3 YEAR WARRANTY

CN3271
High-Low Limit Alarm Unit

User's Guide

ISO 9001 CERTIFIED CORPORATE QUALITY — STAMFORD, CT
ISO 9002 CERTIFIED CORPORATE QUALITY — MANCHESTER, UK

omega.com®
ΩEOMEGA®

OMEGAnet® On-Line Service	**Internet e-mail**
www.omega.com	**info@omega.com**

For immediate technical or application assistance:

Service North America

USA:
ISO 9001 Certified
One Omega Drive, Box 4047
Stamford CT 06907-0047
Tel: (203) 359-1660
FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1, Canada
Tel: (514) 856-6928
FAX: (514) 856-6886
e-mail: info@omega.com

USA and Canada:
Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

Mexico:
En Español: (001) 203-359-7803
FAX: (001) 203-359-7807
e-mail: espanol@omega.com
info@omega.com.mx

Service Europe:

Benelux:
Postbus 8034, 1180 LA Amstelveen
The Netherlands
Tel: +31(0) 20 3472121
Fax: +31(0) 20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: sales@omegaeng.nl

Czech Republic:
Frystatska 184, 733 01 Karviná, Czech Republic
Tel: +420(0)59 6311899
Fax: +420(0)59 6311114
Toll Free: 0800-1-66342
e-mail: info@omegashop.cz

France:
11, rue Jacques Cartier, 78280
Guyancourt, France
Tel: +33 (0)1 61 37 29 00
Fax: +33 (0)1 30 57 54 27
Toll Free in France: 0800 466 342
e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26, D-75392
Deckenpfronn, Germany
Tel: +49 (0)7056 9398-0
Fax: +49 (0)7056 9398-29
Toll Free in Germany:
0800 6397678
e-mail: info@omega.de

United Kingdom:
ISO 9002 Certified
One Omega Drive
River Bend Technology Centre
Northbank, Irlam, Manchester
M44 5BD, United Kingdom
Tel: +44 (0)161 777-6611
Fax: +44 (0)161 777-6622
Toll Free in UK: 0800-488-488
e-mail: info@omega.co.uk

It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification. The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
WARNING: These products are not designed for use in, and should not be used for, human applications.

CN3271-add2.pmd   2   19/08/2004, 16.36

APPROVALS This instrument is U.L. and c.U.L. approved as controller.

CONTENTS

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 µm.

The instrument is shipped with a rubber panel gasket (50 to 60 Sh). To insure 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).
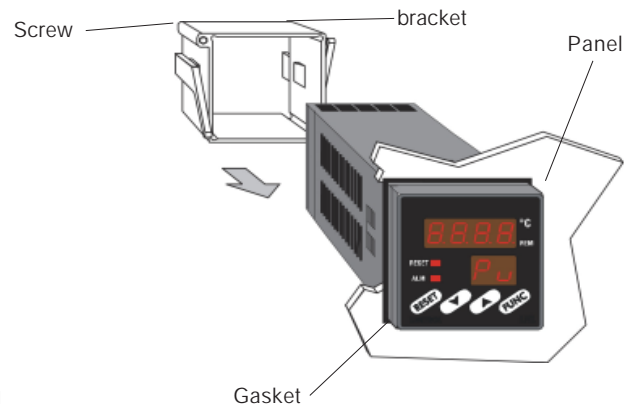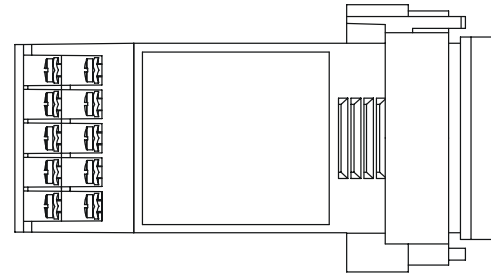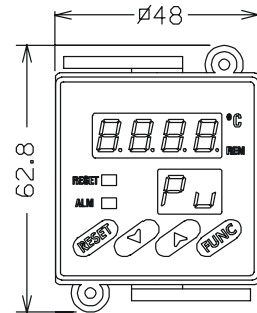5) To insure NEMA 4X/IP65 protection, make sure the instrument does not move within the cutout .

