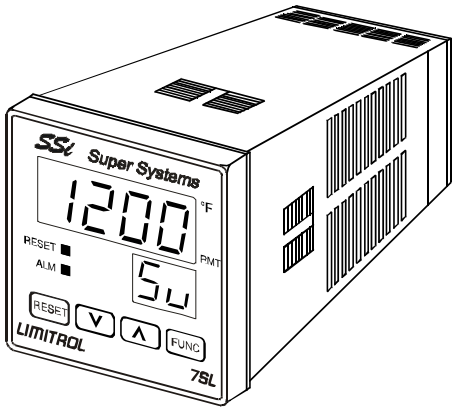
SSi Super Systems



Instruction Manual
PN 31302

MODEL 7SL
HIGH/LOW LIMITROL®

1/16 DIN, FOUR DIGIT HIGH/LOW LIMITROL

MODEL: 07SL-91□□□-0 0 0-0-0 0
Field No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fields 1 through 4. BASE
07SL - Limitrol (High/Low Limit – shipped as High Limit)

Field 5. INPUT
9 - TC types J, K, T, E, N, S, R, B, L, U, G, D, C and Platinel II; and Pt 100 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 jumper. Factory set at Type J.

Field 6. OUTPUT (High/Low Limit)
1 - Relay (Form C)

Fields 7, 8. ALARMS, OPTIONS
00 - None
10 - One alarm – Relay Form A
11 - One alarm – Relay Form A, plus RS485 and one logic input
Note: when code 11 is specified, instrument length is 122 mm.

Field 9. POWER SUPPLY
3 - 100 to 240 Vac
5 - 24 Vac/Vdc

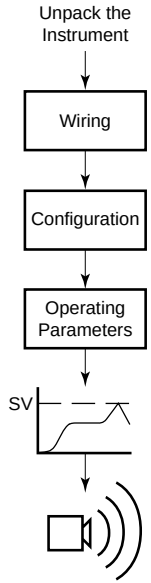
Fields 10 through 15. RESERVED

Congratulations

Congratulations on your purchase of one of the easiest to configure high/low Limitrols on the market. After a 3 step configuration procedure, your process will be up and running.

Guide to simple set-up

To set-up the Limitrol only 3 steps are required:
1. Wire the instrument (page 7).
2. Configure the instrument (page 14).
3. Check the operating parameters (page 22).



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CAUTION:

USE WIRE SUITABLE FOR 75°C MINIMUM.

NOTES

- For supply connections use No 16 AWG or larger wires rated for at least 75 °C.
- Use copper conductors only.
- Class 2 wiring must be a minimum of 1/4 inch from any Class 1 conductors.

MOUNTING REQUIREMENTS

Select a mounting location with the following characteristics:

1) Minimal 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) Relative humidity of 20% to 80% non condensing.

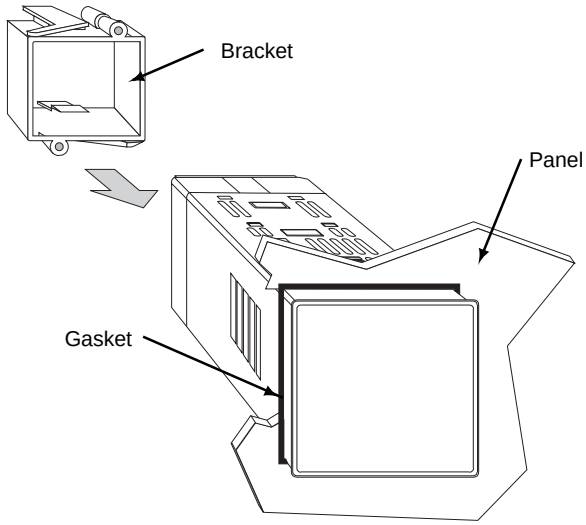
The instrument can be mounted on a panel up to 15 mm (0.591 in) thick with a square cutout of 45 x 45 mm (1.772 x 1.772 in). For outline refer to Dimensions and Panel Cutout.

Panel surface texture must be better than 6.3 µmm.

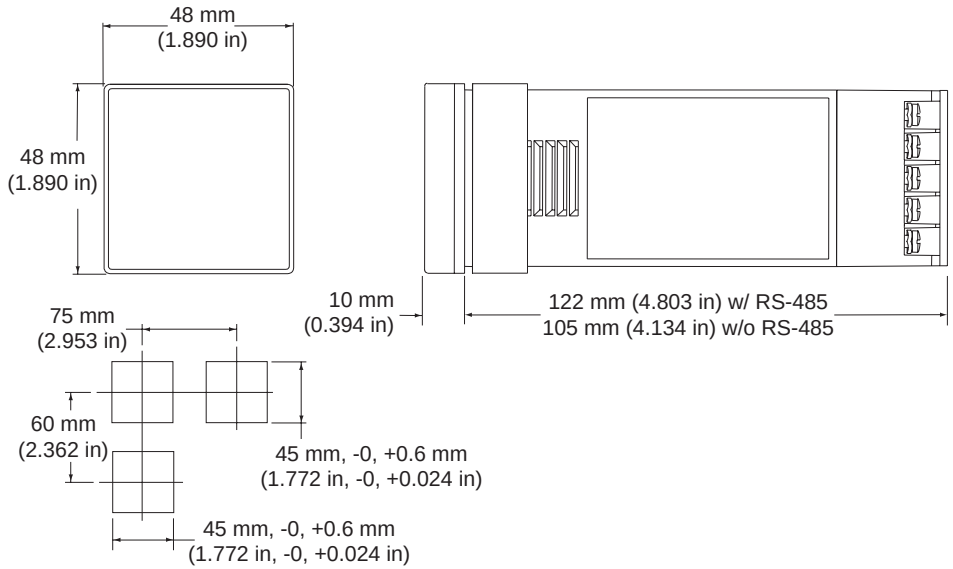
The instrument is shipped with a rubber panel gasket (50 to 60 Sh). To assure the IP65 and NEMA 4 protection, insert the panel gasket between the instrument and the panel as shown below.

Install the instrument as follows:

1) Insert the instrument 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 (2.66 and 3.54 lbf-in).
5) To insure NEMA 4X/IP65 protection, make sure the instrument does not move within the cutout .

