

MELFA Robots

Industrial Robot

Instruction Manual
(SD Series)

PROFIBUS DP-V0 Slave Interface (2D-TZ577)



Safety Instructions

Before attempting to use the robot, carefully read the following safety instructions and those given in the "Safety Manual" that accompanies and take necessary actions.

A. Safety instructions based on the requirements of the Labor Safety and Health Regulations (Articles 36, 104, 150, and 151) are listed below in abbreviated form.



CAUTION

The robot teaching operation should be performed only by workers trained specifically in safety practices.
(This applies to maintenance service done without shutting down the power source as well.)
→ Implementation of safety training



CAUTION

The robot teaching operation should be performed in accordance with established work rules which cover method or procedure used when operating the robot or actions taken to deal with all operating conditions including abnormal situations and subsequent restarting of the equipment.
(This applies to maintenance service done without shutting down the power source as well.)
→ Establishment of work rules



WARNING

The robot teaching operation must be performed with a means being provided which permits an immediate shutdown of the robot.
(This applies to maintenance service done without shutting down the power source as well.)
→ Provision of an emergency shutdown switch



CAUTION

During the performance of the robot teaching operation, an indication to that effect should be given in the immediate vicinity of the start switch or the like.
(This applies to maintenance service done without shutting down the power source as well.)
→ Indication of an ongoing robot teaching operation



DANGER

During the operation of the robot, a fence or enclosure must be put around the robot so that workers are protected from inadvertent contact with the robot.
→ Setting-up of a safety fence



CAUTION

Robot operation should be started on a specific signal given to every worker concerned according to an established rule.
→ A signal for starting an equipment operation



CAUTION

Maintenance service should in principle be carried out with power being shut off. Ensure that an indication showing maintenance service being in progress is given in the immediate vicinity of the start switch or the like.
→ Indication of an ongoing maintenance service



CAUTION

Before starting the operation of the robot, check the robot, emergency stop switch, and other associated devices for good condition.
→ Checkup before starting robot operation

B. Safety instructions contained in the accompanying "Safety Manual" are listed below in abbreviated form.

For more details, read the main text of the "Safety Manual."

-  **CAUTION** Use the robot in an environment where operational parameters (temperature, humidity, atmosphere, noise, etc.) are kept within the specified limits. Otherwise, the robot may diminish in reliability or suffer a breakdown.
-  **CAUTION** When moving the robot, keep it in an attitude specified in the handling instructions that apply. Otherwise, the robot may turn over or drop and result in personal injury or equipment breakdown.
-  **CAUTION** Install the robot securely onto a rigid mount. Insecure installation may cause the robot to become mispositioned or develop undue vibration.
-  **CAUTION** Route cables as far away from a noise source as possible. If allowed to run too close to a noise source, the cable may be a cause for robot misposition or malfunction.
-  **CAUTION** Avoid placing excessive strain on the connector or bending the cable too abruptly. A poor connection or a break in the wiring may result.
-  **CAUTION** Ensure that the mass of work including that of the robot hand does not exceed the rated load and permissible torque. Excessive work mass may give rise to an alarm condition or mechanical failure.
-  **WARNING** The robot hand and tools must be installed securely and the work must be gripped firmly in place. Otherwise, objects may become dangerous projectiles during operation, causing personal injury or property damage.
-  **WARNING** The robot and controller must be well-grounded. Otherwise, noise may give rise to malfunction or, in some cases, an electric shock may be received.
-  **CAUTION** During the operation of the robot, an indication to that effect is put out. Without such an indication, worker may inadvertently get near the robot or make an operational mistake.
-  **WARNING** Before attempting to perform a robot teaching operation within its working radius, worker must make certain that he has acquired a precedence in the control of the robot. Otherwise, the robot may be activated by a command from any external source with a danger of personal injury or property damage.
-  **CAUTION** When applying jog control to the robot, use as low a speed as possible and keep an eye on the robot. Otherwise, interference between the robot and the peripheral equipment or structure may take place.
-  **CAUTION** Before placing the robot in auto operation following a program editing, be sure to check the robot for proper trajectories by manipulating it in stepwise fashion. Otherwise, an error in the programming or other glitch may lead to interference between the robot and the peripheral equipment or structure.
-  **CAUTION** Provision should be such that during the automatic operation of the robot, the entrance/exit door of the safety fence put around the robot is locked to forestall an attempt to open it or the robot is automatically placed in a stopped state to permit the opening of the door. Otherwise, personal injury may result.
-  **CAUTION** Do not make any modification to the product concerned on your own judgment or use maintenance/repair parts other than those that are recommended by the

manufacturer.

Otherwise, mechanical failure or malfunction may be experienced.

When moving the robot arm manually from outside, do not put your hands or fingers into any opening provided on the robot.



WARNING

You may, depending on your posture, get your hands or fingers caught between the structural members.

Do not attempt to stop the robot, whether in normal operation or in emergency, by turning off the main power supply on the robot controller.



CAUTION

If the main power supply on the robot controller is turned off while the robot is in automatic operation, adverse effect may be caused on the precision with which the robot operates. Also, interference with the peripheral equipment or structure may result if the robot arm should drop or as it coasts to stop.

Do not turn off the main power supply on the robot controller when internal information stored on the controller (programs or parameters) is being rewritten.



CAUTION

If the main power supply on the robot controller is turned off during automatic operation or the loading of programs/parameters, internal information stored on the controller may be corrupted.



WARNING

If an horizontally-articulated robot is used, take care as the robot hand possibly sinks under its own weight while the brake release switch is depressed. Sinking of the robot hand may cause the robot hand to hit the peripheral equipment or structure or get your hand or finger caught between the structural members.

■ Introduction

Thank you for purchasing Mitsubishi Electric SD Series Industrial Robot.

The PROFIBUS DP-V0 Slave Interface (2D-TZ577) is an optional device which, installed into the SD Series Robot Controller, permits you to connect the Robot Controller to a PROFIBUS DP-V0 network.

Before using the Interface, read this manual and familiarize yourself with all pages to ensure safe operation and obtain maximum satisfactory service from the PROFIBUS DP-V0 Slave Interface (2D-TZ577).

Note: All descriptions in this manual assume that the user has an adequate understanding about basic operating procedures and functions which pertain to the Mitsubishi Industrial Robot SD Series. For detailed information about the basic operating procedures, refer to the "Instruction Manual - Detailed Description of Functions and Operation" which is separately issued.

■ Safety notation used in this manual:



DANGER

Indicates an immediately hazardous situation which, if not properly dealt with, will result in death or serious injury.



WARNING

Indicates a hazardous situation which, if not properly dealt with, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not properly dealt with, could result in injury, or property damage alone.

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1. Before Using PROFIBUS DP-V0 Slave Interface

This chapter explains checks or precautions that you should perform or take before using the PROFIBUS DP-V0 Slave Interface (2D-TZ577).

1.1 About Terms Used in This Manual

Table 1-1 Terms Used in This Manual

| Term | Description |
|---|---|
| PROFIBUS DP-V0 | A basic version of PROFIBUS DP which permits the execution of the following functions: <ul style="list-style-type: none"> · Input/output data communications · Others |
| PROFIBUS DP-V1 | A version of PROFIBUS DP which permits the execution of the following functions in additions to those available from PROFIBUS DP-V0: <ul style="list-style-type: none"> · A cyclic communications (asynchronous data communications) · Alarm notification · Others |
| PROFIBUS DP-V2 | A version of PROFIBUS DP which permits the execution of the following functions in additions to those available from PROFIBUS DP-V1: <ul style="list-style-type: none"> · Time stamping · Others |
| 2D-TZ577 | PROFIBUS DP-V0 Slave Interface for SD Series (a complete set of products) |
| 2D-TZ577 Card | PROFIBUS DP-V0 Slave Interface Card for SD Series (TZ577) |
| Master Station | A station residing in the equipment (typically, PLS or personal computer) which controls a data link system. There must be at least one Master Station in any system. As described below, Master Station comes in two varieties: Class 1 and Class 2. |
| Class 1 Master Station | Equipment which exchanges input/output data with Slave Stations. |
| Class 2 Master Station | Equipment which verifies station number settings and operating statuses through communications with Slave Stations. It serves as a network administration master station and takes care of such tasks as startup, maintenance service, and diagnosis. |
| Slave Station | A lower-level station which communicates with Master Station. |
| Repeater | A device which provides a link between the segments of a PROFIBUS DP network. |
| Terminator resistor | Resistor connected to the individual segments of a PROFIBUS DP network at each end. Actually, terminator resistors built in the connector used with a PROFIBUS network are enabled to fulfill intended purposes. |
| Slave parameter | Slave station parameter established by Master Station. Items of parameter information are stated on a GSD file. |
| Station number | A number assigned to Master Station or Slave Station. Numbering is in the range of 0 to 125. |
| I/O configuration information (data module) | Information about input/output configuration at Slave Station. |
| Input data | Data which is sent by 2D-TZ577 Card and received by Master Station. (Data inputted by Master Station) |
| Output data | Data which is sent by Master Station and received by 2D-TZ577 Card. (Data outputted by Master Station) |
| Global control | A function which allows Class 1 Master Station to send an input/output data synchronization command to Slave Stations. |
| Communication WDT | A watchdog timer established in the slave parameter at Master Station. |
| GSD file | An electronic file stating parameter settings at Slave Station. A data setting software compliant with Master Station, which is used to establish slave parameter settings. |

1.2 How to Use This Manual

This manual discusses the functions of the 2D-TZ577 Card with its constituent sections organized as shown in the table below. For information about the functions available from the standard Robot Controller and the operating method thereof, refer to the "Instruction Manual" that is supplied with the Controller.

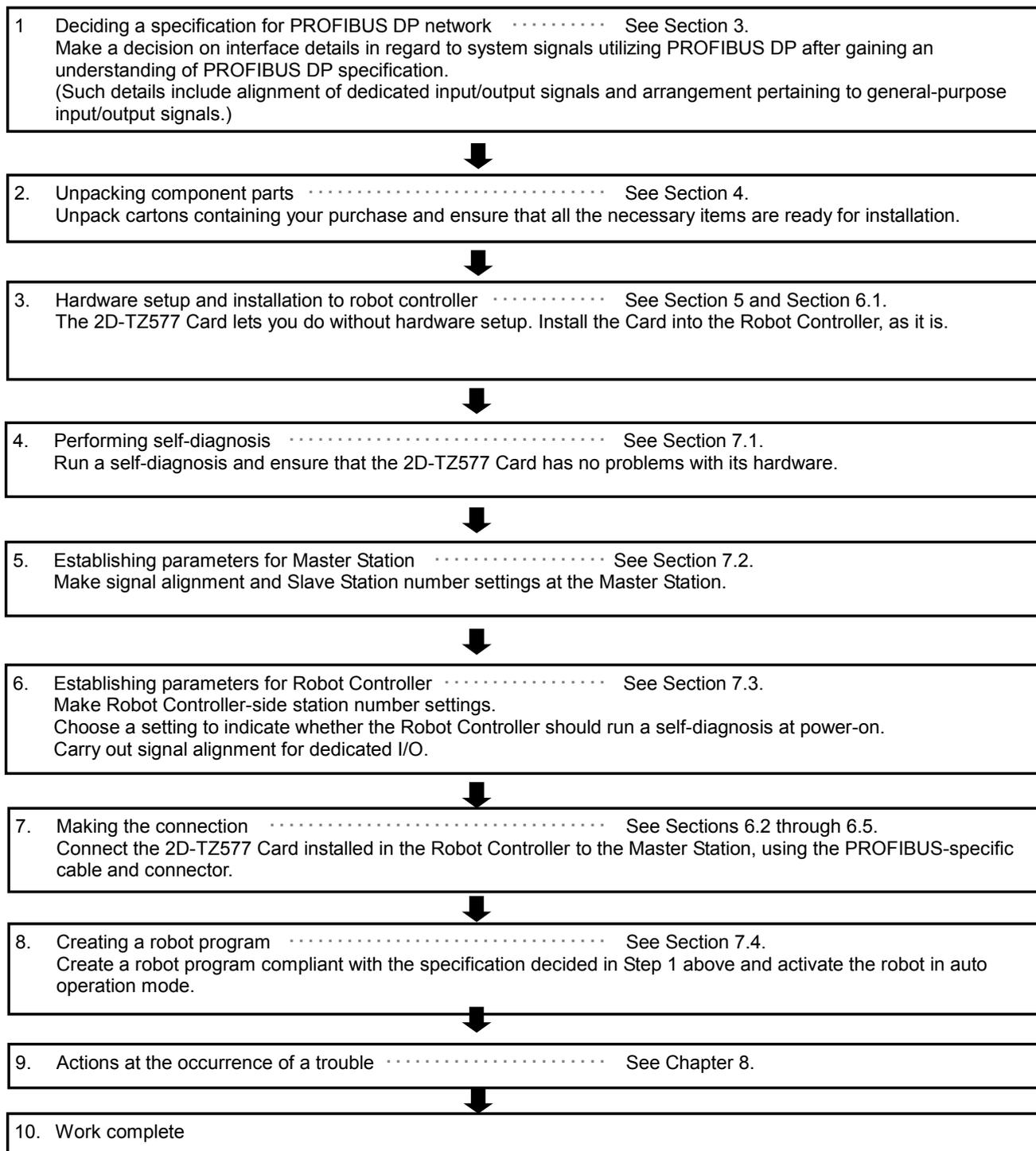
Table 1-2 Organization of This Instruction Manual

| Section | Title | Contents |
|---------|---|---|
| 1 | Before Using PROFIBUS DP-V0 Slave Interface | This section describes how to use this document (PROFIBUS DV-V0 Slave Interface Instruction Manual). Read and familiarize yourself with the information contained before attempting to use the 2D-TZ577 Card. |
| 2 | Workflow | This section describes the work necessary to build a PROFIBUS DP system. Carry out each work step exactly as indicated. |
| 3 | Features and Specification of 2D-TZ577 Card | This chapter describes the features and specification of the 2D-TZ577 Card. |
| 4 | Out of the Package | Upon receipt of the 2D-TZ577 Card, check to see that all items are in the package and that the version of the Robot Controller is as specified. |
| 5 | Hardware Setup | Hardware setup need not be done in regard to the product in question. |
| 6 | Connection and Wiring | This section describes the method used to connect the 2D-TZ577 Card to the Master Station via cables. |
| 7 | Procedure before Startup | This section describes steps you have to take before placing PROFIBUS DP system into operation. |
| 8 | Troubleshooting | This section presents information that helps find solutions when operational anomalies or errors are encountered during the use of the 2D-TZ577 Card. Make reference to this section as occasion arises. |
| 9 | Appendix | The appendix explains the method for displaying information about the 2D-TZ577 Card by means of RT ToolBox2. |

2. Workflow

Workflow you should follow to construct a PROFIBUS DP network system is shown below. Carry out each work step exactly as indicated.

