FANUC Robot series

R-30*i*B/R-30*i*B Mate/
R-30*i*B Plus/R-30*i*B Mate Plus CONTROLLER

CC-Link IE Field Communication Function

OPERATOR'S MANUAL

B-83674EN/02

- **Original Instructions**

Thank you very much for purchasing FANUC Robot.
Before using the Robot, be sure to read the "FANUC Robot SAFETY HANDBOOK (B-80687EN)" and understand the content.

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to ensure the safe use of the robot.
Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.
For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.
In addition, refer to the "FANUC Robot SAFETY HANDBOOK (**B-80687EN)**".

1 DEFINITION OF USER

The user can be defined as follows.

Operator:
- Turns ON/OFF power to the robot
- Starts the robot program from the operator's panel

Programmer:
- Operates the robot
- Teaches the robot inside the safety fence

Maintenance engineer:
- Operates the robot
- Teaches the robot inside the safety fence
- Performs maintenance (repair, adjustment, replacement)

- Operator is not allowed to work in the safety fence.
- Programmers and maintenance engineers are allowed to work in the safety fence. The work inside the safety fence includes lifting, setting, teaching, adjustment, maintenance, etc.
- To work inside the safety fence, the person must receive a professional training for the robot.

During the operation, programming, and maintenance of your robotic system, the programmer, operator, and maintenance engineer should take additional care of their safety by wearing the following safety items.

- Adequate clothes for the operation
- Safety shoes
- A helmet

2 DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "**WARNING**" or "**CAUTION**" according to its severity. Supplementary information is indicated by "**NOTE**". Read the contents of each "**WARNING**", "**CAUTION**" and "**NOTE**" before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

- Check this manual thoroughly, and keep it handy for the future reference.

3 SAFETY OF THE USER

User safety is the primary safety consideration. Because it is very dangerous to enter the operating space of the robot during automatic operation, adequate safety precautions must be observed.
The following lists the general safety precautions. Careful consideration must be made to ensure user safety.

(1) Have the robot system users attend the training courses held by FANUC.

FANUC provides various training courses. Contact our sales office for details.

(2) Even when the robot is stationary, it is possible that the robot is still in a ready to move state, and is waiting for a signal. In this state, the robot is regarded as still in motion. To ensure user safety, provide the system with an alarm to indicate visually or aurally that the robot is in motion.
(3) Install a safety fence with a gate so that no user can enter the work area without passing through the gate. Install an interlocking device, a safety plug, and so forth in the safety gate so that the robot is stopped as the safety gate is opened.

The controller is designed to receive this interlocking signal of the door switch. When the gate is opened and this signal received, the controller stops the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type). For connection, see Fig. 3 (b).

(4) Provide the peripheral equipment with appropriate earth (Class A, Class B, Class C, and Class D).
(5) Try to install the peripheral equipment outside the robot operating space.
(6) Draw an outline on the floor, clearly indicating the range of the robot operating space, including the tools such as a hand.
(7) Install a mat switch or photoelectric switch on the floor with an interlock to a visual or aural alarm that stops the robot when a user enters the work area.
(8) If necessary, install a safety lock so that no one except the user in charge can turn on the power of the robot.

The circuit breaker installed in the controller is designed to disable anyone from turning it on when it is locked with a padlock.

(9) When adjusting each peripheral equipment independently, be sure to turn off the power of the robot.
(10) Operators should be ungloved while manipulating the operator panel or teach pendant. Operation with gloved fingers could cause an operation error.
(11) Programs, system variables, and other information can be saved on memory card or USB memories. Be sure to save the data periodically in case the data is lost in an accident. (refer to Controller OPERATOR'S MANUAL.)
(12) The robot should be transported and installed by accurately following the procedures recommended by FANUC. Wrong transportation or installation may cause the robot to fall, resulting in severe injury to workers.
(13) In the first operation of the robot after installation, the operation should be restricted to low speeds. Then, the speed should be gradually increased to check the operation of the robot.
(14) Before the robot is started, it should be checked that no one is inside the safety fence. At the same time, a check must be made to ensure that there is no risk of hazardous situations. If detected, such a situation should be eliminated before the operation.
(15) When the robot is used, the following precautions should be taken. Otherwise, the robot and peripheral equipment can be adversely affected, or workers can be severely injured.
- Avoid using the robot in a flammable environment.
- Avoid using the robot in an explosive environment.
- Avoid using the robot in an environment full of radiation.
- Avoid using the robot under water or at high humidity.
- Avoid using the robot to carry a person or animal.
- Avoid using the robot as a stepladder. (Never climb up on or hang from the robot.)
- Outdoor

(16) When connecting the peripheral equipment related to stop (safety fence etc.) and each signal (external emergency, fence etc.) of robot, be sure to confirm the stop movement and do not take the wrong connection.
(17) When preparing footstep, please consider security for installation and maintenance work in high place according to Fig. 3 (c). Please consider footstep and safety belt mounting position.

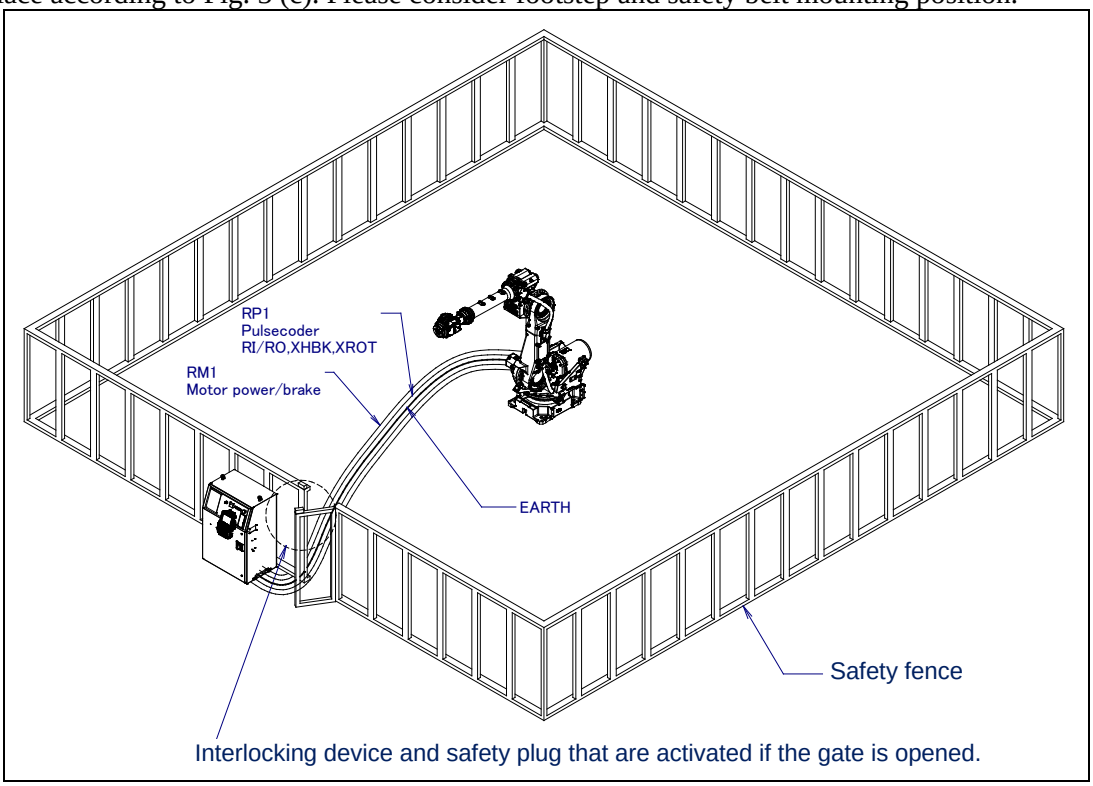


Fig. 3 (a) Safety fence and safety gate

⚠WARNING
When you close a fence, please confirm that there is not a person from all directions of the robot.

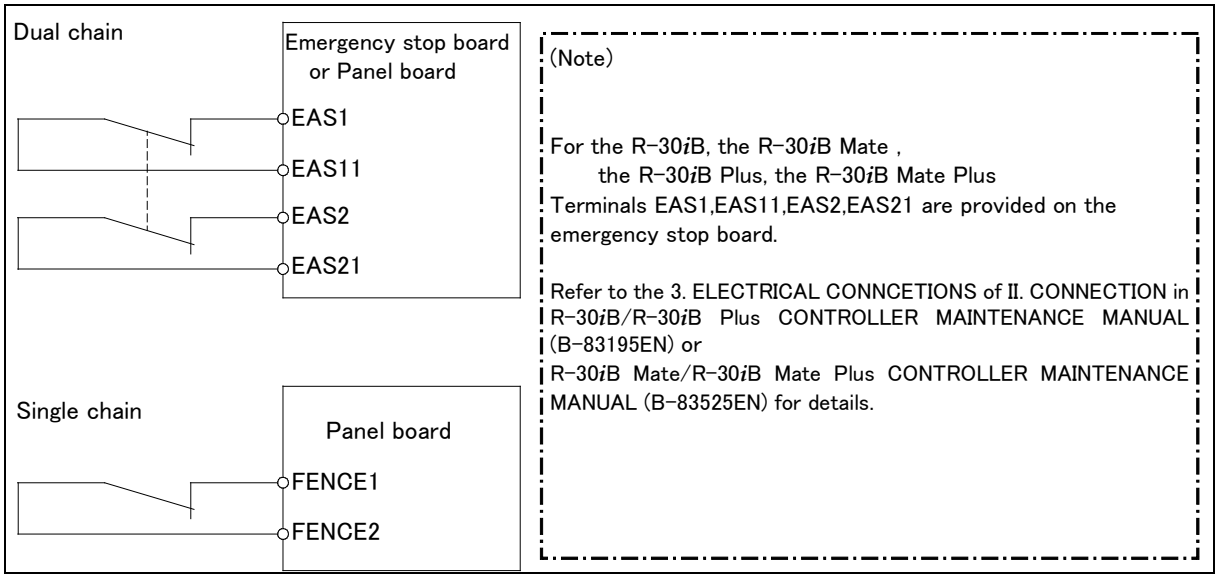


Fig. 3 (b) Connection diagram for the signal of safety fence

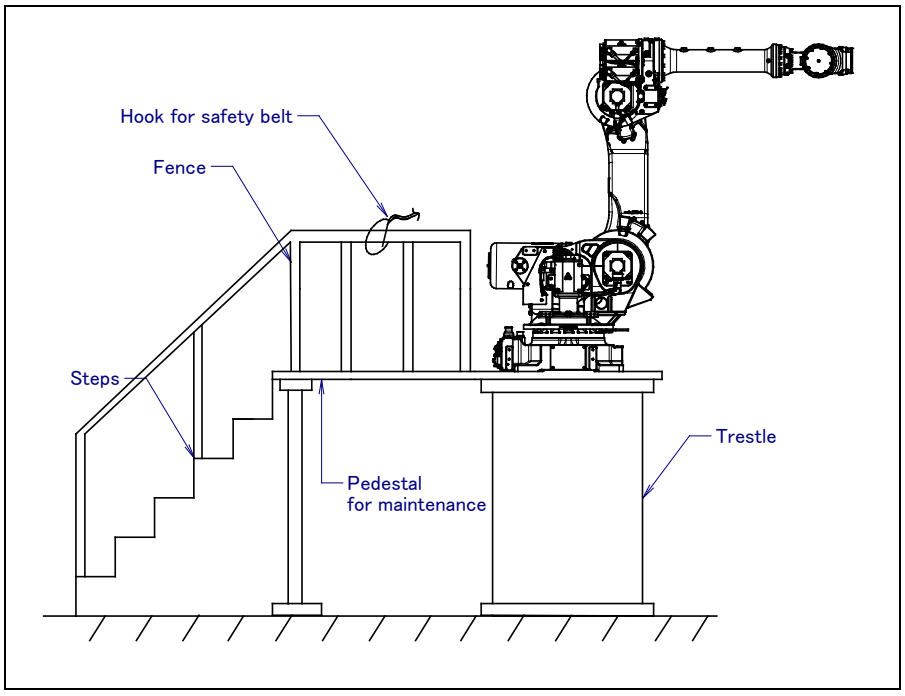


Fig. 3 (c) Pedestal for maintenance

3.1 SAFETY OF THE OPERATOR

An operator refers to a person who turns on and off the robot system and starts a robot program from, for example, the operator panel during daily operation.
Operators cannot work inside of the safety fence.

