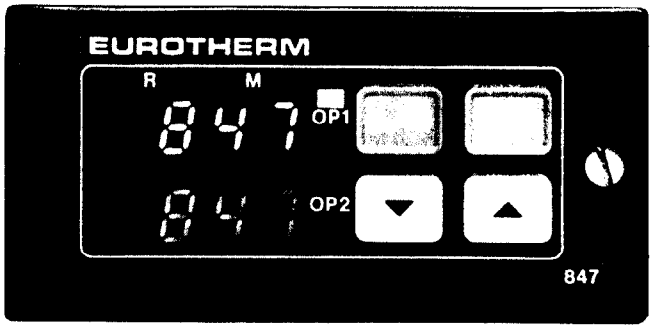
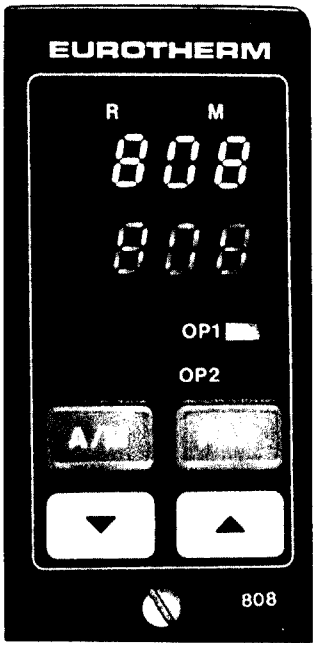
EUROTHERM

Digital temperature/ process controllers

Models 808 and 847





- Dual LED displays for simultaneous viewing of setpoint and measured value
- 3 output channels configurable as heat and cool channels plus alarm, or single-output channel plus 2 alarms
- Optional self-tuning feature for tune at start-up or tune at setpoint
- Choice of type J, K, L, R, S, T, Platinel II™ thermocouples or RTD for input sensor
- Linear process input option with fully flexible, non-interactive 2-point scaling and direct or reverse acting control
- Operation in °F, °C or process units
- Fully isolated bidirectional EIA-232-D or EIA-422-A digital communications for computer supervision and control
- 2 supervisory systems available: *Eurotherm Supervisory Package (ESP)* and *Eurovis*
- 4-button operation with user-selectable security level for each and every parameter
- Ramp-to-setpoint capability
- Advanced PID control with variable overshoot inhibition
- Selection of 4 different cooling algorithms
- Recalibration to factory specifications from front panel
- Splash-proof NEMA 3 (IP-54) front panel

The Models **808** and **847** microprocessor-based controllers combine innovative hardware and software design techniques to integrate features not even avail-able on larger, more costly controllers. They require only 3.78x1.85" of panel space—the 96x48mm "1/8 DIN" size—and are available in either vertical-profile (Model **808**) or horizontal-profile (Model **847**) units.

These temperature/process controllers break from the tradition of 1/8 DIN-size instruments by offering exceptional performance characteristics: 0.15% calibration accuracy, 20:1 CJC rejection, fast input-scan rate of 8 times per second, and 0.67µV input resolution. In addition, Eurotherm has incorporated its proven **EM-1** control algorithm with adjustable overshoot inhibition and four cooling algorithms oriented towards specific applications.

The digital communications link allows remote modification and interrogation of all instrument control and configuration parameters: downloading of parameter schedules or a single parameter from a central computer is possible, as well as monitoring controller parameters and the measured value for data logging.

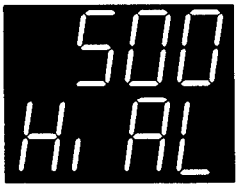
The Models **808** and **847** are completely engineered and manufactured in the United States and are covered by Eurotherm's 2-year warranty.

Front Panel

The front panel comprises 4 dome-membrane pushbuttons and the dual 0.3"-high LED displays. The Models 808 and 847 **display both the measured value and the setpoint simultaneously** under normal conditions.

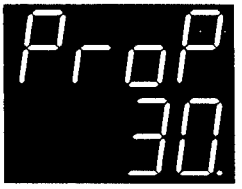
Measured value equal to 449° in upper display. Setpoint of 450° in lower display.

Alarm conditions are annunciated by flashing messages in the lower display and the measured value above.



