

TC-TC-6
24V AC or DC POWERED
THERMOCOUPLE ISOLATING SIGNAL
CONVERTER

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Industrial Interface Systems Ltd

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CONTENTS

1. INTRODUCTION	3
1.1 Hardware Features	3
1.1.1 Isolation Details	3
2. UNPACKING	3
3. CONNECTIONS	4
4. CONFIGURING THE TC-TC	5
4.1.1 Thermocouple Input:	6
4.1.2 Output Configuration	8
5. CALIBRATING THE TC-TC	9
6. INSTALLATION	10
7. TROUBLESHOOTING	11
7.1 Incorrect Reading	11
7.2 Sensor Failure	11
8. SPECIFICATIONS (@ 25°C)	12

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1. INTRODUCTION

1.1 Hardware Features

The TC-TC-6 is a thermocouple input and output isolating converter. Based on the TC-TC-6 hardware the TC-TC-6 unit produces a mV output from a thermocouple input. Usually this is just an identical signal to the thermocouple input and is used where isolation of a thermocouple signal is required. It is also possible to produce a linearised mV output (linear to temperature) and apply Cold Junction Compensation (CJC) if required.

The unit can be powered by any DC voltage between 12 and 36Vdc or 12 and 32Vac. For mains AC voltage the TC-TC-3 is available which can be powered from any supply from 90Vac to 264Vac at 50 or 60Hz.

The instrument is packaged in a very compact 12.5mm wide enclosure which can be mounted on standard TS35 DIN-rail.

The unit can also be equipped with 1 digital output which can be either a relay or an open collector output, or a second analogue output (see DUALCON-6). Note, units with above options are housed in a 17.5mm wide box.

1.1.1 Isolation Details

The TC-TC-6 has full 3 port isolation of 1000V between the Input Stage, Output Stage and Power Supply for functional reasons.

2. UNPACKING

The instrument should be carefully inspected for signs of damage which may have occurred in transit. In the unlikely case that damage has been sustained, DO NOT use the instrument, but please retain all packaging for our inspection and contact your supplier immediately.

The instrument comes with the following items as standard:

- 1 TC-TC-6 Isolating Signal Converter
- 1 TC-TC-6 User Guide

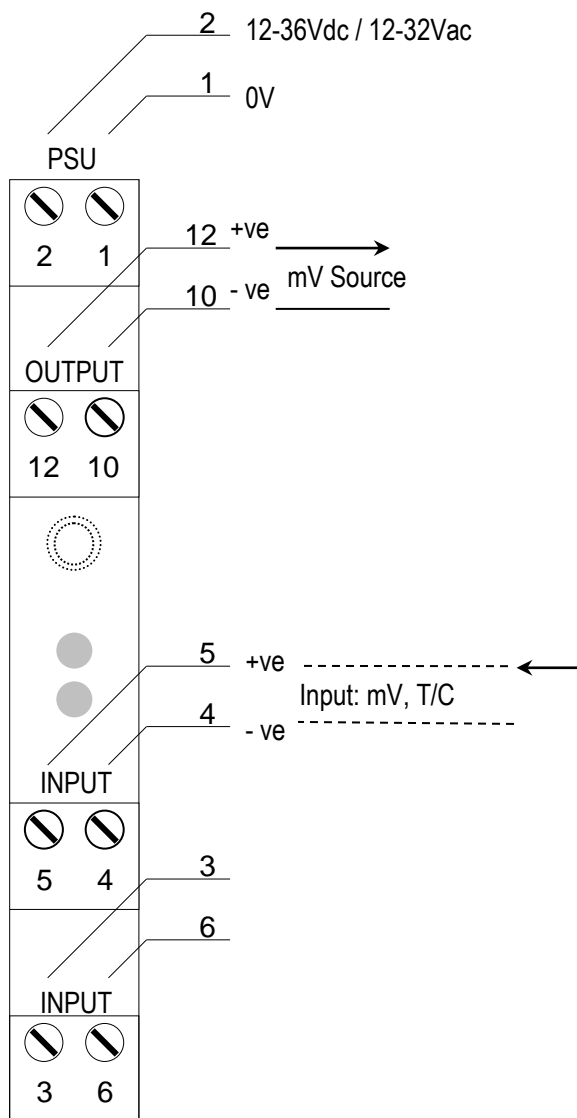
If the instrument has been factory configured the input and output details will be listed on the Serial number label on the side of the unit. If this label is blank then the unit will be set to its default configuration which is 0-70mV input and output. Please check that the details on the side label are correct, especially the power supply voltage.

If re-configuration is required please refer to Section 4 of this manual.

