2408 2404

MODELS

Programmer/Controllers

Product data

invensys
EUROTHERM

Features

- **High stability control**
- **Up to twenty programs**
- **16 ramp/dwell segments**
- **Heating and cooling**
- **Motorised Valve output**
- **Customised operation**
- **Load diagnostics**
- **Heater current display**
- **Multiple alarms on a single output**
- **One-shot tuner with overshoot inhibition**
- **24V Supply option**
- **Auto/manual button**
- **DC retransmission**
- **10amp output (2404 only)**
- **Transmitter supply**
- **Transducer supply**
- **PDSIO master setpoint retransmission or setpoint input**
- **Digital communications**
- **Plug-in from front**
- **Compliant with European EMC and low voltage safety directives**
- **3 Year warranty**

The 2404/2408 is a versatile, high stability temperature or process controller, with self and adaptive tuning, in 1/4 DIN and 1/8 DIN sizes. It comes with a standard 8 segment setpoint programmer, with options for one, four or twenty programs of 16 segments each.
It has a modular hardware construction which accommodates a wide range of plug-in modules. It will accept up to three I/O modules and two communication modules. Two Digital inputs and an optional alarm relay are included as part of the fixed hardware build. The hardware is configurable for heating, cooling, alarms and other functions. A transmitter power supply option is available, as is a 5 or 10V transducer supply option. The 2404/2408 is fully configurable on-site.
The programmer can have up to 8 programmable outputs which can be set in each segment to trigger external events. The two digital inputs can be used to run, hold and reset the program. Parallel operation of several programmers can be performed with synchronisation chosen at the end of any desired segments.

Precise control

An advanced PID control algorithm gives stable ‘Straight-line’ control of the process. A one-shot tuner is provided to set up the initial PID values and to calculate the overshoot inhibition parameters. In addition an adaptive tuner will handle processes with continually changing characteristics. On electrically heated loads, power feedback is used to stabilise the output power and hence the controlled temperature against supply voltage fluctuations. Dedicated cooling algorithms ensure optimum control of fan, water and oil cooled systems.

Universal input

A universal input circuit with an advanced analogue to digital convertor samples the input at 9Hz and continuously corrects it for drift. This gives high stability and rapid response to process changes. High noise immunity is achieved by rejection of 50/60Hz pick-up and other sources of noise. Sensor diagnostics are also provided. The input will accept all standard thermocouples, the Pt100 resistance thermometer and linear millivolts, milliamps or DC volts.
Input filtering from OFF to 999.9 seconds is included.

Customised operation

A custom LED display provides a bright, clear display of the process value and setpoint. Tactile push buttons ensure positive operation. Access to other parameters is simple and easy to understand and can be customised to present only those parameters that need to be viewed or adjusted. All other parameters are locked away under password protection.
A front panel auto/manual button is provided.

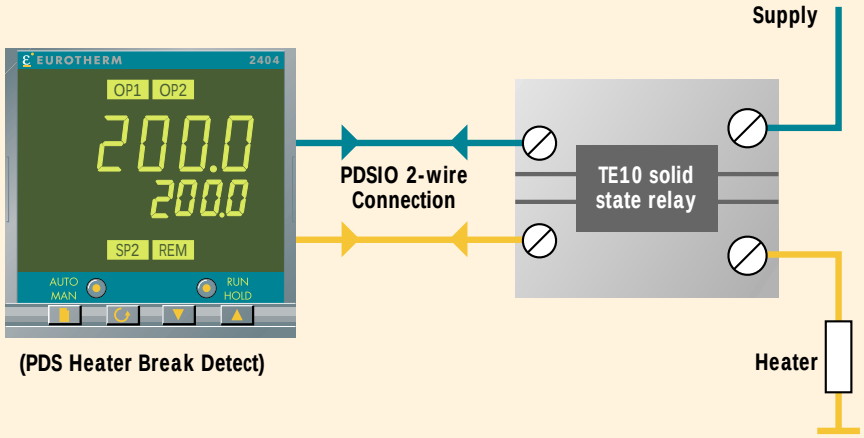
Alarms

Up to four process alarms can be combined onto a single output. They can be full scale high or low, deviation from setpoint, rate of change or load failure alarms. Alarm messages are flashed on the main display. Alarms can be configured as latching or non-latching and also as ‘blocking’ type alarms which means that they will become active only after they have first entered a safe state.

