

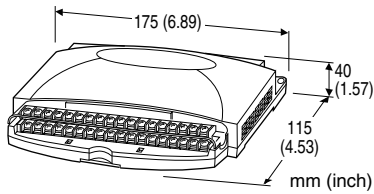
Remote I/O R1M Series

THERMOCOUPLE & DC INPUT MODULE

(8 points, isolated)

Functions & Features

- 8-point thermocouple or DC inputs
- Complete channel-to-channel isolation
- Trigger input and alarm contact output
- Filtering protection against 50/60 Hz noise
- Modbus RS-485 and RS-232-C interface
- Easy system expansion via Modbus RTU



MODEL: R1MS-GH3T-[1]

ORDERING INFORMATION

- Code number: R1MS-GH3T-[1]
- Specify a code from below for [1]
e.g. R1MS-GH3T-M2

FIELD TERMINAL TYPE

T: M3 screw terminals

[1] POWER INPUT

AC Power

M2: 100 - 240 V AC (Operational voltage range 85 - 264 V, 47 - 66 Hz)

DC Power

R: 24 V DC

(Operational voltage range 24 V \pm 10 %, ripple 10 %p-p max.)

RELATED PRODUCTS

- Resistor module (model: REM3-250)
 - R1X configurator software (model: R1CON)
- 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

Power input, transmission: Euro type connector terminal (wire size 0.14 - 1.5 mm² or AWG26 - 16 for both stranded and solid wires)

RS-232-C: 9-pin D-sub connector (male, lock screw No. 4-40 UNC)

I/O: M3 screw terminals (torque 0.6 N·m)

PC Configurator: Miniature jack, RS-232-C level

Isolation: Input 1 to input 2 to input 3 to input 4 to input 5 to input 6 to input 7 to input 8 to trigger input to alarm output to RS-232-C or RS-485 or configurator jack to power to FG

Burnout: Upscale, downscale or no burnout selectable with the operating mode setting rotary switch (default: No). Set to 'No Burnout' when other devices are connected in parallel to the R1MS.

Operating mode setting: Rotary switch; burnout type and line noise frequency setting

Line noise filtering: Specifying line frequency to 50 Hz or 60 Hz in order to increase normal mode noise rejection ratio. (default: 50/60 Hz for use with both frequencies)

Node address setting: Rotary switch; 1 - F (15 nodes)

RUN indicator LED: Green light blinks in normal conditions.

COMMUNICATION

Baud rate: 38.4 kbps

Communication: Half-duplex, asynchronous, no procedure

Protocol: Modbus RTU

Refer to Modbus Protocol Reference Guide (EM-5650) for supported functions.

■ RS-232-C

Standard: Conforms to RS-232-C, EIA

Transmission distance: 10 meters max.

■ RS-485

Standard: Conforms to RS-485, EIA

Transmission distance: 500 meters max.

Transmission media: Shielded twisted-pair cable (CPEV-S 0.9 dia.)

INPUT SPECIFICATIONS

Input: Thermocouple or DC input within \pm 10 V, 8 points

• Input resistance

Thermocouple: \geq 1 M Ω when powered;

\geq 200 k Ω when not powered

DC: \geq 800 k Ω when powered;

\geq 700 k Ω when not powered

Thermocouple types: PR, K, E, J, T, B, R, S, C, N, U, L, P

Sampling rate: 50 millisecc./8 points

• **Trigger input:** Dry contact; ON detected at \leq 1.5 V

Sensing: Approx. 3 V DC @ 0.8 mA

• **Burnout detecting:** \leq 45 nA for upscale or downscale;

≤ 5 nA with no burnout (when measuring 0°C)

Burnout response: ≤ 10 seconds

OUTPUT SPECIFICATIONS

- **Alarm Output:** Photo MOSFET relay (no polarity);
≤ 50 Ω at ON, ≥ 1 MΩ at OFF; OFF when not powered
- Peak load voltage:** 50 V max.
- Continuous load current:** 50 mA max.
- Peak load current:** 300 mA max. (≤0.1 sec.)