3. CONNECTIONS

The TC-TC is housed in a compact DIN rail mounting enclosure, with 8 terminals, arranged in 4 rows of 2 terminals. Two rows are at the top of the front panel and 2 rows are at the bottom. All the sensor input terminals are on the bottom rows and the power supply and analogue outputs are on the top terminals.

The diagram below shows how to connect all the different input, output and power supply types.



4. CONFIGURING THE TC-TC



! WARNING !
**DO NOT OPEN UNIT OR ADJUST SWITCHES WITH
 POWER SUPPLY, INPUT OR OUTPUT CONNECTED**

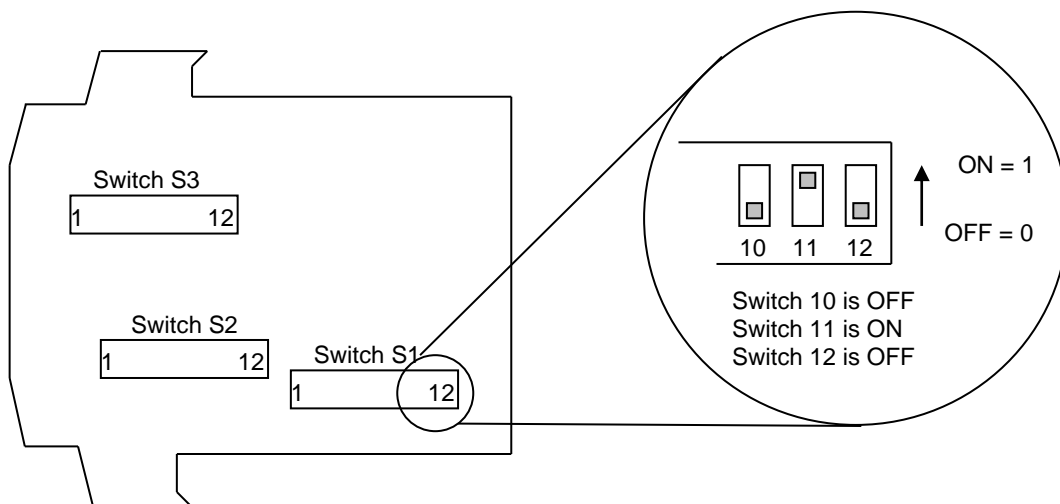
The TC-TC is an extremely versatile device which can support many different types of input. The unit is configured by turning the power off, selecting the internal switch settings required and turning the power back on.

To open the TC-TC, 2 catches just below the outer terminal blocks must be pushed in gently, one at a time. The front of the case can then be pulled and the unit will come out of the box.



Press here gently

There are 3 switch banks, S1, S2, and S3, located inside the TC-TC as shown below:



Switch S1 and S2 configure the input type and range, and switch S3 configures the output type, range and a few additional functions. The switch settings are explained in the next few pages. The diagrams refer to switch positions 0 and 1, with 0 being OFF and 1 being ON. This is illustrated in the picture above.

4.1.1 Voltage Input:

Millivolt (mV) Input

Select the range from the table below and set Switch S1 to the required values.

mV Range	Switch S1											
	1	2	3	4	5	6	7	8	9	10	11	12
0-25mV	0	0	0	0	0	0	0	1	1	1	0	0
0-50mV	0	0	0	1								
0-100mV	0	0	1	0								
0-125mV	0	1	0	0								
0-150mV	1	0	0	0								
0-200mV	0	0	1	1								
0-250mV	0	1	0	1								
0-300mV	1	0	0	1								
0-500mV	0	1	1	0								
0-600mV	1	0	1	0								
0-1000mV	0	1	1	1								
0-1200mV	1	0	1	1								
-125 to +125mV	1	1	0	0								
-125 to +1000mV	1	1	1	1	0	0	0	1	1	1	0	0

And then select the required setting from the table below for switch S2

mV Range	Switch S2											
	1	2	3	4	5	6	7	8	9	10	11	12
All Unipolar Ranges (e.g. 0-500mV)	0	1	0	0	0	0	1	1	0	0	0	0
Bipolar Ranges (e.g. -125 to +125mV)	0	1	0	0	1	0	1	0	0	0	0	0



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4.1.2 Thermocouple Input

Select the range from the table below and set Switch S1 to the required values.