Digital communications

Available with either EIA485 2 wire, 4 wire or EIA232. With industry-standard protocols including: Modbus®, Eurotherm Bisync, and SPI.

PDSIO Load diagnostic

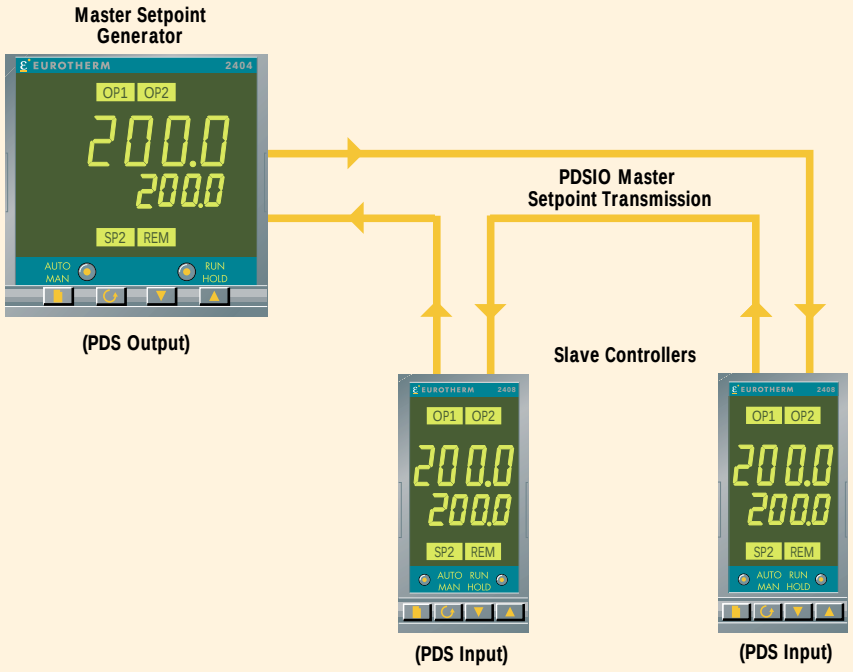


PDSIO Load diagnostics

PDSIO (Pulse Density Signalling I/O) is a major innovation in the 2404/2408. When used in combination with a Eurotherm TE10 solid state relay (SSR), it allows the logic output of a 2404/2408 to transmit the power demand signal and simultaneously read back load fault alarms. These alarms will be flashed as messages on the controller front panel.

Two alarm conditions will be detected, either SSR failure indicating an open or short circuit condition in the SSR and heater circuit failure indicating either fuse failure, heater open circuit or line supply absent.

PDSIO Setpoint transmission



PDSIO master setpoint transmission

PDSIO can be used to digitally transmit the setpoint profile to a number of slave Series 2000 controllers.

If any slave zone departs from the required setpoint by more than a pre-settable amount, a signal from any slave can be transmitted back to the master causing the program to freeze until the error is corrected. Digital accuracy is preserved using PDSIO.

Technical specification

Process inputs

General	Range	± 100mV and 0 to 10Vdc (auto ranging)
	Sample rate	9Hz (110mS)
	Calibration accuracy	0.2% of reading, ±1 LSD or ±1°C/F
	Resolution	<1.6µV for ± 100mV range, <0.2mV for 10Vdc range
	Linearisation accuracy	No discernable error
	Zero drift with ambient temperature	< 0.1µV per °C for ±100mV range, 0.1mV per °C on 10Vdc range
	Gain drift with ambient temperature	< 0.004% of reading per °C
	Input filter	OFF to 999.9secs
	Zero and span offset	User adjustable over the full display range
Thermocouple	Types	See sensor inputs table
	Cold junction compensation	Automatic compensation typically >30 to 1 rejection of ambient temperature change External references 0, 45 and 50°C
RTD/PT100	Type	3-wire, Pt100
	Bulb current	0.2mA
	Lead compensation	No error for up to 22 ohms balanced in all 3 leads
Process	Range	±100mV, 0 to 20mA or 0 to 10Vdc (All configurable between limits)
	Type	Linear, Square root or custom 8 point
	Application	Process value, remote setpoint, setpoint trim, power limit. Value pos. slidewire 330Ω to 15Kohm

