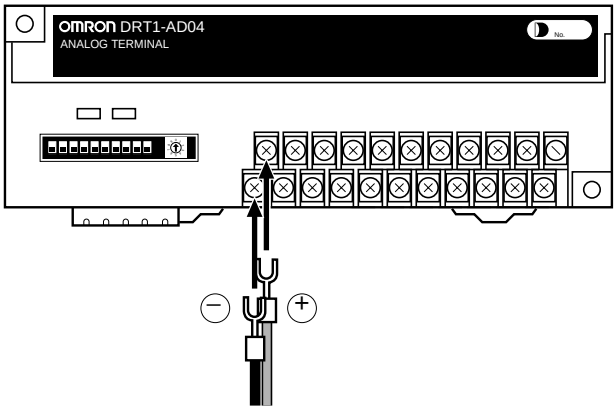
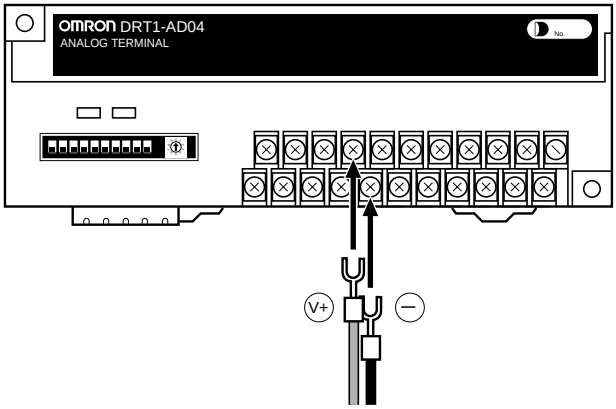
Wiring the Internal Power Supply

Refer to the wiring details for each Slave for information on the terminal arrangement at the terminal block. The following example shows the internal power supply for a DRT1-AD04 Analog Input Terminal.



Wiring I/O

Refer to the wiring details for each Slave for information on the terminal arrangement at the terminal block and external I/O wiring. The following example shows the wiring to input 0 on a DRT1-AD04 Analog Input Terminal.

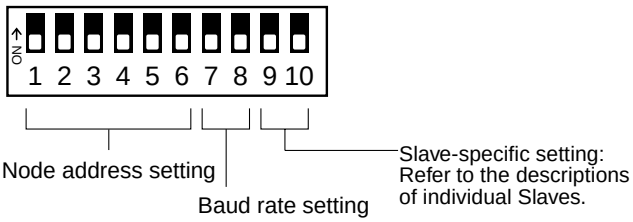


4-9 Temperature Input Terminals

4-9-1 Node Address and Baud Rate Settings

This section describes the Slaves' node address setting, baud rate settings, and hold/clear outputs for communications error setting. These settings are made using the following pins on the DIP switch.

Node address setting: Pins 1 through 6
Baud rate setting: Pins 7 and 8
Slave-specific setting: Pins 9 and 10
(Refer to the descriptions of individual Slaves.)



Node Address Settings

Each Slave's node address is set with pins 1 through 6 of the Slave's DIP switch. Any node address within the setting range can be used as long as it isn't already set on another node.

DIP switch setting						Node address
Pin 6	Pin 5	Pin 4	Pin 3	Pin 2	Pin 1	
0	0	0	0	0	0	0 (default)
0	0	0	0	0	1	1
0	0	0	0	1	0	2
⋮						⋮
1	1	1	1	0	1	61
1	1	1	1	1	0	62
1	1	1	1	1	1	63

Note

1. Refer to *Appendix A Node Address Settings Table* for a complete table of DIP switch settings.
2. The Slave won't be able to participate in communications if the same node address is used for the Master or another Slave node (node address duplication error).

Baud Rate Setting

Pins 7 and 8 are used to set the baud rate as shown in the following table. (These pins are factory-set to OFF.)

Pin 7	Pin 8	Baud rate
OFF	OFF	125 kbps (default)
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Not allowed.

Note

1. Always turn OFF the Slave's power supply (including the communications power supply) before changing the baud rate setting.
2. Set the same baud rate on all of the nodes (Master and Slaves) in the Network. Any Slaves with baud rates different from the Master's rate won't be able to participate in communications. Furthermore, a node with an incorrect baud rate may cause communications errors between nodes with correct baud rate settings.

