OMRON

Machine Automation Controller

CJ-series

PROFIBUS Master Unit

Operation Manual

for NJ-series CPU Unit

CJ1W-PRM21

PROFIBUS Master Unit

W509-E2-01

Introduction

Thank you for purchasing a CJ-series CJ1W-PRM21 PROFIBUS Master Unit.
This manual contains information that is necessary to use the CJ-series CJ1W-PRM21 PROFIBUS Master Unit for an NJ-series CPU Unit. Please read this manual and make sure you understand the functionality and performance of the NJ-series CPU Unit before you attempt to use it in a control system.
Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA systems.
- Personnel in charge of managing FA systems and facilities.

For programming, this manual is intended for personnel who understand the programming language specifications in international standard IEC 61131-3 or Japanese standard JIS B3503.

Applicable Products

This manual covers the following products.

CJ-series CJ1W-PRM21 PROFIBUS Master Unit

Relevant Manuals

There are three manuals that provide basic information on the NJ-series CPU Units: the *NJ-series CPU Unit Hardware User's Manual*, the *NJ-series CPU Unit Software User's Manual* and the *NJ-series Instructions Reference Manual*.
Most operations are performed from the Sysmac Studio Automation Software. Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on the Sysmac Studio.
Other manuals are necessary for specific system configurations and applications.
Read all of the manuals that are relevant to your system configuration and application to make the most of the NJ-series CPU Unit.

	NJ-series User's Manuals								
	Basic information								
	NJ-series CPU Unit Hardware User's Manual	NJ-series CPU Unit Software User's Manual	NJ-series Instructions Reference Manual	NJ-series CPU Unit Motion Control User's Manual	NJ-series CPU Unit Built-in EtherCAT Port User's Manual	NJ-series Motion Control Instructions Reference Manual	NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual	NJ-series Troubleshooting Manual	CJ-series Special Unit Operation Manuals for NJ-series CPU Unit
Introduction to NJ-series Controllers	●								
Setting devices and hardware									
Using motion control				●					
Using EtherCAT	●				●				
Using EtherNet/IP							●		
Using CJ-series Units									●
Software settings		●							
Using motion control				●					
Using EtherCAT					●				
Using EtherNet/IP							●		
Programming		●	●						
Using motion control				●		●			
Using EtherCAT					●				
Using CJ-series Units									●
Programming error processing								●	
Testing operation and debugging		●							
Using motion control				●					
Using EtherCAT					●				
Using EtherNet/IP							●		
Troubleshooting and managing errors in an NJ-series Controller	△ Use the relevant manuals for references according to any error that occurs.	△		△	△		△	●	
Maintenance	●								
Using EtherCAT					●				
Using EtherNet/IP							●		
Using CJ-series Units									●

Manual Configuration

NJ-series CPU Unit Hardware User's Manual (Cat. No. W500)

Section	Description
Section 1 **Introduction**	This section provides an introduction to the NJ-series Controllers and their features, and gives the NJ-series Controller specifications.
Section 2 **System Configuration**	This section describes the system configuration used for NJ-series Controllers.
Section 3 **Configuration Units**	This section describes the parts and functions of the configuration devices in the NJ-series Controller configuration, including the CPU Unit and Configuration Units.
Section 4 **Installation and Wiring**	This section describes where and how to install the CPU Unit and Configuration Units and how to wire them.
Section 5 **Troubleshooting**	This section describes the event codes, error confirmation methods, and corrections for errors that can occur.
Section 6 **Inspection and Maintenance**	This section describes the contents of periodic inspections, the service life of the Battery and Power Supply Units, and replacement methods for the Battery and Power Supply Units.
Appendices	The appendices provide the specifications of the Basic I/O Units, Unit dimensions, load short-circuit protection detection, line disconnection detection, and measures for EMC Directives.

NJ-series CPU Unit Software User's Manual (Cat. No. W501)

Section	Description
Section 1 **Introduction**	This section provides an introduction to the NJ-series Controllers and their features, and gives the NJ-series Controller specifications.
Section 2 **CPU Unit Operation**	This section describes the variables and control systems of the CPU Unit and CPU Unit status.
Section 3 **I/O Ports, Slave Configuration, and Unit Configuration**	This section describes how to use I/O ports, how to create the slave configuration and unit configuration and how to assign functions.
Section 4 **Controller Setup**	This section describes the initial settings of the function modules.
Section 5 **Designing Tasks**	This section describes the task system and types of tasks.
Section 6 **Programming**	This section describes programming, including the programming languages and the variables and instructions that are used in programming.
Section 7 **Simulation, Transferring Projects to the Physical CPU Unit, and Operation**	This section describes simulation of Controller operation and how to use the results of simulation.
Section 8 **CPU Unit Status**	This section describes CPU Unit status.
Section 9 **CPU Unit Functions**	This section describes the functionality provided by the CPU Unit.
Section 10 **Communications Setup**	This section describes how to go online with the CPU Unit and how to connect to other devices.
Section 11 **Example of Actual Application Procedures**	This section describes the procedures that are used to actually operate an NJ-series Controller.
Section 12 **Troubleshooting**	This section describes the event codes, error confirmation methods, and corrections for errors that can occur.
Appendices	The appendices provide the CPU Unit specifications, task execution times, system-defined variable lists, data attribute lists, CJ-series Unit memory information, CJ-series Unit memory allocation methods, and data type conversion information.

Sysmac Studio Version 1 Operation Manual (Cat. No. W504)

Section	Description
Section 1 **Introduction**	This section provides an overview and lists the specifications of the Sysmac Studio and describes its features and components.
Section 2 **Installation and Uninstallation**	This section describes how to install and uninstall the Sysmac Studio.
Section 3 **System Design**	This section describes the basic concepts for designing an NJ-series System with the Sysmac Studio and the basic operating procedures.
Section 4 **Programming**	This section describes how to create programs with the Sysmac Studio.
Section 5 **Online Connections to a Controller**	This section describes how to go online with a Controller.
Section 6 **Debugging**	This section describes how to debug the programs online on the Controller or debug it offline with the Simulator.
Section 7 **Other Functions**	This section describes Sysmac Studio functions other than system design functions.
Section 8 **Reusing Programming**	This section describes how to reuse the programs that you create with the Sysmac Studio.
Section 9 **Support Software Provided with the Sysmac Studio**	This section describes the Support Software that is provided with the Sysmac Studio.
Section 10 **Troubleshooting**	This section describes the error messages that are displayed when you check a program on the Sysmac Studio and how to correct those errors.
Appendices	The appendices describe the following: Driver Installation for Direct USB Cable Connection Specifying One of Multiple Ethernet Interface Cards Online Help Simulation Instructions

CJ-series PROFIBUS Master Unit Operation Manual for NJ-series CPU Unit (Cat. No. W509) (This Manual)

Section	Description
Section 1 **Features and System Configuration**	This section provides an introduction to the PROFIBUS Master Units and their features. It also describes the operating procedure and the specifications of the PROFIBUS Master Units.
Section 2 **Nomenclature and Installation**	This section describes the nomenclature, functionality and installation of the PROFIBUS Master Unit.
Section 3 **Configuration Software**	This section contains the procedures for installing the configuration software. It also presents an overview of the Configuration software and discusses the main aspects of defining a PROFIBUS configuration.
Section 4 **Data Exchange with the CPU Unit**	This section describes the data exchange between the CPU Unit and PROFIBUS Master Unit and the definitions of the device variables for CJ-series Unit.
Section 5 **Operation**	This section describes how to operate the CJ1W-PRM21 PROFIBUS Master Unit in a Network.
Section 6 **Message Communications**	This section describes the message service communications commands concept sent from the user program in the CPU Unit.
Section 7 **Troubleshooting and Maintenance**	This section describes the troubleshooting procedure, event logs and maintenance procedure for the PROFIBUS Master Unit.
Appendices	---

CJ-series PROFIBUS-DP Slave Unit Operation Manual for NJ-series CPU Unit (W510)

Section	Description
Section 1 **Features and System Configuration**	This section provides a brief description of PROFIBUS-DP. It also addresses the overall specification and the communication performance of the PROFIBUS-DP CJ1W-PRT21 Slave Unit.
Section 2 **Nomenclature and Installation**	This section describes the nomenclature and installation of the PROFIBUS Slave Unit.
Section 3 **Data Exchange with the CPU Unit**	This section describes the interface and data exchange between the NJ-series CPU and the PROFIBUS-DP CJ1W-PRT21 Slave Unit.
Section 4 **Troubleshooting and Maintenance**	This section describes the troubleshooting procedure, event logs and maintenance procedure for the CJ1W-PRT21 PROFIBUS Slave Unit.
Appendices	---

CJ1W-PRT21 PROFIBUS-DP Slave Unit Operation Manual (CJ-Series CPU) (W408)

Section	Description
Section 1 **PROFIBUS-DP**	This section provides a brief description of PROFIBUS-DP.
Section 2 **Features ad System Configuration**	This section describes the overall specification and the communication performance of the PROFIBUS-DP CJ1W-PRT21 Slave Unit.
Section 3 **Installation**	This section describes the installation of the PROFIBUS-DP CJ1W-PRT21 Slave Unit.
Section 4 **User Interface**	This section describes the interface between the CJ1-series PLC CPU and the PROFIBUS-DP CJ1W-PRT21 Slave Unit.
Section 5 **Troubleshooting and Maintenance**	This section describes the troubleshooting procedures and maintenance operations needed to keep the PROFIBUS-DP network operating properly.
Appendices	---

SmartSlice GRT1-Series PROFIBUS Communication Unit Operation Manual (Cat. No. W04E)

Section	Description
Section 1 **Features and Specifications**	This section provides an introductory overview of the GRT1 series SmartSlice I/O Units and the GRT1-PRT PROFIBUS, Communication Unit, its functions and how to setup and configure it for a PROFIBUS network.
Section 2 **Installation and Wiring**	This section contains the procedures for setting up the PROFIBUS network. It also describes installing and wiring the Communication Unit as well as the GRT1-series SmartSlice I/O Units.
Section 3 **Setup and Operation**	This section describes the operational aspects of the GRT1-PRT and the SmartSlice I/O system.
Section 4 **Troubleshooting and Maintenance**	This section describes the troubleshooting procedures and maintenance operations for the PROFIBUS Communication Unit.
Appendices	The appendices describe the following: PROFIBUS Technology Slave Diagnostics Messages Explicit Messages

SmartSlice GRT1-Series Slice I/O Units Operation Manual (Cat. No. W455)

Section	Description
Section 1 **Available Units and Features**	This section describes the features of GRT1-series Slice I/O Units and lists the available Units.
Section 2 **Shared Specifications and Functions**	This section describes the specifications and functions that are shared by all of the Slice I/O Units.
Section 3 **Installation and Wiring**	This section provides information on installing and wiring the Slice I/O Units.
Section 4 **Digital I/O Units**	This section provides the specifications and shows the components, terminal arrangements, wiring diagrams and dimensions for the Digital I/O Units.
Section 5 **Analog I/O Units**	This section provides the information required to operate Analog Input Units and Analog Output Units.
Section 6 **Temperature Input Units**	This section provides the information required to operate Temperature Input Units.
Section 7 **Counter Units and Positioning Unit**	This section provides the information required to operate Counter Units and the Positioning Unit.
Section 8 **Other Units**	This section provides the basic specifications for the other Units used in Slice I/O terminals.
Section 9 **Troubleshooting**	This section describes error processing and troubleshooting procedures needed to keep the Slice I/O Units operating properly.
Appendices	The appendices describe the following: Explicit Messages Standard Models Power Consumption and Weight Tables I/O Current Consumption Table Precautions When Connecting Two-wire DC Sensors

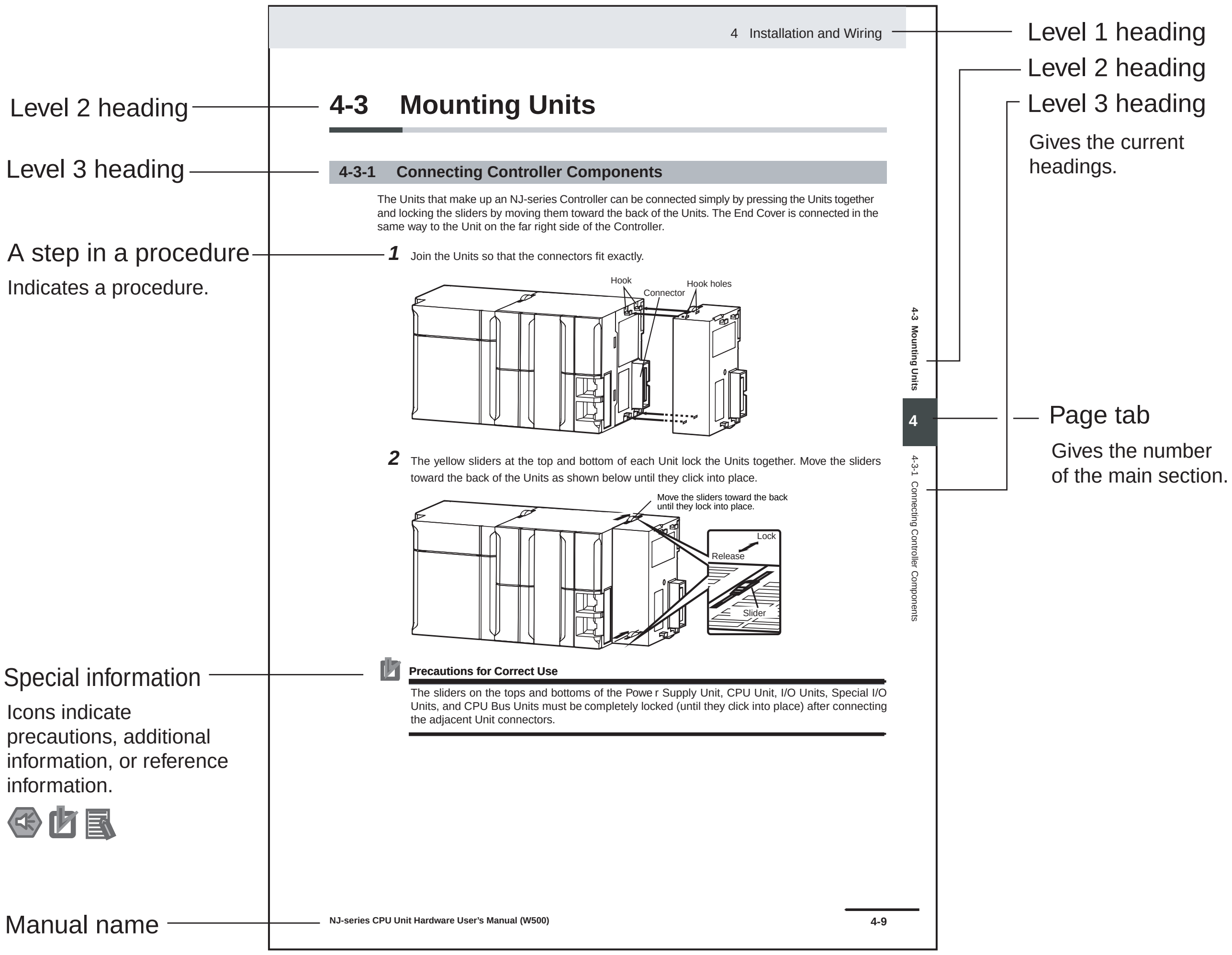
CS/CJ-Series PROFIBUS Master Units Operation Manual (Cat. No. W409)

Section	Description
Section 1 **Features and Specifications**	This section provides an introductory overview of PROFIBUS, its functions and how to setup and configure a network. It also addresses the PROFIBUS Master Units and the configurator, their features and specifications.
Section 2 **Installation and Wiring**	This section shows the PROFIBUS device and identifies its controls and indicators. It contains the procedures for installing the CS1/CJ1W-PRM21 PROFIBUS Master Unit and configuring the PROFIBUS network.
Section 3 **Configuration Software**	This section contains the procedures for installing the configuration software. It also presents an overview of the Configuration software and discusses the main aspects of defining a PROFIBUS configuration.
Section 4 **Allocated CIO and DM Words**	This section describes the words allocated to the CS1/CJ1W-PRM21 PROFIBUS Master Unit in the CIO and DM Areas.
Section 5 **FINS Commands and Responses**	This section describes the FINS message service communications commands concept as well as the commands supported by the CS1/CJ1W-PRM21 PROFIBUS Master Units.
Section 6 **Operation**	This section describes how to operate the CS1/CJ1W-PRM21 PROFIBUS Master Unit in a Network. It will discuss setting up a network, configuring all the connected devices and starting the network. Furthermore, it provides information the I/O data exchange performance and it also provides information on how to monitor a network using the Unit and CX-ConfiguratorFDT.
Section 7 **Troubleshooting and Maintenance**	This section describes the troubleshooting procedures and maintenance operations for the CS1/CJ1W-PRM21, needed to keep the PROFIBUS network optimally working.
Appendix	The appendices describe the following: Bus Parameters Slave Diagnostics I/O Data Conversions Configuration Error and Warning Messages Memory Card Backup Functions Application Notes C200HW-PRM21 Notes

Manual Structure

Page Structure

The following page structure is used in this manual.



