2408
2404
MODELS

CE

EUROTHERM
CONTROLS

Programmer/Controllers

2408
2408

2404
2404

**Product
data**

Features

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. Transmitter and strain gauge power supply options are available. 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.
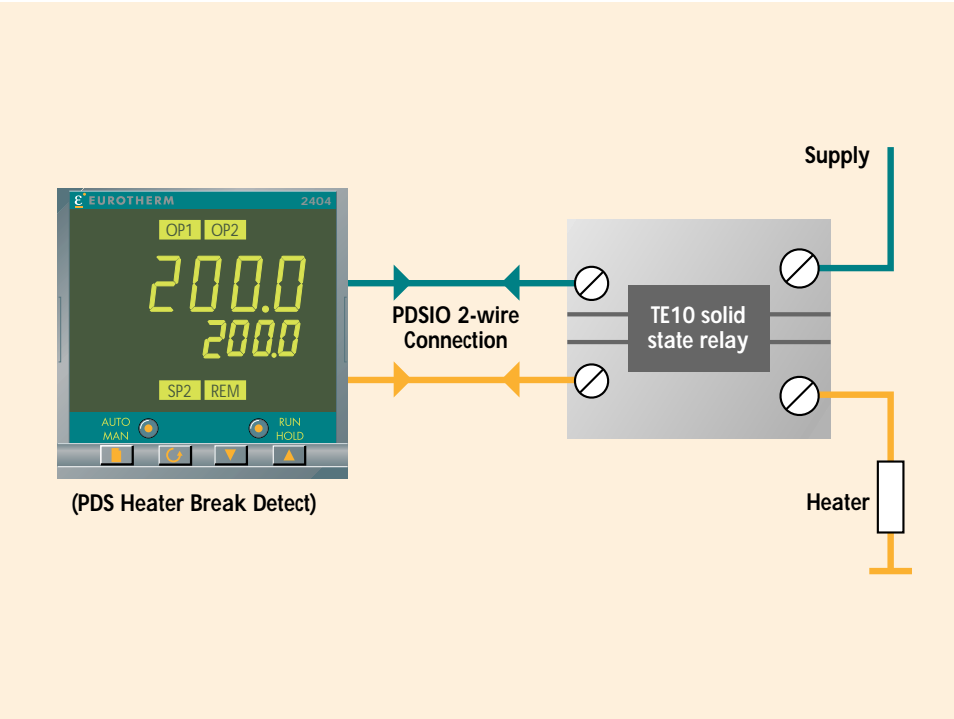A front panel auto/manual button is provided.

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 . Alarms 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.

- **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/strain gauge supplies**
- **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**

PDSIO Load diagnostic

(PDS Heater Break Detect)

PDSIO 2-wire Connection
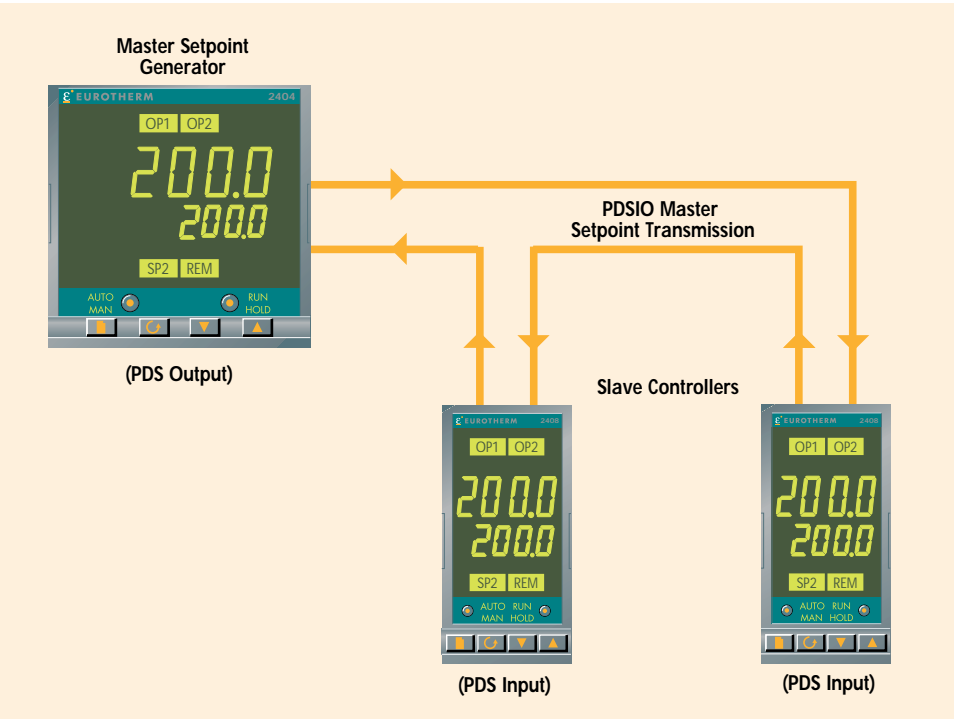
TE10 solid state relay

