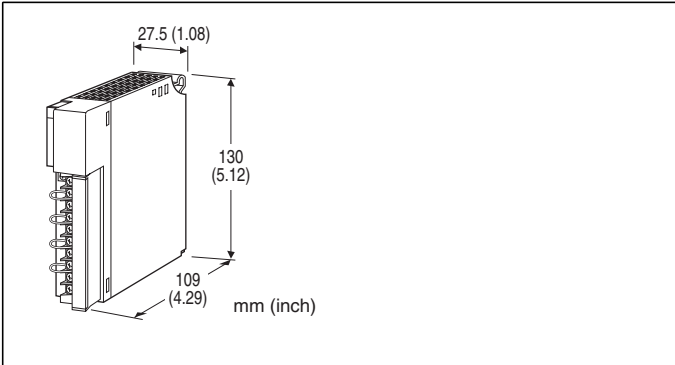


Remote I/O R3 Series

UNIVERSAL INPUT MODULE

(4 points, isolated)



MODEL: R3-US4[1][2]

ORDERING INFORMATION

- Code number: R3-US4[1][2]
- Specify a code from below for each of [1] and [2].
(e.g. R3-US4W/A/Q)
- Specify the specification for option code /Q
(e.g. /C01/SET)

Factory default setting

Input: DC voltage, ± 12 V

Temperature unit: °C

Burnout: Upscale

CJC: ON

NO. OF CHANNELS

4: 4

[1] COMMUNICATION MODE

S: Single

W: Dual

[2] OPTIONS (multiple selections)

Temperature input accuracy

blank: Standard

/A: High accuracy

Other Options

blank: none

/Q: Option other than the above (specify the specification)

SPECIFICATIONS OF OPTION: Q

COATING (For the detail, refer to M-System's web site.)

/C01: Silicone coating

/C02: Polyurethane coating

/C03: Rubber coating

EX-FACTORY SETTING

/SET: Preset according to the Ordering Information Sheet
(No. ESU-8449)

RELATED PRODUCTS

- PC configurator software (model: R3CON)

Downloadable at M-System's web site.

A dedicated cable is required to connect the module to the PC. Please refer to the internet software download site or the users manual for the PC configurator for applicable cable types.

GENERAL SPECIFICATIONS

Connection

Internal bus: Via the Installation Base (model: R3-BSx)

Input: M3 separable screw terminal (torque 0.5 N·m)

Internal power: Via the Installation Base (model: R3-BSx)

Screw terminal: Nickel-plated steel

Isolation: Input 1 to input 2 to input 3 to input 4 to internal bus or internal power

Input range: Selectable with configuration software (model: R3CON)

Temperature unit (Thermocouple or RTD input): Selectable with PC configuration software (model: R3CON)

Burnout for T/C and RTD input: Upscale, downscale or no burnout selectable with PC configurator software
Select "No burnout" to minimize the measuring errors caused by the sensor/wire resistance and the burnout sensing current. With RTD input, the signal may go transiently to the opposite direction from the burnout setting.

Burnout is not detected at DC voltage or potentiometer input. The burnout sensing current is turned off.

Cold junction compensation (CJC) for T/C input: CJC is selectable whether enabled or disabled by using the PC configurator software. The cold junction sensor is mounted to the terminal of each channel.

A/D conversion mode: (Temp. input accuracy: standard)
Low or middle conversion rate selectable with PC configurator software

RUN indicator: Bi-color (red/green) LED;
Red when the bus A operates normally;
Green when the bus B operates normally;
Amber when both buses operate normally.

ERR indicator: Bi-color (red/ green) LED;
Red with burnout; Green in normal operating conditions.

INPUT SPECIFICATIONS

■ DC Voltage

Input resistance: ≥ 600 k Ω

Except the case that the input voltage is out of -1.3 to +1.3 V for ± 60 mV, ± 125 mV, ± 250 mV, ± 500 mV and ± 1000 mV ranges

Input range: See Table 1.

■ Thermocouple

Input resistance: ≥ 600 k Ω

Input range: See Table 2-1 and 2-2. (standard accuracy), see Table 5 (high accuracy).