This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Note References are provided to more detailed or related information.

Precaution on Terminology

In this manual, “download” refers to transferring data from the Sysmac Studio to the physical Controller and “upload” refers to transferring data from the physical Controller to the Sysmac Studio.

In this manual, the CJ1W-PRM21 Unit may be referred to as “PROFIBUS Master Unit”, “Master Unit”, or “PRM21 Unit”. Also, the CJ1W-PRT21 Unit may be referred to as “PROFIBUS Slave Unit”, “Slave Unit”, or “PRT21 Unit”.

Sections in this Manual

CONTENTS

Section 1 Features and System Configuration

Section 5 Operation

Section 6 Message Communications

Section 7 Troubleshooting and Maintenance

Appendices

Index

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of an NJ-series Controller. The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.
The following notation is used.

WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Precautions for Safe Use

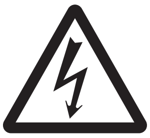
Indicates precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.

Symbols

The circle and slash symbol indicates operations that you must not do.
The specific operation is shown in the circle and explained in text.
This example indicates prohibiting disassembly.



The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a precaution for electric shock.

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a general precaution.

The filled circle symbol indicates operations that you must do.
The specific operation is shown in the circle and explained in text.
This example shows a general precaution for something that you must do.

⚠ WARNING

During Power Supply

Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

Do not attempt to take any Unit apart. In particular, high-voltage parts are present in the Power Supply Unit while power is supplied or immediately after power is turned OFF. Touching any of these parts may result in electric shock. There are sharp parts inside the Unit that may cause injury.

Fail-safe Measures

Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the CPU Unit, other Units, or slaves or due to other external factors affecting operation. Not doing so may result in serious accidents due to incorrect operation.

Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

The Controller outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.

The CPU Unit will turn OFF all outputs from Basic Output Units in the following cases.

- If an error occurs in the power supply
- If the power supply connection becomes faulty
- If a CPU watchdog timer error or CPU reset occurs
- If a major fault level Controller error occurs
- While the CPU Unit is on standby until RUN mode is entered after the power is turned ON

External safety measures must be provided to ensure safe operation of the system even if the outputs turn OFF.

If external power supplies for slaves or other devices are overloaded or short-circuited, the voltage will drop, outputs will turn OFF, and the system may be unable to read inputs. Provide external safety measures in controls with monitoring of external power supply voltage as required so that the system operates safely in such a case.

⚠ WARNING

Fail-safe Measures

Unintended outputs may occur when an error occurs in variable memory or in memory used for CJ-series Units. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.

Provide measures in the communications system and user program to ensure safety in the overall system even if errors or malfunctions occur in data link communications or remote I/O communications.

If there is interference in remote I/O communications or if a major fault level error occurs, output status will depend on the products that are used.
Confirm the operation that will occur when there is interference in communications or a major fault level error, and implement safety measures.
Correctly set all of the EtherCAT slaves.

The NJ-series Controller continues normal operation for a certain period of time when a momentary power interruption occurs. This means that the NJ-series Controller may receive incorrect signals from external devices that are also affected by the power interruption. Accordingly, take suitable actions, such as external fail-safe measures and interlock conditions, to monitor the power supply voltage of the external device as required.

You must take fail-safe measures to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents due to incorrect operation.

Voltage and Current Inputs

Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges.
Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.

Downloading

Always confirm safety at the destination before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio. The devices or machines may perform unexpected operation regardless of the operating mode of the CPU Unit.

⚠ Caution

Application

Do not touch any Unit when power is being supplied or immediately after the power supply is turned OFF. Doing so may result in burn injury.

Wiring

Be sure that all terminal screws and cable connector screws are tightened to the torque specified in the relevant manuals. The loose screws may result in fire or malfunction.

Online Editing

Execute online editing only after confirming that no adverse effects will be caused by deviations in the timing of I/O. If you perform online editing, the task execution time may exceed the task period, I/O may not be refreshed with external devices, input signals may not be read, and output timing may change.

Precautions for Safe Use

Disassembly and Dropping

- Do not attempt to disassemble, repair, or modify any Units. Doing so may result in malfunction or fire.
- Do not drop any Unit or subject it to abnormal vibration or shock. Doing so may result in Unit malfunction or burning.

Mounting

- The sliders on the tops and bottoms of the Power Supply Unit, CPU Unit, I/O Units, Special I/O Unit, and CPU Bus Units must be completely locked (until they click into place) after connecting the adjacent Unit connectors.

Installation

- Always connect to a ground of 100 Ω or less when installing the Units. A ground of 100 Ω or less must be installed when shorting the GR and LG terminals on the Power Supply Unit.

Wiring

- Follow the instructions in this manual to correctly perform wiring.
  Double-check all wiring and switch settings before turning ON the power supply.
- Use crimp terminals for wiring.
  Do not connect bare stranded wires directly to terminals.
- Do not pull on the cables or bend the cables beyond their natural limit.
  Do not place heavy objects on top of the cables or other wiring lines. Doing so may break the cables.
- Mount terminal blocks and connectors only after checking the mounting location carefully.
- Be sure that the terminal blocks, expansion cables, and other items with locking devices are properly locked into place.
- Always remove any dust proof labels that are on the top of the Units when they are shipped before you turn ON the power supply. If the labels are not removed, heat will accumulate and malfunctions may occur.
- Before you connect a computer to the CPU Unit, disconnect the power supply plug of the computer from the AC outlet. Also, if the computer has an FG terminal, make the connections so that the FG terminal has the same electrical potential as the FG (GR) terminal on the Power Supply Unit. A difference in electric potential between the computer and Controller may cause failure or malfunction.
- If the external power supply to an Output Unit or slave has polarity, connect it with the correct polarity. If the polarity is reversed, current may flow in the reverse direction and damage the connected devices regardless of the operation of the Controller.

Power Supply Design

- Do not exceed the rated supply capacity of the Power Supply Units in the NJ-series Controller. The rated supply capacities are given in the *NJ-series CPU Unit Hardware User's Manual*
  (Cat. No. W500).
  If the capacity is exceeded, operation may stop, malfunctions may occur, or data may not be backed up normally for power interruptions.
  Use NJ-series Power Supply Units for both the NJ-series CPU Rack and Expansion Racks.
  Operation is not possible if a CJ-series Power Supply Unit is used with an NJ-series CPU Unit or an NJ-series Power Supply Unit is used with a CJ-series CPU Unit.

- Do not apply voltages or connect loads to the Output Units or slaves in excess of the maximum ratings.
- Surge current occurs when the power supply is turned ON. When selecting fuses or breakers for external circuits, consider the above precaution and allow sufficient margin in shut-off performance. Refer to the relevant manuals for surge current specifications. Refer to the *NJ-series CPU Unit Hardware User’s Manual* (Cat. No. W500) for surge current specifications.
- If the full dielectric strength voltage is applied or turned OFF using the switch on the tester, the generated impulse voltage may damage the Power Supply Unit. Use the adjustment on the tester to gradually increase and decrease the voltage.
- Apply the voltage between the Power Supply Unit's L1 or L2 terminal and the GR terminal when testing insulation and dielectric strength. You do not have to disconnect the LG and GR terminals to perform these tests.
- Do not supply AC power from an inverter or other device with a square-wave output. Internal temperature rise may result in smoking or burning. Always input a sinusoidal wave with the frequency that is given in the *NJ-series CPU Unit Hardware User’s Manual* (Cat. No. W500).
- Install external breakers and take other safety measures against short-circuiting in external wiring.

Turning ON the Power Supply

- It takes up to approximately 10 to 20 s to enter RUN mode after the power is turned ON. During that time, outputs will be OFF or will be the values specified in the Unit or slave settings, and external communications cannot be performed. Use the RUN output on the Power Supply Unit, for example, to implement fail-safe circuits so that external devices do not operate incorrectly.
- Configure the external circuits so that the power supply to the control system turns ON only after the power supply to the Controller has turned ON. If the power supply to the Controller is turned ON after the control power supply, temporary errors may result in incorrect control system signals because the output terminals on Output Units may momentarily turn ON when power supply is turned ON to the Controller.

Actual Operation

- Check the user program, data, and parameter settings for proper execution before you use them for actual operation.

Turning OFF the Power Supply

- Never turn OFF the power supply to the Controller when the BUSY indicator is flashing. While the BUSY indicator is lit, the user program and settings in the CPU Unit are being backed up in the built-in non-volatile memory. This data will not be backed up correctly if the power supply is turned OFF. Also, a major fault level Controller error will occur the next time you start operation, and operation will stop.
- Do not turn OFF the power supply or remove the SD Memory Card while SD Memory Card access is in progress (i.e., while the SD BUSY indicator flashes). Data may become corrupted, and the Controller will not operate correctly if it uses corrupted data. To remove the SD Memory Card from the CPU Unit while the power supply is ON, press the SD Memory Card power supply switch and wait for the SD BUSY indicator to turn OFF before you remove the SD Memory Card.
- Do not disconnect the cable or turn OFF the power supply to the Controller when downloading data or the user program from Support Software.
- Always turn OFF the power supply to the Controller before you attempt any of the following.
  - Mounting or removing I/O Units or the CPU Unit
  - Assembling the Units
  - Setting DIP switches or rotary switches
  - Connecting cables or wiring the system
  - Connecting or disconnecting the connectors

The Power Supply Unit may continue to supply power to the rest of the Controller for a few seconds after the power supply turns OFF. The PWR indicator is lit during this time. Confirm that the PWR indicator is not lit before you perform any of the above.

Operation

- Confirm that no adverse effect will occur in the system before you attempt any of the following.
  - Changing the operating mode of the CPU Unit (including changing the setting of the Operating Mode at Startup)
  - Changing the user program or settings
  - Changing set values or present values
  - Forced refreshing
- Always sufficiently check the safety at the connected devices before you change the settings of an EtherCAT slave or Special Unit.
- If two different function modules are used together, such as when you use CJ-series Basic Output Units and EtherCAT slave outputs, take suitable measures in the user program and external controls to ensure that safety is maintained in the controlled system if one of the function modules stops. The relevant outputs will stop if a partial fault level error occurs in one of the function modules.
- Always confirm safety at the connected equipment before you reset Controller errors with an event level of partial fault or higher for the EtherCAT Master Function Module.
  When the error is reset, all slaves that were in any state other than Operational state due to a Controller error with an event level of partial fault or higher (in which outputs are disabled) will go to Operational state and the outputs will be enabled.
  Before you reset all errors, confirm that no Controller errors with an event level of partial fault have occurred for the EtherCAT Master Function Module.
- Always confirm safety at the connected equipment before you reset Controller errors for a CJ-series Special Unit. When a Controller error is reset, the Unit where the Controller error with an event level of observation or higher will be restarted.
  Before you reset all errors, confirm that no Controller errors with an event level of observation or higher have occurred for the CJ-series Special Unit. Observation level events do not appear on the Controller Error Tab Page, so it is possible that you may restart the CJ-series Special Unit without intending to do so.
  You can check the status of the *_CJB_UnitErrSta[0,0]* to *_CJB_UnitErrSta[3,9]* error status variables on a Watch Tab Page to see if an observation level Controller error has occurred.

Battery Backup

- The user program and initial values for the variables are stored in non-volatile memory in the CPU Unit. The present values of variables with the Retain attribute and the values of the Holding, DM, and EM Areas in the memory used for CJ-series Units are backed up by a Battery. If the Battery is not connected or the Battery is exhausted, the CPU Unit detects a Battery-backup Memory Check Error. If that error is detected, variables with a Retain attribute are set to their initial values and the Holding, DM, and EM Areas in memory used for CJ-series Units are cleared to all zeros. Perform thorough verifications and provide sufficient measures to ensure that the devices perform safe operation for the initial values of the variables with Retain attributes and the resulting operation.

Debugging

- Forced refreshing ignores the results of user program execution and refreshes I/O with the specified values. If forced refreshing is used for inputs for which I/O refreshing is not supported, the inputs will first take the specified values, but they will then be overwritten by the user program. This operation differs from the force-set/reset functionality of the CJ-series PLCs.

- You cannot upload or download information for forced refreshing with the Sysmac Studio.
  After downloading data that contains forced refreshing, change to RUN mode and then use the Sysmac Studio to perform the operation for forced refreshing.
  Depending on the difference in the forced status, the control system may operate unexpectedly.
- Do not specify the same address for the AT specification for more than one variable.
  Doing so would allow the same entity to be accessed with different variable names, which would make the user program more difficult to understand and possibly cause programming mistakes.

General Communications

- When you use data link communications, check the error information given in the status flags to make sure that no error has occurred in the source device. Write the user program to use the received data only if there is no error. If there is an error in the source device, the data for the data link may contain incorrect values.
- Unexpected operation may result if inappropriate data link tables are set. Even if appropriate data link tables have been set, confirm that the controlled system will not be adversely affected before you transfer the data link tables. The data links start automatically after the data link tables are transferred.
- All CPU Bus Units are restarted when routing tables are transferred from Support Software to the CPU Unit. Restarting these Units is required to read and enable the new routing tables. Confirm that the system will not be adversely affected by restarting before you transfer the routing tables.
- Tag data links will stop between related nodes while tag data link parameters are transferred during Controller operation. Confirm that the system will not be adversely affected before you transfer the tag data link parameters.

EtherNet/IP Communications

- All related EtherNet/IP nodes are reset when you transfer settings for the built-in EtherNet/IP port (including IP addresses and tag data links settings). This is performed to read and enable the settings. Confirm that the system will not be adversely affected by resetting nodes before you transfer the settings.
- If EtherNet/IP tag data links (cyclic communications) are used with a repeating hub, the communications load on the network will increase. This will increase collisions and may prevent stable communications. Do not use repeating hubs on networks where tag data links are used. Use an Ethernet switch instead.

EtherCAT Communications

- Make sure that the communications distance, number of nodes connected, and method of connection for EtherCAT are within specifications.
  Do not connect EtherCAT communications to EtherNet/IP, a standard in-house LAN, or other networks. An overload may cause the network to fail or malfunction.
- Malfunctions or unexpected operation may occur for some combinations of EtherCAT revisions of the master and slaves. If you disable the revision check in the network settings, use the Sysmac Studio to check the slave revision settings in the master and the actual slave revisions, and then make sure that functionality is compatible in the slave manuals or other references. You can check the actual slave revisions from the Sysmac Studio or on slave nameplates.
- After you transfer the user program, the CPU Unit is restarted. Communications with the EtherCAT slaves are cut off for up to 45 seconds. During that period, the slave outputs behave according to the slave settings.
  Before you transfer the user program, confirm that the system will not be adversely affected.
- If the Fail-soft Operation parameter is set to stop operation, process data communications will stop for all slaves when an EtherCAT communications error is detected in a slave. For this reason, if Servo Drives are connected, the Servos for all axes will be turned OFF. Make sure that the Fail-soft Operation parameter setting results in safe operation when a device error occurs.

- EtherCAT communications are not always established immediately after the power supply is turned ON. Use the system-defined variables in the user program to confirm that communications are established before attempting control operations.
- If frames sent to EtherCAT slaves are lost due to noise or other causes, slave I/O data is not communicated, and the intended operation is sometimes not achieved. If noise countermeasures are required, use the *_EC_InDataInvalid* (Input Data Disable) system-defined variable as an interlock condition in the user program.
  Refer to the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) for details.
  The slave outputs behave according to the slave settings. Refer to the manuals for the slaves for details.
- When an EtherCAT slave is disconnected, communications will stop and control of the outputs will be lost not only for the disconnected slave, but for all slaves connected after it. Confirm that the system will not be adversely affected before you disconnect a slave.
- If you disconnect the cable from an EtherCAT slave to disconnect it from the network, any current communications frames may be lost. If frames are lost, slave I/O data is not communicated, and the intended operation is sometimes not achieved. Perform the following processing for a slave that needs to be replaced.
  Program the *_EC_InDataInvalid* (Input Data Disable) system-defined variable as an interlock condition.
  Set the Impermissible Number of Continuous Timeouts setting in the EtherCAT master to at least 2.
  Refer to the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) for details.

