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2216e

MODEL



Programmer/Controller

EUROTHERM

CONTROLS
PROCESS AUTOMATION
RECORDERS

invensys
An Invensys company

Features

- **Heating and cooling with two modular outputs**
- **Motorised Valve output**
- **Customised operation**
- **Heater current display**
- **Load diagnostics**
- **Up to two alarm relays**
- **Self-tuning with overshoot inhibition**
- **Optomised fan, water and oil cooling**
- **Setpoint rate limit with timer function**
- **Digital communications**
- **Plug-in from front**
- **IP65, NEMA 4X panel sealing**
- **Compliant with European EMC and low voltage safety directives**
- **3 Year warranty**

The 2216e is a versatile, high stability temperature or process controller, with self tuning, in a 1/16 DIN size. It has a modular hardware construction with the option of two control outputs, one alarm relay and a communications module. The hardware is configurable for heating, cooling or alarms. The 2216e is fully configurable on-site.

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. 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.

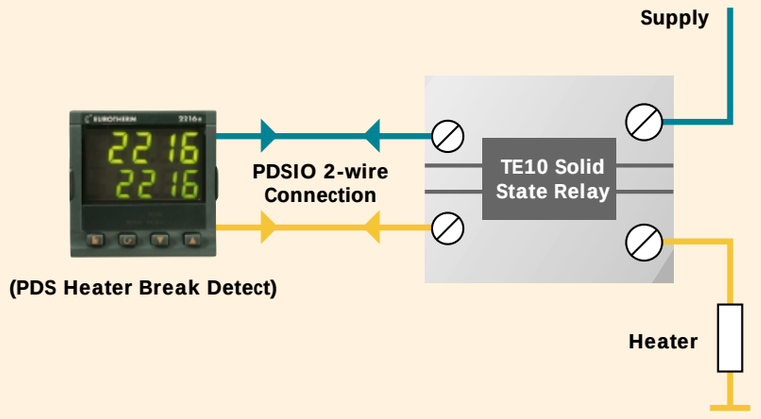
Alarms

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, EIA422 4 wire or EIA232. With industry-standard protocols including: Modbus®, Eurotherm Bisync, DeviceNet®.

PDSIO Load diagnostic



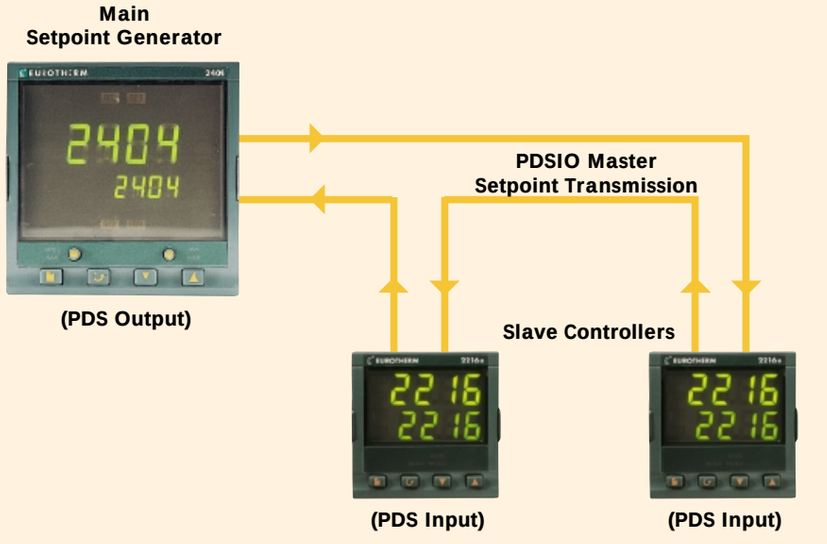
PDSIO Load diagnostics

PDSIO (Pulse Density Signalling I/O) is a major innovation in the 2216e. When used in combination with a Eurotherm TE10 solid state relay (SSR), it allows the logic output of a 2216e 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 mode 2 will monitor load current and display value, giving an alarm if current is out of limits.

PDSIO Setpoint transmission



PDSIO setpoint input

PDSIO can be used to digitally transmit the setpoint profile from a 2404/08 to a number of slave Series 2200e or 2400 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	-10mV to 80mV and 0 to 10Vdc (auto ranging)
	Sample rate	9Hz (110mS)
	Calibration accuracy	0.25% of reading, ±1°C or ±1 LSD or whichever is the greater
	Resolution	<1µV for ± 100mV range, <0.2mV for 10Vdc range
	Linearisation accuracy	<0.1% of reading
	Input filter	OFF to 999.9secs
	Zero offset	User adjustable over the full display range
Thermocouple	Types	See sensor inputs table (ordering information)
	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 DIN43760
	Bulb current	0.2mA
	Lead compensation	No error for up to 22 ohms in all 3 leads
Process	Range	-10 to 80mV, 0 to 20mA or 0 to 10Vdc (All configurable between limits)
	Type	Linear
	Application	Process value
Digital	Type	Contact closure
	Application	Manual select, 2nd setpoint, remote setpoint select, internal hold, acknowledge alarms, standby