(1) If the robot does not need to be operated, turn off the robot controller power or press the EMERGENCY STOP button during working.
(2) Operate the robot system outside the operating space of the robot.

(3) Install a safety fence or safety door to avoid the accidental entry of a person other than an operator in charge or keep operator out from the hazardous place.
(4) Install one or more necessary quantity of EMERGENCY STOP button(s) within the operator's reach in appropriate location(s) based on the system layout.

The robot controller is designed to be connected to an external EMERGENCY STOP button. With this connection, the controller stops the robot operation (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type) when the external EMERGENCY STOP button is pressed. See the diagram below for connection.

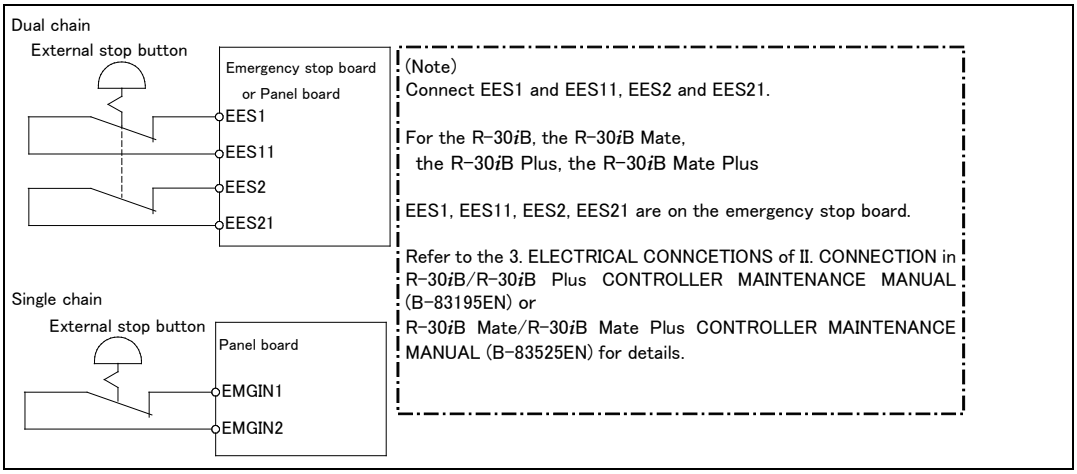


Fig. 3.1 Connection diagram for external emergency stop button

3.2 SAFETY OF THE PROGRAMMER

While teaching the robot, the operator may need to enter the robot operation area. The programmer must ensure the safety especially.

(1) Unless it is specifically necessary to enter the robot operating space, carry out all tasks outside the operating space.
(2) Before teaching the robot, check that the robot and its peripheral equipment are all in the normal operating condition.
(3) If it is inevitable to enter the robot operating space to teach the robot, check the locations, settings, and other conditions of the safety devices (such as the EMERGENCY STOP button, the DEADMAN switch on the teach pendant) before entering the area.
(4) The programmer must be extremely careful not to let anyone else enter the robot operating space.
(5) Programming should be done outside the area of the safety fence as far as possible. If programming needs to be done inside the safety fence, the programmer should take the following precautions:
   - Before entering the area of the safety fence, ensure that there is no risk of dangerous situations in the area.
   - Be prepared to press the emergency stop button whenever necessary.
   - Robot motions should be made at low speeds.
   - Before starting programming, check the whole robot system status to ensure that no remote instruction to the peripheral equipment or motion would be dangerous to the user.

Our operator panel is provided with an emergency stop button and a key switch (mode switch) for selecting the automatic operation (AUTO) and the teach modes (T1 and T2). Before entering the inside of the safety fence for the purpose of teaching, set the switch to a teach mode, remove the key from the mode switch to prevent other people from changing the operation mode carelessly, then open the safety gate. If the safety gate is opened with the automatic operation set, the robot stops (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type). After the switch is set to a teach mode, the safety gate is disabled. The programmer should understand that the safety gate is disabled and is responsible for keeping other people from entering the inside of the safety fence.

Our teach pendant is provided with a DEADMAN switch as well as an emergency stop button. These button and switch function as follows:

(1) Emergency stop button: Causes the stop of the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type) when pressed.
(2) DEADMAN switch: Functions differently depending on the teach pendant enable/disable switch setting status.
   (a) Enable: Servo power is turned off when the operator releases the DEADMAN switch or when the operator presses the switch strongly.
   (b) Disable: The DEADMAN switch is disabled.
   (Note) The DEADMAN switch is provided to stop the robot when the operator releases the teach pendant or presses the pendant strongly in case of emergency. The R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus employs a 3-position DEADMAN switch, which allows the robot to operate when the 3-position DEADMAN switch is pressed to its intermediate point. When the operator releases the DEADMAN switch or presses the switch strongly, the robot stops immediately.

The operator's intention of starting teaching is determined by the controller through the dual operation of setting the teach pendant enable/disable switch to the enable position and pressing the DEADMAN switch. The operator should make sure that the robot could operate in such conditions and be responsible in carrying out tasks safely.

Based on the risk assessment by FANUC, number of operation of DEADMAN SW should not exceed about 10000 times per year.

The teach pendant, operator panel, and peripheral equipment interface send each robot start signal. However the validity of each signal changes as follows depending on the mode switch and the DEADMAN switch of the operator panel, the teach pendant enable switch and the remote condition on the software.

Mode	Teach pendant enable switch	Software remote condition	Teach pendant	Operator panel	Peripheral equipment
AUTO mode	On	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed
	Off	Local	Not allowed	Allowed to start	Not allowed
		Remote	Not allowed	Not allowed	Allowed to start
T1, T2 mode	On	Local	Allowed to start	Not allowed	Not allowed
		Remote	Allowed to start	Not allowed	Not allowed
	Off	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed

T1,T2 mode: DEADMAN switch is effective.

(6) To start the system using the operator box or operator panel, make certain that nobody is the robot operating space area and that there are no abnormalities in the robot operating space.
(7) When a program is completed, be sure to carry out a test operation according to the following procedure.
   (a) Run the program for at least one operation cycle in the single step mode at low speed.
   (b) Run the program for at least one operation cycle in continuous operation at low speed.
   (c) Run the program for one operation cycle in continuous operation at the intermediate speed and check that no abnormalities occur due to a delay in timing.

(d) Run the program for one operation cycle in continuous operation at the normal operating speed and check that the system operates automatically without trouble.
(e) After checking the completeness of the program through the test operation above, execute it in the automatic operation.

(8) While operating the system in the automatic operation, the programmer should leave the safety fence.

3.3 SAFETY OF THE MAINTENANCE ENGINEER

For the safety of maintenance engineer personnel, pay utmost attention to the following.

(1) During operation, never enter the robot operating space.
(2) A hazardous situation may arise when the robot or the system, are kept with their power-on during maintenance operations. Therefore, for any maintenance operation, the robot and the system should be put into the power-off state. If necessary, a lock should be in place in order to prevent any other person from turning on the robot and/or the system. In case maintenance needs to be executed in the power-on state, the emergency stop button must be pressed as far as possible.
(3) If it becomes necessary to enter the robot operating space while the power is on, press the emergency stop button on the operator box or operator panel, or the teach pendant before entering the range. The maintenance worker must indicate that maintenance work is in progress and be careful not to allow other people to operate the robot carelessly.
(4) When entering the area enclosed by the safety fence, the worker must check the whole robot system in order to make sure no dangerous situations exist. In case the worker needs to enter the safety area whilst a dangerous situation exists, extreme care must be taken, and whole robot system status must be carefully monitored.
(5) Before the maintenance of the pneumatic system is started, the supply pressure should be shut off and the pressure in the piping should be reduced to zero.
(6) Before the start of maintenance work, check that the robot and its peripheral equipment are all in the normal operating condition.
(7) Do not operate the robot in the automatic operation while anybody is in the robot operating space.
(8) When you maintain the robot alongside a wall or instrument, or when multiple users are working nearby, make certain that their escape path is not obstructed.
(9) When a tool is mounted on the robot, or when any movable device other than the robot is installed, such as belt conveyor, pay careful attention to its motion.
(10) If necessary, have a user who is familiar with the robot system stand beside the operator panel and observe the work being performed. If any danger arises, the user should be ready to press the EMERGENCY STOP button at any time.
(11) When replacing a part, please contact your local FANUC representative. If a wrong procedure is followed, an accident may occur, causing damage to the robot and injury to the user.
(12) When replacing or reinstalling components, take care to prevent foreign material from entering the system.
(13) When handling each unit or printed circuit board in the controller during inspection, turn off the circuit breaker to protect against electric shock.
If there are two cabinets, turn off the both circuit breaker.
(14) A part should be replaced with a part recommended by FANUC. If other parts are used, malfunction or damage would occur. Especially, a fuse that is not recommended by FANUC should not be used. Such a fuse may cause a fire.
(15) When restarting the robot system after completing maintenance work, make sure in advance that there is no person in the operating space and that the robot and the peripheral equipment are not abnormal.
(16) When a motor or brake is removed, the robot arm should be supported with a crane or other equipment beforehand so that the arm would not fall during the removal.
(17) Whenever grease is spilled on the floor, it should be removed as quickly as possible to prevent dangerous falls.