Fig. 1

1

DIMENSIONS AND REAR TERMINAL BLOCKS

Without RS-485

With RS-485

Fig.2

2

PANEL CUTOUT
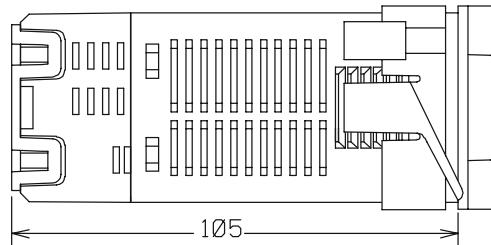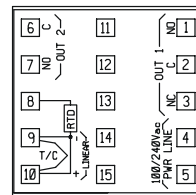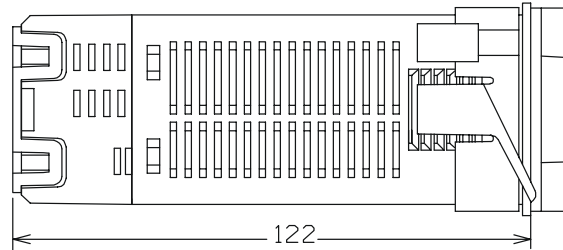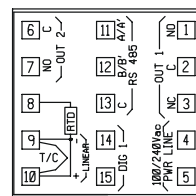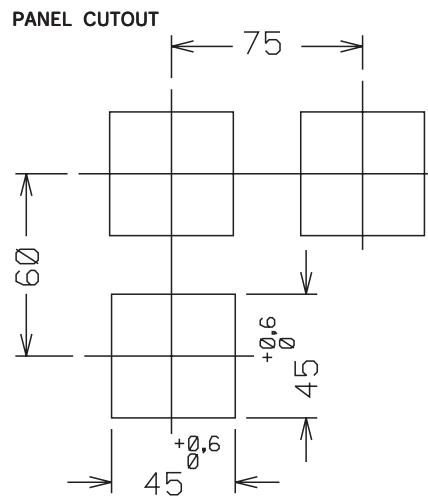
Fig.3

WIRING GUIDELINES

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
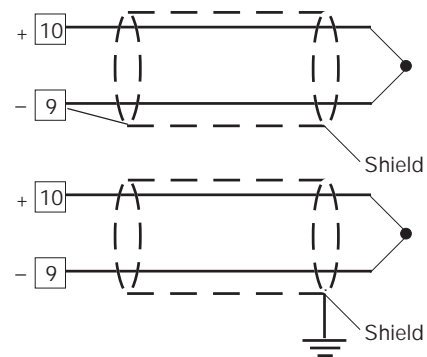
Fig. 4   THERMOCOUPLE INPUT WIRING

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

3
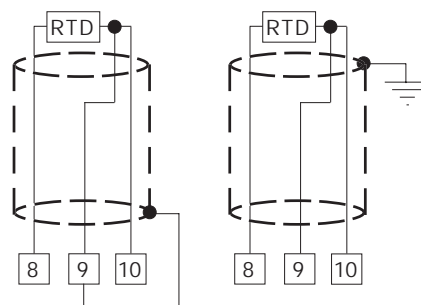
RTD INPUT

Fig. 5   RTD INPUT WIRING

NOTE:
1) Don't 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 resistance of the 3 wires must be the same.

LINEAR INPUT
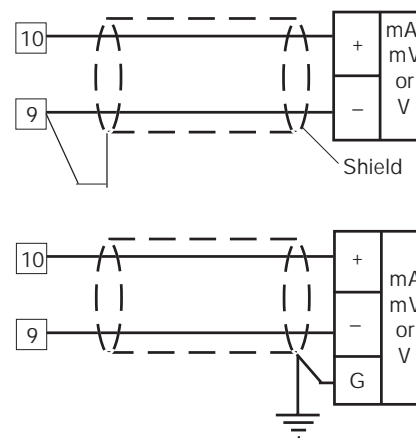
Fig. 6   mA, mV AND V INPUTS WIRING

NOTE:
1) Don't 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:
   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

4

LHL-1-NEUTRO.pmd   4   19/04/2004, 15.07

B) Logic Input (for models with RS-485 only)

This input is used for remote acknowledgement (reset).

Safety note:
- Do not run logic input wiring with AC power cables.
- Use an external dry contact capable of switching 0.5 mA, 5 Vdc.
- The instrument needs 100 ms to recognize a contact status variation.
- The logic inputs are **NOT** isolated from the measuring input.
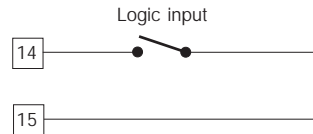
Fig.7

C.1) Relay Outputs
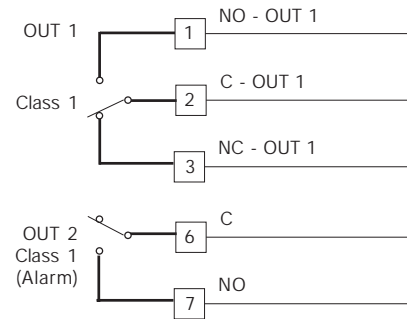
Fig. 8

The OUT 1 contact rating is 3A/250V AC on resistive load.
The OUT 2 contact rating is 2A/250V AC on resistive load.
The number of operations is 1×10^5 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 cupper conductors only.
4) Don't 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 recommendations avoid serious problems which may occur, when relay outputs are used with inductive loads.