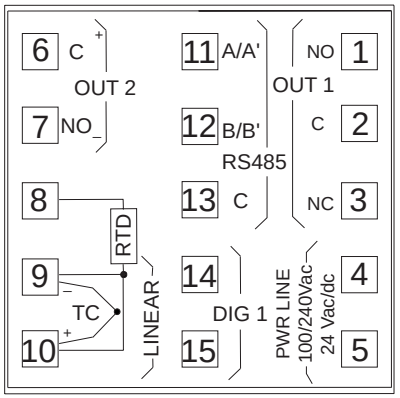


DIMENSIONS AND PANEL CUTOUT

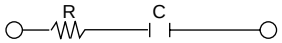


WIRING GUIDELINES

Terminal Layout



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



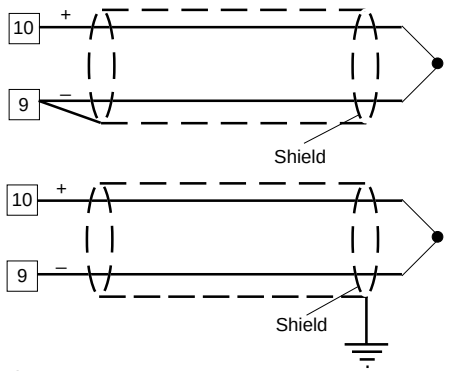
in accordance with the following table:

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

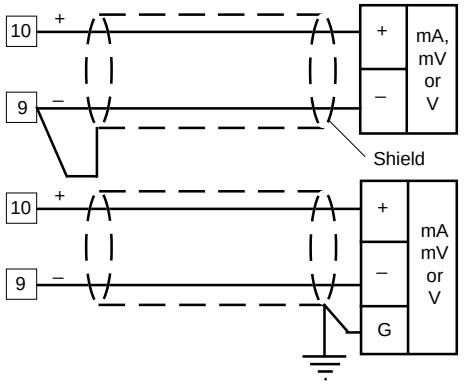
NOTE: Any external components (like Zener diodes, etc.) connected between sensor and input terminals may cause errors in measurement due to excessive and/or not balanced line resistance or possible leakage currents.

TC Input



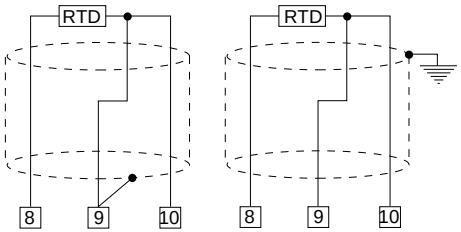
NOTE:
1) Do not run input wires with power cables.
2) For TC wiring use proper compensating cable, preferably shielded (see Thermocouple Compensating Cable Color Codes).
3) Shielded cable should be grounded at one end only.

Linear Input



NOTE:
1) Do not run input wires with power cables.
2) High line resistance can cause measurement errors.
3) When shielded cable is used, ground it at one end only to avoid ground loop currents.
4) The input impedance is equal to:
   Less than 5 Ω for 20 mAdc input
   Greater than 1 MΩ for 60 mVdc input
   Greater than 400 KΩ for 5 Vdc and 10 Vdc input

RTD Input

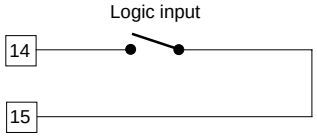


NOTE:
1) Do not run RTD wires with power cables.
2) Ground shielded cable at one end only.
3) Use the correct size copper wires.
4) The resistance of the 3 wires must be the same.

B) Logic Input

This input is used as a remote reset.

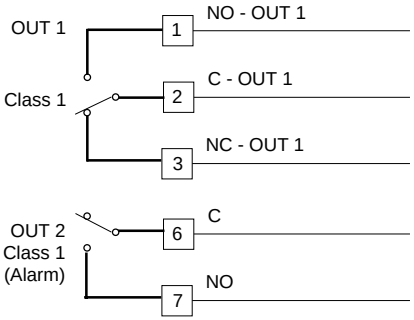
Safety note:
- Do not run logic input wiring with AC power cables.
- Use an external contact with a contact rating greater than 0.5 mA, 5 Vdc.
- The instrument needs 100 ms to recognize a contact status variation.



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	–	–	–	–

C.1) Relay Outputs

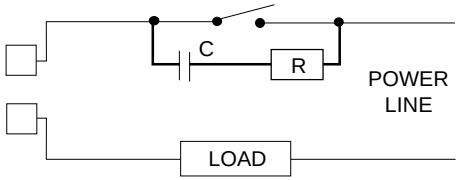


The cable used for relay output wiring must be as far away as possible from input or communication cables.
Relay output: Protected by varistor.
OUT 1: Form C contact rating of 3 Amps/250 Vac resistive load.
OUT 2: Form A Contact rating of 2 Amps/250 Vac resistive load.
Number of operations: 2×10^5 at the specified rating.

NOTES:
1) To avoid shock and possible instrument damage, connect power last.
2) For power connections use 16 AWG or larger wires rated for 75 °C.
3) Use copper conductors only.
4) Do not run input wires with power cables.

C.2) Inductive Loads

High voltage transients may occur when switching inductive loads. Through internal contacts these transients may introduce disturbances which can affect the performance of the instrument. The same problem may occur when a switch is used in series with the internal contacts as shown below.



For all the outputs, the internal protection (varistor) assures protection up to 0.5 Amp on inductive loads.

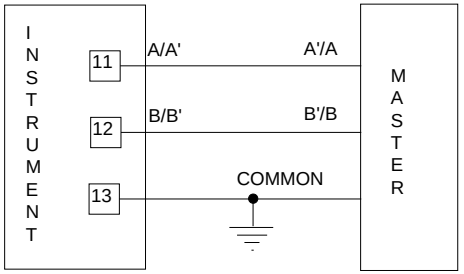
It is good electrical practice to install an additional RC network across and as close to the external contacts as possible.

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

D) Serial Interface

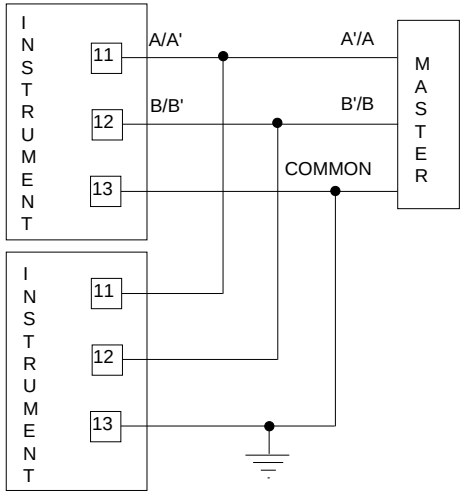
For units built with optional RS-485 communication



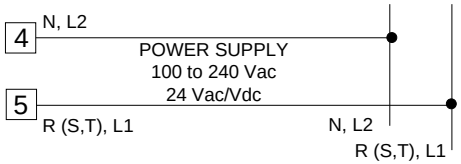
Maximum cable length: 1.5 km (9/10 mile) at 9600 baud.
NOTE: According to EIA specification for RS-485:

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.

The RS-485 interface can connect up to 31 instruments with the remote master unit (see below).



E) Power Line and grounding



NOTE:
1) Before connecting the power line, check that the voltage is correct (see Model Number).
2) For supply connections use 16 AWG or larger wires rated for at least 75 °C.
3) Use copper conductors only.
4) Do not run input wires with power cables.
5) Polarity does not matter for 24 Vdc wiring.
6) 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 the fuse is damaged the instrument should be returned to your supplier to check the power supply.

