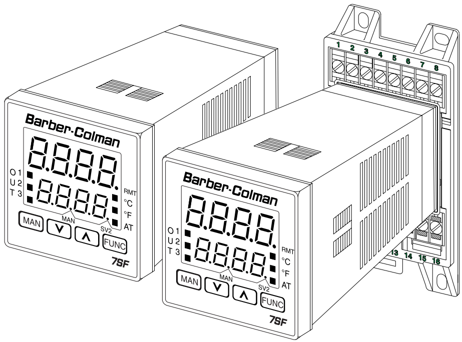
Barber Colman Company

Instruction Manual



1262-IN-005-0-03
February 1998

Model 7SF

SIEBE

A Siebe Group Product

1/16 DIN, FOUR DIGIT DISPLAY CONTROLLER

MODEL:	0	7	S	F	- 9	3	☐	1	☐ -	3	☐	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
07SF - Controller

Field 5. INPUT
9 - TC types J, K, L, N, R and S; Pt 100, 3 wire RTD;
0 to 20 mAdc and 4 to 20 mAdc;
0 to 60 mVdc and 12 to 60 mVdc;
0 to 5 Vdc or 1 to 5 Vdc;
0 to 10 Vdc or 2 to 10 Vdc
NOTE: All inputs are factory calibrated and selectable by keys. Factory set at type J.

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

Field 7. OUTPUT 1
1 - Relay
6 - SSR

Field 8. OUTPUT 2
1 - Relay (cooling/alarm)

Field 9. OPTIONS
0 - None
1 - Alarm 2
2 - Alarm 2, plus Hbd (heater breakdown) (or logic input)
3 - Alarm 2, plus RS-485
4 - Alarm 2, plus RS-485 and Hbd (or logic input)
NOTE: For Hbd, order transformer separately.

Field 10. POWER SUPPLY
3 - 100 to 240 Vac

Field 11. Mounting
0 - Panel Mount
R - Wall or Rail Mount

Fields 12 through 15. RESERVED

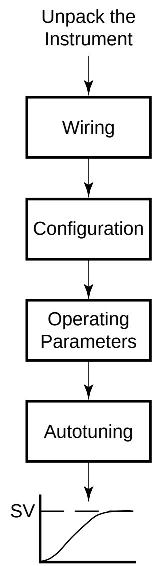
CONGRATULATIONS

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
2. Configure the instrument
3. Check the operating mode parameters
4. Check the autotune (Smart AT) process



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CAUTION: USE WIRE SUITABLE FOR 75 °C MINIMUM

IMPORTANT!

Terminal identification of the panel mount controller is *different* from terminal identification of the wall/rail mount controller! This manual contains wiring instructions for both types of controllers.

Be sure to follow the instructions that pertain to the controller you are installing!

MOUNTING REQUIREMENTS PANEL MOUNT CONTROLLER

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.

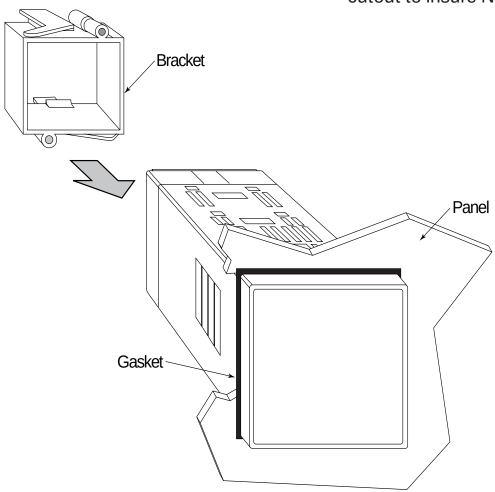
The instrument can be mounted on a panel up to 15 mm (0.591 in) thick with a cutout of 45 x 45 mm (1.772 x 1.772 in) - see outline in “Dimensions and Panel Cutout.”

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 lb/in).
5) Make sure the instrument will not move within the cutout to insure NEMA 4X/IP65 protection.



MOUNTING REQUIREMENTS WALL OR RAIL MOUNT CONTROLLER

WARNING:

1) The correct functionality of these instruments is guaranteed only if transport, storage, installation, wiring, working condition and maintenance are executed in compliance with this manual.
2) The protection degree of these instruments is equal to IP 20 (according to IEC529) and they are connected to dangerous power lines, for these reasons:
   - installation, wiring and maintenance must be executed by qualified personnel;
   - all warnings contained in this manual must be complied.
3) The safety requirements for Permanently Connected Equipment say:
   - a switch or circuit-breaker shall be included in the building installation;
   - It shall be in close proximity to the equipment and easy to reach for the operator;
   - it shall be marked as the disconnecting device for the equipment.

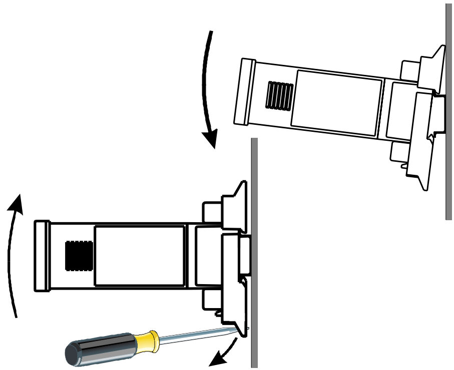
   NOTE: a single switch or circuit-breaker can drive more than one instrument.
4) Before to execute any operation on the connections, disconnect the instrument from the power line by the circuit breaker.

GENERAL ASSEMBLING INFORMATION

Select a cleaned location, easy to reach, where minimum vibrations are present and the ambient temperature is within 0 and 50 °C (32 and 122 °F).
These instruments can be mounted either on wall or on a DIN rail.

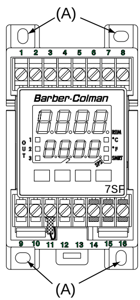
RAIL MOUNTING

Use DIN rail in accordance with EN 50 022 (35 x 7.5 mm or 35 x 15 mm)

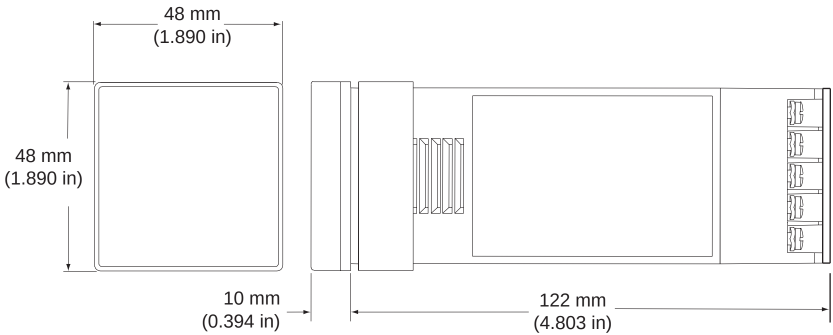


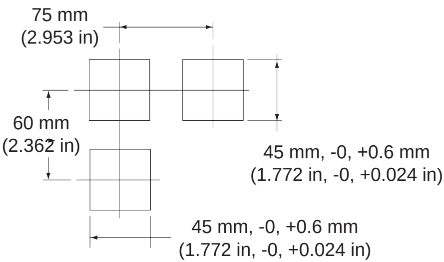
WALL MOUNTING

For wall mounting, use the (A) holes.
In this case it is advisable to use four M4 screws with a torque of 1Nm.

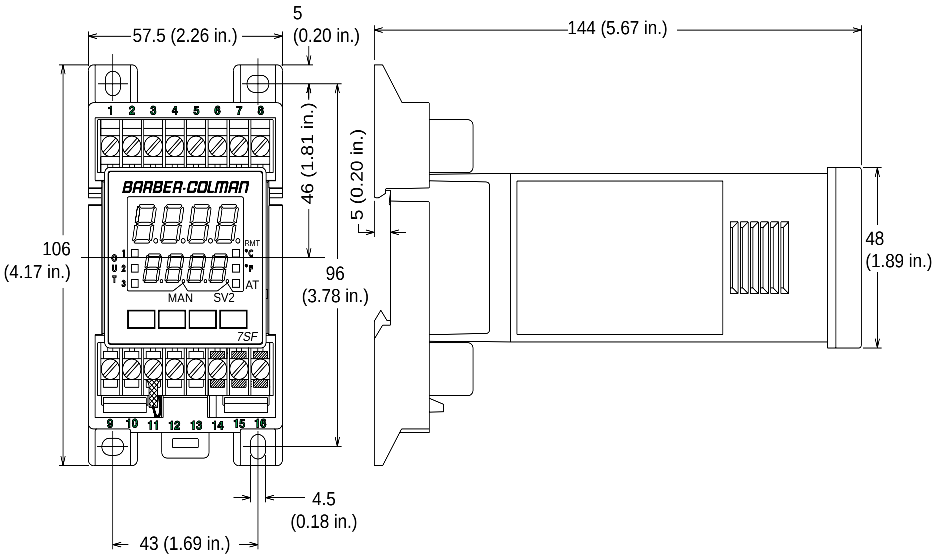


DIMENSIONS
PANEL MOUNT CONTROLLER



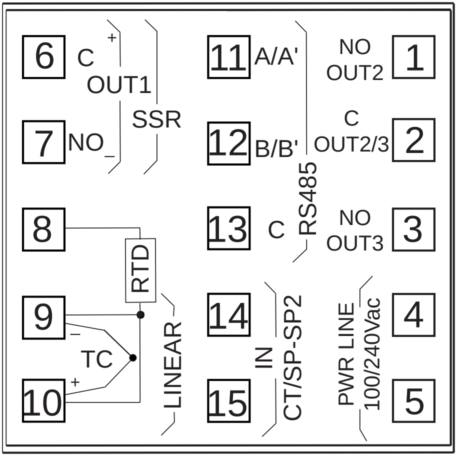


DIMENSIONS
WALL OR RAIL MOUNT CONTROLLER

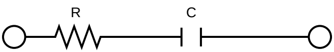


WIRING GUIDELINES
PANEL MOUNT CONTROLLER

TERMINAL BOARD



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



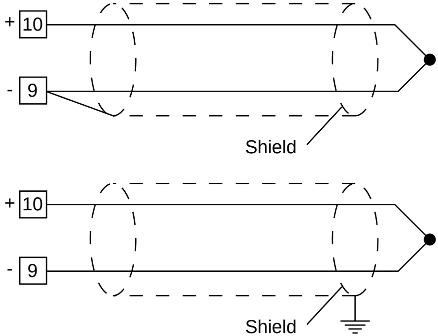
in accordance with the following table:

Load Current	C (μF)	R (Ω)	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 (PANEL MOUNT)

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



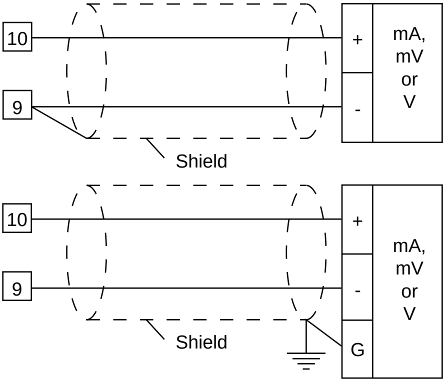
SAFETY NOTE:

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.