C.2) Inductive Loads

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

The same problem may occurs when a switch is used in series with the internal contacts as shown in Fig. 9.
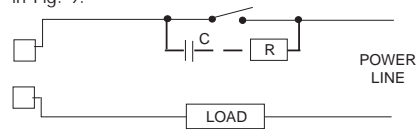
Fig. 9   EXTERNAL SWITCH IN SERIES WITH THE INTERNAL   CONTACT

In this case it is recommended to install an additional RC network across the external contact as show in Fig. 9
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

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

D) Serial Interface

For units built with optional RS-485 communication interface.
RS-485 interface allows to connect up to 30 devices with one remote master unit.
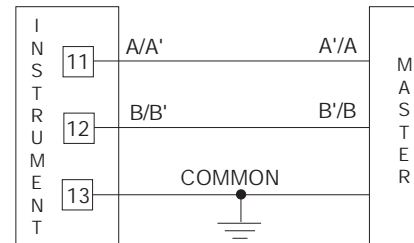
Fig. 10 - RS-485 WIRING
The cable length must not exceed 1.5 km at 9600 BAUD.

NOTES:
1) This RS 485 serial interface is insulated.
2) 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).

6
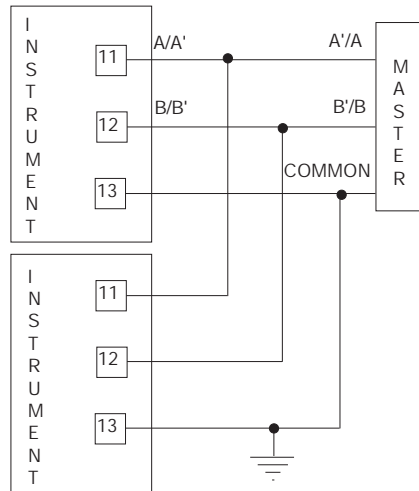
Fig.11

E) Power Line and grounding

| 4 | N, L2 |
| POWER SUPPLY |
| 100 to 240 Vac |
| 24 Vac/Vdc |
| 5 | R (S,T), L1 |
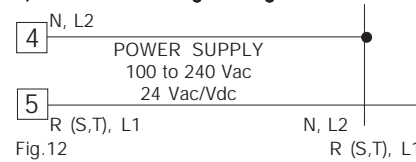
Fig.12

NOTES:
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 V AC/DC	T	500 mA	250 V
100/240 V AC	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 back the instrument to your supplier.
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.

7

PRELIMINARY HARDWARE SETTINGS

1) Remove the instrument from its case.

2) Set J106 according to the desired input type as shown in the following figure.

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

High - Low Limiter without RS-485
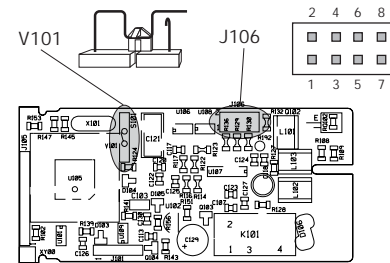
Fig.13.B

High - Low Limiter with RS-485

Fig.13.A

8
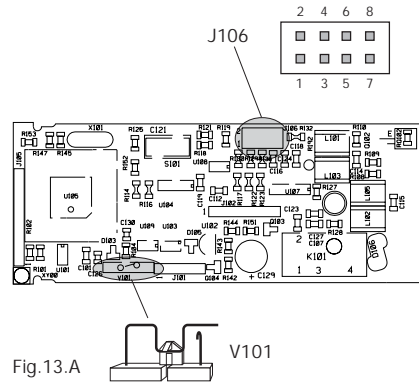
CONFIGURATION   PROCEDURE

CONFIGURATION KEY FUNCTIONS

RESET   In Configuration Mode, it is used only to scroll back parameters without to memorize a new parameter value.

▼   Used in Configuration Mode to decrease the parameter value.

▲   Used in Configuration Mode to increase the parameter value.

FUNC   Used to memorize the new parameter value and go to the next parameter.

▼ + ▲   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.
   NOTE : If "CAL" indication is displayed, press immediately the ▲ pushbutton and return to the configuration procedure.
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).

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: EIA standard allows no more than 31 device connected by one RS-485.

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

9

r 1 = 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 figure
_ _ . _ _   = Two decimal figures
_ . _ _ _   = Three decimal figures

r3 = Initial value of the readout scale
(Available only for linear range r1 = 15 to 22)
Range: From -1999 to 9999

r4 = final value of the readout scale
(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 of the filter applied to the displayed value
Range: From 0 (filter OFF) to 8 seconds.
(First order filter with selected time constant.)

r7 = Alarm action on input fault.
When the instrument detects an input failure condition, the alarm will operate as in presence of:
uP = as in presence of the full scale value.
doun = as in presence of the initial scale value.

C1 = Type of limit action

10

Hi. = High limit (for heating process)
Lo. = Low limit (for cooling process)
Hi.Lo = High and low limit (for special process)

C2 = Rearming Mode
O = Acknowledgements rearm (reset) the limiter (and restart the process) only if the condition which generated the shutdown status no longer exists (points A and C of the Example 1). It do **not** generate any effect if the condition which generated the shutdown status still exists (point B of the Example 1).
I = Acknowledgements enable the automatic rearmament (reset) of the limiter if the condition which generated the shutdown status still exists (point B of the Example 2). (The instrument rearms (reset) automatically when the condition which generated the shutdown status no longer exists).