INSTALLATION

Power consumption

- **AC:** Approx. 9 VA
- **DC:** Approx. 3.5 W

Operating temperature: -5 to +60°C (23 to 140°F)

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

Mounting: Surface or DIN rail

Weight: 450 g (0.99 lbs)

PERFORMANCE (% of measuring range)

Accuracy

DC input: ±0.05 % (±10 mV)

Thermocouple input: See the table below.

Cold junction compensation error: (°C)

≤ ±(1.0 + [Ambient Temp. - 20] × 0.04) in stable ambient temperature (e.g. ±1.4°C at 10°C and 30°C)

Sudden ambient temperature change affects the cold junction compensation. Be sure to place the R1MS in stable ambient.

Temp. coefficient: ≤ (Accuracy / 4) / °C

(e.g. DC: ±0.0125 %/°C or ±2.5 mV/°C,

TC: ±12.5 μV/°C, ±0.2°C/°C with type E)

Response time: Approx. 0.55 sec. (0 - 90 %)

Insulation resistance: ≥ 100 MΩ with 500 V DC

Dielectric strength: 1500 V AC @ 1 minute

(input 1 to input 2 to input 3 to input 4 to input 5 to input 6 to input 7 to input 8 to trigger input to alarm output to RS-232-C or RS-485 or configurator jack)

2000 V AC @ 1 minute (input or alarm output or RS-232-C or RS-485 or configurator jack to power to FG)

Normal mode noise rejection: ≥ 85 dB (50/60 Hz) with the filtering set to a specific frequency; ≥ 35 dB with 50/60 Hz setting

Common mode noise rejection: ≥ 120 dB (50/60 Hz)

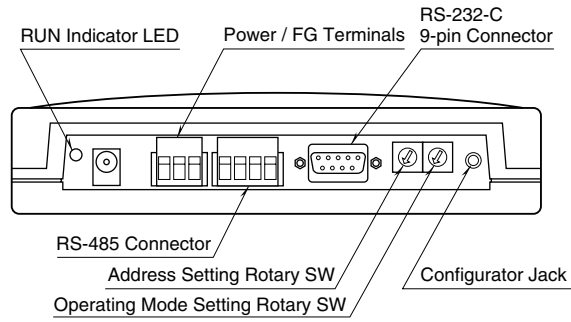
Accuracy (T/C)

| T/C | USABLE RANGE (°C) | CONFORMANCE RANGE (°C) | ACCURACY (°C) |
|-----------------|-------------------|------------------------|---------------|
| (PR) | 0 to 1770 | 400 to 1770 | ±4.6 |
| K (CA) | -270 to +1370 | 0 to 1370 | ±1.5 |
| E (CRC) | -270 to +1000 | 0 to 1000 | ±0.8 |
| J (IC) | -210 to +1200 | 0 to 1200 | ±1.0 |
| T (CC) | -270 to +400 | 0 to 400 | ±1.3 |
| B (RH) | 100 to 1820 | 700 to 1820 | ±7.2 |
| R | -50 to +1760 | 400 to 1760 | ±4.8 |
| S | -50 to +1760 | 400 to 1760 | ±5.3 |
| C (WRe 5-26) | 0 to 2320 | 0 to 2320 | ±4.9 |
| N | -270 to +1300 | 0 to 1300 | ±1.9 |
| U | -200 to +600 | 0 to 600 | ±1.3 |
| L | -200 to +900 | 0 to 900 | ±1.0 |
| P (Platinel II) | 0 to 1395 | 0 to 1395 | ±1.7 |
| T/C | USABLE RANGE (°F) | CONFORMANCE RANGE (°F) | ACCURACY (°F) |
| (PR) | 32 to 3218 | 752 to 3218 | ±8.28 |
| K (CA) | -454 to +2498 | 32 to 2498 | ±2.7 |
| E (CRC) | -454 to +1832 | 32 to 1832 | ±1.44 |
| J (IC) | -346 to +2192 | 32 to 2192 | ±1.8 |
| T (CC) | -454 to +752 | 32 to 752 | ±2.34 |
| B (RH) | 212 to 3308 | 1292 to 3308 | ±13.0 |
| R | -58 to +3200 | 752 to 3200 | ±8.64 |
| S | -58 to +3200 | 752 to 3200 | ±9.54 |
| C (WRe 5-26) | 32 to 4208 | 32 to 4208 | ±8.82 |
| N | -454 to +2372 | 32 to 2372 | ±3.42 |
| U | -328 to +1112 | 32 to 1112 | ±2.34 |
| L | -328 to +1652 | 32 to 1652 | ±1.8 |
| P (Platinel II) | 32 to 2543 | 32 to 2543 | ±3.06 |