Supply

Heater

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

Master Setpoint Generator

(PDS Output)

PDSIO Master Setpoint Transmission

Slave Controllers

(PDS Input)

(PDS Input)

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

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	<1µV 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	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
Strain gauge supply		10Vdc. Minimum bridge resistance: 300Ω

Communications

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

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

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	IP54
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 Omit for 2408	Comms 1	Comms 2	Manual

Model Number

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

Function

PID control
CC Controller only
CG 1x 8 seg Prog
CP 1x16 seg Prog
P4 4x16 seg Prog
CM 20x16 seg Prog
On/Off Control
NF Controller only
NG 1x8 seg Prog
NP 1x16 seg Prog
N4 4x16 seg Prog
NM 20x16 seg Prog
Motorised valve control
VC Valve positioner
VG 1x8 seg Prog
VP 1x16 seg Prog
V4 4x16 seg Prog
VM 20x16 seg Prog

Supply Voltage

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

Note 1. PDS heater break detect will transmit the power demand to a TE10S Solid State Relay and read back a heater break alarm.

Note 2. 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.

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
Or alarm 1 from table A
Logic: (Non-isolated)
L2 Fitted unconfigured
LH Heating output
M1 PDS Heater break detect (note 1)
M2 PDS Current monitoring (note 2)
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 PID heat + PID cool
RM VP raise & lower OPs
Dual triac
TT Fitted unconfigured
TD PID heat + PID cool
TM VP raise & lower OPs
Logic+relay
LR Fitted unconfigured
LD PID heat + PID cool
Logic+triac
LT Fitted unconfigured
GD Heat & cool

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
PO Program event 1 (not with 8-seg programmer)
PE Program END output
Or alarm 2 from table A
Dual relay
RR Fitted unconfigured
PP Program events 1 & 2
Logic
L2 Fitted unconfigured
LC Cooling output
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
PS Transducer supply
MS 24Vdc transmitter
DC retran. (Isolated)
Select from Table B
Potentiometer input
VU Fitted unconfigured
VS Valve position feedback
VR Setpoint input

Module 3

XX Not fitted
Relay: 2-pin
R2 Fitted unconfigured
Relay: change over
R4 Fitted unconfigured
PO Program event 4 (not with 8-seg programmer)
PE Program END output
Or alarm 3 from table A
Logic
L2 Fitted unconfigured
Triac
T2 Fitted unconfigured
Dual relay
RR Fitted unconfigured
PP Program event 4 & 5
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

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

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 (not with 8-seg prog)
PE Program END output

10amp Output

XX Not fitted
R6 Fitted unconfigured.
RH PID heating

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

Comms 1

XX Not fitted
2 wire, RS485
Y2 Fitted unconfigured
YM Modbus protocol
YE EI-Bisync protocol
RS232
A2 Fitted unconfigured
AM Modbus protocol
AE EI-Bisync protocol
4 wire RS422
F2 Fitted unconfigured
FM Modbus protocol
FE EI-Bisync protocol
PDS Output
M7 Fitted unconfigured
PT PV retrans
TS Setpoint retrans
OT Output retrans

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

Configuration coding (optional)

Sensor Input	Setpoint Min	Setpoint Max	Display Units	Digital Input 1	Digital Input 2	Control	Power	Options Cooling	Buttons	Program
	note 3	note 3								

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

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			SC	Prog synchronisation
AC	Alarm acknowledge	RB	Simulates UP button	SG	Skip segment (without changing SP)
RP	SP rate limit enabled	LB	Simulates DOWN button		
RN	Run program			PV	Select PV2
HO	Hold program	SB	Simulates SCROLL button	AG	Advance to end of segment (& step to target SP)
RE	Reset program				
RH	Run/hold prog	PB	Simulates PAGE button		
KL	Keylock			M5	CTX (mode 5) Input 2 only
NT	Run/Reset	B1	Least sig. BCD digit		
TN	Reset/Run	B2	2nd BCD digit		
HB	Program holdback	B3	3rd BCD digit		

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

Note 3. Setpoint limits: Include the decimal position required in the displayed value. Up to one for temperature inputs, up to two for process inputs.

