

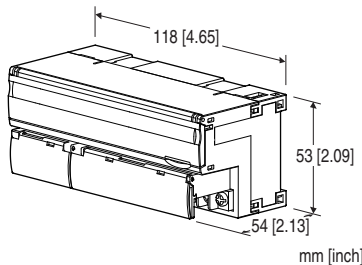
Remote I/O R7 Series

MECHATROLINK I/O MODULE

(thermocouple input, 4 points, isolated, MECHATROLINK-I / -II use)

Functions & Features

- 4 points thermocouple input module for MECHATROLINK -I/-II
- Extension module can be connected
- Input sensor can be selected with the front DIP switches for all channels
- Individual channels, zero adjustment, span adjustment, and scaling can be set with the configurator software (model: R7CON)



MODEL: R7ML-TS4-R[1]

ORDERING INFORMATION

- Code number: R7ML-TS4-R[1]
Specify a code from below for [1].
(e.g. R7ML-TS4-R/Q)
- Specify the specification for option code /Q
(e.g. /C01)

I/O TYPE

TS4: Thermocouple input, 4 points

POWER INPUT

DC Power

R: 24 V DC

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

[1] OPTIONS

blank: none

/Q: With options (specify the specification)

SPECIFICATIONS OF OPTION: Q

COATING (For the detail, refer to our web site.)

/C01: Silicone coating

/C02: Polyurethane coating

/C03: Rubber coating

RELATED PRODUCTS

- PC Configurator cable (model: MCN-CON or COP-US)
- PC configurator software (model: R7CON)
Downloadable at our web site.
- Discrete input extension module (model: R7ML-EAx)
- Discrete output extension module (model: R7ML-ECx)

GENERAL SPECIFICATIONS

Connection

MECHATROLINK: MECHATROLINK-I/-II connector

Power input, input: M3 separable screw terminal (torque 0.5 N·m)

Solderless terminal: Refer to the drawing at the end of the section.

Recommended manufacturer: Japan Solderless Terminal MFG. Co., Ltd., Nichifu Co., Ltd.

Applicable wire size: 0.25 to 1.65 mm² (AWG 22 to 16)

Screw terminal: Nickel-plated steel

Housing material: Flame-resistant resin (gray)

Isolation: Input 0 to input 1 to input 2 to input 3 to MECHATROLINK or FG to power

Zero adjustments: Configurable via R7CON

Span adjustments: Configurable via R7CON

Extension: No extension (*), Discrete input 8 or 16 points, Discrete output 8 or 16 points

Selectable with the front DIP SW

(*) Factory default setting

Conversion rate: Selectable with the front DIP SW

Thermocouple setting: Configurable via the front DIP switch or R7CON

Burnout setting: Selectable between upscale (*) and downscale with the front DIP switch

(*) Factory default setting

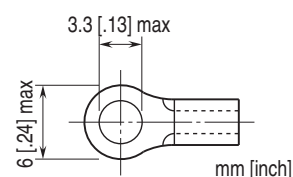
Linearization: Standard

Cold junction compensation: CJC sensor attached to the input terminals

Status indicator LEDs: PWR, RUN, ERR, SD, RD
(Refer to the instruction manual)

Configurator connection: 2.5 dia. miniature jack

■Recommended solderless terminal



MECHATROLINK COMMUNICATION

MECHATROLINK mode: Set with DIP switches
(MECHATROLINK-I or -II, data length; Factory default setting:
MECHATROLINK-II; data length (17 bytes)
(Refer to the instruction manual)

Station address: 60H - 7FH

(Function selected with Rotary SW. Factory default setting:
60H) (Refer to the instruction manual)

MECHATROLINK-I

Baud rate: 4 Mbps

Transmission distance: 50 m max.

Distance between stations: 30 cm min.

Transmission media: MECHATROLINK cable (Model JEPMC-
W6003-x-E, Yaskawa Controls Co., Ltd.)

Max. number of Subordinate Devices: 15

(The maximum number of Subordinate Devices might
change depending on the Main Device unit. Refer to the
manual of the Main Device unit)

Transmission cycle: 2 msec. (fixed)

Data length: 17 bytes

MECHATROLINK-II

Baud rate: 10 Mbps

Transmission distance: 50 m max.

Distance between stations: 50 cm min.

Transmission media: MECHATROLINK cable (Model JEPMC-
W6003-x-E, Yaskawa Controls Co., Ltd.)

