of these inputs connect a device between the particular input and the common, by either a resistance of less than 100Ω, or a voltage of less than 0.7 volts d.c. For an input to be switched to the inactive state, the input device must have a resistance greater than 28kΩ, or a voltage greater than 4.0 volts d.c.

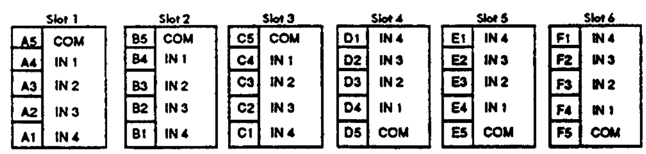


Figure 1-17 Quad logic input connections

Digital inputs

Two digital inputs are available on all types of instrument.

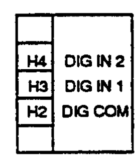


Figure 1-18 Digital input connections

Outputs

Relay outputs

Single and dual relay outputs are available. When a dual relay has been ordered as an alarm output it is shipped in the inverted or 'de-energised' in alarm state. This configuration ensures that the alarm will activate if power to the instrument fails.

For a single relay the contact rating is 2A/264V rms; for dual relays the combined rating is 3A/264V rms limited by the common connector.

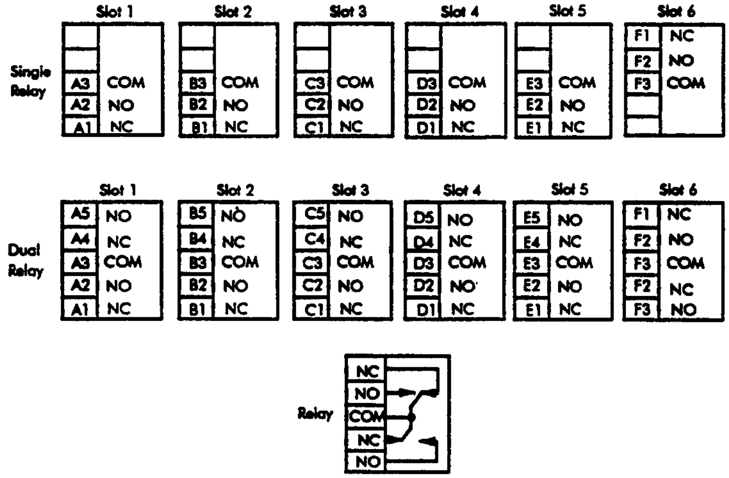


Figure 1-19 Relay connections

Triac outputs

Eurotherm Controls do not manufacture a single triac module for the 900 EPC. Dual modules are fitted for single control outputs. Although it is possible to re-configure for dual control outputs we do not recommend this as the module has a common LINE terminal.

The LIVE supply is connected to the LINE terminals. One side of the load is connected to the LOAD terminals, the other side of the load is connected to the neutral line.

The triac is rated at 0.75A/264V rms per load output.

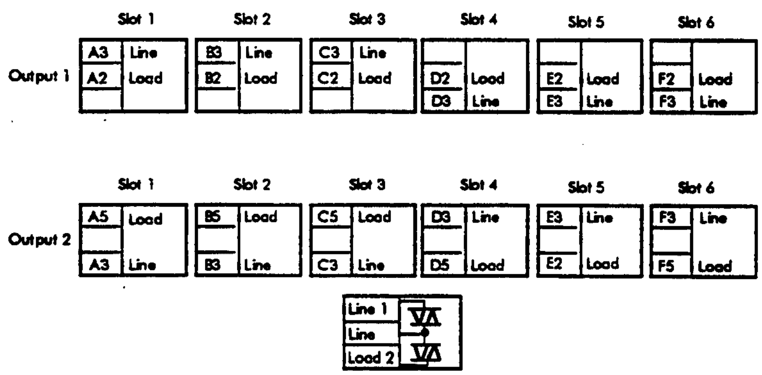


Figure 1-20 Triac connections

DC control, logic outputs

These outputs are isolated dc signals, or logic time proportioning or on/off action.

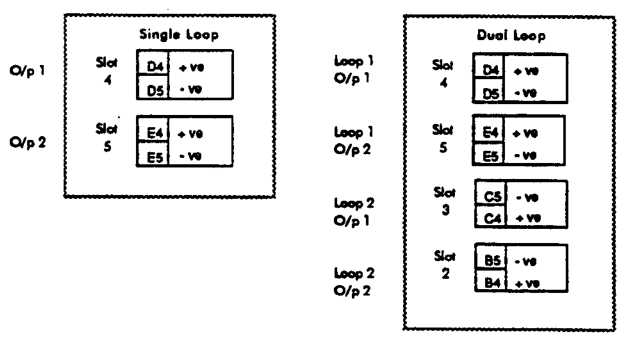


Figure 1-21 DC & logic connections

Triple logic outputs

Each module provides three open collector logic outputs.

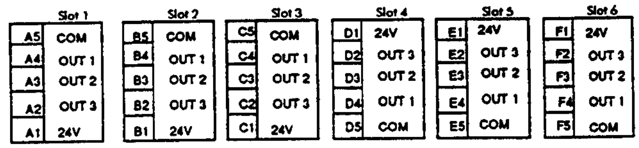


Figure 1-22 Triple logic connections

Quad logic outputs

Each module provides four 5V logic outputs.

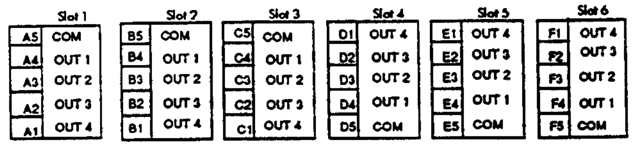


Figure 1-23 Quad logic connections

DC retransmission

Retransmission signals of PV, setpoint, error, power or calculated values can be used on these output channels.

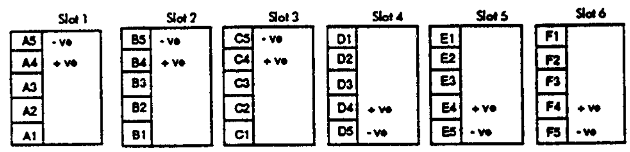


Figure 1-24 DC retransmission connections

Valve positioner

The 900 EPC can use dual relays or dual triacs for motorised valve position control. A link must be set on the module for VP control. See Chapter 2 (figures 2-7 and 2-8) for details. Valve position outputs can be mixed with DC and time proportioning outputs.

Relays

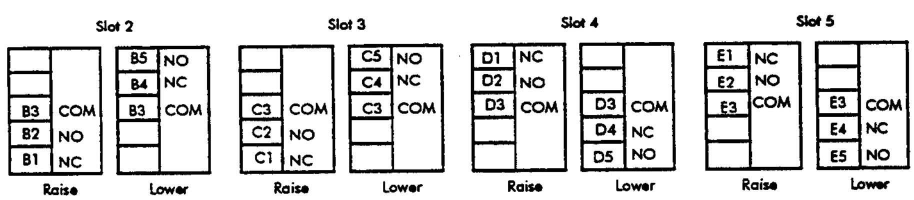


Figure 1-25

Triacs

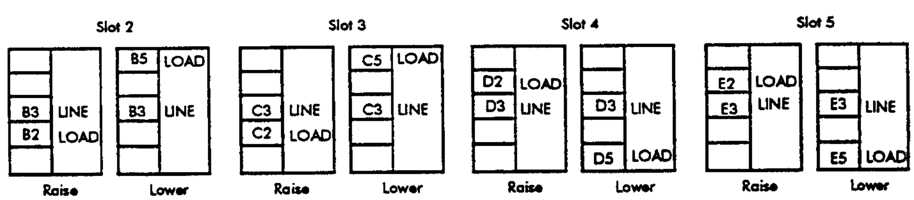


Figure 1-26

Valve positioner potentiometer input

The valve positioner input should be connected so that the resistance between terminals 4 and 5 is lowest when the valve is closed.

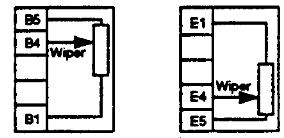


Figure 1-27 VP pot connections

Digital communications

Digital communications - RS422(485)

Terminal 5 is the common and is normally connected to earth via the communications bus. The RS422 interface utilises terminals 3 and 4 for the positive and negative receiver lines and terminals 1 and 2 for the positive and negative transmitter lines.

Digital communications - RS232

Terminal 5 is the common line. Terminal 1 and 3 are the transmitter and receiver lines for the RS232 interface. The communications in the slot on the PSU board is always available.

Refer to figure 2-1 in chapter 2 for the link to select RS232 or RS422/485.

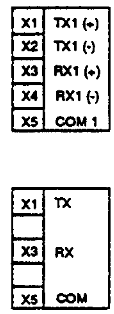


Figure 1-28 Digital communications connections

Transducer power supply

The power supply for a transducer can be either internal or external. If internal the transducer power supply module can be located in any of the slots. Connections are as shown. The +ve and 0V lines must be of the same length and type of wire if accuracy is to be obtained.

The sense line checks the 0V line for any discrepancy in voltage and is therefore connected to the 0V at the transducer. Internal supplies available are 5V, 10V, 12V or 24Vdc.

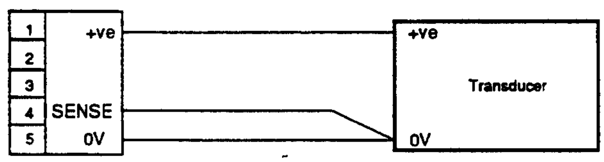


Figure 1-29 Transducer power supply connections

Caution notes

Receiving and unpacking your instrument

This unit is a precision electronic instrument, designed for applications in industrial control rooms, research labs etc. Its shipping container is designed to withstand reasonable shocks. Unpack it carefully, inspect the contents for damage, and keep the original packing materials if re-shipment is required.

If there is evidence of shipping damage, please notify Eurotherm or the carrier within 72 hours. The packaging should be retained for inspection by the manufacturer's representative and/or carrier.

WARNING

Plant and personnel protection

When designing any control system it is essential to consider what will happen if any individual part of the system malfunctions.

In a temperature control application, for example, the danger is that for some reason the heating system remains permanently switched on. This could happen if:-

1. Thermocouple or sensor becomes 'detached' from the system, i.e. is no longer measuring the actual temperature achieved.
2. Thermocouple, or thermocouple wiring, becomes short circuited.
3. Component failure within the controller in such a way as to leave the output switched on.
4. Microprocessor or software failure in a system.
5. Failure of a valve movement or valve linkage.
6. Remote setpoint to controller is faulty.
7. Operation by unauthorised personnel e.g.
   a) Controller left in manual with high output power set
   b) Setpoint set too high
8. Any lack of maintenance in serviceable parts

...and many other unforeseen situations.

If leaving the heater on all the time can cause damage either to the plant itself or its contents, then an independent protection device must be provided.

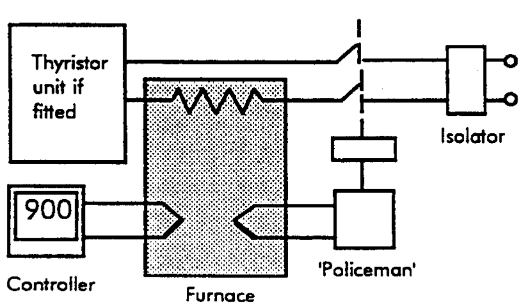


Figure 1-33 Policeman applications

The best form of protection is a completely independent 'policeman'. This is a separate overtemperature alarm with its own thermocouple or sensor, and, on alarm will pull out the main contactor or shut off the valve to ensure the plant's safety.

The normal function of the 'Policeman' is to act as an over temperature alarm forming part of the overall process protection strategy. As such it is essential that all elements of the alarm system be regularly checked to ensure that they are in full working order. We recommend therefore that the system operation, including the 'policeman', be fully tested, on a weekly basis, in order to maximise process protection.

Guidelines for the safe use of electronic equipment

Note. All Eurotherm equipment is designed to operate in harsh industrial environments and is thoroughly tested. These guidelines represent good engineering principles for safe and trouble free operation and are recommended for all control equipment, whether from Eurotherm or any other supplier. They should be used in conjunction with local regulations.

Overcurrent protection

It is recommended that AC power supplies to instruments be protected by fuses or automatic circuit breakers rated at not more than 2 Amperes, and must be separated from any load current circuits.

Voltage ratings

Care must be taken to ensure that maximum voltage ratings are not exceeded. Unless otherwise stated in the specification of any particular unit, the maximum voltage which may be applied between any two isolated circuits, or between any isolated circuit and earth, is limited to the highest rated supply voltage for that unit.

Take particular care not to connect AC supplies to low voltage control inputs such as sensor inputs, logic inputs and outputs.

Enclosure of live parts

Some metal parts of certain types of equipment can become electrically 'live' in some conditions of normal operation.

Unless clearly intended to be panel mounted and accessible during normal operation, all units should be installed inside a suitable earthed metal enclosure to prevent live parts being accessible to human hands and metal tools.

It is recommended that rear terminal covers (available on most Eurotherm units) be fitted wherever possible.

Wiring

It is important to connect all equipment correctly in advance with the installation data provided for each type of unit.

Most connections to equipment require correct polarity to be maintained and due attention must be given to ensure this.

Unlabelled terminals must not be used as 'tie points' for other wires.

Conductors should be commensurate with voltage and current ratings of the units, and should conform to appropriate standards of good practice and local codes and regulations.

Screened cables

In installations where high electrical noise cannot be avoided, twisted pairs of screened cables are recommended as below:

Thermocouples inputs	Use screened compensating cable
Resistance Thermometers	Use screened cable
Logic Inputs/Outputs	Use screened twisted conductors
Analogue Control Outputs	Use screened twisted pairs
Logic Control Outputs	Use twisted pairs
Retransmission Signals	Use twisted pairs
Relay Outputs	Use standard cable

Where screened twisted pairs are used the screen must be earthed at one end only, preferably at the instrument.

Routing of wiring

Care should be taken to ensure maximum separation between low current control or signal wiring and power wiring.

Control wiring refers to those connections to the input of the controller, analogue or logic outputs, digital inputs, remote setpoint inputs and relays switching control signals.

Power wiring refers to those connections to relay or triac switched AC supplies, and wiring associated with external devices such as contactors, alarm relays or motor speed drives, etc.

It is essential that control and power wiring are routed separately through the cabinets and plant.

The A.C. supply, including earth, to all the controllers should be taken from as close to the incoming source as possible and should not under any circumstances be 'daisy chained' from other equipment, especially if it is likely to generate supply borne electrical noise.

Connections to ancillary equipment, such as contactors, should be taken directly from the supply and NOT from the supply terminals of all controllers.

For controllers with digital communications it is strongly recommended that screened cable is used and that only one end of the screen is earthed at the 'cleanest' end, usually at the computer. The screened cable should be routed with the control wiring. Do not use 'spare' wires in the cable for other signals.

If other screened cable is used, e.g. between instrument and sensor, the screen must be earthed at one end only preferably at the instrument.

Earthing

All earth terminals must be securely connected directly to a good local earth by conductors appropriate to the current rating of the units.

Most Eurotherm instruments have internal circuits which are isolated or 'floating'. This is necessary to prevent the occurrence of an 'earth loop' in signal circuits. To avoid possible shock hazards in the event of an internal fault causing breakdown of insulation, it is recommended that all equipment connected to any Eurotherm unit be enclosed in an earthed metal enclosure. Sheaths of thermocouples (or other sensors) should be properly earthed by a separate conductor (instead of being dependent on earthing via the machine framework).

Supply Isolators

Every electrical system should be provided with means for isolating the system from the AC supply to allow safe working during repair and maintenance. Thyristors and triacs are not adequate means of isolating the supply and should always be backed by a suitable mechanical isolator.

