

AMIKON TECHNICAL DOCUMENTATION

Installation Instructions

Siemens 6ES7134-4JB01-0AB0

Standard Thermocouple Input Module

INPUTS	TC TYPES	VOLTAGE	COMPENSATION
2 TC / mV	9 types	±80 mV	External

For qualified personnel only. Isolate the equipment and follow the complete manufacturer and site safety procedures. This reference does not replace the approved project design or the full installation manual.

01

PREPARATION AND WIRING CHECKS

- Match the exact terminal module, TC polarity and extension conductors.
- Verify the external compensating box or assigned RTD reference circuit.
- Observe MANA and common-mode limits for isolated or grounded sensors.
- Deactivate unused channels and fit the documented TC-module jumpers.
- Enable appropriate diagnostics; never apply TC wire-break checking in voltage mode.

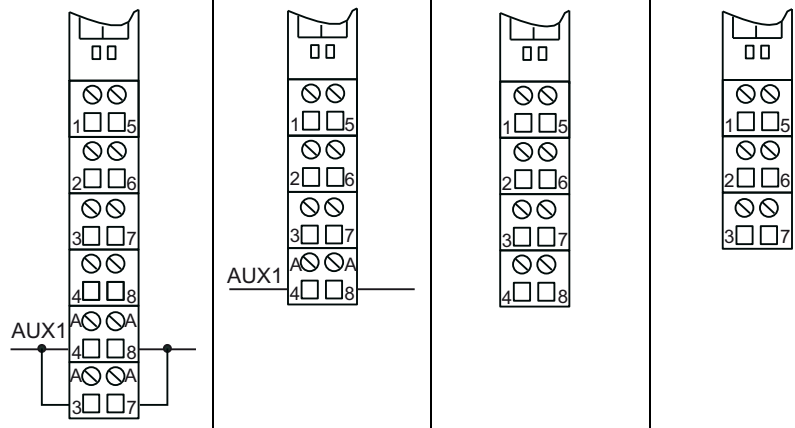
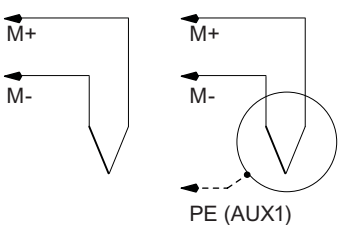
02

ORIGINAL WIRING REFERENCE

Original source PDF pages 8, 2, 7, 9, 11, 12, 13, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34. The following pages retain the original Siemens drawings and printed page numbers.

[Siemens original documentation and product reference](#)

Usable terminal modules

Usable terminal modules for 2AI TC ST (6ES7134-4JB01-0AB0)				
TM-E15C26-A1 (6ES7193-4CA50-0AA0)	TM-E15C24-A1 (6ES7193-4CA30-0AA0)	TM-E15C24-01 (6ES7193-4CB30-0AA0)	TM-E15C23-01 (6ES7193-4CB10-0AA0)	← Spring terminal
TM-E15S26-A1 (6ES7193-4CA40-0AA0)	TM-E15S24-A1 (6ES7193-4CA20-0AA0)	TM-E15S24-01 (6ES7193-4CB20-0AA0)	TM-E15S23-01 (6ES7193-4CB00-0AA0)	← Screw-type terminal
TM-E15N26-A1 (6ES7193-4CA80-0AA0)	TM-E15N24-A1 (6ES7193-4CA70-0AA0)	TM-E15N24-01 (6ES7193-4CB70-0AA0)	TM-E15N23-01 (6ES7193-4CB60-0AA0)	← Fast Connect
				Connection examples  Voltage measurement as for 2AI U ST

