MITSUBISHI

Serial Communication Module for MODBUS

User's Manual
(Hardware)

AJ71UC24-S2

Thank you for buying the Mitsubishi general-purpose programmable logic controller MELSEC-A Series

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

MODEL	AJ71UC24-S2-U-E
MODEL CODE	13J803
IB(NA)-66580-B(9912)MEE	

● SAFETY PRECAUTIONS ●

(Always read before starting use)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For the safety instructions of the programmable controller system, please read the CPU module user's manual.
In this manual, the safety instructions are ranked as "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 medium or slight personal injury or physical damage.

Note that the ⚠CAUTION level may lead to a serious consequence according to the circumstances.
Always follow the instructions of both levels because they are important to personal safety.
Please save this manual to make it accessible when required and always forward it to the end user.

[SYSTEM DESIGN PRECAUTIONS]

⚠DANGER

- When controlling a PLC by connecting a personal computer or other similar control device to a special function module for the purpose of changing the data, changing the program, or changing the operation status (status control), an interlock circuit must be configured in the sequence program so that the entire system will always operate safely.
  If a remote PLC is controlled in the manner indicated above by an external device, the system may fail to respond immediately even when trouble occurs at the remote PLC due to data communication error.
  In addition to configuring the interlock circuit in a sequence program, determine the response to be taken by the system at the occurrence of a data communication error as the processing between the external device and the PLC CPU.

[SYSTEM DESIGN PRECAUTIONS]

⚠CAUTION

- Do not bundle control lines or communication wires together with main circuit or power lines, or lay them close to these lines.
  As a guide, separate these lines by a distance of at least 100 mm, otherwise malfunctions may occur due to noise.

[CAUTIONS ON MOUNTING]

⚠CAUTION

- Use the PLC in an environment that conforms to the general specifications in the manual.
  Using the PLC in environments outside the ranges stated in the general specifications will cause electric shock, fire, malfunction, or damage to/deterioration of the product.
- Switch off all phases of the power supply outside the PLC before starting installing or wiring work.
  If all phases are not switched off, there will be a danger of electric shock or damage to the product.
- Make sure that the module fixing projection on the base of the module is properly engaged in the module fixing hole in the base unit before mounting the module.(AnS series modules must be screwed to the base unit with the specified torque.)
  Failure to mount the module properly will result in malfunction or failure, or in the module falling.
- Tighten screws to the specified torque.
  If a screw is not tightened to the specified torque, the module may fall out, or a short circuit or malfunction may occur.
  If a screw is tightened excessively, exceeding the specified torque, the module may fall out, short circuit, or malfunction due to breakage of the screw or the module.
- Do not touch conductive parts or electronic components of the module with your bare hands.
  This could cause malfunction or failure of the module.
- When connecting a wire to a connector, use the specified tool to connect it by crimping, pressure welding, or soldering correctly.
  Plug the connector into the module securely.

[CAUTIONS ON WIRING]

⚠DANGER

- Communication cables connected to a module must always be run in a duct or held securely using clamps.
  If a cable is not run in a duct or not held seourely using clamps, the cable will sag, move, or be pulled by mistake, which will cause damage to the module and the cable and also malfunctioning due to loose connection of the cable.
- Check the correct type of interface for the connection before connecting cables. Connecting a cable to the wrong interface or miswiring could cause failure of the module or external device.
- Do not connect an external device that requires power supply from the computer link module to the RS-422 interface of the computer link module. This could cause failure of the module or the external device.
- Tighten terminal screws to the specified torque.
  If a terminal screw is not tightened to the specified torque, it the module may fall out, short circuit, or malfunction.
  If a terminal screw is tightened excessively, exceeding the specified torque, the module may fall out, short circuit, or malfunction due to breakage of the screw or the module.
- When removing the communication cable from a module, do not pull it out by the cable.
  For a cable with a connector, hold the connector plugged into the module to disconnect the cable.
  For a cable without a connector, loosen the screws that hold the cable onto the module then remove the cable.
  If the cable is pulled while it is connected to the module, the module and/or the cable will be damaged and may malfunction due to loose connection of the cable.
- Make sure that no foreign matter such as chips or wire offcuts gets inside the module.
  It will cause fire, failure, or malfunction.