Note 1: Measuring accuracy at 50μV emf.

Note 2: CJC error is not included.

EXTERNAL VIEW

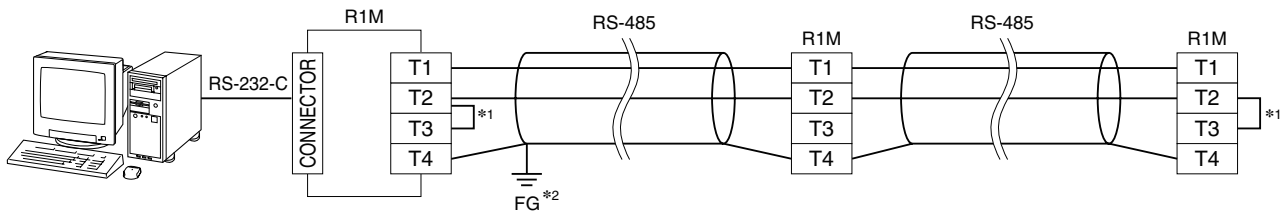


■ RS-232-C INTERFACE



| ABBR. | PIN NO. | EXPLANATION OF FUNCTION |
|---------|---------|--|
| BA (SD) | 2 | Transmitted Data |
| BB (RD) | 3 | Received Data |
| AB (SG) | 5 | Signal Common |
| CB (CS) | 7 | Clear to Send |
| CA (RS) | 8 | Request to Send |
| | 1 | Not Used. |
| | 4 | DO NOT connect. Connecting may cause malfunctions. |
| | 6 | |
| | 9 | |

