



**EUROTHERM**

# 2704 MODEL



## Advanced Process Controller/Programmer

### Ideal for:

- Vacuum heat treatment
- Carburising furnaces
- Semiconductor diffusion
- Creep and tensile testing
- Autoclaves
- Boiler control
- Environmental chambers

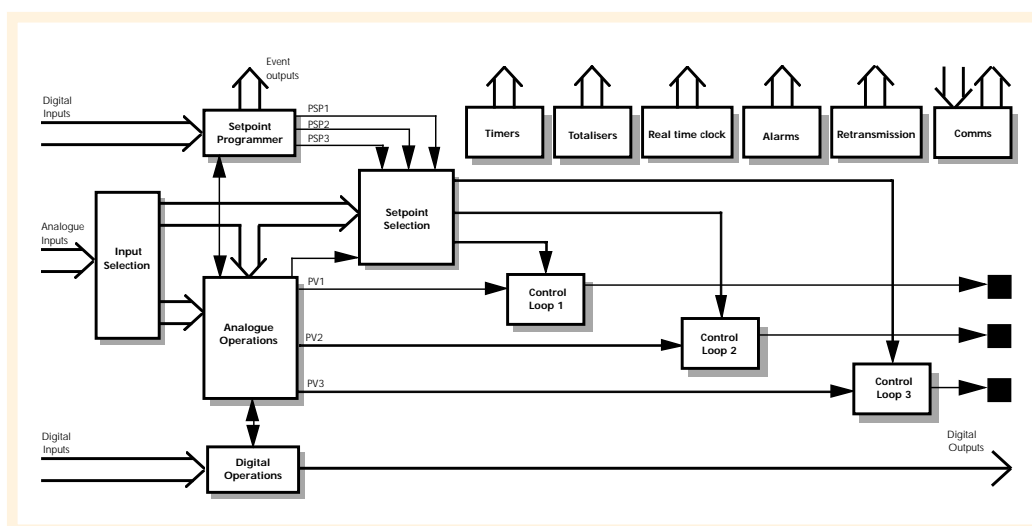
The 2704 is a highly accurate and stable process controller available in a single, dual or triple loop format. Features include setpoint programming and a comprehensive selection of maths and logic functions.

Its user interface incorporates a bright dot matrix display, providing extreme flexibility and ease of use. It is a highly configurable product offering many features previously found only in programmable logic controllers. This allows systems to be implemented integrating the process control and logic functions of a machine, therefore simplifying system complexity and reducing the total system costs.

### Features:

- 3 Control loops
- SP Programmer
- Customisable user interface
- Maths & logic functions
- Open communications

Configuration is achieved either via the front panel interface or using Eurotherm's iTools configuration software.

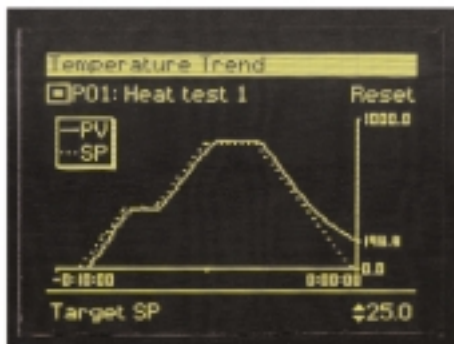


## Control Functions

- **3 Control loops**
- **PID, VP or ON/OFF**
- **Cascade, ratio or override**
- **Gain scheduling**
- **Configurable control strategies**

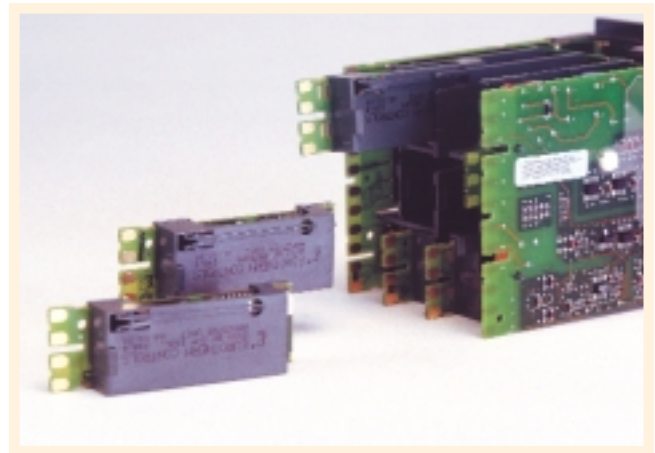
Eurotherm's advanced control algorithm gives stable straight-line control. Automatic tuning simplifies the commissioning procedure by performing a one shot tune to calculate the optimum PID values. To further optimise control especially in programmer applications, gain scheduling can be used to transfer control between up to six sets of PID values.

