

# **MELSEC A Series**

Programmable Logic Controllers

User's Manual

## **Digital Analog Converter Modules AJ65BT-64DAV/DAI**

# ● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

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

These precautions apply only to Mitsubishi equipment. Refer to the CPU module user's manual for a description of the PC system safety precautions.

These ● SAFETY PRECAUTIONS ● classify the safety 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 circumstances, procedures indicated by  **CAUTION** may also be linked to serious results.

In any 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]

### **DANGER**

- Configure a safety circuit so that the safety of the overall system is maintained even when an external power error or PC error occurs.  
Accident may occur due to output error or malfunctioning.
  - (1) The status of analog output changes depending on the setting of various functions that control the analog output. Take sufficient caution when setting for those functions.  
For details of analog output status, refer to Section 3.4.5 "Combinations of functions in each part"
  - (2) Normal output may not be obtained due to malfunctions of output elements or the internal circuits.  
Configure a circuit to monitor signals which may lead to a serious accident.

### **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 the module in the environment given in the general specifications of the CPU module's User's Manual. Using the module outside the range of the general specifications may result in electric shock, fire or malfunctioning, or may damage or degrade the module.
- Securely fix the module with seated P-shape pan screws to the installation holes (two locations). Improper installation may result in breakdowns or cause the module to fall out.
- Do not touch the conducted area or electric parts of the module. Doing so may cause module malfunctioning or breakdowns.

## [WIRING PRECAUTIONS]

### CAUTION

- The FG terminals should always be grounded using the class-3 or higher grounding designed specially for the PC. Failure to ground these terminals may cause malfunctioning.
- When wiring the module, check the rated voltage and terminal layout of the wiring, and make sure the wiring is done correctly. Connecting a power supply that differs from the rated voltage or wiring it incorrectly may cause fire or breakdown.
- Tighten the terminal screws with the specified torque. If the terminal screws are loose, it may result in short circuits, fire or malfunctioning.
- Be careful not to let foreign matter such as filings or wire chips get inside the module. These can cause fire, breakdowns and malfunctioning.

## [STARTING AND MAINTENANCE PRECAUTIONS]

### DANGER

- Do not touch the terminals while the power is on. Doing so may cause malfunctioning.
- Turn off the power supply before cleaning the module or retightening the screws. Doing this work while the power is on may damage the module or cause malfunctioning.

### CAUTION

- Never disassemble or modify the module.  
This may cause breakdowns, malfunctioning, injury and/or fire.

## [DISPOSAL PRECAUTIONS]

### CAUTION

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

## Revisions

\* The manual number is noted at the lower left of the back cover.

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# Introduction

Thank you for purchasing the Mitsubishi Graphic Operation Terminal.

Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the graphic operation terminal you have purchased, so as to ensure correct use.

Please forward a copy of this manual to the end user.

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## About this Manual

The following are manuals related to this product.

Request for the manuals as needed according to the chart below.

### Related Manuals

Manual Name	Manual No. (Type 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)

# 1. OVERVIEW

This user's manual describes the specification and handling of AJ65BT-64DAV digital analog voltage conversion module (abbreviated as AJ65BT-64DAV from here on) and AJ65BT-64DAI digital analog current conversion module (abbreviated as AJ65BT-64DAI from here on), which is used as the remote device for the Control & Communication-Link (abbreviated as CC-Link from here on) data system.

**(1) AJ65BT-64DAV**

This is a module which converts the digital values (16-bit encoded binary value) set in the PC CPU to analog values (-10V to 0V to 10V voltage), and performs an external output to four channels.

**(2) AJ65BT-64DAI**

This is a module which converts the digital values (16-bit encoded binary value) set in the PC CPU to analog values (4mA to 20mA current), and performs an external output to four channels.

In this manual, the name which refers to both AJ65BT-64DAV and AJ65BT-64DAI is abbreviated as "AJ65BT-64DAV/DAI."

**Remark**

The CC-Link may be referred to as "MELSECNET/J" which is a Mitsubishi term.

## 1.1 Features

The AJ65BT-64DAV/DAI has the following features:

**(1) One module can provide four channels of D/A conversion.**

The AJ65BT-64DAV/DAI can produce output of analog values (voltage/current) to four external devices.

**(2) The analog-output enable/prohibit setting is possible for each channel.**

The sequence program can specify whether to enable or prohibit analog output to the external devices after the D/A conversion for each channel.

Analog output from the channel where the analog output is prohibited will be 0V or 0mA.

**(3) The analog output can be held or cleared when the PC CPU is in the STOP status (all channels batch).**

The HOLD/CLR terminal can select whether to hold or clear the analog output obtained immediately before the PC CPU entered the STOP status.

**(4) Offset and gain setting**

When a fine I/O conversion characteristic is required, the offset and gain setting of each channel can be set without a volume control, enabling to modify the I/O conversion characteristic as desired.



## 2. SYSTEM CONFIGURATION

### (1) Applicable CPU

(a) When the master module is AJ61BT11:

- A0J2CPU            • A0J2HCPU    • A1CPU            • A2CPU(S1)    • A3CPU
- A1NCP            • A2NCP(S1) • A3NCP            • A3MCP        • A3HCP
- A2ACP(S1)       • A3ACP        • A2UCP(S1)      • A3UCP        • A4UCP
- A73CPU
- A1SCP(C24-      • A1SJCP       • A2SCP            • A2USCP(S1)
- R2)

(b) When the master module is AJ61QBT11:

- Q2ACP(S1)        • Q3ACP            • Q4ACP
- Q2ASCP(S1)      • Q2ASHCP(S1)

(c) When the master module is A1SJ61BT11:

- A1SCP(C24-      • A1SJCP            • A2SCP            • A2USCP(S1)
- R2)

(d) When the master module is A1SJ61QBT11:

- Q2ASCP(S1)      • Q2ASHCP(S1)

(2) A maximum of 64 AJ65BT-64DAV/DAI stations can be connected to one master station.

(3) A maximum of 42 remote device stations can be connected.

## 2.1 Precautions for the System Configuration

### 2.1.1. Precaution about the external power supply

To use the AJ65BT-64DAV/DAI, external DC24V power has to be supplied.

## 3. SPECIFICATIONS

The general specifications, performance specifications, and I/O characteristics of the AJ65BT-64DAV/DAI are explained.

### 3.1 General Specification

The general specifications of the AJ65BT-64DAV/DAI are shown in Table 3.1.

Table 3.1 General specification

Item	Specification				
Usage ambient temperature	0 to 55°C				
Storage ambient temperature	-20 to 75°C				
Usage ambient humidity	10 to 90%RH, no condensation				
Storage ambient humidity	10 to 90%RH, no condensation				
Vibration durability	Compliance standard	JIS B3501, IEC1131-2			
		Frequency	Acceleration	Amplitude	Sweep count
	When there is intermittent vibration	10 to 57Hz	—	0.075mm (0.0030inch)	10 times in each direction X, Y, Z (80 minutes)
		57 to 150Hz	9.8m/s <sup>2</sup> (1G)	—	
	When there is continuous vibration	10 to 57Hz	—	0.035mm (0.0013inch)	—
57 to 150Hz		4.2m/s <sup>2</sup> (0.5G)	—		
Shock durability	Conforming to JIS B 3501, IEC1131-2 (147m/s <sup>2</sup> (15G), 3 times each in XYZ directions)				
Usage environment	No corrosive gas				
Usage height	Less than 2000 m (Less than 6562 ft.)				
Installation area	Within the control board				
Over-voltage category *1	Less than II				
Pollution rate *2	Less than 2				

#### Remark

- \*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 where the device is used. Level 2 is an environment where only nonconductive objects are formed with some chances of temporary conductivity generation due to occasional condensation.



#### CAUTION

- Use the PC in the environment given in the general specifications of this manual. Using the PC outside the range of the general use specifications may result in electrical shock, fire, or malfunctioning, or may damage or degrade the module.

### 3.2 Performance Specification

The performance specification of the AJ65BT-64DAV/DAI is shown Table 3.2:

Table 3.2 Performance specification

Item	Specification			
	AJ65BT-64DAV		AJ65BT-64DAI	
Digital input value	16-bit encoded binary (valid bit: 12 bits)			
	-2048 to 2047		0 to 4095	
Analog conversion value	Voltage: -10 to 10VDC (External load resistance: 2kΩ to 1MΩ)		Current: 4 to 20mA DC (External load resistance: 0 to 600Ω)	
I/O characteristics	Digital input value	Analog conversion value	Digital input value	Analog conversion value
	+2000	+10V	4000	+20mA
	+1000	+5V	2000	+12mA
	0	±0V	0	+4mA
	-1000	-5V		
	-2000	-10V		
Offset/gain adjustment	Yes (user setting or factory setting)			
Maximum resolution *1	5mA		4μA	
Total accuracy *2	± 1% (accuracy for the maximum value)			
Maximum conversion speed *3	Max. 1ms per channel (4ms per 4 channels)			
Output short-circuit protection	Yes			
Analog output points	4 channels per module			
I/O occupied points	2 stations: 32 points each for RX/RX 8 points each for RWr/RWw			
Connector terminal block	27-point terminal block (M3.5 × 7 screws)			
Supported cable size	0.75 to 2.00mm <sup>2</sup>			
Supported solderless terminal	RAV 1.25-3.5 (according to JIS C2805), RAV 2-3.5			
Module installation screw	M4 x 0.7mm x 16mm or larger screw (tightening torque 78 to 118N·cm {8 to 12kg·cm}) Installable with the DIN rail.			
Supported DIN rail	TH35-7.5Fe, TH35-7.5Al, TH35-15Fe (conforming to JIS-C2812)			
Internal consumption current (24VDC)	0.18A		0.27A	
Noise resistance	Noise voltage: 500Vp-p Measured using a noise simulator with 1μs of noise amplitude and 25 to 60Hz of noise frequency.			
Dielectric withstand voltage	Power and communication systems batch-Analog output batch, 500VAC, one minute			
Insulation resistor	Power and communication systems batch-Analog output batch, 500VDC 10MΩ or more at the insulation resistance tester			
Weight	0.4kg (0.88lb)		0.4kg (0.88lb)	

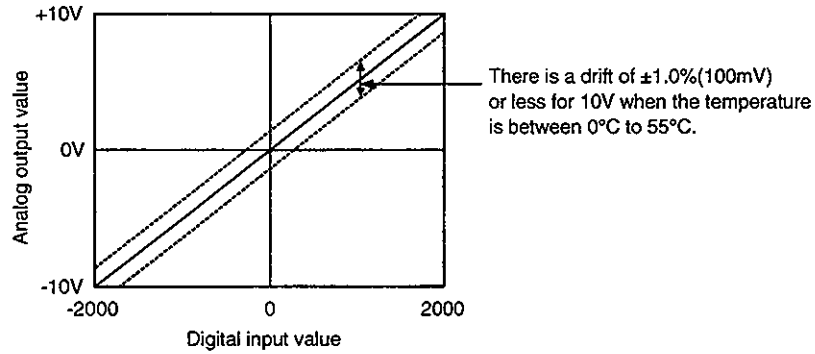
\*1 Maximum resolution of analog value

The maximum resolution of analog value means the variation of analog value when the digital value changes for "1".

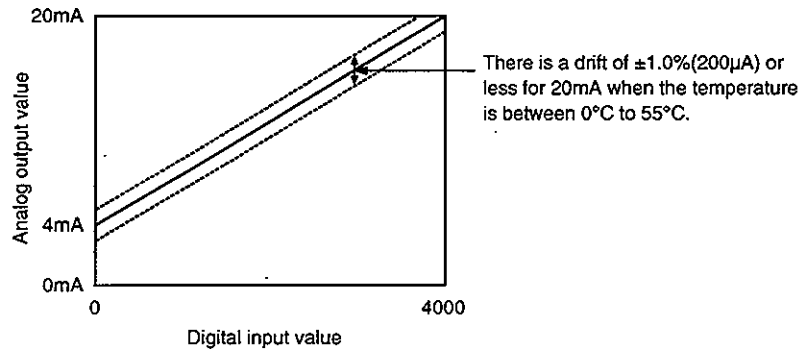
\*2 Total accuracy

The total accuracy is the accuracy of the maximum analog output value.