COMMUNICATION CABLE CONNECTIONS

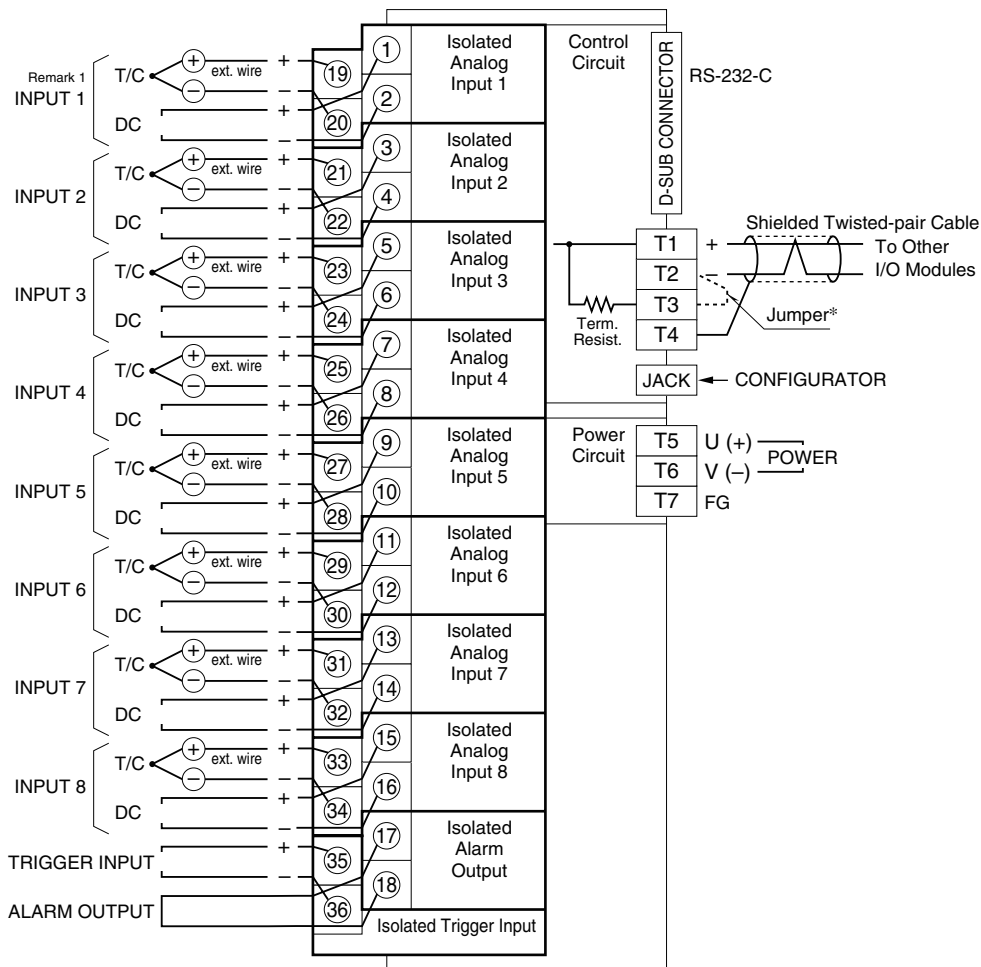


- *1. Internal terminating resistor is used when the device is at the end of a transmission line.
- *2. Install shielded cables to all sections and ground them at single point.

CONNECTION DIAGRAM

Note: In order to improve EMC performance, bond the FG terminal to ground.

Caution: FG terminal is NOT a protective conductor terminal.



* When the device is located at the end of a transmission line via twisted-pair cable, (when there is no cross-wiring), close across the terminal T2 – T3 with the attached jumper pin (or with a leadwire). When the device is not at the end, remove the jumper pin.

Note 1: Separate sets of terminals for DC and TC are assigned to each channel, however, DO NOT connect to both sets of terminals at once. Duplicate connection may affect measuring accuracies. DC and TC can be mixed among eight channels.

Note 2: Be careful to eliminate noise as much as possible by e.g. using shielded cables.

Note 3: Be sure to earth the FG terminal and the cable shielding to a most stable earth point in the environment.

Note 4: Resistor modules (model: REM3-250) can be used to convert current inputs into voltage. However, use of REM3 is not recommended when TC inputs are mixed because the heat developed on and around the REM3 affects the cold junction compensation performance.

MODBUS COMMUNICATION

■ COMMUNICATION PARAMETERS

| PARAMETER | SPECIFICATION |
|---------------------|------------------------------|
| Data Mode | RTU |
| Baud Rate | 9600 / 19200 / 38400 (*) bps |
| Parity | None / Odd (*) / Even |
| Bit Length | 8 |
| Stop Bit | 1 (*) / 2 |
| Node Address | 1 (*) to 15 |
| Floating Point Data | N/A |
| Interface | RS-232-C/ RS-485 |

