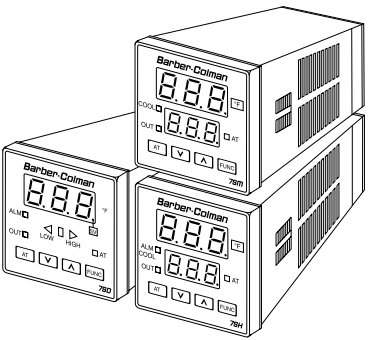
Instruction Manual



1262-IN-001-0-03
July 1998

Models 7SD 7SH 7SM Controllers

A Siebe Group Company

1/16 DIN, THREE DIGIT DISPLAY TEMPERATURE CONTROLLER

MODEL: 0 7☐☐-4 9☐☐☐-☐ 0 0- 0 - 0 0
Field. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fields 1 through 4. BASE
07SD - Deviation Display Controller
07SM - Dual Display Controller
07SH - Heat/Cool Controller

Field 5. INPUT
4 - TC types J, K, L, N; Pt 100 RTD
NOTE: All inputs are factory calibrated and selectable by keys. Factory set at type J.

Field 6. CONTROL ACTION
9 - PID and autotuning (Smart AT)

Field 7. OUTPUT 1
1 - Relay
6 - SSR

Field 8. OUTPUT 2
Models 07SD and 07SM only
0 - None
1 - One alarm (relay input)
Model 07SH only
1 - Relay (cooling/alarm)

Field 9. POWER SUPPLY
Models 07SD and 07SM only
3 - 100 to 240 Vac
Model 07SH only
0 - See Field 10

Field 10. POWER SUPPLY
Models 07SD and 07SM only
0 - See Field 9
Model 07SH only
3 - 100 to 240 Vac
5 - 24 Vac/Vdc

Fields 11 through 15. RESERVED

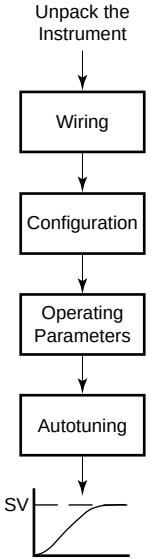
CONGRATULATIONS

Congratulations on your purchase of one of the easiest to configure controllers on the market. After a four step configuration procedure, your process will be up and running.

GUIDE TO SIMPLE SET-UP

Only four steps are required to set-up your controller:

1. Wire the instrument (page 7).
2. Configure the instrument (page 12).
3. Check the operating mode parameters (page 19).
4. Check the autotune (Smart AT) process (page 17).



Index

1/16 DIN, THREE DIGIT DISPLAY
TEMPERATURE CONTROLLER 2
MOUNTING REQUIREMENTS 5
DIMENSIONS AND PANEL CUTOUT 6
WIRING GUIDELINES 7
CONFIGURATION PROCEDURE 12
Configuration Key Functions 12
Configuration Procedure 12
Advanced Configuration Procedure 16
OPERATING MODE 17
Operating Key Functions 17
Autotuning (Smart AT) Function 17
Manual Reset of the Alarms 18
Operating Parameters 19
Error Messages 20
Default Parameters 21
Default Configuration Parameters 22
SPECIFICATIONS 24
General 24
Control Actions 24
Inputs 24
Outputs 25
Alarm 25
3 Digit Deviation Bar Characteristics 25
3 Digit Dual Display and
3 Digit Heat/Cool Characteristics 25
CALIBRATION PROCEDURE 26
General Guidelines 26
Procedure 26
Calibration Parameters 26
Entering Calibration Values 27
MAINTENANCE 29

CAUTION: USE WIRE SUITABLE FOR 75 °C MINIMUM

MOUNTING REQUIREMENTS

Select a mounting location with the following characteristics:

1) Low vibration.
2) An ambient temperature range between 0 and 50 °C (32 and 122 °F).
3) Easy access to the rear of the instrument.
4) No corrosive gases (sulfuric gas, ammonia, etc.).
5) No water or other fluid (i.e., condensation).
6) A relative humidity of 20 to 80% non-condensing.

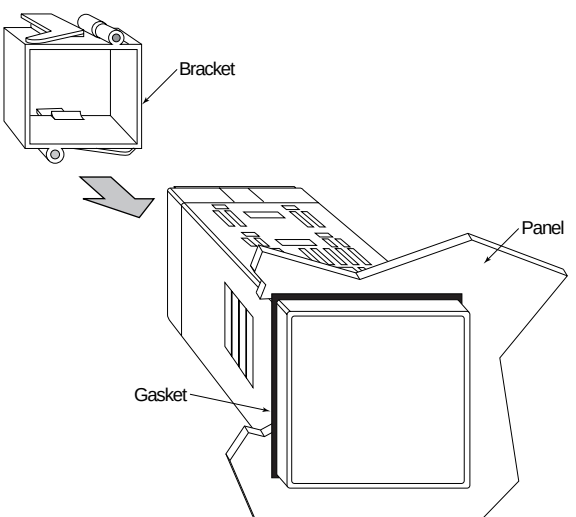
The instrument can be mounted on a panel up to 15 mm (0.591 in) thick with a cutout of 45 x 45 mm (1.772 x 1.772 in) - see outline in “Dimensions and Panel Cutout.”

Panel surface texture must be smoother than 6.3 μm.

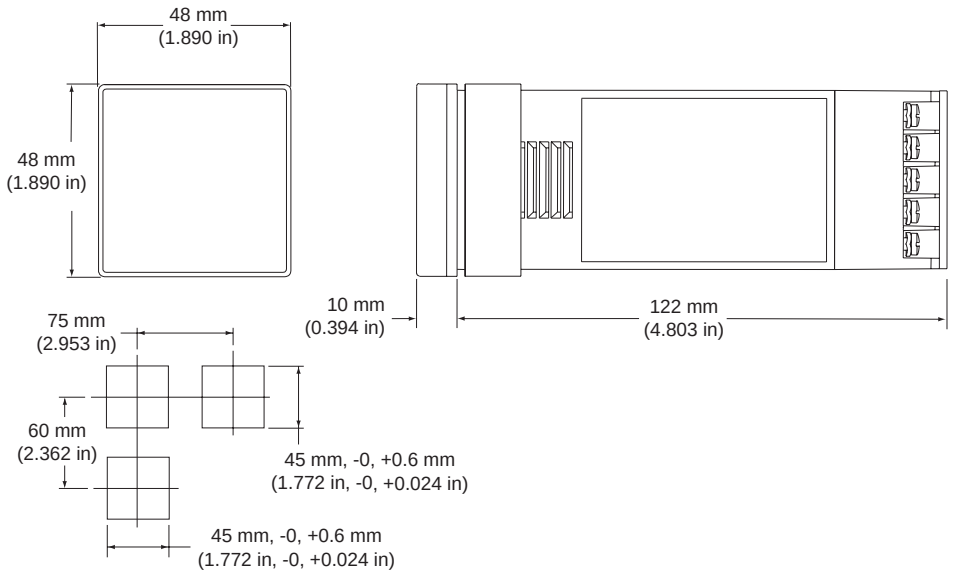
To assure IP65 and NEMA 4X protection, insert the panel gasket between the instrument and the panel as shown below.

