User Guide

IM/C250_5

1/4 DIN Process Controller

C250

ABB

Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use". If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

One or more of the following symbols may appear on the equipment labelling:

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

GETTING STARTED

This manual is divided into 5 sections which contain all the information needed to install, configure, commission and operate the COMMANDER 250. Each section is identified clearly by a symbol as shown below.

Displays and Function Keys

- Displays and function keys
- LED Indication
- Error Messages

Operator Mode (Level 1)

- Operator menus for:
  - *Standard controller*
  - *Heat/Cool controller*
  - *Remote Set Point controller*
  - *Profile controller*
  - *Multiple Fixed Set Points controller*
- Auto tuning

Set Up Mode (Levels 2, 3 and 4)

- Level 2 – Tuning
- Level 3 – Set Points
- Level 4 – Profile

Configuration Mode (Levels 5 and 6)

- Level 5 – Basic hardware and control functions
- Level 6 – Ranges and passwords

Installation

- Siting
- Mounting
- Electrical connections

Symbol Identification and Section Contents

CONTENTS

1 DISPLAYS AND FUNCTION KEYS

1.1 Introduction – Fig. 1.1

The COMMANDER 250 front panel displays, function keys and LED indicators are shown in Fig. 1.1.

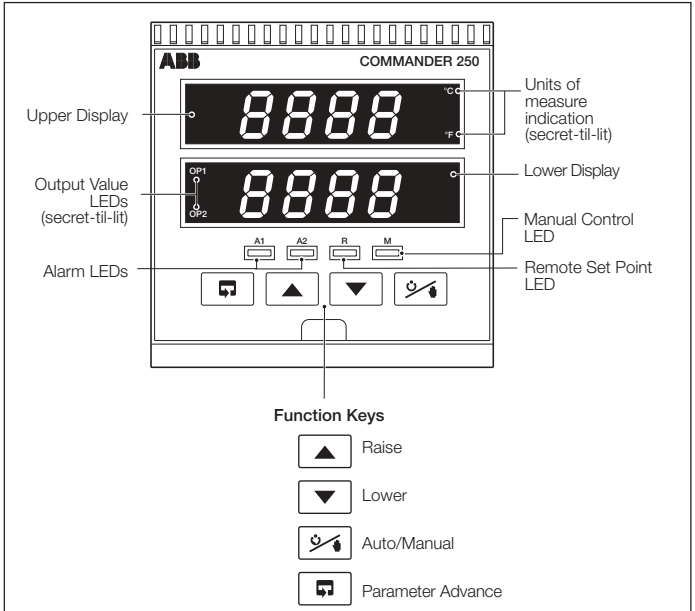
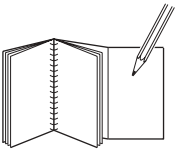
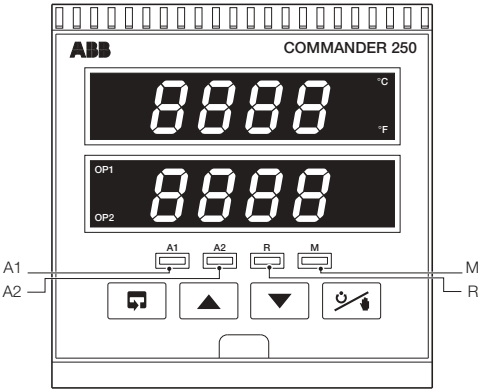


Fig. 1.1 Front Panel Displays, Function Keys and Indicators

Note.
The fold-out page inside on the back cover of this manual shows all the frames in the programming levels. Space is provided on the page for writing the programmed setting or selection for each frame.



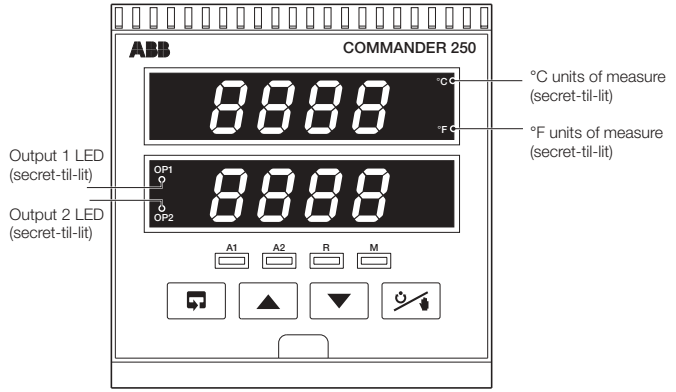
1.2 LED Alarms and Indicators – Figs. 1.2 and 1.3



LED	Status
All	• **All LEDs flashing – controller is in the configuration mode.**
A1	• Flashes when Alarm 1 is active (off when inactive).
A2	• Flashes when Alarm 2 is active (off when inactive).
R	• On when the controller is operating on the remote set point value. • Off when the controller is operating using the local set point value or one of the four fixed set points (in multiple set point mode). • Flashes when a Ramp/Soak profile is running.
M	• On when the controller is operating in Manual control mode. • Off when the controller is operating in Auto control mode. • Flashes when the controller is performing an auto-tune.

Fig. 1.2 LED Alarms and Indicators

...1.2 LED Alarms and Indicators – Figs. 1.2 and 1.3



LED	Status
OPI	• LED indicates when the output 1 (heat) value is displayed in the lower display.
OP2	• LED indicates when the output 2 (cool) value is displayed in the lower display.
°C	• LED indicates when the controller is configured to measure in degrees Celsius.
°F	• LED indicates when the controller is configured to measure in degrees Fahrenheit.

Fig. 1.3 Secret-til-lit Indicators

1.3 Use of Function Keys – Fig. 1.4

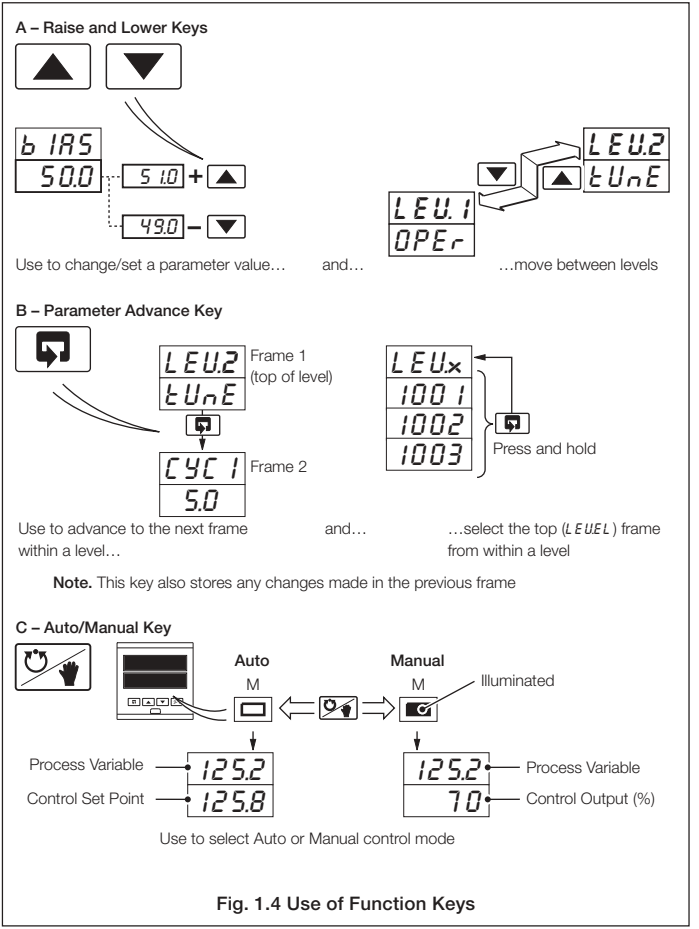


Fig. 1.4 Use of Function Keys

1.4 Error Messages

Display	Error/Action	To Clear Display
	**Calibration Error** Turn mains power off and on again. (If the error persists contact the Service Organization).	Press the ▲ key
	**Calibration Error** The configuration and/or setup data for the instrument is corrupted. Turn mains power off and on again (if the error persists, check the configuration/setup settings).	Press the ▲ key
	**A to D Converter Fault** The analog to digital converter is not communicating correctly.	Turn mains power off & on again. if the error persists contact the Service Organization
	**Process Variable Over/Under Range**	Restore valid input
	**Remote Set Point Over/Under Range** The remote set point value is over or under range. Flashing stops automatically when the remote set point comes back into range.	Select the local set point (rSP.n) in the Operating Page or the Set Points Level
	**Option Error** Communications to the option board have failed.	Contact the Service Organization
	**Auto-tune Error** The number displayed indicates the type of error present – see Table 2.1 in Section 2.7.	Press any key.

2 OPERATOR MODE

2.1 Introduction

Operator Mode (Level 1) is the normal day-to-day mode of the COMMANDER 250.

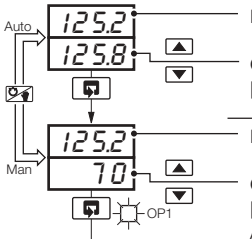
Frames displayed in level 1 are determined by the control strategy which is selected during configuration of the instrument – see Section 4.

Note. Only the operating frames relevant to the configured strategy are displayed in Operator Mode.

The five control strategies are:

- **Standard controller** – page 9
- **Heat/Cool controller** – page 10
- **Remote Set Point controller** – page 12
- **Profile controller** – page 14
- **Multiple Fixed Set Points controller** – page 16

2.2 Standard Controller



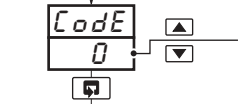
Process Variable Value

Control Set Point Value (Local set point)
[Set point low limit to set point high limit]

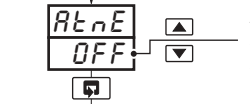
Process Variable Value

Control Output Value (%)
[0 to 100% (–10% to 110% for analog output)]
Adjustable in manual mode only.