Block diagram

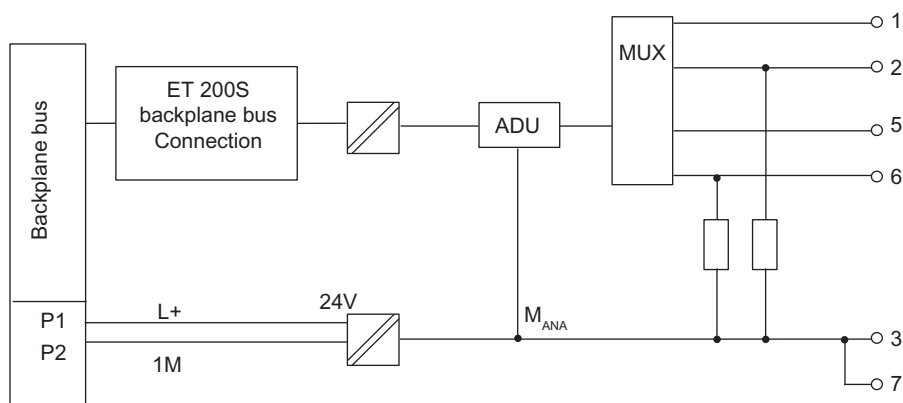


Figure 1-1 Block diagram of the 2AI TC ST

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Properties

1.1 2AI TC ST analog electronic module (6ES7134-4JB00-0AB0)

Properties

- 2 inputs for thermocouple or voltage measurement
- Input ranges:
 - Voltage measurement: ± 80 mV, resolution 15 bits + sign
 - Thermocouples: Type E, N, J, K, L, S, R, B, T, resolution 15 bits + sign
- Isolated from the load voltage L+
- Linearization of the sensor characteristic curves
- Permissible common mode voltage 2 VAC_{SS}
- Extended temperature range from 0 to 50°C with vertical installation
- supports I&M functions
- compatible with 2AI TC ST (6ES7134-4JB00-0AB0)

General terminal assignment

Note

Terminals 4, 8, A4, A8, A3 and A7 are only available at specified terminal modules.

Terminal assignment for 2AI TC ST (6ES7134-4JB01-0AB0)				
Terminal	Assignment	Terminal	Assignment	Notes
1	M ₀₊	5	M ₁₊	• M_{n+}: Measuring line positive, Channel n • M_{n-}: Measuring line negative, Channel n • M_{ana}: Ground of the module • n.c.: Not connected (max. 30 VDC can be connected) • AUX1: Protective-conductor terminal or potential bus (freely usable up to 230 VAC)
2	M ₀₋	6	M ₁₋	
3	M _{ana}	7	M _{ana}	
4	n.c.	8	n.c.	
A4	AUX1	A8	AUX1	
A3	AUX1	A7	AUX1	

2AI TC ST technical specifications (6ES7134-4JB01-0AB0)

Dimensions and weight	
Width (mm)	15
Weight	Approx. 40 g
Module-specific data	
Supports isochronous operation	No
Supports I&M functions	Yes
Number of inputs	2
Cable length	
• Shielded	Max. 50 m
Parameter length	4 bytes
Address space	4 bytes
Voltages, currents, potentials	
Rated load voltage L+ (from the power module)	24 VDC
• Reverse polarity protection	Yes
Electrical isolation	
• Between the channels and backplane bus	Yes
• Between the channels and load voltage L+	Yes
• Between the channels	No
• Between the channels and 24 V supply voltage	Yes
Permissible potential difference	
• Between M _{ANA} and the central grounding point (U _{iso})	75 VDC / 60 VAC
• Between the inputs and M _{ANA} (U _{CM})	2 VAC _{SS}
Insulation tested	500 VDC
Current consumption	
• From load voltage L+	Max. 30 mA
Power dissipation of the module	Typically 0.6 W
Status, interrupts, diagnostics	
Diagnostics function	
• Group error	Red "SF" LED
• Diagnostic functions readable	Yes

1.1 2AI TC ST analog electronic module (6ES7134-4JB00-0AB0)