High alarm annunciation: measured value flashes, high alarm message alternates with setpoint.

All parameter types—PID, alarm, setpoint and configuration—can be viewed in the displays and adjusted with the pushbuttons. The parameter name is shown in mnenomics (English abbreviations) in the upper display, with its current value below:



Proportional band equal to 30°C.

In addition to the yellow LEDs indicating when Output 1 and Output 2 are functioning, there are 3 green LED dots in the upper display for manual mode, communications tranmission in progress, and ramp-to-setpoint in progress.

Operator Controls

OPERATION

All of the configuration, setpoint, and control parameters can be accessed from the front panel. The parameters and their current values are viewed in succession by pushing on the PAR button. Depressing the UP or DOWN buttons adjusts the parameter value. The auto/manual (A/M) button permits operating the controller in the manual mode; for safety, it can be disabled permitting only automatic operation.

SECURITY

The user can tailor the controllers to specific shop-floor requirements by assigning to each parameter one of three security access levels. The priority levels range from complete operator inaccessibility to full modification privileges.

CONFIGURATION

The configuration procedure consists of selecting from the front panel the input sensor to be connected, the plug-in output device types installed, and the control parameters. These parameters can then be removed from the operators' list if desired after configuration. Instruments are delivered pre-configured according to the Product Code.

COMMUNICATIONS

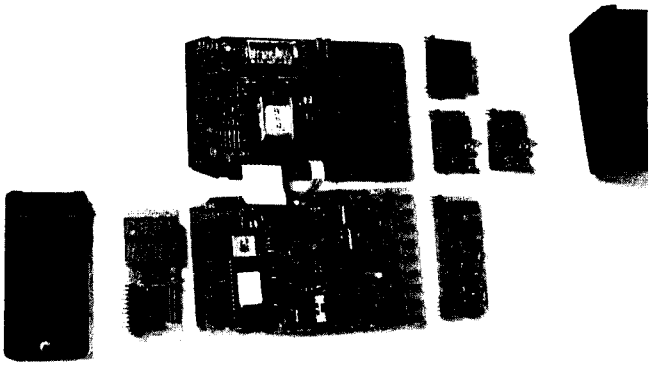
Through the communications port, all the operations that can be performed at the front panel by an operator can be performed remotely by computer. The front panel controls can be disabled by the communications link if desired.

CALIBRATION

No recalibration of the instrument is necessary if the input sensor type or the display units are changed. The original factory calibration parameters reside permanently in memory and can be recalled into service at any time.

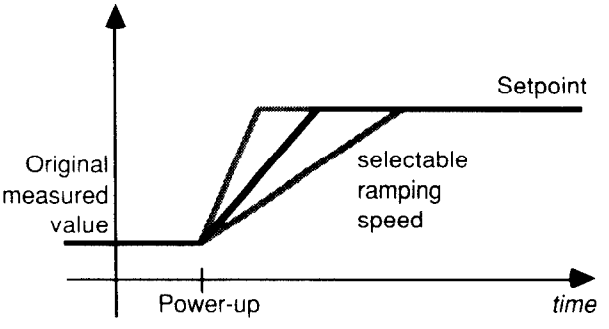
Mechanical Features

- UL-approved rear terminal screws with pressure plates for secure wiring.
- Plug-in construction — boards plug into the sleeve and the output modules plug into the boards.
- Easy removal from sleeve with a screwdriver.



Ramp-to-setpoint Operation

This operating mode is incorporated in the **808/847** control software to minimize thermal shock to the load by insuring that any setpoint change occurs as a ramp over a period of time. When selected, the controller ramps from the current measured value towards the setpoint at a speed determined by the user when setting up the instrument.



Self tuning option QS

The Models **808** and **847** incorporate an optional self-tuning algorithm that automatically determines values for the PID parameters and, if appropriate, values for the overshoot inhibition parameters (cutback).

Self-tuning offers several advantages:

- Fast, simultaneous adjustment of several loops in a multi-zone system saves time.
- Inexperienced personnel can perform the one push-button procedure.
- No elaborate equipment (such as chart recorders or memory oscilloscopes) is required.
- Consistant approach of the tuning algorithm produces repeatable results.