Motion Control

- Confirm the axis number carefully before you perform an MC Test Run.
- The motor is stopped if communications are interrupted between the Sysmac Studio and the CPU Unit during an MC Test Run. Connect the communications cable between the computer and CPU Unit securely and confirm that the system will not be adversely affected before you perform an MC Test Run.
- Always execute the Save Cam Table instruction if you change any of the cam data from the user program in the CPU Unit or from the Sysmac Studio. If the cam data is not saved, the previous condition will be restored when the power is turned ON again, possibly causing unexpected machine operation.
- The positive drive prohibit input (POT), negative drive prohibit input (NOT), and home proximity input (DEC) of the Servo Drive are used by the MC Function Module as the positive limit input, negative limit input, and home proximity input. Make sure that the signal widths for all of these input signals are longer than the control period of the MC Function Module. If the input signal widths are shorter than the control period, the MC Function Module may not be able to detect the input signals, resulting in incorrect operation.

Battery Replacement

- The Battery may leak, rupture, heat, or ignite. Never short-circuit, charge, disassemble, heat, or incinerate the Battery or subject it to strong shock.
- Dispose of any Battery that has been dropped on the floor or otherwise subjected to excessive shock. Batteries that have been subjected to shock may leak if they are used.
- UL standards require that only an experienced engineer replace the Battery. Make sure that an experienced engineer is in charge of Battery replacement.
- Apply power for at least five minutes before changing the Battery. Install a new Battery within five minutes (at 25°C) of turning OFF the power supply. If power is not supplied for at least 5 minutes, the saved data may be lost.

Unit Replacement

- We recommend replacing the Battery with the power turned OFF to prevent the CPU Unit's sensitive internal components from being damaged by static electricity and to prevent malfunctions. The Battery can be replaced without turning OFF the power supply. To do so, always touch a grounded piece of metal to discharge static electricity from your body before you start the procedure.
  After you replace the Battery, connect the Sysmac Studio and clear the Low Battery Voltage error.
- Make sure that the required data, including the user program, configurations, settings, variables, and memory used for CJ-series Units, is transferred to a CPU Unit that was replaced and to externally connected devices before restarting operation.
  Be sure to include the routing tables, network parameters, and other CPU Bus Unit data, which are stored in the CPU Unit.

Disposal

- Dispose of the product and Batteries according to local ordinances as they apply.

  廢電池請回收
- The following information must be displayed for all products that contain primary lithium batteries with a perchlorate content of 6 ppb or higher when shipped to or transported through the State of California, USA.
  Perchlorate Material - special handling may apply.
  See www.dtsc.ca.gov/hazardouswaste/perchlorate.
- The CPU Unit contains a primary lithium battery with a perchlorate content of 6 ppb or higher. Place the above information on the individual boxes and shipping boxes when shipping finished products that contain a CPU Unit to the State of California, USA.

Precautions for Correct Use

Storage, Mounting, and Wiring

- Do not operate or store the Controller in the following locations. Operation may stop or malfunctions may occur.
  - Locations subject to direct sunlight
  - Locations subject to temperatures or humidity outside the range specified in the specifications
  - Locations subject to condensation as the result of severe changes in temperature
  - Locations subject to corrosive or flammable gases
  - Locations subject to dust (especially iron dust) or salts
  - Locations subject to exposure to water, oil, or chemicals
  - Locations subject to shock or vibration
- Take appropriate and sufficient countermeasures when installing the Controller in the following locations.
  - Locations subject to strong, high-frequency noise
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong electromagnetic fields
  - Locations subject to possible exposure to radioactivity
  - Locations close to power lines
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.
- Install the Controller away from sources of heat and ensure proper ventilation. Not doing so may result in malfunction, in operation stopping, or in burning.
- An I/O bus check error will occur and the Controller will stop if an I/O Connecting Cable's connector is disconnected from the Rack. Be sure that the connectors are secure.
- Do not allow foreign matter to enter the openings in the Unit. Doing so may result in Unit burning, electric shock, or failure.
- Do not allow wire clippings, shavings, or other foreign material to enter any Unit. Otherwise, Unit burning, failure, or malfunction may occur. Cover the Units or take other suitable countermeasures, especially during wiring work.
- For EtherCAT and EtherNet/IP, use the connection methods and cables that are specified in the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) and the *NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual* (Cat. No. W506). Otherwise, communications may be faulty.
- Use the rated power supply voltage for the Power Supply Units. Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.
- Make sure that the current capacity of the wire is sufficient. Otherwise, excessive heat may be generated. When cross-wiring terminals, the total current for all the terminals will flow in the wire. When wiring cross-overs, make sure that the current capacity of each of the wires is not exceeded.
- Do not touch the terminals on the Power Supply Unit immediately after turning OFF the power supply. Residual voltage may cause electrical shock.
- If you use reed switches for the input contacts for AC Input Units, use switches with a current capacity of 1 A or greater.
  If the capacity of the reed switches is too low, surge current may fuse the contacts.

Error Processing

- In applications that use the results of instructions that read the error status, consider the affect on the system when errors are detected and program error processing accordingly. For example, even the detection of a minor error, such as Battery replacement during operation, can affect the system depending on how the user program is written.

Unit Replacement

- If you replace a CPU Bus Unit or Special I/O Unit, refer to operation manual for the Unit for information on the data required for individual Units and redo the necessary settings.
- The absolute encoder home offset is backed up with a Battery in the CPU Unit.
  When you change the combination of the CPU Unit and Servomotor, e.g., when you add or replace a Servomotor, define home again.
  To restore the information without changing the CPU Unit-Servomotor combination, remove the absolute encoder home offset from the data to restore.

Task Settings

- If a Task Period Exceeded error occurs, shorten the programs to fit in the task period or increase the setting of the task period.

Motion Control

- Use the system-defined variable in the user program to confirm that EtherCAT communications are established before you attempt to execute motion control instructions. Motion control instructions are not executed normally if EtherCAT communications are not established.
- Use the system-defined variables to monitor for errors in communications with the slaves that are controlled by the motion control function module. Motion control instructions are not executed normally if an error occur in slave communications.
- Before you start an MC Test Run, make sure that the operation parameters are set correctly.
- Do not download motion control settings during an MC Test Run.

EtherCAT Communications

- Do not disconnect the EtherCAT slave cables during operation. The outputs will become unstable.
- Set the Servo Drives to stop operation if an error occurs in EtherCAT communications between the Controller and a Servo Drive.

Battery Replacement

- Be sure to install a replacement Battery within two years of the production date shown on the Battery label.
- Turn ON the power after replacing the Battery for a CPU Unit that has been unused for a long time. Leaving the CPU Unit unused again without turning ON the power even once after the Battery is replaced may result in a shorter Battery life.
- When you replace the Battery, use the CJ1W-BAT01 Battery Set.

SD Memory Cards

- Insert the SD Memory Card all the way.
- Do not turn OFF the power supply to the Controller during SD Memory Card access. The files may be corrupted.
  If there is a corrupted file in the SD Memory Card, the file is automatically deleted by the restoration function when the power supply is turned ON.

Regulations and Standards

Conformance to EC Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

EMC Directive

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards.*
Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer. EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

* Applicable EMC (Electromagnetic Compatibility) standards are as follows:
EMS (Electromagnetic Susceptibility): EN 61131-2 and EN 61000-6-2
EMI (Electromagnetic Interference): EN 61131-2 and EN 61000-6-4 (Radiated emission: 10-m regulations)

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards. The applicable directive is EN 61131-2.

Conformance to EC Directives

The NJ-series Controllers comply with EC Directives. To ensure that the machine or device in which the NJ-series Controller is used complies with EC Directives, the Controller must be installed as follows:

- The NJ-series Controller must be installed within a control panel.
- You must use reinforced insulation or double insulation for the DC power supplies connected to DC Power Supply Units and I/O Units.
- NJ-series Controllers that comply with EC Directives also conform to the Common Emission Standard (EN 61000-6-4). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions.
  You must therefore confirm that the overall machine or equipment complies with EC Directives.

Conformance to Shipbuilding Standards

The NJ-series Controllers comply with the following shipbuilding standards. Applicability to the shipbuilding standards is based on certain usage conditions. It may not be possible to use the product in some locations. Contact your OMRON representative before attempting to use a Controller on a ship.

Usage Conditions for NK and LR Shipbuilding Standards

- The NJ-series Controller must be installed within a control panel.
- Gaps in the door to the control panel must be completely filled or covered with gaskets or other material.
- The following noise filter must be connected to the power supply line.

Noise Filter

Manufacturer	Model
Cosel Co., Ltd.	TAH-06-683

Trademarks

- Sysmac and SYSMAC are trademarks or registered trademarks of OMRON Corporation in Japan and other countries for OMRON factory automation products.
- Windows, Windows 98, Windows XP, Windows Vista, and Windows 7 are registered trademarks of Microsoft Corporation in the USA and other countries.
- EtherCAT® is a registered trademark of Beckhoff Automation GmbH for their patented technology.
- The SD logo is a trademark of SD-3C, LLC.

Other company names and product names in this document are the trademarks or registered trademarks of their respective companies.

Unit Versions

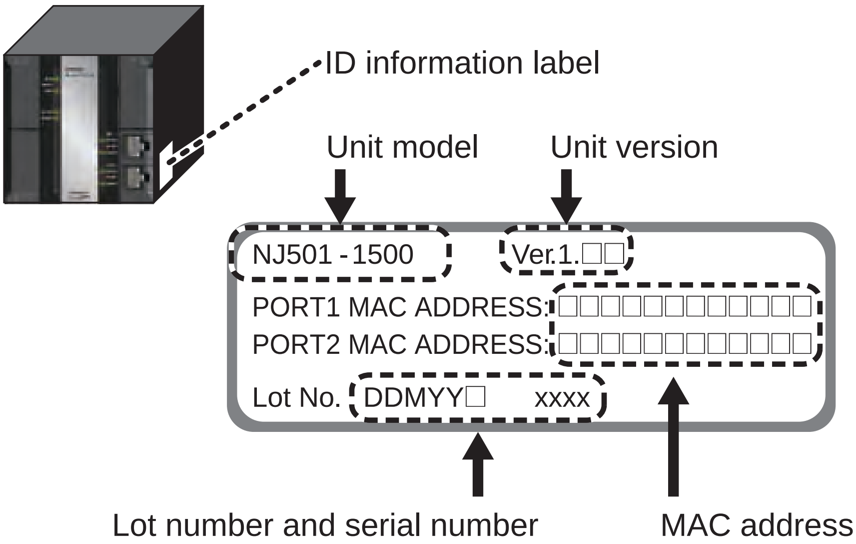
Unit Versions

A “unit version” has been introduced to manage CPU Units in the NJ Series according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

The unit version is given on the ID information label of the products for which unit versions are managed, as shown below.

Example for NJ-series NJ501-□□□□ CPU Unit:



The following information is provided on the ID information label.

Item	Description
Unit model	Gives the model of the Unit.
Unit version	Gives the unit version of the Unit.
Lot number and serial number	Gives the lot number and serial number of the Unit. DDMYY: Lot number, □: For use by OMRON, xxxx: Serial number “M” gives the month (1 to 9: January to September, X: October, Y: November, Z: December)
MAC address	Gives the MAC address of the built-in port on the Unit.

Confirming Unit Versions with Sysmac Studio

You can use the Unit Production Information on the Sysmac Studio to check the unit version of the CPU Unit, CJ-series Special I/O Units, CJ-series CPU Bus Units, and EtherCAT slaves. The unit versions of CJ-series Basic I/O Units cannot be checked from the Sysmac Studio.

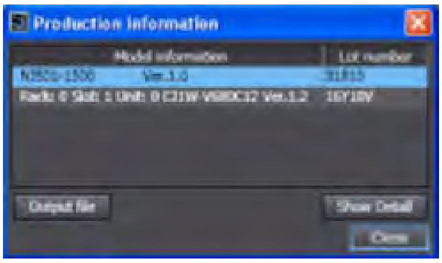
- **CPU Unit and CJ-series Units**

1 Double-click **CPU/Expansion Racks** under **Configurations and Setup** in the Multiview Explorer. Or, right-click **CPU/Expansion Racks** under **Configurations and Setup** and select ***Edit*** from the menu.

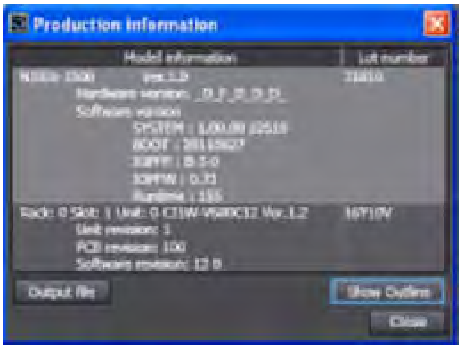
The Unit Editor is displayed for the Controller Configurations and Setup layer.

2 Right-click any open space in the Unit Editor and select ***Production Information***.

The Production Information Dialog Box is displayed.



Simple Display



Detailed Display

In this example, "Ver.1.0" is displayed next to the unit model.

The following items are displayed.

CPU Unit	CJ-series Units
Unit model	Unit model
Unit version	Unit version
Lot number	Lot number
	Rack number, slot number, and unit number

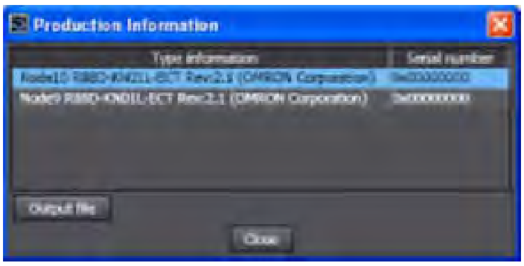
● EtherCAT Slaves

1 Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer. Or, right-click **EtherCAT** under **Configurations and Setup** and select ***Edit*** from the menu.

The EtherCAT Configuration Tab Page is displayed for the Controller Configurations and Setup layer.

2 Right-click the master in the EtherCAT Configurations Editing Pane and select **Display Production Information**.

The Production Information Dialog Box is displayed.



The following items are displayed.
Node address
Type information*
Serial number

* If the model number cannot be determined (such as when there is no ESI file), the vendor ID, product code, and revision number are displayed.

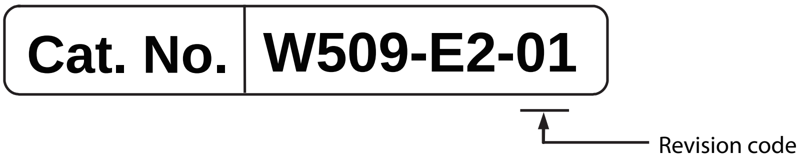
Related Manuals

The following manuals are related to the NJ-series Controllers. Use these manuals for reference.

Manual name	Cat. No.	Model numbers	Application	Description
NJ-series CPU Unit Hardware User's Manual	W500	NJ501-□□□□	Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NJ-series system is provided along with the following information on a Controller built with an NJ501 CPU Unit. • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection Use this manual together with the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).
NJ-series CPU Unit Software User's Manual	W501	NJ501-□□□□	Learning how to program and set up an NJ-series CPU Unit. Mainly software information is provided.	The following information is provided on a Controller built with an NJ501 CPU Unit. • CPU Unit operation • CPU Unit features • Initial settings • Programming based on IEC 61131-3 language specifications Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500).
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2□□□	Learning about the operating procedures and functions of the Sysmac Studio.	Describes the operating procedures of the Sysmac Studio.
CJ-series PROFIBUS Master Units Operation Manual for NJ-series CPU Unit (This document)	W509	CJ1W-PRM21	Learning about the functions and operating procedures when the CJ-series PROFIBUS Master Unit is used in an NJ-series system configuration.	The functions and operating procedures when the CJ-series PROFIBUS Master Unit is used in an NJ-series system configuration are described as well as the operation of CX-ConfiguratorFDT.
CJ-series PROFIBUS Slave Unit Operation Manual for NJ-series CPU Unit	W510	CJ1W-PRT21	Learning about the functions and operating procedures when the CJ-series PROFIBUS Slave Unit is used in an NJ-series system configuration.	The functions and operating procedures when the CJ-series PROFIBUS Slave Unit is used in an NJ-series system configuration are described as well as the operation of CX-ConfiguratorFDT.
SmartSlice GRT1-series Communication Unit Operation Manual	W04E	GRT1-PRT	Learning about the GRT1-series SmartSlice PROFINET Communication Unit.	Describes the GRT1-PRT PROFIBUS Communications Unit for OMRON's SmartSlice I/O Units. It also describes how to install and operation the Unit.
SmartSlice GRT1 Series Slice I/O Units	W455	GRT1-series Digital I/O Units, Analog I/O Units, Counter and Positioning Units, System Units	Learning about the various SmartSlice I/O Units that work with the GRT1-PRT-series Communication Unit.	Describes the models, specifications, functions, operating procedures, and applications of GRT1-series Slice I/O Units.
CS/CJ Series PROFIBUS Master Unit Operation Manual	W409	CS1/CJ1W-PRM21	Learning about the CS1/CJ1W-PRM21 PROFIBUS Master Units.	Describes the operation and configuration details of the CS1W-PRM21 and CJ1W PRM21 PROFIBUS DP and PROFIBUS DP-V1 Master Units when used in CS/CJ series systems.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.