4-9-2 Temperature Input Terminals: DRT1-TS04T and DRT1-TS04P

Specifications

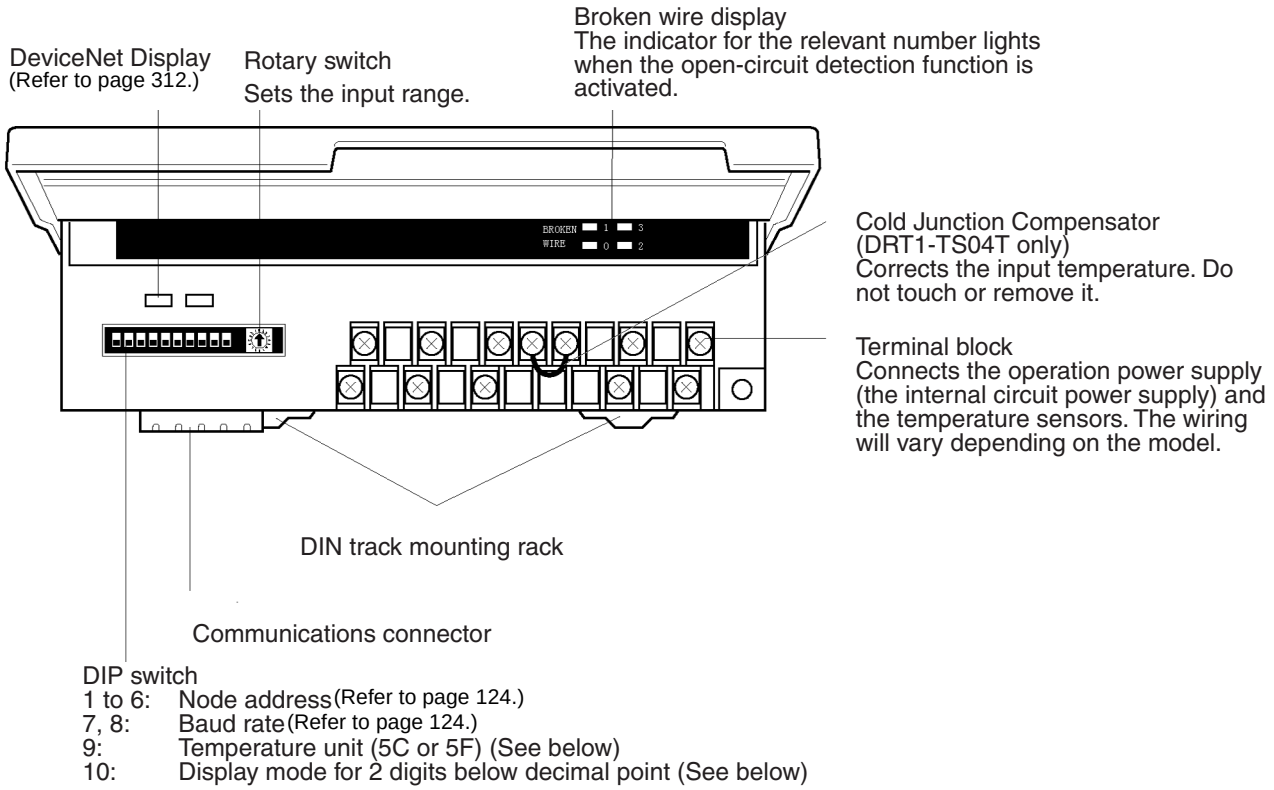
General Specifications

Item	Specification	
Model	DRT1-TS04T	DRT1-TS04P
Input type	Thermocouple input	Resistance temperature sensor input
Input points	4 points (allocated four words in the Master Unit.)	
Communications power supply voltage	11 to 25 V DC (supplied from the communications connector)	
Internal power supply voltage	20.4 to 26.4 V DC (24 V DC –15% to 10%)	
Current consumption	Communications: 30 mA max. Internal circuit: 130 mA max.	
Noise immunity	±1.5 $kV_{p-p,}$ pulse width: 0.1 to 1 μs, pulse rise time: 1 ns (via noise simulator)	
Vibration resistance	10 to 55 Hz, 1.0-mm double amplitude	

Item	Specification	
Shock resistance	200 m/s^2	
Dielectric strength	500 V AC for 1 min (between insulated circuits)	
Insulation resistance	20 MΩ min. at 250 V DC (between insulated circuits)	
Ambient operating temperature	0 to 55°C	
Ambient operating humidity	35% to 85% (with no condensation)	
Ambient operating environment	No corrosive gases.	
Ambient storage temperature	–25 to 65°C	
Mounting method	M4 screw mounting or 35-mm DIN track mounting	
Mounting strength	50 N 10 N min. in the DIN Track direction	
Terminal strength	Pull: 50 N	
Weight	230 g max.	160 g max.
Input classification	R, S, K1, K2, J1, J2, T, E, B, N, L1, L2, U, W, PL II convertible (4-point common input class)	Pt100, JPt100 convertible (4-point common input class)
Instruction precision	(Instruction value ±0.5% or ±2°C, whichever is larger) ±1 digit max. (See note.)	(Instruction value ±0.5% or ±1°C, whichever is larger) ±1 digit max.
Conversion period	250 ms / 4 pts.	
Temperature conversion data	Binary data (4-digit hexadecimal)	
Isolation method	Photocoupler isolation between temperature inputs and communications lines (Photocoupler isolation between temperature input signals.)	

