ROBOSTAR ROBOT
RCS Series Option
CC-Link

☑ **Option Module**
   - CC-Link

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Robostar Co., Ltd

Regarding Product Warranty

Robostar products are manufactured under strict quality control and all Robostar products are covered under one year warranty from the date of manufacture. We offer free services during this warranty period only for mechanical breakdowns caused by faults by Robostar or breakdowns which arise from problem in design and manufacturing faults during normal use.

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(2) Mechanical troubles caused by inappropriate repairs, alteration, movement and other negligent handling directed by your company or a third party.
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(8) Damage not included in robot repair costs

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Composition of User Manual

The User Manual of this product is composed of the following. If this is the first time to use this product, fully understand each and every detail in the manual before use.

■ CC_Link

Explains how to connect a controller to RCS series using a CC_LINK communication module as well as how to use it.

Table of Contents

Chapter 1. Overview

1.1 What is a CC-Link Option Card?

A CC-Link Option Board is responsible for communication of CC-Link (Control & Communication Link) field network system on N1 series controller of Robostar Co., Ltd. Using the CC-Link Option Board, the N2 series controller is capable of performing communication using CC-Link protocols with systems such as PC or PLC by means of CC-Link field network. The CC-Link Option Board is an electrical medium and has an interface in conformity to RS485 standards, enabling communication with any master device by being connected to CC-Link field network which uses CC-Link protocols. Figure 1-1 shows this is equivalent to field network in FA network configuration
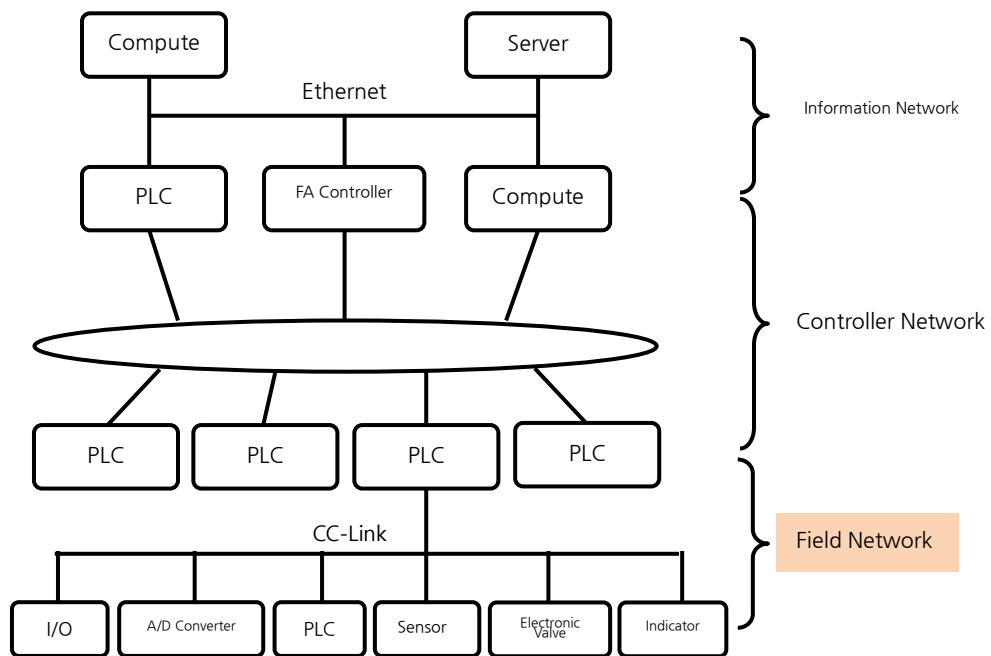
Fig. 1.1 FA Network Range

1.2 System Configuration

Upper network interfaces with equipment such as PC or PLC referred to as CC-Link master station, and master stations are involved in communication with sub-slave stations using CC-Link field network.

Fig. 1.2 CC-Link System Configuration

CC-Link Option Board corresponds to **CC-Link Ver.1.10,** performing the functions of a **remote device station.** The remote device station holds functions of cyclic transfer and reduction of inter-station cable length.

Chapter 2. Function

2.1   Overall CC-Link Version and Function

2.1.1 Master Station, Local Station

Shows in Table 2.1 a glance at functions of master station and local station in each CC-Link version. A Ver.2.00 master station and local station need to have two-way essential functions - cyclic transfer and extended cyclic transfer - to maintain a compatibility with the conventional version.

Function	Ver.1.10	Ver.2.00
Cyclic Transfer	○	○
Extended Cyclic Transfer	－	○
Transient Transfer	△	△
Message Transfer Function	－	△
Inter-station Cable Length Reduction	○	○