LINEAR INPUT (PANEL MOUNT)



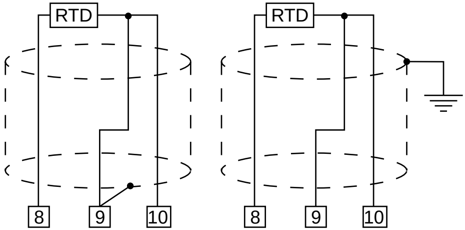
SAFETY NOTE:

1) Do not run input wires with power cables.

NOTES:

1) High line resistance can cause measurement errors.
2) When shielded cable is used, ground it at one end only to avoid ground loop currents.
3) The input impedance is equal to:
   Less than 5 ohms for 2 mA input
   Greater than 1 megohms for 60 mVdc input
   Greater than 200 k ohms for 5 Vdc input.
   Greater than 400 k ohms for 10 Vdc input.

RTD INPUT (PANEL MOUNT)



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
T Copper Constantan	+ White - Blue Blue	+ Blue - Red Blue	+ Red - Brown Brown	+ Yellow - Blue Blue
J/L Iron Constantan	+ Yellow - Blue Black	+ White - Red Black	+ Red - Blue Blue	+ Yellow - Black Black
K Nickel Chromium Nickel Aluminum	+ Brown - Blue Red	+ Yellow - Red Yellow	+ Red - Green Green	+ Yellow - Purple Yellow
R Platinum/Platinum 13% Rhodium	+ White - Blue Green	+ Black - Red Green	+ Red - White White	+ White - Green Green
S Platinum/Platinum 10% Rhodium	+ White - Blue Green	+ Black - Red Green	+ Red - White White	+ White - Green Green
E Chromel Constantan	+ Brown - Blue Brown	+ Violet - Red Violet	- - -	- - -
B Platinum 30% Rh Platinum 6% Rh	- - -	+ Grey - Red Grey	- - -	- - -
N Nicrosil/Nisil	-	-	-	-

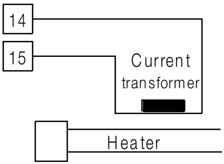
B) CURRENT TRANSFORMER INPUT (PANEL MOUNT)

SAFETY NOTE:

Do not run current transformer input wiring with AC power cables.

NOTE:

1) The minimum active period to perform this measurement is 400 ms.
2) This feature excludes the logic input function.
3) Input impedance is equal to 10 ohms.



This input allows to measure and display the current running in the load driven by output 1 during the on and off period of the out 1 cycle time. By this feature, out 1 failure detection is also available.

C) LOGIC INPUT (PANEL MOUNT)

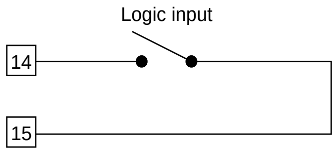
This input selects between SP and SP2 as the operating setpoint.

SAFETY NOTES:

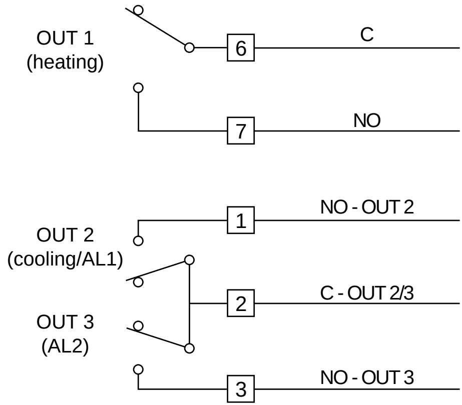
1) Do not run logic input wiring with AC power cables.
2) Use an external dry contact capable of switching 0.5 mA, 5 Vdc.

NOTES:

1) The instrument needs 100 ms to recognize a contact status variation.
2) This feature excludes the current transfrormer input.
3) The logic input is not isolated by the measuring input.



D.1) RELAY OUTPUTS (PANEL MOUNT)



All relay contacts are protected by varistor against inductive load with inductive component up to 0.5 A.

OUT 1: Contact rating of 3 Amps/250 Vac resistive load.

OUT 2 and 3: Contact rating of 2 Amp/250 Vac resistive load.

Operations at specified rating: 1 x 10^5

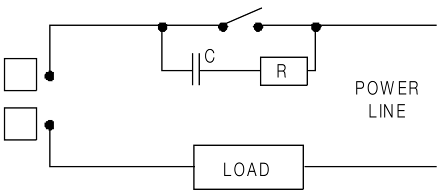
SAFETY NOTES:
1) To avoid electric shock, connect power line at the end of the wiring procedure.
2) Do not run input wires with power cables.

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

D.2) INDUCTIVE LOADS (PANEL MOUNT)

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.



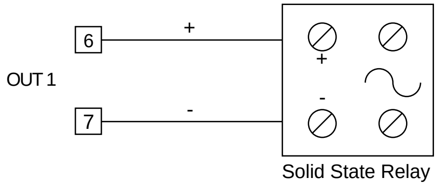
It is recommended to install an additional RC network across the external contacts as close to the instrument terminals as possible.

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

Load Current	C (μF)	R (Ω)	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.

D.3) VOLTAGE OUTPUTS FOR SSR DRIVE (PANEL MOUNT)



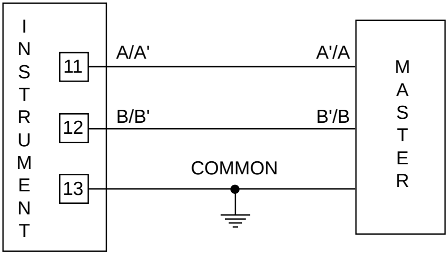
THIS IS A TIME PROPORTIONING OUTPUT.

Logic voltage for SSR drive.
Logic level 0: Less than 0.5 Vdc.
Logic status 1: 24 Vdc ±20% @ 1 mA.
14 Vdc ±20% @ 20 mA.
Maximum current = 20 mA.

NOTE: This output is not isolated. A double or reinforced isolation between the instrument output and the power supply is accomplished by an external solid state relay.

E) SERIAL INTERFACE (PANEL MOUNT)

The RS-485 interface can connect up to 30 instruments with the remote master unit (see below).

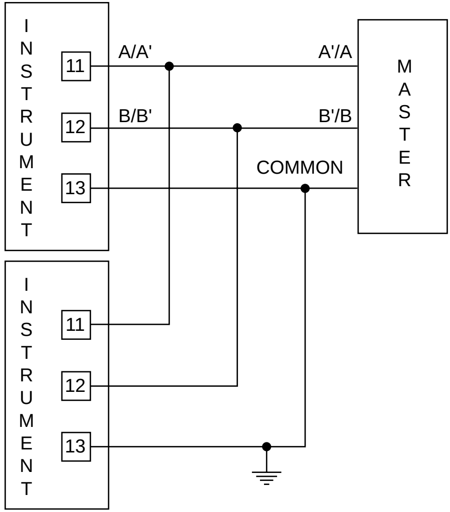


Maximum cable length: 1.5 km (9/10 mile) at 9600 BAUD.

NOTE: According to EIA specification for RS-485:

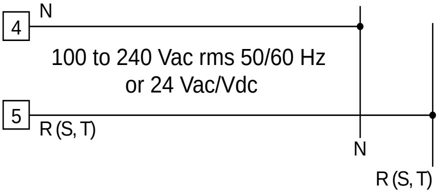
a) The “A“ terminal of the generator shall be negative with respect to the “B“ terminal for a binary 1 (MARK or OFF) state.

b) The “A“ terminal of the generator shall be positive with respect to the “B“ terminal for a binary 0 (SPACE or ON) state.



Connect the instruments (maximum of 30) to the master unit by interface communication type RS-485.

F) POWER LINE WIRING (PANEL MOUNT)



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).
5) Connect neutral line, if present, to terminal 4.

NOTES:

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

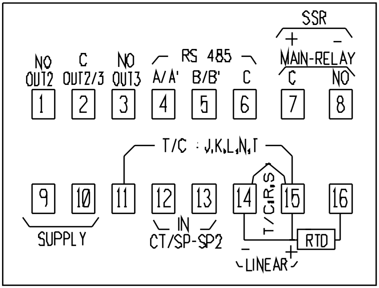
Power Supply	Type	Current	Voltage
24 Vac/Vdc	T	500 mA	250 V
100/240 Vac	T	125 mA	250 V

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

5) For 24 Vdc, the polarity is a do not care condition.

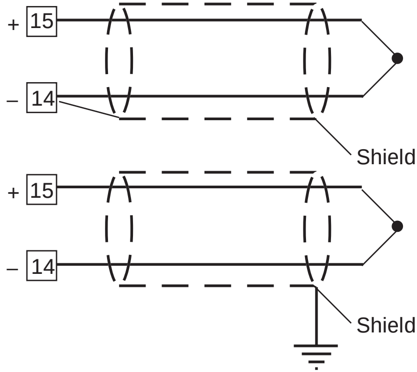
WIRING GUIDELINES WALL OR RAIL MOUNT CONTROLLER

Connections have to be executed when the instrument is placed in its proper location.



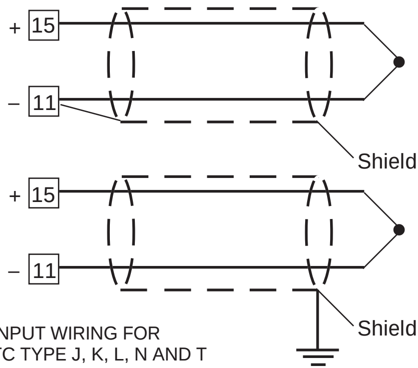
MODEL 7SF RELAY TERMINAL BLOCK

TC INPUT
TC type R and S (Wall & Rail Mount)



INPUT WIRING FOR TC TYPE R AND S

TC type J, K, L, N and T (Wall & Rail Mount)



INPUT WIRING FOR
TC TYPE J, K, L, N AND T

MEASURING INPUTS

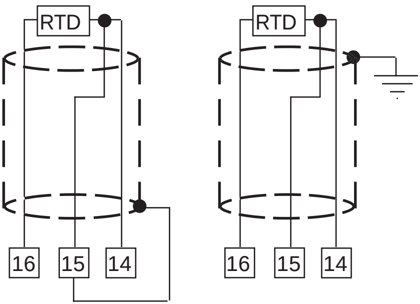
NOTES:

1) Any external components (like zener barriers etc.) connected between sensor and input terminals may cause measurement errors due to excessive and/or not balanced line resistance or possible leakage currents.
2) The input accuracy is equal to ± 0.2 % f.s.v. (**) ± 1 dgt. @ 25°C of ambient temperature.

(**) For TC input, the f.s.v. should be referenced to the higher f.s.v. of the TC selected.

NOTE:
1) Do not run input wires with power cables.
2) For TC wiring use proper compensating cable preferable shielded.
3) when a shielded cable is used, it should be connected to one side only.