Notes about limiter function
The relay of the output 1 operates in fail-safe mode (relay de-energized during shutdown condition) and latching mode.

The OUT 1 turns OFF when:
- C1 = Hi and the measured value is greater than limiter threshold ["Su" parameter (see Operative parameters")] or
- C1 = LO and the measured value is less than limiter threshold ["Su" parameter (see Operative parameters")] or
- C1 = HiLO and the measured value is greater than "Su" parameter (see Operative parameters") or less than "S1" parameter (see Operative parameters").
The Out 1 remains OFF until the condition which

generated the shutdown, no longer exists and the acknowledge action has been performed.

The upper display flashes during a shutdown and returns to a steady display when the shutdown condition no longer exists.
When C2 = 0 and OUT 1 is OFF, the RESET LED is ON.
When C2 = 1 one of the following condition may occur:
- if no acknowledgement has been made, OUT 1 is OFF and the RESET LED is flashing;
- if the acknowledgement has been made but the condition which generated the shutdown status still exists, OUT 1 is OFF and the RESET LED is steady ON.

The shutdown 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 shutdown condition and max/min measured values are stored in memory and available for viewing until the next shutdown condition occurs.
These informations are lost at power down.
During a shutdown condition the max/min measured values are continuously updated and can be monitored.
Example 1 - C1 = Hi and C2 = O

11

A, B, C = Acknowledgment actions.
NOTE: Acknowledgment B has no effect.

Example 2 - C1 = Hi and C2 = 1

A, B = Acknowledgment actions.
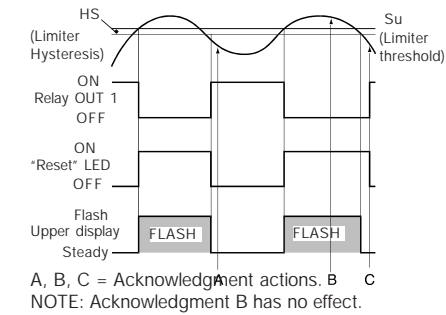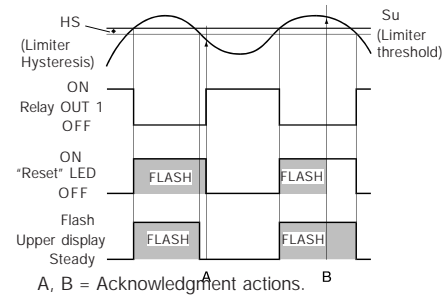
C3 = Rearm at Power-up
Auto = Automatic rearm
ñAn = Manual rearm

C4 = Shutdown memory
0 = The shutdown condition will be saved (at next power up it will be reactivated)
1 = The shutdown condition will be lost in case of power down

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

P1 = Alarm Function
(Skipped when the option is 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 "Silence" function.
L.A.Ac = Low alarm with automatic reset and "Silence" function.
H.L. = High alarm with manual reset
L.L. = Low alarm with manual reset

12

NOTE:
1) 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.
2) The "Silence" function allows the manual reset of the alarm even if the alarm condition is still in progress.

Example for P2 = H.A.
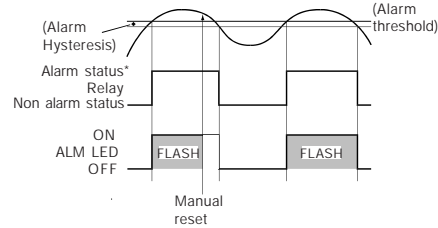
* Alarm Status: Relay energized (P3 = dir)
                 Relay de-energized (P3 =rEV)

Example for P2 = H.A.A.c
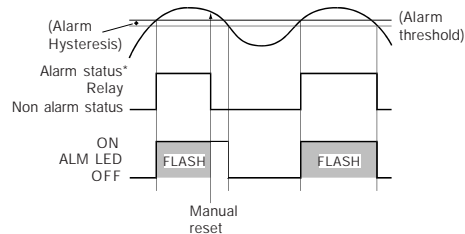
* Alarm Status: Relay energized (P3 = dir)
                 Relay de-energized (P3 =rEV)

Example for P2 = H.L.
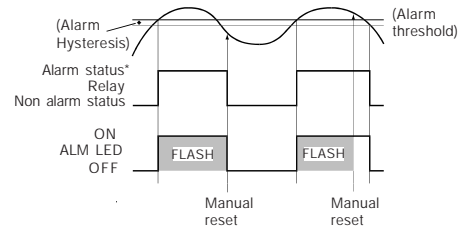
* Alarm Status: Relay energized (P3 = dir)
                 Relay de-energized (P3 =rEV)

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)

13

P 4 =   Alarm Standby (mask) 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 after a "Su" (limit threshold) changement 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 of the Filter
       applied to the   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
dIS =   Digital input disabled
(The digital input is used as a remote
Acknowledgment .)