① The overall accuracy of the AJ65BT-64 DAV is the accuracy for 10V.



② The overall accuracy of the AJ65BT-64 DAI is the accuracy for 20mA.



\*3 Maximum conversion speed

The maximum conversion speed means the time required to read the digital value written in the buffer memory, execute the D/A conversion, and output the specified analog value. It takes the longest (1ms) to produce the maximum analog output value when the current output is the minimum, and to produce the minimum analog output value when the current output is the maximum.

### 3.3 I/O Conversion Characteristics

The I/O conversion characteristics of the AJ65BT-64DAV/DAI are explained.

#### 3.3.1 Offset value and gain value

(1) **Offset value**

This is an analog value (voltage or current value) produced by the AJ65BT-64DAV/DAI when the digital value set by the PC CPU is "0".

(2) **Gain value**

This is an analog value (voltage or current value) produced by the AJ65BT-64DAV/DAI when the digital value set by the PC CPU is "2000" for AJ65BT-64DAV, and "4000" for AJ65BT-64DAI.

(3) **The factory-set offset and gain values are as follows:**

	AJ65BT-64DAV	AJ65BT-64DAI
Offset value	0V	4mA
Gain value	10V	20mA

(4) **The offset value and gain value can be set separately for each channel in the test mode.**

#### 3.3.2 I/O conversion characteristics

(1) **When AJ65BT-64DAV is used:**

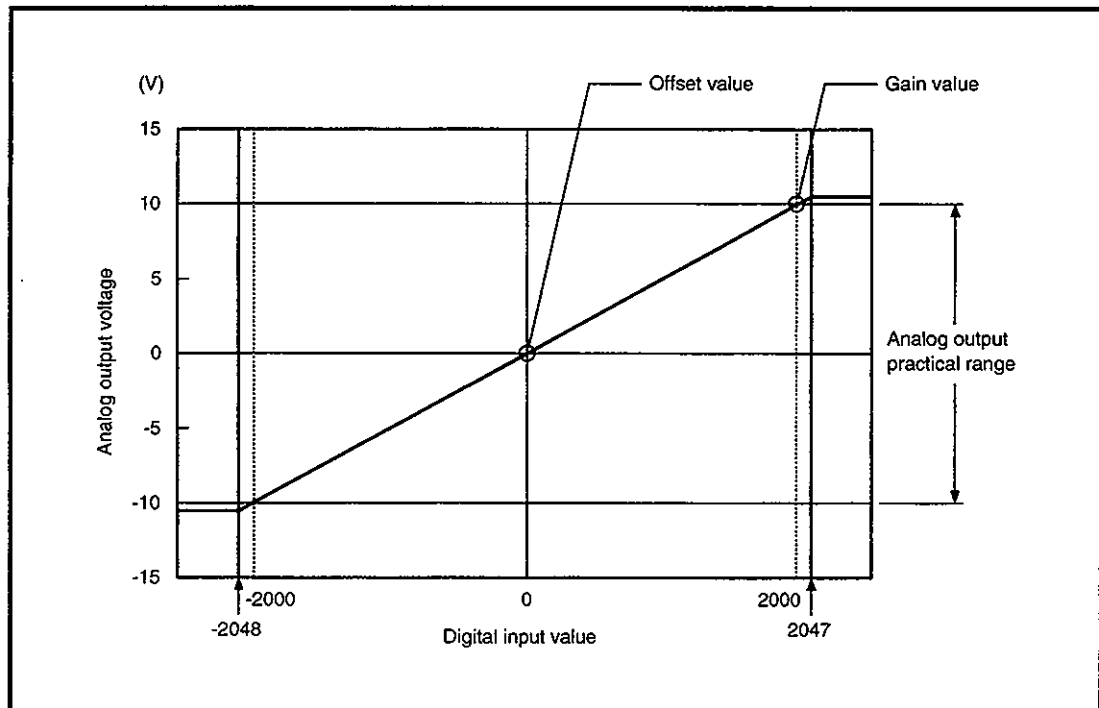


Figure 3.1 I/O conversion characteristics of the AJ65BT-64DAV

① **How to calculate the analog output value:**

The resolution of AJ65BT-64DAV can be set arbitrarily by modifying the settings of the offset value and gain value.

How to calculate the analog value resolution and the analog output value for a given digital input value when the settings of the offset value and gain value are changed is shown next.

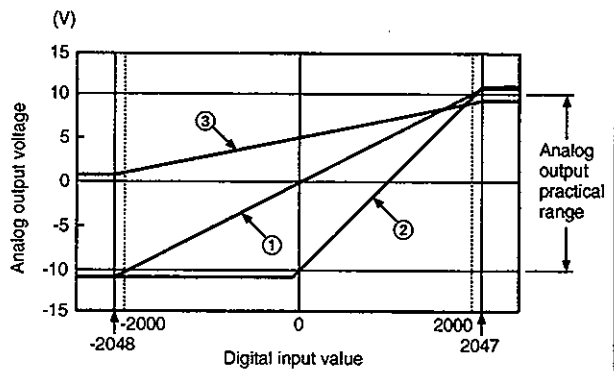
$$(\text{Analog output}) = (\text{Analog resolution}) \times (\text{Digital input value}) + (\text{Offset value})$$

$$(\text{Analog resolution}) = \frac{(\text{Gain value}) - (\text{Offset value})}{2000}$$

- ② The following graph shows the I/O characteristics when the offset and gain values of the AJ65BT-64DAV are changed:

The I/O conversion characteristics are shown in the graph on the right when the offset value and the gain value are set as in the following table:

Number	Offset value	Gain value
①	0V	+10V
②	-10V	+10V
③	+4V	+8V



Example

The analog output voltage for the characteristic graphs ① to ③ becomes as below, when the digital input value is at 1000 and 500:

Number	Digital input value	Analog output voltage
①	1000	+5.0V
	500	+2.5V
②	1000	0V
	500	-5.0V
③	1000	+6.0V
	500	+5.0V

Figure 3.2 I/O conversion characteristics of AJ65BT-64DAV

(2) When AJ65BT-64DAI is used:

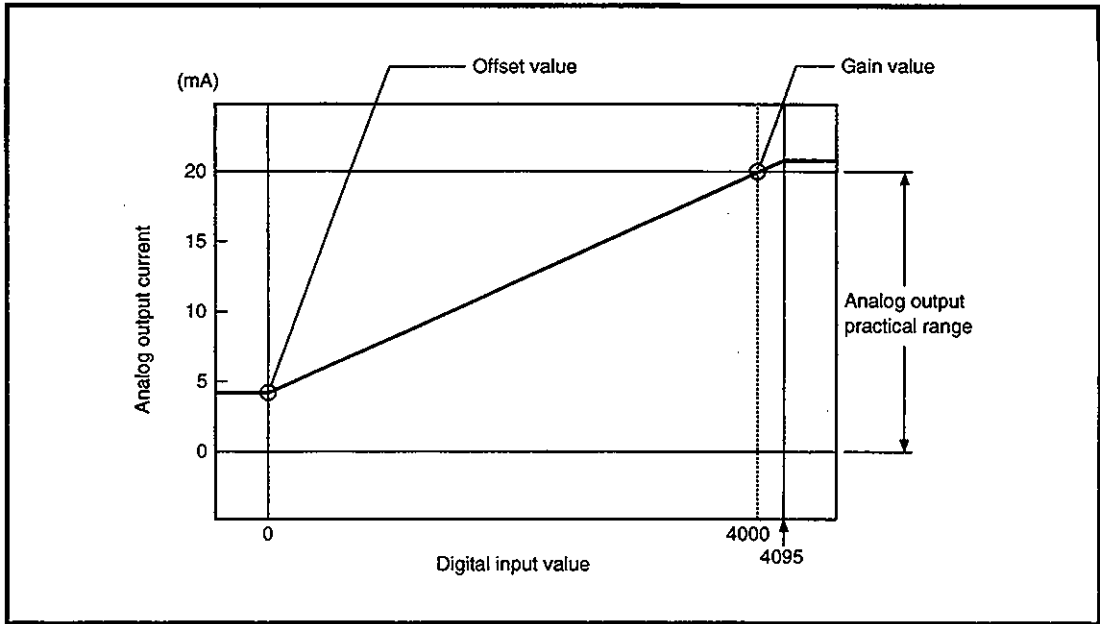


Figure 3.3 I/O conversion characteristics of AJ65BT-64DAI

- ① How to calculate the analog value  
 The resolution of AJ65BT-64DAI can be set arbitrarily by modifying the settings of the offset value and gain value.  
 How to calculate the analog value resolution and the analog output value for a given digital input value when the settings of the offset value and gain value are changed is shown.

$$(\text{Analog output}) = (\text{Analog resolution}) \times (\text{Digital input value}) + (\text{Offset value})$$

$$(\text{Analog resolution}) = \frac{(\text{Gain value}) - (\text{Offset value})}{4000}$$

- ② The following graph shows the I/O characteristic when the offset and gain values of the AJ65BT-64DAI are changed:

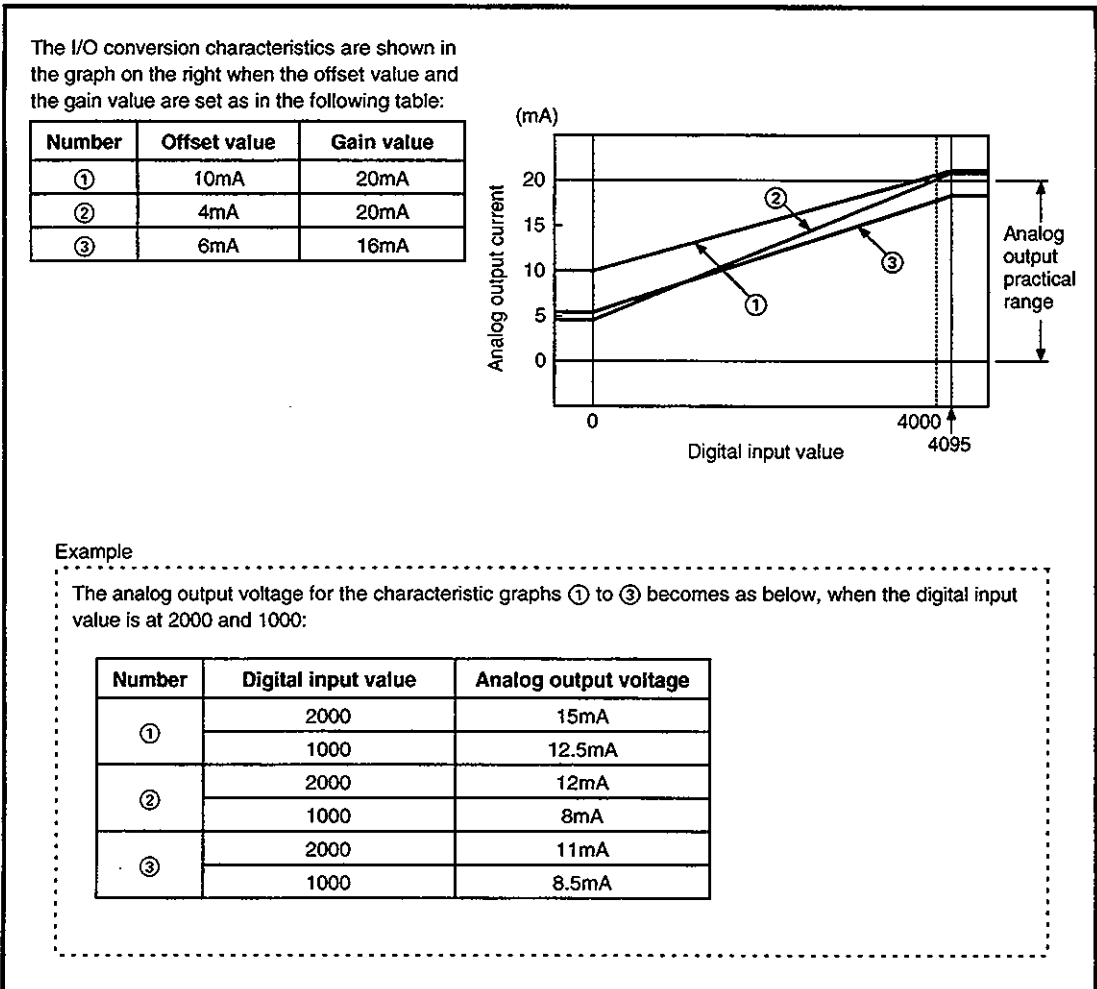


Figure 3.4 I/O conversion characteristics of AJ65BT-64DAI



### 3.4 Various Functions to Control the Analog Output

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Various functions to control the analog output of the AJ65BT-64DAV/DAI are explained.

