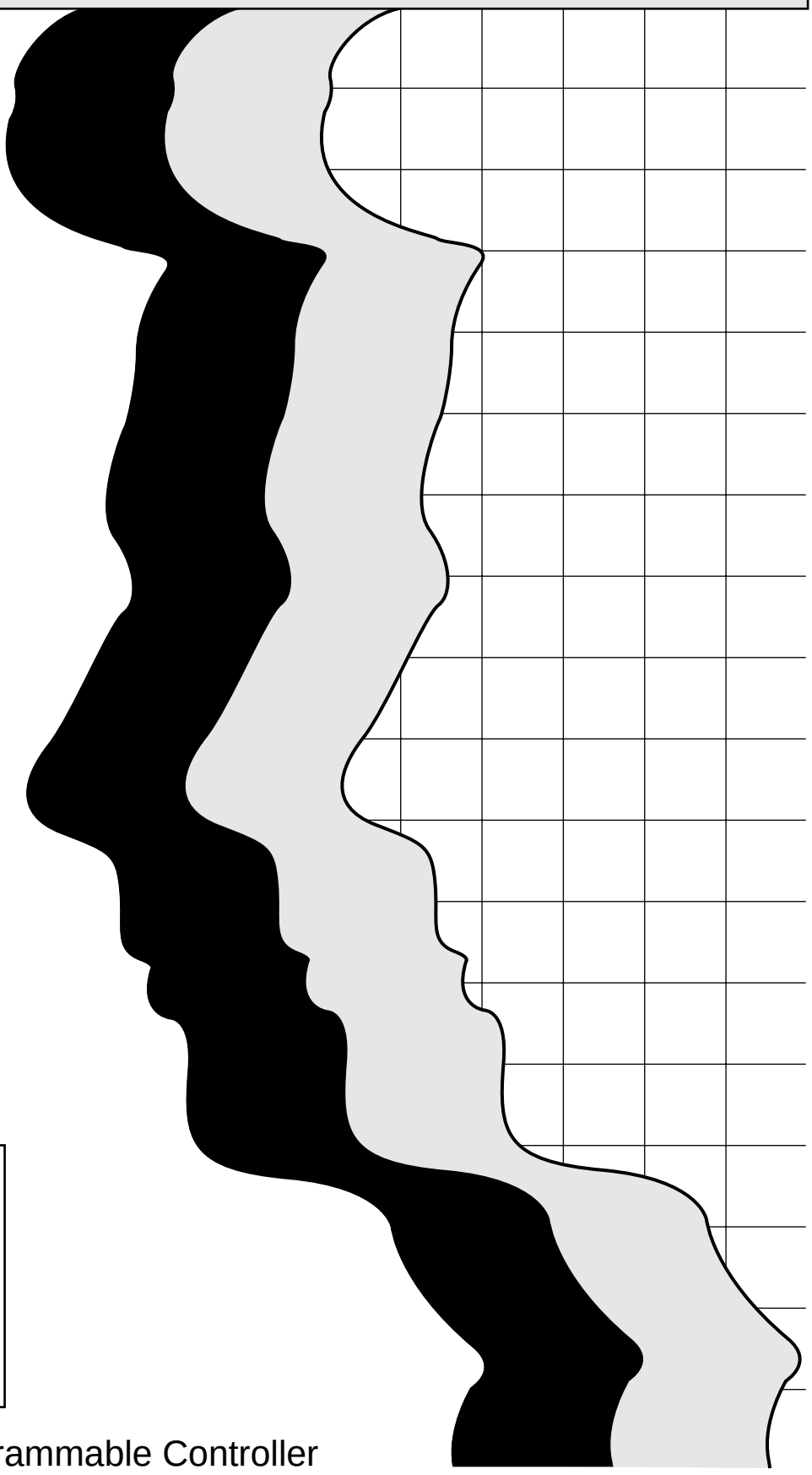
MITSUBISHI

Type A68RD3N/4N,A1S62RD3N/4N Pt100 Input Module

User's Manual



MELSEC

Mitsubishi Programmable Controller

● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using Mitsubishi equipment, thoroughly read this manual. Also pay careful attention to safety and handle the module properly.

These precautions apply only to Mitsubishi equipment. Refer to the user's manual of the CPU module to use for a descriprion of the PLC system safty precautions.

These **●SAFETY PRECAUTIONS●** classifiy the safty precautions into two categories: "DANGER" and "CAUTION".

DANGER	Procedures which may lead to a dangerous condition and cause death or serious injury if not carried out properly.
CAUTION	Procedures which may lead to a dangerous condition and cause superficial to medium injury, or physical damage only, if not carried out properly.

Depending on circumestances, procedures indicated by **CAUTION** may also be linked to serious results.

In many case, it is important to follow the directions for usage.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]

⚠ CAUTION

- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
  They should be installed 100mm (3.9inch) or more from each other.
  Not doing so could result in noise that would cause erroneous operation.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- Use each module in an environment as specified in the "general specification" in the detailed manual.
  Using the PLC outside the range of the general specifications may result in electric shock, fire or malfunction, or may damage or degrade the module.
- Before mounting the module, insert the module fixing hook at the bottom of the module into the fixing hole in the base unit. (The AnS series modules must be screwed to the base unit to the specified torque.) Improper mounting of the module can cause a malfunction, failure or drop.
- Do not touch the conductive area or electronic parts of the module directly. Doing so can cause the module to malfunction or fail.

[WIRING PRECAUTIONS]

⚠ CAUTION

- Always ground the FG terminal and SLD terminal to the protective ground conductor.
  Not doing so can cause a malfunction.
- Carry out wiring to the PLC correctly, checking the rated voltage and terminal arrangement of the product.
  Using a power supply that does not conform to the rated voltage, or carrying out wiring incorrectly, will cause fire or failure.
- Tighten the terminal screws to the stipulated torque.
  Loose screws will cause short circuits, or malfunctions.
  Overtightening can damage the screws and module, causing the module to fall, short or malfunction.
- Make sure that no foreign matter such as chips or wiring offcuts gets inside the module. It will cause fire, failure or malfunction.

[STARTING AND MAINTENANCE PRECAUTIONS]

CAUTION

- Do not touch the terminals before switching power off externally in all phases. Doing so can cause a malfunction.
- Start cleaning or terminal screw retightening after switching power off externally in all phases.
  Not doing so can cause a malfunction.
- Do not disassemble or modify any module.
  This will cause failure, malfuntion, injuries, or fire.
- Mount or dismount the module after switching power off externally in all phases.
  Not doing so can cause the module to fail or malfunction.
- Do not install/remove the terminal block more than 50 times after the first use of the product. (IEC 61131-2 compliant)
- Before touching the module, be sure to touch ground metal or similar material to discharge static electricity from human body, etc.
  Failure to do so can cause the module to fail or malfunction.

[DISPOSAL PRECAUTIONS]

CAUTION

- When disposing of this product, treat it as industrial waste.

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Mar., 2002	SH (NA)- 080193-A	First printing
Dec., 2003	SH (NA)- 080193-B	Partial Correction SAFETY PRECAUTIONS, Section 3.1 Addition Conformation to the EMC Directive and Low Voltage Instruction
Sep., 2006	SH (NA)- 080193-C	Partial Correction SAFETY PRECAUTIONS
Jul., 2007	SH (NA)- 080193-D	Partial Correction Section 4.3

Japanese Manual Version SH-080190-D

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

Contents

Conformation to the EMC Directive and Low Voltage Instruction

For details on making Mitsubishi PLC conform to the EMC directive and low voltage instruction when installing it in your product, please see Chapter 3, "EMC Directive and Low Voltage Instruction" of the User's Manual (Hardware) of the PLC CPU to use.

The CE logo is printed on the rating plate on the main body of the PLC that conforms to the EMC directive and low voltage instruction.

By making this product conform to the EMC directive and low voltage instruction, it is not necessary to make those steps individually.

1. INTRODUCTION

This manual explains the specifications and part names of:

- Type A68RD3N Temperature Sensor Input Module (hereafter abbreviated to the A68RD3N)
- Type A68RD4N Temperature Sensor Input Module (hereafter abbreviated to the A68RD4N)
- Type A1S62RD3N Temperature Sensor Input Module (hereafter abbreviated to the A1S62RD3N)
- Type A1S62RD4N Temperature Sensor Input Module (hereafter abbreviated to the A1S62RD4N)

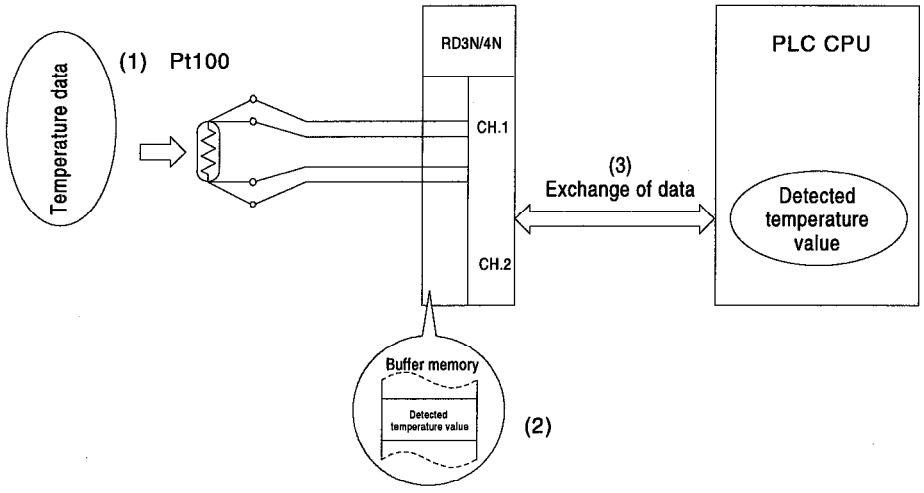
which are used with the MELSEC-A series PLC CPU module (hereafter abbreviated to the PLC CPU).

(The A68RD3N, A68RD4N, A1S62RD3N and A1S62RD4N are generically abbreviated to the RD3N/4N.)

Module name	Summary of specification	
	Module size	Measurement method
A68RD3N	Large-size building block type	3-wire type
A68RD4N		4-wire type
A1S62RD3N	Small-size building block type	3-wire type
A1S62RD4N		4-wire type

The RD3N/4N converts temperature data from a platinum resistance thermometer JPt100 or Pt100 (hereafter called the Pt100) to either 16 or 32 bits of signed binary data. The sixteen (16) bits of signed binary data are expressed to the first decimal place. The thirty-two (32) bits of signed binary data are expressed to the third decimal place.

Temperature-Measuring Process



(1) A change in the ambient temperature of the Pt100 changes the resistance value.
(2) Temperature data is stored as a detected temperature value and is stored in the buffer memory of the RD3N/4N.
(3) A detected temperature value stored in the buffer memory of the RD3N/4N is read from PLC CPU.

1.1 Features

(1) This module can read temperature data (°C) by directly connecting a platinum resistance thermometer to RD3N/4N. Any platinum resistance thermometer that conforms to the following standards can be used.

Platinum resistance thermometer type		Standard
Pt100	1997JIS type	JIS C1604-1997, IEC 751-am2
	1989JIS type	JIS C1604-1989, DIN 43760-1980
JPt100	Old JIS type	JIS C1604-1981

(2) The value to the first or third decimal place of the input temperature data can be stored.

Example:

Temperature data: 150.125 [°C] <
- 150.1 [°C]..... Value to the first decimal place is stored.
- 150.125 [°C] ..... Value to the third decimal place is stored.

(3) Multi-channel temperatures can be measured with one module.
- A68RD3N/4N: 8 channels
- A1S62RD3N/4N: 2 channels

(4) Three conversion processing methods (sample processing, time-averaging processing, and number of times of averaging processing) can be selected.

(5) Pt100 or cable disconnections can be detected.

- A68RD3N, A1S62RD3N:Detection by each channel.
- A68RD4N, A1S62RD4N:Joint detection by all channels.

(6) Each channel can set the conversion enable/disable.

2. SYSTEM CONFIGURATIONS

(1) Applicable CPU

PLC CPU*1 \ RD3N/4N	For A68RD3N/4N		For A1S62RD3N/4N
ACPU	• A0J2CPU • A0J2HCPU • A1CPU • A2CPU(-S1) • A3CPU • A1NCPU • A2NCPU(-S1) • A3NCPU • A3MCPU • A3HCPU • A2ACPU (-S1) • A3ACPU	• A2UCPU(-S1) • A3UCPU • A4UCPU • A73CPU(-S3) *2 • A81CPU • A52GCPU • A1SCPU (-S1) • A1SJCPU(-S3) • A2CCPU • A2ASCPU (-S1/S30) • A1SHCPU • A2SHCPU(-S1) • A1SJHCPU(-S8) • A2USHCPU-S1	• A1SCPU(-S1) • A1SJCPU(-S3) • A2SCPU • A2ASCPU(-S1/S30) • A52GCPU • A1SHCPU • A1SJHCPU(-S8) • A2SHCPU(-S1)
QnACPU	• Q2ACPU(-S1) • Q2ASCPU(-S1) • Q2ASHCPU(-S1)	• Q3ACPU • Q4ACPU • Q4ARCPU	• Q2ASCPU(-S1) • Q2SHCPU(-S1)
QCPU(A mode)	———		• Q02CPU-A • Q02HCPU-A • Q06HCPU-A

*1: It includes a PLC CPU with a link function.
*2: The A73CPU(-S3) is used by installing the A68RD3N/4N in the extension base unit.

(2) Number of Installation Modules
There are no restrictions on the number of modules to be installed as long as the occupied number of I/O points is within the range of number of I/O points of the applicable CPU.

(3) Installation Slots

(a) A module can be installed in any slot in a base unit with an exception of the following cases.
If a module is installed in an extension base (A55B, A58B, A1S52B, A1S55B, A1S58B) which does not have a power supply module, sufficient power may not be supplied.
When installing an RD3N/4N in an extension base which is not equipped with a power supply module, select a power supply module, a base unit, an extension base unit and an extension cable by taking the following into consideration.

1) Current capacity of the power supply module in the base unit

2) Voltage drop at the base unit

3) Voltage drop at the extension unit

4) Voltage drop at the extension cable

(b) When the A3CPU (P21/R21) is used, the A68RD3N/4N cannot be installed in the last seventh slot of the extension unit. (This restriction does not apply to the A3NCPU, A3HCPU, A3MCPU, A73CPU, and A3ACPU.)

(4) Data Link System
In the data link system, the module can be installed at any of the master station, local station, and remote I/O station. For an example of program at the remote I/O station, refer to MELSECNET, MELSECNET/B data link system Reference manual.

REMARK

For the calculation of the range of I/O points and voltage drop, refer to the following manuals.

- A1SJCPU(S3) User's manual ..... IB(NA)66446
- A1S/A1SC24-R2/A2SCPU(S1) User's manual ..... IB(NA)66320
- A2ASCPU(S1/S30) User's manual ..... IB(NA)66536
- A52GCPU(T21B) Reference manual ..... IB(NA)66420
- A2USHCPU-S1 User's Manual ..... IB(NA)66789
- A1SJH(S8)/A1SH/A2SHCPU(S1) User's Manual ..... IB(NA)66779
- Q2AS(H)CPU(S1) User's manual ..... SH(NA)3599

3. SPECIFICATIONS

This chapter describes the general specifications, performance specifications, and I/O conversion characteristics of the RD3N/4N.

3.1 General Specifications

Table 3.1 shows the general specifications of the RD3N/4N.

