Operating Manual

3204 Autotune
Temperature Controller

Operating Manual
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Chromalox®

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Returns

Items returned to Chromalox Instruments and Controls must be accompanied by a Return Authorization Number.

This number may be obtained from Chromalox Instruments and Controls, Customer Service Department, Telephone Number (615) 793-3900. It should appear on the exterior of the shipping carton and on the shipping documents. Defective items will be repaired or replaced at our option, at no charge.

Return the defective part or product, freight pre-paid, to:

Chromalox Instruments and Controls

FUNCTIONS MENU

Range of Adjustment shown in red under description. If applicable, factory settings shown in **bold**.

KEY ★ ▶ OR ★ ▲ TOGETHER TO CHANGE LEVELS OR OPTIONS

KEY ▼ ▲ TO VIEW FUNCTIONS

LEVEL 4 — USER-PROTECTED SETTINGS

- LoCY — Security lock: **nonE**; LEV 3; LEV 2; ALL
- ProG — Disable program auto-exit: **AutO**; StAY
- no.AL — Disable -AL- alarm display: **Off**; on
- d, 5.5 — Display averaging: **dir**; 1 to 32 (**6**)
- dEr.S — Derivative sensitivity: 0.1 to 1.0 x dEr.t (**0.5**)

LEVEL 3

CONFIGURE OUTPUT
- SP 1.d — SP1 output device: **nonE**; rLY; SSd
- SP2.d — SP2 output device: **nonE**; SSd; rLY (read only)

SAFETY SETTINGS
- burn — Sensor burn-out: **uP.SC**; dn.SC; 1u.2d; 1d.2u
- rEu.d — Reverse outputs: **1r.2d**; 1d.2d; 1r.2r; 1d.2r
- rEu.L — Reverse O/P LEDs: **1n.2n**; 1i.2n; 1n.2i; 1i.2i

CALIBRATION
- SPAn — Span adjustment: **0.0** to 95% sensor f/s
- 2Ero — Zero Adjustment: **0.0** to 95% sensor full scale

PERFORMANCE DATA
- ChEY — Set Monitor: **Off**; on
- rEAd — Read Monitor: VAr; hi; lo deg
- tECH — Read Tune Data: CtA; Ctb; Ct4

LEVEL 2

MANUAL ADJUSTMENTS
- SP 1.P — Read SP1 output %: **0** to 100% read only
- hAnd — SP1 manual output %: 0 to 100% proportional mode only
- PL.1 — Limit SP1 output %: **100** to 0%
- PL.2 — Limit SP2 output %: **100** to 0%

SP2 MODES
- SP2.A — Main SP2 mode: **nonE**; dV.hi; dV.Lo; bAnd; FS.hi; FS.Lo; Cool
- SP2.b — Second SP2 mode: **nonE**; Lt.CH; hold; Lt.ho; nLin

RANGING
- d, SP — Display resolution: **1** or 0.1 degree
- h, .SC — Set scale maximum: **0.0** Sensor max to sensor full scale
- Lo.SC — Set scale minimum: **0.0** Sensor min to sensor full scale

CONFIG
- , nPt — Select input sens: **nonE**

LEVEL 1

SP1 SETTINGS
- tunE — Autotune or Park: **oFF**; on; tunE; ParK; At.Sp
- bAnd — SP1 Prop band (gain)/hyst: 0.1 deg to 25% sensor f/s (**10°C/18°F**)
- , nt.t — Integral time (reset): Off; 0.1 to 60 min (**5 min**)
- dEr.t — Derivative time (rate): Off; 1 to 200 sec (**25 sec**)
- dAC — Derivative approach: 0.5 to 5.0 x bAnd (**1.5**)
- CYC.t — Cycle time or on/off: On.oFF; 0.1 to 81 sec (**20 sec**)
- oFSt — Offset (manual reset): **0** to 50% x bAnd (**In.t = oFF**)
- SP.LU — Setpoint lock (SP1): **Off**; on

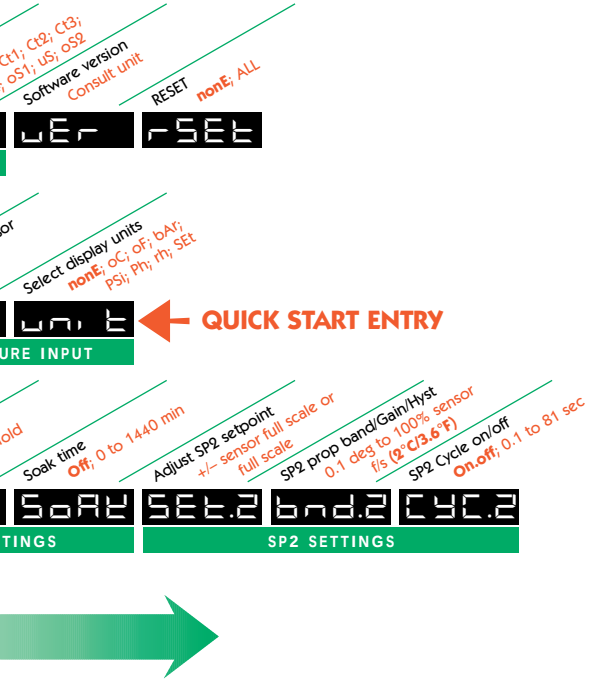
PROGRAMMER SET
- SPrr — Setpoint Ramp rate: **0** to 9990 deg/hour
- SPrn — Ramp off/on: On; **off**; h

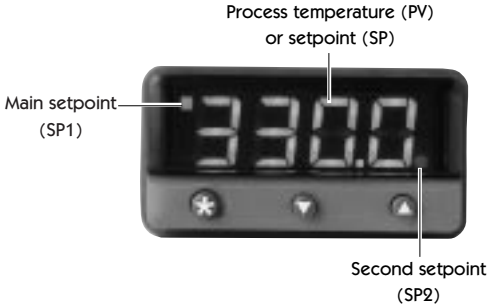
PROGRAM ENTRY

LEVEL C — COMMS SETTINGS

Level C only visable when COMMS Option fitted

- Addr — Instrument address: **0** to 255
- bAud — Baud rate: 1200; 2400; 4800; **9600**; 19k2
- dAtA — Data format: **8n1**; 8E1; 8O1
- dbuG — Tx/Rx activity: **Off**; on





INSTRUMENT ADJUSTMENTS

To enter or exit **program mode**:	Press ▲ ▼ together for 3 seconds
To scroll through **functions**:	Press ▲ or ▼
To change **levels** or **options**:	Press ✶ ▲ together or ✶ ▼ together
To view setpoint:	Press ✶
To increase setpoint:	Press ✶ ▲ together
To decrease setpoint:	Press ✶ ▼ together
To reset an alarm or fault condition:	Press ▲ ▼ together briefly

Notes: If in difficulty by becoming "lost" in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the INSTRUMENT ADJUSTMENTS above and try again.

When in program mode, after 60 seconds of key inactivity the display will revert to either , nPt ***nonE*** or, if the initial configuration has been completed, the measured value. Any settings already completed will be retained.

SAFETY AND WARRANTY INFORMATION

INSTALLATION

Designed for use:
UL873 - only in products where the acceptability is determined by Underwriters Laboratories Inc.
EN61010-1 - within installation Categories II and III environment and pollution degree 2.
To avoid possible hazards accessible conductive parts of final installation should be protectively earthed in accordance with EN61010 for Class 1 equipment. Output wiring should be within a grounded cabinet. Sensor sheaths should be bonded to ground or not be accessible.
Live parts should not be accessible without use of a tool. It is the responsibility of the installation engineer to ensure that this equipment's compliance to EN61010 is not impaired when fitted to the final installation and to use this equipment as specified in this manual, failure to do so may impair the protection provided.
Ensure the installation is in compliance with appropriate wiring regulations.