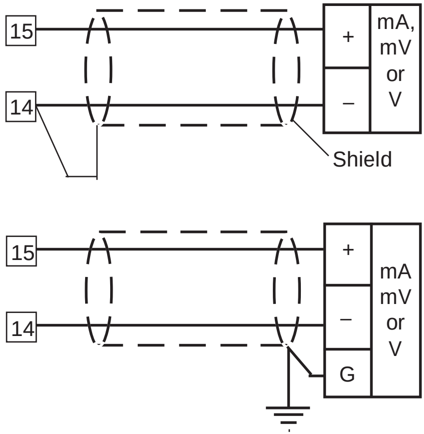
RTD INPUT (Wall & Rail Mount)



RTD INPUT WIRING

NOTE:
1) Don't run input wires together with power cables.
2) Pay attention to the line resistance; an high line resistance may cause measurement errors.
3) When shielded cable is used, it should be grounded at one side only to avoid ground loop currents.
4) The resistance of the 3 wires must be the same.

LINEAR INPUT(Wall & Rail Mount)



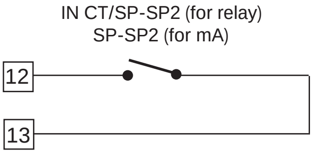
mA, mV AND V INPUTS WIRING

NOTE:
1) Do not run input wires together with power cables.
2) Pay attention to the line resistance; a high line resistance may cause measurement errors.
3) When shielded cable is used, it should be grounded at one side only to avoid ground loop currents.
4) The input impedance is equal to:
< 5 ohms for 20 mA input
> 1 M ohms for 60 mV input
> 200 k ohms for 5 V input
> 400 k ohms for 10 V input

LOGIC INPUT (Wall & Rail Mount)

NOTES:

1) Do not run logic input wiring together with power cables.
2) Use an external dry contact capable of switching 0.5 mA, 5 V dc.
3) The instrument needs 100 ms to recognize a contact status variation.
4) The logic input is NOT isolated by the measuring input.
5) This feature excludes the current transformer input.



LOGIC INPUT WIRING

This input (connections 12 and 13) is used either a current transformer input (relay only) or a logic input. When the logic input is selected, it is used to switch, by an external contact, from main set point to second set point and viceversa.

logic input	op. set point
open	SP
close	SP2

CURRENT TRANSFORMER INPUT (For relay only) (Wall & Rail Mount)

Safety note:

1) Do not run current transformer input wiring together with AC power cables.
2) This feature excludes the logic input function.
3) The input impedance is equal to 10 Ω.

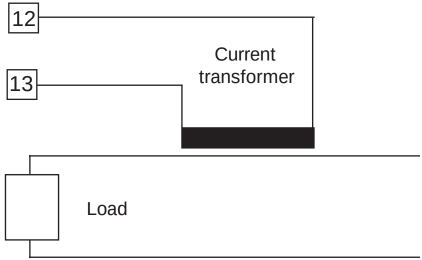


Fig. 10 - CURRENT TRANSFORMER INPUT WIRING

This input allows to measure and display the current running in the load driven by the OUTPUT1 during the ON and OFF period of the OUT 1 cycle time. By this feature it is also available the "OUT 1 failure detection" function.

RELAY OUTPUTS (Wall & Rail Mount)

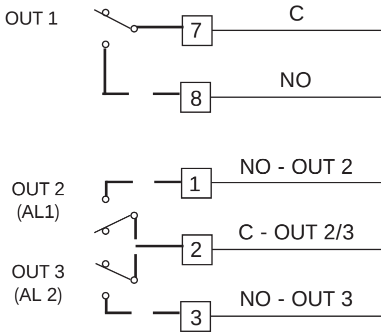


Fig. 12 RELAY OUTPUTS WIRING

The contact rating of OUT 1 is 3A/250V AC on resistive load.
The contact rating of OUT 2 and 3 is 2A/250V AC on resistive load.
The number of operations is 1 x 10^5 at specified rating.

NOTES

1) To avoid electric shock, connect power line at the end of the wiring procedure.
2) For power connections use No 16 AWG or larger wires rated for at last 75 °C.
3) Use copper conductors only.
4) Do not run input wires with power cables.

All relay contacts are protected by varistor against inductive load with inductive component up to 0.5 A.

The following are recommendations avoid serious problems which may occur, when using relay output for driving inductive loads.

INDUCTIVE LOADS (Wall & Rail Mount)

High voltage transients may occur switching inductive loads.
Through the internal contacts these transients may introduce disturbances which can affect the instrument performances .
For all outputs, the internal protection (varistor) assures a correct protection up to 0.5 A of inductive component.

The same problems may occur when a switch is used in series with the internal contacts as shown in Fig. 13.

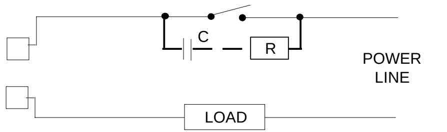


Fig. 13 EXTERNAL SWITCH IN SERIES WITH THE INTERNAL CONTACT

In this case it is recommended to install an additional RC network across the external contact as show in Fig. 13. The value of capacitor (C) and resistor (R) are shown in the following table.

LOAD (mA)	C (µF)	R (Ω)	P. (W)	OPERATING VOLTAGE
<40 mA	0.047	100	1/2	260 V AC
<150 mA	0.1	22	2	260 V AC
<0.5 A	0.33	47	2	260 V AC

Anyway the cable involved in relay output wiring must be as far away as possible from input or communication cables.

VOLTAGE OUTPUTS FOR SSR DRIVE (Wall & Rail Mount)

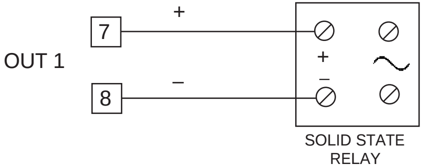


Fig. 14   SSR DRIVE OUTPUT WIRING

It is a time proportioning output.
Logic level 0: Vout < 0.5 V DC.
Logic level 1:
- 14 V ± 20 % @ 20 mA
- 24 V ± 20 % @ 1 mA.
Maximum current = 20 mA.

NOTE: This output is not isolated. A double or reinforced isolation between instrument output and power supply must be assured by the external solid state relay.

SERIAL INTERFACE (Wall & Rail Mount)

RS-485 interface allows to connect up to 30 devices with one remote master unit.

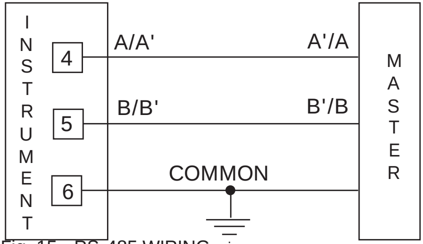


Fig. 15 - RS-485 WIRING

The cable length must not exceed 1.5 km at 9600 BAUD.
NOTE: The following report describes the signal sense of the voltage appearing across the interconnection cable as defined by EIA for RS-485.

a) The " A " terminal of the generator shall be negative with respect to the " B " terminal for a binary 1 (MARK or OFF) state.
b) The " A " terminal of the generator shall be positive with respect to the " B " terminal for a binary 0 (SPACE or ON)

POWER LINE WIRING (Wall & Rail Mount)

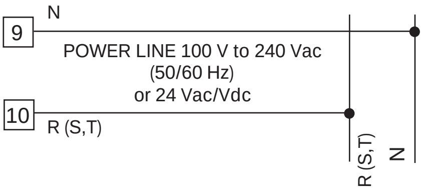


Fig. 16 POWER LINE WIRING

NOTES:

1) Before connecting the instrument to the power line, make sure that line voltage corresponds to the description on the identification label.
2) To avoid electric shock, connect power line at the end of the wiring procedure.
3) For supply connections use No 16 AWG or larger wires rated for at last 75 °C.
4) Use copper conductors only.
5) Do not run input wires with power cables.
6) For 24 V DC the polarity is not a care condition.
7) The power supply input is *not* fuse protected. Please, provide it externally.

Power supply	Type	Current	Voltage
24 Vac/ Vdc	T	500 mA	250 V
100/240 Vac	T	125 mA	250 V

When fuse is damaged, it is advisable to verify the power supply circuit, so that it is necessary to send the instrument back to your supplier.

8) The safety requirements for Permanently Connected Equipment say:
   - a switch or circuit-breaker shall be included in the building installation;
   - It shall be in close proximity to the equipment and within easy reach of the operator;
   - it shall be marked as the disconnecting device for the equipment.

   NOTE: a single switch or circuit-breaker can drive more than one instrument.
9) When neutral line is present, connect it to terminal 9

CONFIGURATION

PRELIMINARY HARDWARE SETTINGS

1) Remove the instrument from its case.
2) Set J106 according to the following table:

Input Type	J106				
	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10
TC-RTD	open	close	open	open	open
60 mV	open	close	open	open	open
5 V	close	open	close	open	open
10 V	open	open	close	open	open
20 mA	open	open	open	close	close

Note: place the jumper not used on pins 7-9.

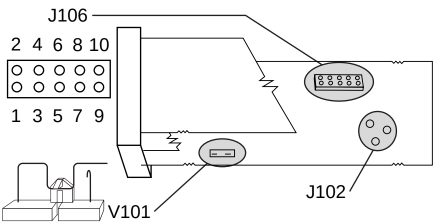


Figure 1

3) Select the output 1 contact; NO (standard) or NC by setting J102 according to the following table:

Contact	NO (standard)	NC
J102	1 - 2	2 - 3

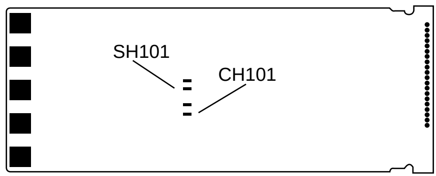
CAUTION: Solder carefully to avoid damage to PCB or other components.

OPEN INPUT CIRCUIT

This instrument is able to identify an open circuit for TC and RTD inputs. The open input circuit condition for RTD input is shown by an “overrange” indication. For TC input, either an overrange indication (standard) or underrange indication can be selected from the following table:

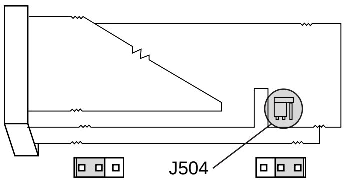
SH101	CH101	Indication
open	close	overrange (default)
close	open	underrange

Both pads are located on the solder side of the CPU card.



SELECTION OF THE "IN CT/SP–SP2" FUNCTION

This instrument can use the input "IN CT/SP–SP2" (terminals 14 and 15) as a current transformer input or a logic input. The current transformer input is used with the output 1 failure detection function; the logic input is used to switch (by an external contact) between the main setpoint (SP) and a second setpoint (SP2). Set J504 as shown in the figure below:



CONFIGURATION KEY FUNCTIONS

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

MAN = 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 V101, located 1 inch behind the upper right corner of the display (see Figure 1).
4) Re-insert the instrument in its case.
5) Switch on power to the instrument.
   NOTE: If instrument displays "CAL", press the ▲ key to select the configuration procedure "ConF".
6) Press the FUNC key.