Max. number of Subordinate Devices: 30

(The maximum number of Subordinate Devices might
change depending on the Main Device unit. Refer to the
manual of the Main Device unit)

Transmission cycle: 0.5 msec., 1 msec., 1.5 msec., 2 msec.,
4 msec., 8 msec.

Data length: 17 bytes / 32 bytes selectable (Must choose
identical data size for all stations on one network)

INPUT SPECIFICATIONS

Input resistance: $\geq 30 \text{ k}\Omega$

Burnout sensing: $\leq 0.1 \mu\text{A}$

T/C	BURNOUT INDICATION (°C)		CONFORMANCE RANGE (°C)
	Downscale	Upscale	
K (CA)	-272	+1472	-150 to +1370
E (CRC)	-272	+1120	-170 to +1000
J (IC)	-260	+1300	-180 to +1200
T (CC)	-272	+ 500	-170 to + 400
B (RH)	24	1920	1000 to 1760
R	-100	+1860	380 to 1760
S	-100	+1860	400 to 1760
C (WRe 5-26)	-52	+2416	100 to 2315
N	-272	+1400	-130 to +1300
U	-252	+ 700	-200 to +600
L	-252	+1000	-200 to +900
P (Platinel II)	-52	+1496	0 to 1395
(PR)	-52	+1860	300 to 1760

T/C	BURNOUT INDICATION (°F)		CONFORMANCE RANGE (°F)
	Downscale	Upscale	
K (CA)	-458	+2682	-238 to +2498
E (CRC)	-458	+2048	-274 to +1832
J (IC)	-436	+2372	-292 to +2192
T (CC)	-458	+932	-274 to +752
B (RH)	75	3488	1832 to 3200
R	-148	+3380	716 to 3200
S	-148	+3380	752 to 3200
C (WRe 5-26)	-62	+4381	212 to 4199
N	-458	+2552	-202 to +2372
U	-422	+1292	-328 to +1112
L	-422	+1832	-328 to +1652
P (Platinel II)	-62	+2725	32 to 2543
(PR)	-62	+3380	572 to 3200

INSTALLATION

Current consumption

• DC: Approx. 70 mA

Operating temperature: 0 to 55°C (32 to 131°F)

Storage temperature: -20 to +65°C (-4 to +149°F)

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

Atmosphere: No corrosive gas or heavy dust

Mounting: DIN rail (35 mm rail)

Weight: 220 g (0.49 lb)

PERFORMANCE

Conversion accuracy: $\pm 1^\circ\text{C}$ ($\pm 1.8^\circ\text{F}$) except $\pm 2^\circ\text{C}$ ($\pm 3.6^\circ\text{F}$)
for B, R, S, C, PR

Conversion rate: 250 msec. (*) or 1 sec. selectable
(*) Factory default setting

Converted data range:

- Engineering unit value ($^\circ\text{C}$, K) $\times 10$ (integer)
- Engineering unit value ($^\circ\text{F}$)

Cold junction compensation error:

$\pm 1.0^{\circ}\text{C}$ at $25 \pm 10^{\circ}\text{C}$ ($\pm 1.8^{\circ}\text{F}$ at $77 \pm 18^{\circ}\text{F}$)

$\pm 1.5^{\circ}\text{C}$ ($\pm 2.7^{\circ}\text{F}$) for R, S, PR

Temp. coefficient: $\pm 0.015\text{ }^{\circ}\text{C}/^{\circ}\text{C}$ ($\pm 0.008\text{ }^{\circ}\text{C}/^{\circ}\text{F}$) of max. span

Response time: Conversion rate $\times 2 + 50\text{ msec.}$ (0 - 90 %)