Ramping Set Point Value (Read only)
The actual set point value is displayed i.e. the instantaneous value the controller is working to.

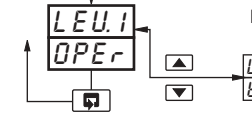


Security Code
[0 to 9999]
Select the appropriate security code to access:
Auto-tune enable frame (Level 1),
Set Up mode (Levels 2, 3, 4).



Auto-tune Enable
On – Auto-tune on
OFF – Auto-tune off

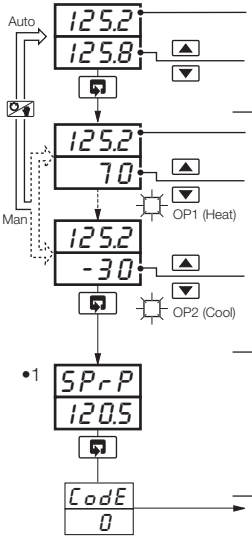
Refer to page 18 for the Auto-tune procedure.



Level 1 (Operator mode)
Refer to Section 3 for levels 2, 3 and 4.

•1 Not displayed if the ramping set point facility is turned off – refer to Section 3.3.

2.3 Heat/Cool Controller



Process Variable Value

Control Set Point Value (Local set point)
[Set point low limit to set point high limit]

Process Variable Value

Control Output Value (Heat %)
[0% to 100% (0% to 110% for analog output)]
If adjusted below 0% the 'Cool' frame is displayed.

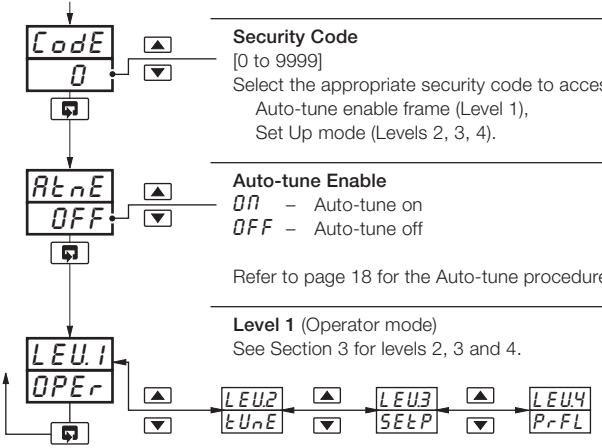
Control Output 2 Value (Cool %)
[0% to –100% (0% to –110% for analog output)]
If adjusted above 0% the 'Heat' frame is displayed.

Ramping Set Point Value (Read only)
The actual set point value is displayed i.e. the instantaneous value the controller is working to.

Continued on next page.

•1 Not displayed if the ramping set point facility is turned off – refer to Section 3.3.

...2.3 Heat/Cool Controller



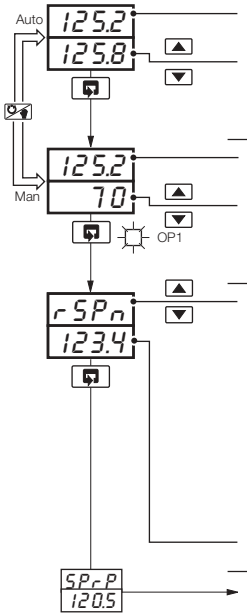
Security Code
[0 to 9999]
Select the appropriate security code to access:
Auto-tune enable frame (Level 1),
Set Up mode (Levels 2, 3, 4).

Auto-tune Enable
ON – Auto-tune on
OFF – Auto-tune off

Refer to page 18 for the Auto-tune procedure.

Level 1 (Operator mode)
See Section 3 for levels 2, 3 and 4.

2.4 Remote Set Point Controller



Process Variable Value

Control Set Point Value
[Set point low to set point high limit]
Adjustable in local Set Point Mode only.

Process Variable Value

Control Output Value (%)
[0% to 100% (–10% to 110% for analog output)]
Adjustable in manual mode only.

Remote Set Point Selection
rSPY – Remote Set Point
rSPn – Local Set Point

Local or remote set point can also be selected using a digital input.

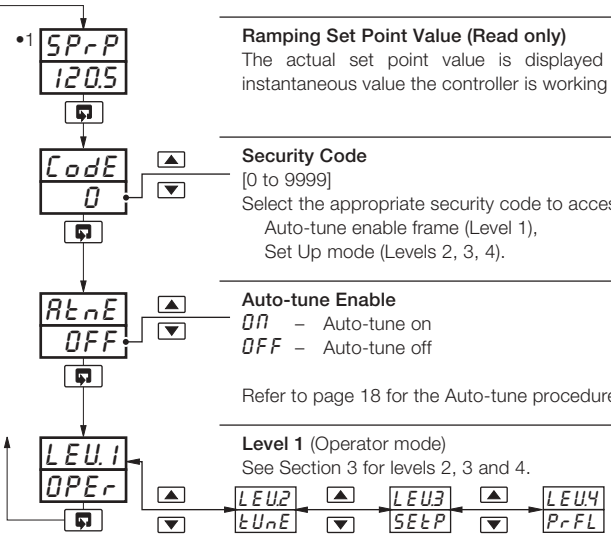
The option to change the set point selection at this frame can be disabled in the configuration level.

Remote Set Point Value (read only)

Continued on next page…

Note. If the remote set point input fails while selected, the controller selects the local set point value automatically. The upper display changes to rSPF and the lower display flashes. When the fault condition is removed the remote set point is re-selected automatically. To clear the error condition while the remote set point input is still outside its allowed range, select the local set point by pressing the ▼ key (rSPn is displayed).

...2.4 Remote Set Point Controller



Ramping Set Point Value (Read only)
The actual set point value is displayed i.e. the instantaneous value the controller is working to.

Security Code
[0 to 9999]
Select the appropriate security code to access:
Auto-tune enable frame (Level 1),
Set Up mode (Levels 2, 3, 4).

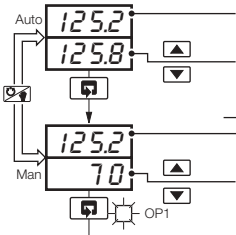
Auto-tune Enable
ON – Auto-tune on
OFF – Auto-tune off

Refer to page 18 for the Auto-tune procedure.

Level 1 (Operator mode)
See Section 3 for levels 2, 3 and 4.

•1 Not displayed if the ramping set point facility is turned off – refer to Section 3.3.

2.5 Profile Controller



Process Variable Value

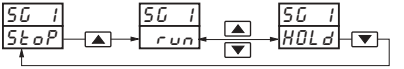
Control Set Point Value
[Set point low limit to set point high limit]

Process Variable Value

Control Output Value (%)
[0% to 100% (–10% to 110% for analog output)]
Adjustable in manual mode only.

Profile Segment Number (1 to 4) currently active

Profile Status



StOP – **Profile inactive** – the control set point is equal to the local set point value when the profile is not running.

run – **Profile active** – currently operating on the segment indicated.

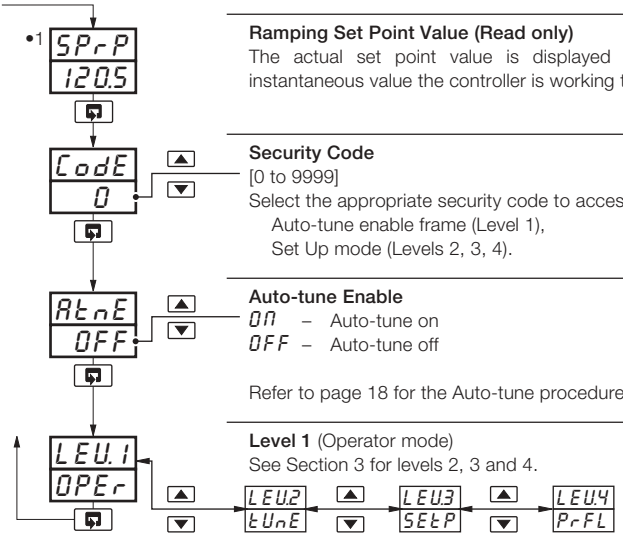
HOLD. – **Profile hold** – pauses the current ramp or soak mode by putting it into 'Hold' mode. The guaranteed ramp soak feature can also be used to put the profile into a 'Hold' mode until the process variable comes back within the hysteresis band.

Note. The profile status can be changed using a digital input.

SPrP
120.5

Continued on next page…

...2.5 Profile Controller



Ramping Set Point Value (Read only)
The actual set point value is displayed i.e. the instantaneous value the controller is working to.

Security Code
[0 to 9999]
Select the appropriate security code to access:
Auto-tune enable frame (Level 1),
Set Up mode (Levels 2, 3, 4).

Auto-tune Enable
ON – Auto-tune on
OFF – Auto-tune off

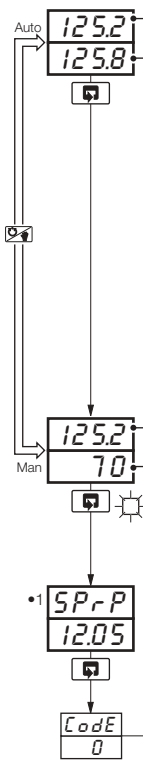
Refer to page 18 for the Auto-tune procedure.

Level 1 (Operator mode)
See Section 3 for levels 2, 3 and 4.

•1 Not displayed if the ramping set point facility is turned off – refer to Section 3.3.

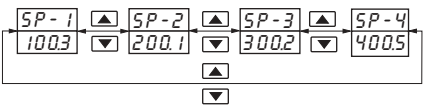
2.6 Multiple Fixed Set Points Controller

If the Multiple Fixed Set Points Controller type is selected during configuration, four fixed control set points can be set – see Section 4.4.



Process Variable Value

Fixed Control Set Point Selected



Notes.