CONFIGURATION

All functions are front selectable, it is the responsibility of the installing engineer to ensure that the configuration is safe. Use the program lock to protect critical functions from tampering.

ULTIMATE SAFETY ALARMS

Do not use SP2 as the sole alarm where personal injury or damage may be caused by equipment failure.

WARRANTY

For warranty information please refer to the inside back cover.

INDEX

QUICK START

Select unit.

Press and hold ✶ and use the ▲ or ▼ buttons to scroll through the unit selection list until the correct unit is displayed. Release the buttons. The display will now alternate selected unit (eg.  and ***°C***).

Press ▲ once The display will now alternate  and ***nonE***

Select SP1 (Main setpoint output device)

Press and hold ✶ and use the ▲ or ▼ buttons to select ***SSd*** or ***rLY*** as required. The controller will now alternately display  and selected output device (eg. ***SSd***).

To enter initial configuration into controller memory

Press and hold both ▲ and ▼ buttons for 3 seconds. The display will now alternate  and measured variable (temperature) (eg. ***23***)  is displayed because a setpoint has not yet been entered.

To display setpoint

Press and hold ✶ The display will now alternate ***0*** and ***unit*** (eg. ***°C***)

To enter setpoint

Press and hold ✶ and use ▲ button to increase or ▼ button to decrease the reading and scroll to required setpoint value. (The digit roll-over rate increases with time).

THE CONTROLLER IS NOW OPERATIONAL WITH FACTORY SETTINGS

Note: For precise control of an application the controller may need to be TUNED. Please study section headed FUNCTIONS and OPTIONS before moving to the section on AUTOTUNE.

INTRODUCTION

THE CONTROLLER

In the 3204 control can be optimised with a single shot autotune either on initial warm-up or at setpoint. A second setpoint can be configured in a variety of alarm modes or PID Heat-Cool strategy. A programmer offers a single ramp to setpoint with a choice of timed soak period before switching off the output.

Control of non temperature processes is achieved by the provision of linear input ranges and scaling in commonly used engineering units.

Serial communication is available as an option on both controllers, and the easy to use **SOFT-3204** is a graphic WINDOWS™ based software package designed for PC supervision of up to 32 instruments, for remote adjustment, configuration, cloning, saving and retrieving settings to files and logging and charting in real time.

SOFT-3204 uses the MODBUS® protocol via either a fully isolated RS232 or RS485 link depending on the number of instruments and the transmission distances involved in the application.

A users manual is supplied with the comms option. For more information contact Chromalox. For details, see rear cover.

It is suggested that users read the **OVERVIEW** section of this manual before any installation or setting-up procedures are undertaken.

Note: The controller will not be operational until either the **QUICK-START** or **SET-UP** procedure has been completed.

NB: Please note that in the manual, functions are reversed out from a black background and options are shown in bold italic;

eg. tunE and ***ParK***

OVERVIEW

INSTALLATION

The Model 3204 controller is designed to be mounted in a 1/32 DIN panel cutout. See the **INSTALLATION** section.

SET-UP

After installation the controller requires programming with the following information:

Type of Input Sensor
Operating unit (C or F etc)
Type of Output Device
Temperature Setpoint

Note: The controller will not be operational until this information is entered.

When the above information has been programmed into the controller it will be operational with the following factory PID (proportional band, integral time, derivative time) settings.

Proportional band/Gain	10°C/18°F
Integral time/Reset	5 mins
Proportional cycle-time	20 secs
Derivative time/Rate	25 secs
DAC Derivative approach control	1.5

AUTOTUNE

To precisely control an application the controller will need to be 'tuned' using the built-in **'AUTOTUNE'** feature. Autotune 'teaches' the controller the main characteristics of the process and 'learns' by cycling the output on and off. The results are measured and used to calculate optimum PID values which are automatically entered in the controller memory.

During **AUTOTUNE** the optimum cycle-time is calculated but is not automatically implemented. The cycle-time requires manual acceptance unless pre-selected.

To ensure good control over a wide range of applications two versions of the Autotune program are provided, **TUNE** and **TUNE AT SETPOINT**.

The **TUNE** method normally achieves the best results. Starting with the load cool, tuning occurs during warm-up preventing overshoot. This method of tuning is recommended.

The **TUNE AT SETPOINT** method is used for specialist applications. eg. Heat-cool, multizones and processes below 100°C/200°F. During the tuning cycle some overshoot occurs because the tuning cycle is at set point.
The **DAC** setting is not re-calculated.

CYCLE-TIME

The choice of cycle-time is influenced by the external switching device or load. e.g. contactor, SSR, Valve. A setting that is too long for the process will cause oscillation and a setting that is too short will cause unnecessary wear to an electro-mechanical switching device.

Cycle-time selection methods
The following methods of cycle-time selection may be used:

Autotune calculated
After **Autotune** has been run and completed the calculated cycle-time can be manually accepted or adjusted to suit the switching device. For selection method see **Select Autotune Calculated Cycle-time**.

Pre-select autotune cycle-time
The controller can be programmed to automatically accept the calculated **Autotune** cycle-time. For selection method see **Pre-Select Automatic Acceptance of Any Autotune Cycle-time**.

Pre-select before autotune
The controller can be programmed manually with any cycle-time between 0.1 and 81 sec. This cycle-time will not be changed by any **Autotune** functions. For selection method see **Pre-Select Cycle-time Before Autotune**.

Factory set
To use the 20 sec factory set cycle-time no action is needed whether **Autotune** is used or not.

Further information can be programmed into the controller, see **SECOND SETPOINT, RANGING AND SETPOINT LOCK, IMPROVING CONTROL ACCURACY**

Functions and options
The facilities of the controller are selected from the multi-level menu using the front panel mounted buttons.

Note: It is advisable to study this section before any programming is undertaken.

Each level within the multi-level menu offers different functions, see **FUNCTIONS MENU** for menu of main functions. Each function has a range of user selections or options, see **FUNCTION LIST** for functions and options details.

Note: Please note that in the manual, functions are reversed out from a black background and options are shown in bold italic;
eg.  and ***ParK***

The controller has two modes, program mode and operating mode. When in program mode the controller can be programmed with settings and functions to suit the application. When in operating mode the controller uses the setting and functions entered in the program mode to control the application and also displays the process variable (temperature). For full details on how to program the controller see **VIEWING AND SELECTING FUNCTIONS.**

Note: In this manual the letter k is represented by the character 

This section give details on:

Power-up,
how to select the input sensor,
how to select the operating unit,
how to select SP1 (the main output device),
how to enter the initial configuration,
how to set the main set point.

POWER-UP

On power-up the controller will display the self test sequence and brief display blanking and then alternately display , nPt and ***nonE***

SELECT INPUT SENSOR

Press and hold ✶ and use either the ▲ or ▼ buttons to scroll through the sensor selection (see **FUNCTION MENU**). When the correct sensor is displayed, release the buttons. The controller will now alternately display selected sensor type , nPt and eg. ***tc.S***

TO SELECT °C/°F

Press and release the ▲ button, the controller will now alternately display unit and ***nonE***.
Press and hold the ✶ button and using the ▲ button select **°C**, **°F**, **Bar**, **PSI**, **Ph**, **Rh** or **SEt** as required. Release the buttons when the correct unit is displayed.

The controller will now alternately display selected range (eg. °C) and ***unit***.

TO SELECT SP1 (Main setpoint output device)
Press and release the ▲ button, the controller will now alternately display SP 1.d and ***nonE***.
Press and hold the ✶ button and using the ▲ button select ***SSd*** or ***rLY*** as required. Release the buttons when the correct device is displayed.
The controller will now alternately display SP 1.d and selected output device (eg. ***SSd***).

