DS4-2731C

CC-Link Space Optical Repeater

SOT-MQ82/162 series

Operation Manual

TOYO ELECTRIC CORPORATION

TABLE OF CONTENTS

1. Introduction

Thank you for choosing our SOT-MQ82/162 series, CC-Link space optical repeater.
To ensure the correct use, please thoroughly read this manual before use.

2. Outline

The SOT-MQ82/162 is a high-speed space optical transmitter using infrared rays.

(1) It optically transmits CC-Link data.
The CC-Link cable can be replaced with space optical communication.
(2) The optical reception status can be communicated to the master station and used for maintenance or another purpose.
(3) The data transfer rates of 156 kbps, 625 kbps, 2.5 Mbps are supported.
(4) Dip switch allows to switch the channel to the one having different carrier frequency and to communicate with up to two opposite directions in series or parallel without interference.

3. Construction

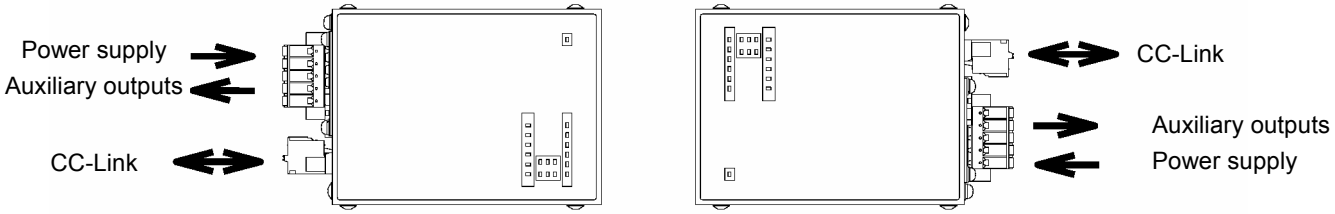
3.1 Model number

SOT - MQ 16 2 □ □

Optional specification	No code: No specification	
Carrier wave frequency	CH1	CH2
	A: 14.5MHz	21.5MHz
	B: 18.0MHz	25.0MHz
Transmission distance	16: 0.2 to 160m	
	8: 0.2 to 80m	
Series name	MQ: 2.5Mbps CC-Link	

3-2. Combination

(1) Use a type A carrier wave unit and a type B one as a pair.
A pair consisting of two type A units or two type B units does not work.
(2) The SOT-MQ82/162 series are not compatible with other space optical transmission units.

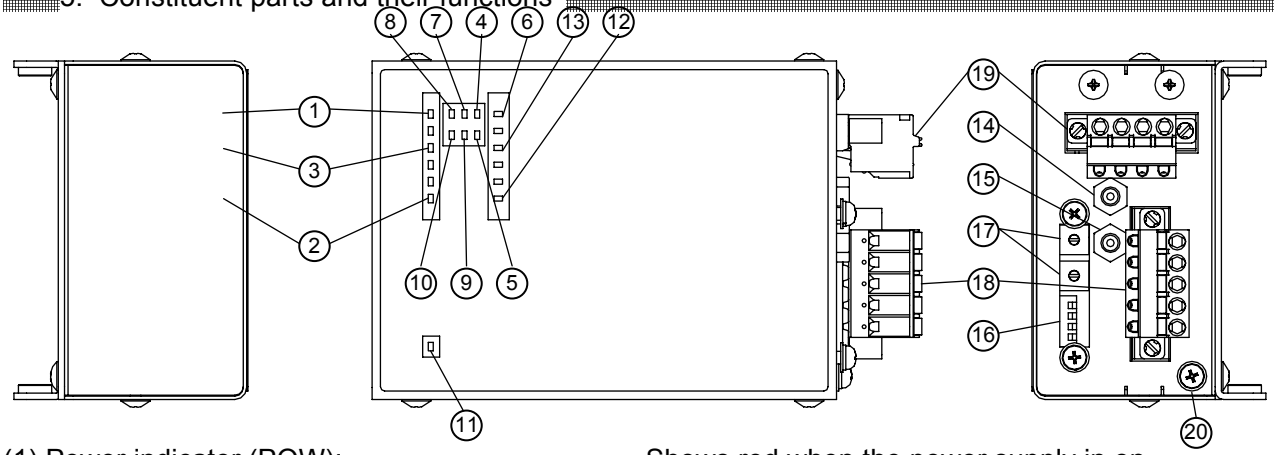


Type A Type B

4. Major specifications

Item	Specifications	
Model	SOT-MQ162A/B	SOT-MQ82A/B
Operating environment	CC-Link Ver.1.10/Ver.2.00	
Data transfer rate	156k, 625k, 2.5Mbps	
Supply voltage	Rated voltage: 24VDC, 10% or less ripples Operating voltage: 18-30VDC, 30V or less at peak including ripples	
Current consumption	Less than 150mA	
Interface	RS485 compliant	
Transmission mode	Semi-duplex, bi-directional	
Communication control mode	Bit forward	
# of occupied stations	When using the monitoring function: 1 When not using the monitoring function: 0	
Transmission distance	0.2-160m	0.2-80m
Detection angle	1° (horizontal and vertical)	1° (horizontal and vertical)
Modulation mode	FSK	
Projector element	Near infrared light emitting diode (870nm in wavelength)	
Receiver element	Photo diode	
Auxiliary outputs	CDO: On when data is received. ALM: Off when the reception level is low. A photo-coupler insulated, NPN open collector output Rated output level: 30VDC, 50mA max.	
Electric connections	For CC-Link signals: 4-pin connector terminal block (PHOENIX MSTB 2,5/4-GF-5,08) For power supply and auxiliary outputs: 5-pin connector terminal block (PHONEIX MSTB 2,5/5-GF-5,08)	
Check terminals	Applies an output DC voltage corresponding to the reception level. (Use the DC voltage range of a 10kΩ/V or higher tester.)	
Operating ambient illumination	Sunlight : 10,000 lx or less Fluorescent or candescent lamps : 3,000 lx or less No ambient light shall directly enter the receiver.	
Operating ambient temperature	-10-55°C No frozen parts allowed.	
Operating ambient humidity	10-85% RH No condensation allowed.	
External dimensions (weight)	See “External dimensions” (approx. 350g).	
Accessories	A set of fittings, mounting screws (4), signal plug (1), power/auxiliary output plug (1), 110Ω terminal resistors (2) and 130Ω terminal resistors (2)	