Switch S1 for Thermocouple Input												T/C Type													
Temperature Range in °C			Switch																						
K	J	R	S	N	E	B	T	1	2	3	4	5	6	7	8	9	10	11	12						
0 to 100						400 to 500	0 to 50	0	0	0	0		0	0		0	}								
0 to 200						400 to 600	0 to 100	0	0	0	1			}			}								
0 to 400						400 to 800	0 to 200	0	0	1	0								}						
0 to 800						400 to 1200	0 to 400	0	0	1	1									}					
0 to 125						400 to 525	-50 to 50	0	1	0	0		}				0			0	0	K			
0 to 250						400 to 650	-50 to 100	0	1	0	1									0	0	1	J		
0 to 500						400 to 900	-50 to 200	0	1	1	0									0	1	0	R		
0 to 1000						400 to 1400	-50 to 400	0	1	1	1									0	1	1	S		
0 to 150						400 to 550	-100 to 50	1	0	0	0		}			1				0	0	N			
0 to 300						400 to 700	-100 to 100	1	0	0	1									1	0	1	E		
0 to 600						400 to 1000	-100 to 200	1	0	1	0									1	0	1	B		
0 to 1200*						400 to 1600	-100 to 400	1	0	1	1									1	1	1	T		
0 to 175						400 to 575	-200 to 50	1	1	0	0		}			}									
0 to 350						400 to 750	-200 to 100	1	1	0	1									}			}		
0 to 700						400 to 1100	-200 to 200	1	1	1	0									}				}	
0 to 1400**						400 to 1800	-200 to 400	1	1	1	1									}					}

Linearisation ON	0
Linearisation off	1

CJC ON	0
CJC off	1

* n/a for types N and E
** n/a for types K, J, N and E

Then select the required setting from the table below for switch S2

Thermocouple	Switch S2											
	1	2	3	4	5	6	7	8	9	10	11	12
All Ranges	0	1	0	0	1	1	1	0	0	0	0	0

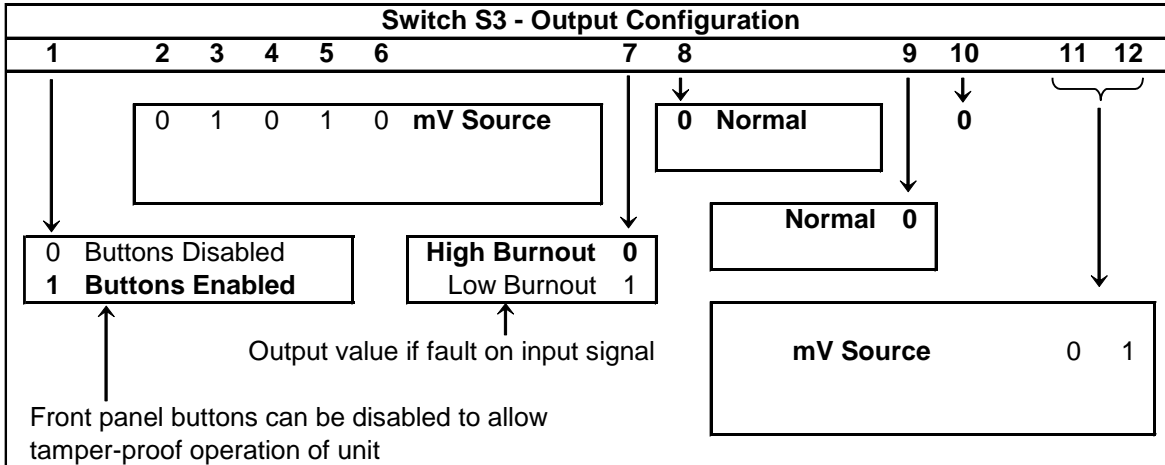


! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.3 Output Configuration

The output of the TC-TC-6 is factory set to a mV output range and so S3 position 7 should only be used to select High or Low Burnout – all other switches should remain in the default settings below:



Typical S3 Settings:

Switch S3 Settings												
	1	2	3	4	5	6	7	8	9	10	11	12
mV Source	1	0	1	0	1	0	0	0	0	0	0	1



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Please note that PC Software is available to provide information on switch settings for your input and output requirements.

5. CALIBRATING THE TC-TC

When the unit is shipped the TC-TC will be calibrated for the input and output types and ranges noted on the side label. If this label is blank then the unit will be calibrated for 0-70mV input and 0-70mV source output.

If the unit is re-ranged by the user it is necessary to re-calibrate the unit to obtain the maximum accuracy. The calibration is achieved by using both switches on the front panel to select the zero or span input and then using the switches as raise/lower buttons to adjust the output to the value required.