2.1 Work Procedure



3. Features and Specification of 2D-TZ577 Card

3.1 What is PROFIBUS DP

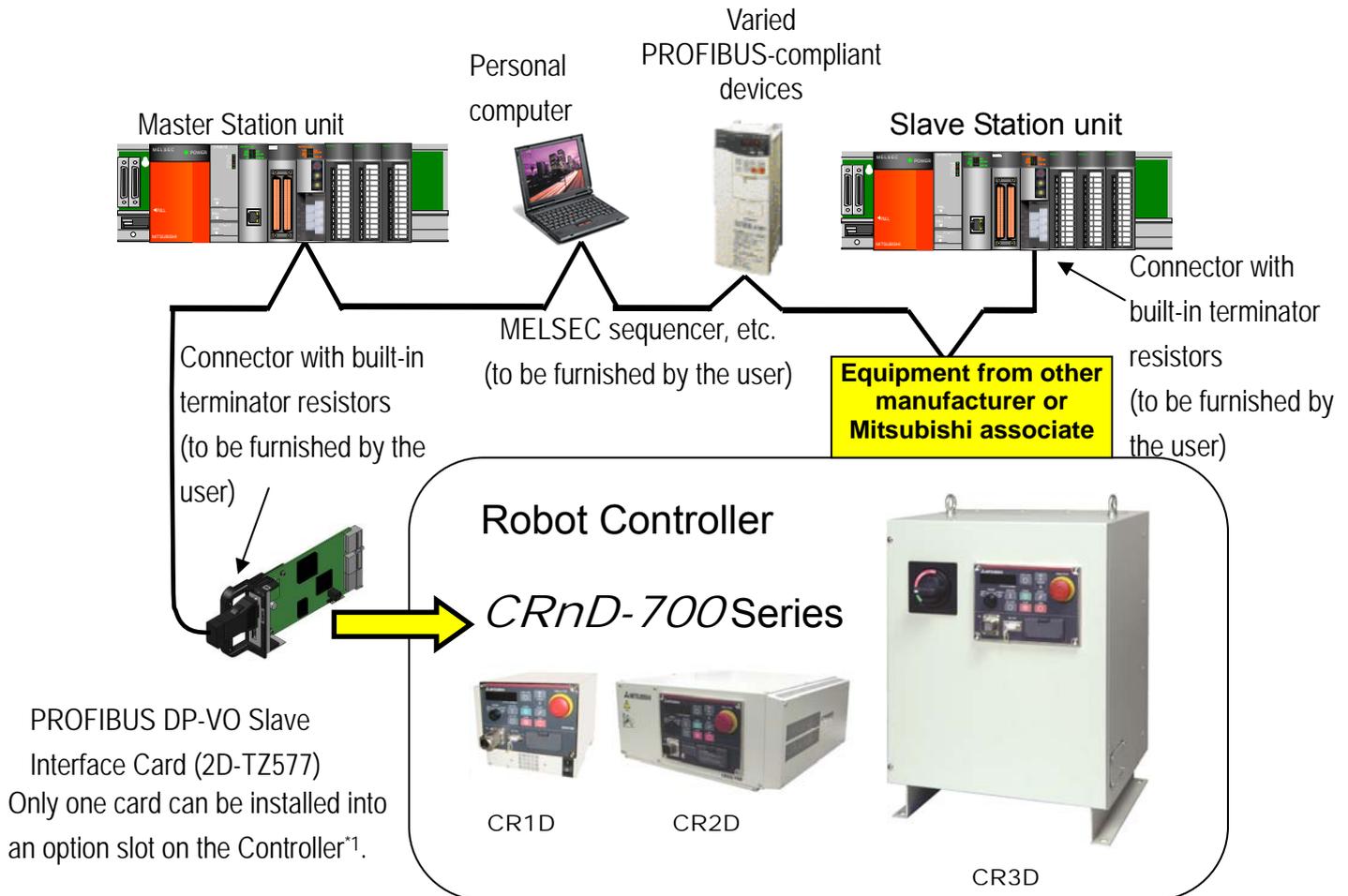


Figure 3-1 An Example of PROFIBUS Network Configuration

PROFIBUS is one of the recognized fieldbus standards. PROFIBUS comes in three variations: general-purpose PROFIBUS FMS, PROFIBUS DP for factory automation application, and PROFIBUS PA for process automation application.

The 2D-TZ577 Card is intended to serve as a slave station which supports **PROFIBUS DP-V0** capabilities. **It does not support PRORIBUS DP-V1 or PROFIBUS DP-V2 which is an extension of PROFIBUS DP-V0.**

(*1) Number of the option slots varies with the Controller you use.
 CR1D: Provided only with Slot 1.
 CR2/3D: Provided with Slots 1 thru 3 (only one of the three slots used to install the Card at any one time)

◆◆◆ Details about PROFIBUS ◆◆◆

To learn more about PROFIBUS, visit a Japan PROFIBUS Association website at <http://www.profibus.com/>

3.2 Features of 2D-TZ577 Card

The 2D-TZ577 Card has the following features:

- (1) Compliance with EN 50170 Volume 2 (Part 1, 2, 3, 4, and 8)
Designed to provide compliance with EN 50170 Volume 2 (Part 1, 2, 3, 4, and 8), the 2D-TZ577 Card serves only as **a slave station in a PROFIBUS DP-V0** network.
- (2) PROFIBUS DP-V0 Slave Interface Card for SD Series
The 2D-TZ577 Card is an optional card for use with SD Series Robot Controller, not usable for SQ Series. To connect SQ Series Robot Controller to a PROFIBUS DP network, use a MELSEC-Q Series PROFIBUS DP unit.
- (3) Input/output data communications with Class 1 Master Station
The 2D-TZ577 Card is capable of conducting input/output data communications with PROFIBUS-DP Class 1 Master Station (Master Station which communicates with Slave Stations on a cyclic basis). **This card is intended to serve as a slave station which supports PROFIBUS DP-V0 capabilities. It does not support PRORIBUS DP-V1 or PROFIBUS DP-V2 which is an extension of PROFIBUS DP-V0.**
 - (a) Communicatable number of pieces of data
A single 2D-TZ577 Card allows communications in the following number:

| | | |
|---------------------------------|---|-----------------------------|
| Input data - 122 words maximum | } | 192 words in combined total |
| Output data - 122 words maximum | | |
- (4) Communications with Class 2 Mater Station
The 2D-TZ577 Card is capable of conducting communications, as detailed below, with Class 2 Master Station (Master Station for network administration which takes care of startup, maintenance and diagnosis services).
 - Reading from input send area/output receive area
 - Reading I/O configuration information
 - Changing station numbers

For instructions on using the each of the listed functions, see instruction manual which is supplied with Class 2 Master Station being installed.
- (5) Input/output data swapping
The 2D-TZ577 Card permits upper/lower bytes to be swapped at the time when input/output data is sent to or received from Master Station. In a PROFIBUS DP network, the way the upper/lower bytes of input/output data is treated differs depending on the type of Master Station, but there is no need for making input/output data swapping at a program level.
- (6) Global control
The 2D-TZ577 Card supports global control capability, enabling Class 1 Master Station to control input/output data updating on the 2D-TZ577 Card by commands it transmits (SYNC, UNSYNC, FREEZE, and UNFREEZE). For instructions on using the global control capability, see instruction manual which is supplied with Class 1 Master Station being installed.

3.3 Specification of 2D-TZ577 Card

The following table shows the specification of the 2D-TZ577 Card.

3.3.1 General Specification

Table 3-1 General Specification (2D-TZ577 Card)

| Item | Specification | Remark |
|--|--|---|
| Type name | TZ577 | |
| PROFIBUS specification complied with | EN50170 Volume2(Part1,2,3,4,8) | |
| PROFIBUS DP version supported | DP-V0 only | DP-V1 and DP-V2 not supported |
| Transmission rate | 9.6k/19.2k/45.45k/93.75k/187.5k/500k/1.5M/3M/6M/12Mbaud | Set by parameters specified on Master Station |
| Station number | 0 to 125 | Set by parameters specified on Robot (default setting: 126 ^{*1}) |
| Maximum communicatable number of pieces of data | 192 words as the combined number of pieces of input/output data (122 words as the total of pieces of input or output data) | |
| Option slot that accepts an interface card | Slot 1/Slop 2/Slot 3 | Only one slot is used at any one time (SR1D is provided with Slot 1 only.) |
| Number of cards installed | One | Installation of more than one card is not permitted. |
| Concurrent use of 2D-TZ577 Card and other fieldbus option card ^{*2} | Not permitted | |
| Robot controller input/output number | 2000 to 3951 | For details about signal alignment, see " Table 3-6 A Listing of PROFIBUS Signals." |
| Terminator resistor | Uninstalled | If the 2D-TZ577 Card is used as a terminal station, terminator resistor on a dedicated connector should be enabled. For information about the connector, see "Table 4-2 Items To Be Furnished by User." |
| Input/output signal access | 2D-TZ577 Card send/receive data is assigned to input/output signal No. 2000 and up. In a MELFA-BASIC V network, these signals are treated as input/output signals like parallel I/O signals are. | |

(*1) Station number 126 causes the interface to be isolated from the PROFIBUS network.

Specify station numbers in the range of 0 to 125 for the purpose of input/output date communications.

(*2) CC-Link Interface Card and Device Net Interface Card (both under development).

3.3.2 Transmission Specification

Table 3-2 Transmission Specification

| Item | | Specification | | | |
|---|--|---|--------------------------------|--|--|
| Transmission specification | Electrical standard and characteristic | Compliant with EIA-RS485 | | | |
| | Medium | Shielded twisted-pair cable (Type A) ^{*1} | | | |
| | Network configuration | Bus type (tree type when repeater(s) is (are) used) | | | |
| | Communication method | Polling | | | |
| | Transmission encoding method | NRZ | | | |
| | Transmission rate/maximum transmission range ^{*2} | Transmission rate | Transmission range [m/segment] | Maximum transmission range with three repeaters being used [m/network] | |
| | | 9.6kbps | 1200 | 4800 | |
| | | 19.2kbps | | | |
| | | 45.45kbps | | | |
| | | 93.75kbps | | | |
| | | 187.5kbps | 1000 | 4000 | |
| | | 500kbps | 400 | 1600 | |
| | | 1.5Mbps | 200 | 800 | |
| | | 3Mbps | 100 | 400 | |
| 6Mbps | | | | | |
| 12Mbps | | | | | |
| Maximum number of intervening repeaters | 3 ^{*2} | | | | |
| Maximum number of units connected (per segment) | 32 (including repeater(s)) | | | | |
| Number of nodes connected/segment | 32 | | | | |

(*1) Specified in EN 50170 standard

(*2) Maximum transmission distance achievable by the use of repeaters:

Maximum transmission distance [m/network] = (number of repeaters + 1) x transmission distance [m/segment]

3.3.3 Network Configuration

When creating a PROFIBUS DP network, note that the network comes in under the following design limits:

- (1) Number of units that can be connected to the entire network (when repeaters are used)
Master + Slave ≤ 126
- (2) Number of units which can be connected to a segment
Master + Slave + repeater^{*1} ≤ 32
- (3) Maximum number of intervening repeaters
Up to 3 repeaters are allowed to intervene in the communication path between Master Station and 2D-TZ577 Card
- (4) It is necessary to enable terminator resistors on a dedicated connector installed at the terminal station of each segment.
- (5) Maximum number of Slave Stations which can be connected to a Master Station depends on the specification of the Master Station.

(*1) Repeater is counted in the number of units at each of the segments.

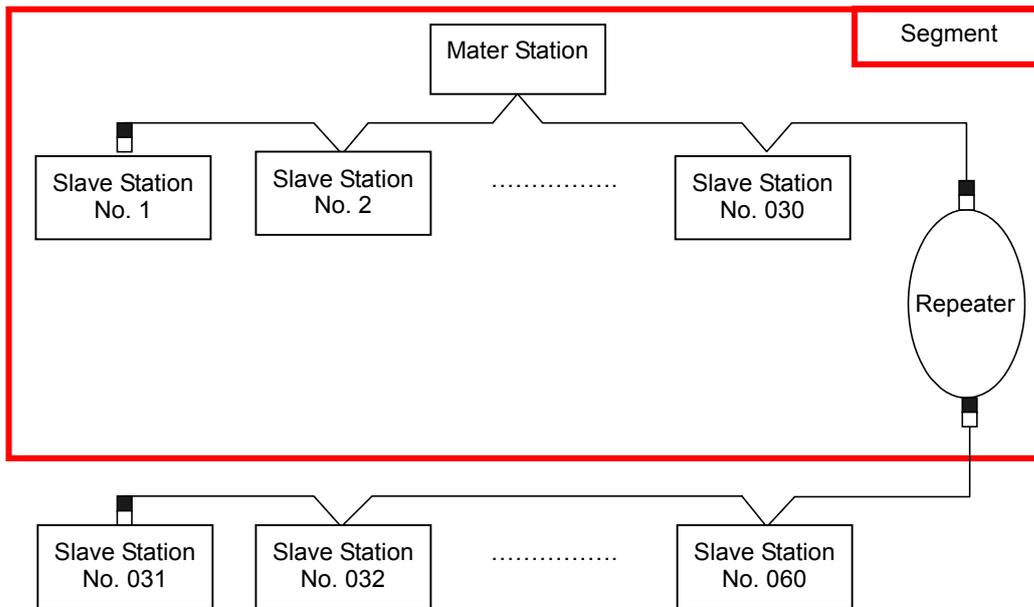


Figure 3-2 An Example of Basic PROFIBUS DP Network Configuration

3.3.4 Accommodated Versions

Table 3-3 Accommodated Versions

| Name | Version |
|------------------------------------|--|
| Robot Controller | P6k or later |
| Personal computer support software | RT Tool Box 2: Ver.1.0.1 or later * Ver. 1.3 or later is provided with a dialog box which can be used for making PROFIBUS-related settings. Even versions preceding 1.3 offer parameter a parameter setting screen that permits you to make PROFIBUS-related settings. For more information, see Section7.3 Parameter Settings on the Side of Robot Controller. |

