

2604

MODEL



EUROTHERM
CONTROLS

- Single, dual & three loop versions
- High stability control
- High precision input
- Cascade control
- Ratio control
- Override control
- Digital I/O expander unit
- Toolkit blocks
- Real Time Clock
- Up to 50 programs
- 500 Ramp/Dwell segments
- 3 Profiles/program
- 16 Program event outputs
- Custom displays
- Digital communications
- Gain scheduling
- Auto tune
- 3 Year warranty
- Plug-in from front

High performance
controller/programmer



Product
data

Features

The 2604 is a high accuracy, high stability temperature and process controller available in a single, dual or three loop format. It has a dual 7-segment display (5 digit) of the process value and setpoint with an LCD panel for display of alarm messages, programmer and loop status information. User defined messages in the LCD panel simplify operation.

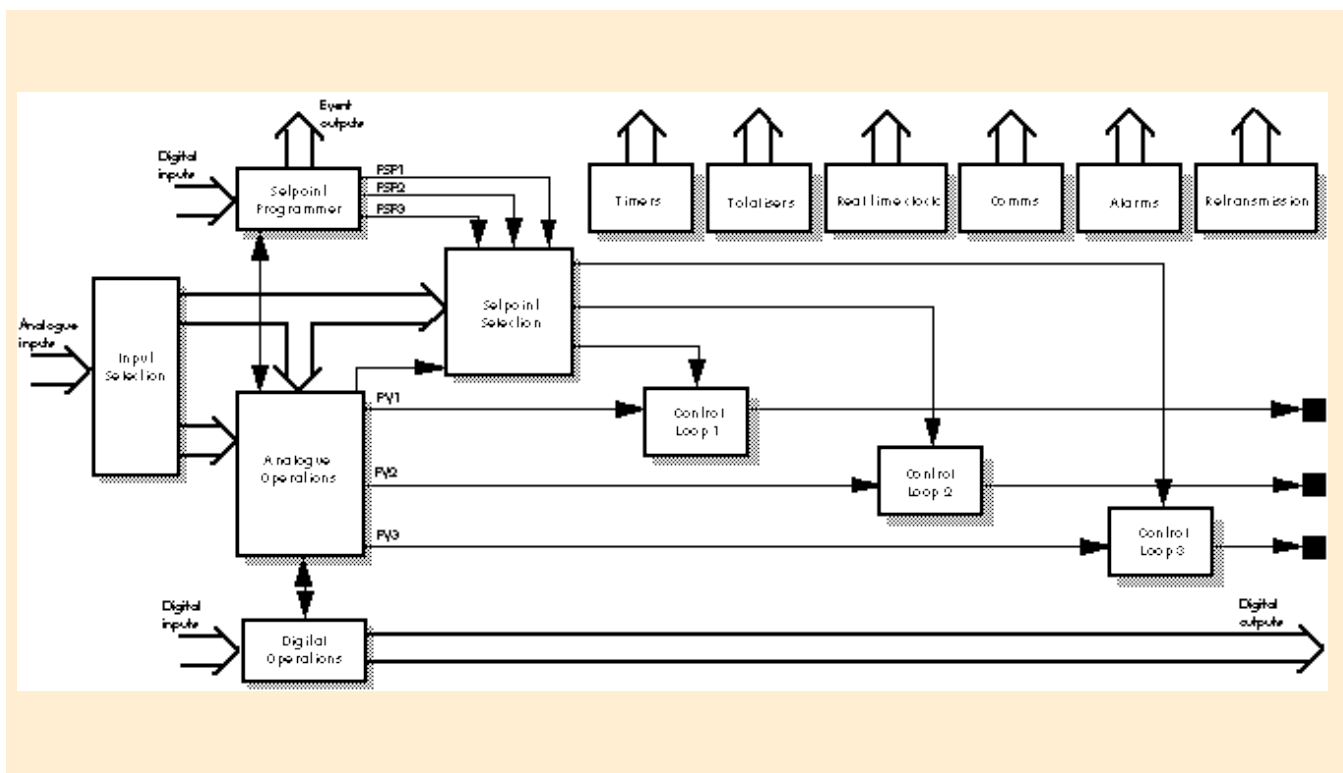
Eurotherm's advanced control algorithm gives stable straight line control. Automatic tuning simplifies the commissioning procedure by performing a one shot tune to calculate the optimum PID and cutback values for each loop. To further optimise each control loop, gain scheduling can be used to automatically transfer control between up to three sets of PID values.

