Transducer for Thermocouples

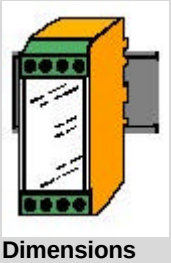
Transducers for all thermocouples. Version in DIN-rail housing or for printed circuits, versions with fixed range or programmable.

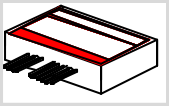
General Description

These transducers convert the output voltage from a thermocouple into an output signal (e.g., 0-10 V or 4-20 mA), which is linearly proportional to the thermovoltage. The measurement range (max. 64 mV) and zero point (offset) of the programmable types can be adjusted in steps of 1 mV using the DIL-switches. All settings are calibrated. DIL-switches are also used for the selection of various operating modes (thermocouple type, voltage or current output).

- Optionally with inductive isolation between the input and output (isolating transducer), 1 kV test voltage
- Electronic cold junction compensation for all common thermocouples - can be deactivated (via DIL-switches)
- Control LED for units with 24 V power supply
- Fixed range types: input and output ranges can be ordered as required, factory calibration

Overview

For DIN-rails	Type	Output	Supply	Range	Special Features
 Dimensions 55x60x23mm	**TCM 70**	V	19-32V/±15V	fixed	One range, voltage output
	TCM 82	0/4-20mA	21-32V	fixed	One range, current output
	TCM 90	V, 0/4-20mA	19-32V	progr.	DIL-switches for range selection
	TCM 80	4-20mA	2-D, 12-32V	fixed	4-20 mA 2-wire connection
	TCM 100	4-20mA	2-D, 13-32V	progr.	DIL-switches for range selection
	ISOT 70	V/Iso.	21-32V/ ±15V	fixed	One range, voltage output
	ISOT 90	V/Iso.	19-32V	progr.	DIL-switches for range selection
	ISOT 80	4-20mA/ Iso.	2-D, 13.5-32V	fixed	4-20 mA 2-wire connection
	ISOT 100	4-20mA/ Iso.	2-D, 13.5-32V	progr.	DIL-switches for range selection

For printed circuits	Type	Output	Supply	Range	Special Features
 Dimensions 55x32x15mm	**SIGT 10**	V	14-32V/ ±15V	fixed	One range, voltage output
	SIGT 32	0/4-20mA	14-32V	fixed	One range, current output
	SIGT 15	V, 0/4-20mA	16-32V	progr.	DIL-switches for range selection
	SIGT 30	4-20mA	2-D, 9-32V	fixed	4-20 mA 2-wire connection
	SIGT 35	4-20mA	2-D, 10-32V	progr.	DIL-switches for range selection
	ISOT 10	V/Iso.	14-32V/ ±15V	fixed	One range, voltage output
	ISOT 30	4-20mA/ Iso.	2-D, 10-32V	fixed	4-20 mA 2-wire connection

Iso: with galvanic insulation between in- and output; 2-D: 4-20mA 2-wire technology (supply and signal on same wire)

For DIN-Heads	Type	Output	Supply	Range	Special Features
	**TCM 40**	4-20mA	2-D, 12-30V	fixed	4-20 mA 2-wire connection

- Transmitters for DIN heads: consult distributor or factory for more details, specs see TCM 80

Technical Data

Specifications for accuracy classes A, C, und D (Max. values at 23°C, unless otherwise stated)

General	A	C	D	Unit
Conversion error (linearity)[1]	0.01	0.02	0.04	%
Calibration error (factory calibrated, only fixed ranges)	0.03	0.05	0.1	%
3 dB-Bandwidth, typ.	1-10	1-10	1-10	Hz
Input impedance, voltage (min.)	200	200	200	kOhm
Influence of supply voltage[1]	0.005	0.01	0.02	%/V
Cold junction compensation[2]	**A**	**C**	**D**	**Unit**
Error, 23°C	0.5	1	1.5	°C
Lin. Error between 0 and 60°C	0.5	0.8	1.0	°C
Output	**A**	**C**	**D**	**Unit**
Output impedance, voltage, typ.[3]	50	50	50	Ohm
Output current (voltage output), max.	5	5	5	mA
Burden, current output, min.[3]	400	400	400	Ohm
Stability of Offset (RTI) with	**A**	**C**	**D**	**Unit**
Temperature[1]	0.2	0.5	2	µV/K
Age, 1 year[1]	5	10		µV
Age, 10 years[1]	20	40		µV
Stability of Gain with	**A**	**C**	**D**	**Unit**
Temperature[1]	30	70	150	ppm/K
Age, 1 year[1]	400	800		ppm
Age, 10 years[1]	1200	2500		ppm

[1] The typical error is two- to four-times smaller than the quoted maximum error.
[2] Only for module temperatures >0°C
[3] Lower cut-off frequencies for small ranges. Different frequencies can be delivered if required.