○：Essential function, △：Optional function, －：No function

Table 2.1 Glance at Functions in Master Station, Local Station

2.1.2 Remote Device Station

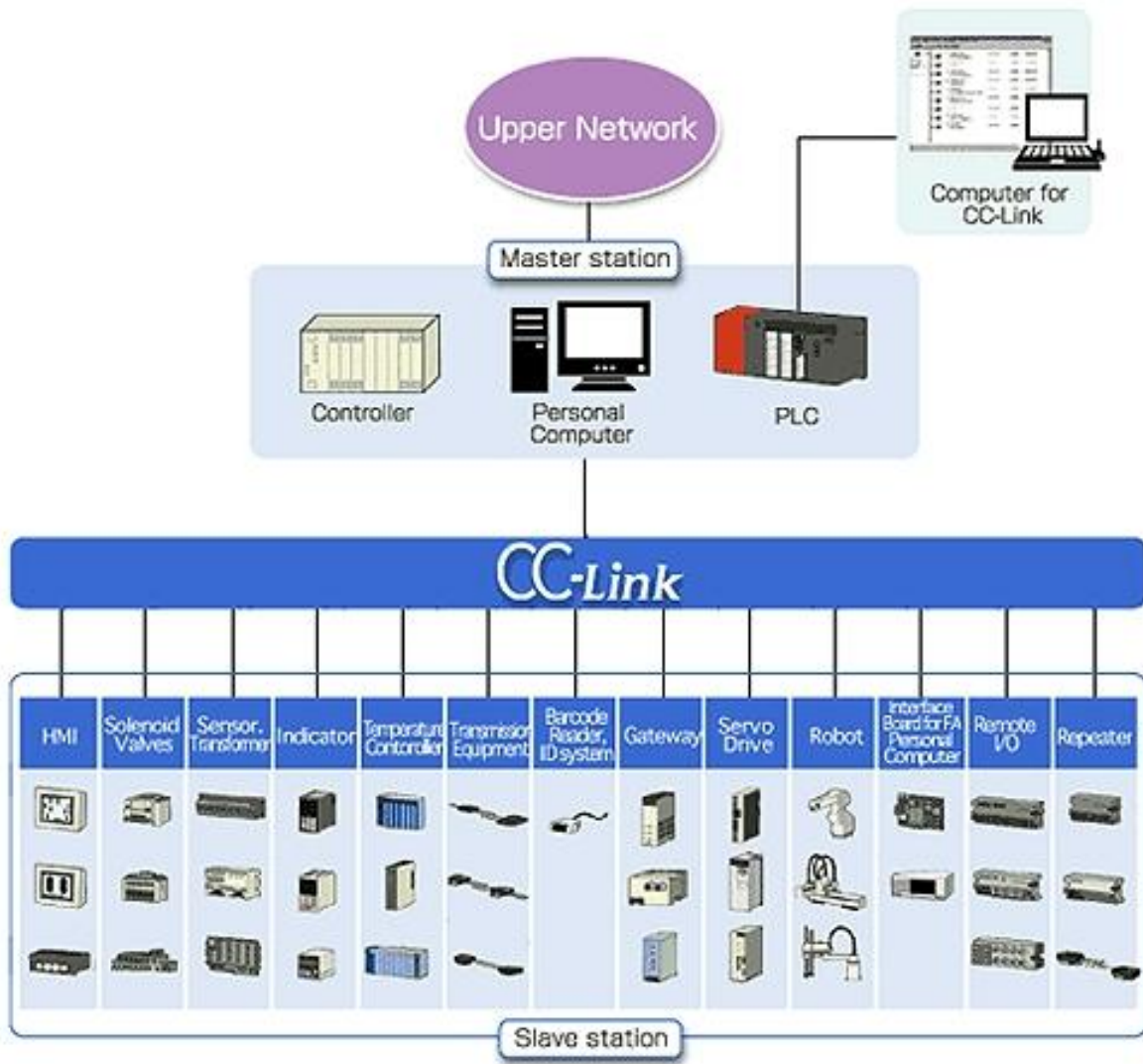Shows in Table 2.1 a glance at functions of a device station in each CC-Link version. A Ver.2.00 master station needs an extended cyclic transfer as an essential function.

Function	Ver.1.10	Ver.2.00
Cyclic Transfer	○	△
Extended Cyclic Transfer	－	○
Transient Transfer	－	－
Message Transfer Function	－	△
Inter-station Cable Length Reduction	○	○

○：Essential function, △：Optional function, －：No function

Table 2.2 Glance at functions in remote device station

2.2 Communication between Inter-station Patterns

Table 2.3 shows the advisability of communication of CC-Link Ver. 1, Ver. 2 between patterns of each station.

Receiving Station / Transfer Station			(Ver.2 Station)				(Ver.1 Station)				
			M	L	ID	RD	M	L	ID	RD	RIO
(Ver.2 Station)	Master Station	M		◎	◎	◎		○	○	○	○
	Local Station	L	◎	◎	—	—	○	○	—	—	—
	Intelligent Device Station	ID	◎	◎	—	—	x	x	—	—	—
	Remote Device Station	RD	◎	◎	—	—	x	x	—	—	—
(Ver.1 Station)	Master Station	M		○	x	x		○	○	○	○
	Local Station	L	○	○	—	—	○	○	—	—	—
	Intelligent Device Station	ID	○	○	—	—	○	○	—	—	—
	Remote Device Station	RD	○	○	—	—	○	○	—	—	—
	Remote I/O Station	RIO	○	○	—	—	○	○	—	—	—

◎ : Communicable by extended cyclic transfer
○ : Communicable by extended cyclic transfer
x : Communication not possible
— : No function

Table 2.3 Communication between inter-station patterns

2.3 Communication Specifications

Specifications	
Communication Speed	10M/5M/2.5M/625k/156kbps
Communication Method	Broadcast polling
Synchronization Method	Frame synchronization method
Encoding Method	NRZI (Non-Return to Zero, Inverted)
Transfer Channel Format	Bus format (Meets EIA RS485)
Transfer Format	Pursuant to HDLC (High-level Data Link Control)
Error Control Method	CRC16 ($X^{16} + X^{12} + X^5 + 1$)
Max Link Score	RX,RY : 2048 points RWw : 256 points (Master station-〉 Slave station) RWr: 256 points (Slave station-〉Master station)
Link Score per 1 Station	RX,RY : 32 points (30 points for local station) RWw :4 points (Master station-〉 Slave station) RWr: 4 points (Slave station-〉 Master station)
Max Number of Stations Possessed	4 stations
Transient Transfer [per 1 link scan]	Max of 960 bytes/station [150 bytes (Master station-〉Intelligent device station, Local station), 34bytes (Intelligent device station, Local station-〉Master station)]
Number of Stations Connected	$(1 \times a)+(2 \times b)+(3 \times c)+(4 \times d) \leq 64$ Stations a: number of possessions by 1 station, b: number of possessions by 1 station, c: number of possessions by 1 station, d: number of possessions by 1 station $16 \times A + 54 \times B + 88 \times C \leq 2304$ A: Number of remote I/O stations ----------------------- Max 64 B: Number of remote device stations -------------------- Max 42 C: Number of local stations, intelligent device stations-------- Max 26
Slave Station Prefix	1~64
RAS Function	Automatic double-row function Function of tidying up slave station Checks data link status Offline test (Hardware test, line test) Stand-by master stations
Connection Cable	CC-Link dedicated cable (Shield attached 3-core twisted pair cable)
Terminating Resistance	110Ω, 1/2W x 2 (Connect between DA-DB) --- both ends of the trunk cable

＊ Of above specifications, communication speed and number of stations connected do not necessarily meet all the contents listed above.