Install the instrument as follows:

1) Insert the instrument case in the gasket.
2) Insert the instrument in the panel cutout.
3) Pushing the instrument against the panel, insert the mounting bracket.
4) Torque the mounting bracket screws between 0.3 and 0.4 Nm (0.25 and 0.32 lbin).
5) Make sure the instrument will not move within the cutout to insure NEMA 4X/IP65 protection.

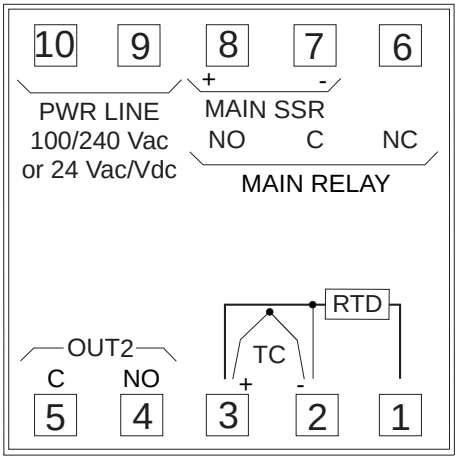


DIMENSIONS AND PANEL CUTOUT

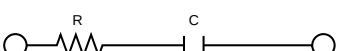


WIRING GUIDELINES

Terminal board



NOTE: When a relay output is used to drive an inductive load, connect an external snubber network (RC) across the terminals:



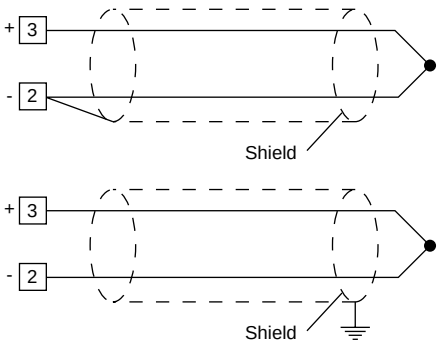
in accordance with the following table:

Load Current	C (µF)	R ( )	P (W)	Resistor and Capacitor Voltage
< 40 mA	0.047	100	1/2	260 Vac
< 150 mA	0.1	22	2	260 Vac
< 0.5 Amp	0.33	47	2	260 Vac

A) Measuring inputs

Any external components (like zener diodes, etc.) connected between the sensor and input terminals may cause measurement errors (excessive or unbalanced line resistance or possible leakage currents).

TC input



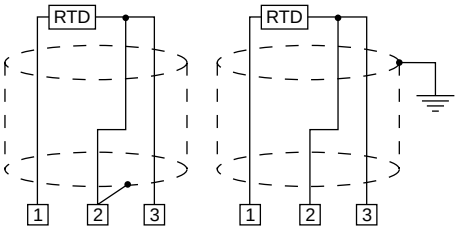
SAFETY NOTE:

1) Do not run input wires with power cables.

NOTES:

1) For TC wiring use proper compensating cable, preferably shielded.
2) Shielded cable should be grounded at one end only.

RTD input



SAFETY NOTE:

1) Do not run RTD wires with power cables.

NOTES:

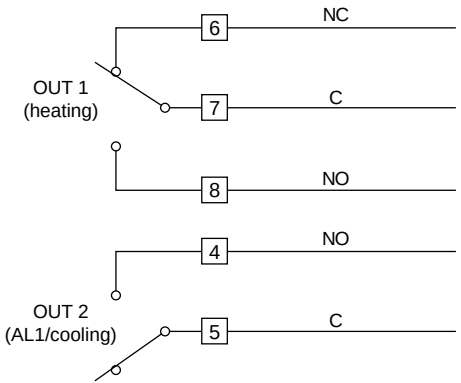
1) Ground shielded cable at one end only.
2) Use the correct size copper wires.
3) The resistance of the 3 wires must be the same.

Any external components (like zener diodes, etc.) connected between the sensor and input terminals may cause measurement errors (excessive or unbalanced line resistance or possible leakage currents).

Thermocouple compensating cable color codes.

Thermocouple Material	British BS 1843	American ANSI MC 96.1	German DIN 43710	French NFE 18-001
Copper T Constantan	+ White - Blue Blue	+ Blue - Red Blue	+ Red - Brown Brown	+ Yellow - Blue Blue
Iron J/L Constantan	+ Yellow - Blue Black	+ White - Red Black	+ Red - Blue Blue	+ Yellow - Black Black
Nickel Chromium K Nickel Aluminum	+ Brown - Blue Red	+ Yellow - Red Yellow	+ Red - Green Green	+ Yellow - Purple Yellow
Platinum/Platinum R 13% Rhodium	+ White - Blue Green	+ Black - Red Green	+ Red - White White	+ White - Green Green
Platinum/Platinum S 10% Rhodium	+ White - Blue Green	+ Black - Red Green	+ Red - White White	+ White - Green Green
Chromel E Constantan	+ Brown - Blue Brown	+ Violet - Red Violet	- - -	- - -
Platinum 30% Rh B Platinum 6% Rh	- - -	+ Grey - Red Grey	- - -	- - -
N Nicrosil/Nisil	-	-	-	-

B.1) Relay outputs



OUT 1 and OUT2: Protected by varistor.
OUT1: Contact rating of 3 Amps/250 Vac resistive load.
OUT2: Contact rating of 1 Amp/250 Vac resistive load.

SAFETY NOTES:

1) To avoid electric shock, connect power line at the end of the wiring procedure.
2) Do not run input wires with power cables.