#### 3.4.1 Function to specify hold or clear of the analog output when the PC CPU is in the STOP status (HOLD/CLEAR setting)

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Using this function, the HLD/CLR terminal on the module front panel can be used to set whether to retain or clear (i.e. to output the offset) the analog output value immediately before the PC CPU enters the STOP status or before the AJ65BT-64DAV/DAI stops the D/A conversion due to an error. All channels are set simultaneously.

#### 3.4.2 Function to specify executing or not executing the D/A conversion processing (Analog output enable signal)

---

Using this function, whether to output the D/A conversion value or the offset value can be selected for each channel by turning on or off the analog output enable signal from the PC program. However, the D/A conversion time (conversion speed) is constant regardless of the setting of the analog output enable signal.

ON: D/A conversion value    OFF: Offset value

#### 3.4.3 Function to specify enabling or prohibiting of the analog value external output (Analog output enable/prohibit setting)

---

Using this function, whether to enable or prohibit the external output of the analog signal can be specified for each channel by writing "0" or "1" to the remote register's address from the PC program.

1: 0V/0mA    0: D/A conversion value or offset value

#### 3.4.4 Offset/gain setting

---

When a fine I/O conversion characteristic is required, the I/O conversion characteristics can be modified arbitrarily by setting the offset and gain of each channel without a volume control, after entering the test mode by short-circuiting the test mode terminal. When it is not necessary, turning on the RYn4, which is the I/O signal to the master station, selects the factory-configured offset and gain values.

Factory-configured values:

AJ65BT-64DAV..... Offset value 0V, Gain value 10V

AJ65BT-64DAI..... Offset value 4mA, Gain value 20mA

#### 3.4.5 Combinations of various functions

---

By combining the functions explained above, the analog output when the PC CPU is in the RUN status and when a module error occurs can be set as desired, as shown in Table 3.3.

Select each function depending on the analog output status of your choice.

Table 3.3 Analog output status combination list

Setting combination Execution status	HOLD/CLEAR setting	CLEAR				HOLD	
	Analog output enable signal	Enable (on)		Prohibit (off)		Enable (on)/Prohibit (off)	
	Analog output enable/prohibit setting	Enable (0)	Prohibit (1)	Enable (0)	Prohibit (1)	Enable (0)	Prohibit (1)
Analog output status when the PC CPU is in the RUN status		Output of the analog value after D/A conversion from the digital value specified by the PC CPU	0V/0mA	Offset value	0V/0mA	Output of the analog value after D/A conversion from the digital value specified by the PC CPU	0V/0mA
Analog output status when the PC CPU is in the STOP status		Offset value	0V/0mA	Offset value	0V/0mA	Analog value before the PC CPU stop is retained.	0V/0mA
Analog output status when the PC CPU is in the error status		Offset value	0V/0mA	Offset value	0V/0mA	Analog value before the CPU error is retained.	0V/0mA
Analog output status when an error has occurred in the AJ65BT-64DAV/DAI		Output of the maximum or minimum analog value	0V/0mA	Offset value	0V/0mA	Output of the maximum or minimum analog value	0V/0mA
Analog output status when a WDT error (*) has occurred in the AJ65BT-64DAV/DAI		0V/0mA					
Analog output status when the LINK RUN LED is turned off		Offset value	0V/0mA	Offset value	0V/0mA	Analog value before the LINK ERR is retained.	0V/0mA
Analog output status after reset		Output of the analog value after D/A conversion from the digital value specified by the PC CPU	0V/0mA	Offset value	0V/0mA	Output of the analog value after D/A conversion from the digital value specified by the PC CPU	0V/0mA

(\*) WDT error .....indicates the abnormal operation time by the PC. The elapsed time for one scan by the program is monitored, and a WDT error results when it does not finish within the scheduled time.

### 3.5 I/O Signals to the Master Station

Assignment of the I/O signals and function of each signal are explained.

#### 3.5.1 I/O signal list

The AJ65BT-64DAV/DAI uses 32 input points and 32 output points for exchanging signals with the master station. The allocation of the I/O signals and the name of each signal are listed in Table 3.4.

An RX device indicates an input signal from the AJ65BT-64DAV/DAI to the master module, and a RY device indicates an output signal from the master module to the AJ65BT-64DAV/DAI.

Table 3.4 I/O signals

Signal direction: AJ65BT-64DAV/DAI→Master		Signal direction: Master→AJ65BT-64DAV/DAI	
Device No.	Signal name	Device No.	Signal name
RXn0  to  RXnF	Unusable	RYn0	CH.1 analog output permission signal
		RYn1	CH.2 analog output permission signal
		RYn2	CH.3 analog output permission signal
		RYn3	CH.4 analog output permission signal
		RYn4	Offset/gain value selection
		RYn5 to RYnF	Unusable
RX (n+1) 0 to RX (n+1) 7	Unusable	RY (n+1) 0 to RY (n+1) 7	Unusable
RX (n+1) 8	Initial data processing request flag	RY (n+1) 8	Initial data processing complete flag
RX (n+1) 9	Initial data setting complete flag	RY (n+1) 9	Initial data setting request flag
RX (n+1) A	Error status flag	RY (n+1) A	Error reset request flag
RX (n+1) B	Remote READY	RY (n+1) B	Unusable
RX (n+1) C	Unusable	RY (n+1) C	Unusable
RX (n+1) D	Unusable	RY (n+1) D	Unusable
RX (n+1) E	(Unusable: QnA)	RY (n+1) E	(Unusable: QnA)
RX (n+1) F	(Unusable: QnA)	RY (n+1) F	(Unusable: QnA)

n: The address allocated to the master station in the station number setting.

Point
If a device not allowed to use is turned on/off from the sequence program, the function of the AJ65BT-64DAV/DAI is not guaranteed.

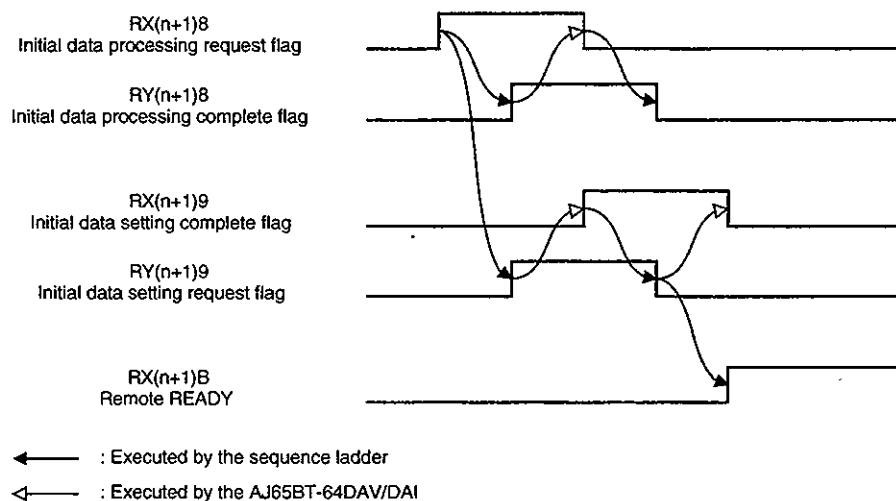
3.5.2 Functions of the I/O signals

Functions of the I/O signals of the AJ65BT-64DAV/DAI are shown in Table 3.5.

Table 3.5 Descriptions of the I/O signals

Device number	Signal Name	Description
RX (n+1) 8	Initial data processing request flag	After the power is turned on or after the hardware reset, the initial data processing request flag is turned on by the AJ65BT-64DAV/DAI in order to request the initial data setting. It is turned off when the initial data setting is complete (i.e. initial data processing complete flag RY(n+1)8 is turned on).
RX (n+1) 9	Initial data setting complete flag	When there is an initial data setting request (i.e. RY(n+1)9 is turned on), it is turned on by the initial data setting completion. When the initial data setting request flag is turned off after the initial data setting completion, the initial data setting complete flag is also turned off.
RX (n+1) A	Error status flag	This is turned on when an error other than the WDT error occurs on the AJ65BT-64DAV/DAI.
RX (n+1) B	Remote READY	This is turned on when the initial data setting is complete and the AJ65BT-64DAV/DAI is in the READY status, after the power is turned on or after the hardware reset. It is turned off during the test mode. (This is used to interlock the read and write from the master module.)
RYn0 to RYn3	CH. □ analog output enable signal	These are the analog value output enable signals for channels 1 through 4. The analog output value from the corresponding channel is enabled when turned on. Turn it off to prohibit the output of the analog value.
RYn4	Offset/gain value selection	"User settings" or "factory settings" of the offset and gain values are selected by switching the RYn4. To select the factory setting, keep the RYn4 set to on.
RY (n+1) 8	Initial data processing complete flag	After the power is turned on or after the hardware reset, the initial data processing is executed by the initial data processing request, and this flag is turned on after the processing is completed.
RY (n+1) 9	Initial data processing request flag	Turn this on to set or modify the initial data.
RY (n+1) A	Error reset request flag	When the error reset request flag (RY(n+1)A) is turned on, the error status flag (RX(n+1)A) is turned off and the error code of the remote register write area is cleared (0000H).

The ON and OFF timing of each flag for the initial data processing request, processing complete, setting complete, and the setting request by the AJ65BT-64DAV/DAI:



## 3.6 Remote Register

The AJ65BT-64DAV/DAI has a remote register (does not have backup) for data communication with the master module. The remote register allocation and data structure are described below.

### 3.6.1 Allocation of the remote register

The allocation of the remote register is shown in Table 3.6.

Table 3.6 Allocation of the remote register

	Address	Description	Initial value	Reference section
Write area (M→R)	RWwm	CH.1 digital value setting area	0	Section 3.6.2
	RWwm+1	CH.2 digital value setting area	0	
	RWwm+2	CH.3 digital value setting area	0	
	RWwm+3	CH.4 digital value setting area	0	
	RWwm+4	Analog output enable/disable area	0	Section 3.6.3
	RWwm+5	Unusable		
	RWwm+6			
	RWwm+7			
Read area (R→M)	RWrn	CH.1 set value check code	0	Section 3.6.4
	RWrn+1	CH.2 set value check code	0	
	RWrn+2	CH.3 set value check code	0	
	RWrn+3	CH.4 set value check code	0	
	RWrn+4	Error code	0	Section 3.6.5
	RWrn+5	Unusable		
	RWrn+6			
	RWrn+7			

m, n: The address set for the master station in the station number setting.

#### Point

Do not execute read or write to the remote register that is not allowed to use. When a read or write is executed, the function of the AJ65BT-64DAV/DAI is not guaranteed.

**3.6.2 Digital value setting area for channels 1 through 4**

- (1) This area is used to write the digital value for the D/A conversion from the PC CPU.
- (2) The digital values at all channels become "0" in the following conditions:
  - (a) After the power is turned on, when the remote READY (RX(n+1)B) is turned on.
  - (b) After the reset of the PC CPU, when the remote READY (RX(n+1)B) is turned on.
- (3) The digital value can be set as 16-bit signed binary data and within the available setting range of the digital value resolution.  
 If a value beyond the range of the digital value resolution is set, the data in Table 3.7 is applied for the D/A conversion.  
 In addition, the checking code is stored in the set value checking code storage area (addresses from RWrn to RWrn+3).

