DATASHEET

NI REM-11120

Temperature Input Module for Remote I/O

- 4 thermocouple channels with input range of ±100 mV
- 1 voltage input channel with range of ±5V
- Optional external CJC or additional PT100 RTD measurements
- Adjustable filter time for improved measurement quality
- Supports the following thermocouple types: U, T, L, J, E, K, N, S, R, B, C, W, HK
- Spring-terminal connectors allow fast wiring without tools
- Communication to the higher-level system via EtherCAT
- -25 °C to 60 °C temperature range to meet a variety of application and environmental needs

Remote I/O Overview

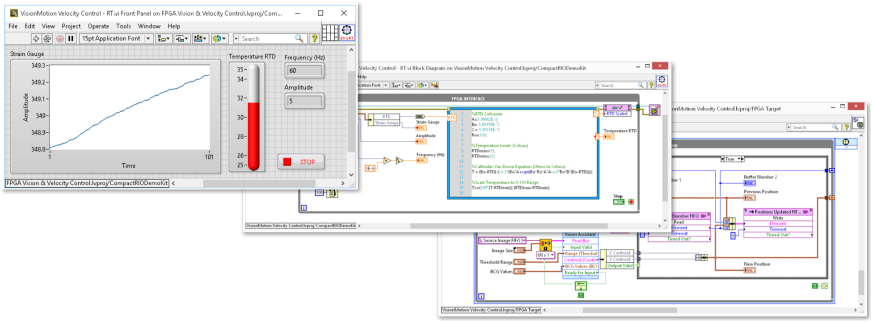
Remote I/O is a low-cost, modular system for simple machine control and measurements. A Remote I/O system consists of an EtherCAT bus coupler and individual modules mounted on a DIN rail and is controlled from a Real-Time controller such as a CompactRIO Controller or Industrial Controller.

- Round out your system with low-cost I/O for simple tasks while your controller handles advanced tasks such as image processing and high-speed or specialty measurements.
- Add only the I/O you need where you need it with the modular, distributed system.
- Connect multiple Remote I/O systems and EtherCAT chassis to meet your I/O needs.

NATIONAL INSTRUMENTS

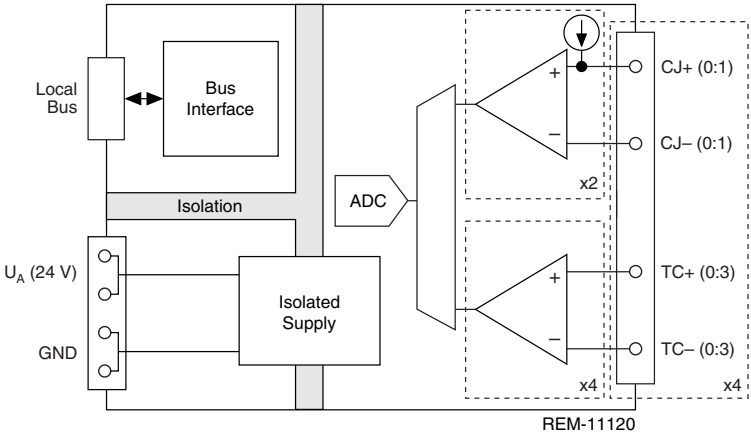
Figure 1. NI Remote I/O System

NI Embedded Control and Monitoring Suite



- Use a single toolchain for every phase of your design cycle – from modeling and simulation, to prototyping and validation, to deployment and beyond.
- NI ECM Suite combines LabVIEW Professional Development System with add-on software for programming Real-Time, FPGA, SoftMotion and Vision Acquisition devices.
- Combine LabVIEW with your expertise to efficiently design a system by integrating graphical, C code, .m files, and state-based simulations in one environment.
- Reduce development time with built-in constructs to manage low-level tasks such as timing and memory in an intuitive programming environment.
- Accelerate your development with over 950 available signal processing, analysis, control, and mathematics functions.
- Get to solutions faster with extensive support and training that scale with the complexity of your systems.

REM-11120 Input Circuitry



REM-11120 Specifications

The following specifications are typical for the range -25 °C to 60 °C unless otherwise noted.