Revision code	Date	Revised content
01	September 2011	Original production

1

Features and System Configuration

This section provides an introductory overview of PROFIBUS, its functions and how to setup and configure a network. It also addresses the PROFIBUS Master Unit and the configurator, their features and specifications.

1-1 Overview of PROFIBUS

1-1-1 Introduction

● Standard EN50170

PROFIBUS (PROcess FIeldBUS) is an open fieldbus standard for a wide range of applications in manufacturing, processing and building automation. The Standard, EN 50170 (the Euronorm for field communications), to which PROFIBUS adheres, guarantees vendor independence and transparency of operation. It enables devices of various manufacturers to intercommunicate without having to make any special interface adaptations.

The PROFIBUS family comprises three mutually compatible versions: PROFIBUS FMS, PROFIBUS DP and PROFIBUS PA.

● PROFIBUS FMS

FMS means Fieldbus Message Specification. This version is the general-purpose solution for high-level extensive and complex communication tasks. Powerful services open up a wide range of applications and provide great flexibility.

● PROFIBUS DP

DP means Decentralized Periphery. PROFIBUS DP is optimized for high speed and low-cost interfacing. It is specially designed for communication between automation control systems and distributed I/O at the device level.

● PROFIBUS PA

PA means Process Automation. It permits sensors and actuators to be connected to one common bus even in areas where intrinsically safe products are required. It also permits data and power to be supplied over the bus using 2-wire technology according the international standard IEC 1158-2.

● Uniform Bus Access Protocol

PROFIBUS DP and PROFIBUS FMS use the same transmission technology and uniform bus access protocol. Consequently, both versions can be operated simultaneously on the same bus. FMS field devices, however, cannot be controlled by DP masters and vice versa.

Precautions for Safe Use

Confirm safety at the destination node before transferring a program to another node or changing contents of the I/O memory area. Doing either of these without confirming safety may result in injury.

1-1-2 PROFIBUS Communication Protocol

● OSI Reference Model ISO-7498

In general, the PROFIBUS communication protocol is based on the Open System Interconnection (OSI) reference model in accordance with the international standard ISO-7498 (see the following illustration). The model defines 7 layers of communication functions, three of which - layers 1, 2, and 7 - are used in PROFIBUS.

- Layer 1, the Physical Layer of this model, defines the physical transmission characteristics.
- Layer 2, the Data Link Layer of this model, defines the bus access protocol. This protocol also includes data security and the handling of transmission protocols and telegrams.
- Layer 7, the Application Layer of this model, defines the application functions. This layer is only applicable to PROFIBUS FMS.

	DP-Profiles	
		DP-Extensions
User Interface Layer	DP Basic Functions	
(7) Application Layer	NOT DEFINED	
(6) Presentation Layer		
(5) Session Layer		
(4) Transport Layer		
(3) Network Layer		
(2) Data Link Layer	Fieldbus Data Link (FDL)	
(1) Physical Layer	RS485 / Fibre Optics	

● PROFIBUS DP

In the rest of this manual, only PROFIBUS DP is considered.

● OSI Layer 1, 2 and User Interface

PROFIBUS DP uses layers 1 and 2, and the user interface. Layers 3 to 7 are not defined for PROFIBUS DP. The user interface Layer defines the interface functions for specific application areas, i.e. the PROFIBUS DP basic functions and communication profiles.This streamlined architecture ensures fast and efficient data transmission. The application functions which are available to the user, as well as the system and device behavior of the various PROFIBUS DP device types, are specified in the user interface.

● OSI Layer 1: Transmission Medium

RS-485 transmission technology or fiber optics are available for transmission. RS-485 transmission is the most frequently used transmission technology. Its application area includes all areas in which high transmission speed and simple inexpensive installation are required. PROFIBUS modules are interconnected by single twisted-pair shielded copper wires.

● RS-485 Technology

The RS-485 transmission technology is very easy to handle. Installation of the twisted pair cable does not require expert knowledge. The bus structure permits addition and removal of devices or step-by-step test run of the system without influencing the other devices. Later expansions have no effect on devices which are already in operation.

● RS-485 Transmission Speed

Transmission speeds between 9.6 kbps and 12 Mbps can be selected as shown in the table below. One unique transmission speed must selected for all devices on the bus when the system is commissioned.

Baud Rate (kbps)	Distance/Segment (m)
9.6	1200
19.2	1200
45.45	1200
93.75	1200
187.5	1000
500	400
1500	200
3000	100
6000	100
12000	100

● Cable Length

The maximum cable length values depend on the transmission speed and are based on type-A cable (see *Cable Type* on page 9). The length can be increased by the use of repeaters. However, it is not recommended to use more than three repeaters in series in a PROFIBUS network.

1-1-3 Device Types

PROFIBUS distinguishes between master devices and slave devices.

● Master Devices

Master devices determine the data communication on the bus. A Master can send messages without an external request, as long as it holds the bus access right (the token). Masters are also referred to as active devices in the PROFIBUS standard.

● Class 1 Master (DPM1)

A PROFIBUS DP Class 1 Master (DPM1) device is a central controller, which exchanges information with the decentralized devices (i.e. DP slaves) within a specified message cycle.

● Class 2 Master (DPM2)

PROFIBUS DP class 2 Master (DPM2) devices are programmers, configuration devices or operator panels. They are used during test runs, for configuration of the DP system, or for operation and monitoring purposes.

As of Unit Version 3.0, the CJ1W-PRM21 is a PROFIBUS DP Class 1 as well as Class 2 Master device.

● Slave Devices

Slave devices are peripheral devices. Typical slave devices include input/output devices, valves, drives, and measuring transmitters. They do not have bus access rights and they can only acknowledge received messages or send messages to the master when requested to do so. Slave devices are also called passive devices.

Device Profile

To enable the exchange of devices from different vendors, the user data has to have the same format. The PROFIBUS DP protocol does not define the format of user data, it is only responsible for the transmission of this data. The format of user data may be defined in so called profiles. Profiles can reduce engineering costs since the meaning of application-related parameters is specified precisely. Profiles have been defined for specific areas like drive technology, encoders, and for sensors/actuators.

PROFIBUS DP-V1

PROFIBUS DP-V1 is an extension to the PROFIBUS DP protocol standard. It defines acyclic message services between a PROFIBUS DP-V1 Master and a PROFIBUS DP-V1 slave device. These acyclic message services allow exchange of extended parameter settings as well as extended diagnostics and alarm information, during regular I/O data exchange. PROFIBUS DP-V1 devices must at least support PROFIBUS DP.

PROFIBUS DP-V1 services are designated as MSACn services (Master- Slave Acyclic, Class n), in which n designates the Master Class (i.e. 1 or 2). The CJ1W-PRM21 supports PROFIBUS DP-V1 Class 1 and Class 2 Master functions as of Unit version 3.0.

1-1-4 Bus Access Protocol

OSI Layer 2: Buss Access Protocol

The PROFIBUS bus access protocol is implemented by OSI layer 2. This protocol also includes data security and the handling of the transmission protocols and messages.

Medium Access Control

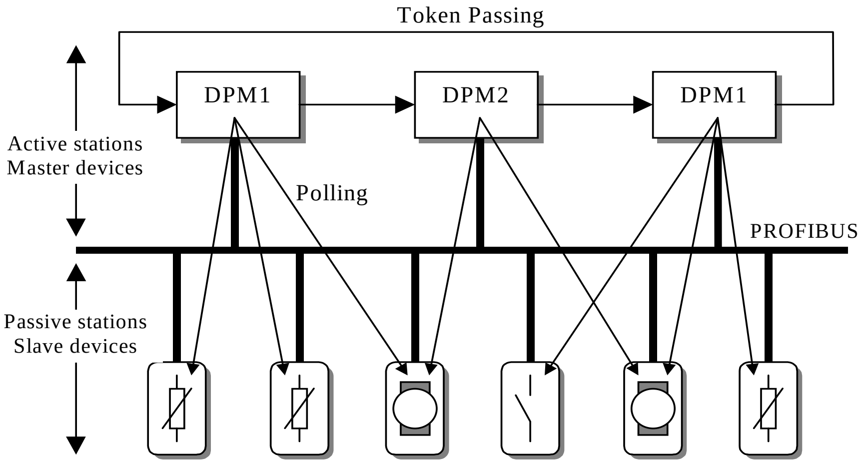
The Medium Access Control (MAC) specifies the procedures which determine when a device is permitted to transmit data. A token passing procedure is used to handle the bus access between master devices, and a polling procedure is used to handle the communication between a master device and its assigned slave device(s).

Token Passing

The token passing procedure guarantees that the bus access right (the token) is assigned to each master within a precisely defined time frame. The token message, a special message for passing access rights from one master to the next master, must be passed around the logical token ring - once to each master - within a specified target rotation time. Each master executes this procedure automatically.

Polling Procedure

The polling or master-slave procedure permits the master, currently in possession of the token, to access its assigned slaves. The figure below shows a possible configuration. The configuration shows three active devices (masters) and six passive devices (slaves).



The three masters form a logical token ring. When an active device receives the token message, it can perform its master role for a certain period of time. During this time it can communicate with all assigned slave devices in a master- slave communication relationship, and a DPM2 master can take the initiative to communicate with DPM1 master devices in a master-master communication relationship.

● Multi-peer Communication

In addition to logical peer-to-peer data transmission, PROFIBUS DP provides multi-peer communication (broadcast and multicast).

● Broadcast Communication

In the case of broadcast communication a master device sends an unacknowledged message to all other devices (masters and slaves).

● Multicast Communication

In the case of multicast communication a master device sends an unacknowledged message to a predetermined group of slave devices.

1-1-5 Diagnostic functions

● Extended Diagnostics

Extended diagnostic functions defined in PROFIBUS DP enable the fast location of error at slave devices. Diagnostic messages are transmitted over the bus and collected at the master. Three diagnostic message types are defined:

- Device Related Diagnostics: Messages concerning the general operational status of the whole device, e.g. over temperature, low voltage.
- Module Related Diagnostics: Messages indicating that an error is present in a specific I/O range of a device, e.g. an 8-bit output module.
- Channel Related Diagnostics: Messages indicating an error at a given input or output, e.g. short circuit on Output 5.

1-1-6 Protection Mechanisms

● Monitoring Time

PROFIBUS DP provides effective protection functions against parameterization errors or failure of the transmission equipment. Time monitoring is provided both at the master and the slave devices. The monitoring interval is specified when the system is configured.

● Monitoring at the Master

The PROFIBUS Master monitors data transmission of the slaves with the Data-Control-Timer. A separate control timer is used for each slave. This timer expires if response data is not correctly transmitted by the slave within the monitoring interval. The user is informed when this happens. If the automatic error reaction (Auto-CLEAR) has been enabled, the PROFIBUS Master exits its OPERATE state, switches the outputs of all assigned slaves to the fail-safe status and changes to the CLEAR state.

● Monitoring at the Slave

Slave devices use a watchdog to detect failures of the master or the bus. If data communication with the master does not occur within the set watchdog time interval, a slave automatically switches its outputs to the fail-safe mode. Also, access protection is provided for the inputs and outputs of the slaves operating in multi-master systems. Only authorized masters can access their slaves.

1-1-7 Network Operation Modes

PROFIBUS DP distinguishes four different network operation modes:

● OFFLINE

Communication with all PROFIBUS DP participants (masters and slaves) is stopped. The Master ceases to access the PROFIBUS network.

● STOP

Cyclic communication as well as PROFIBUS DP-V1 Class 1 communication between the master and its slaves is stopped. Only PROFIBUS DPV1 Class 2 communication and communication between the master and other masters are still possible.

● CLEAR

The master tries to set parameters, check the configuration, and perform data exchange with its associated slaves. Data exchange involves reading the inputs of the PROFIBUS DP slaves and writing zeros to the outputs of the slaves.

● OPERATE

The master exchanges data with its assigned slaves. Inputs are read and outputs are written. Also, the master cyclically sends its local status to all its assigned PROFIBUS DP slaves (using a broadcast message).

The PROFIBUS Master Unit will always be in one of these four modes. Mode transitions from one mode to another will be performed via intermediate modes. For example, a mode transition from OFFLINE to OPERATE, will be performed as OFFLINE→STOP→CLEAR→OPERATE.

Auto-Clear and Fail-safe State

If an error occurs during the data exchange phase of the master, the 'Auto-CLEAR' function determines the subsequent actions. If this function has been disabled, the master remains in the OPERATE mode. If the function has been enabled, the master automatically changes the network to the CLEAR mode, in which the outputs of the assigned PROFIBUS DP slaves are switched to zero, i.e. the 'fail-safe' state. The master continues to read the inputs of the slaves.

1-1-8 Configuring the PROFIBUS Master

In order to operate a PROFIBUS network, each master in the network needs to be configured. This process of configuration involves:

- setting up the network topology, i.e. assigning the slave devices with which the master will be exchanging data
- defining the parameterization data, which the master will send to each of the slave devices, before process data exchange can commence
- defining the configuration data, i.e. defining the process data, which will be exchanged
- setting up the bus parameters, which define the baud rate and the bus timing parameters
- downloading the configuration setup to the master device

Configuration Technology

The configuration process is usually facilitated by a special Computer based program, often referred to as a configurator. The configurator requires special configuration files, defining the configuration options for each device, which is to participate in data exchange. The files must be provided by the manufacturer of the device.

Two types of configuration technology exist:

- Configuration technology based on FDT/DTM technology
- Configuration technology based on GSD-files

1-1-9 FDT/DTM Technology

FDT/DTM Technology

The newer configuration tools are based on FDT/DTM technology.

FDT/DTM Concept

The FDT/DTM concept specifies the interfaces between the engineering systems called Field Device Tools (FDT), and the device-specific software components called Device Type Managers (DTM).

The FDT/DTM concept separates the device dependent functionality (which is in the DTM) from the application. It provides separate interfaces for device configuration, monitoring and maintenance solutions, which before largely depended on the manufacturer of the application. Because of this concept, FDT/DTM technology is not limited to PROFIBUS applications. In concept, any type of network can be configured and accessed, provided the appropriate DTMs are available.

FDT Container Application

A FDT container application facilitates configuration of network devices and parameterizing and/or manipulating their operational modes. All device dependent functionality is concentrated in the DTM.

FDT container applications can be stand-alone tools, or can be part of other engineering tools such web browsers providing FDT interfaces. Since FDT standardizes the interfaces, it allows devices from different manufacturers to be integrated in any automation system, regardless of the fieldbus system.

CX-IntegratorFDT is an example of a FDT container application. It is described in detail in the following sections.

● Device DTM

DTMs are provided by the manufacturer of the device. A DTM is comparable to a printer driver, which allows interactive configuration and diagnostics.

The DTM provides not only the configuration, manipulation and monitoring functions for a device including the user interface functions, it also provides the connection technology to the device.

● DTM Properties

In general, a DTM is a Microsoft COM-component, which can be executed from within a FDT container application. A DTM is not a stand-alone tool, it requires a FDT container application to be executed. The DTM provides a number of interface functions, through which it can be controlled and accessed in order to transfer data to or from the DTM. A DTM provides all the options for configuration and monitoring of a device, which it can present to the user through its own user interface.

● ActiveX User Interface

The user interface for a DTM is provided using ActiveX windows. Control of these windows is done by the DTM, but the FDT container application can request specific user input from the DTM, based on which the DTM will provide the necessary ActiveX windows. In general multi-language user interface windows, including DTM specific Help files are supported by the DTM.

● XML based Data Transfer

Data transfer to and from a DTM is provided using XML-documents. The XML-documents are standardized for the communication between the FDT container application and for communication between DTMs. An additional specification covers the definition of XML-data formats for the transfer of application specific data, such as PROFIBUS data.

● Communication DTM

In general, a device configuration DTM is accompanied by a communication DTM. This specific DTM facilitates device specific communication, e.g. for downloading a configuration to a PROFIBUS Master Unit and/or for retrieving monitoring information from PROFIBUS Master Unit. It may incorporate the specific communication protocol, or rely on other available drivers.

● CX-ConfiguratorFDT

CX-ConfiguratorFDT is an FDT container application. Together with this container application, OMRON provides four DTMs:

- A DTM to facilitate configuration and operation of the CJ1W-PRM21 PROFIBUS DP-V1 Master Unit (As of Unit version 2.0).
- A DTM to facilitate configuration of the CJ1W-PRM21 PROFIBUS DP Master Unit (Unit version 1.0).
- A DTM to facilitate configuration of the SmartSlice GRT1-series GRT1-PRT PROFIBUS Communication Unit.
- A DTM to facilitate integration of GSD file based devices into CX-Integrator FDT (*1-1-10 GSD File Technology* for more information)

1-1-10 GSD File Technology

● GSD File Technology

The older and most commonly used configuration technology is the based on GSD files (General Slave Data file). A GSD file is a text file, containing the characteristic features and configuration options of a device. The device data base file of each device is loaded in the configurator and downloaded to the master device.

