Installation & Operation Manual

3204
1/32 DIN Autotune Temperature Controller

CHROMALOX
Advanced Thermal Technologies

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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 and Returns Statement

These products are sold by Chromalox under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Chromalox or from a Chromalox distributor, representative or reseller and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

Warranty

- These products are warranted to be free from functional defects in material and workmanship at the time the products leave Chromalox factory and to conform at that time to the specifications set forth in the relevant C instruction manuals sheet or sheets, for such products for a period of three years.
- THERE ARE NO EXPRESSED OR IMPLIED WARRANTIES, WHICH EXTEND BEYOND THE WARRANTIES HEREIN AND ABOVE SET FORTH.

CHROMALOX MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCTS.

Limitations

Chromalox shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses excepting only the cost or expense of repair or replacement as described above. Products must be installed and maintained in accordance with Chromalox instructions. There is no warranty against damage to the product resulting from corrosion. Users are responsible for the suitability of the products to their application.

For a valid warranty claim, the product must be returned carriage paid to the supplier within the warranty period. The product must be properly packaged to avoid damage from electrostatic discharge or other forms of harm during transit.
Functions Menu

**USER PROTECTED SETTINGS**

- **Security Lock**
  - nonE; LEV 3; LEV 2; ALL
- **Disable Program Auto-Exit**
  - Auto; STAY
- **Display Averaging**
  - dir. 1 to 32 (6)
- **Derivative Sensitivity**
  - 0.1 to 1.0 x dEr.t (0.5)

**TOGETHER TO CHANGE LEVELS OR OPTIONS**

**LEVL4**

<table>
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<th>LoCK</th>
<th>Prog</th>
<th>no.AL</th>
<th>d.s.S</th>
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**LEVL3**

- **SP1 d**
  - SP1 Output Device
  - nonE; rY; SSD
- **SP2 d**
  - SP2 Output Device
  - nonE; SSd; rY (read only)
- **burn**
  - Sensor Burn-Out
  - uP.SC; dn.SC; 1u.2d; 1d.2u
- **rEv.d**
  - Reverse O/P LEDs
  - 1n.2i; 1i.2n; 1n.2i; 1i.2n
- **rEu.L**
  - Reverse Outputs
  - 1r.2d; 1d.2d; 1r.2r; 1d.2r
- **SPAn**
  - SP1 Prop Band (gain)/hyst
  - 0.1 deg to 25% sensor f/s
- **2ZeRo**
  - Zero Adjustment
  - 0.0 to 25% sensor full scale

**CALIBRATION**

- **SPAN**
  - SP2 Prop Band/Gain/Hyst
  - 0.1 deg to 100% sensor f/s (2°C/3.6°F)

**PERFORMANCE DATA**

- **SP1 SETTINGS**
  - Integral Time (Reset)
  - Off; 0.1 to 60 min (5 min)
  - Derivative Time (Rate)
  - Off; 1 to 200 sec (25 sec)
- **SP2 SETTINGS**
  - Cycle Time or On/Off
  - On/Off; 0.1 to 81 sec (20 sec)
  - Offset (Manual Reset)
  - Off; 0.1 to 50% x bAnd (in.t = off)

**RANGING**

- **Set Scale**
  - Max.
  - 0.0 Sensor max to sensor full scale
  - Set Scale Min.
  - 0.0 Sensor min to sensor full scale

- **SP1 SETTINGS**
  - Autotune or Park
  - off; on; tune; Park; At.Sp
  - Prop Band
  - (gain)/hyst
  - 0.1 deg to 25% sensor f/s (10°C/18°F)
  - Integral Time (Reset)
  - Off; 0.1 to 60 min (5 min)
  - Derivative Time (Rate)
  - Off; 1 to 200 sec (25 sec)
- **SP2 SETTINGS**
  - Cycle Time or On/Off
  - On/Off; 0.1 to 81 sec (20 sec)
  - Offset (Manual Reset)
  - Off; 0.1 to 50% x bAnd (in.t = off)

**CONFIGURE INPUT**

- **SP1 Prop Band**
  - nonE; SSd
- **SP2 Prop Band**
  - nonE; SSd; rY (read only)
- **Main SP2 Mode**
  - nonE; dV.hi; dV.Lo; bAnd; FS.hi; FS.Lo; Cool
- **Second SP2 Mode**
  - nonE; LtCH; hold; Lt.ho; nLin
- **Set Scale**
  - Max.
  - 0.0 Sensor max to sensor full scale
  - Set Scale Min.
  - 0.0 Sensor min to sensor full scale
- **Select Input Sensor**
  - nonE; °C; °F; bAr; PSI; Ph; rh; SET