Outputs

Relay	Rating: 2-pin relay	Min: 12V, 100mA dc. Max: 2A, 264Vac resistive
	Rating: change-over, alarm relays	Min: 6V, 1mA dc. Max: 2A, 264Vac resistive
	Application	Heating, cooling or alarms
Logic	Rating	18Vdc at 24mA (non-isolated)
	Application	Heating, cooling or alarms
		PDSIO mode 1: Logic heating with load failure alarm
		PDSIO mode 2: Logic heating with load/SSR failure alarm and load current display
		PDSIO mode 5: For use with external SSR and contactors not fitted with PDSIO input
Triac	Rating	1A, 30 to 264Vac resistive
	Application	Heating or cooling
Analogue	Range	Isolated, 0 to 20mA @ 12V (configurable between limits). 600Ω max load resistance
	Application	Heating or cooling
Retransmission		Process value, setpoint or error, mA or volts with external burden resistor

Communications

Digital	Transmission standard	EIA232, EIA422, EIA485 at 1200, 2400, 4800, 9600 and 19,200 baud
	Protocols	Modbus® or Eurotherm Bisych or DeviceNet®
PDSIO	Setpoint input	Setpoint input from master PDSIO controller. Holdback to master controller

Control functions

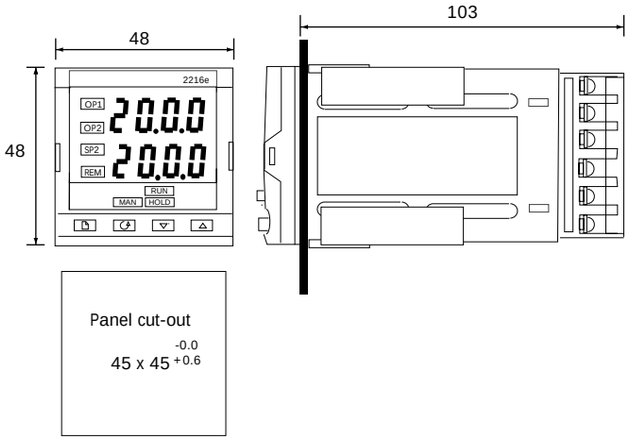
Control	Modes	PID or PI with overshoot inhibition, PD, P only or On/Off
	Application	Heating and cooling or process output
	Auto/manual	Bumpless transfer
	Setpoint rate limit	OFF to 999.9 degrees or display units per minute
	Cooling algorithms	Linear; Water (non-linear); Fan (minimum on time), Oil (Proportional only)
Tuning	One-shot tune	Automatic calculation of PID and overshoot inhibition parameters
	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. High current, low current
	Modes	Latching or non-latching. Normal or blocking action
		Up to four process alarms can be combined onto a single output

General

	Display	Dual, 4 digit x 7 segment high intensity LED
	Dimensions & weight	48W x 48H x 103D mm. 250g
	Supply	85 to 264Vac -15%, +10%. 48 to 62Hz. 10watts max
	Temperature and RH	Operating: 0 to 55°C, RH: 5 to 90% 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.

Dimensional details

All dimensions in mm



Ordering information

Hardware coding

Model Number	Function	Supply Voltage	Output 1	Output 2	Output 3	Comms	Manual
2216e		VH					

Model Number

2216e	48x48mm unit

Function

CC	PID Control
NF	On/off control
VC	Motorised Valve control
AL	Alarm unit

Supply Voltage

VH	85-264Vac

Output 1

XX	Not fitted
Relay: 2-pin	
R1	Fitted unconfigured
RH	Heating output
RU	Valve raise output
FH	High alarm 1
FL	Low alarm 1
DB	Dev. band alarm 1
DL	Dev. low alarm 1
DH	Dev. high alarm 1
Logic	
L1	Fitted unconfigured
LH	Heating output
M1	PDS Heater break detect (note 1)
M2	PDS Current monitoring (note 2)
Triac	
T1	Fitted unconfigured
TH	Heating output
TU	Valve raise output
DC control (Isolated)	
D3	Fitted unconfigured
H6	0-20mA PID heating
H7	4-20mA PID heating
C6	0-20mA PID cooling
C7	4-20mA PID cooling
DC retran. (Isolated)	
Select from Table A	