Burnout sensing

Upscale: ≤ 130 nA

Downscale: ≤ 220 nA

No burnout: ≤ 10 nA

■ RTD (3-wire)

Excitation: 1.25 V / (1.31 k Ω + load resistance across the terminals A - C)

Input range: See Table 3 (standard accuracy), see Table 6 (high accuracy).

Allowable leadwire resistance: 20 Ω per wire

■ Potentiometer

Excitation: 1.25 V / (1.31 k Ω + total resistance)

Total resistance: See Table 4.

Thermocouple K (CA), E (CRC), J (IC), N, L, P (Platinel II):

≤ 20 sec. for upscale

≤ 10 sec. for downscale

RTD or the other thermocouple types: ≤ 10 sec.

Insulation resistance: ≥ 100 M Ω with 500 V DC

Dielectric strength: 500 V peak @ 1 minute (input 1 to input 2 to input 3 to input 4 to internal bus or internal power)

2000 V AC @ 1 minute (power input to FG; isolated on the power supply module)

INSTALLATION

Operating temperature: -10 to +55°C (14 to 131°F)

Operating humidity: 30 to 90 %RH (non-condensing)

Atmosphere: No corrosive gas or heavy dust

Mounting: Installation Base (model: R3-BSx)

Weight: 210 g (0.46 lb)

PERFORMANCE

Conversion accuracy: See Table 1 through 6.

Conversion rate: See Table 1 through 6.

Data range

DC Voltage or potentiometer: 0 to 10000 for input range

Thermocouple or RTD (standard accuracy)

°C, absolute temperature: Engineering unit value $\times 10$ (integer)

°F: Engineering unit value (integer)

Thermocouple or RTD (high accuracy)

°C: Engineering unit value $\times 100$ (integer)

°F: Engineering unit value $\times 10$ (integer)

(Absolute temperature not available for high accuracy)

Data allocation: 4

Current consumption: 60 mA

Cold junction compensation error: ± 1.0 °C maximum (at 25°C ± 10 °C); ± 1.8 °F maximum (at 77°F ± 18 °F) (± 1.5 °C or ± 2.7 °F for R, S, PR)

Cold junction compensation is not available for B thermocouple.

Temp. coefficient: See Tables 1 through 6.

Burnout response

INPUT TYPE, RANGE, CONVERSION ACCURACY & TEMPERATURE COEFFICIENT

■ DC VOLTAGE

Table 1

VOLTAGE RANGE	CONVERSION RATE		TEMPERATURE COEFFICIENT
	CONVERSION ACCURACY (%)		
	Low (300ms)	Middle (210ms)	
±60mV	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±125mV	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±250mV	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±500mV	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±1000mV	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±3V	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±6V	±0.05	±0.08	±0.015%/°C (±0.008%/°F)
±12V	±0.05	±0.08	±0.015%/°C (±0.008%/°F)

■ THERMOCOUPLE

Table 2-1

THERMO-COUPLE	USABLE RANGE °C	CONFORMANCE RANGE °C	ACCURACY CONVERSION RATE "Low (300ms)/ Middle (210ms)"	BURNOUT (°C × 10)	TEMPERATURE COEFFICIENT
(PR)	-50 to +1860	400 to 1770	±4.6°C	-500, +18600	±0.087%/°C
K (CA)	-273 to +1470	0 to 1370	±1.5°C	-2750, +14700	±0.030%/°C
E (CRC)	-273 to +1020	0 to 1000	±0.8°C	-2750, +10200	±0.021%/°C
J (IC)	-260 to +1300	0 to 1200	±1.0°C	-2600, +13000	±0.024%/°C
T (CC)	-273 to +500	0 to 400	±1.3°C	-2750, +5000	±0.065%/°C
B (RH)	40 to 1920	700 to 1820	±7.2°C	400, 19200	±0.125%/°C
R	-100 to +1860	400 to 1760	±4.8°C	-1000, +18600	±0.088%/°C
S	-100 to +1860	400 to 1760	±5.3°C	-1000, +18600	±0.098%/°C
C (WRe5-26)	-50 to +2415	0 to 2320	±4.9°C	-500, +24150	±0.070%/°C
N	-273 to +1400	0 to 1300	±1.9°C	-2750, +14000	±0.040%/°C
U	-250 to +650	0 to 600	±1.3°C	-2500, +6500	±0.054%/°C
L	-250 to +1000	0 to 900	±1.0°C	-2500, +10000	±0.030%/°C
P (Platinel II)	-50 to +1495	0 to 1395	±1.7°C	-500, +14950	±0.041%/°C