The 2604 incorporates a self-correcting input circuit (INSTANT ACCURACY®) to preserve the instrument calibration accuracy. This maximises accuracy and performance during warm up and changes in ambient temperature.

Configuration is achieved either via front panel interface or by using our iTools configuration package which runs under the Windows 95 or NT operating systems. A wide variety of inputs are available including thermocouples, PT100 resistance thermometers and process inputs. Direct connection of zirconia oxygen probes is also supported for use in heat treatment furnaces and ceramic kiln applications. Each control loop can be defined to be PID, ON/OFF or Valve Positioning and can control using a variety of strategies including single loop, cascade, ratio and override control.

Further information on the cascade, ratio and override controllers are available on request.

Relevant documents are:
 Cascade feature supplement.
 Ratio feature supplement.
 Override feature supplement.



2604 Functional block diagram

Setpoint programmer

The 2604 can store 50 programs with a maximum of 500 segments, allowing control loop setpoints to follow a predetermined series of ramp and dwell segments. Each program may profile up to three separate variables with each connected to its own control loop. Alternatively, one profile may be assigned to more than one loop. Program segments can trigger up to 16 digital events allowing dynamic interaction functions. Digital inputs can be assigned to different programmer functions e.g. Run, Hold, Reset, Wait, etc.

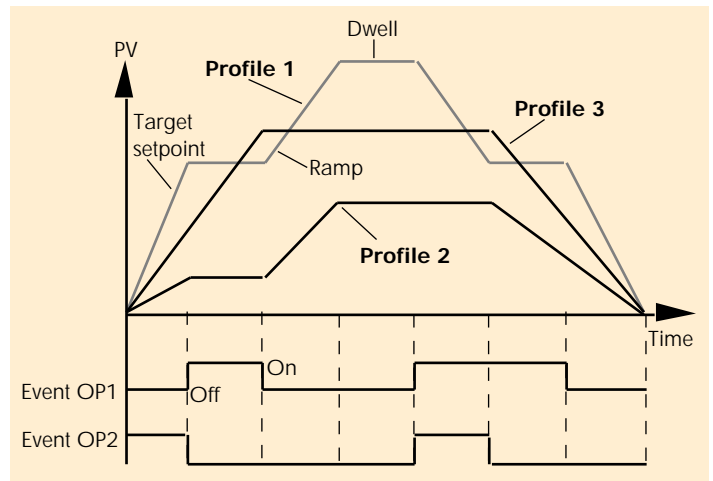
A holdback function is used to ensure guaranteed dwell periods. It can be applied on a per program or per segment basis and can be active on a low, high or band deviation from the setpoint.

While a program is in hold, changes to the currently running segment are possible. In a Time to Target

segment, the target setpoint and segment time remaining are editable. In a Ramp Rate segment edits can be made to target setpoint, ramp rate and time remaining, while in a Dwell segment changes can be made to current working setpoint and time remaining.

Program cycling of all or part of a program is possible by use of the loop Count or "Go Back" Segment commands.