Table 2.4 Communication Specifications
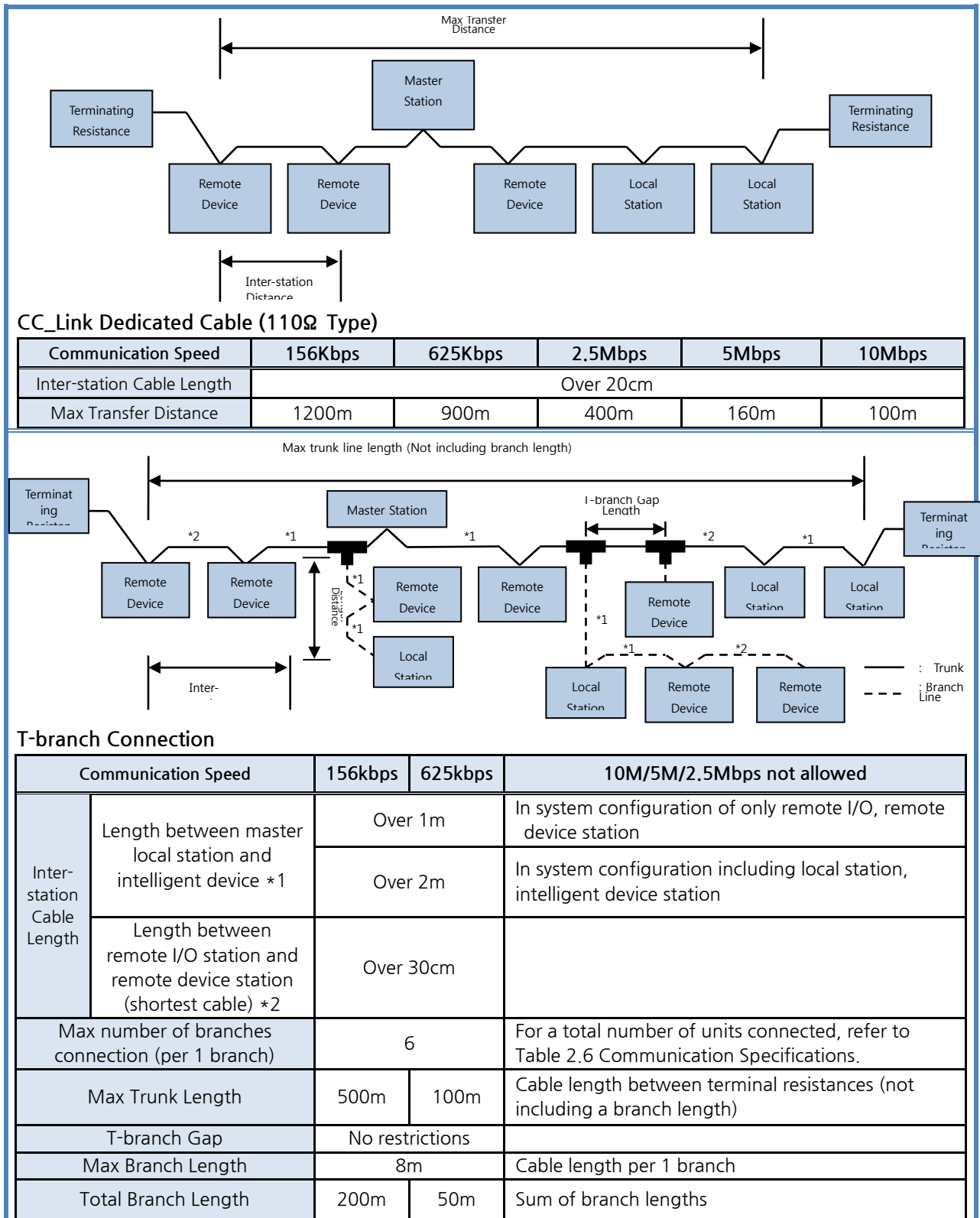
2.4 Maximum Transfer Distance

CC_Link Dedicated Cable (110Ω Type)

Communication Speed	156Kbps	625Kbps	2.5Mbps	5Mbps	10Mbps
Inter-station Cable Length	Over 20cm				
Max Transfer Distance	1200m	900m	400m	160m	100m

T-branch Connection

Communication Speed		156kbps	625kbps	10M/5M/2.5Mbps not allowed
Inter-station Cable Length	Length between master local station and intelligent device *1	Over 1m		In system configuration of only remote I/O, remote device station
		Over 2m		In system configuration including local station, intelligent device station
	Length between remote I/O station and remote device station (shortest cable) *2	Over 30cm		
Max number of branches connection (per 1 branch)		6		For a total number of units connected, refer to Table 2.6 Communication Specifications.
Max Trunk Length		500m	100m	Cable length between terminal resistances (not including a branch length)
T-branch Gap		No restrictions		
Max Branch Length		8m		Cable length per 1 branch
Total Branch Length		200m	50m	Sum of branch lengths