Table 2-2

THERMO-COUPLE	USABLE RANGE °F	CONFORMANCE RANGE °F	ACCURACY CONVERSION RATE "Low (300ms)/ Middle (210ms)"	BURNOUT	TEMPERATURE COEFFICIENT
(PR)	-58 to +3380	752 to 3218	±8.3°F	-58°F, +3380 °F	±0.048%/°F
K (CA)	-459 to +2678	32 to 2498	±2.7°F	-463°F, +2678 °F	±0.017%/°F
E (CRC)	-459 to +1868	32 to 1832	±1.5°F	-463°F, +1868 °F	±0.012%/°F
J (IC)	-436 to +2372	32 to 2192	±1.8°F	-436°F, +2372 °F	±0.013%/°F
T (CC)	-459 to +932	32 to 752	±2.4°F	-463°F, +932 °F	±0.036%/°F
B (RH)	104 to 3488	1292 to 3308	±13°F	104°F, 3488 °F	±0.069%/°F
R	-148 to +3380	752 to 3200	±8.7°F	-148°F, +3380 °F	±0.049%/°F
S	-148 to +3380	752 to 3200	±9.6°F	-148°F, +3380 °F	±0.054%/°F
C (WRe5-26)	-58 to +4379	32 to 4208	±8.9°F	-58°F, +4379 °F	±0.039%/°F
N	-459 to +2552	32 to 2372	±3.5°F	-463°F, +2552 °F	±0.022%/°F
U	-418 to +1202	32 to 1112	±2.4°F	-418°F, +1202 °F	±0.030%/°F
L	-418 to +1832	32 to 1652	±1.8°F	-418°F, +1832 °F	±0.017%/°F
P (Platinel II)	-58 to +2723	32 to 2543	±3.1°F	-58°F, +2723 °F	±0.023%/°F

Note 1: Conversion accuracy is at 50µV emf.

Note 2: CJC error is not included.

■ RTD

Table 3 - 1

°C					
RTD	USABLE RANGE	CONFORMANCE RANGE	ACCURACY CONVERSION RATE "Low (600ms)/ Middle (420ms)"	BURNOUT (°C × 10)	TEMPERATURE COEFFICIENT
Pt 100 (JIS'89)	-240 to +900	-200 to +660	±1.1°C	-2400, +9000	±0.025%/°C
Pt 100 (JIS'97, IEC)	-240 to +900	-200 to +850	±1.3°C	-2400, +9000	±0.024%/°C
Pt 1000	-240 to +900	-200 to +850	±3.8°C	-2400, +9000	±0.077%/°C
Pt 50Ω (JIS'81)	-236 to +700	-200 to +649	±2.0°C	-2360, +7000	±0.021%/°C
JPt 100 (JIS'89)	-236 to +560	-200 to +510	±1.0°C	-2360, +5600	±0.022%/°C
Ni 100	-130 to +320	-80 to +260	±0.3°C	-1300, +3200	±0.016%/°C
Ni 120	-130 to +360	-80 to +260	±0.3°C	-1300, +3600	±0.016%/°C
Ni 508.4 Ω	-100 to +330	-50 to +280	±0.5°C	-1000, +3300	±0.029%/°C
Ni 1000	-56 to +152	-40 to +120	±1.8°C	-560, +1520	±0.077%/°C
Cu 50	-100 to +200	-50 to +150	±1.1°C	-1000, +2000	±0.021%/°C