The configuration procedure is now completed.
The display will show "COnF".

14

OPERATING MODE

1) Remove the instrument from its case.
2) Set switch V101 (see fig. 13) 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).
   If this display was active at power down, it will be active at powerup.
2) The upper display shows the limiter 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 second limiter 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 shutdown condition while the lower displays shows "t." If no shutdown condition was detected, 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 measured value detected during the last shutdown condition while the lower display shows "Ph.". If no shutdown condition was detected, the upper display will show "- - - -". This information is not available if C1 = HI.Lo. The information is lost at power down and at powerup the device will display the process variable.

NOTE: When the shutdown condition was generated by an input fault condition, the upper display will indicate "$\overline{m}$.Err"

6) The upper display shows the minimum mesured value detected during the last shutdown condition while the lower display shows "PL." If no shutdown condition was detected, 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: When the shutdown condition was generated by an input fault condition, the upper display will indicate "$\overline{m}$.Err"

If, at power off, the device was in shutdown condition and shutdown memoy function is selected (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.

15

Indicators

"RESET" = Indicates control output 1 status as
follows:
  a) When C2 parameter has been
    configured equal to 0,
    LED ON when Output 1 is OFF
    LED OFF when Output 1 is ON
  b) When C2 parameter has been
    configured equal to 1,
    LED flashes when Output 1 is OFF
    LED ON when Output 1 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 resetted but
    the alarm condition is still present.
  - OFF when alarm is OFF
"REM" = Indicates the remote status of the
instrument.
  - Flashes when instrument is in remote
    mode.
  - OFF when instrument is in local mode.

Key Functions In Normal Display Mode

"FUNC" = By pressing it, the display changes from
"Normal Display Mode" to "Operative
Parameter Display Mode."
= Pressing it for more than ten seconds
initiates the Lamp Test. During the Lamp
Test the device function 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 rearm
(reset) the limiter.
▲ + 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.

Operative Parameter Display Mode

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

The lower display shows the parameter code while the
upper display shows the parameter value or status.
The value of the selected parameter 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 instrument will automatically return to
the "Normal Display Mode" in the previous display
and any modification of the last displayed
parameter will be lost.

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

The LOCK/UNLOCK status can be selected in
configuration using "n1" parameter or during the
operating mode with the "nn" parameter (pass-
word).

16

To switch from LOCKED to UNLOCKED, assign to the "nn" parameter a value equal to the "n1" parameter setting. To switch from UNLOCKED to LOCKED, assign to the "nn" parameter any number other than the n1 parameter setting.
When the device is in remote mode (the serial link controls the device) no parameters can be modified.

Key Functions in Operative Parameter Display Mode

FUNC = Pressing the "FUNC" key, 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 for limiter rearmament.

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

Lower   Description
Display
AR   **Manual reset of the alarm.**
            (Available only if P1 = AL.p, AL.b or AL.d)
            ON = Starts the manual reset of the alarm
            OFF = Do not start the alarm reset.
            Select ON and press the FUNC key in order to reset the alarm.
            After a manual reset of the alarm the instrument returns in Normal Display Mode.

nn   **Software Key**
      (Skipped if n1 = 0 or 1)
      ON = the device is LOCKED.
      OFF = the device is UNLOCKED.
      When it is desired to switch from LOCK to UNLOCK condition, set a value equal to "n1" parameter.
      When it is desired to switch from UNLOCK to LOCK condition, set a value different from "n1" parameter.

Su   **Limiter Threshold**
      Range: Span limits (From "S1" to full scale value when C1 = Hi.Lo)

S1   **Second Limiter Threshold**
      (Available when C1 = Hi.Lo)
      Range: From initial scale value to "Su"

HS   **Limiter Hysteresis**
      Range: From 0.1% to 10.0% of the input span or 1 LSD

AL   **Alarm Threshold (optional)**
      (Available only if the option is fitted and P1= AL.P, AL.b or AL.d.)
      Ranges:
      span limits for process alarm (P1 = AL.P)
      from 0 to 500 for band alarm (P1 = AL.b)
      from -500 to 500 for deviation alarm (P1 = AL.d)

HA   **Alarm Hysteresis (optional)**
      (Available only if the option is fitted and P1 = AL.P, AL.b or AL.d)
      Range: From 0.1% to 10.0% of the input span or 1 LSD.

17

Limiter function

The relay of the output 1 operates in fail-safe mode (relay de-energized during shutdown condition) and latching mode.

The OUT 1 turns OFF when:
- The instrument is configured as a high limiter (C1 = Hi) and the measured value is greater than limiter threshold ["Su" parameter (see Operative parameters")] or
- The instrument is configured as a low limiter (C1 = LO) and the measured value is less than limiter threshold ["Su" parameter (see Operative parameters")] or
- The instrument is configured as a high/low limiter (C1 = HiLO) and the measured value is greater than "Su" parameter (see Operative parameters") or less than "S1" parameter (see Operative parameters").