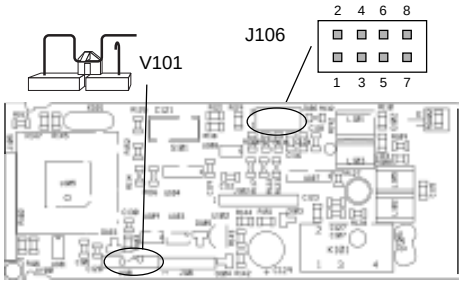
7) Safety requirements for permanently connected equipment:
   - Include a switch or circuit-breaker in the installation.
   - Place the switch in close proximity to the equipment and within easy reach of the operator.
   - Mark the switch as the disconnecting device for the equipment. NOTE: A single switch or circuit-breaker can drive more than one instrument.
8) When the NEUTRAL line is present, connect it to terminal 4.
9) To avoid shock and possible instrument damage, connect power last.

PRELIMINARY HARDWARE SETTINGS

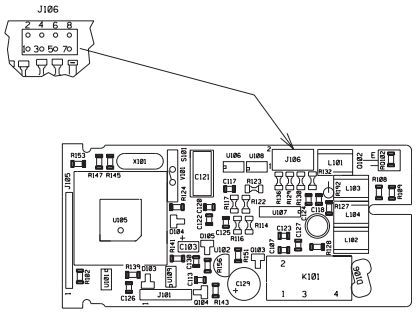
1) Remove the instrument from its case.
2) Set J106 according to the following table:

Input Type	J106			
	1-2	3-4	5-6	7-8
T/C, RTD, 0-60 mV, 12-60 mV (standard configuration)	close	open	open	open
0-5 V, 1-5V	open	close	open	open
0-10V, 2-10 V	open	open	close	open
0-20 mA, 4-20 mA	open	open	open	close
Input CTTC R192=180K SH120=Closed CH101=Open				

Limitrol with RS-485



Limitrol without RS-485



CONFIGURATION KEY FUNCTIONS

RESET In Configuration Mode, used only to scroll back parameters

▼ Used in Configuration Mode to decrease the parameter value.

▲ Used in Configuration Mode to increase the parameter value.

FUNC Monitors/Modifies parameters.

▼ + ▲ Loads the default parameters.

▲ + FUNC or ▼ + FUNC
Increases/decreases values at a higher rate when modifying parameters.

▲ + RESET or ▼ + RESET
Jumps to the Maximum or Minimum parameter value when modifying parameters.

CONFIGURATION PROCEDURE

1) Remove the instrument from its case.
2) Open switch V101 (See illustrations under “Preliminary Hardware Settings.”)
3) Re-insert the instrument in its case.
4) Switch on power to the instrument.
   The upper display will show COnF.
5) Press the “▼” key and the lower display will show the firmware version.

Press the "FUNC" key to start the configuration procedure with the first parameter (L1). Press the "RESET" key to start the configuration procedure with the last parameter (d1).

The following is a complete list of parameters. The lower display will show the parameter code (L1 to d1) and the upper display will show the selection code or numerical value. No timeout is applied in the configuration mode.

L1 = Serial Interface Protocol
(Skipped if option is not available.)
OFF = No serial interface
nbUS= Modbus
jbUS = Jbus

L2 = Serial Link Device Address
(Skipped if option is not available or L1 = OFF)
From 1 to 255
NOTE: The device can connect up to 31 instruments.

L3 = Baud Rate for Serial Link
(Skipped if option is not available or L1 = OFF)
Set value from 600 to 19200 baud.
(19200 baud is shown on display as 1920)

L4 = Byte Format for Serial Link
(Skipped if option is not available or L1 = OFF)
8E = 8 bits + even parity
8O = 8 bits + odd parity
8 = 8 bits without parity

r1 =	Input Type and Range Value					
0 =	TC J	From	-100	to	1000	°C
1 =	TC K	From	-100	to	1370	°C
2 =	TC T	From	-200	to	400	°C
3 =	TC E	From	-100	to	800	°C
4 =	TC N	From	-100	to	1400	°C
5 =	TC S	From	-50	to	1760	°C
6 =	TC R	From	-50	to	1760	°C
7 =	TC B	From	0	to	1820	°C
8 =	TC L	From	-100	to	900	°C
9 =	TC U	From	-200	to	600	°C
10 =	TC G	From	0	to	2300	°C
11 =	TC D	From	0	to	2300	°C
12 =	TC C	From	0	to	2300	°C
13 =	TC Plat. II	From	-100	to	1400	°C
14 =	RTD Pt 100	From	-200	to	850	°C
15 =	Linear	From	0	to	60	mV
16 =	Linear	From	12	to	60	mV
17 =	Linear	From	0	to	20	mA
18 =	Linear	From	4	to	20	mA
19 =	Linear	From	0	to	5	V
20 =	Linear	From	1	to	5	V
21 =	Linear	From	0	to	10	V
22 =	Linear	From	2	to	10	V
23 =	TC J	From	-150	to	1830	°F
24 =	TC K	From	-150	to	2500	°F
25 =	TC T	From	-330	to	750	°F
26 =	TC E	From	-150	to	1470	°F
27 =	TC N	From	-150	to	2550	°F
28 =	TC S	From	-60	to	3200	°F
29 =	TC R	From	-60	to	3200	°F
30 =	TC B	From	32	to	3300	°F
31 =	TC L	From	-150	to	1650	°F
32 =	TC U	From	-330	to	1110	°F
33 =	TC G	From	0	to	4170	°F
34 =	TC D	From	0	to	4170	°F
35 =	TC C	From	0	to	4170	°F
36 =	TC Plat. II	From	-150	to	2550	°F
37 =	RTD Pt100	From	-330	to	1560	°F

r2 = Decimal Point Position
(Available only for linear range r1 = 15 to 22)

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

r3 = Low Scale Range Value
(Available only for linear range r1 = 15 to 22)
Range: From -1999 to 9999

r4 = High Scale Range Value
(Available only for linear range r1 = 15 to 22)
Range: From -1999 to 9999

r5 = Offset Adjustment
Range: From -500 to 500
Offset value algebraically added to the measured value.

r6 = Time Constant for Filter on Displayed Value
Range: From 0 (filter OFF) to 8 seconds.
(First order filter with selected time constant.)

r7 = Alarm Action on Fault
uP = The alarm assumes an upscale reading.
doun = The alarm assumes a downscale reading.

C1 = Type of Limit Action
Hi. = High limit (for heating process)
Lo. = Low limit (for cooling process)
Hi.Lo = Band limit (for special process)

C2 = Acknowledgment Mode
O = The acknowledgment action is ignored if performed when setpoint is exceeded.
I = The acknowledgment action is recognized also when the setpoint is exceeded. (In this case, the control output is instantaneously restored when process variable is within setpoint).

Control Output Function
The relay output operates in fail-safe mode (relay de-energized during reset condition) and latching mode.

The control output turns OFF when the setpoint is exceeded when C1 = Hi, or C1 = Lo. (When C1 = Hi.Lo control output turns off when the process is greater than "Su" or less than "S1").