**COMMS SETTINGS**

- **Addr**
  - Instrument Address
  - 0 to 255
- **Baud**
  - Baud Rate
  - 1200; 2400; 4800; 9600; 19k2
- **Data Format**
  - 18n1:18E1:18O1
- **Tx/Rx Activity**
  - Off; on

**Quick Start Entry**

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

*Note: Dual Relay and Dual SSd Output Options Models have their outputs pre-configured.*
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 experiencing 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 INPUT nonE or, if the initial configuration has been completed, the measured value. Any settings already completed will be retained.
Quick Start

After power-up the controller requires programming with the following information:

• Type of Sensor
• Operating unit
• Allocation of Output Device to SP1/SP2 (Relay or SSd)
• Temperature Setpoint eg. Degrees

When the above information has been programmed into the controller it will be operational with the following factory settings.

- Proportional band/Gain: 10°C/18°F
- Integral time/Reset: 5 mins
- Derivative time/Rate: 25 secs

- Proportional cycle-time: 20 secs
  (Typical setting for relay output)
- DAC Derivative approach control: 1.5
  (Average setting for min. overshoot)

Press ▲ once. The display will now alternate unit and nonE

2. 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. unit and °C).

Press ▲ once. The display will now alternate SP1 and nonE

3. 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 alternate selected output device (e.g. SP1.d and SSd).

4. To enter initial configuration into controller memory

Press and hold both ▲ and ▼ buttons for 3 seconds. The display will now alternate Park and measured variable (temperature) (eg. 23) Park 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

The 3204 control can be optimized 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 the 3204, 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 user’s manual is supplied with the comms option. For more information, contact Chromalox. See contact information on the last page of this manual.

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

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

TIP: Please note that in this manual, the functions are reversed out from a black background and the 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 MECHANICAL INSTALLATION section.

Set-Up

After installation the controller is to be programmed 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, e.g. 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 multilevel 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.

TIP: Please note that in this manual, the functions are reversed out from a black background and the options are shown in bold italic: eg. TunE 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 ☺
Set-Up

This section gives 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 \texttt{inPt} and \texttt{nonE}.

Select Input Sensor

Press and hold \texttt{H} and use either the \texttt{H} or \texttt{t} buttons to scroll through the sensor selection (see \texttt{FUNCTION MENU}). When the correct sensor is displayed, release the buttons. The controller will now alternately display selected sensor type \texttt{inPt} and eg. \texttt{tc.S}.

To Select °C/°F

Press and release the \texttt{H} button, the controller will now alternately display \texttt{inPt} and \texttt{nonE}.

Press and hold the \texttt{H} button and using the \texttt{s} 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 \texttt{H} button, the controller will now alternately display \texttt{Sp1.d} and \texttt{nonE}.

Press and hold the \texttt{H} button and using the \texttt{s} button select \texttt{SSd} or \texttt{rLY} as required. Release the buttons when the correct device is displayed.

The controller will now alternately display \texttt{Sp1.d} and selected output device (eg. \texttt{SSd}).

To Enter Initial Configuration into Controller Memory

Press and hold both \texttt{H} and \texttt{t} buttons for 3 seconds. The process temperature (e.g. 23°C) and \texttt{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 \texttt{H} button. °C and 0 or °F and 32 will be alternately displayed.

Press and hold the \texttt{H} button. Press \texttt{H} to increase or \texttt{t} 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 multilevel 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 is displayed, this is the program entry point. The controller will now alternately display the function and option (setting of that function), e.g. 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.

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

To Exit Program Mode
Press and hold both ▲ and ▼ buttons for at least 3 seconds.

REMINDER OF INSTRUMENT ADJUSTMENTS

• Press ▲ and ▼ 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 experiencing 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.
**Autotune**

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 minimizes 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.

The controller will alternately display \[\text{tunE}\] and \[\text{oFF}\].

Press and hold \[\star\] and press \[\uparrow\] once,

The controller will alternately display \[\text{tunE}\] and \[\text{on}\].

Exit program mode.