(18) The following parts are heated. If a maintenance user needs to touch such a part in the heated state, the user should wear heat-resistant gloves or use other protective tools.
- Servo motor
- Inside the controller
- Reducer
- Gearbox
- Wrist unit

(19) Maintenance should be done under suitable light. Care must be taken that the light would not cause any danger.
(20) When a motor, reducer, or other heavy load is handled, a crane or other equipment should be used to protect maintenance workers from excessive load. Otherwise, the maintenance workers would be severely injured.
(21) The robot should not be stepped on or climbed up during maintenance. If it is attempted, the robot would be adversely affected. In addition, a misstep can cause injury to the worker.
(22) When performing maintenance work in high place, secure a footstep and wear safety belt.
(23) After the maintenance is completed, spilled oil or water and metal chips should be removed from the floor around the robot and within the safety fence.
(24) When a part is replaced, all bolts and other related components should put back into their original places. A careful check must be given to ensure that no components are missing or left not mounted.
(25) In case robot motion is required during maintenance, the following precautions should be taken :
- Foresee an escape route. And during the maintenance motion itself, monitor continuously the whole robot system so that your escape route will not become blocked by the robot, or by peripheral equipment.
- Always pay attention to potentially dangerous situations, and be prepared to press the emergency stop button whenever necessary.

(26) The robot should be periodically inspected. (Refer to the robot mechanical manual and controller maintenance manual.) A failure to do the periodical inspection can adversely affect the performance or service life of the robot and may cause an accident
(27) After a part is replaced, a test execution should be given for the robot according to a predetermined method. (See TESTING section of “Controller operator’s manual”.) During the test execution, the maintenance worker should work outside the safety fence.

4 SAFETY OF THE TOOLS AND PERIPHERAL EQUIPMENT

4.1 PRECAUTIONS IN PROGRAMMING

(1) Use a limit switch or other sensor to detect a dangerous condition and, if necessary, design the program to stop the robot when the sensor signal is received.
(2) Design the program to stop the robot when an abnormality occurs in any other robots or peripheral equipment, even though the robot itself is normal.
(3) For a system in which the robot and its peripheral equipment are in synchronous motion, particular care must be taken in programming so that they do not interfere with each other.
(4) Provide a suitable interface between the robot and its peripheral equipment so that the robot can detect the states of all devices in the system and can be stopped according to the states.

4.2 PRECAUTIONS FOR MECHANISM

(1) Keep the component cells of the robot system clean, operate the robot where insulated from the influence of oil, water, and dust.

(2) Don't use unconfirmed liquid for cutting fluid and cleaning fluid.
(3) Adopt limit switches or mechanical stoppers to limit the robot motion, and avoid the robot from collisions against peripheral equipment or tools.
(4) Observe the following precautions about the mechanical unit cables. Failure to follow precautions may cause problems.
- Use mechanical unit cable that have required user interface.
- Do not add user cable or hose to inside of the mechanical unit.
- Please do not obstruct the movement of the mechanical unit when cables are added to outside of mechanical unit.
- In the case of the model that a cable is exposed, please do not perform remodeling (Adding a protective cover and fix an outside cable more) obstructing the behavior of the outcrop of the cable.
- When installing user peripheral equipment on the robot mechanical unit, please pay attention that the device does not interfere with the robot itself.

(5) The frequent power-off stop for the robot during operation causes the trouble of the robot. Please avoid the system construction that power-off stop would be operated routinely. (Refer to bad case example.) Please perform power-off stop after reducing the speed of the robot and stopping it by hold stop or cycle stop when it is not urgent. (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type.)
(Bad case example)
- Whenever poor product is generated, a line stops by emergency stop and power-off of the robot is incurred.
- When alteration is necessary, safety switch is operated by opening safety fence and power-off stop is incurred for the robot during operation.
- An operator pushes the emergency stop button frequently, and a line stops.
- An area sensor or a mat switch connected to safety signal operates routinely and power-off stop is incurred for the robot.
- Power-off stop is regularly incurred due to an inappropriate setting for Dual Check Safety (DCS).

(6) Power-off stop of Robot is executed when collision detection alarm (SRVO-050) etc. occurs. Please try to avoid unnecessary power-off stops. It may cause the trouble of the robot, too. So remove the causes of the alarm.

5 SAFETY OF THE ROBOT MECHANICAL UNIT

5.1 PRECAUTIONS IN OPERATION

(1) When operating the robot in the jog mode, set it at an appropriate speed so that the operator can manage the robot in any eventuality.
(2) Before pressing the jog key, be sure you know in advance what motion the robot will perform in the jog mode.

5.2 PRECAUTIONS IN PROGRAMMING

(1) When the operating spaces of robots overlap, make certain that the motions of the robots do not interfere with each other.
(2) Be sure to specify the predetermined work origin in a motion program for the robot and program the motion so that it starts from the origin and terminates at the origin. Make it possible for the operator to easily distinguish at a glance that the robot motion has terminated.

5.3 PRECAUTIONS FOR MECHANISMS

(1) Keep the robot operation area clean, and operate the robot in an environment free of grease, water, and dust.

5.4 PROCEDURE TO MOVE ARM WITHOUT DRIVE POWER IN EMERGENCY OR ABNORMAL SITUATIONS

For emergency or abnormal situations (e.g. persons trapped in or pinched by the robot), brake release unit can be used to move the robot axes without drive power.
Please refer to controller maintenance manual and mechanical unit operator's manual for using method of brake release unit and method of supporting robot.

6 SAFETY OF THE END EFFECTOR

6.1 PRECAUTIONS IN PROGRAMMING

(1) To control the pneumatic, hydraulic and electric actuators, carefully consider the necessary time delay after issuing each control command up to actual motion and ensure safe control.
(2) Provide the end effector with a limit switch, and control the robot system by monitoring the state of the end effector.

7 STOP TYPE OF ROBOT (R-30*i*B, R-30*i*B Mate)

There are following four types of Stopping Robot.

Power-Off Stop (Category 0 following IEC 60204-1)

Servo power is turned off, and the robot stops immediately. Servo power is turned off when the robot is moving, and the motion path of the deceleration is uncontrolled.
"**Power-Off stop**" performs following processing.

- An alarm is generated, and then the servo power turns off. Instantly the robot stops.
- Execution of the program is paused.

Frequent Power-Off stop of the robot during operation can cause mechanical problems of the robot.
Avoid system designs that require routine or frequent Power-Off stop conditions.

Controlled stop (Category 1 following IEC 60204-1)

The robot is decelerated until it stops, and servo power is turned off.
"**Controlled stop**" performs following processing.

- The alarm "**SRVO-199 Controlled stop**" occurs along with a decelerated stop. The program execution is paused.
- An alarm is generated, and then the servo power turns off.

Smooth stop (Category 1 following IEC 60204-1)

The robot is decelerated until it stops, and servo power is turned off.
"**Smooth stop**" performs following processing.

- The alarm "**SRVO-289 Smooth Stop**" occurs along with a decelerated stop. The program execution is paused.
- An alarm is generated, and then the servo power turns off.
- In Smooth stop, the robot decelerates until it stops with the deceleration time shorter than Controlled stop.

Hold (Category 2 following IEC 60204-1)

The robot is decelerated until it stops, and servo power remains on.
"**Hold**" performs following processing.

- The robot operation is decelerated until it stops. Execution of the program is paused.

⚠ WARNING

1 The stopping distance and time of Controlled stop and Smooth stop are longer than those of Power-Off stop. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time is necessary when Controlled stop or Smooth Stop is used. Please refer to the operator's manual of a particular robot model for the data of stopping distance and time.
2 In multi arm system, the longest stopping distance and time of Controlled Stop or Smooth Stop among each robot are adopted as those for the system. A risk assessment for the whole robot system which takes into consideration a possibility that the stopping distance and time increase, is necessary on the multi arm system.
3 In the system which has extended axis, the longer stopping distance and time of Controlled Stop or Smooth Stop among robot and extended axis are adopted as those for the system. A risk assessment for the whole robot system which takes into consideration a possibility that the stopping distance and time increase, is necessary on the system which has extended axis. Please refer to the extended axis setup procedure of the controller operator's manual for considering the stopping distance and time of the extended axis.
4 When Smooth stop occurs during deceleration by Controlled stop, the stop type of robot is changed to Power-Off Stop.
When Smooth stop occurs during deceleration by Hold, the stop type of robot is changed to Power-Off Stop.
5 In case of Controlled stop or Smooth Stop, motor power shutdown is delayed for a maximum of 2 seconds. In this case, a risk assessment for the whole robot system is necessary, including the 2 seconds delay.

When the emergency stop button is pressed or the FENCE is open, the stop type of robot is Power-Off stop, Controlled stop, or Smooth stop. The configuration of stop type for each situation is called *stop pattern*. The stop pattern is different according to the option configuration.

There are the following 3 Stop patterns.

Stop pattern	Mode	Emergency stop button	External Emergency stop	FENCE open	SVOFF input	Deadman switch (*)
A	AUTO	P-Stop	P-Stop	C-Stop	C-Stop	-
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop
C	AUTO	C-Stop	C-Stop	C-Stop	C-Stop	-
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop
D	AUTO	S-Stop	S-Stop	C-Stop	C-Stop	-
	T1	S-Stop	S-Stop	-	C-Stop	S-Stop
	T2	S-Stop	S-Stop	-	C-Stop	S-Stop

P-Stop: Power-Off stop
C-Stop: Controlled stop
S-Stop: Smooth stop
-: Disable
(*) The stop pattern of NTED input is same as Deadman switch.

The following table indicates the Stop pattern according to the controller type or option configuration.

Option	R-30*i*B/ R-30*i*B Mate
Standard	A(**)
Controlled stop by E-Stop (A05B-2600-J570)	C(**)
Smooth E-Stop (A05B-2600-J651)	D(**)

(**)R-30*i*B Mate does not have SVOFF input.

The stop pattern of the controller is displayed in "Stop pattern" line in software version screen. Please refer to "Software version" in operator's manual of controller for the detail of software version screen.

"Controlled stop by E-Stop" option

When "**Controlled stop by E-Stop**" (A05B-2600-J570) option is specified, the stop type of the following alarms become Controlled stop but only in AUTO mode. In T1 or T2 mode, the stop type is Power-Off stop which is the normal operation of the system.

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.

Controlled stop is different from **Power-Off stop** as follows:

- In Controlled stop, the robot is stopped on the program path. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path.
- In Controlled stop, physical impact is less than Power-Off stop. This function is effective for systems where the physical impact to the mechanical unit or EOAT (End Of Arm Tool) should be minimized.
- The stopping distance and time of Controlled stop is longer than those of Power-Off stop, depending on the robot model and axis.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

> **⚠ WARNING**
> The stopping distance and time of Controlled stop are longer than those of Power-Off stop. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time, is necessary when this option is loaded.

"Smooth E-Stop Function" option

When "**Smooth E-Stop Function**" (A05B-2600-J651) option is specified, the stop type of the following alarms becomes Smooth stop in all operation modes (AUTO, T1 and T2 mode).