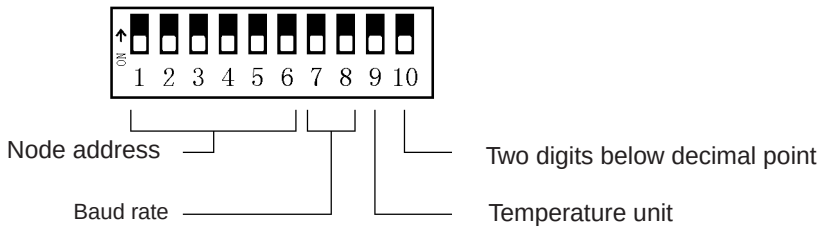
Note Less than –100°C of K1, T, N: ±4°C ±1 digit max.
U, L1, L2: ±4°C ±1 digit max.
Less than 200°C of R, S: ±6°C ±1 digit max.
Less than 400°C of B: No regulation
W: (Instruction value ±0.5% or ±6°C, whichever is larger) ±1 digit max.
PL II: (Instruction value ±0.5% or ±4°C, whichever is larger) ±1 digit max.

Components of the DRT1-TS04T and DRT1-TS04P



DIP Switch Settings

The following diagram shows the functions of the DIP switch for the DRT1-TS04T and DRT1-TS04P Temperature Input Terminals.



Pin(s)	Function	Settings	
1 through 6	Node address setting	Refer to *4-9-1 Node Address and Baud Rate Settings* for details.	
7 and 8	Baud rate setting		
9	Temperature unit setting	OFF (factory setting)	°C
		ON	°F
10	Display mode for 2 digits below the decimal (Refer to page 164.)	OFF (factory setting)	Normal mode (0 or 1 digit depending on input classification)
		ON	Two digits below decimal point

Note Always turn OFF the Slave's power supply (including the communications power supply) before changing any settings.

Rotary Switch Setting

Set the common input classification and input signal range for each input with the rotary switch. (The input classification and input range cannot be set for 4-point classification.)

Note Always turn OFF the Slave's power supply (including the communications power supply) before changing any settings.

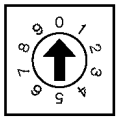
DRT1-TS04T

The following table shows the input classifications and input ranges according to the rotary switch settings.

Number	Input classification	Range (°C)	Range (°F)
0	R	0 to 1700	0 to 3000
1	S	0 to 1700	0 to 3000
2	K1	–200 to 1300	–300 to 2300
3	K2	0.0 to 500.0	0.0 to 900.0
4	J1	–100 to 850	–100 to 1500
5	J2	0.0 to 400.0	0.0 to 750.0
6	T	–200.0 to 400.0	–300.0 to 700.0
7	E	0 to 600	0 to 1100
8	L1	–100 to 850	–100 to 1500
9	L2	0.0 to 400.0	0.0 to 750.0
A	U	–200.0 to 400.0	–300.0 to 700.0
B	N	–200 to 1300	–300 to 2300
C	W	0 to 2300	0 to 4100
D	B	100 to 1800	300 to 3200
E	PL II	0 to 1300	0 to 2300
F	Cannot be set.		

DRT1-TS04P

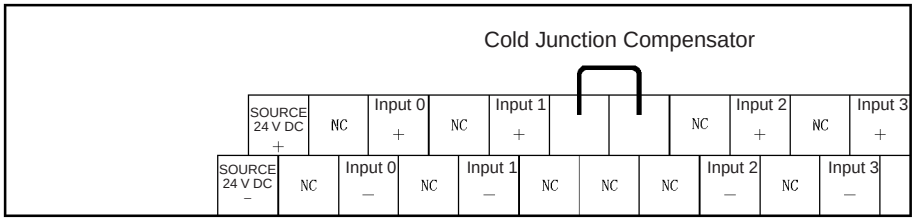
The following table shows the input classifications and input ranges according to the rotary switch settings.