Table 2.5 Max Transfer Distance

Chapter 3. Standards Specifications

3.1 Standards for CC-Link Option Card

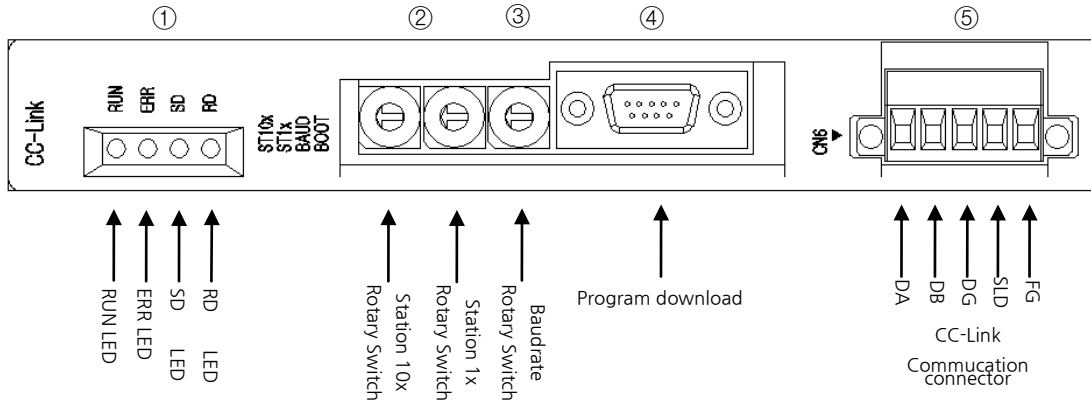The front view of CC-Link Option Board is shown in Fig. 3.1.

Fig. 3.1 Front View of CC-Link Option Card

Standards for CC-Link Option Board are shown in Table 3.1.

Function	Description
Status Display	- Status LED
Setting Switch	- Baud rate Switch - Station Number Switch
Communication Port	- RS485-based CC-Link protocol Interface
Operating Voltage	- Internal +5V ± 5% : 0.5 A nominal Maximum - External +24V ± 5% : 0.15 A nominal Maximum
Operating Temperature	- Temperature : operating 0 ~ 40 ℃ storage -15 ~ 60 ℃
Operating Humidity	- Humidity : 20 ~ 80% RH (non-condensing)

Table 3.1 CC-Link Option Board Standards

3.2　Description of LED Functions

　CC-Link Option Board, equipped with a total of 4 LEDs, is able to know the CC-Link Adapter status from the outside. Fig. 3.1 ④ shows how it looks like with the following functions.

	LED Color	Function
RUN	YELLOW	Turns on when in normal communication with CC-Link field network
ERR	RED	Turns on when in abnormal communication with CC-Link field network
SD	GREEN	Maintains ON status when transmitting data
RD	GREEN	Maintains ON status when receiving data

Table 3.2 Definition of LED Functions

Under normal condition where cyclic communication is in progress, all LEDs are turned on for operation except for ERR LED.

3.3　Station Number Setting

Use the Station 10x Rotary Switch and Station 1x Rotary Switch in Fig. 3.1 ③ and change into Station Number set in Master to have communication with CC-Link Master. Rotary Switch makes use of a decimal number so you can set a tenth place with 10x Rotary Switch and the first place with 1x Rotary Switch.
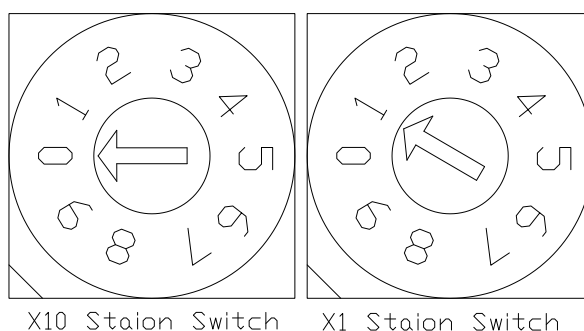

Fig. 3.2 Examples of Station Number Setting

Station Number setting can be done from Station 0 to 63, where the remote device station where CC-Link Option Board belongs is capable of setting from Station 1 to 63. Fig. 3.2 shows an example set by 1 Station.

3.4   Baud rate Setting

Communication speed with CC-Link Master is set by using Baud rate Rotary Switch in Fig.3.1 ②. Rotary Switch uses a decimal number and communication speed for each number is shown in Table 3.3.

Set Value of Baud rate	
Value	Communication Speed
0	156 Kbps
1	625 Kbps
2	2.5 Mbps
3	5 Mbps
4	10 Mbps
Other values than above value	Error

Table 3.3 Set Value of Baud rate

3.5   Connector Pin Wiring

- **CC-Link Connector**

This is a STL(Z) 950 5-pin OPEN Connector. It looks like Fig. 3.1 ① and its cable for use should be CC-Link Ver.1.10 defined in CC-Lin. Its colors are defined as DA(Blue), DB(White), and DG(Yellow), while SLD and FG have no definition of color. SLD means cable Shield and FG means Frame Ground. For further details, refer to 4.2 "How to connect CC_LINK network cable".
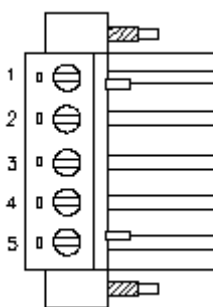
CN PIN	Signal Name	Description
1	DA	Data A
2	DB	Data B
3	DG	Data Ground
4	SLD	Shield
5	FG	Frame Ground

Fig. 3.3 CC-Link Connector Pin Number

Chapter 4. Installation and Operation Setting

4.1 How to install Hardware

Take the following procedure to be able to use CC_LINK Option Board on RCS series controller.

1) Turn the power OFF.
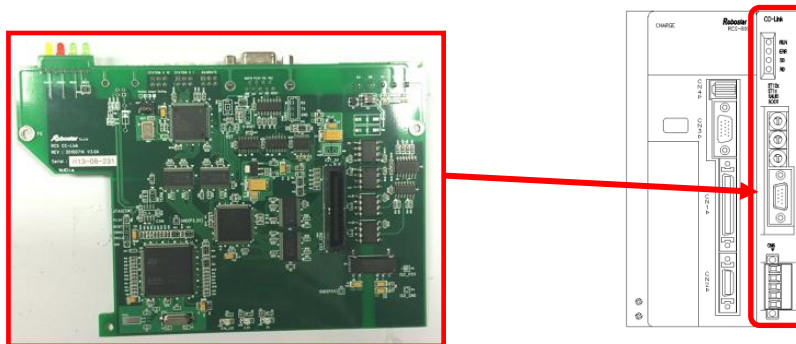2) Remove the cover from RCS Controller and attach the CC-Link Board.