The Out 1 remains OFF until the condition which generated the shutdown, no longer exists and the acknowledge action has been performed.

The upper display flashes during a shutdown and returns to a steady display when the shutdown condition no longer exists.

When the OUT 1 is OFF the RESET LED is ON [if the selected rearming mode is equal to 0 (C2 = 0)] or flashes [if the selected rearming mode is equal to 1 (C2 = 1)].
When the selected rearming mode is equal to 1 (C2 = 1) the RESET LED is steady ON when OUT 1 is OFF and acknowledged.
The shutdown 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 shutdown condition and max/min measured values are stored in memory and available for viewing (see "Normal Display Mode") until the next shutdown condition occurs.
These informations are lost at power down.

During a shutdown condition the max/min measured values are continuously updated and can be monitored.

Example 1 - C1 = Hi and C2 = O

Example 2 - C1 = Hi and C2 = 1

18
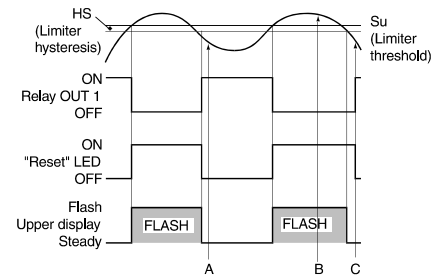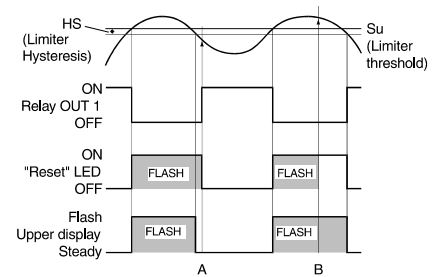
Alarm functions

(Skipped if option is not available or P1 = none)
The alarm can be programmed as:
- process alarm
- band alarm
- deviation alarm.
Band and deviation alarms are referred to the limiter threshold and are possible only if an high limiter or a low limiter function has been selected.
For all the alarm types, it is possible to select automatic or manual reset or the "Silence" function.
The "Silence" function is a typical function of the alarm annunciators (see ISA "Alarm annunciator operational sequence") and it is usually applied to audible alarm indications (horn). This function allows the manual reset of the alarm even if the alarm condition is still in progress.

It is also possible to assign to the alarm a stand by (mask) function.
If the alarm is programmed as band or deviation alarm, this function masks the alarm condition after a safety threshold change or at the instrument start-up until process variable reaches the alarm threshold plus or minus hysteresis. If the alarm is programmed as a process alarm, this function masks the alarm condition at instrument start-up until process variable reaches the alarm threshold plus or minus hysteresis.
Graphic example of the alarm behaviour are shown at pages 12 and 13.

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 shown by the decimal point to the left of "REM" which is on the right side of the numerical 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.

For other details require ENG 816-E document.

ERROR MESSAGES

Overrange, Underrange and Sensor Break Indications

This device detects input fault conditions. (OVERRANGE, UNDERRANGE OR SENSOR BREAK). When the process variable exceeds the span limits an OVERRANGE condition will appear as:

```
0000
```

An UNDERRANGE condition will appear as:

```
_000
```
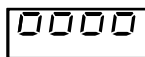
A sensor break is signalled as "OPEn". On the mA/V input, a sensor break can be detected only when the range selected has a zero elevation (4/20 mA, 12/60 mV, 1/5 V or 2/10 V.)

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 power up, 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 parameters.
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, press and hold the ▼ key and press the ▲ key and load the default parameters; then repeat the control parameter setup.
3) For all other errors, contact your Service Representative.

20

GENERAL SPECIFICATIONS

Case: Polycarbonate grey case

Self extinguishing degree: V-0 according to UL94.

Front protection - designed and tested for IP 65 (*) and NEMA 4X (*) for indoor locations (when panel gasket is installed).

(*) Test were performed in accordance with IEC 529, CEI 70-1 and NEMA 250-1991 STD.

Installation: panel mounting.

Rear terminal board: 15 screw terminals (screw M3, for cables from ϕ 0.25 to ϕ 2.5 mm^2 or from AWG 22 to AWG 14), connection diagram and safety rear cover.

Dimensions: 48 x 48 mm (according to DIN 43700); depth
- 122 mm for models with RS-485.
- 105 mm for models without RS-485

Weight: 250 g. max. (8.75 oz.).

Power supply : (switching mode) from 100 to 240 V AC. 50/60 Hz (+10 % to -15 % of the nominal value) or
24 V DC/AC (+10 % of the nominal value).

Power consumption: 8 VA.

Insulation resistance: > 100 MΩ according to IEC 1010-1.

Isolation voltage: 1500 V r.m.s. according to IEC 1010-1.

Common mode rejection ratio:
120 dB @ 50/60 Hz.

Normal mode rejection ratio: 60 dB @ 50/60 Hz.