3.4 Robot Parameters

Table 3-4 A Listing of Robot Parameters Used with PROFIBUS

| Parameter name | Initial value | Setting range | Description |
|---------------------------------------|---|------------------|--|
| STOP2 | -1, -1 | -1 /2000 to 3951 | A parameter that specifies a dedicated input signal number to stop robot programs. (Because the parameter "STOP" is fixed at "0", 2D-TZ577 Card uses "STOP2" to define an external stop signal.) |
| ORST2000 ORST2032 : ORST3920 | 00000000, 00000000, 00000000, 00000000 | 0/1/* | A parameter that specifies value of output send data on the 2D-TZ577 Card at the time of signal output reset. (For details about related settings, see Section 3.8 Before Using PROFIBUS DP-V0 Slave Interface.) |
| PBMODE | 0 | 0/2 | A parameter that switches the operating mode of the 2D-TZ577 Card between "normal" and "self-diagnosis." Normal mode = 0, self-diagnosis mode = 2 <ul style="list-style-type: none"> · When the self-diagnosis identifies an anomaly, an error message is displayed. ("H.8504: PROFIBUS self-diagnosis shows occurrence of an error.") · Return the operating mode to normal to continue with normal operation. |
| PBMC | 1 | 1/2 | A parameter that designates Master Station as Class 1 or Class 2. Class 1 Master Station is designated at factory default. To use "Class 2," choose another parameter setting. <ol style="list-style-type: none"> 1: Class 1 Master (effected when the station number setting parameter PBNUM shown below is used) 2: Class 2 Master (effected when changes of station numbers are made from Class 2 Master Station - with PBNUM not being used) |
| PBNUM | 126 | -1 to 125 | A parameter that specifies station number for the 2D-TZ577 Card. 0 to 125: Station number setting value (Rewriting of station number settings takes place within the flash ROM as well.) -1: Station number clear (Station number settings within the flash ROM are cleared.) * After the station numbers are cleared, the value 126 is taken on. * If "No_Add_Chg" is specified with "true" when making station number settings from Class 2 Master Station, 2D-TZ577 Card is disabled for change of station numbers. To cancel this setting, clear station numbers with "PBNUM = -1." |
| E8500 | 0 | 0/1 | A parameter that is used to temporarily reset an error state when PROFIBUS-related error (indicated by a number in the 8500s) occurred. (1: Resettable (But no communications are to be carried out.) / 0: Always error during the occurrence of an anomaly in the link) * This parameter does not require power supply resetting on the Robot Controller. The initial value of 0 will return if power supply resetting is done. |

3 Features and Specification of 2D-TZ577 Card

| Parameter name | Initial value | Setting range | Description |
|----------------|---------------|---------------|---|
| PBCNT | 40 | 0 to 65535 | <p>A parameter that specifies an interval at which the 2D-TZ577 Card is checked for error. Unit interval: msec In normal condition, use the 2D-TZ577 Card at its factory default (40). User may change the setting only when communication errors are frequently encountered under the undue influence from noise in his installation environment. Normally, a setting in the range of 40 to 70msec will do. Increase the setting with great care as this may result in the inability to generate an error indication even when one occurs in the 2D-TZ577 Card. With a value greater than "1" being specified (rounding-up checked), the Controller generates an error indication only when it has detected a 2D-TZ577 Card error continuously during a specified period of time. The Controller does not generate an error indication unless it has had continuous error detection. With "0" being specified, an error indication is generated immediately upon a 2D-TZ577 Card error being detected by the Controller.</p> |

3.5 Robot Controller Input/Output Signals

Input/output signals processed in the Robot Controller are in the range of 2000 to 3951 maximum (equivalent to 192 words), respectively, irrespective of station numbers.

Table 3-5 PROFIBUS Input/Output Signal Numbers

| | Input (received from Master Station) | Output (sent to Master Station) |
|--------|--------------------------------------|---------------------------------|
| Number | 2000 to 3951 | 2000 to 3951 |

The data sizes of input/output signal are specified by parameter settings on the side of the Master Station. The combined number of pieces of input/output data is 192 words maximum while the respective number of pieces of input/output data is 122 words maximum.

Examples: (Input - 122 words) + (output - 70 words) = 192 words in total
 (Input - 96 words) + (output - 96 words) = 192 words in total
 (Input - 10 words) + (output - 10 words) = 20 words in total

Table 3-6 A Listing of PROFIBUS Signals

| Number of words | Usable number of points | Start | End |
|-----------------|-------------------------|------------|-----|
| 0 | 0 | - | - |
| 1 | 16 | 2000to2015 | |
| 2 | 32 | 2000to2031 | |
| 3 | 48 | 2000to2047 | |
| 4 | 64 | 2000to2063 | |
| 5 | 80 | 2000to2079 | |
| 6 | 96 | 2000to2095 | |
| 7 | 112 | 2000to2111 | |
| 8 | 128 | 2000to2127 | |
| 9 | 144 | 2000to2143 | |
| 10 | 160 | 2000to2159 | |
| 11 | 176 | 2000to2175 | |
| 12 | 192 | 2000to2191 | |
| 13 | 208 | 2000to2207 | |
| 14 | 224 | 2000to2223 | |
| 15 | 240 | 2000to2239 | |
| 16 | 256 | 2000to2255 | |
| 17 | 272 | 2000to2271 | |
| 18 | 288 | 2000to2287 | |
| 19 | 304 | 2000to2303 | |
| 20 | 320 | 2000to2319 | |
| 21 | 336 | 2000to2335 | |
| 22 | 352 | 2000to2351 | |
| 23 | 368 | 2000to2367 | |
| 24 | 384 | 2000to2383 | |
| 25 | 400 | 2000to2399 | |
| 26 | 416 | 2000to2415 | |
| 27 | 432 | 2000to2431 | |
| 28 | 448 | 2000to2447 | |
| 29 | 464 | 2000to2463 | |
| 30 | 480 | 2000to2479 | |
| 31 | 496 | 2000to2495 | |
| 32 | 512 | 2000to2511 | |
| 33 | 528 | 2000to2527 | |
| 34 | 544 | 2000to2543 | |
| 35 | 560 | 2000to2559 | |
| 36 | 576 | 2000to2575 | |
| 37 | 592 | 2000to2591 | |
| 38 | 608 | 2000to2607 | |
| 39 | 624 | 2000to2623 | |
| 40 | 640 | 2000to2639 | |
| 41 | 656 | 2000to2655 | |
| 42 | 672 | 2000to2671 | |
| 43 | 688 | 2000to2687 | |
| 44 | 704 | 2000to2703 | |
| 45 | 720 | 2000to2719 | |
| 46 | 736 | 2000to2735 | |
| 47 | 752 | 2000to2751 | |
| 48 | 768 | 2000to2767 | |
| 49 | 784 | 2000to2783 | |
| 50 | 800 | 2000to2799 | |
| 51 | 816 | 2000to2815 | |
| 52 | 832 | 2000to2831 | |
| 53 | 848 | 2000to2847 | |
| 54 | 864 | 2000to2863 | |
| 55 | 880 | 2000to2879 | |
| 56 | 896 | 2000to2895 | |
| 57 | 912 | 2000to2911 | |
| 58 | 928 | 2000to2927 | |
| 59 | 944 | 2000to2943 | |
| 60 | 960 | 2000to2959 | |
| 61 | 976 | 2000to2975 | |
| 62 | 992 | 2000to2991 | |
| 63 | 1008 | 2000to3007 | |
| 64 | 1024 | 2000to3023 | |
| 65 | 1040 | 2000to3039 | |
| 66 | 1056 | 2000to3055 | |
| 67 | 1072 | 2000to3071 | |
| 68 | 1088 | 2000to3087 | |
| 69 | 1104 | 2000to3103 | |
| 70 | 1120 | 2000to3119 | |
| 71 | 1136 | 2000to3135 | |
| 72 | 1152 | 2000to3151 | |
| 73 | 1168 | 2000to3167 | |
| 74 | 1184 | 2000to3183 | |
| 75 | 1200 | 2000to3199 | |
| 76 | 1216 | 2000to3215 | |
| 77 | 1232 | 2000to3231 | |
| 78 | 1248 | 2000to3247 | |
| 79 | 1264 | 2000to3263 | |
| 80 | 1280 | 2000to3279 | |
| 81 | 1296 | 2000to3295 | |
| 82 | 1312 | 2000to3311 | |
| 83 | 1328 | 2000to3327 | |
| 84 | 1344 | 2000to3343 | |
| 85 | 1360 | 2000to3359 | |
| 86 | 1376 | 2000to3375 | |
| 87 | 1392 | 2000to3391 | |
| 88 | 1408 | 2000to3407 | |
| 89 | 1424 | 2000to3423 | |
| 90 | 1440 | 2000to3439 | |
| 91 | 1456 | 2000to3455 | |
| 92 | 1472 | 2000to3471 | |
| 93 | 1488 | 2000to3487 | |
| 94 | 1504 | 2000to3503 | |
| 95 | 1520 | 2000to3519 | |
| 96 | 1536 | 2000to3535 | |
| 97 | 1552 | 2000to3551 | |
| 98 | 1568 | 2000to3567 | |
| 99 | 1584 | 2000to3583 | |
| 100 | 1600 | 2000to3599 | |
| 101 | 1616 | 2000to3615 | |
| 102 | 1632 | 2000to3631 | |
| 103 | 1648 | 2000to3647 | |
| 104 | 1664 | 2000to3663 | |
| 105 | 1680 | 2000to3679 | |
| 106 | 1696 | 2000to3695 | |
| 107 | 1712 | 2000to3711 | |
| 108 | 1728 | 2000to3727 | |
| 109 | 1744 | 2000to3743 | |
| 110 | 1760 | 2000to3759 | |
| 111 | 1776 | 2000to3775 | |
| 112 | 1792 | 2000to3791 | |
| 113 | 1808 | 2000to3807 | |
| 114 | 1824 | 2000to3823 | |
| 115 | 1840 | 2000to3839 | |
| 116 | 1856 | 2000to3855 | |
| 117 | 1872 | 2000to3871 | |
| 118 | 1888 | 2000to3887 | |
| 119 | 1904 | 2000to3903 | |
| 120 | 1920 | 2000to3919 | |
| 121 | 1936 | 2000to3935 | |
| 122 | 1952 | 2000to3951 | |

3.6 About Dedicated Input/Output

Signal numbers are assigned to 2D—TZ577 Cards. Assignment of these numbers to dedicated input/output parameters permits them to be used as dedicated input/output. For more information about the dedicated input/output, see Section 6 "Functions of External Input/Output" of the "Instruction Manual - Detailed Description of Functions and Operation" which is separately issued.

3.7 Specification Relative to Robot Language

The follow subsection explains robot language (MELFA-BASIC V) which pertains to the 2D-TZ577 Card.

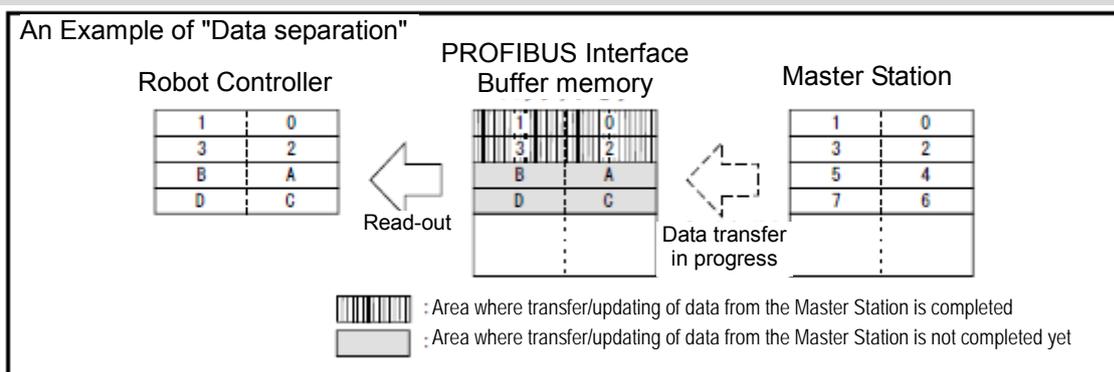
3.7.1 Robot System State Variables Relative to 2D-TZ577 Card

Table 3-7 A Listing of System State Variables Used for Data Input/Output

| Item | Type | Function | Read/write |
|--------|-----------|--|------------|
| M_In | Integer 1 | Reads one bit of data from specified input signal. | Read |
| M_Out | Integer 1 | Writes one bit of data into specified output signal. | Write |
| M_Inb | Integer 1 | Reads 8 bits of data from specified input signal. | Read |
| M_Outb | Integer 1 | Writes 8 bits of data into specified output signal. | Write |
| M_Inw | Integer 1 | Read 16 bits of data from specified input signal. | Read |
| M_Outw | Integer 1 | Write 16 bits of data into specified output signal. | Write |

◆◆◆ "Data separation" ◆◆◆

If data writing takes place on any of the robot programs before data transfer is completed on the Master Station, an phenomenon called "tearful parting" (a loss of compatibility between input/output data on the Robot Controller side and that on the Master Station side) is experienced. For example, suppose an application program is introduced which involves writing data consecutively into an identical output address, what may happen is that no values but the one last written are conveyed to the receiver at the other end. The following diagram shows a typical case of "Data separation" which results if data reading from the Robot Controller is initiated during the course of data transfer from the Master Station to the buffer memory.



To avoid "Data separation" a read/write interlock as shown below need be provided in the application concerned (robot program or PLC ladder).

An example of interlock being used where one-word data is sent from the Master Station to the robot is illustrated in the form of a flowchart below.

Table 3-8 An Example of Input/Output Signal Alignment between Master Station and Robot

| Meaning | Master Station ^{*1} | Robot |
|---------------------------------|------------------------------|---------------------|
| Data send/receive region | Data send region | Input: 2000 to 2015 |
| PLC data write completed flag | WRTFLG | Input No. 2016 |
| Robot data write completed flag | RDFLG | Output No. 2020 |

(*1) For the purposes of explanation, a name is given to the Master Station input/output signal alignment. Actually, you can make any input/output signal alignment in accordance with a Master Station instruction manual that governs.