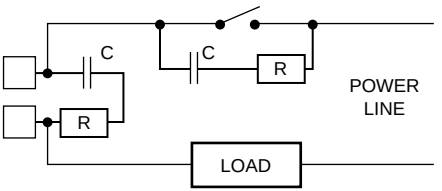
NOTES:

1) For power connections use 16 AWG or larger wires rated for at least 75 °C.
2) Use copper conductors only.

B.2) Inductive loads

High voltage transients can occur when switching inductive loads. It is recommended to install an additional RC network across the internal contacts as shown.

The same problem can occur when a switch is used in series with the internal contacts.



It is recommended to install an additional RC network across the external contacts as close to the instrument terminals as possible.

The value of capacitor (C) and resistor (R) are shown in the following table.

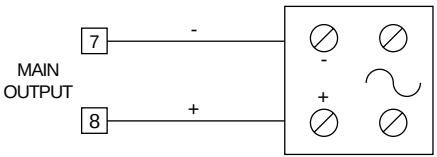
Load Current	C (µF)	R ( )	P (W)	Resistor and Capacitor Voltage
< 40 mA	0.047	100	1/2	260 Vac
< 150 mA	0.1	22	2	260 Vac
< 0.5 Amp	0.33	47	2	260 Vac
< 1 Amp	0.47	47	2	260 Vac

Relay output wiring must be as far away as possible from input wiring and communication cables.

B.3) Voltage outputs for SSR drive

This is a time proportioning output.

Logic voltage for SSR drive.
Logic level 0: Less than 0.5 Vdc.

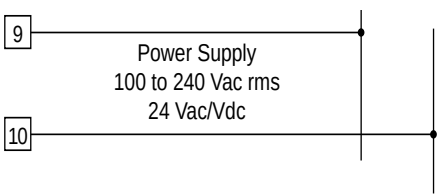


Solid State Relay

Logic status 1: 24 Vdc ±20% @ 1 mA.
14 Vdc ±20% @ 20 mA.

NOTE: This output is not isolated. Isolation between the instrument output and the power supply is accomplished by an external solid state relay.

C) Power line wiring



SAFETY NOTES:

1) Do not run input wires with power cables.
2) Permanently connected equipment must include a switch or circuit-breaker in the installation. Place it in close proximity to the equipment and within easy reach of the operator. Mark it as the disconnecting device for the equipment.
   A single switch or circuit-breaker can drive more than one instrument.
3) To avoid shock and possible instrument damage, connect power last.
4) Before connecting the power line, check that the voltage is correct (see Model Number).

NOTES:

1) For supply connections use 16 AWG or larger wires rated for at least 75 °C.
2) Use copper conductors only.
3) 24 Vdc supplies are not polarity sensitive.
4) The power supply input is *not* fuse protected. Please provide fusing as shown:

Power Supply	Type	Current	Voltage
24 Vac/Vdc	T	500 mA	250 V
100/120 Vac	T	125 mA	250 V
200/240 Vac	T	63 mA	250 V

When the fuse is damaged the instrument should be returned to your supplier to check the power supply.

CONFIGURATION PROCEDURE

Configuration Key Functions

FUNC = The new setting of the selected parameter is stored and the display advances to the next parameter.

AT = Scrolls back through the parameters without storing the new setting.

▲ = Increases the setting of the selected parameter.

▼ = Decreases the setting of the selected parameter.

Configuration Procedure

1) Switch off power to the instrument.
2) Remove the instrument from its case.
3) Open switch V2, located 1 inch behind the upper right corner of the display (see Figure 1).

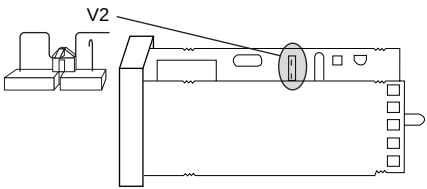


Figure 1

4) Re-insert the instrument in its case.
5) Switch on power to the instrument. If “CAL” is displayed, press the ▲ key to select the configuration procedure “CnF”.
6) Press the FUNC key.
   The 3 digit dual display and 3 digit heat/cool models show the parameter code on the lower display and the parameter value on the upper display. The 3 digit deviation bar model alternately shows the parameter code and its value on the display.

P1 Input type and standard range

0	=	TC type	L	range	0 to +800 °C
1	=	TC type	J	range	0 to +800 °C
2	=	TC type	K	range	0 to +999 °C
3	=	TC type	N	range	0 to +999 °C
4	=	RTD type	Pt 100	range	-199 to +500 °C
5	=	RTD type	Pt 100	range	-19.9 to +99.9 °C
6	=	TC type	T	range	0 to +400 °C
8	=	TC type	L	range	0 to +999 °F
9	=	TC type	J	range	0 to +999 °F
10	=	TC type	K	range	0 to +999 °F
11	=	TC type	N	range	0 to +999 °F
12	=	RTD type	Pt 100	range	-199 to +999 °F
13	=	TC type	T	range	0 to +400 °C

NOTE: If using °C, add the label (located on the INDEX page) to the front of the instrument.

P2 Span low

Not present when P1 = 5.
Enter the low end setting of the span.

P3 Span high

Not present when P1 = 5.
Enter the high end setting of the span.

NOTE: The minimum input span (P3 - P2) is 300 °C or 600 °F for a thermocouple input and 100 °C or 200 °F for an RTD input.

P4 Main output action

The 3 digit heat/cool controller skips this parameter when P5 = 5.

r = Reverse acting (heating).
d = Direct acting (cooling).

P5 Output 2 function

0 = None
1 = Process alarm
2 = Band alarm
3 = Deviation alarm
4 = Instrument failure indicator
5 = Cooling output (3 digit heat/cool controller only)

NOTE: For the 3 digit heat/cool model, when parameter P5 = 5, parameter P4 = "r".

P6 Output 2 operating mode

Not available when P5 = 0.
If P5 = 1, 2 or 3:

H.A = High alarm (outside of the band) with automatic reset.
L.A = Low alarm (inside the band) with automatic reset.
H.L = High alarm (outside band) with manual reset.
L.L = Low alarm (inside band) with manual reset.

When P5 = 4:

Selections H.A and L.A indicate an instrument failure with automatic reset while the H.L and L.L selections indicate an instrument failure with manual reset.

If P5 = 5:

(3 digit dual display model only) P6 selects the cooling medium:
AIr = Air
OIL = Oil
H2O = Water

NOTE: Different cooling settings cause automatic modification of both the relative cooling gain and the cooling cycle time.