The TUNE program will now start. The controller will alternately display \[\text{tunE}\] 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 \[\text{tunE}\].

Select \[\text{At.SP}\].

Exit program mode.
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.

*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**.

---

**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**.

- **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.

**Cycle-Time Recommendations**

<table>
<thead>
<tr>
<th>Output Device</th>
<th>Factory Setting</th>
<th>Recomm. Minimum</th>
<th>Load Max. (resistive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal relay rLY/rLY1</td>
<td>20 seconds</td>
<td>10 seconds</td>
<td>2A/250 Vac</td>
</tr>
<tr>
<td>Internal relay rLY/rLY2</td>
<td>20 seconds</td>
<td>10 seconds</td>
<td>1A/250 Vac</td>
</tr>
<tr>
<td>Solid state drives SSD/SSd1/SSd2</td>
<td>20 seconds</td>
<td>0.1 seconds</td>
<td>Externally fitted SSR (n/a)</td>
</tr>
</tbody>
</table>

**To Select AUTOTUNE CALCULATED CYCLE-TIME**

On completion of Autotune enter program mode. Select **Cyc.**

The controller will now alternately display **Cyc.** 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 **Cyc.** and eg. **A 16**. This indicates that the calculated cycle-time is 16 seconds.
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.

1. Select **Cyc**.

2. Press and hold the ★ button then press and hold ▼ until indexing stops and A - - is displayed.
   
   **Note:** A - - indicates that no cycle-time exists.

3. Press and hold ▼ to scroll to **tun**.

The controller will now alternately display **tun** 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**.

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

Select **tun** or index to another function then exit program mode.
Programmer

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

Set Ramp rate (0 to 9995 deg/hour)
1. Press ▲ and ▼ buttons for 3 seconds to enter program entry point.
2. Press s to scroll to SPrr
3. Press and hold *, then press ▲ or ▼ to scroll to required value.
   Set Soak (if required) 0 to 1440 minutes
4. Press ▲ to scroll to SoAK
5. Press and hold *, then press ▲ or ▼ to scroll to required soak period.
6. Set Ramp On (Off) : On : hold
7. Press ▲ to scroll to SPrrn
8. Press and hold *, then press ▲ to select On

Exit program to enter settings into memory and commence ramp to target setpoint.

Notes:
• 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 no Soak period has been set, control at target setpoint continues indefinitely.

SP2 deviation alarms follow the ramp setpoint and can be used to alarm “out of limits” ramp rate.

WARNING
The Soak timer is triggered when the ramp setpoint reaches the target setpoint. If the ramp rate is set too fast for the process, the Soak timer will be triggered before the process temperature reaches the target setpoint.
Second Set-Point (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, followed by the required option below:

- Deviation high alarm
- Deviation low alarm
- Deviation band alarm

Select level 1 and select SET then set the required setpoint value (°). If the factory set hysteresis 2.0°C/3.6°F is unsuitable: Index to bnd and adjust the setting.

Check CYC is set to on. (for alarm).

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

COOL see heat-cool configuration.

SUBSIDIARY SP2 MODE: SP2 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 then select the required option.

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

In level 1 select SET and then set the setpoint (SP2) value (°).
### SP2 Output and LED Indication States - In Alarm Condition

<table>
<thead>
<tr>
<th>Alarm Type</th>
<th>On-Off Operating Mode</th>
<th>Proportional Operating Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deviation</td>
<td>SP2 Output State</td>
<td>SP2 LED State</td>
</tr>
<tr>
<td>Δ</td>
<td>Δ</td>
<td>Δ</td>
</tr>
<tr>
<td>dU.h,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>dU.Lo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bAnd</td>
<td></td>
<td>bAnd On-Off Mode Only</td>
</tr>
<tr>
<td>Full Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS.h,</td>
<td></td>
<td>FS.h</td>
</tr>
<tr>
<td>FS.Lo</td>
<td></td>
<td>FS.Lo</td>
</tr>
<tr>
<td>Cool</td>
<td>Temperature above setpoint</td>
<td>Cool</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Output ON (Relay or SSd energized)  
Output OFF (Relay or SSd de-energized)  
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 no.AL option on in level 4.