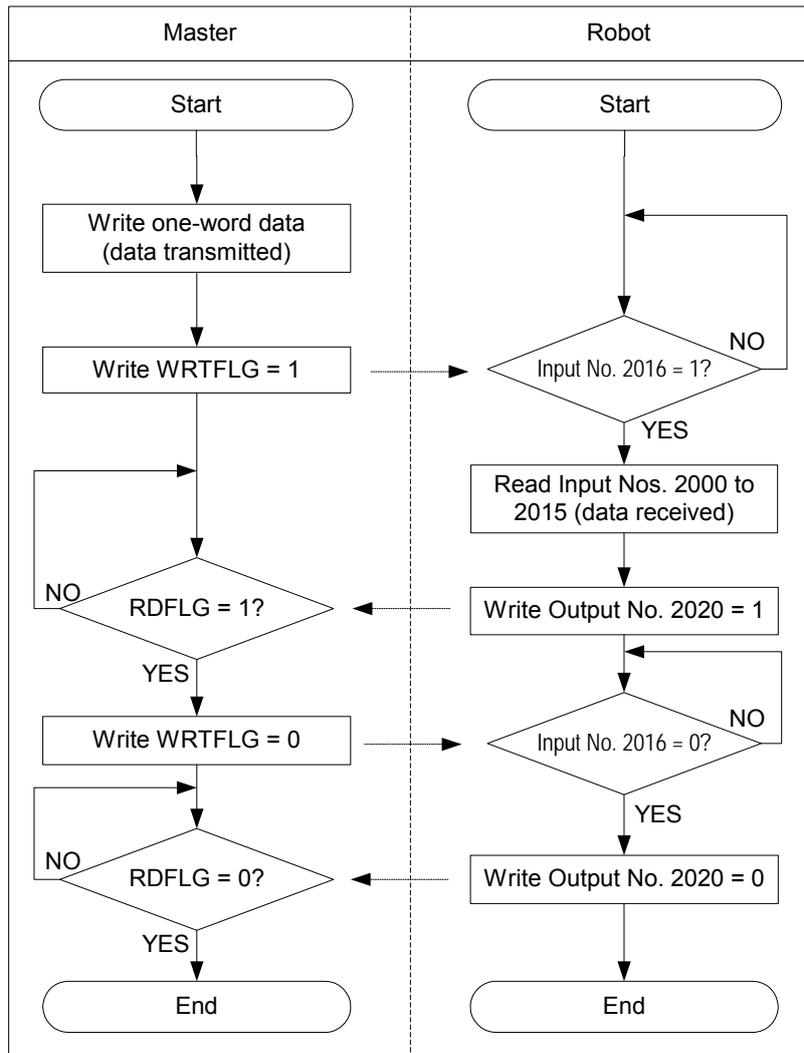


Figure 3-3 An Example of Use of Interlock

Below is an example of robot program which corresponds to the flowchart shown in Fig. 3-3. For information about the Master Station-side program (ladder, etc.), refer to the instruction manual for the equipment being used.

```

*Loop1: If M_In(2016) = 0 Then *Loop1
Mdata = M_InW(2000)
M_Out(2020) = 1
*Loop2: If M_In(2016) = 1 Then *Loop2
M_Out(2016) = 0
    
```

Table 3-9 A Listing of System State Variables Used to Verify Configuration

| Variable name | Type | Designation | Function | Read/write |
|---------------|-----------|--------------------------------------|---|------------|
| M_PBNUM | Integer 1 | Number of station in action | Number of station which is currently in action | Read |
| M_PBFNUM | Integer 1 | Station number settings in flash ROM | Number of station which is stored in flash ROM | Read |
| M_PBSYNM | Integer 1 | SYNC mode signal | <ul style="list-style-type: none"> (a) Takes on the value "1" when 2D-TZ577 Card goes into SYNC mode in response to SYNC request from Master Station. (b) Takes on the value "0" when SYNC mode terminates due to UNSYNC request from Master Station/stopping of communications/reset. (c) Takes on the value "0" when communications with Master Station are stopped with "1" being an existing value and communication timeout error occurs. However, if communication WDT setting in Master Station-side parameter is disabled, the value "0" is not taken on because communication timeout error does not occur (output data is retained). | Read |
| M_PBFNZM | Integer 1 | FREEZE mode signal | <ul style="list-style-type: none"> (a) Takes on the value "1" when 2D-TZ577 Card goes into FREEZE mode in response to FREEZE request from Master Station. (b) Takes on the value "0" when FREEZE mode terminates due to UNFREEZE request from Master Station/stopping of communications/reset. (d) Takes on the value "0" when communications with Master Station are stopped with "1" being an existing value and communication timeout error occurs. However, if communication WDT setting in Master Station-side parameter is disabled, the value "0" is not taken on because communication timeout error does not occur (output data is retained). | Read |

For information about MELF-BASIC V commands and state variables other than those listed above, refer to the "Instruction Manual - Detailed Description of Functions and Operation" which is separately issued.

3.8 About Output Signal Reset Patterns

Factory default settings are such that startup takes place with all general-purpose output signals being off (0). You can change the state of general-purpose output signals at power-on by re-specifying the parameters listed in the table below. Note that these parameters are intended to serve the following purpose as well: performing general-purpose output signal reset operation (which is carried out with dedicated input signals) and selection of reset pattern during the execution of Clr command.

Parameter setting options include "off," "on," and "hold." The following table lists parameters which are used on the 2D-TZ577 Card for general-purpose output resetting.

Table 3-10 A Listing of Output Signal Reset Pattern Parameters

| Parameter name | Leading number | Last number | Parameter name | Leading number | Last number |
|----------------|----------------|-------------|----------------|----------------|-------------|
| ORST2000 | 2000 | 2031 | ORST3024 | 3024 | 3055 |
| ORST2032 | 2032 | 2063 | ORST3056 | 3056 | 3087 |
| ORST2064 | 2064 | 2095 | ORST3088 | 3088 | 3119 |
| ORST2096 | 2096 | 2127 | ORST3120 | 3120 | 3151 |
| ORST2128 | 2128 | 2159 | ORST3152 | 3152 | 3183 |
| ORST2160 | 2160 | 2191 | ORST3184 | 3184 | 3215 |
| ORST2192 | 2192 | 2223 | ORST3216 | 3216 | 3247 |
| ORST2224 | 2224 | 2255 | ORST3248 | 3248 | 3279 |
| ORST2256 | 2256 | 2287 | ORST3280 | 3280 | 3311 |
| ORST2288 | 2288 | 2319 | ORST3312 | 3312 | 3343 |
| ORST2320 | 2320 | 2351 | ORST3344 | 3344 | 3375 |
| ORST2352 | 2352 | 2383 | ORST3376 | 3376 | 3407 |
| ORST2384 | 2384 | 2415 | ORST3408 | 3408 | 3439 |
| ORST2416 | 2416 | 2447 | ORST3440 | 3440 | 3471 |
| ORST2448 | 2448 | 2479 | ORST3472 | 3472 | 3503 |
| ORST2480 | 2480 | 2511 | ORST3504 | 3504 | 3535 |
| ORST2512 | 2512 | 2543 | ORST3536 | 3536 | 3567 |
| ORST2544 | 2544 | 2575 | ORST3568 | 3568 | 3599 |
| ORST2576 | 2576 | 2607 | ORST3600 | 3600 | 3631 |
| ORST2608 | 2608 | 2639 | ORST3632 | 3632 | 3663 |
| ORST2640 | 2640 | 2671 | ORST3664 | 3664 | 3695 |
| ORST2672 | 2672 | 2703 | ORST3696 | 3696 | 3727 |
| ORST2704 | 2704 | 2735 | ORST3728 | 3728 | 3759 |
| ORST2736 | 2736 | 2767 | ORST3760 | 3760 | 3791 |
| ORST2768 | 2768 | 2799 | ORST3792 | 3792 | 3823 |
| ORST2800 | 2800 | 2831 | ORST3824 | 3824 | 3855 |
| ORST2832 | 2832 | 2863 | ORST3856 | 3856 | 3887 |
| ORST2864 | 2864 | 2895 | ORST3888 | 3888 | 3919 |
| ORST2896 | 2896 | 2927 | ORST3920 | 3920 | 3951 |
| ORST2928 | 2928 | 2959 | ORST3024 | 3024 | 3055 |
| ORST2960 | 2960 | 2991 | ORST3056 | 3056 | 3087 |
| ORST2992 | 2992 | 3023 | ORST3088 | 3088 | 3119 |

Parameter ORST $\circ\circ\circ\circ$ has the default values of "0000000, 00000000, 00000000, and 00000000", and can be set to specify "off," "on," and "hold" (= "0," "off," and "1") for 32 points. Leading number is assigned **from the left side**.

For example, if ORST2000 is set to "*0000001, 00000000, 11110000, and 00000000," the following will result when power to the Robot Controller is turned back on:

Output No. 2000: Holds a state in which it was before power to the robot controller has been turned on

Output No. 2007: On

Output Nos. 2016 to 2019: On

3.9 Hardware of 2D-TZ577 Card

The following subsections explain the hardware of the 2D-TZ577 Card.

3.9.1 Overall View

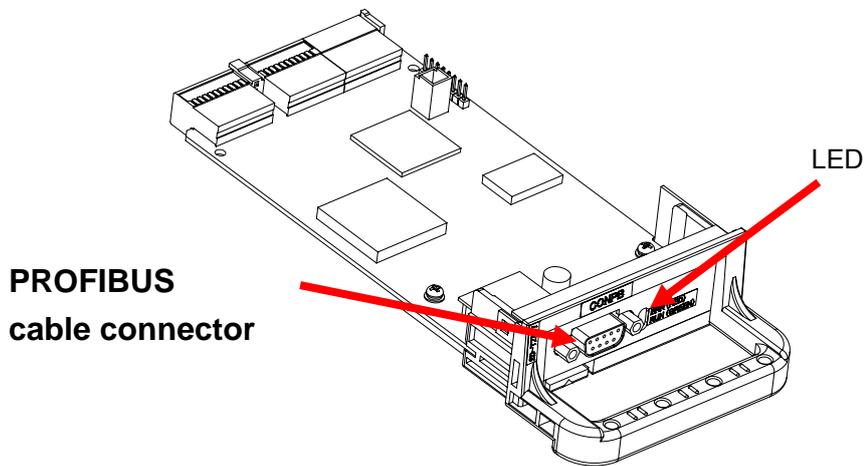


Figure 3-4 Overall View of 2D-TZ577 Card

3.9.2 LED

There are two LEDs provided on the 2D-TZ577 Card, each of which indicates the state of the Card by going on or off.

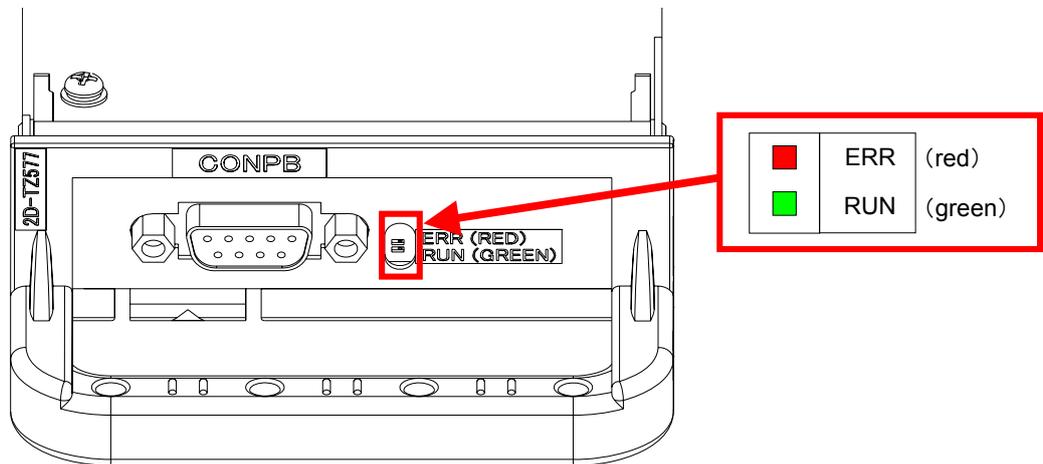


Figure 3-5 Location of LEDs

Table 3-11 A Listing of LEDs

| LED name | Color | Indications |
|----------|-------|--|
| RUN | Green | On: Normal Off: Watchdog timer error occurred. |
| ERR | Red | On: Parameter setting error or unit error occurred. Off: Normal |

4. Out of the Package

4.1 Checking Component Parts

The 2D-TZ577 Card comes standard with the component parts listed in the table below. Check your 2D-TZ577 Card to ensure that it is complete with these parts.

Table 4-1 2D-TZ577 Component Parts

| No. | Item name | Type name | Quantity |
|-----|--|-----------------|----------|
| [1] | Instruction manual (CD-ROM) | BFP-A8740 | 1 |
| [2] | PROFIBUS DP-V0 Slave Interface Card | TZ577 | 1 |
| [3] | Ferrite core | E04SR301334 | 2 |
| [4] | GSD file (CD-ROM) | MLFA0BE4.gsd | 1 |
| [5] | Icon file for setting software(CD-ROM) | 2DTZ577ICON.bmp | 1 |
| [6] | Cable clamp | AL4 | 1 |
| [7] | Cable clamp | AL6 | 1 |

Note: Numbers in the table corresponds to those in the figure below.

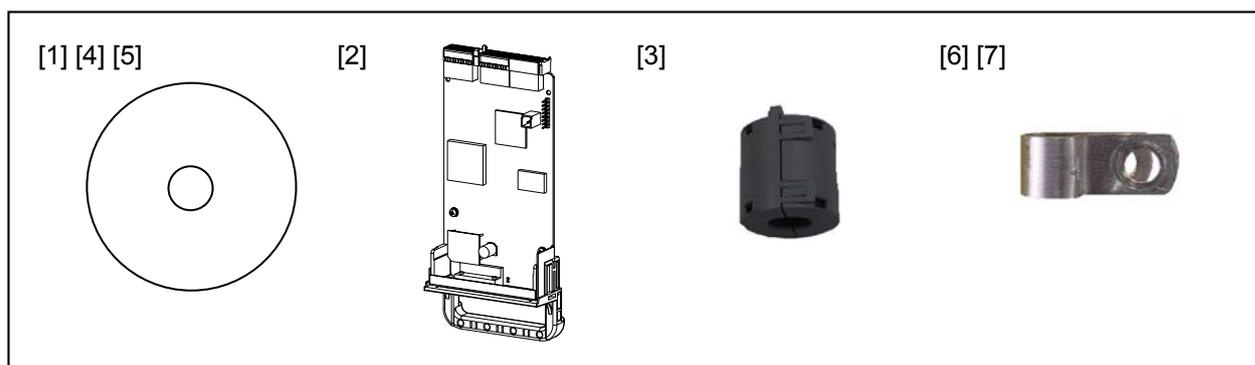


Figure 4-1 2D-TZ577 Component Parts (Illustrated)

4.2 Items To Be Furnished by User

The following table shows the items that the user is requested to have ready before using the 2D-TZ577 Card.