(*) Ex-factory setting

■ FUNCTION CODES & SUPPORTED CODES

| CODE | NAME | | |
|------|---------------------------|---|---|
| 01 | Read Coil Status | X | Digital output from the slave |
| 02 | Read Input Status | X | Status of digital inputs to the slave |
| 03 | Read Holding Registers | X | General purpose register within the slave |
| 04 | Read Input Registers | X | Collected data from the field by the slave |
| 05 | Force Single Coil | X | Digital output from the slave |
| 06 | Preset Single Registers | X | General purpose register within the slave |
| 07 | Read Exception Status | | |
| 08 | Diagnostics | | |
| 09 | Program 484 | | |
| 10 | Poll 484 | | |
| 11 | Fetch Comm. Event Counter | | Fetch a status word and an event counter |
| 12 | Fetch Comm. Event Log | | A status word, an event counter, a message count and a field of event bytes |
| 13 | Program Controller | | |
| 14 | Poll Controller | | |
| 15 | Force Multiple Coils | X | Digital output from the slave |
| 16 | Preset Multiple Registers | X | General purpose register within the slave |
| 17 | Report Slave ID | | Slave type / 'RUN' status |
| 18 | Program 884/M84 | | |
| 19 | Reset Comm. Link | | |
| 20 | Read General Reference | | |
| 21 | Write General Reference | | |
| 22 | Mask Write 4X Register | | |
| 23 | Read/Write 4X Register | | |
| 24 | Read FIFO Queue | | |

■ DATA ADDRESS

| | ADDRESS | DATA FORMAT | NAME | |
|-----------------------|-----------|-------------------------|--|---|
| Coil (0X) | 1 – 32 | bit | DO: Alarm (Only Address 10001 is enabled.) | |
| | 33 – 40 | bit | Cold junction compensation SW (0: Disable, 1: Enable) *1 | |
| Input Status (1X) | 1 – 32 | bit | DI: Trigger contact input (Only Address 10001 is enabled.) | |
| | 33 – 40 | bit | ADC overrange | |
| Input Register (3X) | 1 – 8 | I | AI per channel in engineering unit (DC: x 1000, TC: x 10) | |
| | 17 – 32 | F | AI per channel in engineering unit | |
| | 33 – 48 | F | Calibrated voltage value | |
| | 49 – 64 | F | Cold junction temperature *2 | |
| | 65 – 72 | F | Temperature measured at Ch.1 thr. 4 | |
| | 81 – 88 | I | Channel status | |
| | 513 | I | Bit | System Status |
| | | | 0 to 5 | Reserved for system use |
| | | | 6 | E ² PROM diagnostics (0: Normal, 1: Error) |
| | | | 7 | ADC error (0: Normal, 1: Error) |
| | 8 to 15 | Reserved for system use | | |
| 514 – 521 | B16 | Model No. | | |
| 522 – 529 | B16 | Serial No. | | |
| 530 – 537 | B16 | Hardware version No. | | |
| 538 – 545 | B16 | Firmware version No. | | |
| Holding Register (4X) | 49 – 50 | F | Input filter time constant (seconds) *3 | |
| | 145 – 152 | I | I/O type No. | |
| | 514 | I | Burnout type (0: No burnout, 1: Upscale, 2: Downscale) *1 | |
| | 515 | I | Line noise filtering type (0: 50/60 Hz, 1: 50 Hz, 2: 60 Hz) *1 | |

bit = 1 bit, I = 16-bit integer, F = 32-bit floating, B16 = 16-byte character

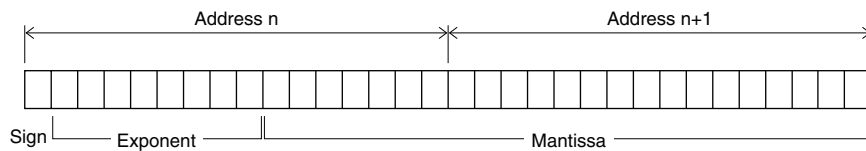
*1. Changeable only when the mode SW is set to 0 for R1MS-GH3.

*2. Thermocouple input only.

*3. Effective for large noise in the input signal. 0 sec. = No Filtering.

■ INPUT DATA

- 32-bit Floating



■ INPUT REGISTERS DESCRIPTION

(1) ANALOG INPUT IN ENGINEERING UNIT (30017 to 30032)

Indicates analog input values in engineering unit for each channel (1 – 8). The unit is specific to each input type: °C for temperature, Volts for voltage. The data are 32-bit floating values, which requires two consecutive registers for one module.