### SP2 in Cool Strategy
(See heat-cool configuration in ADVANCED SETTINGS)

---

Main Setpoint (SP1) LED Indication  
Process Temperature (PV) or Setpoint (SP) Value  
Second Setpoint (SP2) LED Indication
Error Messages

Sensor Fault
Display flashing: \textcolor{red}{inPt} and \textcolor{red}{Fail}
Indicates: thermocouple burnout RTD/Pt100 open or short circuit or negative over-range.
Action: Check sensor/wiring

Non-Volatile Memory Error
Display flashing: \textcolor{red}{Data} and \textcolor{red}{Fail}
Action: De-power briefly. Replace unit if problem persists

Manual Power Error
Display flashing: \textcolor{red}{Data} and \textcolor{red}{Fail}
SP1 set to ON/OFF in \textcolor{red}{CYC.t}
Action: Select proportional mode

Immediate Fail On Autotune Start
Display flashing: (setpoint), \textcolor{red}{tunE} and \textcolor{red}{Fail}
1. No setpoint entered
Action: Enter setpoint
2. SP1 set to ON/OFF in \textcolor{red}{CYC.t}
Action: Select proportional mode

Note: To reset and clear error press \textcolor{red}{\uparrow\downarrow \cdot} together briefly to cancel message.

Immediate Fail On Autotune Start
Display flashing: (setpoint), \textcolor{red}{tunE} and \textcolor{red}{Fail}
1. No setpoint entered
Action: Enter setpoint
2. SP1 set to ON/OFF in \textcolor{red}{CYC.t}
Action: Select proportional mode

Action: 1. Change the conditions. eg. raise setpoint
2. Try \textcolor{red}{tunE At.SP}
3. Check SP1.P percentage power (see IMPROVING CONTROL ACCURACY)
4. If the error message persists, call for advice.

Reading Autotune Tuning Cycle Results in \textcolor{red}{tECh}
1. Index to \textcolor{red}{tECh}, release \textcolor{red}{\uparrow\downarrow \cdot} or \textcolor{red}{\leftarrow}, display will alternately display \textcolor{red}{tECh} and \textcolor{red}{Ct.A}
2. Press and hold \textcolor{red}{\star}, the display will alternate \textcolor{red}{Ct.A} and value (eg. 10.4)
3. Keep \textcolor{red}{\uparrow\downarrow \cdot} pressed and press \textcolor{red}{\star} once, the display Ct.B and value (eg. 19.6)
4. Repeat step 3 above to view: \textcolor{red}{Ct} 1, \textcolor{red}{Ct} 2, \textcolor{red}{Ct} 3, \textcolor{red}{Ct} 4, \textcolor{red}{oS} 1, \textcolor{red}{uS} and \textcolor{red}{oS} 2.

Autotune tuning data and limits

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 \textcolor{red}{tECh} eg. Ctb = 0.0 see diagram below.
Improving Control Accuracy

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

**SPI.P Read Sp1 Output Percentage Power**
Poor control may be due to incorrectly sized heaters. **SPI.P** (Level 2) constantly displays the output percentage power applied, which at normal setpoint should ideally be within 20 - 80% to achieve stable control.

**CHEY 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] shown in brackets

Select Autotune

\[\text{tunE} \ [\text{oFF}] \ on \ ParK \ At.Sp\]

Used to switch the Autotune feature on and off, to select \textit{ParK} or Autotune at setpoint.

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

SP1 Operating Parameters

\[\text{bRnd} \ 0.1 \ to \ * \ °C/°F \ [10ºC/18ºF]\]

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.

SP1 Derivate Time/Rate

\[\text{dER} \ \text{oFF} \ 1 - 200 \ seconds \ [25]\]

SP1 Derivative Approach Control dAC

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

SP1 Integral Time/Reset

\[\text{int.t} \ \text{oFF} \ 0.1 \ to \ 60 \ minutes \ [5.0]\]

SP1 Proportional Cycle-Time

Determines the cycle rate of the output device for proportional control. Select \texttt{on.oF} for ON/OFF mode.

SP1 Offset/Manual Reset

* ±50% \texttt{bAnd}. Applicable in proportional and ON/OFF mode with integral disable: \texttt{int.t oFF}.

SP. LT \ \texttt{[oFF]} \ on

Lock Main Setpoint

Locks the setpoint preventing unauthorised adjustment.