Number	Input classification	Range (°C)	Range (°F)
0	PT100	–200.0 to 650.0	–300.0 to 1200.0
1	JPT100	–200.0 to 650.0	–300.0 to 1200.0
2 to 9	Cannot be set.		

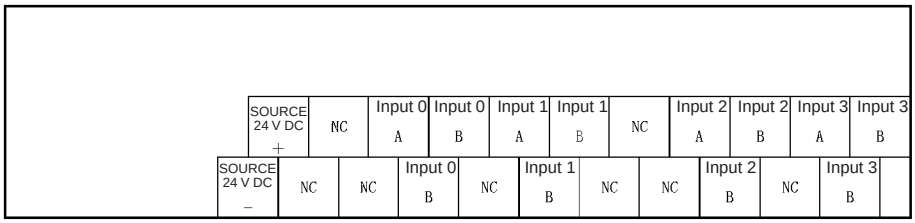
Terminal Arrangement

DRT1-TS04T



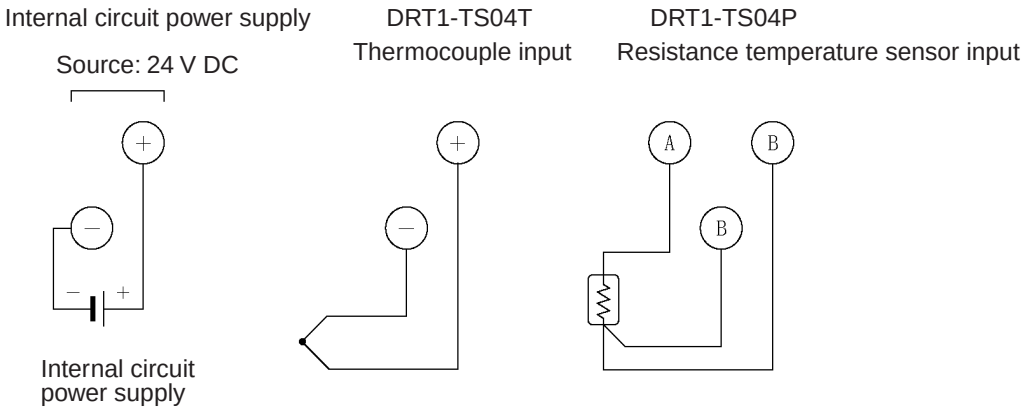
Note Do not touch or remove the Cold Junction Compensator.

DRT1-TS04P



Wiring

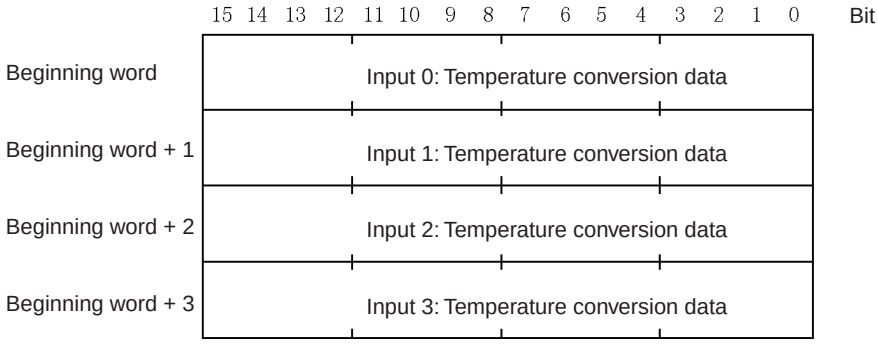
Connect the inputs to the Temperature Input Terminal's terminal block as shown in the following diagram, depending on whether thermocouple inputs or resistance temperature sensor inputs are used.



Temperature Conversion Data for the DRT1-TS04T and DRT1-TS04P

Data that is input is converted to binary data (4-digit hexadecimal) and the Master is notified. If the converted data is a negative number, it is expressed as a two's complement.

The four inputs occupy four words at the Master, as shown below. If the input classification is set for up to one digit below the decimal point, a multiple of 10 will be transmitted as binary data.



Input classification	Unit: 1°C (°F)	R, S, K1, J1, E, L1, N, W, B, PL	850° → 0352 (4 digits hex) –200° → FF38 (4 digits hex)
	Unit: 0.1°C (°F)	K2, J2, T, L2, U, Pt100, JPt100	x10 500.0° → 5000 → 1388 (4 digits hex) –20.0° → 200 → FF38 (4 digits hex) –200.0° → 2000 → F830 (4 digits hex)

Note

1. For more details regarding temperature conversion data with a unit setting of two digits below the decimal point (unit: 0.01), refer to page 164.
2. If there is a sudden temperature change, condensation may develop inside of the Terminal and cause incorrect values to be displayed. If condensation does develop, leave the Terminal for approximately one hour at a stable temperature before using it.