Supply Impedance

Control cabinets and equipment should be sited as close to the incoming supply as possible. This is essential on high power systems using thyristors driving large transformer loads. In all cases, both inside and outside the cabinet, long supply cables should be avoided. If they are unavoidable, conductors of an adequate rating must be used. Avoid running instruments from a supply which has shared wiring with high current circuits, particularly if these are switched by contactors or thyristors.

Hazardous Atmospheres

No product should be connected to a circuit which passes into or through a hazardous area unless appropriate precautions are taken (even though the instrument itself may be located in a safe area). Such an installation should conform to the requirements of the relevant local regulations.

Unless categorically stated in the published specification of any particular unit, it should be assumed they are not suitable for direct use in areas subject to hazardous atmospheres.

Caution

If it becomes necessary to remove or replace any circuit board contained in the instrument, or remove any internal electrical connector, make certain the power is OFF, or disconnected.

Some circuit boards contain static sensitive components. Before you remove any board make certain that you, the area in which you place it, or work on it, and the board are properly electrostatically grounded.

Do not exceed the maximum voltage rating for the instrument.

FAILURE TO OBSERVE THE PRECAUTIONS LISTED ABOVE COULD LEAD TO FAILURE OF THE INSTRUMENT'S CIRCUITRY. FAILURES SO CAUSED ARE OUTSIDE THE MANUFACTURER'S WARRANTY.

When the instrument has been installed, configured and commissioned, it is strongly recommended that the instrument configuration is recorded. This can be done by using the IPS tool or manually using the configuration sheets provided in Appendix A of this manual. This record should then be kept in a safe place for future reference.

Chapter 2

HARDWARE TECHNICAL DATA

Edition 1

Contents

Environmental 2-1
Power supply boards 2-2
Digital communications 2-2
Microboards 2-2
    Obsolescence of controller microboard 2-2
        Controller plus software variant 2-2
    Inputs 2-4
    Linear inputs 2-5
    Thermocouple inputs 2-5
    Resistance thermometer inputs 2-5
    Standard version offers -200 to +1000°C range 2-6
    High resolution version offers -200 to +430°C range 2-6
    Digital logic inputs on microboard 2-6
    Power line voltage measurement 2-6
Analogue remote input module 2-6
Analogue retransmission output module 2-7
Analogue control output module 2-8
Valve position input module 2-9
Relay output module 2-9
Triac output module 2-10
Transducer power supply module 2-11
Single logic output module 2-12
Triple logic output module 2-12
Quad logic output module 2-13
Quad logic input module 2-14

Chapter 2 HARDWARE TECHNICAL DATA

Quoted at 25°C unless otherwise stated

Environmental

High voltage power supply: Supply voltage	85 to 264 V ac
Supply frequency	48 to 62 Hz or 360 - 440 Hz
Low voltage power supply: Supply voltage	20 to 32 V ac
or	17.5 to 30 V dc
Maximum input power under normal Operating conditions	< 20 W
Typical start up inrush current	< 3 A
Operating temperature: 4 output modules or less	0 to 50°C
5 or 6 output modules	0 to 45°C
NOTE Total current simultaneously switched by triacs in an instrument not to exceed 2.0 amps.	
Relative humidity	0 to 95% (non-condensing)
Storage temperature	-20 to +75°C
Isolation, creepage and clearance	Designed to conform to IEC 348, UL 1092,VDE 411 and BS4743. Single phase supply operation only is supported.
Susceptibility to electromagnetic interference Conducted fast transients	Designed to conform to IEC 801.4
Radiated	Designed to conform to IEC 801.6
Susceptibility to electrostatic discharge	Designed to conform to IEC 801.2 when panel mounted.
Panel sealing	The instrument fascia meets IP65 when fitted with the sealing gasket supplied and mounted into a cut out as defined in installation instructions.
Mounting	Plug in with panel mounting sleeve. Panel cut-out 92 x 92 mm (+0.8 -0.0 mm) to DIN 43710
Weight (typical)	1.1 Kg (2.5 lbs)

Power supply boards

The low voltage power supply variant carries a label with the words " 24 VOLT PSU ". This label distinguishes it from the high voltage power supply.

The rear terminal connections for the HV and LV PSU's are different, as shown in the installation section. This ensures that if an LV PSU instrument is placed in a sleeve which is correctly wired for the HV PSU, then there will be no connection and the LV PSU will not be damaged. However if by a wiring error HV mains is connected to the LV PSU, then the PSU will be destroyed. An HV PSU will not be damaged however, by connection to an LV supply.

Digital communications

The power supply board also carries the standard RS 232 and RS 422(485) communications channel. The circuitry level shifts and isolates the external signals to those within the instrument. RS 232 or 422(485) are selected with links on the power supply board as shown in figure 2-1.

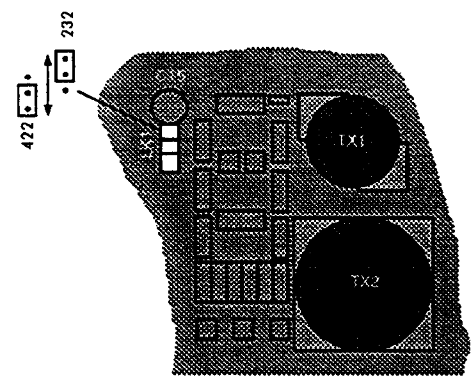


Figure 2-1 Communications mode 232/422 selection

Microboards

The following applies in general to the programmer and controller microboards. Where a difference exists between the programmer and controller boards, this is indicated.

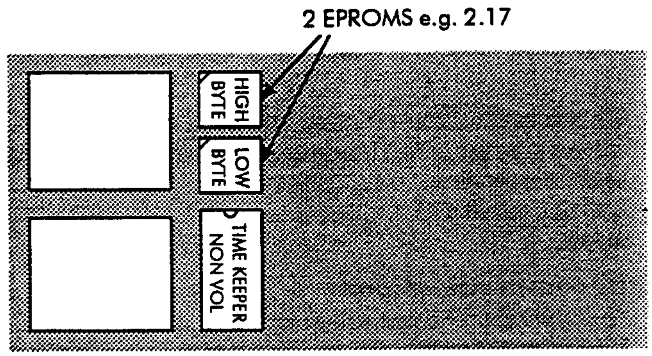
Obsolescence of controller microboard

The controller board in its current format will not be available after the end of 1992. This applies to orders for instruments and spare boards. Instead the programmer board will be supplied in all cases. However the instrument variants previously referred to as controllers (software versions such as 2.10 and 2.17) will be supplied in the programmer board but with only one non-volatile memory fitted. Hence it will still be possible to order spare boards for old controllers that are plug-in compatible replacements. Refer to the latest version of the spare parts list for order codes.

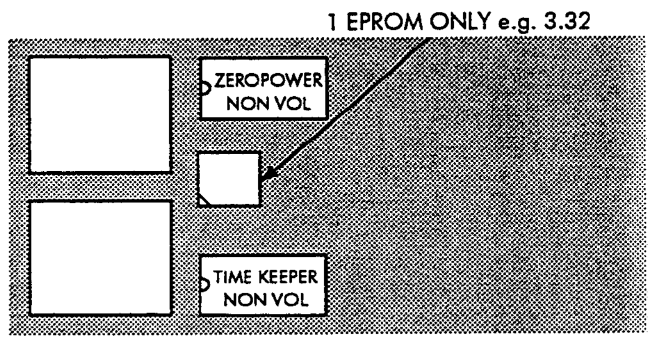
Controller plus software variant

The controller plus introduced in October 1992 consists of special controller software in the programmer microboard hardware. It is not possible to upgrade this to programmer software without corrupting the security data. Figure 2-2 shows the 4 combinations of hardware and software.

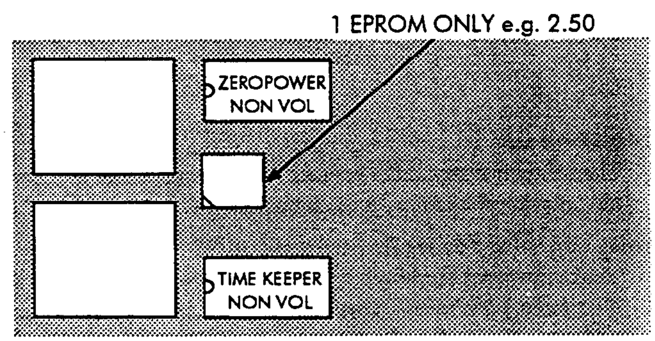
A - Controller microboard hardware



B - Programmer microboard hardware with programmer software



C - Programmer microboard hardware with controller plus software



D - Programmer microboard hardware with controller software

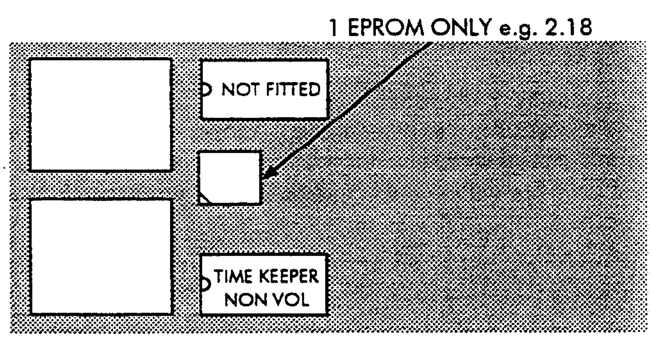


Figure 2-2 Microboard layouts

Inputs

Absolute maximum differential voltage	+/- 15 V at inputs, loop 1 or loop 2.
Inter-channel isolation	Loop 1 and loop 2 inputs are isolated from each other and from all other I/O functions
Sampling rate	10 Hz on 1 or 2 input instruments 20 Hz on single input instruments only
Input filtering	0.1 Sec time constant H/W filter (-3dB at 1.6 Hz) + fixed software filter with 0.1 sec time constant + configurable software filter.
Series mode noise rejection:	
10 Hz sampling	>87dB in ranges 48-52 and 58-62 Hz
20 Hz sampling	>57dB in ranges 48-52 and 58-62 Hz
The series mode rejection filter is automatically selected for 50 or 60 Hz operation at power up by measurement of the power line frequency. If the power line is DC or 400 Hz then the rejection frequency defaults to 50 Hz.	
Common mode noise rejection:	
10 and 20 Hz sampling	>150dB in ranges 48-52 and 58-62 Hz
Sensor break	On all controller microboard hardware and on version 1 of the programmer microboard hardware the sensor break action is selected automatically.Sensor break on this hardware is 'on' for thermocouple but 'off' for linear and resistance thermometer. However, on version 2 of the programmer microboard hardware the automatic selection is disabled and replaced with a link selection. Thus it is possible to enable or disable sensor break for all input options.(Except +/-10V where it is always off). The link positions are shown in figure 2-3. The factory default is to enable the sensor break for thermocouple only. It is left to the user to enable sensor break for the other options if required.

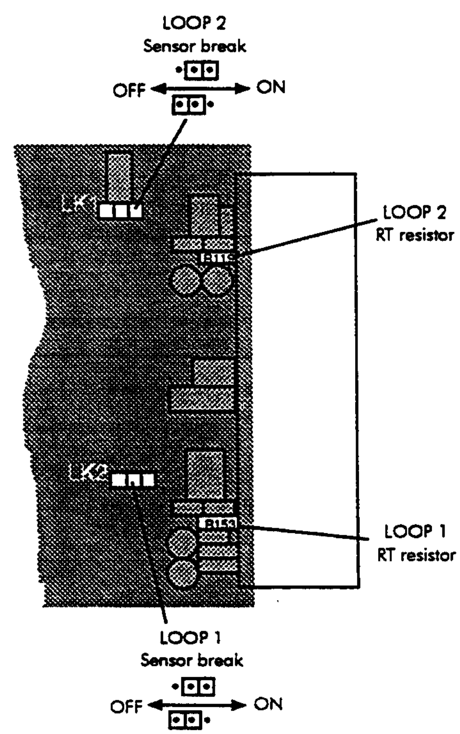


Figure 2-3 Link positions

Linear inputs

Input range +100/-20 mV	
Typical resolution	2.5uV
Minimum resolution	3.0uV
Input range +50/-10 mV	
Typical resolution	1.5uV
Minimum resolution	2.0uV
Input range +20/-20 mV	
Typical resolution	0.8uV
Minimum resolution	1.0uV
Input range +8/-8 mV	
Typical resolution	0.5uV
Minimum resolution	1.0uV
Input range +10/-10 V	
Typical resolution	400uV
Minimum resolution	600uV
Maximum Input linearity error	< 0.01 % of range
Minimum input impedance (resistive)	100 MΩ (20 MΩ if sensor break is on)
Temperature drift of measured input voltage in range 0 - 50℃ ambient.	
Each millivolt range:	
typical	< +/-[25ppm (of reading) + 0.3μV] per ℃
+/- 10 volt range:	
typical	< +/-[43ppm (of reading) + 26μV] per ℃
Factory set calibration accuracy at span	
of range	< 0.1% of the full input range
Typical factory set calibration accuracy at	
zero mV input	< 0.02% of the full input range

If no sensor break action is active on linear mV or V inputs, then a floating input reading will drift slowly up or down from its last valid input value. A mA input is provided with a 5Ω burden resistor.

Thermocouple inputs

Sensor break current	0.125μA, results in upscale sensor break for open circuit input.
Internal CJC	Separate terminal temperature sensor for each loop.
Compensation performance	> 30:1 after 1 minute in range 0 - 50℃
Standards	BS4937 (1973), DIN 43710, ASTM E230 (1972)
Linearisation error	< +/- 0.2℃ for standard thermocouples
Thermocouples supported	All standard types, refer to input coding table in product data sheet for an up to date list.

Resistance thermometer inputs

Connection lead resistances	2 wire or 3 wire with automatic compensation for matched leads
Standards	BS 1904, DIN 43760 PT 100; JIS 100
Sensor break action	This depends on the sensor break link position. If the link is OFF then there is only break detection on the bulb current pth. If the link is ON then there is also break detection on the lead compenstion input. The link position does not effect the calibration accuracy.

Standard version offers -200 to +1000°C range.

Lead compensation error at 25°C (typical)	With remote 3 wire connection, negligible error up to a total of 100 Ω matched lead resistance. Typically the average error is less than 0.01 deg C / Ω.
Bulb current	185μA
Typical resolution	0.05°C
Linearisation error	< +/-0.2°C over span.

High resolution version offers -200 to +430°C range.

This higher resolution range is only available on the programmer microboard hardware when fitted with programmer software versions of 5 or later or controller plus software.
To change to this range it is necessary to change the RT. resistor shown in figure 2-3 from 27K to 13K. It is essential to use the correct resistor type which is available from the catalogue file as CA9B13K0.
A loop dependent comms mnemonic rt. sets the range for the instrument. This parameter is only available over comms and when the instrument is in configuration mode.
A value of 1 sets up the high resolution range and 0 the normal range.
After changing the resistor and range it is necessary to re calibrate the RT. input. All other calibrations are unaffected.
This change should only be carried out by a Eurotherm service engineer.

Lead compensation error at 25°C (typical)	With remote 3 wire connection, negligible error up to 100 Ω total matched lead resistance. Typically the average error is less than 0.01 deg C / Ω.
Bulb current	380 μA
Typical resolution	0.02°C
Linearisation error	< +/-0.2°C over span.

Digital logic inputs on microboard

It is recommended that these inputs are used with volt free isolated contacts only.

Isolation	Isolated from mains power and all other I/O functions, but not from each other. These inputs are electrically connected to the microboard circuitry.
Active state, closed	< 100 Ω (or <0.7 volts dc)
Inactive state, open	> 28 KΩ (or >4.0 volts dc)

Power line voltage measurement

The line input voltage is measured for power feedback correction. The error in the absolute accuracy of the measurement is less than +/- 8% of the maximum line voltage, however the error in the relative correction accuracy is less than +/- 2%.

