MITSUBISHI

4Mpps Capable High-Speed Counter Module

User's Manual
(Hardware)

QD64D2

Thank you for purchasing the Mitsubishi programmable controller MELSEC-Q series.

Prior to use, please read this and relevant manuals thoroughly to fully understand the product.

MELSEC-Q
Mitsubishi Programmable Controller

MODEL	QD64D2-U-HW
MODEL CODE	13JY56
IB(NA)-0800406-A(0710)MEE	

● SAFETY PRECAUTIONS ●

(Read these precautions before 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 precautions given in this manual are concerned with this product. For the safety precautions of the programmable controller system, please read the User's Manual for the CPU module.

In this manual, the safety precautions 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 precautions 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.

[DESIGN PRECAUTIONS]

◇ DANGER

● Do not write data to "read-only area" or "reserved area" in the buffer memory of the intelligent function module. Also do not turn ON/OFF the "reserved" signal in I/O signals to the programmable controller CPU.
  Doing any of these operations may cause a malfunction of the programmable controller system.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

● Do not install the control lines and/or pulse input lines together with the main circuit or power lines, and also do not bring them close to each other.
Keep a distance of 150 mm (5.91 inch) or more between them. Failure to do so may cause a malfunction due to noise.

● Use the programmable controller in the environment conditions given in the general specifications of the User's Manual for the CPU module.
Failure to do so may cause an electric shock, fire, malfunction, or damage to or deterioration of the product.

● While pressing the installation lever located at the bottom of the module, insert the module fixing projection into the fixing hole in the base unit, and mount the module with using the hole as a supporting point.
Incorrect module mounting may cause a malfunction, failure, or drop of the module.
In an environment of frequent vibrations, secure the module with screws.

● The screws must be tightened within the specified torque range.
If the screw is too loose, it may cause a drop, short circuit, or malfunction.
Excessive tightening may damage the screw and/or the module, resulting in a drop, short circuit or malfunction.

● Be sure to shut off all phases of the external power supply used by the system before mounting or removing the module.
Failure to do so may cause an electric shock or damage to the product.

● Do not directly touch any conductive part or electronic part of the module.
Doing so may cause a malfunction or failure of the module.

[WIRING PRECAUTIONS]

⚠ CAUTION

● For wiring and connection, properly press, crimp or solder the connector with the tools specified by the manufactures and attach the connector to the module securely.

● Be careful to prevent foreign matter such as dust or wire chips from entering the module.
Failure to do may cause a fire, failure or malfunction.

[WIRING PRECAUTIONS]

⚠ CAUTION

● A protective film is attached to the module top to prevent foreign matter such as wire chips from entering the module during wiring.
Do not remove the film during wiring.
Be sure to remove it for heat dissipation before system operation.

● Be sure to place the cables connected to the module in a duct or clamp them.
If not, dangling cables may swing or inadvertently be pulled, resulting in damage to the module and/or cables, or malfunctions due to poor cable connection.

● When disconnecting the cable, do not pull it by holding the cable part.
Disconnect the cable with connector with holding the connector plugged into the module. Pulling the cable part with the cable still connected to the module may cause a malfunction or damage to the module and/or cable.

● Always ground the shielded cable on the module side.
Failure to do may cause a malfunction.

● Correctly wire cables to the module after checking the rated voltage and terminal layout of the product.
Connecting a voltage different from the rated voltage or incorrect wiring may result in a fire or failure.

Revisions

Print date	*Manual number	Revision
Oct., 2007	IB(NA)-0800406-A	First edition

CONTENTS

1. OVERVIEW

This manual describes the specifications and part names of type QD64D2 multichannel high-speed counter module (hereinafter abbreviated as QD64D2) that is used with the MELSEC-Q series CPU module.

2. PERFORMANCE SPECIFICATIONS

The following table shows the performance specifications of the QD64D2.