Data Ranges and the Open-circuit Detection Function

The following table shows the convertible data ranges according to the number set by the rotary switch.

DRT1-TS04T

Number	Input classification	Range (°C)	Range (°F)
0	R	–20 to 1720	–20 to 3020
1	S	–20 to 1720	–20 to 3020
2	K1	–220 to 1200	–320 to 2320
3	K2	–20.0 to 520.0	–20.0 to 920.0
4	J1	–120 to 870	–120 to 1520
5	J2	–20.0 to 420.0	–20.0 to 770.0
6	T	–220.0 to 420.0	–320.0 to 720.0
7	E	–20 to 620	–20 to 1120
8	L1	–120 to 870	–120 to 1520
9	L2	–20.0 to 420.0	–20.0 to 770.0
A	U	–220.0 to 420.0	–320.0 to 720.0
B	N	–220 to 1320	–320 to 2320
C	W	–20 to 2320	–20 to 4120
D	B	80 to 1820	280 to 3220
E	PL II	–20 to 1320	–20 to 2320
F	Cannot be set.		

DRT1-TS04P

Number	Input classification	Range (°C)	Range (°F)
0	Pt100	–220.0 to 670.0	–320.0 to 1220.0
1	JPt100	–220.0 to 670.0	–320.0 to 1220.0
2 to 9	Cannot be set.		

If the input temperature goes outside of the permissible conversion range, the temperature data is fixed at the upper or lower limit.

If the input temperature goes beyond a given constant value, outside of the permissible conversion range, it is determined that the input wiring has been disconnected. The open-circuit detection function is then activated so that the temperature data is set to 7FFF (hexadecimal), and the broken wire indicator on the Temperature Input Terminal lights up. The open-circuit detection function will operate even if there is an error at the Cold Junction Compensator.

When the input temperature returns to within the conversion range, the open-circuit detection function is automatically cleared and the conversion data is returned to normal.

Temperature Input Terminal's Display Mode for 2 Digits Below the Decimal Point

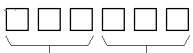
This section explains the Temperature Input Terminal's display mode for 2 digits below the decimal point.

When the Temperature Input Terminal is in this mode, each single item of temperature data (four integer digits and two digits below the decimal point, in six digits of hexadecimal binary data) is provided to the Master Unit multiplied by 100 with the sign affixed. At that time the temperature data is divided into two parts as shown below, and these parts are alternately transmitted every 125 ms. (The two respective data items are each configured as one word of data.)

⚠ Caution In the display mode for 2 digits below the decimal point, temperature data is converted for up to two digits below the decimal point, but the actual resolution is not 0.01°C (°F). Therefore there may be some oscillation or jumping at the 0.01°C (°F) and 0.1°C (°F) digits. Resolutions beyond those prescribed for the normal mode should be treated as reference data.

The following diagram shows how temperature data is divided and the data configuration.

Temperature data (Actual temperature x 100, in binary data)



Notification format for leftmost 3 digits

15	14	13	12	11 10 9 8 7 6 5 4 3 2 1 0	Bit
Left/right	Temp. unit	Broken wire	Not used.	$\times 16^5$ $\times 16^4$ $\times 16^3$	
0: Left 1: Right	0: C° 1: F°	0: OK 1: Error	0 (Fixed)		
Sign/determination area				Data area	

Notification format for rightmost 3 digits

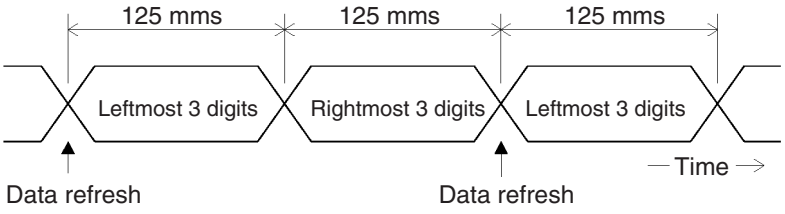
15	14	13	12	11 10 9 8 7 6 5 4 3 2 1 0	Bit
Right/left	Temp. unit	Broken wire	Not used.	$\times 16^2$ $\times 16^1$ $\times 16^0$	
0: Left 1: Right	0: C° 1: F°	0: OK 1: Error	0 (Fixed)		
Sign/determination area				Data area	

Leftmost/rightmost bit: Determines whether leftmost or rightmost digits are displayed.