Analogue remote input module

Isolation	Isolated from mains power and all other I/O functions.
Slot location	slots 4, 5 and 6 for loop 1 slots 1, 2 and 3 for loop 2
Sampling rate	10 Hz only.
Current input range	By 500 Ω burden resistor at rear terminals. If 500 Ω generates too much voltage replace the 500 Ω burden with a 50 Ω burden. Then re-configure the input range to 1 volt
Technical performance	As +/- 10 V linear range on the microboard.

Sensor break	A sensor break pull down resistor of 20M is switched in by link. See figure 2-4.Feature not available before version ML(issue) 2 of the PCB. If sensor break is not selected then the measured value will float at the previous input voltage.

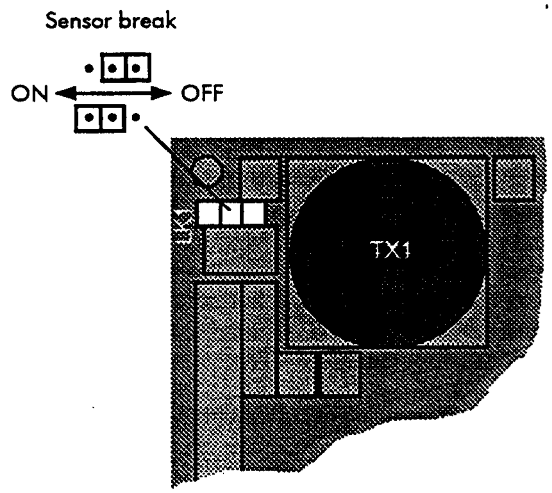


Figure 2-4 Location of sensor break link for remote inputs

Analogue retransmission output module

Selection between voltage and current output is by selection link as shown.

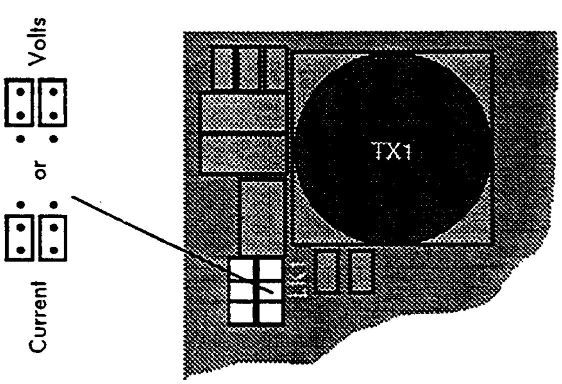


Figure 2-5 Link selection of current or voltage retransmission

Until March 1992 the analogue retransmission module was supplied as a double sized module, but from then as a single sized module.

Isolation	Isolated from mains power and all other I/O functions.
Voltage Output Mode:	
Output voltage range	0 to 10 V span in the range -5 to +10 V
Output current capability	> 20 mA at 10 V output
Output impedance	< 1 Ω
Current Output Mode:	
Output current range	0 to 20 mA
Output voltage capability	> 20 mA output into 18 V
Change in output current with load voltage	< 0.1 μA/V

Resolution	< 1.0 mV or 2.0 µA
Output update rate:	
10 Hz input sampling	10 Hz
20 Hz input sampling	20 Hz
Factory set calibration accuracy:	
maximum error	< +/- 10 mV or 20µA error.
Typical cal error at 0 V. output	< +/- 1mV
Linearity error	< +/- 0.25 % of the full output range
Max settling time 10% to 90%	< 500mS
Typical setting time 10% to 90%	<250mS
Short circuit output current	< 25 mA, voltage output mode
Open circuit output voltage	< 25 V, current output mode
Maximum span drift over 0 to 50°C	< 25mV or 190µA
Maximum zero drift over 0 to 50°C	< 11mV or 40µA
Typical span drift over 0 to 50°C	< 6mV or 40µA
Typical zero drift over 0 to 50°C	< 3mV or 10µA
Output ripple over 0 to 50°C	< 40mV or 80µA at 730 Hz peak to peak

Residual output noise note:- As the output ripple is at 730 Hz a simple input filter such as the 1.6 Hz 1st order RC on the inputs will reduce the ripple to less than 3mV peak to peak. (The analogue inputs on all Eurotherm products are fitted with a filter of this type). The fixed software filter on the 900 EPC inputs further reduces the ripple level to less than 1mV.
If the output is not fed into a Eurotherm instrument ensure that a H/W filter of about 0.1 sec time constant is added externally.

Analogue control output module

Selection between voltage and current output is by selection link as shown.

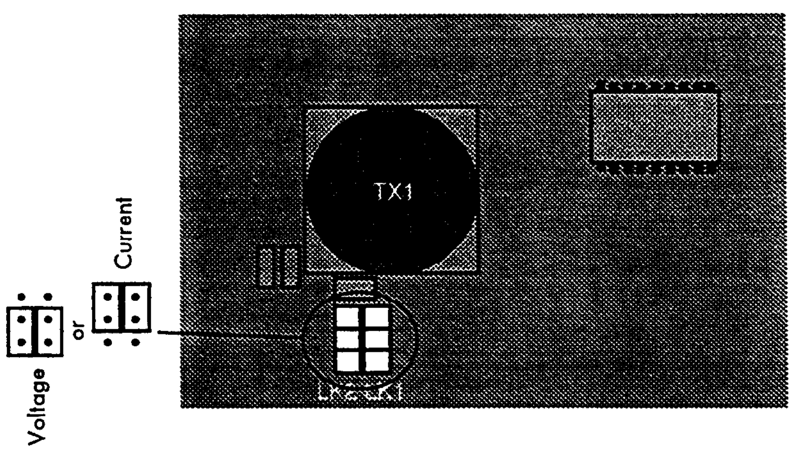


Figure 2-6 Link selection between voltage and current output

Isolation	Isolated from mains power and all other I/O functions.
Voltage Output Mode:	
Output voltage range	0 to 10 V span in the range 0 to +10 V
Output current capability	> 20 mA at 10 V output
Output impedance	< 1.0 Ω

Current Output Mode:	
Output current range	0 to 20 mA
Output voltage capability	>20 mA output into 18 V.
Change in output current with load voltage	<0.1 μA/V
Resolution	0.7 mV or 1.4 μA
Output update rate:	
10 Hz input sampling	10 Hz
20 Hz input sampling	20 Hz
Factory set calibration accuracy at span	<+/- 10 mV or 20μA error
Linearity error (max.)	<+/- 3.0 % of the full output range
Linearity error (typ)	<+/- 1.0 % of the full output range
Settling time 10% to 90%	<50mS
Output ripple over 0 to 50°C	<40mV or 80μA at 730 Hz peak to peak
See also residual output noise note under retransmission output	
Short circuit output current	<25 mA, voltage output mode
Open circuit output voltage	<25 V, current output mode
Maximum span drift over 0 to 50°C	<25mV or 190uA
Maximum zero drift over 0 to 50°C	<11mV or 40uA

Valve position input module

Isolation	Isolated from mains power and all other I/O functions
Potentiometer resistance range	> 100 to < 1000 Ω
Excitation voltage	0.5 V
Input linearity error	< 3.0 % of the potentiometer range
Input resolution	1.0 % of the potentiometer range
Short circuit detection	< 75 Ω
Open circuit detection	> 1200 Ω
Wiper open circuit	Indicated as potentiometer short circuit

Relay output module

1 or 2 relays are provided on each module, subject to build.

Isolation	The relay contacts are isolated from mains power and from all other I/O functions. Note that 2 relays have a shared common connection. To ensure isolation the relays should be used to switch only the same ac mains phase as used on the power supply connection to the instrument.
Contact configuration	Common, N/O and N/C
Snubber (1 per relay)	100 Ω and 0.022μF. This is positioned from common to N/C or N/O by selection link. See figure 2-7.
Off leakage current at 264V ac	< 2mA. due to snubber.
Norm/VP link	This link (see figure 2-7) if set in the VP position ensures that the 2 relays can never both be closed at the same time.
Max. switched current per relay	2 amp at 264 V ac into a resistive load for 1 million operations.
Max. DC current rating per relay	2 amp at 30 V dc
Max. switched current per module (2 relays)	3 amp, limited by connector.
Min permissible load	10 mA at 5 Vdc

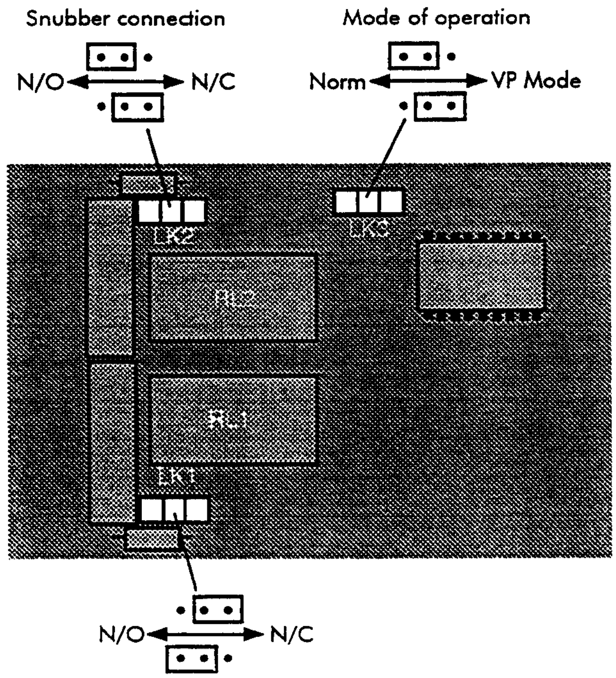


Figure 2-7 Relay module link positions

Triac output module

2 triacs are provided on each module.

Isolation	The triac terminals are isolated from mains power and from all other I/O functions. The triacs have a shared line connection. To ensure isolation the triacs should be used to switch the only same ac mains phase as used for the power supply connection to the instrument.
Max. switched current per triac	0.75 amp at 264 V ac into resistive load
Min switched current	50 mA
Off leakage current at 264V ac	< 2mA. due to snubber
Norm/VP link	This link (see figure 2.8) if set in the VP position ensures that the relays can never both be closed at the same time.
Min switched voltage	85 V rms

The average current switched by all the triacs in an instrument should be less than 2.0 amps in order to limit heat dissipation.

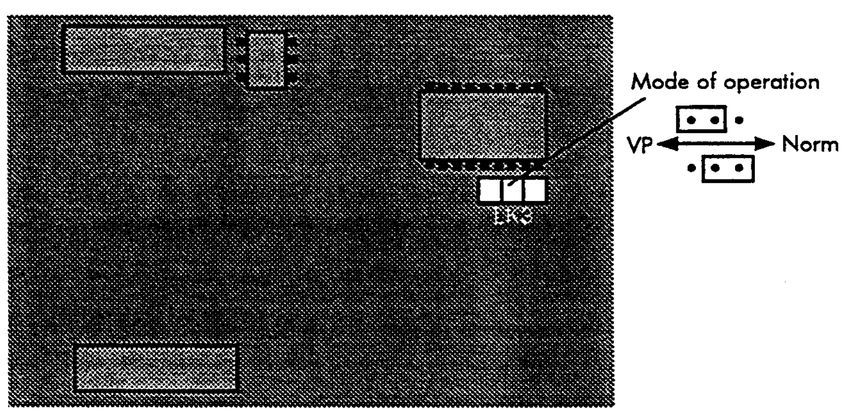


Figure 2-8 Triac module link position

Transducer power supply module

The transducer power supply is capable of delivering a stable excitation voltage for strain gauges and pressure sensors or a supply current for 4-20mA transmitters and transducers.

Isolation	Isolated from mains power and all other I/O functions.
Connection	2 or 3 wire with automatic lead compensation in the return lead. If remote lead compensation is not required connect sense to 0V
Output voltages	Link selectable, (see figure 2-9) between +5 V, +10 V, +12 V and +24 V
Current source capability	10 V into 350 Ω or 29 mA
Short circuit current limit	> 34 mA
Output voltage accuracy	
5 and 10 V	+/- 0.25% of range
12 and 24 V	+/- 2.0 % of range
Typical output voltage variation on 5 and 10 V outputs at fixed temperature and across full load current range	< +/- 1 mV
Output voltage temperature stability 0 to 50°C	
5 V	+/- 4.5 mV
10 V	+/- 6.0 mV
12 and 24 V	+/- 1.0 % of range
Lead compensation error	< 3 mV, for matched lead resistances.
Lead compensation range	max. compensation voltage of 1.0 V

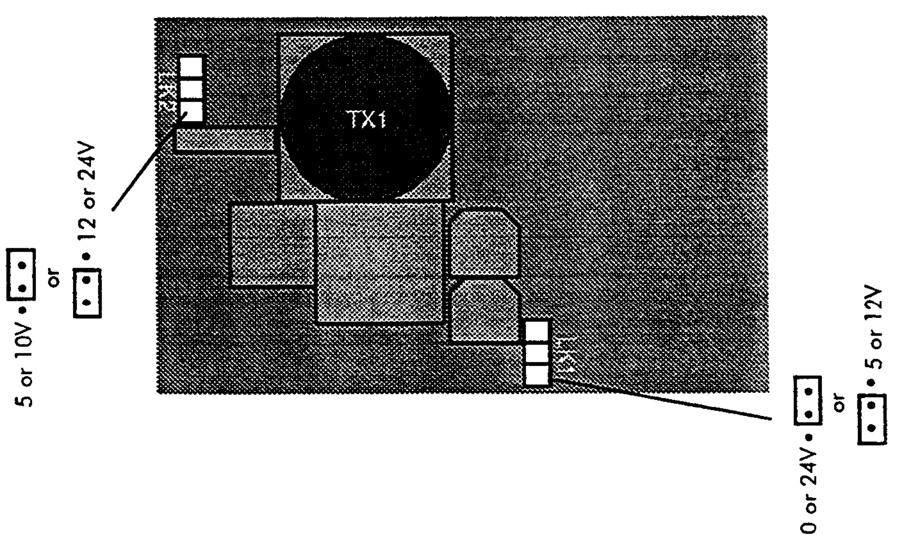


Figure 2-9 Transducer power supply link positions

Single logic output module

Isolation	Isolated from mains power and all other I/O functions.
Switching characteristic	When activated the output functions as a pull up to the on state voltage. When off the output is effectively a high impedance, it does not have an active pull down to common and cannot sink current.
Minimum output	18 volts at 20 mA
Typical output	21 volts at 23 mA
Maximum output	27 volts at 25 mA
Short circuit current limit	> 20 mA
Maximum on state output voltage into open circuit load	37 V
Output transition time	< 1.0 mS

Triple logic output module

Isolation	Isolated from mains power and all other I/O functions. No isolation between the 3 outputs.
Output characteristic	Each output is an open collector transistor. There is no internal pull up so the off state voltage without load is undefined.
Internal supply operation	There is a 24 +/- 1 V internal supply which may be used to source current to the loads.
Current limit with internal supply	There is a current limit of 20mA on the internal supply. This is the sum of the currents in the 3 outputs.
Load connection with internal supply	Connect the load between the 24 V internal supply and the appropriate output. The module common should be unconnected. Due to the diode in the common line, this pin cannot be used as an external reference.
External supply operation	It is possible to use an external supply to source the current to be switched by the outputs. If an external supply is used then the 24 V internal supply should be left unconnected.
Current limit with external supply	There is a current limit 40mA on the external supply. This is the sum of the currents in the 3 outputs. Due to the current sense component the collectors will be offset from the common voltage by 1 V at 40 mA.
Load connection with external supply	Connect the load between the external supply and the appropriate output. Connect the common to ground of the external supply. The internal 24 V supply should be left unconnected.
External supply maximum voltage	The voltage of the external supply should not exceed 48 V absolute maximum.
Connection to relay coils	Where the output is used to switch relay coils or other inductive loads from an internal or external supply, a clamp diode must be externally fitted across each relay coil.
Output transition time	< 1.0 mS