Trending enables the user to view, both current and historical information on the process on the process variable and setpoint of each control loop.



## IO Hardware

- **0.25uV PV input resolution**
- **Fixed and modular IO**
- **250Vac isolation**
- **Expandable IO**
- **Easily upgraded**



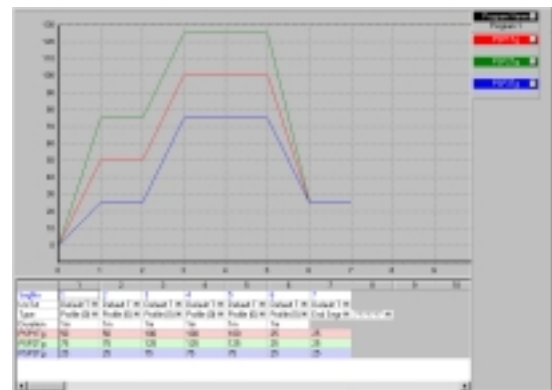
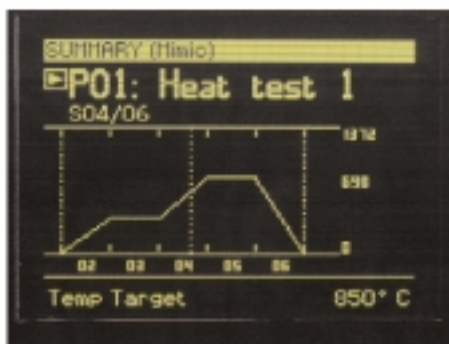
The 2704 incorporates a self correcting input circuit (INSTANT ACCURACY) to maximise accuracy and performance during initial warm up and changes in ambient temperature.

One universal and one high level analogue inputs, along with 10 digital IO are included as standard. Additionally, a further 5 IO modules may be fitted providing very flexible input/output combinations. The series 2000IO expander unit can provide a additional 20 digital inputs and 20 digital outputs

## Setpoint Programmer

- **50 Programs,**
- **3 Profiled setpoints/program**
- **500 Segments**
- **16 Event outputs**
- **Program mimic display**

Ideal for applications such as atmosphere or vacuum furnaces, and environmental chambers. The 2704 user interface offers the user an extremely easy method of editing, selecting and running programs



- **Offline or online editing on PC**
- **Graphical representation**
- **Advanced editing functions**
- **Storage and retrieval of program files**

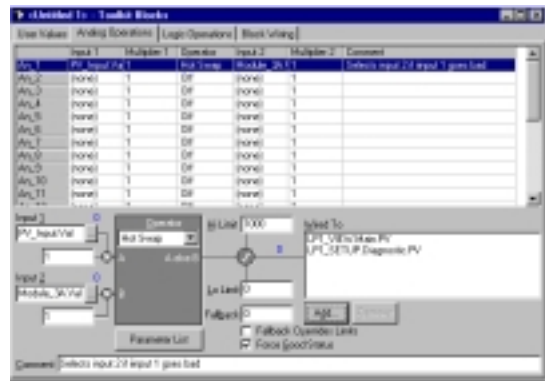
## Toolkit Functions

- **Mathematical calculations**
- **Combinational logic**
- **Real time clock**
- **Timer functions**

### Operators include;

Add, Subtract, Log, Exp, SQRT, AND, OR, Max, Min, Select and many more

ToolKit blocks allows the user to create custom solutions by internally wiring analogue and digital operations together in flexible ways. 24 analogue and 32 digital operations are available. Other functions are available including timers, totalisers and a real time clock.



## I/O Expander

- **20 Logic inputs**
- **20 Relay outputs**

The 2000IO expander can increase the digital IO providing the option for greater remote operation of the programmer and expands the 2704 logic capability.



## Slave Communications

- **Modbus™ RTU**
- **Profibus® DP**
- **DeviceNet®**
- **EI-Bisync**

The 2704 supports two slave communication ports. Its modular build provides the user with a selection of communication protocols allowing easy integration into both PLC and PC supervisory systems.