5. Constituent parts and their functions



(1) Power indicator (POW): Shows red when the power supply in on.

(2) Clear data indicator (↓CD): Shows red when the reception level at the station is sufficient for communication.

(3) Reception level indicator (↓1 to 4): Shows green to indicate the reception level at the station.

(4) Monitor running indicator (LRUN): Shows green during normal communication using the monitoring function.
Remains off when the monitoring function is not used.

(5) Monitor error indicator (LERR): Shows red during faulty communication using the monitoring function.
Remains off during normal communication using the monitoring function or when the monitoring function is not used.

(6) Communication error indicator (ERR): Shows red during faulty CC-Link communication.

(7) Sent data to cable indicator (SD1): Shows red when data is transmitted to the cable.

(8) Sent data to optical unit indicator (SD2): Shows red when data is transmitted to the optical unit.

(9) Received data from cable indicator (RD1): Shows green when data is received from the cable.

(10) Received from optical unit indicator (RD2): Shows green when data is received from the optical unit.

(11) Channel indicator (CH) Remains off when choosing CH1.
Shows red when choosing CH2.

(12) Opposite station data clear indicator (↑CD): Shows red when the monitoring function is used and the reception level at the opposite station is sufficient for communication.

(13) Opposite station reception level indicator (↑1 to 4): Shows green to indicate the reception level at the opposite station when the monitoring function is used.

(14) + check terminal (red): Applies an output DC voltage corresponding to the reception level. (Use the DC voltage range of a 10kΩ/V or higher tester).

(15) – check terminal (black)

(16) Setting switches: Used to select the data transfer rate and to switch carrier frequency.

(17) Station number setting switches: Used to select the data transfer rate and carrier frequency.

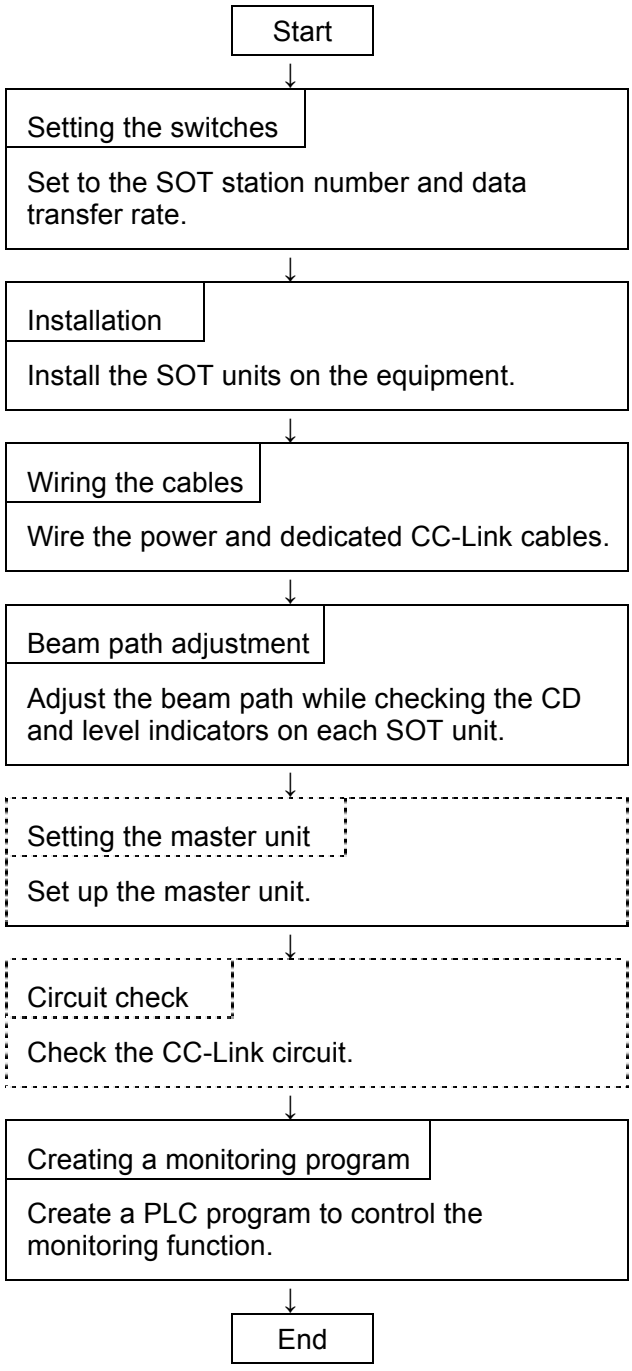
(18) Power/auxiliary output plug: FKCT 2.5/5-STF-5.08, Phoenix Contact

(19) Signal plug: FKC 2.5/4-STF-5.08, Phoenix Contact

(20) FG terminal: For connecting external FG, M3 threaded

6. Data linking procedure

6-1. Procedure

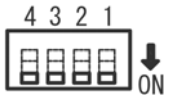


is the step recommended to see the User's Manuals for the CC-Link master and local units.