TO ENTER INITIAL CONFIGURATION INTO CONTROLLER MEMORY

Press and hold both ▲ and ▼ buttons for 3 seconds.
The process temperature (e.g. **23°C**) and ***ParK*** will be alternately displayed as no setpoint has yet been selected.

TO SET THE MAIN SETPOINT

To display the setpoint, press and hold the ✶ button. ***°C*** and ***0*** or ***°F*** and ***32*** will be alternately displayed.
Press and hold the ✶ button. Press ▲ to increase or ▼ to decrease the setpoint.
The main setpoint LED will flash indicating that SP1 output is ON.

The controller will now be set with the factory PID settings.

MENU NAVIGATION

The facilities of the controller are selected from the multi-level menu using the front panel mounted buttons.
Each level within the multi-level menu offers different functions, see **FUNCTIONS MENU** for menu of main functions. Each function has a range of user select or input options, see **FUNCTION LIST** for functions and options details.
The controller has two modes, program mode and operating mode. When in program mode the controller can be programmed with settings and functions to suit the application. When in operating mode the controller uses the setting and functions entered in the program mode to control the application.

USING PROGRAM MODE

Note: The controller will auto-exit program mode after 60 seconds of inactivity.

To enter program mode from normal operating mode
Press and hold both ▲ and ▼ buttons for at least 3 seconds.
Release the buttons together when the function tunE is displayed, this is the program entry point.
The controller will now alternately display the function and option (setting of that function), e.g. tunE and ***oFF***.

To view function on the same level
Press ▲ or ▼ button once to view the next function.
Press and hold ▲ or ▼ buttons to scroll through functions.

To display the current option or value for a function
On release of ▲ or ▼ buttons, option alternates with the function.

To change an option value or setting
Press and hold the ✶ button, then press ▲ to increase or ▼ to decrease the value or select the next option.

Note: Check the new option value before moving to another function or exiting program mode.

To change levels
Press and hold ▼ to scroll through the functions until ***LEUL*** is displayed. Release ▼ to display current level. Press and hold the ✶ button, then press ▲ to increase or ▼ to decrease the level. Release buttons when required level is obtained.

To exit program mode
Press and hold both ▲ and ▼ buttons for at least 3 seconds.

Note: Control commences with any new instructions now entered in the memory.

REMINDER OF INSTRUMENT ADJUSTMENTS
Press ▲ ▼ together for 3 seconds for program entry or exit.
Press ▲ or ▼ to scroll through functions.
Press ✶ ▲ together or ✶ ▼ together to change levels or alter options.
Note: If in difficulty by becoming "lost" in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the Menu Navigation summary above and try again.

Select the most appropriate method of Autotune , Tune or Tune at Setpoint, to suit the application.

Note: The proportional cycle-time can be pre-selected before starting Autotune, **see PROPORTIONAL CYCLE-TIME**.

The **TUNE** program should be run with the load cool. The output is cycled at 75% of the setpoint value to avoid any overshoot during the tuning cycle. The warm-up characteristics are monitored and set DAC which minimises overshoot on subsequent warm-ups.

The **TUNE AT SETPOINT** program is recommended:

when the setpoint is below 100°C/200°F, where TUNE's tuning cycle at 75% setpoint may be too close to ambient to produce good results;

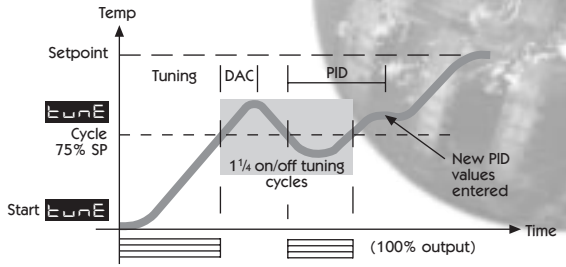
when the process is already hot and the cooling rate is slow;

when controlling multi-zone or heat-cool applications;

to re-tune if the setpoint is changed substantially from previous Autotune.

Note: dAC is not re-tuned by **TUNE AT SETPOINT**.

TUNE PROGRAM



Enter program mode and select tunE

The controller will alternately display tunE and ***oFF***.

Press and hold ✶ and press ▲ once,

The controller will alternately display tunE and ***on***.

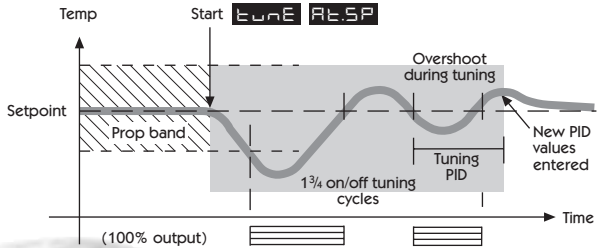
Exit program mode.

The **TUNE** program will now start. The controller will alternately display tunE and the process temperature as it climbs to setpoint.

Note: During tuning, the main setpoint (SP1) LED will flash.

When the **TUNE** program is complete the alternating display stops and the process temperature is displayed. The PID values are entered automatically. The process temperature will rise to setpoint and control should be stable. If not, this may be because optimum cycle time is not automatically implemented. To set the cycle time see **PROPORTIONAL CYCLE-TIME**.

TUNE AT SETPOINT PROGRAM



Enter program mode and select tunE

The controller will alternately display tunE and ***oFF***.

Select tunE ***At.SP***.

The controller will alternately display tunE and ***At.SP***.

Exit program mode.

The **TUNE AT SETPOINT** program will now start. The controller will alternately display tunE and the process temperature as it climbs to setpoint.

Note: During tuning the main setpoint (SP1) LED will flash.

When the **TUNE AT SETPOINT** program is complete the alternating display stops and the process temperature is displayed. The PID values are entered automatically. The process temperature will rise to setpoint and control should be stable. If not, this may be because optimum cycle time is not automatically implemented. To set the cycle time see **PROPORTIONAL CYCLE-TIME**.

REMINDER OF INSTRUMENT ADJUSTMENTS

Press ▲ ▼ together for 3 seconds for program entry or exit.
Press ▲ or ▼ to scroll through functions.
Press ✶ ▲ together or ✶ ▼ together to change levels or alter options.

Note: If in difficulty by becoming "lost" in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the Menu Navigation summary above and try again.

PROPORTIONAL CYCLE-TIME

The choice of cycle-time is influenced by the external switching device or load. eg. contactor, SSR, valve. A setting that is too long for the process will cause oscillation and a setting that is too short will cause unnecessary wear to an electro-mechanical switching device.

CYCLE-TIME SELECTION METHODS

The following methods of cycle-time selection may be used:

Autotune calculated
After Autotune has been run and completed the calculated cycle-time can be manually accepted or adjusted to suit the switching device. For selection method see **Select Autotune Calculated Cycle-time.**

Pre-select Autotune cycle-time
The controller can be programmed to automatically accept any calculated Autotune cycle-time. For selection method see **Pre-Select Automatic Acceptance of Any Autotune Cycle-time**, page 10**.**

Pre-select before Autotune
The controller can be programmed manually with any cycle-time between 0.1 and 81 sec. This cycle-time will not be changed by any Autotune functions. For selection method see **Pre-Select Cycle-time Before Autotune**, page 10**.**

Factory set
To use the 20 sec factory set cycle-time no action is needed whether autotune is used or not.

CYCLE-TIME RECOMMENDATIONS

Output Device	Cycle-time	Load (resistive)
Internal relay ***rLY***	20 sec or more 10 sec minimum	2A/250V~
	5 sec minimum	1A/250V~
Solid state drive (device) ***SSd***	1–3 sec typical (Range 0.1 - 81 sec) 0.1 sec	SSR Logic

To Select AUTOTUNE CALCULATED CYCLE-TIME

On completion of Autotune enter program mode.