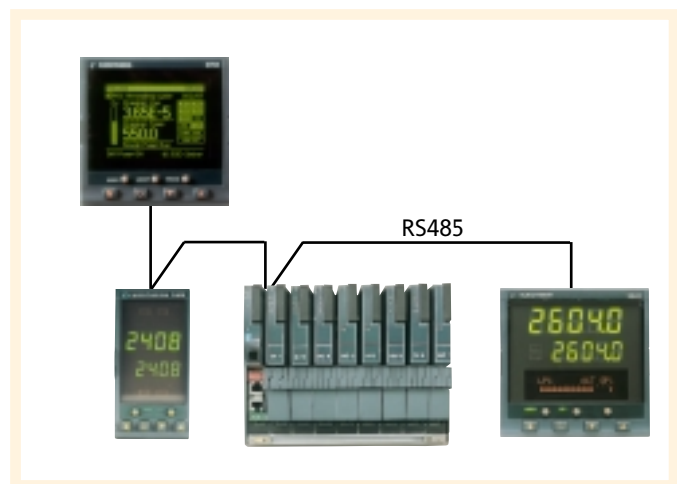
When using Profibus DP a GSD file has to be created, containing the information relating to the instruments parameters, that a Profibus master needs in order to communicate with its slave device. The GSD file for a 2704 is created using Eurotherm's GSD file editor.



## Master Communications

- **Modbus Protocol**
- **38 read/write parameters**
- **Expands available hardware**
- **Interfaces to most Modbus slaves**

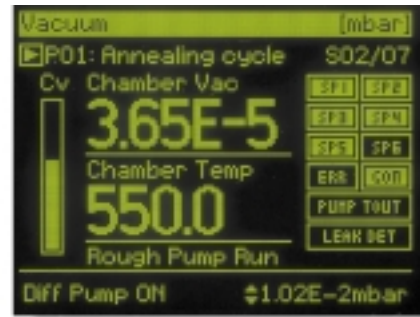
Master modbus communications significantly increases the applications open to 2704. In its simplest form it can be used to retransmit a setpoint to a number of slave controllers in a multi-zone furnace. Alternatively, it can be integrated with an 8 loop blind controller to provide a remote operator interface with SP programmer functions.



## Vacuum

- Direct interface to vacuum gauges
- Auto Hi/Lo gauge selection
- 6 Vacuum setpoints
- Pump timeout alarm
- Leak detection routine

At the heart of the vacuum controller is a specially designed function block capable of accepting up to three vacuum inputs. The 2704 is capable of being used solely to control the vacuum pump down sequence of a furnace, or as an integral furnace controller where both temperature and vacuum are controlled.



## Carbon potential

- %CP, O2 or Dewpoint Measurement
- CO correction
- Probe burn off and sooting alarm
- Sooting alarm

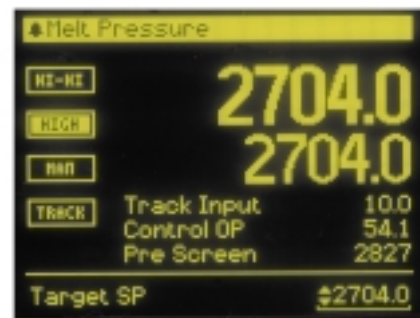
Ideal for use in gas carburising furnaces where Zirconia probes are used to measure Carbon Potential. A three loop controller can be used to control furnace temperature, carbon potential and quench. The setpoint programmer is used in batch applications to generate synchronised temperature and carbon profiles.



## Melt Pressure

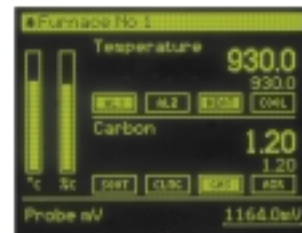
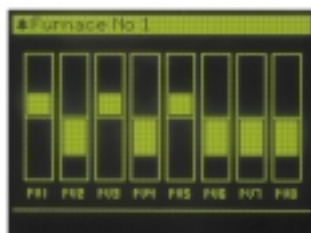
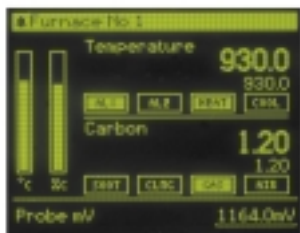
- 350Ω Strain gauge input
- Transducer excitation
- Pressure alarms
- Screen blockage alarm
- Simple user calibration with shunt

Suitable for precision pressure control in the plastic extrusion industries. Additionally a second pressure transducer can be used to provide a differential pressure alarm when the screen starts to block. Various machine start up strategies can be used to ensure a smooth transition from auto to manual mode.