The control output remains OFF until the process is within setpoint and the acknowledge action has been performed (the sequence of action may or may not be important depending on parameter C2).

The upper display flashes when the setpoint is exceeded and returns to a steady display when the process is within setpoint.

When the control output is OFF the RESET LED is ON (if C2 = 0) or flashes (if C2 = 1).

When C2 = 1 the RESET LED is steady ON when control output is OFF and acknowledged.

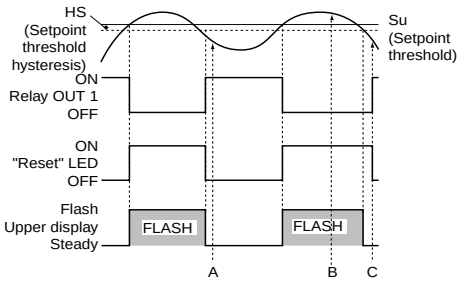
The reset condition can be stored in permanent memory (see C4).

Acknowledgment can be performed by pressing the RESET key, by momentarily closing the external dry contact or by a command from the serial link.

The length of the reset condition and max/min values detected are stored in memory and available for viewing until the next reset condition occurs. The information is lost at power down.

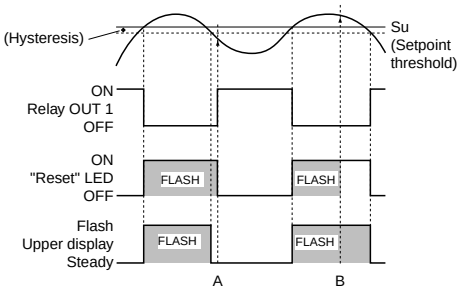
During a reset condition the values are continuously updated and can be monitored.

Example of limit function when C1 = Hi and C2 = O



A, B, C = Acknowledgment action by RESET button, digital input or serial link. NOTE: Acknowledgment B has no effect.

Example of limit function when C1 = Hi and C2 = 1



A, B = Acknowledgment action by RESET button, digital input or serial link.

C3 = Reset at Power-up
Auto = Automatic reset
ñAn = Manual reset

C4 = Reset Memory
0 = The reset condition will be saved (at next power up it will be reactivated)
1 = The reset condition will be lost in case of power down

C5 = Time Constant for Filter on Measured Value for Reset Action
Range: From 0 (filter OFF) to 8 seconds
Note: First order filter with selected time Constant.

P1 = Alarm Function
(Skipped if option not available)
nonE = Not provided
AL.P = Process alarm
AL.b = Band alarm
AL.d = Deviation alarm
When C1 = Hi.Lo, “AL.b” and “AL.d” are not available.

P2 = Alarm configuration
(Skipped if option is not available or P1 = none)
H.A. = High alarm with automatic reset
L.A. = Low alarm with automatic reset
H.A.Ac = High alarm with automatic reset and acknowledge
L.A.Ac = Low alarm with automatic reset and acknowledge
H.L. = High alarm with manual reset
L.L. = Low alarm with manual reset

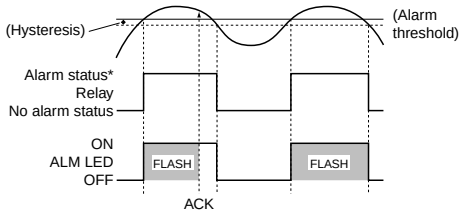
NOTE: For band alarm, H.A./H.A.Ac/H.L. signifies outside band alarm, while L.A./ L.A.Ac/L.L. signifies inside band alarm.

For every alarm configuration:
LED flashes, relay placed in alarm status

P2 = H.A.	Alarm still exists	Ack.	LED lit steady Relay in alarm status
		No Ack.	LED flashing Relay in alarm status
P2 = L.A.	Alarm clears	LED off Relay not in alarm status	
P2 = H.A.Ac	Alarm still exists	Ack.	LED lit steady Relay not in alarm status
		No Ack.	LED flashing Relay in alarm status
P2 = L.A.Ac	Alarm clears	LED off Relay not in alarm status	
P2 = H.L.	Alarm still exists	Ack.	LED lit steady Relay in alarm status
		No Ack.	LED flashing Relay in alarm status
P2 = L.L.	Alarm clears	Ack.	LED OFF Relay not in alarm status
		No Ack.	LED flashing Relay in alarm status

Ack. = Alarm Acknowledgment
(For relay status see configuration parameter P3.)

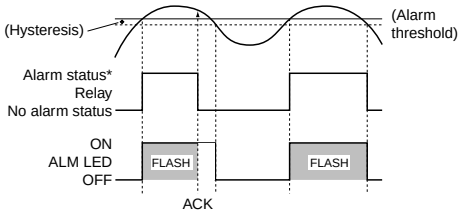
Example for P2 = H.A.



ACK = Alarm acknowledgment from "AK" parameter or serial link.

* Alarm Status: Relay energized (P3 = dir)
Relay de-energized (P3 =rEV)

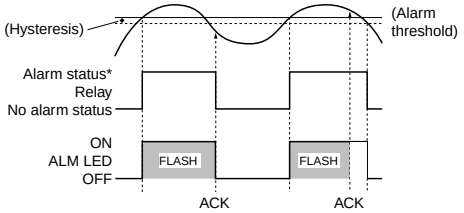
Example for P2 = H.A.A.c



ACK = Alarm acknowledgment from "AK" parameter or serial link.

* Alarm Status: Relay energized (P3 = dir)
Relay de-energized (P3 =rEV)

Example for P2 = H.L.



ACK = Alarm acknowledgment from "AK" parameter or serial link.

* Alarm Status: Relay energized (P3 = dir)
Relay de-energized (P3 =rEV)

P3 = Alarm Action
(Skipped if option not is available or P1 = none)
dir = Direct action
(Relay energized in alarm condition)
rEV = Reverse action
(Relay energized in non-alarm condition)

P4 = Alarm Standby Function
(Skipped if option is not available or P1= none)
OFF = Standby function disabled
On = Standby function enabled

If the alarm is programmed as band or deviation, this function masks the alarm condition at start up and at a “Su” setpoint change until the process variable reaches the alarm threshold, plus or minus hysteresis. This standby function masks a Process Alarm condition at start up until the process variable reaches the alarm threshold plus or minus hysteresis.

PF = Time Constant for Filter on Measured Value for Alarm Action
(Skipped if option is not available or P1 = none)
Range: From 0 (filter OFF) to 8 seconds
(First order filter with selected time constant.)

n 1 = Safety Lock
0 = UNLOCKed. The device is always UNLOCKed and all parameters can be modified.
l = LOCKed. The device is always LOCKed and no parameters can be modified
From 2 to 9999 = This number is a password, to be used in run time (see “nn”), to LOCK/UNLOCK the device.

t1 = Timeout Selection
tn10 = 10 second timeout
tn30 = 30 second timeout

d1 = Digital Input (contact closure)
(This is a read only parameter)
Enb = Digital input enabled
dlS = Digital input disabled
(The digital input is used as a remote process restart.)