Fig. 4.1 How to install Option Board

3) Turn the power ON.

4.2 How to Connect CC-Link Network Cable

How to connect Cable to Connector allows the use of a STL(Z) 950 5-pin OPEN Connector in CC-Link Option Card, therefore 4 wires such DA(Blue), DB(White), DG(Yellow), and SLD on CC-Link field network are used to fix with a screwdriver. A CC-Link certified cable is basically used. Wire as shown below for cable-connector wiring.
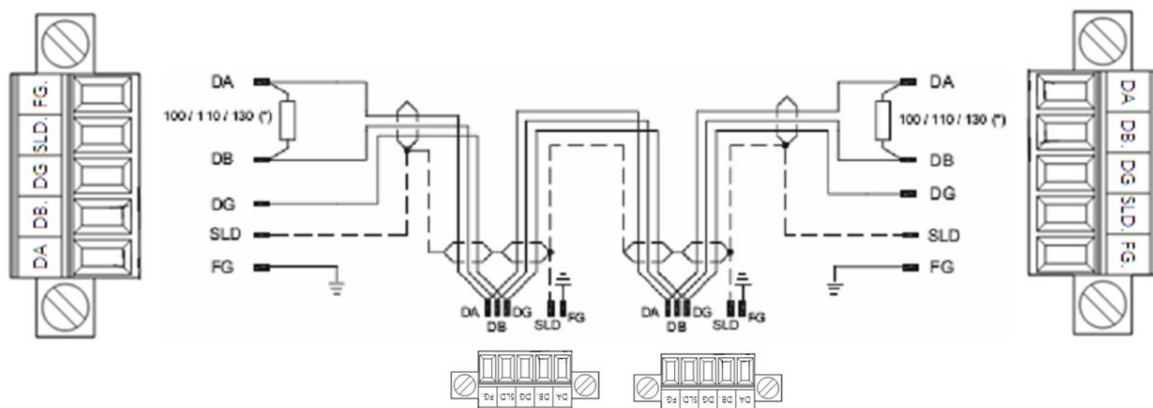

Fig. 4.2 How to Wire Cable

A terminating resistance is connected to a spot in between Connector DA and DB. Connect as shown in Fig. 4.3 as an example of connection.
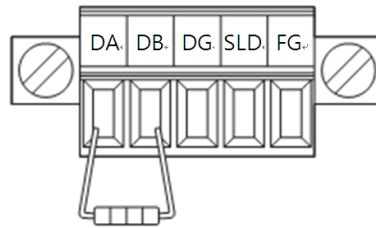

Fig. 4.3 How to Connect a Terminating Resistance

4.3 Controller Setting

To use a CC-Link on RCS series controller, Controller FIELD BUS should be set to CC-Link Mode.

1. Setting Step

Step 1. **Shift to MAIN screen**

```
TPS-9000T Ver1.3
F1: Teach Pendant
F2: RS-422 Multipoint
F3: Data up/Down Load
```

F1

Turn ON power to controller and select Teach Pendant.

```
RoboStar RCS-8000C
Servo Controller
PARA V00.22
        PRESS ENT KEY
```

ENT

Press ENT.

Step 2. **Move to Parameter**

```
        Servo Controller

ROBOT   PLC   PARA   VIEW
```
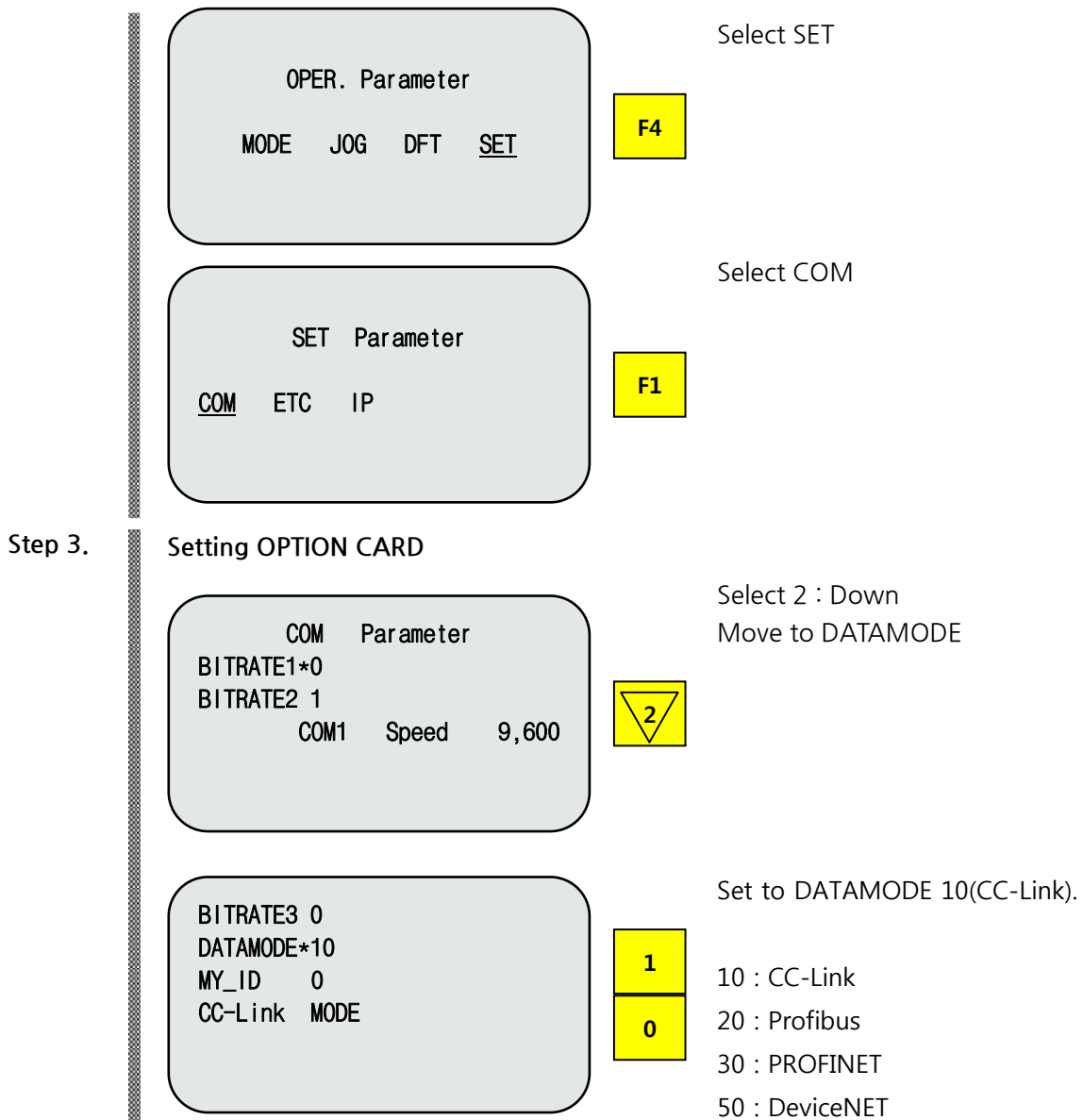
F3