## Customisable Display

By using flexible User Pages, the user has the option of defining how the process screens are viewed. A maximum of eight user pages can be configured.



## Technical specification

Quoted at 0 to 50°C unless otherwise stated.  
Refer to Engineering Manual for more details

### Control options

No. of loops	1, 2 or 3 loops
Options	Cascade, Ratio or Override
Modes	PID, ON/OFF or Valve Position
Applications	Carbon Potential, Humidity and Vacuum

### STANDARD I/O

Precision PV Input	
Accuracy	±0.1%
Ranges	mV, mA, volts or RTD (PT100)
Thermocouple types	J,K,L,N,R,S,B,PII,C, plus others
Cold junction	Ext 0°C, 45°C or 50°C

### Analogue input

Allocation	1 fitted
Accuracy	±0.1%
Ranges	-10V to 10V or 0 to 20mA

### Digital I/O

Types	1 digital input 7 Bi-directional input/outputs 1 Changeover relay
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### MODULES

#### Digital outputs

Types	Single relay, dual relay, Single Triac, Dual Triac, Single Logic and Triple Logic module
Allocation	Slot 1, 3, 4, 5 or 6 (Max 3 Triacs per unit)

#### Digital inputs

Types	Triple contact input, Triple logic input
Allocation	Slot 1, 3, 4, 5 or 6

#### Analogue outputs

Types	DC Control or DC Retransmission (5 Max)
Allocation	Slot 1, 3, 4, 5 or 6
Range	0 to 20mA or 0 to 10Vdc

#### Dual Analogue outputs

Allocation	Slot 1, 4 or 5
Range	4-20mA or 24Vdc transmitter PSU

#### High Resolution Analogue output

Allocation	Slot 1, 4 or 5
Range	4-20mA and 24Vdc transmitter PSU

#### Transmitter PSU

Allocation	Slot 1, 3, 4, 5 or 6
Transmitter	24Vdc @ 20mA

#### Transducer supply

Bridge voltage	Software selectable, 5 or 10Vdc
Bridge resistance	300Ω to 15Kohms

#### Potentiometer input

Potentiometer resistance	330Ω to 150Kohms
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#### Precision PV input (Module)

Allocation	Slot 3 or 6
Accuracy	±0.1%
Ranges	mV, mA, volts or RTD (PT100)
Thermocouple types	J, K, T, L, N, R, S, B, PII, C, plus others
Cold junction	Ext 0°C, 45°C or 50°C

### Dual (Probe) input

Allocation	Slot 3 or 6
Accuracy	±0.1%
Ranges	mV, mA, volts or RTD (PT100)
Thermocouple types	J, K, T, L, N, R, S, B, PII, C, plus others
Cold junction	Ext 0°C, 45°C or 50°C

### Analogue input (module)

Allocation	Slot 1, 3, 4 or 6
Accuracy	±0.2%
Ranges	mV, mA, volts or RTD (PT100)
Thermocouple types	J, K, T, L, N, R, S, B, PII, C, plus others
Cold junction	Ext 0°C, 45°C, or 50°C

### SETPOINT PROGRAMMER

No profiles	1, 2 or 3 profiles
No. of programs	50 programs max.
No. of segments	500 time to target segments (Max) or 400 ramp rate segments (max.)
Event outputs	Up to 16

### I/O Expander

10 I/O Version	4 Changeover and 6 normally open relay contacts 10 Logic inputs
20 I/O Version	4 Changeover and 16 normally open contacts 20 Logic inputs

### ADVANCED FUNCTIONS

Application blocks	32 digital operations 24 analogue operations 12 user values
Timers	4 ON pulse, OFF delay, one shot and min-ON
Totalisers	4, trigger level and reset input
Pattern generators	16 patterns each with 16 bits
Real time clock	Day of week and time
Customisable screens	8 user screens
User switches	8, toggle and momentary function