Table 3.1 General Specifications

<table>
<tr><th>Item</th><th colspan="5">Specifications</th></tr>
<tr><td>Usage ambient temperature</td><td colspan="5">0 to 55°C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="5">–20 to 75°C</td></tr>
<tr><td>Usage ambient humidity</td><td colspan="5">10 to 90%RH, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="5">10 to 90%RH, non-condensing</td></tr>
<tr><td rowspan="8">Vibration durability</td><td rowspan="8">Conforming to JIS B 3502, IEC 61131-2</td><td colspan="4">When there is intermittent vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep Count</td></tr>
<tr><td>10 to 57 Hz</td><td>–</td><td>0.075 mm (0.0030 inch)</td><td rowspan="5">10 times in each direction X, Y, Z (80 minutes)</td></tr>
<tr><td>57 to 150 Hz</td><td>9.8 m/s^2</td><td>–</td></tr>
<tr><td colspan="3">When there is continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10 to 57Hz</td><td>–</td><td>0.035mm (0.0013 inch)</td></tr>
<tr><td>57 to 150Hz</td><td>4.9m/s^2</td><td>–</td></tr>
<tr><td>Shock durability</td><td colspan="5">Conforming to JIS B 3502, IEC61131-2 (147m/s^2, 3 times each in 3 directions)</td></tr>
<tr><td>Usage environment</td><td colspan="5">No corrosive gas</td></tr>
<tr><td>Usage height *3</td><td colspan="5">Less than 2000 m (less than 6562 ft.)</td></tr>
<tr><td>Installation area</td><td colspan="5">Within the control board</td></tr>
<tr><td>Over-voltage category *1</td><td colspan="5">Less than II</td></tr>
<tr><td>Pollution level *2</td><td colspan="5">Less than 2</td></tr>
</table>

*1 Indicates the location where the device is connected from the public cable network to the device structure wiring area.
Category II applies to the devices to which the power is supplied from a fixed equipment.
Surge withstand voltage for devices with up to 300V of rated voltage is 2500V.

*2 This is an index which indicates the degree of conductive object generation in the environment Pollution level 2 is when only non-conductive pollution occurs.
A temporary conductivity caused by condensation must be expected occasionally.

*3 Do not use or store the PLC under pressure higher than the atmospheric pressure of altitude 0m. Doing so can cause a malfunction.
When using the PLC under pressure, please contact your sales representative.

3.2 Performance Specifications

The following table gives the performance specifications of the RD3N/4N.

Table 3.2 Performance Specifications

Item		A68RD3N	A68RD4N	A1S62RD3N	A1S62RD4N
Measuring method		3-wire type	4-wire type	3-wire type	4-wire type
Output (temperature value)		16-bit, signed binary data (-1800 to 6000: Value to first decimal place x 10 times) 32-bit, signed binary data (-180000 to 600000: Value to third decimal places x 1000 times)			
Applicable platinum resistance thermometers		Pt100 (JIS C1604-1997, IEC 751-am2, JIS C1604-1989, DIN 43760-1980) JPt100 (JIS C1604-1981)			
Temperature input range	Pt100	-180 to 600°C (27.10 to 313.71 Ω)			
	JPt100	-180 to 600°C (25.80 to 317.28 Ω)			
Accuracy		±1% (accuracy relative to full-scale)			
Resolution		0.025°C			
Conversion speed		40ms / 1channel			
Number of temperature input points		8 channels/1 module		2 channels/1 module	
Temperature detecting output current		1mA			
Insulation method		Across platinum resistance thermometer input - PLC power supply: Photocoupler-insulated Across platinum resistance thermometer input - channel: Non-insulated			
Dielectric withsland voltage		Across platinum resistance thermometer input - PLC power supply: 500VAC for 1 minute			
Wire break detection		Detected channel by channel	Batch-detected on all channels	Detected channel by channel	Batch-detected on all channels
Number of occupied I/O points		32 points			
Connection terminals		38-point terminal block		20-point terminal block	
Applicable wire size		0.75 to 2mm^2		0.75 to 1.5mm^2	
Applicable crimping terminals		V1.25-3, V1.25-YS3A, V2-S3, V2-YS3A			
Cable across RD3N/4N - platinum resistance thermometer		Refer to Section 3.2.1.			
Internal current consumption (5VDC)		0.94A	0.41A	0.49A	0.39A
Weight		0.43kg	0.43kg	0.27kg	0.27kg
Outline dimensions		250(9.84)[H]37.5(1.48)[W]131(5.16)[D] mm(inch)		130(5.12)[H]34.5(1.36)[W]107.4(4.23)[D] mm(inch)	

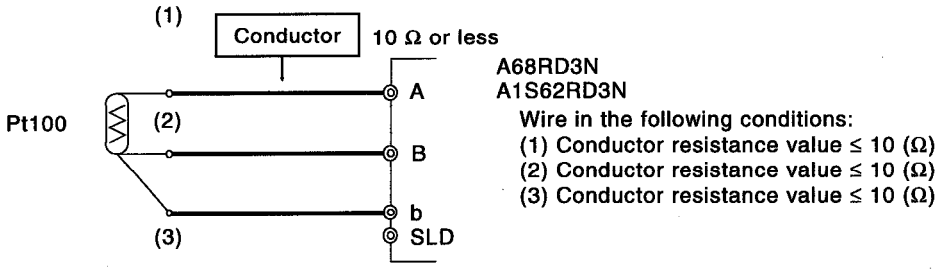
3.2.1 Specifications when connecting with a platinum resistance thermometer

The following specifications apply when an RD3N/4N is connected with a platinum resistance thermometer.

(1) For A68RD3N and A1S62RD3N

Make sure that the conductor resistance value between the Pt100 and A68RD3N/A1S62RD3N is 10[Ω] or less per wire.

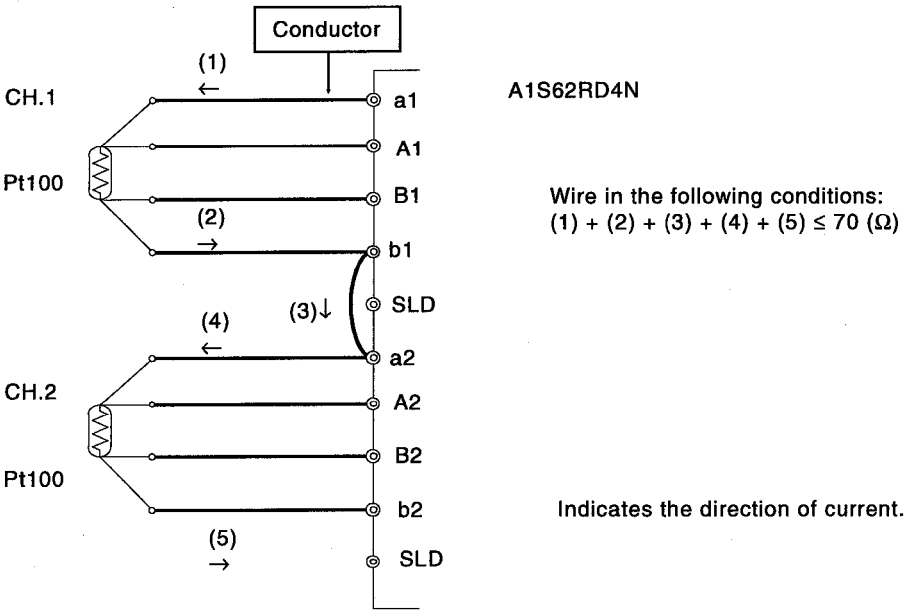
All channels have the same specifications.



(2) For A68RD4N and A1S62RD4N

Set the total resistance value of the conductor where the current runs to 70 Ω or less.

Example: To connect Pt100 to both CH.1 and CH.2 (A1S62RD4N)



3.3 Functions

This section explains the various functions of the RD3N/4N

3.3.1 Functions list

The following table lists the functions of the RD3N/4N.

Table 3.3 List of Functions

<table>
<tr><th>Item</th><th>Description</th><th>Section Reference</th></tr>
<tr><td>Conversion enable/disable setting of each channel</td><td>Temperature detection enable/disable is set.</td><td>3.3.2</td></tr>
<tr><td>Sampling/averaging processing setting</td><td>The detected temperature is processed according to the set processing method. The result is stored in buffer memory.
There are three kinds of processing methods:
• Sample processing
• Time-averaging processing
• Count-averaging processing</td><td>3.3.3</td></tr>
<tr><td>Storage of a detected temperature value</td><td>Values to the first and third decimal places are given.
• Value to the first decimal place (16-bit signed binary)
Example: 53.8 [°C] → 538
• Value to the third decimal place (32-bit signed binary)
Example: 216.025 [°C] → 216025</td><td>3.3.4</td></tr>
<tr><td>Disconnection detection</td><td>Disconnection of Pt100 or cable is detected.
• A68RD3N, A1S62RD3N
A disconnection at a channel is detected and the disconnection-detected flag that corresponds to that channel is set.
• A68RD4N, A1S62RD4N
If either channel disconnects, it is detected and the disconnection-detected flag is set.</td><td>3.3.5</td></tr>
<tr><td>Setting of a platinum resistance thermometer</td><td>The type of platinum resistance thermometer to be used is set.
There are two kinds of platinum resistance thermometers:
<table>
<tr><th colspan="2">Platinum resistance thermometer type</th><th>Standard</th></tr>
<tr><td rowspan="2">Pt100</td><td>1997JIS type</td><td>JIS C1604-1997, IEC 751-am2</td></tr>
<tr><td>1989JIS type</td><td>JIS C1604-1989, DIN 43760-1980</td></tr>
<tr><td>JPt100</td><td>Old JIS type</td><td>JIS C1604-1981</td></tr>
</table></td><td>3.3.6</td></tr>
</table>

3.3.2 Conversion enable/disable channel setting

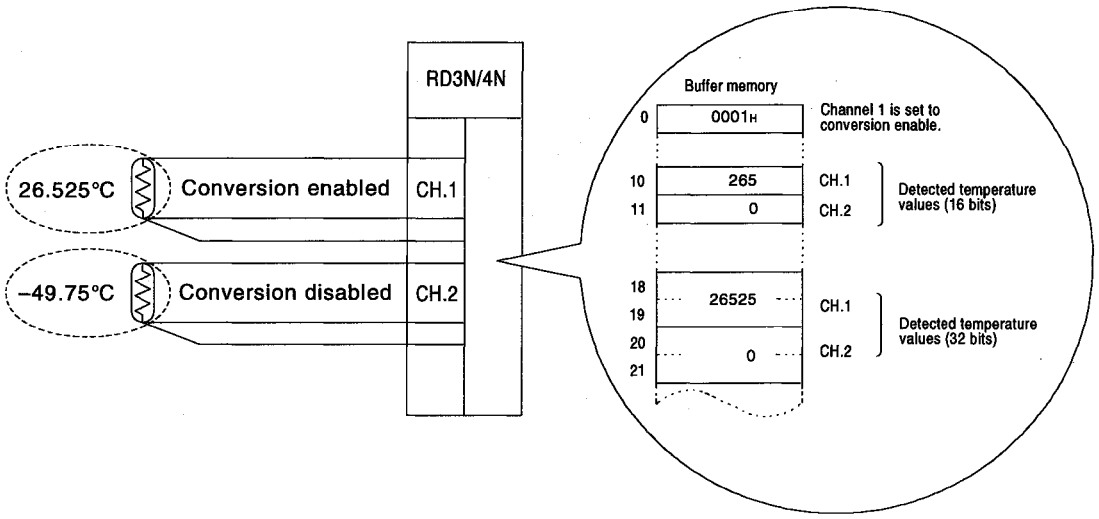
(1) Temperature detection enable/disable is set for each channel.

- Conversion enable : The external temperature is received, and disconnection detection is done.
- Conversion disable: The external temperature is not received, and disconnection detection is not done.

(2) All channels are set to the default conversion disable.

Set the channel to the buffer memory (address 0) for conversion enable/disable setting to convert to the conversion enable. (See section 3.5.2)

Example: When channel 1 is set to conversion enable



(3) The unused channel is set to conversion disable to shorten the sampling time.

Example:

1) When channels 1 and 2 are set to conversion enable

   Sampling time = 2 x 40 ms = 80 ms

2) When channel 1 is set to conversion enable

   Sampling time = 1 x 40 ms = 40 ms

(4) When the conversion enable is switched to conversion disable, the following processing is executed.

(a) Buffer memory (address 35) to store the conversion completed flag of channels 1 and 2 is reset.

(b) Disconnection-detected flag is reset.

POINT

The detected temperature value stored in the buffer memory holds data before writing a conversion enable/disable setting.

REMARKS

(1) Section 3.5 gives details about the buffer memory.

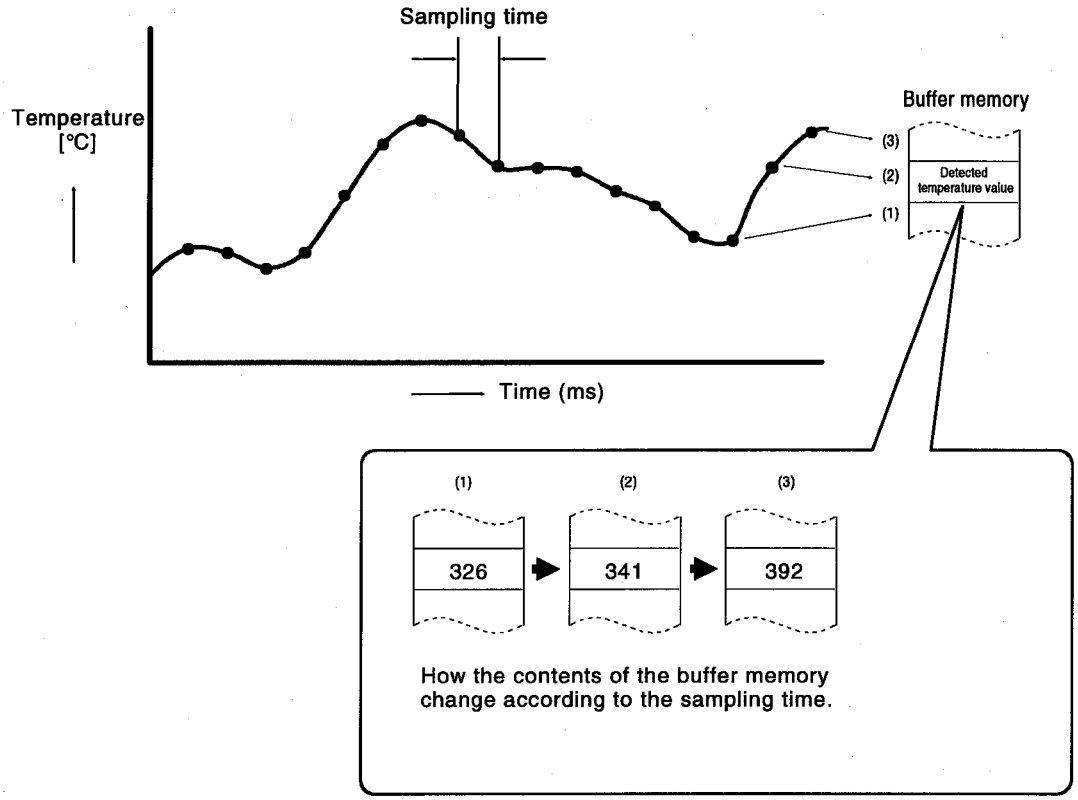
(2) Section 3.3.5 gives details about the disconnection detection, and Section 3.4 gives details about the disconnection-detected flag.

3.3.3 Sampling and time-averaging processing

Designation of sampling processing or time-averaging processing is made by buffer memory (address 1) where averaging processing is designated.

(1) Sampling

Data in a channel is converted according to the sampling time set in the PLC CPU. The detected temperature values are stored in the buffer memory.



REMARKS

(1) The sampling time varies according to the number of channels.

Sampling time = number of channels to be used x 40 ms (ms)

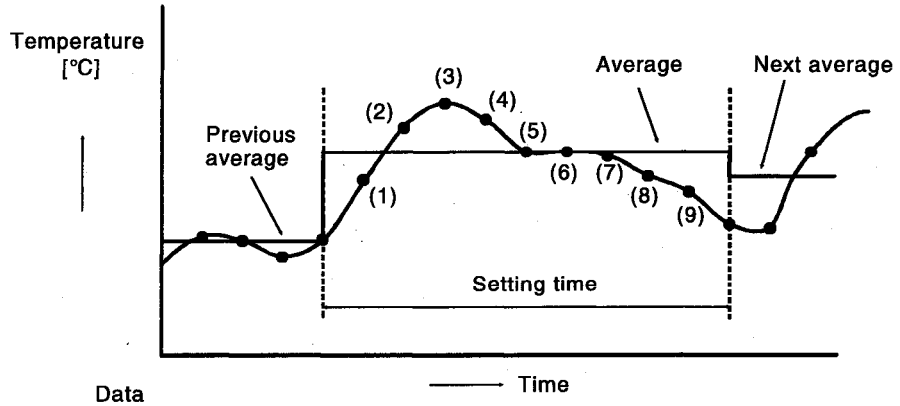
Example: When channel 1 is used
1 x 40 = 40 [ms]

(2) Section 3.5 gives details about the buffer memory.