Table 3 - 2

°F					
RTD	USABLE RANGE	CONFORMANCE RANGE	ACCURACY CONVERSION RATE "Low (600ms)/ Middle (420ms)"	BURNOUT	TEMPERATURE COEFFICIENT
Pt 100 (JIS'89)	-400 to +1652	-328 to +1220	±2.0°F	-400°F, +1652°F	±0.014%/°F
Pt 100 (JIS'97, IEC)	-400 to +1652	-328 to +1562	±2.4°F	-400°F, +1652°F	±0.013%/°F
Pt 1000	-400 to +1652	-328 to +1562	±6.9°F	-400°F, +1652°F	±0.043%/°F
Pt 50Ω (JIS'81)	-392 to +1292	-328 to +1200	±3.6°F	-393°F, +1292°F	±0.012%/°F
JPt 100 (JIS'89)	-392 to +1040	-328 to +950	±1.8°F	-393°F, +1040°F	±0.012%/°F
Ni 100	-202 to +608	-112 to +500	±0.6°F	-202°F, +608°F	±0.009%/°F
Ni 120	-202 to +680	-112 to +500	±0.6°F	-202°F, +680°F	±0.009%/°F
Ni 508.4 Ω	-148 to +626	-58 to +536	±0.9°F	-148°F, +626°F	±0.016%/°F
Ni 1000	-68 to +305	-40 to +248	±3.3°F	-69°F, +306°F	±0.043%/°F
Cu 50	-148 to +392	-58 to +302	±2.0°F	-148°F, +392°F	±0.012%/°F

■ POTENTIOMETER

Table 4

TOTAL RESISTANCE RANGE	CONVERSION RATE		TEMPERATURE COEFFICIENT
	CONVERSION ACCURACY (%)		
	Low (600ms)	Middle (420ms)	
Max. 200Ω	±0.12	±0.12	±0.005%/°C (±0.003%/°F)
Max. 500Ω	±0.14	±0.14	±0.005%/°C (±0.003%/°F)
Max. 5kΩ	±0.14	±0.14	±0.005%/°C (±0.003%/°F)

Note3: Potentiometer with total resistance of 50% minimum of the input total resistance range is recommended.

■ THERMOCOUPLE (HIGH ACCURACY)

Table 5

°C						
THERMOCOUPLE	USABLE RANGE	CONFORMANCE RANGE	CONVERSION ACCURACY	RESOLUTION	BURNOUT (°C×100)	TEMPERATURE COEFFICIENT
K(CA)	-50 to +150	-20 to +100	±0.5	0.01	-5000, +15000	± 0.064 %/°C
E(CRC)	-50 to +150	-20 to +100	±0.5	0.01	-5000, +15000	± 0.045 %/°C
J(IC)	-50 to +150	-20 to +100	±0.5	0.01	-5000, +15000	± 0.050 %/°C
T(CC)	-50 to +150	-20 to +100	±0.5	0.01	-5000, +15000	± 0.077 %/°C
°F						
THERMOCOUPLE	USABLE RANGE	CONFORMANCE RANGE	CONVERSION ACCURACY	RESOLUTION	BURNOUT (°F×10)	TEMPERATURE COEFFICIENT
K(CA)	-58 to +302	-4 to +212	±0.9	0.02	-580, +3020	± 0.036 %/°F
E(CRC)	-58 to +302	-4 to +212	±0.9	0.02	-580, +3020	± 0.025 %/°F
J(IC)	-58 to +302	-4 to +212	±0.9	0.02	-580, +3020	± 0.028 %/°F
T(CC)	-58 to +302	-4 to +212	±0.9	0.02	-580, +3020	± 0.043 %/°F

Conversion rate: 300 ms

Response time: Approx. 7 sec. (0 to 90 %)

CJC error is not included in conversion accuracy.