[CAUTIONS ON STARTUP AND MAINTENANCE]

⚠DANGER

- Do net touch terminals while the power is ON.
  This will cause malfunctions.
- Switch off all phases of the power supply outside the PLC before cleaning or re-tightening screws. If all phases are not switched off, the module may fail or malfunction.
  If a screw is not tightened securely, the module may fall out, short circuit, or malfunction.
  If a screw is tightened excessively, the module may fall out, short circuit, or malfunction due to breakage of the screw or the module.

[CAUTIONS ON STARTUP AND MAINTENANCE]

⚠CAUTION

- Do not disassemble or modify any module.
  This will cause failure, malfunction, injuries, or fire.
- Switch off all phases of the power supply outside the PLC before mounting or removing the module.
  If all phases are not switched off, the module may fail or malfunction.

[CAUTIONS ON OPERATION]

⚠DANGER

- Do not write data in the "system area" in the buffer memory of a special function module.
  Among the signals output from the PLC CPU to a special function module, do not output the "usage prohibited" signals.
  Writing data in the "system area" or outputting the "usage prohibited" signals will cause malfunctions of the PLC system.

⚠CAUTION

- When controlling a PLC by connecting a personal computer or other similar control device to a special function module for the purpose of changing the data, changing a program, or changing the operation status (status control), read this manual carefully and start the intended control only after ensuring that it can be performed safely.
  Errors in changing the data, changing the program, or controlling the status will cause system malfunction, and machine damage or accidents.

[CAUTIONS ON DISPOSAL]

⚠CAUTION

- Dispose of this product as industrial waste.

Revisions

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

Print Date	*Manual Number	Revision
July, 1999	IB-(NA)-66580-A	First edition
Dec., 1999	IB-(NA)-66580-B	Correction Section 2.1, 5.2

CONTENTS

1. General Description

This manual describes specifications and names of parts of AJ71UC24-S2 serial communication module for MODBUS *1 for use with MELSEC-A Series compact building block type PLC CPU.
Upon unpacking the AJ71UC24-S2, make sure that the items shown below are contained.

Name of Item	Quantity
AJ71UC24-S2 serial communication module for MODBUS	1
Terminal resistance 330Ω 1/4W (orange orange brown ☐)	2
Terminal resistance 110Ω 1/2W (brown brown brown ☐)	2

*1:MODBUS is a registered trade mark of MODICON INC.

1.1 Related Manual

For details on the specifications, functions, and handling of the AJ71UC24-S2, refer to the following manuals.
User's Manual for AJ71UC24-S2, A1SJ71UC24-R2-S2, and A1SJ71UC24-R4-S2 serial communication modules for MODBUS. (IB-66583)

2. System Configurations

2.1 Applicable Systems

1) Applicable PLC CPU modules and the number of AJ71UC24-S2 modules to be connected

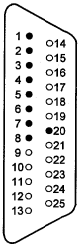
The table below shows the applicable PLC CPU modules for which the AJ71UC24-S2 will be used, and the number of AJ71UC24-S2 modules to be connected to the modules.

Applicable PLC CPU Modules	Number of Connectable AJ71UC24s	Notes
A0J2H A1, A1N A1SJ(S3) A1SJH A1S(S1) A1SH A2S(S1) A2SH A2(S1), A2N(S1) A3, A3N A3H, A3M A73	2	If the A1S series special function modules and/or the A series special function modules are connected to a PLC CPU, the total number of these special function modules is regarded as the maximum number of modules connectable to the PLC CPU. • A1SJ71C24-R2 Computer link module • A1SJ71C24-PRF Computer link/ printer function module • A1SJ71C24-R4 Computer link/multidrop link module • AD51(S3)/AD51H(S3) Intelligent Communication Module • AD51FD(S3) External Failure Diagnosis Module
A2A(S1) A2U(S1) A2AS(S1) A2USH-S1 A3A A3U A4U Q2AS(S1) Q2ASH(S1) Q3A Q4A	6	• AD57G(S3) Graphic Controller Module • AJ71C21(S1) Terminal Interface Module (Only in BASIC Program Mode) • AJ71C22(S1) Multidrop Link System Module • AJ71C23 Higher Controller High Speed Link Module • AJ71C24(S3/S6/S8) Computer Link Module • AJ71UC24 Computer Link/Multidrop Link Module • AJ71P41 SUMINET Interface Module • AJ71E71 Ethernet Interface Module • A0J2C214-S1 Computer Link/Multidrop Link Module
A52G	1	