TYPES OF SELF TUNING

The Models **808** and **847** feature 2 types of self tuning. Both are operable on heat-only, cool-only, and heat/cool systems encompassing endothermic or exothermic processes (negative feedback systems only).

Tune from ambient

A self-tune procedure from ambient is performed if the measured value is not near the control setpoint. This can apply to a "normal" heat-up condition or tuning a load which operates predominantly in cooling, i.e. the setpoint is well below ambient.

Tune from setpoint

A self-tune procedure from setpoint is performed if the measured value is near the control setpoint. This can apply to either an endothermic or an exothermic process or a process which must be cooled to maintain control point.

PARAMETERS CALCULATED

Both types of self tuning calculate values for the PID parameters: proportional band (mnemonic: ProP), integral time constant (Int.t), and derivative time constant (der.t).

In addition, the tune-from-ambient operation calculates the high- and low-cutback levels (H cb and L cb) for overshoot inhibition. The tune-from-setpoint simply verifies that the cutback levels are not within the proportional band; if they are, they are moved out to the edge of the proportional band.

PROCEDURES

Two different parameters can be used to launch a tune operation. Both determine if a tune from ambient or a tune from setpoint would be appropriate. These two parameters can be manipulated through the communications port.

While the tuning algorithm is running, the message tunE flashes in the lower display. Upon completion of the tuning operation, the lower display again shows the setpoint and the values calculated for the parameters can be viewed in the scroll list.

Tune on demand

This parameter (mnenomic tunE) is set to on by the operator to launch the tuning operation

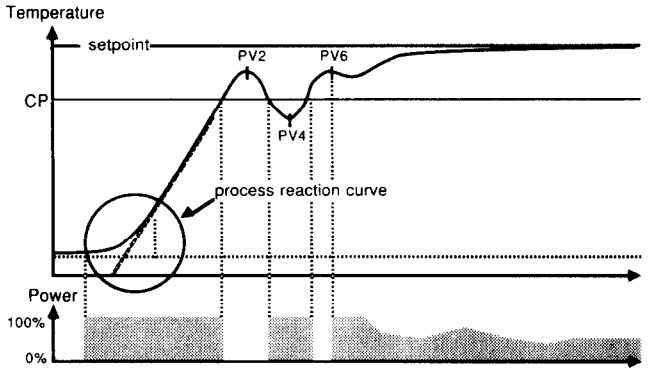
Tune on start-up

When the parameter t Su (tune on start-up) is set to YES, the controller automatically performs a tuning operation upon the next application of power. After a successful tuning operation, the controller switches t Su to no, disabling the tune on start-up feature. As long as t Su remains set to YES (meaning that a successful start-up tune operation has never been performed) a self-tuning operation will be launched the next time power is applied to the unit.

OPERATION

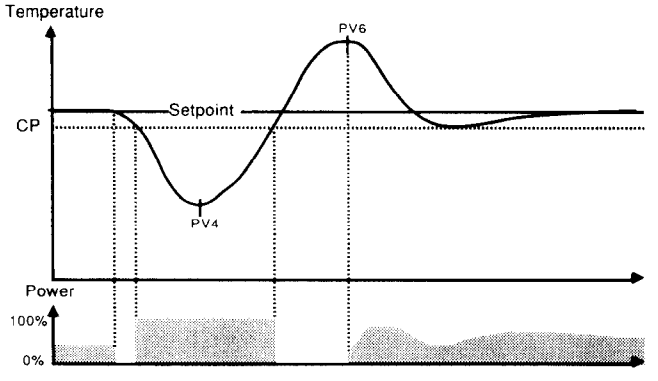
Tune from ambient

The example below illustrates the heat-up case for a start-up tune. The outputs from the controller are turned OFF for 1 minute. Heat is applied and the start-up process reaction curve is evaluated. Once the temperature has reached the switch-off point, **CP**, power is set to 0%. Oscillations through **PV4** and **PV6** are forced as shown. Values for the PID terms and the high and low cutback levels are then calculated from this response.



Tune from setpoint

Self tuning of an endothermic process is illustrated here. Upon initiation the output power is fixed for 1 minute. Both outputs are turned off and the direction of the response noted. When the temperature drops, oscillations are induced around the control point **CP**. Values for the PID terms are then calculated from the response.