6-2. Setting the switches

6-2-1. Setting switches

(1) Detail of settings

	Detail of settings
	SW1 ┐ Used to select the data transfer rate SW2 ┘ SW3 Not used (used when off) SW4 Used to switch channels

(2) Data transfer rate selection (SW1, 2)

SW1	SW2	Data transfer rate
OFF	OFF	156k
ON	OFF	625k
OFF	ON	2.5M
ON	ON	Not valid

The switches have been factory-set to “156 kbps.”

(3) Channel select switch (SW4)

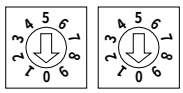
SW4	Carrier frequency
OFF	CH1 selected
ON	CH2 selected

The switches have been factory-set to “CH1 selected.”

6-2-2. Station number setting switches

(1) Detail of settings

(2)

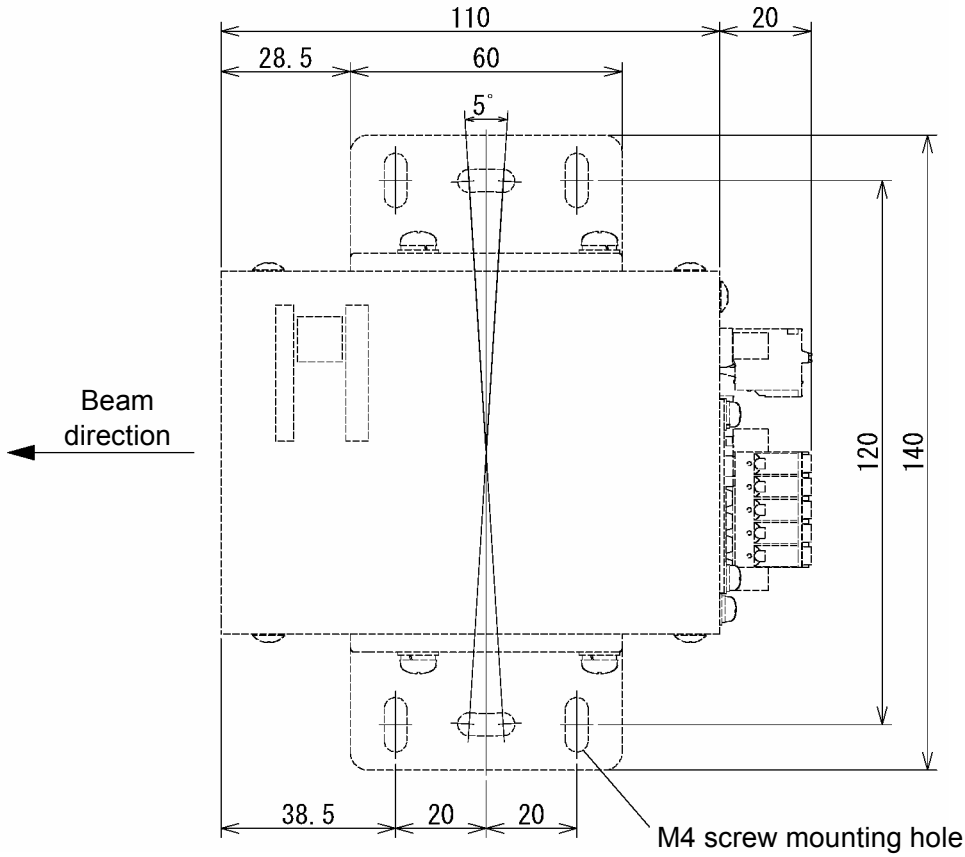
	Detail of settings
×10 ×1 	x10: Set to the first-digit value of the station number. X1: Set to the second-digit value of the station number. Set to 00 when using the monitoring function. 01 to 64: Specifies the station number when using the monitoring function. 65 to 99: Not valid

The switches have been factory-set to “00.”

(2) When using the monitoring function, set the station number to “01” if there is no preceding station.
If there is any preceding station, set to the “preceding station number + the number of stations occupied by the preceding station unit.”
Example: If the previous station number is “01” and two stations are occupied by the unit, the current station number will be “03.”

6-3. Installation

6-3-1. Drilling dimensions for mounting holes



6-3-2. Caution about the place for installation

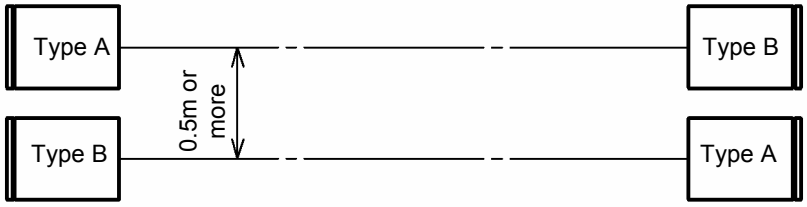
In order not to spoil the transmitter performance, the transmitter shall not be installed in a place where:

(1) it may be directly exposed to splashes of water, oil, dust and/or chemical,
(2) optical signals may be dampened by aqueous vapor, smoke, corrosive gas or the like (the projector and receiver ports are made of resin and shall not be cleaned with paint thinner based solvent),
(3) the transmitter may be exposed to temperatures, humidity, vibration and/or impact exceeding the ratings (the transmitter shall be protected when it is continuously exposed to vibration or impact even not exceeding the rating),
(4) a device generating a strong magnetic field, e.g. magnet or motor, or a device or power wire generating strong noises, e.g. inverter, is used nearby,
(5) the sunlight or incandescent light containing strong infrared rays directly enters the receiver within 10 degrees from the center of the beam path (the transmitter shall be used indoors),
(6) the beam path between the receiver and projector may be interrupted by a passing person or obstacle or optical signals may be dampened by aqueous vapor or smoke (communication may be suspended when the beam path is interrupted)
(7) a reflective object or beams coming from another photoelectric switch that may optically interfere with the transmitter is located above the beam path, or
(8) the beam path to a moving unit, if used, will be inclined by 1 degree or more when the moving unit is making a zigzag, vibrating or given an impact.