Data for selecting a sensor		
Input range (rated value)/input resistance		
• Voltage	± 80 mV/min. 1 MΩ	
• Thermocouple	Type E, N, J, K, L, S, R, B, T/min. 1 MΩ	
Permitted input voltage (destruction limit)		
± 10 V, continuous		
Connection of the sensors		
• For measuring voltage	Supported	
Characteristic curve linearization		
Yes, can be assigned parameters for Type E, N, J, K, L, S, R, B, T as per IEC 584		
Temperature compensation		
• Internal temperature compensation	Not supported	
• External temperature compensation by looping a compensating box into the measuring circuit	Possible, one external compensating box per channel	
• External compensation by means of temperature value obtained at an analog module of the same ET 200S station	Yes	
Smoothing of the measured values		
Yes, can be assigned parameters in 4 steps by means of digital filtering		
	Step	Time constant
	None	1 x cycle time
	Weak	4 x cycle time
	Medium	32 x cycle time
	Strong	64 x cycle time
1 For Type N: From -150 °C. Type B: from 200 °C. Type T: from -230 °C		

Compensation of thermocouples with a compensating box

As well as the error limits of the 2AI TC ST electronic module (see table "Technical data 2AI TC ST (6ES7134-4JB01-0AB0)" in this chapter) you must also take the accuracy of the compensating box into account.

Compensation of thermocouples with a Pt100 on 2AI RTD ST, 2/4AI RTD ST and 2AI RTD HF

Factors affecting the accuracy of the temperature measurement	
Wiring rules	Ensure there is good thermal contact between the reference junction and the Pt100 used for compensation.
	We recommend that you wire the Pt100 with a four-wire connection.
Additional technical data on the error limits of the 2AI TC	The accuracy of the thermal resistor (Pt100) used for compensation must be taken into account. ¹
	The error of the measurement input (2AI RTD ST) used for compensation must be taken into account. ¹
¹ In the case of thermocouples with a characteristic curve with a very shallow gradient, these errors can lead to a major measurement discrepancy. For the following thermocouples, this causes a limitation of the input range of the thermocouples in which the accuracy information in the manual applies: • Type N: -100 °C • Type K: -230 °C • Type E: -230 °C	

I&M functions

The interface modules identified in the table below (as of order number) can be used to read and write I&M data from the module and for the firmware update:

Interface module	as of order number
IM 151-1 STANDARD	6ES7151-1AA05-0AB0
IM 151-1 FO STANDARD	6ES7151-1AB05-0AB0
IM 151-1 HIGH FEATURE	6ES7151-1BA02-0AB0
IM 151-3 PN	6ES7151-3AA22-0AB0
IM 151-3 PN HIGH FEATURE	6ES7151-3BA22-0AB0
IM 151-3 PN HIGH SPEED	6ES7151-3BA60-0AB0
IM 151-3 PN FO	6ES7151-3BB22-0AB0
IM 151-7 CPU	6ES7151-7AA20-0AB0
IM 151-7 F-CPU	6ES7151-7FA20-0AB0
IM 151-8 PN/DP CPU	6ES7151-8AB00-0AB0
IM 151-8 PN/DP F-CPU	6ES7151-8FB00-0AB0

Parameters

2.1 Parameters

Table 2- 1 Parameters for analog input module

2AI TC ST	Range of values	Default setting	Applicability
Group diagnostics (parameter assignment error, internal error, channel diagnostics)	• Disable • Enable	Disable	Module
Diagnostics: Overflow/underflow	• Disable • Enable	Disable	Module
Diagnostics: Wire-break check *	• Disable • Enable	Disable	Channel
Smoothing	• None • Weak • Medium • Strong	None	Channel
Comparison point	• None • RTD	None	Channel
Reference junction number	• None • 1 to 8 (in the case of the IM151-1 STANDARD and IM151-1 FO STANDARD) • 1 (in the case of the IM151-1 BASIC, IM151-1 COMPACT, IM151-1 HIGH FEATURE)	None	Module
Type/range of measurement	• Deactivated • Voltage ± 80 mV • TC-EL Type T (Cu-CuNi) • TC-EL Type K (NiCr-Ni) • TC-EL Type B (PtRh-PtRh) • TC-EL Type N (NiCrSi-NiSi) • TC-EL Type E (NiCr-CuNi) • TC-EL Type R (PtRh-Pt) • TC-EL Type S (PtRh-Pt) • TC-EL Type J (Fe-Cu-Ni) • TC-EL Type L (Fe-Cu-Ni)	TC-EL Type K (NiCr-Ni)	Channel
* Only with thermocouples. A parameter assignment error occurs when the wire break diagnosis is enabled in the voltage measuring range. The module does not start up.			