Digital inputs

Type	Single and triple input: Contact closure or 24Vdc logic input
Application	Manual select, 2nd setpoint, 2nd PID, keylock, setpoint rate limit enable, Program run, hold, reset, synchronisation and fast run

Outputs

Relay	Rating: 2-pin relay	Min: 12V, 100mA dc. Max: 2A, 264Vac resistive (single and dual modules available)
	Rating: change-over, alarm relays	Min: 6V, 1mA dc. Max: 2A, 264Vac resistive
	Application	Heating, cooling, alarms or program event
Logic	Rating	18Vdc at 24mA (isolated and non-isolated versions available)
	Application	Heating, cooling, alarms or program event
		PDSIO mode 1: Logic heating with load failure alarm
		PDSIO mode 2: Logic heating with load/SSR failure alarm and load current display
Triac	Rating	1A, 30 to 264Vac resistive (single and dual modules available)
	Application	Heating, cooling or program event
High Current	Rating	10amp, 264Vac resistive
	Application	Heating (2404 only)
Analogue	Range	0 to 20mA (into 600Ω max) or 0 to 10Vdc (Isolated and non-isolated versions available)
	Application	Heating or cooling or process output. PV retransmission or setpoint retransmission
Transmitter supply	Rating	24Vdc at 20mA
Transducer supply	Voltage	5 or 10Vdc
	Bridge resistance	300Ω to 10kΩ
	Internal shunt resistance	30.1kΩ at 25%, used for calibration of 350Ω bridge

Communications

Digital	Transmission standard	EIA 485 or EIA232 at 1200, 2400, 4800, 9600, 19,200 baud
	Protocols	Modbus® or Eurotherm Bisync or DeviceNet
PDSIO	Setpoint input	Setpoint input from master PDSIO controller. Holdback to master controller
	Setpoint output	Master setpoint retransmission to slave PDSIO controllers
	Update time	500mS

Control functions

Control	Modes	PID or PI with overshoot inhibition, PD, P only or On/Off
	Application	Heating, cooling or process output
	Auto/manual	Bumpless transfer or forced manual output
	Setpoint rate limit	OFF to 999.9 degrees or display units per second, minute or hour
	Cooling algorithms	Linear; Water (non-linear); Fan (minimum on time), Oil and proportional only
Tuning	One-shot tune	Automatic calculation of PID and overshoot inhibition parameters
	Adaptive Tune	Continuous assessment of the PID values
	Automatic droop compensation	Automatic calculation of manual reset value when using PD control
Alarms	Types	Full scale high or low. Deviation high, low, or band. Rate of change
	Modes	Latching or non-latching. Normal or blocking action
		Up to four process alarms can be combined onto a single output

Programmer parameters

	Programs	One, up to four or up to twenty programs
	Segments	16 segments per program
	Ramp	Ramp Rate or Time to Target Hours, Minutes or Seconds (0.1 to 999.9)
	Dwell	Hours, Minutes or Seconds (0.0 to 999.9)
	Holdback	Per Program or per Segment (0.0 to 999.9)
	End Segment	Dwell, Reset or Set output level
	Cycles	Continuous or 1 to 999
	Event outputs	Up to eight – relay, logic or triac
	Timing accuracy	±2% of duration

General

	Display	Dual, 4 digit x 7 segment high intensity LED
	Dimensions & weight	96W x 96H x 150D mm. 600g
	Supply	85 to 264Vac, 48 to 62Hz. 10watts max (or 20 to 29Vac or dc)
	Temperature and RH	Operating: 0 to 55°C, RH: 5 to 95% non-condensing. Storage: -10 to 70°C
	Panel sealing	IP65
	Electromagnetic compatibility	Meets generic emissions standard EN50081-2 for industrial environments Meets general immunity requirements of EN50082-2(95) for industrial environments
	Safety standards	EN61010, installation category 2. (voltage transients must not exceed 2.5kV)
	Atmospheres	Electrically conductive pollution must be excluded from the cabinet in which this controller is mounted. This product is not suitable for use above 2000m or in corrosive or explosive atmospheres without further protection.