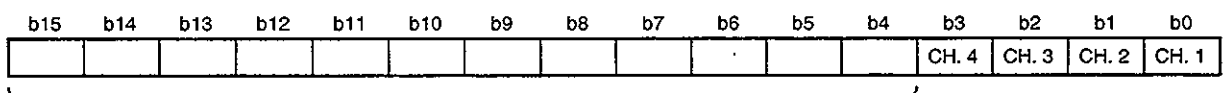
Table 3.7 Available setting range of the digital value

Model Name	Available setting range	Digital value for the D/A conversion when the value beyond the range is set
AJ65BT-64DAV	-2048 to 2047 (Practical range: -2000 to 2000)	2048 or higher: 2047 -2049 or lower: -2048
AJ65BT-64DAI	0 to 4095 (Practical range: 0 to 4000)	4096 or higher: 4095 -1 or lower: 0

**3.6.3 Analog output enable/prohibit channel**

- (1) Enable or prohibit of the external output of the analog value from each channel is set in this area.
- (2) Output is prohibited at all channels in the following conditions:
  - (a) When the power is turned on.
  - (b) When the power is reset.
- (3) Enable/prohibit of the external output is set to 0 or 1 for each channel.
  - (a) 0 .....Enabled
  - (b) 1 .....Prohibited
- (4) Configuration of the output enable/prohibit area for each channel is as follows:

Configuration of the output enable/prohibit area for each channel



Ignored

### 3.6.4 Set value checking code storage area for channels 1 through 4

This area is used to check if the digital value is within or out of the setting range. One of the following checking codes is stored when the digital value lower or higher than the setting range is set.

Check code list

Check code	Description
000FH	A digital value which exceeds the setting range was set.
00F0H	A digital value which is below the setting range was set.
00FFH	Both a digital value below the setting range and digital value exceeding the setting range were set.

- (1) The check code once stored is not reset even if the set value is set to within the valid setting allowed range.
- (2) The storage area or the set value check code is reset by turning on the error reset request flag (RY (n+1) A).

### 3.6.5 Error code

- (1) If an error occurs when writing the data to the AJ65BT-64DAV/DAI (the RUN LED flashes), the following error code is stored in the error code (RW<sub>n+4</sub>) in the AJ65BT-64DAV/DAI remote register.

Error code list

Description	Error code	Corrective action
The digital value set value was set out of range.	11□	Correct the digital value within the allowable range.

The □ indicates the channel number where the error occurred.

- (2) When multiple errors occurred, the error code of the first error is stored, but the other errors are not stored.
- (3) The error code reset is performed by turning on the error reset request flag (RY (n+1) A).

# 4. SETUP AND PREPARATION BEFORE OPERATION

## 4.1 Precautions When Handling

The precautions when handling the AJ65BT-64DAV/DAI are described below:

### DANGER

- Do not touch the terminals and connectors while the power is on. Doing so may cause electric shock or malfunctioning.

### CAUTION

- Be careful not to let foreign matter such as filings or wire chips get inside the module. These can cause fire, breakdowns and malfunctioning.
- Never disassemble or modify the module. This may cause breakdowns, malfunctioning, injury and/or fire.
- Do not touch the conducted area or electric parts of the module. Doing so may cause module malfunctioning or breakdowns.
- The module case is made from resin, so do not drop or apply strong shock to the module. This may cause the module to be damaged.
- Do not remove the module print board from the case. This may cause breakdowns.
- Tighten the terminal screws within the specified torque range. If the terminal screws are loose, it may result in, fire or malfunctioning.
- When disposing of this product, treat it as industrial waste.
- Use the module in the environment given in the general specifications of the Manual. Using the module outside the range of the general specifications may result in electric shock, fire or malfunctioning, or may damage or degrade the module.
- Secure the module with DIN rail or installation screws. Tighten the installation screws securely within the regulated torque range. Failure to do so may cause the damage of the module due to falling of the module.
- Perform the installation/removal from/to the module board after the power supply is turned off. When this is performed while the power is on, it may cause module breakdowns or malfunctioning.

- (1) Tighten the screws such as module installation screws and terminal screws with the following torque :

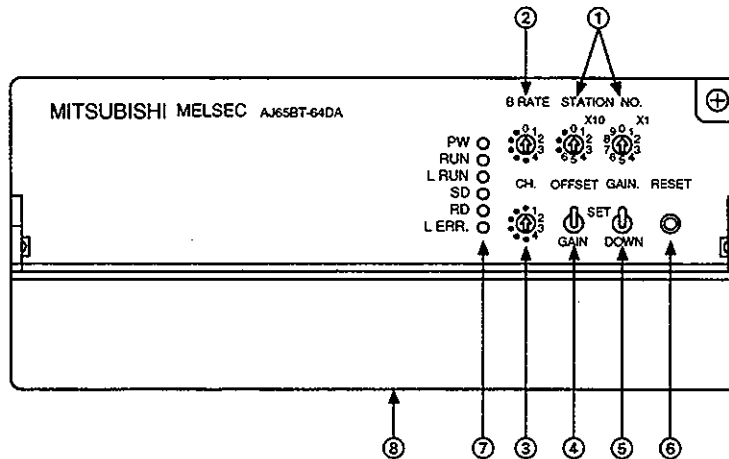
Screw location	Tightening torque range
Module installation screw (M4 screw)	78 to 118 N·cm{8 to 12kg·cm}
Terminal block terminal screw (M3.5 screw)	59 to 88 N·cm{6 to 9kg·cm}
Terminal block installation screw (M4 screw)	78 to 118 N·cm{8 to 12kg·cm}

- (2) When using the DIN rail adapter, install the DIN rail by making sure of the following:
- Applicable DIN rail models (35mm(1.4inch)-wide top-hat rail which conforms to DIN, EN, and IEC standards  
TH35-7.5Fe  
TH35-7.5Al  
TH35-15Fe
  - DIN rail installation screw interval  
When installing the DIN rail, tighten the screws with less than 200mm (7.87 inch) pitches.
- (3) Refer to CC-Link system Master Module user's manual for the name, specification, and manufacturers of supported cables for the use with AJ65BT-64DAV/DAI.



### 4.2 Name of Each Part

The name of each part in the AJ65BT-64DAV/DAI is described.

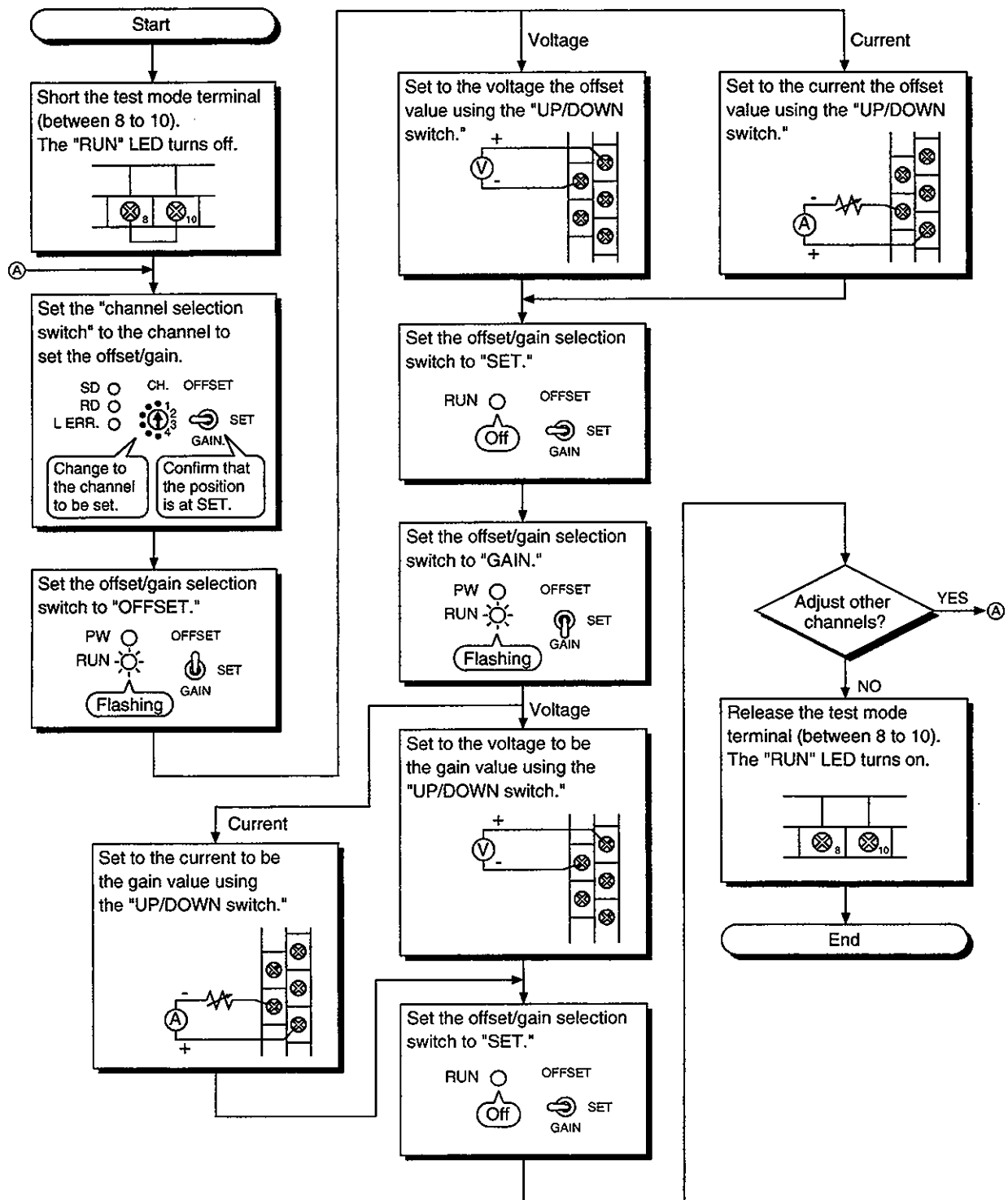


Number	Name	Description												
①	Station number setting switch	<table border="0"> <tr> <td>⬇ ×10</td> <td rowspan="2">                     The AJ65BT-64DAV/DAI station number is set within the range 1 to 63. (Factory shipment setting : 00)                 </td> </tr> <tr> <td>⬇ ×1</td> </tr> </table>	⬇ ×10	The AJ65BT-64DAV/DAI station number is set within the range 1 to 63. (Factory shipment setting : 00)	⬇ ×1									
⬇ ×10	The AJ65BT-64DAV/DAI station number is set within the range 1 to 63. (Factory shipment setting : 00)													
⬇ ×1														
②	B RATE (Transfer baud rate) setup switch	<table border="1"> <thead> <tr> <th>Setting number</th> <th>Transfer baud rate</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>156kbps(Factory shipment setting)</td> </tr> <tr> <td>1</td> <td>625kbps</td> </tr> <tr> <td>2</td> <td>2.5Mbps</td> </tr> <tr> <td>3</td> <td>5Mbps</td> </tr> <tr> <td>4</td> <td>10Mbps</td> </tr> </tbody> </table> <p>Unused (When a value other than 0 to 4 is set, L ERR. LED turns on, and results in a communication error.)</p>	Setting number	Transfer baud rate	0	156kbps(Factory shipment setting)	1	625kbps	2	2.5Mbps	3	5Mbps	4	10Mbps
Setting number	Transfer baud rate													
0	156kbps(Factory shipment setting)													
1	625kbps													
2	2.5Mbps													
3	5Mbps													
4	10Mbps													
③	CH. (CHANNEL) selection switch	Select the channel to perform offset adjustment or gain adjustment. (Positions other than 1 to 4 are not processed.)												
④	OFFSET/GAIN (Offset/gain) setting switch	The switch to set the offset/gain values during test mode. (1) OFFSET position : Calibration mode for the offset value (2) GAIN position : Calibration mode for gain value (3) SET position : When the switch is set from the OFFSET/GAIN position, which are modes to record offset/gain value to the SET position, to the SET position, the offset/gain value is recorded.												
⑤	UP/DOWN switch	The switch to adjust the analog output value for the offset/gain of the specified channel. The analog output value increases/decreases by turning on the UP/DOWN switch.												
⑥	RESET switch	Resets the H/W. Initializes the AJ65-BT-64DAV/DAI I/O signals, remote register, and operation processing. When the switch is turned on, AJ65BT-64DAV/DAI initial data processing request flag turns on.												