GSD files are usually supplied with a Unit, or can be downloaded from the Internet, either from the manufacturer's site, or from the GSD library of the PROFIBUS International at the following website:

http://www.profibus.com

● GSD File Language

The language used in the GSD file is indicated by the last letter of the file extension, *.GS?:

Default = GSD

English = GSE

German = GSG

Italian = GSI

Portuguese = GSP

Spanish = GSS

The GSD files are prepared individually by the vendor for each type of device, according to a fixed format. Some parameters are mandatory, some have a default value and some are optional. The device data base file is divided into three parts:

● General Section

This section contains the vendor name, the device name, hardware and software release versions, device type and identification number, protocol specification and supported baud rates.

● DP-master Section

This section contains all parameters which only apply to DP master devices (e.g. maximum memory size for the master parameter set, maximum number of entries in the list of active devices, or the maximum number of slaves the master can handle).

● DP-slave Section:

This section contains all specification related to slaves (e.g. minimum time between two slave poll cycles, specification of the inputs and outputs, and consistency of the I/O data). For PROFIBUS DP-V1 devices this section also specifies what services for PROFIBUS DP-V1 are supported.

● DTM versus GSD File

When comparing the two configuration technologies, a GSD file only provides information on the device characteristics and configuration options. It has no GUI of its own, nor can it connect to the device itself. A GSD file always requires a separate configurator program to interpret the data. In the FDT/ DTM concept all these device related functions are included in the DTM. The DTM can be executed from any program, which provides FDT interfaces.

Sending PROFIBUS DP-V1 commands to a device from the configuration tool is only possible using DTM technology. The GSD file does not provide this means.

1-2 PROFIBUS Master Unit

1-2-1 PROFIBUS Master Unit Features

● PROFIBUS Master Unit

The PROFIBUS Master Unit is a CPU Bus Unit, which can be installed on an NJ-series Controller system.

● CPU Bus Unit

A total of up to 16 CPU Bus Units can be mounted on the CPU Rack or an Expansion Rack. The total of 16 must include all PROFIBUS Master Units and all other CPU Bus Units.

● Unit Control and Status

Up to 25 words of control and status words are exchanged between the PROFIBUS Master Unit and a dedicated CIO memory area, of which can be accessed by Device Variables (see *4-1-1 Data Flow*). Control bits allow the Controller program to switch the Unit between OFFLINE, STOP, CLEAR and OPERATE mode, which represent the main PROFIBUS DP modes of operation. The control words also allow for user initiated transmission of a Global-Control command over the PROFIBUS network to any group of slave devices.

The remaining CIO words provide status and diagnostics information on the Unit itself, the PROFIBUS network and the slave devices.

● I/O Data

The total size of I/O data however, must not exceed the maximum I/O size of up to 7168 words, which it can exchange with the Controller memory. The I/O data can be distributed over up to two input areas and two output areas. Each of the input and output areas can be mapped to any location in the DM Area, CIO Area, WR Area, HR Area, or the EM banks, of which can be accessed with user-defined variables (see *4-1-1 Data Flow*).

● PROFIBUS DP Class 1 Services

The PROFIBUS Master Unit supports all mandatory Class 1 services defined in the PROFIBUS DP standard EN50170, Volume 2 for Master - Slave Communication. These functions includes the following services:

- Set_Prm
- Chk_Cfg
- Slave_Diag
- Data_Exchange
- Global-Control (FREEZE, UNFREEZE, SYNC, UNSYNC, CLEAR)

The PROFIBUS Master Unit supports cyclic Master - Slave communications for networks with up to 125 slave devices. With each slave device it can exchange up to 244 bytes of input data and up to 244 bytes of output data.

For diagnostics purposes the PROFIBUS Master Unit collects all Slave Diagnostics messages, which it can transfer to the CPU memory, using commands. From every allocated slave device it can receive up to 244 bytes of diagnostics data.

PROFIBUS DP Class 2 Services

The PROFIBUS Master Unit also supports additional PROFIBUS DP Class 2 services defined in the PROFIBUS DP standard EN50170, Volume 2 for Master - Slave Communication. These functions includes the following services:

- Set_Slave_Addr
- Get_Cfg
- Rd_Inp
- Rd_Outp

These services can be invoked from the CPU using message communication.

PROFIBUS DP-V1 Service

The PROFIBUS Master Unit supports PROFIBUS DP-V1 Class 1 and Class 2 services. Additional parameter data can be written/read to and from PROFIBUS DP-V1 compatible slave devices. These services can be initiated either from the CPU or from the associated DTM.

Configuration

Before the PROFIBUS Master Unit can control the PROFIBUS network, it must be configured using the dedicated configuration program CX-Integrator FDT. Without this configuration, the Unit will not be able to achieve data exchange, neither to send any acyclic messages. The configurator is explained in *1-3 CX-ConfiguratorFDT*.

Troubleshooting Functions

The PROFIBUS Master Unit is provided with a variety of troubleshooting functions for prompt recovery in case of errors:

- Extensive self-diagnostic function at startup
- Data exchange flags, indicating if I/O data is being exchanged with the slave devices
- Diagnostics flags, indicating if new Slave diagnostics data is available
- Extensive status and error flags, indicating the status of the Unit and the PROFIBUS network
- Error log for recording error history data

1-2-2 Specifications

The CJ1W-PRM21 is a remote I/O Communication units providing PROFIBUS DP and PROFIBUS DP-V1 Master capabilities. The Unit version number on the side case of the housing indicates supported functionality. If no version number is shown, the version number is 1.0. The following table lists the functions supported per version number.

Alternatively, the PROFIBUS DP Master DTM can be used to obtain the Units version number, refer to *3-3-1 Configuration User Interface*.

Model Name	Unit Classification	Unit Version	Supporting DTM Version	Functions Supported
CJ1W-PRM21	CPU Bus Unit	3.0	0.3.0.0	• PROFIBUS DP (Class 1) Master • PROFIBUS DP (Class 2) Master • PROFIBUS DP-V1 (Class 1) Master • PROFIBUS DP-V1 (Class 2) Master

Note Only latest unit version 3.0 is fully supported with NJ-series Controllers. Please consult with your OMRON representative if unit version 1.0 or 2.0 is used.

General Specifications

General specifications of the CJ-series PROFIBUS Master Units conform to the general specifications for the NJ-series Controller Units.

Item		Specification
Installation	Mounting position	• CPU Rack, • Expansion Rack
	Unit classification	CPU Bus Unit
	Applicable unit numbers	0 to F (Hex)
	Maximum number of Units per NJ-series Controller Unit	16
	Current consumption	400 mA max at 5 VDC
	Dimensions (W x H x D)	31 x 90 x 65 mm
	Weight	100g (typical)
Environment	Ambient temperatures	Operating temperature: 0 to 55°C Storage temperature: –20 to 75°C
	Ambient operating humidity	10% to 90% (with no condensation)
	Vibration resistance	Conforms to IEC60068-2-6, test Fc. 10 to 54.8Hz, 0.25-mm amplitude, 54.8 to 300Hz, acceleration: 29.4 m/s^2 in X, Y, and Z directions for 120 minutes each. (Total time: 12 linear sweeps x 10 minutes / sweep = 120 minutes)
	Shock resistance	Conforms to IEC60068-2-27, test Ea. 196 m/s^2 three times each in X, Y, and Z directions
	Dielectric strength	600 VAC (between isolated circuits)
	Conformance to EMC and Electrical safety standards	EN61000-6-2: 2001 EN61000-6-4: 2001/CISPR11 EN61131-2:1994+a12:2000
Front Case	Settings	Unit Number rotary switch, range: 0 to F (Hex)
	Indicators	7 LEDs, indicating Unit status and PROFIBUS status: Unit status: RUN (Green indicator) ERC (Red indicator) Host CPU status: ERH (Red indicator) Configuration status: PRM (Green indicator) PROFIBUS status: BST (Green indicator) COMM (Green indicator) BF (Red indicator)
	PROFIBUS Connector	9-pin sub-D female connector (#4/40 UNC thread)
Memory Area Allocation	CIO Area words allocated for the CPU Bus Unit	Fixed allocation of 25 words per Unit.
		CIO words provide: • 2 words for software switches • 1 word for the Global-Control • 21 words for the Unit and Slave statuses
	DM Area words allocated for the CPU Bus Unit.	Fixed allocation of 100 words per Unit.
		DM Area allocated to the Unit is reserved for future use.
	I/O Data allocations	Maximum total size: 7168 words I/O Data can be allocated to up to 2 input areas and 2 output areas. Input and output areas can be mapped to CIO, DM, WR, and HR Areas, as well as EM banks. Mapping must be defined through configurator.
	PROFIBUS DP-V1 status flags	DPV1 Connection/Abort status flags: 16 words. The status flags can be mapped to CIO, DM, WR, and HR Areas, as well as EM banks. Mapping must be defined through configurator.

Item		Specification
Message Communica-tions	Reading slave device diagnostics	The MEMORY AREA READ (0101) command can be used to obtain the last received Slave Diagnostics message.
	Clearing the Error Log	Clearing the Error Log with the ERROR LOG CLEAR (2103) com-mand.
	PROFIBUS DP messages	The PROFIBUS MESSAGE SEND (2809) command can be used to send PROFIBUS DP and PROFIBUS DP-V1 messages over the PROFIBUS network from the CPU.The following services can be initiated: • PROFIBUS DP services: • Get_Cfg • Set_Slave_Add • Rd_Inp • Rd_Outp • PROFIBUS DP-V1 Class 1 services: • MSAC1 - Read • MSAC1 - Write • PROFIBUS DP-V1 Class 2 services: • MSAC2 - Initiate • MSAC2 - Read • MSAC2 - Write • MSAC2 - Abort
	Explicit Messages	The EXPLICIT MESSAGE SEND (2801) command can be used to send CIP based messages to OMRON slave devices using PROFI-BUS DP-V1 Class 2 messages.
	Error history size and storage	The PROFIBUS Master Unit supports storage of up to 80 error events, including time stamps in volatile memory. 16 error events can be logged in non-volatile memory.
Words allo-cated in the memory used for CJ-series Unit	I/O port (without power OFF retention) (Access via the device variables for CJ-series Unit)	25 words/Unit (allocation for one Unit)
		1 word for the software switches, 1 word for the Global-Control command, 21 words for status, 2 words reserved
	I/O port (with power OFF retention)(	100 words/Unit (allocation for one Unit)
		No exchange, Reserved for future use
	User-set allocations	Any I/O memory (Set with device-variables for CJ-series Unit and CX-ConfiguratorFDT)

Protocol Specification

Item		Specification
PROFIBUS Interface	Applicable standards	EN50170, Volume 2
	Protocol type supported	PROFIBUS DP, PROFIBUS DP-V1
	PROFIBUS Unit types	PROFIBUS DP-V1 Class 1 and Class 2 Master
	PROFIBUS Media type	RS-485, galvanically isolated from the CPU
	PROFIBUS Connector	9-pin sub-D female connector (#4/40 UNC thread) Termination according to EN50170 provided by the cable connector
	Unit device address range	0 to 125, set through the configurator (See Note 4)
	Number of slave devices supported	125 max, address range 0 to 125
	baud rates supported	Selectable through the configurator: • 9.6 kbps • 19.2 kbps • 45.45 kbps • 93.75 kbps • 187 kbps • 500 kbps • 1.5 Mbps • 3 Mbps • 6 Mbps • 12 Mbps
	Bus timing definitions	Calculated by the configurator
PROFIBUS Services	PROFIBUS DP Master Class 1 - Slave cyclic services	• Set_Prm • Chk_Cfg • Data_Exchange • Slave_Diag • Global-Control - CLEAR
		Global-Control, initiated from CIO Word. (Access via the Device Variable for CJ-Series Unit) Can be addressed to all or a specified group of slave devices. Supported commands: • SYNC • UNSYNC • FREEZE • UNFREEZE
	PROFIBUS DP Master Class 2 - Slave acyclic services available to the CPU	Acyclic message services, initiated through commands and can be addresses to one slave device at a time (See Note 1). Supported PROFIBUS DP services: • Get_Cfg • Set_Slave_Add • Rd_Inp • Rd_Outp
	PROFIBUS DP Master - Master services	Not supported
	PROFIBUS DP-V1 Master Class1 - Slave acyclic message services (See Note 1)	• MSAC1 - Read • MSAC1 - Write
	PROFIBUS DP-V1 Master Class2 - Slave acyclic message services (See Note 2)	• MSAC2 - Initiate • MSAC2 - Read • MSAC2 - Write • MSAC2 - Abort

Item		Specification
I/O Data	Number of I/O module definitions	4000 max. over all configured slave devices
	Number of I/O data supported by Master	Up to 244 bytes input and 244 bytes output max. per slave device (defined by slave device) Total sum of all I/O Data must not exceed 7168 words
	Number of diagnostics data supported by Master	Up to 244 bytes of diagnostics max. per slave device Diagnostic data is collected at the Unit and can be obtained from the Unit using message communications.
	Additional status flags	DPV1 Connection/Abort status flags. The status flags - 16 words in total - can be mapped by the user to any CPU memory location and accessed via the Device Variables for CJ-Series Units.

Note 1 These functions are implemented as of Unit version 2.0.

2 These functions are implemented as of Unit version 3.0.

3 The maximum data length for messages which are redirected to the PROFIBUS network is 1004 bytes.

4 Although the Unit device address can be set to address 0, this number should not be used, since this number is reserved in message communications.

1-3 CX-ConfiguratorFDT

1-3-1 CX-ConfiguratorFDT Features

● CX-ConfiguratorFDT

The PROFIBUS Master Unit requires a configuration before it can exchange I/O data with the slave devices. For this purpose OMRON provides the CX-ConfiguratorFDT Configuration program, which runs under Microsoft Windows™ NT 4.0, Windows™ 2000, Windows™ XP or Windows™ 7.

Together with CX-ConfiguratorFDT, OMRON provides the following DTM COM Objects:

- A DTM to configure the CJ1W-PRM21 PROFIBUS DP-V1 Master
- A DTM to configure the CJ1W-PRM21 PROFIBUS DP Master
- A DTM to configure the SmartSlice GRT1-series GRT1-PRT.
- A DTM to allow the handling of classic GSD files in CX-ConfiguratorFDT

The following provides a quick overview of the functions.

● CX-ConfiguratorFDT Container Application

CX-ConfiguratorFDT provides an FDT environment in which DTMs can be executed. The main function of CX-ConfiguratorFDT is to facilitate the DTMs and the data exchange between them. It provides:

- Network setup functions: A tree view shows the relations between the DTMs, i.e. the relation between the Master and slave devices.
- Device Catalogue functions: A Device Catalogue containing the installed DTMs is maintained, to which the user can add new DTMs or delete them. Device DTMs can be added to the network from this Catalogue.
- Project maintenance functions: CX-ConfiguratorFDT provides the functions to create, save and open project files. It facilitates user access control, which limits of use to authorized personnel only, using password protection.
- Additional functions: CX-ConfiguratorFDT provides additional functions like printing, error logging, FDT Communication logging and help files.

● CJ1W-PRM21 PROFIBUS DP-V1 DTM

The CJ1W-PRM21 DTM provided to configure the CJ1W-PRM21 PROFIBUS DP-V1 Master Unit provides:

- The Settings User Interface, which handles the configuration for the PROFIBUS Master Unit. This includes the bus parameters settings, the I/O data mappings and Master specific settings. The Settings DTM provides its own user interface.
- The Monitoring User Interface, which handles the status monitoring and control over the PROFIBUS Master Unit, when it is on-line and communicating over the PROFIBUS network. It provides its own user interface to read out Master status flags and Error log, as well as Slave status flags and the Slave diagnostics messages received by the Unit. It also allows the user to send Global-Control commands over the network and to change the PROFIBUS Master Unit's mode on the PROFIBUS network.
- The communication interface between the CJ1W-PRM21 DTMs and CX-Server. CX-Server, provided with the CX-ConfiguratorFDT package, is the driver for communication between the PC and the NJ-series Controller Unit.
- A communication channel to the user to change a remote slave device address. This channel has its own user interface.