The configuration procedure is now complete. The display should show "COnF".

OPERATING MODE

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

Normal Display Mode

On powerup the device starts in the "Normal Display Mode."

By pressing the ▲ or ▼ key, it is possible to change the displayed information; therefore, one of the following display modes can be selected:

1) The upper display shows the measured value while the lower display shows the "Pu" (Process variable)
2) The upper display shows the setpoint threshold while the lower display shows "Su." If this display was active at power down, it will be active at powerup.
3) The upper display shows the setpoint1 threshold while the lower display shows "S1." This information is available only if C1 = Hi.Lo If this display was active at power down, it will be active at powerup
4) The upper display shows the total time (hh.mm) of the last reset condition while the lower displays shows "t." (if no data is available, the upper display will show "- - - -"). The information is lost at power down and at powerup the device will display the process variable.
5) The upper display shows the maximum value of process variable detected during the last "reset" condition while the lower display shows "Ph." (if no data is available, the upper display will show "- - - -"). This information is not available if C1 = Lo. The information is lost at power down and at powerup the device will display the process variable.

NOTE: In case the reset condition was generated by a fault condition in the measure variable, the upper display will indicate "m̄.Err"

6) The upper display shows the minimum value of the process variable detected during the last "reset" condition while the lower display shows "PL." (if no data is available, the upper display will show "- - - -") This information is not available if C1 = Hi. The information is lost at power down and at powerup the device will display the process variable .

   NOTE: in case the "reset condition" was generated by a fault condition in the measure variable, the upper display will indicate "m̄.Err"

At powerup the display will show the process variable unless otherwise stated in one of the above display options

If, at power off, the device was in reset condition and configured to save it (C4 = 0), and/or it was programmed for manual reset at startup (C3 = 1), then at the next power up the lower display will be flashing.

Indicators

"RESET"	=	Indicates control output status as follows: a) With configuration parameter C2 = 0 LED ON when Output is OFF LED OFF when Output is ON b) With configuration parameter C2 = 1 LED flashes when Output is OFF LED ON when Output is OFF and acknowledged LED OFF when Output is ON
"ALM"	=	Indicates alarm status as follows: Flashes when alarm is ON ON when alarm has been acknowledged OFF when alarm is OFF

Key Functions in Normal Display Mode

"FUNC" = By pressing it, the display changes from "Normal Display Mode" to "Parameter Display Mode."

= Pressing it for more than ten seconds initiates the Lamp Test. During the Lamp Test the device functions normally while all display segments and LED's are lit with a 50% duty cycle. No timeout is applied to a lamp test.

Press the "FUNC" key again to end the Lamp Test.

"▲" or "▼" = By pressing these keys it is possible to change the displayed information. See "Normal Display Mode" on previous page.

"RESET" = Press and hold for 1 second to initiate "reset."

Parameter Display Mode

The "FUNC" key initiates the Parameter Display Mode when pressed for less than 10 seconds in the "Normal Display Mode."

The lower display shows the parameter identification code while the upper display shows the parameter value. The value of these parameters can be modified with the ▲ and ▼ keys.

Press the "FUNC" key again to store the new value and advance to the next parameter.

If no keys are pressed within the timeout period (see t1), the display will automatically return to the "Normal Display Mode" in the previous display and any modifications of the last displayed parameter will be lost.

All parameters (except R5) can be modified only when the device is UNLOCKed.

The LOCK/UNLOCK status can be selected in configuration using parameter n1 or during the operating mode with the parameter password.

To switch from LOCKED to UNLOCKED, enter the n1 parameter setting. To switch from UNLOCKED to LOCKED, enter any number other than the n1 parameter setting.

When the device is in remote (the serial link controls the device) no parameters can be modified.

Key Functions in Parameter Display Mode

FUNC = Press the "FUNC" key again and the instrument stores the new setting (if changed) and goes to the next parameter.

▲ or ▼ = Changes the setting of the selected parameter.

RESET = Press and hold for more than 1 second to initiate reset.

OPERATING PARAMETERS

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

Alarm Acknowledge
(Available only if P1 = AL.p, AL.b or AL.d)
Lower display: AA
Upper display: OFF/ON
Select ON and press the FUNC key in order to acknowledge the alarm.
ON = Alarm Acknowledged
OFF = Alarm Not Acknowledged

Software Key
(Skipped if n1 = 0 or 1)
Lower display: nn
Upper display: Numeric password to LOCK/UNLOCK the device
NOTE: The upper display will initially show the "LOCK" status.
ON = the device is LOCKED.
OFF = the device is UNLOCKED.

Setpoint Threshold
Lower display: Su
Upper display: Setpoint threshold value
Range: Span limits (From "S1" to high span limit when C1 = Hi.Lo)

Setpoint1 Threshold
(Available when C1 = Hi.Lo)
Lower display: S1
Upper display: Setpoint threshold value
Range: From low span limit to "Su"

Setpoint Threshold Hysteresis
Lower display: HS
Upper display: Hysteresis value
Range: From 0.1% to 10.0% of span value or 1 LSD

Alarm Threshold (optional)
(Available only if P1=AL.P, AL.b or AL.d.)
Lower display: AL
Upper display: Alarm threshold value
Range:

Span limits	(if process alarm	P1 = AL.P)
From 0 to 500	(if band alarm	P1 = AL.b)
From -500 to 500	(if deviation alarm	P1 = AL.d)

Alarm Hysteresis (optional)
(Available only if P1 = AL.P, AL.b or AL.d)
Lower display: HA
Upper display: Hysteresis value
Range: From 0.1% to 10.0% of span value or 1 LSD

Serial LInk (optional)
The device can be connected to a host computer via serial link.

The host can put the device in LOCAL (parameters are controlled via keyboard) or in REMOTE (functions and parameters are controlled via serial link).

REMOTE is signified by the decimal point to the left of "RMT" which is on the right side of the numeric display.

Via serial link it is possible to read and/or to modify all the operative and configuration parameters.
The following conditions must apply to implement this function:
1) Configure parameters L1 through L4 with the front keyboard
2) The device must be in the Operating mode.

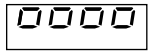
Control output is OFF during the download procedure.

At the end of configuration downloading procedure the device preforms an automatic reset and returns to normal condition.

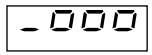
ERROR MESSAGES

Overrange, Underrange and Sensor Break Indications

This device detects process variable faults (OVERRANGE, UNDERRANGE OR SENSOR BREAK). When the process variable exceeds the span limits established by configuration parameter r1 an OVERRANGE condition will appear as:



An UNDERRANGE condition will appear as:



A sensor break is signaled as "OPEN". On the mA/V input, a sensor break can be detected only when the range selected has a zero elevation (4/20 mA, 12/60 mV, 1/5 V or 2/10 V.)

On the RTD input "shrt" is signalled when input resistance is less than 15 Ω (short circuit sensor detection).

This device detects reference junction errors or errors on the internal autozero measurement. When a fault is detected the output goes OFF and the alarm assumes an upscale/downscale reading in accordance with r7.