- The top display momentarily displays the set point selected before reverting to the display of the process variable value.
- A digital input can also be used to select the fixed set points.

Process Variable Value

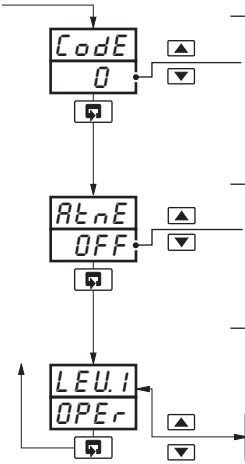
Control Output Value (%)
[0% to 100% (–10% to 110% for analog output)]
Adjustable in manual mode only.

Ramping Set Point Value (Read only)
The actual set point value is displayed i.e., the instantaneous value the controller is working to.

Continued on next page…

•1 Not displayed if the ramping set point facility is turned off – refer to Section 3.3.

...2.6 Multiple Fixed Set Points Controller



Security Code
[0 to 9999]
Select the appropriate security code to access:
Auto-tune enable frame (Level 1),
Set Up Mode (Levels 2, 3, 4).

Auto-tune Enable
ON – Auto-tune on
OFF – Auto-tune off

Refer to page 18 for the Auto-tune procedure.

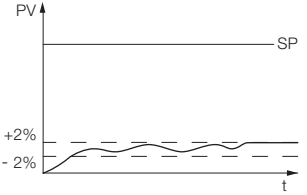
Level 1 (Operator mode)
See Section 3 for Levels 2, 3 and 4.

2.7 Auto-tune

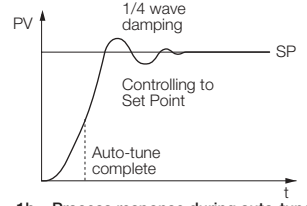
Notes.

- Auto-tune optimizes process control by monitoring process performance and automatically updates the control parameters.
- Before starting auto-tune, the process variable must be stable (±2% of engineering range).

1 – 'Start up' auto-tune (from manual mode)

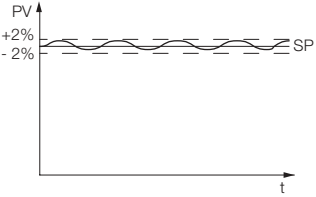


1a – Stable process before auto-tune

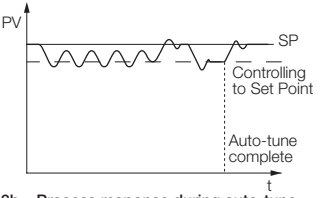


1b – Process response during auto-tune

2 – 'At set point' auto-tune (from manual or automatic mode)

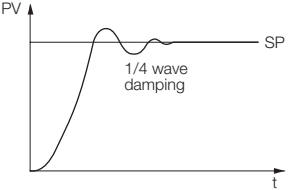


2a – Stable process before auto-tune



2b – Process response during auto-tune

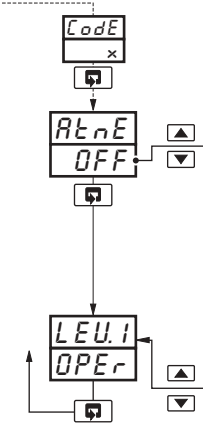
Note. The time taken to complete autotune depends upon the system response time.



Typical process response after auto-tune

Fig 2.1 Typical Auto-tune Cycles

...2.7 Auto-tune



From **Security Code** frame (any Operating page)
The correct password must be entered to access the auto-tune frame.

Auto-tune Enable
ON – Auto-tune on
OFF – Auto-tune off

Auto-tune can be stopped at any time by pressing the key.

Settings for P + I control only
To tune for P + I control only, set the derivative term to 'OFF' in the Tuning Level – see Section 3.2.

Notes.

- On completion of auto-tune, the controller enters auto control mode and begins to control the process using the new PID values. For fine-tuning – see Section 3.
- For heat/cool control the cool proportional band is set to the same value as the heat proportional band (this value may need modification).
- If an error occurs during auto-tune, the controller reverts to manual mode with the control output set to the configured output value. An error message is displayed – see Table 2.1.

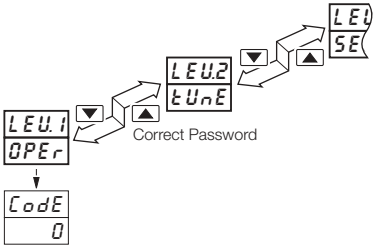
Error	Description	Error	Description
1	PV failed during auto-tune	7	A resultant P, I or D value was calculated out of range
2	Auto-tune has timed out during an auto-tune step	8	PV limit exceeded (At start up auto-tune)
3	Process too noisy to auto-tune	9	Controller put into configuration mode
4	Process too fast to auto-tune	10	Auto-tune terminated by user
5	Process too slow to auto-tune	11	PV is changing in the wrong direction during step test
6	PV deviated from set point by >25% eng. span during frequency response test		

Table 2.1 Auto-tune Error Codes

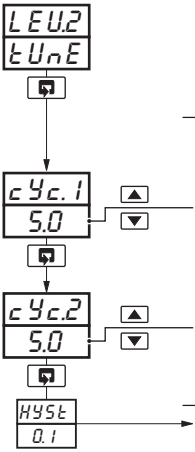
3 SET UP MODE

3.1 Introduction

To access the Set Up Mode (Levels 2, 3 and 4) the correct password must be entered in the security code frame (the default password code is 0). Refer to the fold-out sheet at the back of this manual for the contents of these levels.



3.2 Tuning (Level 2)



Level 2 – Tuning Level

Note. To select this frame from anywhere in this page, press the [⟲] key for a few seconds.

Cycle Time

Heat Time Proportioning Output
[1.0 to 300.0 seconds (<1.0 = 'On/Off' control)]

Cool Time Proportioning Output
[1.0 to 300.0 seconds (<1.0 = 'On/Off control)]

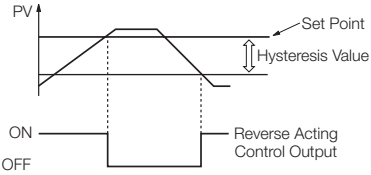
Continued on next page.

•1 Displayed only if output 1 is assigned to a relay or logic output.
•2 Displayed only if heat/cool hardware configuration is selected.

…3.2 Tuning (Level 2) – Fig. 3.2

•1 HYSt 0.1

On/Off Hysteresis Value
(used for both heat and cool outputs)
[In engineering units]



Proportional Band
Enter the proportional band value for the heat and cool outputs.

Pb-H 100.0

Heat Output (Output 1)
[0.1% to 999.9%]

•2 Pb-c 100.0

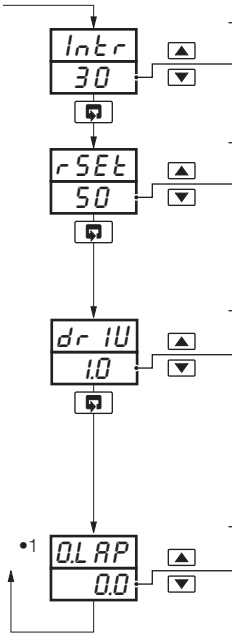
Cool Output (Output 2)
[0.1% to 999.9%]

Intr 30

Continued on next page.

•1 Displayed only if On/Off control is selected for either output.
•2 Displayed only if heat/cool hardware configuration is selected.

...3.2 Tuning (Level 2)



Integral Action Time
[1 to 7200 seconds or OFF (OFF=0)]

Manual Reset Value
[0% to 100% or –100% to +100% for heat/cool]
This value is applied as a bias to the control output.

Note. Manual reset is applied with integral action both on and off.

Derivative Action Time
[0.1 to 999.9 seconds or OFF (OFF=0)]

Overlap for Heat/Cool Control
[–20.0% to +20.0%]
This frame defines the portion of the proportional band (Proportional band heat + Proportional band cool) over which both outputs are active – see Fig. 3.1. Neither output is active in the deadband.

A positive value gives an overlap and a negative value a deadband.

•1 Displayed only if a heat/cool hardware configuration is selected.

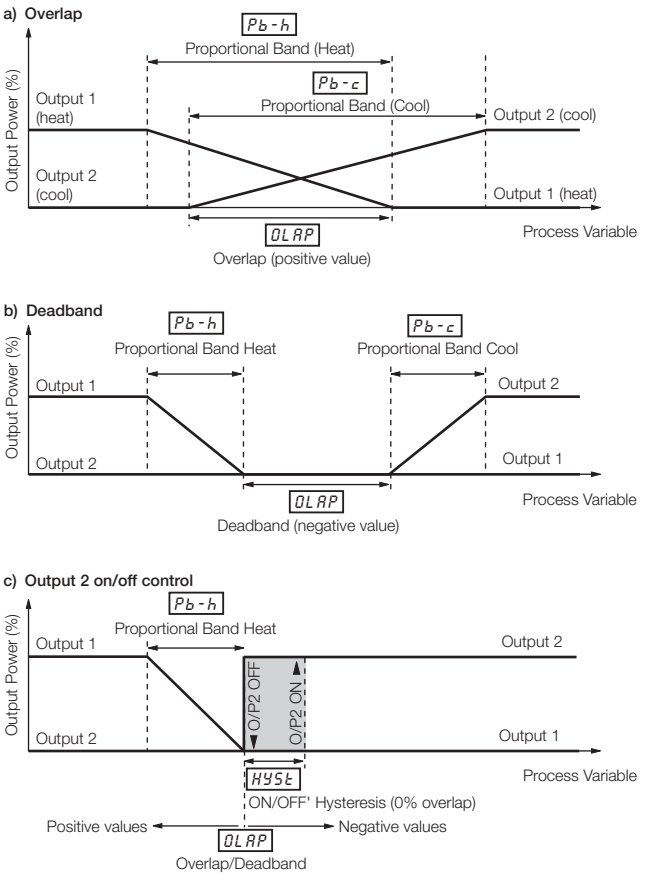
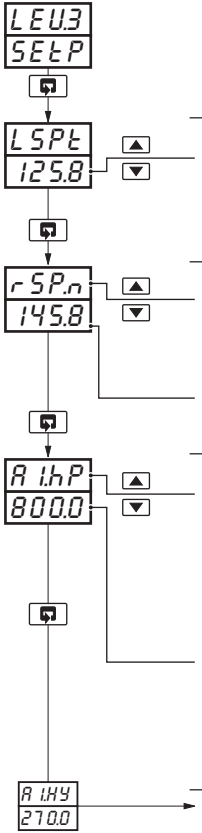


Fig. 3.1 Proportional Band & Deadband/Overlap – Heat/Cool Control Only

3.3 Set Points (Level 3)



Level 3 – Set Points Level

Note. To select this frame from anywhere in this page, press the [⟲] key for a few seconds.