3. Specifications

3.1 RS-232C Interface

3.1.1 RS-232C interface specifications



Pin Number	Name	Signal Abbreviation	Signal Direction AJ71UC24-S2 ↔ Master Station
1	Frame ground	FG	←→
2	Send data	SD(TXD)	→
3	Receive data	RD(RXD)	←
4	Request to send	RS(RTS)	→
5	Clear to send	CS(CTS)	←
6	Data set ready	DSR(DR)	←
7	Signal ground	SG	←→
8	Receive carrier detecation	CD	←
20	Data terminal ready	DTR(ER)	→

The following type of RS-232C connector is used. Use a matching connector.
25-pin D-sub(female) screw-fixing type

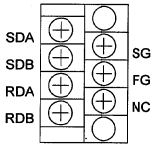
3.1.2 RS-232C cable

Use a cable that conforms to RS-232C standards and is no longer than 15 m for RS-232C communications.

3.2 RS-422/485 Interface

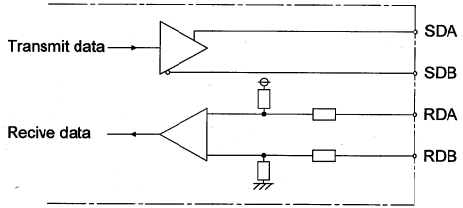
3.2.1 RS-422/485 interface specifications

1) The specifications of the RS-422/485 interface for connection to a master station or for connection to another AJ71UC24-S2 are shown below.



Signal Abbreviation	Signal Direction AJ71UC24-S2 ↔ Master Station	Description
SDA	→	Send data
SDB	→	Send data
RDA	←	Receive data
RDB	←	Receive data
SG	↔	Signal ground
FG	↔	Frame ground

2) The following function block diagram shows the RS-422/485 inter face function block diagram.



3.2.2 RS-422/485 cable specifications

Use a cable that conforms to RS422/485 standards and is no longer than 500 m for RS-422/485 communications.

Use a cable that conforms to the specifications listed in the following table.

Item	Description
Cable type	Shielded cable
Number of pairs	3 pairs
Conductor resistance (20°C)	88.0 Ω/km or less
Insulation resistance	10,000 MΩ km or more
Dielectric strength	500 VDC, 1 minute
Electrostatic capacity (1 kHz)	60 nF/km or less on average
Characteristic impedance (100 kHz)	110 ± Ω 10

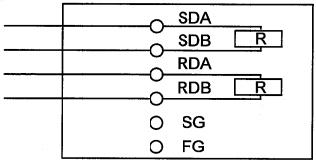
(km = 0.621 mile)

3.2.3 Connecting terminal resistances

If the AJ71UC24-S2 is either the first or the last station, be sure to connect terminal resistances as shown below.
Failure to do so may cause faulty data transmission.
Select a suitable terminal resistance according to the transmission specifications adopted.

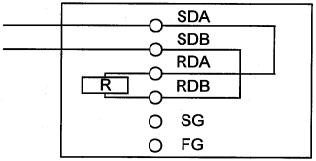
- When using the RS-422, select 330 Ω terminal resistances.
- When using the RS-485, select 110 Ω terminal resistances.

1) Method for connecting a 4-wire type terminal register



Install a terminal resistance both between SDA and SDB and between RDA and RDB.