Linear input option QL

The Model **808/847** linear input package is indicated for the following applications:

- Linear process input signals.
- Differential temperature control.
- Direct-acting temperature control.
- Pyrometer inputs (through linearizing transmitter)
- Thermocouple inputs to be directly read in mV using an external cold-junction reference.

CONTROL ACTION

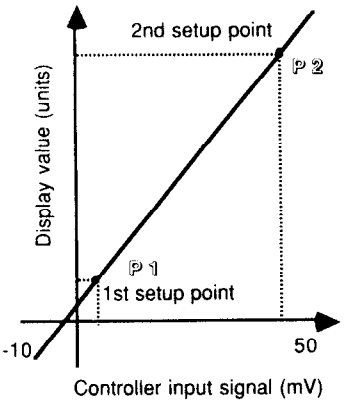
A scroll list parameter allows the user to select either direct-acting or reverse-acting control.

INPUTS

For input signals greater than 50mV, an input adapter **IA** is required. Input adapters are available for all common industrial process signal ranges—see the product code on page 7. The adapter is screwed to the rear terminals, and the signal wires brought to the adapter.

INPUT SCALING

Scaling the Model **808/847** is an easily performed front-panel procedure entailing the adjustment of 2 setup points that link known-value input signals to specific display values. These 2 scaling values are used to define a straight line and are not interactive. The maximum display range can be either –999 to 9999 units or –99.9 to 999.9 units.



Specifications

1. INPUTS

All inputs	
Calibration accuracy	0.15% of reading +12µV ±1/2 l.s.d. (typ.)
Sampling frequency	8Hz
Maximum sensor break reaction time	30s
Sensor break output level adjustment range	-99.9 to 100.0%
Maximum common-mode voltage @ 50/60Hz	$264V_{ac\ rms}$ (with respect to neutral)
Common mode rejection @ 50/60 Hz	≥120dB
Series mode rejection @ 50/60 Hz	≥60dB
Thermocouples	
Number of thermocouple types	7 (J, K, L, R, S, PL2, T)
Thermocouple linearization accuracy	0.2°C
Cold junction compensation rejection ratio	20:1 (with internal detector) ±0.5°C
Resistance temperature detector	
Device	100Ω Pt (DIN 43760/BS 1904/JIS C1602), 3-wire connection
Resistance at 0°C	100Ω
Resistance at 100°C	138.5Ω
Linearization accuracy	0.1°C
Linear inputs (option QL...)	
Temperature coefficient	50ppm/°C
Resolution (without input adapter)	1.67µV
Base range	-10 to +50mV
Other ranges (requiring an input adapter **IA...**)	-40 to +200mV, -200 to +1000mV, -1 to +5V, -2 to +10V, -5 to +25V, -4 to +20mA

2. OUTPUT DEVICES

Triac module (isolated from all other circuits)	
Maximum load current (resistive load)	$1A_{rms}$
Line fuse	2AG, 1A, 250V (Littelfuse 225001)
Logic module (not isolated from thermocouple circuit)	
Output	10mA into a maximum of 1.8KΩ ($18V_{dc}$ compliance)
Maximum short-circuit current	20mA (typ.)
Relay module (isolated from all other circuits)	
Output contacts	
O/P 1 and O/P 2 channels	Form A, isolated
Alarm 1 channel	Form C, isolated
Maximum load voltage	$264V_{ac}$
Maximum load current (resistive load)	$2A_{rms}$
Minimum load voltage	$10V_{peak}$

DC module (not isolated from thermocouple circuit)

Current output ranges	0-20mA and 4-20mA
Compliance	18V
Resolution	<0.01%
Linearity	±0.5%

3. CONTROL CHARACTERISTICS

General

Automatic operation

Control mode	ON/OFF, or PID with or without ramp-to-setpoint feature
Proportional band range	1-4500°C (1-8100°F) or equivalent in %
Integral time constant range	"OFF" and 1-8000s
Derivative time constant range	"OFF" and 1-999s
Overshoot suppression	Adjustable high and low "cutback" points
Ramping speed	0.01-99.99°C/min or °F/min

Manual operation

Auto/manual selection	Bumpless changeover
Power level adjustment range	-99.9 to 100.0%