Local Set Point Value
[Within set point high and low limits, in engineering units]

Remote Set Point Selection
Set Point Type:
- rSP.Y – remote set point
- rSP.n – local set point

Remote set point value.

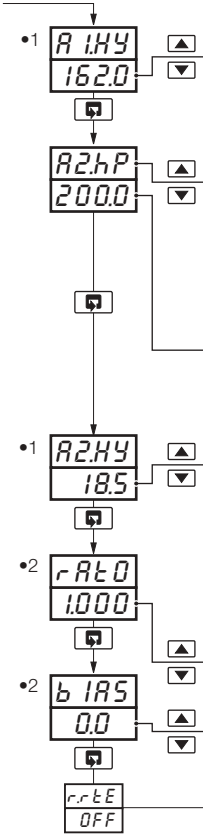
Alarm 1 Trip Point
Alarm type:
- A 1.hP = High process alarm
- A 1.LP = Low process alarm
- A 1.hd = High deviation alarm
- A 1.Ld = Low deviation alarm
- A 1.Lb = Loop break alarm

Trip Point:
Process & deviation alarms [in engineering units]
Loop break alarm [1 to 9999 seconds]

Continued on next page.

•1 Displayed only if the remote set point option is selected.

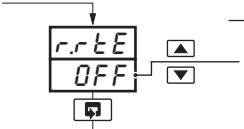
...3.3 Set Points (Level 3)



•1 Displayed only if custom alarm hysteresis is selected – see section 4.3.2, not displayed if Loop Break Alarm type selected.

•2 Displayed only if the remote set point option is selected.

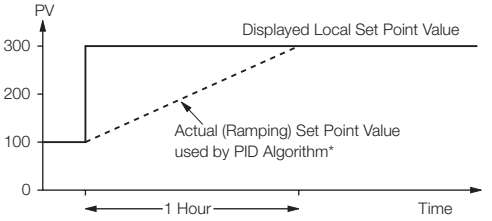
...3.3 Set Points Level



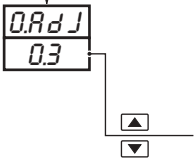
Ramp Rate (for ramping set point facility)
[1 to 9999 engineering units per hour, or OFF]

The ramping set point facility can be used to prevent a large disturbance to the control output when the set point value is changed. This only applies to the local and multiple fixed set points.

Note. For remote set points, the ramp rate is applicable only when switching from remote to local mode, not from local to remote.



* e.g. Ramp Rate = 200 Increments/Hour

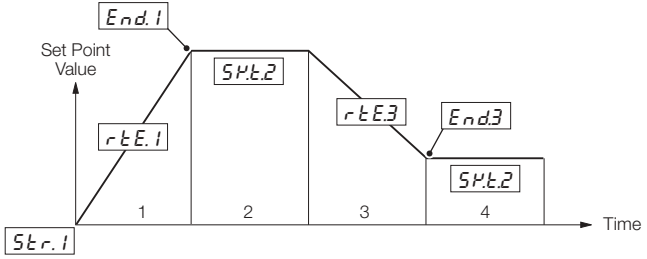


Offset Adjustment
An offset can be applied to the process variable input to enable spot calibration or the removal of system errors.

[±10% of engineering range in engineering units]

3.4 Profile (Level 4)

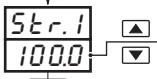
A four segment ramp/soak profile facility is provided. This level can only be accessed if the profile option is selected in the configuration level. The four segments are fixed as ramps or soaks as follows:



Level 4 – Profile Level

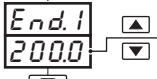
Note. To select this frame from anywhere in this page, press the [↵] key for a few seconds.

•1



Start value for 1st Segment (ramp).
[Within display range (in engineering units)]

Enter the start value required.



End Value for 1st Segment (ramp).
[Within display range (in engineering units)]

Enter the end value required.

Continued on next page.

•1 With the self-seeking set point facility enabled, the first ramp starts at the current process variable value instead of the start value for the 1st segment.

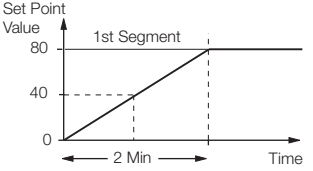
...3.4 Profile (Level 4)

•1 rtE.1 / 40.00

Ramp Rate for 1st Segment.
[Engineering units*]

Enter the ramp rate required.

* The time option Eng Units/hr or Eng Units/min is set in the configuration level – see section 4.3.2.



Example. Required Ramp Rate 40°C/min
Ramp Rate set to 40, Time Option set to 'Min' – see section 4.3.2

SPt.2 / 60.00

Soak Time for 2nd Segment.
[0 to 999.9 minutes or hours]*

End.3 / 100.0

End Value for 3rd Segment (ramp).
[Within display range (in engineering units)]

rtE.3 / 20.00

Ramp Rate for 3rd Segment.
[Engineering units/hour or /minute]*

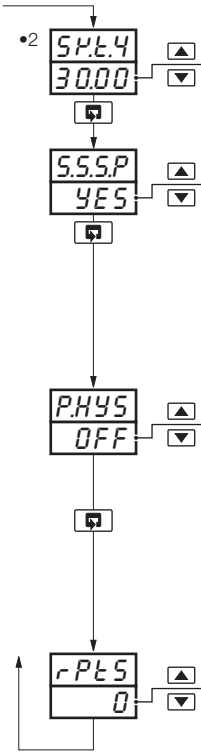
* Depending on the time option selected in the configuration level.

SPt.4 / 30.00

Continued on next page.

•1 The engineering value is shown with an extra decimal place (up to a maximum of 3) for greater accuracy in setting the ramp rate.

...3.4 Profile (Level 4)



Soak Time for 4th Segment.
[0 to 999.9 minutes or hours]*
* Depending on the time option selected in the configuration level.

Self Seeking Set Point Enable.
YES – enable self seeking set point
nO – disable self seeking set point

When enabled, the controller inserts the current process variable value as the starting point on initiation of the profile (instead of the start value for segment 1).

Profile Hysteresis for Guaranteed Ramp/Soak.
[In engineering units or OFF = 0]

If the process variable deviates from the set point by more than the value set, the program is suspended but continues automatically when the process variable returns within the set limits. The hysteresis value applies above and below set point under all program conditions.

Number of Program Repeats
[0 to 99 or infinite (InFt > 100]

•2 The engineering value is shown with an extra decimal place (up to a maximum of 3) for greater accuracy in setting the ramp rate.

4 CONFIGURATION MODE

4.1 Introduction

The Configuration Mode comprises two levels (5 and 6) as shown in Fig. 4.2.

Level 5 is divided into four frames. For most simple applications it is only necessary to set up the parameters in the first frame.

Note.
When in the configuration level:

- All the LED indicators flash.
- All relays and logic outputs are turned off.
- The analog output reverts to 0% (4mA) output level.

4.2 Accessing the Configuration Mode – Fig. 4.1

To access the Configuration Mode, set the security switch to the 'Configure' position (levels 1 to 4 cannot be accessed from this setting). When the configuration parameters are programmed, reset the security switch to the 'Normal' position. The Operating page is displayed automatically.

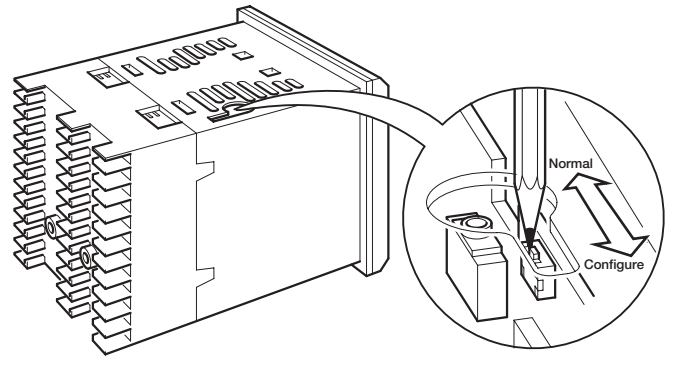


Fig. 4.1 Accessing the Configuration Mode (Config./Normal Switch)

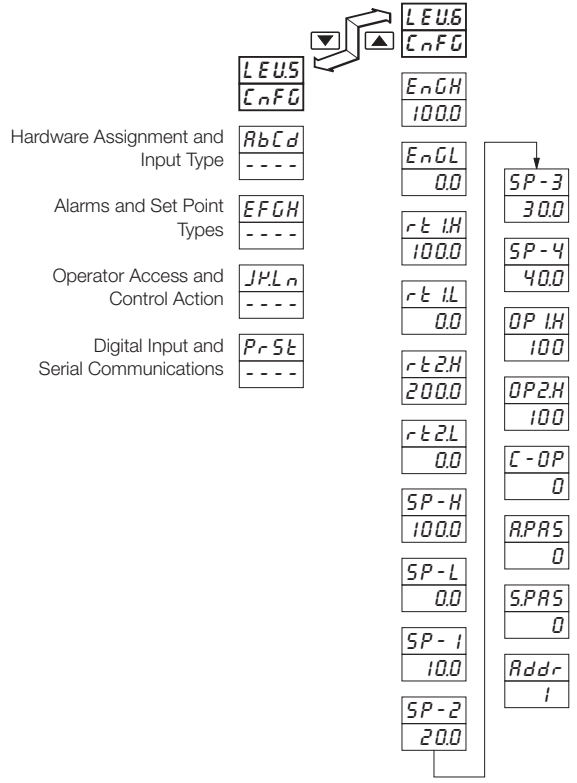


Fig. 4.2 Configuration Frames (Levels 5 and 6)

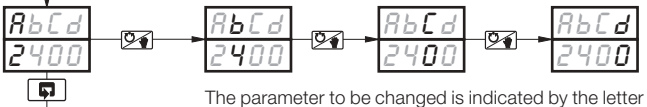
4.3 Basic Hardware and Configuration (Level 5)

4.3.1 Hardware Assignment and Input Type – Fig. 4.3

Level 5 – Configuration

Note. To select this frame from anywhere in this page, press the [↩] key for a few seconds.

