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Model 301 - Signal Converter Universal Input (TC/RTD/mV/mA/V/Potentiometer)

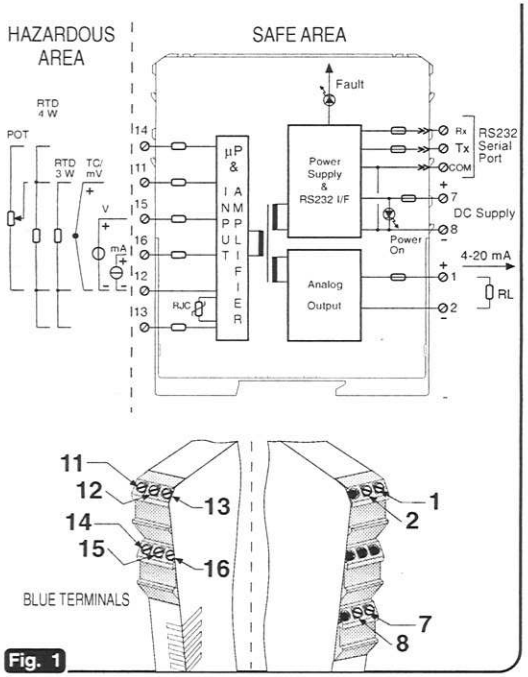

Fig. 1

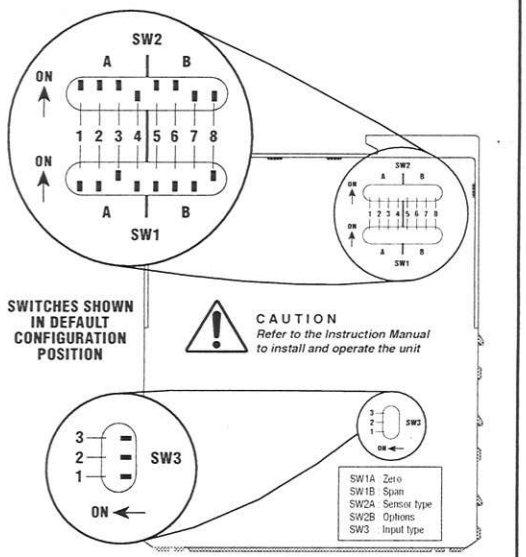

Fig. 2

Warnings

The installation must be performed by qualified personnel, complying with the relevant national/international standards (eg BS5345 Pt.4, DIN VDE 165, ISA RP-12.6) and in line with established installation rules.

The conformity of hazardous area devices with the related system documentation should always be checked; this isolator is not intended for "hazardous area" installation, unless it is included in a proper "explosion proof" enclosure which conforms to the applicable standards. For I.S. applications, the maximum limit for AC power supply is 250 Vrms.

On request, ELCON will provide the manual *"Introduction to Intrinsic Safety"*, a comprehensive tutorial about the constraints imposed by the I.S. regulation; the *"Instruction Manual"* is also available for a full functional description and a detailed technical specification of the unit.

Installation

The unit can be mounted in two different ways, either on a 35 mm DIN rail (top hat), through the tabs located on the base of the unit, or on a surface/panel by fully extracting the clips and using self-threading screw (fig. 3).

The function and location of each termination need first to be identified (fig. 1), connections can then be made, with a maximum wire section of 2,5 square mm (14AWG). The blue colour of the termination identifies the hazardous-side connections, which wires are to be segregated according to the standard BS5345 Pt.4, ISA RP-12.6 or to other applicable national regulations.

To properly identify each signal, ad-hoc labels are available and can be fixed to the unit (Elcon code PN. 601136 and PN. 601137). All isolators must be properly protected against dirt, dust, and extreme mechanical/temperature stress, the risk of casual contacts should be minimised and any unauthorised unit modification avoided.

Operation

The μD 301 isolator is a configurable, microprocessor-based intrinsically safe galvanic isolator. The μD 301 can accept a wide range of input sensors and signals located in a hazardous area and provide a 0/4-20 mA or factory specified 0/1-5 V output to a safe area load.

The unit can be field configured for most frequently used input sensor types (see Table 1), selected calibrated ranges, burnout, °C/°F and output ranges via DIP switches.

As an option, a Windows95® based software package and cable kit are available to connect to the internal RS232 serial line.

The software provides a simple user interface to program the same functions as provided through the DIP switch selection tables (see the chapter "Configuration") and extends the capability to permit selecting additionals input sensor types and programming of exact temperature ranges, reversed output and checking both the corrected input value and the calculated output value. The additional sensor types may be found on the "User Manual" 109/GB with PN. 991165.

Note: when the isolator is vertical mounted and configured for TC input but the sensor is not connected (Burnout, open input status), the internal temperature of the isolator increases.

After the TC sensor connection, allow at least two (2) hours before the compensation (and the instrument calibration) is restored to the right value.