Error Messages

On powerup, the instrument performs a self-diagnostic test. When an error is detected, the lower display shows an "Er" indication while the upper display shows the code of the detected error.

Error List

100	Error in EEPROM writing
150	Short circuit on CPU's outputs
200	Error on "protect register" in EEPROM
XXX	Configuration parameter error.
301	Error on calibration of selected input.
307	rj input calibration error.
400	Error on operative parameter.
500	Error on autozero measurement.
502	Error on reference junction measurement.
510	Error during calibration procedure.

Dealing with Error Messages

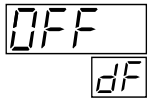
1) When a configuration parameter error is detected, repeat the configuration procedure of that specific parameter.
2) If an error 400 is detected, simultaneously press the ▼ and ▲ keys to load the default parameters and then repeat the control parameter setup.
3) For all other errors, contact your Service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

DEFAULT PARAMETERS

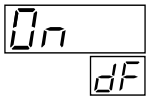
Loading Default Operating Parameters

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) Press and hold the ▼ key and press the ▲ key; the displays will show:



b) Press either the ▼ or ▲ key; the display will show:



c) 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 Parameters List

Parameter	Default Value
Alarm Acknowledge	OFF
Software Key	Unlock
Setpoint Threshold	Low range value (if low limit) High range value (if high or high/low limit)
Setpoint1 Threshold	Low range value
Setpoint Threshold Hysteresis	0.1%
Alarm Threshold	Low range (if process alarm) 100 (if deviation or band alarm)
Alarm Hysteresis	0.1%

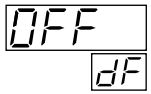
Loading Default Configuration Parameters

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:

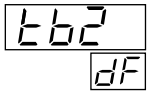
a) Internal switch V101 must be open.
b) The upper display will show:

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) Press the ▲ key to select Table 1 (European) or Table 2 (American) default parameters; the display will show:



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

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

Default Configuration Parameter List

PARA.	Table 1	Table 2
	European	American
L1	nbUS	nbus
L2	1	1
L3	19200	19200
L4	8E	8E
r1	Type J (-100 to 1000 °C)	Type J (-150 to 1830 °F)
r2	——.	——.
r3	-100	-150
r4	1000	1830
r5	0	0
r6	1 second	1 second
r7	uP	uP
c1	Hi	Hi
c2	1	0
c3	Auto	Auto
c4	0	0
c5	1 second	1 second
P1	nonE	nonE
P2	H.A.	H.A.Ac
P3	rEV	rEV
P4	OFF	OFF
PF	1 second	1 second
n1	0	0
t1	10 seconds	30 seconds

SPECIFICATIONS

Case RABS Grey dark color (RAL 7043). Self-extinguishing degree V0 according to UL 94

Front panel Designed and tested for IP65 and NEMA 4X for indoor location (when panel gasket is installed). Tests were performed in accordance with IEC 529, CEI 70-1 and NEMA 250-1991 STD.

Installation Panel mounting

Rear Terminal Block
15 screw terminals with safety rear cover

Dimensions Unit with RS-485 communications
DIN 43700 48 x 48 mm x 122 mm
(1.890 x 1.890 in. x 4.803 in).

Dimensions Unit without RS-485 communications
DIN 43700 48 x 48 mm x 105 mm
(1.890 x 1.890 in. x 4.134 in).

Cutout 45 x 45 mm (1.772 x 1.772 in).

Weight 250 g (8.75 oz).

Upper Display 4 digits, 7 segment red LED's with decimal point, 7.62 mm high (0.3 in).

Lower Display 2 digits, 7 segment red LED's with decimal point, 7.62 mm high (0.3 in).

Indicator 2 red LED annunciators for:
"RESET" Indicates control output status as follows:

a) With configuration parameter C2 = 0
LED ON when Output is OFF
LED OFF when Output is ON

b) With configuration parameter C2 = 1
LED flashes when Output is OFF
LED ON when Output is OFF and acknowledged
LED OFF when Output is ON

"ALM" indicates alarm status as follows:
Flashes when alarm is ON.
ON when alarm has been acknowledged
OFF when alarm is OFF

RMT A decimal point on the right side of the upper display flashes to indicate the device is controlled by serial link

Keyboard Four keys (covered by polyester membrane) labelled RESET, ▲, ▼ & FUNC.

Power Supply 100 to 240 Vac 50/60 Hz switching or 24 Vac/Vdc with interruptions less than 100 ms

Power Supply Variation
-15% to 10% (for 100 to 240 Vac)
-10% to 10% (for 24 Vac/Vdc)

Power Consumption 8 VA max

Insulation Resistance Greater than 100 MΩ

Insulation Strength1500 V rms for 1 minute

EC Compatibility
Conforms with 89/336/EEC directives regarding electro-magnetic compatibility
Emission Complies with:
Generic emission standard EN50081-2
Immunity Complies with the generic immunity standard EN50082-2. Conforms with 72/23/EEC and 93/68/EEC directives regarding low voltage. It complies with the safety requirements for electrical equipment for measurement, control and laboratory use, Generic Standard EN61010-1, Installation Category II.

Sampling Time
250 ms for linear input
500 ms for TC/RTD input

Display Update Time
500 ms
The display value can be filtered

Reference Accuracy
± 0.2% fsv ±1 digit @ 25 °C and nominal power supply voltage.

Temperature Drift
Less than 200 ppm/°C of full span for mV and TC ranges 1, 2, 4, 5, 9, 14 (CJ excluded).
Less than 300 ppm/°C of full span for mA/V and TC ranges 11, 12, 13 (CJ excluded)
Less than 400 ppm/°C of full span for RTD range 15 and TC range 10 (CJ excluded).
Less than 500 ppm/°C of full span for TC ranges 3, 6, 7 (CJ excluded).
Less than 600 ppm/°C of full span for TC range 8.
NOTE: Precision and drift guaranteed (for T>300°C/570°F).

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

Ambient Temperature
0 to 50 °C

Storage Temperature
-20 to 70 °C

Humidity Maximum of 85% RH non condensing

Input Thermocouple (J, K, T, E, N, S, R, B, L, U, G, D, C, Platinel II), RTD Pt100, mVdc, Vdc, mAdc. The type of inputs are keyboard and jumper selectable.