2) Method for connecting a 2-wire type terminal register

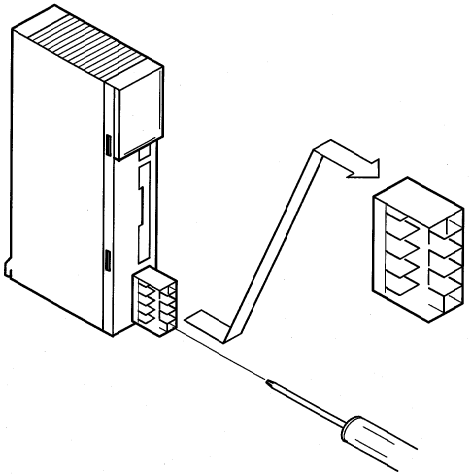


Install a terminal resistance between RDA and RDB.

3.2.4 How to mount and detach the RS-422/485 interface terminal block

The RS-422/485 interface of the AJ71UC24-S2 is provided with a two piece terminal block. This feature allows the module to be replaced without removing the signal wires connected with the terminal block.

The following illustration shows how to mount and detach the interface terminal block.



3.3 Handling Instructions

Tighten the module mounting and terminal screws as specified below.

Screw	Tightening Torque (N•cm)
Module mounting screws (M4)	78 to 117
RS-422/485 terminal block mounting screw (M3.5)	58 to 88
RS-422/485 terminal block terminal screw (M3.5)	58 to 88

3.4 Self Loopback Test

The function of this test is to check if the AJ71UC24-S2 operates normally without connecting the AJ71UC24-S2 to an external device.

Cable connection

- Connection of RS-232C interface

AJ71UC-S2		Cable Connecrion
Name of Signal	Pin Number	
FG	1	
SD	2	
RD	3	
RS	4	
CS	5	
DSR	6	
SG	7	
CD	8	
DTR	20	

- Connection of RS-422/485 interface

AJ71UC24-S2	Cable Connecrion
Name of Signal	
SDA	
SDB	
RDA	
RDB	
SG	
FG	

Setting of Mode Setting Switch

- Set the switch to "F".

Executing a self loopback test

- Testing startus upon turning on the power of the PLC CPU or resetting the PLC CPU.

Checking LED status

Check Item	LED Status when Normal		LED Srarus when Abnormal (When an error is detected.)	
Checking CPU transmission	2-C/N	OFF	2-C/N	ON
	CPU R/W	Flash		
Checking RS-232C transmission	2-SIO	OFF	2-SIO	ON
	2-SD	Flash		
	2-RD			
Checking RS-422/485 transmission	4-SIO	OFF	4-SIO	ON
	4-SD	Flash		
	4-RD			

End

- Testing ends when the power supply is shut off.

4. External Wiring

4.1 How to Connect an RS-232C Line

The diagram below shows a standard method of connecting an RS-232C line to the AJ71UC24-S2.

1) Connection example: connection to an external device capable of switching the CD signal (pin No.8) ON and OFF.

AJ71UC24-S2		Cable Connections and Signal Directions	Master Station
Signal Names	Pin Numbers		Signal Names
FG	1		FG
SD(TXD)	2		SD(TXD)
RD(RXD)	3		RD(RXD)
RS	4		RS
CS(CTS)	5		CS(CTS)
DSR(DR)	6		DSR(DR)
SG	7		SG
CD	8		CD
DTR(ER)	20		DTR(ER)

2) Connection example: connection to an external device that is not capable of switching the CD signal (pin No.8) ON and OFF.

AJ71UC24-S2		Cable Connections and Signal Directions	Master Station
Signal Names	Pin Numbers		Signal Names
FG	1		FG
SD(TXD)	2		SD(TXD)
RD(RXD)	3		RD(RXD)
RS	4		RS
CS(CTS)	5		CS(CTS)
DSR(DR)	6		DSR(DR)
SG	7		SG
CD	8		CD
DTR(ER)	20		DTR(ER)

4.2 How to Connect an RS-422 Line

The diagram below shows a standard method of connecting an RS-422 line to the AJ71UC24-S2.