Input Characteristics

Number of inputs	
Thermocouple/Linear voltage	4
Voltage (-5 V to +5 V)	1
Input types	
TC	U, T, L, J, E, K, N, S, R, B, C, W, HK
RTD	Pt 100 (2 external cold junctions, can also be used as input)
Resolution A/D	24-bit
Measuring principle	Sigma/Delta process
Measured value representation	16 bits (15 bits + sign bit)
Input filter time	40 ms, 60 ms, 100 ms, 120 ms (adjustable)

Accuracy	
Relative[1]	0.01%, typical
Absolute[2]	±0.19 K, typical
Short-circuit protection, overload protection of the inputs	Yes
Transient protection of inputs	Yes
Crosstalk attenuation	113 dB, typical (channel/channel, thermocouple type K) 114 dB, typical (channel/channel, linear voltage ±100 mV) 107 dB, typical (channel/channel, external Pt 100 connection)

Table 1. Common Mode Rejection (CMR)[3]

Input	Channel/FE		Channel/AGND	
	Minimum	Typical	Minimum	Typical
TC/Linear voltage	100 dB	140 dB	100 dB	131 dB
Voltage -5 V to +5 V	95 dB	105 dB	—	—

Input resistance[4]	
TC/Linear voltage	20 MΩ, typical
Voltage -5 V to +5 V	5 MΩ, typical
TC voltage (1 min.)	40 VDC

Input Scaling

Hex	Dec	Temperature sensors		Linear voltage ±100 mV	
		1 °C or 1 °F	0.1 °C or 0.1 °F	1 µV	10 µV
8001	Overrange	>Limit value	>Limit value	>32.512 mV	>100 mV
03E8	1000	1000 °C or 1000 °F	100 °C or 100 °F	1 mV	10 mV
1	1	1 °C or 1 °F	0.1 °C or 0.1 °F	1 µV	10 µV

[1] Thermocouple type K, NiCr-Ni
[2] Thermocouple type K, plus tolerance of cold junction
[3] For DC up to 100 kHz, V_{cm} = -10 V to +10 V)
[4] With 24 V I/O supply voltage present.

Hex	Dec	Temperature sensors		Linear voltage ±100 mV	
		1 °C or 1 °F	0.1 °C or 0.1 °F	1 µV	10 µV
0	0	0 °C or 0 °F	0 °C or 0 °F	0 µV	0 µV
FFFF	-1	-1 °C or -1 °F	-0.1 °C or -0.1 °F	-1 µV	-10 µV
FC18	-1000	-1000 °C or -1000 °F	-100 °C or -100 °F	-1 mV	-10 mV
8080	Underrange	<Limit value	<Limit value	<-32.512 mV	<-100 mV

Power Requirements

Communications power from U_{Bus}	5 VDC, via bus connector
Current consumption from U_{Bus}	23 mA, typical 40 mA, maximum
Power consumption at U_{Bus}	
Typical	0.54 W
Maximum	0.8 W
Total power consumption	
Typical	1.05 W
Maximum	1.76 W

Note The typical values for current and power consumption are measured values. The maximum values are theoretical worst-case values.

I/O Supply

Supply of analog output modules U_A	24 VDC (I/O supply and sensor supply)
Maximum permissible voltage range	19.2 VDC to 30 VDC (including all tolerances, including ripple)
Current consumption from U_A	112 mA, typical 160 mA, maximum
Surge protection	Electronic (35 V, 0.5 s)
Polarity reversal protection	Polarity protection diode
Protection	Suppressor diode
External fuse rating	8 A

Caution Connect an external fuse to the 24 V U_A supply to protect against polarity reversal. The power supply must provide four times the nominal current of the external fuse. This rating ensures that the fuse trips in the event of an error.

Remote I/O Local Bus

Connection method	Bus connector
Transmission speed	100 MBit/s

Cable Length

The maximum cable length specification is valid from the sensor to the connection terminal block and includes the maximum specified tolerances. The measuring tolerances of all channels will only be observed if the permissible cable types are used.

Maximum Cable Length	Sensor Type [5, 6]	Connection Method	Sensor Cable	Cable Type
10 m	TC0 to TC3	2-wire	Unshielded, twisted	TC sensor cable or equalizing conductor
250 m	TC0 to TC3	2-wire	Shielded, twisted	TC sensor cable or equalizing conductor
10 m	AI0 to AI3 -100 mV to +100 mV	2-wire	Unshielded, twisted	Reference cable type LiYY (TP) 2 × 2 × 0.5 mm^2
250 m	AI0 to AI3 -100 mV to +100 mV	2-wire	Shielded, twisted	Reference cable type LiYCY (TP) 2 × 2 × 0.5 mm^2
2 m	Pt 100 external cold junction sensor	2-wire	Unshielded, twisted	Reference cable type LiYY (TP) 2 × 2 × 0.5 mm^2

[5] Use the appropriate TC equalizing conductors for TC sensors (according to DIN EN 60584-3, IEC 60584-3, and DIN 43722).