Ordering information

Hardware coding

Model Number	Function	Supply Voltage	Module 1	Module 2	Module 3	Alarm Relay	10amp Output	Comms 1	Comms 2	Manual
							Omit for 2408			

Model Number

Panel size
- **2408** 48 x 96mm
- **2404** 96 x 96mm

Profibus units
- **2408f** 48 x 96mm
- **2404f** 96 x 96mm

Function (2408)

PID control
- **CC** Controller only
- **CG** 1x 8 seg Prog
- **CP** 1x16 seg Prog
- **P4** 4x16 seg Prog
- **CM** 20x16 seg Prog (note 1)

On/Off Control
- **NF** Controller only
- **NG** 1x8 seg Prog
- **NP** 1x16 seg Prog
- **N4** 4x16 seg Prog
- **NM** 20x16 seg Prog (note 1)

Motorised valve control
- **VC** Valve positioner
- **VG** 1x8 seg Prog
- **VP** 1x16 seg Prog
- **V4** 4x16 seg Prog
- **VM** 20x16 seg Prog (note 1)

Function (2404)

PID control
- **CC** Controller only
- **CG** 1x 8 seg Prog
- **CP** 1x16 seg Prog
- **P4** 4x16 seg Prog
- **CM** 20x16 seg Prog (note 1)

On/Off Control
- **NF** Controller only
- **NG** 1x8 seg Prog
- **NP** 1x16 seg Prog
- **N4** 4x16 seg Prog
- **NM** 20x16 seg Prog (note 1)

Motorised valve control
- **VC** Valve positioner
- **VG** 1x8 seg Prog
- **VP** 1x16 seg Prog
- **V4** 4x16 seg Prog
- **VM** 20x16 seg Prog (note 1)

Supply Voltage

- **VH** 85-264Vac
- **VL** 20-29Vac/dc

Module 1

- **XX** Not fitted

Relay: 2-pin
- **R2** Fitted unconfigured
- **RH** Heating output
- **RU** Valve raise output

Relay: change over
- **R4** Fitted unconfigured
- **YH** Heating output
- **RP** Valve raise (note 6)

Or alarm 1 from table A

Logic: (Non-isolated)
- **L2** Fitted unconfigured
- **LH** Heating output
- **M1** PDS Heater break detect (note 2)
- **M2** PDS Current monitoring (note 3)

Logic: (Isolated)
- **LO** Single logic OP

Triac
- **T2** Fitted unconfigured
- **TH** Heating output
- **TU** Valve raise output

DC control (Isolated)
- **D4** Fitted unconfigured
- **H6** 0-20mA PID heating
- **H7** 4-20mA PID heating
- **H8** 0-5V PID heating
- **H9** 1-5V PID heating
- **HZ** 0-10V PID heating

Digital I/O (unconfig'd)
- **TK** Triple contact input
- **TL** Triple logic input
- **TP** Triple logic output

Dual relay
- **RR** Fitted unconfigured
- **RD** Heat + cool
- **RM** VP raise & lower OPs

Dual triac
- **TT** Fitted unconfigured
- **TD** Heat + cool
- **TM** VP raise & lower OPs

Logic+relay
- **LR** Fitted unconfigured
- **LD** Heat + cool
- **QC** Mode 2 + cool

Logic+triac
- **LT** Fitted unconfigured
- **GD** Heat & cool
- **QD** Mode 2 + cool

Transducer PS
- **G3** 5Vdc transducer PSU
- **G5** 10Vdc transducer PSU

Table A: alarm codes
- **FH** High alarm
- **FL** Low alarm
- **DB** Dev. band alarm
- **DL** Dev. low alarm
- **DH** Dev. high alarm

Module 2

- **XX** Not fitted

Relay: 2-pin
- **R2** Fitted unconfigured
- **RC** Cooling output
- **RW** Valve lower output

Relay: change over
- **R4** Fitted unconfigured
- **YC** Cooling output
- **RL** Valve lower (note 6)
- **PO** Program event 1 (note 7)
- **PE** Program END output

Or alarm 2 from table A

Dual relay
- **RR** Fitted unconfigured
- **PP** Program events 1 & 2 (note 7)

Logic: (Non-isolated)
- **L2** Fitted unconfigured
- **LC** Cooling output

Logic: (Isolated)
- **LO** Single logic OP

Triac
- **T2** Fitted unconfigured
- **TC** Cooling output
- **TW** Valve lower output