PROGRAMMER SETTINGS

\[\text{5Pr} \ [0] \ to \ 9995 \ deg/hour\]

Sets the ramp rate

\[\text{5Prn} \ on \ [\text{oFF}] \ hoLd\]

Switches the ramp on or off, or hold at last ramp value
**SP2 OPERATING PARAMETERS**

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

**Scc.2** 0 to * °C/°F [0]
Adjust SP2 setpoint
* Deviation Alarms DV.hi, DV.Lo, bAnd 25% sensor maximum.
* Full scale alarms FS.hi, FS.Lo sensor range f/s

**LEVEL 2**

**MANUAL CONTROL MODES**

**SP1.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**

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

**LEVEL 3**

**OUTPUT CONFIGURATION**

Note: ‘Read only’ after initial configuration. rSET ALL full reset to factory settings required to change subsequently.

**SP1.d** [nonE] rLY SSd rLY1 rLY2 SSd1
Select SP1 output device

**SP2.d** [nonE] SSd rLY rLY2 rLY1 SSd2
Read SP2 output device (read only)

Dual Relay and Dual SSd output options Models are factory set. See Factory Set Output Options.

**burn**
Sensor burn-out/break protection

**CAUTION**
Settings affect fail safe state.
**rEd**
Select output modes: Direct/Reverse

**CAUTION**
Settings affect fail safe state.

<table>
<thead>
<tr>
<th></th>
<th>SP1</th>
<th>SP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1r.2d</td>
<td>Reverse</td>
<td>Direct</td>
</tr>
<tr>
<td>1d.2d</td>
<td>Direct</td>
<td>Direct</td>
</tr>
<tr>
<td>1r.2r</td>
<td>Reverse</td>
<td>Reverse</td>
</tr>
<tr>
<td>1d.2r</td>
<td>Direct</td>
<td>Reverse</td>
</tr>
</tbody>
</table>

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

**rEl**
Select SP1/2 LED indicator modes

<table>
<thead>
<tr>
<th></th>
<th>SP1</th>
<th>SP2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1n.2n</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>1i.2n</td>
<td>Invert</td>
<td>Normal</td>
</tr>
<tr>
<td>1n.2i</td>
<td>Normal</td>
<td>Invert</td>
</tr>
<tr>
<td>1i.2i</td>
<td>Invert</td>
<td>Invert</td>
</tr>
</tbody>
</table>

**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.

**2Ero** [0.0] to ±25% sensor f/s
Zero sensor error, see SPAn

**CheX** [off] on
Select control accuracy monitor

**rEr** [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

**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 **LoCt** 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, tECh, rLPk**)

**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

**dS.5** dir 1 to 32 [6]
Display sensitivity
dir = direct display of input
1 = maximum, 32 = minimum sensitivity

**dEr.5** 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
**Factory Set Output Options**

**Dual Relay or Dual SSd Output Models**

The table below details the factory set output options. rLY2 is a 1A electromechanical relay, and SSd1/SSd2 is an identical second SSR drive output.

<table>
<thead>
<tr>
<th>Model Type</th>
<th>Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Dual Relay</td>
<td>rLY1 (2A)</td>
</tr>
<tr>
<td>Dual SSR Drive</td>
<td>SSd1</td>
</tr>
<tr>
<td></td>
<td>(+)</td>
</tr>
</tbody>
</table>

**QUICK START or SET-UP**

Follow steps 1 and 2 ignore step 3 and proceed straight to step 4.

**Advanced Settings**

Before embarking on the Advanced Settings, please familiarize 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. R 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.1 to 10 and CYC.2 to 10
- Level 2 set SP2. R to Cool
- Level 1 set Tun.E to At.SP

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

If regular temperature oscillations occur, change CYC.t to optimum value. **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 \[ \text{bnd.2} \]
If no improvement, return to the original value and; In level 1 halve the value of \[ \text{clyt.2} \]
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 \[ \text{sel.2} \]

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 \[ \text{SP2.b} \] to \[ nL \] in

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

Calibration to Other Instrument
If the controller and instrument readings are different, the \[ \text{Zero} \] and/or \[ \text{SPAN} \] function in Function Menu Level 3 will require adjustment.
Adjust \[ \text{Zero} \] 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.

To adjust using the ZERO function
1. Substitute measured values in the expression:
   \[ \text{Instrument reading} - \text{controller reading} = \text{Zero} \]
   Example:
   \[ \text{Instrument reading} = 396° \]
   \[ \text{Controller reading} = 400° \]
   \[ 396 - 400 = (-)4° \]
2. Adjust \[ \text{Zero} \] to (-) 4° to correct error. To make a correction when there are different errors across the scale.