Connecting

5.1 Connecting measuring sensors

Introduction

You can connect encoders with voltage signals and thermocouples to the 2AI TC ST analog input module.

In this chapter you will find out how to connect the measuring encoders and what to watch out for when doing so.

Cables for analog signals

You should use shielded and twisted-pair cables for the analog signals. This reduces the effect of interference. You should ground the shield of the analog cables at both ends. If there are differences in potential between the cable ends, an equipotential bonding current that may interfere with the analog signals will flow across the shield. If this is the case, you should only ground the shield at one end of the cable.

Analog input modules

The analog input modules are electrically isolated:

- Between the logic and backplane bus
- Between the load voltage and the channels.
 - Electrical isolation: No link between M_{ANA} and the central grounding point (U_{ISO})

Note

Ensure that this difference in potential U_{ISO} does not exceed the permitted value. If there is a possibility of exceeding the permitted value, establish a connection between terminal M_{ANA} and the central grounding point.

Connecting measuring encoders to analog inputs

There can be only a limited potential difference U_{CM} (common mode) between the measuring lines M- of the input channels and the reference point of the measuring circuit M_{ANA} .

To ensure that the permitted value is not exceeded, you must take different steps depending on whether the encoders are isolated or non-isolated. The steps you have to take are described in this chapter.

Abbreviations used

The meanings of the abbreviations in the figures below are as follows:

M+:	Measuring line (positive)
M-	Measuring line (negative)
M_{ANA}	Reference potential of the analog measuring circuit
M	Ground connection
L+	Rated load voltage 24 V DC
U_{CM}	Potential difference between inputs and reference potential of the measuring circuit M_{ANA}
U_{ISO}	Potential difference between M_{ANA} and central grounding point

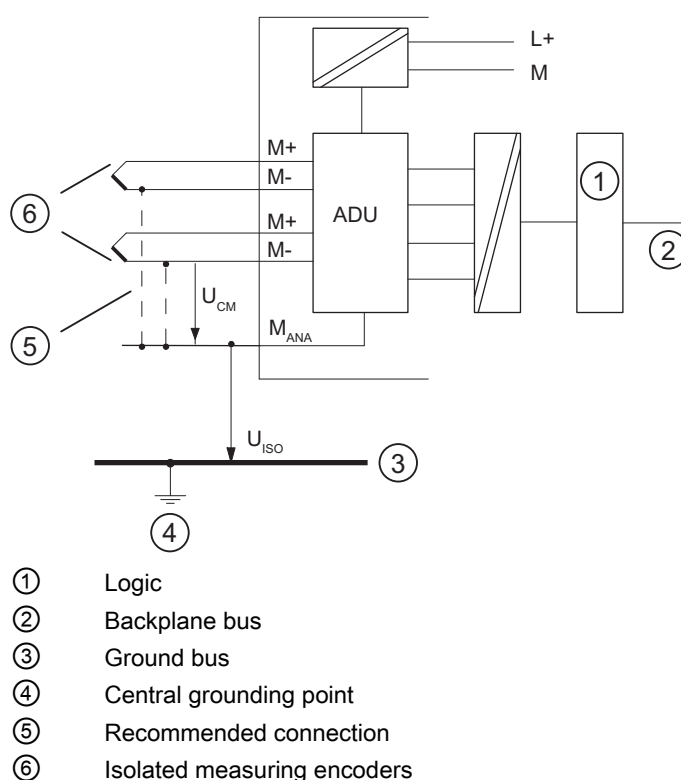
Isolated measuring encoders

The isolated measuring encoders are not connected to the local ground potential. These can be potential-free. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the measuring lines M- of the input channels and the reference point of the measuring circuit M_{ANA} .