Insulation resistance: $\geq 100\text{ M}\Omega$ with 500 V DC

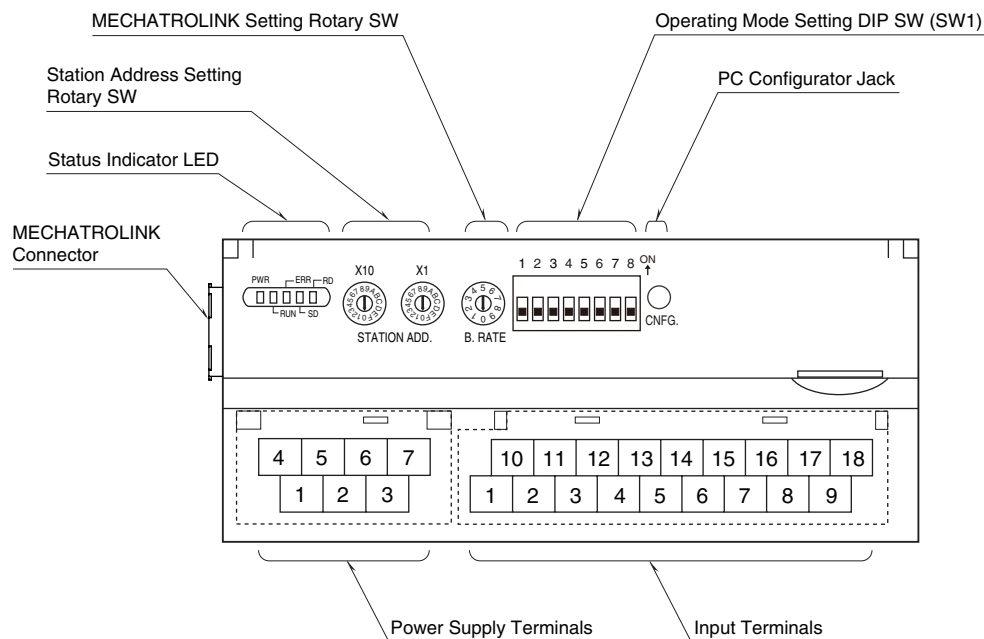
Dielectric strength: 1500 V AC @ 1 minute

(input 0 to input 1 to input 2 to input 3 to power)

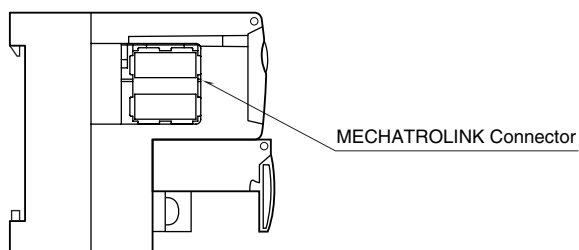
500 V AC @ 1 minute (MECHATROLINK or FG to input or power)

EXTERNAL VIEW

■ FRONT VIEW

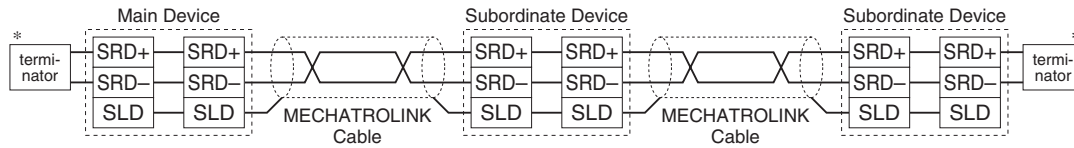


■ SIDE VIEW



COMMUNICATION CABLE CONNECTIONS

MECHATROLINK CONNECTION



*Terminator

Be sure to connect the terminating resistors to the unit at both ends of transmission line.

Use the terminating resistor dedicated for MECHATROLINK: Model JEPMC-W6022, Yaskawa Controls Co., Ltd.

Certain types of Main Device units may have incorporated terminating resistors. Consult the instruction manual for the Main Device.

TERMINAL ASSIGNMENTS

INPUT TERMINAL ASSIGNMENT

10	11	12	13	14	15	16	17	18
+IN0	-IN0	+IN1	-IN1	NC	+IN2	-IN2	+IN3	-IN3
1	2	3	4	5	6	7	8	9
+CJ0	-CJ0	+CJ1	-CJ1	NC	+CJ2	-CJ2	+CJ3	-CJ3

NO.	ID	FUNCTION	NO.	ID	FUNCTION
1	+CJ0	CJC + 0	10	+IN0	T/C + 0
2	-CJ0	CJC - 0	11	-IN0	T/C - 0
3	+CJ1	CJC + 1	12	+IN1	T/C + 1
4	-CJ1	CJC - 1	13	-IN1	T/C - 1
5	NC	No connection	14	NC	No connection
6	+CJ2	CJC + 2	15	+IN2	T/C + 2
7	-CJ2	CJC - 2	16	-IN2	T/C - 2
8	+CJ3	CJC + 3	17	+IN3	T/C + 3
9	-CJ3	CJC - 3	18	-IN3	T/C - 3

POWER SUPPLY TERMINAL ASSIGNMENT

4	5	6	7
NC	NC	+24V	0V
1	2	3	
NC	NC	FG	

NO.	ID	FUNCTION, NOTES
1	NC	----
2	NC	----
3	FG	FG
4	NC	----
5	NC	----
6	+24V	Power input (24V DC)
7	0 V	Power input (0V)

MECHATROLINK RELATED COMMANDS

Related commands are as follows.