Adjust using the \[ \text{SPAN} \] Function
1. Choose a temperature near the bottom and another near the top of the scale.
2. Run the process at the lower temperature (T1).
   Note the error (E1) between the controller and the instrument readings.
3. Repeat at the upper temperature (T2) and note error (E2).
4. Substitute the values for T1, T2, E1 and E2 in the expression below to calculate \[ \text{SPAN} \]
   \[ \frac{E_2 - E_1}{T_2 - T_1} \times \text{hi.SC} = \text{SPAN} \]
   For \[ \text{hi.SC} \] settings see level 2.
   Example:
   \[ \begin{align*}
   T_1 & = 58° \\
   T_2 & = 385° \\
   \text{Instrument reading} & = 60° \\
   \text{Controller reading} & = 400° \\
   \text{Error} & = \begin{cases} 
   E_1 & (-) 2° \\
   E_2 & (-) 15° 
   \end{cases} \\
   \end{align*} \]
   \[ (-15) - (-2) \times 450 = (-13) \times 450 = (-)17.9 \]
   \[ 385 - 58 \]
   \[ 327 \]
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 stabilize at T2 before making any further adjustment. At this point, a \[ \text{Zero} \] adjustment may be needed, refer to step 1 above.
(2) Check that the temperature correctly stabilizes 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 \[ \text{hi.SC} \] \[ \text{Zero} \] and \[ \text{SPAN} \] 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 1. Other low Vdc signals can be connected via a suitable voltage divider network to match the controller input requirements.
1. Power up the controller, and in response to the prompt **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.

<table>
<thead>
<tr>
<th>Linear Range</th>
<th>Nom. Signal Span</th>
<th>Nom. Scale Span</th>
<th>Max. Scale Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin 1</td>
<td>0–20 mV</td>
<td>0 – 100</td>
<td>0 – 400</td>
</tr>
<tr>
<td>Lin 2</td>
<td>4–20 mV</td>
<td>0 – 100</td>
<td>-25 to 400</td>
</tr>
<tr>
<td>Lin 3</td>
<td>0–20 mV</td>
<td>0 – 1000</td>
<td>0 to 3000</td>
</tr>
<tr>
<td>Lin 4</td>
<td>4–20 mV</td>
<td>0 – 1000</td>
<td>-250 to 3000</td>
</tr>
<tr>
<td>Lin 5</td>
<td>0–20 mV</td>
<td>0 – 2000</td>
<td>0 to 3000</td>
</tr>
</tbody>
</table>

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 **SPI.d** as described in **SET-UP**, enter the configuration into the memory and proceed as follows:

   Calculate the values for the controller settings for **hi.SC** and **SPAN** 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

   \[
   hi.SC = \frac{\text{Nominal Signal Span} \times \text{required span}}{\text{actual signal span}} \times (20-4) \times (110-0) = 587 \\
   (7-4)
   \]

   \[
   \text{SPAN} = (hi.SC - \text{nominal scale span}) \times hi.SC \\
   \text{Nominal Scale Span}
   \]

   \[
   (587-1000) \times \frac{587}{1000} = -242
   \]

   These settings should provide the correct scaling adjustment, but a value for **Ero** 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 **Ero** adjustment. Should there be a difference between the two readings, a further adjustment of the **SPAN** setting can be made.
Communications
Installation/Cabling

RS232 Connections
RS232 is widely used for interfacing peripherals to PC’s and is designed for serial communications with single instrument up to distances of 15 metres, in a low electrical noise environment.

Connection is via a screened two core cable where the voltage signal on each line is referenced to the screen which is grounded. Most PC’s have one or two RS232 compatible ports fitted as standard.

Figure 2

RS485 Connections
RS485 is a half duplex serial communications link and is the standard most commonly used for industrial applications due to its high noise immunity and multi-drop capability. It enables a PC to communicate with up to 128 instruments over distances up to 1200 metres, and requires the addition of an RS485 interface card, or a separate RS232/485 converter.

Figure 3

Instrument Comms Settings
Immediately after power-up, both instrument, and PC comms settings need to be made compatible before communication between them is possible. Instrument defaults are shown below together with available options.