'ABCD' Settings



The parameter to be changed is indicated by the letter which is flashing. Parameter options are shown in Fig. 4.3.

- A = Hardware configuration
- b = Input type and range
- C = Temperature units
- d = Process variable display decimal places

Note 1. When the input type (parameter b) is changed, the range is set automatically to the maximum permissable for the input type selected.

Note 2. For custom settings contact the local distributor.

Continued on page 34.

A – Hardware Configuration

Frequency		Rly 1	Rly 2*	Rly 3*	Logic O/P	An. O/P 1	An. O/P 2*	Control Type
50Hz	60Hz							
1	A	O/P 1	Alm 1	Alm 2	O/P 1	PV	SP	Time Prop. or On/Off
2	b	Alm 1	Alm 2	None	None	O/P 1	PV	Analog Prop.
3	C	O/P 1	O/P2	Alm 1	O/P 1	PV	SP	Heat – Time Prop. Cool – Time Prop.
4	d	O/P2	Alm 1	Alm 2	O/P2	O/P 1	PV	Heat – Analog Cool – TP or On/Off
5	E	Alm 1	Alm 2	None	O/P 1	PV	SP	Alm Unit or Logic O/P Time Prop.
U		Custom	Custom	Custom	Custom	Custom	Custom	Custom

* Available only if option board is fitted

B – Input Type and Range Configuration

Display		Display	
b	THC Type B	1	0 to 20 mA
E	THC Type E	2	4 to 20 mA
J	THC Type J	3	0 to 5 V
K	THC Type K	4	1 to 5 V
n	THC Type N	6	0 to 50 mV
r	THC Type R	7	4 to 20 mA (square root linearisers)
S	THC Type S	U	Custom Configuration
t	THC Type T		
P	PT100 RTD		

C – Temperature Units

Display	Temperature Units
C	Degrees C*
F	Degrees F*
0	No temperature units

* Temperature inputs only

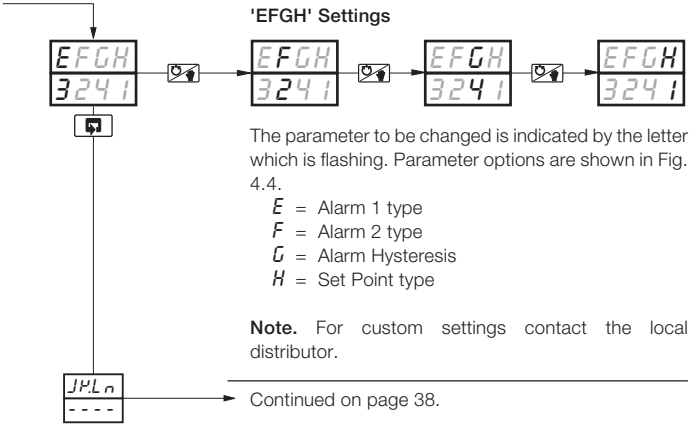
D – Process Variable Display Decimal Places

Display	
0	xxxx
1	xxx . x
2	xx . xx
3	x . xxx

Fig. 4.3 Hardware Assignment and Input Type

4.3.2 Alarms and Set Point Types – Fig. 4.4

Note. All relays are **de-energised** in the alarm state.



'EFGH' Settings

The parameter to be changed is indicated by the letter which is flashing. Parameter options are shown in Fig. 4.4.

- E = Alarm 1 type
- F = Alarm 2 type
- G = Alarm Hysteresis
- H = Set Point type

Note. For custom settings contact the local distributor.

Continued on page 38.

E – Alarm 1 Type*

Display	
0	None
1	High Process
2	Low Process
3	High Deviation
4	Low Deviation
5	Loop Break

F – Alarm 2 Type*

Display	
0	None
1	High Process
2	Low Process
3	High Deviation
4	Low Deviation
5	Loop Break

* Refer to Figs. 4.5 and 4.6 for alarm action

G – Alarm Hysteresis

Display		
0	None	Value in % of engineering range
1	0.1%	
2	0.2%	
3	0.5%	
4	1.0%	
5	2.0%	
6	5.0%	
U	Custom	Value in engineering units **(See Note 1)**

Note 1. When custom alarm hysteresis is selected, the alarm hysteresis values are set individually in the **set up level** – see section 3.3.

H – Set Point Type

Display		
0	Local Set Point Only	
1	Local + Remote Set Point (no Remote Set Point Tracking)**	**(See Note 2)**
2	Local + Remote Set Point (with Remote Set Point Tracking)**	
3	Multiple Fixed Set Points	
4	Ramp/Soak (Time Units in Minutes)	
5	Ramp/Soak (Time Units in Hours)	

**Only available if option board is fitted. Remote set point input is 4 to 20 mA

Note 2. With remote set point tracking enabled the local set point tracks the remote set point when in the remote set point mode.

Fig. 4.4 Alarms and Set Point Types

...4.3.2 Alarms and Set Point Types – Fig. 4.4

Note. All relays are **de-energised** in the alarm state.

Loop Break Alarm

The loop break alarm indicates a fault in the control loop (e.g. failure of a heating element in a furnace). If the control output remains at maximum or minimum for a time exceeding the trip value (in seconds) without any response in the process value, the loop break alarm is activated.

Process and Deviation Alarms (High/Low) – Figs 4.5 and 4.6

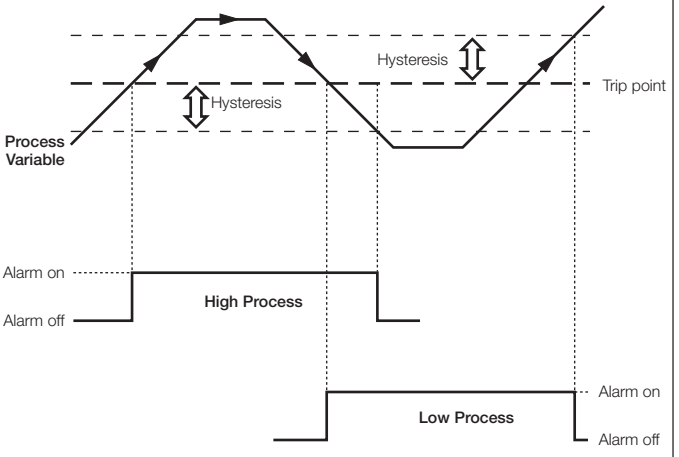
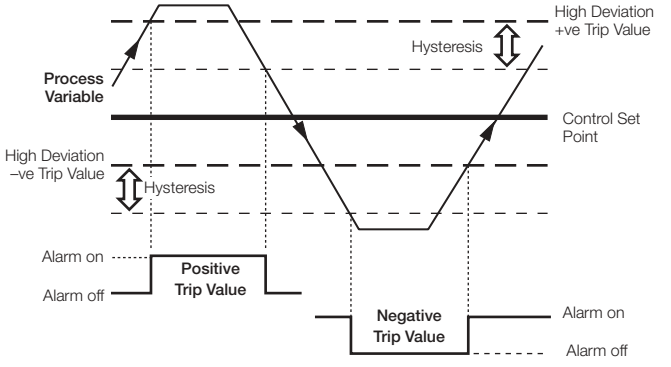
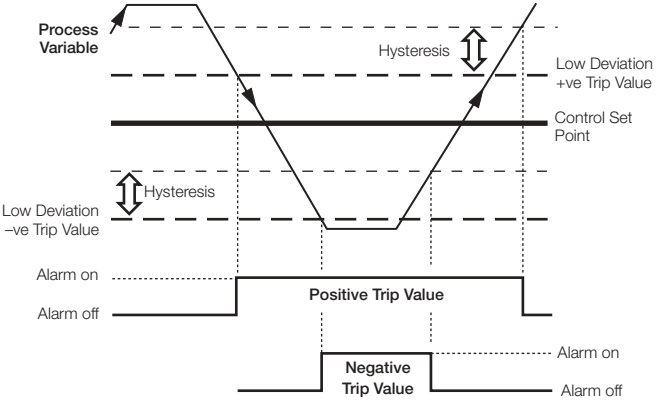


Fig. 4.5 High and Low Process Alarm Action



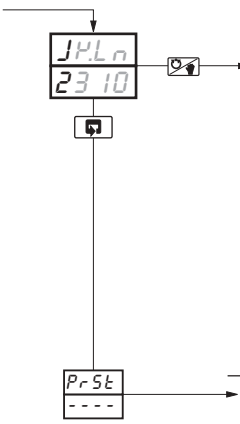
High Deviation Alarm



Low Deviation Alarm

Fig. 4.6 High and Low Deviation Alarm Action

4.3.3 Operator Access and Control Action – Fig. 4.7



'JKLN' Settings

The parameter to be changed is indicated by the letter which is flashing. Parameter options are shown in Fig. 4.7.