To ensure that the permitted value for U_{CM} is not exceeded in environments with strong EMC interference, the following applies:

- For the 2AI TC analog input module: Connect M- to M_{ANA} !

The following schematic representation illustrates the connection of isolated measuring encoders to the optically isolated analog input modules.



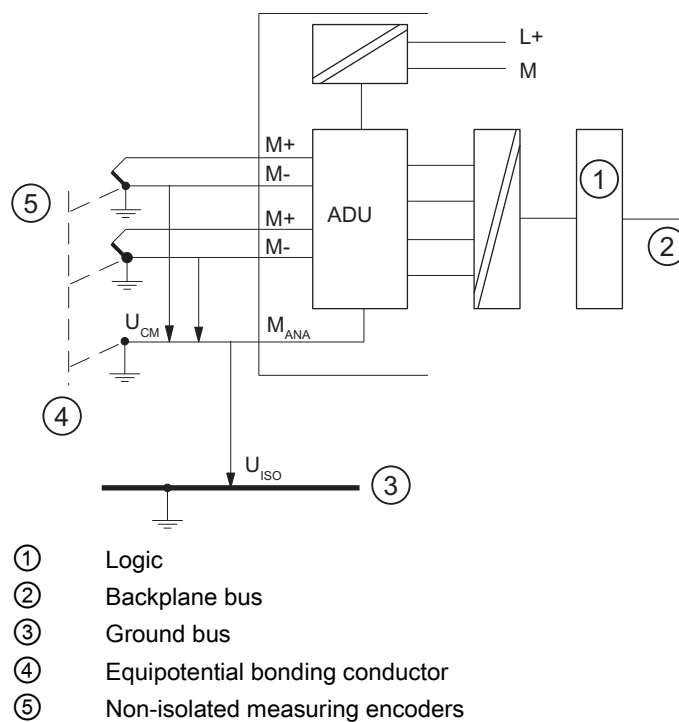
Non-isolated measuring encoders

The non-isolated measuring encoders are connected to the local ground potential. You must connect M_{ANA} to the ground potential. Depending on local conditions or interference, potential differences U_{CM} (static or dynamic) can occur between the locally distributed measuring points.

If the permitted value for U_{CM} is exceeded, there must be equipotential bonding conductors between the measuring points.

The following schematic representation illustrates the connection of non-isolated measuring encoders to an optically isolated analog input module.

Connection of non-isolated measuring encoders to an optically isolated analog input module:



5.2 Connecting thermocouples

Introduction

This section contains additional information on connecting thermocouples.

Compensation of the comparison point temperature

There are various ways of obtaining the comparison point temperature in order to get an absolute temperature value from the temperature difference between the comparison point and the measuring point.

Table 5- 1 Compensation of the comparison point temperature

Option	Description	Comparison point parameters
No compensation	It is not just the temperature of the measuring point that you need to record: The temperature of the comparison point (transition from Cu line to thermocouple line) also affects the thermo-electromotive force. The measured value on its own is incorrect.	None
Using a compensating box on the supply lines of a single thermocouple	You compensate using a compensating box. The compensating box is the transition point from the Cu line to the thermocouple line. No further processing is necessary using the 2AI TC.	None
Use of a Pt 100 Climatic Range resistance thermometer to record the reference junction temperature (best method)	You can record the reference junction temperature using a resistance thermometer (Pt 100 Climatic Range). Given appropriate parameter assignment, this temperature value in the ET 200S is distributed to the 2AI TC modules and calculated in the modules together with the temperature value obtained for the measurement point. Number of reference junctions: 1	The parameter assignment of the IM151-1 and the 2AI TC must be coordinated: • 2AI RTD configured to Pt 100 climatic range at the correct slot; • 2AI TC: Reference junction : RTD; select reference junction number 1 • IM : Assignment of the reference junction to a slot with the 2AI RTD; selection of a channel;

Extension to a comparison point

The thermocouples can be extended from their connection point by means of compensating lines to the comparison point (transition to Cu line) or the compensating box. The comparison point can also be an ET 200S terminal module.

The compensating lines are made of the same material as the wires of the thermocouple. The supply lines are made of copper. Ensure the correct polarity when connecting.