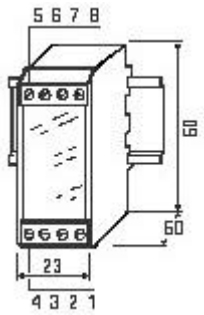
Temperature range °C: recommended: 0/60 °C functional: -20/90 °C

Please note:

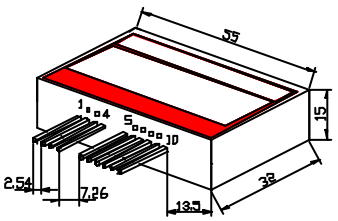
The errors quoted are only valid for a measurement range where the start of the range is not more than 50% of full scale (e.g., 40°C-100 °C). Where the zero-point is shifted considerably (e.g. measurement range of 400-500 °C), then the quoted error refers to the range calculated to have begun at zero (0-500 °C).

Dimensions and Connections

DIN-rail module

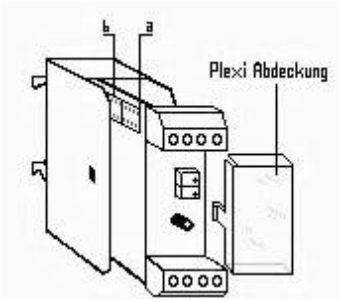


Printed circuit module

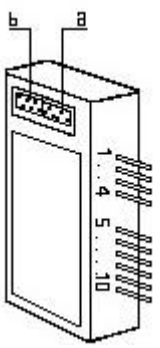


DIL – Range Switches

DIN-rail module



Printed circuit module



Programmable Modules

Input

Modules for all thermocouples are delivered. Overvoltage protection up to 30 VDC, surge/burst impulse protection up to 3 kV.

Input (programmable modules)

Span: Adjustment in steps of 1 mV between 1 and 63 mV using a binary code: 1, 2, 4, 8, 16, 32 mV. Intermediate values are set by a potentiometer, approx. ±10% adjustment range.

Offset: Adjustment in steps of 1 mV from -16 to 15 mV (with binary code: -16, 1, 2, 4, 8 mV). Intermediate values are set by a potentiometer.

Other Settings (programmable modules)

Input: Cold junction compensation can be disabled. Output goes into positive saturation if input open (for offset adjustment <5 mV).

Output: Adjustable between -5 and 10 V (eg. 0-10 V) or between 0 and 20 mA (eg. 4-20 mA). Cold junction compensation: for type K, T, S, R, J, E, L; or disabled. Negative output voltages (down to –5V) do not need a negative power supply (internal DC-DC-converter, not isolated). A negative output voltage is not available for ISOT 90.

Output

Voltage Output: Output impedance typ. 50 Ohm, max. 5 mA output current. Standard between 0 und 10 V, on request also negative values (down to –10 V, a negative power supply or the optional DC-DC-converter must be used for fixed range modules). The output is short circuit proof and protected against overvoltages (up to 30 VDC) and burst/surge (up to 3 kV). The technical data (specs) are valid for the current output; the voltage output is usually slightly more accurate and stable (no voltage-to-current conversion).

Min. output voltage with unipolar power supply (fixed range modules): approx. 10 mV. Using the optional DC-DC-converter (without galvanic insulation) one can obtain also exactly 0 mV.

Current Output: Burden min. 400 Ohm. Standard 0-20 mA or 4-20 mA, short circuit proof and protected against overvoltages. Other output ranges on request.

Option: Frequency output (max. 20 kHz), for more info, see „transmitters with frequency outputs“.

Power Supply

All modules are suited for unregulated, noisy industrial power supplies; nominal value is 24 VDC (min. 19 V, max. 32 V). Other supply voltages on request (e.g. 15 V). Current consumption without load is between 3 and 15 mA. AC power supply on request.

Negative outputs (down to –10 V) do not require a negative power supply (built in DC-DC-converter) in case of programmable modules.

Accuracy (programmable versions)

The transducers are delivered with the following setting: 0-20 mV = 0-10 V output, 0.1% calibration error. The calibration error is approx. 0.1% when switching to another range (max. 0.3% for span and offset). ISOT-types can show a greater error using certain ranges.

Options

DC-DC converter (integrated in the DIN-rail module) for galvanic isolation of the power supply, 1 kV test voltage (3 kV available on request).

Programmable limit switch (integrated in the DIN-rail module), 2.8 mm flat connectors on the side (for built in relay) for monitoring and control.

Frequencies output (max. 20 kHz), galvanically isolated, see Datasheet “Analog to Frequency Converters" for more information.