(2) Time-averaging processing time

Data conversion in the channel is done in the time that is set in the PLC CPU for averaging processing.

A detected temperature value is read per sampling time in the range of setting time (320 to 32000 ms for A68RD3N/4N, and 80 to 32000 ms for A1S62RD3N/4N) and the average of the remaining values (except for maximum and minimum values) is stored in buffer memory.



Data

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
180	210	220	215	205	200	195	180	170

Maximum value

Minimum value

$$\text{Average} = \frac{180 + 210 + 215 + 205 + 200 + 195 + 180}{7} = 198$$

Stored in buffer memory.

The previous average is stored in buffer memory until the average of the new detected temperature value is stored.

REMARKS

(1) The sampling count at a specified time varies with the number of channels.

$$\text{Sampling count} = \frac{\text{setting time}}{\text{number of channels used} \times 40 \text{ ms [ms]}}$$

Example: When channels 1 and 2 are used, and the setting time is 60 ms

$$\text{Sampling count} = \frac{600 \text{ ms}}{2 \times 40 \text{ ms}} = 7.5$$

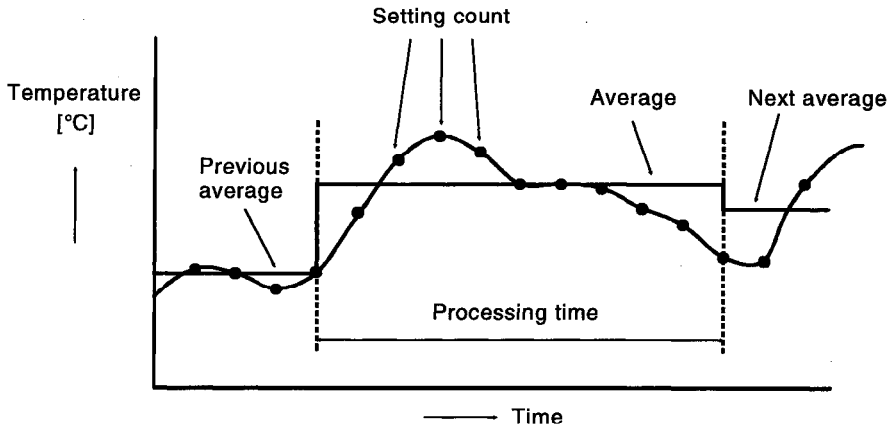
The sampling count is rounded down to 7.

(2) Section 3.5 gives the buffer memory to store a detected temperature value.

(3) Count averaging processing

Data conversion in the channel is done in the time set in the PLC CPU for averaging processing.

A detected temperature value is read per the sampling time in the range of (1 to 800 times) and the average of the remaining values (except for maximum and minimum values) is stored in buffer memory.



The previous average is stored in the buffer memory until the average of the newly detected temperature value is stored.

REMARKS

(1) The sampling time at a specified count varies with the number of channels.

Sampling time = setting count x number of channels used x 40 ms [ms]

Example When channels 1 and 2 are used, the setting count is 10 and 15, and the sampling time is as follows:

Channel	Setting Count	Sampling Time
CH. 1	10	10 times x 2 x 40 ms = 800 [ms]
CH. 2	15	15 times x 2 x 40 ms = 1200 [ms]

(2) Section 3.5 gives the detected temperature value to store to the buffer memory .

3.3.4 Storage of a detected temperature value

Temperature can be detected with the RD3N/4N within the range of –180 °C to 600 °C.

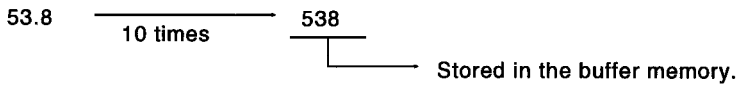
Detected temperature values to the first and third decimal places are stored in the buffer memory.

(1) Values to the first decimal place:

Values to the first decimal place are multiplied by 10 and expressed as 16-bit signed binary values.

The data within the range of –1800 to 6000 is stored.

Example: 53.8 °C

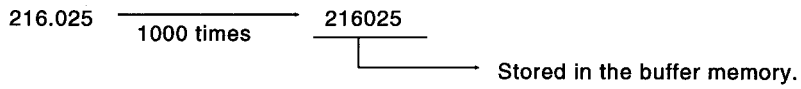


(2) Values to the third decimal place:

Values to the third decimal place are multiplied by 1000, and expressed as 32-bit signed binary values.

The data within the range of –180000 to 600000 is stored.

Example: 216.025 °C



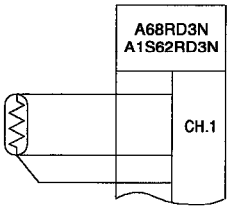
3.3.5 Disconnection detection

Disconnection of a Pt100 or cable is detected.

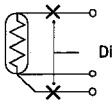
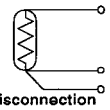
(1) For A68RD3N and A1S62RD3N (3-wire type)

Disconnection at each channel is detected and the disconnection-detected flag (X3 to XA for A68RD3N, and X3 or X4 for A1S62RD3N) that corresponds to that channel is set.

However, this applies only in channels specified for conversion enabled.



Connections between CH1 and a Pt100

Connection Example	Conversion-Enabled/Disabled Specification	Disconnection-Detected (X3)
 Disconnected	Conversion enabled	ON
	Conversion disabled	OFF
Disconnection	Conversion enabled	ON
No connection	Conversion disabled	OFF
 No disconnection	Conversion enabled	OFF
	Conversion enabled	

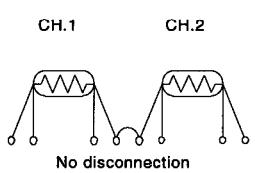
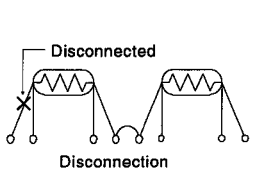
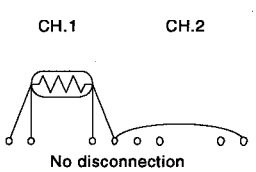
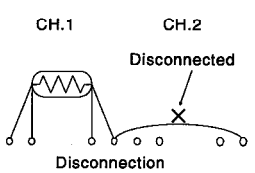
(2) For A68RD4N and A1S62RD4N (4-wire type)

Disconnection at each channel is detected and the Σ disconnection-detected flag (X3) is set.

However, if all channels are specified for conversion disabled, disconnections are not detected.

If at least one channel is specified for conversion enabled, disconnections are detected.

[Example] For A1S62RD4N

	Σ Disconnection-Detected Flag (X3)			
	All Channels are Used		CH.1 is Used	
Connection example				
CH.1 and CH.2 are enabled.	OFF	ON		
CH.1 is enabled.	OFF	ON	OFF	ON
CH.2 is enabled.	OFF	ON		
CH.1 and CH.2 are disabled.	OFF			

POINTS

(1) Be sure to set the channel which is not connected to or used by the Pt100 to conversion disabled. If it is set to conversion enabled, the disconnected-detected flag is set.

(2) Section 3.4.4 gives details about disconnection-detected flags.

(3) Section 4.5 gives details about Pt100 connections.

3.3.6 Specifying platinum resistance thermometers

The following platinum resistance thermometers can be used for the RD3N/4N:

Platinum resistance thermometer type		Standard
Pt100	1997JIS	JIS C1604-1997, IEC 751-am2
	1989JIS	JIS C1604-1989, DIN 43760-1980
JPt100	JIS	JIS C1604-1981

Specifying the type of platinum resistance thermometers by using buffer memory (address 36) sets all channels to a specified type.

(The type is set to Pt100 when power is turned ON or the CPU is reset.)

POINT

Two different types of platinum resistance thermometers cannot be used simultaneously in one module. If two types are used, the correct temperature detection cannot be achieved in the channel which has a different platinum resistance thermometer than the one specified.

REMARKS

(1) Appendix 3 gives details about the standard resistance values of the platinum reisistance thermometers.

(2) Section 3.5 gives details about the buffer memory.

3.4 CPU I/O Signal

This section explains the functions of I/O signals that control the RD3N/4N and the PLC CPU.

X devices refer to input signals from the RD3N/4N to the CPU.

Y devices refer to output signals from the CPU to the RD3N/4N.

The device signals (X and Y) shown in this section are used when the RD3N/4N is loaded into slot 0 of the main base unit.

(1) For A68RD3N

Signal Direction: A68RD3N → PLC CPU		Signal Direction: PLC CPU → A68RD3N	
Device No.	Description	Device No.	Description
X0	WDT error flag	Y0 to YC	Unusable
X1	READY flag		
X2	Write data error flag		
X3	CH.1: disconnection-detected flag		
X4	CH.2: disconnection-detected flag		
X5	CH.3: disconnection-detected flag	YD to YF	Interlock flag for RFRP and RTOP instructions when setting an A68RD3N to a remote I/O station
X6	CH.4: disconnection-detected flag		
X7	CH.5: disconnection-detected flag		
X8	CH.6: disconnection-detected flag		
X9	CH.7: disconnection-detected flag	Y10 to Y11	Unusable
XA	CH.8: disconnection-detected flag		
XB to X1C	Unusable	Y12	Error code reset flag
X1D to X1F	Interlock flag for RFRP and RTOP instructions when setting an A68RD3N to a remote I/O station	Y13 to Y1F	Unusable

(2) For A68RD4N

Signal Direction: A68RD4N → PLC CPU		Signal Direction: PLC CPU → A68RD4N	
Device No.	Description	Device No.	Description
X0	WDT error flag	Y0 to YC	Unusable
X1	READY flag		
X2	Write data error flag		
X3	Disconnection detected flag (CH1 to CH8)	YD to YF	Interlock flag for RFRP and RTOP instructions when setting an A68RD4N to a remote I/O station
X4 to X1C	Unusable	Y10 to Y11	Unusable
		Y12	Error code reset flag
X1D to X1F	Interlock flag for RFRP and RTOP instructions when setting an A68RD4N to a remote I/O station	Y13 to Y1F	Unusable

(3) For A1S62RD3N

Signal Direction: A1S62RD3N → PLC CPU		Signal Direction: PLC CPU → A1S62RD3N	
Device No.	Description	Device No.	Description
X0	WDT error flag	Y0 to Y11	Unusable
X1	READY flag		
X2	Write data error flag		
X3	CH.1: Disconnection-detected flag		
X4	CH.2: Disconnection-detected flag		
X5 to X1F	Unusable	Y12	Error code reset flag
		Y13 to Y1F	Unusable

(4) For A1S62RD4N

Signal Direction: A1S62RD4N → PLC CPU		Signal Direction: PLC CPU → A1S62RD4N	
Device No.	Description	Device No.	Description
X0	WDT error flag	Y0 to Y11	Unusable
X1	READY flag		
X2	Write data error flag		
X3	Σ disconnection-detected flag (CH.1 and CH.2)		
X4 to X1F	Unusable	Y12	Error code reset flag
		Y13 to Y1F	Unusable

3.4.1 WDT (watch dog timer) error flag (X0)

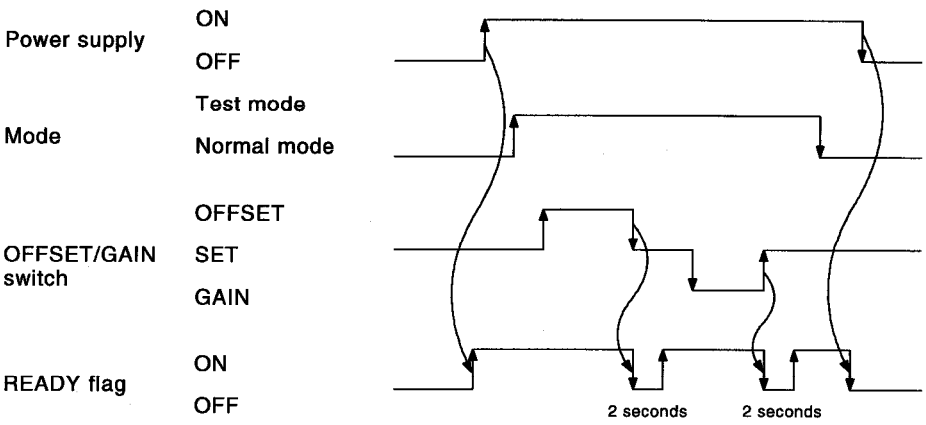
This flag is set when the self-diagnosis function of the RD3N/4N detects a WDT error.

While the error flag is set, the conversion of the RD3N/4N does not RUN. If the error flag (X0) is set, hardware malfunctions may occur.

3.4.2 READY flag (X1)

This flag is set when the conversion is ready after turning ON or resetting the CPU in the normal mode.

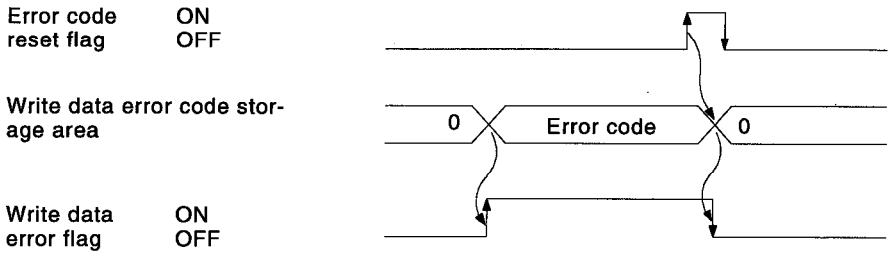
This flag is reset in the test mode (Refer to Section 4.4.2) when the OFFSET/GAIN switch is set to SET.



3.4.3 Write data error flag (X2) and error code reset flag (Y12)

This flag is set when an error other than the watchdog timer error occurs in the RD3N/4N and the error code is stored in the buffer memory error code storage area (address 34).

If "0" is written to the setting value check code storage area or the error reset flag is set with a sequence program, the error code is reset.

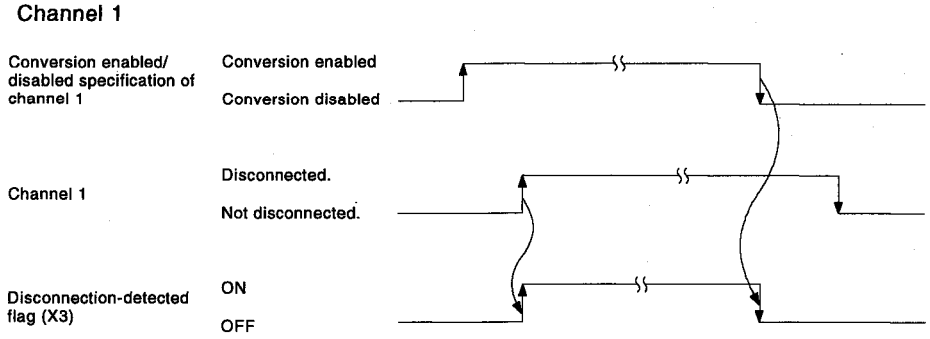


3.4.4 Disconnection-detected flag

(1) For A68RD3N, A1S62RD3N (3-wire type)

When a channel set to conversion enabled is disconnected, the disconnection-detected flag (X3 to XA for A68RD3N, and X3 or X4 for A1S62RD3N) of its channel is set.

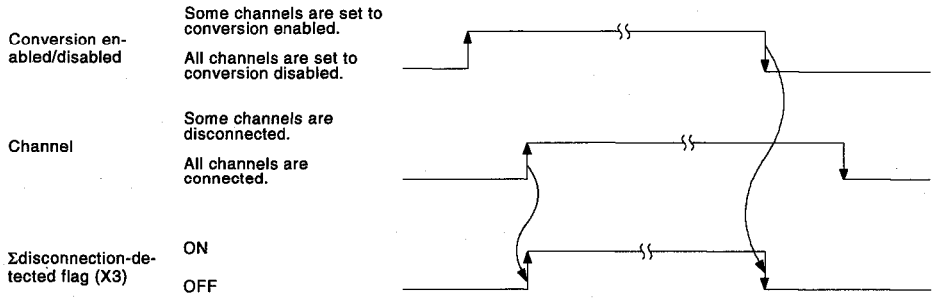
If a channel is set to conversion disabled, the disconnection-detected flag is always reset.



(2) For A68RD4N, A1S62RD4N (4-wire type)

When some of the channels are set to conversion enabled, and any of the channels are disconnected, the Σdisconnection-detected flag (X3) is set.