Select PARA

```
        Parameter Setting

SERVO    MECH    OPER    I/O
```

F3

Select OPER

```
            OPER. Parameter

    MODE    JOG    DFT    SET
```
F4   Select SET

```
            SET  Parameter

  COM    ETC    IP
```
F1   Select COM

Step 3. Setting OPTION CARD

```
        COM    Parameter
  BITRATE1*0
  BITRATE2 1
        COM1    Speed    9,600
```
▽2   Select 2 : Down
Move to DATAMODE

```
  BITRATE3 0
  DATAMODE*10
  MY_ID    0
  CC-Link  MODE
```
Set to DATAMODE 10(CC-Link).

1   10 : CC-Link

0   20 : Profibus

30 : PROFINET

50 : DeviceNET

4.4 PLC Data Transfer Speed

When sending data from PLC, a maximum time delay of 10ms may occur. As the controller's data scan time is 20ms, an accurate operation cannot be guaranteed if data values are changed in less than 20ms.

⚠ **CAUTION**

> ➢ **When DATAMODE 10(CC-Link) is set and OPTION board is not fastened in normal condition, alarm E15.02 "Not find Fieldbus" sounds**

Chapter 5.　Examples of CC-Link Setting

The program used in setting program parameters of CC-Link Option Card is MISUBITH GX Developer, while Q Series from the same company was used for PLC.

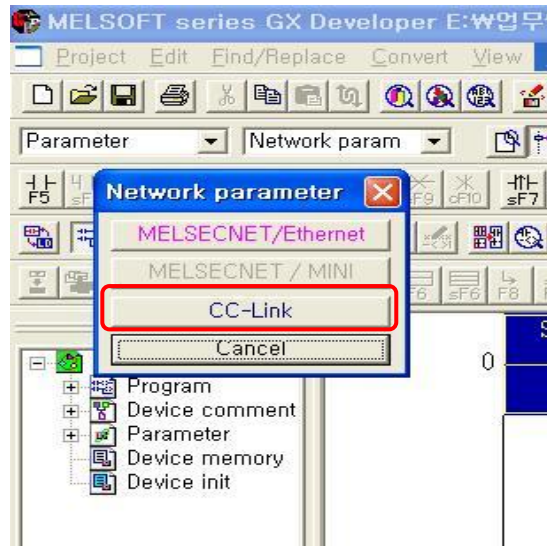## 5.1　Setting CC_link Network Parameters

Fig. 5.1 How to set CC-Link network parameters in GX Developer

To set CC-Link network parameters in GX Developer, click the following in order of Parameter → Network parameter → CC-Link as the setting shown in Fig. 5.1 and open a window for setting CC-Link network parameters as seen in Fig. 5.2.

⚠ CAUTION

> ➢ **How to set A series may vary**.

5.2 Setting CC-Link Master Station Parameters

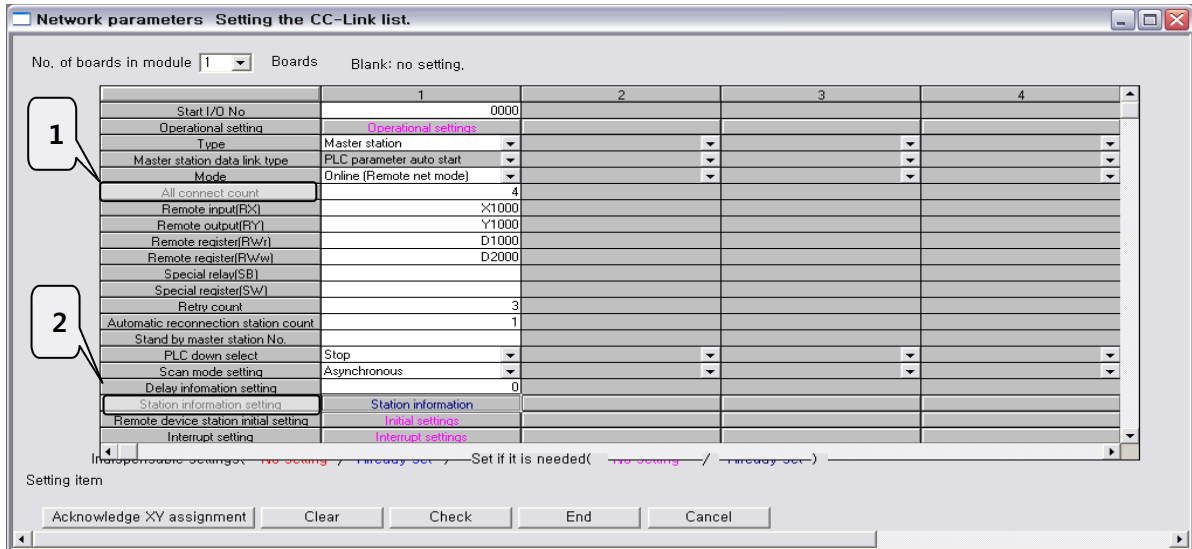
Fig. 5.2 Setting CC-Link master station network parameters

1) All connect count : Represents the number of entire slave stations attached to one master station. Fig. 5.2 shows setting in which 4 slave stations are used.