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-003 Deadman switch released	Both deadman switches on Teach pendant are released.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-037 IMSTP input (Group: %d)	IMSTP input (*IMSTP signal for a peripheral device interface) is OFF.
SRVO-232 NTED input	NTED input (NTED1-NTED11, NTED2-NTED21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.
SRVO-410 DCS SSO NTED input	In DCS Safe I/O connect function, SSO[5] is OFF.
SRVO-419 DCS PROFIsafe comm. error	PROFINET Safety communication error occurs.

Smooth stop is different from **Power-Off stop** as follows:

- In Smooth stop, the robot is stopped along the program path. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path.
- In Smooth stop, physical impact is less than Power-Off stop. This function is effective for systems where the physical impact to the mechanical unit or EOAT (End Of Arm Tool) should be minimized.
- The stopping distance and time of Smooth stop is longer than those of Power-Off stop, depending on the robot model and axis.

Smooth stop is different from **Controlled stop** as follows:

- The stopping distance and time of Smooth stop is normally shorter than those of Controlled stop, depending on the robot model and axis.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

> **⚠ WARNING**
> The stopping distance and time of Smooth stop are longer than those of Power-Off stop. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time, is necessary when this option is loaded.

8 STOP TYPE OF ROBOT (R-30*i*B Plus, R-30*i*B Mate Plus)

There are following three types of Stop Category.

Stop Category 0 following IEC 60204-1 (Power-off Stop)

Servo power is turned off, and the robot stops immediately. Servo power is turned off when the robot is moving, and the motion path of the deceleration is uncontrolled.

"**Stop Category 0**" performs following processing.

- An alarm is generated, and then the servo power turns off. Instantly the robot stops.
- Execution of the program is paused.

Frequent Category 0 Stop of the robot during operation can cause mechanical problems of the robot.
Avoid system designs that require routine or frequent Category 0 Stop conditions.

Stop Category 1 following IEC 60204-1 (Controlled Stop, Smooth Stop)

The robot is decelerated until it stops, and servo power is turned off.

"**Stop Category 1**" performs following processing.

- The alarm "**SRVO-199 Controlled stop**" or "**SRVO-289 Smooth Stop**" occurs along with a decelerated stop. The program execution is paused.
- An alarm is generated, and then the servo power turns off.

In Smooth stop, the robot decelerates until it stops with the deceleration time shorter than Controlled stop.
The stop type of Stop Category 1 is different according to the robot model or option configuration. Please refer to the operator's manual of a particular robot model.

Stop Category 2 following IEC 60204-1 (Hold)

The robot is decelerated until it stops, and servo power remains on.

"**Stop Category 2**" performs following processing.

- The robot operation is decelerated until it stops. Execution of the program is paused.

⚠ WARNING

1 The stopping distance and time of Stop Category 1 are longer than those of Stop Category 0. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time is necessary when Stop Category 1 is used. Please refer to the operator's manual of a particular robot model for the data of stopping distance and time.
2 In multi arm system, the longest stopping distance and time of Stop Category 1 among each robot are adopted as those for the system. A risk assessment for the whole robot system which takes into consideration a possibility that the stopping distance and time increase, is necessary on the multi arm system.
3 In the system which has extended axis, the longer stopping distance and time of Stop Category 1 among robot and extended axis are adopted as those for the system. A risk assessment for the whole robot system which takes into consideration a possibility that the stopping distance and time increase, is necessary on the system which has extended axis. Please refer to the extended axis setup procedure of the controller operator's manual for considering the stopping distance and time of the extended axis.
4 When Stop Category 1 occurs during deceleration by Stop Category 2, the stop type of robot is changed to Stop Category 0.
5 In case of Stop Category 1, motor power shutdown is delayed for a maximum of 2 seconds. In this case, a risk assessment for the whole robot system is necessary, including the 2 seconds delay.

When the emergency stop button is pressed or the FENCE is open, the stop type of robot is Stop Category 0 or Stop Category 1. The configuration of stop type for each situation is called *stop pattern*. The stop pattern is different according to the option configuration.

There are the following 3 Stop patterns.

Stop pattern	Mode	Emergency stop button	External Emergency stop	FENCE open	SVOFF input	Deadman switch (*)
A	AUTO	Category 0	Category 0	Category 1	Category 1	-
	T1	Category 0	Category 0	-	Category 1	Category 0
	T2	Category 0	Category 0	-	Category 1	Category 0
C	AUTO	Category 1	Category 1	Category 1	Category 1	-
	T1	Category 0	Category 0	-	Category 1	Category 0
	T2	Category 0	Category 0	-	Category 1	Category 0
D	AUTO	Category 1	Category 1	Category 1	Category 1	-
	T1	Category 1	Category 1	-	Category 1	Category 1
	T2	Category 1	Category 1	-	Category 1	Category 1

Category 0: Stop Category 0
Category 1: Stop Category 1
-: Disable

(*) The stop pattern of NTED input is same as Deadman switch.

The following table indicates the Stop pattern according to the controller type or option configuration. The case R651 is specified.

Option	R-30*i*B Plus/ R-30*i*B Mate Plus
Standard	C(**)
Old Stop Function (A05B-2670-J680)	A(**)
All Smooth Stop Function (A05B-2670-J651)	D(**)

The case R650 is specified.

Option	R-30*i*B Plus/ R-30*i*B Mate Plus
Standard	A(**)
Stop Category 1 by E-Stop (A05B-2670-J521)	C(**)
All Smooth Stop Function (A05B-2670-J651)	D(**)

(**)R-30*i*B Mate Plus does not have SVOFF input.

The stop pattern of the controller is displayed in "Stop pattern" line in software version screen. Please refer to "Software version" in operator's manual of controller for the detail of software version screen.

"Old Stop Function" option

When "**Old Stop Function**" (A05B-2670-J680) option is specified, the stop type of the following alarms becomes Stop Category 0 in AUTO mode.

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.

Stop Category 0 is different from **Stop Category 1** as follows:

- In Stop Category 0, servo power is turned off, and the robot stops immediately. Servo power is turned off when the robot is moving, and the motion path of the deceleration is uncontrolled.
- The stopping distance and time of Stop Category 0 is shorter than those of Stop Category 1, depending on the robot model and axis.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

"All Smooth Stop Function" option

When "**All Smooth Stop Function**" (A05B-2670-J651) option is specified, the stop type of the following alarms becomes Stop Category 1 in all operation modes (AUTO, T1 and T2 mode).

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-003 Deadman switch released	Both deadman switches on Teach pendant are released.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-037 IMSTP input (Group: %d)	IMSTP input (*IMSTP signal for a peripheral device interface) is ON.
SRVO-232 NTED input	NTED input (NTED1-NTED11, NTED2-NTED21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.
SRVO-410 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[5] is OFF.
SRVO-419 DCS PROFIsafe comm. error	PROFINET Safety communication error occurs.

Stop Category 1 is different from **Stop Category 0** as follows:

- In Stop Category 1, the robot is stopped along the program path. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path.

- In Stop Category 1, physical impact is less than Stop Category 0. This function is effective for systems where the physical impact to the mechanical unit or EOAT (End of Arm Tool) should be minimized.
- The stopping distance and time of Stop Category 1 is longer than those of Stop Category 0, depending on the robot model and axis.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

> ⚠ **WARNING**
> The stopping distance and time of Stop Category 1 are longer than those of Stop Category 0. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time, is necessary when this option is loaded.

"Stop Category 1 by E-Stop" option

When "**Stop Category 1 by E-Stop**" (A05B-2670-J521) option is specified, the stop type of the following alarms become Category 1 Stop but only in AUTO mode. In T1 or T2 mode, the stop type is Category 0 Stop which is the normal operation of the system.

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator panel emergency stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.

Stop Category 1 is different from **Stop Category 0** as follows:

- In Stop Category 1, the robot is stopped along the program path. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path.
- In Stop Category 1, physical impact is less than Stop Category 0. This function is effective for systems where the physical impact to the mechanical unit or EOAT (End of Arm Tool) should be minimized.
- The stopping distance and time of Stop Category 1 is longer than those of Stop Category 0, depending on the robot model and axis.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option.

> ⚠ **WARNING**
> The stopping distance and time of Stop Category 1 are longer than those of Stop Category 0. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping time, is necessary when this option is loaded.

170406

TABLE OF CONTENTS

1 SPECIFICATION

Item	Description
Type	Intelligent device station
Transfer speed (Baudrate)	1Gbps fixed
Max number of CC-Link IE communication board for 1 robot controller	1
Max number of link points	Sum of RX (DO), remote register RWr (AO and R[*]) and system area are 256 words in all.* Sum of RY (DI), remote register RWw (AI and R[*]) and system area are 256 words in all.*

*** About max number of link points**

1 1 AI/O and 1 register uses 1 word (2 byte).

2 Sending or receiving size is up to 256 words, but "AI/O + register" is counted by round up to 4 word unit when counting max number of link points.
For example if "Number of AOs" is 5 and "Number of register" in RWr is 2, 5 + 2 = 7 is round up to 8. 8 [words] is used to count the max number of link points. 8 should be set to RWr in master.

3 Minimum size of RWr/RWw is 4 words. For example, if "Number of AOs", "Number of Registers" in RWr, "Number of AIs", "Number of Registers" in RWw are set to 0, communication parameter RWr and RWw are set to 4 words in background. 4 should be set in master. Even when 4 is set in master, if "Number of AOs", "Number of Registers" in RWr, "Number of AIs", "Number of Registers" in RWw are set to 0, AI/O and registers aren't assigned to CC-Link IE. In this case, 4 words are used to count the max number of link points.
By same reason, default value for "Number of AOs", "Number of Registers" in RWr, "Number of AIs", "Number of Registers" in RWw are 0, but RWr/RWw size is 4 in CSP+ file.

4 If RX and RY assign word number are different, larger size is adopted to both sizes. The same is true when RWr and RWw sizes are different.
For example, if "RX assign word number" is set to 2 and "RY assign word number" is set to 4, RX and RY size is used as 4. But DO is assigned only 2 word.

5 Existence of system area, which is in first 1 word (16 points) of RX and RY, is selectable by $CCIE.$SYSTEM_AREA. If $CCIE.$SYSTEM_AREA is 1, system area exists, if 0 , not exists. This system area isn't assigned to DI/DO but master or local station can see system area. The way of using this system area is fixed. User can't use this area freely. If system area exists, use from 17th point, which excludes first 16 points, in master assigned point for normal use. 17th point in master is assigned to RACK 105, SLOT 1, START 1.

6 Only Remote Ready, which is RX 12th point (Bit 11), is supported in system area. But pay attention to even when Remote Ready become ON, robot may not be READY state. This becomes ON when CC-Link IE Field slave function become READY state. Remote Ready doesn't become OFF even when error happens in robot. See UOP if necessary.