SER1 SERIAL INTERFACE PROTOCOL

Off = No serial interface.
Ero = Poll/select using proprietary protocol.
nbUS = Modbus
jbUS = Jbus

SER2 SERIAL LINK DEVICE ADDRESS

Not available when "SEr1" = OFF.
From 1 to 95 for proprietary protocol.
From 1 to 255 for all other protocols.
NOTE: The electrical characteristics of the RS-485 serial interface allows 31 devices maximum.

SER3 BAUD RATE FOR SERIAL LINK

Not available when "SEr1" = OFF.
From 600 to 19200 baud.
NOTE: 19200 baud is displayed as 19.20.

SER4 BYTE FORMAT FOR SERIAL LINK

Not available when "SEr1" = OFF.

7E = 7 bits + even parity (for proprietary protocol only).
7O = 7 bits + odd parity (for proprietary protocol).
8E = 8 bits + even parity.
8O = 8 bits + odd parity.
8 = 8 bits without parity.

P1 INPUT TYPE AND STANDARD RANGE

0 =	TC type	L	range	0 to +400.0 °C
1 =	TC type	L	range	0 to +900 °C
2 =	TC type	J	range	-100.0 to +400.0 °C
3 =	TC type	J	range	-100 to +1000 °C
4 =	TC type	K	range	-100.0 to +400.0 °C
5 =	TC type	K	range	-100 to +1370 °C
6 =	TC type	N	range	-100 to +1400 °C
7 =	TC type	R	range	0 to +1760 °C
8 =	TC type	S	range	0 to +1760 °C
9 =	RTD type	Pt 100	range	-199.9 to +400.0 °C
10 =	RTD type	Pt 100	range	-200 to +800 °C
11 =	mV	Linear	range	0 to 60 mV
12 =	mV	Linear	range	12 to 60 mV
13 =	mA	Linear	range	0 to 20 mA
14 =	mA	Linear	range	4 to 20 mA
15 =	V	Linear	range	0 to 5 V
16 =	V	Linear	range	1 to 5 V
17 =	V	Linear	range	0 to 10 V
18 =	V	Linear	range	2 to 10 V
19 =	TC type	L	range	0 to +1650 °F
20 =	TC type	J	range	-150 to +1830 °F
21 =	TC type	K	range	-150 to +2500 °F
22 =	TC type	N	range	-150 to +2550 °F
23 =	TC type	R	range	0 to +3200 °F
24 =	TC type	S	range	0 to +3200 °F
25 =	RTD type	Pt 100	range	-199.9 to +400.0 °F
26 =	RTD type	Pt 100	range	-330 to +1470.0 °F
27 =	TC type	T	range	-199.9 to +400.0°C
28 =	TC type	T	range	-330 to +750°C

NOTE: Selecting P1 = 0, 2, 4, 9, 25 or 27 sets the digital filter (P36) to "FLtr", all remaining ranges it will set to "nOFL". If a different selection is needed, P36 can be modified.

P2 DECIMAL POINT POSITION

This parameter is available only when a linear input is selected (P1 = 11, 12,13,14,15,16, 17 or 18).

- - - - . = No decimal.
- - - . - = One decimal place.
- - . - - = Two decimal places.
- . - - - = Three decimal places.

P3 INITIAL SCALE VALUE (LOW)

Can be set with keys from -1999 to 4000 for linear inputs, and within the input range for TC and RTD. When this parameter is modified, rL will also change.

P4 FULL SCALE VALUE (HIGH)

Can be set with keys from -1999 to 4000 for linear inputs, and within the input range for TC and RTD. When this parameter is modified, rH will also change.

The initial and full scale values determine the input span used by the PID algorithm, autotuning (Smart AT), and the alarm functions.

NOTE: Minimum input span in absolute value (S= P4 - P3) is as follows:

For linear inputs, S ≥100 units.
For TC input with °C readout, S ≥ 300 °C.
For TC input with °F readout, S ≥• 550 °F.
For RTD input with °C readout, S •≥ 100 °C.
For RTD input with °F readout, S ≥ 200 °F.

P5 OUTPUT 1 TYPE

rEL = Relay (cycle time, "CY1", will be forced to 15 seconds).
SSr = SSr (cycle time, "CY1", will be forced to 4 seconds).

P6 OUTPUT 1 ACTION

This parameter is skipped if P7 = 4.

rEV = Reverse acting (Heating).
dir = Direct acting (Cooling).

P7 OUTPUT 2 FUNCTION

0 = None
1 = Used as Alarm 1 output and Alarm 1 is programmed as a process alarm.
2 = Used as Alarm 1 output and Alarm 1 is programmed as a band alarm.
3 = Used as Alarm 1 output and Alarm 1 is programmed as a deviation alarm.
4 = Used as second control output (Cooling output).

NOTE: Setting P7 = 4 forces P6 = “rEV”.

P8 COOLING MEDIA

Available only when P7 = 4.

AIr = Air OIL = Oil H2O = Water

Changing P8 forces the cycle time and relative cooling gain to the default settings of the selected cooling media.

When:	P8 = AIr	- CY2 = 10s	and rC = 1.00
	P8 = OIL	- Cy2 = 4s	and rC = 0.80
	P8 = H2O	- CY2 = 2s	and rC = 0.40

P9 ALARM 1 OPERATING MODE

Available only when P7 = 1, 2 or 3.

H.A. = High alarm (or outside the band) with auto. reset.
L.A. = Low alarm (or inside the band) with auto. reset.
H.L. = High alarm (or outside the band) with man. reset.
L.L. = Low alarm (or inside the band) with man. reset.

P10 OPTIONAL FEATURES

OFF = No option.
SP2 = Digital input for SP/SP2 selection.
n.O. = Current measurements made during the ON period (load driven from a N.O. relay contact or a logic status 1 for an SSR).
n.C. = Current measurements made during the OFF period (load driven from a N.C. relay contact or a logic status 0 for an SSR).

P11 CURRENT TRANSFORMER RANGE

Not available when P10 = “OFF” or “SP2.” Can be programmed from 10 to 100 Amps.

P12 OUTPUT 3 FUNCTION

0 = Not used for Alarm 2.
1 = Used as Alarm 2 output and Alarm 2 is programmed as a process alarm.
2 = Used as Alarm 2 output and Alarm 2 is programmed as a band alarm.
3 = Used as Alarm 2 output and Alarm 2 is programmed as a deviation alarm.

NOTE: The output 3 relay operates as a logical OR between Alarm 2 and the output 1 failure detection (OFD) function.

P13 ALARM 2 OPERATING MODE AND OFD ALARM RESET TYPE

Not available when P12 = 0 or P10 = “OFF” or SP2.

H.A. = High alarm (outside band) with auto. reset.
L.A. = Low alarm (inside band) with auto. reset.
H.L. = High alarm (outside band) with man. reset.
L.L. = Low alarm (inside band) with man. reset.

NOTE: Use one of the low alarm types for OFD.

P14 PROGRAMMABILITY OF THE ALARM 2 SETPOINT AND HYSTERESIS VALUES

Not available when P12 = 0.

OPrt = Alarm 2 setpoint and hysteresis can be set with keys in the operating mode.
COnF = Alarm 2 setpoint and hysteresis can be set with keys in the configuration mode.

P15 ALARM 2 SETPOINT

Not available when P12 = 0 and P14 = “OPrt”.

Range: For process alarm: Within the range limits.
For band alarm: From 0 to 500 units.
For deviation Alarm: From -500 to 500 units.

P16 ALARM 2 HYSTERESIS VALUE

Not available when P12 = 0 and P14 = “OPrt”.

Range: From 0.1 to 10.0% of the range selected with P3 and P4 parameters, or 1 LSD.

P17 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 start-up when the measured value is lower than the setpoint. Enter the setpoint in engineering units.

NOTE: This setpoint setting will not be used when tOL = InF.

P18 SAFETY LOCK

0 = Unlocked. All the parameters can be modified.

1 = Locked. No parameter, except setpoints and alarm manual reset, can be modified. For Smart AT, see P27.

2 to 4999 = Code, used in run time (see nnn parameter), to lock/unlock the device. For SP, SP2, and manual reset of alarm, the lock/unlock condition has no affect. For Smart AT status, see P27.

5000 to 9999 = Code, used in run time (see nnn parameter), to lock/unlock the device. For SP, SP2, manual reset of alarm, AL1, AL2, Hbd, and SCA, the lock/unlock has no affect. For Smart AT, see P27.

Note: when safety lock is selected the code cannot be displayed. The display will show 0, 1, SFt.A if P18 is 2 to 4999; or SFt.b if P18 is 5000 to 9999.

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 234 on the display.
2) Press the FUNC key.

ADVANCED CONFIGURATION PROCEDURE

P19 ALARM 1 ACTION

Not available when P7 = 0 or 4.

rEV = Reverse (relay de-energized in alarm condition).
dir = Direct (relay energized in the alarm condition).

P20 ALARM 1 STANDBY

Not available when P7 = 0 or 4.

OFF = Standby disabled.
ON = Standby enabled.

NOTE: If the alarm is a band or deviation alarm, the alarm is masked after a setpoint change or at start-up 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.

P21 ALARM 2 AND OUT 1 FAILURE DETECTION ACTION

Not available when P12 = 0 or P10 = “OFF”.

rEV = Reverse (relay de-energized in alarm condition).
dir = Direct (relay energized in the alarm condition).

P22 ALARM 2 STANDBY FUNCTION

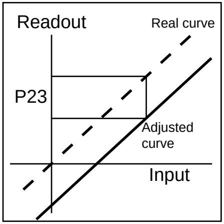
Not available when P12 = 0.

OFF = Standby disabled.
ON = Standby enabled.

NOTE: If the alarm is a band or deviation alarm, the alarm is masked after a setpoint change 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.

P23 OFFSET APPLIED TO MEASURED VALUE

Used to apply a constant OFFSET throughout the entire readout range (not used for linear inputs). For ranges with a decimal place, set with keys from -19.9 to 19.9; without a decimal place, from -199 to 199.



P25 PROTECTED DISPLAY PARAMETERS

This parameter is skipped when P18 = 0.

OFF = Protected parameters cannot be displayed.
ON = Protected parameters can be displayed.

P26 MANUAL FUNCTION

OFF = Manual function is disabled.
ON = Manual function can be enabled/disabled by MAN pushbutton.

P27 AUTOTUNE (SMART AT) FUNCTION

0 = Autotuning disabled.
1 = Autotuning is NOT protected by safety lock.
2 = Autotuning is under safety lock protection.

P28 RELATIVE COOLING GAIN CALCULATED BY AUTOTUNING

This parameter is present only if P7 = 4 and P27 is not 0.

OFF = Autotuning algorithm does not calculate rC.
ON = Autotuning algorithm calculates rC.

P29 MAXIMUM VALUE OF THE PROPORTIONAL BAND CALCULATED BY AUTOTUNING

This parameter is present only if P27 is different from 0.
Can be set with keys from P30 or P31 to 100.0%.