When all of the channels are set to conversion disabled, the disconnection-detected flag (X3) is always reset.



REMARK

Section 3.3.5 gives details of disconnection detection.

3.5 Buffer Memory

3.5.1 Buffer memory allocation

The following describes the buffer memory allocation (not battery-backed) of an RD3N/4N.

(1) For A68RD3N/4N

Address (decimal)		
0	Conversion enabled/disabled specification	
1	Average processing and specification	
2	CH1 Averaging time/count	
3	CH2 Averaging time/count	
4	CH3 Averaging time/count	
5	CH4 Averaging time/count	
6	CH5 Averaging time/count	
7	CH6 Averaging time/count	
8	CH7 Averaging time/count	
9	CH8 Averaging time/count	
10	CH1 Detected temperature value (16 bits)	
11	CH2 Detected temperature value (16 bits)	
12	CH3 Detected temperature value (16 bits)	
13	CH4 Detected temperature value (16 bits)	
14	CH5 Detected temperature value (16 bits)	
15	CH6 Detected temperature value (16 bits)	
16	CH7 Detected temperature value (16 bits)	
17	CH8 Detected temperature value (16 bits)	
18	CH1 Detected temperature value (32 bits)	(L)
19		(H)
20	CH2 Detected temperature value (32 bits)	(L)
21		(H)
22	CH3 Detected temperature value (32 bits)	(L)
23		(H)
24	CH4 Detected temperature value (32 bits)	(L)
25		(H)
26	CH5 Detected temperature value (32 bits)	(L)
27		(H)
28	CH6 Detected temperature value (32 bits)	(L)
29		(H)
30	CH7 Detected temperature value (32 bits)	(L)
31		(H)
32	CH8 Detected temperature value (32 bits)	(L)
33		(H)
34	Write data error code	
35	Conversion-completed flag	
36	Type specification of a platinum resistance thermometer	

Read/write area using a PLC CPU

Read-only area using a PLC CPU

Read/write area using a PLC CPU

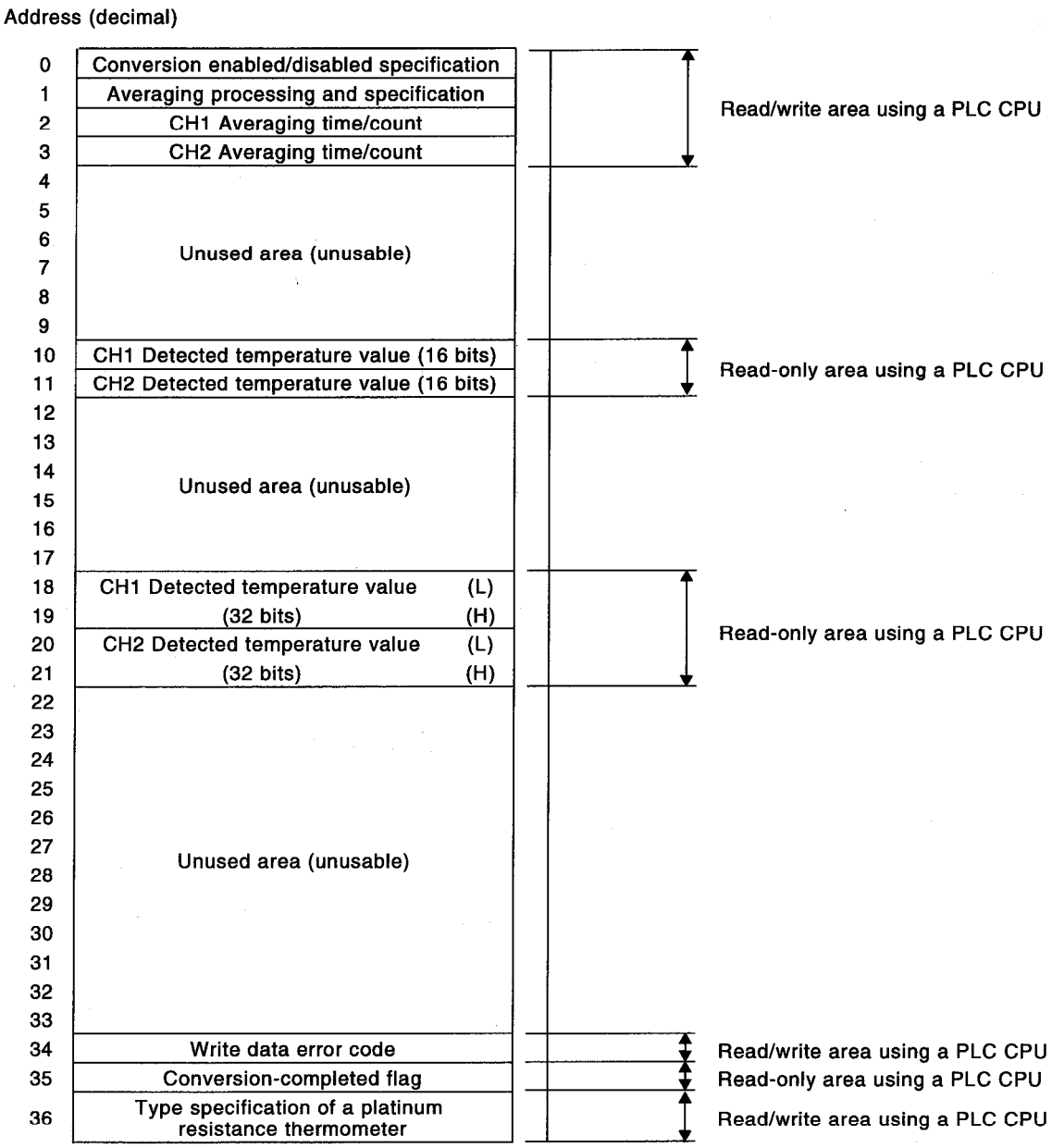
Read-only area using a PLC CPU

Read/write area using a PLC CPU

POINT

When using a PLC CPU, buffer memory addresses 10 to 33 and 35 are read-only areas. Therefore, never write data to the areas with a PLC CPU because the A68RD3N/4N always overwrites a detected temperature value. Thus, if writing is done to these areas, buffer memory data will be destroyed.

(2) For A1S62RD3N/4N



POINT

When using a PLC CPU, the buffer memory addresses 10, 11, 18 to 21, and 35 are read areas. Therefore, never write with a PLC CPU because the A1S62RD3N/4N always overwrites a detected temperature value. Thus, even when only writing, the buffer memory data is cleared.

3.5.2 Buffer for conversion enabled/disabled specifications (Address 0)

This area is used to set the temperature detection.

(1) When the power is turned ON, the channel specification is set at "0000H(0)" for conversion disabled for all channels.

(2) Conversion enabled/disabled can be changed with the sequence program to reduce the sampling time.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
–	–	–	–	–	–	–	–	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For A68RD3N/4N, b8 through b15 are ignored.
For A1S62RD3N/4N, b2 through b15 are ignored.

Channel specifications
1: Conversion enabled
0: Conversion disabled

Example: To specify channel 1 for conversion

By writing 0001H(1) to specify the channels for conversion enabled/disabled, the sampling time is obtained as 40 ms x 1 = 40 ms.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	→ 0001H (1)
														CH2	CH1	

REMARK

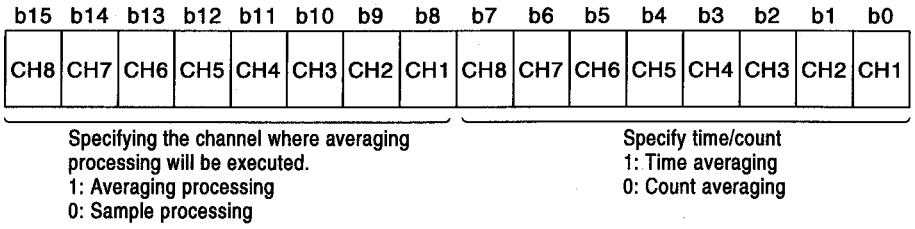
Section 3.3.2 gives conversion enabled/disabled specifications

3.5.3 Buffer for averaging processing specifications (Address 1)

This area is used to set the sample processing or averaging processing.

(1) When the power is turned ON and the READY flag of the RD3N/4N is set, all of the channels are set for sample processing.

(2) Use the buffer memory address 1 for selection of sample processing or averaging processing and the specification of the processing method (time averaging/count averaging).



For A1S62RD3N/4N, b2 through b7 and b10 through b15 are ignored.

POINT

When the averaging processing is not specified, sample processing is set without regard to the time/count specification.

REMARK

Section 3.3.3 gives sample processing and averaging processing-details.

3.5.4 Buffer for averaging time/count (For A68RD3N/4N: Addresses 2 Through 9, for A1S62RD3N/4N: Addresses 2 and 3)

This area sets the time or count to perform averaging processing when averaging processing is designated.

(1) When the power is turned ON, the averaging time and averaging count are set to 0.

(2) The setting ranges are as indicated below:

Item	Available setting range	
	When A68RD3N/4N is used	When A1S62RD3N/4N is used
Averaging processing in terms of time	320 to 32000 ms	80 to 32000 ms
Averaging processing in terms of count	1 to 800 times	

POINT

If a value outside of the above range has been written, a setting error occurs and the buffer memory for averaging time/count is rewritten. However, the RD3N/4N performs conversion processing at the averaging time or count previously set.

REMARK

(1) Section 3.3.3 gives averaging time/count-details.

3.5.5 Buffer for detected temperature value (For A68RD3N/4N: Addresses 10 Through 33, for A1S62RD3N/4N: Addresses 10 and 11, 18 Through 21)

Two types of detected temperature storing areas are provided depending on the bit size of the data - 16-bit data storing area and 32-bit data storing area.

(1) For 16 bit data (For A68RD3N/4N: Addresses 10 Through 17, for A1S62RD3N/4N: Addresses 10 and 11)

Ten (10) times the value of a detected temperature is stored in the range from –1800 to 6000 as a 16-bit signed binary value.

If a detected temperature value is negative, this is stored as a complement of 2.

Example 1: If a detected temperature value is 123.025°C, 1230 is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	0

Example 2: If a detected temperature value is –123.025 °C, –1230 is stored.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
1	1	1	1	1	0	1	1	0	0	1	1	0	0	1	0

(2) For 32 bit data (For A68RD3N/4N: Addresses 18 Through 33, for A1S62RD3N/4N: Addresses 18 and 21)

One-thousand (1000) times the value of a detected temperature value is stored in the range from –180000 to 600000 as a 32-bit signed binary value.

If a detected temperature value is negative, this is stored as a complement of 2.

Example 1: If a detected temperature value is 123.025 °C, 123025 is stored.

b31	to	b24	b23	to	b16	b15	to	b8	b7	to	b0
0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0			0 0 0 1 1 1 1 0			0 0 0 1 0 0 1 0			0 0 0 1

Example 2: If a detected temperature value is –123.025 °C, –123025 is stored.

b31	to	b24	b23	to	b16	b15	to	b8	b7	to	b0
1 1 1 1 1 1 1 1		1 1 1 1 1 1 1 1			1 0 0 0 0 1 1 1			1 0 1 1 0 1 1 1			0 1 1 1 1

REMARK

Section 3.3.4 gives detected temperature value-details.

3.5.6 Buffer for write data error code (Address 34)

This area is used to check whether data written to an RD3N/4N from a CPU has been written to the WRITE area within the setting range.

(1) When data is read from the PLC CPU, the RD3N/4N checks the following:

- Data range check for the averaging count and averaging time.
- Data check for writing to the read-only area.

If any value is outside the specified range or if data is written to the read-only area, the RD3N/4N stores the error code as a 16-bit binary value. Section 6.1 gives error code details.

(2) If there is more than one error code, the first data error code detected by the RD3N/4N will be stored. The others are not stored.

(3) To reset an error code, write 0 from the PLC CPU.

If an error is reset without correcting the error, the data error code is set to 0 and the RUN LED of RD3N/4N stops flashing.

POINTS

(1) When a value other than "0" is written, the error code is not reset.

(2) Error code reset can be done by setting the error reset flag (Y12). (See Section 3.4.3.)

3.5.7 Buffer for conversion-completed flag (Address 35)

This area is used to check whether the channel specified for conversion-enabled can detect the temperature correctly.

(1) After power ON, the processing of the conversion-completed flag is performed only once, when the channel specification for conversion enabled/disabled (address 0) is changed.

- Conversion enabled/disabled specification change from 0 to 1:

  After setting conversion enabled and storing a detected temperature value in buffer memory, the conversion-completed flag of its corresponding channel is set to 1.
- Conversion enabled/disabled specification change from 1 to 0:

  The conversion-completed flag of its corresponding channel is set to 0.

(2) A conversion-completed flag is provided to each channel.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

For A68RD3N/4N, b8 through b15 are fixed at 0.
For A1S62RD3N/4N, b2 through b15 are fixed at 0.

Conversion-completed flag
1: Conversion completed
2: Conversion not completed

(3) The conversion-completed flag can be used for the interlock when reading the detected temperature value of the channel where averaging processing is executed.

3.5.8 Buffer for the type of specifications for a platinum resistance thermometer (Address 36)

(1) When the power supply is turned ON, the type is set to Pt100.

(2) All channels correspond to a specified type.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
															1/0

Ignored

Type specifications of a platinum resistance thermometer
1: JPt100
0: Pt100

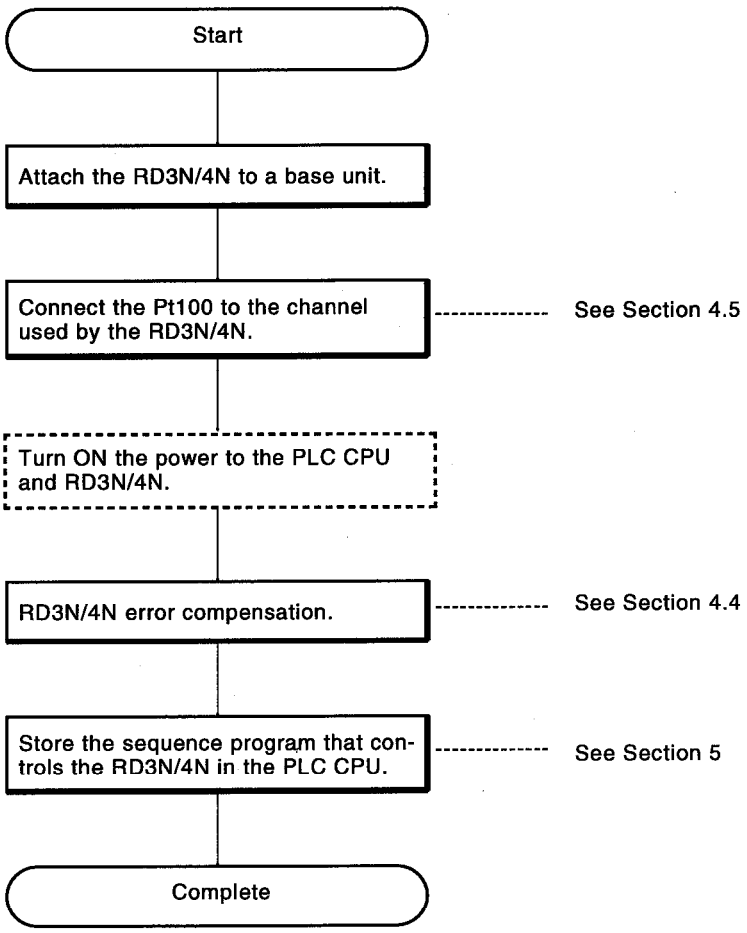
REMARK

Section 3.3.6 gives platinum resistance thermometer-details.

4. PRE-OPERATION SETTINGS AND PROCEDURES

4.1 Pre-Operation Procedures

The pre-operation settings and procedures of the RD3N/4N are given below.



4.2 Handling Instructions

The following explains the handling instructions for the RD3N/4N.

(1) Since the case and terminal block of the module are plastic, do not drop the module. Hard impacts must not be applied, either.

(2) Do not remove the printed circuit boards from their housing. Otherwise, it will cause fault.