Command of MECHATROLINK has a two-layer structure, which is composed of Data Link Layer (upper layer) and Application Layer (lower layer). All the Application Layer Commands are located in lower layer of Data Link Layer (CDRW).

COMMAND	COMMAND NAME	COMMAND (hexadecimal)	DESCRIPTION
Data Link Layer Command	MDS	04H	Product type reading
	CDRW	03H	Data transmission
Application Layer Command	NOP	00H	Invalid
	ID_RD	03H	Product information reading
	CONNECT	0EH	Communication start with Main Device
	DISCONNECT	0FH	Communication stop with Main Device
	DATA_RWA	50H	I/O data update

■ DATA LINK LAYER COMMAND

• MDS (04H) Command Data Format

Reads product type.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
0	04H	90H	Product type reading
1	00H	00H	Reserved
2	00H	80H	Intelligent I/O
3 – 31	00H	00H	3 – 17 bytes at 17-byte mode

• CDRW (03H) Command Data Format

Data transmission command is located in upper layer of Application Layer Command.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
0	03H	90H	Data transmission
1	CMD	RCMD	CMD : Application Layer command RCMD : Response (Same value as Application Layer Command)
2	00H	ALARM	Error code (Refer to the following table)
3	00H	STATUS1	Transmission status (Refer to the following table)
4	00H	STATUS2	Reserved
5 – 31	XX	YY	Depend upon the Application Layer Command

• ALARM

Communication error codes at the Subordinate Device are sent to the Main Device.

ERROR CODE (hexadecimal)	DESCRIPTION	CLASSIFICATION
00H	MECHATROLINK communication is in normal status	----
01H	Unsupported command is received.	Warning
02H	Command execution conditions are not met.	Warning
03H	Data in the command is not correct.	Warning
04H	Synchronization Error	Error

• STATUS1

The status of the Subordinate Device is sent to the Main Device in accordance with the classification of the error codes at ALARM.

Bit	DEFINITION	DESCRIPTION
0	Error Bit	1 : Error, 0 : Normal
1	Warning Bit	1 : Warning, 0 : Normal
2	Command Ready Bit	1 : Command can be accepted (ready), 0 : Command cannot be accepted (busy)
3 – 7	Unused	----

■ APPLICATION LAYER COMMAND

Application Layer Command is located in lower layer of Data Link Layer Command (CDRW). Following tables are details on bytes 5 through 31 dependent upon Application Layer Command.

Note : At 17 bytes mode, bytes dependant upon Application Layer Command are to be 5 through 17.

• NOP (00H) Command Data Format

0, which indicates invalid command, is sent to the Main Device.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
5 – 31	00H	00H	Invalid

• ID_RD (03) Command Data Format

Reads product information. (max. 8 bytes at a time) Repeat reading multiple times in order to read out all the data.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
5	DEVICE_CODE	DEVICE_CODE	DEVICE_CODE : Selection of product information 00 : Product model (data length : 32 bytes) 02 : Product version (data length : 32 bytes) 0F : Vendor code (data length : 48 bytes)
6	OFFSET	OFFSET	OFFSET : Specify read position
7	SIZE	SIZE	SIZE : Specify length of read data (max. 8 bytes)
8 – 15	00H	ID	Product information data
16 – 31	00H	00H	Unused

• CONNECT (0EH) Command Data Format

Starts communication with the Main Device.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
5	VER	VER	MODE : Selection of MECHATROLINK version 10 : MECHATROLINK - I 21 : MECHATROLINK - II
6	COM_MODE	COM_MODE	COM_MODE : Selection of data length 00 : 17-byte mode 80 : 32-byte mode
7	COM_TIME	COM_TIME	COM_TIME : Communication cycle (milliseconds) MECHATROLINK-I: Multiples of two (2) MECHATROLINK-II: Integral multiples of the transmission cycle
8 – 31	00H	00H	Unused

• DISCONNECT (0FH) Command Data Format

Stops communication with the Main Device.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
5 – 31	00H	00H	Unused

• DATA_RWA (50H) Command Data Format

Transmits I/O data from/to the Main Device. Data allocation is as follows.