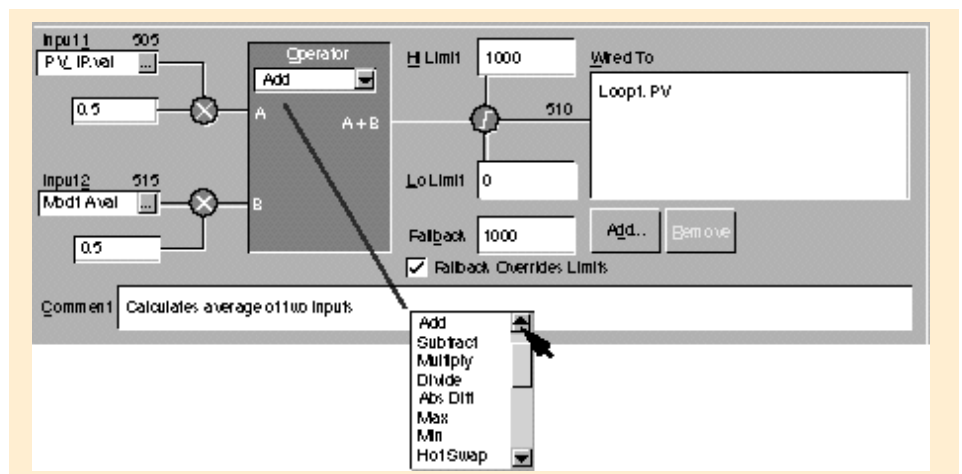
A hot start facility provides the option for the program to start its profile at the correct segment for the current operating value of the process.



Instrument toolkit application blocks

Toolkit blocks allow the user to create solutions by internally wiring analogue and digital operations together in flexible ways. 24 analogue and 32 digital operations as well as timers and totalisers are available.

Configuration of toolkit blocks can be achieved either from the controller front panel interface or by using Eurotherm's iTools configuration software.



Example of Analogue Operation

I/O Expander

The 2000 I/O DIN rail mounting expander can increase the digital I/O capability by a maximum of 20 inputs and 20 outputs. This facility provides the option for greater remote operation of the programmer and expands the 2604 controller PLC logic capability. Communication to this unit is via a 2-wire proprietary communication link.

Technical specification

Quoted at 0 to 50°C unless otherwise stated. Resolution is quoted as a typical figure with filter time constant (f.t.c.)=0.4sec. Resolution generally improves by a factor of 2 with every quadrupling of f.t.c.

Precision PV input

No of inputs	One standard and up to two additional PV input modules can be fitted in I/O slots 3 and 6 (isolated)
Sample rate	9Hz (110msec.)
Input filtering	OFF to 999.9 seconds of filter time constant (f.t.c.). Default setting is 0.4 seconds.
mV input	Two ranges: $\pm 40\text{mV}$ & $\pm 80\text{mV}$, used for thermocouple, linear mV source or 0 - 20mA with 2.49 Calibration accuracy @25°C: $\pm(1.5\mu\text{V} + 0.05\%$ of absolute reading), Resolution (noise free): $0.5\mu\text{V}$ ($\pm 40\text{mV}$) & $1\mu\text{V}$ ($\pm 80\text{mV}$) Drift with ambient Temperature: $< \pm(0.05\mu\text{V} + 0.003\%$ of absolute reading) per °C Input impedance: $>100\text{M}$, Leakage: $< 1\text{nA}$
0 - 2V input	-1.4V to +2V, used for zirconia Calibration accuracy @25°C: $\pm(0.5\text{mV} + 0.05\%$ of absolute reading) , Resolution (noise free): $60\mu\text{V}$ Drift with ambient Temperature: $< \pm(0.05\text{mV} + 0.003\%$ of absolute reading) per °C Input impedance: $>100\text{M}$, Leakage: $< 1\text{nA}$
0 - 10V input	-3V to +10V, used for voltage input Calibration accuracy @25°C: $\pm(0.5\text{mV} + 0.1\%$ of absolute reading), Resolution (noise free): $180\mu\text{V}$ Drift with ambient Temperature: $< \pm(0.1\text{mV} + 0.01\%$ of absolute reading) per °C Input impedance: 0.66M
Pt100 input	3 wire, 0 to 400ohms (-200°C to +850°C) Calibration accuracy @25°C: $\pm(0.1^\circ\text{C} + 0.04\%$ of absolute reading in °C), Resolution (noise free): 0.02°C Drift with ambient temperature: $< \pm(0.006^\circ\text{C} + 0.002\%$ of absolute reading in °C) per °C Bulb current: 0.2mA. Up to 22 in each lead without errors.
Thermocouple types	Most linearisations including K,J,T,R,B,S,N,L,PlI,C,D,E with error $< \pm 0.2^\circ\text{C}$ Internal compensation: CJC rejection ratio $>40:1$ typ., CJ Temperature calibration error: $< \pm 0.5^\circ\text{C}$ 0°C, 45°C and 50°C external compensation available. Refer to 'Ambient Temperature Rejection' document.
Zirconia probes	Most probes supported. Contact Eurotherm for details.
User calibration	Both the user calibration and a transducer scaling can be applied.
Sensor break	a.c. sensor break on each input (i.e. fast responding and no dc errors with high impedance sources).