6-3-3. Intervals between adjacent pairs

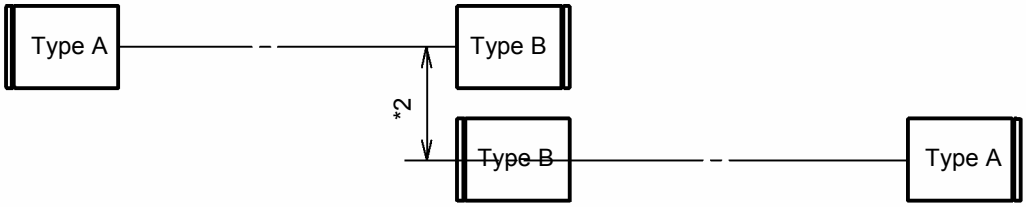
When installing two or more pairs of SOT units or using a one near another photoelectric sensor, reserve a sufficient space between them to prevent optical interferences.

Example 1



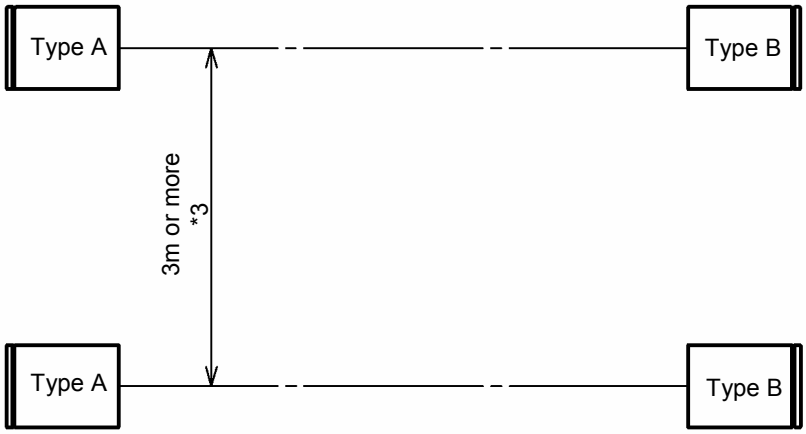
*1. This setup does not interfere with data transfer but will affect the reception level indicated on each unit. (When adjusting the beam path or checking the reception level, turn off the other pair of units.)

Example 2



*2. This setup does not cause interferences unless disturbed by any reflective object.

Example 3



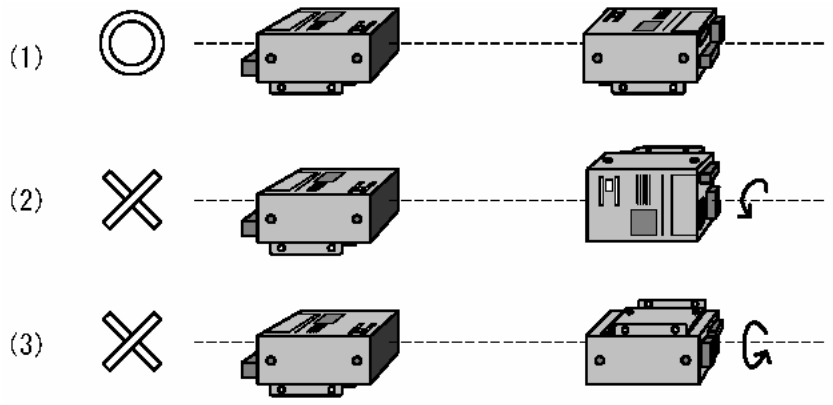
*3. Same condition is applicable as Example 1 when the channel is different.

Caution

Note that the severity of optical interferences depends on the beam path adjustment and misalignment factors such as vibration or impact. When installing a unit on a moving cart or the like, adjust the beam path according to 6-5 “Beam path adjustment” and check the performance before use to ensure normal communication throughout the whole communication area.

6-3-4. Installing directions

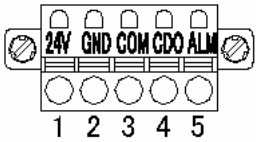
Install the SOT units in the opposite directions as shown in (1) below.
They do not work if rotated as shown in (2) or (3).



6-4. Electric connections

6-4-1. Power/auxiliary output connector

Signal name	Code	Terminal number
Power supply	24V	1
	GND	2
Auxiliary outputs	CDO	4
	ALM	5
	COM	3



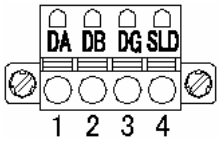
Arrangement of cable connecting terminals

(1) Applicable connector (enclosed)
Plug, FKCT 2.5/5-STF-5.08 (1902330), Phoenix Contact or equivalent

(2) Recommended cable
Use a 0.3mm^2 or thicker cable for power supply and auxiliary outputs.
(Check the voltage drop across the cable and use it within a length not exceeding 50m.)