[6] Observe the cable resistance values when operating the external Pt 100 cold junction. Long cables and/or small cable cross sections increase measuring tolerances.

Maximum Cable Length	Sensor Type [5, 6]	Connection Method	Sensor Cable	Cable Type
10 m	Pt 100 external cold junction sensor	2-wire	Shielded, twisted	Reference cable type LiYCY (TP) $2 \times 2 \times 0.5\ mm^2$
5 m	-5 V to +5 V input	2-wire	Shielded, twisted	Reference cable type LiYCY (TP) $2 \times 2 \times 0.5\ mm^2$

Note When using the NI Remote I/O Shield Set, connect the braided shield of long sensor cables at one end to the functional earth ground potential upstream of the REM-11120.

Thermocouple Measuring Ranges

Sensor Type	Standard	Measuring range		Average Basic Value for Sensitivity	Voltage Level at Measuring Range Final Value
		Lower Limit	Upper Limit		
B	DIN EN 60584	+50 °C	+1820 °C	6 µV/K	13.820 mV
E	DIN EN 60584	-270 °C	+1000 °C	65 µV/K	76.373 mV
J	DIN EN 60584	-210 °C	+1200 °C	54 µV/K	69.553 mV
K	DIN EN 60584	-270 °C	+1372 °C	42 µV/K	54.886 mV
N	DIN EN 60584	-270 °C	+1300 °C	27 µV/K	47.513 mV
R	DIN EN 60584	-50 °C	+1768 °C	10 µV/K	21.101 mV
S	DIN EN 60584	-50 °C	+1768 °C	10 µV/K	18.693 mV
T	DIN EN 60584	-270 °C	+400 °C	40 µV/K	20.872 mV
C	—	-18 °C	+2316 °C	15 µV/K	37.07 mV
W	—	-18 °C	+2316 °C	12 µV/K	38.56 mV
HK	—	-200 °C	+800 °C	69 µV/K	66.42 mV

[5] Use the appropriate TC equalizing conductors for TC sensors (according to DIN EN 60584-3, IEC 60584-3, and DIN 43722).

[6] Observe the cable resistance values when operating the external Pt 100 cold junction. Long cables and/or small cable cross sections increase measuring tolerances.

Sensor Type	Standard	Measuring range		Average Basic Value for Sensitivity	Voltage Level at Measuring Range Final Value
		Lower Limit	Upper Limit		
L	DIN 43710	-200 °C	+900 °C	54 µV/K	53.14 mV
U	DIN 43710	-200 °C	+600 °C	40 µV/K	34.31 mV

Tolerances at T_A = +25 °C

The tolerances of the thermocouple inputs (TC sensors) are based on differential temperature recording plus the tolerances due to cold junction compensation during nominal operation in the preferred mounting position.

Input	Sensor Type	Measuring Range		Absolute Tolerance		Relative tolerance (with reference to MRFV)[7]	
		Lower Limit	Upper Limit	Typical	Maximum	Typical	Maximum
Thermocouples	B	+500 °C	+1820 °C	±0.5 K	±4.17 K	±0.03%	±0.23%
	E	-226 °C	+1000 °C	±0.15 K	±1.38 K	±0.02%	±0.19%
	J	-210 °C	+1200 °C	±0.19 K	±1.67 K	±0.02%	±0.14%
	K	-200 °C	+1372 °C	±0.19 K	±0.71 K	±0.01%	±0.05%
	N	-200 °C	+1300 °C	±0.39 K	±3.15 K	±0.03%	±0.23%
	R	-50 °C	+1768 °C	±0.8 K	±2.5 K	±0.05%	±0.14%
	S	-50 °C	+1768 °C	±0.8 K	±2.5 K	±0.05%	±0.14%
	T	-270 °C	+400 °C	±0.18 K	±0.63 K	±0.04%	±0.16%
	C	-18 °C	+2316 °C	±0.53 K	±0.81 K	±0.02%	±0.03%
	W	+250 °C	+2316 °C	±1.33 K	±2.5 K	±0.06%	±0.11%
	HK	-200 °C	+800 °C	±0.16 K	±1.3 K	±0.02%	±0.16%
	L	-200 °C	+900 °C	±0.15 K	±1.67 K	±0.02%	±0.19%
	U	-200 °C	+600 °C	±0.15 K	±0.75 K	±0.03%	±0.13%