P6	C	RCG
Air	10 seconds	1
Oil	4 seconds	0.8
H2O	2 seconds	0.4

P7 Alarm action

Not available when P5 = 0 or 5.

r = Reverse (relay de-energized in the alarm condition).

d = Direct (relay energized in the alarm condition).

P8 Alarm standby

Not available when P5 = 0, 4 or 5.

OFF = Standby disabled.

ON = Standby enabled.

NOTE: If the alarm is a band or deviation alarm, the alarm is masked after a process or at startup until the process variable reaches the alarm setpoint plus or minus hysteresis. If the alarm is a process alarm, the condition is masked at startup until the process variable reaches the alarm setpoint plus or minus hysteresis.

P9 OFFSET applied to the measured value

Used to apply a constant OFFSET throughout the entire readout range (not used for linear inputs).

If P1 = 5 P9 can be set with keys from -19.9 to 19.9 °C.

If P1 ≠ 5 P9 can be set with keys from -199 to 199 °C or °F.

P10 Soft start setpoint

The "soft start" function allows the maximum output power to be limited (see the OLH operating parameter) for a programmable time period (see the tOL operating parameter) at instrument startup when the measured value is lower than the setpoint. Enter the setpoint in engineering units.

P11 Safety lock

0 = Unlocked. All the parameters can be modified.

1 = Locked. Nothing can be modified except the SP.

2 to 499 = This code number is a password used to unlock the device.

a) When the display shows "OFF", the device is unlocked and all parameters can be modified. To lock, enter a number different from the code number.

b) When the display shows "ON", the device is locked and no parameters can be modified except the SP. To unlock, enter the code number.

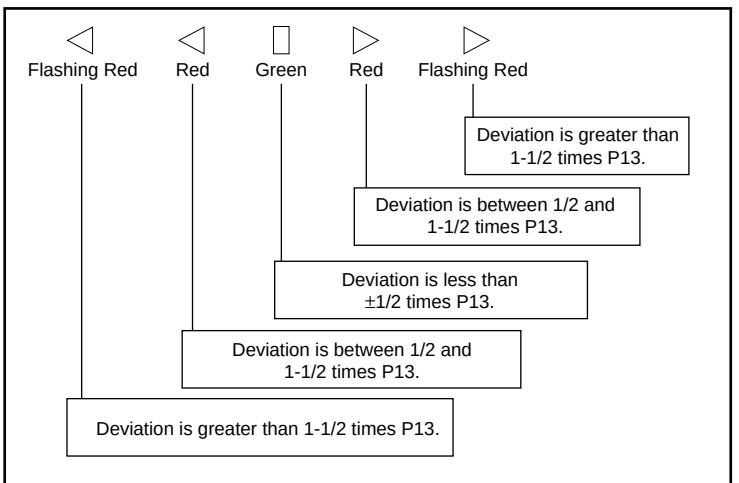
500 to 999 = Using a code between these two numbers, everything occurs as described in "2 to 499" above except when the device is locked, the setpoint and the alarm setpoint can be modified.

P12 Output maximum rate of rise

Can be set with keys from 1 to 10% of the output signal per second. Setting a value greater than 10%/second causes the instrument to show "InF" and no limit is applied.

P13 Deviation bar graph resolution (3 digit deviation bar only)

For an RTD input with a decimal place, P13 can be set from 0.2 to 20.0 °C. For all other inputs, it can be set from 2 to 200 engineering units. P13 is the band around the setpoint at which the deviation display changes (see graphic).



The configuration procedure is now complete. The instrument should show "-.-.-." on both displays. Press the FUNC key; the instrument will return to the beginning of the configuration procedure. To continue with controller set-up go to the operating mode found in the next section. To access the advanced configuration parameters proceed as follows:

1) Use the ▲ and ▼ keys to enter 219 on the display.
2) Press the FUNC key.

Advanced Configuration Procedure

P14 Enable/disable the display of the protected parameters

Not available when P11 = 0. Enables/disables the display of the protected parameters during "operating mode."

OFF = Protected parameter cannot be displayed.

ON = Protected parameter can be displayed.

P15 Autotuning (Smart AT) function enabling/disabling

0 = Autotuning is disabled.

1 = Autotuning enable/disable is NOT protected by the safety lock.

2 = Autotuning enable/disable is protected by the safety lock.

P16 Maximum value of the proportional band settable by autotuning

This parameter can be programmed from the P17 or P18 value to 99.9%.

P17 Minimum value of the proportional band settable by autotuning in heating control only.

Not available when P5 = 5.

It can be programmed from 1.0% to P16 value.

P18 Minimum value of the proportional band settable by autotuning in heating/cooling control (3 digit dual display model)

This parameter is present only when P5 = 5. This parameter can be programmed from 1.5% to P27 value.

P19 Automatic modification of "relative cooling gain" (3 digit dual display model)

This parameter is present only when P5 = 5.

OFF = Autotuning does not modify the "relative cooling gain."

ON = Autotuning modifies the "relative cooling gain."

P20 Min. value of integral time settable by autotuning

P20 is programmable from 00.1 (10 sec.) to 02.0 (2 min.).

P21 Extension of the anti-reset windup

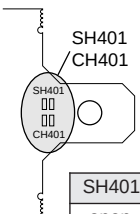
Range: From -30 to +30% of the proportional band.

NOTE: A positive value increases the high limit of the anti-reset windup (over setpoint) while a negative value decreases the low limit of the anti-reset windup (under setpoint).

This completes the configuration procedure. The display should show "COnF". Close switch V2, see configuration procedure Figure 1.

OPERATING MODE

1) Remove the instrument from its case.
2) Close switch V2 (see Figure 1, Configuration Procedure).
3) The default setting for a sensor break indication is an overrange condition. If an underrange indication is desired, set SH401 and CH401 according to the following table:



SH401	CH401	Indication
open	close	overrange (default)
close	open	underrange

4) During the configuration procedure, if a °C readout has been selected, use the provided label to cover the °F.

°C

5) Re-insert the instrument in its case.
6) Switch on power to the instrument.
   The 3 digit dual display and 3 digit heat/cool model show the measured value on the upper display and the programmed setpoint on the lower display (this is the "normal display mode").

   The "normal display mode" of the 3 digit deviation bar model shows the measured value or the setpoint value (the SP LED will be flashing). To change the display, press the ▲ key.