To avoid this, we suggest to short-circuit the input teminals 11 and 12. For this purpose a jumper device is available upon request (PN 601138).

NOTE: For information about the heat dissipation and thermal behaviour of modules please refer to the user Manual IM-ENG-110/GB (PN. 991168).

Configuration

The μD 301 is a universal I.S. isolator, which is user programmable via RS232 serial port and a Windows based software package (on serial comms units) or via DIP switches on all versions. The input sensors selectable via dip switches are shown in Table 1.

A first set of DIP switches, termed "SW" (see Fig. 2 for the switches identification and position), is directly connected to the microprocessor which implement under software control the configuration options that the dip switches define. The DIP switches control the following operating modes:

- **SW1A** (4 positions) permit the selection of 16 distinct zero values (start of scale). The values are different depending on the selected input sensor (see Table 2).
- **SW1B** (4 positions) permit the selection of 16 distinct span values which, when summed to the selected zero value, give the end of scale value. The values are different depending on the selected input sensor. You should always check that the selected end of scale value is within the operating range allowed for the selected input sensor (see Table 3).
- **SW2A** (4 positions) permit the selection of the desired ***sensor type*** among 15 available options (see Table 4), to complete the sensor type selection procedure, it could be required to modify also the "HW" switches (see SW3). A specific dip switch setting is available to disable all SW switches; when this is done, the configuration options stored in the EEPROM non volatile memory override all the ones set on the "SW" switches. The "disable" position must also be used when any configuration parameter stored in the EEPROM memory is to be changed (this operation is possible throught the serial line only).
- **SW2B** select between various options (see Table 5):
  - **SW2B** (positions 5 and 6) select the ***burn-out*** handling on the analog output.
  - **SW2B** (position 7) set the ***analog output range*** either to 0-20 mA or to 4-20 mA.
  - **SW2B** (position 8) express the digital temperature values either in °F or in °C. A different zero/span table becomes active, according to this selection for SW1A and SW1B (see Table 5, Option Selection).

INPUT SENSORS	
Thermocouples	(B, E, J, K, L, N, R, S, T)
Resistance Temperature Detectors (RTD)	(Pt100, Ni100; 2/3/4 wire)
Generic current-output sensors	(±20 mA, passive sink mode)
Generic voltage-output sensors	(±100 mV and ± 10 V)
Potentiometric sensors	(from 200 ohm to 10 Kohm)

Table 1

SW1A — ZERO SELECTION

Posit. 1234	mA	Volt	mV	TC B/R/S °C (°F)	TC T °C (°F)	TC K/N J/E °C (°F)	TC L RTD Pt100	RTD Ni100 °C (°F)	Pot. %
0000	-20	–	-100	50 (120)	-200 (-320)	-200 (-320)	-200 (-320)	-60 (-70)	0
1000	-16	–	-50	100 (210)	-150 (-230)	-150 (-230)	-150 (-230)	-50 (-50)	5
0100	-15	–	-20	150 (300)	-100 (-140)	-100 (-140)	-100 (-140)	-40 (-40)	10
1100	-12	–	-10	200 (390)	-50 (-50)	-50 (-50)	-50 (-50)	-30 (-20)	15
0010	-10	-10	-5	250 (480)	0 (30)	0 (30)	0 (30)	-20 (0)	20
1010	-8	-8	0	300 (570)	50 (120)	50 (120)	50 (120)	-10 (10)	25
0110	-5	-5	5	350 (660)	100 (210)	100 (210)	100 (210)	0 (30)	30
1110	-4	-4	10	400 (750)	150 (300)	150 (300)	150 (300)	10 (50)	35
0001	-2	-2	15	500 (930)	200 (390)	200 (390)	200 (390)	20 (60)	40
1001	-1	-1	20	600 (1110)	250 (480)	250 (480)	250 (480)	30 (80)	45
0101	0	0	25	700 (1290)	300 (570)	300 (570)	300 (570)	40 (100)	50
1101	1	1	30	800 (1470)	–	350 (660)	350 (660)	50 (120)	55
0011	2	2	35	900 (1650)	–	400 (750)	400 (750)	60 (140)	60
1011	4	4	40	1000 (1830)	–	450 (840)	450 (840)	70 (150)	65
0111	5	5	45	1100 (2010)	–	500 (930)	500 (930)	80 (170)	70
1111	10	–	50	1200 (2190)	–	550 (1020)	550 (1020)	90 (190)	75