Number	Name	Description																																																																																																																
⑦	Operation status display LED	<table border="1"> <tr> <td data-bbox="497 302 730 392">PW LED</td> <td colspan="2" data-bbox="730 302 1452 392">                     On : When the power is on                      Off : When the power is shut off                 </td> </tr> <tr> <td data-bbox="497 392 730 862" rowspan="2">RUN LED</td> <td data-bbox="730 392 877 526">Normal mode</td> <td data-bbox="877 392 1452 526">                     On : Normal operation                      Flashing : Write data error                      Off : 24VDC power shutoff or watchdog timer error                 </td> </tr> <tr> <td data-bbox="730 526 877 862">Test mode</td> <td data-bbox="877 526 1452 862">                     Flashing : Flashes in 0.5 second intervals when the offset/gain setting switch is at OFFSET or GAIN. Flashes in 0.1 second intervals when exceeding the upper or lower limits of the allowable setting using the UP/DOWN switch.                       Off : When the offset/gain setting switch is at SET.                 </td> </tr> <tr> <td data-bbox="497 862 730 929">L RUN LED</td> <td colspan="2" data-bbox="730 862 1452 929">                     On : Normal communication                      Off : Communication interrupted (timeout error)                 </td> </tr> <tr> <td data-bbox="497 929 730 974">SD LED</td> <td colspan="2" data-bbox="730 929 1452 974">On : Data being transferred</td> </tr> <tr> <td data-bbox="497 974 730 1019">RD LED</td> <td colspan="2" data-bbox="730 974 1452 1019">On : Data being received</td> </tr> <tr> <td data-bbox="497 1019 730 1211">L ERR. LED</td> <td colspan="2" data-bbox="730 1019 1452 1211">                     On : When the baud rate or the station number setting is out of range.                      Flashing : When the baud rate or the station number setting is changed after the power is turned on or reset.                      Off : Normal communication                 </td> </tr> </table>	PW LED	On : When the power is on Off : When the power is shut off		RUN LED	Normal mode	On : Normal operation Flashing : Write data error Off : 24VDC power shutoff or watchdog timer error	Test mode	Flashing : Flashes in 0.5 second intervals when the offset/gain setting switch is at OFFSET or GAIN. Flashes in 0.1 second intervals when exceeding the upper or lower limits of the allowable setting using the UP/DOWN switch.  Off : When the offset/gain setting switch is at SET.	L RUN LED	On : Normal communication Off : Communication interrupted (timeout error)		SD LED	On : Data being transferred		RD LED	On : Data being received		L ERR. LED	On : When the baud rate or the station number setting is out of range. Flashing : When the baud rate or the station number setting is changed after the power is turned on or reset. Off : Normal communication																																																																																													
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⑧	Terminal block	<p data-bbox="497 1211 718 1243">AJ65BT-64DAV</p> <table border="1" data-bbox="558 1243 1372 1377"> <tr> <td>1</td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td><td>17</td><td>19</td><td>21</td><td>23</td><td>25</td><td>27</td> </tr> <tr> <td>DA</td><td>DG</td><td>+24V</td><td>24G</td><td>HLD/CLR</td><td>HLD/CLR</td><td>CH1/V+</td><td></td><td>CH2 V+</td><td></td><td>CH3 V+</td><td></td><td>CH4 V+</td><td></td> </tr> <tr> <td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>18</td><td>20</td><td>22</td><td>24</td><td>26</td><td></td> </tr> <tr> <td>DB</td><td>SLD</td><td>(FG)</td><td>TEST</td><td>TEST</td><td></td><td>COM</td><td></td><td>COM</td><td></td><td>COM</td><td></td><td>COM</td><td></td> </tr> </table> <p data-bbox="497 1377 718 1411">AJ65BT-64DAI</p> <table border="1" data-bbox="558 1411 1372 1545"> <tr> <td>1</td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td><td>17</td><td>19</td><td>21</td><td>23</td><td>25</td><td>27</td> </tr> <tr> <td>DA</td><td>DG</td><td>+24V</td><td>24G</td><td>HLD/CLR</td><td>HLD/CLR</td><td>CH1/I+</td><td></td><td>CH2 I+</td><td></td><td>CH3 I+</td><td></td><td>CH4 I+</td><td></td> </tr> <tr> <td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>18</td><td>20</td><td>22</td><td>24</td><td>26</td><td></td> </tr> <tr> <td>DB</td><td>SLD</td><td>(FG)</td><td>TEST</td><td>TEST</td><td></td><td>COM</td><td></td><td>COM</td><td></td><td>COM</td><td></td><td>COM</td><td></td> </tr> </table> <p data-bbox="497 1545 1372 1686">                     HLD/CLR setting terminal                      ....HOLD is set by shorting between terminals, and CLEAR is set by releasing.                      Test mode setting terminal                      ....By shorting between terminals, the system enters the test mode                 </p>	1	3	5	7	9	11	13	15	17	19	21	23	25	27	DA	DG	+24V	24G	HLD/CLR	HLD/CLR	CH1/V+		CH2 V+		CH3 V+		CH4 V+		2	4	6	8	10	12	14	16	18	20	22	24	26		DB	SLD	(FG)	TEST	TEST		COM		COM		COM		COM		1	3	5	7	9	11	13	15	17	19	21	23	25	27	DA	DG	+24V	24G	HLD/CLR	HLD/CLR	CH1/I+		CH2 I+		CH3 I+		CH4 I+		2	4	6	8	10	12	14	16	18	20	22	24	26		DB	SLD	(FG)	TEST	TEST		COM		COM		COM		COM	
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DB	SLD	(FG)	TEST	TEST		COM		COM		COM		COM																																																																																																						

### 4.3 Offset/Gain Setting

When changing the I/O conversion characteristics, follow the procedure below.



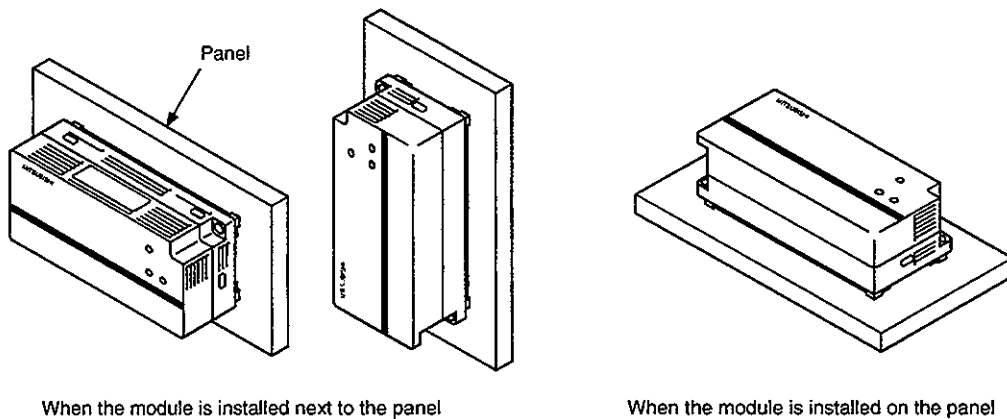
Point
(1) Set the offset and gain values in the actual usage state.
(2) The offset and gain values are stored in the AJ65BT-64DAV/DAI, and are not erased even the power supply is shut off.
(3) Perform the offset/gain setting when the PC CPU is stopped. When in the test mode, D/A conversion is stopped for all channels, so use the remote READY signals as an interlock.
(4) Perform the offset/gain setting in the range from DC -10 to +10V or from 4 to +20mA. When the setting exceeds this range, the maximum resolution or total precision may not be in the range indicated in the performance specification.

#### 4.4 Station Number Setting

By the AJ65BT-64DAV/DAI station number setting, the addresses to store the control I/O signal data and read/write data are determined.

For details, refer to the AJ61BT11/A1SJ61BT11 CC-Link System Master/Local Module User's Manual or AJ61QBT11/A1SJ61QBT11 CC-Link System Master/Local Module User's Manual.

#### 4.5 Facing Direction of the Module Installation



## 4.6 Data link Cable Wiring

The wiring of the twisted pair cable which connects the AJ65BT-64DAV/DAI and the master module is described.

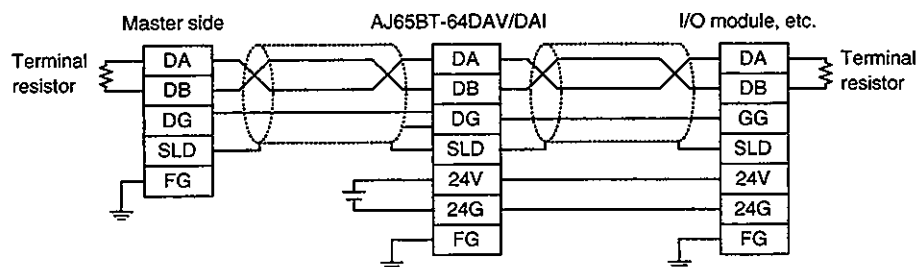
### 4.6.1 Precautions when handling the twisted pair cable

Do not handle the twisted pair cable in extreme ways as bellow, for the cable may be damaged:

- (1) Compact with a sharp object
- (2) Twist the cable excessively.
- (3) Pull the cable hard. (more than the permitted elasticity.)
- (4) Step on the cable.
- (5) Place an object on the top.
- (6) Scratch the cable's protective layer.

### 4.6.2 Twisted pair cable connections

The twisted pair cable connections between the AJ65BT-64DAV/DAI and master module are as follows:



## 4.7 Wiring

Precautions when wiring the AJ65BT-64DAV/DAI and how to wire to the external devices are explained.

### 4.7.1 Precautions when wiring

To obtain maximum performance from the functions of AJ65BT-64DAV/DAI and improve the system reliability, an external wiring with high durability against noise is required.

The precautions performing external wiring for the AJ65BT-64DAV/DAI are shown below:

- (1) Use separate cables for the AC and AJ65BT-64DAV/DAI external input signals, in order not to be affected by the AC side surge or conductivity.
- (2) Do not bunch the control wires or load cables from other than the PC with the wires to the module, or install them close to each other. Doing this makes the wiring easy to accept the noise, surge or induction effects.
- (3) Perform a one-point grounding for the shielded line or the shield of the shielded cable.

### 4.7.2 Wiring between the AJ65BT-64DAV/DAI and external devices

- (1) Wiring example of the AJ65BT-64DAV and external devices is shown in Figure 4.1.

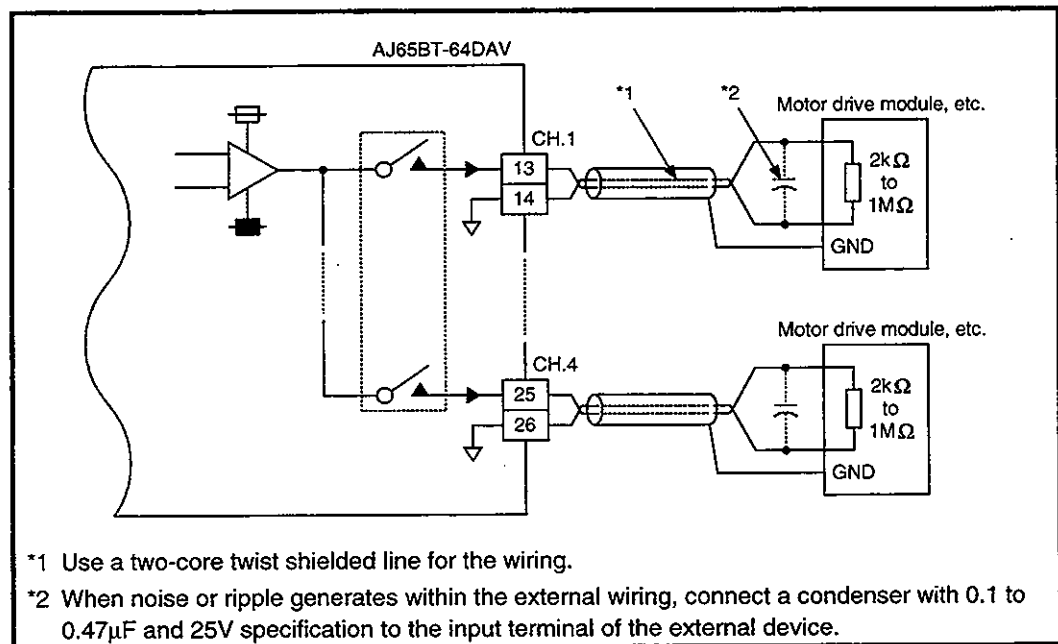


Figure 4.1 Wiring example of the AJ65BT-64DAV and external devices

(2) Wiring example of the AJ65BT-64DAI and external devices is shown in Figure 4.2.