Range

1) TC type J	-100	to	1000	°C
	-150	to	1830	°F
2) TC type K,	-100	to	1370	°C
	-150	to	2500	°F
3) TC type T	-200	to	400	°C
	-330	to	750	°F
4) TC type E	-100	to	800	°C
	-150	to	1470	°F
5) TC type N	-100	to	1400	°C
	-150	to	2550	°F
6) TC type S	-50	to	1760	°C
	-60	to	3200	°F
7) TC type R	-50	to	1760	°C
	-60	to	3200	°F
8) TC type B	0	to	1820	°C
	32	to	3300	°F
9) TC type L [DIN43710-1977]				
	-100	to	900	°C
	-150	to	1650	°F
10) TC type U [DIN43710-1977]				
	-200	to	600	°C
	-330	to	1110	°F
11) TC type G [W - W, 26% Re]				
	0	to	2300	°C
	0	to	4170	°F
12) TC type D [W, 3% Re - W, 25% Re]				
	0	to	2300	°C
	0	to	4170	°F
13) TC type C	0	to	2300	°C
	0	to	4170	°F
14) TC type Platinel II				
	-100	to	1400	°C
	-150	to	2550	°F
15) RTD PT100	-200	to	850	°C
	-330	to	1560	°F
16) Linear	0	to	20	mA
17) Linear	0	to	60	mV
18) Linear	0	to	5	V
19) Linear	0	to	10	V

Source Impedance
100 Ω maximum for TC/mV input
Less than 20 Ω per wire for RTD input

Input Impedance
Greater than 1 MΩ for TC/mV input
Greater than 400 KΩ for 5V to 10V input range
Less than 5 Ω for mA input

Cold Junction
Automatic compensation from 0 to 50 °C

Digital Input Input from dry contact (voltage free) to restart process (optional)

Control OUT 1
Relay (form C) 3 Amp @ 250 Vac resistive load (with varistor on contacts)
(Relay operates in failsafe mode)

Limit Type High limit (for heating process)
Low limit (for cooling process)
High/Low limit (for special process)

Acknowledgment Mode
To restart the process, two conditions must apply
a) The process returns within setpoint
b) The operator has acknowledged the process (from keyboard, digital input or serial link)
The "a" and "b" sequence may or may not matter depending on C2 (see C2)

Power-Up Mode
Automatic or Manual restart. When in automatic restart the control output is guaranteed OFF for 1 second.

Setpoint Threshold
Span limits

Threshold hysteresis
From 0.1 to 10.0% of span value or 1 LSD (whichever is greater)

OUT 2 Relay (form A) 2 Amp @ 250 Vac resistive load. OUT 2 is used as alarm output (optional)

Alarm Function
Process alarm
Deviation alarm
Band alarm

Type of Alarm
High/Low (Outside/Inside if band alarm)
Direct/Reverse
Automatic/Manual reset
Standby sequence/No standby sequence

Alarm Threshold
Span limits for process alarm
From 0 to 500 digits for band alarm
From -500 to 500 digits for deviation alarm

Alarm Hysteresis
From 0.1 to 10.0% of span value or 1 LSD (whichever is greater)

Serial Interface
RS-485 Opto-isolated (optional)

Protocol Type
Modbus/Jbus (RTU mode)

Device Address
From 1 to 255. NOTE: The interface can support up to 31 devices

Baud Rate 600 up to 19200 baud

Format 1 start bit
8 bit with/without parity
1 stop bit

Parity Even/Odd

Watch dog Hw/Sw is provided for automatic restart

Protection Internal dip switch for calibration and configuration parameter protection.

References

UL 94 Tests for flammability of plastic materials for pans in devices and appliances

CEI 70-1 (IEC 529)
Degrees of protection provided by enclosures (IP Code)

NEMA 250-1991
Enclosures for equipment (1000 Volts maximum)

DIN 43700 Measurements and control instruments for panel mounting. Nominal front and cut-out dimensions.

EN 50081-2 Electromagnetic compatibility - Generic emission standard - Part 2. Industrial environment.

EN 55011 Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment.

EN 50082-2 Electromagnetic compatibility - Part 2 - Industrial environment

ENV50140 Electromagnetic compatibility - Basic immunity standard -
Radiated radio - frequency electro-magnetic field- Immunity test.

IEC 1000-4-2 Electromagnetic compatibility (EMC)
Part 4: Testing and measurement technique. Section 2: Electrostatic discharge immunity test.

EN-61000-4-8 Electromagnetic compatibility (EMC)
Part 4: Testing and measurement techniques
Section 8: Power frequency magnetic field immunity test.

IEC 1000-4-4 Electromagnetic compatibility. Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test.

ENV50141 Electromagnetic compatibility - Basic immunity standard - Conducted disturbances induced by radio-frequency fields - Immunity test.

DIN 43710-1977
Thermocouples - Reference table.

IEC 584-1 Thermocouples - Part 1 - Reference table.

DIN 43760 Thermometer Reference table.

CALIBRATION PROCEDURE

Calibration parameters are logically divided into groups of two parameters each – initial scale value and final scale value. A calibration check is provided after entering the values of each group. It is also possible to perform a calibration check without making an entry: press the FUNC button twice when "OFF" is displayed. The instrument goes directly to the group check.

Before beginning calibration, be sure the internal DIP switch V101 is open.

WARNING: Perform the calibration procedure according to J106 jumper positions as shown in Figure 1. Otherwise, the stored calibration values may be lost.

Input Type	J106			
	1-2	3-4	5-6	7-8
T/C, RTD, 0-60 mV, 12-60 mV (standard configuration)	close	open	open	open
0-5 V, 1-5V	open	close	open	open
0-10V, 2-10 V	open	open	close	open
0-20 mA, 4-20 mA	open	open	open	close
Input CTTC R192=180K SH120=Closed CH101=Open				

Figure 1. J106 Settings

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 of 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 mV
RTD Input:	+0.02%
	+0.0025 Ω decade
CJ Compensation:	better than 0.1°C
Current Transformer:	0.1 mA AC rms

Resolution

TC Input:	1 mV
RTD Input:	10 mΩ
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 Initial Scale Value
tH	TC Input Final Scale Value
t.	TC Input Check
rJ	Cold Junction Compensation
rJ.	Cold Junction Compensation Check
PL	RTD Input Initial Scale Value
PH	RTD Input Final Scale Value
P.	RTD Input Check
AL	Current Input Initial Scale Value
AH	Current Input Final Scale Value
A.	Current Input Check
nL	5 Volt Input Initial Scale Value
nH	5 Volt Input Final Scale Value
n.	5 Volt Input Check
UL	10 Volt Input Initial Scale Value
UH	10 Volt Input Final Scale Value
U.	10 Volt Input Check

Procedure
Switch on the instrument; the upper display will show "COnf". Press the ▲ button; the upper display will show "CAL".

Using the ▲ and ▼ pushbuttons (buttons), it is possible to select between ON and OFF. To go to the next parameter without modifying the calibration, press the FUNC button when the display shows "OFF". To enter a calibration value, press the FUNC button when the display shows "ON".

Press the FUNC button to show the first calibration code on the lower display. Repeatedly press the FUNC button until the desired calibration (parameter) code appears.

NOTE: by pushing the SMRT button it is possible to go back to a previous parameter without memorizing the new calibration.

Entering Calibration Values
Following is a detailed, sequential procedure for entering and checking values for each calibration parameter:

tL TC Input Initial Scale Value
a) Connect calibrator and instrument as shown in Figure 2.