7 Set parameter which is added 16 points in system area for points in master RX/RY setting. In other words, following expression is adopted.
Points in RX/RY setting in master = MAX("RX assign word number", "RY assign word number") X 16 + 16 [points](If system area exists.)

- "CC-Link IE Field Slave (A05B-*-J779)" and “CC-Link IE Field Slave board (A05B-*-J111)” must be ordered to use this function.
  R-30*i*B Mate and R-30iB Mate Plus, other than both of open air type isn’t supported because board can’t be inserted.

- The value used in analog input and output AI/O, which is assigned to remote register, is always 16bit unsigned integer (0~65535(0x0000~0xFFFF)).

- The valid value using for register (R[*]) which is assigned for remote register is 16 bit unsigned integer (0~65535) or 16 bit signed integer (-32768~32767).
  If you want to send the value larger than 65535, you should use 2 register.
  Concretely, for example, set integral part of the value, which is divided by 65536 from sent value, to R[2], set the odd to R[1], and send both register by CC-Link IE.

  Example of TP program (When you want to send R[100])
  R[1] = R[100] MOD 65536
  (Pay attention R[100] isn't changed at here.)
  R[2] = R[100] DIV 65536

  When you want to receive the value larger than 65535, convert the value received by 2 register.

  Example of TP program (When you convert received data by R[1] and R[2] to R[100])
  R[100] = R[2] *65536 + R[1] (Pay attention R[1] and R[2] are not changed during running this line.)

  You can send value less than signed 16 bit value or real number by similar way.

- RWr/RWw are placed Analog I/O -> Register order.

- Register update may delay than I/O.
  Pay attention even when I/O is changed later than register change, I/O may be changed before register changing at receiving side.
  If register update and I/O update should be synchronized, use group I/O instead of register, just before the flag DI/O. ("before" at here means relation to the area specified in I/O assignment screen of START, not before of DI/O index.)
  Analog I/O is synchronized than register but analog I/O update may delay than DI/O update.
  Or regard invalid data when register is 0 etc., read after register value is changed (after valid value).

- Irregular communication which can communicate data at communication requirement (transient transmission) is unsupported.

- CSP+ file for robot is prepared, but without CSP+ file, master can be set. Benefits for using CSP+ file for setting is only R-30*i*B is displayed in master setting screen and icon become robot image.
  By 7DC3/18 or later, CSP+ file can be saved to selected device by FILE screen -> F4 [BACKUP] -> "Com. Conf.".

- Application running status (CPU RUN status) is unsupported.

2 SETTING

2.1 SETUP SCREEN

You can display following SETUP SCREEN by MENU key -> 6 SETUP -> F1 key [TYPE] -> CC-Link IE F.

```
SETUP CC-Link IE Field
  Intelligent Device Station          1/12
    1 Error one shot        :DISABLE
    2 Network No.           :    1
    3 Node No.              :    1
    4 RX assign word number:    8
    5 RY assign word number:    8
      RWr
    6   Number of AOs       :    0
    7   Number of Registers:    0
    8   Reg start index     :    1
      RWw
    9   Number of AIs       :    0
   10   Number of Registers:    0
   11   Reg start index     :    1
   12   Reg data            :[Unsigned Int]

    [TYPE]                                  >
```

Item	Description
Error one shot Default: DISABLE	ENABLE: When "PRIO-702 CC-IE off line" happens, error can be reset regardless link state. This is used when robot should be moved with link error. DISABLE: When "PRIO-702 CC-IE off line" is happened, alarm can't be reset until online. ATTENTION）When ENABLE, robot may move with off line. This should be DISABLE normally. This setting takes effect without COLD or HOT START.
Network No.	1 ~ 239 (Default：1)
Node No.	1 ~ 120 (Default : 1) Set DIP switch 1~7 on board to ON if this setting sets node number. See 8.3 Configuration Switches.
RX assign word number Setting range: 0~128 Default:32	Set word size assigned to DO. 1 word = 16 points. This setting doesn't include system area. For points in master RX/RY setting, set MAX(this setting, RY assign word number) x 16 + 16 [points] (if system area exists).
RY assign word number Setting range: 0~128 Default:32	Set word size assigned to DI. 1 word = 16 points. This setting doesn't include system area. For points in master RX/RY setting, set MAX(this setting, RX assign word number) x 16 + 16 [points] (if system area exists).
RWr	By following settings, analog output AO and register (R[*]) are assigned to remote register RWr. For master, wrap up to 4 multiple from larger size (Number of AOs + Number of Registers in RWr) or (Number of AIs + Number of Registers in RWw).
Number of AOs Setting range: 0~252 Default:0	Set assigned number of AO. See aforementioned RWr.

Item	Description
Number of Registers Setting range: 0~252 Default:0	Set assigned number of register (R[*]). See aforementioned RWr.
Reg start index Setting range: 1~5000 Default:1	Register (R[*]) first number assigned for RWr. Example) When "Number of Registers" is 2 and "Reg start index" is 1, R[1],R[2] are assigned to RWr. ATTENTION) Set existing register number.
RWw	By following settings, analog input AI and register (R[*]) are assigned to remote register RWw. For master, wrap up to 4 multiple from larger size (Number of AOs + Number of Registers in RWr) or (Number of AIs + Number of Registers in RWw).
Number of AIs Setting range: 0~252 Default:0	Set assigned number of AI. See aforementioned RWw.
Number of Registers Setting range: 0~252 Default:0	Set assigned number of register (R[*]). See aforementioned RWw.
Reg start index Setting range: 1~5000 Default:1	Register (R[*]) first number assigned for RWw. Example) When "Number of Registers" is 2 and "Reg start index" is 5, R[5],R[6] is assigned to RWw. ATTENTION) Set existing register number.
Reg data Setting range: Unsigned Int or Signed Int Default: Unsigned Int	When robot receiving remote register RWw is assigned to register (R[*]), set Unsigned Int (0 - 65535) or Signed Integer(-32768 - 32767) to decide how to treat bit data. ATTENTION) 1. This setting doesn't affect to RWr, which is robot sending register. Accommodate the range of sending register and this setting. When not accommodating, data can't communicate correctly. 2. RWr and RWw assigned to analog input and output (AI/O) are always treated as unsigned integer.

2.2 SETTING DETAIL

- In DI/O and AI/O CONFIG screen, Rack No. for this function is 105. Slot No. should be always 1.
- If $CCIE.$SYSTEMAREA is set to 0, system area, which is first 1 word (16points) in RX and RY, vanished. If $CCIE.$SYSTEMAREA is set to 1, system area exists. Changes are take effect after restart.
- If you want to use more DI/O than default, you can get more DI/O by changing $MAX_DIG_PRT to the number of DI/O. You must perform a COLD or HOT START for the change to take effect.
- After changing master or robot settings, both master and robot may have to be powered off and re-power. In this case, existence of all node power is OFF timing is important.
- Before changing setting of assignment or size, following I/O assignments clear operation may necessary. Try if it doesn't work out after setting changing, or try wherever possible.
  In CC-Link IE Field setup screen, press [NEXT] key and [F1] CLR_ASG, "Clear ALL I/O assignments?" is displayed and press [F4] "YES" then all I/O assignments are cleared.
- Settings in this screen are saved to "CCIEDEF.SV". Even when "Setup data saved to CCIEDEF.SV" is displayed, if device is write protected, setup data doesn't saved to CCIEDEF.SV. So please check the device isn't protected writing.

3 STATUS SCREEN

3.1 STATUS SCREEN

You can display following STATUS SCREEN by MENU key -> 0 -- NEXT -- -> 4 STATUS -> F1 key [TYPE] -> CC-Link IE F.

```
STATUS CC-Link IE Field
  1 Node Number:       1
  2 Network Number:    1

   Current Cyclic Size
  3 Ry  size:     256 byte
  4 RWw size:     256 byte
  5 Rx  size:     256 byte
  6 RWr size:     256 byte

   Cyclic Word Offset
  7 RWw offset:   256 byte
  8 RWr offset:   256 byte

   Cyclic Communication Status
  9 Cyclic communication Parameter Stat:
      Received parameter is valid
 10 Cyclic communication parameter check
      Check completed
 11 Node number setting:
      valid
 12 Reserved node setting:
      Not set as reserved node
 13 Cyclic operation setting(group):
      Cyclic operation
 14 Cyclic operation setting(individual
      Cyclic operation
 15 Cyclic communication continuation:
      No error
 16 Node number duplication:
     No duplication
 17 Node type error: No error
 18 Connection status: Normal
 19 Other communication stop:
      Normal communication

 20 Port1 State: Link up
 21 Port2 State: Link up
 22 Master Application operating status:
      Run
 23 Master Application error status:
      No error
 24 Master Application error code:
      0x00000100
   Master Action Cmd
   Cyclic stop order
 25 node number out of range:    0
 26 reserved node setting:       0
 27 master station's order:      0
 28 node number out duplicated:  0
 29 Illegal node type (node type
    assigned by master station does not
    match the actual node type): 0
 30 Illegal assigned data size (the
    data size for the cyclic
    communication, that is assigned by
    the master station, is bigger than
    the maximum data size from the node)
      0
```

```
  Current Parameter Size
31 Out parameter size:         0
32 In  parameter size:         0

  Parameter Offset
33 Out parameter offset:      512
34 In  parameter offset:      512

35 Mac Address: 00:11:22:33:44:55:66
36 DIP switch:  0x7f

[ TYPE ]          [OTHER ]  UPDATE
```

From F3 OTHER, other screen can be displayed.
By pressing F4 UPDATE, screen is updated.

Followings are the possible value.