(2) CHANNEL STATUS (30081 to 30088)

Indicates the current status of analog inputs (1 – 8). The following list shows the names and descriptions of each bit.

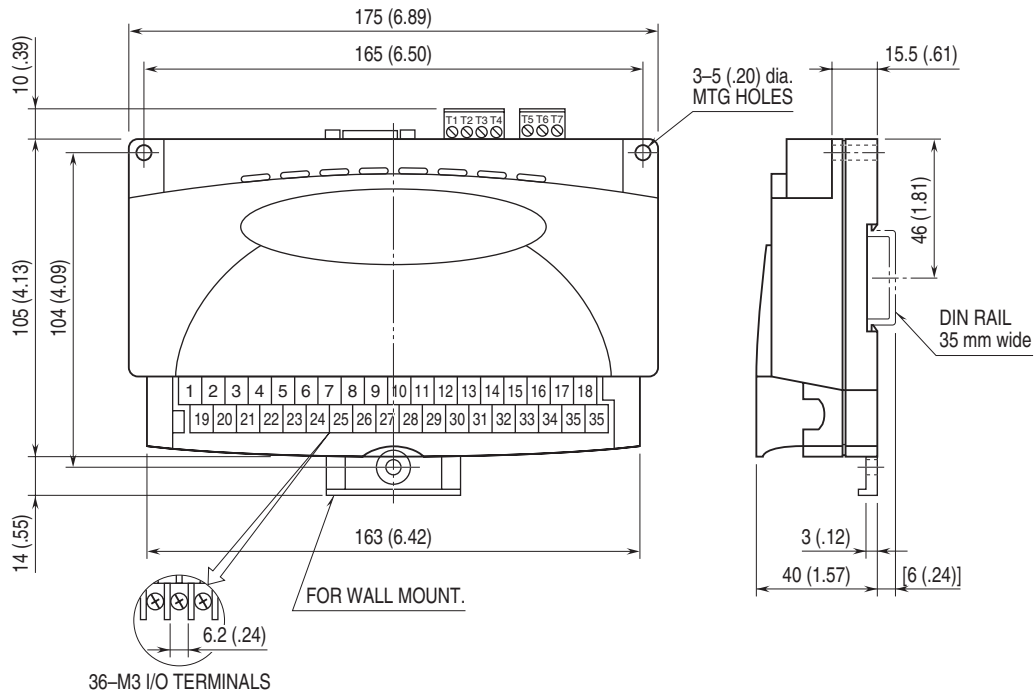
| BIT | NAME | DESCRIPTION |
|--------|-------------------------------|--|
| 6 | Input Overage | Indicates the designated analog input is in overrange, defined as one or more of the following condition: <ul style="list-style-type: none"> • ADC input value 0X0000 or 0XFFFF • Burnout status for thermocouple input • Out of range defined in the temperature table (thermocouple) • ADC error 0 : Normal 1 : Overage |
| 7 | ADC Error | Indicates the status of ADC. 0 : Normal 1 : Error |
| 12 | Cold Junction Compensation SW | Indicates whether the cold junction compensation is enabled or disabled, for thermocouple input. 0 : Disable 1 : Enable |
| Others | Reserved | For system's use |