Temperature unit bit: Determines whether temperature is expressed in °C or °F.

Broken wire bit: Turns ON (1) to notify of broken wire. At that time the data in the leftmost three digits is “7FF” and the data in the rightmost three digits is “FFF.”

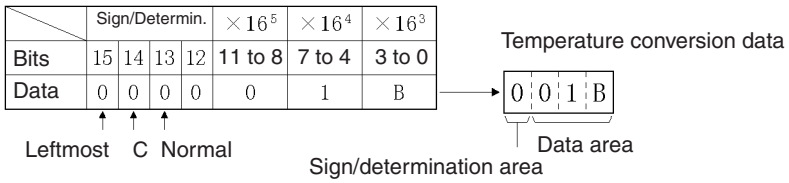
The three leftmost digits and three rightmost digits, each comprising one word of data, are alternately provided to the Master every 125 ms as shown in the following diagram.



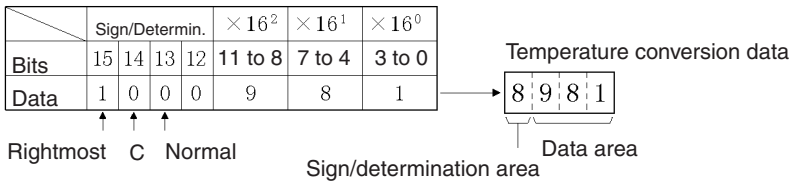
Example 1: 1130.25°C

Value multiplied by 100: 113025
Notification value: 01B981 (113025 expressed in hexadecimal)

Contents of 3 Leftmost Digits



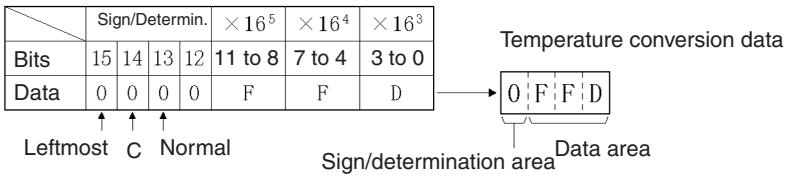
Contents of 3 Rightmost Digits



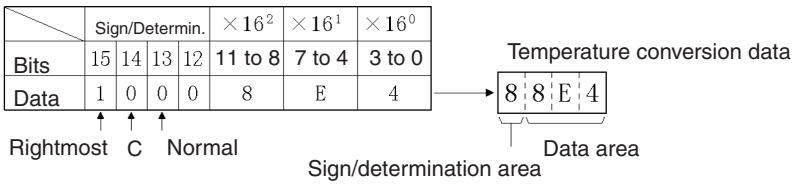
Example 2: –100.12°C

Value multiplied by 100: –10012
Notification value: FFD8E4 (–10012 expressed in hexadecimal)

Contents of 3 Leftmost Digits



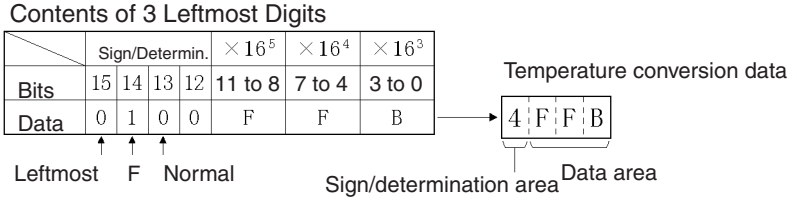
Contents of 3 Rightmost Digits



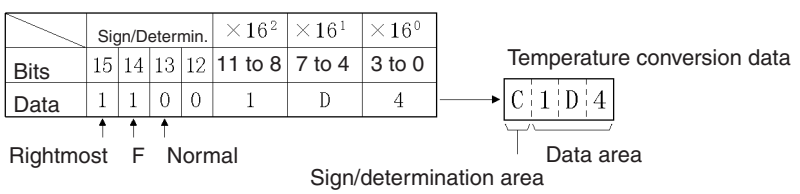
Example 3: –200.12°F

Value multiplied by 100: –20012
Notification value: FFB1D4 (–20012 expressed in hexadecimal)

Contents of 3 Leftmost Digits



Contents of 3 Rightmost Digits



Example 4: Input Error (Broken Wire) (Unit:°F)

Notification value: 7FFFFF

Contents of 3 Leftmost Digits

	Sign/Determin.				$\times 16^5$	$\times 16^4$	$\times 16^3$
Bits	15	14	13	12	11 to 8	7 to 4	3 to 0
Data	0	1	1	0	7	F	F