### Slave communications

Allocation	Slot H or J (DeviceNet/Profibus slot H only)
Types	Profibus RS485 Modbus RS485 (2 wire), RS485 (4 wire) or RS232 DeviceNet EI-Bisyc (subset of parameters)

### Master communications

Allocation	Slot J
Types	Modbus RS485 (2 wire), RS485 (4 wire) or RS232
Parameters	38 read/write

### GENERAL SPECIFICATION

Display range	5 digits up to 3 decimal places 85 to 264Vac, 20 watts (max.) or 24Vdc or ac, 10 watts (max)
Operating ambient	0 to 50°C and 5 to 95%RH non condensing
Storage temperature	-10 to 70°C
Panel seal	IP65
EMC standards	EN50081-1 and 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. Completion of the quick start code opposite will assist you in configuring the 2704. 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 2704 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 H	Comms J	Manual	Toolkit Functions	Config. Tools
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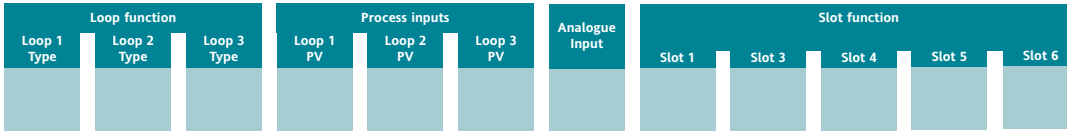
Controller Type	Loop/Programs	I/O slots 1,3,4,5,6	Memory Module	Manual	Config Tools
<b>2704</b> Standard <b>2704f</b> Profibus	<b>First digit</b> 1- One loop 2- Two loops 3- Three loops <b>Second digit</b> -XX No programs -2- Twenty programs -5- Fifty programs <b>Third digit</b> -XX No programs -1 1 Profile -2 2 Profile -3 3 Profile	<b>XX</b> None fitted <b>R4</b> Change over relay <b>R2</b> 2 Pin relay <b>RR</b> Dual relay <b>T2</b> Triac <b>TT</b> Dual triac <b>D4</b> DC Control <b>D6</b> DC retransmission <b>PV</b> PV Input (slots 3 & 6 only) <b>TL</b> Triple logic input <b>TK</b> Triple contact input <b>TP</b> Triple logic output <b>MS</b> 24Vdc transmitter PSU <b>VU</b> Potentiometer input <b>G3</b> 5Vdc transducer PSU <b>G5</b> 10Vdc transducer PSU <b>DO</b> Dual 4-20mA OP/24Vdc PSU (Slots 1, 4 & 5 only) <b>LO</b> Isolated single logic OP <b>HR</b> Hi Resolution DC retrans & 24Vdc PSU (Slots 1, 4 & 5 only)	<b>XX</b> Not fitted <b>Comms H</b> <b>XX</b> None fitted <b>A2</b> 232 Modbus <b>Y2</b> 2-wire 485 Modbus <b>F2</b> 4-wire 485 Modbus <b>AE</b> 232 Bisync <sup>(a)</sup> <b>YE</b> 2-wire 485 Bisync <sup>(a)</sup> <b>FE</b> 4-wire 485 Bisync <sup>(a)</sup> <b>PB</b> Profibus <b>DN</b> DeviceNet <b>Comms J</b> <b>XX</b> None fitted <b>A2</b> 232 Modbus <b>Y2</b> 2-wire 485 Modbus <b>F2</b> 4-wire 485 Modbus <b>M1</b> 232 Master <b>M2</b> 2 Wire 485 Master <b>M3</b> 4 Wire 485 Master	<b>ENG</b> English <b>FRA</b> French <b>GER</b> German <b>ITA</b> Italian <b>NED</b> Dutch <b>SPA</b> Spanish <b>SWE</b> Swedish	<b>XX</b> None <b>IT</b> iTools
<b>Supply Voltage</b> <b>VH</b> 85-264Vac <b>VL</b> 20-29Vac/dc	<b>Applications</b> <b>XX</b> Standard <b>ZC</b> Zirconia <b>V1</b> 1 Gauge vacuum <b>V2</b> 3 Gauge vacuum			<b>Toolkit Functions</b> <b>XX</b> Standard <b>U1</b> Toolkit level 1 <sup>(a)</sup> <b>U2</b> Toolkit level 2 <sup>(a)</sup>	<b>Hardware notes:</b> 1. Basic Controller/Programmer includes 8 digital registers, 4 timers and 4 totalisers. 2. Toolkit 1 includes 16 analogue, 16 digital, pattern generator, digital programmer, analogue switch and 4 user values. 3. Toolkit 2 includes Toolkit 1 plus extra 8 analogue, 16 digital operations and 8 user values. 4. Dual analogue input suitable for Carbon Probes. (Inputs not isolated from each other) 5. EI-Bisync includes only a subset of parameters. 6. The HR module has 1 high resolution DC output and 1 24Vdc power supply.