■ INPUT REGISTERS DESCRIPTION

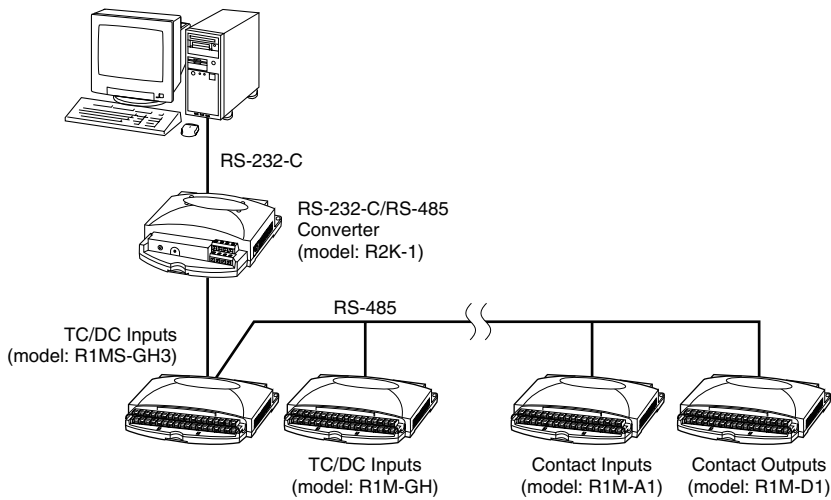
Indicates I/O type for each channel. The data are 16-bit integer values.

| MODEL | I/O | I/O TYPE | SELECTION | USABLE RANGE | NOTES |
|--------------------------------|-----------|---------------|----------------------|------------------|-----------|
| R1MS-GH3 R2M-2G3 | DC input | 0X00 | -10 to 10 V | -10 to 10 V | |
| R1M-GH2 | DC input | 0X00 | -20 to 20 V | -22.7 to 22.7 V | ATT SW ON |
| | | 0X01 | -5 to 5 V | -5.6 to 5.6 V | ATT SW ON |
| | | 0X02 | -1 to 1 V | -1.4 to 1.4 V | ATT SW ON |
| | | 0X03 | -800 to 800 mV | -860 to 860 mV | |
| | | 0X04 | -200 to 200 mV | -215 to 215 mV | |
| | | 0X05 | -50 to 50 mV | -53 to 53 mV | |
| | | 0X06 | -10 to 10 mV | -13.4 to 13.4 mV | |
| R1M-GH2 R1MS-GH3 R2M-2H3 | T/C input | 0X10 | (PR) | 0 to 1770 °C | |
| | | 0X11 | K (CA) | -270 to 1370 °C | |
| | | 0X12 | E (CRC) | -270 to 1000 °C | |
| | | 0X13 | J (IC) | -210 to 1200 °C | |
| | | 0X14 | T (CC) | -270 to 400 °C | |
| | | 0X15 | B (RH) | 100 to 1820 °C | |
| | | 0X16 | R | -50 to 1760 °C | |
| | | 0X17 | S | -50 to 1760 °C | |
| | | 0X18 | C (WRe 5-26) | 0 to 2320 °C | |
| | | 0X19 | N | -270 to 1300 °C | |
| | | 0X1A | U | -200 to 600 °C | |
| | | 0X1B | L | -200 to 900 °C | |
| | | 0X1C | P (Platinel II) | 0 to 1395 °C | |
| R1M-J3 | RTD input | 0X30 | JPt 100 (JIS '89) | -200 to 500 °C | |
| | | 0X31 | Pt 100 (JIS '89) | -200 to 660 °C | |
| | | 0X32 | Pt 100 (JIS '97/IEC) | -200 to 850 °C | |
| | | 0X33 | Pt 50Ω (JIS '81) | -200 to 649 °C | |
| | | 0X34 | Ni 508.4Ω | -50 to 280 °C | |
| | 0X35 | Pt 1000 | -200 to 850 °C | | |
| | POT input | 0X40 | 0 to 100 ohms | 0 to 100 % | |
| | | 0X41 | 0 to 500 ohms | 0 to 100 % | |
| | | 0X42 | 0 to 1k ohms | 0 to 100 % | |
| 0X43 | | 0 to 10k ohms | 0 to 100 % | | |
| R1M-D1 | DO | 0X60 | | | |
| R1M-A1 | DI | 0X70 | | | |

EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)



SYSTEM CONFIGURATION EXAMPLES



When the cable distance between the PC and the R1Ms is long, insert an RS-232-C/RS-485 Converter for isolation.



Specifications are subject to change without notice.