Table 2.1 Performance specifications
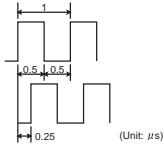
Item		specifications
Number of channels		2 channels
Number of occupied I/O points		32 points (I/O assignment: Intelligent 32 points)
Count input signal	Signal level (ϕA, ϕB)	EIA Standard RS-422-A Differential line driver level (AM26LS31 [manufactured by Texas Instruments] or equivalent)
Counter	Counting speed (max.)[*1, *2]	4 multiples of 2 phases : 4Mpps 2 multiples of 1 phase, 2 multiples of 2 phases: 2Mpps 1 multiple of 1 phase, 1 multiple of 2 phases, CW/CCW: 1Mpps
	Counting range	32-bit signed binary (-2147483648 to 2147483647)
	Type	Addtion method, Subtraction method Linear counter format, Ring counter format Preset counter function, Latch counter function
	Minimum count pulse width (Duty ratio 50 %)	 (Min. phase difference for 2-phase input: 0.25 μs) For details, refer to Section 2.1
Coincidence output	Comparison range	32-bit signed binary
	Comparison result	Setting value < Count value Setting value = Count value Setting value > Count value
	Interrupt	With coincidence detection interrupt function
External input	Preset	24V DC 2 to 5mA
	Count value latch	
External output	Coincidence output	Transistor (sinking type) output: 2 points/channel 12/24 V DC 0.5 A/point 2 A/common
	Derating	Applied (refer to Section 2.1 (3))
Applicable connector[*3]		A6CON1 (soldering type, straight out) A6CON2 (crimp type, straight out) A6CON4 (soldering type, usable for both straight out and diagonal out)
5 VDC internal current consumption		0.53 A

Table 2.1 Performance specifications (Continued)

Item	specifications
Weight	0.16 kg

*1 Note that counting a pulse whose phase difference between phase A and phase B is small
    may result in a count error.
    For the relation of phase difference between phase A and phase B, refer to Section 2.1 (1).
*2 The maximum counting speed is determined in the pulse input mode.
    Counting speed cannot be changed.
*3 The A6CON3 connector (crimp type, straight out) cannot be used for the QD64D2.

Remarks

For general specifications of the QD64D2, refer to the User's Manual for
the CPU module.

2.1 Relation of phase difference between phase A and phase B

The relation indicated below is for each pulse input mode at the maximum counting speed.

Pulse input waveform that does not reach to the maximum counting speed is also applicable.

(1) At 1-phase input

Pulse input waveform at 1-phase input input needs to satisfy the following conditions (duty ratio of 50%).

$t \ (= t_H + t_L) = 1.0 \ \mu s$

$t_H, t_L = 0.5 \ \mu s \ (= 0.5 \times t)$

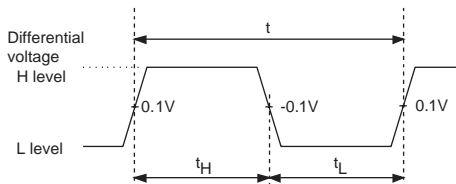Figure 2.1 Pulse input waveform at 1-phase input

(2) At 2-phase input
Pulse input waveform at 2-phase input needs to satisfy both the condition at 1-phase input and the condition below.
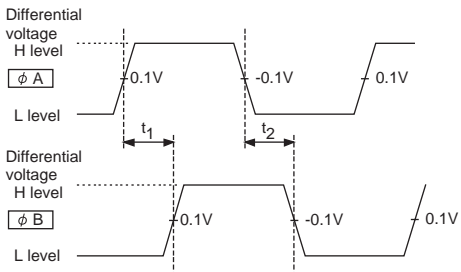t_1, t_2, t_3, $t_4 = 0.25 \mu s$ (= $0.25 \times t$)
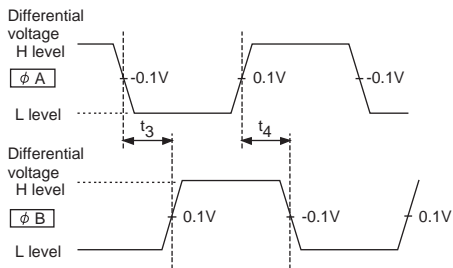
Figure 2.2 Pulse input waveform at 2-phase input 1

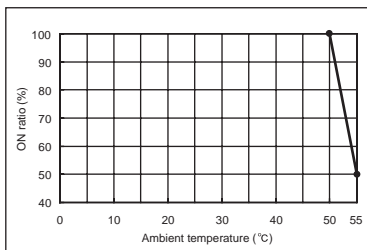Figure 2.3 Pulse input waveform at 2-phase input 2