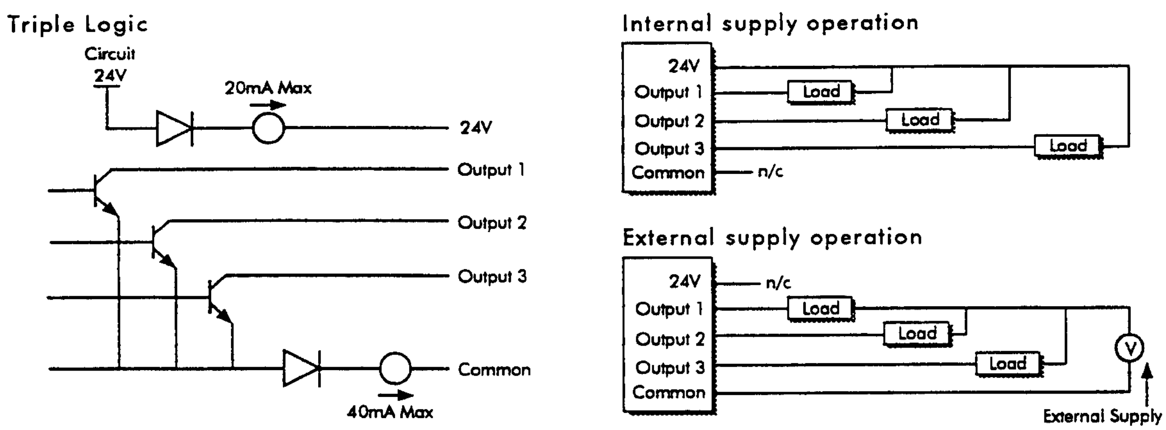


Figure 2-10 Example of connection of the triple logic output

Quad logic output module

Isolation	Isolated from mains power and all other I/O functions. No isolation between the 4 outputs.
Output characteristic	The outputs will sink and source current. Source is from a 5V supply through a diode and 220 Ω resistor. Sink is through a transistor with 10 Ω emitter resistor. See figure 2-11.
Switching capability	Each output will drive 6 standard TTL loads. So each output will source 2 mA at 3.5 V and sink 20 mA at 0.8 V. Output source current is limited by the 220 Ω series resistor. Output sink current limits at typically 50mA.
Connection to systems with other than 5V. logic	As the current source is protected by the series diode it is possible to use the module in systems of greater than 5 V logic. However in these cases it is vital to protect the output transistor by inclusion of a series resistor. See figure 2-11. In general the triple logic module should be used for systems operating at greater than 5 V.
Output transition time	< 1.0 mS

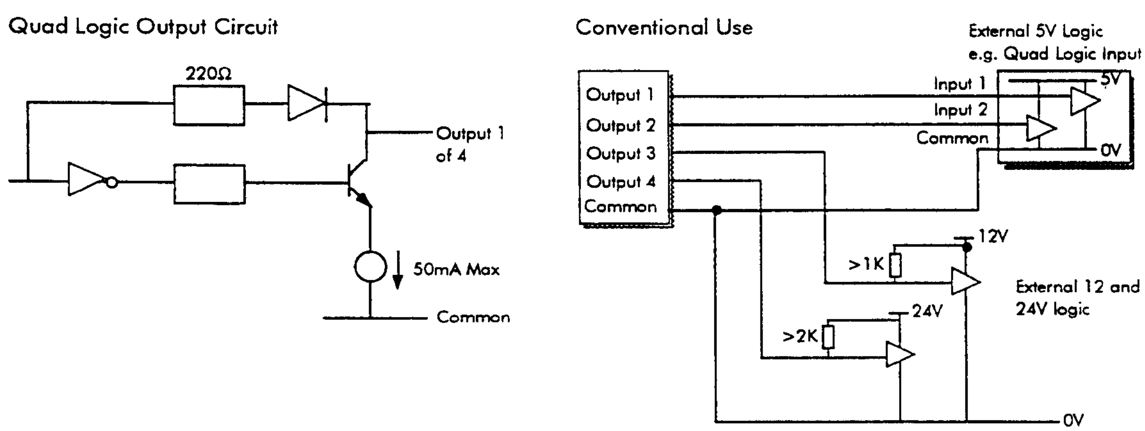


Figure 2-11 Example of the connection of the quad logic output

Quad logic input module

Isolation	Isolated from mains power and all other I/O functions. No isolation between the 4 inputs.
Volt free closed state	Terminate with < 100 Ω
Volt free open state	Terminate with > 28 KΩ
Volt driven closed state	Apply < 0.7 V
Volt driven open state	Apply > 4.0 V
Absolute maximum input voltage	6.0 V
Input impedance	Each input has an internal 10 KΩ pull up to 5V. See figure 2-12.
Noise suppression and debounce	Achieved through a combination of h/w and s/w.

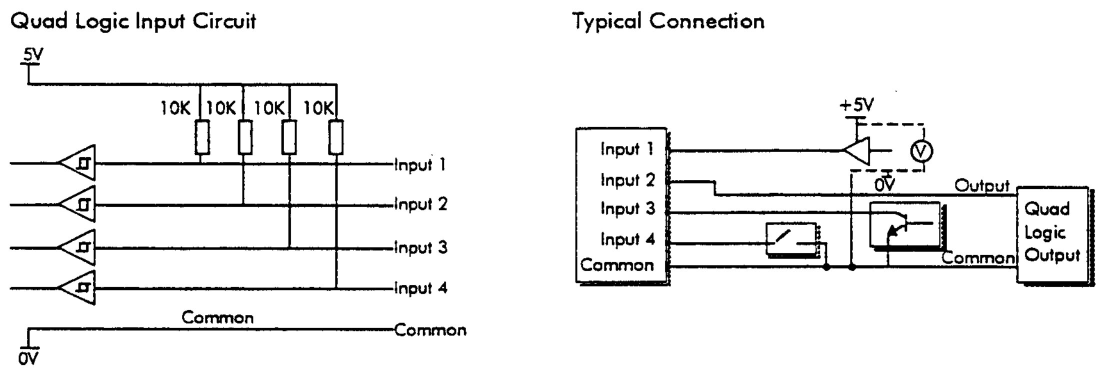


Figure 2-12 Example of the connection of the quad logic input

Chapter 3

FIELD CALIBRATION PROCEDURE

Edition 1

Contents

Equipment 3-1
General information and procedure 3-1
+100/-20mV calibration 3-2
+50/-10mV calibration 3-3
+20/-20mV calibration 3-3
+8/-8mV calibration 3-4
High level input calibration 3-4
Remote input calibration 3-5
CJC calibration 3-5
Resistance thermometer calibration 3-7
DC control and DC retransmission 3-7
Checking input calibration 3-8
Checking output calibration 3-9
Aborting from a failed calibration 3-9
Errors in calibration 3-9
Restoring calibration from backup values 3-10
Initialising the backup values 3-11
Restoring calibration from default values 3-11
Pot. position module (VP feedback) calibration 3-11

Chapter 3 FIELD CALIBRATION PROCEDURE

Equipment

To perform a complete calibration of the 900 EPC controller the following equipment is required.

Two Eurotherm model 239 calibrators or other voltage and milli-voltage sources with a comparable accuracy specification and including some means to switch 'in' and 'out' compensation for the cold junction of thermocouples. An Ice cell or other temperature reference bath can also be used for CJC calibration.

One digital volt meter (DVM) with a basic accuracy of at least 0.1% to be used for output calibration only.

A decade resistance box capable of being set to 50.00 and 250.00 Ω such as the Cropico RBB5. Alternatively two precision resistors of this accuracy can be used.

Check that the above equipment has a valid calibration certificate or stamp.

In addition a 0.25 meter length of K type thermocouple extension wire is needed.

The use of compensation cable is not recommended.

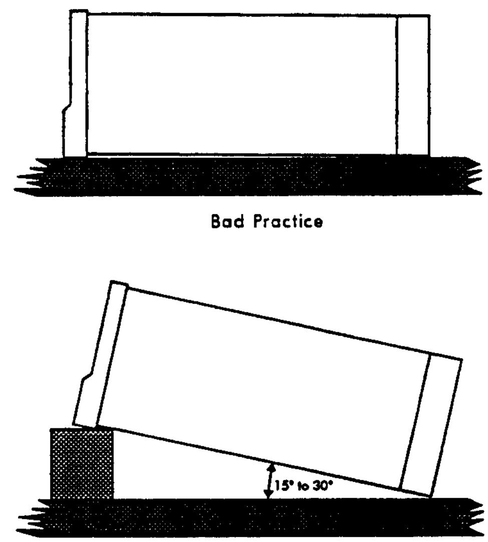


Figure 3-1 Calibration position

General information and precautions

Ensure that the calibration equipment is switched on and allowed to stabilize to ambient temperature for a minimum of 45 minutes before any calibration operations are started. Similarly ensure that the instrument for calibration is switched on and allowed to warm up for a minimum of 30 minutes before calibration operations are commenced.

Ensure that the environment in which the calibration is taking place is as stable and draught free as possible. It is recommended that calibration is not attempted if the ambient temperature is outside the range +10°C to +30°C.

Ensure that at all times during the calibration and warm up sequence the instrument is mounted at an angle of between 15 to 30 degrees to a flat surface. This is to ensure that the air vents in the case are not blocked and a free flow of air is possible. This requirement is most likely to be met if the calibration is carried out with the instrument in sleeve on a bench with a small support under the front.

When the 900 EPC instrument is despatched from the factory it has been calibrated for all thermocouples, resistance thermometers, pyrometers, volts, millivolts and current inputs. Any remote inputs will have been calibrated and DC retransmission and DC outputs will have been calibrated for voltage or current as ordered.

An excellent result is possible when using this procedure to calibrate the instrument in the field. However it remains the responsibility of the engineer to ensure that equipment and environmental conditions are appropriate and to check that the required calibration accuracy is achieved.

The following procedures describe how to calibrate instruments from the front panel user interface. It is also possible to calibrate by using EI Bisync comms. The relevant comms mnemonics are described in the 900 Series Digital Communications Handbook (Order code: SUB900/SPARE/MANUAL/BISYNC).

Millivolt input calibration

There are 4 millivolt ranges on each loop:

+100mV	to	-20mV
+50mV	to	-10mV
+20mV	to	-20mV
+8mV	to	-8mV

To calibrate a given millivolt range it is not necessary to change the configured input range or display range, simply select the required range for calibration as described.

Thermocouple inputs switch to the most appropriate millivolt input range for the required display range by reference to the thermocouple table. It is therefore advised that where a thermocouple input is configured all the millivolt ranges for that loop are calibrated.

Where a loop 1/2 input is fitted with a burden resistor, for conversion from milliamps, this must be removed and the input calibrated as a 100mV input. Calibration of a current input with a burden resistor by using a current source is not recommended as most current sources are of lower accuracy than voltage sources. If required check the burden resistor using an ohmmeter with a measurement accuracy of better than 0.05% on the resistance range. Check that the burden resistor is within 0.1% of stated value.

Where a pyrometer load resistor is fitted, it should be removed before calibration.

Copper wire rather than any thermocouple wire should be used for all calibrations except for that of the CJC.

+100/-20mV calibration.

Connect the input of the instrument to the calibration source as shown in figure 3-2.

This range has an 80mV calibration point so if you are using 239's with a 59.9mV range it is necessary to connect the mV outputs of two 239's in series. Do not use the 9.999V high level range of a 239 as this is far too inaccurate for millivolt calibration.

Enter config and select loop1 or 2 cal as appropriate.

Set the 239 for zero mV output and wait 1 minute.

Perform the low point calibration as shown in figure 3-3.

Set each of the two 239 for 40.0mV (to achieve a overall input voltage of 80mV) and wait 1 minute.

Perform the high point calibration as shown in figure 3-4.

Connect the 239's to loop 2 and repeat for the other loop as required.

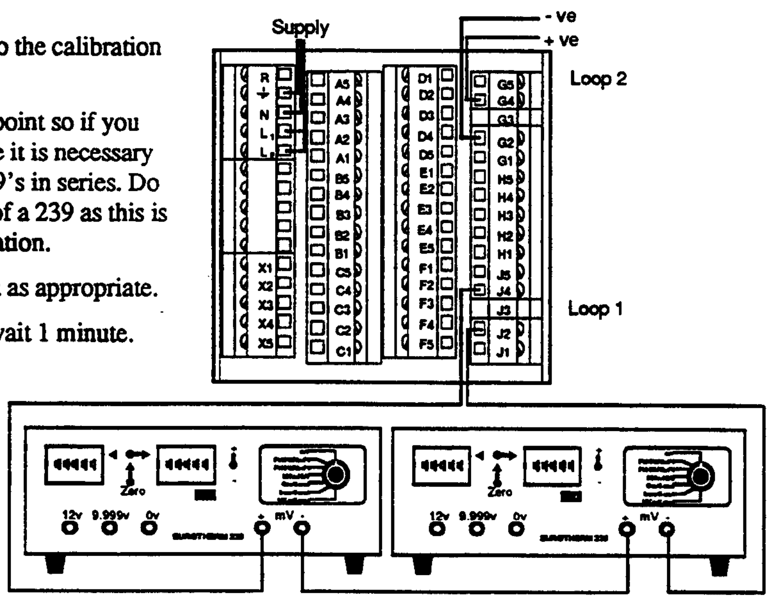


Figure 3-2 mV Input connections

If you require to check the input readings at the calibration points, or others, it is necessary to configure the inputs for the +100/-20 mV range.

The measured input voltage can then be read by reference to the loop 1/2 screens or the process inputs diagnostic page. See also section Checking Input Calibration, on page 3-8.

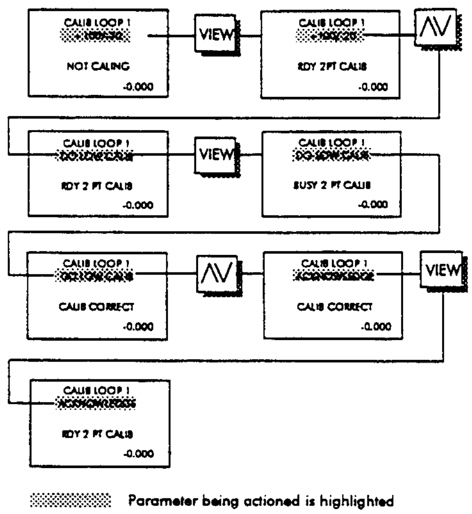


Figure 3-3 Low point calibration sequence

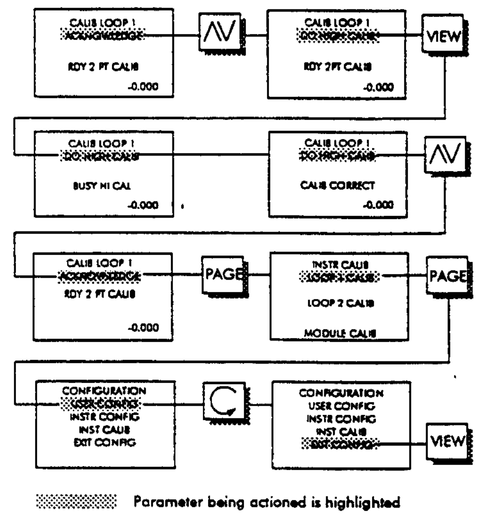


Figure 3-4 High point calibration sequence

+50/-10 mV calibration

Connect the input of the instrument to the calibration source as shown in figure 3-5.

Ensure that a single 239 is used for this range. Do not use two 239's in series.

Enter config and select loop1 or 2 calibration as appropriate.

Set the 239 for zero mV output and wait 1 minute.

Perform the low point calibration as shown in figure 3-3 but substituting -10/50 RANGE.

Set the 239 for 40.0mV and wait 1 minute.

Perform the high point calibration as shown in figure 3-4.

Repeat for the other loop as required.

If you require to check the input readings at the calibration points, or others, it is necessary to configure the inputs for the +50/-10 mV range.

The measured input voltage can then be read by reference to the loop 1/2 screens or the process inputs diagnostic page. See also section Checking Input Calibration, on page 3-8.

