MITSUBISHI

# AJ65BT-68TD
# Thermocouple
# Temperature Input Module

Mitsubishi General-Purpose Programmable Controller

# User's Manual

(Hardware)

Thank you for purchasing the Mitsubishi general-purpose programmable controller MELSEC-A series.

Prior to use, please read this manual thoroughly and familiarize yourself with the product.

| | |
|---|---|
| Type | AJ65BT68TD-U-HW-E |
| Type Code | 13JL49 |
| IB(NA)-66830-F(0810)MEE | |

© 1996 MITSUBISHI ELECTRIC CORPORATION

## ● SAFETY PRECAUTIONS ●

**(Read these precautions before using this product.)**

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
These precautions apply only to Mitsubishi equipment. Refer to the CPU module user's manual for a description of the programmable controller system safety precautions.
In this manual, the safety precautions are classified into two levels: "DANGER" and "CAUTION".

| | |
|---|---|
| ⚠DANGER | **Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.** |
| ⚠CAUTION | **Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.** |

Under some circumstances, failure to observe the precautions given under "⚠ CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

### [Design Precautions]

**⚠DANGER**

- In the case of a communication failure in the network, data in the master module are held.
  Check the communication status information (SB, SW) and configure an interlock circuit in the sequence program to ensure that the entire system will operate safely.

**⚠CAUTION**

- Do not install the control lines or communication cables together with the main circuit lines or power cables.
  Keep a distance of 100mm (3.94 inches) or more between them.
  Failure to do so may result in malfunction due to noise.

### [Installation Precautions]

**⚠CAUTION**

- Use the programmable controller in an environment that meets the general specifications in this manual.
  Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- For protection of the switches, do not remove the cushioning material before installation.
- Securely fix the module with a DIN rail or mounting screws. Tighten the screws within the specified torque range.
  Undertightening can cause drop of the screw, short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Do not directly touch any conductive part of the module.
  Doing so can cause malfunction or failure of the module.

### [Wiring Precautions]

**⚠CAUTION**

- Shut off the external power supply for the system in all phases before wiring.
  Failure to do so may result in damage to the product.
- After installation or wiring, attach the included terminal cover to the module before turning it on for operation.
  Undertightening can cause short circuit or malfunction.
- Ground the FG terminals to the protective ground conductor dedicated to the programmable controller.
  Failure to do so may result in malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and terminal layout before wiring to the module, and connect the cables correctly.
  Connecting a power supply with a different voltage rating or incorrect wiring may cause a fire or failure.
- Tighten the terminal screw within the specified torque range.
  Undertightening can cause short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module.
  Such foreign matter can cause a fire, failure, or malfunction.

### [Wiring Precautions]

**⚠CAUTION**

- Place the cables in a duct or clamp them.
  If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Failure to do so may result in malfunction due to noise.
- When disconnecting the cable from the module, do not pull the cable by the cable part. Loosen the screws of connector before disconnecting the cable.
  Failure to do so may result in damage to the module or cable or malfunction due to poor contact.

### [Starting and Maintenance Precautions]

**⚠CAUTION**

- Do not touch any terminal while power is on.
  Doing so may cause malfunction.
- Shut off the external power supply for the system in all phases before cleaning the module or retightening the terminal screws.
  Failure to do so may cause the module to fail or malfunction.
  Undertightening the terminal screws can cause short circuit or malfunction.
  Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Do not disassemble or modify the module.
  Doing so may cause failure, malfunction, injury or a fire.
- Do not drop or apply any strong shock to the module.
  Doing so may damage the module.
- Shut off the external power supply for the system in all phases before mounting or removing the module to or from the panel.
  Failure to do so may cause the module to fail or malfunction.
- Mounting/removing the terminal block is limited to 50 times after using a product. (IEC61131-2-compliant)
- Before handling the module, touch a grounded metal object to discharge the static electricity from the human body.
  Failure to do so may cause the module to fail or malfunction.

### [Disposal Precautions]

**⚠CAUTION**

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

## About Manuals

The following are manuals related to this product.
Request for the manuals as needed according to the chart below.