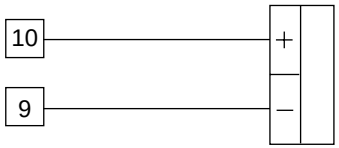


Figure 2. Calibrator Connection

b) The upper display shows "OFF", the lower displays shows "tL".
c) Set calibrator to 0.000 mV.
d) Push the ▲ button; the display changes to "ON".
e) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

tH TC Input Final Scale Value
a) Set the calibrator to 60.000 mV.
b) Push the ▲ button; the displays will show "ON" and "tH".
c) After a few seconds, start calibration by pressing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

t. TC Input Check
The display (Figure 3) shows "t." followed by a number showing the measured value in counts:

Figure 3. TC Calibration Check Display

a) Check the calibration (linear) by setting:
0.000 mV – the readout must be equal to "t.000 00" ± 10 counts;
60.000 mV – the readout must be equal to "t.300 00" ± 10 counts;
30.000 mV – the readout must be equal to "t.150 00" ± 10 counts.
b) Push the FUNC button to go to the next parameter.

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 – for example, MEMOCAL. See Figure 4.

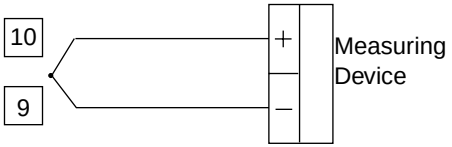


Figure 4. Measure Temperature Near Terminals

b) Wait a few minutes to allow temperature stabilization of the entire system (compensation cable, sensor, calibrator and instrument).
c) The displays show "rJ" and "OFF". Using the ▼ or ▲ button, make the readout value equal to the temperature measured by the measuring device in tenths of °C.
d) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

rJ. Cold Junction Compensation Check

The displays show "rJ." and the cold junction temperature in tenths of °C. Make sure the display readout is equal to the value read on the measuring device. Then, push the FUNC button to go to the next parameter.

PL RTD Input Initial Scale Value

a) Connect a resistor box and the instrument as shown in Figure 5.

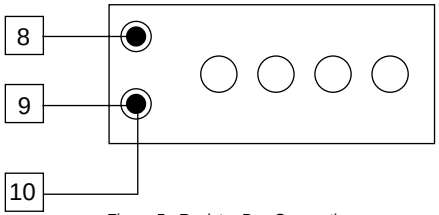


Figure 5. Resistor Box Connection

b) Set 0.00 Ω on the resistor box.
c) Push the ▲ button; the displays show "ON" and "PL".

d) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

PH RTD Input Final Scale Value

a) Set resistor box to 375.00 Ω.
b) Push the ▲ button; the displays will show "ON" and "PH".
c) After a few seconds, start calibration by pressing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

P. RTD Check

The display (Figure 6) shows "P." followed by a number showing the measured value in counts:

Figure 6. RTD Calibration Check Display

a) Check the calibration (linear) by setting:
0.00 Ω – the readout must be equal to "P.000 00" ± 10 counts;
125.000 Ω – the readout must be equal to "P.101 90" ± 10 counts;
375.00 Ω – the readout must be equal to "P.300 00" ± 10 counts.
b) Push the FUNC button to go to the next parameter.

AL Current Input Initial Scale Value

a) Connect calibrator and instrument as shown in Figure 7.

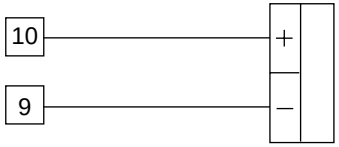


Figure 7. Calibrator Connection

b) The upper display shows “OFF”, the lower displays shows “AL”.
c) Set calibrator to 0.000 mA (even if the minimum range value is 4mA).
d) Push the ▲ button; the display changes to “ON”.
e) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

AH Current Input Final Scale Value

a) Set the calibrator to 20 mA
b) Push the ▲ button; the displays will show “ON” and “AH”.
c) After a few seconds, start calibration by pressing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

A. Current Input Check

The display shows “A.” followed by a number showing the measured value in counts.

a) Check the calibration (linear) by setting:
0.000 mA – the readout must be equal to “A.000 00” ± 10 counts;
20.000 mA – the readout must be equal to “A.300 00” ± 10 counts;
10.000 mA – the readout must be equal to “A.150 00” ± 10 counts.
b) Push the FUNC button to go to the next parameter.

nL 5 VOLT Input Initial Scale Value

a) Connect calibrator and instrument as shown in Figure 8.

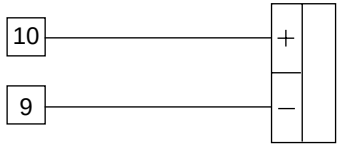


Figure 8. Calibrator Connection

b) The upper display shows “OFF”, the lower displays shows “nL”.
c) Set calibrator to 0.000 V (even if the minimum range value is 1V).
d) Push the ▲ button; the display changes to “ON”.
e) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

nH 5 Volt Input Final Scale Value

a) Set the calibrator to 5.000 V.
b) Push the ▲ button; the displays will show “ON” and “nH”.
c) After a few seconds, start calibration by pressing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

n. 5 Volt Input Check

The display shows “n.” followed by a number showing the measured value in counts.

a) Check the calibration by setting:
0.000 V – the readout must be equal to “n.000 00” ± 10 counts;
5.000 V – the readout must be equal to “n.300 00” ± 10 counts;
2.500 V – the readout must be equal to “n.150 00” ± 10 counts.
b) Push the FUNC button to go to the next parameter.

UL 10 VOLT Input Initial Scale Value

a) Connect calibrator and instrument as shown in Figure 9.

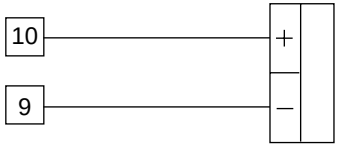


Figure 9. Calibrator Connection

b) The upper display shows “OFF”, the lower displays shows “UL”.
c) Set calibrator to 0.000 V (even if the minimum range value is 2 V).
d) Push the ▲ button; the display changes to “ON”.
e) After a few seconds, start calibration by pushing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

UH 10 Volt Input Final Scale Value

a) Set the calibrator to 10.000 V.
b) Push the ▲ button; the displays will show “ON” and “10UH”.
c) After a few seconds, start calibration by pressing the FUNC button. When this calibration is complete, the instrument will go to the next parameter.

U. 10 Volt Input Check

The display shows “10UH.” followed by a number showing the measured value in counts.

a) Check the calibration by setting:
   0.000 V – the readout must be equal to “U.000 00” ± 10 counts;
   10.000 V – the readout must be equal to “U.300 00” ± 10 counts;
   5.000 V – the readout must be equal to “U.150 00” ± 10 counts.
b) Push the FUNC button.

MAINTENANCE

1. Remove power from the power supply terminals and from relay output terminals.
2. Remove the instrument from case.
3. Using a vacuum cleaner or a compressed air jet (max. 3kg/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 only with a cloth moistened with ethyl alcohol (pure or denatured) [C_2H_5OH]; or isopropyl alcohol (pure or denatured) [$(CH_3)_2CHOH$]; 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 perfectly dry.
7. Re-insert the instrument and turn it ON.

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