DC control (Isolated)
- **D4** Fitted unconfigured
- **C6** 0-20mA PID cooling
- **C7** 4-20mA PID cooling
- **C8** 0-5V PID cooling
- **C9** 1-5V PID cooling
- **CZ** 0-10V PID cooling

Digital I/O (unconfig'd)
- **TK** Triple contact input
- **TL** Triple logic input
- **TP** Triple logic output

Power supply
- **MS** 24Vdc transmitter

DC retran. (Isolated)

Select from Table B

Potentiometer input
- **VU** Fitted unconfigured
- **VS** Valve position feedback
- **VR** Setpoint input

Transducer PS
- **G3** 5V transducer PSU
- **G5** 10V transducer PSU

Table B: DC retransmission
- **D6** Fitted unconfigured

First character
- **V-** PV retrans
- **S-** Setpoint retrans
- **O-** Output retrans
- **Z-** Error retrans

Second character
- **-1** 0-20mA
- **-2** 4-20mA
- **-3** 0-5V
- **-4** 1-5V
- **-5** 0-10V

Module 3

- **XX** Not fitted

Relay: 2-pin
- **R2** Fitted unconfigured

Relay: change over
- **R4** Fitted unconfigured
- **PO** Program event 4 (not e 7)
- **PE** Program END output

Or alarm 3 from table A

Logic (Non-isolated)
- **L2** Fitted unconfigured

Logic: (Isolated)
- **LO** Single logic OP

Triac
- **T2** Fitted unconfigured

Dual relay
- **RR** Fitted unconfigured
- **PP** Program event 4 & 5 (note 7)

Digital I/O (unconfig'd)
- **TK** Triple contact input
- **TL** Triple logic input
- **TP** Triple logic output

Power supply
- **MS** 24Vdc transmitter

DC remote input
- **D5** Fitted unconfigured
- **W2** 4-20mA setpoint
- **W5** 0-10V setpoint
- **WP** Second PV input

DC retran. (Isolated)

Select from Table B

Potentiometer input
- **VU** Fitted unconfigured
- **VS** Valve position feedback
- **VR** Setpoint input

Transducer supply
- **G3** 5V transducer PSU
- **G5** 10V transducer PSU

Alarm Relay

- **XX** Not fitted

Alarm 4 relay
- **RF** Fitted unconfigured

Table A alarm options plus:
- **RA** Rate of change alarm

PDS Alarms
- **LF** Heater break detect
- **HF** Current monitoring heater break
- **SF** Current monitoring SSR failure
- **PO** Program event 7 (note 7)
- **PE** Program END output

10amp Output

- **XX** Not fitted
- **R6** Fitted unconfigured.
- **RH** Heating

Comms 1

- **XX** Not fitted

2 wire, RS485
- **Y2** Fitted unconfigured
- **YM** Modbus protocol
- **YE** EI-Bisync protocol (note 1)

RS232
- **A2** Fitted unconfigured
- **AM** Modbus protocol
- **AE** EI-Bisync protocol (note 1)

4 wire RS422
- **F2** Fitted unconfigured
- **FM** Modbus protocol
- **FE** EI-Bisync protocol (note 1)

PDS Output
- **M7** Fitted unconfigured
- **PT** PV retrans
- **TS** Setpoint retrans
- **OT** Output retrans

Profibus Module
- **PB** High speed RS485

DeviceNet
- **DN** DeviceNet

Comms 2

- **XX** Not fitted

PDS Input
- **M6** Fitted unconfigured
- **RS** Setpoint input

PDS Output
- **M7** Fitted unconfigured
- **PT** PV retrans
- **TS** Setpoint retrans
- **OT** Output retrans

Manual

- **XXX** No manual
- **ENG** English
- **FRA** French
- **GER** German
- **NED** Dutch
- **SPA** Spanish
- **SWE** Swedish
- **ITA** Italian

Note 1.
Not available with profibus controllers

Note 2.
PDS heater break detect will transmit the power demand to a TE10S Solid State Relay and read back a heater break alarm.

Note 3.
PDS current monitoring will transmit the power demand signal to a TE10S Solid State Relay and read back load current and open and short circuit alarms.

Note 4.
Setpoint limits: Include the decimal position required in the displayed value. Up to one for temperature inputs, up to two for process inputs.