Electromagnetic compatibility and safety requirements: This instrument is marked CE. Therefore, it is conforming 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

D/A conversion: dual slope integration.

Sampling time :
- for linear inputs = 250 ms.
- for TC or RTD inputs = 500 ms.

Display updating time: 500 ms.

Resolution: 30000 counts.

Temperature Drift (CJ excluded)
- Less than 200 ppm/°C of full span for mV and TC ranges 0, 1, 3, 4, 8, 13, 23, 24, 26, 27, 31, 36 (CJ excluded).
- Less than 300 ppm/°C of full span for mA, V and TC ranges 10, 11, 12, 33, 34, 35 (CJ excluded)
- Less than 400 ppm/°C of full span for RTD and TC range 9, 32 (CJ excluded).
- Less than 500 ppm/°C of full span for TC ranges 2, 5, 6, 25, 28, 29 (CJ excluded).
- Less than 600 ppm/°C of full span for TC ranges 7, 30.
   NOTE: Precision and drift guaranteed (for T>300°C/570°F).

Accuracy: + 0.2% f.s.v. @ 25 °C (77 °F) and nominal power supply voltage.

Operative temperature: from 0 to +50 °C (32 to 122 °F).

Storage temperature: from -20 to +70 °C (-4 to 158 °F).

Humidity: from 20% to 85 % RH not condensing.

INPUTS

A) THERMOCOUPLE
Type : J, K, T, E, N, S, R, B, L, U, G(W), D(W3), C(W5), Platinel II, °C/°F selectable.
External resistance: 100 Ω max, maximum error 0,1% of span.
Burn out: It is shown as an overrange condition (standard). It is possible to obtain an underrange indication by cut and short.
Cold junction: automatic compensation from 0 to 50 °C.
Cold junction accuracy : 0.1 °C/°C
Input impedance: > 1 MΩ
Calibration : according to IEC 584-1 and DIN 43710 - 1977.
STANDARD RANGES TABLE

T/C type		Ranges		
J	0	-100 / 1000 °C	23	-150 / 1830 °F
K	1	-100 / 1370 °C	24	-150 / 2500 °F
T	2	-200 / 400 °C	25	-330 / 750 °F
E	3	-100 / 800 °C	26	-150 / 1470 °F
N	4	-100 / 1400 °C	27	-150 / 2550 °F
S	5	-50 / 1760 °C	28	-60 / 3200 °F
R	6	-50 / 1760 °C	29	-60 / 3200 °F
B	7	0 / 1820 °C	30	32 / 3300 °F
L	8	-100 / 900 °C	31	-150 / 1650 °F
U	9	-200 / 600 °C	32	-330 / 1110 °F
G(W)	10	0 / 2300 °C	33	0 / 4170 °F
D(W3)	11	0 / 2300 °C	34	0 / 4170 °F
C(W5)	12	0 / 2300 °C	35	0 / 4170 °F
P.(*)	13	-100 / 1400 °C	36	-150 / 2550 °F

(*) P. equal to Platinel II

B) RTD (**R**esistance **T**emperature **D**etector)
Input: for RTD Pt 100 Ω, 3 wire connection.
Input circuit: current injection.
°C/°F selection: via front pushbuttons or serial link.
Line resistance: automatic compensation up to 20 Ω/wire with no measurable error.
Calibration: according to DIN 43760
Burn out : The instrument detect the open condition of one or more wires. It is able to detect also the short circuit of the sensor.

STANDARD RANGES TABLE

Input type		Ranges	
RTD Pt 100 Ω	14	- 200 / 850	°C
DIN 43760	37	- 330 / 1560	°F

C) LINEAR INPUTS
Read-out: keyboard programmable between -1999 and +9999.
Decimal point: programmable in any position
Burn out: the instrument shows the burn out condition as an underrange condition for 4-20 mA, 1-5 V and 2-10 V input types.
It shows the burn out condition as an underrange or an overrange condition (selectable by soldering jumper) for 0-60 mV and 12-60 mV input types. No indication are available for 0-20 mA, 0-5 V and 0-10 V input types.

22

STANDARD RANGES TABLE

	Input type	impedance	Accuracy
15	0 - 60 mV	> 1 MΩ	
16	12 - 60 mV		
17	0 - 20 mA	< 5 Ω	0.2 % + 1 digit @ 25°C (77 °F)
18	4 - 20 mA		
19	0 - 5 V	> 400 kΩ	
20	1 - 5 V		
21	0 - 10 V	> 400 kΩ	
22	2 - 10 V		

D) LOGIC INPUTS
        (for models with RS-485 only)
This instrument is provided of 1 logic input used for remote acknowledgement.
NOTES
1) Use an external dry contact capable of switching 0.5 mA, 5 V DC.
2) The instrument needs 100 ms to recognize a contact status variation.
3) The logic inputs are **NOT** isolated by the measuring input.

OUTPUTS

Output updating time :
- 250 ms when a linear input is selected
- 500 ms when a TC or RTD input is selected.