Operating Key Functions

FUNC = The new setting of the selected parameter is stored and the next parameter is displayed (in increasing order).

AT = Starts and stops autotuning (press and hold for 1.5 seconds).

▲ = Increases the setting of the selected parameter.

▼ = Decreases the setting of the selected parameter.

NOTE: A 10 second timeout is in effect during parameter modification. If no key is pressed for 10 seconds, the instrument automatically reverts to the "normal display mode." The last parameter modified will not be stored unless the FUNC key was pressed before the timeout.

Autotuning (Smart AT) Function

Autotuning is used to automatically optimize the control action. To enable autotuning, press and hold the AT key for more than 1.5 seconds while the instrument is in the "normal display mode." The AT LED will light or flash according to the selected algorithm. With autotune enabled, the control parameters (PB, TI, TD and rC) can be displayed but not modified.

To disable autotuning, press and hold the AT key a second time for more than 1.5 seconds. The instrument maintains the actual set of control parameters but allows parameter modification.

NOTES:
1) When ON/OFF control is programmed (PB = 0), autotuning is disabled.
2) Autotune enable/disable can be protected by a safety lock password (see P15 in the Configuration Procedure).

Setpoint Access

To change the setpoint, follow this procedure:

1) Press the ▲ or ▼ key (and hold for 3 seconds); the setpoint will start to change.
2) Once the desired setting is reached, wait 3 seconds before pressing a key and the new setpoint will be used.

Pressing the FUNC key within 3 seconds will return the instrument to the "normal display mode" without storing the new setpoint.

Manual Reset of the Alarms

If the alarm has been configured as a latched alarm, the alarm status continues after the condition disappears. To reset the alarm, press the FUNC key to select the "n.rS" parameter (the display will show "n.rS" and "OFF". Use the ▲ or ▼ key to select "ON" and press the FUNC key again.

The alarm condition must disappear before an alarm reset action can be applied.

Output Power Off

To turn OFF the output signal, press and hold the ▲ and FUNC keys for 3 seconds, the current setpoint will be replaced with "OFF".

For the 3 digit deviation bar model, pressing the ▲ key toggles from "OFF" to the measured value (the bargraph LEDs will be flashing to show that the instrument is working as an indicator only). In the output power off condition, parameters can always be reviewed and modified. When control is disabled (output power off), the alarms are in a no alarm condition. The alarm output status depends on the programmed alarm action.

To return to the "normal display mode" press and hold the ▲ and FUNC keys for 3 seconds.

Displaying the Setpoint
(3 digit deviation bar model)

To display the programmed setpoint, press the ▲ key. The display will show the setpoint with the decimal point of the least significant digit flashing to indicate that the number shown is the setpoint. To return to displaying the measured value, press the ▲ key again.

Bargraph Operation
(3 digit deviation bar model)

The 3 bargraph LEDs show the deviation between the measured value and the setpoint. The middle (green) LED is lit when the deviation is less than 1/2 of the value configured in the P13 parameter. If the deviation is greater than 1/2 of P13 but less than 1-1/2 times P13, one of the red LEDs will be lit (the right or left LED, depending on the deviation direction). When the deviation is more than 1-1/2 times P13, the relative LED (left or right) will be flashing. (See P13, Configuration Procedure.)

Operating Parameters

From the "normal operating mode," press the FUNC key. The lower display will show the code while the upper display shows the setting or the status (ON or OFF) of the selected parameter.

Press the ▲ or ▼ key to change the setting.

Press the FUNC key again and the instrument stores the new setting and goes to the next parameter.

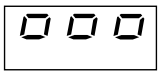
Some of the following parameters may not appear, depending on the configuration.

Param	Description
SP	Control setpoint (in engineering units). Range: From rL to rH.
n.rS	Manual reset of the alarms. This parameter is available only when one alarm with manual reset has been programmed. Set ON and press the FUNC key to reset the alarms.
nnn	Software key for parameter protection. This parameter is skipped if P11 = 0 or 1 ON = The instrument is LOCKed OFF = The instrument is UNLOCKed To switch from LOCKed to UNLOCKed, enter the stored P11 numeric safety lock. To switch from UNLOCKed to LOCKed, enter a value different from the stored P11 numeric safety lock.
AL	Alarm setpoint (in engineering units).
HSA	Alarm hysteresis (0.1 to 10.0% of span).
Pb	Proportional band (1.0 to 99.9% of the span for heating). For heating/cooling, 3 digit dual display only (1.5 to 99.9%). If Pb = 0, the instrument performs ON/OFF control; tI, tD, C, C2, rC, OLP, OLh and tOL are skipped; and autotuning (Smart AT) is turned off.
hS	Hysteresis (for ON/OFF control) Range: 0.1 to 10% of input span.
tI	Integral time (from 1 minute and 20 seconds to 20 minutes and 0 seconds; when above the upper limit the display blanks out and the integral is not used).
td	Derivative time (from 1 second to 9 minutes and 59 seconds; setting td = 0 turns off the derivative action).
IP	Integral pre-load. This parameter is skipped if PB = 0. Range: - From 0 to 100% for one control output - From -100 to 100% for two control outputs (3 digit dual display model only).
C	Heating cycle time (from 1 to 200 seconds).
C2	Cooling cycle time (3 digit dual display model only; from 1 to 200 seconds).
rC	Relative cooling gain (3 digit dual display model only; from 0.20 to 1.00).
OLP	Deadband/Overlap (3 digit dual display model only; from -20 to +50% of the proportional band).
rL	SP minimum setting (from the initial scale value (P2) to rH).
rH	SP maximum setting (from rL to the full scale value (P3).
OLH	Output maximum power (from 0 to 100% of the heating output). From -100 to 100% for heating/cooling output (3 digit dual display model only).
tOL	Duration of the output power limit. From 1 to 100 minutes. Above 100, the display shows "InF"" and the limit is always enabled. **NOTE:** The tOL can be modified but the new value will become operative only at the next instrument start up.

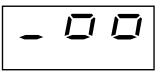
Error Messages

Overrange or underrange indication

The instrument shows the OVERRANGE and UNDERRANGE conditions with the following indications:



Overrange



Underrange

The sensor break can be signaled as:

- For TC input: OVERRANGE or UNDERRANGE selected by a solder jumper
- For RTD input: OVERRANGE

On the RTD input, a special test is provided to signal an OVERRANGE when input resistance is less than 15 Ohms (short circuit sensor detection).