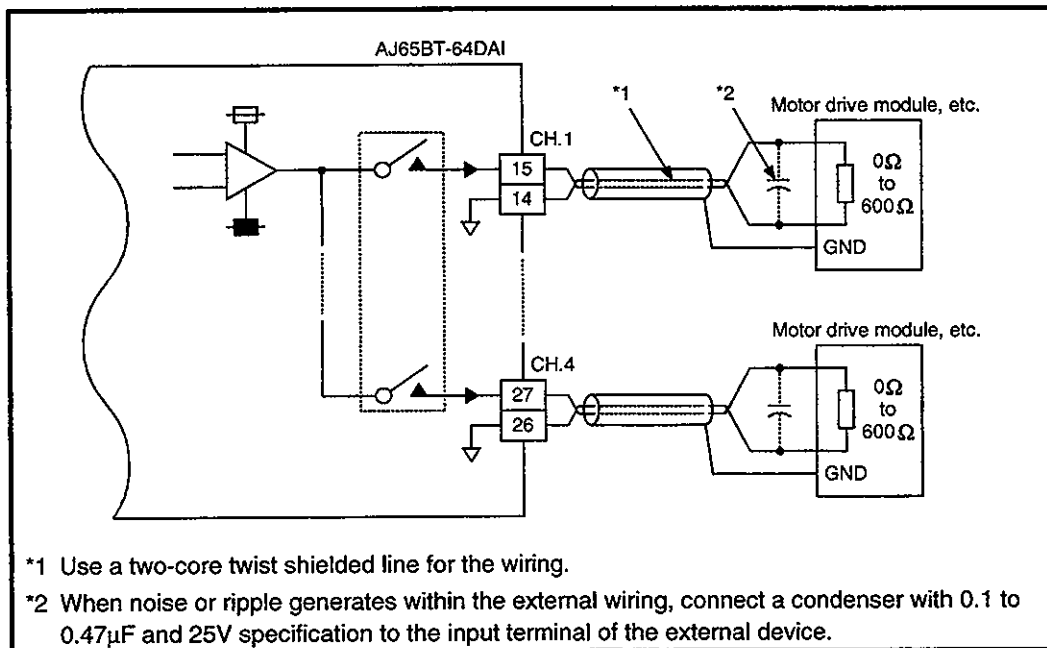


Figure 4.2 Wiring example of the AJ65BT-64DAI and external devices

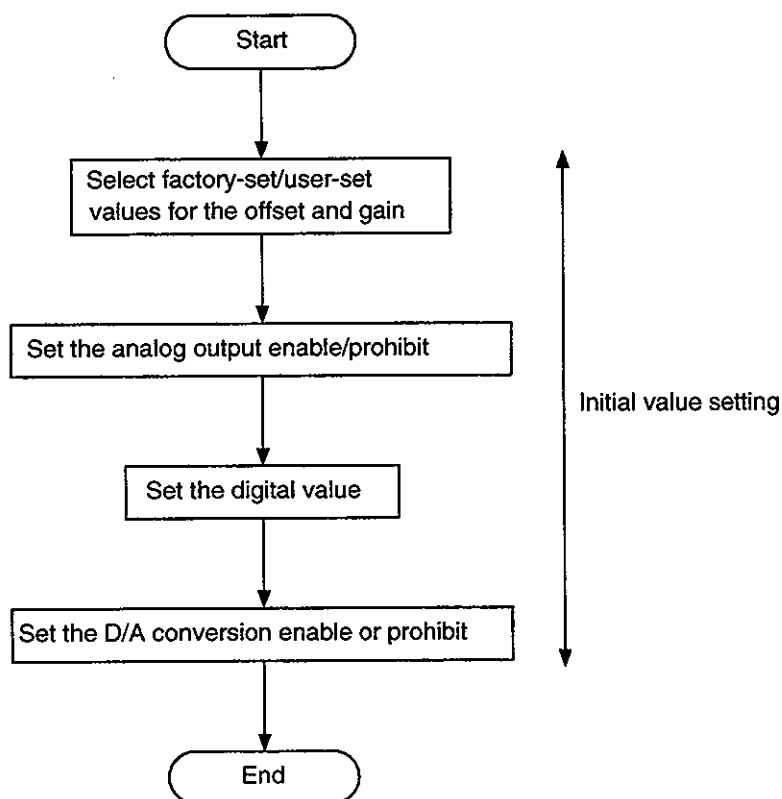
## 5. PROGRAMMING

The programming procedure, basic read/write programs, and program examples for the AJ65BT-64DAV/DAI are described.

Refer to Section 3.6 about the remote register, and refer to the ACPU Programming Manual or QnACPU Programming Manual for the details of each instruction.

### 5.1 Programming Procedure

Create a program which executes the AJ65BT-64DAV/DAI analog/digital conversion by following the procedure below:



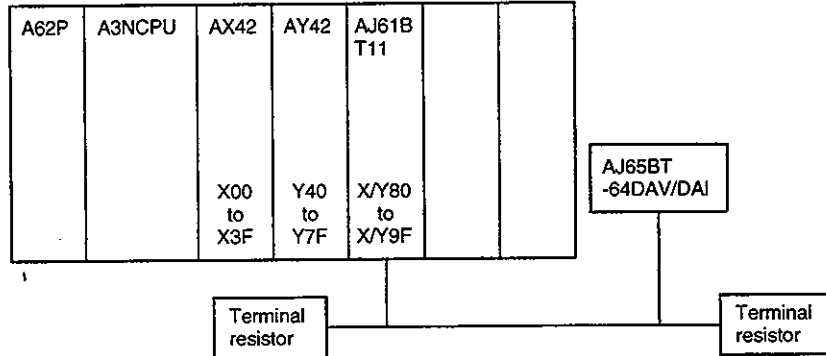


## 5.2 Program Example

This example shows a program which writes digital values to the digital-value set area (addresses 1E0H to 1E3H of the remote register) for channels 1 through 4 of the AJ65BT-64DAV/DAI. If a digital-value error occurs, the error code is read from the set-value error code area (address 2E4H of the remote register) and recalled to the read register (D14).

**Conditions for the sample program**

① System configuration



② Initial setting details

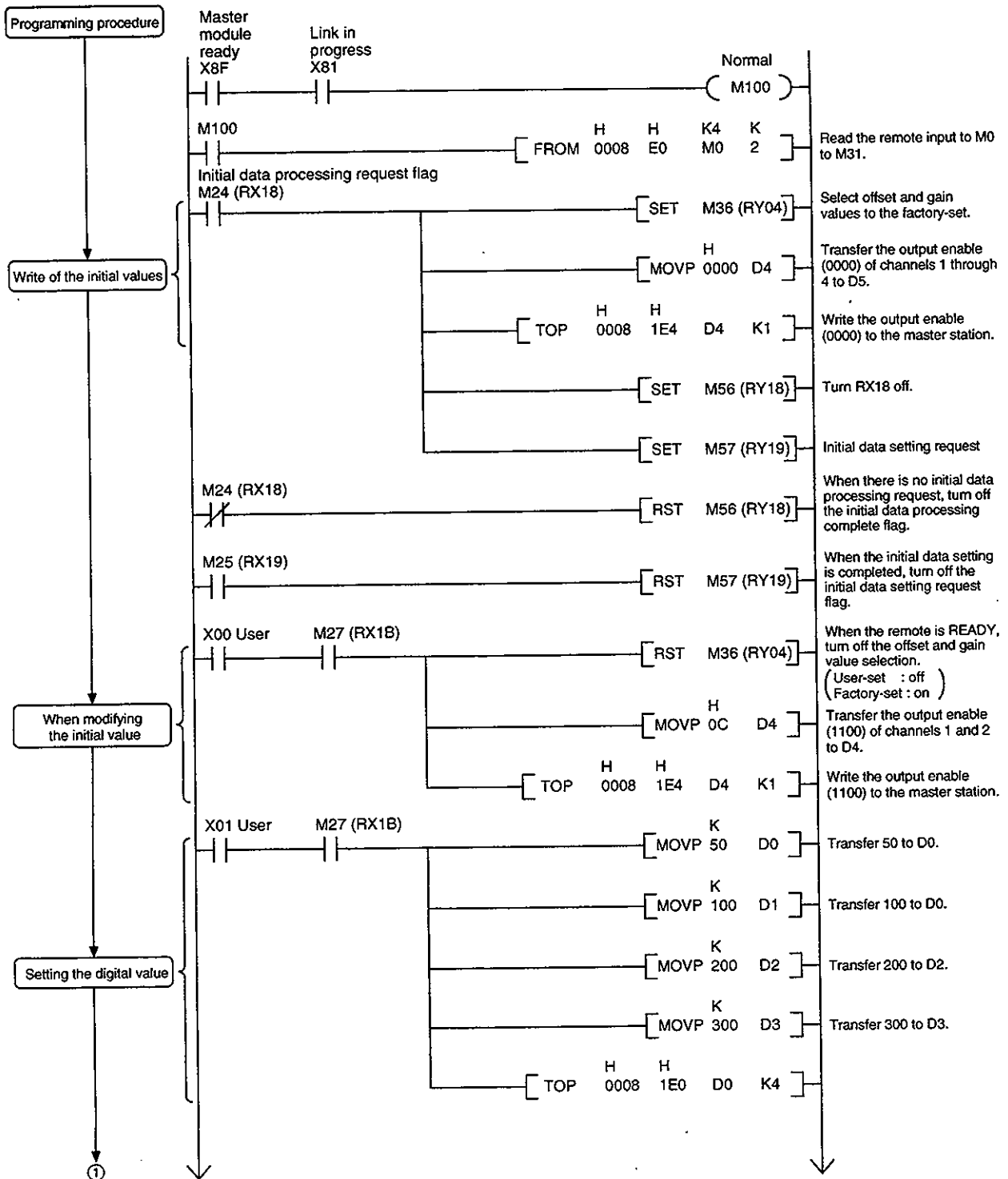
- a) Station number setting ..... 1 station
- b) D/A conversion enabled channels ..... Channels 1, 2, and 3