Leftmost F Error

Temperature conversion data: 6 7 F F

Sign/determination area: 6 | Data area: 7 F F

Contents of 3 Rightmost Digits

	Sign/Determin.				$\times 16^2$	$\times 16^1$	$\times 16^0$
Bits	15	14	13	12	11 to 8	7 to 4	3 to 0
Data	1	1	1	0	F	F	F

Rightmost F Error

Temperature conversion data: E F F F

Sign/determination area: E | Data area: F F F

Note

1. Data notification is provided in order, from the leftmost digits to the rightmost. When reading data with the program, be sure to read it in that same order.
2. Taking the Programmable Controller's cycle time and the communications time into consideration, lower the reading cycle to 125 ms or less. If the reading cycle exceeds 125 ms, normal data cannot be read.

Sample Program for the DRT1-TS04T and DRT1-TS04P

The following program is an example of using the Temperature Input Terminal in the display mode for 2 digits below the decimal point.

Settings

Temperature Input Terminal's allocated words: 350 to 353
Temperature Input Terminal's mode: Two digits below decimal point (DIP switch pin 10: ON)

Operation

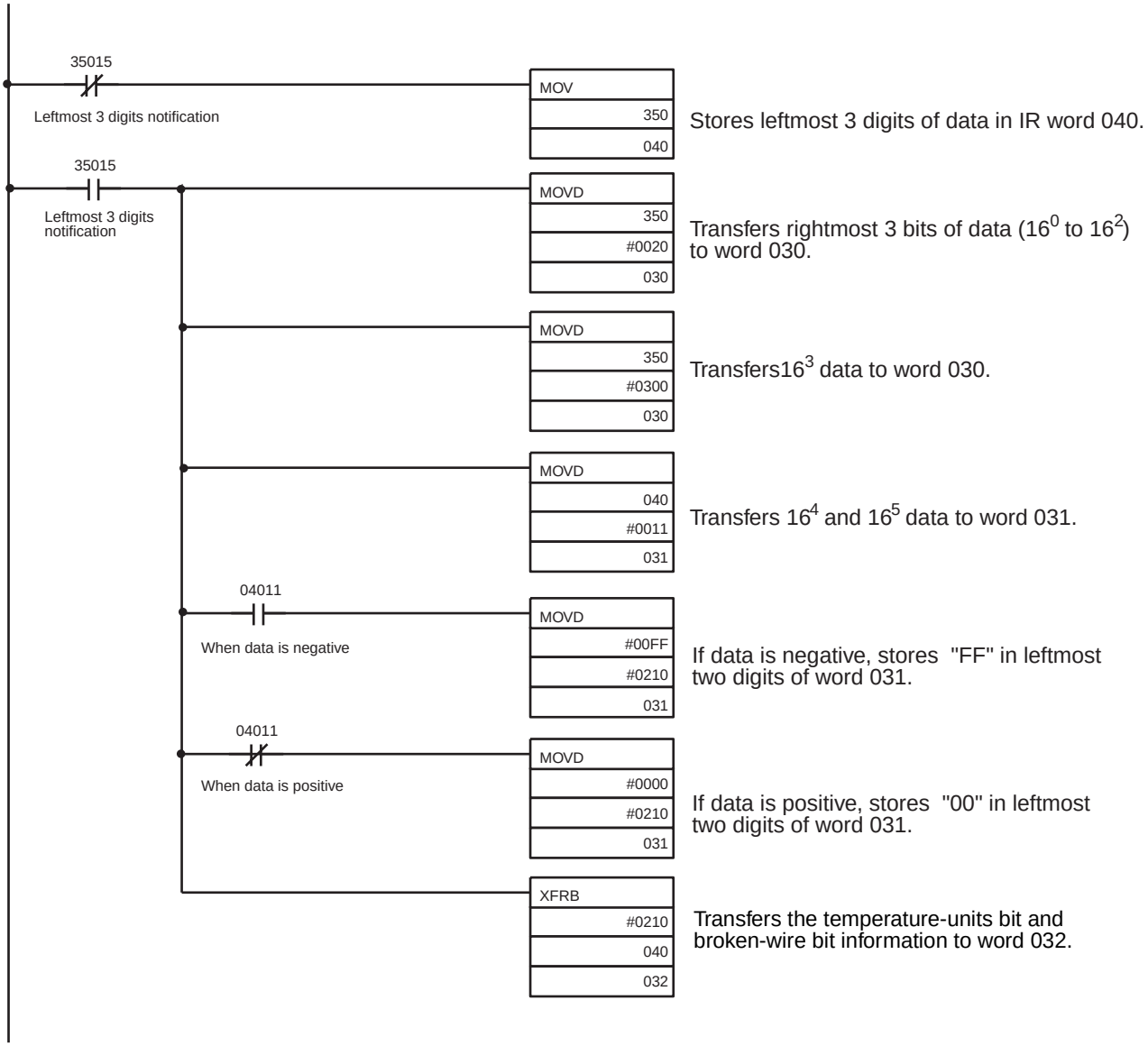
The temperature data from the Temperature Input Terminal's input 0 is stored in words 30 to 32 in binary data multiplied by 100, as shown below.