6-4-2. Signal connector

Signal name	Code	Terminal number
Signal A	DA	1
Signal B	DB	2
Signal ground	DG	3
Shielded	SLD	4

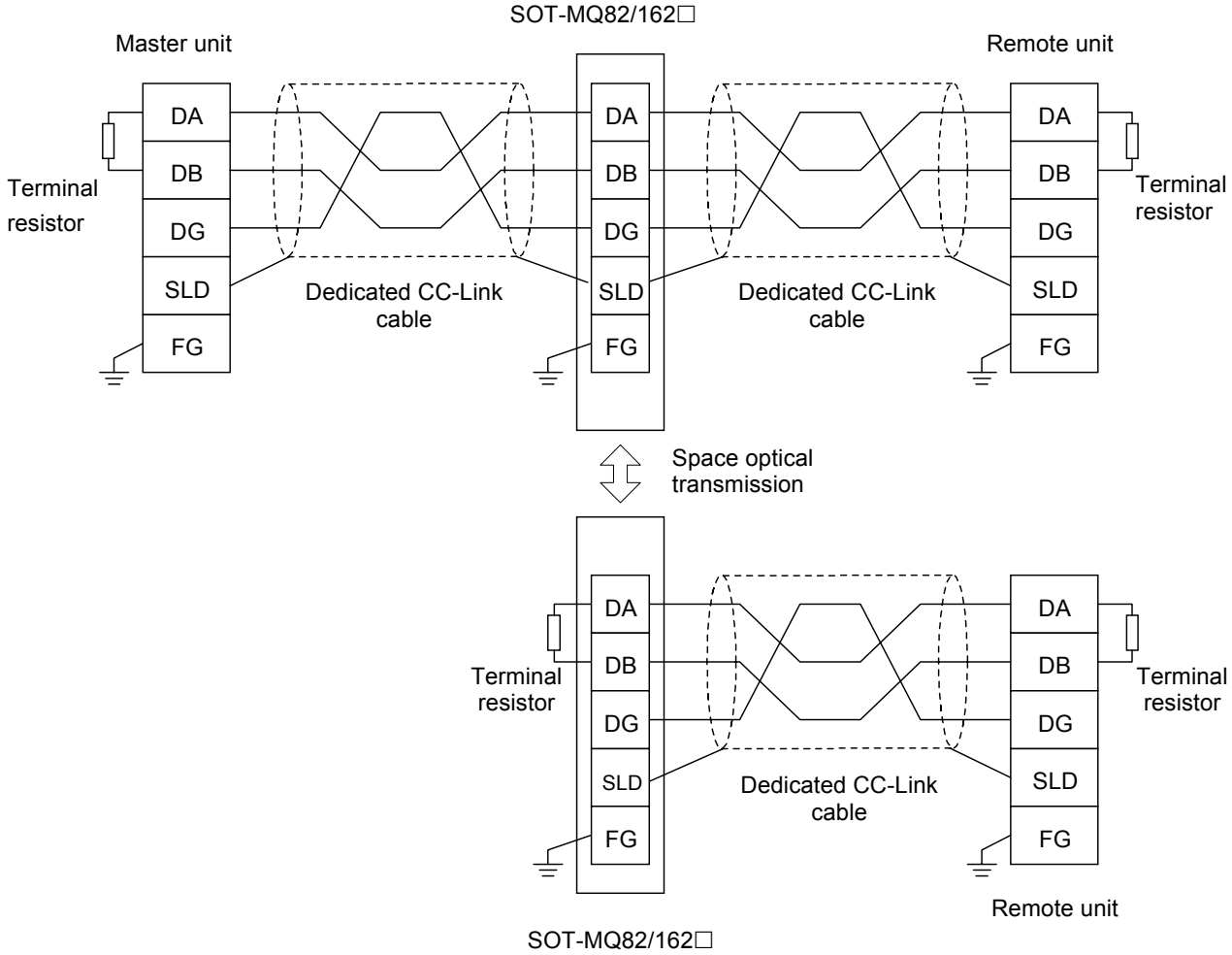


Arrangement of cable connecting terminals

(1) Applicable connector (enclosed)
Plug, FKC 2.5/4-STF-5.08 (1873223), Phoenix Contact or equivalent

(2) Recommended cable
Use a dedicated CC-Link cable.
The CC-Link system performance cannot be guaranteed if used with a cable other than dedicated for CC-Link.
For specifications and other details of the dedicated CC-Link cable, see:
CC-Link Partner Association's homepage: http://www.cc-link.org/

6-4-3. Connecting the dedicated CC-Link cables



(1) Use dedicated CC-Link cables of the same type in each segment. Using different types of cables together does not guarantee normal data transfer.
(2) The intervals required between adjacent dedicated CC-Link cables and the maximum extension length depend on the data transfer rate and the construction of the equipment used. For detail, see the User's Manual for the master unit.
(3) For the units at either ends of each segment, always connect the terminal resistor between DA and DB. The SOT units themselves contain no terminal resistor.
Use compatible ones of the attached terminal resistors (110Ω and 130Ω) with the cable.

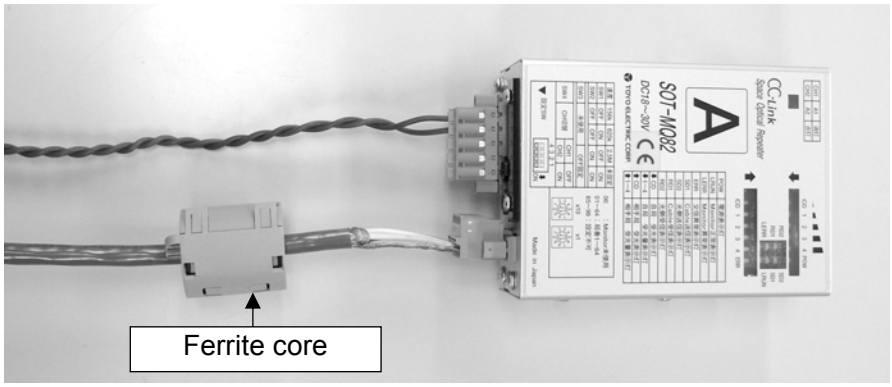
6-4-4. Measures to be taken to comply with the EMC Directive

The measures to be taken to ensure conformity of this optical transmission device with the EMC Directive are described below.