(3) Derating chart

Figure 2.4 Derating chart

2.2 Electrical Specifications of I/O Signals

(1) input specifications

Table 2.2 Input specifications of QD64D2

Signal name	Rated input voltage/ current	Operating voltage range	ON voltage/ current	OFF voltage/ current	Input resistance	Responce time
Phase A pulse output Phase B pulse output	• RS-422-A compliant differential receiver (AM26C32 [manufactured by Texas Instruments] or equivalent) V_{IT+} differential input ON voltage (H level threshold voltage) 0.1V V_{IT-} differential input OFF voltage (L level threshold voltage) -0.1V Vhys Hysteresis voltage (V_{IT+} - V_{IT-}) 60mV (A current type line driver cannot be used.)					
preset input	24VDC /5mA	21.6 to 26.4VDC	21.6 to 26.4VDC /2 to 5mA	5VDC or less /0.1mA or less	Approx. 10kΩ	OFF → ON 0.5ms or less ON → OFF 1.0ms or less
latch counter input	24VDC /5mA	21.6 to 26.4VDC	21.6 to 26.4VDC /2 to 5mA	5VDC or less /0.1mA or less	Approx. 10kΩ	OFF → ON 0.5ms or less ON → OFF 1.0ms or less
External coincidence output power supply 12/24V	12 or 24VDC /8mA (TYP DC24V)	10.2 to 30VDC	-	-	Approx. 3.9kΩ	-

(2) Output specifications

Table 2.3 Output specifications of QD64D2

Signal name	Rated load voltage	Working load voltage range	Max. load current/ rush current	Max. voltage drop at ON	Leakage current at OFF	Response time
Coincidence output point No.1	12 or 24VDC	10.2 to 30VDC	0.5A/1point 2A/ 1common	1.5VDC	0.1mA or less	OFF → ON 0.05ms or less
Coincidence output point No.2	12 or 24VDC	10.2 to 30VDC	0.5A/1point 2A/ 1common	1.5VDC	0.1mA or less	ON → OFF 0.1ms or less

3. IMPLEMENTATION AND INSTALLATION

3.1 Handling Precautions

The following explains the precautions for handling the module.

(1) Since the module case is made from resin, do not drop the module or apply a strong impact to it.

(2) Do not remove the printed-circuit board of the module from the case.
Doing so may cause a failure.

(3) Be careful to prevent foreign matter such as dust or wire chips from entering the module.
Failure to do may cause a fire, failure or malfunction.

(4) A protective film is attached to the module top to prevent foreign matter such as wire chips from entering the module during wiring.
Do not remove the film during wiring.
Be sure to remove it for heat dissipation before system operation.

(5) Tighten the module fixing screw within the following specified range.

Table 3.1 Tightening torque range of module fixing screw

Screw	Tightening torque range
Module fixing screw (M3)[1]	0.36 to 0.48 N·m
Connector screw of module (M2.6)	0.20 to 0.29 N·m

[1] The module can be easily fixed onto the base unit using the hook at the top of the module. However, it is recommended to secure the moudule with the module fixing screw if the module is subject to singificant vibration or shock.

(6) When mounting the module to the base unit, insert the module fixing projection into the fixing hole in the base unit, and mount the module with using the hole as a supporting point.
Incorrect module mounting may cause a malfunction, failure, or drop of the module.

3.2 Installation Environment

Refer to the User's Manual for the CPU module.

4. PART NAMES

The following explains the part names of the QD64D2.
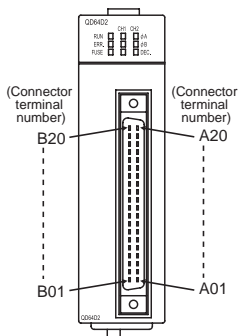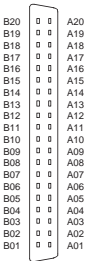
Table 4.1 Part names

Figure 4.1 Appearance of
the QD64D2

(Connector terminal number) B20
(Connector terminal number) A20
B01
A01

LED name	Description
RUN	Indicates operation status of the QD64D2. ON: Normal operation OFF: Watchdog timer error
ERR.	Indicates error status of the QD64D2. ON: Error at 1CH or more OFF: All channels in normal operation
FUSE	Indicates fuse status of external coincidence output part of the QD64D2. ON: Blown fuse detected OFF: Blown fuse not detected
φA_CH1 to CH2	Indicates input status of A-phase pulse terminal. ON: Pulse ON OFF: Pulse OFF
φB_CH1 to CH2	Indicates input status of B-phase pulse terminal. ON: Pulse ON OFF: Pulse OFF

Table 4.2 Terminal assignment of each channel

Terminal layout	CH1		CH2	
	Terminal number	Signal name	Terminal number	Signal name
	B20	NC	A20	NC
	B19	PULSE A+	A19	PULSE A+
	B18	PULSE A-	A18	PULSE A-
	B17	PULSE B+	A17	PULSE B+
	B16	PULSE B-	A16	PULSE B-
	B15	PULSE COM	A15	PULSE COM
	B14	NC	A14	NC
	B13	PRST COM	A13	PRST COM
	B12	PRST	A12	PRST
	B11	NC	A11	NC
	B10	NC	A10	NC
	B09	LATCH COM	A09	LATCH COM
	B08	LATCH	A08	LATCH
	B07	NC	A07	NC
	B06	NC	A06	NC
	B05	EQU1	A05	EQU1
Front view of the module	B04	EQU2	A04	EQU2
	B03	12V/24V	A03	12V/24V
	B02	0V	A02	0V
	B01	NC	A01	NC