Output 1 (Heat)

Signal type	Time proportioned or continuously variable
Cycle time range (time proportioned)	0.3-80s
Power feedback compensation range (selectable with t.p. only)	±15% of nominal supply voltage

Output 2 (Cool or Alarm 2)

Cool

Signal type	Time proportioned
Cycle time range	0.3-80s
Cool gain multiplier (relative to heat channel)	0.1-10.0
Modes (specialized algorithms)	Water, air, oil, 5% minimum cycle time, OFF and ON

Alarm 2 (see §4)

4. ALARMS

Number of independent alarm output channels	2: AL1 and AL2 (AL2 occupies Output 2)
Number of independent alarm input functions	3: "Full-scale" high, "Full-scale" low, and deviation band, each with its own setpoint
Annunciation memory	Latching or non-latching. Memory for each of the 3 alarm functions can be independently selected.
Hysteresis	1°C
Alarm 1 action	Failsafe (alarm state affirmed by de-energized output)
Alarm 2 action	Alarm state affirmed by energized output
Number of alarm functions assignable to output channel	Alarm 1: 3; Alarm 2: 1

5. COMMUNICATIONS

Transmission standard	EIA-232-D or EIA-422-A (formerly RS designations)
Transmission rate selection	300, 600, 1200, 2400, 4800, 9600 or 19200 baud
Number of stop bits	1
Parity	Even

6. GENERAL

Overall dimensions	3.78" x 1.89" x 6.5" deep (96 x 48 x 165 mm)

Power supply

Line voltage range	85-264$V_{ac\ rms}$ (switchmode)
Line frequency range	48-62Hz
Power dissipation	5W

Environmental considerations

Operating temperature range	0-50°C
Relative humidity	5-95%, non-condensing
Vibration specification	Mil Std 810D, method 516-I
Fascia seal rating	NEMA 3 (IP-54) with optional gasket kit

7. SELF TUNING (option QS)

Self-tune initiation means	On demand or on startup
Parameters determined	
Tune from ambient	PID terms, high and low cutback levels
Tune from setpoint	PID terms

Input sensors

THERMOCOUPLES			RANGE				Precision
Type	Positive material	Negative material	°F min.	°F max.	°C min.	°C max.	°F or °C
J	Iron	SAMA constantan (Cu-45%Ni)	-211	1832	*-135*	*1000*	1
K	Chromel™ (Ni-10%Cr)	Alumel™ (Ni-2%Al-2%Mn-1%Si)	-418	2543	*-250*	*1395*	1
L	Iron	DIN Konstantan	-148	1652	*-100*	*900*	1
PL2	Platinel II™ (alloy #5355)	Platinel II™ (alloy #7674)	32	2543	*0*	*1395*	1
R	Platinum-13% Rhodium	Platinum	32	2912	*0*	*1600*	1
S	Platinum-10% Rhodium	Platinum	32	2912	*0*	*1600*	1
T	Copper	Adams constantan (Cu-45%Ni)	-418	752	*-250*	*400*	1
J	Iron	SAMA constantan (Cu-45%Ni)	-99.9	752.0	*-75.0*	*400.0*	0.1
L	Iron	DIN Konstantan	-99.9	752.0	*-99.9*	*400.0*	0.1
RTD-3	DIN 43760 / BS 1904 / JIS C1602		-99.9	752.0	*-99.9*	*400.0*	0.1

Product code for temperature controllers with thermocouple or RTD inputs

HARDWARE CODE [1]

Model	*output 1*	*output 2*	*alarm*	***options [4]*** *comms*	*additional options*
808 or 847 /	/	/	/	/	/

CONFIGURATION CODE [1]

config. type	*sensor*	*setpoint range*	*display units*	*output 1*	*output 2*	*alarm output*
(**A**						)/

HARDWARE CODE *[1]*
output 1 (heat) and output 2 (cool or alarm)