- Communication channels to facilitate data transfer through PROFIBUS DP-V1 MSAC1 acyclic message transfer between a PROFIBUS DP-V1 slave device DTM and the physical slave device.
- Communication channels to facilitate data transfer through PROFIBUS DP-V1 Class 2 acyclic message transfer between a PROFIBUS DP-V1 slave device DTM and the physical slave device. This also allows direct connection to third-party PROFIBUS slave devices supporting PROFIBUS DP-V1 Class 2, e.g. PROFIBUS PA devices.

● SmartSlice GRT1-series GRT1-PRT DTM

SmartSlice GRT1-series GRT1-PRT DTM allows configuration of the GRT1- PRT PROFIBUS Communication Unit and SmartSlice I/O Units. The DTM provides the following user interfaces:

- The Configuration User interface to define the I/O configuration and parameter setting for I/O data exchange with the PROFIBUS Master Unit.
- Configuration User Interfaces to configure individual SmartSlice I/O Units attached to the GRT1-PRT.
- A monitoring User interface to monitor the status of the GRT1-PRT and individual SmartSlice I/O Units.

● Generic Slave DTM

The Generic Slave DTM allows the handling of classic GSD files of up to GSD revision 3 within CX-ConfiguratorFDT. Upon allocating a slave device, for which only a GSD file is available to a Master Unit in the network, this DTM will be invoked. This DTM consists of two parts:

- The Settings User Interface will provide the user interface to display the device’s information and the selectable values, as defined in the GSD. After making the necessary configuration settings, and saving them, these will be transferred to the Master DTM.
- The Monitoring User Interface will provide a diagnostics interface, allowing the user to check the Slave’s status. This DTM obtains the necessary information from the PROFIBUS Master Unit’s monitoring DTM.

Note Note The Generic Slave DTM provides parameter settings related to PROFIBUS DP-V1. However, it does not support PROFIBUS DP-V1 communication.

● Downloading the Configuration

After setting up the configuration, it must be downloaded to the PROFIBUS Master Unit.

Connection to the CJ1W-PRM21 Unit is achieved through a communication port of the NJ-series Controller Unit, using CX-Server. CX-Server also allows routing the download through multiple systems, if supported by these systems. The CJ1W-PRM21 does not support message routing.

1-3-2 Specifications

Functional Specifications

Item		Specification
Operating environment	Hardware platform	• Personal computer: IBM PC/AT or compatible • Processor: Pentium 700 MHz or higher • Memory: 256 Mbytes • Hard disk: A minimum of 256 Mbytes • CD-ROM drive • Graphics resolution: 800 x 600 pixels minimum
	Operating System	MS Windows 7 MS Windows NT4.0, SP6 MS Windows 2000, SP2 MS Windows XP Internet Explorer 6.0 or higher is also required.
	Connection to CJ1W-PRM21	Ethernet or USB port of PC with CPU.

Item		Specification
CX-Configu-ratorFDT	General Project functions	File handling: CX-ConfiguratorFDT supports overall handling of project files as well as network data. • New: Start a new project. • Open: Open an existing project file. • Save (As): Save a project file. • Export: Export project data to HTML. • Properties: Edit project property information.
		User management: Functionality of CX-ConfiguratorFDT can be limited as defined by several password protected access levels: • Administrator • Planning engineer • Maintenance • Operator • Observer
	Network setup functions	CX-ConfiguratorFDT provides network tree view, from which hierarchy between Master and slave devices can clearly be distinguished.
		The following network functions are available: Network DTMs (i.e. devices) can be added or deleted, using drag and drop from the Device Catalogue. • Network DTMs can be copied and moved from one location to another in the network view. • DTM names can be edited by the user. • Any change to the parameters of a DTM is clearly marked in the tree view, until the project is downloaded to the Master Unit.
	Device Catalogue functions	The Device Catalogue maintains the installed device DTMs. After installation of a new DTM, the user must refresh the database. The Device Catalogue provides the following functions: • Update Device Catalogue. • Add device DTMs to the network directly. • Install a GSD file. This function allows copying of GSD files to a specific directory, after which they are available for the Generic Slave DTM.
	Support functions	CX-ConfiguratorFDT provides the following additional support functions: • Context sensitive help functions. • Error logging. • Monitoring of FDT communication between DTMs. • Multi-language support.

Item		Specification
CJ1W-PRM21 DTM	Device setup	Device setup allows the user to: • Select the PROFIBUS Master Unit's unit number. • Configure the communication link between the PC and the Unit. This function invokes the user interface of CX-Server. • Test the Units communication link and read out the Unit's information.
	Master setup	It allows enabling of Auto Addressing to facilitate I/O data mapping, as well as defining the Unit's behavior in case of • a network malfunction. • CPU mode changes between PROGRAM and RUN mode.
	Bus parameter setup	The bus parameter setup allows the selection of baud rate and calculation and editing of specific bus parameters.
	Slave area setup	The Slave area setup allows the user to define the I/O Data mapping of the I/O Data from each of the slave devices on to CPU memory areas.
	Monitoring functions	• Master status read out. • Slave status and slave diagnostics read-out. • Read out of the Unit's error log.
	Additional Master functions	• Set remote slave address. • Communication channels for PROFIBUS DP-V1 MSAC1 messages. • Communication channels for PROFIBUS DP-V1 MSAC2 messages. These functions are implemented as of Unit version 3.0.
	Support functions	• Context sensitive help functions. • Multi-language support.
Generic Slave DTM	Support functions	• Context sensitive help functions. • Multi-language support.
	I/O configuration setup	The I/O configuration setup function allows: • Selection of device address. • Enable/disable watchdog. • Overview of available I/O modules. • Selection of I/O modules, including Addition, Insertion and Removal of multiple modules.
	Parameter setup	The Parameter setup function: • Setting of common as well as module dependent parameters. • Setting of PROFIBUS DP Extension parameters. • Setting of PROFIBUS DP-V1 dependent parameters.
	Group setting	The Group setup function allows definition of the group to which the associated slave device will belong.
	Monitoring functions	The Monitoring functions provides a display of • Standard Slave diagnostics flags. • Extended diagnostics messages.
	Support functions	• Context sensitive help functions. • Multi-language support.

Note Note For more information on the GRT1-PRT DTM, refer to the SmartSlice GRT1- series G*RT1-PRT PROFIBUS Communication Unit Operation Manual* (Cat. No. W04E-EN-☐).

1-4 Basic Operating Procedure

1-4-1 Overview

The following diagram provides an overview of the installation procedures. For experienced installation engineers, this may provide sufficient information. For others, cross-references are made to various sections of this manual where more explicit information is given.

Mount the PROFIBUS Master Unit to the NJ-series controller (See *2-2-2 Mounting*) Installing the CJ1W-PRM21 Unit

↓

Select a unique Unit Number (0 - F) for the Unit using the rotary switch on the front of the Unit (See section *2-1-3 Switch Settings*)

↓

Connect the PROFIBUS Master unit to the PROFIBUS network (See section *2-3 Network Installation*)

↓

Switch ON the power supply for the CPU and create an I/O table in Sysmac Studio. Refer to *NJ-series CPU Unit Software User's Manual* (Cat. No. W501).

↓

Configure the PROFIBUS Master Unit using CX-ConfiguratorFDT on the PC. (See sections *3-2 CJ1W-PRM21 PROFIBUS Master DTM* and *5-4 Configuring the Master*)

↓

Download configuration data to PROFIBUS Master Unit. (See sections *3-2-3 Connecting to the CJ1W-PRM21* and *5-4-5 Downloading the Configuration*)

↓

PROFIBUS DP starts communicating, confirmed by the COMM indicator continuously lit. Check status of other indicators (See sections *5-5 I/O Communication Characteristics*, *5-6 Operating the Network* and *5-7 Monitoring the Network*)

1-4-2 Preparations for Communications

1 Mount the Master Unit on the NJ-series controller unit (refer to *2-2 Installing the PROFIBUS Master Unit*).

- Treat the Unit as a CPU Bus Unit.
- It can be mounted to a CPU Rack or Expansion Rack.
- Number of Units: 16 (Max).

2 Set the Unit No. (UNIT No.) for the PROFIBUS Master Unit (refer to *2-1-3 Switch Settings*).

3 Connect a PC to the NJ-series controller unit and turn ON the power supply to the CPU.

4 Create the Unit configuration (refer to *Sysmac Studio User Manual* (Cat. No. W501).

5 Install CX-ConfiguratorFDT and the DTMs to the PC.

1-4-3 Procedures Prior to Starting Communications

Use the following procedure to configure the Unit using CX-ConfiguratorFDT:

1 Wire the network, to connect the PROFIBUS Master Unit to the slave devices.

2 Turn ON the CPU power supply and the power supplies of the slave device on the network.

3 In CX-ConfiguratorFDT, create a network and define the parameters and I/O configurations for the PROFIBUS Master Unit settings and the allocated slave devices. Determine the baud rate and the bus parameter setup. Make sure that the “Go to OPERATE mode“option is selected, to force the Unit to OPERATE mode upon a CPU mode change to RUN mode.

4 Download the network configuration to the PROFIBUS Master Unit. After downloading the configuration, CX-ConfiguratorFDT will restart the PROFIBUS Master Unit.

5 After restarting the PROFIBUS Master Unit it will automatically start communication.

2

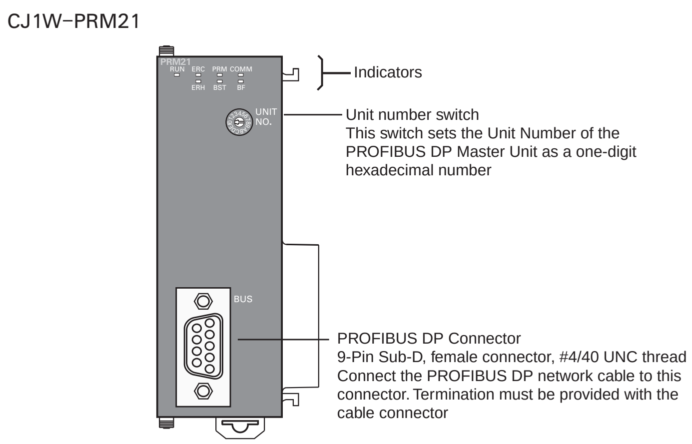
Nomenclature and Installation

This section describes the nomenclature and installation of the PROFIBUS Master Unit. It contains the procedures for installing the CJ1W-PRM21 PROFIBUS Master Unit on the NJ-series controller and setting up the PROFIBUS network.

2-1 Unit Components

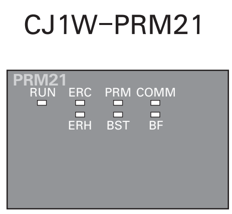
2-1-1 Nomenclature

The illustration below shows the Status indicators, the Unit number selector switch and a 9-pin female sub-D connector on the front side of the CJ1W-PRM21 Unit. Each of these components are explained in the following sections.



2-1-2 Indicators

The CJ1W-PRM21 PROFIBUS Master Units are each fitted with seven LEDs to indicate the operational mode and status of the Unit and the PROFIBUS network.



● Indicator Specifications

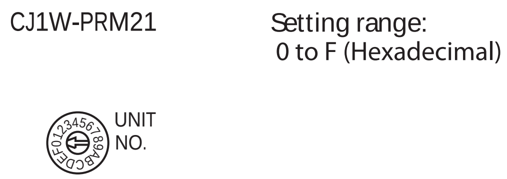
Indicator	Color	Status	Meaning
RUN	Green	Not lit	• Startup test failed, Unit not operational. • Operation stopped, due to a fatal error.
		Lit	Initialization successful, Unit is in normal operation.
ERC (PROFIBUS Master Unit Error)	Red	Not lit	Unit is in normal operation.
		Lit	• One of the following errors occurred: • Startup error. • Non-volatile memory error (checksum failed, write-verify failed). • Invalid PROFIBUS parameter configuration setting. • Fatal error in program execution.
ERH (CPU Error)	Red	Not lit	CPU in normal operation.
		Lit	One of the following errors occurred: • CPU Bus error. • Cyclic Refresh Monitor Time-out. • Routing table error.
PRM (Parameter database)	Green	Not lit	PROFIBUS Parameter configuration is not available or incorrect.
		Flashing	PROFIBUS Parameter configuration is being transferred to the Unit and is not yet available.
		Lit	PROFIBUS Parameter configuration is correct, and operational.
BST (Bus status)	Green	Not lit	The PROFIBUS Master Unit is in OFFLINE or STOP mode.
		Flashing	The PROFIBUS Master Unit is in CLEAR mode.
		Lit	The PROFIBUS Master Unit is in OPERATE mode.
COMM (I/O Data communication)	Green	Not lit	No PROFIBUS data exchange with any of the allocated slaves.
		Flashing	Fatal error occurred (ERC indicator is ON). Unit initialization failed.
		Lit	PROFIBUS data exchange ongoing with at least one allocated slave.
BF (Bus Fail)	Red	Not lit	No PROFIBUS communication errors occurred.
		Flashing	At least one allocated slave is not in data exchange with the Unit.
		Lit	An error occurred in the PROFIBUS interface of the Unit (see section *7-2 Troubleshooting with the PROFIBUS Master Unit Indicators*).

Note Unless otherwise specified, the frequency of a flashing indicator is 1 Hz (50% duty cycle).

2-1-3 Switch Settings

● Setting the Unit Number

The unit number is used to identify individual CPU Bus Units when more than one CPU Bus Unit is mounted to the same CPU. The unit number must be unique for each CPU Bus Unit. Selecting a non-unique number for a CPU Bus Unit will prevent the NJ-series controller unit from starting correctly.



1 Turn OFF the power supply before setting the Unit number.

2 Set the switch to the new Unit number. Use a small screwdriver to make the setting, taking care not to damage the rotary switch. The unit number is factory-set to 0.

3 Turn ON the power again.

Note If the unit number is being set for the first time or changed, then an I/O table must be created for the CPU.

Precautions for Correct Use

- Use a small flat-blade screwdriver to turn the rotary switches; be careful not to damage the switch.
- Always turn OFF the Controller before you change the unit number setting.

Additional Information

If the unit number is the same as one set on another CPU Bus Unit connected to the same CPU Unit, a duplicate number error will occur in the CPU Unit and it won't be possible to start up the PROFIBUS network.

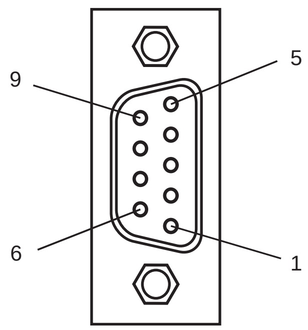
● Unit Number and CPU Bus Unit Word Allocations

With NJ-series controller units, words can be allocated in the CIO Area and the DM Area via Device Variables. The PROFIBUS Master Unit uses these words for receiving control data from the CPU Unit and for notifying the CPU Unit of PROFIBUS Master Unit and communications status. The word addresses in the allocated areas for the CPU Bus Unit are important when creating the user program for using the PROFIBUS Master Unit. This must be considered when setting the unit number.

The CIO and DM Word allocations are discussed in detail in section *4-1 Data Exchange with the CPU Unit*

2-1-4 PROFIBUS Connector

The PROFIBUS connector on the font of the Unit is a 9-pin female sub-D connector, as recommended by the PROFIBUS standard EN 50170.



Pin No.	Signal	Description
1	Shield	Shield/protective ground
2	--	
3	RxD/TxD-P	Receive/Transmit data - plus (B wire)
4	RTS	Control signal for repeaters (direction control) (TTL)
5	DGND	Data ground (reference potential for VP)
6	VP	Supply voltage of the terminator resistance (5 VDC)
7	--	

Pin No.	Signal	Description
8	RxD/TxD-N	Receive/Transmit data - minus (A wire)
9	--	

The signal RTS (TTL signal) is for the direction control of repeaters, which do not have a self-controlling capability.

The signals DGND and VP are used to power the bus terminator located in the cable connector.

Note 1 The orientation of the sub-D connector allows the use of PROFIBUS connectors with a 90° angle cable outlet, e.g ERNI, Delconec and Phoenix.

2 The 9-pin sub-D connector uses #4/40 UNC thread, for mechanical fixation of the cable connector. Make sure that if non-standard PROFIBUS connectors are used, the corresponding thread is used on the cable connector.