Analog input

No of inputs	One fixed (Not isolated) Can be used with either floating or ground referenced transducers of low impedance.
Input range	-3V to +10V linear or 0 -20 mA with burden resistor of 100 . The average voltage of the two inputs measured with respect to Screen or Com terminals can be up to $\pm 42\text{Vdc}$. Calibration accuracy @25°C: $\pm(1.5\text{mV} + 0.1\%$ of [reading]), Resolution (noise free): 0.9mV Drift with ambient Temperature: $< \pm(0.1\text{mV} + 0.006\%$ of absolute reading, per °C Input Impedance: 0.46M (floating input), 0.23M (ground referenced input) CMRR : $>110\text{dB}$ at 50/60Hz, $>80\text{dB}$ at DC (i.e. input error $<1\text{mV}$ per 10Vdc of the inputs average)
Sample rate	9Hz (110msec)
Input filtering	OFF to 999.9 seconds of filter time constant (f.t.c.). Default setting is 0.4 seconds.
User calibration	Both the user calibration and a transducer scaling can be applied
Sensor break	a.c. sensor break on each input
Functions	Process variable, remote setpoint, power limit and feedforward etc.

Standard digital I/O

Allocation	1 digital input standard and 7 I/O which can be configured as inputs or outputs (Not isolated) plus 1 changeover relay
Digital inputs	Voltage level : input active $< 2\text{Vdc}$, inactive $>4\text{Vdc}$ Contact closure : input active $<100\text{ohms}$, inactive $>28\text{kohms}$
Digital outputs	Open collector, 24Vdc@40mA drive capability, requires external supply
Changeover relay	Contact rating 2A@264Vac resistive
Functions	Refer to engineering manual
Operations	1,000,000 operations with snubber fitted

Digital input modules

No of inputs	Three per module (isolated)
Allocation	Can be fitted into slots 1,3,4,5 or 6
Contact closure	Active $<100\text{ohms}$, inactive $>28\text{kohms}$
Logic inputs	Current sinking : active 10.8Vdc to 30Vdc@2.5mA inactive -3 to 5Vdc @ $<-0.4\text{mA}$
Functions	Refer to engineering manual

Digital output modules

Module types	Single relay, dual relay, single triac, dual triac, triple logic module (isolated)
Allocation	Can be fitted into slot 1,3,4,5 or 6 (max. 3 triac modules per instrument)
Relay rating	2A, 264Vac resistive
Logic drive	12Vdc @ 8mA
Triac rating	0.75A, 264Vac resistive
Functions	Refer to engineering manual

Analogue outputs

Module types	1 channel DC control, 1 channel DC retransmission (5 max.) (Isolated)
Allocation	Can be fitted into slot 1,3,4,5 or 6
Range	0-20mA, 0-10Vdc (isolated)
Resolution	1 part in 10,000 (2,000-noise free) 0.5% accurate for retransmission 1 part in 10,000 2.5% accurate for control
Functions	Refer to engineering manual

Transmitter PSU

Allocation	Can be fitted into slots 1,3,4,5 or 6 (Isolated)
Transmitter	24Vdc@20mA

Digital communications

Allocation	2 modules fitted in slots H & J
Modbus	RS232, 2 wire or 4 wire RS485, max baud 19.2kB in H module & 9.6kB in J module (Isolated)