P30 MINIMUM VALUE OF THE PROPORTIONAL BAND CALCULATED BY AUTOTUNING WHEN THE INSTRUMENT HAS TWO CONTROL OUTPUTS

This parameter is available only if P7 = 4 and P27 is not 0. Can be set with keys from 1.5% to P29 setting.

P31 MINIMUM VALUE OF THE PROPORTIONAL BAND CALCULATED BY AUTOTUNING WHEN THE INSTRUMENT HAS ONE CONTROL OUTPUT

Not available when P7 is not 4 and P27 is not 0.
Can be set with keys from 1.0% to P29 setting.

P32 MINIMUM VALUE OF THE INTEGRAL TIME CALCULATED BY AUTOTUNING

This parameter available only when P27 is not 0.
Can be set with keys from 1 sec. (00.01) to 2 min. (2.00).

P33 DEVICE STATUS AT INSTRUMENT STARTUP

This parameter is skipped when P26 = “OFF”.

0 = The instrument starts in auto mode.
1 = The instrument starts in the same mode it was in prior to shutdown.

P35 TIMEOUT SELECTION

This parameter sets the duration of the timeout used by the instrument during the operating mode.

tn 10 = 10 seconds
tn 30 = 30 seconds

P36 DIGITAL FILTER ON THE MEASURED VALUE

noFL. = No filter.
FLtr = Filter enabled:
A first order digital filter with a time constant equal to 4 seconds for TC and RTD inputs; 2 seconds for linear inputs.

P37 CONDITIONS FOR OUTPUT SAFETY VALUE

0 = No safety value (default).
1 = Safety value applied when overrange or underrange condition is detected.
2 = Safety value applied when overrange condition is detected.
3 = Safety value applied when underrange condition is detected.

P38 OUTPUT SAFETY VALUE

This parameter is skipped when P37 = 0.
This value can be set from 0 to 100% when P7 is not 4; from -100 to 100% when P7 = 4.

P39 EXTENSION OF ANTI-RESET WIND UP.

Range: -30 to 30% of proportional band.
A positive value increases the high limit of the anti-reset wind up (over setpoint); a negative value decreases the low limit of the anti-reset wind up (under setpoint).

P40 CONTROL ACTION TYPE

Pid = Controller operates with PID algorithm.
Pi = Controller operates with Pi algorithm.

P41 SETPOINT INDICATION

Fn.SP = In operating mode, controller shows final setpoint during ramp.
OP.SP = In operating mode, controller shows operating setpoint during ramp.

P42 OPERATING SETPOINT ALIGNMENT AT START UP

0 = Operating setpoint aligned to SP or SP2 according to digital input status.
1 = Operating setpoint aligned to measured value; selected setpoint will be reached by programmed ramp (see Grd1 and Grd2 operating parameters).

Note: if the controller detects an out of range, or error condition on the measure value, it will operate as P42=0.

Configuration complete. Display should show “COnF”.

OPERATING MODE

1) Remove the instrument from its case.
2) Close switch V101
3) Re-insert the instrument in its case.
4) Switch on the instrument.

DISPLAY FUNCTION

The upper display shows the measured value while the lower display shows the programmed setpoint (this is the “normal display mode.”)

NOTE: When the rate of change (Grd1, Grd2) is used, the displayed setpoint may be different from the operating setpoint.

It is possible to change the information on the lower display as follows:

- Press and hold the FUNC key for 3 seconds. The lower display will show an “A.” followed by the OUT 1 current when the load is in the ON condition (measured by the current sensing transformer).
- Press the FUNC key again. The lower display will show “b.” followed by the leakage current running in the load (driven by OUT 1) when the load is in OFF condition. See also OUT 1 failure detection.
- Press the FUNC key again. The lower display will show “H.” followed by the OUT 1 power (from 0 to 100%).
- Press the FUNC key again. The lower display will show “C.” followed by the OUT 2 power (from 0 to 100%).
- Press the FUNC key again. The display will return to the “normal display mode.”

NOTE: The OUT 1 current and the OUT 2 power appear only if the respective function is configured.

If no keys are pressed within the timeout period (see P35), the display will automatically return to the "normal display mode."

In order to keep the desired information continuously on the lower display, press the ▲ or ▼ key to stop the timeout. To return to the "normal display mode," press the FUNC key again.

INDICATORS

°C Lit, process variable shown in degrees Celsius.
°F Lit, process variable shown in degrees Fahrenheit.
AT Flashes during autotuning (Smart AT).
Lit, autotuning is active.
OUT1 Lit, Output 1 is on.
OUT2 Lit, Output 2 is on or Alarm 1 is in the alarm state.
OUT3 Lit, Alarm 2 is in the alarm state.
Flashes (slow rate), out 1 failure detection is in alarm state.
Flashes (faster rate), out 1 failure detection and alarm 2 are in alarm state.

Other functions are shown by decimal points:

A) When the decimal point to the right of the upper display is flashing at a slow rate, the instrument is in the RMT condition (functions and parameters are controlled via serial link).
B) When the decimal point to the right of the lower display is flashing:
   - At a slow rate, SP2 is being used.
   - At a fast rate, the serial link is providing the setpoint.
C) When the decimal point to the right of the second digit of the lower display is flashing at a slow rate, the instrument is in the manual mode.

OPERATING KEY FUNCTIONS

FUNC = In normal display mode, press:
- less than three seconds to start parameter modification procedure. (During parameter modification, the FUNC key stores displayed value, and advances controller to next parameter);
- three to ten seconds to change the lower display;
- longer than ten seconds to perform lamp test. (Controller turns on all LEDs with 50% duty cycle. Press FUNC again to resume normal display mode.)

MAN = In normal display mode, enables/disables the manual function. During parameter modification, scrolls back through the parameters without storing the new setting.

▲ = In manual mode, increases the output value. During parameter modification, increases the setting of the selected parameter.

▼ = In manual mode, decreases the output value. During parameter modification, decreases the setting of the selected parameter.

▲ + FUNC = In normal display mode, enables/disables the control output.

▲ + MAN = During parameter modification, jumps to maximum programmable value.

▼ + MAN = During parameter modification, jumps to minimum programmable value.

NOTE: A 10 or 30 second timeout (P35) can be selected during parameter modification. If no key is pressed for during this time period, 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.

ENABLE/DISABLE THE CONTROL OUTPUT

With the instrument in the "normal display mode," press and hold (for 5 seconds) the ▲ key and the FUNC key to disable the control outputs. The device will function as an indicator. All control outputs will be off and the word “OFF” will be shown on the lower display. Alarms will be in a non-alarm condition. The alarm output condition depends on the alarm action type (see P19-P21).

Press and hold (for 5 seconds) the ▲ key and the FUNC key a second time to restore the control status. If the alarm stand has been configured, alarms will respond as though it were a power-up condition.

SP/SP2 SELECTION

The operating setpoint (SP or SP2) can be switched only by an external contact (terminals 14 and 15). This function excludes the out 1 failure detection function and current transformer.

OUT1 Failure Detection Function

The instrument measures the current flowing through the Output 1 load and signals if this current is lower than the Hbd parameter setting. It also signals, when the load is de-energized, if the leakage current is higher than the SCA parameter. A fault condition is shown by a flashing OUT 3 LED and by Output 3 relay status. The “Display Function” section of this manual describes how to show the two current values.

If the ON or OFF period is less than 400 ms, the relative measurement can’t be performed and the controller will flash the last measured value.

SETPOINT ACCESS

When the device is in the AUTO mode and the “normal display mode,” the setpoints (SP and SP2) can be directly accessed.

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

MANUAL FUNCTION

The MANUAL mode can be accessed (if P26 = “On”) by pressing the MAN key for 1 second. The command is accepted and executed only if the display is in the “normal display mode.” When in the MANUAL mode, the MAN LED is lit and the lower display shows the power output values. The value of OUT 1 is shown in the two most significant digits field while the value of OUT 2 (if present) is shown in the two least significant digits. The decimal point between the two values will be flashing to indicate the instrument is in the MANUAL mode.

NOTE: “□□” is used for OUT1 = 100
“ □□ ” is used for OUT2 = 100

Power output can be modified by using the ▲ and ▼ keys. To return the device to AUTO mode, press and hold (for 2 seconds) the MAN key.

The transfer from AUTO to MANUAL and back is bumpless (this function is not provided if integral action is excluded). If the transfer from AUTO to MANUAL occurs during the first part of the autotuning (Smart AT) algorithm (TUNE), then it will return to the AUTO mode in the second part of the autotuning algorithm (ADAPTIVE).

At power-up, the device will be in the AUTO mode or as it was left prior to power shutdown (depending on P33).

NOTE: When start-up occurs in the MANUAL mode, the power output (OUT1 - OUT2) is set to 0.

DIGITAL COMMUNICATIONS

The instrument can be connected to a host computer by a serial link. The host computer can then put the device in either LOCAL (functions and parameters are controlled by keys) or REMOTE (functions and parameters are controlled via serial link).

REMOTE is signified by the decimal point following LSD of upper display (labeled RMT).

It is also possible to download the device configuration through the serial link.

The necessary conditions to implement this function are:
1) Serial parameters SEr1 to SEr4 must be properly configured from the keys.
2) The device must be in the operating mode.

During downloading of the configuration, the device goes into open loop control with all outputs in the OFF state. At the end of the configuration procedure the device performs an automatic reset and returns to closed loop control.

AUTOTUNING (SMART AT) FUNCTION

Autotuning is used to automatically optimize the control action. To enable autotuning, repeatedly press the FUNC key until the "Snrt" parameter is shown. Press the ▲ or ▼ key to set the display to "On" and press the FUNC key. The AT LED will turn on or begin flashing according to the selected algorithm. When autotuning is enabled, the control parameters can be displayed but not modified.

To disable autotuning, press the FUNC key again until the "Snrt" parameter is shown. Press the ▲ or ▼ key to set the display to "OFF" and press the FUNC key again. The AT LED will turn off. Once autotuning is turned off, the instrument maintains the calculated control parameters, but allows the parameters to be modified.

NOTES:

1) When ON/OFF control is programmed (PB = 0), autotuning is disabled.
2) Autotune enable/disable can be protected by the safety lock password (see P27 in the 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. Operative when external contact is open.
Snrt	Autotune (Smart AT) status "ON" or "OFF" indicates the status of autotuning (enabled or disabled respectively). Set to "ON" to enable autotuning. Set to "OFF" to disable autotuning.
n.rSt	Manual reset of the alarms. Set to "ON" to reset the alarms. Skipped if no alarm has manual reset function.
SP2	Auxiliary setpoint (in engineering units). Range from rL to rH. Operative when external contact is closed.
nnn	Software key for parameter protection. Skipped if P18 = 0 or 1. ON = The instrument is LOCKed. OFF = The instrument is UNLOCKed. To switch from locked to unlocked, set a value equal to P18 parameter. To switch from unlocked to locked, set a value different from P18 parameter.
AL1	Alarm 1 setpoint (in engineering units). Available only if P7=1, 2, or 3. Ranges:

span limits for process alarm; 0 to 500 units for band alarm; -500 to 500 units for deviation alarm.