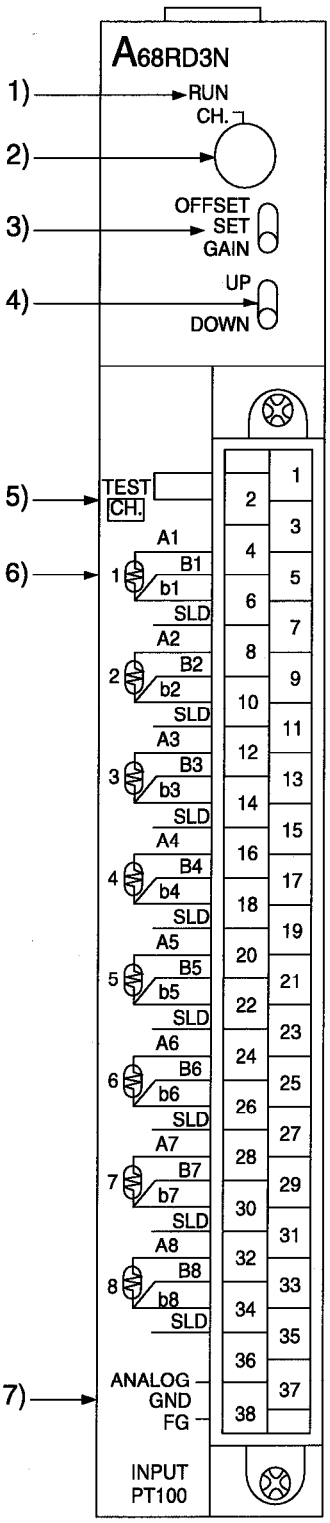
(3) Make sure that no conductive debris can enter the module. If it does, make sure that it is removed.

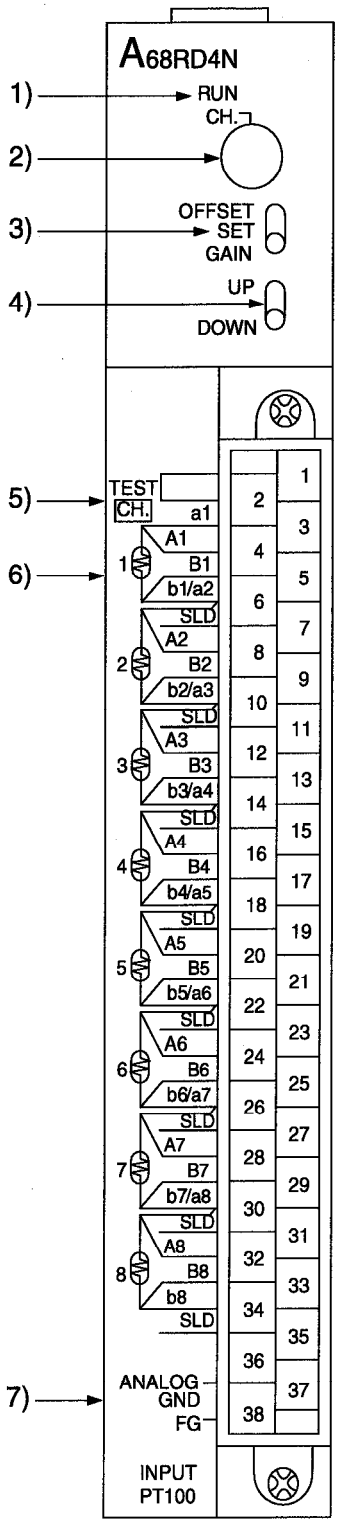
(4) Tighten the terminal screws as specified below:

Screw Position	Tightening Torque Range	
	A68RD3N/4N is used	A1S62RD3N/4N is used
Module installation screw	78 to 118N • cm (M4 screw)	78 to 118N • cm (M4 screw)
Terminal block installation screw	39 to 59N • cm (M3 screw)	59 to 88N • cm (M3.5 screw)
Terminal block terminal screw	78 to 118N • cm (M4 screw)	78 to 118N • cm (M4 screw)

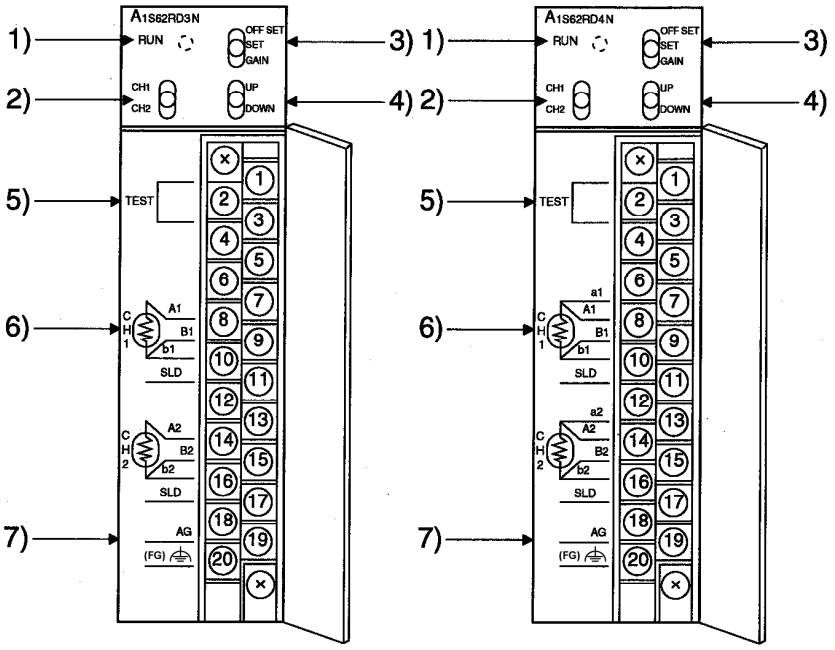
4.3 Nomenclature

The following gives the nomenclature of each part of the RD3N/4N.





Terminal Block Layout		
Signal name	Terminal number	
	A68RD3N	A68RD4N
1	TEST	
2	TEST	
3	Blank	a1
4	A1	
5	B1	
6	b1	b1/a2
7	SLD	
8	A2	
9	B2	
10	b2	b2/A3
11	SLD	
12	A3	
13	B3	
14	b3	b3/a4
15	SLD	
16	A4	
17	B4	
18	b4	b4/a5
19	SLD	
20	A5	
21	B5	
22	b5	b5/a6
23	SLD	
24	A6	
25	B6	
26	b6	b6/a7
27	SLD	
28	A7	
29	B7	
30	b7	b7/a8
31	SLD	
32	A8	
33	B8	
34	b8	
35	SLD	
36	Blank	
37	ANALOG GND	
38	FG	



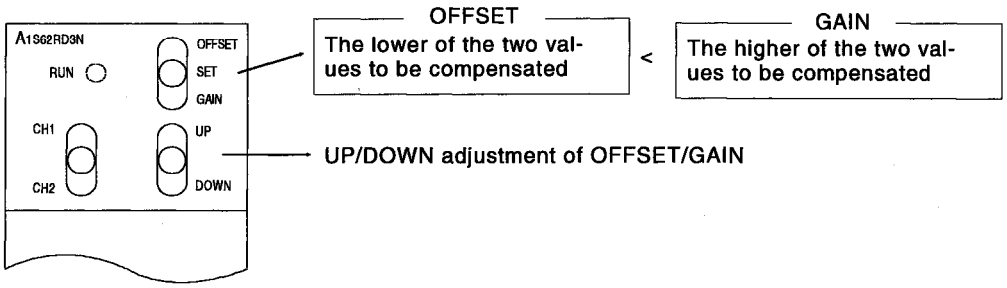
Terminal Block Layout		
Signal name	Terminal number	
	A1S62RD3N	A1S62RD4N
1	TEST	
2	Blank	
3	TEST	
4	Blank	
5	Blank	
6	Blank	
7	Blank	a1
8	A1	
9	B1	
10	b1	
11	SLD	
12	Blank	
13	Blank	a2
14	A2	
15	B2	
16	b2	
17	SLD	
18	Blank	
19	AG	
20	FG	

No.	Description	Application	
1)	Operating status display LED (RUN LED)	Normal mode	ON : In normal operation Flash : Write data error occuring OFF : 5 VDC power OFF or WDT error occuring
		Test mode	Flicker: When the OFFSET/GAIN setting switch is set to OFFSET or GAIN, this LED will flicker at 0.5 second intervals. OFF : OFFSET/GAIN setting switch set to SET.
2)	Channel select switch	Selects the channel for adjusting the offset and gain for error compensation. (When A68RD3N/4N is used, the 0, 9 position setting is not managed.) Factory-Set A68RD3N/4N : 0 A1S62RD3N/4N : CH1	
3)	OFFSET/GAIN setting switch	Sets the offset value and gain value for the test mode. Factory-set : SET (1) OFFSET position : Offset value compensation mode (2) GAIN position : Gain value compensation mode (3) SET position : Offset value/gain value save mode The temperature detection value at the time the switch is changed from the OFFSET/ GAIN position to the SET position is saved in the RD3N/4N internal memory as the offset/gain value.	
4)	UP/DOWN switch	Increments/decrements the offset value/gain value for the channel being used at the following rate. (1) ON for less than 1.5 seconds : Increments/decrements In 0.025°C units. (2) ON for 1.5 seconds or more : Increments/decrements in 0.1°C unit every 0.04 seconds.	
5)	Test mode terminal	Short the terminals when making error compensation.	
6)	Pt100 connecting terminal	Connect the Pt100. (See Section 4.5.)	
7)	Analog/ground terminal	Use to provide a separate ground.	

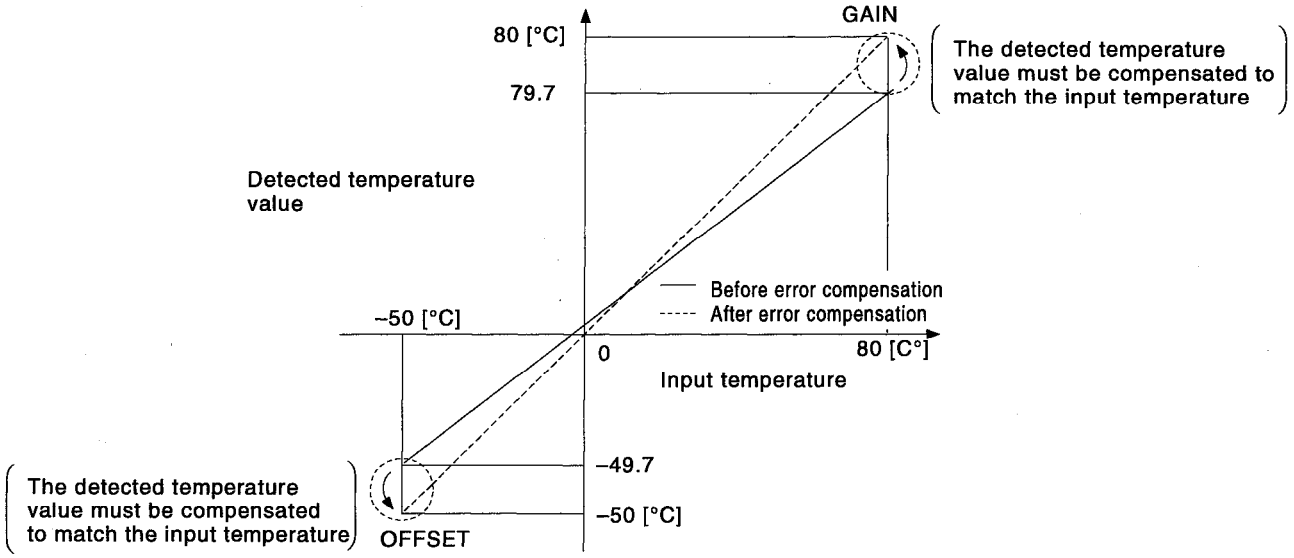
4.4 Error Compensation

Error compensation is done (a) when starting up a system, or (b) when a correct detected temperature value cannot be obtained.

Error compensation is done by reading a detected temperature value from the buffer memory with a sequence program, and monitoring it with a peripheral device.



The characteristics of the detected temperature value for an input temperature are indicated below. Compensate detected temperature values so that the detection value corresponds to the input temperature.



* Error compensation can be done using a standard resistor instead of inputting a direct temperature to the Pt100.

Resistance value of a standard resistor	=	Standard resistance value of Pt100 for an input temperature that is an offset/gain value (see Appendix 3).

POINTS

(1) Complete the error compensation at the highest and lowest temperatures of the available range. Doing so yields a high-precision offset/gain value.

(2) To set an offset/gain value, read the detected temperature value with a sequence program. However, provide interlock to read a detected temperature value when the READY flag (X1) is set.

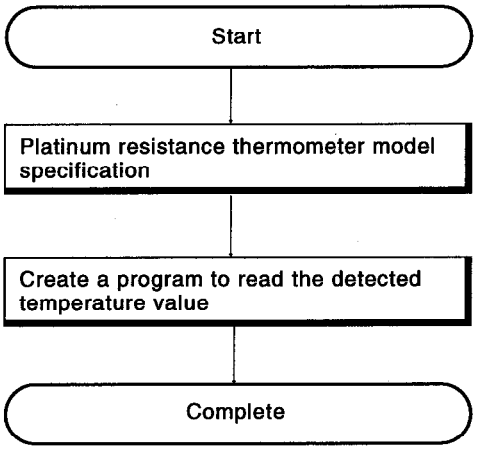
(3) The offset/gain value must be within the input temperature range.

(4) The offset/gain value is stored in the RD3N/4N.
Even if the power supply is turned OFF, this data is not cleared from memory.

(5) If error compensation is executed in test mode, error is occurred within the overall accuracy (±1 %) after the mode is changed to the normal mode.

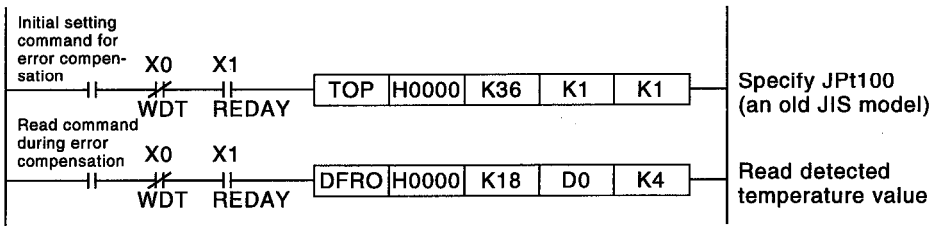
4.4.1 Initial setting

The initial setting procedure shown below must be used for error compensation.



Sample program

When channels 1 and 2 are set to JPt100 (old JIS)

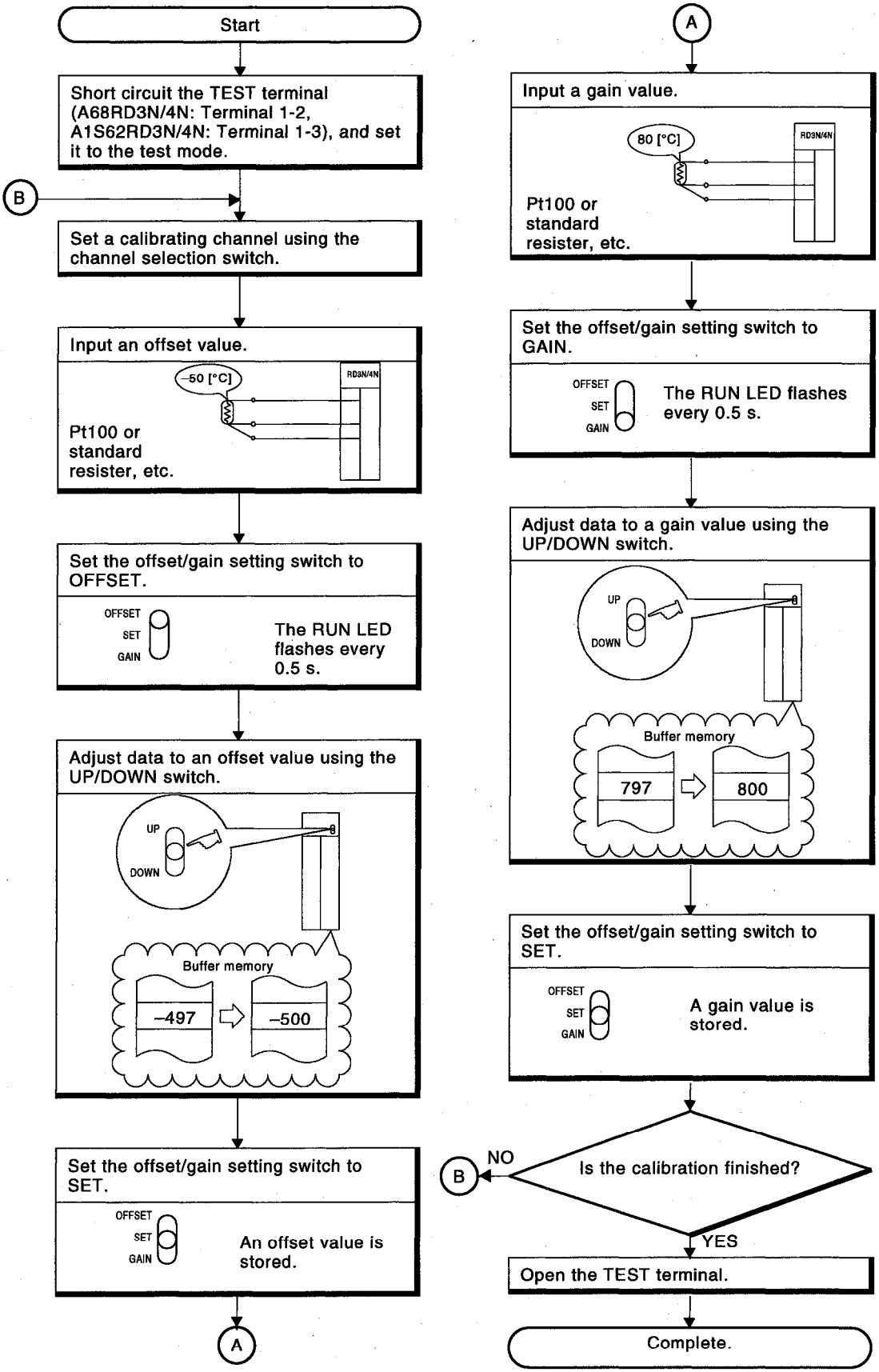


POINT

Before setting the test mode, do the initial setting for error compensation in the normal mode.