1) Method for connecting a 4-wire type terminal resistor

AJ71UC24-S2 Signal Names	Cable Connections and Signal Directions	Master Station Signal Names	Description
SDA		RDA	Receive data
SDB		RDB	Receive data
RDA		SDA	Send data
RDB		SDB	Send data
		RSA	Request to send
		RSB	Request to send
		CSA	Clear to send
		CSB	Clear to send
NC			
SG		SG	Signal ground
FG		FG	Frame ground

2) Method for connecting a 4-wire type terminal resistor

AJ71UC24-S2 Signal Names	Cable Connections and Signal Directions	Master Station Signal Names	Description
SDA		RDA	Send data
SDB		RDB	Send data
RDA		SDA	Receive data
RDB		SDB	Receive data
		RSA	Request to send
		RSB	Request to send
		CSA	Clear to send
		CSB	Clear to send
NC			
SG		SG	Signal ground
FG		FG	Frame ground

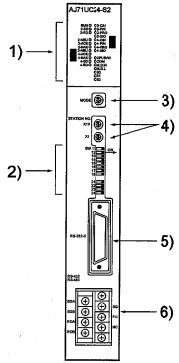
5. Transmission Specifications/Nomenclature And Setting

5.1 Transmission Specifications

Item		Specifications		
Transmission mode		RTU mode	ASCII mode	
Data format	Start bit	1	1	
	Data bit	8	7	
	Parity bit	1 or none		Switch Selected
	Stop bit	2 or 1		
Error detection		CRC	LRC	
		Parity check present (odd/even)/absent		
Interface		Conform to RS-232C.		
		Conform to RS-422/485.		
Transmission method		Half-duplex communications system		
Synchronous system		Asynchronous system		
Transmission system		300, 600, 1200, 2400, 4800, 9600, 19200 BPS (switch selected)		
Access cycle		Each request is processed in the END processing of the sequence program. Therefore, access cycle is 1 scan time		
DTR/DSR (ER/DR) control		Absent		
DC1/DC3, DC2/DC4 control		Absent		
System configuration (Master station: A1SJ71UC24-S2)		1:1, 1:n n: max 32		
Transmission distance		Up to 15 m (49.2 ft) for RS-232C		
		Up to 500 m (1640.5 ft) for RS-422/485		
Current consumption		5 VDC, 1.4 A		
Number of I/O points occupied		32 points *1		
Weight		630g		

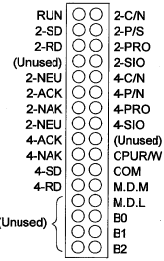
*1: Set "special function module, 32 points" (F32 points) as the I/O allocation in the parameters.
For general specifications, refer to the User's Manual for the PLC CPU you are using.

5.2 Nomenclature and setting



No.	Name	Description	
1)	LED RUN 2-C/N 2-SD 2-P/S 2-RD 2-PRO (Unused) 2-SIO 2-NEU 4-C/N 2-ACK 4-P/N 2-NAK 4-PRO 2-NEU 4-SIO 4-ACK (Unused) 4-NAK CPUR/W 4-SD COM 4-RD M.D.M M.D.L (Unused) B0 B1 B2	RUN	Normal run display Normal : ON Abnormal : OFF
		2-SD	RS-232C transmitting display During data transmission: Flash
		2-RD	RS-232C receiving display During data receive: Flash
		2-NEU	Unused
		2-ACK	RS-232C Acknowledge indication After sending Acknowledge : ON After sending Negative acknowledge : OFF
		2-NAK	RS-232C Negative acknowledge indication After sending Negatuve acknowledge : ON After sending Acknowledge : OFF
		4-NEU	Unused
		4-ACK	RS-422/485 Acknowledge indication After sending Acknowledge : ON After sending Negative acknowledge : OFF
		4-NAK	RS-422/485 Negative acknowledge indication After sending Negative anknowledge : ON After sending Acknowledge : OFF
		4-SD	RS-422/485 transmitting display During data transmission: Flash