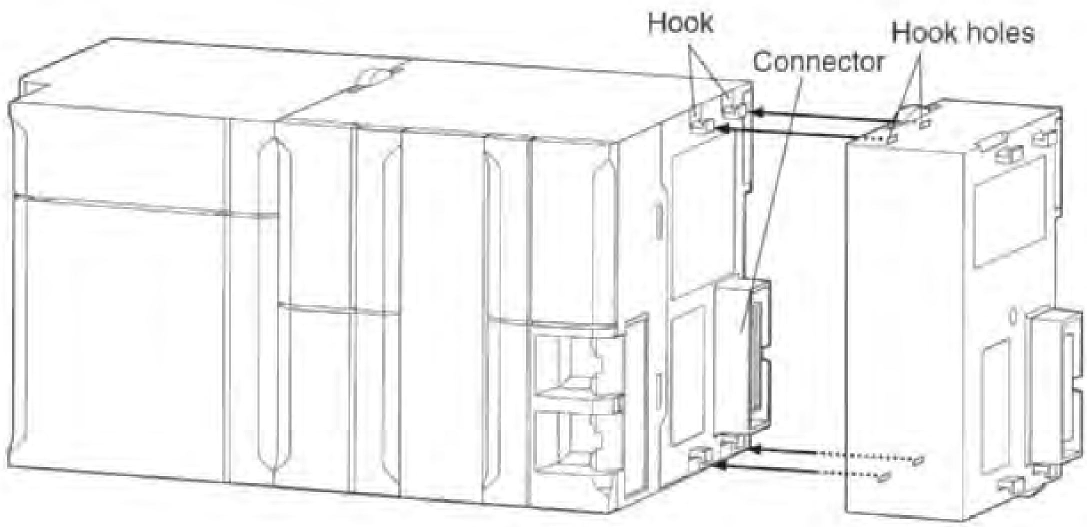
2-2 Installing the PROFIBUS Master Unit

2-2-1 System Configuration Precautions

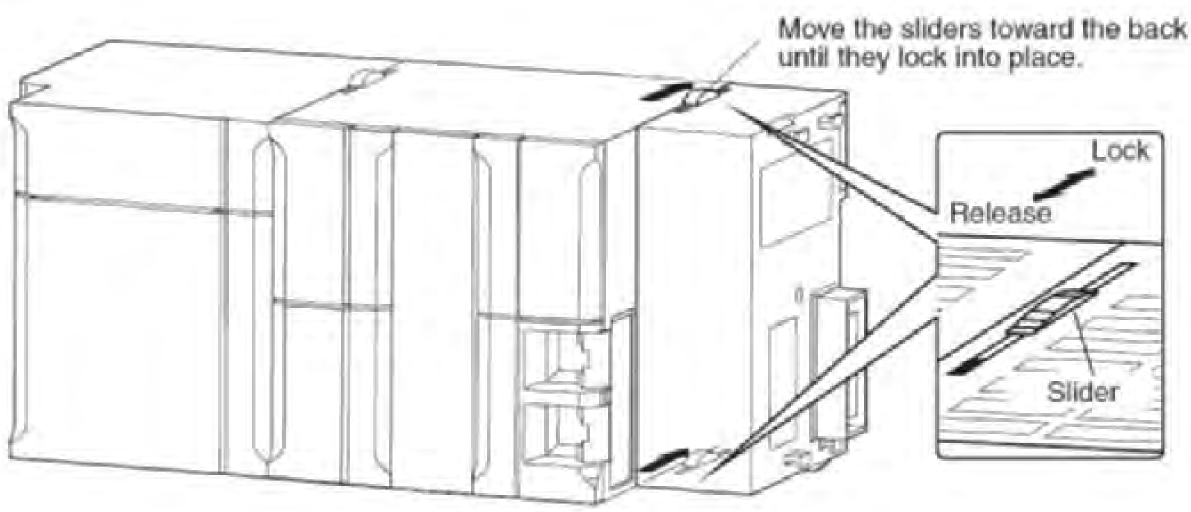
You can mount up to 16 Units on the CPU Rack or an Expansion Rack per CPU (but no more than 10 Units on one Rack).

2-2-2 Mounting

1 Carefully align the connectors to mount the PROFIBUS Master Unit.



2 Move the yellow sliders on the top and bottom of the Unit until they click into position, to lock.



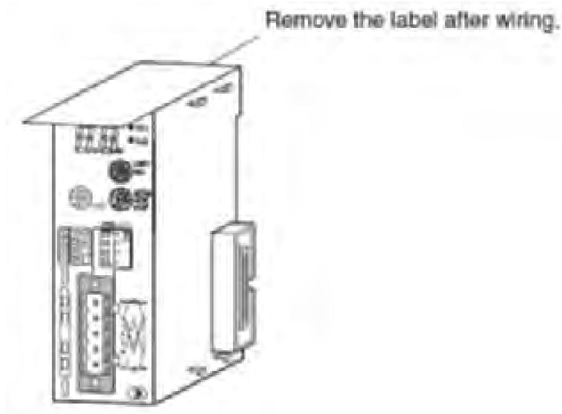
Precautions for Safe Use

If the sliders are not securely locked, the PROFIBUS Master Unit may not operate sufficiently.

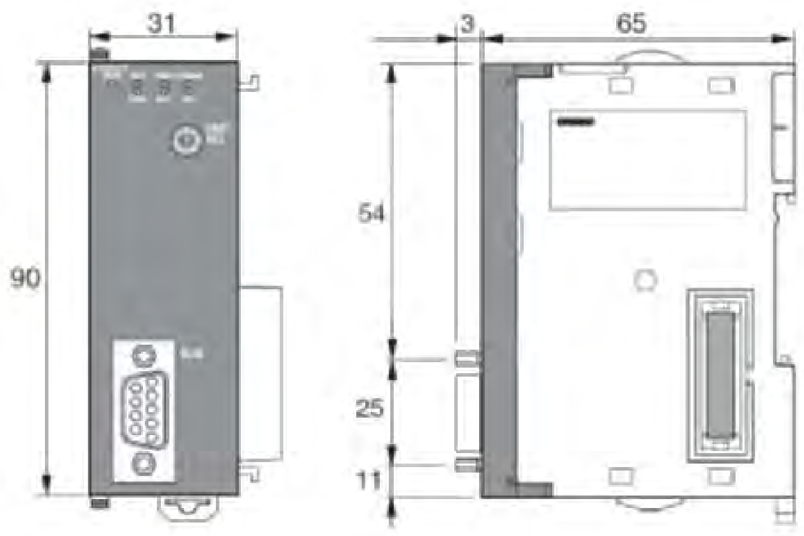
To dismount the Unit, move the sliders to the “Release” direction.

2-2-3 Handling Precautions

- Always turn OFF the power supply to the Controller before you mount or dismount a Unit or connect or disconnect cables.
- Provide separate conduits or ducts for the I/O lines to prevent noise from high-tension lines or power lines.
- Prevent wire clippings, cutting chips or other materials from getting inside the Unit. They could cause scorching, failure and malfunction. Pay particular attention to this during installation and take measures such as covering the unit.
- If the Unit was shipped from the factory with the dust protection label on top of the unit, be sure to remove that label before switching ON the power. The label prevents heat dissipation and could cause a malfunction.



2-2-4 External Dimensions



2-3 Network Installation

2-3-1 Network Structure

Communication Medium

The PROFIBUS standard defines the use of EIA RS-485 as the main communication transport medium. The PROFIBUS Master Unit is designed to interface directly to this type of medium. This section will discuss the setup of networks based on this medium.

Note The other communication medium specified for PROFIBUS is optical fibre. The PROFIBUS Master Units does not provide a direct interface to this type of medium. However, by using third party couplers an interface between EIA RS-485 and optical fibre networks can be made.

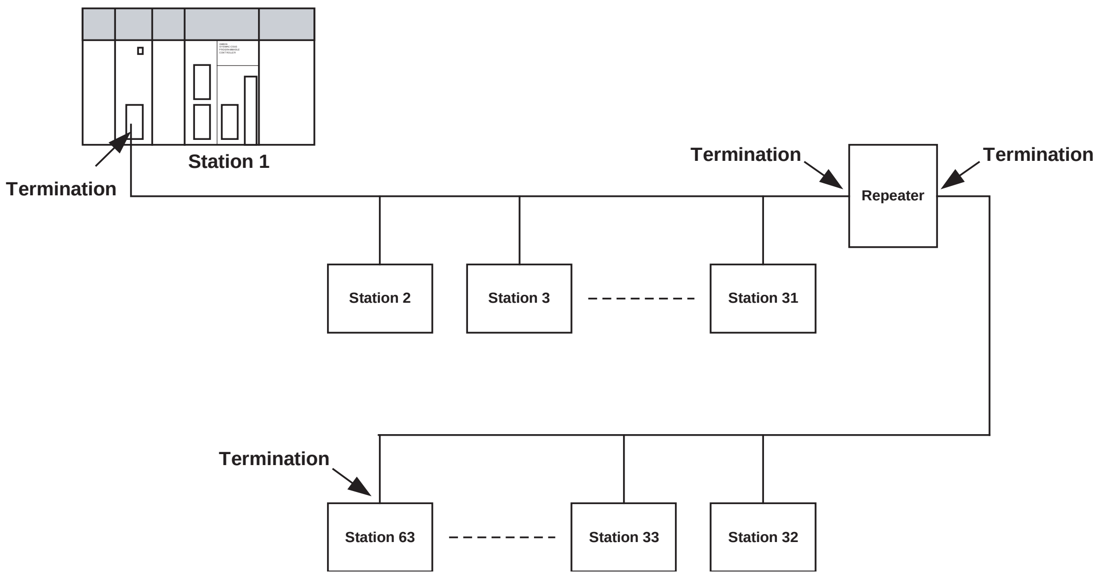
Linear Bus Topology

PROFIBUS DP defines the use of the Linear Bus Network Topology. The Bus must be terminated at both ends, and must not contain network branches. The total cable length of the bus depends on the cable and the selected baud rate. Also, RS-485 specifies a maximum of up to 32 devices - master and slave devices - per line segment. If more than 32 devices are to be connected, or if the total length of the segment must be extended beyond its maximum, repeaters must be used to link the separate segments.

Note Repeaters are devices which connect two segments. They do not have a device address of their own, but they do count in the total number of devices in a segment.

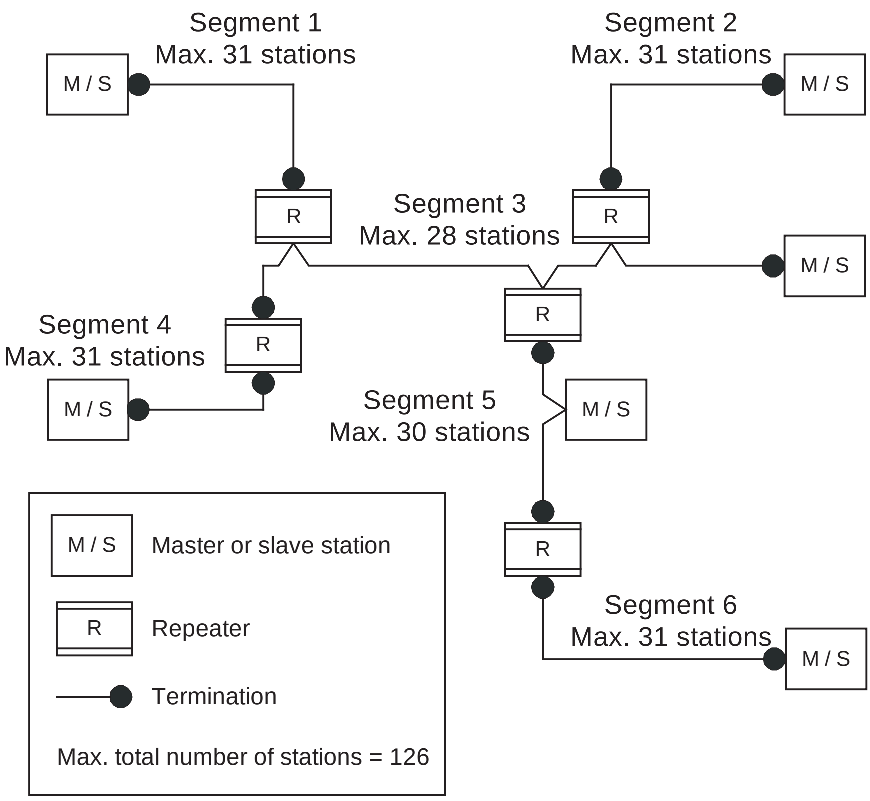
Repeaters

A maximum of up to three repeaters between two devices in a network can be used, i.e. a network can consist of up to 4 segments. The maximum number of PROFIBUS devices in such a network is then 122. The figure below shows an example of a two-segment network.



Tree Topology

The use of repeaters allows the extension of three or more Linear Bus segments into a Tree topology. In a tree topology more than three repeaters are allowed, provided that there are no more than three repeaters between any two devices in the network. The following figure presents an example of a network with more than three segments and repeaters.



Cable Type

The PROFIBUS standard EN 50170 specifies Type A shielded, twisted-pair cable as the recommended cable type for use in an RS-485 based PROFIBUS network. This cable type has the following characteristics.

Characteristic	Value
Impedance	135 - 165 Ωs
Capacitance per unit length	< 30pF/m
Loop resistance	110 Ω/km
Core diameter	0.64 mm
Core cross section	0.34 mm^2

Note The PROFIBUS standard EN 50170 also specifies a Type B cable with different cable characteristics. Use of Type B cable is no longer recommended.

Maximum PROFIBUS Cable Length

The transmission speed defines the maximum advised cable distance or cable segment in metres before the use of a repeater is recommended. The cable lengths specified in the following table are based on PROFIBUS type A cable.

Baud Rate (kbps)	Distance/segment (m)
9.6	1200
19.2	1200
45.45	1200
93.75	1200
187.5	1000
500	400
1500	200
3000	100
6000	100
12000	100

Note 1 If network extension beyond the range of the advised cable length is required, the use of fibre optic cable to cross the larger distance should be considered.

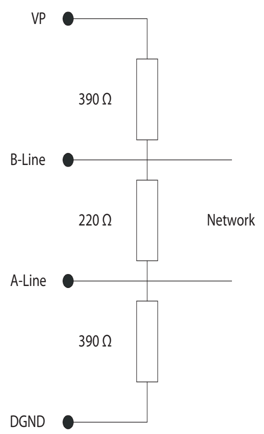
2 The recommended minimum cable length is 1 m.

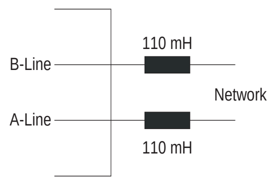
● Stub Lines

Passive Stub lines (branches from the main line) should be avoided for data transmission speeds of more than 500 kbps. Except at end devices with termination, it is recommended to always use plug connectors that permit two data cables to be connected directly to the plug. This method allows the bus connector to be plugged and unplugged at all times without interrupting data communication between other devices.

2-3-2 Bus Termination

● Termination Resistors





In order to minimize cable reflections and ensure a defined signal level on the data lines, the data transfer cable must be terminated at both ends with a terminating resistor combination. The bus termination diagram is shown on the left.

The bus terminator connects the two data lines via a 220 Ω resistor which, in turn, is connected to VP 5VDC and DGND via two 390 Ω resistors. Powering the terminator resistor via VP 5V and DGND ensures a defined idle state potential on the data lines.

To ensure the correct functioning up to the highest baud rate, the bus cable must be terminated at both its ends.

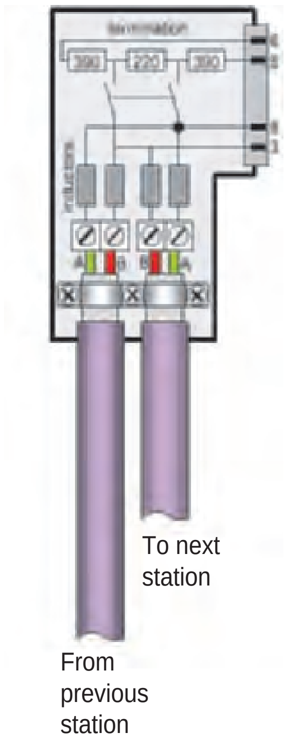
A missing bus termination can cause errors during data transfer. Problems can also arise if too many bus terminators are fitted, since each bus terminator represents an electrical load and reduces the signal levels and thus the signal-to-noise ratio. Too many or missing bus terminators can also cause intermittent data transfer errors, particularly if the bus segment is operated close to the specified limits for maximum numbers of devices, maximum bus segment length and maximum data transfer rate.

In addition to the bus termination, additional precautions must be taken to ensure proper operation at high baud rates, i.e. baud rates of 500 kbps and higher. Due to the capacitive load of the device and the resulting cable reflections, bus connectors must be provided with built-in series inductors, of 110 mH each, as shown in the figure on the left.

Installing the inductors applies to all devices on the network, and not only to the devices at both ends of the bus cable.

2-3-3 PROFIBUS Cable Connector

● Bus Cable Connector



The plug connector to be used on the CJ-series PROFIBUS Master Unit is a 9-pin male sub-D type, preferably encased in metal and having a facility to connect the shield of the cable to the case or to pin 1. The cable should be connected to the receive / transmit lines, pin 3 (B-line) and pin 8 (A-line).