Table 4-2 Items To Be Furnished by User

| Item | Requirement | Remark |
|-----------------------------------|---|---|
| Master Station ^{*1} | Master Station which is compatible with PROFIBUS DP | |
| Communication cable ^{*1} | Cable specifically designed for use with PROFIBUS DP * There are limits to maximum total cable length and inter-segment cable length. For details, see Figure 3-2 An Example of Basic PROFIBUS DP Network Configuration. | Mitsubishi Electric disclaims all guarantees of PROFIBUS system performance if any cable or connector other than those described here are used. |

4 Out of the Package

| | | |
|------------------------|--|--|
| Connector ¹ | Connector specifically designed for use with PROFIBUS, having built-in terminator resistors. Recommended type name: 6GK1 500-0FC00 *Siemens. * Use a connector of straight type (180° cable outlet). When using a connector of right-angle type (90° cable outlet), note that it may give rise to problems with the cable run including interference with other cables or the rear cover (CR2D) | |
|------------------------|--|--|

(*1) For more details, contact the International PROFIBUS Organization.
Association website at <http://www.profibus.com/>

5. Hardware Setup

5.1 Hardware Setup for 2D-TZ577 Card

Hardware setup need not be done in regard to the 2D-TZ577 Card.

Entire setup activity is performed by using parameter settings on the side of the Master Station and the Robot Controller.

For details, see Section 7.2 Parameter Settings on the Side of Master Station and Section 7.3 Parameter Settings on the Side of Robot Controller.

6. Connection and Wiring

6.1 Installing A 2D-TZ577 Card into Robot Controller

Note that only one 2D-TZ577 Card should be installed into an **option slot**^{*1} of the Robot Controller at any one time. If more than one card are installed into the slots, Error H.8502 "More than one PROFIBUS Card is installed" will be indicated.

(*1) Number of the option slots varies with the Controller being used.

CR1D: Provided only with Option Slot 1

CR2/3D: Provided with Option Slots 1 thru 3

6.1.1 CR1D Robot Controller

Remove the option slot interface cover on the rear of the Controller and install a 2D-TZ577 Card into the slot. During installation, use the handle fitted to the Card.

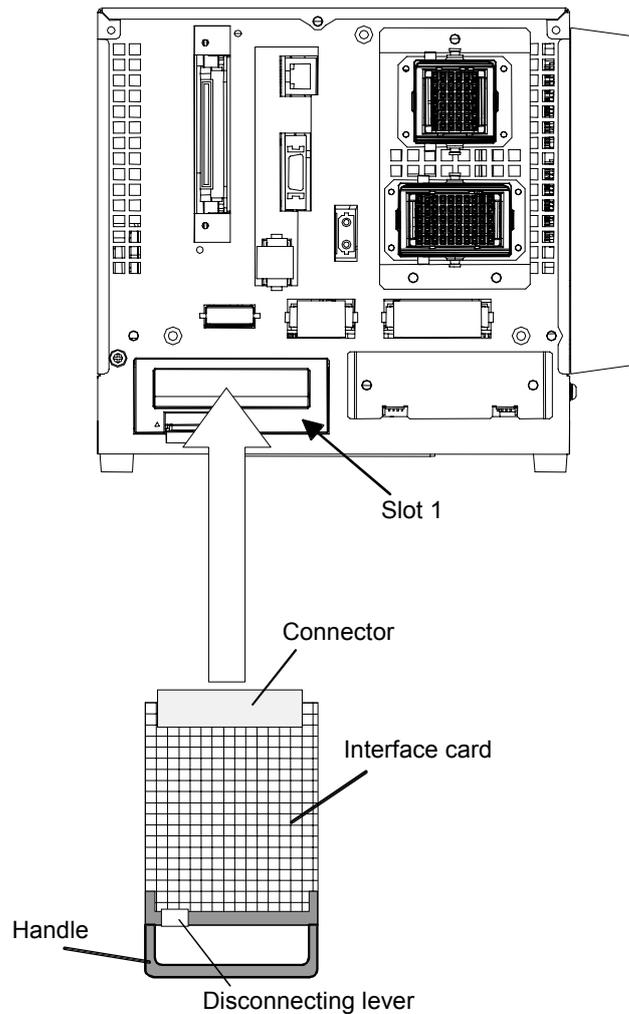


Figure 6-1 Installing A 2D-TZ577 Card (in the case of CR1D Controller)

6.1.2 CR2D Robot Controller

Remove any one of the interface covers provided for option slots 1 thru 3 on the rear of the Controller and install a 2D-TZ577 Card into the slot.

During installation, use the handle fitted to the Card.

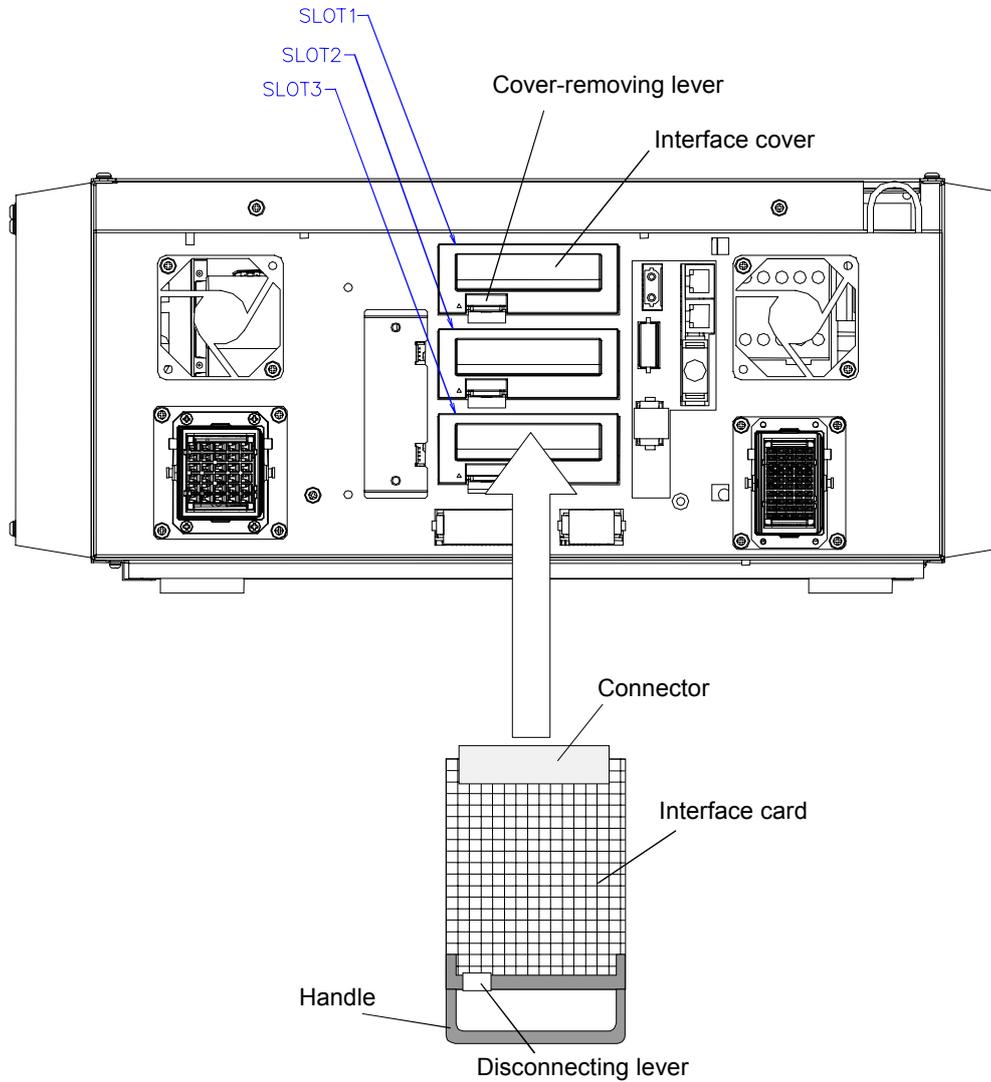


Figure 6-2 Installing A 2D-TZ577 Card (in the case of CR2D Controller)

6.1.3 CR3D Robot Controller

Open the door of the Robot Controller and you will see R700 CPU unit installed at the right-hand end. Remove any one of the option slot interface covers provided for option slot 1 thru 3 on the CPU unit and install a 2D-TZ577 Card into the slot.

During installation, use the handle fitted to the Card.

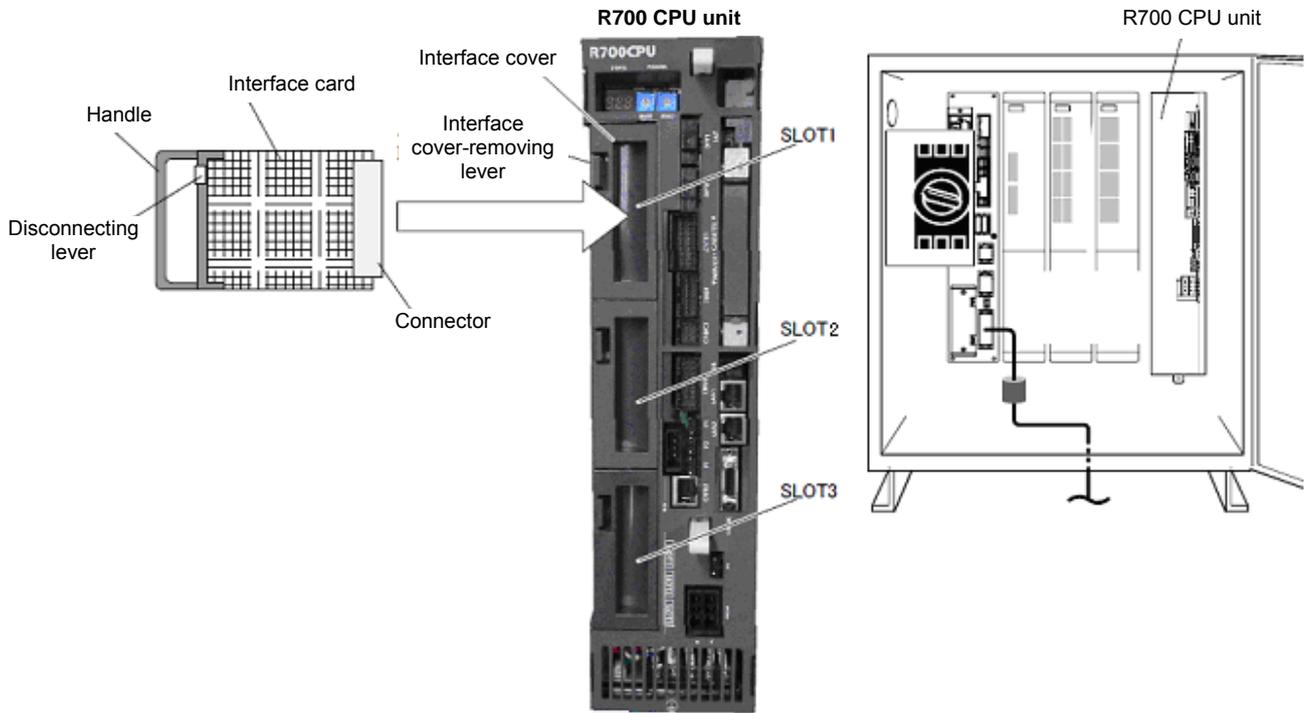


Figure 6-3 Installing A 2D-TZ577 Card (in the case of CR3D Controller)

6.2 Connector Pin Configuration (D-SUB9 Pin)

Table 6-1 Connector Pin Configuration

| Pin No. | Name | Service |
|---------|---------------------|-----------------------------|
| 1 | Not assigned | - |
| 2 | Not assigned | - |
| 3 | RxD/TxD-P | Received/transmitted data-P |
| 4 | Not assigned | - |
| 5 | DGND ^(*) | Data ground earth (0V) |
| 6 | VP ^(*) | Voltage + (+5V) |
| 7 | Not assigned | - |
| 8 | RxD/TxD-N | Received/transmitted data-N |
| 9 | Not assigned | - |

(*1) Signal used when terminator resistors are connected.

6.3 Wiring

The terminal station of each segment on a communication line need be provided with terminator resistors. Use a connector specifically designed for use with PROFIBUS which has built-in terminator resistors. Note: Terminator resistors are arranged so as to apply: 220Ω between (+) and (-), 390Ω between 5V and (+), and 390Ω between 0V and (-).

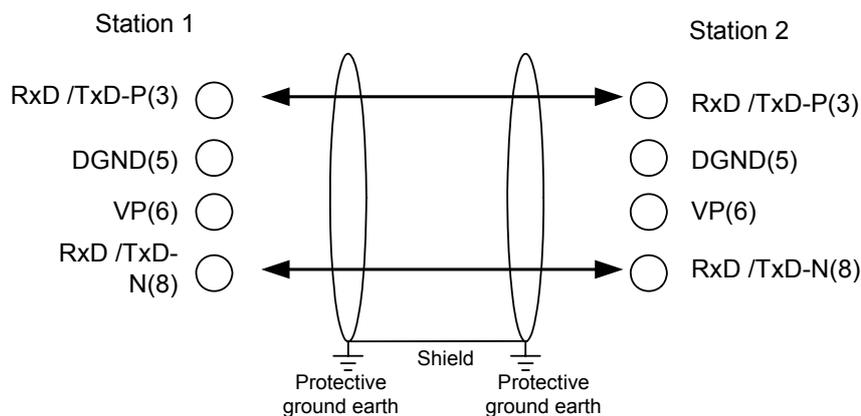


Figure 6-4 Cable Routing

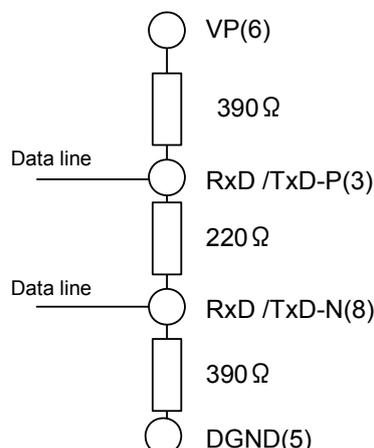


Figure 6-5 Bus Terminator Resistors

6.4 About Noise Control

To avoid an adverse impact from noise, strip off some sheath of the PROFIBUS cable, and attach the cable's metal blade portion to the controller casing with an earth clamp and install the accompanying ferrite core within 30cm of where the cable is clamped onto the casing.

Connection method is shown below by controller type.