Output action on overrange/underrange

When:

- The instrument is set for one output only and an OVERRANGE is detected, OUT 1 turns OFF (if reverse acting) or ON (if direct acting).
- The instrument is set for heating/cooling and an OVERRANGE is detected, OUT 1 turns OFF and OUT 2 turns ON.
- The instrument is set for one output only and an UNDERRANGE is detected, OUT 1 turns ON (if reverse acting) or OFF (if direct acting).
- The instrument is set for heating/cooling and an UNDERRANGE is detected, OUT 1 turns ON and OUT 2 turns OFF.

Error list

100	EEPROM write error.
150	CPU error.
200	Attempt to write to protected memory.
201 - 2xx	Configuration parameter error. The two least significant digits show the number of the wrong parameter (ex. 209 Err indicates an Error in parameter P9).
301	RTD input calibration error.
305	TC input calibration error.
307	RJ input calibration error.
400	Control parameters error.
500	Auto-zero error.
502	RJ error.
510	General error during calibration procedure.

Dealing with error messages

1) When a configuration parameter error is detected, repeat the configuration procedure of that specific parameter.
2) If an error 400 is detected, simultaneously press the ▲ and ▼ keys (see Loading default operating parameters) to load the default parameters and then repeat the control parameter setup.
3) For all other errors, contact your Service Representative.

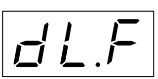
Default Parameters

Loading default operating parameters

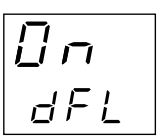
The control parameters can be loaded with predetermined default values. These are the settings loaded into the instrument prior to shipment from the factory. To load the default values proceed as follows:

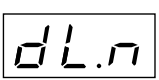
a) Close switch V2 (see Figure 1, Configuration Procedure).
b) The safety lock must be off.
c) Autotuning (Smart AT) must be disabled.
d) The upper display will show the process variable while the lower display shows the setpoint or the measured current.
e) Hold down the ▼ key and press the ▲ key; the display will show:

3 digit dual display **3 digit deviation bar**
3 digit heat/cool

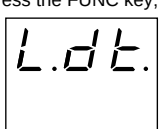


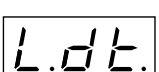
f) Within 10 seconds, press the ▲ key.
The display will show:





g) Press the FUNC key; the display will show:





This indicates that the loading procedure has been initiated. After about 3 seconds the loading procedure is complete and the instrument reverts to the "normal display mode." The following is a list of the default operating parameters loaded during the procedure:

Default operating parameter list

Param	**Default Value**
SP	Minimum range
nnn	OFF
AL	Minimum of range (process alarms) 0 (deviation or band alarms)
HSA	0.1%
PB	4.0%
HS	0.5%
tl	04.0 (4 minutes)
td	1.00 (1 minute)
IP	30% for 1 control output 0% for 2 control outputs
C	20 seconds (relay output) 2 seconds (SSR output)
C2	10 seconds for P6 = Alr 4 seconds for P6 = OIL 2 seconds for P6 = H2O
rC	1.00 for P6 = Alr 0.80 for P6 = OIL 0.40 for P6 = H2O
OLP	0
rL	Initial scale value (Low)
rH	Full Scale value (High)
OLH	100%
tOL	Infinite

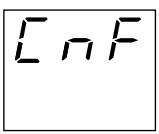
Default Configuration Parameters

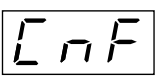
The configuration parameters can be loaded with predetermined default values. These are the settings loaded into the instrument prior to shipment from the factory. To load the default values proceed as follows:

a) Open switch V2 (see Figure 1, Configuration Procedure).

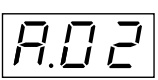
b) The upper display will show:

3 digit dual display **3 digit deviation bar**
3 digit heat/cool

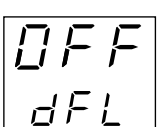


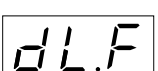


c) Press the ▼ key; the lower display will show the firmware version.

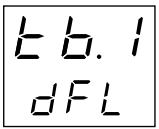


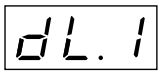
d) Still holding the ▼ key, press the ▲ key. The display will show:



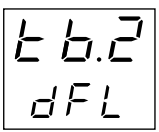


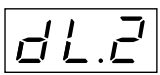
e) Within 10 seconds, press the ▲ key. The display will show:



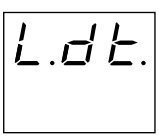


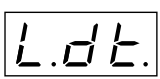
f) Press the ▲ or ▼ key to select the desired default parameters (see table on following page).





g) Press the FUNC key; the display will show:





This indicates that the loading procedure has been initiated. After about 3 seconds the loading procedure is complete and the instrument reverts to the display shown in step b. The following is a list of the default configuration parameters loaded during the procedure:

Default configuration parameter list

PRODUCT	3 digit deviation bar		3 digit dual display		3 digit heat/cool	
PARAMETER	TABLE 1	TABLE 2	TABLE 1	TABLE 2	TABLE 1	TABLE 2
	European	USA	European	USA	European	USA
P1	1 = J/0-800 °C	9 = J/0-999 °F	1 = J/0-800 °C	9 = J/0-999 °F	1 = J/0-800 °C	9 = J/0-999 °F
P2	0 °C	0 °F	0 °C	0 °F	0 °C	0 °F
P3	400 °C	999 °F	400 °C	999 °F	400 °C	999 °F
P4	r	r	r	r	r	r
P5	0	0	0	0	5	5
P6	H	H	H	H	Air	Air
P7	r	r	r	r	r	r
P8	OFF	OFF	OFF	OFF	OFF	OFF
P9	0	0	0	0	0	0
P10	0	0	0	0	0	0
P11	0	0	0	0	0	0
P12	10	10	10	10	10	10
P13	2	2	--	--	--	--
P14	ON	ON	ON	ON	ON	ON
P15	2	2	2	2	2	2
P16	30.0	30.0	30.0	30.0	30.0	30.0
P17	1.0	1.0	1.0	1.0	1.0	1.0
P18	--	--	--	--	1.5	1.5
P19	--	--	--	--	OFF	OFF
P20	00.3	00.3	00.3	00.3	00.3	00.3