Alarms

No of Alarms	Input alarms (2), loop alarms (2) User alarms (8)
Alarm types	Full scale, deviation, rate of change, sensor break plus application specific
Modes	Latching or non-latching, blocking, time delay
Parameters	Refer to engineering manual

User messages

No of messages	Maximum 50. Used for custom parameter names
Format	On LCD display, 2 lines x 16 characters

Control functions

No of loops	One, two or three
Modes	On/off, PID, motorised valve without feedback
Options	Cascade, ratio, override or feed forward
Cooling algorithms	Linear, water, oil or fan
PID sets	3 per loop (Cascade loop includes master and slave parameters)
Manual mode	Bumpless transfer or forced manual output, manual tracking available
Setpoint rate limit	Display units per second, minute or hour

Setpoint programmer

No of programs	A maximum of 50 programs assignable over 500 time to target segments or 400 if ramp rate. A program can consist of up to 3 variables. Programs can be given user defined 16 character names
Event outputs	Up to 16, can be assigned individually to segments

Advanced functions

Application blocks	32 digital operations 24 Analogue calculations
Timers	4, ON Pulse, Off delay, one shot and min-ON
Totalisers	4, trigger level & reset input
Real time clock	Day of week and time (Year 2000 compliant)

General specification

Display range	5 digits including up to 3 decimal places
Supply	85-264Vac, 20Watts (max)
Operating ambient	0 - 50°C and 5 to 95% RH non condensing
Storage temperature	-10 to +70°C
Panel sealing	IP54
Dimensions	96H x 96W x 150D (mm)
EMC standards	EN50081-1 & EN50082-2 generic standards - suitable for domestic, commercial and light industrial as well as heavy industrial environments
Safety standards	Meets EN61010 installation category II, pollution degree 2
Atmospheres	Not suitable for use above 2000m or in explosive or corrosive atmospheres

Ordering information

It is only necessary to order the hardware required. In this instance, you need only complete the hardware configuration code. Completion of the quick start code opposite will assist you in configuring the 2604.

If you require Eurotherm to supply a **fully configured product**, you can use the iTools configuration software to generate a clone file which will be downloaded into the 2604 prior to shipment. Eurotherm will then assign a specific number to your instrument allowing you to easily re-order the same configuration. If you have not previously purchased iTools, please contact your local Eurotherm sales office.

Controller Type	Supply Voltage	Loop/Programs	Applications	I/O slot 1	I/O slot 3	I/O slot 4	I/O slot 5	I/O slot 6	Memory Module	Comms	Comms	Manual	Toolkit Functions
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Config Tools

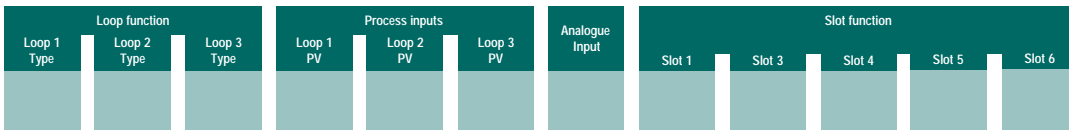
Controller Type	Loop/Programs	I/O slots 1,3,4,5,6	Memory Module	Manual	Config Tools
2604 Standard	<p>First digit</p> <p>1-- One loop 2-- Two loops 3-- Three loops</p> <p>Second digit</p> <p>--XX No programs -2- Twenty programs -5- Fifty programs</p> <p>Third digit</p> <p>--XX No programs --1 1 Profile --2 2 Profile --3 3 Profile</p>	<p>XX None fitted R4 Change over relay R2 2 Pin relay RR Dual relay T2 Triac TT Dual triac D4 DC Control D6 DC retransmission PV PV Input (slots 3 & 6 only) TL Triple logic input TK Triple contact input TP Triple logic output MS 24Vdc transmitter PSU</p>	<p>XX Not fitted</p>	<p>ENG English FRA French GER German ITA Italian NED Dutch SPA Spanish SWE Swedish</p>	<p>XX None</p>
Supply Voltage			Comms	Toolkit Functions	
VH 85-264Vac			<p>Both slots</p> <p>XX None fitted A2 EIA-232 Y2 2-wire EIA-485 F2 4-wire EIA-485</p>	<p>XX Standard U1 16 Analog + 16 Digital U2 24 Analog + 32 Digital</p>	
	Applications				
	<p>XX Standard ZC Zirconia</p>				