**Detailed Manual**

| Manual Name | Manual No. (Model Code) |
|---|---|
| AJ65BT-68TD Thermocouple Temperature Input Module User's Manual | SH-3304 (13JL52) |

**Related Manuals**

| Manual Name | Manual No. (Model Code) |
|---|---|
| AJ61BT11/A1SJ61BT11 CC-Link System Master · Local Module User's Manual | IB-66721 (13J872) |
| AJ61QBT11/A1SJ61QBT11 CC-Link System Master · Local Module User's Manual | IB-66722 (13J873) |
| Control & Communication Link System Master/Local Module type QJ61BT11N User's Manual | SH-080394 (13JR64) |

# 1. Overview

This user's manual explains the specifications, handling, programming methods, etc. of the AJ65BT-68TD Thermocouple Input Module (hereinafter referred to as AJ65BT-68TD) used as a remote device station for the CC-Link system.

The AJ65BT-68TD is a module that converts the thermocouple input values from outside the programmable controller to the temperature values or scaling values of 16-bit signed BIN data.

# 2. EMC and Low-Voltage Commands

(1) For programmable controller system
To configure a system meeting the requirements of the EMC and Low Voltage Directives when incorporating the Mitsubishi programmable controller (EMC and Low Voltage Directives compliant) into other machinery or equipment, refer to the "EMC AND LOW VOLTAGE DIRECTIVES" chapter of the User's Manual for the CPU module used.
The CE mark, indicating compliance with the EMC and Low Voltage Directives, is printed on the rating plate of the programmable controller.

(2) For the product
For the compliance of this product with the EMC and Low Voltage Directives, refer to the "CC-Link module" section in the "EMC AND LOW VOLTAGE DIRECTIVES" chapter of the User's Manual for the CPU module used.

# 3. Specification

## 3.1 Performance Specification

The performance specification of the AJ65BT-68TD are shown below.
And, refer to master module user's manual which is used about the general specification.

| Item | | Specification |
|---|---|---|
| Temperature sensor input | | –200 to 1700°C |
| Output | Detected temperature | 16-bit signed binary (–2000 to 17000 : value to one decimal place multiplied by 10) |
| | Scaling value | 16-bit signed binary (0 to 2000) |
| Applicable thermocouples and temperature measurement range accuracy *1 | | Refer to Table 3.1 |
| Cold junction compensation accuracy | | ± 1.0°C |
| Overall accuracy | | By the calculation of *2 |
| Maximum resolution | | B, R, S : 0.3 °C  K, E, J, T : 0.1 °C |
| Conversion speed (sampling time) | | 45 ms/ch |
| Absolute maximum input | | ± 5 V |
| Number of analog input points | | 8-channel + Pt 100 connection channel |
| CC-Link station type | | Remote device station |
| Number of occupied stations | | 4 Stations : RX/RY 128 points each<br>RWw/RWr 16 points each |
| Connection cable | | CC-Link dedicated cable |
| Noise durability | | Depends on noise simulator of noise voltage at 500Vp-p, noise width at 1ms and noise frequency at 25 to 60 Hz |
| Dielectric withstand voltage | | Between batch power supply system and ground<br>Between batch power supply system and batch communication system<br>Between batch communication system and batch thermocouple input<br>Between batch thermocouple input and ground<br>500 V AC, 1 minute |
| Insulation method | | Thermocouple input to CC-Link transmission : Transfer insulation<br>Between channels : Transfer insulation |
| Insulation resistor | | Between batch power supply system and ground<br>Between batch power supply system and batch communication system<br>Between batch communication system and batch thermocouple input<br>Between batch thermocouple input and ground<br>500 V DC, more than 10 MΩ by the insulation resistance taster |
| Connected terminal block | | 27-point terminal blocks (M3.5 × 7 screws) |
| Applicable wire size | | 0.75 to 2.00 $mm^2$ |
| Applicable solderless terminal | | RAV1.25-3.5, RAV2-3.5 (Conforms to JIS C 2805) |
| Module mounting screw | | Screws M4 × 0.7 mm × 16 mm or larger (tightening torque range 78 to 118 N • cm {8 to 12 kg • cm})<br>May be attached using DIN rails |
| Applicable DIN rail | | TH 35-7.5 Fe, TH 35-7.5 Al, TH 35-15 Fe (conform to JIS C 2812) |
| External power supply | | 24 V DC (18 to 30 V DC) |
| Internal consumption current | | 0.081 A (at 24VDC) |
| Allowable momentary power failure period | | 1 ms |
| Weight | | 0.40 (0.88) kg (lb.) |

*1 : The thermocouple type can be set using the remote register RY (n + 1) 0 to RY (n + 5) 6 for each channel.