To ensure conformity of the entire CC-Link system with the EMC Directive, it is necessary to take all the necessary measures for the peripheral devices, such as the slave unit and power supply, referring to the appropriate hardware manuals for the sequencer CPU.

(1) Attaching a ferrite core to the CC-Link cable

Attach a ferrite core to the CC-Link cable in the vicinity of the optical transmission device.



This ferrite core must have attenuation characteristics equivalent to those of the TDK ZCAT3035-1330 ferrite core.

Please note that the measures described above are deemed as the best method based on the information on the regulatory requirements and standards that is currently available to us. However, use of the entire system incorporating this optical transmission device after completion of these measures does not always ensure conformance to the EMC Directive.
It is the responsibility of the system manufacturer to specify the method for ensuring conformity of the entire system with the EMC Directive and make a final decision on its compliance.

6-5. Beam path adjustment

A data link error occurs during beam path adjustment.
Before starting, remove the cable from the connector or check that no trouble will be caused if a data link error occurs.

(1) After ensuring correct wiring, turn on the SOT units.
The power indicator (POW) on each unit shows red.
(2) Loosen the unit and fitting mounting screws and move the unit in every direction until the clear data indicator (CD) on the opposite unit shows red.
Note: The opposite station reception level indicator on the unit only lights when the monitoring function is used and the reception level at the station is CD or higher. First, adjust while checking the reception level indicated on the opposite unit.
(3) Finely adjust until the reception level indicator on the opposite unit shows green at level 3 or higher. The accurate reception level can be measured with a tester connected to the check terminals on the opposite unit.
Use the DC voltage range of a tester with an input resistance of 10kΩ/V around 10V.
Insert ϕ2 tester probes into the (+) and (-) check terminals.
(4) The maximum voltage at the check terminals shall be 4.2V.
As a guide, the voltage shall be 2.2V or higher at the maximum transmission distance and fixed nearly around the maximum level.
(5) Adjust the opposite unit in the same manner.
(6) When installing a unit on a moving object such as stacker crane, check that the reception level indicators on both the moving and fixed units show green at level 3 or higher throughout the entire region of motion.
(7) The communication error indicator (ERR) shows red when disturbed by reflected or ambient light. When installing a unit on a moving object such as stacker crane, check that the communication error indicators on both the fixed and moving units will not show or blink red throughout the entire region of motion.

6-6. Monitoring function

The monitoring function communicates the reception status of each SOT unit to the master station.
When using the monitoring function, it is necessary to specify the station number and set parameters as remote I/O station.

6-6-1. Master unit input/output signals

(1) Input signals (SOT-MQ to master unit)

Device No.	Signal name	Description
RXn0	Local CD	Input station's CD signal
RXn1	Local ALM	Input station's ALM signal
RXn2	LocalL1	Input station's L1 signal
RXn3	LocalL2	Input station's L2 signal
RXn4-RX(n+1)	Reserve	Reserved

* The reserved signals cannot be used.

(2) Output signals (master unit to SOT-MQ)

Device No.	Signal name	Description
RYn0-RYnF	Reserve	Reserved
RY(n+1)0	Remote CD	Opposite station's CD signal
RY(n+1)1	Remote ALM	Opposite station's ALM signal
RY(n+1)2	RemoteL1	Opposite station's L1 signal
RY(n+1)3	RemoteL2	Opposite station's L2 signal
RY(n+1)4-RY(n+1)F	Reserve	Reserved

* The reserved signals cannot be used.

6-6-2. Correspondence between input/output signals and indicators

The correspondence between the input/output signal on/off statuses and the indicator statuses is shown below:

Signal				Indicator				
					LEVEL			
CD	ALM	L1	L2	CD	1	2	3	4
OFF	OFF	OFF	OFF	×	×	×	×	×
ON	OFF	OFF	OFF	○	×	×	×	×
ON	ON	OFF	OFF	○	○	×	×	×
ON	ON	ON	OFF	○	○	○	×	×
ON	ON	OFF	ON	○	○	○	○	×
ON	ON	ON	ON	○	○	○	○	○