NO	Not fitted	
D1	DC (0-20mA & 4-20mA)	*[2]*
L1	Logic	
R1	Relay (2 A rms)	
T1	Triac (1 A rms)	*[3]*

alarm

NO	Not fitted
L1	Logic
R1	Relay (2 A rms)

options *[4]*
communications

NO	Not fitted
C2	EIA-232-D
C4	EIA-422-A

additional options

NO	None
QS	Self tuning

CONFIGURATION CODE *[1]*
configuration type *[5]*

A	Standard
@A	Non-standard

sensor input

Thermocouples		
J	Fe/SAMA constantan	*[6]*
K	Chromel™/Alumel™	
L	Fe/Konstantan (DIN)	*[6]*
P	Platinel II™	
R	Pt-13%Rh/Pt	
S	Pt-10%Rh/Pt	
T	Cu/Adams constantan	
Resistance temperature detector (RTD/3-wire)		
Z	DIN43760/BS1904/JIS C1602	

setpoint range *[7]*

	(°C)	(°F)	J	K	L	P	R	S	T	Z
A	-250+250	-400+500		•					•	
B	-100+100	-150+200		•					•	
C	-100+400	-100+750		•					•	
D	-75.0+400.0	-99.9+750.0	•		•					•
E	0-100	32-200	•	•	•	•	•	•	•	•
F	0-200	32-400	•	•	•	•	•	•	•	•
G	0-300	32-600	•	•	•	•	•	•	•	•
H	0-400	32-800	•	•	•	•	•	•		
J	0-600	32-1200	•	•	•	•	•	•		
K	0-800	32-1400	•	•		•	•	•		
L	0-1000	32-1800		•		•	•	•		
M	0-1200	32-2100		•		•	•	•		
N	0-1600	32-2900					•	•		

display units *[8]*

C	Degrees Centigrade	
F	Degrees Fahrenheit	

output 1 (Heat)

1	Slow cycle	*[9]*
2	Fast cycle	*[10]*
3	0-20mA	*[11]*
4	4-20mA	*[11]*
5	ON/OFF	*[12]*

output 2 (Cool or Alarm)

0	None	
1	Water cooling	
2	Oil cooling	
3	Fan cooling	
4	Full scale low alarm	*[13]*
5	Full scale high alarm	*[13]*
6	Deviation band alarm	*[13]*

alarm output *[14]*

0	None
4	Full scale low alarm
5	Full scale high alarm
6	Deviation band alarm

NOTES:

1. *The complete Product Code consists of both the Hardware and the Configuration Codes.*
2. *DC analog output module not available on Output 2.*
3. *Triac output module not available on Output 2 when used as second alarm output.*
4. *If a particular option is not desired, the corresponding option field must be omitted from the Product Code.*
5. *Standard: selections from this page. Non-standard: configurations requiring other parameter combinations or hardware modifications. Call your nearest Eurotherm sales and service representative.*
6. *Selection of setpoint range* **D** *with type J or*

type L thermocouple invokes tenths' precision display.

7. These are preconfigured setpoint limits only; the input sensor is always linear over the entire range given in the Input Sensors table.
8. Units for all adjustable temperature parameters.
9. Available only with hardware modules **L1**, **R1** and **T1**.
10. Available only with hardware modules **L1** and **T1**.
11. Available only with hardware module **D1**.
12. Output 2 must be configured as Alarm 2 or OFF. Not available with hardware module **D1**.
13. Alarms are non-latching. Alarm state affirmed by energized output.
14. Alarms are non-latching. Alarm state affirmed by de-energized output.

Product code
for optional NEMA 3 (IP-54) front-panel gasket kit:
KIT / 808NEMA3 / GASKET

Product code for controllers with linear process inputs (option QL...)

	HARDWARE CODE [1]						CONFIGURATION CODE [1]			
				options [4]						
Model	output 1	output 2	alarm	comms	input adapter	add'l options	config. type	sensor	setpoint range	display units
808 or 847 /	[ ] /	[ ] /	[ ] /	[ ] /	[ ] /	QL... /(	A	X	X	X

CALIBRATION CODE [1]									
			input signal			display range		
output 1	output 2	alarm output	lower limit	upper limit	units	lower limit	upper limit	units
[ ]	[ ]	[ ])/[	[ ] <	[ ]	[ ]	= [ ] <	[ ]	[ ]]

HARDWARE CODE [1]

output 1 (heat) and output 2 (cool or alarm)