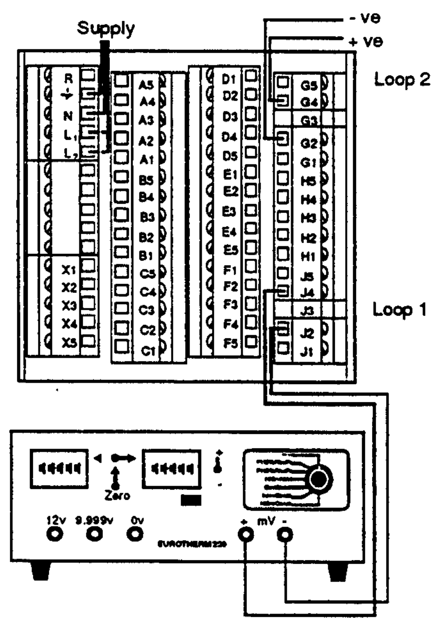


Figure 3-5 mV Input connections

+20/-20 mV calibration

Connect the input of the instrument to the calibration source as shown in figure 3-5.

Ensure that a single 239 is used for this range. Do not use two 239's in series.

Enter config and select loop 1 or 2 cal as appropriate.

Set the 239 for zero mV output and wait 1 minute.

Perform the low point cal as shown in figure 3-3 but substituting -20/20 RANGE.

Set the 239 for 20.0mV and wait 1 minute.

Perform the high point cal as shown in figure 3-4.

Repeat for the other loop as required.

If you require to check the input readings at the calibration points, or others, it is necessary to configure the inputs for the +20/-20 mV range.

The measured input voltage can then be read by reference to the loop 1/2 screens or the process inputs diagnostic page. See also section Checking Input Calibration, on page 3-8.

+8/-8 mV calibration

Connect the input of the instrument to the calibration source as shown in figure 3-5.

Ensure that a single 239 is used for this range. Do not use two 239's in series.

Enter config and select loop 1 or 2 cal as appropriate.

Set the 239 for zero mV output and wait 1 minute.

Perform the low point cal as shown in figure 3-3 but substituting -8/8 RANGE.

Set the 239 for 8.0mV and wait 1 minute.

Perform the high point cal as shown in figure 3-4.

Repeat for the other loop as required.

If you require to check the input readings at the calibration points, or others, it is necessary to configure the inputs for the +8/-8 mV range.

The measured input voltage can then be read by reference to the loop 1/2 screens or the process inputs diagnostic page. See also section Checking Input Calibration, on page 3-8.

High level input calibration

For high level input calibration it is not necessary to change the configuration of the instrument.

Connect the instrument to the 9.999V range of the 239 as shown in figure 3-6.

Enter config and select loop 1 or 2 calibration as appropriate.

Set the 239 for zero V output and wait 1 minute.

Perform the low point calibration as shown in figure 3-3 but substituting HIGH LVL CAL.

Set the 239 for +9.999V. and wait 1 minute.

Perform the high point calibration as shown in figure 3-4.

Repeat for the other loop as required.

If you require to check the input readings at the calibration points, or others, it is necessary to configure the inputs for the +10/-10 mV range.

The measured input voltage can then be read by reference to the loop 1/2 screens or the process inputs diagnostic page. See also section Checking Input Calibration, on page 3-8.

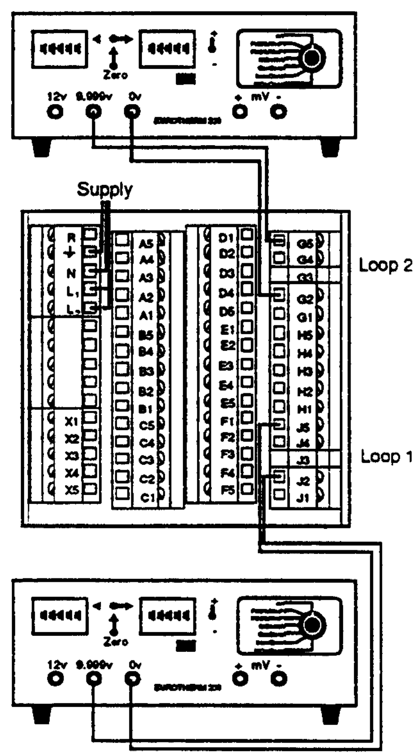


Figure 3-6 High input connections

Remote input calibration

For remote input module calibration it is not necessary to change the configuration of the instrument.

Where a remote input is fitted with a burden resistor, this must be removed and the input calibrated as a voltage input.

Connect the instrument to the 9.999V range of the 239 as shown in figure 3-7.

Enter config and identify the slot number of the module to be calibrated. This is done by examining slot occupancy in INSTR CONFIG / SLT OCCUPANCY. The slot number relates to the rear connector wiring as follows;

Slot no.		Terminal block ident. letter
1	is	A
2	is	B
3	is	C
4	is	D
5	is	E
6	is	F

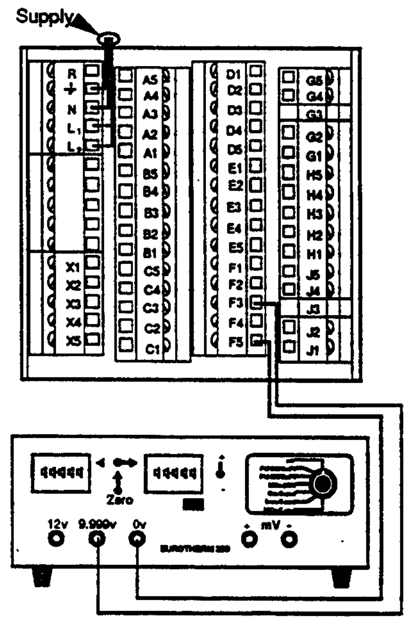


Figure 3-7 Remote input connections

Select MODULE CALIB and enter the appropriate CALIB SLOT number.

Set the 239 for zero volts output and wait 1 minute.

Perform the low point calibration by pressing the VIEW key with DO LO IP CAL selected. When CALIB CORRECT shows, select ACKNOWLEDGE and press the VIEW key.

Set the 239 for +9.999V. and wait 1 minute.

Perform the high point calibration by pressing the VIEW key with DO HI IP CAL selected. When CALIB CORRECT shows, select ACKNOWLEDGE and press the VIEW key.

The calibration is most simply checked by reference to the remote inputs diagnostic page in operating mode at LEVEL 3/DIAGNOSTICS/REMOTE I/PS.

See also section Checking Input Calibration, on page 3-8.

CJC calibration

It is recommended that the CJC sensor is calibrated using type K thermocouple. It is therefore necessary to temporarily reconfigure the instrument for type K if a different type is in use.

There is no advantage to be gained from using other thermocouple types for the CJC calibration, however in principle the same procedure may be applied successfully as long as a display range of +/- 50 °C can be defined.

Before starting the CJC calibration, ensure that the millivolt input calibrations are correct.

The two loops use different CJC sensors and so each requires its own calibration.

The two sensors can be warmed up and stabilized in parallel, but only if you have two 239's. Do not connect both loops to the same 239 at the same time.

Record existing configuration.

Enter config and set the linearisation to type K.

Record the existing configuration, then set the display range for a span of -50°C to +50°C and resolution to at least 1 decimal place.

Set the CJC DEFN in INPUT DEFN in USER CONFIG to INTERNAL CJC.

Exit config to confirm the altered configuration. This is essential.

Connect the instrument to the 239 using the thermocouple extension wire as shown in figure 3-8.

Check that the connection is the correct polarity for the thermocouple type.

If type K is used then connect brown to +ve terminal and blue to -ve terminal. Select NiCr-NiAl (Type K) on the 239.

Set the 239 to zero output.

Protect the instrument from draughts.

Ensure that the rear terminal cover is fitted during CJC calibration.

Check that air is free to circulate through the instrument from bottom to top.

Enter config and select loop 1 or 2 calibration as appropriate.

Wait 5 minutes for the CJC sensor to stabilize.

Perform CJC calibration as shown in figure 3-9. Remember to ACKNOWLEDGE after calibration.

Immediately after calibration and before disconnecting the instrument from the 239, exit from calibration to operating mode and check the temperature that the instrument measures.

If the instrument type is single or dual loop, ratio or cascade you may read the measured temperature on the LEVEL 1 pages. For all other types read the measured temperature in LEVEL 2/3 / INPUTS / LINEARISED / LV1 or LV2.

Check that the instrument reads 0.0 +/- 0.3°C a few seconds after exiting to operating mode.

If the reading is outside these limits then the calibration failed.

If the calibration failed check the thermocouple type, connections, 239 setting and environmental conditions and then repeat the calibration.

Repeat as necessary for the other loop.

Restore the original configuration of both loops.

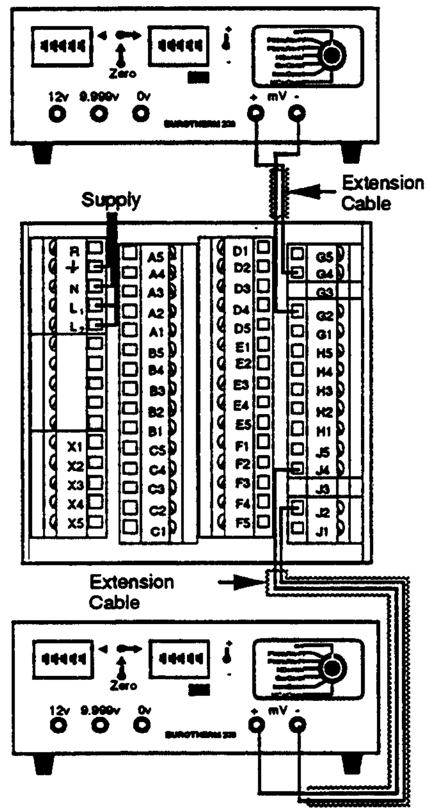


Figure 3-8 C.J.C. input connections

It is recommended that the CJC calibration point is 0 °C as defined by an ice cell or Eurotherm 239.

However if another calibration temperature is required then this temperature can be entered at calibration time as illustrated in figure 3-9. In this case the 239 must be set for the appropriate output voltage as defined by thermocouple tables.

If an ice cell or other fixed temperature bath is used as the reference, then a calibrated thermocouple should be used for the connection to the instrument.

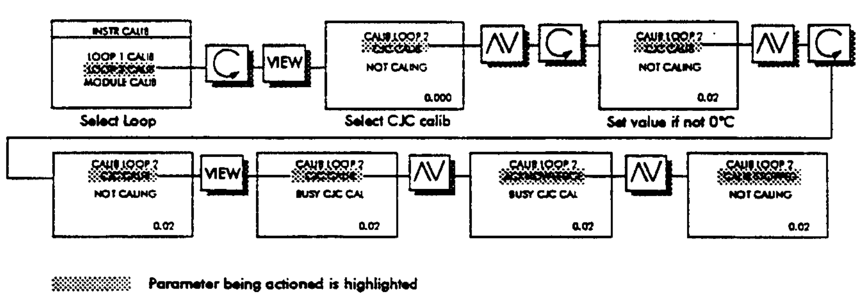


Figure 3-9 C.J.C. calibration sequence

Resistance thermometer calibration

For RT. input calibration it is not necessary to change the configuration of the instrument. This procedure is valid for both the standard and high resolution versions of the resistance thermometer.

Field calibration of the RT input uses the instrument internal RT calibration procedure. This uses the +100mV input range to measure the terminal voltage during calibration.

Accordingly it vital that this millivolt range is within calibration. If in doubt re-calibrate the millivolt input before the RT calibration.

Connect the input to the resistance box as shown in figure 3-10.

If both loops are to be calibrated use two resistance boxes.

The lead resistance between the instrument and the resistance box should be minimised to maximise the accuracy of the RT calibration. Use short lengths of thick copper wire and ensure that connections are well made using screw down terminals onto bare wire. Do not use plug in connectors. Ensure that terminals 1 and 4 are connected directly at the rear of the instrument.

When the instrument is switched on ensure that the calibration resistor is connected. During RT calibration do not let the RT. input become open circuit as this will extend the settling time and reduce the accuracy of the result.

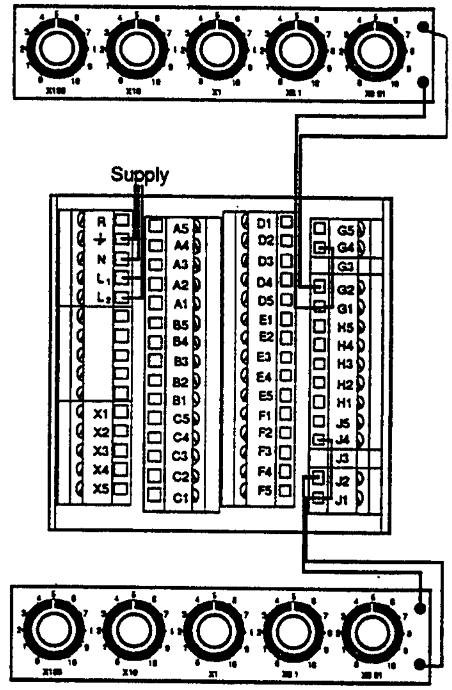


Figure 3-10 RT input connections for calibration

Enter config and select loop 1 or 2 calibration as appropriate.

Set the resistance box to 50.00 Ω and wait 4 minutes.

Perform the low point calibration as shown in figure 3-3 but substituting INTNL RT CAL.

Set the resistance box to 250.00 Ω and wait 2 minutes.

Perform the high point calibration as shown in figure 3-4.

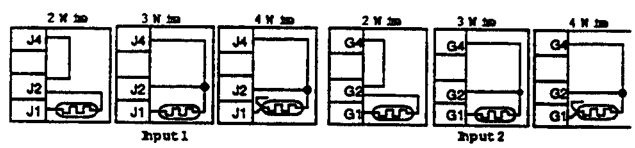


Figure 3-11 RT operating connections

If you require to check the calibration then configure the instrument for the resistance thermometer range and exit to operating mode.

See also section Checking Input Calibration, on page 3-8.

Re-connect the wiring for normal resistance thermometer operation as shown in figure 3-11.

Read the measured input resistance on the process inputs diagnostic page.

Check that the measured resistance is within +/- 0.3 ohms at the calibration points.

DC control and DC retransmission

There are 2 DC output module types that require calibration, the DC retransmission module and the DC control module.

When calibrating either of these modules it is not necessary to change the configuration of the instrument.

Connect the module output to the DVM as appropriate to volts or current mode.

Ensure the module links are set as required for current or voltage output - see chapter 2, Hardware Technical Data.

We recommended that output modules are calibrated without load resistance. However there may be reasons why in specific circumstances it is preferable to calibrate with a load connected.
This is acceptable provided the load is within the specification of the module.

Enter config and select MODULE CALIB. Select the appropriate CALIB SLOT number as described for remote input calibration.

Wait 1 minute for the instrument to stabilize.

Perform the low point calibration as shown in figure 3-12. As shown enter the DVM reading when OP READY shows.

Perform the high point calibration as shown in figure 3-12 but substituting DO HI OP CAL.

The most suitable method for checking the output module calibration will depend on instrument configuration. See also section, Checking Input Calibration, on page 3-8.

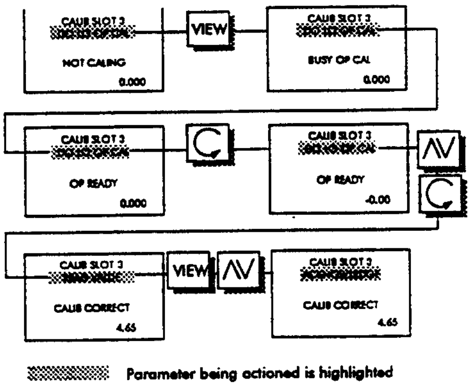


Figure 3-12 Output calibration sequence

Checking input calibration

When calibration is carried out at the factory, an accuracy of +/- 0.1 % of the maximum input range is guaranteed. Maximum input range is defined as the full span of a given range. For example if the input range is configured as 0 to 60 mV, then the +100/-20 mV range will be selected by the instrument. So the calibration accuracy will be +/- 0.1 % of the 120 mV span or +/- 12 µV.