 ADDR (Address) This is a unique identification number that must be allocated to each instrument connected to the network.
Default = 0. Options; 1 to 247

 Baud (Baud rate) The setting determines the serial communication data transmission rate in bits/sec, and must match the PC settings.
Default = 9600.
Options:
1200; 2400; 4800; 9600 and 19200
NOTE: If a comms board has been retro fitted the default baud rate is 1200.

 Data (Data) Sets the transmission format, and must match the PC settings.

<table>
<thead>
<tr>
<th>Settings</th>
<th>Start Bits</th>
<th>Data Bits</th>
<th>Parity</th>
<th>Stop Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>1</td>
<td>8</td>
<td>n (none)</td>
<td>1</td>
</tr>
<tr>
<td>Option 1</td>
<td>1</td>
<td>8</td>
<td>e (even)</td>
<td>1</td>
</tr>
<tr>
<td>Option 2</td>
<td>1</td>
<td>8</td>
<td>o (odd)</td>
<td>1</td>
</tr>
</tbody>
</table>

 DBG (Debug) Commissioning and troubleshooting aid. Display shows when the instrument is transmitting or receiving data by rapidly flashing the three horizontal segments of the first and last digit of the display.
First digit = Tx; last digit = Rx
Default = Off. Options; off; on

Only use dbuG during commissioning or troubleshooting because it shares display segments and therefore corrupts the normal display.
Configuring Instrument Comms Settings

This should also be done immediately after power-up, and is only possible from the instrument front panel.

On power-up the controller will display the self test sequence followed by Alternating, inPT and none.

**Note:** During the following procedure the display will revert to alternating inPT and none after 60 seconds of keying inactivity, but will retain any settings already completed. Should this occur, or in the event of becoming ‘lost’ in the program, please start again from the alternating inPT and none display.

To select Level C (communications settings)

Press ▼ once display alternates LEUL and 5
Press and hold ★ and ▼ five times to reach level C display alternates LEUL and C

**Note:** Level C is only visible when the comms interface board is fitted to the unit

To set instrument comms address

Press ▲ once display alternates Addr and 0
Press and hold ★ and ▲ to index to chosen address number (1 to 247)

**Note:** In the absence of any conflicting information the following comms settings should be left as the default values.

To Read or Adjust Comms Settings

**Baud Rate**

Press ▲ once display alternates baud and 9600 (Default setting)
Press and hold ★ and use ▲ or ▼ keys to select preferred value.

**Data Format**

Press ▲ once display alternates dATa and 18n1 (Default setting)
Press and hold ★ and use ▲ or ▼ keys to select preferred setting.

**Debug Setting**

Press ▲ once display alternates dBUG and OFF (Default setting)
Press and hold ★ and use ▲ or ▼ keys to select ON

To Enter Settings Into Memory

Press and hold ▲ and ▼ for 3 seconds display alternates inPT and none

To check settings, repeat the above procedure

The unit is now ready to be configured from the PC.

**Note:** Where more than one instrument is connected to the system, it is useful at this point to list them by location, title and comms address. The list can then be used as a reference to ensure that the instruments are given the same identity when configuring the comms link from the PC.
**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.

**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.

**Cleaning**

Wipe down with damp cloth (water only).

**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.

**DIN Panel Cutout Size**

**1/32 DIN panel cutout size**

- 45.0mm ±0.6mm -0.0mm (1.77in. ±0.02in. -0.0in.) wide
- 22.2mm ±0.3mm -0.0mm (0.87in. ±0.01in. -0.0in.) high
- 9.5mm (0.374in) maximum panel thickness.

**Minimum Spacing**

1/16 DIN Cut out

1/32 DIN Cut out

20 mm (0.79)

10 mm (0.39)
## 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 factory set output options.

### 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 1.0mm² (18AWG/0.04in²).

### Inductive Loads

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

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**CAUTION**

*Snubber leakage current can cause some electromechanical devices to be held ON. Check with the manufacturers specifications.*

EN61010 - /CSA 22.2 No 1010.1 92

Compliance shall not be impaired when fitted to the final installation.

Designed to offer a minimum of basic insulation only. The body responsible for the installation is to ensure that supplementary insulation suitable for Installation Category II or III is achieved when fully installed.

To avoid possible hazards, accessible conductive parts of the final installation should be protectively earthed in accordance with EN6010 for Class 1 Equipment.

Output wiring should be within a protectively earthed cabinet.