Using a compensating box

The effect of the temperature on the comparison point of a thermocouple (such as a terminal box) can be adjusted with a compensating box.

The compensating box contains a bridge circuit that is adjusted for a certain comparison point temperature (compensating temperature). You connect the thermocouples or their compensating lines to the compensating box. The compensating box then forms the comparison point.

If the actual reference temperature differs from the compensating temperature, the temperature-dependent bridge resistance changes. A positive or negative compensation voltage occurs; this is added to the thermo-electromotive force.

Compensating boxes with a **comparison point temperature of 0°C** must be used for the compensation of the analog input modules.

Note:

- The power supply to the compensating box must be isolated.
- The power supply unit must have adequate interference filtering (by means of a grounded shielding winding, for example).

Compensation by means of a resistance thermometer at the 2AI RTD

If thermocouples that are connected to the inputs of the 2AI TC have the same reference junction, compensate by means of a 2AI RTD.

For both channels of the 2AI TC module, you can select "RTD" or "None" as the reference junction. If you select "RTD," the same reference junction (RTD channel) is always used for both channels.

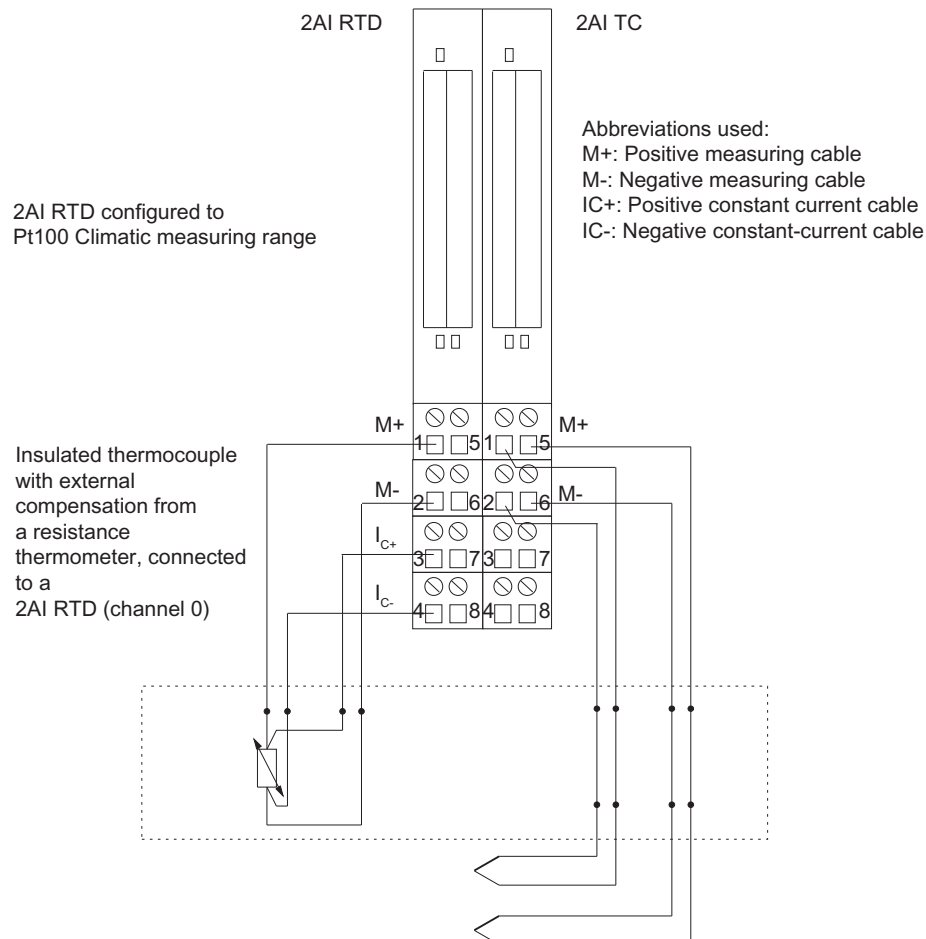


Figure 5-1 Compensation by means of the 2AI RTD

Note

In the case of 2/4AI RTD ST analog electronic module, use the channels 0 and 1 for compensation.