After field calibration, accuracy can be checked to the same 0.1 % figure.

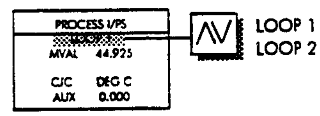


Figure 3-13 Process input diagnostics

The application of these procedures will achieve a result well within this limit. Alternatively it is possible, where required, to check to a narrower limit. In this case it is the responsibility of the calibration authority to ensure that the calibration equipment is of the necessary accuracy.

1. Microboard inputs

   It is simple to check the calibration accuracy of the ranges that the instrument is configured to use. To check other ranges requires changes to the configuration. The input reading is compared to the voltage source setting by reading the process input diagnostics page as shown in figure 3.13.

   On these pages MVAL is the primary measured value. CJC is the internal cold junction temperature and AUX is the lead compensation reading for RTs.

   Resolution is always shown to 3 decimal places.

   For all linearisation types the diagnostic page readings are unaffected by transducer scaling and input inversion.

   If the linearisation is a thermocouple type then MVAL shows the actual input in mV and the measured cold internal junction temperature in °C.

   If the linearity definition is platinum resistance for RT100 or JIS100 then the diagnostics page shows the actual input in ohms and the measured lead resistance in ohms.

   If the linearisation is linear and the input range units mV or V, then MVAL shows the actual input in mV or V.

   However if the units are mA then MVAL shows the millivolts read at the terminal, divided by 5.000.

   Hence if the input is actually current into a burden resistor, then MVAL shows the input in mA.

   Even if the units are mA, it is possible to apply an input voltage for the purposes of checking calibration by checking against MVAL * 5.

   If the linearity definition is square root then MVAL shows as for linear and again depends on the input range units. In addition the input range can be V. in which case MVAL shows the high level input in volts.

   If the linearity definition is pyrometer then MVAL shows mV or V as appropriate to the pyrometer type.

   If the linearity definition is characterised or customer linearisation with CJC or custom linearisation with emissivity adjustment or square root, then MVAL is as defined by the input range units in the same way as for linear.

2. Remote inputs

For remote input modules the remote inputs diagnostic page as shown in figure 3-14 can be used to check calibration. This page shows measured (MV) and linearised (LV) values for remote inputs to loops 1 and 2.

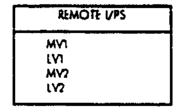


Figure 3-14 Remote input diagnostics

For all remote input linearisation types MV1 and MV2 has the units of the remote input range. If the units are volts then MV shows volts. But if the units are mA then MV shows the volts read at the terminal, divided by 500.00 (the default value of the burden resistor).

Hence if the input is actually current into a burden resistor, then MV shows the input in mA. In this way even if the range is mA, it is possible to apply an input voltage for the purposes of checking calibration.

The quad logic input module does not require calibration. The valve position input module requires calibration only in the sense of alignment to customer chosen values on the potentiometer. This procedure is described in the 900 EPC Series Handbook (Part no. HA021482).

Checking output calibration

Checking of output calibration can generally be carried out from the level 1 screens. However inspection of the configuration screens of SLT FUNCTION, ANAL OP CONF and ANAL OP RANGE will be required to determine the output parameter, output span, units and range of the output parameter over which the span operates.

For instance if the output parameter is Loop 1 SP, the loop 1 display range is 0 - 1000 °C, the output span is 0 - 10 volts and the output range is 400 - 600. Then

Loop 1 SP	Output Voltage
400 °C	0 V
500°C	5 V
600°C	10 V

So in this example by varying loop 1 setpoint it is possible to set up output voltages that can be measured and checked against the predicted values.

The output modules of single logic, triple logic, quad logic, relay and triac do not require calibration.

The transducer power supply cannot be calibrated but the output voltage can be checked by measurement against a voltmeter with an accuracy of +/- 3 mV better. See chapter 2, Hardware Technical Data for accuracy specification.

Aborting from a failed calibration

It is important to note that if the low point calibration has been carried out and acknowledged it is stored in instrument memory. Aborting during the high point will not restore the original low point calibration value.

Aborting the calibration sequence is achieved by selecting CALIB STOPPED and then pressing the View key. The abort procedure is the same irrespective of whichever calibration is in progress

After aborting from the calibration it is possible to restart a new calibration by making the appropriate selection. Alternatively exit from calibration and resume operation with the existing calibration values.

Errors in calibration

In carrying out calibration a numbers of error messages may be displayed instead of CALIB CORRECT.

LOW CAL ERR....The input parameter (volts, millivolts or ohms) is too far from the specified value. Typically the instrument will reject low calibration inputs that are outside the limits shown in table, figure 3-15. Check the input parameter and wiring then attempt to recalibrate. If it fails repeatedly there may be a H/W fault.

HIGH CAL ERR...The input parameter (volts, millivolts or ohms) is too far from the specified value. Typically the instrument will reject high calibration inputs that are outside the limits shown in table. Check the input parameter and wiring then attempt to recalibrate. If it fails repeatedly there may be a hardware fault.

The numbers in this table represent the range of values that the instrument will accept as valid calibration inputs. They do not represent an acceptable accuracy.

OFFSET ERROR....This is a hardware fault where the internal input biasing is incorrect.

INPUT COUNT 0....Check that input wiring is correct for the selected range. If CJC calibration, check that configuration is correct, including linearisation, display range and CJC type. Attempt to re-calibrate. If it fails repeatedly the instrument is faulty.

Range	Low Point	High Point
± 8mV	0 ± 20μV	8mV ± 20μV
± 20mV	0 ± 20μV	20mV ± 20μV
+50/-10mV	0 ± 50μV	40mV ± 40μV
+100/-20mV	0 ± 50μV	80mV ± 80μV
± 10V	0 ± 5mV	10V ± 10mV
R.T.	50 ± 0.25Ω	250 ± 0.25Ω

Figure 3-15 Calibration range windows

SOURCE NOISY....The input reads an unstable or noisy value. Check input source stability and wiring then repeat the calibration.

If it fails repeatedly there may be an instrument fault.

SENSOR BREAK...This is an input or CJC calibration error and indicates that the input signal is out of range or that the display range does not include the temperature of the calibration point. Check the input signal and wiring and also for CJC calibration check linearisation, display range and CJC type.

If it fails repeatedly there may be a hardware fault.

CJC IP ERR....This indicates that the value entered for the CJC calibration temperature is inconsistent with the instrument's reading. Repeat the calibration taking care to set the calibration point temperature (bottom right number). This will be 0.000 unless the cal point is not 0°C. If it fails repeatedly there may be a hardware fault.

VAL OUTSD RNG...This is an error in the calibration of DC output modules or RT and indicates that the value entered for READ VALUE is too far from the nominal.

Check the number entered and the accuracy of the DVM (at least 0.1% on each range).

If it fails repeatedly there may be a hardware fault.

HW NOT FOUND...This is an error in module calibration and indicates that the instrument does not find the required module in the specified slot. Check slot occupancy in INSTR CONFIG to confirm the location of the modules. Also check your slot number with the installation section in the operating manual. If the instrument sees an incorrect module type in a slot, it is likely that the module hardware is faulty or badly mounted.

Restoring calibration from backup values

A set of backup calibration values are held in non volatile memory and can be used to restore working calibration after an unsuccessful attempt at calibration. See figure 3-16.

The backup values are available individually for each loop and the modules.

The backup module calibration values will not be correct if the module hardware has been replaced without performing an initialisation of backup values. Likewise the backup values will not be correct if the non-vol memory has been cleared without subsequent calibration and initialisation of backup values. After non-vol. clear the backup values are equal to the default values.

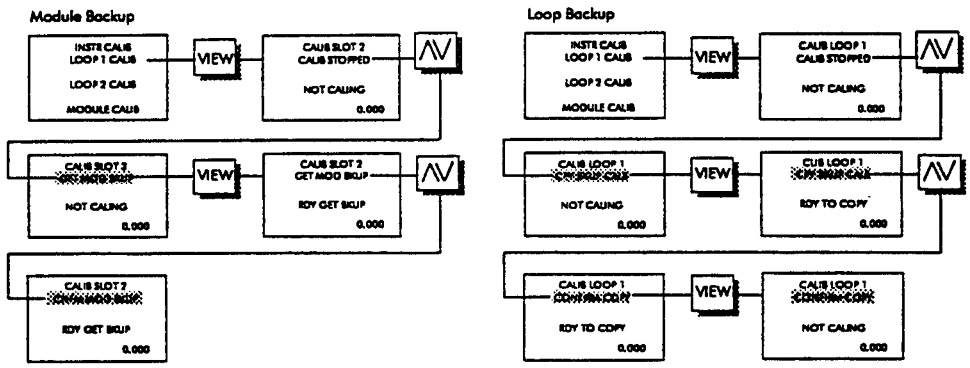
To restore backup values select the required calibration page in config.

Select loop 1/2 or the modules.

Select CPY BKUP CALS and press the view key. When the message RDY TO COPY shows, select CONFIRM COPY and press the view key. It is possible to abort up until the CONFIRM COPY stage.

Repeat the procedure for the other loop or modules as required.

Exit from config.



Parameter being actioned is highlighted

Figure 3-16 Backup calibration sequences

Initialising the backup values

The backup calibration values can be set from the current working calibration values. It is not recommended that you do this unless the non vols. have been replaced or cleared to upgrade the software or if an I/O module has been replaced.

The backup calibration values are initialised as a group. It is not possible to initialise loops or modules individually.

Before initialising the backup values ensure that the current working values are correct. This is done by checking the calibration of loops and modules.

To perform the initialisation select the module calibration page in config. The CALIB SLOT NO is not relevant in this case. Select INIT BKUP CAL and press the view key. When RDY INIT BKUP shows select CNFM INIT BAK and press the view key.

Exit from config.

Restoring calibration from default values

All instruments contain default calibration values in program memory. These are automatically selected when the non vol. memory has been cleared. They are also available for recall to enable recovery from a calibration disaster. The default values might be used, where it is impossible to calibrate and the backup values are not valid or have not been initialised.

Default values are typically accurate to only 2% of span and are loaded only as a group. It is not possible to load default values to a loop or module individually.

To perform restoration of default values select the module calibration page in config. The CALIB SLOT NO is not relevant in this case. Select GET DFLT CALS and press the view key. When RDY GET DFLT shows select CNFM GET DFLT and press the view key.

Exit from config.

Pot. position module (VP feedback) calibration

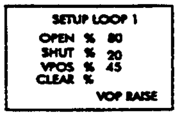
It is necessary to calibrate a valve position input to the particular valve and potentiometer being used since they will vary considerably from valve to valve. The factory settings are inevitably arbitary and are intended only to get you started.

To calibrate the valve position input first set up the valve calibration positions in configuration mode under USER CONFIG / VP POT SETUP. The OPEN and SHUT numbers are the pot positions at which the user wishes to calibrate his pot position input. e.g. 0% would be fully closed and 100% fully open. If the valve characteristics are not very linear at the extremes of travel then other values are more likely to be appropriate (e.g. 10% and 90%).

Next set the limits of valve travel to 0% and 100% under LEVEL 3 / OUTPUTS / VP LIMITS and put the instrument into manual.

The actual calibration is now done as follows:

Go to the valve setup page under LEVEL3 / OUTPUTS / VAL POT SETUP.



Move the valve to its open calibration position using the VOP entry at the bottom right of the screen to raise and lower the valve. When satisfied with the valve position scroll to the OPEN% entry and press the VIEW key. The displayed valve position should jump to the calibration position. Now repeat for the shut position. Move the valve to the shut calibration position, highlight the SHUT% entry and press the VIEW key.

The valve position input is now calibrated and the limits to valve movement can be set to values other than 0% and 100% if necessary.

Two error messages might be encountered. The first is "POT NO MOVE" which occurs if the instrument reads the same valve position when OPEN% and SHUT% are actioned. The other is "RESERVED" which occurs if the resistance measured for an open valve is lower than measured for a shut valve. Also, VSB replaces VPOS if sensor break occurs and value goes to 0% to indicate an open circuit potentiometer and 100% for short circuit.

The calibration can be cleared by pressing VIEW on the CLEAR legend.

Chapter 5

PASSWORDS

Edition 1

Contents

Default password and loss of user passwords 5-1

Chapter 5 PASSWORDS

Default password and loss of user passwords

Entry into configuration mode and also operating modes at levels 2 and 3 is protected by passwords. There are 2 valid passwords that will gain access to any of the above 3 modes. Firstly there is the user definable password and secondly there is the default password which is constant for all instruments.

The user definable passwords can be changed in operating mode in LEVEL 3/UI_SECURITY/PASSWORDS. After the non-vols have been cleared the user passwords are all set to zero.

The fixed default passwords are;

Configuration	1106
Level 2	4485
Level 3	9756

In the event of the user passwords getting lost just enter level 3 using the default passwords and set the user passwords as required.

Chapter 6

MEMORY LIFETIME

Edition 1

Contents

Checking the non-volatile memory lifetime 6-1

Chapter 6 MEMORY LIFETIME

Checking the non-volatile memory lifetime

The non-volatile memory devices used in the 900 EPC, are components with a long, but limited lifetime. The expected useful working life of the devices is 10 years.

In order to ensure that the non-volatile devices are replaced with minimum disruption and inconvenience we recommend that the lifetime remaining is checked whenever a microboard is serviced. This is done by examination of the manufacturers date code printed on each device. The date codes are illustrated in figure 6-1

The first digit is not part of the date code and should be ignored.

If the date code shows that the device is more than 8 years old we recommend that it is replaced with a new non-volatile memory of the appropriate type. That is ensure that the zeropower or timekeeper are used as in the original.

Replacements parts are available under a spares code and are despatched already cleared. Refer to current spares list.

Eurotherm UK offer non-volatile memory replacement as a service item.

The controller requires a TIMEKEEPER ram.

The programmer requires a TIMEKEEPER and a ZEROPOWER ram. The location of this component is shown in figure 2-2 in chapter 2.

Before fitting the replacement devices it is necessary to save the instrument configuration. This can be done either manually or using IPS. If IPS is used refer to the IPS manual for detailed instructions.

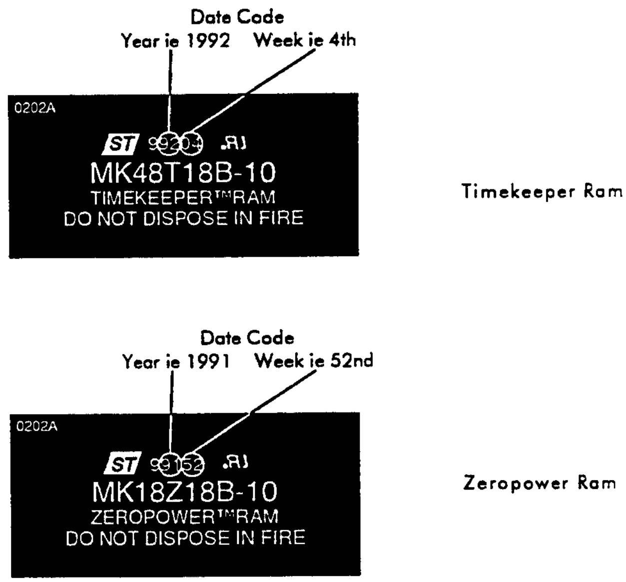


Figure 6-1 Date codes

After fitting the new devices and restoring configuration it is necessary to perform a complete recalibration of the instrument including both microboard and modules. In addition it will be necessary to initialize the security data to enable selection of protected features.