HSA1 Alarm 1 hysteresis
Available only if P7 = 1, 2, or 3. Range from 0.1% to 10.0% of input span or 1 LSD. If hysteresis of band alarm is larger than the alarm band, the instrument will use a hysteresis value equal to the programmed band minus 1 digit.

AL2 Alarm 2 setpoint (in engineering units).
Available only if P12 = 1, 2, or 3 and P14 = OPrt. Ranges: span limits for process alarm; 0 to 500 units for band alarm; -500 to 500 units for deviation alarm.

HSA2 Alarm 2 hysteresis. Available only if P12 = 1, 2, or 3 and P14 =OPrt. Range from 0.1% to 10.0% of input span or 1 LSD. If hysteresis of band alarm is larger than the alarm band, the instrument will use a hysteresis value equal to the programmed band minus 1 digit.

Pb Proportional band.
Range from 1.0% to 100.0% of the input span for one control output; from 1.5% to 100.0% of the input span for two control outputs. When Pb is set to 0.0, control action becomes on/off. When controller is working with with SMART algorithm, Pb value will be limited by P29, P30 and P31 parameters.

hYS Hysteresis for ON/OFF control action.
Available only when Pb = 0. Range from 0.1% to 10.0% of the input span.

ti Integral time.
Skipped if Pb = 0 (on/off). Range from 00.01 to 20.00 (mm.ss). Above this value the display blanks and integral action is excluded. When the controller is working with the SMART algorithm, minimum value of ti is limited by P32.

td Derivative time.
Skipped if Pb = 0 (on/off) or P40 = Pi. Range from 00.00 to 10.00 (mm.ss). When controller is working with SMART algorithm, td value equals 1/4 of Ti value.

IP Integral pre-load.
Skipped if Pb = 0 (on/off). For one control output, IP is programmable from 0 to 100% of output span. For two control outputs, programmable from -100% (100% cooling) to 100% (100% heating).

CY1 Output 1 cycle time.
Range from 1 to 200 seconds.

CY2 Output 2 cycle time.
Available only if P7 = 4. Range from 1 to 200 seconds.

rC Relative cooling gain.
Available only when controller is configured for two control outputs, and Pb is not 0. Range from 0.20 to 1.00. When the controller is working with SMART algorithm, and P28 = ON, rC value is limited by the cooling media selected: Air: 0.85 to 1.00; OIL: 0.80 to 0.90; and H2O: 0.30 to 0.60.

OLAP Deadband/Overlap between H/C outputs.
Available only when controller is configured for two control outputs, and Pb is not 0. Range from -20 to 50% of the proportional band. A negative OLAP value shows a dead band; a positive value shows an overlap.

rL SP minimum setting.
Range from initial scale value (P3) to rH. When P3 has been modified, rL will be realigned to it.

rH SP maximum setting.
Range from rL to full scale (P4) When P4 has been modified, Rh will be realigned to it.

Grd1 Ramp applied to an increasing setpoint change.
Range from 1 to 100 digits per minute. Above this value the display shows “InF” meaning the transfer will be done as a step change.

Grd2 Ramp applied to a decreasing setpoint change.
Range from 1 to 100 digits per minute. Above this value the display shows “InF” meaning the transfer will be done as a step change.

OLH Output maximum power.
Range from 0 to 100% when controller is configured with one control output; from -100 to 100% when configured with two control outputs.

tOL Duration of the output power limiter (soft start).
Range from 1 to 540 minutes. Above this value the display shows “InF” meaning the limiting action is always on. The tOL can be modified, but the new value becomes operative only at next controller start up.

Hbd Out 1 breakdown alarm setpoint.
Available only when P10 = N.O. or N.C. Range from 0 to P11 value (Amps). Setpoint resolution equals 0.1 Amp for range to 20 Amps, and 1 Amp for range to 100 Amps. Hysteresis is 1% of fsv.

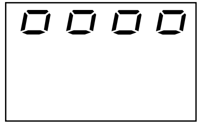
SCA Out 1 short circuit alarm.
Available only when P10 = N.O. or N.C. Range from 0 to P11 value (Amps). Setpoint resolution equals 0.1 Amp for range to 20 Amps, and 1 Amp for range to 100 Amps. Hysteresis is 1% of fsv.

mP Control output maximum rate of rise.
Programmable from 1% to 25% of the output per second. Above 25%, the display will show “InF” meaning that no ramp is imposed.

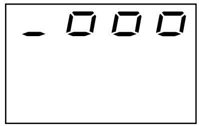
Errors

OVERRANGE OR UNDERRANGE AND SENSOR BREAK INDICATIONS

This device is capable of detecting process variable faults (OVERRANGE, UNDERRANGE or SENSOR BREAK). When the process variable exceeds the span limits established by configuration parameter P1, an OVERRANGE condition will appear as:



An UNDERRANGE condition will appear as:



If P37 is not zero and an out of range condition is detected, the instrument operates in accordance with P37 and P38.

OUTPUT ACTION ON OVERRANGE/UNDERRANGE

If P37 is zero, the following conditions may occur if the:

- Instrument is set for one output only and an OVERRANGE is detected, then OUT 1 turns OFF (if reverse acting) or ON (if direct acting).
- Instrument is set for heating/cooling and an OVERRANGE is detected, then “reV” 1 turns OFF and “dir” turns ON.
- The instrument is set for one output only and an UNDERRANGE is detected, then OUT 1 turns ON (if reverse acting) or OFF (if direct acting).
- The instrument is set for heating/cooling and an UNDERRANGE is detected, then ‘rev” output turns ON and “dir” output turns OFF.

The sensor break can be signalled as:

- For TC/mV input: OVERRANGE or UNDERRANGE (selected by a solder jumper).
- For RTD input: OVERRANGE.
- For mA/V input: UNDERRANGE.

NOTE: On the mA/V input, a sensor break can be detected only when the range selected has a zero elevation (4-20 mA, 1-5 V or 2-10 V).

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

ERROR MESSAGES

On power-up, the instrument performs a self-diagnostic test. When an error is detected, the lower display shows an “Err” indication while the upper display shows the code of the detected error.

ERROR LIST

Ser	Serial interface parameter
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/mV input calibration error.
307	RJ input calibration error.
310	CT input calibration error.
311	20 mA input calibration error.
312	5 V input calibration error.
313	10 V input calibration error.
400	Control parameter error.
500	Auto-zero error.
502	RJ error.
510	Calibration procedure

DEALING WITH ERROR MESSAGES

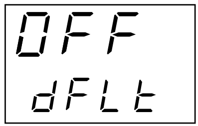
1) When a configuration parameter error is detected, repeat the configuration procedure of that specific parameter.
2) If an error 400 is detected, simultaneously press the ▲ and ▼ keys (see Loading default operating parameters) to load the default parameters and then repeat the control parameter setup.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

DEFAULT PARAMETERS

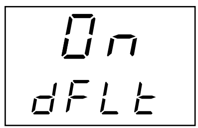
LOADING DEFAULT OPERATING PARAMETERS

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:

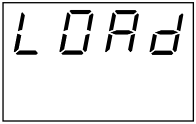
a) Close switch V101 (see Configuration Procedure, Figure 1).
b) Autotuning (Smart AT) must be disabled.
c) Controller should be in stand-by mode.
d) Hold down the ▼ key and press the ▲ key; the display will show:



e) Press the ▲ or ▼ key and 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:

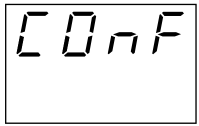
DEFAULT OPERATING PARAMETER LIST

Param	Default Value
SP	Minimum of range value
Snrt	Disabled
n.RSt	OFF
SP2	Minimum of range
nnn	OFF
AL1, AL2	Minimum of range (process alarms)
	0 (deviation or band alarms)
HSA1, HAS2	0.1%
Pb	4.0%
hys	0.5%
tl	4.00 (4 minutes)
td	1.00 (1 minute)
IP	30%
CY1	15 seconds (relay output)
	4 seconds (SSR output)
CY2	10 seconds for P8 = Alr
	4 seconds for P8 = OIL
	2 seconds for P8 = H2O
rC	1.00 for P8 = Alr
	0.80 for P8 = OIL
	0.40 for P8 = H2O
OLAP	0
rL	Initial scale value
rH	Full scale value
Grd1	Infinite (step transfer)
Grd2	Infinite (step transfer)
OLH	100%
tOL	Infinite
Hbd	50% of the full scale
SCA	100% of full scale
mP	25% of the output per second

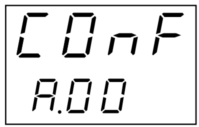
DEFAULT CONFIGURATION PARAMETERS

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:

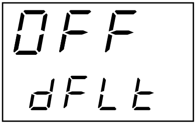
a) Open switch V101 (see Configuration Procedure, Figure 1).
b) The upper display will show:



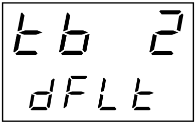
c) Press the ▼ key; the lower display will show the firmware version.



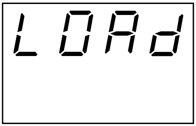
d) Still holding the ▼ key, press the ▲ key. The display will show:



e) Use the ▲ key to select the desired default parameters (see table).



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 “COnF” display. The following table is a list of the default configuration parameters loaded during the procedure:

PARA.	Table 1	Table 2
	European	USA
SEr1	Ero	Ero
SEr2	1	1
SEr3	19.20	19.20
SEr4	7E	7E
P1	3	20
P2	- - - - .	- - - - .
P3	0	0
P4	400	1000
P5	rEL	rEL
P6	rEV	rEV
P7	1	1
P8	Alr	Alr
P9	H.A.	H.A.
P10	OFF	OFF
P11	10	10
P12	0	0
P13	H.A.	H.A.
P14	OPrt.	OPrt.
P15	0	0
P16	0.1	0.1
P17	0	0
P18	0	0
P19	rEV	rEV
P20	OFF	OFF
P21	rEV	rEV
P22	OFF	OFF
P23	0	0

P25	ON	ON
P26	ON	ON
P27	2	2
P28	OFF	OFF
P29	30	30
P30	1.5	1.5
P31	1.0	1.0
P32	00.50	00.50
P33	0	0
P35	tn 10	tn 30
P36	nO.FL	nO.FL
P37	0	0
P38	0	0
P39	10	10
P40	Pid	Pid
P41	Fn.Sp	Fn.Sp
P42	0	0

SPECIFICATIONS

General

Case: Polycarbonate dark grey color (RAL 7043); self-extinguishing degree; V-0 according to UL94.

Front Protection: Designed, tested for IP65 and NEMA 4X for indoor locations when panel gasket is installed. Tests were performed in accordance with CEI70-1 and NEMA 250-1991 Std.

Installation: Panel mounting, or wall mounting or rail mounting.

Rear Terminal Block: Screw terminals for cables 0.25 to 2.5 mm^2 or from AWG 22 to AWG 14.