2) Station information setting : Sets network parameters in slave station.

3) Ex) Value for setting PLC Program network Parameter
   Set the remote input (RX) refresh device to X1000.
   Set the remote output (RY) refresh device to Y1000
   Set the remote register (RWr) refresh device to D1000.
   Set the remote register (RWw) refresh device to D2000.
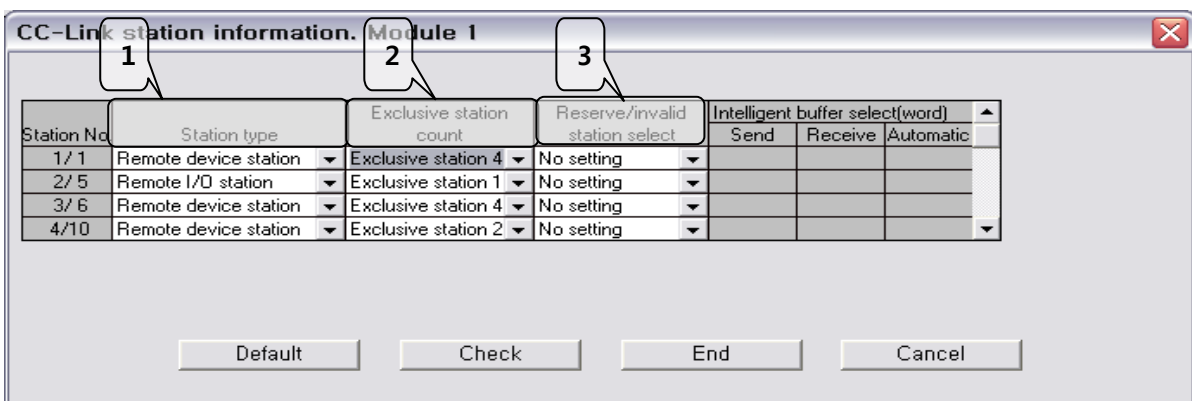
5.3 Setting CC-Link Slave Station Network Parameters

Fig. 5.3 Window for setting information on status of slave station

1) Station type : Sets the station status, detailing Remote I/O station, Remote device station and Intelligent device station, and Robostar CC_Link Board only supports a Remote device.

2) Exclusive station count : Selects the number of stations to use in each slave station and Robostar

CC_Link supports up to 4 stations. Basic product specifications are set to 4 stations when shipped out of the factory, where a Station No. corresponds to the prefix of each station. In other words, the 4th Remote device station is given a prefix of no. 10.
3) Reserve/Invalid station select : Selects a reserved or invalid station.

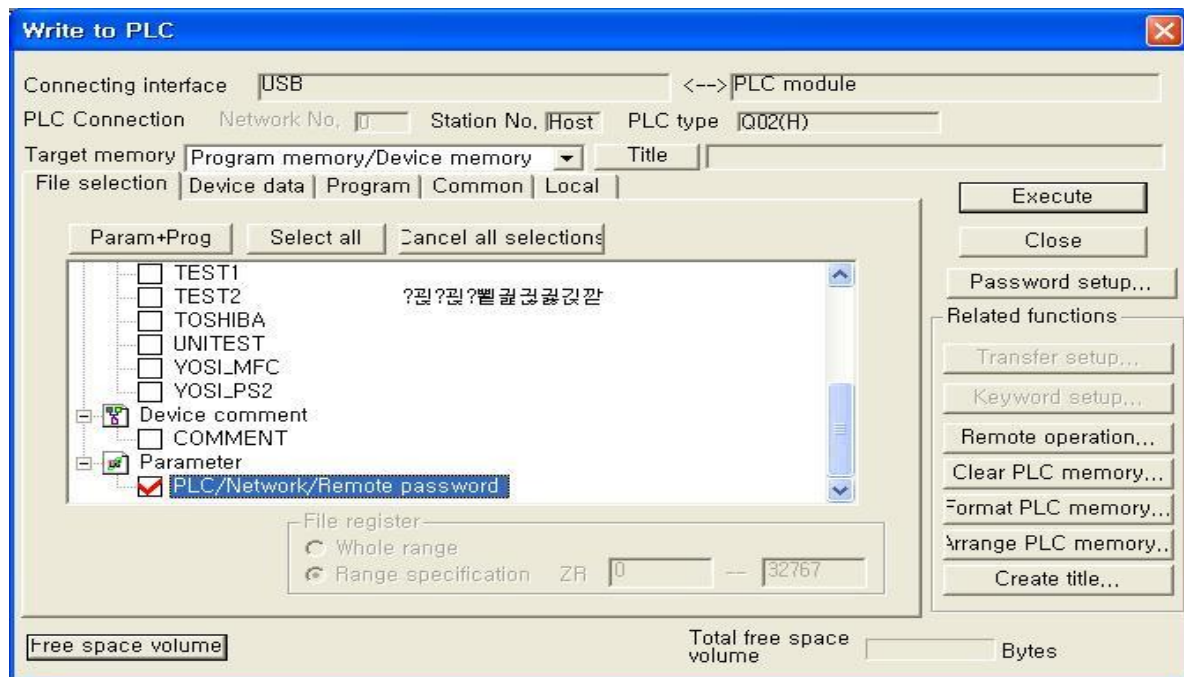### 5.4   Application of Converted CC-Link Network Parameters

Fig. 5.4 How to download network parameters to PLC

To apply the set CC-Link network parameter to PLC, take the following steps.

    1) Connect computer to PLC.

    2) Click Online → Write to PLC on menu to open a window as shown in Fig. 5.4.