Configuration coding (optional)

Sensor Input	Setpoint Min	Setpoint Max	Display Units	Digital Input 1	Digital Input 2	Control	Power	Options Cooling	Buttons	Program
	note 4	note 4								

Sensor Input		Setpoint Min	Setpoint Max
Standard Sensor Inputs		**Min °C**	**Max**
J	J Thermocouple	-210	1200
K	K Thermocouple	-200	1372
T	T Thermocouple	-200	400
L	L Thermocouple	-200	900
N	N Thermocouple-Nicrosil/Nisil	-250	1300
R	R Thermocouple-Pt/Pt13%Rh	-50	1768
S	S Thermocouple-Pt /Pt10%Rh	-50	1768
B	B Thermocouple-Pt/Pt30%Rh -6%Rh	0	1820
P	Platinel II Thermocouple	0	1369
Z	RTD/PT100 DIN 43760	-200	850
Factory downloaded input		**Min °C**	**Max**
C	C Thermocouple - W5%Re/W26%Re (Hoskins)	0	2319
D	D Thermocouple - W3%Re/W25%Re	0	2399
E	E Thermocouple	-250	1000
1	Ni/Ni18%Mo Thermocouple	0	1399
2	Pt20%Rh/Pt40%Rh Thermocouple	0	1870
3	W/W26%Re (Engelhard) Thermocouple	0	2000
4	W/W26%Re (Hoskins) Thermocouple	0	2010
5	W5%Re/W26%Re (Engelhard) Thermocouple	10	2300
6	W5%Re/W26%Re (Bucose) Thermocouple	0	2000
7	Pt10%Rh/Pt40%Rh Thermocouple	200	1800
8	Exegen K80 I.R. pyrometer	-45	650
Process Inputs (scaled to setpoint min and max)		**Min °C**	**Max**
F	-100 to +100mV linear	-1999	9999
Y	0 to 20mA linear (note 4)	-1999	9999
A	4 to 20mA linear (note 4)	-1999	9999
W	0 to 5Vdc linear	-1999	9999
G	1 to 5Vdc linear	-1999	9999
V	0 to 10Vdc linear	-1999	9999

Note 5.
An external 1% current sense resistor is supplied as standard. If greater accuracy is required, a 0.1% 2.49Ω can be ordered as part no. SUB2K/249R.1.

Note 6
Only available with Profibus controller.

Note 7.
Not available with 8 segment programmer

Display Units

C	Celsius
F	Fahrenheit
K	Kelvin
X	Linear input

Digital Input 1 & 2

XX	Disabled	P2	Second PID	B4	4th BCD digit
AM	Manual select	ST	One shot tune enable	B5	5th BCD digit
SR	Remote SP select	AT	Adaptive tune enable	B6	Most significant digit
S2	Second setpoint	FA	Select full access level	SY	Standby-all O/Ps OFF
EH	Integral hold	RB	Simulates UP button	SC	Prog synchronisation
AC	Alarm acknowledge	LB	Simulates DOWN button	SG	Skip segment (without changing SP)
RP	SP rate limit enabled	SB	Simulates SCROLL button	PV	Select PV2
RN	Run program	PB	Simulates PAGE button	AG	Advance to end of segment (& step to target SP)
HO	Hold program	B1	Least sig. BCD digit	M5	CTX (mode 5) Input 2 only
RE	Reset program	B2	2nd BCD digit		
RH	Run/hold prog	B3	3rd BCD digit		
KL	Keylock				
NT	Run/Reset				
TN	Reset/Run				
HB	Program holdback				

Options

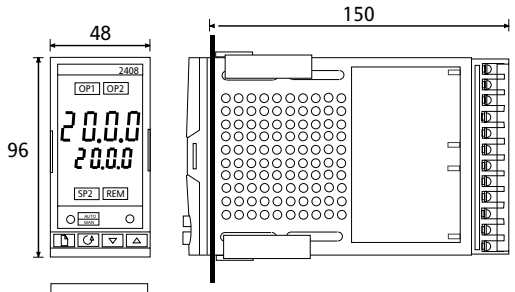
Control action	
XX	Reverse acting (standard)
DP	Direct acting
Power feedback	
XX	Enabled on logic, relay & triac heating
PD	Feedback disabled
Cooling options	
XX	Linear cooling
CF	Fan cooling
CW	Water cooling
CL	Oil cooling
CO	On/Off cooling
Front panel buttons	
XX	Enabled
MD	Auto/manual disabled
MR	Auto/man & run/hold disabled
RD	Run/hold disabled
Programmer time units	
XX	Dwell & ramp in mins
HD	Dwell time in hours
HR	Ramp rate in units/hrs