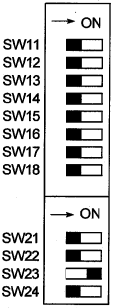
No.	Name	Description	
1)	LED (Continued)	4-RD	RS-422/485 receiving display During data receiving: Flash
		2-C/N	Result of RS-232C and PLC CPU communications display Abnormal : ON Normal : OFF
		2-P/S	RS-232C parity,CRC/LRC error display Parity,CRC/LRC error : ON Normal : OFF
		2-PRO	RS-232C protocol error display Communications protocol error : ON Normal : OFF
		2-SIO	RS-232C SIO error display Overrun, framing error : ON Normal : OFF
		4-C/N	Result of RS-422/485 and PLC CPU communications display Abnormal : ON Normal : OFF
		4-P/S	RS-422/485 parity, CRC/LRC error display Parity, CRC/LRC error : ON Normal : OFF
		4-PRO	RS-422/485 protocol error display Communications protocol error : ON Normal : OFF
		4-SIO	RS-422/485 SIO error display Overrun, framing error : ON Normal : OFF
		CRUR /W	Communications with PLC CPU display During communications with PLC CPU (ON at no communications) : Flash When not communicating with the PLC CPU:ON
		COM	Unused(always OFF)
		M.D.M	
		M.L.M	
		B0	Baud rate status Refer to *1
		B1	
		B2	



*1: Baud rate status

Baud Rate (BPS)	300	600	1200	2400	4800	9600	19200
B0	OFF	ON	OFF	ON	OFF	ON	OFF
B1	OFF	OFF	ON	ON	OFF	OFF	ON
B2	OFF	OFF	OFF	OFF	ON	ON	ON

No.	Name	Description
2)	Transmission Specification Setting Switches	Setting of Transmission Specifications

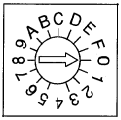


SW	Setting Items	Position of Setting Switch	
		ON	OFF
11	Main channel settings *2	-	Fix
12	Transmission mode	RTU (8 bits)	ASCII (7 bits)
13	Tansmission speed setting	Refer to *3	
14			
15			
16	Parity bit setting	Set	Not set
17	Even/odd parity setting	Even	Odd
18	Stop bit settng	2 bits	1 bit
21	Unusable	-	-
22	Write during RUN	Enabled	Disabled
23	Unusable	Fix	-
24	Unusable	-	-

*2: Effective when the main channel is RS-232C and the mode setting switch is set to "2"

*3: Transmission speed setting

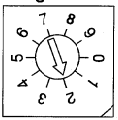
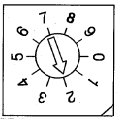
Baud Rate (BPS)	300	600	1200	2400	4800	9600	19200
SW13	OFF	ON	OFF	ON	OFF	ON	OFF
SW14	OFF	OFF	ON	ON	OFF	OFF	ON
SW15	OFF	OFF	OF	OFF	ON	ON	ON

No.	Name	Description		
3)	Mode Setting Switch	Used to set the mode. (Factory setting: 0)		
		Mode	Mode Settings	
			RS-232C	RS-422/485
		0 *4	MODBUS Protocol	Unusable
		1 *5	Unusable	MODBUS Protocol
		2 *6	MODBUS Protocol	MODBUS Protocol
		3 to E	Unusable	
	MODE	F	For module test	

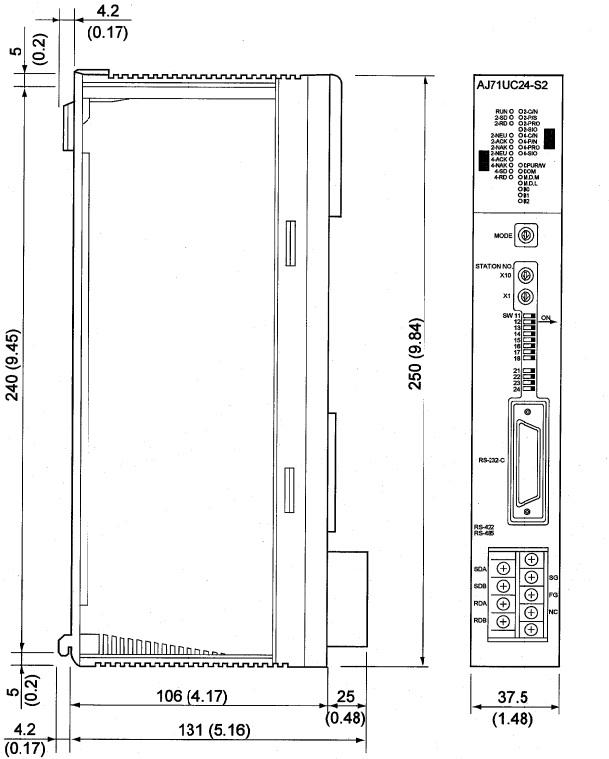
*4: Used when connecting to the master station with RS-232C.
*5: Used when connecting to the master station with RS-422/485.
*6: Used when using the RS-232C and RS-422/485 interface in conjunction.