[7] MRFV = measuring range final value

Input	Sensor Type	Measuring Range		Absolute Tolerance		Relative tolerance (with reference to MRFV)[7]	
		Lower Limit	Upper Limit	Typical	Maximum	Typical	Maximum
Internal cold junction	Pt DIN	-70 °C	+150 °C	±0.25 K	±1.6 K	±0.17%	±1.07%
External external cold junction sensor	Pt DIN	-100 °C	+400 °C	±0.3 K	±0.8 K	±0.08%	±0.20%
		-100 °C	+100 °C	±0.10 K	±0.60 K	±0.03%	±0.15%
Voltage input	Linear voltage	-100 mV	+100 mV	±10 µV	±100 µV	±0.01%	±0.10%
		-30 mV	+30 mV	±7 µV	±30 µV	±0.007%	±0.03%
		-10 mV	+10 mV	±5 µV	±25 µV	±0.005%	±0.03%
5 V DC voltage input channel	Linear voltage	-5 V	+5 V	±1.5 mV	±10 mV	±0.03%	±0.10%

Temperature and Drift Response

The following data refers to nominal operation (U_A = 24 V) in a horizontal mounting position.

Channel	Measuring range	Drift[8]	
		Typical	Maximum
External Pt 100	-100 °C to +400 °C	±15 ppm/K	±30 ppm/K
Linear voltage	-100 °C to +100 °C	±10 ppm/K	±25 ppm/K
	-10 mV to +10 mV	±3 ppm/K	±12 ppm/K
	-30 mV to +30 mV	±6 ppm/K	±15 ppm/K
	-100 mV to +100 mV	±11 ppm/K	±20 ppm/K
±5 V voltage input	—	±13 ppm/K	±25 ppm/K
TC inputs	Type K	±8 ppm/K	±20 ppm/K

Note The measurement is performed within a Remote I/O system in which another REM-11120 is located to the right and left of the module in question.

[7] MRFV = measuring range final value

[8] The drift values refer to the full measuring range final value, i.e., 1372 °C in the case of TC sensor type K, +400 °C in the case of the external Pt 100, and +100 mV in the case of the linear voltage.

Tolerances for TC Sensor Type K with Internal Cold Junction Compensation

The tolerances of the thermocouple inputs (TC sensors) are based on absolute temperature recording during nominal operation in the preferred mounting position.

Temperature	Absolute tolerance		Relative tolerance (with reference to MRFV)[9]	
	Typical	Maximum	Typical	Maximum
+25 °C	±0.20 K	±2.4 K	±0.01%	±0.17%
-25 °C to +60 °C	±0.71 K	±3.9 K	±0.05%	±0.28%

Tolerance Guidelines

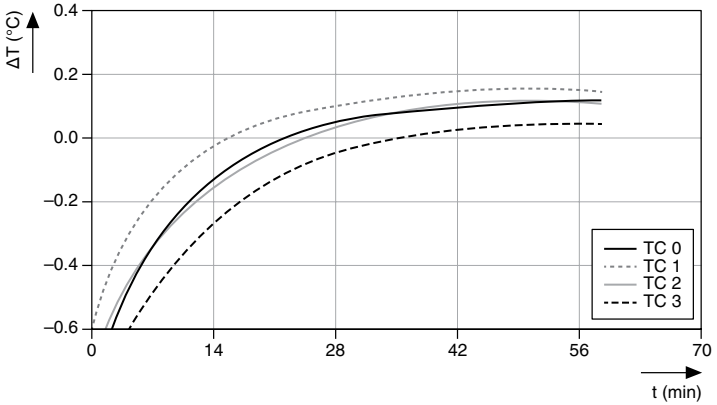
- The measurements are performed within a Remote I/O system in which another REM-11120 is located to the right and left of the module in question.
- To achieve optimum accuracy in the various mounting positions of the system, configure the system in different installation positions.
- The tolerance values for the TC inputs are based on the average basic values for sensitivity.
- The typical values were determined from the maximum tolerances of the measured practical values.
- The maximum tolerances represent the worst-case measurement inaccuracy. They contain the theoretical maximum possible tolerances in the measuring ranges as well as the theoretical maximum possible tolerances of the test and calibration equipment. The data is valid for at least 24 months from delivery of the module. Thereafter the modules can be recalibrated by the manufacturer at any time.
- An additional path calibration function for maximum accuracy is possible at any time in the application. Using the temperature offset, you can finely tune the tolerances for each channel by means of the connecting cables and the sensors. The specified tolerances are then reduced accordingly.
- The tolerances increase slightly for a short time immediately after power up.
- In the -100 mV to +100 mV linear voltage input range, smaller measuring windows with closer tolerances were also specified. The reference value of the relative tolerance value is always based on +100 mV.
- Please note when using linear voltage signals: for voltages above +32.7 mV and below -32.7 mV, parameterize the process data resolution as 10 µV/LSB (instead of 1 µV/LSB) in order to prevent overrange or underrange messages from occurring.