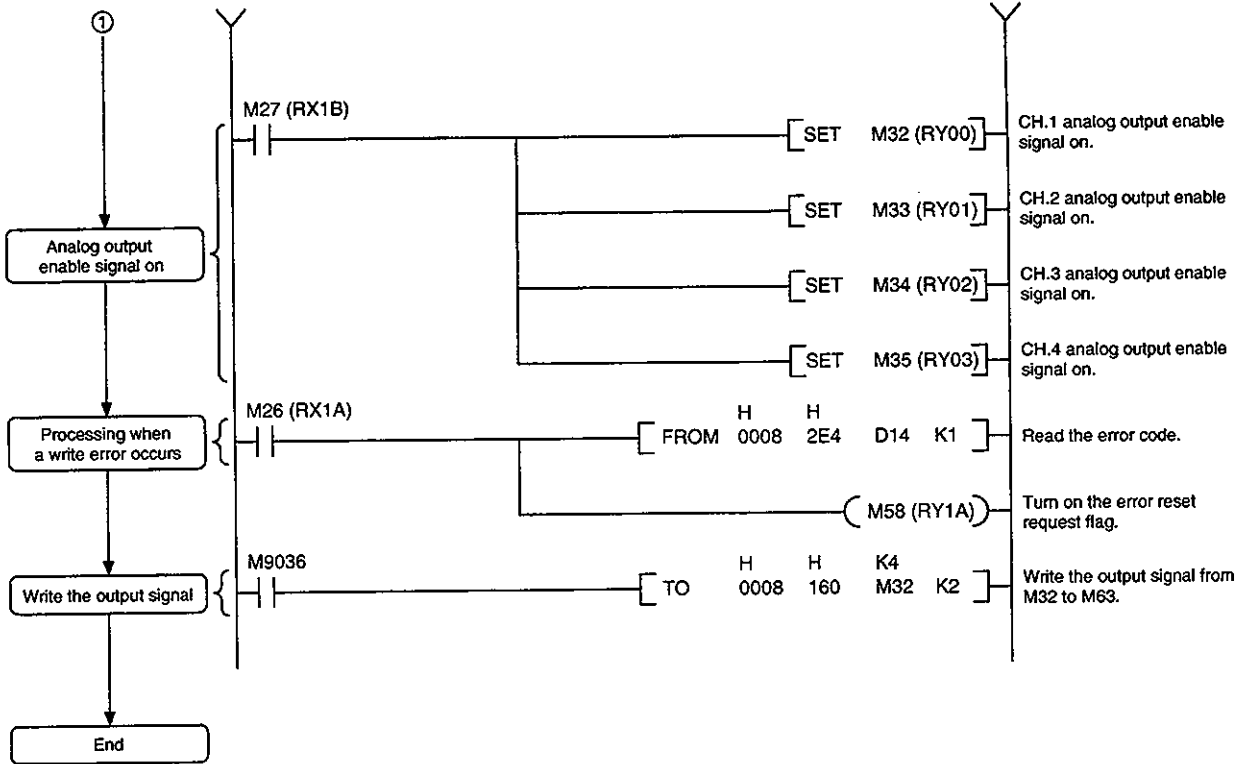
③ Device used by the user

- a) Input signal storage device..... M0 to M31
- b) Output signal storage device..... M32 to M63
- c) Digital value setting register for channels 1 to 4 ..... D0 to D3
- d) Analog output enable/prohibit setting register ..... D4
- e) Data register to store the write-data error code..... D14
- f) Initial value modify command signal..... X00
- g) Digital value modify command signal..... X01
- h) Data link status signal at local ..... X81
- i) Master module ready signal ..... X8F

④ Master module buffer memory address

- a) For the remote input (station 1) ..... E0H to E1H(RX0 to RX1F)
- b) For the remote output (station 1)..... 160H to 161H(RY0 to RY1F)
- c) Remote register for write (station 1) ..... 1E0H to 1E7H(RWw0 to RWw7)
- d) Remote register for read (station 1)..... 2E0H to 2E7H(RWr0 to RWr7)





## 6. TROUBLESHOOTING

The details of the errors which may occur when using the AJ65BT-64AD and troubleshooting are described.

### 6.1 Error Code List

When the data is written from the PC CPU to the master module, and an error occurs (AJ65BT-64DAV/DAI RUN LED flashes), the error code is stored to the AJ65BT-64DAV/DAI remote register RWrn+4.

Refer to Section 3.6.5 for the error code.

### 6.2 Troubleshooting

A simple troubleshooting method for using the AJ65BT-64DAV/DAI is described.

Refer to the PC CPU and Master Module User's Manuals regarding problems related to the PC CPU and master module.

(a) When the AJ65BT-64DAV/DAI RUN LED is flashing

Check item	Corrective action
There is an error in the write data.	Check the cause of the error using the error code, and correct the sequence program.
Is there a short between the TEST terminals (test mode)?	Release between the TEST terminals after adjusting the offset/gain.
Is it flashing in 0.1sec. intervals (fast-speed) in test mode?	Change the offset/gain adjustment to within the allowable range.

(b) When the AJ65BT-64DAV/DAI RUN LED is off

Check item	Corrective action
Is the 24VDC power on?	Check the power. (External power supply)
Is the 24VDC power voltage at the regulated value?	Set the voltage within the range 18 to 30V.
Is there a short between the TEST terminals(test mode)?	Release the TEST terminal after adjusting the offset/gain.

(c) When the AJ65BT-64DAV/DAI LINK RUN LED turns off

Refer to the master module troubleshooting section.

(d) When the AJ65BT-64DAV/DAI LINK ERR LED is flashing

Check item	Corrective action
Was the station number or baud rate switch changed during normal operation?	Set the station number or baud rate used during normal operation.

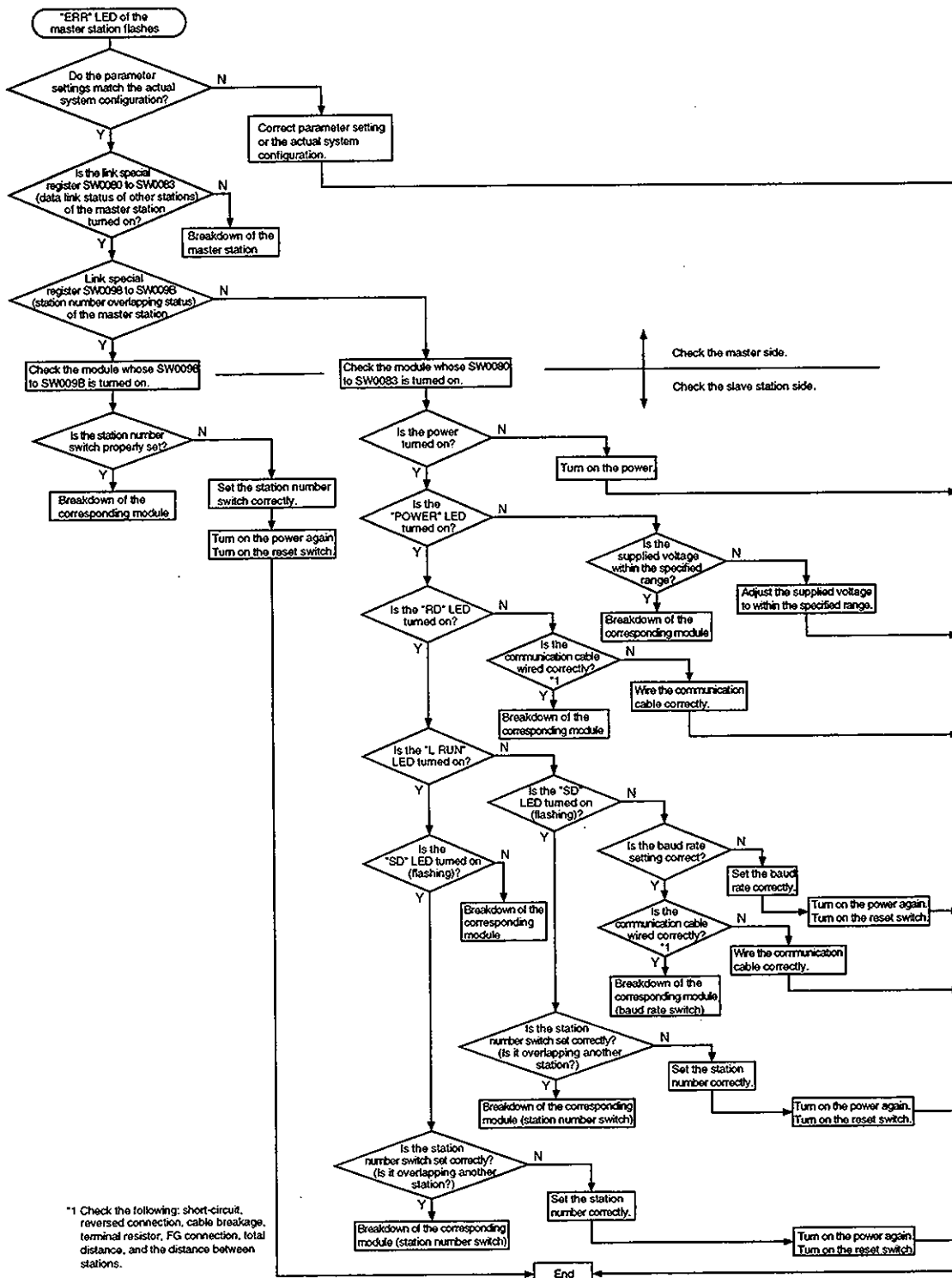
(e) When the AJ65BT-64DAV/DAI LINK ERR LED is on

Check item	Corrective action
Is the station number or baud rate setting correct?	Set a correct station number or baud rate.

### 6.2.1 When a communication fault occurs between the master station and this module

If the station-number-overlapping bit is turned on in the link special register SW0098 to SW009B (station number overlapping status), check the AJ65BT-64DAV/DAI module of the corresponding station number by following the flow shown below:

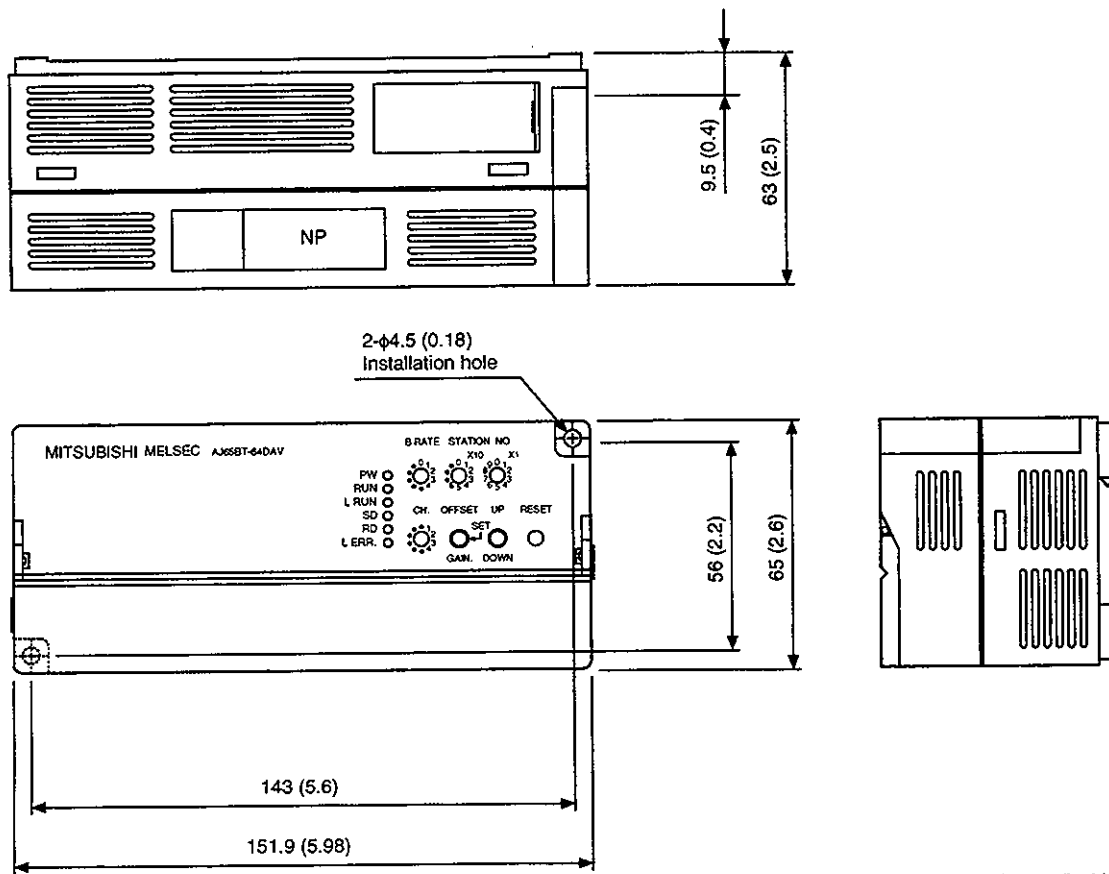
Troubleshooting flow when the ERR LED on the master station is flashing



\*1 Check the following: short-circuit, reversed connection, cable breakage, terminal resistor, FG connection, total distance, and the distance between stations.