Byte	COMMAND (hexadecimal)	RESPONSE (hexadecimal)	REMARKS
5	00H	Input 0 low 8 bits	
6	00H	Input 0 high 8 bits	
7	00H	Input 1 low 8 bits	
8	00H	Input 1 high 8 bits	
9	00H	Input 2 low 8 bits	
10	00H	Input 2 high 8 bits	
11	00H	Input 3 low 8 bits	
12	00H	Input 3 high 8 bits	
13	Discrete output data of extension module low 8 bits	Discrete input data of extension module low 8 bits or echo back of set value at command area	
14	Discrete output data of extension module high 8 bits	Discrete input data of extension module high 8 bits or echo back of set value at command area	"0" for R7ML-EA8 and R7ML-EC8x
15	00H	Status low 8 bits	See I/O data status
16	00H	Status high 8 bits	See I/O data status
17 – 31	00H	00H	Unused

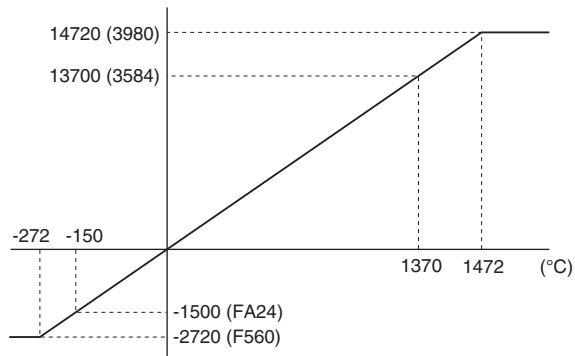
DATA CONVERSION

■ INPUT RANGE AND DATA CONVERSION (FACTORY DEFAULT SETTING)

Engineering unit value °C or K is multiplied by 10 and expressed in 16 bits. °F data is represented in engineering unit value, without multiplication. Negative value is represented in 2's complements.

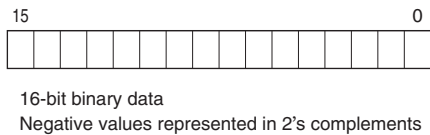
• Input TYPE K Thermocouple

Input Value	Converted Data, Decimal	Converted Data, Hex
≤ -272°C	-2720	F560
-150°C	-1500	FA24
1370°C	13700	3584
≥ 1472°C	14720	3980