6.4.1 CR1D Controller

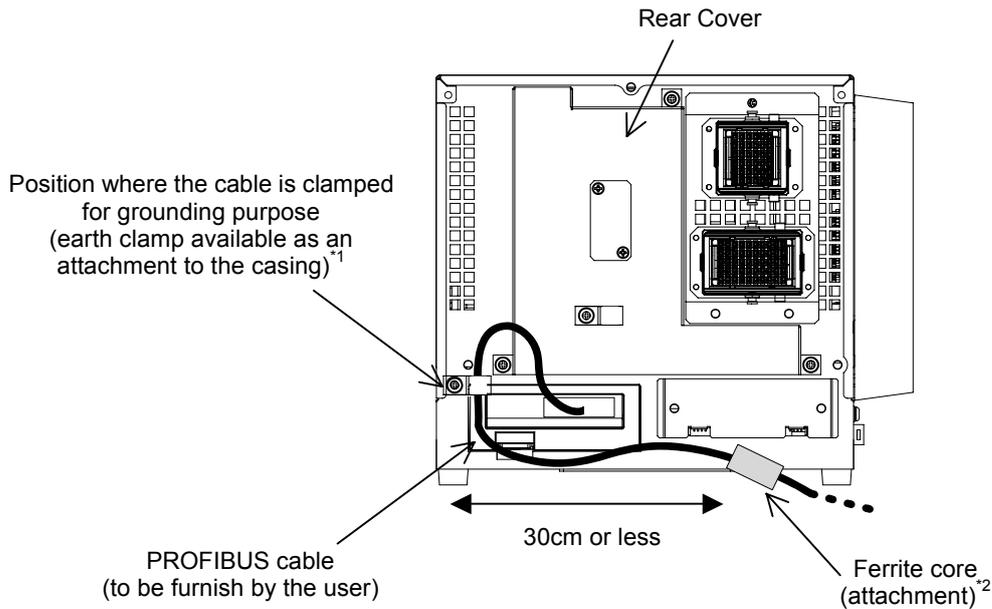


Figure 6-6 Installing PROFIBUS Cable (CR1D Controller)

6.4.2 CR2D Controller

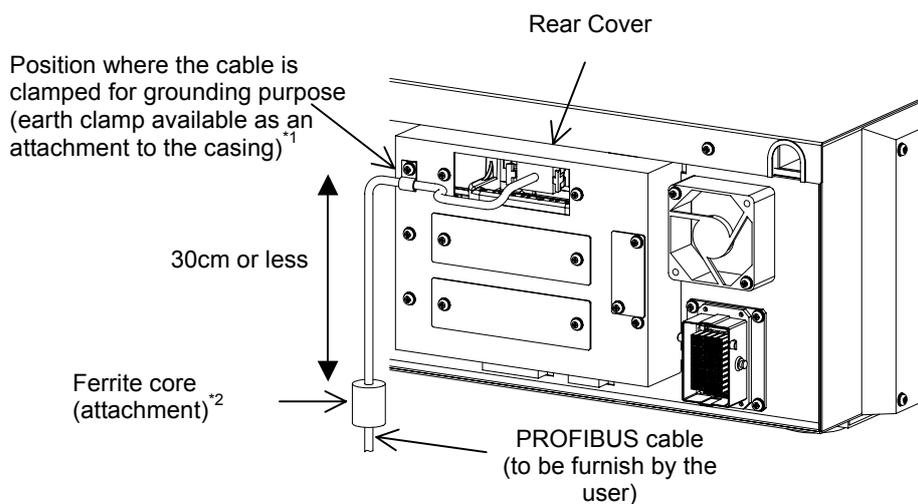


Figure 6-7 Installing PROFIBUS Cable (CR2D Controller)

6.4.3 CR3D Controller

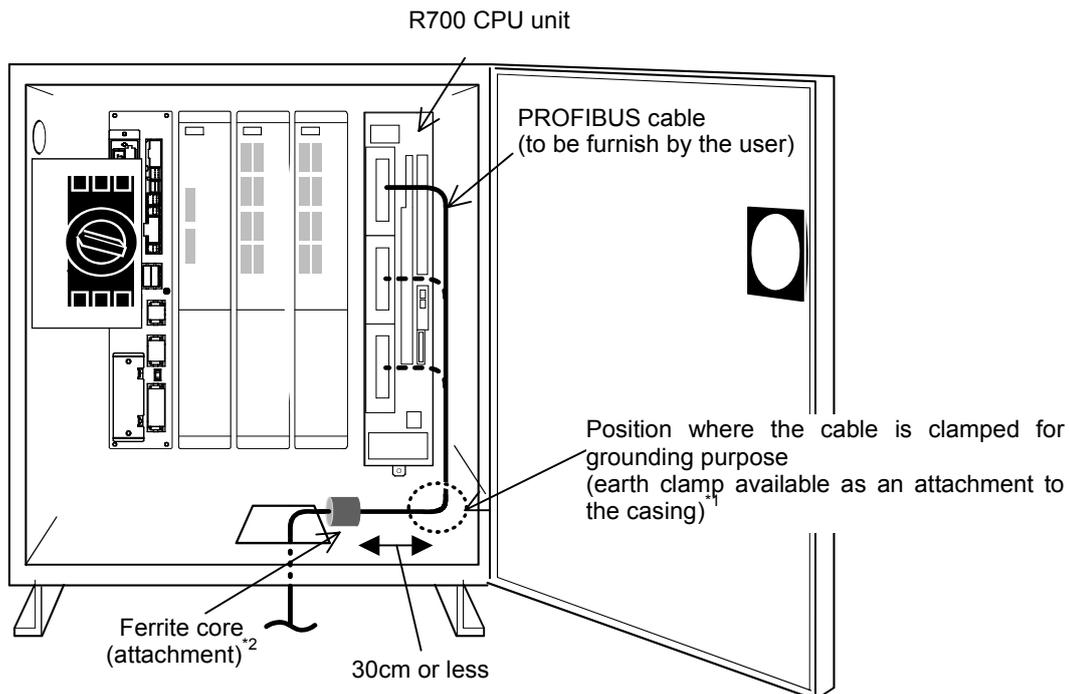
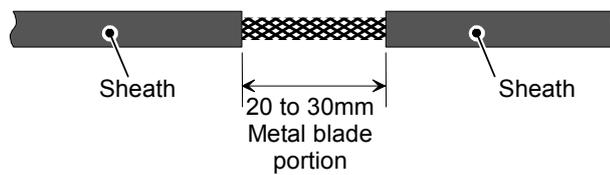
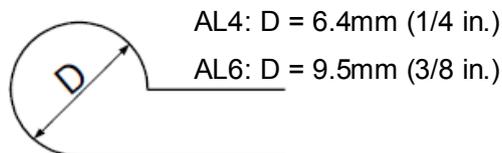


Figure 6-8 Installing PROFIBUS Cable (CR3D Controller)

- (*1) Position where the cable is clamped for grounding purpose
Strip off some sheath of the cable and keep metal blade portion in contact with the controller casing.



- (*2) When Siemens PROFIBUS FC standard cable (8.0mm O.D.) is used, recommended metal clamps are:
AL4 or AL6 *RICHCO INC



6.5 Checking Connections

Before placing the 2D-TZ577 Card in service, go through the following checklist to avoid oversights.

Table 6-2 Checklist for Proper Connections

| No. | Item confirmed | Check |
|-----|--|-------|
| 1 | Is the 2D-TZ577 Card securely installed into the Controller's slot? | |
| 2 | Is the RPOFIBUS Cable linking the 2D-TZ577 Card to the user's external equipment properly connected? | |
| 3 | Is the special-purpose connector installed at each end of the PROFIBUS network configured to apply terminal resistance as specified? | |
| 4 | Is the ferrite core is installed in place? | |

7. Procedure before Startup

The following diagram shows the procedure performed to place the 2D-TZ477 Card in operation.

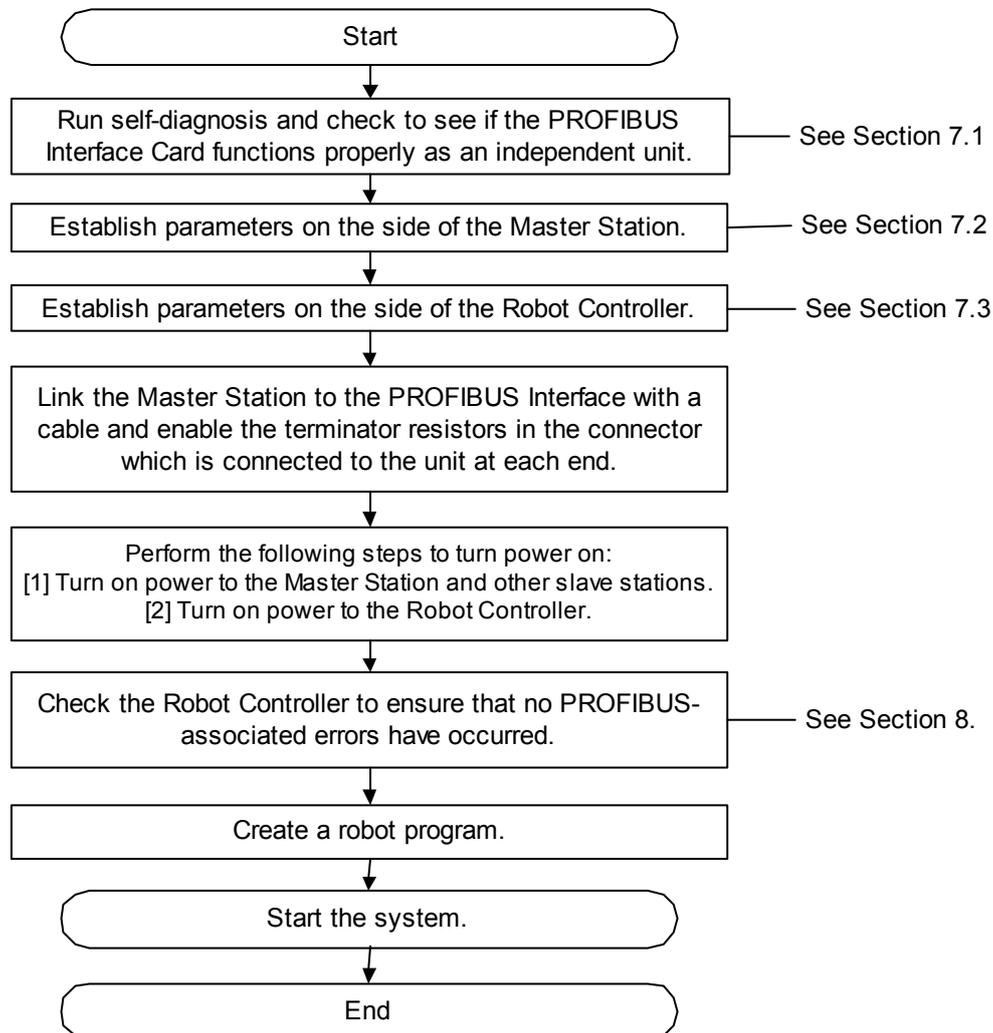


Figure 7-1 Procedure Before Startup



CAUTION

About setting station numbers from Class 2 Master Station

When setting station numbers from Class 2 Master Station, ensure that cable link is established between the Master Station and the PROFIBUS Interface Card.

7.1 Procedure for Running Self-diagnosis

The following subsections explain the procedure used to run self-diagnosis and states which are observed while the self-diagnosis goes on.

- (1) Procedure for running self-diagnosis
 - [1] Turn on power to the Robot Controller.
 - [2] Set robot parameter to self-diagnosis mode. (Set robot parameter as "PBMODE = 2." For details, see "Table 3-4 A Listing of Robot Parameters Used with PROFIBUS".)
 - [3] Turn off power to the Robot Controller and turn power back on.
 - [4] While self-diagnosis goes on, display on the operation panel of the Robot Controller flashes like >777< ↔ blank.
 - [5] If the results of self-diagnosis are "normal"The Robot Controller will start normally and the 2D-TZ577 Card will stand by for parameters from the Master Station.

If the results of self-diagnosis are "abnormal" ... H.8504 Error (error identified in PROFIBUS self-diagnosis) will occur.

* Parameter need be set as "PBMODE = 0" if it is not desired to run self-diagnosis at the subsequent startup.

- (2) Corrective actions at the occurrence of error

If the results of self-diagnosis are "error," replace the 2D-TZ577 Card.

When replacing the card, contact its manufacturer for advice.

7.2 Parameter Settings on the Side of Master Station

7.2.1 Procedure for Establishing Parameters

Establish parameters listed below on the side of Master Station.

Table 7-1 Master-side Parameters

| Parameters established on the side of Master Station | | Reference |
|---|--|---|
| Master parameters (parameters for Master Station itself) | | -([*] 1) |
| Bus parameters (communication parameters for PROFIBUS-DP network) | | -([*] 1) |
| Slave parameters (for 2D-TZ577 Card) | Station number (FDL Address) | For details, see "Table 7-2 A Listing of Slave Parameters." |
| | Communication WDT (Watchdog) | |
| | Minimum response time (Min T_sdr) | |
| | Group number (group identification number) | |
| | Data module setting | |
| | Data alignment setting | |
| | Swap setting | |

- (^{*}1) For information about items of setting, see the instruction manual for the Master Station.
 For method to specify parameter settings, refer to the instruction manual for the software that is used.

<Procedure for establishing 2D-TZ577 Card slave parameters to Master Station>

- [1] Read GSD file stored in the CD-ROM supplied with the 2D-TZ577 Card into a setting software which is compatible with the Master Station.
- [2] Establish 2D-TZ577 Card slave parameters, using the setting software.
- [3] Write the parameters into the Master Station.

For information about operating the setting software, refer to the instruction manual for the software that is used.

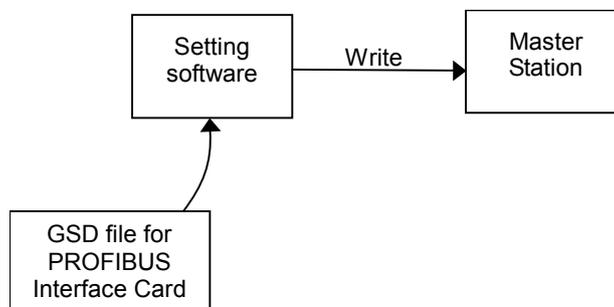


Figure 7-2 Conceptual illustration of GSD file being loaded

7.2.2 Slave Parameters

Parameters other than slave station numbers need be established as slave parameters for use in the Master Station. The following table shows slave parameters for use in the 2D-TZ577 Card.