OUTPUT 1
Type: relay SPDT contact .
Contact rated: 3 A at 250 V AC on resistive load.
Function: Safety limiter output.
Action: reverse (fail-safe).

OUTPUT 2
Type: relay SPST contact .
Contact rated: 2 A at 250 V AC on resistive load.
Function: Alarm output
Action: direct/reverse programmable by front keyboard.

ALARM

Action: Direct or reverse acting.
Alarm functions: configurable as process alarm, band alarm or deviation alarm.
Alarm reset: automatic reset, manual reset or "Silence" function is programmable.
Stand by (mask) alarm: the alarm can be configured with or without stand by (mask) function.

Process alarm:
Operative mode : High or low programmable.
Threshold : programmable in engineering unit within the readout span.
Hysteresis: programmable from 0.1 % to 10.0 % of the readout span.

23

Band alarm
Operative mode: Inside or outside band programmable.
Threshold: programmable from 0 to 500 units.
Hysteresis : programmable from 0.1 % to 10.0 % of the readout span.

Deviation alarm
Operative mode : High or low programmable.
Threshold : programmable from - 500 to +500 units.
Hysteresis : programmable from 0.1 % to 10.0 % of the readout span.

SERIAL COMMUNICATION INTERFACE (OPTION)
Type: insulated RS-485.
Protocol type: MODBUS or JBUS.
Baud rate: programmable from 600 to 19200 BAUD.
Byte format: 8 bit.
Parity: even, odd or none programmable.
Stop bit: one.
Address: from 1 to 255.
Output voltage levels: according to EIA standard.

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. 3 kg/cm^2) remove all deposit of dust and dirt which may be present on the louvers and on the internal circuits trying to be careful for not damage the electronic components.
4) To clean external plastic or rubber parts use only a cloth moistened with:
   - Ethyl Alcohol (pure or denatured) [C_2H_5OH] or
   - Isopropil 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 that it is perfectly dry.
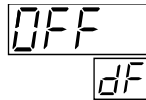7) re-insert the instrument and turn it ON.

APPENDIX A
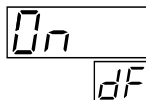# DEFAULT PARAMETERS

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:

```
OFF
 dF
```

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

```
On
dF
```

c) Press the "FUNC" key; the display will show:

```
LOAd
```

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%

Appendix A.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:

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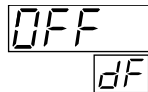
c) Press the ▼ key; the lower display will show the firmware version.

```
COnF
 AO
```
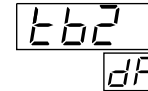
d) Still holding the ▼ key, press the ▲ key; the display will show:

```
OFF
 dF
```

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

```
tb2
 dF
```

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

```
LOAd
```

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:

Appendix A.2

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

Appendix A.3

APPENDIX B

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

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:
1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:
1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 2003 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 37 months from date of purchase. The OMEGA® Warranty adds an additional one (1) month grace period to the normal three (3) years product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; or misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/ DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

**Where Do I Find Everything I Need for Process Measurement
and Control? OMEGA…Of Course!**
Shop online at www.omega.com

TEMPERATURE

- ☐ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☐ Wire: Thermocouple, RTD & Thermistor
- ☐ Calibrators & Ice Point References
- ☐ Recorders, Controllers & Process Monitors
- ☐ Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- ☐ Transducers & Strain Gages
- ☐ Load Cells & Pressure Gages
- ☐ Displacement Transducers
- ☐ Instrumentation & Accessories

FLOW/LEVEL

- ☐ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☐ Air Velocity Indicators
- ☐ Turbine/Paddlewheel Systems
- ☐ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☐ pH Electrodes, Testers & Accessories
- ☐ Benchtop/Laboratory Meters
- ☐ Controllers, Calibrators, Simulators & Pumps
- ☐ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☐ Data Acquisition & Engineering Software
- ☐ Communications-Based Acquisition Systems
- ☐ Plug-in Cards for Apple, IBM & Compatibles
- ☐ Datalogging Systems
- ☐ Recorders, Printers & Plotters

HEATERS

- ☐ Heating Cable
- ☐ Cartridge & Strip Heaters
- ☐ Immersion & Band Heaters
- ☐ Flexible Heaters
- ☐ Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- ☐ Metering & Control Instrumentation
- ☐ Refractometers
- ☐ Pumps & Tubing
- ☐ Air, Soil & Water Monitors
- ☐ Industrial Water & Wastewater Treatment
- ☐ pH, Conductivity & Dissolved Oxygen Instruments

omega.com®
ΩEOMEGA®

M4084

Free Manuals Download Website

http://myh66.com

http://usermanuals.us

http://www.somanuals.com

http://www.4manuals.cc

http://www.manual-lib.com

http://www.404manual.com

http://www.luxmanual.com

http://aubethermostatmanual.com

Golf course search by state

http://golfingnear.com

Email search by domain

http://emailbydomain.com

Auto manuals search

http://auto.somanuals.com

TV manuals search

http://tv.somanuals.com