NO	Not fitted	
D1	DC (0-20mA & 4-20mA)	[2]
L1	Logic	
R1	Relay (2 A rms)	
T1	Triac (1 A rms)	[3]

alarm

NO	Not fitted
L1	Logic
R1	Relay (2 A rms)

options [4]

communications

NO	Not fitted
C2	EIA-232-D
C4	EIA-422-A

input adapter [5]

NO	Not fitted (-10 to +50mV)
IAV2	-40 to +200mV
IA1V	-200 to 1000mV
IA5V	-1 to +5V
IA10V	-2 to +10V
IA25V	-5 to +25V
IAA02	-4 to +20mA

additional options [6]

QL	Linear input
QLP	Linear input with setpoint programming
QLS	Linear input with self tuning
QLPS	Linear input, setpoint programming and self tuning

CONFIGURATION CODE [1]

configuration type [7]

A	Standard
@A	Non-standard

sensor input

X	Linear process or diff. temp. input

setpoint range

X	Linear process or diff. temp. input

display units

X	Linear process or diff. temp. input

output 1 (Heat)

1	Slow cycle	[8]
2	Fast cycle	[9]
3	0-20mA	[10]
4	4-20mA	[10]
5	ON/OFF	[11]

output 2 (Cool or Alarm)

0	None	
1	Water cooling	
2	Oil cooling	
3	Fan cooling	
4	Full scale low alarm	[12]
5	Full scale high alarm	[12]
6	Deviation band alarm	[12]

alarm output [13]

0	None
4	Full scale low alarm
5	Full scale high alarm
6	Deviation band alarm

CALIBRATION CODE

input signal [14]

lower limit

upper limit

units

mV	Millivolts
V	Volts
mA	Milliamps

display range

lower limit [15]

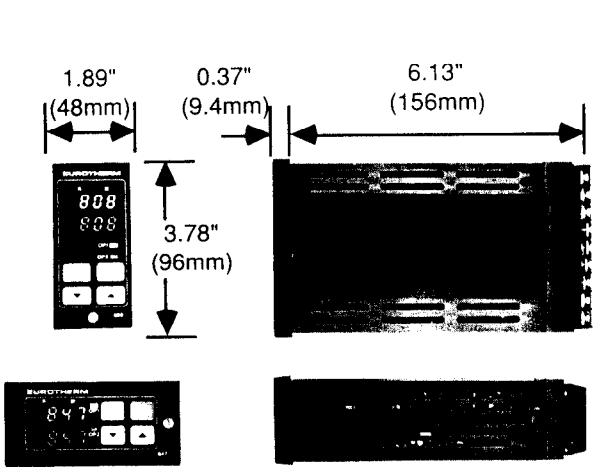
upper limit [15]

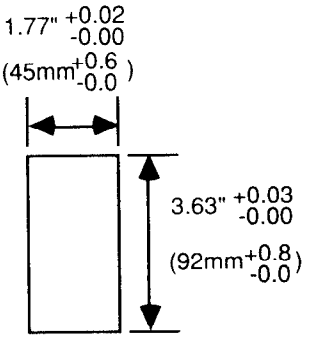
units [16]

NOTES:

1. The complete Product Code consists of the Hardware, Configuration, and Calibration Codes.
2. DC analog output module not available on Output 2.
3. Triac output module not available on Output 2 when used as second alarm output.
4. If a particular option is not desired, the corresponding option field must be omitted from the Product Code.
5. Dynamic range of input adapter must be greater than or equal to that of the input signal. The input adapter increases the panel depth of the controller to 7.0105" (180.5mm).
6. Minimum additional option of **QL** must be specified.
7. Standard: selections from this page. Non-standard: configurations requiring other parameter combinations or hardware modifications. Call your nearest Eurotherm sales and service representative.
8. Available only with hardware modules **L1**, **R1** and **T1**.
9. Available only with hardware modules **L1** and **T1**.
10. Available only with hardware module **D1**.
11. Output 2 must be configured as Alarm 2 or OFF. Not available with hardware module **D1**. Setpoint programming and ON/OFF control are mutually exclusive and cannot be configured or utilized together.
12. Alarms are non-latching. Alarm state affirmed by energized output.
13. Alarms are non-latching. Alarm state affirmed by de-energized output.
14. Lower and upper limits must be within the bounds of the selected input adapter and the units must agree. Specify up to 4 significant figures.
15. Display units must be within either –99.9 to 999.9 or –999 to 9999.
16. Write in display units. Use only the letters **A** to **Z** and **a** to **z**. For reference only; not displayed on front panel.