Hardware code example:

2604/VH/323/XX/RR/PV/D4/TP/PV/XX/A2/XX/ENG/U1/IT

This code describes a 3 loop controller with capability to store 20 three profile programs. Supply voltage is 85-264Vac.
Modular hardware: 2 x PV input, 1 x Dual relay, 1 x DC control, 1 x Triple logic output
EIA-232 Comms
16 analogue and 32 digital operations
iTools supplied with controller

Quick start code



Loop function	Process inputs (Input type)	Analogue input	Slot function
XXXX None	X None	XXX None	XXX Unconfigured
S Standard PID	J J Thermocouple	P2- PV Loop 2	1-- Loop no. 1
C Cascade(7)	K K Thermocouple	P3- PV Loop 3	2-- Loop no. 2
R Ratio	T T Thermocouple	S1- SP Loop 1	3-- Loop no. 3
O Override(7)(8)	L L Thermocouple	S2- SP Loop 2	Single relay or triac
_PID PID control	N N Thermocouple	S3- SP Loop 3	-HX Heat
_ONF On/Off control	R R Thermocouple	Input range	-CX Cool
_PIF PID/OnOff control	S S Thermocouple	Select third digit from table 1	Dual relay or triac
_VP1 VP without feedback	B B Thermocouple		-HC PID Heat & Cool
_VP2 VP with feedback	P Platinell II		-VH VP Heat
	C C Thermocouple		-AA FSH & FSH
	Z RTD/Pt100		-AB FSH & FSL
	A 4-20mA linear		-AC DH & DL
	Y 0-20mA linear		-AD FSH & DH
	W 0-5Vdc linear		-AE FSL & DL
	G 1-5Vdc linear		P12 Prog events 1 & 2
	V 0-10Vdc linear		P34 Prog events 3 & 4
	Custom downloads (replace C)		P56 Prog events 5 & 6
	D D thermocouple		P78 Prog events 7 & 8
	E thermocouple		Triple logic output
	1 Ni/Ni18%Mo		-HX CH1 Heat
	2 Pt20%Rh/Pt40%Rh		-CX CH1 Cool
	3 W/W26%Re (Engelhard)		-HC CH 1 Heat, CH2 Cool
	4 W/W26%Re (Hoskins)		HHH Heat OP for loops 1, 2 & 3
	5 W5%Re/W26%Re (Engelhard)		DC outputs
	6 W5%Re/W26%Re (Bucose)		-H- PID Heat
	7 Pt10%Rh/Pt40%Rh		-C- PID Cool
			-T- PV retransmission
			-S- SP retransmission
			For output range select third digit from table 1
			Precision PV input
			-PV PV input module
			-PA Aux PV input (9)
			-PL Ratio lead input

A	4-20mA linear
Y	0-20mA linear
W	0-5Vdc linear
G	1-5Vdc linear
V	0-10Vdc linear

Notes:

- Loop 1 PV defaults to main input on microboard. Loop 2 and 3 PV inputs must be fitted in I/O slots 3 or 6 or be assigned to the analogue input.
- This alarm configuration refers to loop alarms only. One selection is allowed per loop. Additional alarms are available for the user to configure.
- Thermocouple and RTD inputs assume sensor min and max values with no decimal point.
- Linear inputs are ranged 0-100%, no decimal point.
- Temperature inputs will be C unless ordered by USA where F will be supplied.
- Remote setpoints assume loop min & max ranges.
- In Cascade and Override configuration, both PV inputs will be set to the same sensor input.
- VP1 or VP2 not available with override function.
- For Cascade and Override inputs only.