- J = Power recovery mode
- K = Operator selection enable – control functions
- L = Operator selection enable – set point functions
- n = Control action

Note. For custom settings contact the local distributor.

Continued on page 40.

J – Power Recovery Mode

Display	Mode
0	Last Mode
1	Manual with Last Output
2	Manual with 0.0% Output
3	Manual with 100.0% Output
4	Auto
U	Custom

K – Operator Selection Enable Control Functions

Display	Auto/Manual and Autotune
0	Enable Both Functions
1	Disable A/M, Enable Auto-tune
2	Enable A/M, Disable Auto-tune
3	Disable Both Functions

L – Operator Selection Enable – Set Point Functions

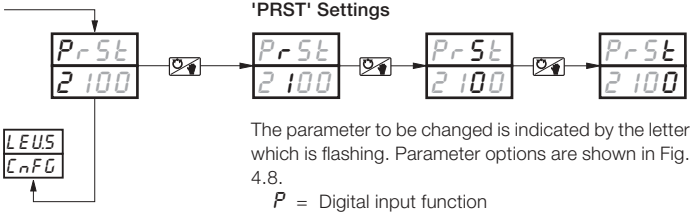
Display	Local Set Point Adjustment and Local/Remote Set Point Selection
0	Enable Both Functions
1	Disable Set Point Adjust, Enable Local/Remote Selection
2	Enable Set Point Adjust, Disable Local Remote Function
3	Disable Both Functions

N – Control Action

Display	Heat Action	Cool Action
0	Reverse	Direct
1	Direct	Reverse

Fig. 4.7 Operator Access and Control Action

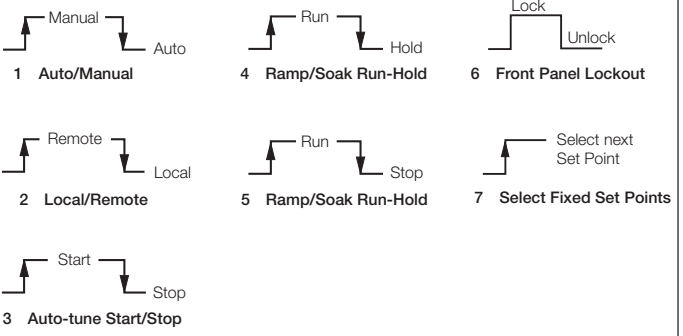
4.3.4 Digital Input and Serial Communications – Fig. 4.8



The parameter to be changed is indicated by the letter which is flashing. Parameter options are shown in Fig. 4.8.

- P = Digital input function
- r = Analog input digital filter
- S = Serial communications configuration
- t = Serial communication parity

Note. For custom settings contact the local distributor.



Note. All digital input functions except 6 are triggered on the rising/falling edge, to enable the front panel keys to change the function when the digital input is operational.

Fig. 4.8 Digital Inputs

P – Digital Input Functions

Display	Function
0	None
1	Auto/Manual
2	Local/Remote
3	Auto-tune Start
4	Ramp/Soak Run-Hold
5	Ramp/Soak Run-Stop
6	Front Panel Lockout
7	Select Fixed Set Points

R – Analog Input Digital Filter

Display	
0	0 seconds
1	1 second
2	2 seconds
5	5 seconds
A	10 seconds
B	20 seconds
C	40 seconds
D	60 seconds

Input filter averages the process variable input values over the time set

S – Serial Communication Configuration

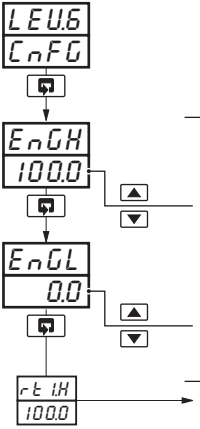
Display	Baud Rate, 2/4 Wire
0	Off
1	2400, 2 Wire
2	2400, 4 Wire
3	9600, 2 Wire
4	9600, 4 Wire

T – Serial Communications Parity

Display	
0	None
1	Odd
2	Even

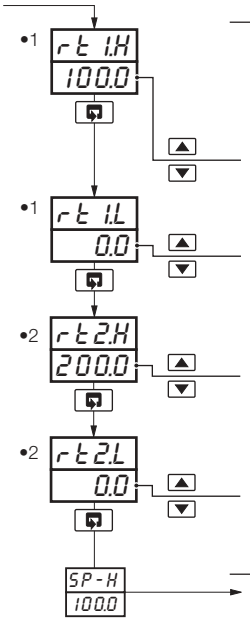
Fig. 4.9 Digital Input and Serial Communications

4.4 Ranges and Passwords (Level 6)



•1 The engineering range high and low values are automatically set to the maximum allowed value when thermocouple or RTD is selected in the configuration level – see Section 4.3.1.

...4.4 Ranges and Passwords (Level 6)



Retransmission Range
The retransmission range defines engineering range to be transmitted

Retransmission High (20mA) Analog Output 1
[–999 to 9999 (in engineering units)]

Retransmission Low (4mA) Analog Output 1
[–999 to 9999 (in engineering units)]

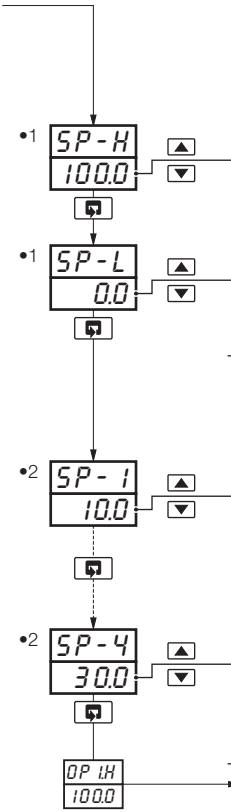
Retransmission High (20mA) Analog Output 2
[–999 to 9999 (in engineering units)]

Retransmission Low (4mA) Analog Output 2
[–999 to 9999 (in engineering units)]

Continued on next page...

•1 Displayed only if the analog output is configured to retransmit the process variable or control set point value.
•2 Displayed only if the retransmission option board is fitted.

...4.4 Ranges and Passwords (Level 6)



Set Point Limit
The Set Point Limit defines limits within which the local set point can be adjusted (these limits also apply to remote set point).

•1 **High Limit**
[–999 to 9999]

•1 **Low Limit**
[–999 to 9999]

Fixed Set Point Values (1 to 4)
Select the set point values required in the multiple fixed set point facility.

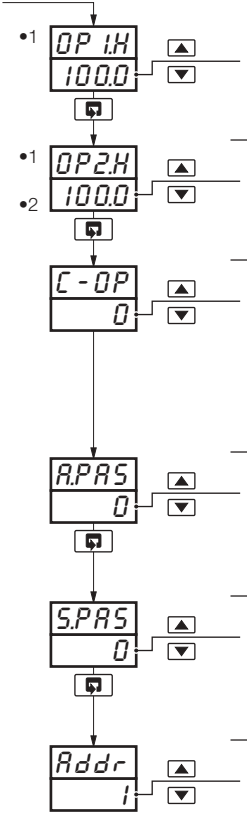
•2 **Fixed Set Point 1**
[–999 to 9999 (in engineering units)]

•2 **Fixed Set Point 4**
[–999 to 9999 (in engineering units)]

Continued on next page…

•1 This limit applies to the local and remote set point values.
•2 Displayed only if the multiple fixed set point facility is selected.

…4.4 Ranges and Passwords (Level 6)



Output 1 (Heat) High Limit
[0% to 110%]

Output 2 (Cool) High Limit
[0% to 110%]

Configured Output
[–10% (–110% for heat/cool) to 110% or LAST (default)]
This output value is used when:
- Manual control is selected using a digital input,
- the process variable input fails,
- the auto-tune fails.

Auto-Tune Password
[0 to 9999 (default 0)]

Enables access to the auto-tune facility in the operating level (Level 1).

Setup Password
[0 to 9999 (default 0)]

This password enables access to the setup levels (levels 2, 3, and 4) and to the auto tune facility.

Modbus Address
[1 to 99]

This frame allows the Modbus address to be set.

•1 This value applies only in automatic mode.
The low limit is set automatically to 0.0% (–10% for analog outputs).
•2 Displayed only if a heat/cool hardware configuration is selected.

EC Directive 89/336/EEC

In order to meet the requirements of the EC Directive 89/336/EEC for EMC regulations, this product must not be used in a non-industrial environment.

End of Life Disposal

This instrument does not contain any substance that will cause undue harm to the environment. It can therefore be safely considered as normal waste and disposed of accordingly.

Cleaning

Clean the front panel only, using warm water and a mild detergent.