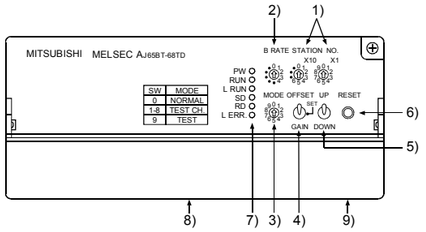
*2 : Overall accuracy computation method is as follows:
(Overall accuracy) = (Conversion accuracy) + (Temperature characteristics) × (Ambient operating temperature change) + (Cold junction compensation accuracy)
The ambient operating temperature change refers to the value that falls outside the range of 25 ±5 °C.
Example) The overall accuracy when using thermocouple K, measured temperature 150 °C, ambient operating temperature 35 °C will be:
(± 0.5 °C) + (± 0.06 °C) × (5 °C) + (± 1 °C) = ± 1.8 °C

Table 3.1 Applicable thermocouples and temperature measurement range accuracy

| Applicable thermocouple type | Temperature measurement range [°C ] | Conversion accuracy (When ambient operating 25 ± 5 °C) | Temperature characteristic (Per 1 °C of ambient operating temperature change) |
|---|---|---|---|
| B | 600 to 1700 | ± 2.5 °C | ± 0.4 °C |
| R | 0 to 200 | ± 2.0 °C | ± 0.4 °C |
| | 200 to 1600 | | ± 0.3 °C |
| S | 0 to 200 | ± 2.0 °C | ± 0.4 °C |
| | 200 to 1600 | | ± 0.3 °C |
| K | – 200 to 0 | ±0.5 °C or ±0.25 % of the measured temperature, whichever is greater | ±0.06 °C or ±0.3 % of the measured temperature, whichever is greater |
| | 0 to 1200 | | ±0.06 °C or ±0.02 % of the measured temperature, whichever is greater |
| E | – 200 to 0 | | ±0.06 °C or ±0.3 % of the measured temperature, whichever is greater |
| | 0 to 800 | | ±0.06 °C or ±0.02 % of the measured temperature, whichever is greater |
| J | 0 to 750 | | ±0.06 °C or ±0.02 % of the measured temperature, whichever is greater |
| T | – 200 to 0 | | ±0.06 °C or ±0.3 % of the measured temperature, whichever is greater |
| | 0 to 350 | | ±0.06 °C or ±0.02 % of the measured temperature, whichever is greater |

# 4. Name of Each Part

The name of each part in the AJ65BT-68TD is described.




| Number | Name | |
|---|---|---|
| 1) | Station setting switch | |
| 2) | Transmission baud rate setting switch | |
| 3) | Mode switch | |
| 4) | Offset/gain setting switch | |
| 5) | UP/DOWN switch | |
| 6) | Reset switch | |
| 7) | LED display | PW |
| | | RUN |
| | | L RUN |
| | | SD |
| | | RD |
| | | L ERR. |
| 8) | Terminal block | |
| 9) | Temperature-measuring resistor Pt 100 | |

# 5. Handling

## 5.1 Handling Precautions

(1) Because it is made of resin, do not drop or given a strong shock to the module case and the terminal block.

(2) Do not take the printed circuit board of the module out of the case. It may result in a failure.

(3) Be careful not to let foreign matter such as filings or wire chips get inside the module while wiring. Remove all foreign matters if any get inside.

(4) Tighten the module mounting screws within the following torque range.

| Screw area | Tightening torque range |
|---|---|
| Module mounting screws (M4 screw) | 78 to 118 N · cm |
| Terminal block terminal screws (M3.5 screw) | 59 to 88 N · cm |
| Terminal block mounting screws (M3.5 screw) | 98 to 137 N · cm |

(5) When using a DIN rail adapter, install the DIN rail considering the precautions described below.