Key: 1 = ON 0 = OFF

Table 2

SW1B — SPAN SELECTION

Posit. 5678	mA	Volt	mV	TC B/R/S °C (°F)	TC T °C (°F)	TC K/N °C (°F)	TC J/E/L RTD Pt100	RTD Ni100 °C (°F)	Pot. %
0000	1	1	4	300 (570)	100 (210)	100 (210)	50 (120)	30 (80)	25
1000	2	2	5	350 (660)	150 (300)	150 (300)	75 (160)	40 (100)	30
0100	3	3	7	400 (750)	200 (390)	200 (390)	100 (210)	50 (120)	35
1100	4	4	10	450 (840)	250 (480)	250 (480)	125 (250)	60 (140)	40
0010	5	5	15	500 (930)	300 (570)	300 (570)	150 (300)	70 (150)	45
1010	6	6	20	600 (1110)	350 (660)	350 (660)	200 (390)	80 (170)	50
0110	8	8	25	700 (1290)	400 (750)	400 (750)	250 (480)	90 (190)	55
1110	10	10	30	800 (1470)	450 (840)	450 (840)	300 (570)	100 (210)	60
0001	12	12	40	900 (1650)	500 (930)	500 (930)	350 (660)	110 (230)	65
1001	15	15	50	1000 (1830)	600 (1110)	600 (1110)	400 (750)	120 (240)	70
0101	16	16	60	1100 (2010)	–	700 (1290)	450 (840)	140 (280)	75
1101	20	20	80	1200 (2190)	–	800 (1470)	500 (930)	150 (300)	80
0011	25	–	100	1300 (2370)	–	900 (1650)	600 (1110)	160 (320)	85
1011	30	–	125	1400 (2550)	–	1000 (1830)	700 (1290)	180 (350)	90
0111	35	–	150	1500 (2730)	–	1100 (2010)	800 (1470)	200 (390)	95
1111	40	–	200	1600 (2910)	–	1200 (2190)	900 (1650)	220 (420)	100

Key: 1 = ON 0 = OFF

Table 3

ELCON INSTRUMENTS
INTRINSIC SAFETY and Ex SPECIALISTS

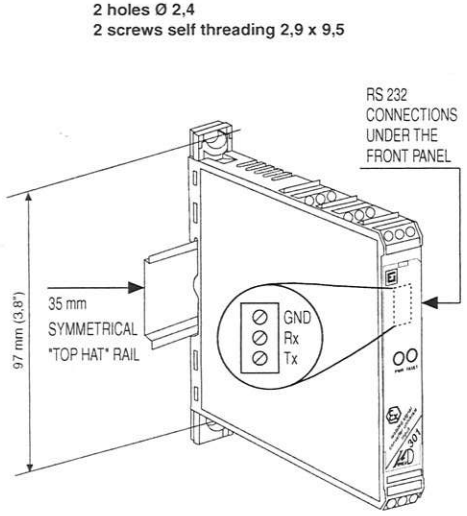

Fig. 3

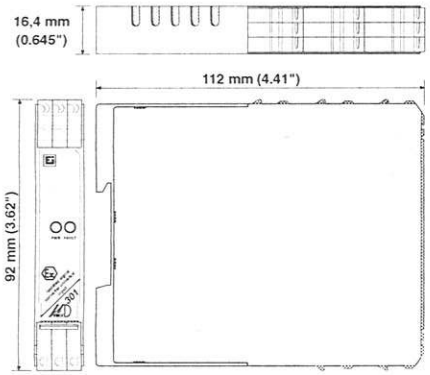

Fig. 4

Safety Description	Maximum External Parameters				
	Groups CENELEC	USA	Co (µF)	Lo (mH)	L/R (µH/Ω)
Uo = 13.1 V	II C	A-B	1.1	47	373
Io = 26 mA	II B	C-E	3.3	180	1350
Po = 85 mW	II A	D-F-G	8.8	400	3100

Fig. 5

• **SW3**, acts directly at the hardware level and is not "visible" to the microprocessor. The HW switches control the following operating modes:

- positions 1 and 2 configure the input stage front end for ***3 wire RTD***.
- position 3 configure the input stage front end for ***potentiometric sensors*** (see Table 6).

To change the "SW" switch position, it is not required to power down the unit; in fact, the microprocessor continuously monitors the switch status and immediately takes care of handling any change.

Serial Line Configuration

Refer to the information provided with the serial configuration kit.
IMPORTANT: You must only use either the DIP switches or software program to set up a µD 301. You CANNOT use both!! Selecting serial line configuration overrides most of the DIP switches.

DIP-SWITCHES, Default Configurations

In Table 7, the factory default settings are shown.
If not otherwise stated, the unit will be shipped with this configuration.

Start-up

Verify on the unit's side label that the available supply voltage is within specification, and connect it to the terminals 7 and 8.
After power-on the PWR (supply) green LED should be on. Also verify that the red fault LED is OFF.

Errors (Front Panel FAULT red LED)

1. If the front red fault LED is ***fast blinking***, this indicates that an internal problem may exist, and the unit should be returned to the factory for repair.
2. If the front red fault LED is **slow blinking**, this indicates that there is a problem with the serial line. Check the serial line cable connection and settings.
3. If the front red fault LED is **fixed on**, this indicates that a configuration error, input overload or a burn-out condition on the input exist. When the error is cleared, the LED will be extinguished.