Select 

The controller will now alternately display  and ***20*** (the factory setting).

To view the calculated optimum cycle-time press and hold the ✶ button then press and hold ▼ until indexing stops. The controller will display the calculated cycle-time  and eg. ***A 16***. This indicates that the calculated cycle-time is 16 seconds.

Proportional Cycle-time (continued)

If this cycle-time is suitable press and hold both ▲ and ▼ buttons for 3 seconds to enter it into the controllers memory.

If the calculated cycle-time is not compatible with the switching device press and hold the ✶ button then press and hold ▲ or ▼ until a more suitable cycle-time is displayed. Release the buttons, then press and hold both ▲ and ▼ buttons for 3 seconds to enter it into the controllers memory.

Pre-Select Automatic Acceptance of Any Autotune Cycle-time
Before selecting Autotune, enter program mode.

Select CYC.t

Press and hold the ✶ button then press and hold ▼ until indexing stops and ***A - -*** is displayed.

Note: ***A - -*** indicates that no cycle-time exists.

Press and hold ▼ to scroll to tunE
The controller will now alternately display tunE and ***oFF***. Press and hold the ✶ button and use ▲ to select either ***on*** or ***At.SP***. Release ▲.

The controller will now run Autotune and will accept the calculated cycle-time.

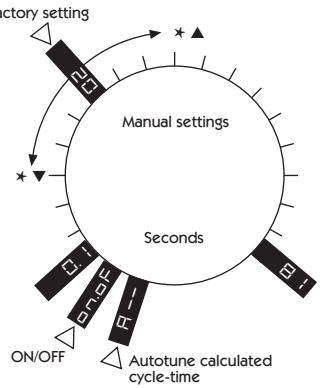
To Pre-Select Cycle-time Before Autotune

Before selecting Autotune, enter program mode.

Select CYC.t

Press and hold the ✶ button, then press ▲ to increase or ▼ to decrease the displayed cycle-time. Release buttons when required value is displayed.

Exit program mode or index to another function.



RAMP-SOAK

Enables the controller to ramp up or down from current temperature to setpoint at a pre-determined rate. It then controls the temperature at setpoint for an adjustable soak period before switching off the heat output.

If no Soak period has been set, control at setpoint continues indefinitely.

Set **Ramp rate (**0 to 9995 deg/hour)

Press ▲ and ▼ buttons together for 3 seconds to enter program entry point 

Press ▲ to scroll to 

Press and hold ✶, then press ▲ or ▼ to scroll to required value.

Set ***Ramp run*** [off]: on; hold

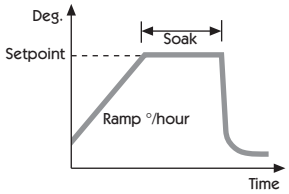
Press ▲ to scroll to 

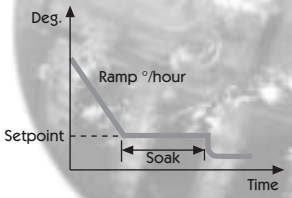
Press and hold ✶, then press ▲ to select ***on***.

Exit program to enter ramp rate into memory and commence ramp to setpoint.

In **Ramp on** configuration, if power is removed from the controller, the Ramp will re-start when power is restored.

The **Ramp hold** option suspends the ramp at its last value.





If timed SOAK is required

Set **Ramp rate** 0 to 9995 deg/hour

Press ▲ and ▼ buttons for 3 seconds to enter program entry point 

Press ▲ to scroll to 

Press and hold ✶ then press ▲ or ▼ to scroll to required value.

Set Soak (0 to 1440 minutes)

Press ▲ to scroll to 

Press and hold ✶ then press ▲ or ▼ to scroll to required soak period.

Press ▼ to scroll to 

Press and hold ✶ then press ▲ to select ***on***.

Exit program to enter ramp rate into memory and commence ramp to setpoint.

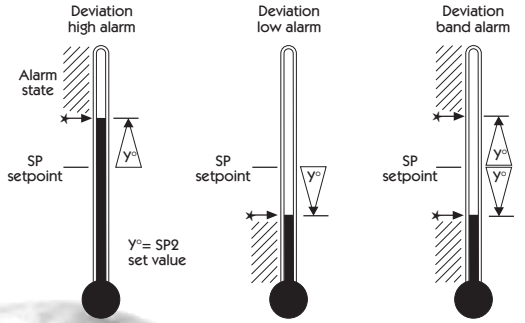
SECOND SETPOINT (SP2)

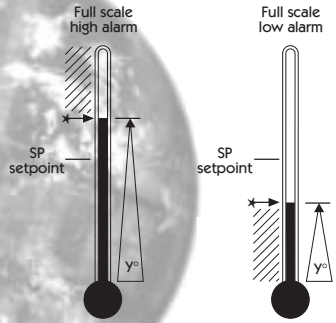
The second setpoint SP2 can be used to trigger an alarm or as a proportional control output.

TO CONFIGURE SP2 AS AN ALARM

Enter program mode.

Select level 2 then SP2.A , followed by the required option below:





dV.hi sets off alarm signal when temperature rises above a pre-set temperature above the setpoint.

dV.Lo sets off alarm signal when temperature falls below a pre-set temperature below the setpoint.

bAnd sets off alarm signal when temperature rises above or falls below a pre-set temperature above or below the setpoint.

FS.hi sets off alarm signal when the temperature rises above setpoint to a pre-set temperature above scale minimum.

FS.Lo sets off alarm signal when the temperature falls below setpoint to a pre-set temperature above scale minimum.

Select level 1 and select SEt.2 and set the required setpoint value (y°).

If the factory set hysteresis 2.0°C/3.6°F is unsuitable:

Index to bnd.2 and adjust the setting.

Check cYC.2 is set to ***on.oF*** (for alarm).

Exit program mode. SP2 is now operational as an alarm.

CooL see heat-cool configuration, page 23.

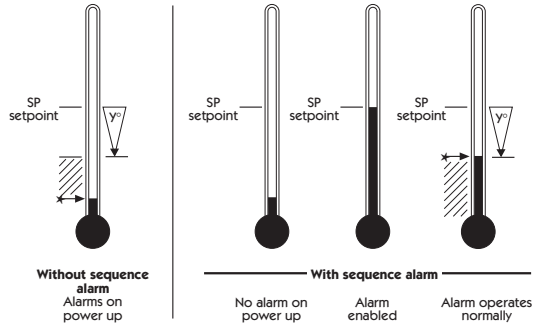
SUBSIDIARY SP2 MODE: SP2.b **Latch/sequence or non-linear cool.**

Latch alarm ***LtCh***

When activated, the alarm latches until manually reset, even though the alarm condition may have disappeared.

Sequence alarm ***hoLd***

When ***hoLd*** is selected, in any alarm mode, it prevents an alarm signal on power-up. The alarm is enabled only when the process temperature reaches setpoint.



TO CONFIGURE SP2 AS A PROPORTIONAL CONTROL OUTPUT

In level 2 select SP2.A , then select the required option.

In level 1 select bnd.2 and then set the required proportional band.

In level 1 select SEt.2 a
value (y°).

SP2 OUTPUT AND LED IND
ALARM CONDITION

Alarm type	ON-OFF operating mode		Proportional operating mode	
	SP2 Output state	SP2 LED state	SP2 Output state	SP2 LED state
Deviation dU.h, dU.Lo bAnd			bAnd : on-off mode only	
Full scale FS.h, FS.Lo				
Cool Strategy	Temperature above setpoint			

Output ON (Relay or SSd energised)

Output OFF (Relay or SSd de-energised)

LED ON

SP2 ALARM ANNUNCIATOR

When an SP2 alarm mode is selected in SP2.A the alarm annunciator ***-AL-*** is displayed, alternating with the process temperature, during alarm condition.