(a) Applicable DIN rail types (conform to JIS C 2812)

TH 35-7.5 Fe
TH 35-7.5 Al
TH 35-15 Fe

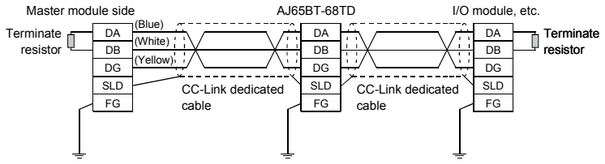
(b) Space between DIN rail mounting screws

When installing a DIN rail, tighten the screws with a space of less than 200 mm (7.9 in.).

# 6. Wiring

## 6.1 Wiring Example with Each CC-Link Modules

The following shows the connection between the AJ65BT-68TD and master module using twisted cables.




**Point**

For the modules at both ends of the data link, make sure to connect the "terminal resistor" that is attached to a master module (connect between DA and DB).

## 6.2 Precautions when Wiring

To obtain maximum performance from the functions of AJ65BT-68TD and improve the system reliability, a wiring with high durability against noise is required.

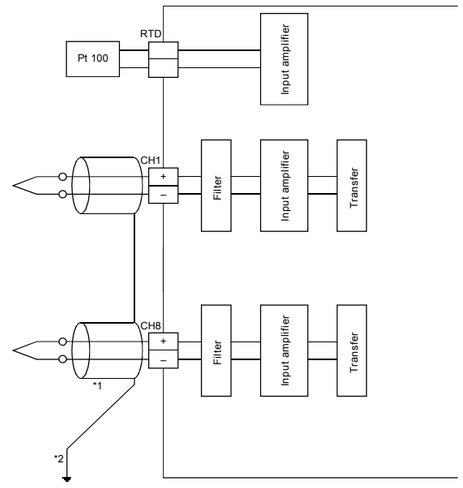
The following describes the external wiring precautions.

(1) Use separate cables for the AC and the external input signals of the AJ65BT-68TD, in order not to be affected by the AC side surge or conductivity.

(2) Always place a thermocouple at least 10 cm (3.94 in.) apart from the main circuit line and AC control circuit line. Place a thermocouple sufficiently apart from circuits with high frequency, such as high-voltage lines and inverter load main circuits. If they are placed close to each other, the thermocouple is influenced more easily by the noise, surge, or conductivity.

## 6.3 Example of Connecting Module

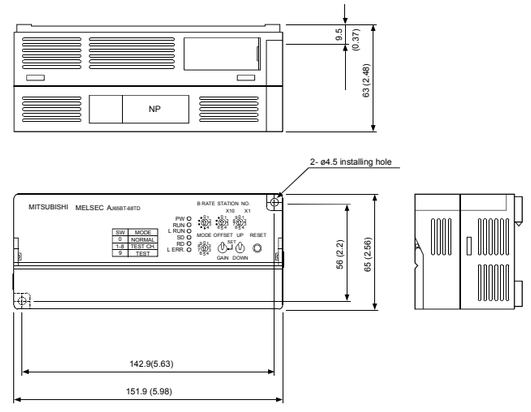
The following shows the wiring example between AJ65BT-68TD and thermocouple.




*1 Be sure to use the shielded compensating conductor for the cable.

*2 Be sure to ground.

# 7. External Dimensions Diagram




Unit: mm (in.)

**Warranty**

Mitsubishi Electric shall not be liable for any loss caused by reasons for which Mitsubishi is not held accountable, lost business opportunities or unrealized gain on the customer's side resulting from failure of the product, or any other damage, secondary disaster, accident, damage to equipment other than the product or disruption of other business operations arising out of special circumstances which may or may not have been predicted at Mitsubishi.