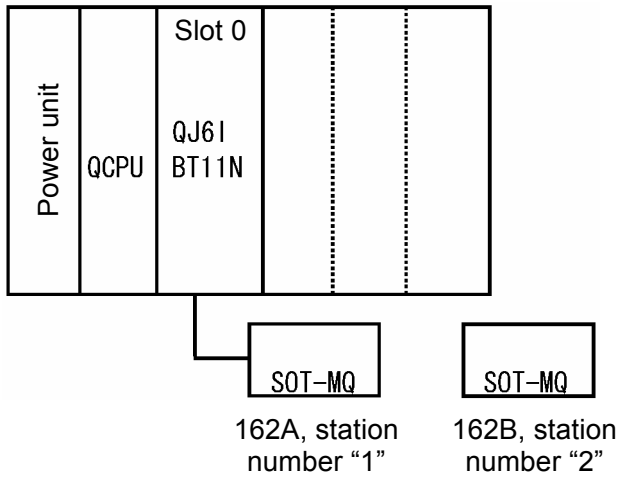
× : Off
○: On

6-6-3. Example of program

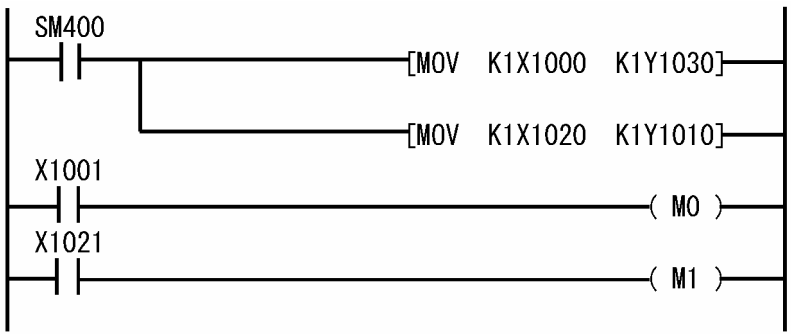
(1) Example of system construction

In this example, the QCPU, QJ61BT11N and SOT-MS are set up as shown below for explanation.

1. Insert the QJ61BT11N into slot 0.
2. Set the station number of SOT-MS162A to “1” and that of SOT-MS162B to “2.”
3. Program the automatic refreshing.
   RX refreshing device: X1000
   RY refreshing device: Y1000
4. Set parameters
   Station type: Remote I/O
\# of occupied stations: 1
   * For detail of parameter settings, see the User’s Manual for the master unit.

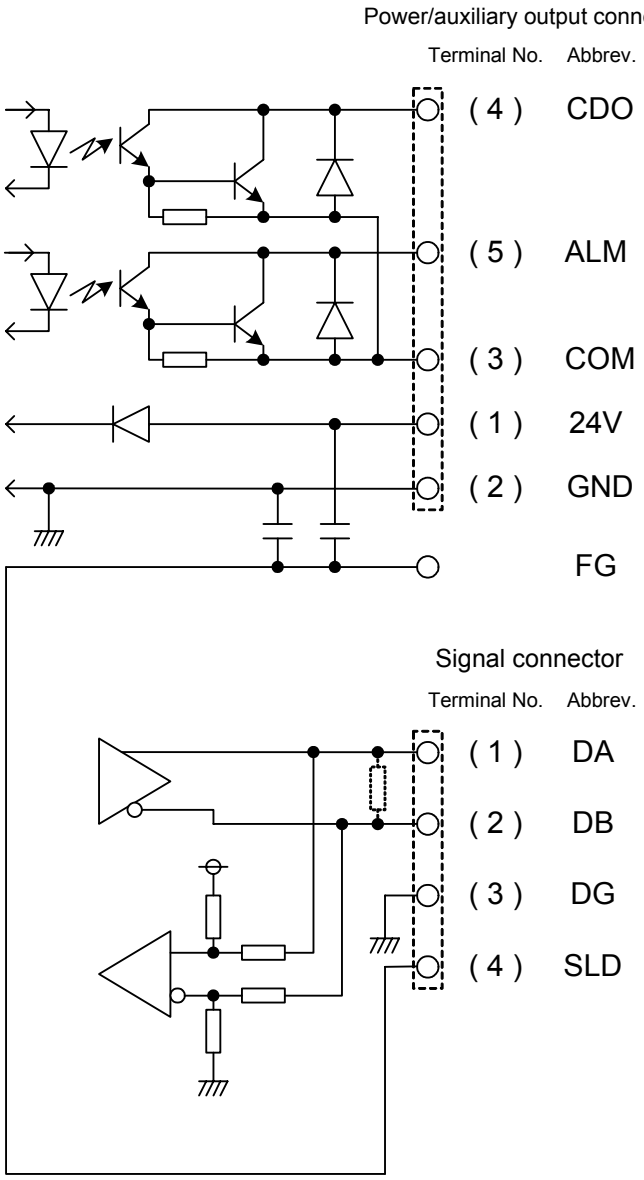


(2) Monitoring program



With this monitoring program, the reception level at the opposite station can be determined with the indicator and used for fine adjustment and maintenance.

7. External output circuit



8. Inspection and maintenance

(1) Periodically check the front cover for contamination.
The product optically transmits data and may malfunction if the front cover is contaminated. If it is heavily contaminated, wipe it clean with a dry cloth or the like.
The projector and receiver ports are made of resin and must not be cleaned with toluene based solvent.

(2) Check for loose or chattering mounting screws and tighten, if any.