■ RTD (HIGH ACCURACY)

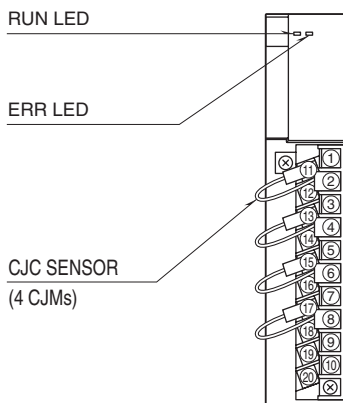
Table 6

°C						
RTD	USABLE RANGE	CONFORMANCE RANGE	CONVERSION ACCURACY	RESOLUTION	BURNOUT (°C×100)	TEMPERATURE COEFFICIENT
Pt 100 (JIS '89)	-50 to +150	-20 to +100	± 0.3	0.01	-5000, +15000	± 0.015 %/°C
Pt 100 (JIS '97, IEC)	-50 to +150	-20 to +100	± 0.3	0.01	-5000, +15000	± 0.015 %/°C
Pt 50Ω (JIS '81)	-50 to +150	-20 to +100	± 0.3	0.01	-5000, +15000	± 0.024 %/°C
JPt 100 (JIS '89)	-50 to +150	-20 to +100	± 0.3	0.01	-5000, +15000	± 0.015 %/°C
°F						
RTD	USABLE RANGE	CONFORMANCE RANGE	CONVERSION ACCURACY	RESOLUTION	BURNOUT (°F×10)	TEMPERATURE COEFFICIENT
Pt 100 (JIS '89)	-58 to +302	-4 to +212	±0.5	0.02	-580, +3020	± 0.008 %/°F
Pt 100 (JIS '97, IEC)	-58 to +302	-4 to +212	±0.5	0.02	-580, +3020	± 0.008 %/°F
Pt 50Ω (JIS '81)	-58 to +302	-4 to +212	±0.5	0.02	-580, +3020	± 0.013 %/°F
JPt 100 (JIS '89)	-58 to +302	-4 to +212	±0.5	0.02	-580, +3020	± 0.008 %/°F

Conversion rate: 600 ms

Response time: Approx. 7 sec. (0 to 90 %)

EXTERNAL VIEW



INPUT DATA DESCRIPTIONS

■ UNIVERSAL INPUT DATA (SCALING CONVERSION DATA)

16-bit binary data.

When scaling setting is initial value, 0 to 10000, data is 0 to 10000 for input 0 to 100% setting.

Input range is -10 to +110% (-1000 to +11000). When out of input range, it is fixed to -1000 or 11000.

Minus value is converted into negative values, represented in 2's complements.



■ UNIVERSAL INPUT DATA (TEMPERATURE DATA)

16-bit binary data.

• Temperature input accuracy is 'Standard'

With °C temperature unit or K temperature unit, raw data is multiplied by 10. For example, 25.5°C is converted into 255.

With °F temperature unit, the integer section of raw data is directly converted into the data.

For example, 135.4°F is converted into 135.

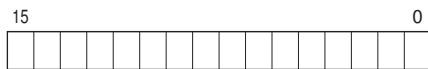
Minus temperature is converted into negative values, represented in 2's complements.

• Temperature input accuracy is 'High accuracy (Option code /A)'

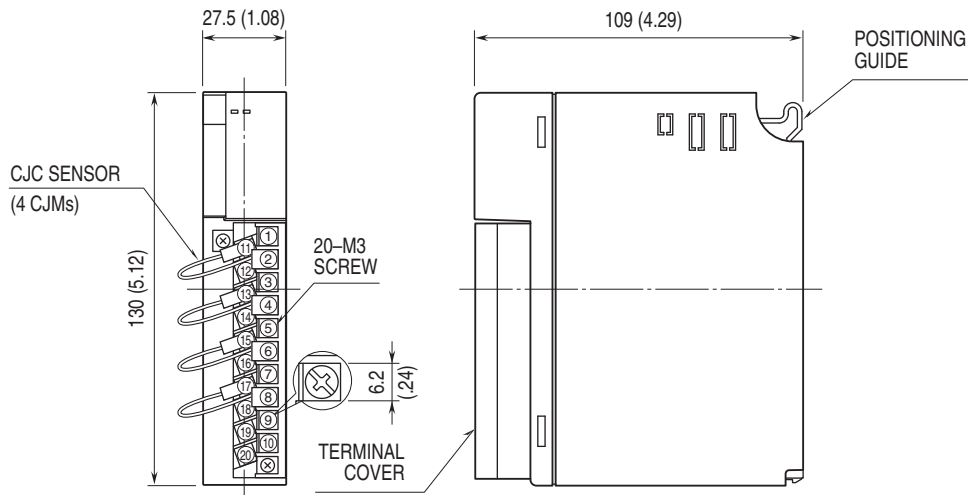
With °C temperature unit, raw data is multiplied by 100. For example, 25.5°C is converted into 2550.