⚠ **For safe use of the product**

- This product is manufactured as a general-purpose product intended for general industrial use only. It is not designed nor manufactured for use in an equipment or system affecting human lives.
- If you are considering to use this product in equipment or systems for nuclear power generation, power generation, aerospace, medical or passenger transport applications, consult our sales representatives.
- This product is manufactured under our strict quality control system. However, if the product is used in the intended facility in such a way that a failure of the product may lead to serious accident or loss, incorporate backup or fail-safe functions into the system design.


| Country/Region | Sales office/Tel | Country/Region | Sales office/Tel |
|---|---|---|---|
| U.S.A | Mitsubishi Electric Automation Inc.<br>500 Corporate Woods Parkway Vernon Hills, IL 60061, U.S.A.<br>Tel : +1-847-478-2100 | Hong Kong | Mitsubishi Electric Automation (Hong Kong) Ltd.<br>10th Floor, Manulife Tower, 169 Electric Road, North Point, Hong Kong<br>Tel : +852-2887-8870 |
| Brazil | MELCO-TEC Rep. Com.e Assessoria Tecnica Ltda.<br>Rua Correia Dias, 184,<br>Edificio Paraiso Trade Center-8 andar Paraiso, Sao Paulo, SP Brazil<br>Tel : +55-11-5908-8331 | China | Mitsubishi Electric Automation (Shanghai) Ltd.<br>4/F Zhi Fu Plazz, No.80 Xin Chang Road, Shanghai 200003, China<br>Tel : +86-21-6120-0808 |
| Germany | Mitsubishi Electric Europe B.V. German Branch<br>Gothaer Strasse 8 D-40880 Ratingen, GERMANY<br>Tel : +49-2102-486-0 | Taiwan | Setsuyo Enterprise Co., Ltd.<br>6F No.105 Wu-Kung 3rd.Rd, Wu-Ku Hsiang, Taipei Hsine, Taiwan<br>Tel : +886-2-2299-2499 |
| U.K | Mitsubishi Electric Europe B.V. UK Branch<br>Travellers Lane, Hatfield, Hertfordshire., AL10 8XB, U.K.<br>Tel : +44-1707-276100 | Korea | Mitsubishi Electric Automation Korea Co., Ltd.<br>1480-6, Gayang-dong, Gangseo-ku Seoul 157-200, Korea<br>Tel : +82-2-3660-9552 |
| Italy | Mitsubishi Electric Europe B.V. Italian Branch<br>Centro Dir. Colleoni, Pal. Perseo-Ingr.2 Via Paracelso 12, I-20041 Agrate Brianza., Milano, Italy<br>Tel : +39-039-60531 | Singapore | Mitsubishi Electric Asia Pte, Ltd.<br>307 Alexandra Road #05-01/02, Mitsubishi Electric Building, Singapore 159943<br>Tel : +65-6470-2460 |
| Spain | Mitsubishi Electric Europe B.V. Spanish Branch<br>Carretera de Rubi 76-80,<br>E-08190 Sant Cugat del Valles, Barcelona, Spain<br>Tel : +34-93-565-3131 | Thailand | Mitsubishi Electric Automation (Thailand) Co., Ltd.<br>Bang-Chan Industrial Estate No.111 Moo 4, Serithai Rd, T.Kannayao, A.Kannayao, Bangkok 10230 Thailand<br>Tel : +66-2-517-1326 |
| France | Mitsubishi Electric Europe B.V. French Branch<br>25, Boulevard des Bouvets, F-92741 Nanterre Cedex, France<br>TEL: +33-1-5568-5568 | Indonesia | P.T. Autoteknindo Sumber Makmur<br>Muara Karang Selatan, Block A/Utara No.1 Kav. No.11 Kawasan Industri Pergudangan Jakarta - Utara 14440, P.O.Box 5045 Jakarta, 11050 Indonesia<br>Tel : +62-21-6630833 |
| South Africa | Circuit Breaker Industries Ltd.<br>Private Bag 2016, ZA-1600 Isando, South Africa<br>Tel : +27-11-928-2000 | India | Messung Systems Pvt, Ltd.<br>Electronic Sadan NO:III Unit No15, M.I.D.C Bhosari, Pune-411026, India<br>Tel : +91-20-2712-3130 |
| | | Australia | Mitsubishi Electric Australia Pty. Ltd.<br>348 Victoria Road, Rydalmere, N.S.W 2116, Australia<br>Tel : +61-2-9684-7777 |

**MITSUBISHI ELECTRIC CORPORATION**

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14, YADA-MINAMI 5-CHOME, HIGASHI-KU, NAGOYA, JAPAN



When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.
Printed in Japan on recycled paper.