## Example ordering code

**2704 - 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 16 digital operations, iTools supplied with controller

# Quick start code



Loop function	Process inputs (Input type)	Analogue input	Slot function										
XXXX None S Standard PID C Cascade R Ratio O Override(7) _PID PID control _ONF On/Off control _PIF PID/OnOff control _VP1 VP without feedback _VP2 VP with feedback	X None J J Thermocouple K K Thermocouple T T Thermocouple L L Thermocouple N N Thermocouple R R Thermocouple S S Thermocouple B B Thermocouple P Platinell II C C Thermocouple Z RTD/Pt100 A 4-20mA linear Y 0-20mA linear W 0-5Vdc linear G 1-5Vdc linear V 0-10Vdc linear <b>Custom downloads (replace C)</b> Q Custom curve D D thermocouple E E thermocouple 1 Ni/Ni18%Mo 2 Pt20%Rh/Pt40%Rh 3 W/W26%Re (Engelhard) 4 W/W26%Re (Hoskins) 5 W5%Re/W26%Re (Engelhard) 6 W5%Re/W26%Re (Bucoze) 7 Pt10%Rh/Pt40%Rh 8 Exergen K80 I.R pyrometer	XXX None P2- PV Loop 2 P3- PV Loop 3 S1- SP Loop 1 S2- SP Loop 2 S3- SP Loop 3 A1- Aux. PV Loop 1 A2- Aux. PV Loop 2 A3- Aux. PV Loop 3 L1- Ratio Lead PV Loop 1 L2- Ratio Lead PV Loop 2 L3- Ratio Lead PV Loop 3 <b>Input range</b> Select third digit from table 1  <table border="1"> <caption>Table 1</caption> <tr><td>A</td><td>4-20mA linear</td></tr> <tr><td>Y</td><td>0-20mA linear</td></tr> <tr><td>W</td><td>0-5Vdc linear</td></tr> <tr><td>G</td><td>1-5Vdc linear</td></tr> <tr><td>V</td><td>0-10Vdc linear</td></tr> </table>	A	4-20mA linear	Y	0-20mA linear	W	0-5Vdc linear	G	1-5Vdc linear	V	0-10Vdc linear	XXX Unconfigured 1- Loop no. 1 2- Loop no. 2 3- Loop no. 3 <b>Single relay, triac, logic</b> -HX Heat -CX Cool <b>Dual relay or triac</b> -HC PID Heat & Cool -VH VP Heat -AA FSH & FSH -AB FSH & FSL -AC DH & DL -AD FSH & DH -AE FSL & DL -AF FSL & FSL -AG FSH & DB -AH FSL & DB -AJ DB & DB HHX Heat output for loops 1 & 2 CCX Cool OP's loops 1 & 2 P12 Prog events 1 & 2 P34 Prog events 3 & 4 P56 Prog events 5 & 6 P78 Prog events 7 & 8 <b>Triple logic output</b> -HX CH1 Heat -CX CH1 Cool -HC CH 1 Heat, CH2 Cool HHX Heat output for loops 1, 2 & 3 HHH Heat output for loops 1, 2 & 3  <b>Single DC outputs</b> -H- PID Heat -C- PID Cool -T- PV retransmission -S- SP retransmission For output range select third digit from table 1 <b>Precision PV input</b> -PV PV input module -PA Aux PV input (8) -PL Ratio lead input <b>Analogue input</b> -R- Setpoint For input range select third digit from table 1 <b>Aux. &amp; lead PV inputs</b> -L- Ratio lead input -B- Aux. PV input For input range select third digit from table 1 <b>Potentiometer input</b> -VF VP Heat feedback -RS Remote SP <b>Dual DC 4-20mA/24Vdc PSU Output</b> HHX Heat output for loops 1 & 2 -HC Heat Cool -HT CH1 Heat, Chan 2 PSU TTX Both channels PSU <b>High Resolution DC Output</b> -TA 4-20mA PV Retrains -TV 0-10V PV Retrains -SA 4-20mA SP Retrains -SV 0-10V SP Retrains
A	4-20mA linear												
Y	0-20mA linear												
W	0-5Vdc linear												
G	1-5Vdc linear												
V	0-10Vdc linear												