Word \ Bit	15 to 12	11 to 8	7 to 4	3	2	1	0
30	$x16^3$	$x16^2$	$x16^1$	$x16^0$			
31	$x16^7$	$x16^6$	$x16^5$	$x16^4$			
32	0 (Fixed)	0 (Fixed)	0 (Fixed)	0	Temperature unit bit	Broken wire bit	0

Temperature unit bit 0: °C; 1: °F
Broken wire bit: 0: Normal; 1: Error

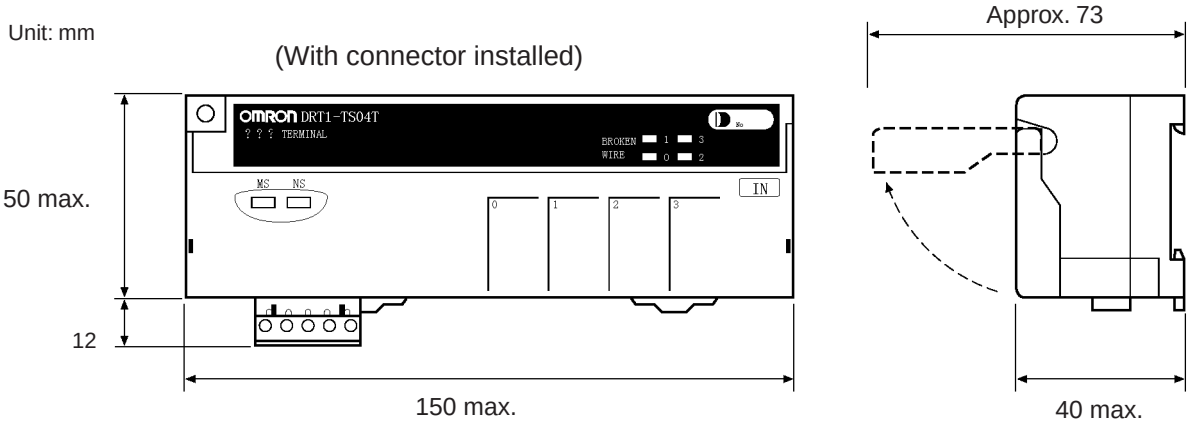
The data in words 30 and 31 can be treated as 32-bit binary data.

Program Example

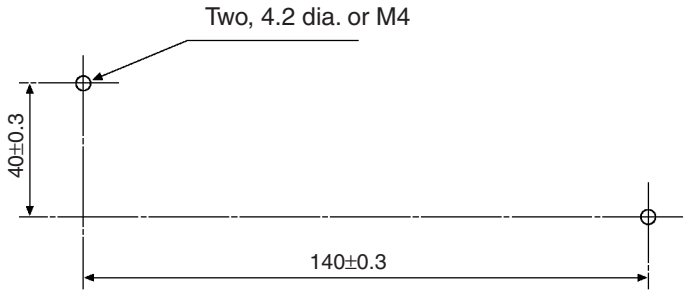


Dimensions

The following diagram shows the dimensions for the DRT1-TS04T and DRT1-TS04P Temperature Input Terminals. All dimensions are in mm.



Mounting Hole Dimensions



4-9-3 Mounting in Control Panels

Either of the following methods can be used to mount a Temperature Input Terminal in a control panel.

Using Screws

Open mounting holes in the control panel according to the dimensions provided for mounting holes in the dimensions diagrams and then secure the Temperature Input Terminals with M4 screws. The appropriate tightening torque is 0.6 to 0.98 N·m.

Using DIN Track

Mount the back of the Temperature Input Terminal to a 35-mm DIN Track. To mount the Terminal, pull down on the mounting hook on the back of the Terminal with a screwdriver, insert the DIN Track on the back of the Terminal, and then secure the Terminal to the DIN Track. When finished, secure all Slaves on both ends of the DIN Track with End Plates.