Note: The annunciator may be disabled by selecting function noAL , option ***on*** in level 4.

SP2 in cool strategy

(See heat-cool configuration in **ADVANCED SETTINGS** page 23).

ERROR MESSAGES

SENSOR FAULT

Display flashing: , nPt and ***FaiL***

Indicates: thermocouple burnout RTD/Pt100 open or short circuit or negative over-range.

Action: Check sensor/wiring

NON-VOLATILE MEMORY ERROR

Display flashing: dAtA and ***FaiL***

Action: De-power briefly. Replace unit if problem persists

MANUAL POWER ERROR

Display flashing: dAtA and ***FaiL***
SP1 set to ON/OFF in ***CYC.t***

Action: Select proportional mode

IMMEDIATE FAIL ON AUTOTUNE START

Display flashing: (setpoint), tunE and ***FaiL***
1. No setpoint entered

Action: Enter setpoint

2. SP1 set to ON/OFF in CYC.t

Action: Select proportional mode

Note: To reset and clear error press ▲▼ together briefly to cancel message.

FAIL LATER DURING AUTOTUNE CYCLE

The thermal characteristics of the load exceed the Autotune algorithm limits. The failure point indicated by any display 0.0 in tECh eg. Ctb = 0.0 see diagram below.

Action: 1. Change the conditions. eg. raise setpoint
2. Try tunE ***At.SP***
3. Check SP1.P percentage power (see **IMPROVING CONTROL ACCURACY)**
4. If the error message persists, call Chromalox.

READING AUTOTUNE TUNING CYCLE RESULTS IN tECh

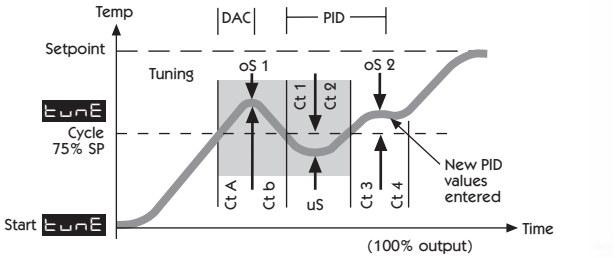
1. Index to tECh , release ▲ or ▼, display will alternately display tECh and ***Ct.A***

2. Press and hold ✶, the display will alternate ***Ct.A*** and value (eg. 10.4)

3. Keep ✶ pressed and press ▲ once, the display ***Ct.B*** and value (eg. 19.6)

4. Repeat step 3 above to view:
Ct 1, Ct 2, Ct 3, Ct 4, oS 1, uS and **oS 2**.

Autotune tuning data and limits



IMPROVING CONTROL ACCURACY

The following functions are to assist engineers with machine development, commissioning and troubleshooting.

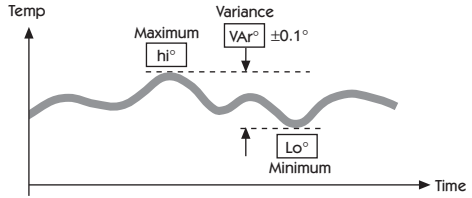
SP 1.P READ SP1 OUTPUT PERCENTAGE POWER

Poor control may be due to incorrectly sized heaters. SP 1.P (Level 2) constantly displays the output percentage power applied, which at normal setpoint should ideally be within 20 - 80% to achieve stable control.

ChEK CONTROL ACCURACY MONITOR

This measures the control stability, to within 0.1 °C/°F.

The monitor is started using ChEY (Level 3) and the variance (deviation), maximum and minimum temperatures are displayed and constantly updated in rEAd



Using the ChEY Control accuracy monitor

To start the monitor select ChEY ***on***

Note: During monitoring either return to normal operation or remain in program mode.

To view monitor readings: index to rEAd

The display will alternate between rEAd and ***Var°***

Press and hold ✶, the display will alternate between ***Var°*** and the variance displayed in degrees (e.g. 0.6)

Press and hold ✶ and press ▲ once, the display will alternate between ***VAr°*** and the maximum ***hi°*** displayed in degrees (e.g. 320.3)

Press and hold ✶ and press ▲ once, the display will alternate between ***VAr°*** and the minimum ***Lo°*** displayed in degrees (e.g. 319.7)

ChEY ***oFF*** stops monitor retaining readings

ChEY ***on*** resets readings.

On de-powering ChEY resets to ***oFF*** and rEAd is zeroed.

FUNCTION LIST

The functions and options are available in four levels.

Note: A Functions Menu is shown on the cover fold-out

LEVEL 1

Function **Options** *[Factory settings]*

SELECT AUTOTUNE

tunE *[oFF] on ParK At.Sp*

Used to switch the Autotune feature on and off, to select ***ParK*** or Autotune at setpoint.

ParK temporarily turns the output(s) off. To use select ***ParK*** and exit program mode. To disable re-enter program at tunE and select ***oFF***.

SP1 OPERATING PARAMETERS

bAnd *0.1 to * °C/°F* *[10°C/18°F]*

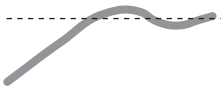
SP1 proportional band/Gain or Hysteresis

* 25% sensor maximum

Proportional control eliminates the cycling of on-off control. Heater power is reduced, by time proportioning action, across the proportional band.

Too narrow
(oscillates)

increase bAnd



Too wide
(slow warm up and response)

decrease bAnd

rnt.t *oFF 0.1 to 60 minutes* *[5.0]*

SP1 integral time/reset

Auto-corrects proportional control offset error

Too short
(overshoots and oscillates)

Too long
(slow warm up and response)

dEr.t *oFF 1 - 200 seconds* *[25]*

SP1 derivate time/rate

Suppresses overshoot and speeds response to disturbances

Too short
(slow warm up and response, under corrects)

Too long
(oscillates and over corrects)

dAC *0.5 - 5.0 x bAnd* *[1.5]*

SP1 derivative approach control dAC

Tunes warm-up characteristics, independant of normal operating conditions, by controlling when derivative action starts during warm-up (smaller dAC value = nearer setpoint).

Too small
(overshoots)

Too large
(slow stepped warm up)

LEVEL 1 (continued)

CYC.t ***A - - on.oF 0.1 - 81 sec*** *[20]*

SP1 proportional cycle-time (see pages 9/10)
Determines the cycle rate of the output device for proportional control. Select ***on.oF*** for ON/OFF mode.

oFSt ***0 to * °C/°F***

SP1 offset/manual reset
* ±50% ***bAnd***. Applicable in proportional and ON/OFF mode with integral disable: ***Int.t oFF***.

SP.LY ***[oFF] on***

Lock main setpoint
Locks the setpoint preventing unauthorised adjustment.

PROGRAMMER SETTINGS (see page 11)

SPrr 0 to 9995 deg/hour
Sets the ramp rate

SPrn ***on [oFF] hoLd***
Switches the ramp on or off, or hold at last ramp value

SoAY ***[oFF] 0 to 1440 min***
Sets the soak time

SP2 OPERATING PARAMETERS (see pages 12/13)

SEt.2 ***0 to * °C/°F*** *[0]*

Adjust SP2 setpoint
* Deviation Alarms ***DV.hi, DV.Lo, bAnd***
  25% sensor maximum (see figure 7).
* Full scale alarms ***FS.hi, FS.Lo***
  sensor range f/s (see figure 8)

bnd.2 ***0.1 - * °C/°F*** *[2.0 °C/3.6°F]*

Adjust SP2 hysteresis or proportional band/gain
(see ***CyC.2*** setting)
* 25% sensor f/s

CYC.2 ***on.oFF 0.1–81 seconds***

Select SP2 ON/OFF or proportional cycle-time
Select on.oFF for ON/OFF mode, or the cycle rate of SP2 output device for proportional mode.