The terminal layout (front view of the module) shows two columns of pins:

B20	□ □	A20
B19	□ □	A19
B18	□ □	A18
B17	□ □	A17
B16	□ □	A16
B15	□ □	A15
B14	□ □	A14
B13	□ □	A13
B12	□ □	A12
B11	□ □	A11
B10	□ □	A10
B09	□ □	A09
B08	□ □	A08
B07	□ □	A07
B06	□ □	A06
B05	□ □	A05
B04	□ □	A04
B03	□ □	A03
B02	□ □	A02
B01	□ □	A01

5. EXTERNAL WIRING

5.1 Wiring Precautions

(1) Inputting a signal of different voltage may result in a malfunction or mechanical failure.

(2) For 1-phase input, perform pulse input wiring on the phase A side.

(3) When pulse status noise is input, the QD64D2 may miscount.

(4) Take the following measures against noise for high-speed pulse input.

    (a) Always use a shielded twisted pair cable and ground it on the QD64D2 side.

    (b) Wire the shielded twisted pair cables so that they are not in parallel with wires causing much noise such as power lines or I/O wires. Also install the cables at least 150 mm (5.91 inch) away from the lines and wires and wire them as short as possible.

5.2 Input/output interface internal circuit

The following table shows the list of external device interface for the QD64D2.

Table 5.1 External device interface list for the QD64D2

Input/output class	Internal circuit	Terminal number CH1	Terminal number CH2	Signal name
Input	+5V (Base) / +5V (DC/DC converter) 27kΩ 1/10W, 4.7kΩ 1/10W, Isolator (Isolating element), Line receive, 100Ω 1/2W, 4.7kΩ 1/10W, 27kΩ 1/10W	B19	A19	Phase A pulse input +
		B18	A18	Phase A pulse input -
	+5V (Base) / +5V (DC/DC converter) 27kΩ 1/10W, 4.7kΩ 1/10W, Isolator (Isolating element), Line receive, 100Ω 1/2W, 4.7kΩ 1/10W, 27kΩ 1/10W	B17	A17	Phase B pulse input +
		B16	A16	Phase B pulse input -
		B15, A15		Pulse input common
	1kΩ 1/10W, 10kΩ 1/3W	B12	A12	Preset input
		B13	A13	Preset input common
	1kΩ 1/10W, 10kΩ 1/3W	B08	A08	Latch Counter input
		B09	A09	Latch Counter input common

Table 5.1 External device interface list for the QD64D2 (Continued)

Input/ output class	Internal circuit	Terminal number		Signal name
		CH1	CH2	
Output		B05	A05	Coincidence output point No. 1
		B04	A04	Coincidence output point No. 2
	To blown fuse detection circuit FUSE	B03, A03		External coincidence output power supply 12/24V
		B02, A02		External coincidence output power supply GND (0V)

5.3 External Wiring

5.3.1 Example of wiring the module and an encoder

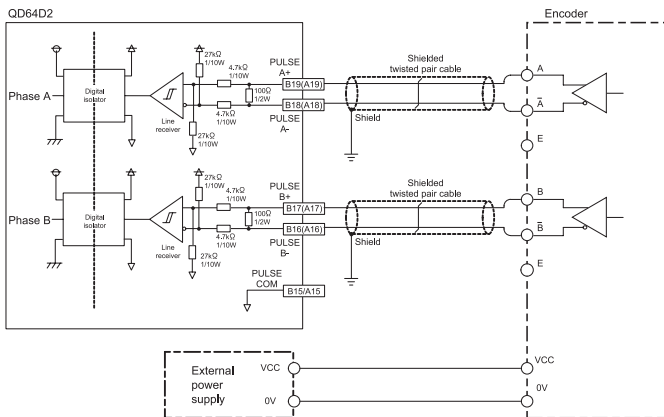(1) Example of wiring with a line driver (AM26LS31 equivalent) encoder