[9] MRFV= Measuring range final value

- Always position temperature modules at the end of the station. For modules that must be positioned next to a bus coupler, the typical measuring tolerance can be increased by up to 0.9 K.
- The maximum tolerances are observed even in the event of electromagnetic interference. They apply for both shielded and unshielded I/O cables.

Switch-On Behavior of TC Inputs with Internal Cold Junction Compensation

Figure 2. Typical Switch-On Behavior of Type K TC Sensors



Transient period	Typical tolerance
5 minutes	-0.7 K
10 minutes	-0.3 K
35 minutes	±0.2 K
45 minutes	±0.2 K

- The switch-on behavior must only be taken into consideration for TC measurements with internal cold junction temperature, it does not apply for differential measurements or measurements with external compensation.
- The typical characteristic curves of the TC inputs after power up were recorded in the horizontal mounting position, in nominal operation (U_A = 24 V, T_A = 25°C), and with unobstructed ventilation ducts (free air flow).
- The measurement is performed within an NI Remote I/O system in which another REM-11120 is located to the right and left of the module in question.

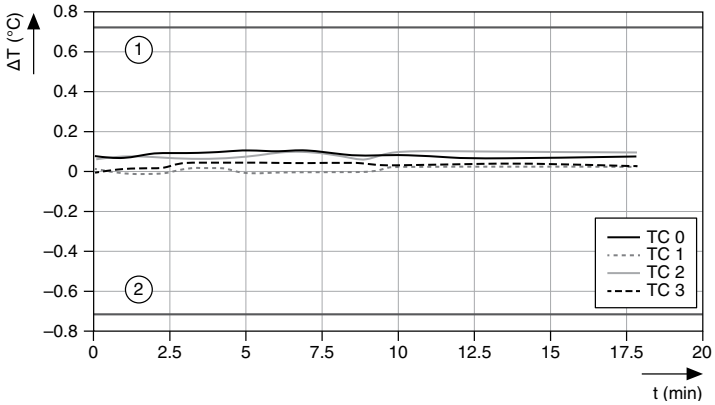
- Installation positions where the REM-11120 is affected by external sources of heat can result in a different thermal switch-on behavior.
- The measuring probes of the type K TC sensors were kept at a constant temperature.

Note In the event of sudden changes in the ambient temperature, the time curve for the transient response is comparable with that of the switch-on behavior.

Switch-On Behavior of TC Inputs with External Cold Junction Compensation

The REM-11120 supports the connection of two external Pt 100 cold junction sensors.

Figure 3. Typical Switch-On Behavior of Type K TC Sensors[10]



1. Maximum tolerance limit
2. Minimum tolerance limit

Tolerance Data for Cold Junctions

Internal Cold Junctions

Implement simple cold junction compensation for thermocouple inputs using the internal cold junctions. To ensure accuracy, you can compensate the mounting position of the internal cold junction.