Other versions (ranges, inputs, outputs, time behaviour/filters, noise) and special versions

When ordering, please specify:

Module type, thermocouple type

Accuracy class (A, C or D)

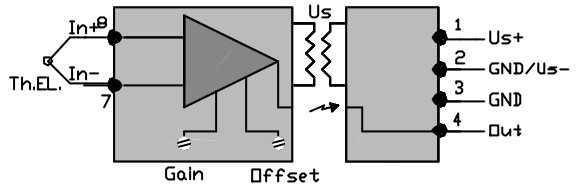
Input range (in mV, °C or K) and **output range** (in V or mA, in Hz for frequency output) for fixed range modules or if a adjustment prior to delivery is required

Programmable versions: no more information required

Power supply (24 V standard, 15 V or ±15 V on request).

Other version (ranges, inputs, outputs, time behaviour/filters, noise) and special versions.

Block Diagram and Connections, 2-Port-Isolation, DIN-Rail Modules



ISOT70-100; TCM70-100

Modules with no isolation (TCM70-90) do not have the isolation barrier shown in the figure

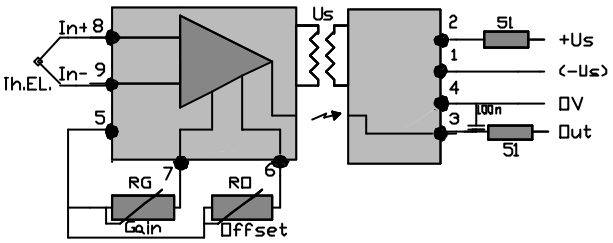
Connection of supply, 4-20mA 2-wire-modules Module (TCM80,100; ISOT80,100): see below

Terminal 1: Pos. power supply, 24 VDC nominal
Terminal 2: Power supply ground or neg. power supply
Terminal 3: Signal ground, power ground (with neg. supply)
Terminal 4: Signal output (plus)

Terminal 7: Thermocouple input (minus)
Terminal 8. Thermocouple input (plus)

Cold junction compensation may be disabled with a short circuit between terminal 7 and 6 (only fixed ranged modules)

Block Diagram and Connections, Modules for Printed Circuits



SIGT10-35, ISOT10-35

Modules with no isolation (SIGT10-31) do not have the isolation barrier shown in the figure
Connection of supply, 4-20 mA 2-wire-modules (SIGT30/35, ISOT30): see below

Terminal 1: Power supply ground
Terminal 2: Pos. power supply, 24 VDC nominal
Terminal 3: Signal output (plus)
Terminal 4: Signal Ground

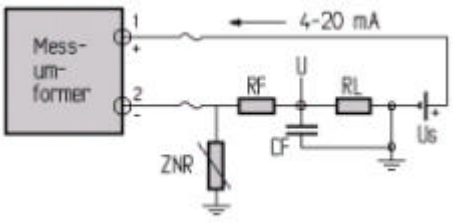
Terminal 5: Ground
Terminal 6, 7: Potentiometer (option)
Terminal 8: Thermocouple input (plus)
Terminal 9. Thermocouple input (minus)

If HF-noise can't be excluded, we recommend adding filters (e.g. 51 Ohm/100nF).

External Potentiometer: 1 KOhm each, adjustment range approx. 5%

Cold junction compensation may be disabled with a short circuit between terminal 9 and 5 (only fixed ranged modules)

Connection of Power Supply and Output of a 4-20 mA module



DIN-rail module TCM 80,100, ISOT80, 100.
Exchange 1 and 2 with printed circuit modules (SIGT30, ISOT30)
Connection 3,4: leave open

Terminal 1: Pos. power supply
Terminal 2: Neg. power supply, 4-20 mA output

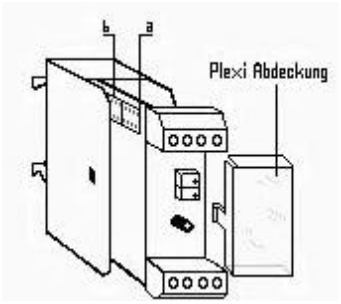
The resistor RL converts the current (4-20 mA) to a voltage signal, U. Where HF interference cannot be excluded, it is recommended that a filter (CF and RF) be installed in front of the shunt resistor (RL). RF is typically approx. 100 Ohm and CF 100 nF up to several mF. Such a filter is generally required (usually together with an overvoltage arrester, e.g., a ZNR) in order to fulfil EC-EMC standards.