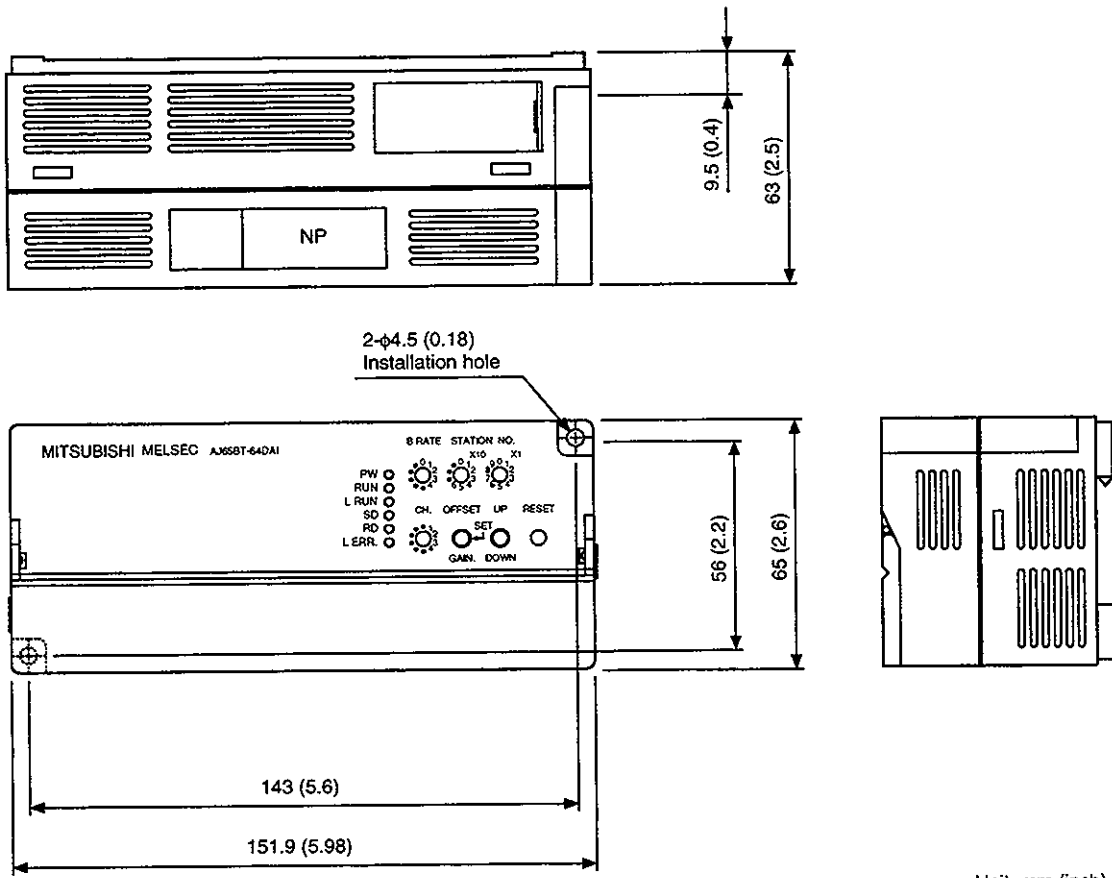
# APPENDIX

## Appendix 1 External Dimensions of the AJ65BT-64DAV



Unit: mm (inch)

**Appendix 2 External Dimensions of the AJ65BT-64DAI**



Unit: mm (inch)

**HEADQUARTERS**

**MITSUBISHI ELECTRIC EUROPE B.V.** EUROPE  
German Branch  
Gothaer Straße 8  
**D-40880 Ratingen**  
Phone: +49 (0) 21 02 / 486-0  
Fax: +49 (0) 21 02 / 4 86-1 12  
e mail: megfamail@meg.mee.com

**MITSUBISHI ELECTRIC EUROPE B.V.** FRANCE  
French Branch  
25, Boulevard des Bouvets  
**F-92741 Nanterre Cedex**  
Phone: +33 1 55 68 55 68  
Fax: +33 1 49 01 07 25  
e mail: factory.automation@framee.com

**MITSUBISHI ELECTRIC EUROPE B.V.** ITALY  
Italian Branch  
Via Paracelso 12  
**I-20041 Agrate Brianza (MI)**  
Phone: +39 039 6053 1  
Fax: +39 039 6053 312  
e mail: factory.automation@it.mee.com

**MITSUBISHI ELECTRIC EUROPE B.V.** SPAIN  
Spanish Branch  
Carretera de Rubí 76-80  
**E-08190 Sant Cugat del Vallés**  
Phone: +34 9 3 / 565 3131  
Fax: +34 9 3 / 589 2948  
e mail: industrial@sp.mee.com

**MITSUBISHI ELECTRIC EUROPE B.V.** UK  
UK Branch  
Travellers Lane  
**GB-Hatfield Herts. AL10 8 XB**  
Phone: +44 (0) 1707 / 27 61 00  
Fax: +44 (0) 1707 / 27 86 95

**MITSUBISHI ELECTRIC CORPORATION** JAPAN  
Office Tower "Z" 14 F  
8-12,1 chome, Harumi Chuo-Ku  
**Tokyo 104-6212**  
Phone: +81 3 / 622 160 60  
Fax: +81 3 / 622 160 75

**MITSUBISHI ELECTRIC AUTOMATION** USA  
500 Corporate Woods Parkway  
**Vernon Hills, IL 60061**  
Phone: +1 847 / 478 21 00  
Fax: +1 847 / 478 22 83

**EUROPEAN REPRESENTATIVES**

**GEVA GmbH** AUSTRIA  
Wiener Straße 89  
**A-2500 Baden**  
Phone: +43 (0) 2252 / 85 55 20  
Fax: +43 (0) 2252 / 488 60  
e mail: office@geva.co.at

**Getronics bv** BELGIEN  
Control Systems  
Pontbeeklaan 43  
**B-1731 Asse-Zellik**  
Telefon: +32 (0) 2 / 467 17 51  
Telefax: +32 (0) 2 / 467 17 45  
E-Mail: infoautomation@getronics.com

**TELECON CO.** BULGARIA  
4, A. Ljapchev Blvd.  
**BG-1756 Sofia**  
Phone: +359 92 / 97 44 05 8  
Fax: +359 92 / 97 44 06 1  
e mail: —

**INEA CR d.o.o.** CROATIA  
Drvinje bb  
**HR-10000 Zagreb**  
Phone: +385 (0) 1 / 366 71 40  
Fax: +385 (0) 1 / 366 71 40  
e mail: inea-cr@zg.tel.hr

**AutoCont Control Systems s.r.o.** CZECHIA  
Nemocnicni 12  
**CZ-702 00 Ostrava 2**  
Phone: +420 (0) 69 / 615 21 11  
Fax: +420 (0) 69 / 615 21 12  
e mail: petr.pustovka@autocont.cz

**louis poulsen** DENMARK  
Geminivej 32  
**DK-2670 Greve**  
Phone: +45 (0) 43 / 95 95 95  
Fax: +45 (0) 43 / 95 95 91  
e mail: lpia@lpmail.com

**UTU Elektrotehnika AS** ESTONIA  
Pärnu mnt.160i  
**EE-11317 Tallinn**  
Phone: +372 6 / 51 72 80  
Fax: +372 6 / 51 72 88  
e mail: utu@utu.ee

**Beijer Electronics OY** FINLAND  
Elannontie 5  
**FIN-01510 Vantaa**  
Phone: +358 (0) 9 / 615 20 11  
Fax: +358 (0) 9 / 615 20 500  
e mail: info@elc.beijer.fi

**MITSUBISHI ELECTRIC EUROPE B.V. – Irish Branch** IRELAND  
Westgate Business Park  
**IRL-Dublin 24**  
Phone: +353 (0) 1 / 419 88 00  
Fax: +353 (0) 1 / 419 88 90  
e mail: sales.info@meuk.mee.com

**EUROPEAN REPRESENTATIVES**

**Getronics bv** NETHERLANDS  
Control Systems  
Donauweg 2B  
**NL-1043 AJ Amsterdam**  
Phone: +31 (0) 20 / 587 68 30  
Fax: +31 (0) 20 / 587 68 39  
e mail: info.gia@getronics.com

**Beijer Electronics A/S** NORWAY  
Teglverksveien 1  
**N-3002 Drammen**  
Phone: +47 (0) 32 / 24 30 00  
Fax: +47 (0) 32 / 84 85 77  
e mail: info@elc.beijer.no

**MPL Technology SP. z.o.o** POLAND  
ul. Wroclawska 53  
**PL-30011 Kraków**  
Phone: +48 (0) 12 / 632 28 85  
Fax: +48 (0) 12 / 632 47 82  
e mail: mpl@krakow.ipl.net

**Sirius Trading & Services srl** ROMANIA  
Bd. Ghica nr. 112, Bl. 41, Sc.2, ap. 98  
**RO-72235 Bucuresti 2**  
Phone: +40 (0) 1 / 210 55 11  
Fax: +40 (0) 1 / 210 55 11  
e mail: sirius\_t\_s@fx.ro

**ACP AUTOCOMP a.s.** SLOVAKIA  
Chalupkova 7  
**SK-81109 Bratislava**  
Phone: +421 (0) 7 592 22 48  
Fax: +421 (0) 7 592 22 54  
e mail: acp.autocomp@nextra.sk

**INEA d.o.o.** SLOVENIA  
Ljubljanska 80  
**SI-1230 Domžale**  
Phone: +386 (0) 1 / 721 80 00  
Fax: +386 (0) 1 / 724 16 72  
e mail: inea@ineas.si

**Beijer Electronics AB** SWEDEN  
Box 325  
**S-20123 Malmö**  
Phone: +46 (0) 40 / 35 86 00  
Fax: +46 (0) 40 / 93 23 01  
e mail: info@elc.beijer.se

**ECONOTEC AG** SWITZERLAND  
Postfach 282  
**CH-8309 Nürensdorf**  
Phone: +41 (0) 1 / 838 48 11  
Fax: +41 (0) 1 / 838 48 12  
e mail: info@econotec.ch

**GTS** TURKEY  
Darülaceze Cad. No. 43A KAT: 2  
**TR-80270 Okmeydani-Istanbul**  
Phone: +90 (0) 212 / 320 1640  
Fax: +90 (0) 212 / 320 1649  
e mail: gts@turk.net

**MIDDLE EAST REPRESENTATIVE**

**TEXEL Electronics LTD.** ISRAEL  
Rehov Hamerkava 19  
**IL-42160 Netanya**  
Phone: +972 (0) 9 / 863 08 91  
Fax: +972 (0) 9 / 885 24 30  
e mail: texel\_me@netvision.net.il

**EURASIAN REPRESENTATIVES**

**MITSUBISHI ELECTRIC EUROPE B.V.** RUSSIA  
Moscow Representative Office  
52 Kosmodamianskaya Nab., bld. 5  
**RUS-113054 Moskow**  
Phone: +7 (0) 95 / 721 2070  
Fax: +7 (0) 95 / 721 2071  
e mail: info@mitsubishi-electric.ru

**NPP Uralelektra** RUSSIA  
Sverdlova 11A  
**RUS-620027 Ekaterinburg**  
Phone: +7 34 32 / 53 27 45  
Fax: +7 34 32 / 53 24 61  
e mail: elektra@etel.ru

**JV-CSC Automation** UKRAINE  
15, Marina Raskovoyi St.  
**U-02002 Kiev**  
Phone: +380 (44) / 238 83 16  
Fax: +380 (44) / 238 83 17  
e mail: mkl@csc-a.kiev.ua

**AFRICAN REPRESENTATIVE**

**Circuit Breaker Industries Ltd.** SOUTH AFRICA  
Private Bag 2016  
**ZAF-1600 Isando**  
Phone: +2711 928 2000  
Fax: +2711 392 2354