Item	Possible value
Node Number	1 ~ 120
Network Number	1 ~ 239
Ry size	2 ~ 256
RWw size	4 ~ 252
Rx size	2 ~ 256
RWr size	4 ~ 252
RWw offset	2 ~ 256
RWr offset	2 ~ 256
Cyclic communication Parameter Stat	● Received parameter is valid ● no parameter available or wrong ID ● Now checking parameter ● Received parameter is invalid ● Off line
Cyclic communication parameter check	● Check completed ● Now checking
Node number setting	● Valid ● Not valid(out of range)
Reserved node setting	● Not set as reserved node ● Set as reserved node
Cyclic operation setting(group)	● Cyclic operation ● Stop
Cyclic operation setting(individual)	● Cyclic operation ● Stop
Cyclic communication continuation	● No error ● Error occurred
Node number duplication	● No duplication ● Node number duplicated
Node type error	● No error ● Error occurred
Connection status	● Normal ● Disconnected
Other communication stop	● Normal communication ● Cyclic communication stop due to other reason than mentioned above
Port1 State	● Link down ● Link up

Item	Possible value
Port2 State	● Link down ● Link up
Master Application operating status	● Stop ● Run
Master Application error status	● No error ● Error occurred
Master Application error code	● No error or no valid MyStatus from the master ● 0x00000000 ~ 0xffffffff
node number out of range	0 or 1
reserved node setting	0 or 1
master station's order	0 or 1
node number out duplicated	0 or 1
Illegal node type (node type assigned by master station does not match the actual node type)	0 or 1
Illegal assigned data size (the data size for the cyclic communication, that is assigned by the master station, is bigger than the maximum data size from the node)	0 or 1
Out parameter size	0
In parameter size	0
Out parameter offset	6 ~ 512
In parameter offset	6 ~ 512
Mac Address	00:30:11:00:00:00 ~ 00:30:11:ff:ff:ff
DIP switch	0x00 ~ 0xff

3.2 RUNTIME STATUS SCREEN

From aforementioned STATUS SCREEN, pressing F3 and select RUNTIME displays following RUNTIME STATUS SCREEN.
This screen is supported from 7DC3.
In the following screen, port 2 data can be displayed by changing 1 to 2 in “4 Following data is for port 1”.

```
RUNTIME STATUS CC-Link IE F
                                  1/24
  TX/RX counter information
1 Received cycle frame counter :
                                    0
2 Received transient frame counter :
                                    0
3 Received transient frame
  reject/discard counter :
                                    0

4 Following data is for port 1

 MAC port counter information
5 Received frame counter :
                                    0
6 Sent frame counter :
                                    0
```

```
 7 Received undersized frame counter :
                                    0
 8 Received oversized frame counter :
                                    0
 9 Received frame with FCS error
   counter :
                                    0
10 Received frame with erroneous
   fragment counter :
                                    0
11 Detected illegal inter-frame gap
   (IFG) counter :
                                    0
12 Detected illegal start-of-frame
   delimiter (SFD) counter :
                                    0
13 Received code error counter :
                                    0
14 Received False Carrier error
   counter :
                                    0
15 Received Carrier Extended error
   counter :
                                    0


  Ring controller counter
16 Frame with HEC error counter :
                                    0
17 Frame with DCS/FCS error counter :
                                    0
18 Undersized frame counter :
                                    0
19 Repeated frame counter :
                                    0
20 Upper forwarding frame counter :
                                    0
21 Repeated buffer full discard
   counter :
                                    0
22 Upward buffer full discard counter :
                                    0
23 Link down counter :
                                    0


[ TYPE ]      [OTHER ]  UPDATE   CLEAR
```

By pressing [F3]"[OTHER]", you can display other screen.

By pressing [F4]"UPDATE", screen data are updated.

By pressing [F5]"CLEAR", screen data are cleared.

4 SYSTEM VARIABLES

In this chapter, when nothing is described, changes are take effect after restart.

$MAX_DIG_PRT
The number of DI/O.

4.1 SYSTEM VARIABLES UNDER $CCIE

$ASGUOP default 1
BIT0 (1)
0: RX, RY aren't auto assigned to UOP automatically.
1: RX, RY are auto assigned to UOP automatically.

BIT7 (128) (from 7DC2/17, 7DC3/03)
If this value is 0, hardware check is performed. If this value is 1(128), hardware check is not performed.

$AUTO_REGCHG default 0
0: When register, which is assigned to RWr, is set to real number which contains decimal part, alarm "PRIO-703 CC-IE R[%d] data invalid" is happen.
1: When register, which is assigned to RWr, is set to the real number, which is larger than -32769 and smaller than 65536, sending data are cutting off the decimal part.

$REG_ER_WARN default 0

You don't have to cycle power for the change to take effect.
0: When register, which is assigned to RWr, is set to the number smaller than -32768 or larger than 65535, alarm "PRIO-703 CC-IE R[%d] data invalid" is happen with severity STOP.G.
1: In the aforementioned case, "PRIO-703 CC-IE R[%d] data invalid" is happen with severity WARN.

$WARNINGENB default 1
0: "CC-IE Board not installed" isn't happen. When $CCIE.$REG_ER_WARN is 1, " PRIO-703 CC-IE R[%d] data invalid" isn't happen. Pay attention to "PRIO-704 CC-IE I/O data size is changed", whose severity is WARN, is happen.
1: Aforementioned warnings happen.

$OP_MODE default 0
This variable decides the data when offline.
0: All input data is cleared.
2: All input data is keep as current value.
4: All input data is set to ON or 0xffff (65535 or -32768).

$CYC_STPMODE default 0
This defines how the module should handle OUT cyclic data when the network master shifts operation mode from RUN to STOP when there is still a LINK. This also defines how the module should handle this data if the master station is in ERROR state.

0: Out area cleared (OFF or 0).

1: Out area freezed (hold)

2: Out area set (ON or 0xffff (65535 or -32768))
$SCAN_TIME_R default 4(8ms)

Scan Time for register. Unit is 2ms.

$SCAN_TIME default 4(8ms)
Interval time for scan during CC-Link IE Field intelligent device station board and DI/O, AI/O, register exchanging task. Unit is 2ms.

$SYSTEM_AREA default 1
If 0, system area, which is first 1 word (16points) in RX and RY, vanished.
If 1, system area exists.

$DEAD_BAND default 30000 (60seconds)
During this time from specific timing in startup, "PRIO-702 CC-IE off line" doesn't happen. Unit is 2ms.

5 ALARM

PRIO-700 WARN CC-IE Board not installed

Cause: No CC-Link IE PCB is installed.

Remedy: Install CC-Link IE PCB.

PRIO-701 STOP.G CC-IE Sys err (%d,%xh)

Cause: Internal system error occurred.

Remedy: When size is changed in master, this alarm may happen. Cycle power the controller. If this alarm happens even after cycle power, contact your local FANUC service representative. The ID number in the brackets is required to track the problem.

PRIO-702 STOP.G CC-IE off line

Cause: CC-Link IE became off line.

Remedy: Check CC-Link IE settings and cable. If you changed RX, RY, RWr, RWw size to larger in master, robot setting should be changed to the larger size and robot should be cycling power.

PRIO-703 STOP.G CC-IE R[%d] data invalid

Cause: A outlying numerical value is set to a remote register.

Remedy: Reset, this alarm is only 1 shot. If register is changed, judgement for this alarm is done again. CC-Link IE function of robot supports unsigned or signed 16bits word data. Do not enter another type of value to remote register. You can send float value, which is larger than -32769 and smaller than 65536, if $CCIE.$AUTO_REGCHG is set to 1. The value are sent with integer by cutting off the floating part. Severity of this alarm can be changed to warning if $CCIE.$REG_ER_WARN is set to 1.

PRIO-704 WARN CC-IE I/O data size is changed

Cause: Cyclic data size has been reduced by the master.

Remedy: Only notification for user.

6 INSTALLATION

This chapter provides information required for installation of the CC-Link IE Field slave board.

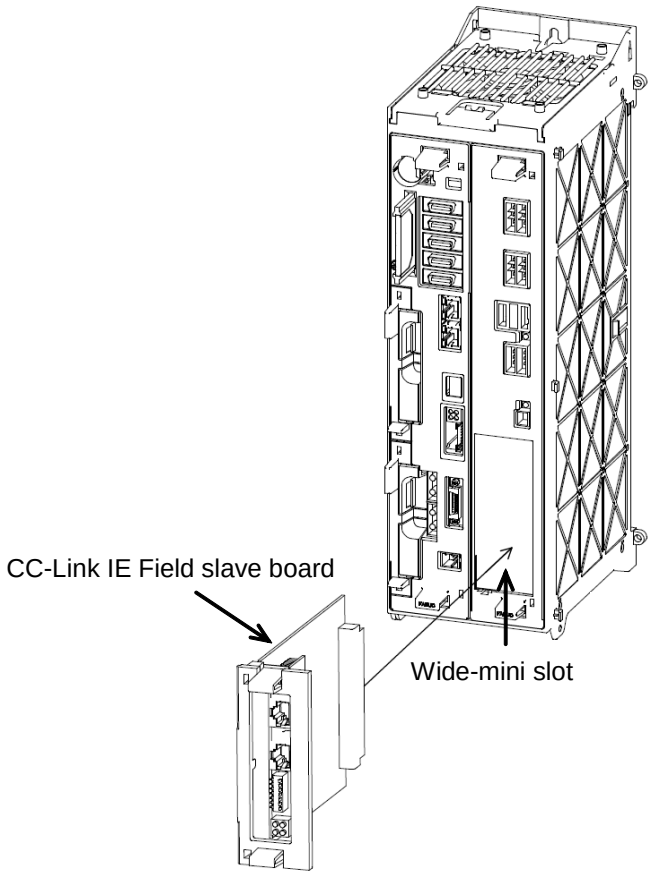
6.1 SPECIFICATIONS

The specifications of the CC-Link IE Field slave board are described below.

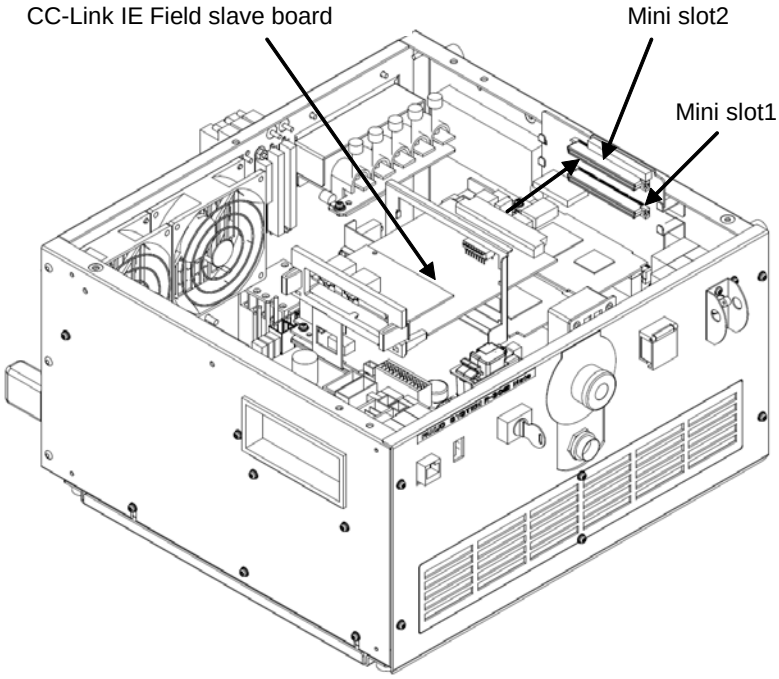
Name	CC-Link IE Field slave board
Ordering code	A05B-*-J111(R-30*i*B, R-30*i*B Mate Open Air, R-30*i*B Plus)
Board drawing number	A20B-8101-0920