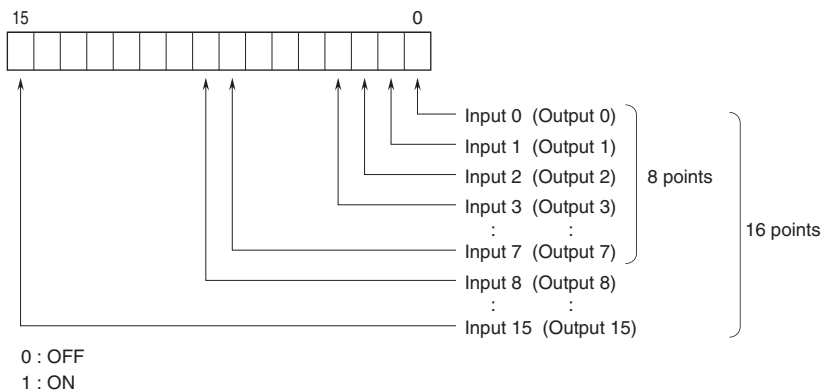


I/O DATA DESCRIPTIONS

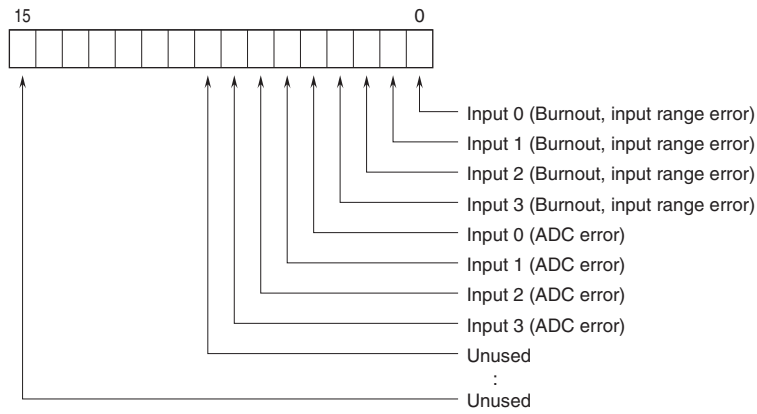
■ ANALOG INPUT



■ DISCRETE I/O



■ STATUS



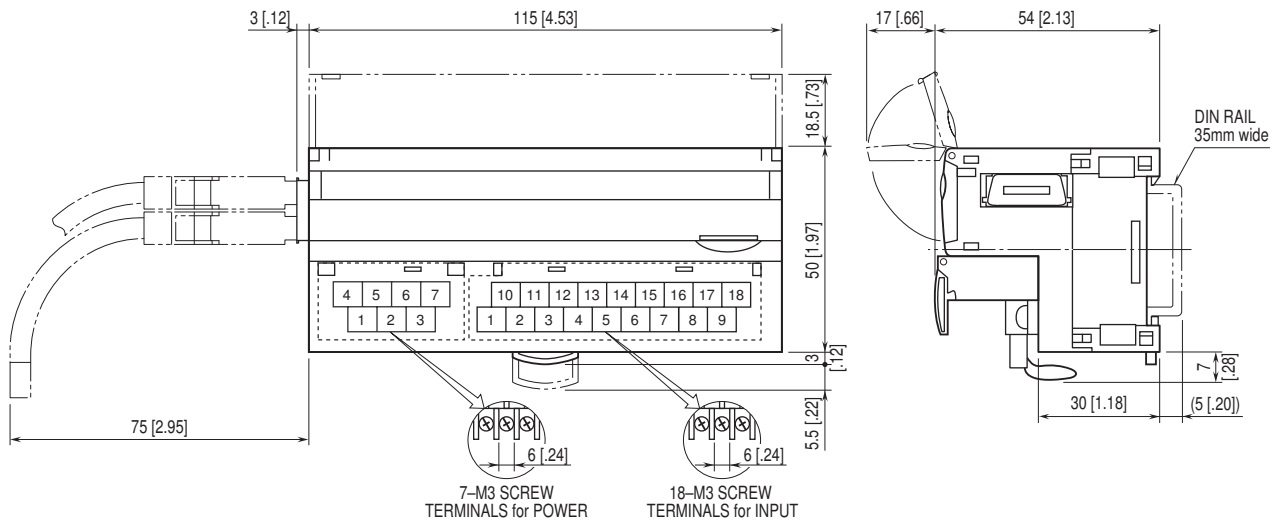
Burnout, input range error ($\leq -15\%$, $\geq +115\%$)

0 : Normal 1 : Error

ADC error (no response from ADC)

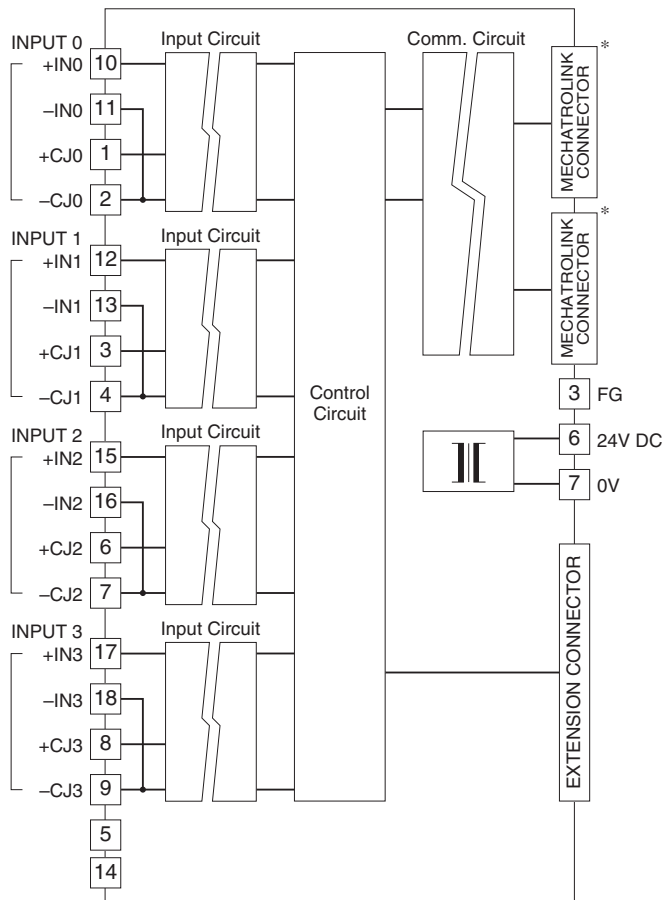
0 : Normal 1 : Error

EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm [inch]



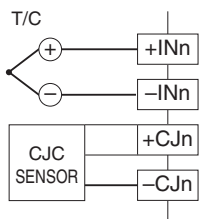
SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

Caution: FG terminal is NOT a protective conductor terminal.



*MECHATROLINK connectors are internally connected.
The network cable can be connected to either one.

■ Input Connection Example



Specifications are subject to change without notice.