The mode the unit is in is indicated by the colour of the LED:

Green	-	Normal Operation
Red	-	Span Adjust
Yellow	-	Zero Adjust

Setting of the zero and span points is non-interactive, so each point need only be set once. A typical calibration sequence would be as follows:

LED Colour	Mode	Action
Green	Normal	Apply full scale input. Press and release both buttons together to enter span mode
RED	Span Adjust	Press raise / lower buttons to adjust output value Press and release both buttons together to return to normal mode
Green	Normal	Apply zero scale input Press and release both buttons together to enter zero mode
YELLOW	Zero Adjust	Press raise / lower buttons to adjust output value Press and release both buttons together to return to normal mode
Green	Normal	Use product

The unit is now calibrated and ready for use.

Note: The unit will retain the new settings on power down.

When the unit is used to convert a thermocouple input it is important when calibrating to ensure that the thermocouple simulator employed is switched to automatic cold junction compensation and is at the same ambient temperature as the TC-TC. Note that this is not always easy to achieve, especially if the TC-TC is mounted in a warm cabinet. An alternative method is to use an ice-point reference and a mV source.

6. INSTALLATION

The TC-TC's input and output circuits are classed as Separated Extra Low Voltage (SELV). This means that they must not be externally connected to voltages exceeding 30V ac or 60V dc, nor do they generate voltages above these limits internally. Where a higher voltage input is required a specially designed DIVIDER unit can be used to condition the input signal prior to connection to the process input terminals.

The TC-TC unit clips directly onto 'Top Hat' (TS35) symmetrical DIN rail. Ideally, mounting orientation should be vertical, with the power supply situated on the top face to minimise temperature rise. Good airflow around the unit will maximise reliability of the instrument.

The use of bootlace ferrules is recommended on wiring terminations.

Do not exceed terminal torque rating of 0.4 Nm – use an appropriate screwdriver. The unit can be removed from the DIN rail by sliding a small screwdriver into the slot at the rear of the enclosure on the lower face and gently levering the metal clip, whilst lifting the unit from the rail.

7. TROUBLESHOOTING

The TC-TC has some built in self diagnostic functions. If the LED on the front panel is flashing then the fault mode can be found by counting the number of flashes between gaps and using the table below to locate the problem.

No of Flashes	Nature of Fault	Corrective Action
0 (Green On)	Unit Working – no suspected fault	Check Wiring and switch settings
2,3,4,5,6,8,9, 10,11,12 Green	Hardware Error, extreme noise, poor supply	Switch off unit, check switch settings, and wiring, and retry. If still faulty please contact supplier
7 Green	Thermocouple burnout	Repair T/C or wiring
3 or 4 Red	Span point is too close to zero point	Change input span value and retry
3 or 4 Yellow	Zero point is too close to span point	Change input zero value and retry
No LED	Power Failure	Check supply lines and voltage

7.1 Incorrect Reading

- Check that Unit is configured for the correct Sensor
- Check that Input Scaling is as required.
- Check that Linearisation has not been set incorrectly.
- Check that Thermocouples have correct compensation cables, and polarity.

7.2 Sensor Failure

- Check that sensor wiring is correct.
- Check Thermocouple polarity.
- Check that the TC-TC is configured for correct sensor.
- Check that applied millivoltage is out of range.

8. SPECIFICATIONS (@ 25°C)

Operating Temperature	0 to 55 °C
Operating Altitude	Sea Level to 2000m
Humidity	0-90% RH
Power Requirements	
DC Supply	12 to 36Vdc
AC Supply	12 to 32Vac
Current Consumption	55mA @ 24Vdc (Default configuration)
Transmitter Power Supply	260mA for 50ms on 24Vdc power up 22V to 29V @ up to 24mA Dependant on supply voltage and load
Calibration accuracy	±0.05% full scale
Linearity	±0.05% full scale
Temperature Stability	50ppm / °C
Input Impedance:	
Current Input	15 ohms
Voltage Input	1 Mohm
Millivolt Input	Greater Than 10 Mohm
Thermocouple Burn Out Current:	500nA Nominal
Cold junction compensation accuracy	±0.5°C over operating range
Maximum Voltage Output	11.5 V into a minimum of 7Kohm
Maximum Current Output	23.0 mA into a maximum of 1Kohm
Time Response (90% of step change):	50ms ± 10ms
Unit has full 3 port Isolation to 1kV between Power Supply, Input and Output.	
The unit can also withstand transients of 2.5kV for 50 µsecs.	
Dimensions	114.5 mm x 99mm x 12.5mm (H x D x W)
Mounting	DIN Rail TS35
Connections	Screw Clamp with pressure plate
Conductor Size	0.5 to 4.0 mm
Insulation Stripping	12 mm
Maximum Terminal Torque	0.4 Nm
Weight	Approx. 95g
EMC	BS EN61326
LVD Standards	EN61010-1
Installation Category (IEC 664)	II
Pollution Degree (EN61010-1)	2
Equipment Class (IEC 536)	II