5.1 Siting – Figs. 5.1 and 5.2

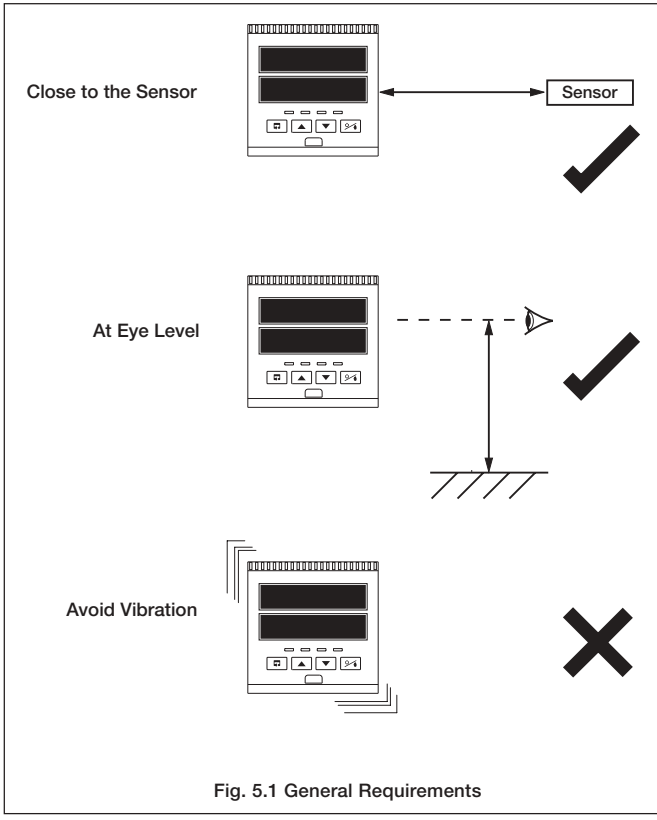
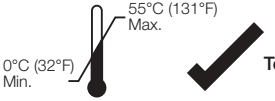


Fig. 5.1 General Requirements

...5.1 Siting – Figs. 5.1 and 5.2



Temperature Limits

Humidity Limits

0 to 90% RH

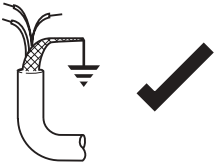
IP66/NEMA4X
(front panel)

IP20
(rear)

Environmental Limits

Use Screened Cable

+



Warning. Select a location away from strong electrical and magnetic fields. If this is not possible, particularly in applications where mobile communications equipment is expected to be used, screened cables within earthed (grounded) metal conduit must be used.

Fig. 5.2 Environmental Requirements

5.2 Mounting – Figs. 5.3 and 5.4

The instrument is designed for panel mounting (see Fig. 5.4). Overall dimensions are shown in Fig. 5.3.

Note. For NEMA4X protection, a minimum panel thickness of 2.5mm is recommended.

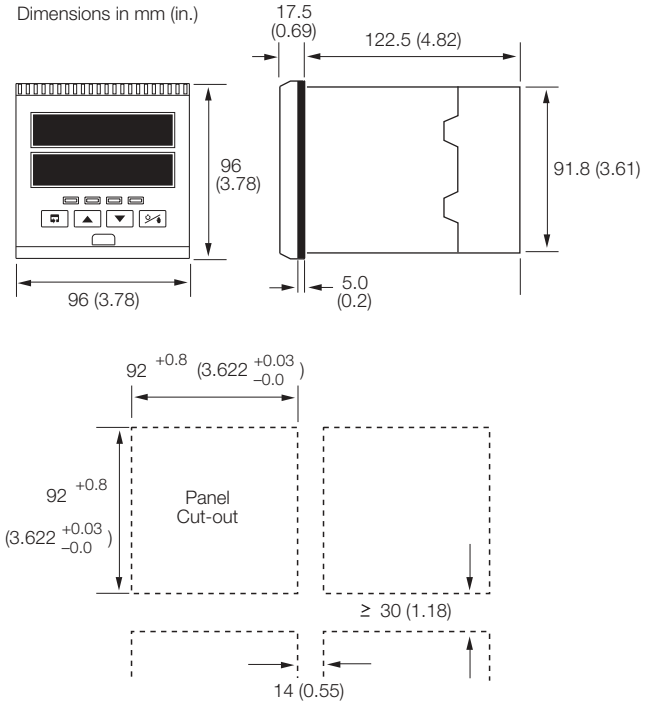


Fig. 5.3 Overall Dimensions

...5.2 Mounting – Figs. 5.3 and 5.4

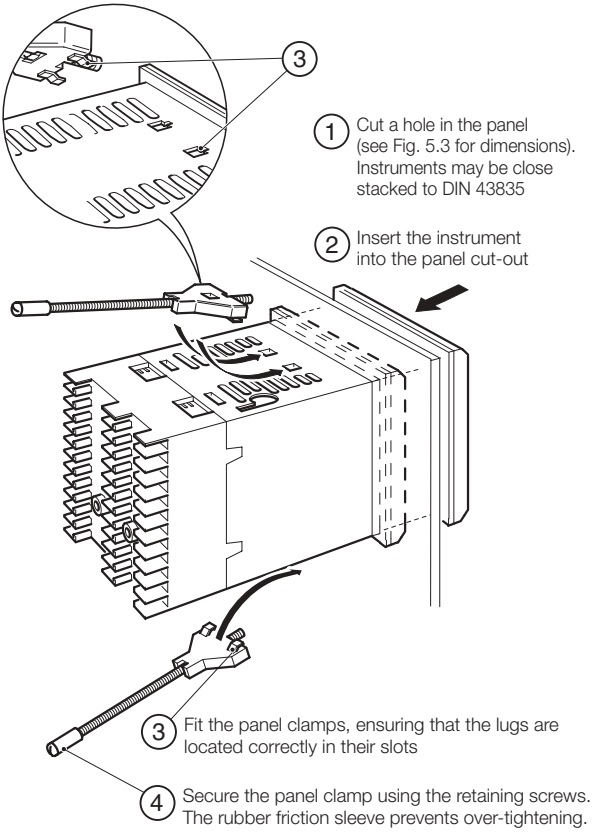
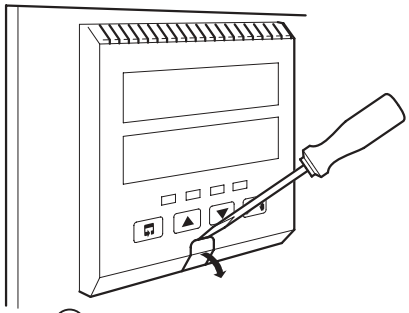
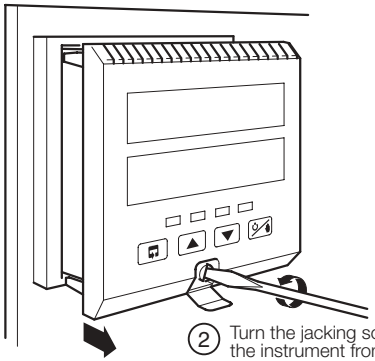


Fig. 5.4 Mounting Details

5.3 Removing the Instrument from the Case – Fig. 5.5



1 Release the jacking screw cover



2 Turn the jacking screw anticlockwise to pull the instrument from the case

Fig. 5.5 Removing the Instrument from the Case

5.4 Electrical Connections – Fig. 5.6

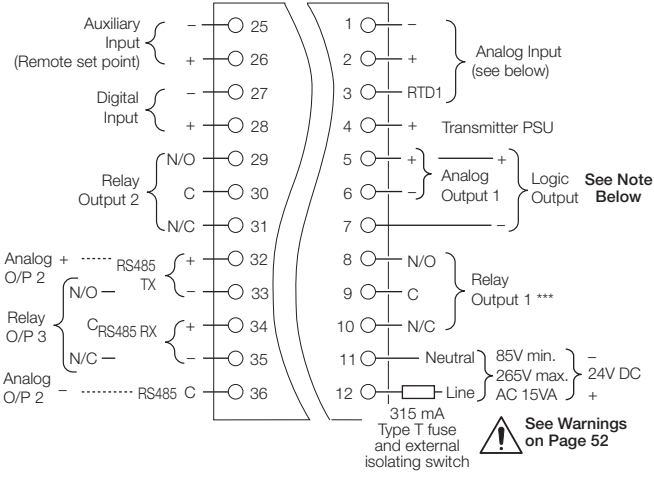
Warning.

- The instrument is not fitted with a switch therefore a disconnecting device such as a switch or circuit breaker conforming to local safety standards must be fitted to the final installation. It must be mounted in close proximity to the instrument within easy reach of the operator and must be marked clearly as the disconnection device for the instrument
- Remove all power from supply, relay and any powered control circuits and high common mode voltages before accessing or making any connections.
- Use cable appropriate for the load currents. The terminals accept cables up to 14AWG (2.5mm^2).
- The instrument conforms to Mains Power Input Insulation Category 2, Pollution Degree 2 (EN601010–1).
- All connections to secondary circuits must have basic insulation.
- After installation, there must be no access to live parts, e.g. terminals
- Terminals for external circuits are for use only with equipment with no accessible live parts.
- If the instrument is used in a manner not specified by the Company, the protection provided by the equipment may be impaired.
- All equipment connected to the instrument's terminals must comply with local safety standards (IEC 60950, EN601010–1).

Note.

- Always route signal leads and power cables separately, preferably in earthed (grounded) metal conduit.
- It is strongly recommended that screened cable is used for signal inputs and relay connections.

This equipment is protected through double insulation (Class II).



Note. Analog output 1 and the logic output use a common positive terminal, capable of driving both outputs simultaneously.

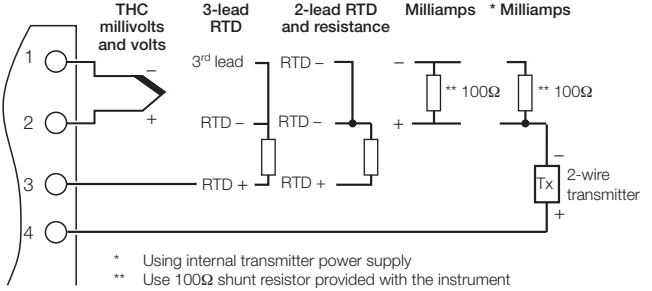


Fig. 5.6 Electrical Connections

5.5 Relays, Arc Suppression and Outputs

5.5.1 Relay Contact Ratings

Relay contacts are rated at:

115/230V AC at 5A (non-inductive).

250V DC 25W max.

A suitable fuse must be fitted.

5.5.2 Arc Suppression

Arc suppression components are fitted to relays 2 and 3 only. If relay 1 is required to switch inductive loads, the arc suppression components supplied must be fitted.

5.5.3 Logic Output

18V DC at 20mA.

Min load 900Ω.

Isolated from inputs (not isolated from analog O/P 1), dielectric strength – 500V DC for 1 minute.

5.5.4 Control or Retransmission Analog Outputs

Max. load 15V (750Ω at 20mA).