Table 7-2 A Listing of Slave Parameters

| Item | Setting range | Description | Remark |
|--|---------------|---|---|
| Station number (FDL Address) | 0 to 125 | Station number of 2D-TZ577 Card is defined. | If connection is made to Class 1 Master, station number need be set in the robot parameter "PBNUM" as well. |
| Communication WDT (Watchdog) | 0/2 to 65000 | Watchdog timer is defined. 0: Communication WDT setting is disabled. 2-65000: Communication WDT setting is enabled (set value x 10msec). | - |
| Minimum response time (Min T_sdr) | 1 to 255 | A minimum response time lapsed until response frames are permitted to be sent to the Master Station is defined. | - |
| Group number (Group identification number) | Grp1 to Grp8 | Group to which a station belongs is defined. Any station is allowed to belong to more than one group (Grp 1 thru 8). | - |
| Data module settings (Module Configuration) | - | I/O configuration information (defined in "Cfg_Data" on the Master Station) · Types of settings: 48 patterns · Number of settings: 1 - 40 | - |
| Data alignment mode settings (Data Alignment Mode) | 0 | Position of data in the output receive area/input send area of buffer memory (defined in "User_Prm_Data" on the Master Station) 0: Lump alignment mode (LUMP mode) * This parameter takes on "0" only. No change is permitted. | - |

7 Procedure before Startup

| Item | Setting range | Description | Remark |
|-----------------------------------|---------------|--|--------|
| Swap settings (Word Data Swap) | 0 to 1 | Indication as to whether there is swapping of word data sent/received at 2D-TZ577 Card (defined in "User_Prm_Data" on the Master Station) 0: No swapping takes place. 1: Swapping takes place. | - |

(1) Number of data module settings

Make settings so that the number of data modules per 2D-TZ577 Card falls within the limits shown below:

- Number of data modules: 40 maximum
- Combined data size

| | | |
|---|---|-----------------------------|
| Input data - 122 words maximum Output data - 122 words maximum | } | 192 words in combined total |
|---|---|-----------------------------|

(2) Data module setting pattern

An appropriate pattern is selected from among 48 patterns which derive from a combination of 3 input/output options and 16 data sizes. Note that input/output notations are based on the Master Station being the origin. For more information, see Subsection (3) **Data alignment mode settings**.

Table 7-3 Data Module Settings

| Item | Type |
|--------------------------|-----------------|
| Input/output designation | Input/output/IO |
| Data size | 1 to 16 words |

(3) Data alignment mode settings

Method by which to align each module in the output receive area/input send area of buffer memory is specified. The 2D-TZ577 Card comes with a lump alignment mode (lump mode) alone, permitting no changes to these settings.

- (a) Lump alignment mode (lump mode)

Input data/output data is aligned on the front in the input send area/output receive area, respectively, in the order of data module. The table below shows examples of usage statuses in the output receive area/input send area which occur on the data module settings shown.

Table 7-4 Examples of Data Module Settings

| Data module settings | | Output data | Input data |
|----------------------|---|-------------|------------|
| Data module 0 | One-word input (1 word In) | | One-word |
| Data module 1 | 2-word output (2 word Out) | 2-word | |
| Data module 2 | One-word input/output (1 word In, 1 word Out) | One-word | One-word |
| Data module 3 | One-word output (1 word Out) | One-word | |
| Data module 4 | 2-word input (2 word In) | | 2-word |
| Data module 5 | One-word output (1 word Out) | One-word | |

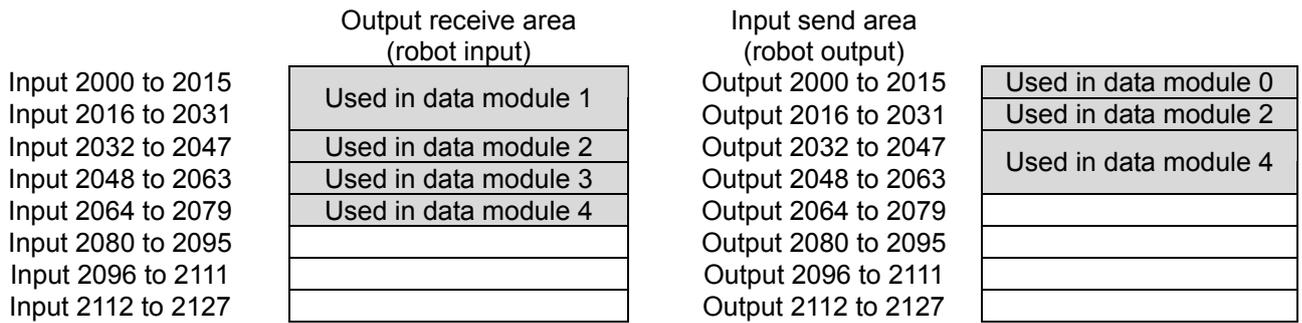


Figure 7-3 Example of Lump Alignment

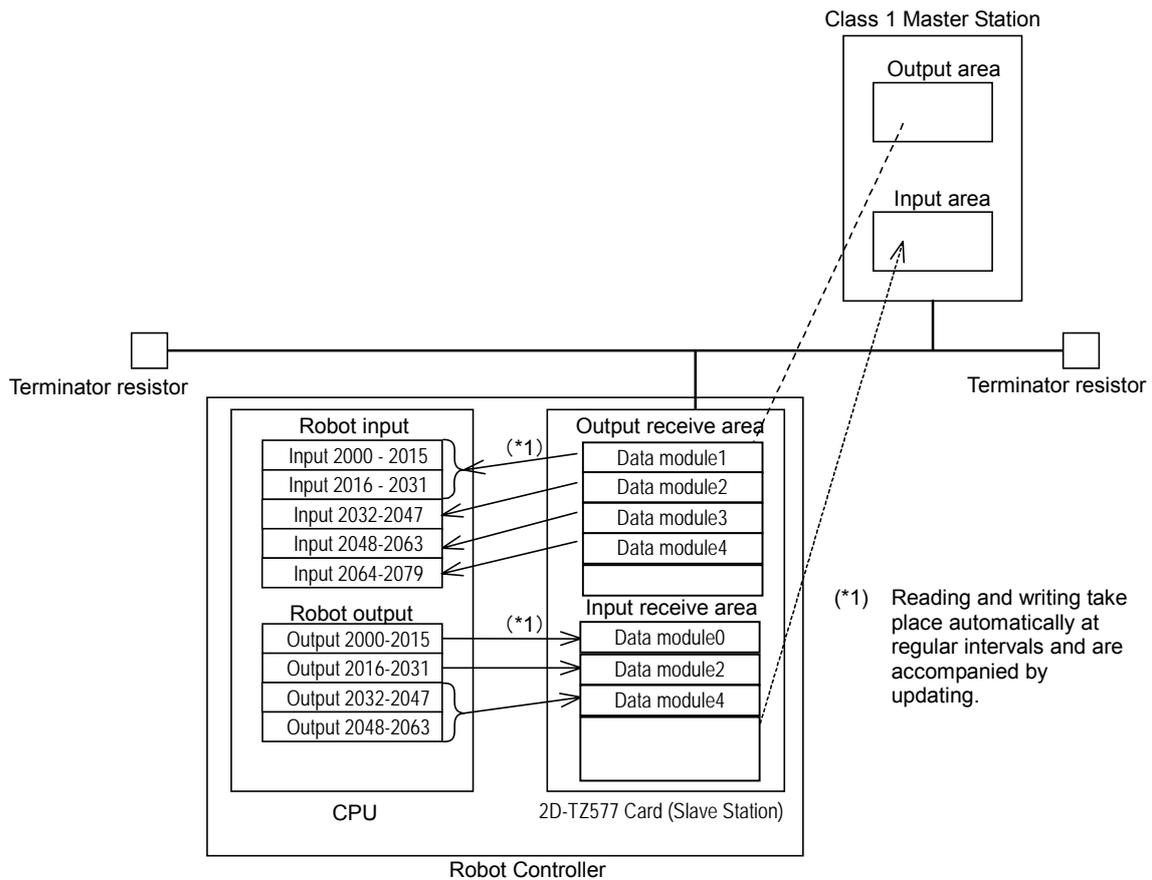


Figure 7-4 Flow of Data

7.3 Parameter Settings on the Side of Robot Controller

(1) Parameter settings under R32TB, R56TB, and RT ToolBox2 (versions earlier than Ver. 1.3)

To place the 2D-TZ577 Card in operation, it is necessary to establish three typical parameters, as listed below, on the Robot Controller. For information about what to do about other parameters, see Table 3-4 A Listing of Robot Parameters Used with PROFIBUS.

For information about changing parameters, refer to the "Instruction Manual - Detailed Description of Functions and Operation" which is separately issued.

Table 7-5 Parameters on the Side of Robot Controller

| Parameter name | Initial value | Setting range | Description |
|----------------|---------------|---------------|--|
| PBMODE | 0 | 0/2 | A parameter that switches the operating mode of the 2D-TZ577 Card between "normal" and "self-diagnosis." Normal mode = 0, self-diagnosis mode = 2 <ul style="list-style-type: none"> · When the self-diagnosis identifies an anomaly, an error message is displayed. ("H.8504: PROFIBUS Self-diagnosis shows occurrence of an error.") · Return the operating mode to normal to continue with normal operation. |
| PBMC | 1 | 1/2 | A parameter that designates Master Station as Class 1 or Class 2. Class 1 Master Station is designated at factory default. To use "Class 2," choose another parameter setting. <ol style="list-style-type: none"> 1: Class 1 Master (effected when the station number setting parameter PBNUM shown below is used) 2: Class 2 Master (effected when changes of station numbers are made from Class 2 Master Station - with PBNUM not being used) |
| PBNUM | 126 | -1 to 125 | A parameter that specifies station number for the 2D-TZ577 Card. 0~125: Station number setting values (Rewriting of station number settings takes place within the flash ROM as well.) <ul style="list-style-type: none"> -1: Station number clear (Station number settings within the flash ROM are cleared.) * After the station numbers are cleared, the value 126 is taken on. * If "No_Add_Chg" is specified with "true" when making station number settings from Class 2 Master Station, 2D-TZ577 Card is disabled for change of station numbers. To cancel this setting, clear station numbers with "PBNUM = -1." |

(2) Parameter settings under RT ToolBox2 (versions later than Ver. 1.3)

Under RT ToolBox2 versions later than 1.3, a PROFIBUS-specific setting window shown in Figure 7-5 is offered. You can establish three parameters shown in Table 7-5 on this screen.

In regard to the PROFIBUS Error Detection Filter (PBCNT), you may change its set values only when communication errors are frequently encountered under the undue influence from noise in your installation environment. (For more information, see Table 3-4 A Listing of Robot Parameters Used with PROFIBUS.)

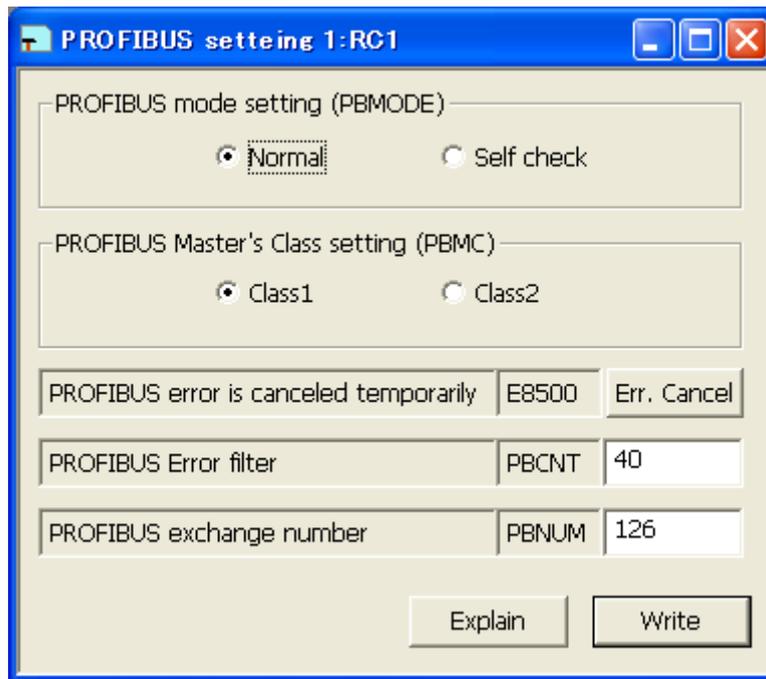


Figure 7-5 PROFIBUS Setting Screen

You can call up the PROFIBUS setting screen by expanding the Test tree under the Work Space and going through "Online" and "Parameter" and double-clicking the "PROFIBUS setting" entry or alternatively right-clicking this entry and clicking Open on the pull-down menu that appears.

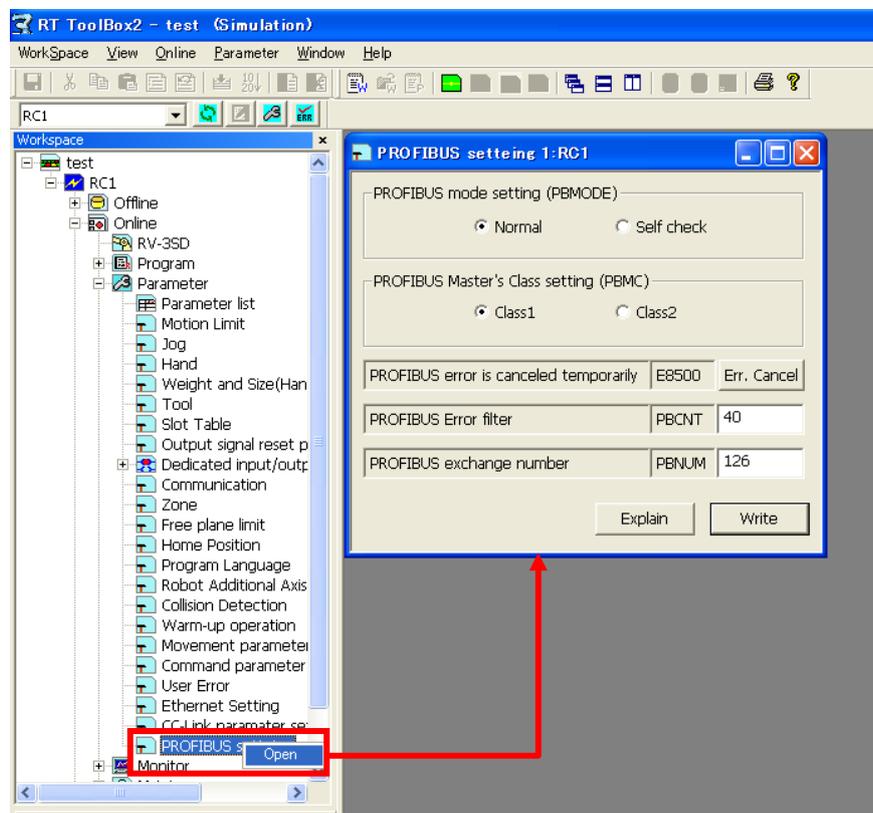


Figure 7-6 Opening PROFIBUS Setting Screen

7.4 Have A Try For It

7.4.1 Setting Dedicated Input/Output

Make settings for dedicated input/output as listed in the table. After changing the parameter settings, power the system off and on again.