Connection method	2-wire connection
Sensor type	Pt 100 DIN
R_0 (sensor resistance at T_A = 0 °C)	100 Ω

[10] With external Pt 100 cold junction compensation and path calibration function for the cold junction at connector 1 at an ambient temperature of +25°C

Measuring range	-55 °C to +125 °C
Resolution	
Process data	0.1 K/LSB
Floating point object	<0.001 K
Filter time	120 ms

Table 2. Internal Cold Junction Tolerances

Tolerance structure	Temperature	Tolerances	
		Typical	Maximum
Cold junction temperature drift	-25 °C to +60 °C	10 ppm/K	25 ppm/K
Total tolerance of the internal cold junction	+25 °C	±0.15 K	±1.76 K
	-25 °C to +60 °C	±0.85 K	±2.4 K

External PT 100 Cold Junctions

NI recommends an external cold junction when using external isothermal blocks or distributed terminal boxes. You can connect up to two Pt 100 sensors to the REM-11120.

Connection method	2-wire connection
Sensor type	Pt 100 DIN
R_0 (sensor resistance at T_A = 0 °C)	100 Ω
Measuring range	-100 °C to 400 °C
Resolution	
Process data	0.1 K/LSB
Floating point object	<0.001 K
Filter time	120 ms

Table 3. Tolerances of the External Pt100 Cold Junction Inputs

	Ambient temperature	Tolerances	
		Typical	Maximum
Tolerances	+25 °C	±0.3 K	±0.8 K
Drift	-25 °C to +60 °C	±10 ppm/K	±25 ppm/K

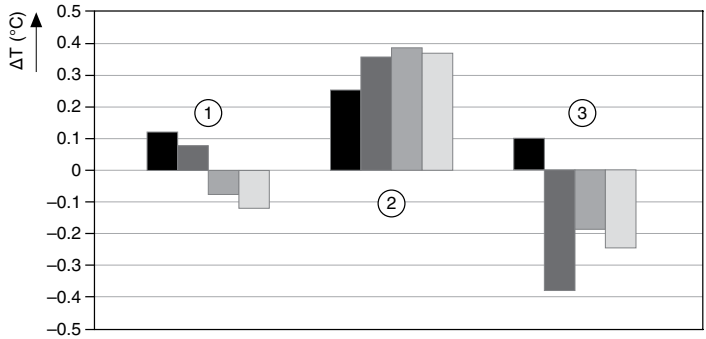
The data contains the offset error, gain error, and linearity error in its respective setting.

The drift data and the tolerances specified as a percentage refer to the measuring range final value of +400 °C.

Typical tolerance values are measured application values that are based on the maximum variance of all test objects.

The maximum tolerance values represent the worst-case measurement inaccuracy. They contain the theoretical maximum possible tolerances in the corresponding measuring ranges as well as the theoretical maximum possible tolerances of the calibration and test equipment. The data is valid for at least 24 months from delivery of the module. Thereafter the modules can be recalibrated by the manufacturer at any time.

Figure 4. Typical Tolerance Distribution[11]



1. Ambient temperature +25 °C
2. Ambient temperature +60 °C
3. Ambient temperature -25 °C

The diagram shows the typical tolerance distribution in the entire ambient temperature range of the module with external Pt 100 compensation and path calibration of the cold junction in the entire ambient temperature range of T_U = -25 °C to +60 °C.

Technical Data for ±5 V DC Voltage Input

Use this input to acquire additional voltage signals.

Connection method	2-wire connection
Measuring range	-5 V to +5 V
Resolution	16-bit
Quantization	166.7 µV/LSB
Filter time	120 ms
Input resistance	5 MΩ, typical

[11] Type K TC detection with external cold junction compensation and path calibration function for the cold junction

Table 4. Voltage Input Tolerances

	Temperature	Absolute		Relative	
		Typical	Maximum	Typical	Maximum
Tolerance	+25 °C	±1 mV	±10 mV	±0.02%	±0.20 %
	-25 °C to +60 °C	±2.3 mV	±15 mV	±0.05 %	±0.30%
Drift	-25 °C to +60 °C	±8 ppm/K	±20 ppm/K	—	—

Typical tolerance values are measured application values based on the maximum variance of all test objects.

The maximum tolerance values represent the worst-case measurement inaccuracy. They contain the theoretical maximum possible tolerances in the corresponding measuring ranges as well as the theoretical maximum possible tolerances of the calibration and test equipment. The data is valid for at least 24 months from delivery of the REM-11120. Thereafter the modules can be recalibrated by the manufacturer at any time.