Figure 5.1 Example of wiring with a line driver (AM26LS31 equivalent) encoder

5.3.2 Example of wiring a controller and an external input terminal

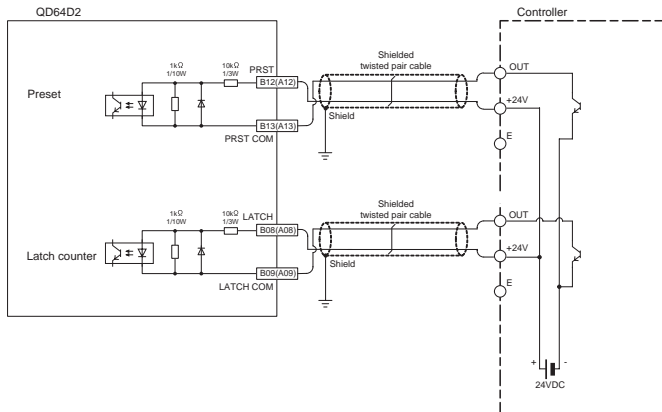(1) Example of wiring with a controller (sink loading type)

Figure 5.2 Example of wiring with a controller (sink loading type)

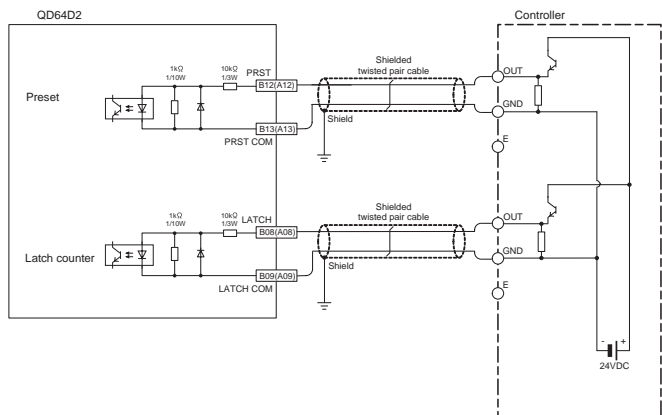(2) Example of wiring with a controller (source loading type)

Figure 5.3 Example of wiring with a controller (source loading type)

5.3.3 Example of wiring with an external output terminal

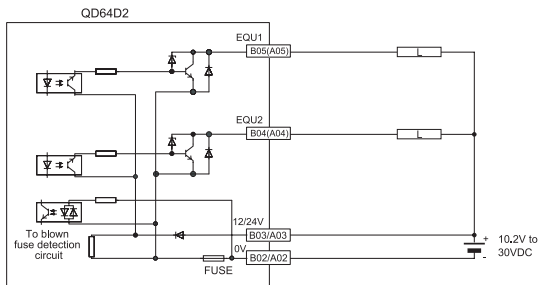(1) Example of wiring with an external output terminal (sink output type)

Figure 5.4 Example of wiring with an external output terminal (sink output type)
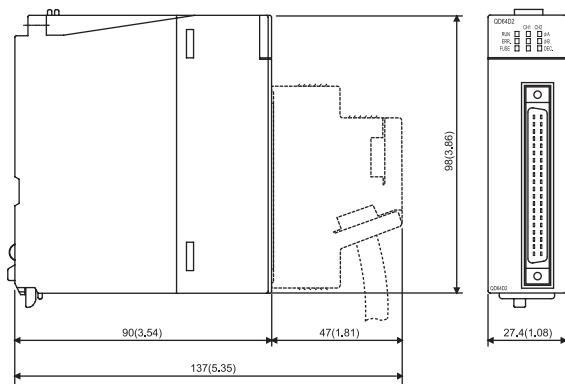
5.4 Intelligent Function Module Switch Settings

The intelligent function module switches are set on the I/O assignment screen of GX Developer.

Table 5.3 Intelligent function module switch

	Setting item	Setting value	Default
Switch 1 (CH1)	Empty: Fixed to 0	1) Pulse input mode 0_H : 1 multiple of 1 phase 1_H : 2 multiples of 1 phase 2_H : CW/CCW 3_H : 1 multiple of 2 phases 4_H : 2 multiples of 2 phases 5_H : 4 multiples of 2 phases b11 b8 Empty: Fixed to 0 2) Counter format 0_H : Linear counter 1_H : Ring counter b15 b12 Empty: Fixed to 0 3) Counter value comparison function selection 0_H : Coincidence output function 1_H : Continuous comparison function	0000_H
Switch 2 (CH2)	Same as for the switch 1		0000_H
Switch 3	Empty: Fixed to 0		
Switch 4	Empty: Fixed to 0		
Switch 5	Empty: Fixed to 0		

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6. EXTERNAL DIMENSIONS

(Unit: mm(inch))

Figure 6.1 External dimensions

MEMO

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.

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