For information about making these settings, refer to the "Instruction Manual - Detailed Description of Functions and Operation" which is separately issued.

Table 7-6 Setting Dedicated Input/Output

| Parameter name | Input | | Output | |
|----------------|-------------------------|--------|-----------------------------------|------|
| | Meaning | Number | Meaning | No. |
| IOENA | Enable operating right. | 2000 | Operating right is being enabled. | 2000 |
| START | Start programs. | 2001 | Programs are being started. | 2001 |
| STOP2 | Stop. | 2002 | During suspension. | 2002 |
| SLOTINIT | Program reset. | 2003 | Program selection is permitted. | 2003 |
| SRVON | Servo power on. | 2004 | Servo being turned on. | 2004 |
| SRVOFF | Servo power off. | 2005 | | |

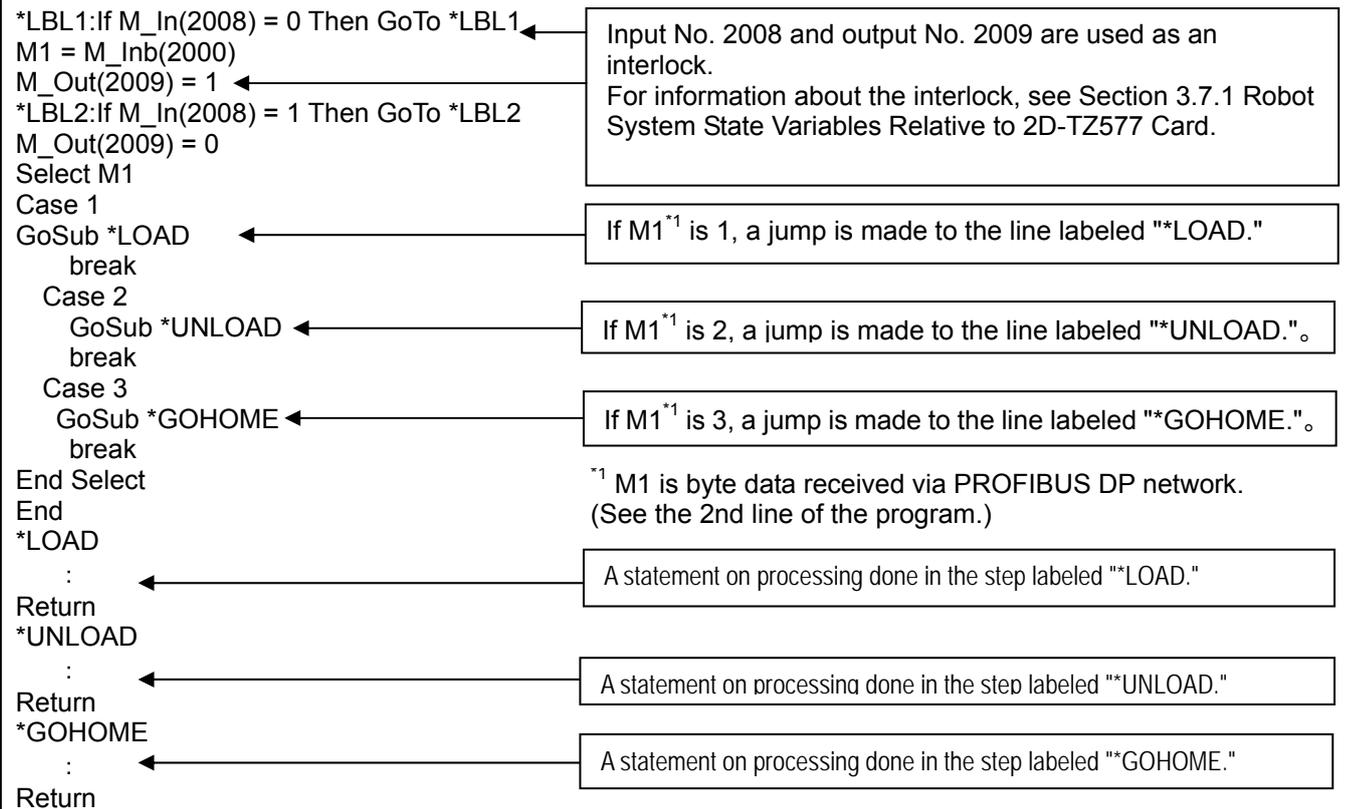
7.4.2 About General-purpose Input/Output

General-purpose input/output, too, are accessible by using system variables for I/O, such as M_In and M_Out. However, you are not permitted to make such access as spans beyond the region used in PROFIBUS, like 1999, by using variables which access a plurality of bits, including M_Inb, M_Inw, M_Outb, and M_Outw. Ensure that your programming stays within the region ranging from 2000 and 3951.

Correct example: M_In (2000), M_Inb (2010), M_Out (3000), M_Outb (3010), etc.

Incorrect example: M_Inb(1999), M_Inw (5070), M_Outb (1999), M_Outw (1999), etc.

7.4.3 Examples of Robot Program (Using General-purpose I/O)



7.4.4 A Sample Program for Checking Input/Output

Shown below is a sample program which can be used for checking input/output on the 2D-TZ577 Card.
Use this program during a checkup at startup or as otherwise required.

Table 7-7 Signal Alignment Conditions

| | |
|--|---|
| Robot-side input (Master Station output) | Input 2000~3535 (equivalent to 96 words) |
| Robot-side output (Master Station input) | Output 2000~3535 (equivalent to 96 words) |

Robot program specification

Input bits are copied in their entirety onto output bits.

[Robot Program - Example 1]

Input signals to the Robot are looped back in their entirety to output signals (for the purpose of bit check).

For M1 = 2000 To 3535

 M_Out(M1) = M_In(M1) ' Copied in the form of a variable for bit

Next M1

End

[Robot Program - Example 2]

Input signals to the Robot are looped back in their entirety to output signals (for the purpose of byte check).

For M1 = 2000 To 3535 Step 8

 M_Outb(M1) = M_Inb(M1) ' Copied in the form of a variable for byte

Next M1

End

[Robot Program - Example 3]

Input signals to the Robot are looped back in their entirety to output signals (for the purpose of word check).

For M1 = 2000 To 3535 Step 16

 M_Outw(M1) = M_Inw(M1) ' Copied in the form of a variable for word

Next M1

End

Run this program and check the looped-back signals on the side of the Master Station.

8. Troubleshooting

Check this section before concluding that your system is out of order.

8.1 A Listing of Errors

◆◆◆ An error number contains information as listed below ◆◆◆

□0000 *



An error marked with an asterisk * requires a power reset.
Take a corrective action which is stated in the "Solutions" section of the table below.
The type of error is indicated by a 4-digit number.
Errors are sorted into three classifications:
H: High-level error Servo mechanism is shut down.
L: Low-level error Operation is suspended.
C: Caution Operation continues.

Table 8-1 A Listing of PROFIBUS-related Errors

| Error No. | Causes and Solutions | |
|-----------|----------------------|--|
| H.8500 | Error message | PROFIBUS Initial error |
| | Cause | An error was detected in the hardware. The hardware may be at fault. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8501 | Error message | PROFIBUS watch dog timer error |
| | Cause | An error was detected in the hardware. The hardware may be at fault. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8502* | Error message | Plural PROFIBUS cards are set. |
| | Cause | Only one card is accepted at any one time. |
| | Solution | Install only one card. |
| H.8503* | Error message | PROFIBUS/CC-Link cards are set. |
| | Cause | Either PROFIBUS or CC-Link card is accepted at any one time. |
| | Solution | Install either a PROFIBUS card or a CC-Link card. |
| H.8504 | Error message | Either of the following messages is displayed: (1) PROFIBUS self-check error n (n = 1~7). (2) PROFIBUS cannot self-check |
| | Cause | An error was detected in the hardware. The hardware may be at fault. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8505 | Error message | Illegal param (PBMODE) |
| | Cause | PBMODE parameters are not defined validly. |
| | Solution | Correct PBMODE parameters. (0 - normal, 2 - self-diagnosis) |
| H.8506 | Error message | Exchange number cannot be set. |
| | Cause | Power the system off and on again. |
| | Solution | If the error recurs, contact the manufacturer for advice. |
| H.8507 | Error message | Illegal param (PBMC) |
| | Cause | PBMC parameters are not defined validly. |
| | Solution | Correct PBMODE parameters. (1 - Class 1, 2 - Class 2) |

8 Troubleshooting

| Error No. | Causes and Solutions | |
|-----------|----------------------|---|
| H.8510 | Error message | PROFIBUS exchange No. is wrong. |
| | Cause | Either of the following causes may be responsible: (1) Station numbers stored in the flash memory are outside the prescribed range. (2) An attempt was made to change to a station number being outside the prescribed range. |
| | Solution | Specify PBNUM parameter with numbers in the range of 1 to 125. |
| H.8520 | Error message | PROFIBUS St.number write error. |
| | Cause | An attempt was made to change station numbers when rewriting was disabled. |
| | Solution | Enter "-1" in the "station number" box (robot parameter "PBNUM = -1") so that the existing station numbers are cleared. |
| | Error message | An attempt was made to change station numbers when "No_Add_Chg" had been specified with "true" during station number setting from Class 2 Master Station. |
| H.8530 | Error message | PROFIBUS St.number write error. |
| | Cause | More than 60 consecutive rewrite attempts were made on the flash ROM. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8540 | Error message | PROFIBUS flash ROM access error. |
| | Cause | An anomaly in the hardware. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8550 | Error message | PROFIBUS master bureau's parameter is illegal |
| | Cause | Any one of the following causes may be responsible: (1) Parameters established at the Master Station are incorrect. (2) Set value for communication WDT is too long. (3) Value specified for minimum response time Min_Tsdr is outside the prescribed range. |
| | Solution | Check the slave parameter settings on the Master Station. (Refer to the instruction manual for Master Station.) |
| H.8560 | Error message | PROFIBUS communication chip ERR |
| | Cause | An anomaly in the hardware. |
| | Solution | Replace the 2D-TZ577 Card. When replacing the card, contact its manufacturer for advice. |
| H.8570 | Error message | PROFIBUS communication Time-out |
| | Cause | Timeout occurred in the communications with the Master Station. |
| | Solution | Check Master Station state and cable connections, and choose a longer communication WDT setting. |
| H.8580 | Error message | PROFIBUS I/O composition error. |
| | Cause | Any one of the following causes may be responsible: (1) Data module is not of word type. (2) Swap set value is outside the prescribed range. (3) Data alignment mode set value is outside the prescribed range. (4) Number-of-data modules set value is outside the prescribed range. (5) Data module settings are outside the prescribed range. (6) Parameter setting station numbers are invalid. |
| | Solution | Check the slave parameter settings on the Master Station. (Refer to the instruction manual for Master Station.) |

8.2 At the Occurrence of Error 8570

(PROFIBUS Communication Timeout)

When this error occurred, take the corrective action suggested in the troubleshooting chart in Section 8.1. If the error still persists, check to see the following:

- (1) Is power to the Master Station unit on?
- (2) Is the Master Station functioning properly?
* H.8570 occurs unless the Master Station is up and running before power is turned on to the Robot Controller.
- (3) Is the Master Station properly connected?
- (4) Are the parameter settings on the Master Station consistent with those on the Robot Controller?
- (5) Doesn't any of the peripheral equipment contain a noise emission source?
- (6) If it is desired to ignore Error 8570, change E8570 parameter setting.

9. Appendix

9.1 Displaying Option Card Information

You can call up information about the option card on the screen using the RT ToolBox2 (Option) screen. Clicking Slotn(n=1~3):PROFIBUS under the Option Card entry on the Work Space tree lets you have information about the 2D-TZ577 Card displayed on a property window.

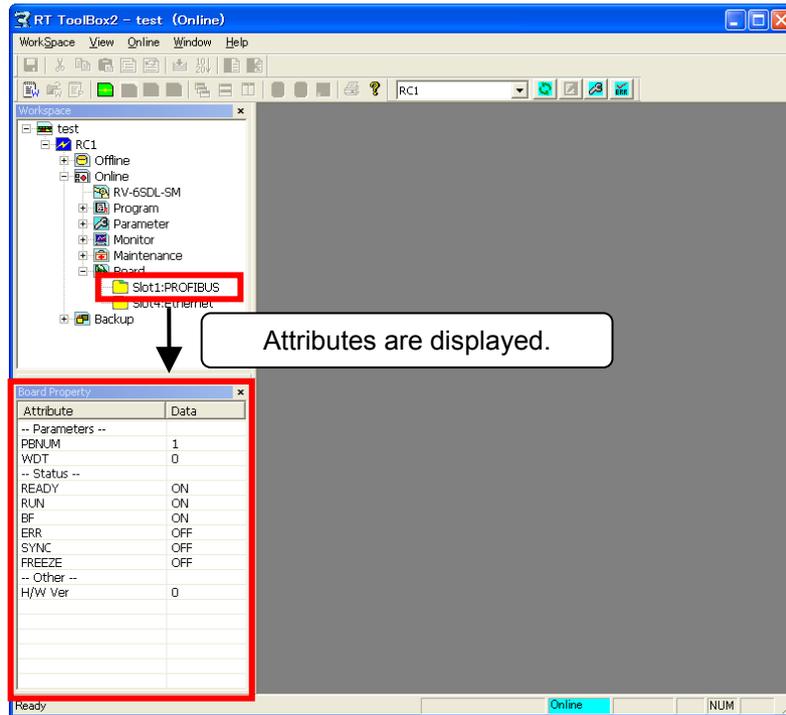


Figure 9-1 An Example of Option Card Information Displayed on RT ToolBox2 Window

Table 9-1 Information about 2D-TZ577 Card

| Item of display | Example of information displayed | Meaning | Remark | |
|---------------------|----------------------------------|-----------|--|--|
| Designation of card | PROFIBUS | Card name | | |
| Card information | [PBNUM] | 1 | Number of station in action Station number: 0 to 125 (Default setting: 126(*1)) | |
| | [WDT] | 5 | Watchdog timer | |
| | [Ready] | ON or OFF | Unit being in Ready state | |
| | [RUN] | ON or OFF | Run state | ON = normal, OFF = WDT error occurred |
| | [BF] | ON or OFF | BF state | ON = Before data communications or communications error detected OFF = Communications proceeding normally |
| | [ERR.] | ON or OFF | Error-occurred state | ON = Parameter setting error or unit error OFF = Communications proceeding normally |
| | [SYNC] | ON or OFF | SYNC-mode state | ON = SYNC-mode state |
| | [FREEZE] | ON or OFF | FREEZE-mode state | ON = FREEZE-mode state |
| | [H/W Ver] | 0 | Hardware version | |

(*1) Station Number 126 gets the card isolated from a PROFIBUS network.

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