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Temperature Measuring with the ET 200SP in the Case of High Common-Mode Voltages (AI 4xRTD/TC 2-/3-/4-wire HF and AI 8xRTD/TC 2-wire HF)

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The functions and solutions described in this entry are predominantly limited to the realization of the automation task. When linking your system to other system components, to the company network or to the internet, make sure that you take the appropriate industrial security measures. More information about this is available in Entry ID: !50203404!.

http://support.automation.siemens.com/WW/view/en/50203404

Contents

1 Introduction

You can use the following analog modules of the ET 200SP to measure temperatures with the aid of resistance thermometers or thermocouples:

- AI 4xRTD/TC 2-/3-/4-wire HF (article number 6ES7134-6JD00-0CA1)
- AI 8xRTD/TC 2-wire HF (article number 6ES7134-6JF00-0CA1)

The measuring inputs of the modules are differential and voltage free However, there is no electrical isolation between the individual channels of a module. The channels are queried sequentially via an input multiplexer.

In practice, through the interface of these temperature sensors there are differences in potential between the individual channels, which have the effect of common-mode interferences. More information is available in the manual entitled "Analog Value Processing" under Common-mode Interferences (Ucm).

The following chapters will show you;

- Which technical data the maximum permitted common-mode interference describes.
- The effect of exceeding this value.
- A remedy for reducing common-mode interferences that are too high through an additional wiring of the above-mentioned modules

2 Specifications of Common-Mode Voltage

The specifications of the common-mode voltage between the channels are given in the technical data of the modules under "Interference Suppression". With reference to the maximum permitted common-mode voltage, there is also specification of the value of the achieved suppression of the common-mode interference (attenuation in dB).

The following example shows that up to a maximum common-mode voltage of 10 V the interference is attenuated with at least 90 dB.

Interference voltage suppression for f = n x (f1 +/- 1 %), f1 = interference frequency	
• Series mode interference (peak value of interference < rated value of input range), min.	70 dB
• Common mode voltage, max.	10 V
• Common mode interference, min.	90 dB

Figure 1

The following links take you to the technical data of the two analog groups.

- AI 4XRTD/TC 2-/3-/4-WIRE HF
- AI 8XRTD/TC 2-WIRE HF

3 Effects When the Maximum Common-Mode Voltage is Exceeded

If the specified maximum common-mode voltage is exceeded, the suppression of this common-mode interference on the measured value decreases. This causes the measured value to be imprecise and start to fluctuate (excited by the interference).

If the common-mode voltage continues to increase, this can lead to destruction of the input multiplexer and consequently to complete failure of the module.

4 Connection Type for Decreasing the Common-Mode Voltage

The specifications in the manual are mandatory for connecting the measuring circuits to achieve the documented measuring accuracy.

Information about this is available in:

- SIMATIC S7-1500, ET 200MP, ET 200SP, ET 200AL Designing interference-free controllers

Pay attention here to the shielding of the analog measuring circuits and the proper connection of the shield to the shield connection with the shield clamp (available as an accessory).

If these measures are not sufficient, we recommend the following type of connection:

In practice, the common-mode voltages between the channels refer to a common reference potential. This is usually the functional earth (FE) or the 24V DC power supply chassis. In this way you can greatly decrease the common-mode voltages by connecting the potential-free input channels with the reference potential.

Connect all the Mn- - connections (n: channel number 0..3 or 0..8) with the reference potential. If there is only one common reference potential, then this connection is also possible via multiple modules.

Figure 2 shows you an example of the connection type for reducing common-mode voltages:

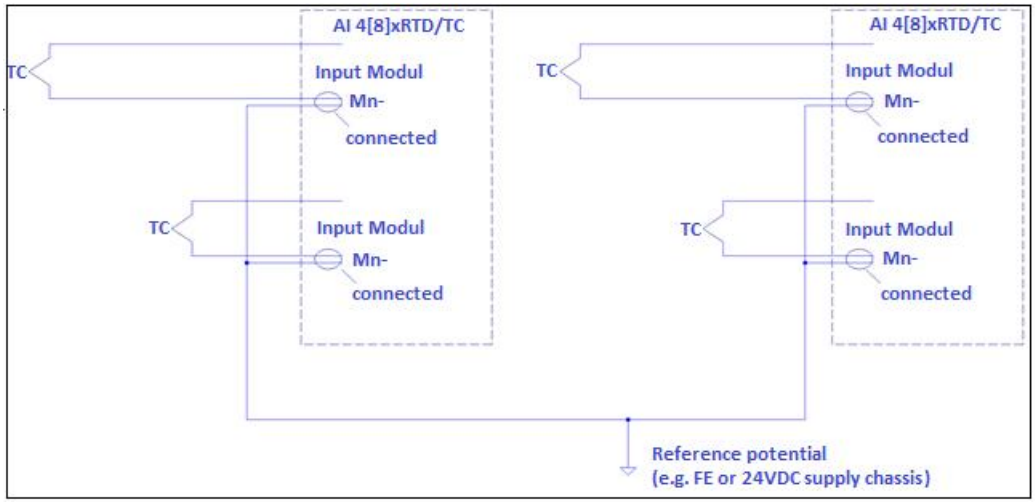

Figure 2

Notes

Pay attention to the following points:

- The common connection of the Mn- - connections with the reference potential means that the channels are no longer potential-free.
- The safety concept of the plant must not be negatively affected by this.
- There must be no compensating current flowing through this additional potential connection. If, for example, the sensors are not potential-free, then via the additional connection point (grounding point) there might be compensating currents through the differences in potential.
- With the changed type of connection, low-resistance common-mode voltages lead to a considerable current flow through short circuit and destroy the module. In this case, you must avoid this type of connection.
- High-resistance common-mode voltages can be ineffective in this way.
- The connection of the Mn- - connections with thermocouples must not corrupt the necessary cold junction compensation. If you are using the internal reference junction (with Base Unit BU Type A1), then the connection must be made directly in the terminal clamp.