With °F temperature unit, raw data is multiplied by 10. For example, 135.4°F is converted into 1354.

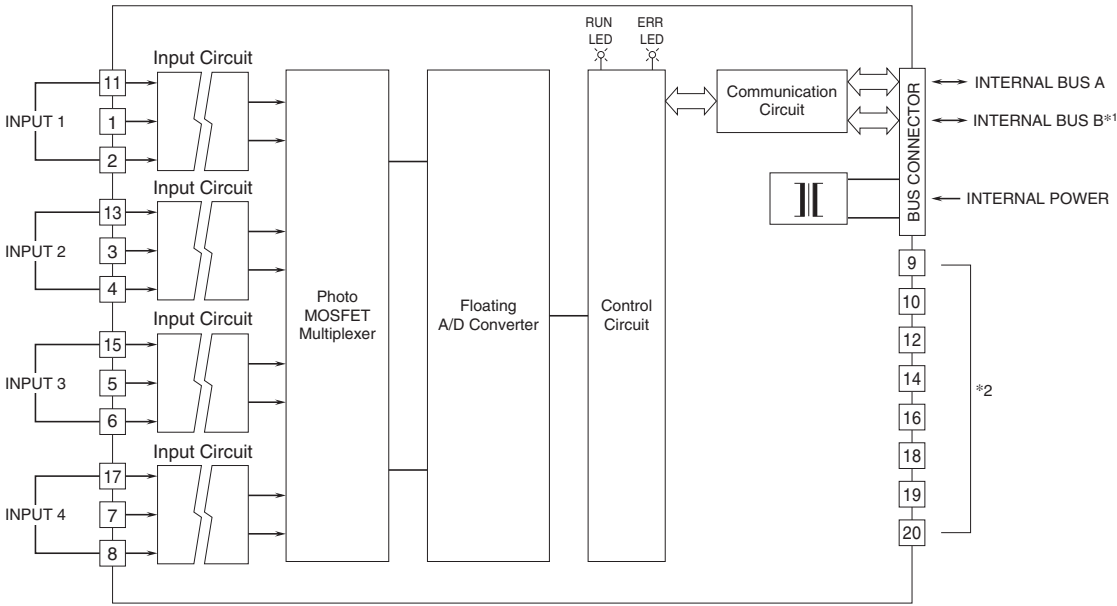
Minus temperature is converted into negative values, represented in 2's complements.



EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)



SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM



*1. For dual redundant communication.
 *2. DO NOT connect the terminals 9, 10, 12, 14, 16, 18, 19 and 20.

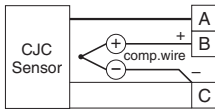
INPUT CONNECTION

DC VOLTAGE

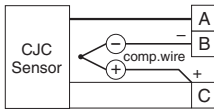


THERMOCOUPLE

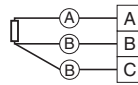
• Upscale/no burnout



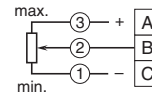
• Downscale burnout



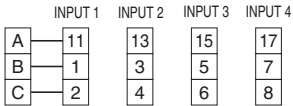
RTD



POTENTIOMETER



TERMINAL NETWORK



Note 1: Remove CJC sensor for RTD or potentiometer input. The CJC sensor does not affect to DC voltage input.

Note 2: Be sure to eliminate noise as much as possible by e.g. using shielded cables. Ground the signal shield to a most stable earth point in the environment.

Note 3: The temperature imbalance around the terminal affects greatly the cold junction compensation accuracy.

In order to minimize such imbalance, do not expose the input terminals directly to the wind from a cooling fan.



Specifications are subject to change without notice.