LEVEL 2

MANUAL CONTROL MODES

SP 1.P *0 to 100 % 'read only'*
Read SP1 output percentage power

hAnd *[oFF] 1 to 100 % (not in ON/OFF)*
SP1 manual percentage power control
For manual control should a sensor fail.
Record typical ***SP1.P*** values beforehand.

PL.1 *100 to 0 % duty cycle [100]*
Set SP1 power limit percentage
Limits maximum SP1 heating power during warm-up and in proportional band.

PL.2 *100 to 0 % duty cycle [100]*
Set SP2 percentage power limit (cooling)

SP2 OPERATING MODES (see page 12/13)

SP2.A *[nonE] dV.hi dV.Lo bAnd FS.hi FS.Lo Cool*
Main SP2 operating mode

SP2.b *[nonE] LtCh hoLd nLin*
Subsidiary SP2 mode: latch/sequence
Non-linear cool proportional band

INPUT SELECTION AND RANGING

d. SP *[1] 0.1*
Select display resolution: for display of process temperature, setpoint, ***OFSt, Set.2, hi.SC, LoSC***.

h. SC **sensor minimum [sensor maximum] °C/°F**
Set full scale

Lo.SC **[sensor minimum] sensor maximum °C/°F**
Set scale minimum (default 0°C or 32°F)

. inP Select input sensor ***[nonE]***
(See **SENSOR SELECTION** table, page 31)

unit *nonE °C °F bAr Psi Ph rh SEt*
Select °C/°F or process units

LEVEL 3

OUTPUT CONFIGURATION

SP1.d *[nonE] rLY SSD*

Select SP1 output device

Note: 'Read only' after initial configuration. ***rSEt ALL*** full reset to factory settings required to change **SP 1.d** subsequently.

SP2.d *[nonE] SSd rLY*

Read SP2 output device

Shows SP2 output device

burn

Sensor burn-out/break protection

Caution: Settings affect fail safe state.

	SP1	**SP2**
[uP.SC]	Upscale	Upscale
dn.SC	Downscale	Downscale
1u.2d	Upscale	Downscale
1d.2u	Downscale	Upscale

rEv.d

Select output modes: Direct/Reverse

Caution: Settings affect fail safe state.

	SP1	**SP2**
[1r.2d]	Reverse	Direct
1d.2d	Direct	Direct
1r.2r	Reverse	Reverse
1d.2r	Direct	Reverse

Select **Reverse** on SP1 for heating and **Direct** for cooling applications.

rEv.L

Select SP1/2 LED indicator modes

	SP1	**SP2**
[1n.2n]	Normal	Normal
1i.2n	Invert	Normal
1n.2i	Normal	Invert
1i.2i	Invert	Invert

SPAn ***[0.0] to ±25% sensor maximum***

Sensor span adjust

For recalibrating to a remote standard e.g. External Meter, data logger. See **ADVANCED SETTINGS** page 24,25.

LEVEL 3 (continued)

ZEro *[0.0] to ±25% sensor f/s*
Zero sensor error, see SPAn

ChEY *[oFF] on*
Select control accuracy monitor

rEAd *Var hi Lo*
Read control accuracy monitor

tECh *Ct A CT b Ct 1 Ct 2 Ct 3 Ct 4 oS 1 uS oS 2*
Read Autotune tuning cycle data (see figure, page 14)

UEr
Software version number

rSEt *[nonE] ALL*
Resets all functions to factory settings
Caution: Note current configuration before using this function, otherwise initial configuration and OEM settings must be re-entered.

LEVEL 4

Access to level 4 is gained through UEr in level 3. Press and hold ▲ and ▼ for 10 seconds.

Enter level 4 at ***Lock***, release ▲ and ▼ together. Display will alternate LoCY and ***nonE***

Program security using Lock

Select from three ***Lock*** options:

Press and hold ✶, press ▲ to index.

LEV.3 locks level 3 and 4 only- Technical Functions.

LEV.2 locks levels 2, 3 and 4 only - Configuration and Technical Functions.

ALL locks all functions (unrestricted ***LEVL, VEr, dAtA, SP.LK***)

Note: Locked functions and options may be read.

Press ▼ to access following functions

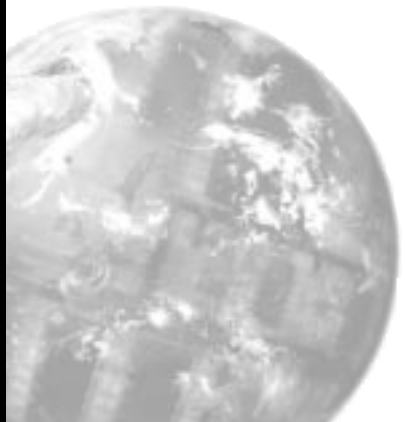
PrOG ***[Auto] StAY***
Program mode auto-exit switch
Auto-exit returns display to normal if 60 seconds of key inactivity, select ***StAY*** to disable

no.AL ***[oFF] on***
Disable SP2 alarm annunciator -AL-
Select on to disable -AL-

di SS ***dir 1 to 32 [6]***
Display sensitivity
dir = direct display of input
1 = maximum, ***32*** = minimum sensitivity

dEr.S ***0.1 to 1.0 [0.5]***
Derivative sensitivity

IMPORTANT NOTE FOR OEM's: For safety and to protect settings from tampering USE THE SOFTWARE SECURITY LOCK.... THEN REMOVE THIS SECTION.



ADVANCED SETTINGS

Before embarking on the Advanced Settings, please familiarise yourself with the basic operation of the controller as described in this manual. The following instructions assume that the user understands how to make the initial configuration, can navigate through the Function Menu and successfully Autotune the controller in heating mode.

HEAT COOL STRATEGY CONFIGURATION

Using SP2.A ***Cool* option**

Heat-Cool strategy is a feature that improves control of processes that need heating and cooling, depending on the conditions, for example:

> Environmental test chambers used in rooms where the ambient temperature swings above and below the test temperature.
>
> Plastics extruders where the material initially needs heating, then cooling, when it begins to heat itself exothermically due to pressure and friction applied by the process.

The purpose of cool strategy is to maintain smooth control of the process during transition from heating to cooling. This is achieved by using PID control for heating and cooling with the proportioning bands linked by an adjustable deadband.

From cold (normal procedure on a new installation)

Enter setpoint and allow the process to reach the setpoint using factory settings for **heating only**.

Autotune at setpoint

Make the following pre-settings:

Level 1 set dAC to ***1.0*** CYC.t to ***10***
and CYC.2 to ***10***

Level 2 set SP2.A to ***Cool***

Level 1 set tunE to ***At.SP***

Autotune will cause a temporary disturbance. Check that the temperature has stabilised in **heating** mode before running the process in cooling mode.

If regular temperature oscillations occur, change ***CYC.t*** to optimum value. See page 9. **To select Autotune Calculated Cycle-time**

Further adjustments – Cooling

Autotune uses the same calculated bAnd value for both ***SP1*** (heating) and ***SP2*** (cooling). In some processes, regular temperature oscillations occur when cooling.

Make the following manual adjustment:

In level 1 double the value of bnd.2

Heat Cool Strategy Configuration (continued)

If no improvement, return to the original value and;

In level 1 halve the value of CYC.2

If the process hunts between heating and cooling, a deadband setting may be needed. Enter a small value, eg. 1 and observe the process. Increase the setting until hunting stops.

Level 1 adjust value SEt.2

Water cooled applications

Water cooled applications operating at temperatures greater than 100°C may suffer from the non linear effect caused by water turning to steam. This can be countered by the non linear setting for SP2;

In level 2 set SP2.b to ***nL in***

Multi zone applications

When tuning multi zone applications like extruders, distortions due to thermal interaction between adjacent zones can be minimised by running autotune on all controllers at the same time.