SPECIFICATIONS

General

Case: Dark grey polycarbonate. Self-extinguishing degree V-0 according to UL-94.
Front Protection: Designed and tested for IP65 and NEMA 4X for indoor locations (when panel gasket is installed).
Installation: Panel mounting.
Rear Terminal Block: Ten screw terminals with safety rear cover.
Dimensions: 48 x 48 mm (1.890 x 1.890 in.) according to DIN 43700; 100 mm (3.937 in.) depth.
Cutout: 45 x 45 mm -0 mm, +0.6 mm (1.772 x 1.772 in -0 in, +0.024)
Weight: 160 grams (6.6 ounces).
Power Supply: From 100 to 240 Vac, 50/60 Hz or 24 Vac/Vdc.
Power Supply Variation: -15 to +10% of nominal value.
Power Consumption: 5 VA.
Insulation Resistance: Greater than 100 MΩ (Class III apparatus) according to IEC 348.
Isolation Voltage: 1500 Vrms.
D/A Conversion: Dual slope integration.
Noise Immunity:
a) Electrical fast transient/burst requirements: Severity Level 3 (according to IEC 801-4).
b) Electrical discharge requirements: Severity Level 8 (according to IEC 801-2).
Sampling Time: 500 msec typical.
Accuracy: ±0.3% full scale value ±1 digit @ 25 °C and nominal power supply value.
Temperature Drift:
Less than 200 ppm/°C of full scale value selected (RJ excluded).
Less than 400 ppm/°C of full scale value for RTD range -19.9 to 99.99.
Reference Junction Drift: 0.1 °C/°C.
Common Mode Rejection Ratio: 120 dB @ 50/60 Hz.
Normal Mode Rejection Ratio: 60 dB @ 50/60 Hz.
Operating Temperature: 0 to 50 °C.
Storage Temperature: -20 to 70 °C.
Humidity: From 20 to 85% RH non-condensing.

Control Actions

On/Off, PID or autotuning (Smart AT)
Special Function: Standby alarm sequence.
Protection: Internal jumper for calibration and configuration parameter protection.

Inputs

Input: Thermocouples (J, L, K, N) or RTD Pt 100. Input types are keyboard programmable.
Engineering Units: °C or °F configurable.
Reference Junction: Automatic compensation from 0 to 50 °C.
Line Impedance: 100 Ω max for TC input. Less than 4 Ω per wire for RTD input.
Sensor Break: Downscale or upscale programmable. On RTD input, a special test is provided to signal OVERRANGE when input resistance is less than 15 Ω. (Short circuit sensor detection.)
Calibration: According to IEC 584-1 and DIN 43710-1977.

Input	Ranges		
TC L	0 to 800 °C	0 to 900 °F	DIN 43710-1977
TC J	0 to 800 °C	0 to 999 °F	IEC 584-1
TC K	0 to 999 °C	0 to 999 °F	IEC 584-1
TC N	0 to 999 °C	0 to 999 °F	IEC 584-1
RTD Pt 100	-19.9 to 99.9 °C		DIN 43760
RTD Pt 100	-199 to 500 °C	-199 to 999 °F	DIN 43760

Outputs

Main Output

a) Relay SPDT, contact rating 3 Amps @ 250 Vac on resistive load.
b) Logic output for SSR, 700 Ω maximum load, short circuit protected.
Logic Level 1:
14 Vdc ±20% @ 20 mA max.
24 Vdc max ±20% @ 1 mA.
Logic Level 0:
Less than 0.5 Vdc.

Cooling Output (3 digit heat/cool only):
Relay SPST, contact normally open, contact rating 1 Amp @ 250 Vac on resistive load.

Alarm

Alarm Functions:
Process Alarm.
Deviation Alarm.
Band Alarm.
Instrument Malfunctioning Annunciator.

Type of Alarm:
High/Low (Outside/Inside for band alarm).
Direct/Reverse.
Standby Sequence/No Standby Sequence.

Alarm Hysteresis:
0.1 to 10.0% of input span or 1 least significant digit.

Alarm Output:
Relay SPST 1 Amp @ 250 Vac resistive load.

3 Digit Deviation Bar Characteristics

Display:
3 digit 7 segment LED display; 10 mm high.

Bargraph:
1 green LED + 2 red LEDs for 5 level deviation indication.

Indicators:
1 red LED when heating output is ON.
1 red LED when Alarm 1 is ON.
1 green LED when autotuning (Smart AT) is enabled.

3 Digit Dual Display and 3 Digit Heat/Cool Characteristics

Upper Display:
3 digit 7 segment LED display; 10 mm high.

Lower Display:
3 digit 7 segment LED display; 7.6 mm high.

Indicators:
1 red LED when heating output is ON.
1 red LED when cooling output is ON or alarm is ON.
1 green LED when autotuning (Smart AT) is enabled.

Cooling Output (3 digit heat/cool only):
Relay SPST and contact normal open, contact rating 1 Amp @ 250 Vac resistive load.

CALIBRATION PROCEDURE

Calibration parameters are logically divided into groups of two parameters each - minimum range value and maximum range value. A calibration check is provided after entering the values of each group. A calibration check can be initiated without making an entry: press the FUNC key to advance to the desired calibration check (t. - rj. - P.).

Before beginning calibration, be sure internal switch V2 is open (see Configuration Procedure, Figure 1).

General Guidelines

a) The instrument should be mounted in its case in order to keep the internal temperature constant.
b) Ambient temperature should be stable. Avoid drift due to air conditioning or other mechanical devices.
c) Relative humidity should not exceed 70%.
d) Minimum warm up time should be at least 20 minutes.
e) Operate as much as possible in a noise free environment.
f) During calibration, connect one input at a time to the rear terminal block.
g) Use calibrators with the following:

Accuracy	
TC Input:	±0.005% output
	±0.001% range
	±5 microvolt
RTD Input:	±0.02%
	±0.0025 Ω/decade
CJ Compensation:	Better than 0.1 °C

Resolution	
TC Input:	1 microvolt
RTD Input:	10 milliohm
CJ Compensation:	Better than 0.1 °C

Calibration Parameters

Following is a complete list of calibration symbols:

Code	Parameter
tL	TC Input Minimum Range Value
tH	TC Input Maximum Range Value
t.	TC Input Check
rJ	Cold Junction Compensation
rJ.	Cold Junction Compensation Check
PL	RTD Input Minimum Range Value
PH	RTD Input Maximum Range Value
P.	RTD Input Check

Procedure

Switch on the instrument; the display will show “CnF”. Press the ▲ key and the display will show “CAL”. Press the “FUNC” key to start the calibration process. Repeatedly press the FUNC key until the desired calibration (parameter) code appears.