Chapter 7

INSTRUMENT REPAIR AND FAULTS

Edition 1

Contents

Display blank when power applied 7-1
Display illuminates but continues to flash the warm up screen 7-2
Display shows warning page - hardware in instrument changed check 7-2
Display shows warning page- non-vol memory corrupted instrument in standby mode 7-2
Clock fails to keep correct time when power is off 7-3
Instrument error log 7-3
Input and output modules failure 7-4
Instrument communications failure 7-4
Front panel switch failure 7-4

Chapter 7 INSTRUMENT REPAIR AND FAULTS

Customers are advised to contact a Eurotherm service engineer if an instrument fault is suspected. Do not to attempt any repair on an instrument which is within its warranty period as this will invalidate the Eurotherm warranty.

Caution

Always observe anti-static precautions when handling circuit boards and memory components

The 900 EPC instruments make very extensive use of surface mount assembly from very small passives to 84 pin PLCC integrated circuits. These advanced techniques enable such a remarkably powerful instrument to be packaged within the 1/4 DIN size. To repair the 900 EPC circuit boards, specialized equipment is required. For this reason, field repair is limited to board or memory swap. Boards which are suspected of a fault should always be returned to a Eurotherm service engineer for repair.

This section provides a short guide to the diagnosis of which of the boards in the instrument is faulty. It is assumed that replacement boards are available.

Where spares are required refer to the separate 900 EPC spares list.

Display blank when power applied

This is the fault condition that is likely to be encountered most often. A number of different reasons can cause this fault to occur. These are:-

software changed without non-vol. clear
incorrect power supply variant or wiring
PSU fuse blown
PSU fault
PSU wiring fault
microboard fault
input or output module fault
display board fault

Check that the instrument has not been fitted with a different software version without clearing the non-volatile memory. If this is the case refer to chapter 4, Upgrading of Software Versions in the 900 EPC Controller and Programmer.

Check power supply connections are correct for the low or high voltage variant as appropriate and that the supplies are within the instrument specification.

Inspect the mains connector inside the sleeve for obvious signs of damage. Replace the connector block if damage is apparent.

Check that the power supply fuse (F101, shown in figure 1-11 in chapter 1). If failed, the fuses are available as spares. It is unlikely that the fuses would fail without other malfunctions in the instrument. The fuses are PCB mounting and should only be replaced by a Eurotherm service engineer.

Check the PSU board operation by testing it in another instrument. If the PSU operates correctly in another instrument this probably eliminates the PSU as the cause of the fault.

If the PSU operates correctly in another instrument, try it again in the original instrument but with all other input and output connections removed. This is done most easily by moving the instrument to another sleeve.

If it still fails to start test the microboard by moving it to another instrument and retesting. This may indicate that the reason for the fault is the microboard, in which case it should be replaced.

If the microboard appears to work in another instrument replace it in the original instrument and start to remove modules one by one and retest each time. This may identify that the fault lies with one of the input/output modules. If this is the case change the faulty module.

If the fault still remains try swapping another bezel assembly from a working instrument and retest. If the instrument now works the display PCB was the reason for the fault and should be replaced. See chapter 8, Display Board Removal and Bezel Replacement.

If none of these operations identify the reason for the fault it will be necessary to send the complete instrument to a service centre for further tests.

Display illuminates but continues to flash the warm up screen

Remove or replace any DC input modules and re-try. If it continues to fail to start then a microboard fault is indicated. Confirm this by trying the microboard in a different instrument.

It is possible that the problem may be with the EPROMS or non-volatile memory. Test by moving them both together to another microboard. If this microboards then starts correctly the problem is with the microboard PCB itself.

If it has been possible to move the EPROMS and non-volatile memory to another microboard and start operation then configuration can be recovered. This is done either by using IPS or manually.

Display shows warning page - hardware in instrument changed check configuration

This indicates that I/O module positions or types have been changed since the last time the instrument was powered.

Check that the hardware is as required including slot numbers.

Enter configuration and read SLT OCCUPANCY in INSTR CONFIG. Check this corresponds with the hardware. On exit from configuration the message should not re-appear.

If the message continues to appear replace the microboard.

If the instrument is subject during operation to a series of short power cycles it may be unable to read the hardware and display this warning page. This does not generally represent a fault. The warning can be cleared by entering configuration, checking the hardware as above and then exiting from configuration.

Display shows warning page - non-vol memory corrupted instrument in standby mode

This indicates that one of a number of check bytes throughout the non volatile memory do not contain the expected value.

This warning will always occur the first time the instrument is powered after the software version is upgraded. On this occasion the message can be disregarded.

If this warning appears at other times a fault may be indicated. The most likely causes are electrical interference exceeding the immunity level of the instrument or failure of one of the non volatile memory devices.

The non-volatile memory lifetime should be checked as in chapter 6 and the devices replaced as necessary. If the devices are within their expected lifetime, clear the warning as described below and test the devices. The devices are tested by switching the instrument on and off an number of times to see if the warning is repeated. The test should ideally be carried out with all the instrument inputs and outputs disconnected and power supplied from a noise free supply.

If the non-volatile memories are not faulty then electrical interference must be suspected as a cause of the corruption. Examine the wiring of the installation for evidence of poor wiring practice. Also check that the two digital inputs on the microboard are used for volt free contacts only and that the wiring is short.

The warning is cleared by entering and then exiting from configuration. However it is possible that configuration may have been corrupted. It is therefore essential that configuration is read and checked. This can be done manually or using IPS. Using IPS it is necessary to record the current configuration to disc and then under DOS compare it with a configuration file that has been previously saved.

To enable a swift recovery from a faulty microboard it is essential for the customer or service engineer to have local access to an IPS record of the configuration on disc.

Clock fails to keep correct time when power is off

This indicates imminent failure of the non vol memory device(s). As soon as possible ensure that you have recorded the instrument configuration, either manually or using IPS. Then proceed to replace the non vol device(s) as described in chapter 6.

Instrument error log

The instrument error log page in LEVEL 3/DIAGNOSTICS/ERROR LOGs shows the last 16 recorded errors.

An error is only added to the log if it is different to the last recorded error.

The following are operational errors;

Message	Cause of error	Source of error
L1 PV OVRNG	PV i/p overange on loop 1	Microboard
L1 PV UNDRNG	PV i/p underrange on loop 1	Microboard
L2 PV OVRNG	PV i/p overange on loop 2	Microboard
L2 PV UNDRNG	PV i/p underrange on loop 2	Microboard
L1 REM OVRNG	Remote i/p overange on loop 1	Module
L1 REM UNDRNG	Remote i/p underrange on loop 1	Module
L2 REM OVRNG	Remote i/p overange on loop 2	Module
L2 REM UNDRNG	Remote i/p underrange on loop 2	Module

In the event of the above errors occurring then check the input signal value and connections, input configuration, hardware link configuration and sensor break position.

The input signal should be checked using the diagnostics pages.

See also section Checking Input Calibration, on page 3-8.

For a remote input check that the module is in slots 4, 5 or 6 for loop 1 and slots 1, 2 or 3 for loop 2.

If the input is actually over or under the limit for a given range then the diagnostics page shows the last valid reading before going off scale. So the reading will not to respond to input changes until the signal is no longer off scale.

A hardware fault is only indicated if it is not possible to achieve an in-range reading on the diagnostics page.

Message	Cause of error	Source of error
L1 POT POS OC	VP pot position o/c on loop 1	Module
L1 POT POS SC	VP pot position s/c on loop 1	Module
L2 POT POS OC	VP pot position o/c on loop 2	Module
L2 POT POS SC	VP pot position s/c on loop 2	Module

Check that the configuration of the valve position module is correct. The module must be in slots 4, 5 or 6 for loop 1 and slots 1, 2 or 3 for loop 2.

Check that the valve position potentiometer value is in the range 100 to 1000 ohms.

Check that the output voltage from the module (terminals 1 and 5) is approx. 0.5V.

Check that the input connection to the module is made (terminal 4) and that the voltage is less than or equal to the output voltage.

If the above are all OK then a fault with the module hardware is indicated.

Other possible error codes;

IIC BUS ERROR.....microboard or power supply hardware problem

50MS SLOW ERROR....check for a microboard hardware problem. If this is eliminated then a software fault is indicated - please report this to your local Eurotherm sales office or representative.

CAL INIT ERROR......this indicates that out of range calibration data has been read from the non-vol memory on power up. This is expected if cleared non-vols. are present. However if it occurs at any other time non-vol memory corruption is suspected. See fault condition...Non vol corrupted message as above.

Any other error codes indicate microboard hardware failure. In which case the microboard should be replaced.

Input and output modules failure

To test an I/O module with a suspected fault first check that the module is correctly seated and level relative to the options board. If it still fails change the module PCB and then re-test. If another failure occurs it is possible that there may be a microboard or options board problem. In some cases it may be found that the failure results from inappropriate configuration. Check the configuration details of the module by reference to the instrument handbook.

To remove modules where the non-latching clip is fitted use a small screwdriver to carefully lever the module off. If the latching clip (fitted from March 1992) is present then use an empty BIC biro tube pushed over the latch to depress it whilst at the same time levering the module off.

Instrument communications failure

Software versions up to and including 2.17 for the controller board and version 5 for the programmer board support only a single comms channel. The comms interface module is located on the power supply board.

If a comms problem is present check instrument and system wiring. Also check the 232/422 selection link on the module. See figure 2-1 in chapter 2. If problems persist refer to the instrument communications manual, either JBus (Order code: SUB900/SPARE/MANUAL/JBUS) or Bisync (Order code: SUB900/SPARE/MANUAL/BISYNC) as appropriate.

When a software version supporting dual channel comms is released, the second comms module must be located in slot 1 (terminals A).

Front panel switch failure

If the instrument fails to respond to one of the 6 front panel keys, the fault may lie with the membrane switch ,the microboard or the connector. First check that the membrane switch tail is correctly seated in the display board connector.

Try the bezel assembly with a different microboard. If the fault moves with the bezel, replace the bezel (see chapter 8) otherwise replace the microboard.

Chapter 8

INSTRUMENT DISMANTLING AND RE-ASSEMBLY

Edition 1

Contents

Display board removal and bezel replacement 8-1
Failure of the rear terminal connectors 8-2

Chapter 8 INSTRUMENT DISMANTLING AND RE-ASSEMBLY

Before starting to dismantle the instrument ensure that the power connection has been removed.

To remove the instrument from the sleeve grip the top and bottom in one hand as shown in figure 8-1.

Squeeze the top and bottom together whilst firmly pulling the instrument towards you. Do not squeeze the top and bottom of the case at the same time as this prevents disengagement of the latches.

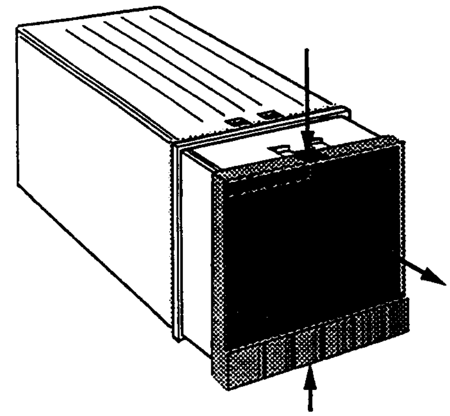


Figure 8-1 Removing instrument from

Remove the RFI frame by pulling it towards the rear.

Remove the PCBs by bending out one of the card guides on the bezel to free the latch and then lifting the PCB on that side just enough to prevent the latch from re-engaging. Then repeat on the other side and withdraw the PCB.

Where an options board is fitted adjacent to the power supply board, the power supply should be removed first to prevent a mechanical clash. When replacing these boards the options board should be put in first.

When replacing PCBs ensure that the latch on both sides of the bezel is correctly engaged.

When replacing the RFI frame ensure that it fully engages with the locating hole in each PCB.

When replacing the instrument into the sleeve ensure that it locates fully and does not leave a gap between sleeve and rubber seal. If it is not possible to close the gap, it is probable that the RFI frame has not been fully engaged.

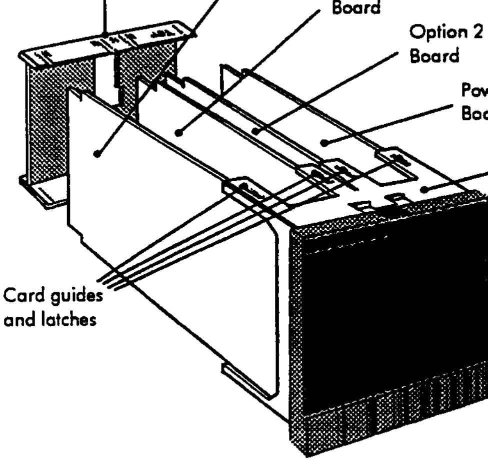


Figure 8-2 Instrument out of sleeve

Display board removal and bezel replacement

1. Remove the instrument from its sleeve.

   Separate the bezel assembly (front panel) from the rest of the instrument, by removing the RFI frame and PCBs. See section above.

   Disconnect the tail of the membrane switch from the PCB connector. Pull inner white connector moulding from outer moulding until a 'stop' is felt. The membrane tail will now pull easily from connector.

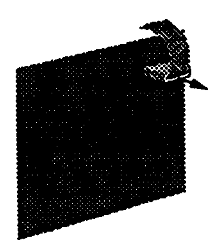


Figure 8-3 Releasing membrane switch tail

2. Grasp the bezel assembly in one hand and depress the central, top card locks inwards whilst pushing from the inside, outwards in order to distort the moulding and release the top end of the PCB. See figure 8-4.

3. Once the PCB is free of the latch tap the bezel firmly against a flat surface to release the PCB, which will drop out.

   Remove and retain the display support bar.

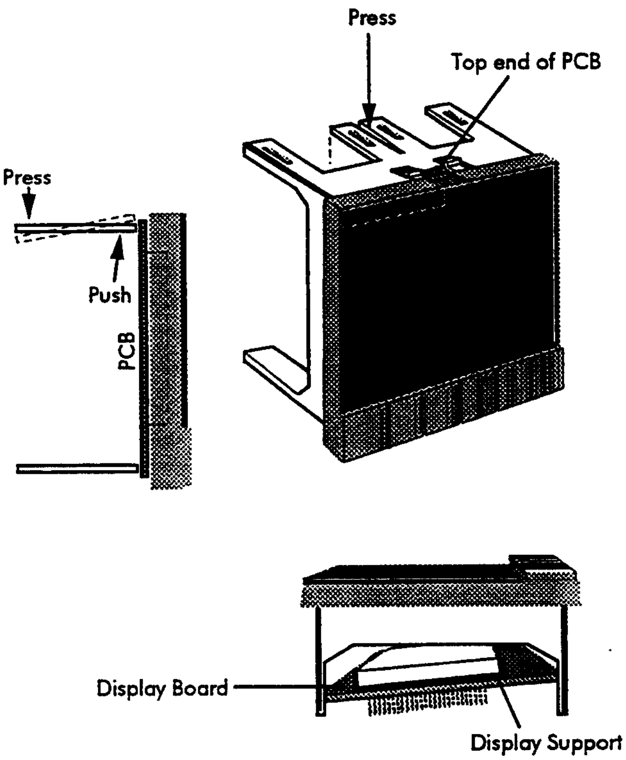


Figure 8-4 Removing display board

4. To replace the display PCB, position the display support as shown in fihure 8-5 and insert bottom latches on PCB into corresponding slots in the new bezel.

   Ensure that the membrane tail is not trapped inside the PCB and then push the top of the card home. It is important to replace the display support as it prevents distortion of the display PCB when inserting the microboard.

5. Replace the tail of the membrane switch in the PCB connector and then close the connector by pushing inwards on it.

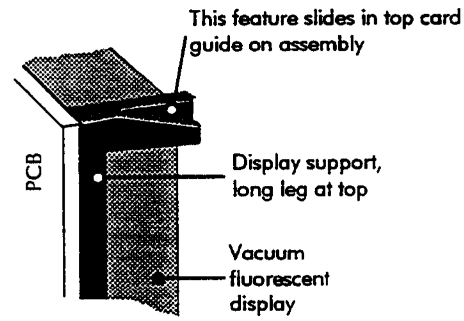


Figure 8-5 Display support

Failure of the rear terminal connectors

If one of the rear terminal connectors have failed due to the use of wire gauge greater than 14 AWG (21 mm^2) and/or tightening to a torque of greater than 0.4Nm it may be necessary to fit a new sleeve with new connectors.