Cycle times

Filter time	Channel conversion time for TC operation with internal compensation
120 ms	120 ms
100 ms	100 ms
60 ms	60 ms
40 ms	40 ms

Filter time	Typical scan repeat time for all four measuring channels[12]
120 ms	962 ms
100 ms	880 ms
60 ms	720 ms
40 ms	640 ms

[12] TC operation with internal cold junction compensation

Filter time	Typical scan repeat time for a measuring channel[13]
120 ms	600 ms
100 ms	580 ms
60 ms	540 ms
40 ms	520 ms

Tolerances Influenced by Electromagnetic Interference

Type of electromagnetic interference	Standard	Level	Additional tolerances of measuring range final value	Criterion
Electromagnetic fields	EN 61000-4-3/ IEC 61000-4-3	10 V/m	None	A
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	1.1 kV	None	A
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	150 kHz to 80 MHz, 10 V, 80% (1 kHz)	None	A

- The values determined apply for both shielded and unshielded twisted sensor cables.
- For all tested electromagnetic interferences, the measured values were within the maximum tolerances.

The values were determined under nominal conditions with the following sensor settings and sensor circuits:

- Thermocouple type K (NiCr-Ni) with internal cold junction compensation, filter = 120 ms
- External RTD sensor type Pt 100 as sensor input, filter = 120 ms
- -100 mV to +100 mV linear voltage signals, 1 µV/LSB resolution, filter = 120 ms

Note No additional tolerances occur due to the influence of high-frequency interference of wireless transmission systems.

[13] TC operation with internal cold junction compensation; channels 0 to 3 deactivated

Physical Characteristics

Note For more information about connecting your device, refer to the device getting started guide on *ni.com/manuals*

Spring-terminal wiring	
Gauge	0.2 mm^2 to 1.5 mm^2 (24 AWG to 16 AWG), solid or stranded
Wire strip length	8.0 mm (0.31 in.) of insulation stripped from the end
Wires per connection	1- wire
Dimensions[14]	126.1 mm (4.96 in.) × 35.0 mm (1.38 in.) × 54.0 mm (2.13 in.)
Weight[15]	144 g (5.08 oz)

Note For dimensional drawings of the REM-11120, visit *ni.com/dimensions* and search by module number.

Isolation Withstand Voltages

Test section	Test voltage
5 V communications power (logic), 24 V supply (I/O)	500 VAC, 50 Hz, 1 min.
5 V supply (logic) / analog inputs	500 VAC, 50 Hz, 1 min.
5 V supply (logic) / functional earth ground	500 VAC, 50 Hz, 1 min.
24 V supply (I/O) / analog inputs	500 VAC, 50 Hz, 1 min.
24 V supply (I/O) / functional earth ground	500 VAC, 50 Hz, 1 min.
Analog inputs / functional earth ground	500 VAC, 50 Hz, 1 min.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment.

- EN 61000-4-2 (IEC 61000-4-2): Electrostatic discharge (ESD); Criterion B; 6 kV contact discharge, 8 kV air discharge
- EN 61000-4-3 (IEC 61000-4-3): Electromagnetic fields; Criterion A; Field intensity: 10 V/m
- EN 61000-4-4 (IEC 61000-4-4): Fast transients (burst); Criterion B, 2 kV

[14] The depth is valid when a TH 35-7.5 DIN rail is used (according to EN 60715).
[15] With connectors and bus connector.

- EN 61000-4-5 (IEC 61000-4-5): Transient surge voltage (surge); Criterion B; DC supply lines: ±0.5 kV/±0.5 kV (symmetrical/asymmetrical); ±1 kV to shielded I/O cables
- EN 61000-4-6 (IEC 61000-4-6): Conducted interference; Criterion A; Test voltage 10 V
- EN 61000-6-2: Noise immunity
- EN 61000-6-3: Noise emission
- EN 55022: Radio interference properties; Class B

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

Shock and Vibration

Vibration resistance (EN/IEC 60068-2-6)	5 g
Shock (EN/IEC 60068-2-27)	30 g
Continuous shock (EN/IEC 60068-2-27)	10 g

Environmental

Operating temperature	-25 °C to 60 °C
Storage temperature	-40 °C to 85 °C
Ingress protection	IP20
Protection class	III, EN/IEC 61140, VDE 0140-1
Operating humidity	5% to 95%, non-condensing
Storage humidity	5% to 95%, non-condensing
Maximum altitude	3,000 m
Air pressure	70 kPa to 106 kPa

Indoor use only.

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