Dimensions: See illustrations elswhere in this manual.

Weight: 250 g.

Power Supply: 100 to 240 Vac, 50/60 Hz., -15% to 10% of nominal value; 24 Vac/Vdc ±10% nominal value.

Power Consumption: 8 VA maximum.

Insulation Resistance: > 100 M ohms according to IEC 1010-1.

Dielectric Strength: 1500 V rms according to IEC 1010-1.

Display Updating Time: 500 ms.

Sampling Time: 250 ms for linear inputs; 500 ms for TC and RTD inputs.

Resolution: 30000 counts.

Accuracy: ±0.2% fsv; ±1 digit @ 25°C ambient temperature.

Common Mode Rejection: 120 dB @ 50/60 Hz.

Normal Mode Rejection: 60 dB @50/60 Hz.

Electromagnetic Compatibility and Safety Requirements: Conforms to council directives 89/336/EEC (reference harmonized standard EN-50081-2 and EN-50082-2) and to council directives 73/23/EEC and 93/68/EEC (reference harmonized standard En 61010-1).

Installation Category: II.

Temperature Drift (reference junction excluded): <200 ppm/°C of span for mV and TC ranges 1, 3, 5, 6, 19, 20, 21, 22. <300 ppm/°C of span for mA/V. <400 ppm/°C of span for RTD range 10, 26, and TC range 0, 2, 4, 27,28. <500 ppm/°C for RTD range 9 and TC ranges 7, 8, 23, 24. <800 ppm/°C of span for RTD range 25.

Operating Temperature: 0 to 50°C (32 to 122°F).

Storage Temperature: -20 to 70°C (-4 to 158°F).

Humidity: 20% to 85% rh, non-condensing.

Protections: Watchdog circuit for automatic restart; DIP switch against tampering of configuration and calibration parameters.

Inputs

Thermocouple types J, K, L, N, R, S, T:

°C°F: selectable.

External Resistance: 100 ohms max., maximum error 0.1% of span.

Burn Out: Shown as overrange condition (standard). Possible to obtain underrange indication by cut and short.

Reference Junction: Automatic compensation from 0 to 50°C.

Reference Junction Accuracy: 0.1°C/°C.

Input Impedance: > 1 megohms.

Calibration: According to IEC 584-1 and DIN 43710-1977. Standard Ranges:

Type	*Range °C*				*Range °F*			
L	0	0	to	400.0				
L	1	0	to	900	19	0	to	1650
J	2	-100.0	to	400.0				
J	3	-100	to	1000	20	-150	to	1830
K	4	-100.0	to	400.0				
K	5	-100	to	1370	21	-150	to	2500
N	6	-100	to	1400	22	-150	to	2550
R	7	0	to	1760	23	0	to	3200
S	8	0	to	1760	24	0	to	3200
T	27	-199.9	to	400.0	28	-330	to	750

RTD (Resistance Temperature Detector)

Input: Pt 100 ohms, 3 wire connection.

Input Circuit: Current injection.

°C/°F Selection: Via front keys, or serial link.

Line Resistance: Automatic compensation up to 20 ohms/wire with no measurable error.

Calibration: According to DIN 43760.

Burnout: Up scale. A special test is provided to signal overrange when input resistance is less than 15 ohms.

Standard Ranges: Pt.100 ohms, DIN 43760

9	-199.9	to	400.0	°C
10	-200	to	800	°C
25	-199.9	to	400.0	°F
26	-330	to	1470	°F

Linear

Readout: Keyboard programmable between -1999 and 4000.

Decimal Point: Programmable in any position.

Burn Out: Controller shows burn out condition as underrange condition for 4 to 20 mA, 1 to 5 V, and 2 to 10 V input types. It shows burn out as underrange or overrange (selectable by soldering jumper) for 0 to 60 mV and 12 to 60 mV input types. No indication is available for 0 to 20 mA, 0 to 5 V, and 0 to 10 V input types.

Accuracy: 0.2% + 1 digit @ 25°C.

Impedance:	>1 M ohms	0 to 60 mV	(11)
	>1 M ohms	12 to 60 MV	(12)
	<5 ohms	0 to 20 mA	(13)
	<5 ohms	4 to 20 mA	(14)
	>200 k ohms	0 to 5 V	(15)
	>200 k ohms	1 to 5 V	(16)
	>400 k ohms	0 to 10 V	(17)
	>400 k ohms	2 to 10 V	(18)

Logic

Controller is equipped with one input from voltage free contact for setpoint selection.

Contact Open: Main setpoint.

Contact Closed: Auxiliary setpoint.

Use an external dry contact capable of switching 0.5 mA, 5 Vdc. Controller needs 100 ms to recognize a contact status variation. The logic input is *not* isolated by the measuring input. This optional function is alternative to amp sensing transformer input.

Current Transformer

Controllers with this feature can detect and signal a possible failure of the line driven by OUT 1.

Input Range: 50 mAac

Scaling: Programmable from 10 Amps to 100 Amps in 1 Amp steps.

Resolution: 0.1 Amp for full scale up to 20 Amps; 1 Amp for full scale from 21 to 100 Amps.

Minimum duration of on/off period to perform measurement: 400 ms. This function excludes the logic input (external setpoint selection).

Setpoints

This controller allows use of two setpoints: SP and SP2. Setpoint selection is possible only by logic input.

Setpoint Transfer: From one setpoint to another, or between two different setpoint values accomplished by a step transfer or by a ramp with two different programmable rates of change (ramp up and ramp down).

Slope Value: 1 to 100 engineering units/minute or step.

Setpoints Limiter: RLO and RHI parameters, programmable.

Control Actions

Control Action: PID + SMART.

Type: One (heating or cooling) or two (heating and cooling) control outputs.

Proportional Band (Pb): Range from 1.0 to 100.0% of the input span for process with one control output; from 1.5 to 100.0% of the input span for process with two control outputs. When Pb = 0, control action is on/off.

Hysteresis (for on/off control action): from 0.1% to 10.0% of the input span.

Integral Time (ti): From 1 second to 20 minutes, or excluded.

Derivative Time (td): From 0 seconds to 10 minutes. If zero value is selected, the derivative action is excluded.

Integral Pre-load: From 0.0 to 100.0% for one control output; from -100.0 (cooling) to 100.0% (heating) for two control outputs.

Autotune (SMART): Keyboard enabling/disabling.

Auto/Manual: Keyboard selectable.

Auto/Manual Transfer: Bumpless method type.

Indicator: “MAN” off in auto mode; lit in manual mode.

Outputs

Control Output Updating Time: 250 ms for linear output; 500 ms for TC or RTD.

Action: Direct/reverse programmable from front keyboard.

Output Level Indication: Separate displays for output 1 (heating) level and output 2 (cooling) level.

Output Status Indication: Two indicators – OUT 1 and OUT 2. Each is lit when its respective output is on.

Output Level Limiter: 0 to 100% for one control medium; -100 to 100% for two control mediums. This function may operate at controller start up for a programmable time (to avoid thermal shock and/or pre-heating the plant). Otherwise, it can be enabled by an external contact.

Cycle Times: Outputs 1 and 2 each programmable for 1 to 200 seconds.
Relative Cooling Gain: Programmable from 0.20 to 1.00.
Overlap/Deadband: Programmable from -20% to 50% of the proportional band.

Output 1

Type: Relay, SPDT contact. NO or NC selectable by jumper.
Contact Rating: 3 Amp @ 250 Vac on resistive load.
Function: Programmable as heating or cooling output.
Output Cycle Time: Programmable from 1 to 200 seconds.

Output 2

Type: Relay, SPST contact.
Contact Rating: 2 Amp @ 250 Vac on resistive load.
Function: Programmable as cooling control output, or alarm 1 output.
Output Cycle Time: Programmable from 1 to 200 seconds when used as a control output.

Output 3

Type: Relay, SPST contact.
Contact Rating: 2 Amp @ 250 Vac on resistive load.
Function: Alarm 2.

Alarms

Action: Direct or reverse acting.
Functions: Each alarm can be configured for process, band or deviation.
Reset: Automatic or manual programmable on each.
Stand-by (mask); Each alarm can be configured with or without mask function. This function allows you to preclude false indication at controller start up, or after a setpoint change.

<u>Process Alarm</u>
Operating Mode: high or low programmable.
Setpoint: Programmable in engineering units within the input span.
Hysteresis: Programmable from 0.1% to 10.0% of the input span (P4 - P3).

<u>Band Alarm</u>
Operating Mode: Inside or outside programmable:
Setpoint: Programmable from 0 to 500 units.
Hysteresis: Programmable from 0.1% to 10.0% of the input span.

<u>Deviation Alarm</u>
Operating Mode: High or low programmable.
Setpoint: Programmable from -500 to 500 units.
Hysteresis: Programmable from 0.1% to 10.0% of the input span.

Serial Communications Interface

Type: RS-485.
Protocol: MODBUS, JBUS, proprietary polling/ selecting.
Baud: Programmable from 600 to 19200.
Byte Format: 7 or 8 bit, programmable.
Parity: Even, odd, or none programmable.
Stop Bits: one
Address: 1 to 95 for proprietary protocol; 1 to 255 for other protocols.
Output Voltage Levels: According to EIA standard.

CALIBRATION

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. - nA. - 5V. - 10V. - Ct.).

Before beginning calibration, be sure internal switch V101 (see configuration procedure, Figure 1) is open.

WARNING: Perform the calibration procedure according to J106 jumper positions as shown below. Otherwise, stored calibration values may be lost.

Input Type	J106				
	1 - 2	3 - 4	5 - 6	7 - 8	9 - 10
TC-RTD	open	close	open	open	open
60 mV	open	close	open	open	open
5 V	close	open	close	open	open
10 V	open	open	close	open	open
20 mA	open	open	open	close	close

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:

<u>Accuracy</u>

TC Input:	±0.005% output ±0.001% range ±5 microvolt
RTD Input:	±0.02% ±0.0025 ohms/decade
CJ Compensation:	Better than 0.1 °C
Current Transformer:	0.1 mA Ac rms

<u>Resolution</u>

TC Input:	1 microvolt
RTD Input:	10 milliohm
CJ Compensation:	Better than 0.1 °C
Current Transformer:	0.1 mA ac rms

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
nAL	Current Input Minimum Range Value
nAH	Current Input Maximum Range Value
nA.	Current Input Check
5VL	Volt Minimum Range Value
5VH	Volt Maximum Range Value
5V.	Volt Input Check
10VL	Volt Minimum Range Value
10VH	Volt Maximum Range Value
10V.	Volt Input Check
Ct.L	Current transformer minimum range value
Ct.H	Current transformer maximum range value
Ct.	Current transformer input check

PROCEDURE

Switch on the instrument; the display will show “COnF”. 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”.

Use the ▲ and ▼ keys 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”.