Should the fault LED remain on, please refer to the instruction manual for further details.

Technical Specifications

Reference conditions: 23°C, 24 Vdc, 250 ohm out. load; all values typical unless otherwise stated.

General Specifications

Supply voltage: 24 Vdc, -15 / +20%
Supply current: 55 mA
Power dissipation: 1.1 W (500 Ω output load)
Operating temperature: 0 / 60°C
Storage temperature: -20 / +70°C
Relative humidity (non condensing): 50 / 90%, 35°C max
Input to output / supply isolation: 1500 Vrms
Output to supply isolation: 250 Vrms
Input drift: 50 ppm / °C, % of input value
Output drift: 50 ppm / °C, % of output value
CJC error: < ±1°C

Analog to Digital and Digital to Analog Conversion

AD Conversion type: sigma/delta, 1° order modulator
AD Input range: ±100 mV, 20% overrange
AD Resolution: >17 bit
AD Conversion time: 100 ms
DA Conversion type: mark-space
DA Resolution: 13 bit
DA Output range: 0 / 20 mA, 20% overrange (13 V max)

Input Specifications

Type	*Range-Type*	*Accuracy (Resolution)*
TC	B.E.J.K.L.N.R.S.T	<20 µV or 0.05% of input value (1.25 µV or 0.1°C)
mV	-100 to +100 mV	<20 µV or 0.05% of input value (10 µV)
RTD	Pt100,Ni100 2-3-4 wire	<0.2 Ω (0.1°C)
mA	-20 to +20 mA	<10 µA (1 µA)
Volt	-10 to +10 V	<5 mV (1 mV)
Pot	200 Ω to 10 KΩ	<0.2% (0.1%)

OPERATING RANGE LIMITS FOR TEMPERATURE SENSORS:

Th. B	+0 / 1800°C
Th. E	-200 / +1000°C
Th. J	-200 / +750°C
Th. K	-200 / +1300°C
Th. L	-200 / +800°C
Th. N	-200 / +1300°C
Th. R	-50 / +1750°C
Th. S	-50 / +1750°C
Th. T	-200 / +400°C
RTD Pt100	-200 / +850°C
RTD Ni100	-60 / +180°C

MINIMUM SPAN SETTINGS:

2 mV	(TC / mV)
50°C	(Pt100)
35°C	(Ni 100)
1 mA	(20 mA)
0.5 V	(10 V)

OTHER INPUT SPECIFICATIONS:
Thermocouple burn-out current: 3 µA
RTD current: 250 µA
Potentiometer sensor supply: 100 mV

Output Specifications

Accuracy: ±20 µA
Load error (0-650 ohm): ± 20 µA
Resistor for voltage output: 250 ohm (0.01%, 25 ppm, factory conf. option)

Serial Line Specifications

RS232 compatible
4800 baud, fixed
8 bit word
1 start bit, 1 stop bit, no parity bit

SW2A

SENSOR TYPE SELECTION	
Posit. 1234	**Sensor**
0000	Switches disable
1000	mA
0100	Volt
1100	mV
0010	TC B
1010	TC E
0110	TC J
1110	TC K
0001	TC N
1001	TC R
0101	TC S
1101	TC T
0011	RTD Pt100
1011	RTD Ni100
0111	Potentiometer
1111	TC L

Key: 1 = ON 0 = OFF

Table 4

SW2B

OPTIONS SELECTION	
Posit. 5678	**Option**
0■■■	Burnout as Down-scale
1■■■	Burnout as Up-scale
■0■■	Burnout "frozen"
■1■■	Burnout Up or Down Scale
■■0■	4-20mA Output Range
■■1■	0-20mA Output Range
■■■0	°C Temperature Table
■■■1	°F Temperature Table

Key: 1 = ON 0 = OFF

Table 5

SW3

HARDWARE SELECTION	
Posit. 123	**Hardware Configuration**
000	All other cases
001	Potentiometer connection
110	RTD 3 wire connection

Key: 1 = ON 0 = OFF

Table 6

DEFAULT CONFIGURATIONS					
Posit.	**1 5**	**2 6**	**3 7**	**4 8**	
SW1A / SW1B	0 / 0	0 / 0	1 / 0	0 / 1	= Zero at 0°C = Span at 500°C
SW2A / SW2B	1 / 1	1 / 1	1 / 0	0 / 0	= "K" type THC input = °C, 4-20 mA, Burn-out upscale
SW3 / SW3	0 / -	0 / -	- / 0	- / -	= 3 wire RTD disabled = Potentiometric sensor disabled

Key: 1 = ON 0 = OFF

Table 7