4.4.2 Error compensation procedure

The error compensation procedure is shown below.



POINTS

(1) If the offset/gain setting switch is returned back to the OFFSET position after setting the offset/gain in the test mode, the set offset value cannot be checked. The set value is retained.

(2) After operating the module in the normal mode with the offset/gain set in the test mode, the set offset and gain values cannot be checked even if the mode is changed back to the test mode. The set values are retained.

4.5 Connecting a Platinum Resistance Thermometer

The method for connecting a Pt100 to a 3-wire (A68RD3N, A1S62RD3N) or 4-wire (A68RD4N, A1S62RD4N) model is explained below

4.5.1 Cautions on connection

To design the reliable system allowing the RD3N/4N to operate at its full performance, it is necessary to design the external wiring so that it is not influenced by noise.
The cautions that require your careful attention are indicated below.

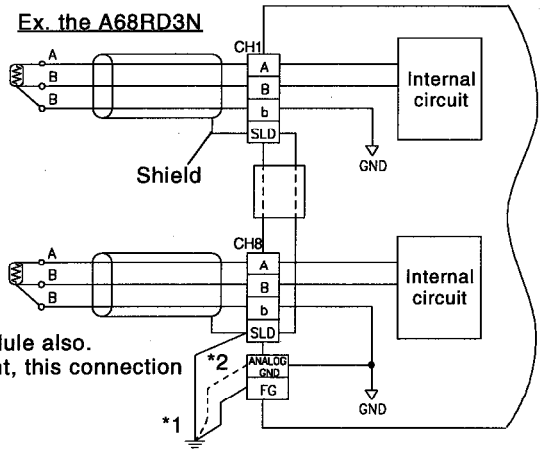
(1) Use separate cable for external input signals of RD3N/4N from the cable that carries AC power so that the signals will not be influenced by AC surge and induction.

(2) Do not run the external wiring cables with or near the cables such as main circuit cable, high-voltage cable, and cables carrying load from other than the programmable controller.

(3) The shield of the shielded wire or cable must be grounded at the programmable controller side (one-point grounding). There are cases the shield should be grounding externally depending on external noise condition.

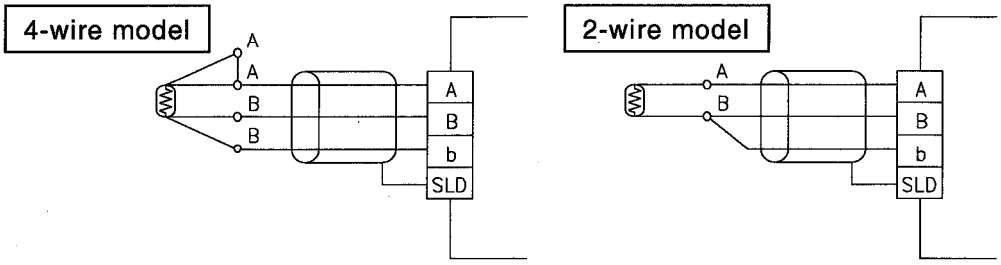
4.5.2 Connection to A68RD3N, A1S62RD3N

(1) The highest precision can be achieved by connecting a 3-wire type Pt100 to the A68RD3N and A1S62RD3N.
An example of connecting a 3-wire Pt100 is shown below.



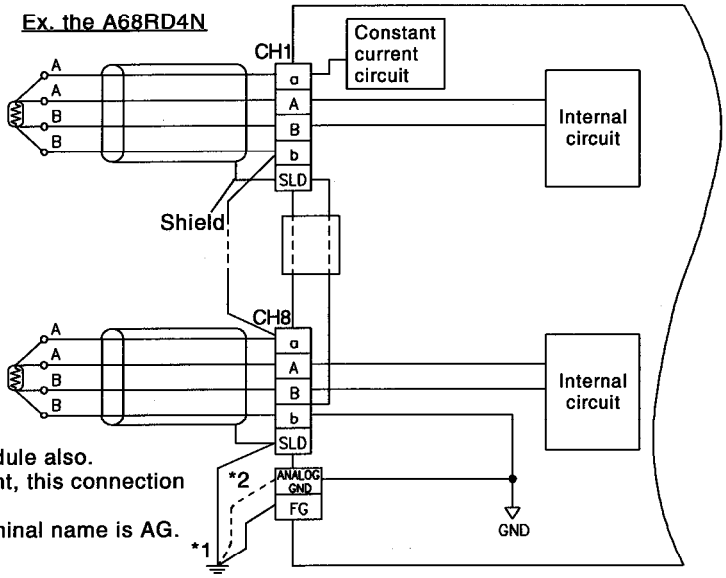
*1 Ground the FG of the power supply module also.
*2 Depending on the operation environment, this connection may give better results.
When the A1S62RD3N is used, the terminal name is AG.

(2) A 4-wire type or 2-wire type Pt100 can also be used with the A68RD3N and A1S62RD3N.
The following shows the diagrams for connecting a 2-wire or 4-wire Pt100.



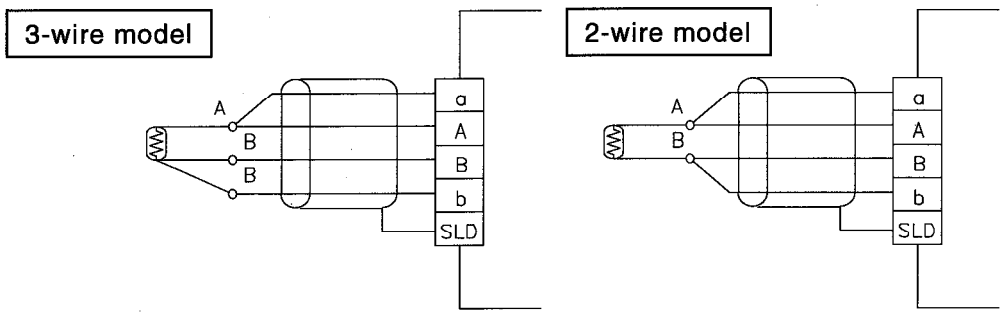
4.5.3 Connection to A68RD4N, A1S62RD4N

(1) The highest precision can be achieved by cocnnecting a 4-wire type Pt100 to the A68RD4N and A1S62RD4N.
An example of connecting a 4-wire Pt100 is shown below.



*1 Ground the FG of the power supply module also.
*2 Depending on the operation environment, this connection may give better results.
When the A1S62RD4N is used, the terminal name is AG.

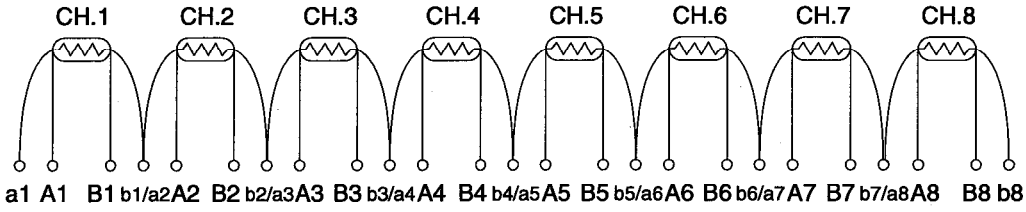
(2) A 3-wire type or 2-wire type Pt100 can also be used with the A68RD4N and A1S62RD4N. Connect as shown below when connecting a 3-wire type or 2-wire type Pt100.



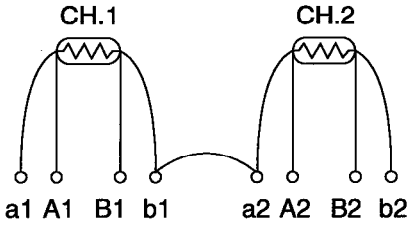
(3) Precautions for connection to A68RD4N and A1S62RD4N
The following are the precautions for connection of Pt100 to the A68RD4N and A1S62RD4N.

(a) Perform wiring so that there is continuity between the following terminals.

When all channels are used on A68RD4N

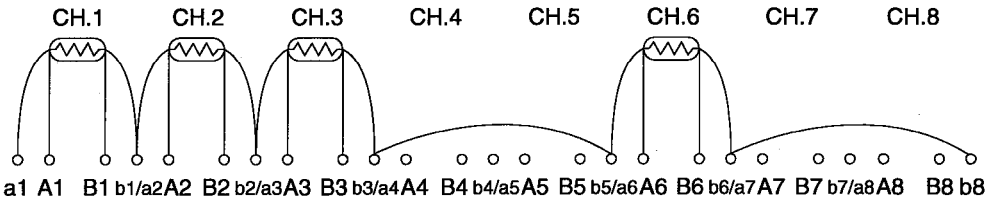


When all channels are used on A1S62RD4N



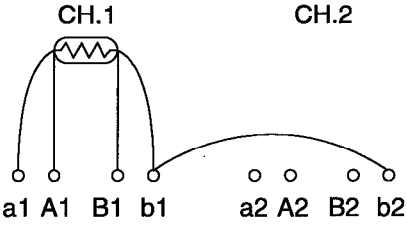
(b) Skip the terminals of the unused channels.

When only CH1, 2, 3 and 6 are used on A68RD4N



*Always wire terminals a1 and b8.

When only CH1 is used on A1S62RD4N



*Always wire terminals a1 and b2.

Point

Always specify "conversion disable" for the channels not connected with Pt100.

When the channels not connected with Pt100 are specified as "conversion enable", the wire break detection flag turns ON if a wire break does not occur on the channel connected with PT100.

5. PROGRAMMING

The following explains the programming to use with the RD3N/4N.

5.1 Programming Procedure

Figure 5.1 shows the procedure for writing a program to execute data write/read between a PLC CPU and an RD3N4N.

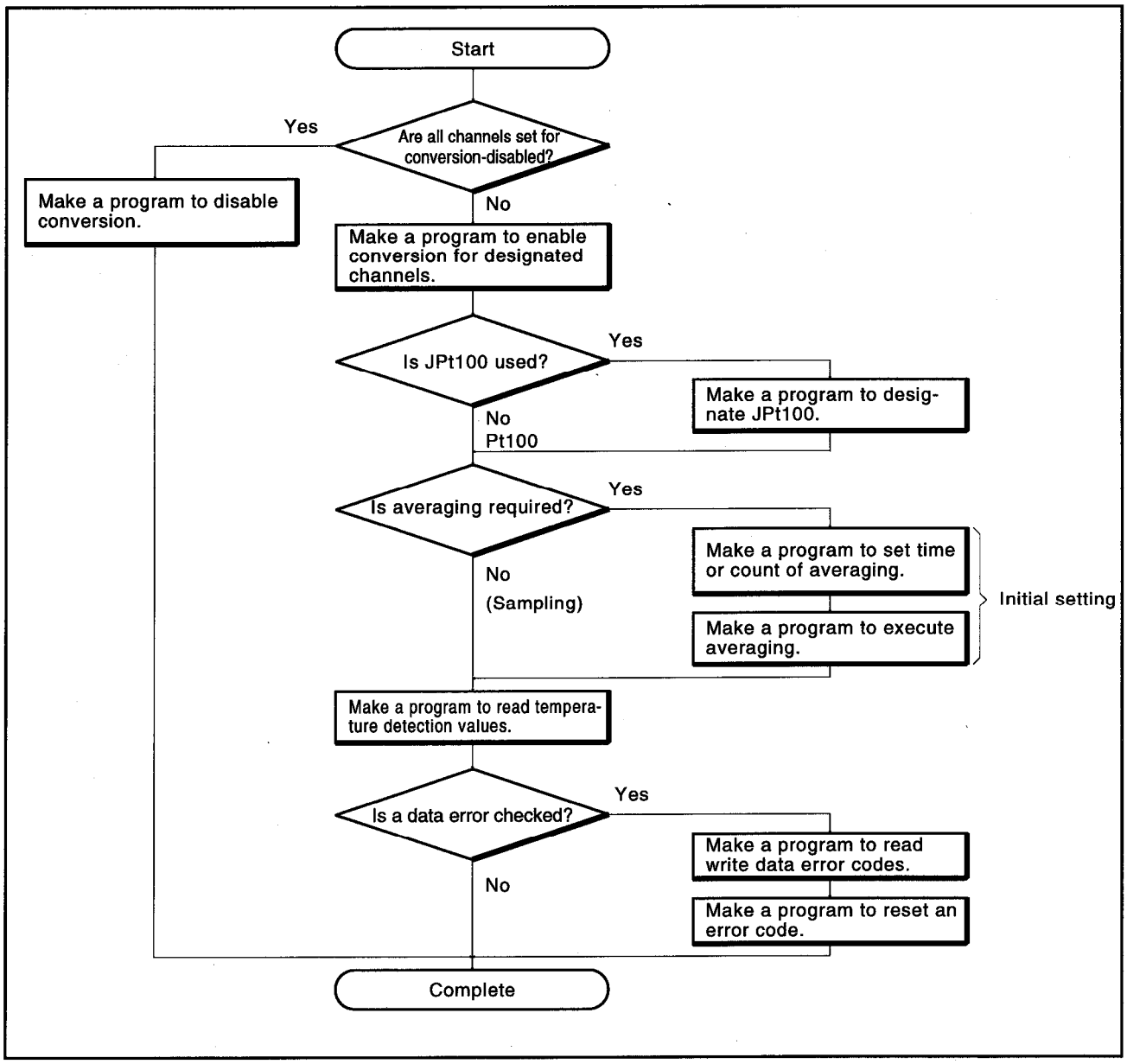


Fig. 5.1 Programming Procedure

POINT

(1) Initial setting must be done as indicated in Figure 5.1. If averaging processing is designated before setting the time or count of averaging, a write data error may sometimes occur. It is recommended that the initial setting be executed by a batch writeinstruction.

(2) Access from the PLC CPU takes priority among various types of processing of the special function module. If access from the PLC CPU to the buffer memory of the special function module is gained frequently, not only the scanning time of the PLC CPU will be prolonged but also the various types of processing of the special function module will be delayed. Carry out the access from the PLC CPU.

(3) For the type designation of the platinum resistance thermometer, see Section 3.3.6.

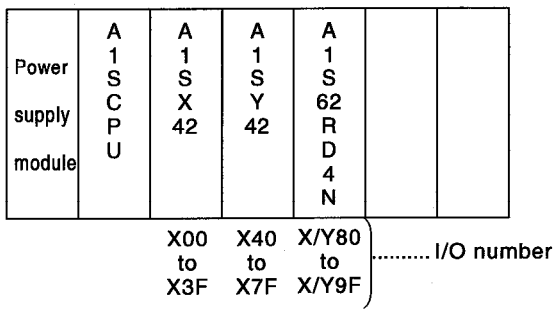
5.2 Programming Example

The following gives an example of programming to use an RD3N/4N.
Except that the number of channels that can be used is different between the A68RD3N/4N and the A1S62RD3N/4N, the contents of the programs are the same.
The following explains an example for the A1S62RD4N.
If the sample program explained in this chapter is used in the actual system, be sure to verify that there is no controllability problem in the target system in advance.