Note 4. 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.
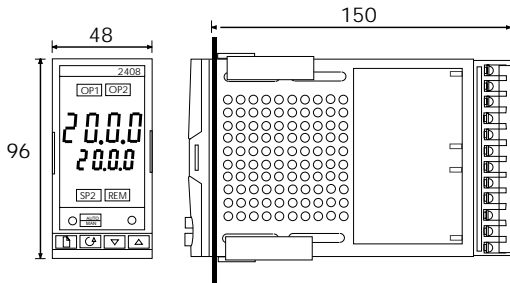
Example ordering code:-
2408 - CC - VH - LH - RC - FL - FH - YM - TS - K - 0 - 1000 - C - AM - S2 - XX - XX - XX - MD - XX
2408, PID Controller, 85 to 264Vac, Logic heating, Relay cooling, Low alarm relay, High alarm relay, RS485, Modbus comms, PDSIO setpoint retrans, Type K Thermocouple, 0 to 1000°C, Auto/manual select, 2nd setpoint select, Manual button disabled.
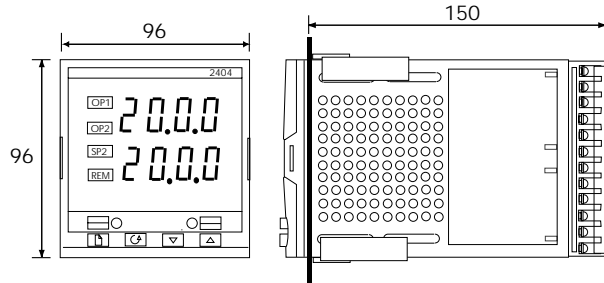
Dimensional details

All dimensions in mm

2408

48

96

150

2408

OP1 OP2

20.0.0
20.0.0

SP2 REM

Panel cut-out

92 -0.0 / +0.8
x
45 -0.0 / +0.6

2404

96

96

150

2404

OP1
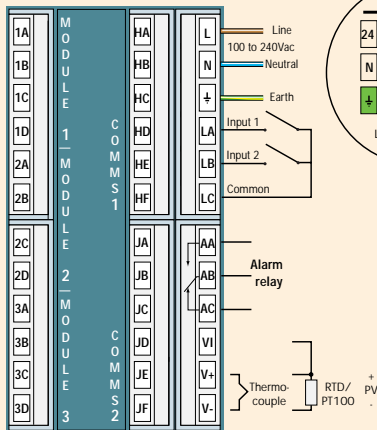OP2
20.0.0
SP2
REM
20.0.0

Panel cut-out
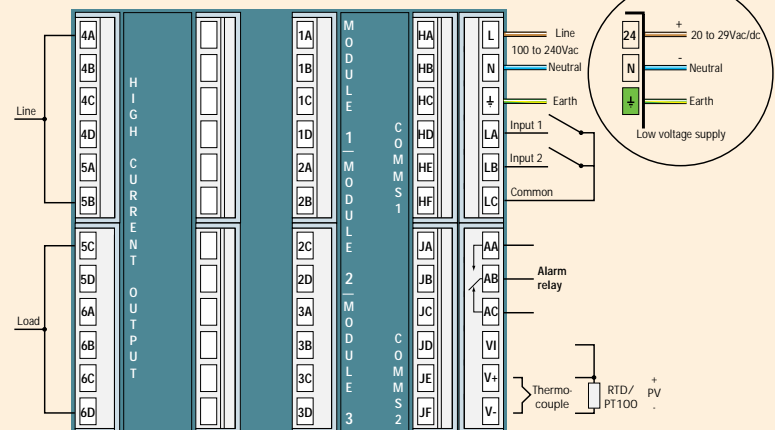
92 x 92 -0.0 / +0.8

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

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