6.2 INSTALLATION

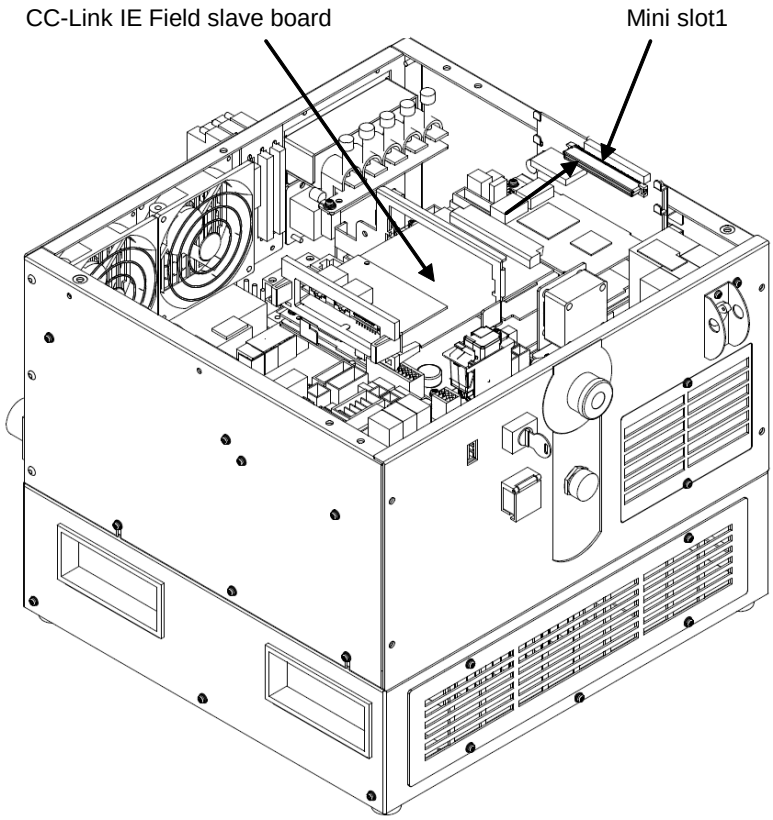
This section describes information about the installation of the CC-Link IE Field slave board.
In the R-30*i*B/R-30*i*B Plus controller, a CC-Link IE Field slave board can be installed to an option slot like the figure below.



In the R-30*i*B Mate Open Air controller (Small size), (1) CC-Link IE Field slave board can be installed to Mini slot2 like the figure below.



In the R-30*i*B Mate Open Air controller (Large size), (1) CC-Link IE Field slave board can be installed to Mini slot1 like the figure below.

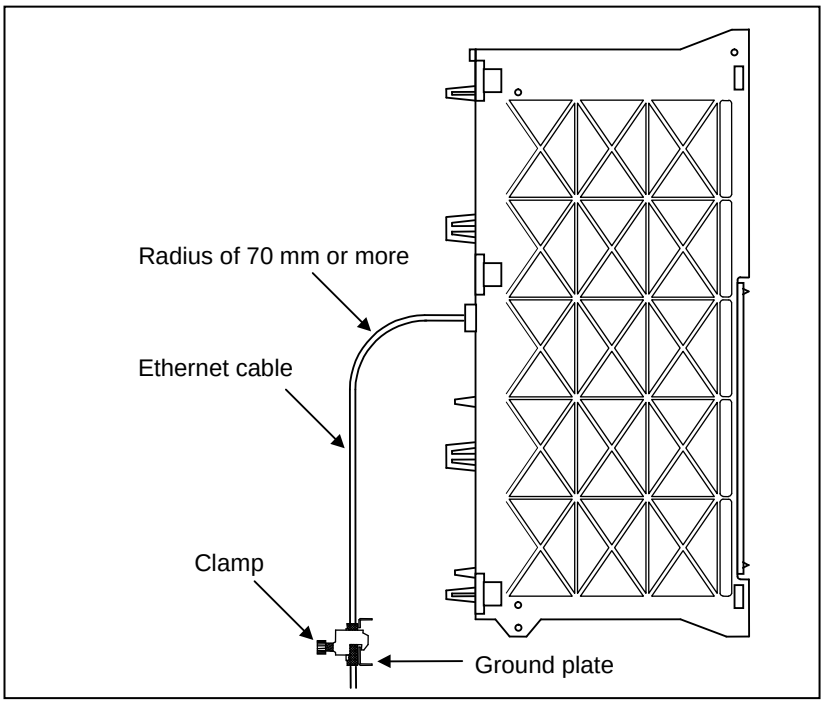


7 CONNECTION OF THE COMMUNICATION FUNCTION

This chapter provides information required for Ethernet connection of the CC-Link IE Field slave board.

7.1 ROUTING OF THE ETHERNET CABLE

The Ethernet cable can be routed only from the front of the control unit.
For connector location information, see the layout of components of CC-Link IE Field slave board.



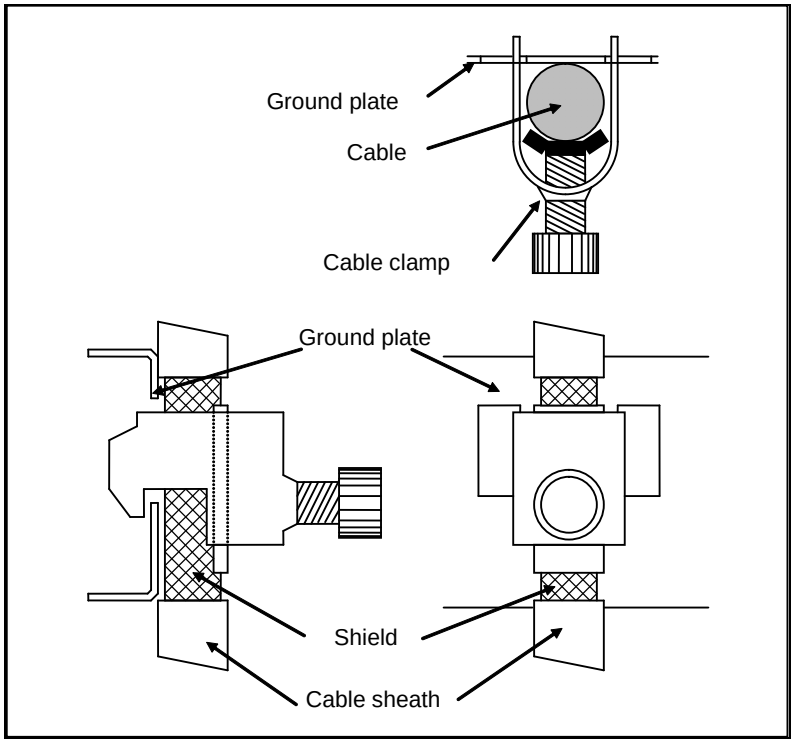
The Ethernet cable needs to be secured with a clamp so that no tension is applied to the connector (RJ-45) installed at the end of the cable even if the cable is pulled. This clamping also serves as the grounding of the cable shield.

NOTE
In CC-Link IE Field communication, be sure to use twisted pair cables with a common shield in category 5 or more (STP cables).

7.2 ANTI-NOISE MEASURES

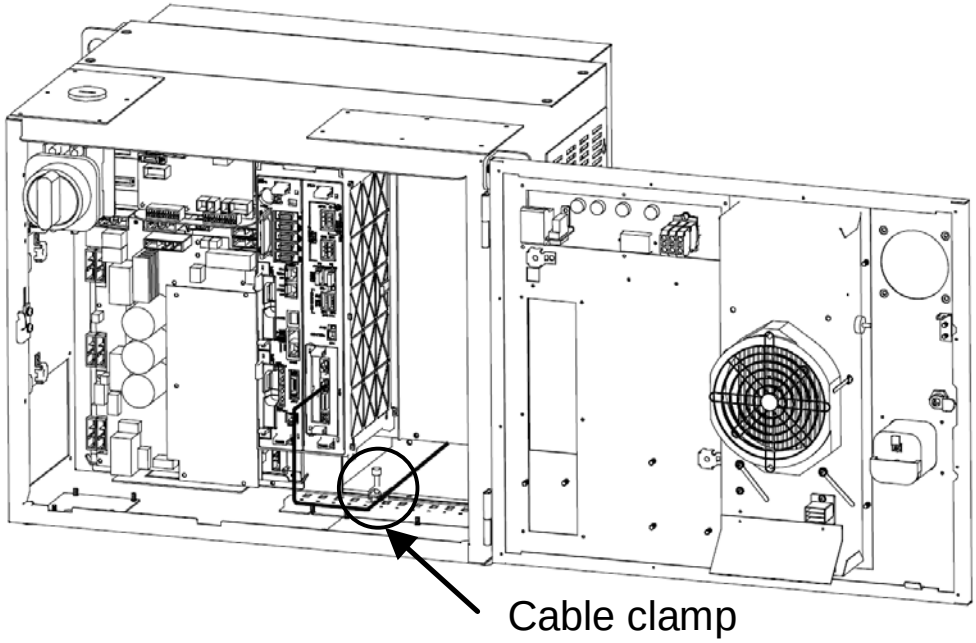
7.2.1 Clamping and Shielding of Cables

For information on how to wire the CC-Link IE Field cable, refer to the "CC-Link IE Field Network Cable Installation Manual (CC1006-15-A)" of CLPA.
The Ethernet twisted pair cable needs to be clamped in the same way as the cables need to be shielded, as shown below. The clamping is required to shield and fix the cable. Be sure to perform the clamping to ensure the stable operation of the system.
As shown in the figure, strip a part of the cable sheath to expose the metal shield and push the shield against the ground plate with the clamping hardware.

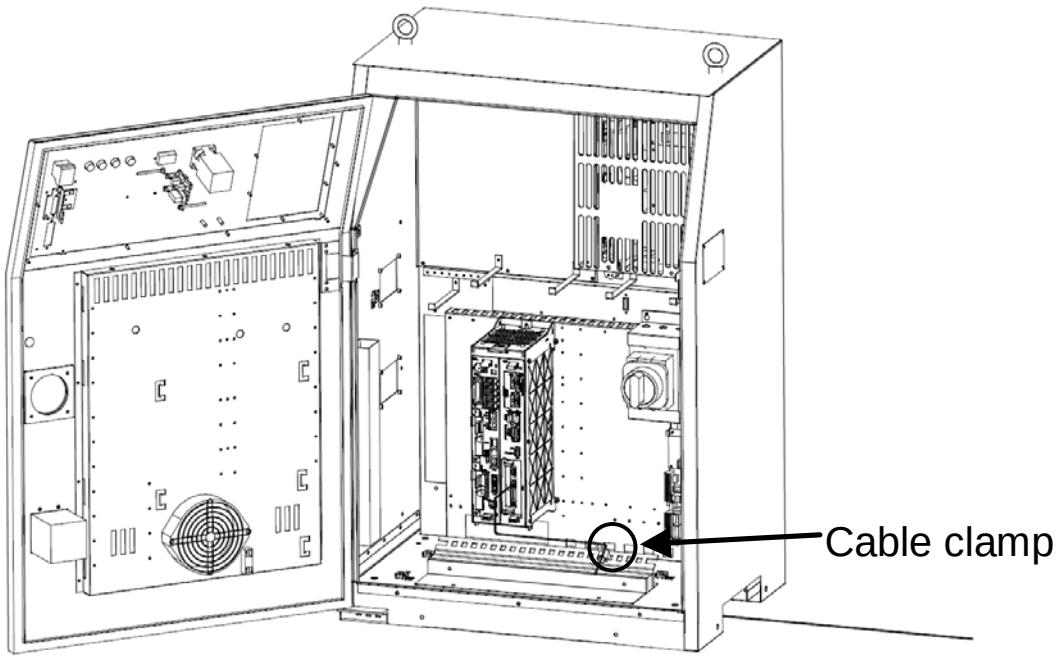


NOTE
1 Be sure to clamp and shield the cable to ensure the stable operation of the system.
2 The shield of the master device side, check the manual of the master device.
3 Unlike general Ethernet communication, CC-Link IE Field communication does not perform retransmission at intervals of several seconds to achieve high responsibility. Accordingly, severer anti-noise measures must be taken as compared with general Ethernet wiring.
4 Upon completion of cabling, perform a communication test sufficiently not only before but also after system operation to ensure anti-noise measures.