Exchange 1 and 2 with printed circuit modules

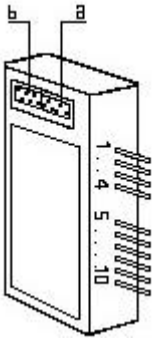
Adjustment of Measurement Range and Zero Point (Offset)

The modules with a fixed measurement range are precisely calibrated at the factory (error usually less than 0.05%), further calibration is generally unnecessary. If the output values are not correct, first of all check the connections, the power supply (is the supply voltage correct?), the experimental arrangement and all instruments in use.
We recommend that when working with programmable or configurable modules, the calibration should be checked after each new adjustment.
Adjustment is performed using a calibrator or a calibrated sensing device. The zero point (offset) is adjusted via the "Offs" potentiometer and the full-scale value is adjusted via the "gain" potentiometer. The zero point is adjusted first and then the full scale. Where large adjustments are necessary, the procedure should be carried out several times.
For additional reliability, the output value should be measured at half the measurement range (linearity test).
The output voltage of modules with a unipolar supply voltage can't reach exactly 0 mV. In such cases, zero point adjustment must be performed with an input value, which produces a non-zero output value.

Programming of XXXX90 und XXXX100 (DIL Range Switches)



DIN-rail Module



Printed Circuit Module

DIL-Switches

The programming switches 1a to 8a and 1b to 8b are located inside the module. Carefully remove the plexiglas cover. The printed circuit board can now be removed by pulling gently on the screw terminals.

A binary code is used for the setting of zero point (offset) and span: the desired values are the sum of the corresponding switches. All values in the table below are valid for a standard output of 0-10 V or 0-20mA (TCM90/ISOT90) or 4-20mA (TCM100, ISOT100).

Switch a

Switch	Function	off	on
1a			
2a	Output	Iout	Uout
3a	Cold junction	off	K,T
4a	Cold junction	off	S,R
5a	Cold junction	off	J
6a	Offset	0	-16 mV
7a	Offset	0	+8 mV
8a	Offset	0	+4 mV

Switch b

Switch	Function	off	on
1b	Offset	0	+2 mV
2b	Offset	0	+1 mV
3b	Span	0	+32 mV
4b	Span	0	+16 mV
5b	Span	0	+8 mV
6b	Span	0	+4 mV
7b	Span	0	+2 mV
8b	Span	0	+1 mV

Selection of Thermocouple:

Type	3a	4a	5a
K,T	on		
S,R		on	
E	on		on
J			on
L		on	on

Switch 3a,4a,5a: all "off" in order to switch off the electronic cold junction compensation

The setting can also be done using the following formula. Replace the switch designator (6a, 7a, ...) with 1 (if „on") or with 0 (if „off"). This results in a standard output (0-10 V or 0/4-20 mA).

Offset = -16 mV x 6a + 8 mV x 7a +4 mV x 8a + 2 mV x 1b + 1 mV x 2b **Offset in mV**
Span = 1 mV x 8b + 2 mV x 7b + 4 mV x 6b + 8 mV x 5b +16 mV x 4b + 32 mV x 3b **Span in mV**

Example: 10-50 mV = 0-10 V; the offset is 10 mV, the span 40 mV

Adjustment of offset: 7a und 1b „on", together +8 mV +2 mV = 10 mV
Adjustment of span: 3b und 5b "on", together 32 mV + 8 mV = 40 mV

Other output voltages or currents:

The values in the table are for an output of 0-10 V or 0/4-20 mA. For other output values (e.g. 0-10 mV = 0-5 V), one must calculate the corresponding span for 0-10 V: In the example (0-10 mV = 0-5 V) the corresponding range is 0-20 mV = 0-10 V. With this setting, one gets automatically 0-10 mV = 0-5 V.

Rule: Always calculate first the range for a standard output (0-10V/0-20mA XXXX90) or 4-20mA XXXX100).

Adjustment of Measurement Range and Zero Point (Offset)

The modules with a fixed measurement range are precisely calibrated at the factory (error usually less than 0.05%), further calibration is generally unnecessary. If the output values are not correct, first of all check the connections, the power supply (is the supply voltage correct ?), the experimental arrangement and all instruments in use.
We recommend that when working with programmable or configurable modules, the calibration should be checked after each new adjustment.
Adjustment is performed using a calibrator or a calibrated sensing device. The zero point (offset) is adjusted via the "Offs" potentiometer and the full scale value is adjusted via the "gain" potentiometer. The zero point is adjusted first and then the full scale. Where large adjustments are necessary, the procedure should be carried out several times. For additional reliability, the output value should be measured at half the measurement range (linearity test).
The output of modules with a unipolar supply voltage can't reach exactly 0. In such cases, zero point adjustment must be performed with an input value which produces a non-zero output value.

Important note:

Soclair Electronics is continually working to improve the quality and reliability of its products. MTBF (using MIL217) is well above 10 years (in most cases even more than 100 years). Nevertheless, electronic devices in general can malfunction or fail due to their inherent physical and chemical properties. It is the responsibility of the buyer, when utilizing Soclair Electronic products, to observe standards of safety and to avoid a situation in which a malfunction or failure of a Soclair Electronic device could cause loss of human life, injuries or damage to properties. Soclair Electronic products are not authorized for use in life support systems.