Analog O/P 1 – Isolated from inputs (not isolated from logic O/P), dielectric strength – 500V DC for 1 minute.

Analog O/P 2 – Non-isolated.

SPECIFICATION

Summary

P, PI, PID single loop controller
Autotune facility
Fully user configurable
NEMA4X/IP66
PC Configuration

Operation

Display

High-intensity 7-segment, 2 x 4-digit red LED display

Display range	–999 to +9999
Display resolution	±1 digit
Display height	12mm (0.43 in.)

Configuration

User defined via front panel or PC Configurator

Standard Functions

Control types

Programmable for manual, on/off, time proportioning, current proportioning and heat/cool control

Set points

Local
Remote
4 selectable, fixed value
Ramping set point

Profile controller

Number	4 ramp/soak segments
Features	Guaranteed ramp/soak, self seeking set point, program repeat
Controls	Run, hold and stop from front panel switches Run/hold or run/stop from digital input

Alarms

Number	Two user-defined
Type	High/low process High/low deviation Loop break alarm

Standard Build

Control output/retransmission

Analog, configurable in the range of 4 to 20mA

Max. load	15V (750Ω at 20mA)
Accuracy	≤0.25% of span
Dielectric	500V DC from input (not isolated from logic output)

Logic output

18V DC	at 20mA
Min. load	400Ω
Dielectric	500V DC from input (not isolated from control output)

Relay output

One relay as standard (SPDT) 5A @ 115/230V AC

Analog Input

Number

One as standard

One optional 4 to 20mA remote set point input

Input sampling rate

250ms per channel

Type

Universally configurable to provide (Channel 1 only):

Thermocouple (THC)

Resistance Thermometer (RTD)

Millivolt

Current

DC voltage

Input impedance

mA	100Ω
mV, V	>10MΩ

Linearizer functions

Programmable for standard inputs:

√, THC types B, E, J, K, N, R, S, T or Pt100

Broken sensor protection

Upscale drive on THC and RTD

Downscale drive on milliamps and voltage

Cold junction compensation

Automatic CJC incorporated as standard

Stability <0.05°C/°C change in ambient temperature

Input protection

Common mode isolation	>120dB at 50/60Hz with 300Ω imbalance
Series mode rejection	>60dB 50/60Hz

Transmitter power supply

24V, 30mA max. powers one 2-wire transmitter

Standard Analog Input Ranges

Thermocouple	Maximum Range °C	Maximum Range °F	Accuracy (% of reading)
B	–18 to 1800	0 to 3270	0.25% or ±2°C (3.6°F) above 200°C (392°F)] *
E	–100 to 900	–140 to 1650	0.25% or ±0.5°C (0.9°F)
J	–100 to 900	–140 to 1650	0.25% or ±0.5°C (0.9°F)
K	–100 to 1300	–140 to 2350	0.25% or ±0.5°C (0.9°F)
N	–200 to 1300	–325 to 2350	0.25% or ±0.5°C (0.9°F)
R	–18 to 1700	0 to 3000	0.25% or ±1.0°C (1.8°F) [above 300°C (572°F)] *
S	–18 to 1700	0 to 3000	0.25% or ±0.5°C (0.9°F) [above 200°C(392°F)] *
T	–250 to 300	–400 to 550	0.25% or ±0.5°C (0.9°F)

* For B, R and S thermocouples, performance accuracy is not guaranteed below value stated

Min. span below zero Type T 70°C (126°F)
Type N 105°C (189°F)

THC standards DIN 43710
IEC 584

RTD	Maximum Range °C	Maximum Range °F	Accuracy (% of reading) **
PT100	–200 to 600	–325 to 1100	0.25% or ±0.5°C (0.9°F)

** RTD, 3-wire platinum, 100Ω per DIN 43760 standard (IEC751), with range of 0 to 400Ω

Linear Inputs	Range	Accuracy (% of reading)
Milliamps	0 to 20	0.25% or ±2μA
Milliamps	4 to 20	0.25% or ±2μA
Volts	0 to 5	0.25% or ±200μV
Volts	1 to 5	0.25% or ±200μV
Millivolts	0 to 50	0.25% or ±20μV

Square Root Input	Range	Accuracy (% of reading)
Milliamps	4 to 20	0.25% or ±2μA

*** Below input of 4.64mA (20% flow) the input is linear

Options

One option board can be installed from:

Type 1	One relay
Type 2	Two relays + one digital input + remote set point
Type 3	One relay + one digital input + remote set point + Modbus serial communications
Type 4	One relay + one digital input + remote set point + retransmission

Relay output

SPDT 5A @ 115/230V AC

Digital input

Type	Volt-free
Minimum pulse	250ms

Modbus serial communications

Connections	RS422/485, 2 or 4-wire
Speed	2.4k or 9.6k baud rate
Protocol	Modbus RTU slave

Remote Set Point Input

4 to 20 mA DC, 100Ω nominal input impedance

Preset to process variable engineering units

Auxiliary Analog Output

Analog, configurable in the range of 4 to 20mA

Max. load	15V (750Ω at 20mA)
Isolation	500V DC from input

Physical

Size

96 wide x 96 high x 122.5mm
(3.78 in. wide x 3.78 in. high x 4.82 in.)

Weight

520g (1.1lb) approximate

Electrical

Voltage

85 to 265V AC (50/60Hz)

24V DC

Power consumption

<6VA

Power interruption protection

<60ms/<3 cycles, no effect

>60ms/>3 cycles, instrument returns to operation after a controlled reset

Environmental

Operating limits

0 to 55°C (32 to 131°F)

5 to 95%RH non-condensing

Temperature stability

<0.02% of reading or 2μV/°C (1μV/°F)

Front face

IP66 (NEMA4X), rear IP20

EMC

Emissions and Immunity

Meets requirements of IEC 61326 for an Industrial Environment

Design and manufacturing standards

CE Mark

Safety standards

EN61010 – 1

UL 310 – 1

FM 3810

SS/C250 Issue 6

Customer Support

We provide a comprehensive after sales service via our Worldwide Service Organization. Contact one of the following offices for details of your nearest Service and Repair Centre.

United Kingdom
ABB Limited
Tel: +44 (0)1480 475321
Fax: +44 (0)1480 217948

United States of America
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

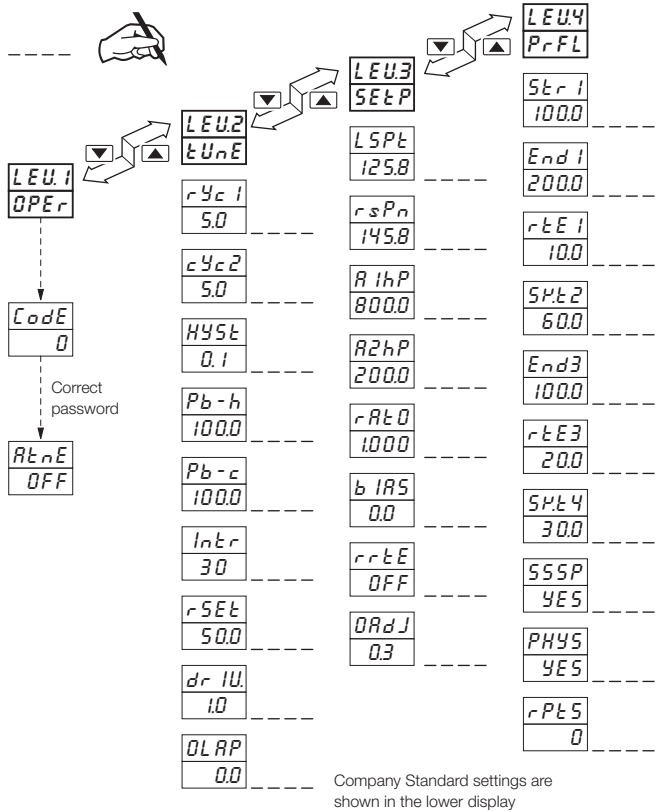
Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

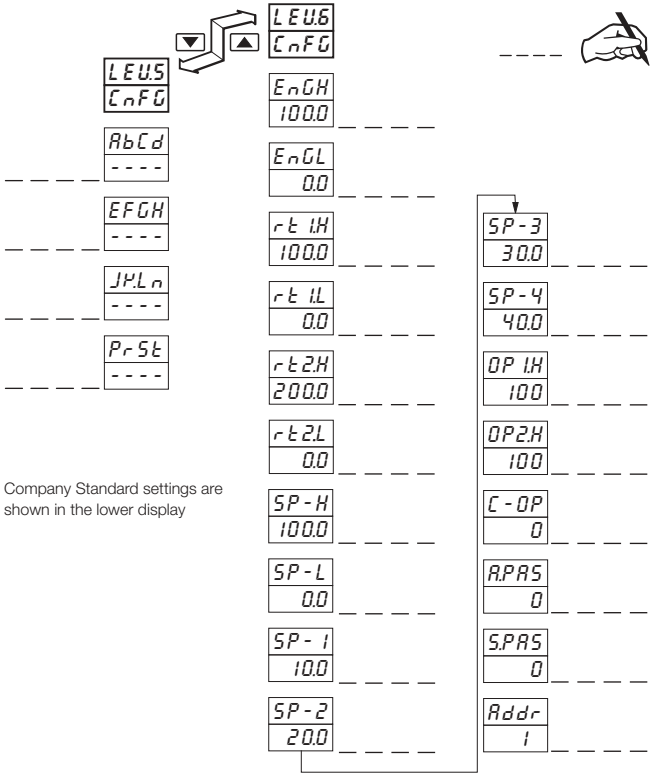
CUSTOMER SETUP LOG



Instrument Serial Number: _____

Product Code: C 250 / __ __ __ __/__ __ __

CUSTOMER CONFIGURATION LOG



Company Standard settings are shown in the lower display

IM/C250 Issue 5

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