POINT

When the mode setting switch is set to "2", if there is an interface not used to connect a peripheral device, noise will enter from that interface and make normal operation impossible. To prevent this, set the mode setting switch to "0" or "1".

No.	Name	Description
4)	Station Number Setting Switches  X10  X1	Used to set the station number. (Factory setting : 1, station No.0 must not be used) The station number is set to enable specification of the AJ71UC24-S2 to be accessed by the MODBUS master station. When setting a station number, make sure it is not duplicated in the system. <<Setting range>> 1 to 99 (however the maximum number of AJ71UC24-S2 slave station is 32. X10····· Sets the tens digit X1····· Sets the units digit.
5)	RS-232C interface	RS-232C interface for connection to an external device
6)	RS-422/485 interface	RS-422/485 interface for connection to an external device

6. Outside Dimensions



Unit:mm(inch)

IMPORTANT

(1) Design the configuration of a system to provide an external protective or safety interlocking circuit for the PL7Cs.
(2) The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.
   (a) Ground human body and work bench.
   (b) Do not touch the conductive areas of the printed circuit board and its electrical parts with and non-grounded tools etc.

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation.
Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

Warranty

Mitsubishi will not be held liable for damage caused by factors found not to be the cause of Mitsubishi; machine damage or lost profits caused by faults in the Mitsubishi products; damage, secondary damage, accident compensation caused by special factors unpredictable by Mitsubishi; damages to products other than Mitsubishi products; and to other duties.

⚠For safe use

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi.
- This product has been manufactured under strict quality control. However, when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

Country/Region	Sales office/Tel
U.S.A	Mitsubishi Electric Automation Inc. 500 Corporate Woods Parkway Vernon Hills, IL 60061 Tel : 1-847-478-2100
Brazil	MELCO-TEC Rep. Com.e Assessoria Tecnica Ltda. Av. Rio Branco, 123-15 ,and S/1507, Rio de Janeiro, RJ CEP 20040-005, Brazil Tel : 55-21-221-8343
U.K	Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, Hatfield, Herts., AL10 8XB,UK Tel : 44-1707-276100
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India	Messung Systems Put,Ltd. Electronic Sadan NO:111 Unit No15, M.I.D.C BHOSARI,PUNE-411026 Tel : 91-212-793130
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Country/Region	Sales office/Tel
Indonesia	P.T. Autoteknindo SUMBER MAKMUR Kompleks Agung Sedayu Propertindo (Harco Mangga Dua) Blok H No.4 Jl Mangga Dua Raya Jakarta Pusat 10730-Indonesia. Tel : 62-21-336292
Thailand	F. A. Tech Co.,Ltd. 1138/33-34 Rama 3 Road, Yannawa, Bangkok 10120, Thailand Tel : 66-2-295-2861
Hong Kong	Ryoden International Ltd. 10th Floor, Manulife Tower, 169 Electric Road, North Point, HongKong Tel : 852-2887-8870
China	Ryoden International Shanghai Ltd. 3F Block5 Building Automation Instrumentation Plaza 103 Cao Bao Rd. Shanghai 200233 China Tel : 86-21-6475-3228
Taiwan	Setsuyo Enterprise Co., Ltd. 6F., No.105 Wu-Kung 3rd.RD, Wu-Ku Hsiang Taipei Hsine, Taiwan R.O.C. Tel : 886-2-2299-2499
Australia	Mitsubishi Electric Australia Pty. Ltd. 348 Victoria Road, PostalBag, No 2, Rydalmere, N.S.W 2116, Australia Tel : 61-2-9684-7777

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE:MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310 TELEX:J24532 CABLE MELCO TOKYO
NAGOYA WORKS:1-14, YADA-MINAMI 5, HIGASHI-KU, NAGOYA, JAPAN

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