CALIBRATION TO ANOTHER INSTRUMENT

If the controller and instrument readings are different, the ZEro and/or SPAn function in Function Menu Level 3 will require adjustment.

Adjust ZEro to make an equal adjustment across the full scale of the controller and SPAn to make a correction when the error increases/decreases across the scale.

1 To adjust using the ZEro function

1.1 Substitute measured values in the expression:

Instrument reading – controller reading = ZEro

Example:

Instrument reading = 396°
Controller reading = 400°
396 – 400 = (-)4°

1.2 Adjust ZEro to (-) 4° to correct error.

To make a correction when there are different errors across the scale.

Calibration to Another Instrument (continued)

2 Adjust using the SPAn function

2.1 Chose a temperature near the bottom and another near the top of the scale.

2.2 Run the process at the lower temperature (**T1**). Note the error (**E1**) between the controller and the instrument readings.

2.3 Repeat at the upper temperature (**T2**) and note error (**E2**).

2.4 Substitute the values for T1, T2, E1 and E2 in the expression below to calculate SPAn

$$\frac{\text{E2-E1}}{\text{T1-T2}} \times \textit{hi.SC} = \textit{SPAn}$$

For ***hi.SC*** settings see level 2.

Example:	T1	T2
Instrument reading	58°	385°
Controller reading	60°	400°
Error	**E1**(-) 2°	**E2** (-) 15°

$$\frac{(-15) - (-2)}{385 - 58} \times 450 = \frac{(-13) \times 450}{327} = (-)17.9$$

2.5 Therefore adjust ***SPAn*** to (-) 18 to correct error.

Notes: (1) After making the adjustment the reading will immediately change. Allow time for the temperature to stabilise at T2 before making any further adjustment. At this point, a ***ZEro*** adjustment may be needed, refer to step 1 above.

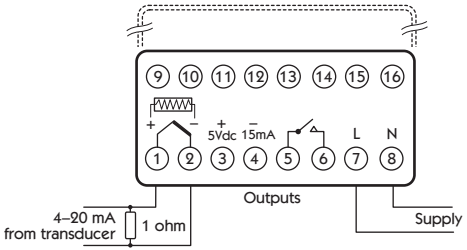
(2) Check that the temperature correctly stabilises at T2 and then adjust setpoints to T1. If an error is present at T1 repeat from step 2.

LINEAR INPUT CALIBRATION

In addition to the ten temperature inputs, the controller has five linear input ranges which can be calibrated to display a range of engineering units. This procedure involves making adjustments to the controller's hi.SC , ZEro and SPAn adjustments found in function menu levels 2 and 3.

Note: The controllers linear inputs are in mV. If your transducer provides an output in mA this should be converted to mV by feeding the controller input via a high stability one ohm resistor, see figure page 26. Other low Vdc signals can be connected via a suitable voltage divider network to match the controller input requirements.

Linear Input Calibration (continued)



1 Power up the controller, and in response to the prompt , nPt ***nonE*** select an appropriate Linear Range from the table below.

Ensure that the Nominal Signal Span chosen is wider than the transducer's actual signal span, and the Nominal Scale is wider than the full scale of the engineering units to be displayed.

Linear Range	Nom. Signal Span	Nom. Scale Span	Max. Scale Settings
Lin 1	0–20 mV	0 – 100	0 – 400
Lin 2	4–20 mV	0 – 100	-25 to 400
Lin 3	0–20 mV	0 –1000	0 to 3000
Lin 4	4–20 mV	0 – 1000	-250 to 3000
Lin 5	0–20 mV	0 – 2000	0 to 3000

2 Select unit, then select the process unit, ***°C***, ***°F***, ***Bar***, ***PSI***, ***Ph***, or ***rh***. If the required unit is not shown select ***Set***.

3 Allocate the output devices at function SP 1.d as described in ***SET-UP***, enter the configuration into the memory and proceed as follows:

Calculate the values for the controller high scale hi.SC, SPAn and 2Ero using the example below as a guide:

4 to 7mV input from transducer is required to display 0 - 110 units

Chose Linear Range Lin4 4-20mV = 0 to 1000 units.

hi.SC = $\frac{\text{Nominal Signal Span}}{\text{actual signal span}}$ x required span

$\frac{(20-4)}{(7-4)}$ x (110-0) = 587

SPAn = (***hi.SC*** - nominal scale span) x $\frac{\textbf{\textit{hi.SC}}}{\text{Nominal Scale Span}}$

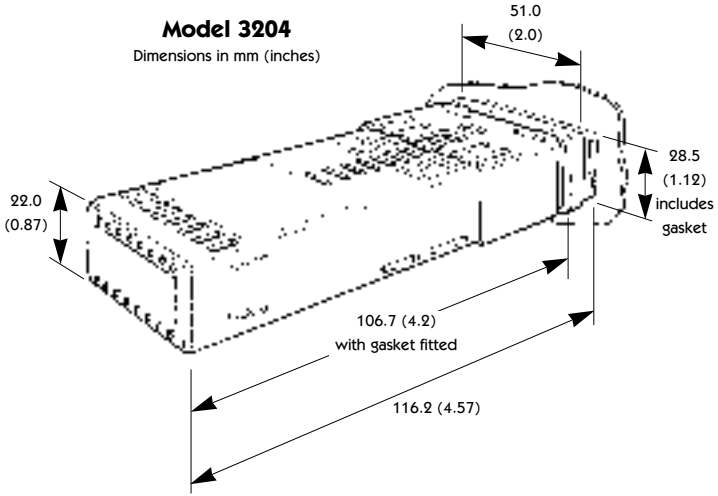
(587-1000) x $\frac{587}{1000}$ = -242

These settings should provide the correct scaling adjustment, but a value for 2Ero may need to be established by applying the lowest and highest mV input signal and recording the display offset. Check that this is the same at each end, and enter this plus or minus value as a 2Ero adjustment. Should there be a difference between the two readings, a further adjustment of the SPAn setting can be made.

MECHANICAL INSTALLATION

3204's are sleeve mounted with their front bezel assembly rated NEMA4/IP66 provided that:

- the panel is smooth and the panel cutout is accurate;
- the mounting instructions are carefully followed.

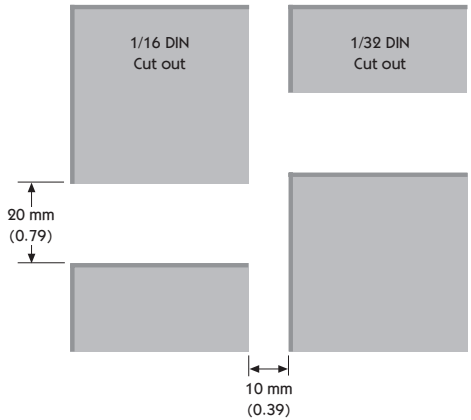


DIN PANEL CUTOUT SIZES

1/32 DIN panel cutout size

45.0mm +0.6mm -0.0mm (1.77in.
22.2mm +0.3mm -0.0mm (0.87in.
9.5mm (0.374in) maximum panel thi

MINIMUM SPACING



MOUNTING

To mount a Controller proceed as follows:

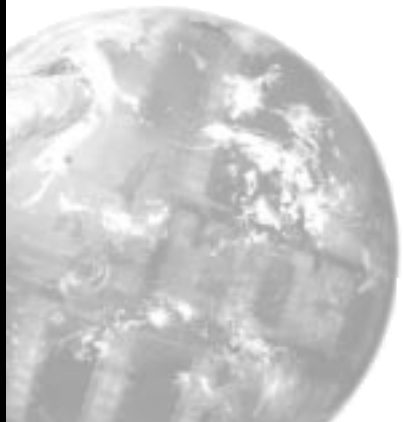
1 Check that the controller is correctly orientated and then slide the unit into the cutout.