5.2.1 Program to read a detected temperature value

This program performs time averaging processing of 500 ms on channel 1 that uses a JPt100, and reads the detected temperature value after conversion is complete.
(A program for reading write data error codes and doing error code reset is included.)

[System configuration]



[Specifications]

(1) Commands that can be executed

(a) Write command of specified type of platinum resistance thermometer : X0

(b) Write command of the specified conversion-enabled channel and the time averaging processing specification : X1

(c) Read command of a conversion-completed flag and detected temperature values : X2

(d) Positive and negative distinguishing command of a detected temperature value : X3

(e) Read command of a write data error code : X82
(Write data error flag)

(f) Error code reset command : X4

(2) Output when a detected temperature value is negative : Y70

(3) Output of a detected temperature value (4 digits of BCD numbers) : Y40 to Y4F

(4) Output of a write data error code (2 digits of BCD numbers) : Y50 to Y57

(5) Storage register of a conversion-enabled channel specification : D0

(6) Storage register of time averaging processing specification : D1

(7) Storage register of averaging time : D2

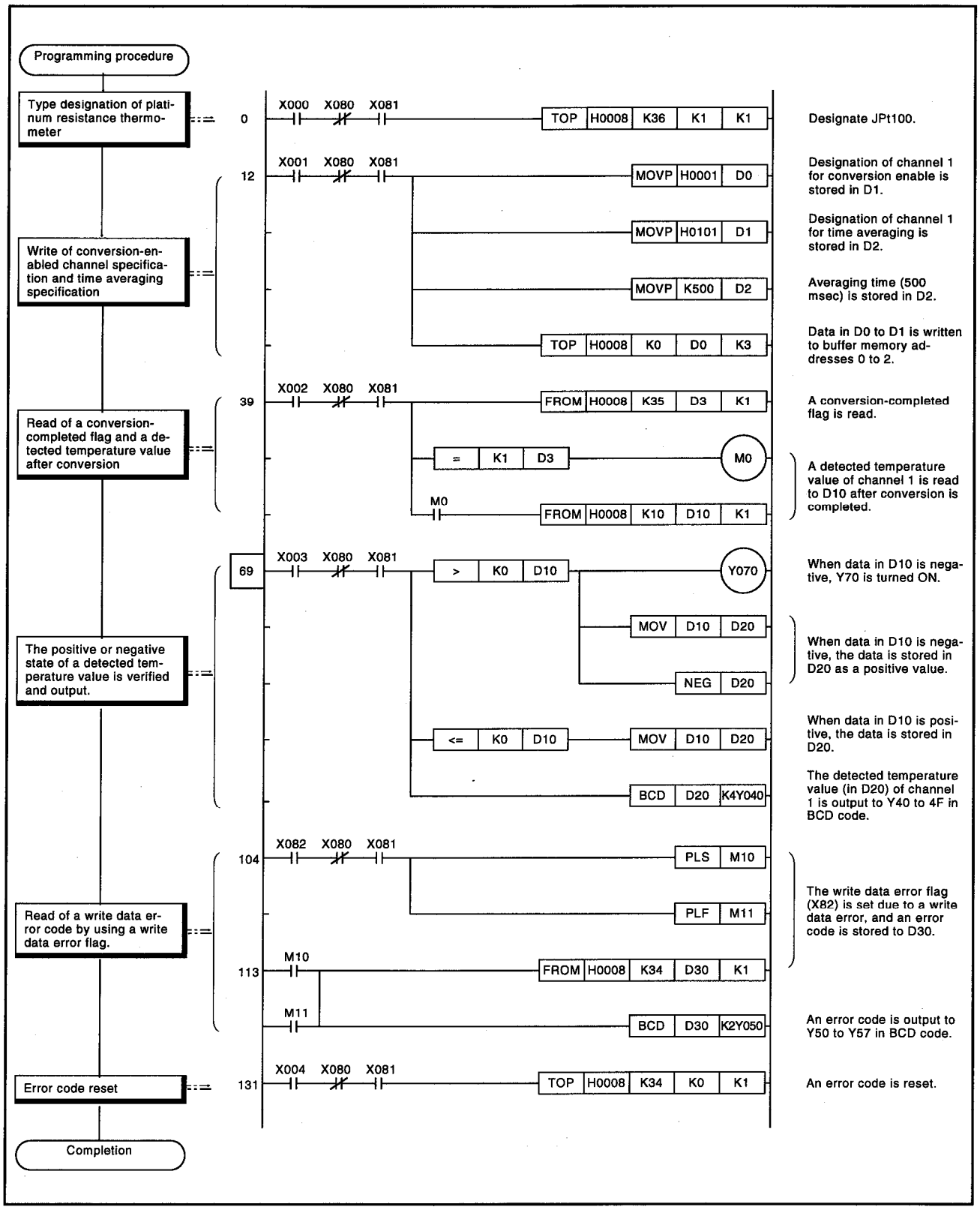
(8) Storage register of a conversion-completed flag : D3

(9) Storage register of a read detected temperature value : D10

(10) Storage register of a detected temperature value after positive/negative verification : D20

(11) Storage register of a write data error code : D30

[Sample program]



6. TROUBLESHOOTING

This section gives lists of error codes, causes, and corrective actions for the errors which may occur when an RD3N/4N is in operation.

6.1 Error Code List

Any of the following error codes are stored in the buffer address 34 of an RD3N/4N if an error occurs (the RUN LED flashes) when data is written from a PLC CPU to the RD3N/4N.

Table 6.1 Error Code List

Error Code	Cause	Corrective Action
102	• Data write was attempted to the read-only areas. [Addresses of read-only areas] A68RD3N/4N: Buffer memory addresses 10 to 33, 35 A1S62RD3N/4N: Buffer memory addresses 10, 11, 18 to 21, 35	Correct the program so that it does not execute data write to read-only areas.
[ ] [0 to 4]	• An out-of-range value was set as the averaging time value. [Setting ranges of averaging time values] A68RD3N/4N: 320 to 32000 ms A1S62RD3N/4N: 80 to 32000 ms • [ ] indicates the number of the channel where an error occurred. • Numbers [0 to 4] do not have any particular meaning. They indicate the averaging time setting errors.	Correct the averaging time setting so that it will be within the range.
[ ] [5 to 8]	• The set values of the averaging count are no within the 1 to 800 times range. • [ ] indicates the number of the channel where an error occurred. • Numbers [5 to 8] do not have any particular meaning. They indicate averaging count setting errors.	Correct the averaging count setting so that the values set are within the 1 to 800 times range.

(1) If more than one error has occurred, only the first error code will be stored.

(2) An error code can be reset by writing "0" to the buffer address 34 or by setting an error code reset flag (Y12). (See Section 3.5.6.)

6.2 If the RUN LED Flashes or is Turned OFF

(1) Flashes

Check Item	Corrective Action
Is the write error flag set?	Follow the procedure given in Section 6.5.
Are the TEST terminals open?	Fix the error by opening the TEST terminals.

(2) Turned OFF

Check Item	Corrective Action
Is the 5 VDC power supplied?	• Check the power supply. • Connect the module securely to the base unit.
Is the WDT error flag set?	Follow the procedure given in Section 6.3.
Are the TEST terminals open?	Compensate error and open the TEST terminals.

6.3 If the WDT Error Flag is Set

Check Item	Corrective Action
Has a WDT error occurred?	Reset the PLC CPU or turn the PLC power OFF and ON. If the power is not restored, a hardware fault is probable. Consult your nearest Mitsubishi representative.

6.4 If the READY Flag is not Set

Check Item	Corrective Action
Is the WDT error flag set?	Follow the procedure given in Section 6.3.
Has an error occurred within the PLC CPU?	Refer to the user's manual of the PLC CPU in use and take an appropriate action.

6.5 If the Write Data Error Flag is Set

Check Item	Corrective Action
Has a write data error occurred?	• Check the error code list in Section 6.1 and modify the sequence program. • Check the initial setting procedure given in Section 5.1 and modify the sequence program.

6.6 If the Disconnection-Detected Flag is Set

Check Item	Corrective Action
Is a channel that is not connected to a Pt100 designated for conversion-enabled?	Designate a channel that is not connected to a Pt100 for conversion-disabled.
Is there any disconnection?	A68RD3N/A1S62RD3N Securely connect or replace the Pt100 of the corresponding channel.
	A68RD4N • Make the connection between terminals a1 and b8. • Securely connect or replace the Pt100.
	A1S62RD4N • Make the connection between terminals a1 and b2. • Securely connect or replace the Pt100.

6.7 If a CPU Cannot Read Detected Temperature Values

Check Item	Corrective Action
Is the channel designated for conversion-enabled?	Designate the channel for conversion-enabled.
Is the RUN LED flashing or turned OFF?	Follow the procedure given in Section 6.2.
Is the RUN LED on the CPU flashing or turned OFF?	Check the error content in the user's manual of the PLC CPU in use.
Is the ERROR LED on the CPU flashing or turned OFF?	
Is a Pt100 securely connected or is there a disconnection within the Pt100?	Securely connect or replace the Pt100.
Has the error been fixed correctly?	Follow the procedure given in Section 4.4.

6.8 If the Temperature Input Values do not Correspond to the Temperature Detection Values

Check Item	Corrective Action
Does the designated type of Pt100 correspond to the actual Pt100 used?	Make sure the designated type corresponds to the actual Pt100 being used.
Is error compensation done correctly?	Follow the procedure given in Section 4.4.
Is the disconnection detection flag set?	Follow the procedure given in Section 6.6.
Is the CPU in the RUN state?	Set the CPU to the RUN state.

APPENDICES

APPENDIX 1 COMPARISON OF PERFORMANCE SPECIFICATIONS BETWEEN CONVENTIONAL MODELS AND RD3N/4N

Table 1 Comparison of Performance Specifications

Item		Specifications							
		RD3N/4N				Conventional models			
		A68RD3N	A68RD4N	A1S62RD3N	A1S62RD4N	A68RD3	A68RD4	A1S62RD3	A1S62RD4
Measuring method		3-wire type	4-wire type	3-wire type	4-wire type	3-wire type	4-wire type	3-wire type	4-wire type
Output (temperature value)		16-bit, signed binary data (-1800 to 6000: Value to first decimal place x 10 times) 32-bit, signed binary data (-180000 to 600000: Value to third decimal places x 1000 times)							
Applicable platium resistance thermometers		Pt100 (JIS C1604-1997, IEC 751-am2, JIS C1604-1989, DIN 43760-1980), JPt100 (JIS C1604-1981)				Pt100 (JIS C1604-1989, DIN 43760-1980) JPt100 (JIS C1604-1981)			
Temperature input ranges	Pt100	-180°C to 600°C (27.10 Ω to 313.71 Ω)				-180°C to 600°C (27.08 Ω to 313.59 Ω)			
	JPt100	-180°C to 600°C (25.80 Ω to 317.28 Ω)							
Accuracy		±1% (accuracy relative to full-scale)							
Resolution		0.025 °C							
Conversion speed		40 ms/1 channel							
Number of temperature input points		8 channels/1 module		2 channels/1 module		8 channels/1 module		2 channels/1 module	
Temperature detecting output current		1 mA				4.2 mA (MIN.) 4.7mA (MAX.)			
Insulation method		Across platinum resistance thermometer input - PLC power supply: Photocoupler-insulated Across platinum resistance thermometer input - channel : Non-insulated							
Dielectric withstand voltage		Across platinum resistance thermometer input -PLC power supply : 500 V AC for 1 minute							
Wire break detection		Detected channel by channel	Batch-detected on all channels	Detected channel by channel	Batch-detected on all channels	Detected channel by channel	Batch-detected on all channels	Detected channel by channel	Batch-detected on all channels
Number of occupied I/O points		32							
Connection terminals		38-point terminal block		20-point terminal block		38-point terminal block		20-point terminal block	
Internal current consumption (5 V DC)		0.94 A	0.41 A	0.49 A	0.39 A	0.94 A	0.75 A	0.54 A	0.44 A
Weight		0.43 kg	0.43 kg	0.27kg	0.27 kg	0.62 kg	0.60 kg	0.29 kg	0.28 kg
Outline dimensions		250(H) x 37.5 (W) x 131 (D) mm		130 (H) x 34.5 (W) x 107.4 (D) mm		250(H) x 37.5 (W) x 131 (D) mm		130 (H) x 34.5 (W) x 107.4 (D) mm	

APPENDIX 2 PRECAUTIONS WHEN REPLACING THE CONVENTIONAL MODELS

Any of the conventional models (A68RD3, A68RD4, A1S62RD3, and A1S62RD4) can be replaced easily with the RD3N/4N by just swapping the modules.

No modifications related to system control are required (i.e., no program modifications are required).

However, since this module handles analog data, a measurement error within total accuracy (±1%) will occur after module replacement.

Therefore, verify measurement results after module replacement, and compensate the error if necessary.

REMARK

The conventional models do not support the platinum resistance thermometer for 1 mA output current for detecting temperature. If a platinum resistance thermometer for 1 mA is used, the self-heating of the platinum resistance thermometer caused by overcurrent may generate a significant error in measurement results.

Furthermore, if the optimization (compensation) of the entire system has been carried out under the condition that includes an error, measurement results will be normal after module replacement; thus, generating a difference in measured values by the amount of compensation.

Therefore, if the module is to be replaced, it is necessary to optimize the entire system again as necessary.

APPENDIX 3 STANDARD RESISTANCE VALUE OF PLATINUM RESISTANCE THERMOMETERS

3.1 1997JIS Type (Pt100)

JIS C1604-1997, IEC 751-am2

Unit : Ω

-100	-0	Temperature °C	Temperature °C	0	100	200	300	400	500	600
60.26	100.00	-0	0	100.00	138.51	175.86	212.05	247.09	280.98	313.71
56.19	96.09	-10	10	103.90	142.29	179.53	215.61	250.53	284.30	
52.11	92.16	-20	20	107.79	146.07	183.19	219.15	253.96	287.62	
48.00	88.22	-30	30	111.67	149.83	186.84	222.68	257.38	290.92	
43.88	84.27	-40	40	115.54	153.58	190.47	226.21	260.78	294.21	
39.72	80.31	-50	50	119.40	157.33	194.10	229.72	264.18	297.49	
35.54	76.33	-60	60	123.24	161.05	197.71	233.21	267.56	300.75	
31.34	72.33	-70	70	127.08	164.77	201.31	236.70	270.93	304.01	
27.10	68.33	-80	80	130.90	168.48	204.90	240.18	274.29	307.25	
	64.30	-90	90	134.71	172.17	208.48	243.64	277.64	310.49	

3.2 1989JIS Type (Pt100)

JIS C 1604-1989, DIN 43760-1980

Unit : Ω

-100	-0	Temperature °C	Temperature °C	0	100	200	300	400	500	600
60.25	100.00	-0	0	100.00	138.50	175.84	212.02	247.04	280.90	313.59
56.19	96.09	-10	10	103.90	142.29	179.51	215.57	250.48	284.22	
52.11	92.16	-20	20	107.79	146.06	183.17	219.12	253.90	287.53	
48.00	88.22	-30	30	111.67	149.82	186.82	222.65	257.32	290.83	
43.87	84.27	-40	40	115.54	153.58	190.45	226.17	260.72	294.11	
39.71	80.31	-50	50	119.40	157.31	194.07	229.67	264.11	297.39	
35.53	76.33	-60	60	123.24	161.04	197.69	233.17	267.49	300.65	
31.32	72.33	-70	70	127.07	164.76	201.29	236.65	270.86	303.91	
27.08	68.33	-80	80	130.89	168.46	204.88	240.13	274.22	307.15	
	64.30	-90	90	134.70	172.16	208.45	243.59	277.56	310.38	