Select PLC/Network/Remote password, the submenu of the Parameter positioned at lower end of Fig. 5.4, and click Execute button

⚠ CAUTION

> ➢ When writing PLC Program, refer to "Ch.6 Memory Mapping", "Field Bus Timing Diagram"

Chapter 6. Memory Mapping

6.1 RCS Controller Data Mapping

Controller Data Mapping			
CC-Link Data	Description	CC-Link Data	Description
RY00	Updata Flag	RX00	Complete Flag
RY01-0F	User IO (10, 11)	RX01-0F	User IO (18, 19)
RY10-1F	User IO (12, 13)	RX10-1F	User IO (20, 21)
RY20-2F	User IO (14, 15)	RX20-2F	User IO (22, 23)
RY30-37	User IO (16, 17)	RX30-3F	User IO (24, 25)
RWw0	Write POS Number	RWr0	Current Position LSB
RWw1	Write POS LSB	RWr1	Current Position MSB
RWw2	Write POS MSB	RWr2	Read POS LSB
RWw3	Write INT Value	RWr3	Read POS MSB
RWw4	Write INT Number	RWr4	Read INT Value
RWw5	Read INT Number	RWr5	Read Alarm Value
RWw6	Read POS Number	RWr6	Current Speed
RWw7	Write PGM Number	RWr7	Current Torque

6.2 Updata Flag, Complete Flag

If the update flag (RY00) is set after sending the value to the data area in the PLC, apply the data transferred from the controller. After completing the application, Complete Flag (RX00) is set and initialized after 1 second.

Updata Flag, Complete Flag (M0.0 ~ M0.F)			
RY00	Updata Flag	RX00	Complete Flag
RY01	User IO 10.1	RX01	User IO 18.1
RY02	User IO 10.2	RX02	User IO 18.2
RY03	User IO 10.3	RX03	User IO 18.3
RY04	User IO 10.4	RX04	User IO 18.4
RY05	User IO 10.5	RX05	User IO 18.5
RY06	User IO 10.6	RX06	User IO 18.6
RY07	User IO 10.7	RX07	User IO 18.7

⚠️ CAUTION

➢ User IO 10.0 and User 18.0 can not be used because they are assigned with Update Flag (RY00) and Complete Flag (RX00).
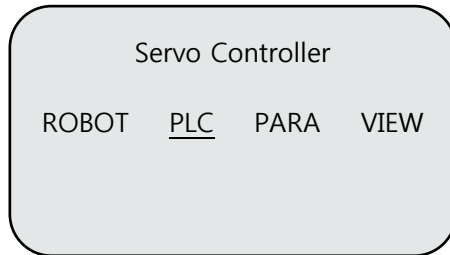
6.3 How to check Internal contact point

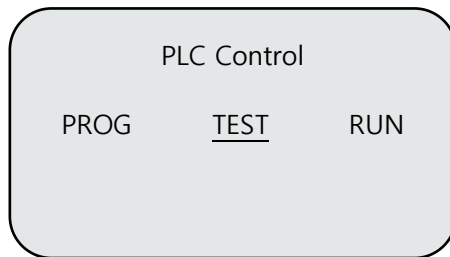Teach pant handle to check internal contact point.
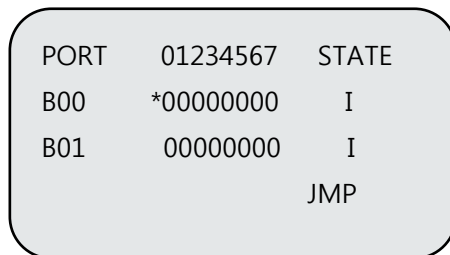
1. **Procedure**

Step 1. **Shift to PLC TEST screen**

Select PLC.

> Servo Controller
>
> ROBOT   <u>PLC</u>   PARA   VIEW

F2

Select TEST.

> PLC Control
>
> PROG   <u>TEST</u>   RUN

F2

Step 2

> PORT   01234567   STATE
> B00   *00000000   I
> B01   00000000   I
>   JMP

- PORT: B10 ~ B25
- BIT Input/Output: 0(OFF), 1(ON)

<PORT Movement>

2 : Moves upper PORT

8 : Moves lower PORT

<BIT Movement>

4 : Moves lower BIT

6 : Moves upper BIT

Chapter 7. Appendix

7.1   Summary of Terms

1) PLC
Means a Programmable Logic Controller.

2) Master Station
A station that holds control information (Parameter) to control the overall network. One prefix for one network is needed and fixed.

3) Slave Station
General name for other stations than the master station.

4) Remote Station
General name for a remote I/O station and remote device station.

5) Intelligent Device Station
Means a station capable of a 1:n cyclic transfer to/from the master station as well as a transient transfer.

6) Remote Device Station
Means a station enabling use of bit data and word data. (Ex: Analog unit, indicator, digital unit, electronic valve, and so on)

7) Remote I/O Station
A station allowing only bit data to be used and only one station to be shared.. (Unit, electronic value, and sensor)

8) Local Station
Means a station capable of a n:n cyclic transfer between the master station and other local stations and 1:n as well as a transient transfer.

9) Number of Stations
Sum of the number of stations shared by all slave stations connected to CC-Link.

10) Prefix

Numbers from 1 to 64 which are allocated to the master station O and slave station on CC-Link. A slave station needs to be allocated not to overlap by considering the number of stations shared.

11) Number of Shared Stations

Number of stations on network used by 1 slave station, configurable from Station 1 to 4 depending on the number of data.

12) Standby Master Station

Proceeds with a data link for a master station when the functions of a master station stops. This station holds the same function as the master station, normally used as a local station.

13) RX ・ RY

Remote input (RX), Remote output (RY).

Represents the bit data transferred to each station by cyclic transfer or the area storing this information in RX ・ RY for convenient use. In the master station, input data is regarded as RX and output data as RY.

14) RWr ・ RWw

Remote register.

Represents the word data transferred to each station by cyclic transfer or the area storing this information in RWr ・ RWw for convenient use. In the master station, input data is regarded as RWr and output data as RWw.

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RCS ROBOT CONTROLLER

CONTROLLER MANUAL

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ROBOSTAR CO, LTD
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