Example ordering code:-
2408 - CC - VH - LH - RC - FL - FH - YM - TS - K - 0 - 1000 - C - AM - S2 - XX - XX - XX - MD - XX
2408, PID Controller, 85 to 264Vac, Logic heating, Relay cooling, Low alarm relay, High alarm relay, RS485, Modbus comms, PDSIO setpoint retrans, Type K Thermocouple, 0 to 1000°C, Auto/manual select, 2nd setpoint select, Manual button disabled.

Dimensional details

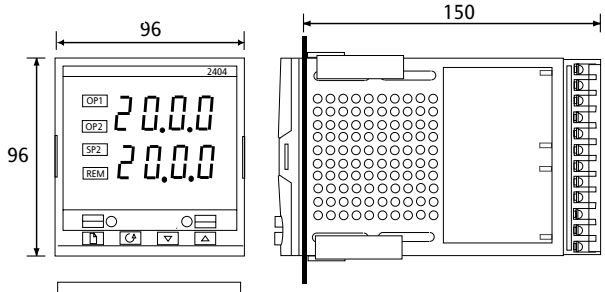
All dimensions in mm

2408



Panel cut-out
92 -0.0 +0.8
x
45 -0.0 +0.6

2404

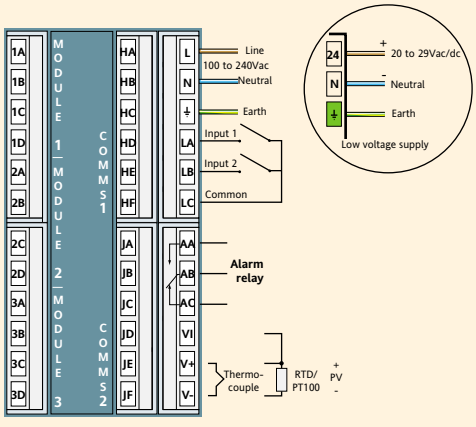


Panel cut-out
92 x 92 -0.0 +0.8

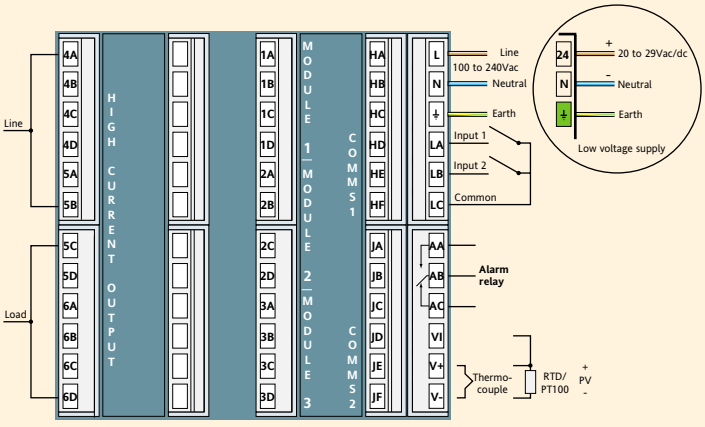
Rear terminal connections

Modules 1, 2 and 3 are plug-in modules.
They can be any one of the types shown in the ordering information on previous pages

2408



2404



EUROTHERM LIMITED UK
Faraday Close Durrington Worthing BN13 3PL
Tel. +44 (0)1903 268500 Fax +44 (0)1903 695666
Email info@eurotherm.co.uk
www.eurotherm.co.uk

EUROTHERM US
741-F Miller Drive Leesburg VA 20175-8993
Tel. 1-703-443-0000 Fax 1-703-669-1300
Email info@eurotherm.com
www.eurotherm.com

EUROTHERM WORLDWIDE
www.eurotherm.co.uk

Part No. HA026553 Issue 3.1 2408/2404 Data sheet Printed in England 08.04