Sensor sheaths should be bonded to protective earth or not be accessible.

Live parts should not be accessible without the use of a tool.

When fitted to the final installation, an IEC/CSA APPROVED disconnecting device should be used to disconnect both LINE and NEUTRAL conductors simultaneously.

A clear instruction shall be provided not to position the equipment so that it is difficult to operate the disconnecting device.

### Typical Connection Diagram

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

**F1 Fuse:** time lag type to IEC127. CSA/UL rating 1A 250Vac

**F2 Fuse:** High Rupture Capacity (HRC) Suitable for maximum rated load current

**S1 Switch:** IEC/CSA/UL Approved disconnecting Device

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![Typical Connection Diagram](image-url)
# Specifications

## 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
0-20 mV, 4-20 mV  
0-20 mA, 4-20 mA (must use 1Ω resistor)

## 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/SSd1/SSd2: solid state relay driver: To switch a remote SSR 5Vdc +0/-15% 15mA non-isolated  
Miniature power relay: form A/SPST contacts (AgCdO)  
rLY and rLY1: 2A/250ac resistive load  
rLY2: 1A/250ac 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  
3 elastomeric buttons

## Environmental
**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:** 0-50ºC (32-130°F)  
**Mouldings:** flame retardant polycarbonate  
**Weight:** 110g (3.9 oz)
# Ordering Information

<table>
<thead>
<tr>
<th>Model</th>
<th>3204 1/32 DIN Auto Tuning PID Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>3204</td>
<td>Compact 1/32 DIN AutoTune PID controller with the following standard features: User selectable inputs (thermocouple, RTD or 0-20, 4-20 mV or mA** linear process inputs), dual outputs for heat, cool and alarm; single ramp &amp; soak program, latching alarm and limit control capability, with user program security levels. Also, NEMA 4X / IEC IP66 front panel; large 4-digit display. Optional features include RS-485 or RS-232 ModBus RTU digital communications. 3 year warranty. Approvals: UL, cUL, CE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Outputs 1 and 2, Control Output or Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>11*</td>
<td>Two Relay Outputs: Output 1: 2 Amps at 250 VAC. Output 2: 1 Amp at 250 VAC. Both resistive loads</td>
</tr>
<tr>
<td>71</td>
<td>Two Outputs: Output 1: Solid State Relay Drive, 5 Vdc, 15mA. Output 2: Relay, 1 Amp at 250 VAC</td>
</tr>
<tr>
<td>77</td>
<td>Two Solid State Relay Drive Outputs: 5 Vdc, 15mA (X 2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>RS-485 Digital Communications Interface</td>
</tr>
<tr>
<td>2</td>
<td>RS-232 Digital Communications Interface</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>90-264 Vac</td>
</tr>
<tr>
<td>1</td>
<td>12-24 VDC/AC +/-20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3204 - 71 0 0 0</th>
<th>Typical Model Number</th>
</tr>
</thead>
</table>

*2 Relay Output Code “11” is not available with the 12-24 VDC/AC Power supply option

**0-20 mA or 4-20 mA Linear input signal requires a 1Ω resistor
# Sensor Selection

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

<table>
<thead>
<tr>
<th>Resistance Temperature Detector</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>rtd</td>
<td>-200 / 400°C -273 / 752°F</td>
<td>Pt100/RTD-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Linear Process Inputs (Input mV range: 0 to 50mV)</th>
<th>Displays</th>
<th>0 - 20mV</th>
<th>4 - 20mV</th>
<th>setpoint limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lin1</td>
<td>0 - 100</td>
<td></td>
<td>0 to 400</td>
<td>± 0.5%</td>
</tr>
<tr>
<td>Lin2</td>
<td>0 - 1000</td>
<td>0 - 100</td>
<td>-25 to 400</td>
<td>± 0.5%</td>
</tr>
<tr>
<td>Lin3</td>
<td>0 - 1000</td>
<td></td>
<td>0 to 3000</td>
<td>± 0.5%</td>
</tr>
<tr>
<td>Lin4</td>
<td>0 - 1000</td>
<td></td>
<td>-250 to 3000</td>
<td>± 0.5%</td>
</tr>
<tr>
<td>Lin5</td>
<td>0 - 2000</td>
<td></td>
<td>0 to 3000</td>
<td>± 0.5%</td>
</tr>
</tbody>
</table>

**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

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**Limited Warranty:**