9. Caution in use

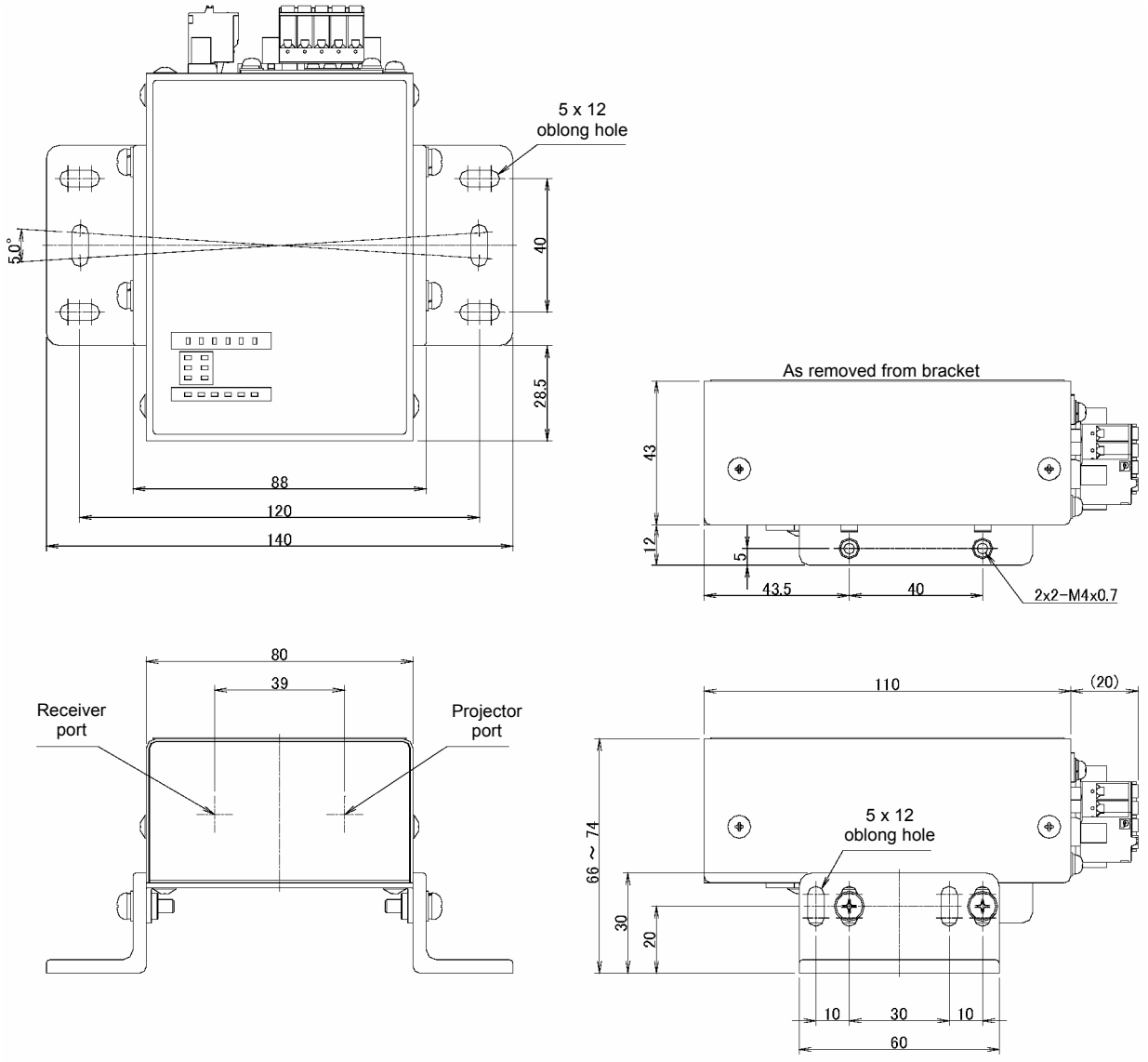
(1) Caution about voltage ripples
Use a power supply that meets power specifications for the product.
When supplying from the power unit of a PLC (sequencer), check that the product will normally function.

(2) Caution about the power reset
Data cannot be transmitted for about two seconds after power-up.

(3) Beam path adjustment
When installing the SOT units, never fail to adjust the beam path.
Data can be transmitted when the clear data indicator (CD) lights and the clear data output signal (CDO) is on.
When the reception level indicator (level 1) does not light, the low reception level output (ALM) signal is issued (off).

(4) Power wiring
The power cable length shall not exceed 50m.
Electric noises in various forms are induced into the power cable from electric appliances on the power circuit and power cables coming from other equipment. They may cause the units to malfunction even if the power cable is shorter than 50m.
In case the power cable wiring circuit has such disturbing factors:
(1) install the power unit nearby,
(2) shorten or separately wire the power cable, or
(3) use a cable shielded from electromagnetic fields.

10. External dimensions



11. Warranty

(1) Warranty period
A year after delivery to the specified location.

(2) Scope of Warranty
If the product is found to have a fault attributable to us within the Warranty period specified above, the faulty part will be replaced or repaired at our cost. This does not apply to the faults resulting from:

(1) incorrect handling or abuse by the user,
(2) causes not related with the product,
(3) alternation or repair made by a party other than us, or
(4) natural disasters and accidents beyond our control.

Note that the Warranty only applies to the product itself and does not cover secondary damages arising from a failure of the product.

12. Contact

For detail of the product, please contact the nearest sales office or the Kagiya Factory.

TOYO ELECTRIC CORPORATION

Kagiya Factory

Head office /Kagiya Factory	1-39 Aza-hikizawa, Kagiya-cho, Kasugai City, Aichi Prefecture, 480-0393 Tel <0568>88-1181 (Rep.) Fax <0568>88-3086
Tokyo office	Uchikanda Tosei building 3F, 1-18-12 Uchikanda, Chiyoda Ward, Tokyo, 101-0047 Tel <03>5282-3308 Fax <03>5282-3309
Nagoya office	2-156 Ajiyoshi-cho, Kasugai City, Aichi Prefecture, 486-8585 Tel <0568>35-3456 Fax <0568>34-4666
Osaka office	Asahi seimei doushu-machi building 5F, 1-5-18 Doushu-machi, Chuo Ward, Osaka City, 541-0045 Tel <06>6221-5361 Fax <06>6221-5363

Homepage: URL http://www.toyo-elec.co.jp

* The specifications and external dimensions shown herein may be revised to reflect future improvements without notice.

13. Revision history

Date	Contents of revision	Remarks
2010.03.31	Newly issued	Development 1
2010.04.09	CC-Link version added	Development 1
2010.07.26	Editorial errors with addresses in 12 “Contact” corrected	Development 1
2011.04.22	Page 1, CE mark added. Page 13, 6-4-4. Measures to be taken to comply with the EMC Directive, added. Page 19, Department names changed due to change of organization in 12. Contact.	Development 1
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