When re-wiring the new sleeve remember that excessive force is not required in order to clamp the wire.

The failed connector should not be removed and replaced as removal destroys the alignment mechanism between connector and sleeve. Although a replaced connector may appear to function correctly, the isolation distance and hence electrical safety will have been compromised.

Appendix A CONFIGURATION SHEETS

900 EPC Instrument Configuration Record
(For use with S/W versions 2.50, 4.12 & 5.11)

(Please copy these master configuration sheets, so that you have a blank set the next time you need to record a configuration.)

Customer Name & Address :

Sales / Service Engineer : Date :

INSTRUMENT CONFIGURATION

Instrument Type (INSTR TYPE) ______________________

Process Inputs

	Loop 1	Loop 2
Linear Defn.	________	________
Charact Type.	________	________
Input Range		
Max	________	________
Min	________	________
Units	________	________
Display Range		
Max	________	________
Min	________	________
Resoln.	________	________

Remote Inputs

	Loop 1	Loop 2
Linear Defn.	________	________
Input Range		
Max	________	________
Min	________	________
Units	________	________
Display Range		
Max	________	________
Min	________	________
Resoln.	________	________

Slot Occupancy

Slot 1	________	Slot 2	________
Slot 3	________	Slot 4	________
Slot 5	________	Slot 6	________

Slot Function

Slot 1		Slot 4	
Function 1	________	Function 1	________
Function 2	________	Function 2	________
Function 3	________	Function 3	________
Function 4	________	Function 4	________

Slot 2		Slot 5	
Function 1	________	Function 1	________
Function 2	________	Function 2	________
Function 3	________	Function 3	________
Function 4	________	Function 4	________

Slot 3		Slot 6	
Function 1	________	Function 1	________
Function 2	________	Function 2	________
Function 3	________	Function 3	________
Function 4	________	Function 4	________

Dig IP Functions

Dig IP 1 ________ Dig IP 2 ________

Control Definition

Loop 1 ________ Loop 2 ________

Ratio Type ________

USER CONFIGURATION

Alarm Configuration

Alarm Number	One	Two	Three	Four
Alarm Type	________	________	________	________
Parameter	________	________	________	________
Latching	________	________	________	________
Hysterisis	________	________	________	________
Delay	________	________	________	________

Control Configuration

	Loop 1	Loop 2
Reverse/Direct	________	________
Deriv. Action	________	________
Power Feedbk	________	________

SP Tracking

	Loop 1	Loop 2
Manual	____________	____________
Remote	____________	____________
Ratio	____________	
Cascade	____________	

FN Available

Loop Indep.

Standby ____________ Timers ____________

	Loop 1	Loop 2
SP Rate Limit	____________	____________
Manual	____________	____________
OP Rate Limit	____________	____________
SP / PV FFWD	____________	____________
Feedforward	____________	____________

Tuning Configuration

	Loop 1	Loop 2
Autotune (Y/N)	____________	____________
Adaptive Tune (Y/N)	____________	____________
Adaptive Tune Type	____________	____________

Digital Comms ____________

Output Configuration

	Loop 1	Loop 2
Cooling Type	____________	____________

Anal OP Conf

Slot 1	Max	________	Min	________	Units	________
Slot 2	Max	________	Min	________	Units	________
Slot 3	Max	________	Min	________	Units	________
Slot 4	Max	________	Min	________	Units	________
Slot 5	Max	________	Min	________	Units	________
Slot 6	Max	________	Min	________	Units	________

Anal OP Rng

Slot 1	Max	________	Min	________
Slot 2	Max	________	Min	________
Slot 3	Max	________	Min	________
Slot 4	Max	________	Min	________
Slot 5	Max	________	Min	________
Slot 6	Max	________	Min	________

Pulsed Burner

No. of Burner Sets ________________

Input Definition

Filter Defn.

PV1 __________ PV2 __________ REM1 __________ REM2 __________

Sampling Defn

Rate __________ Mains __________

CJC Defn

	Loop 1	Loop 2
CJC Type		
CJC Value		

Input Type (Normal / Inverted)

PV1 __________ PV2 __________ REM1 __________ REM2 __________

Drvd I/P Conf

	Loop 1	Loop 2
IP1 Frct		
IP2 Frct		
Max Limit		
Min Limit		
Scaling Type		
Customer Lin		

Pair No.	Loop 1 Input	Loop 1 Display	Loop 2 Input	Loop 2 Display
1	.	.	.	.
2	.	.	.	.
3	.	.	.	.
4	.	.	.	.
5	.	.	.	.
6	.	.	.	.
7	.	.	.	.
8	.	.	.	.
9	.	.	.	.
10	.	.	.	.
11	.	.	.	.
12	.	.	.	.
13	.	.	.	.
14	.	.	.	.
15	.	.	.	.
16	.	.	.	.

Sensor Break Position

PV1 ________ PV2 ________ REM1 ________ REM2 ________

Zirconia Probe (only relevant to Carbon Potential and Oxygen)

Probe Function ____________ Oxygen (%, VPM or LOG) ____________
Max ________ Min ________ Res. ________

Program Configuration

SubPrograms ________ Holdback ________ Digital OPs ________
Fast Run ________ No. of Programs ________

Instrument Units

Process IPs Loop 1 ____________ Loop 2 ____________
PID Params PB ____________ TI & TD ____________
Rate Limits SP ____________ OP ____________

Norm/Inv I/O

Slot 1 ____________ Slot 2 ____________
Slot 3 ____________ Slot 4 ____________
Slot 5 ____________ Slot 6 ____________

Screen Conf ________________

Totaliser Configuration

Total 1 ________ Total 2 ________ Total 3 ________ Total 4 ________

User Wiring

Availability

Calc Value ____________ Prog Logic ____________ User Scrns ____________

Calc Values

Calc Value No.	Scaler 1	Input 1	Operator	Scaler 2	Input 2	Wired To
1	______	______	______	______	______	______
2	______	______	______	______	______	______
3	______	______	______	______	______	______
4	______	______	______	______	______	______
5	______	______	______	______	______	______
6	______	______	______	______	______	______
7	______	______	______	______	______	______
8	______	______	______	______	______	______

Calc Value No.	Upper Limit	Lower Limit	Resolution	Default Value
1				
2				
3				
4				
5				
6				
7				
8				

User Values

User Value No.	Upper Limit	Lower Limit	Resolution
1			
2			
3			
4			

Programmable Logic

Register No.	NOT	Input 1	Operator	NOT	Input 2	Wired To
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

User Screens - See Last Page.

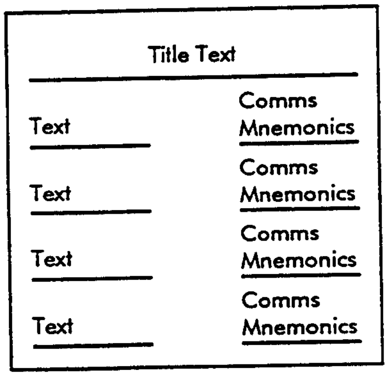
Valve Pot Setup

	Loop 1	Loop 2
% Shut		
% Open		

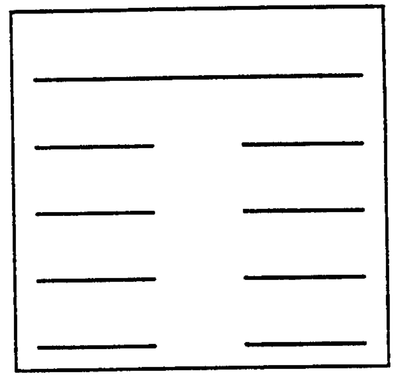
Timer Configuration

Timer No.	Timer Type	Input	Wired To
1			
2			
3			
4			

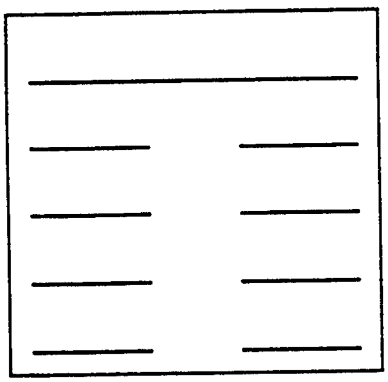
User Screens



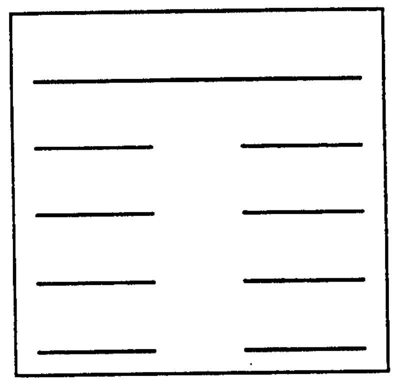
Example



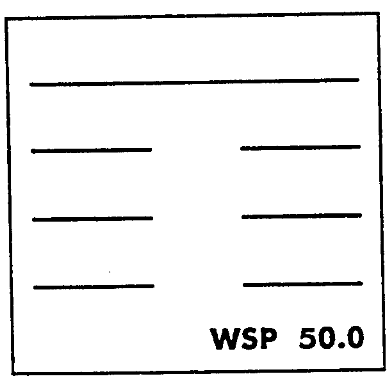
Dual Loop Summary



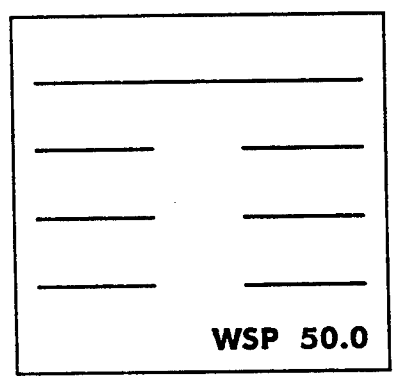
Loop 1 Summary



Loop 2 Summary



Loop 1 Scroll



Loop 2 Scroll

Eurotherm Controls Limited

UK Regional Sales and Service

Southern Area
Home Counties, South and South East
Eurotherm Controls Limited
Faraday Close, Durrington
Worthing
West Sussex BN13 3PL
Telephone Worthing (0903) 693379
Telex 87114 EUROWG G
Fax (0903) 265982

Midlands Area
Midlands, South Wales, East Anglia and South West
Eurotherm Controls Limited
Miller House
Corporation Street
Rugby Warwickshire CV21 2DW
Telephone (0788) 562011
Telex 311874
Fax (0788) 536249

Northern Area
Northern Counties, North Wales and Scotland
Eurotherm Controls Limited
4/5 Chetham Court
Calver Road Warrington
Cheshire WA2 8RF
Telephone (0925) 572111
Telex 629852
Fax 0925) 413099

Service & Support Around the World

Australia
Eurotherm Pty. Limited
PO Box 1605
Hornsby Northgate
NSW 2077
Telephone Sydney (2) 4777022
Telex AA74362
Fax (2) 4777756
Also regional offices

Austria
Eurotherm GmbH
Geiereckstr 18
A-1110 Wien
Telephone Wien (0222) 787 601
Telex 113200 EI AUT/A
Fax (0222) 787805

Belgium
Eurotherm B.V.
Herentalsebaan 71-75
2100 Deurne (Antwerpen)
Telephone Antwerpen (3) 3223870
Telex 04633317 EIBNL B
Fax (3) 3217363

Denmark
Eurotherm A/S
Finsensvej 86
DK-2000 Frederiksberg
Copenhagen
Telephone Copenhagen (31) 871622
Telex 32317 TELMET S
Fax (31) 872124

France
Eurotherm Automation SA
Parc d'Affaires de Dardilly
6 chemin des Joncs, B.P. 55
69572 Dardilly Cedex
Telephone Lyon (78) 661943
Telex 380038 EURTERM F
Fax (78) 352490
Also regional offices

Germany
Eurotherm Regler GmbH
Ottostrasse 1, Postfach 1453
6250 Limburg a.d. Lahn 1
Telephone Limburg (06431) 2980
Telex 484791 EUROT D
Fax (06431) 298119
Also regional offices

Hong Kong
Eurotherm Limited
Unit D 18/F
Gee Chang Hong Centre
65 Wong Chuk Hang Road
Aberdeen
Telephone Hong Kong (5) 8733826
Telex 69257 EIFEL HX
Fax (5) 8700148

Ireland
Eurotherm Ireland Limited
I.D.A. Industrial Estate
Monread Road
Naas
Co. Kildare
Telephone Naas (045) 79937
Telex 0500-60745 ETMA EI
Fax (045) 75123

Italy
Eurotherm S.p.A.
Via XXIV Maggio
22070 - Guanzate
Como
Telephone Como (31) 975111
Telex 380893 EUROTH I
Fax (31) 977512

Japan
Eurotherm KK
Marushima Building
28-2 Chuo 1, Chome
Nakano-ku
Tokyo 164
Telephone Tokyo (3) 33638324
Telex 02324016 EUROJA J
Fax (3) 33638320
Also regional offices

Korea
Eurotherm Korea Limited
Suite #303, Chang Hak Hwe Kwan Building
945-15 Daechi-Dong, Kangnam-Ku
Seoul 135-280
Telephone Seoul (2) 5548507
Telex EIKOR K23105
Fax (2) 5539655

Netherlands
Eurotherm B.V.
Johan Frisostraat 1
2382 HJ Zoeterwoude
Nederland
Telephone Leiden (71) 411841
Telex 39073 EIBNL NL
Fax (71) 414526

New Zealand
Eurotherm Limited
P.O. Box 8497
Symonds Street
Auckland
Telephone Auckland (9) 3588106
Fax (9) 3581350

Norway
Eurotherm A/S
Kongeuein 49
Post Box 199
1412 Sofiemyr
Telephone Oslo (2) 803330
Fax (2) 803331

Spain
Eurotherm España S.A.
Polígono Industrial De Alcobendas
C/ de la Granja, 74
28100 Alcobendas
Madrid
Telephone (1) 6616001
Fax (1) 6619093

Sweden
Eurotherm AB
PO Box 24
Hantverkaregatan 18
S-23221 Arloev
Telephone Malmo (40) 435460
Fax (40) 435520

Switzerland
Eurotherm Produkte (Schweiz) A.G.
Kenalstrasse 17
8152 Glattbrugg
Telephone Zurich (1) 8103646
Fax (1) 8108920

United Kingdom
Eurotherm Controls Limited
Faraday Close, Durrington
Worthing
West Sussex BN13 3PL
Telephone Worthing (0903) 268500
Telex 87114 EUROWG G
Fax (0903) 265982
Also regional offices

U.S.A
Eurotherm Controls Inc.
11485 Sunset Hills Road
Reston Virginia 22090
Telephone Reston (703) 4714870
Fax (703) 7873436
Also regional offices

Sales and Service in over 30 countries
For countries not listed above all enquiries/orders to:
Eurotherm Controls Limited:
Export Dept.,Faraday Close, Durrington, Worthing, West Sussex, BN13 3PL England.
Telephone (0903) 268500 Telex 87114 EUROWG G Fax (0903) 265982

Eurotherm Regional Sales and Service

Southern Area
Home Counties,
South and South East

Eurotherm Ltd
Faraday Close, Durrington
Worthing
West Sussex BN13 3PL
Telephone (0903) 693379
Telex 87114 EUROWG G
Fax 09 03 65 98 2

Midlands Area
Midlands, South Wales,
East Anglia and South West

Eurotherm Ltd
Miller House
Corporation Street, Rugby
Warwickshire CV21 2DW
Telephone (0788) 562011
Telex 311 874
Fax 07 88 53 62 49

Northern Area
Northern Counties,
North Wales and Scotland

Eurotherm Ltd
4/5 Chetham Court
Calver Road, Warrington
Cheshire WA2 8RF
Telephone (0925) 572111
Telex 629852
Fax 09 25 41 30 99