3.3 Old JIS Type (JPt100)

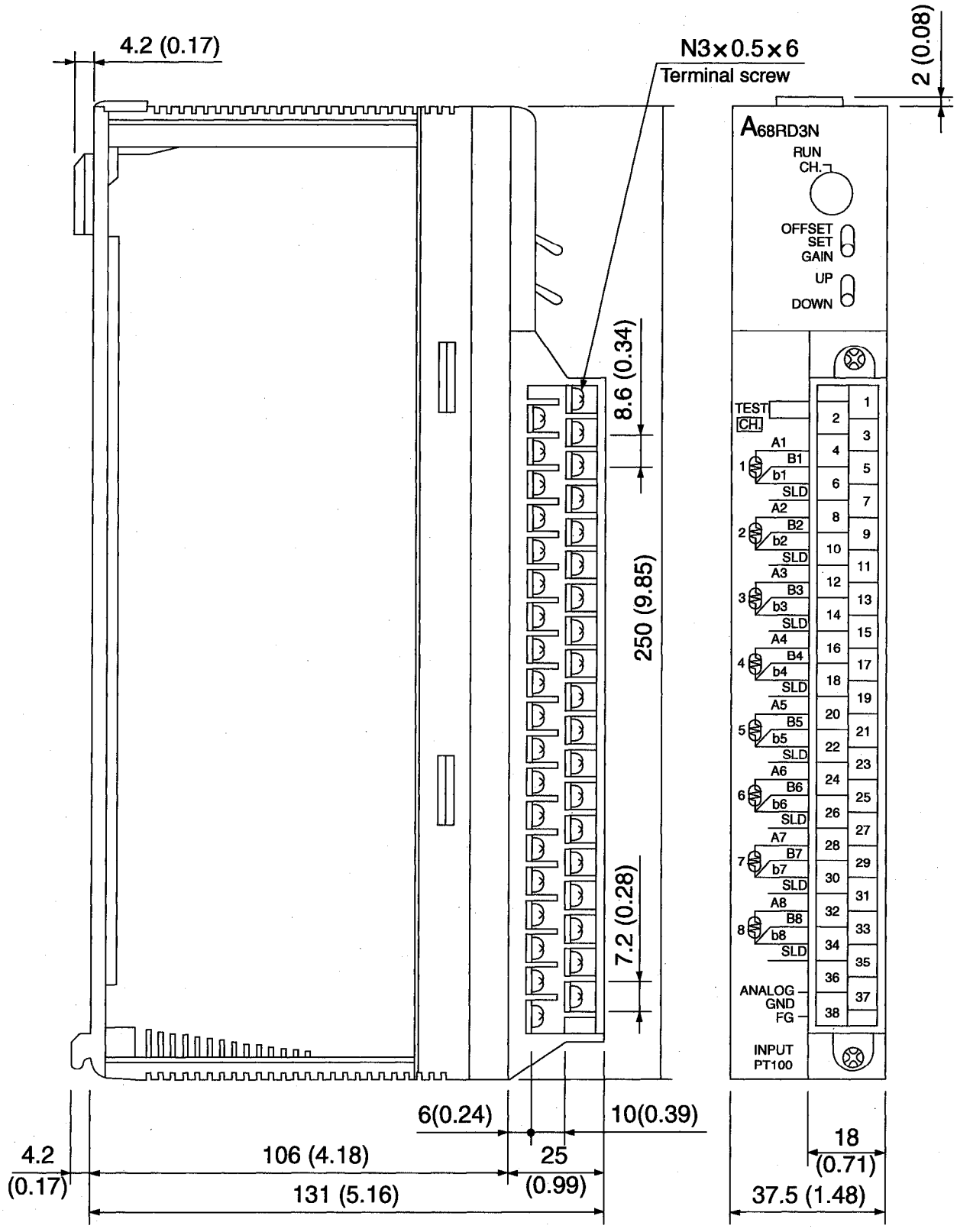
JIS C 1604-1981

Unit : Ω

-100	-0	Temperature °C	Temperature °C	0	100	200	300	400	500	600
59.57	100.00	-0	0	100.00	139.16	177.13	213.30	249.56	284.02	317.28
55.44	96.02	-10	10	103.97	143.01	180.86	217.54	253.06	287.40	
51.29	92.02	-20	20	107.93	146.85	184.58	221.15	256.55	290.77	
47.11	88.01	-30	30	111.88	150.67	188.29	224.74	260.02	294.12	
42.91	83.99	-40	40	115.81	154.49	191.99	228.32	263.49	297.47	
38.68	79.96	-50	50	119.73	158.29	195.67	231.89	266.94	300.80	
34.42	75.91	-60	60	123.64	162.08	199.35	235.45	270.38	304.12	
30.12	71.85	-70	70	127.54	165.86	203.01	238.99	273.80	307.43	
25.80	67.77	-80	80	131.42	169.63	206.66	242.53	277.22	310.72	
	63.68	-90	90	135.30	173.38	210.30	246.05	280.63	314.01	

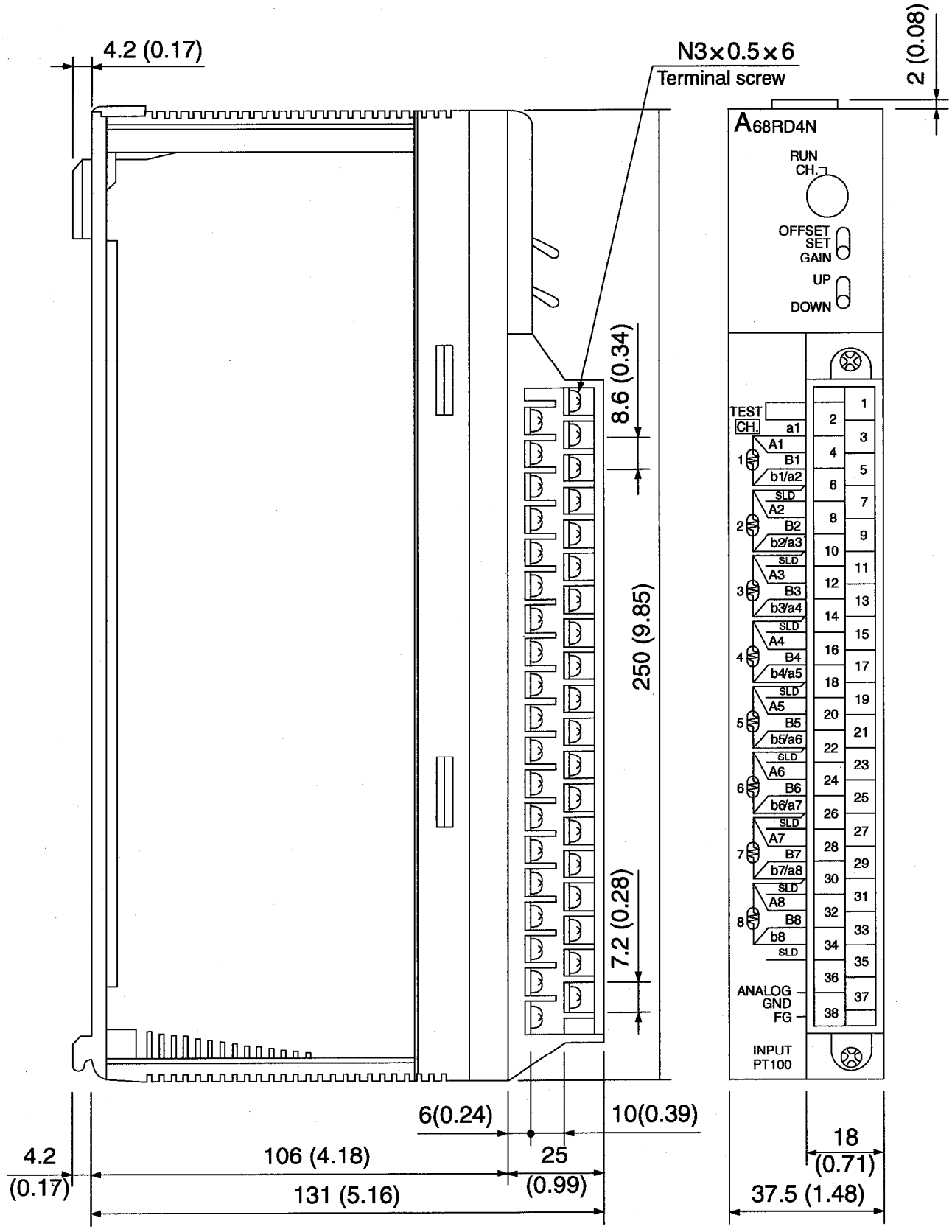
APPENDIX 4 OUTSIDE DIMENSIONS

4.1 A68RD3N



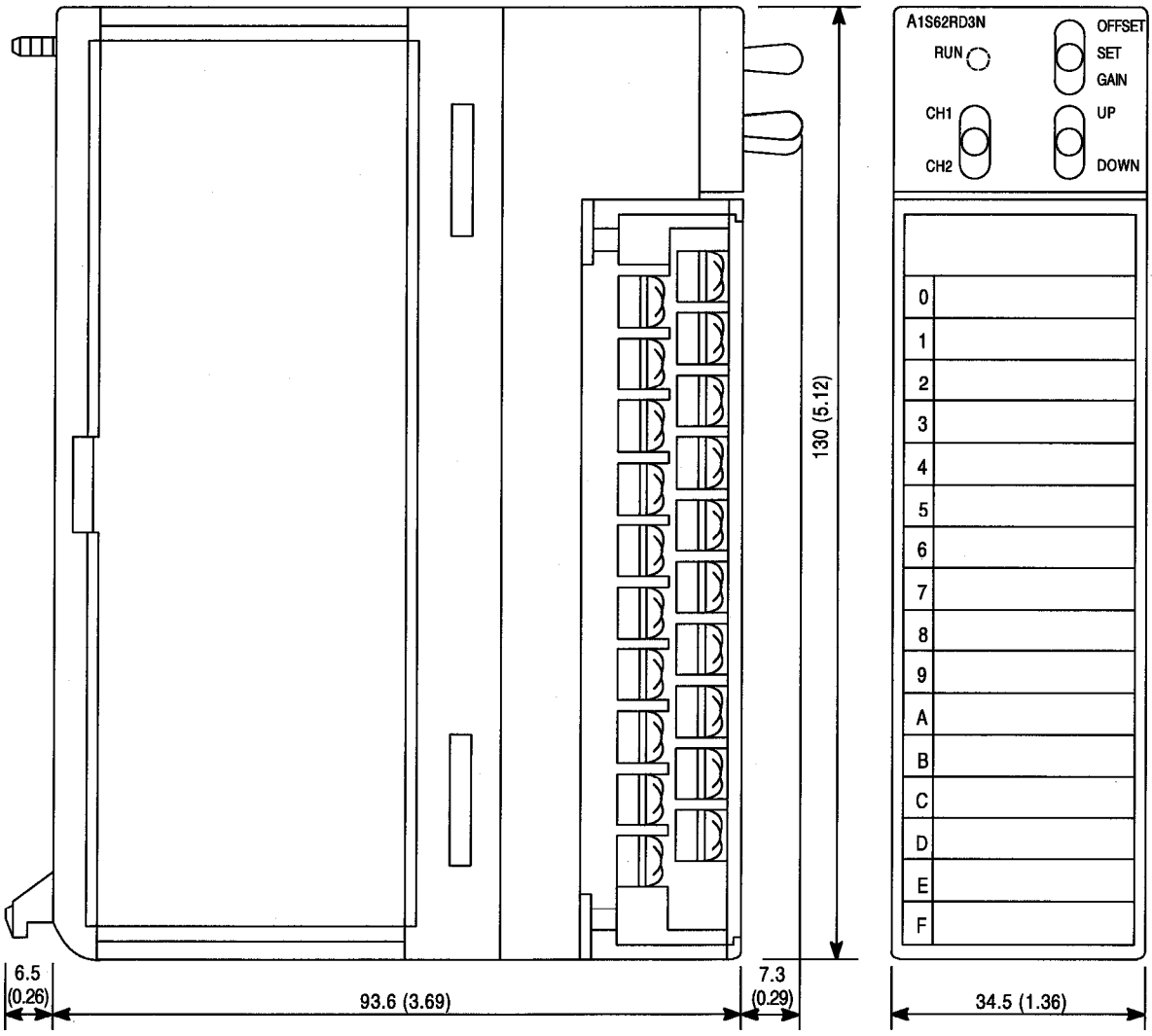
Unit : mm (in)

4.2 A68RD4N



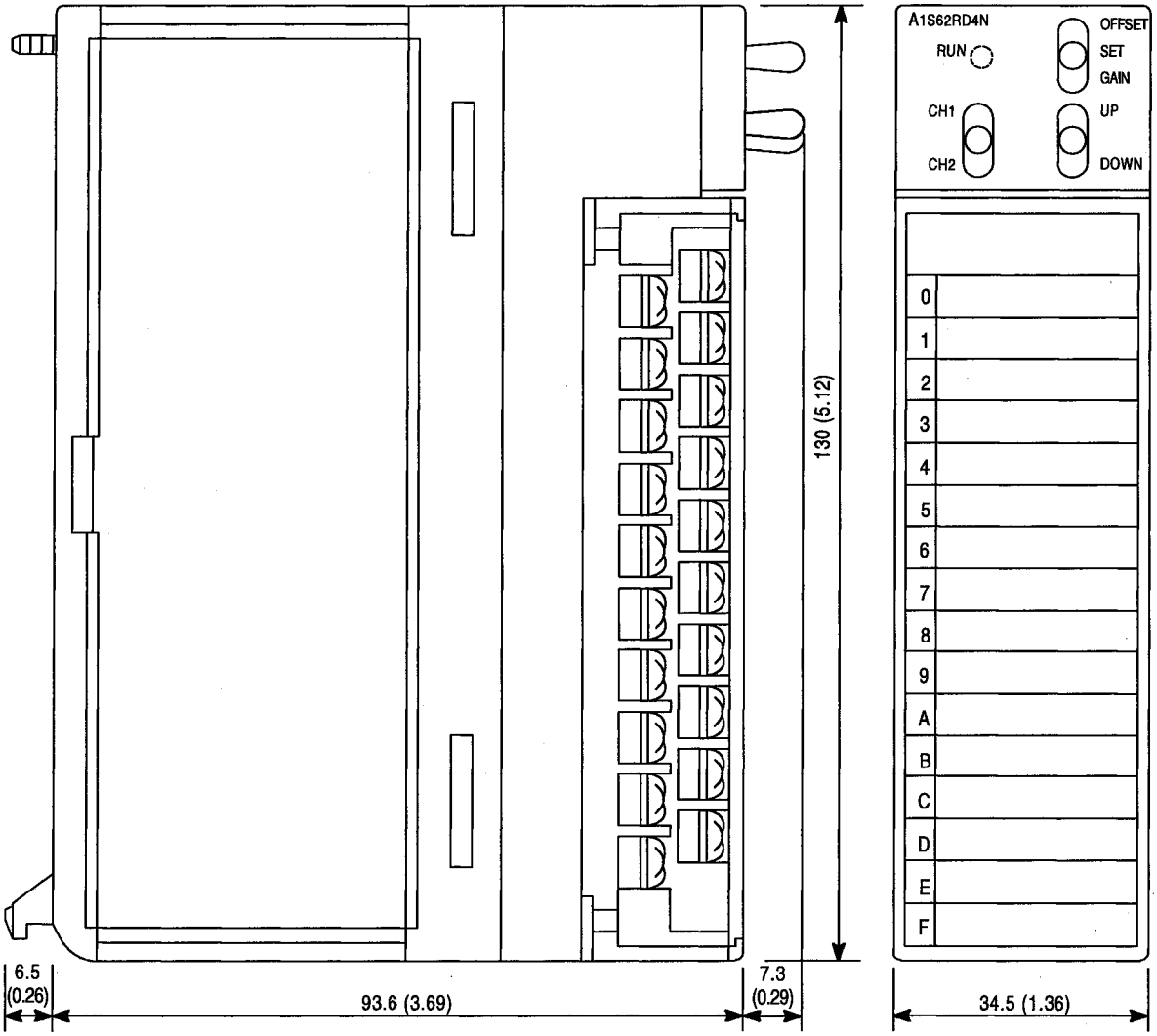
Unit : mm (in)

4.3 A1S62RD3N



Unit : mm (in)

4.4 A1S62RD4N



Unit : mm (in)

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.
However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
(2) The Mitsubishi programmable controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

Type A68RD3N/4N,A1S62RD3N/4N Pt100 Input Module

User's Manual

MODEL	A68/A1S62RD-U-SY-E
MODEL CODE	13JR46
SH(NA)-080193-D(0707)MEE	

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