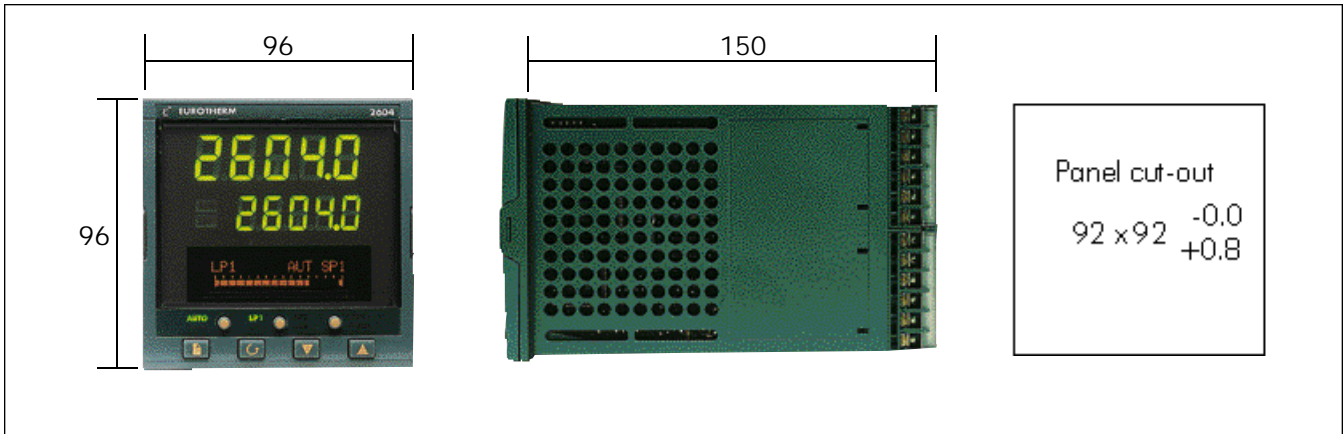
Quick start code example:

SVP1/SPID/SPID/K/Z/A/S1A/1VH/2PV/2HV/3HC/3PV

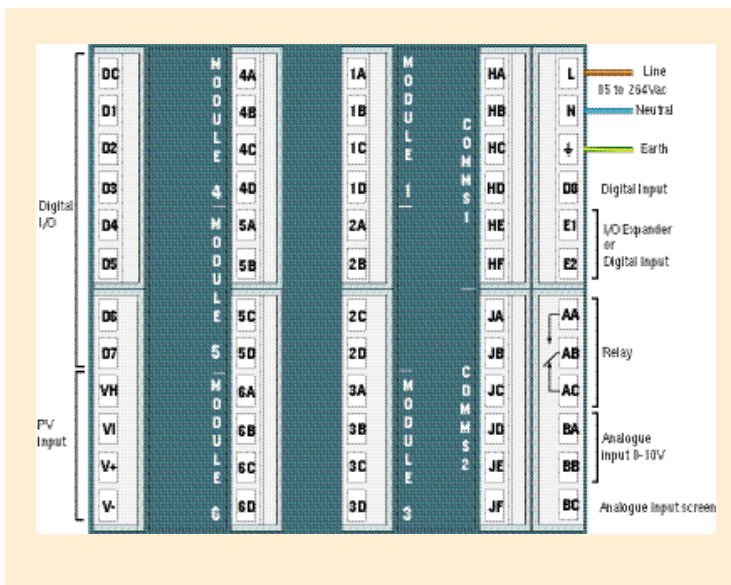
This code configures the hardware specified on the previous page to be:
 Loop 1: Valve position control, Type K input, Heat VP output in slot 1, 4-20mA remote setpoint input
 Loop 2: PID control, RTD input in slot 3, 0-10Vdc Heat output in slot 4.
 Loop 3: PID control, 4-20mA input in slot 6, Logic heat/cool output in slot 5.

Dimensional details

All dimensions in mm



Rear terminal connections



EUROTHERM CONTROLS LIMITED <http://www.eurotherm.co.uk>

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INSTANT ACCURACY--US Patent # 5,484,206

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