The following figure is how to lead the cable into the R-30*i*B/R-30*i*B Plus controller.

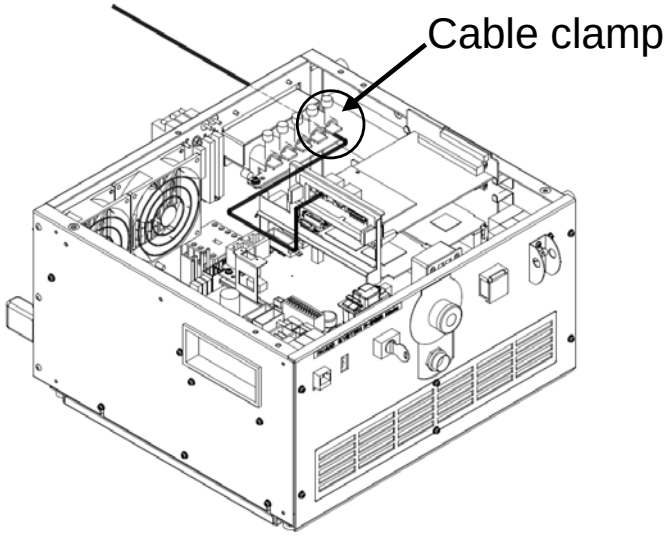


A-cabinet

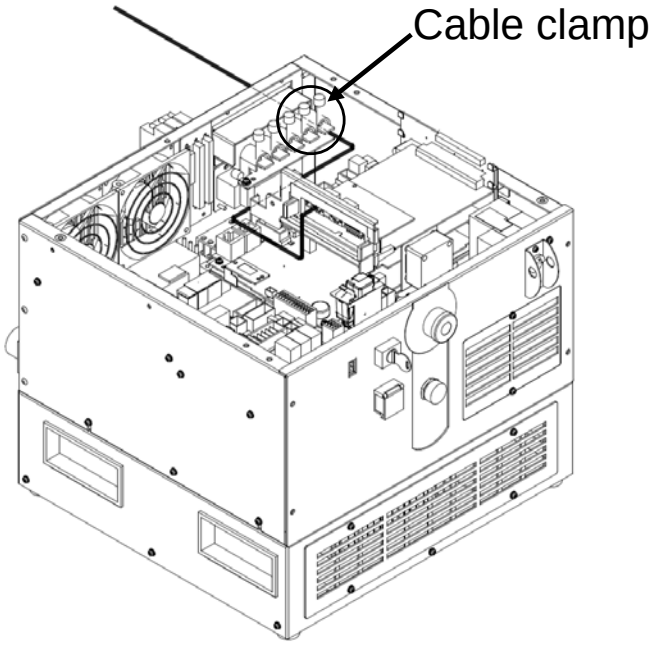


B-cabinet

The following figure is how to lead the cable into the R-30*i*B Mate Open Air controller.
In case of using of (2) cables, be sure to clamp together (2) cables.



Open Air controller (Small size)

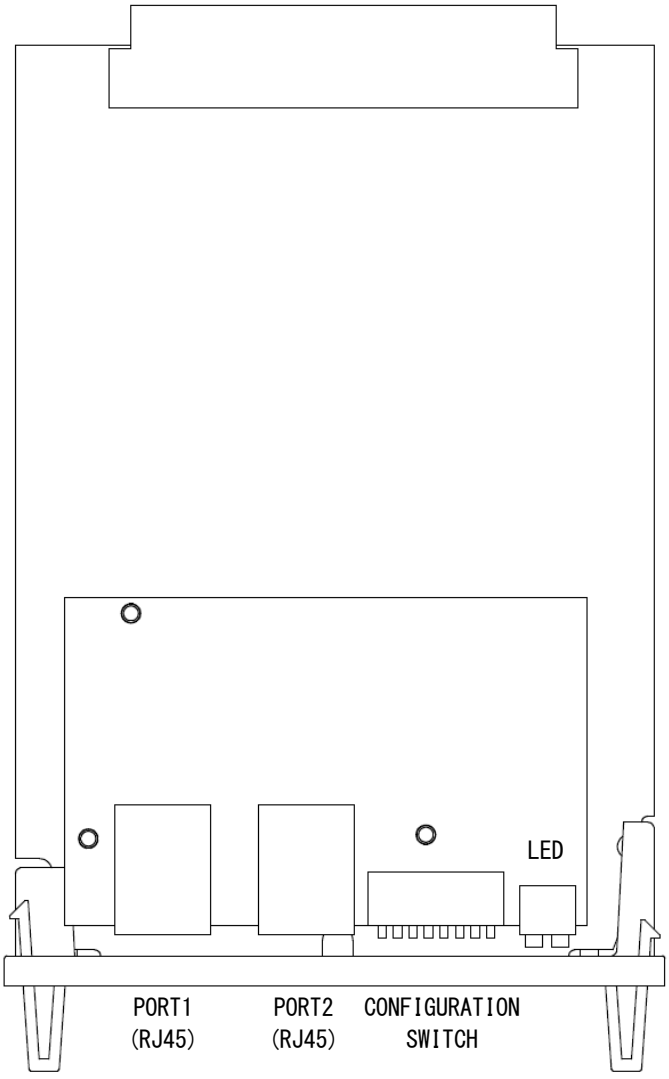


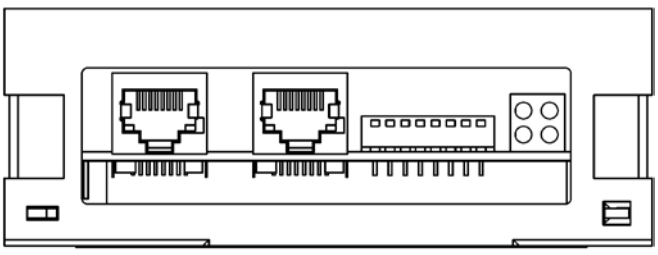
Open Air controller (Large size)

8 HARDWARE

This chapter provides hardware information required for the maintenance of the CC-Link IE Field slave board.

8.1 LAYOUT OF COMPONENTS

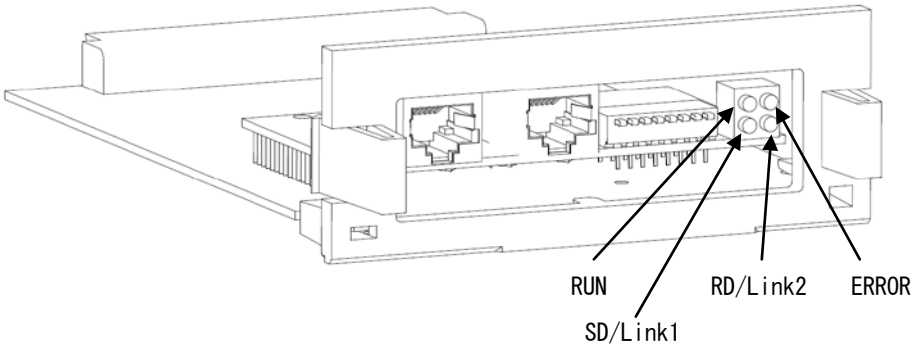




Name	PCB drawing number
CC-Link IE Field slave board	A20B-8101-0920

8.2 LED INDICATION

The CC-Link IE Field slave board has 4 LEDs. The following table shows their functions.



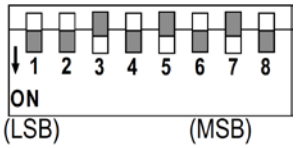
When the configuration switch 8 is OFF, the meanings of SD/Link1 and RD/Link2 are RD/SD, and when configuration switch 8 is ON, the meanings are Link 1/2.

Name		Color	State	Description
RUN		Green	Off	No power No network detected Network timeout
			On	Normal operation
ERROR		Red	Off	Normal operation No power
			On	Station not operating normally Duplicate station number Master parameter error Illegal station address during initialization
			Blinking	Link error
SD/LINK1	SD	Green	Off	No data transmission No power
			On	Data transmission
	Link1		Off	No data link No power
			On	Link is established to an Ethernet network
			Blinking	Activity
RD/LINK2	RD	Green	Off	No data received No power
			On	Data received
	Link2		Off	No data link No power
			On	Link is established to an Ethernet network
			Flashing	Activity

8.3 CONFIGURATION SWITCHES

The CC-Link IE Field slave board has configuration switches. The following table shows their functions. Switches 1 to 7 are used to set the module node number before startup of the module. Any changes will take effect after a restart.

Switch Setting (1-7)	Description
0	Reserved. The ERROR LED indicates solid red.
1-120	Node number setting. Switch 1 is LSB (Least Significant Bit) and switch 7 is MSB (Most Significant Bit). i.e. Switch 1 means 1 Switch 2 means 2 Switch 3 mesans 4 Switch 4 mesans 8 Switch 5 mesans 16 Switch 6 mesans 32 Switch 7 mesans 64 Node number is described by the sum of these value.
(121-126)	Invalid Node numbers. No network communication, and the ERROR LED indicates solid red.
127	Node number is assigned from the setting screen.



Switch 8 is used to decide what indications to show on LED SD/Link1 and LED RD/Link2, either data transmission information (SD/RD) or link information (Link1 and Link2).
Switch 8 can be changed at any time, and the change will take immediate effect.

Switch Setting(8)	Description
ON	Link status indication on LED SD/Link1 and LED RD/Link2
OFF	SD/RD status information on LED SD/Link1 and LED RD/Link2 (Default)

INDEX

REVISION RECORD

Edition	Date	Contents
02	Sep., 2017	Support for R-30iB Plus, R-30iB Mate Plus. How to communicate with real number etc.. How to down load CSP+ file. etc.
01	Aug., 2014	

B-83674EN/02

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