### General notes:

1. Loop 1 PV defaults to main PV 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.
2. Alarm configuration refers to loop alarms only. One selection is allowed per loop. Additional alarms are available for the user to configure.
3. Thermocouple and RTD inputs assume sensor min and max values with no decimal point.
4. Linear inputs are ranged 0-100%, no decimal point.
5. Temperature units will be °C unless ordered by USA where °F will be used.
6. Remote setpoints assume loop min & max ranges.
7. VP1, VP2, VP3 and VP4 are not available with over ride function.
8. For Cascade and Override inputs only.
9. HR module should be used in feedback mode, please refer to TIBC160.

# Quick start order code

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

This code configures the hardware specified above:

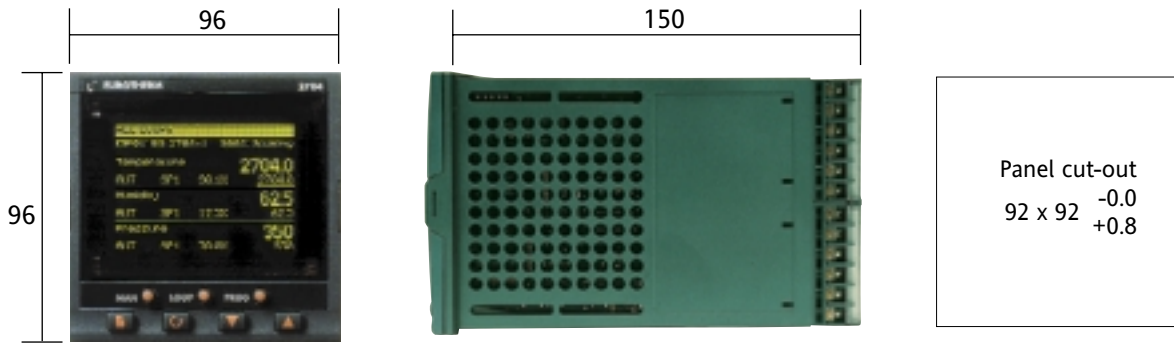
Loop 1: Valve position control, Type K input, Heat VP output in slot 1, 4-20mA remote setpoint input

Loop 2: PID control, RTD input in slot 3, 0-10Vdc Heat output in slot 4.

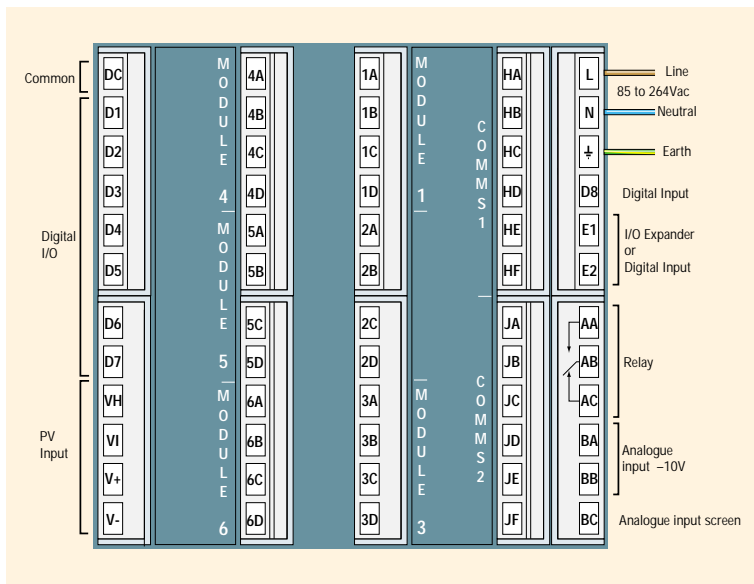
Loop 3: PID control, 4-20mA input in slot 6, Logic heat/cool output in slot 5.

## Dimensional details

All dimensions in mm



## Rear terminal connections



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