The lower display will show the parameter code while the upper display shows “ON” or “OFF”. The deviation display controller will display the parameter code followed by “F” for OFF or “N” for ON.

Use the ▲ key to select between ON and OFF. To go to the next parameter without modifying the calibration, press the FUNC key when the display shows “OFF” (“F” for the deviation display controller).

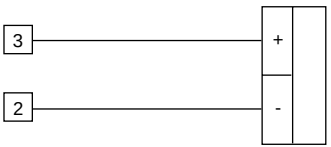
To start parameter calibration, press the FUNC key when the display shows “ON”.

NOTE: Press the AT key to display the previous parameter without storing the new calibration.

Entering Calibration Values

tL TC input minimum range value

a) Connect calibrator and instrument as shown below.



b) The upper display shows “OFF”, the lower display shows “tL”. The deviation display controller will show “tL.F”.
c) Set the calibrator to 0.000 mV.
d) Press the ▲ key; the display changes to “ON”. The deviation display controller will show “tL.n”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When calibration is complete, the instrument will proceed to the next parameter.

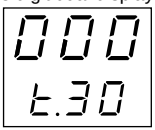
tH TC input maximum range value

a) The upper display shows “OFF”, the lower display shows “tH”. The deviation display controller will show “tH.F”.
b) Set the calibrator to 50.000 mV.
c) Press the ▲ key; the display changes to “ON”. The deviation display controller will show “tH.n”.
d) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When the calibration is complete, the instrument will proceed to the next parameter.

t. TC input check

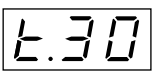
The display will show ”t.” followed by a number showing the measured value in counts. The calibration for “tH” is correct if the indication is “t.30 000” ±10 counts.

3 digit heat/cool
3 digit dual display



3 digit deviation bar

Alternately

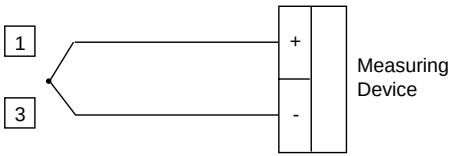


a) Check the “Minimum Range” calibration (see parameter tL) by setting the calibrator to 0.000 mV - the readout must be equal to “t.00 000” ±10 counts.
b) Check linearity at half scale by setting 25.000 mV on the calibrator. The readout must be “t.15 000” ±10 counts.
c) Check the “Maximum Range” calibration by setting the calibrator to 50.000 mV - the readout must be equal to “t.30 000” ±10 counts.
d) Press the FUNC key, “OFF” and “rJ” will appear on the displays. The deviation display controller will display “rJ.F”.

rJ Cold junction compensation

NOTE: Make sure tL and tH are correctly calibrated before attempting rJ calibration.

a) Measure the temperature close to terminals 1 and 3 using an appropriate instrument, as shown below.



b) Wait a few minutes to allow temperature stabilization of the entire system (compensation cable, sensor, calibrator and instrument).

c) Using the ▲ key, make the readout value equal to the temperature measured by the measuring device in tenths of a °C.

d) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When this calibration is complete, the instrument will proceed to the cold junction compensation check.

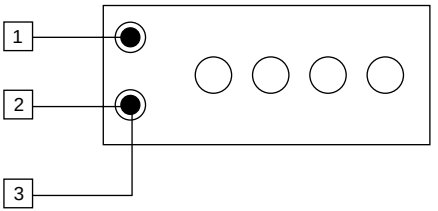
rJ. Cold junction compensation check

The display will show "rJ." and the temperature in tenths of a degree, measured by the CJ compensator. Check that the display readout is equal to the value read by the measuring device.

Press the FUNC key, the instrument will proceed to the next parameter.

PL RTD input minimum range value

a) Connect a resistor box and the instrument as shown below.



b) The upper display shows "OFF", the lower display shows "PL". The deviation display controller will display "PL.F".

c) Set 0.000 Ω on the resistor box.

d) Press the ▲ key; the display changes to "ON". The deviation display controller will display "PL.n".

e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When this calibration is complete, the instrument will proceed to the next parameter.

PH RTD input maximum range value

a) The upper display shows "OFF", the lower display shows "PH". The deviation display controller will show "PH.F".

b) Set the resistor box to 300.000 Ω.

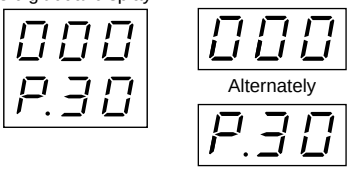
c) Press the ▲ key; the display changes to "ON". The deviation display controller will display "PH.n".

c) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When this calibration is complete, the instrument will proceed to the RTD input check.

P. RTD input check

The display shows “P.” followed by a number showing the measured value in counts. The calibration for “PH” is correct if the indication is “P.30 000” ±10 counts.:

3 digit heat/cool 3 digit deviation bar
3 digit dual display



a) Check the “Maximum Range” calibration by setting 300.000 Ω (see parameter PL) on the resistance box; the readout should be “P.30 000” ±10 counts.
b) Check the “Minimum Range” calibration by setting 0.000 Ω on the resistance box; the readout should be “P.00 000” ±10 counts.
c) Check linearity.
NOTE: The relation between the input signal and counts for RTD input is not linear. The correct relation is shown in the following table:

Resistor Box	Display Counts
0	0 ±10 counts
125	1 0190 ±10 counts
250	2 0189 ±10 counts
375	3 0000 ±10 counts

d) Press the FUNC key.

This completes the calibration procedure. To enter the configuration procedure press the ▲ key, the display will show “CnF”. If configuration and calibration are complete, switch the instrument off and close the switch V2.

MAINTENANCE

1. Disconnect the power from the power supply terminals and relay output terminals.
2. Remove the instrument from its case.
3. Using a vacuum cleaner or a compressed air jet (max. 3 kg/cm^2) remove dust and dirt which may be present on the louvers and on the internal circuits, being careful to not damage the electronic components.
4. Clean external plastic or rubber parts with a cloth moistened with ethyl alcohol (pure or denatured) [C_2H_5OH]; or isopropyl alcohol (pure or denatured) [$(CH_3)_2$ CHOH]; or water [H_2O].
5. Verify that there are no loose terminals.
6. Before re-inserting the instrument in its case, be sure it is dry.
7. Re-insert the instrument and turn it on.

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Notes...

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