Dimensions

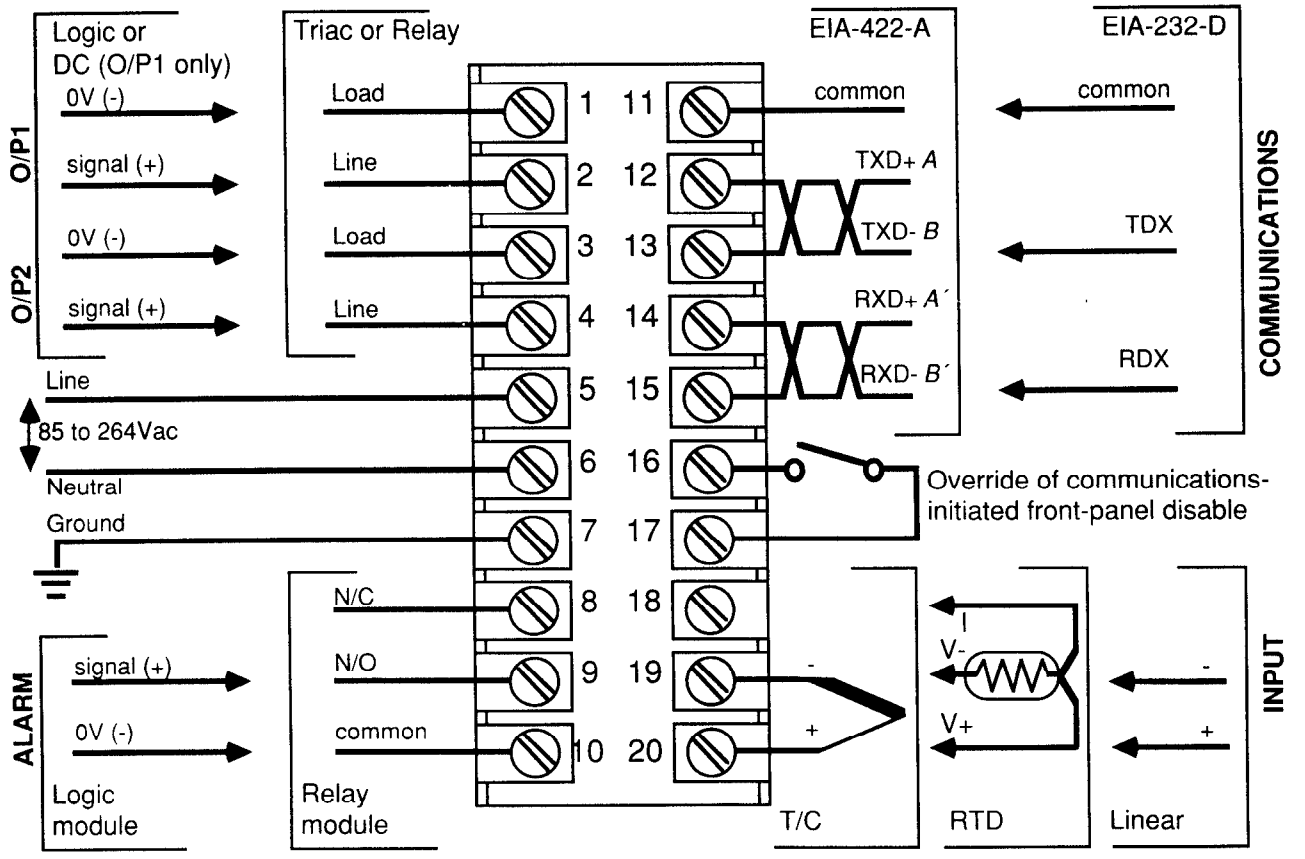




Panel Cutout
Maximum panel thickness:
0.25" (6mm)

Panel depth: with input adapter IA...: 7.11" (180.5mm)

Rear terminal connections



Subject to change without notice.

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