2 Slide the panel clamp over the controller sleeve pressing it firmly against the panel until the controller is held firmly.

3 The controller front bezel and circuit board assembly can be unplugged from the sleeve. Grasp the bezel firmly by the recesses on each side and pull. A screwdriver can be used as a lever if required.

4 When refitting the bezel assembly it is important to press it firmly into the sleeve until the latch clicks in order to compress the gasket and seal to NEMA4X/IP66.

Note: The controller should be isolated before removing or refitting it in the sleeve, and electrostatic precautions should be observed when handling the controller outside the sleeve.



ELECTRICAL INSTALLATION

SUPPLY VOLTAGE

The controllers are designed for use with the following supply voltages:

100-240V 50-60 Hz ±10% 4.0VA
12V-24V (AC/DC) ±20% 4.0VA
Polarity is not required.
The controllers are fitted with an internal 250mA time lag fuse.

Output devices

Two output devices are fitted to the controllers.

1 **Solid state relay drive (SSd)**
5Vdc +0/-15%, 15mA non-isolating.
To switch a remote SSR (or logic)
2 **Miniature power relay (rLY)**
2A/250V resistive, Form A/SPST contacts.

OUTPUT DEVICE ALLOCATION

Either output device may be chosen as the output device for the main setpoint (SP1), the remaining device being automatically allocated to the second setpoint (SP2). Choose the most suitable output device arrangement for the application and wire accordingly. Refer to Figures 16 and 17.

WIRING THE CONNECTOR

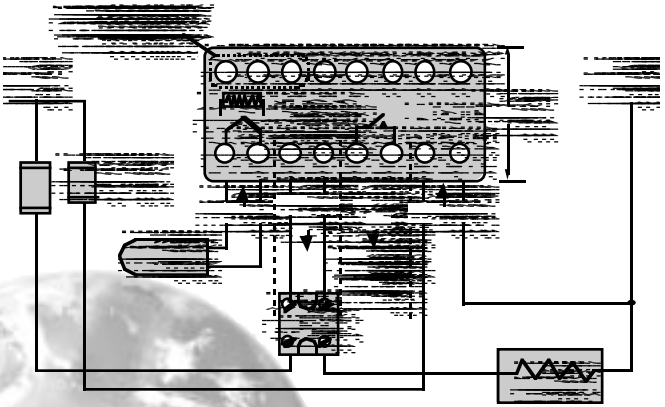
Prepare the cable carefully, remove a maximum of 7mm (0.275in) insulation and ideally tin to avoid bridging. Prevent excessive cable strain. Maximum recommended wire size: 32/0.2mm 1.0mm^2 (18AWG/0.04in^2).

INDUCTIVE LOADS

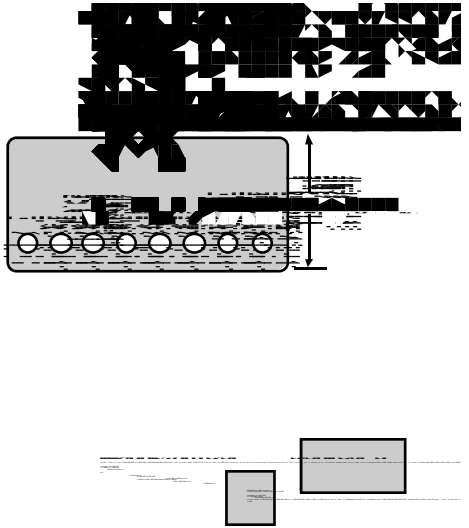
To prolong relay contact life and suppress interference it is recommended engineering practice to fit a snubber (0.1uf/100 ohms), refer to Figure 17.

CAUTION:
Snubber leakage current can cause some electro-mechanical devices to be held ON. Check with the manufacturers specifications.

The SSd output is allocated to SP1 and wired to switch the load (heater) using an SSR



The relay output is allocated to SP1 and wired to switch the load (heater) using a contactor



SENSOR SELECTION

Option/Sensor type		Sensor range			Linearity
Thermocouples					
tc b	B	0 to 1800 °C	32 to 3272 F	Pt-30%Rh/Pt-6%Rh	2.0 *
tc E	E	0 to 600 °C	32 to 1112 F	Chromel/Con	0.5
tc J	J	0 to 800 °C	32 to 1472 F	Iron/Constantan	0.5
tc K	K	-50 to 1200 °C	-58 to 2192 F	Chromel/Alumel	0.25*
tc L	L	0 to 800 °C	32 to 1472 F	Fe/Konst	0.5
tc n	N	-50 to 1200 °C	-58 to 2192 F	NiCrosil/NiSil	0.25*
tc r	R	0 to 1600 °C	32 to 2912 F	Pt-13%Rh/Pt	2.0*
tc s	S	0 to 1600 °C	32 to 2912 F	Pt-10%Rh/Pt	2.0*
tc t	T	-200 / 250 °C	-273 / 482 F	Copper/Con	0.25*

Resistance temperature detector

rtd	-200 / 400 C	-273 / 752 F	Pt100/RTD-2	0.25*

Linear process inputs (Input mV range: 0 to 50mV)

Displays	0 - 20mV	4 - 20mV	setpoint limits	
Lin1	0 - 100		0 - 400	± 0.5%
Lin2		0 - 100	-25 - 400	± 0.5%
Lin3	0 - 1000		0 - 3000	± 0.5%
Lin4		0 - 1000	-250 - 3000	± 0.5%
Lin5	0 - 2000		0 - 3000	± 0.5%

Notes: 1 Linearity: 5-95% sensor range

2* Linearity B:5° (70° - 500°C) K/N:1° >350°C exceptions: R/S: 5°<300°C T:1° <- -25° >150°C RTD/Pt100: 0.5° <-100°C

SPECIFICATION

Thermocouple
9 types
Standards: IPTS/68/DIN 43710
CJC rejection: 20:1 (0.05°/°C) typical
External resistance: 100Ω maximum

Resistance temperature detector
RTD-2/Pt100 2 wire
Standards: DIN 43760
(100Ω 0°C/138.5Ω 100°C Pt)
Bulb current: 0.2mA maximum

Linear process inputs
mV range: 0 to 50mV

Applicable to all inputs SM = sensor maximum
Calibration accuracy: ±0.25%SM ±1°C
Sampling frequency: input 10Hz, CJC 2 sec.
Common mode rejection: Negligible effect up to 140dB, 240V, 50-60Hz
Series mode rejection: 60dB, 50-60Hz
Temperature coefficient: 150ppm/°C SM
Reference conditions: 22°C ±2°C, rated voltage after 15 minutes settling time.

Output devices
SSd: solid state relay driver: To switch a remote SSR 5Vdc +0/-15% 15mA non-isolated

Miniature power relay: form A/SPST contacts (AgCdO) 2A/250~ resistive load

General
Displays: Main, 4 Digits high brightness green LED. 10mm (0.4") high.
Digital range -199 to 9999
Hi-res mode -199.9 to 999.9

LED output indicators - flashing SP1 square, green; SP2 round, red
Keypad: 3 elastomeric buttons

Environmental
Safety: (Approvals pending)
UL 873, EN 61010,
CSA 22.2 No.1010.1-92
Humidity: Max 80%
Altitude: up to 2000M
Installation: Categories II and III
Pollution: Degree II
Protection: NEMA 4X, IP66
EMC emission: EN50081-1 FCC Rules 15 subpart J Class A
EMC immunity: EN50082-2
Ambient: 0-50°C (32-130°F)
Mouldings: flame retardant polycarbonate
Weight: 3300: 110g (3.9 oz)
9300: 120g (4.2 oz)

PROHEAT

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