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

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

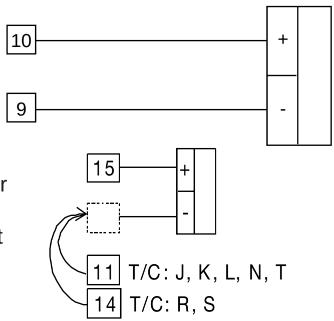
ENTERING CALIBRATION VALUES

TL TC INPUT MINIMUM RANGE VALUE

a) Connect calibrator and instrument as shown below.

Panel Mount Controller

Wall or Rail Mount



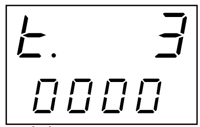
b) The upper display shows “OFF”, the lower display shows “tL”.
c) Set the calibrator to 0.000 mV.
d) Press the ▲ or ▼ key; the display changes to “ON”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument 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”.
b) Set the calibrator to 60.000 mV.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the TC input check.

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. 3 0000” ±10 counts.



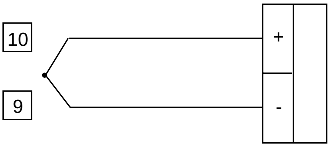
a) Check the “Minimum Range” calibration (see parameter tL) by setting the calibrator to 0.000 mV - the readout must be equal to “t. 0 0000” ±10 counts
b) Check linearity at half scale by setting 30.000 mV on the calibrator. The readout must be “t. 1 5000” ±10 counts.
c) Check the “Maximum Range” calibration by setting the calibrator to 60.000 mV - the readout must be equal to “t. 3 0000” ±10 counts
d) Press the FUNC key and the instrument will proceed to cold junction compensation.

RJ COLD JUNCTION COMPENSATION

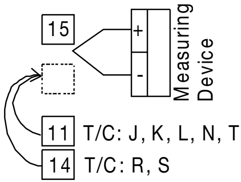
NOTE: Make sure “tL” and “tH” are correctly calibrated before attempting “rJ” calibration.

a) Measure the temperature close to terminals 9 and 10 using an appropriate instrument, as shown below.

Panel Mount Controller



Wall or Rail Mount



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

c) Using the ▲ and ▼ keys, 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 calibration is complete, the instrument will proceed to the cold junction compensation check.

RJ. COLD JUNCTION COMPENSATION CHECK

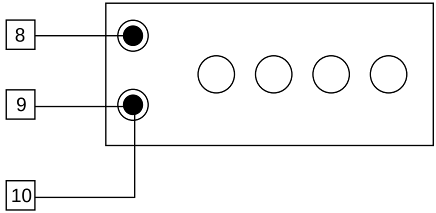
The display will show “rJ.” and the temperature in tenths of a degree, measured by the CJ compensator. Check that the display readout is equal to the value read by the measuring device.

Press the FUNC key, the instrument will proceed to RTD input minimum range value.

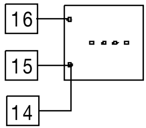
PL RTD INPUT MINIMUM RANGE VALUE

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

Panel Mount Controller



Wall or Rail Mount



b) The upper display shows “OFF”, the lower display shows “PL”.

c) Set 0.000 ohms on the resistor box.

d) Press the ▲ or ▼ key; the display changes to “ON”.

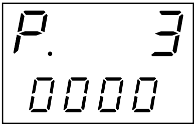
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When calibration is complete, the instrument will proceed to the next parameter.

PH RTD INPUT MAXIMUM RANGE VALUE

a) The upper display shows “OFF”, the lower display shows “PH”.
b) Set the resistor box to 375.000 ohms.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the RTD input check.

P. RTD INPUT CHECK

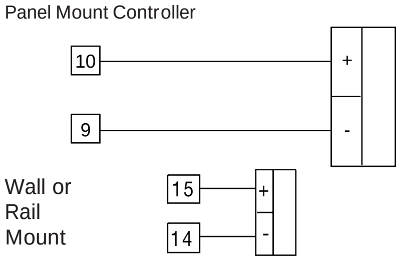
The display shows “P.” followed by a number showing the measured value in counts. The calibration for “PH” is correct if the indication is “P. 3 0000” ±10 counts.



a) Check the “Minimum Range” calibration (linear) by setting 0.000 ohms (see parameter PL) on the resistance box; the readout should be “P. 0 0000” ±10 counts.
b) Check the linearity at half scale calibration by setting 125.000 ohms on the resistance box; the readout should be “P. 1 0190” ±10 counts.
c) Check the “Maximum Range” calibration by setting 375.000 ohms on the resistance box; the readout should be “P. 3 0000” ±10 counts.
d) Press the FUNC key and the instrument will proceed to the current input minimum range calibration.

NAL CURRENT INPUT MINIMUM RANGE VALUE

a) Connect the calibrator and instrument as shown below.



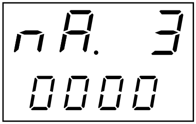
b) The upper display shows “OFF”, the lower display shows “nAL”.
c) Set calibrator to 0.000 mA (even if the minimum range value is 4 mA).
d) Press the ▲ or ▼ key; the display changes to “ON”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When calibration is complete, the instrument will proceed to the next parameter.

NAH CURRENT INPUT MAXIMUM RANGE VALUE

a) The upper display shows “OFF”, the lower display shows “nAH”.
b) Set calibrator to 20.000 mA.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the current input check.

NA. CURRENT INPUT CHECK

The display shows “nA.” followed by a number showing the measured value in counts. The calibration for “nAH” is correct if the indication is “nA. 3 0000” ±10 counts.

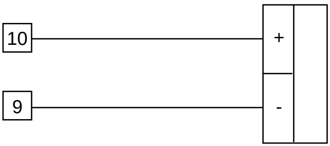


a) Check the “Minimum Range” calibration (linear) by setting 0.000 mA (see parameter nAL) on the calibrator; the readout should be “nA. 0 0000” ±10 counts.
b) Check the linearity at half scale by setting 10.000 mA on the calibrator; the readout should be “nA. 1 5000” ±10 counts.
c) Check the “Maximum Range” calibration by setting 20.000 mA on the calibrator; the readout should be “nA. 3 0000” ±10 counts.
d) Press the FUNC key and the instrument will proceed to 5 volt input minimum range value calibration.

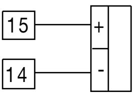
5VL 5 VOLT INPUT MINIMUM RANGE VALUE

a) Connect the calibrator and instrument as shown below.

Panel Mount Controller



Wall or Rail Mount



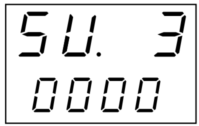
b) The upper display shows “OFF”, the lower display shows “5VL”.
c) Set calibrator to 0.000 V (even if the minimum range value is 1 V).
d) Press the ▲ or ▼ key; the display changes to “ON”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When calibration is complete, the instrument will proceed to the next parameter.

5VH 5 VOLT INPUT MAXIMUM RANGE VALUE

a) The upper display shows “OFF”, the lower display shows “5VH”.
b) Set calibrator to 5 V.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the 5 volt input check.

5V. 5 VOLT INPUT CHECK

The display shows “5V.” followed by a number showing the measured value in counts. The calibration for “5VH” is correct if the indication is “5V. 3 0000” ±10 counts.

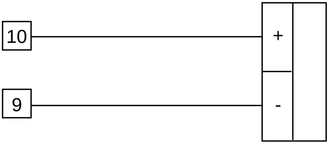


a) Check the “Minimum Range” calibration (linear) by setting 0.000 V (see parameter 5VL) on the calibrator; the readout should be “5V. 0 0000” ±10 counts.
b) Check the linearity at half scale by setting 2.500 V on the calibrator; the readout should be “5V. 1 5000” ±10 counts.
c) Check the “Maximum Range” calibration by setting 5.000 V on the calibrator; the readout should be “5V. 3 0000” ±10 counts.
d) Press the FUNC key and the instrument will proceed to 10 volt input minimum range value calibration.

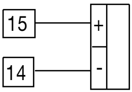
10VL 10 VOLT INPUT MINIMUM RANGE VALUE

a) Connect the calibrator and instrument as shown below.

Panel Mount Controller



Wall or Rail Mount



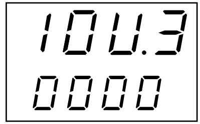
b) The upper display shows “OFF”, the lower display shows “10VL”.
c) Set calibrator to 0.000 V (even if the minimum range value is 2 V).
d) Press the ▲ or ▼ key; the display changes to “ON”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument is performing the calibration. When calibration is complete, the instrument will proceed to the next parameter.

10VH 10 VOLT INPUT MAXIMUM RANGE VALUE

a) The upper display shows “OFF”, the lower display shows “10VH”.
b) Set calibrator to 10 V.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the 10 volt input check.

10V. 10 VOLT INPUT CHECK

The display shows “10V.” followed by a number showing the measured value in counts. The calibration for “10VH” is correct if the indication is “10V.3 0000” ±10 counts.

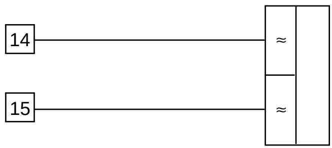


a) Check the “Minimum Range” calibration (linear) by setting 0.000 V (see parameter 10VL) on the calibrator; the readout should be “10V.0 0000” ±10 counts.
b) Check the linearity at half scale by setting 5.000 V on the calibrator; the readout should be “10V.1 5000” ±10 counts.
c) Check the “Maximum Range” calibration by setting 10.000 V on the calibrator; the readout should be “10V.3 0000” ±10 counts.
d) Press the FUNC key and the instrument will proceed to current transformer minimum range value calibration.

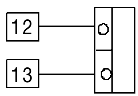
CT.L CURRENT TRANSFORMER MINIMUM RANGE VALUE

a) Connect the calibrator and instrument as shown below.

Panel Mount Controller



Wall or Rail Mount



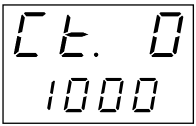
b) The upper display shows “OFF”, the lower display shows “Ct.L”.
c) Set calibrator to 0.000 mA.
d) Press the ▲ or ▼ key; the display changes to “ON”.
e) After a few seconds, start calibration by pressing the FUNC key. The decimal point of the least significant digit will light to indicate the instrument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

CT.H CURRENT TRANSFORMER MAXIMUM RANGE VALUE

a) The upper display shows “OFF”, the lower display shows “Ct.H”.
b) Set calibrator to 50.000 mA r.m.s.
c) Press the ▲ or ▼ key; the display changes to “ON”.
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 calibration is complete, the instrument will proceed to the Current transformer input check.

CT. CURRENT TRANSFORMER INPUT CHECK

The display shows “Ct.” followed by a number showing the measured value in counts. The calibration for “Ct.H” is correct if the indication is “Ct. 0 1000” ±10 counts.



a) Check the “Minimum Range” calibration by setting 0.000 mA (see parameter 10VL) on the calibrator; the readout should be “Ct. 0 0000” ±10 counts.
b) Check the linearity at half scale by setting 25.000 mA on the calibrator; the readout should be “Ct. 0 0500” ±10 counts.
c) Check the “Maximum Range” calibration by setting 50.000 mA on the calibrator; the readout should be “Ct. 0 1000” ±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 V101 (see configuration procedure, Figure 1).

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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