Parameter assignment of the reference junction for the 2AI TC and the interface module

You set the reference junctions for the 2AI TC electronic modules by means of the following parameters:

Table 5- 2 Reference junction parameters

Parameters	Module	Range of values	Explanation
Reference junction slot	IM 151	None, 2 to 12 (IM151-1 BASIC) None, 2 to 13 (IM151-1 COMPACT) none, 2 to 63 (IM151-1 HIGH FEATURE, IM151-1 STANDARD, IM151-1 FO STANDARD)	A slot with the channel for measuring the reference temperature (determining the compensation value) can be assigned with this parameter.
Reference junction input	IM 151	RTD at Channel 0 RTD at Channel 1	This parameter can be used to set the channel (0/1) for measuring the reference temperature (calculation of the compensation value) for the assigned slot
Reference junction E0 and reference junction E1	AI TC	None, RTD	This parameter allows you to enable the use of the reference junction.
Reference junction number	AI TC	1	With this parameter, you assign the reference junction (1) containing the reference temperature (compensation value).

Example of assigning parameters of reference junctions

Setup: For simplification, only RTD and TC modules are shown in the following figure:

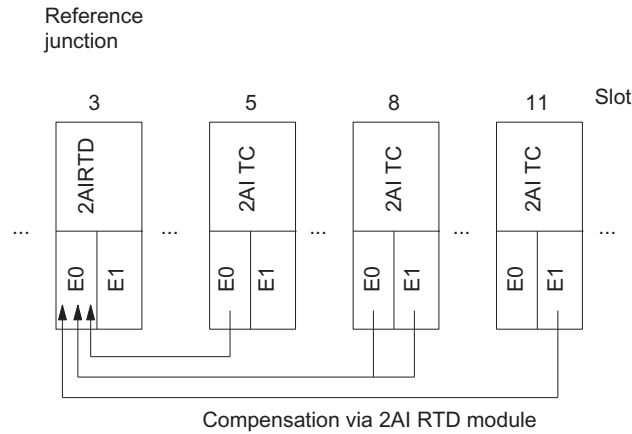


Figure 5-2 Example of assigning parameters of reference junctions

Relevant parameters to be set for the interface module:

Parameters	Value
Reference junction slot	3
Reference junction input	RTD at Channel 0

Relevant parameters to be set for the 2AI TC:

Slot	Parameters	Value
5 (2AI TC)	Reference junction E0	RTD
	Reference junction E1	None
	Reference junction number	1
	Type/range of measurement E0	TC-EL Type...
	Type/range of measurement E1	(any)
8 (2AI TC)	Reference junction E0	RTD
	Reference junction E1	RTD
	Reference junction number	1
	Type/range of measurement E0	TC-EL Type...
	Type/range of measurement E1	TC-EL Type...
11 (2AI TC)	Reference junction E0	None
	Reference junction E1	RTD
	Reference junction number	1
	Type/range of measurement E0	(any)
	Type/range of measurement E1	TC-EL Type...

Non-isolated thermocouples

When you use non-isolated thermocouples, you must comply with the permitted common-mode voltage.

5.3 Wiring unused channels of the analog input modules

Rules

Pay attention to the following instructions when wiring unused channels:

- "Deactivate" unused input channels when assigning parameters.
- A deactivated channel always returns the value 7FFF_H.
- The module cycle time is halved with the 2AI TC ST module.
- To adhere to the permissible potential differences (U_{CM}), you must wire jumpers on the terminal module for the unused channels.

Analog input module	TM connecting terminal							
	Channel 0				Channel 1			
	1	2	3	4	5	6	7	8
2AI TC ST								

5.4 Using the shield connection

Rules

To prevent interference we recommend the following for analog electronic modules:

- Use shielded wires to the sensors and actuators.
- Lay out the wire shields on the shield connection.
- Connect the shield connection to the ground bus with low impedance.