Table A: 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

Output 2

XX	Not fitted
Relay: 2-pin	
R1	Fitted unconfigured
RC	Cooling output
RH	Heating output
RW	Valve lower output
FH	High alarm 2
FL	Low alarm 2
DB	Dev. band alarm 2
DL	Dev. low alarm 2
DH	Dev. high alarm 2
AL	High & low alarms 1 & 2
Logic output	
L1	Fitted unconfigured
LC	Cooling output
LH	Heating output
Logic input	
AM	Auto manual select
S2	Setpoint 2 select
AC	Alarm ack/reset
EH	Integral hold
SB	Standby mode
SR	PDS Remote SP select
M5	CTX mode 5 current I/P
Triac	
T1	Fitted unconfigured
TC	Cooling output
TH	Heating output
TW	Valve lower output

Output 3

XX	Not fitted
Relay	
RF	Fitted unconfigured
RH	PID heating
RC	PID cooling
FH	High alarm 3
FL	Low alarm 3
DB	Dev. band alarm 3
DL	Dev. low alarm 3
DH	Dev. high alarm 3
AL	High & low alarms 3 & 4
PDS Alarms	
LF	Heater break detect
HF	Current monitoring heater break
SF	Current monitoring SSR failure

Comms

2XX	Not fitted
Modbus protocol	
2YM	2-wire EIA485
2FM	4-wire EIA422
2AM	EIA232
DeviceNet®	
2DN	DeviceNet
EI-Bisynch protocol	
2YE	2-wire EIA485
2FE	4-wire EIA422
2AE	EIA232
PDS input	
2RS	Setpoint input

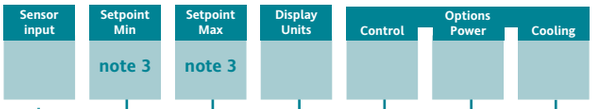
Manual

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

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.

Configuration coding (optional)



Sensor Input

	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	-200		1300
R	R Thermocouple-Pt/Pt13%Rh	-50		1700
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 (Englehard) 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	Exergen K80 I.R. pyrometer	-45		650
	Process Inputs (Scaled to setpoint min and max)	**Min**	**°C**	**Max**
M	-9.99 to 80.00mV linear	-999		9999
Y	0 to 20mA linear (note 4)	-999		9999
A	4 to 20mA linear (note 4)	-999		9999
W	0 to 5Vdc linear	-999		9999
G	1 to 5Vdc linear	-999		9999
V	0 to 10Vdc linear	-999		9999

Display Units

C	Celsius
F	Fahrenheit
K	Kelvin
X	Linear input

Options

Control action	
XX	Reverse acting (std)
DP	Direct acting
Power feedback	
XX	Enabled on logic, relay & triac heating outputs
PD	Feedback disabled
Cooling options	
XX	Linear cooling
CF	Fan cooling
CW	Water cooling

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:

2216e - CC - VH - LH - TC - FL - 2YM - ENG - K - 0 - 1000 - C - XX - XX - XX

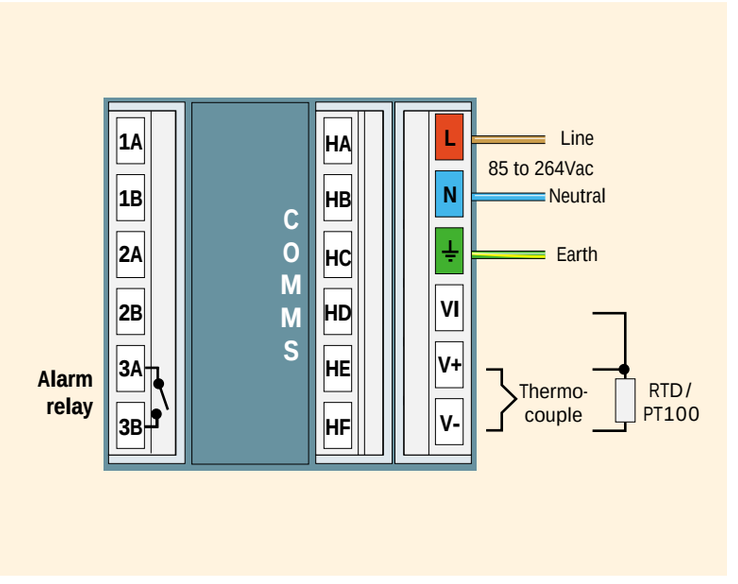
2216e, Controller, 85 to 264Vac, Logic heating, Triac cooling, Low alarm relay, EIA485, Modbus comms, English manual, type K thermocouple, 0 to1000°C, reverse acting, power feedback enabled, linear cooling

Rear terminal connections

Outputs 1 and 2 are optional outputs which can be any one of the types shown in the tables below. They can be configured for heating, cooling or alarms.

Output 1	Relay	Logic Output	Triac	DC Output
1A		+		+
1B		-		-

Output 2	Relay	Logic Output	Triac
2A		+	
2B		-	



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