The use of special PROFIBUS DP cable connectors, which are available from several manufacturers, is highly recommended. Various models are widely available, with or without the bus termination and inductors built-in. If provided in the connector, the Bus termination can often be enabled or disabled through a switch on the connector.

The special PROFIBUS DP cable connectors often provide a convenient way of connecting the cables. The figure on the left, provides an example of such a bus cable connector.

A standard 9-pin sub-D plug can only be used if the PROFIBUS Master Unit is not at the start or the end of a bus segment, or on a stub line at a baud rate of 500 kbps or less.

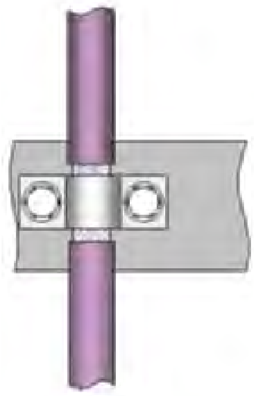
The two PROFIBUS data lines are designated A and B. There are no regulations on which cable core color should be connected to which of the two data terminals on each PROFIBUS device; the sole requirement is to ensure that the same core color is connected to the same terminal (A or B) for all devices throughout the entire system (across all devices and bus segments). The PROFIBUS Organization recommends the following rule for data line color codes: PROFIBUS cables in general will use the colors red and green for the data lines, with the following assignment:

- Data cable wire A - green
- Data cable wire B - red

This rule applies to both the incoming and the outgoing data lines.

2-3-4 Shielding Precautions

Bus Cable Connector



To ensure electro-magnetic compatibility (EMC), the shield of the cable should be connected to the metal case of the plug connector.

If the Unit is installed in a control cabinet, the bus cable shield should be brought into physical contact with a grounding rail using a grounding clamp or similar device. The cable shield should continue in the cabinet right up to the PROFIBUS device.

Ensure that the CPU and the control panel in which it is mounted have the same ground potential by providing a large-area metallic contact to ground, e.g. galvanized steel to ensure a good electrical connection. Grounding rails should not be attached to painted surfaces.

For further information regarding PROFIBUS network installation, please refer to “Installation Guideline for PROFIBUS DP/FMS” (PNO Order No. 2.112), which is available at every regional PROFIBUS Organization. The information covers:

- Test run of PROFIBUS equipment.
- Testing the PROFIBUS cable and bus connectors.
- Determining loop resistance.
- Testing for correct bus termination.
- Determining the segment length and cable route.
- Other test methods.
- Example of an equipment report in the PROFIBUS guideline.

2-4 Software Configuration

Defining the Configuration

After making the physical connections of the network, the configuration then has to be defined in the software. OMRON provides a dedicated PC-based configuration program, called CX-ConfiguratorFDT, as well as the required DTMs for this purpose. It can be used to:

- Define the master(s).
- Assign slaves to their respective master(s).
- Define I/O Configuration and parameters of individual slave devices.
- Define bus parameters, e.g. baud rate, target rotation time etc.

Downloading the Configuration

The configuration must be downloaded to the Master Unit before system operation can take place. This is made possible by either connecting the USB port of the PC to the NJ-series controller unit with a USB interface cable, or use an ethernet connection between the PC and the NJ-series controller unit.

3

Configuration Software

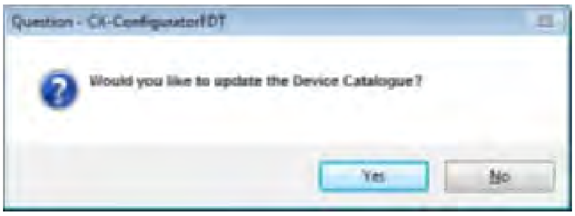
3

This section presents an overview of the Configuration software and discusses the main aspects of defining a PROFIBUS configuration. A more detailed description of the use of the Configuration software can be found in section 5 *Operation*.

3-1 CX-ConfiguratorFDT

3-1-1 Starting CX-ConfiguratorFDT

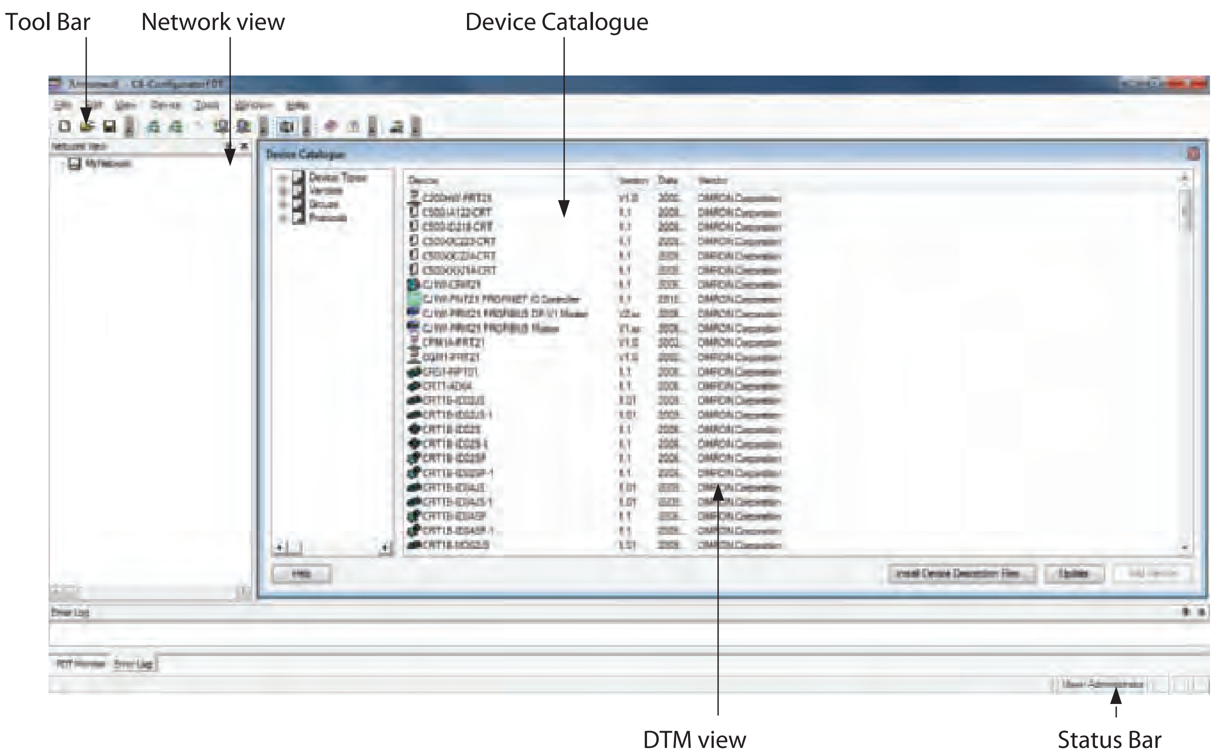
Select Program, OMRON, and CX-ConfiguratorFDT from the Start Menu if the default program folder name is used. The first time CX-ConfiguratorFDT is started, the Device Catalog will still be empty. Therefore, the following dialog will be displayed on top of the CX-ConfiguratorFDT application window.



Select **Yes** to generate the Device Catalogue for the first time. This action may take several minutes depending on the number of installed DTMs.

After updating the Device Catalogue, it will open in the CX-ConfiguratorFDT application window.

3-1-2 CX-ConfiguratorFDT Main Window



The main components in this window are:

- The Network view
- The DTM / Catalogue view
- The Error Log view (not shown in the figure above)
- The FDT Monitoring view (not shown in the figure above)
- The Main menu (not shown in the figure above)
- The Tool Bar and the Status Bar

Network View

The Network view displays the structure of the PROFIBUS network in a tree view format. The tree has at least three levels:

- The project level
- The master level
- The slave level

The highest level of the tree is the project. The next level is the PROFIBUS Master level. On this level one or more PROFIBUS Master devices can be allocated. The third level contains the slave DTMs.

The PROFIBUS network must be assembled in the Network view, i.e. the various DTMs are added to the network via this window. From the Network view the individual DTM User Interfaces can be opened, and accessed.

CX-ConfiguratorFDT supports context menu in the Network view, which are made visible when selecting a device DTM and right clicking the mouse. The contents of the menu may depend on the functionality supported by the DTM.

DTM/Device Catalogue Window

The DTM / Device Catalogue window will hold the Device Catalogue as well as every opened DTM User Interface. The window is an MDI type window, or Multiple Document Interface. One or more user interface windows can be opened, re-sized and moved inside this window.

Error Log View

The Error Log view at the bottom of the CX-ConfiguratorFDT application window displays the error messages reported by DTMs to CX-ConfiguratorFDT. A Time stamp, a Date stamp and the DTM name are added to the message.

The contents of the window can be cleared, or copied to the clipboard, to allow pasting it into another document.

The Error Log view is opened by default, when starting CX-ConfiguratorFDT.

FDT Monitoring View

The FDT Monitoring view at the bottom of the CX-ConfiguratorFDT application window displays the FDT-DTM communication function calls between CX-ConfiguratorFDT and the DTMs. A Time stamp, a Date stamp, the type of information and the DTM name are added to the message.

The sequence of messages can be used to troubleshoot problems that may occur when using third party DTMs in CX-ConfiguratorFDT.

The contents of the window can be cleared, or copied to the clipboard, to allow pasting it into another document.

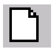
The FDT Monitoring view is not opened by default, when starting CX-ConfiguratorFDT. It can be opened through the **View - FDT Monitoring** menu option.

Main Menu

The main menu of CX-ConfiguratorFDT provides all the necessary functionality to handle a complete project. The table below lists the main menu and their sub menu items.

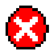
Menu	Command	Short Key	Description
File	New	CTRL-N	Creates a new Project.
	Open	CTRL-O	Opens an existing Project.
	Save	CTRL-S	Saves the displayed Project to a file.
	Save As...	---	Save as is the same as Save, but the Filename Specification Window is always displayed.
	Export Project to HTML	---	Exports Project data in HTML format and launches the browser.
	Project Properties...	---	Opens an edit window to add or edit Project information.
	Recently used File List	---	Lists the recently used Project files.
	Exit	---	Exits CX-ConfiguratorFDT.
Edit	Cut	CTRL-X	Cuts devices and pastes them to the clipboard
	Copy	CTRL-C	Copies devices to the clipboard.
	Paste	CTRL-V	Copies devices from the clipboard to the cursor position.
View	Network view	---	Hides or un-hides the Network view.
	Device Catalogue	---	Opens or closes the Device Catalogue.
	Tool Bar	---	Hides or un-hides the Tool Bar.
	Status Bar	---	Hides or un-hides the Status Bar.
	Error Logging	---	Hides or un-hides the Error Logging window.
	FDT Monitoring	---	Hides or un-hides the FDT Monitoring view.
Device	Add Device...	---	Opens up the Device Catalog Add window, from which devices can be added to the selected network tree.
	Upload Parameters	---	Uploads the parameters from a device to its associated DTM.
	Download Parameters	---	Downloads the parameters from DTM to its associated device.
	Export to HTML	---	Exports the properties and parameters of the selected DTM, or the network to a HTML file and opens the default browser.
	Properties	---	Displays the properties of the selected DTM, or the network.
Tools	User Management...	---	Displays the user management (i.e password management) window.
Window	Cascade	---	Cascades all open DTM User Interfaces.
	Tile Horizontally	---	Tiles all open DTM User Interfaces horizontally.
	Tile Vertically	---	Tiles all open DTM User Interfaces vertically.
	Close All	---	Closes all open DTM User Interfaces.
Help	Contents	---	Opens the Help dialog and lists the Help file contents.
	Index	---	Opens the Help dialog and lists the Help Index.
	About CX-ConfiguratorFDT....	---	Opens the About dialog window for CX-ConfiguratorFDT.

● Tool Bar

Icon	Description	Equivalent menu command
	Creates a new project.	File-New
	Opens an existing project file.	File-Open
	Saves the displayed project to a file.	File-Save
	Connects the configurator to the selected devices.	Device-Go Online
	Downloads the parameters to the device.	Device-Download Parameters
	Uploads the parameters from the device.	Device-Upload Parameters
	Opens the Device Catalogue.	View-Device Catalogue

● Status Bar

The status bar displays the current user role, i.e. the login level.

In case the Error Log view has been closed, the status bar will additionally display a  symbol to indicate that new errors are available in the Error Log view. Double-clicking the symbol will open the Error Log view.

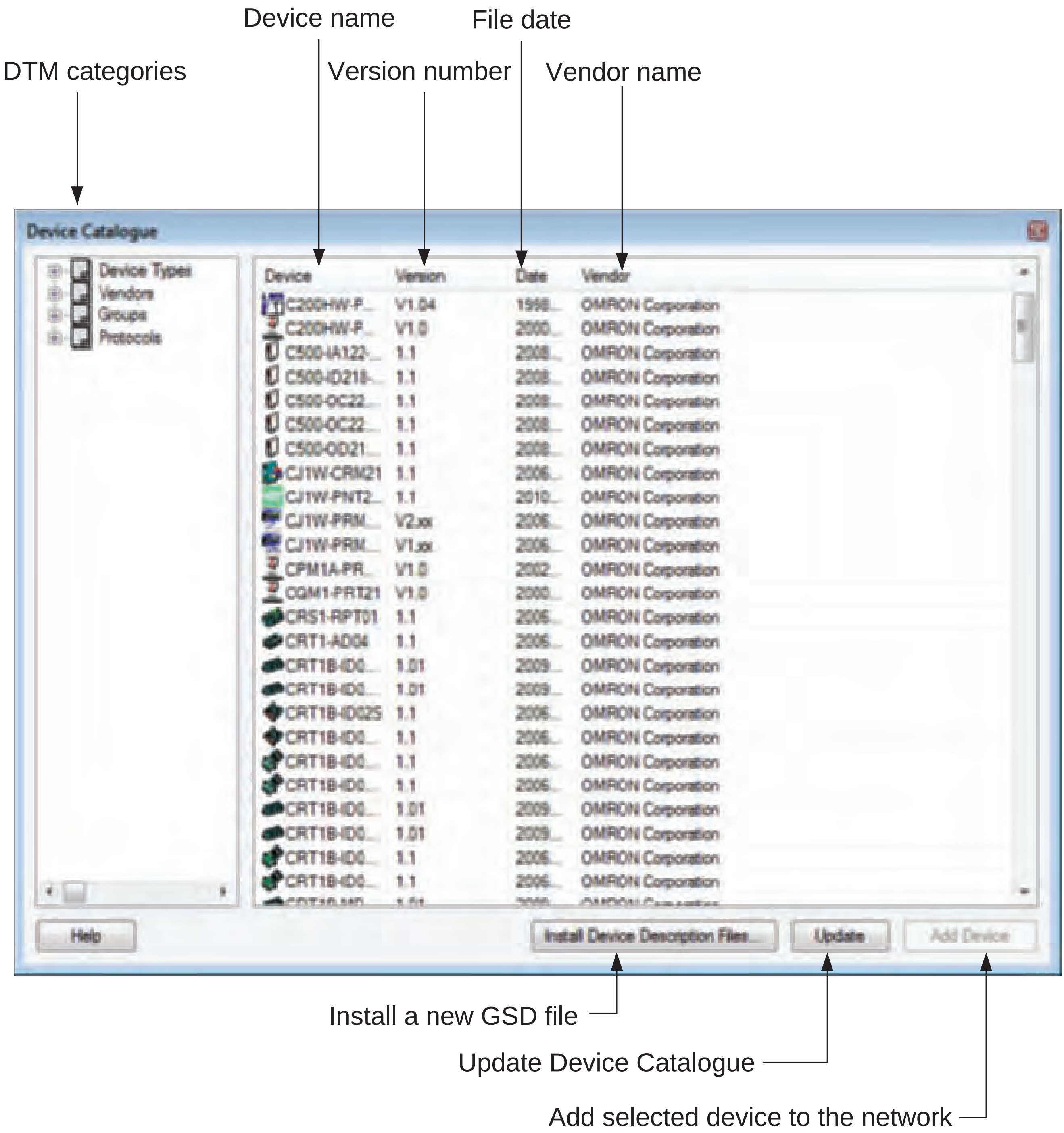
3-1-3 Device Catalogue

● Device Catalogue Main Components

The Device Catalogue is one of the main components in CX-ConfiguratorFDT. Its main functions are:

- to maintain a list of installed DTM and GSD files.
- to provide convenient sorting and categorizing of the list.
- to allow updating the list, after installation of new DTMs or GSD files.
- to provide detailed information on selected DTMs

The main layout of the Device Catalogue is shown below.



● Invoking the Device Catalogue

The Device Catalogue window is opened by either selecting the icon in the CX-ConfiguratorFDT toolbar or by selecting the **View - Device Catalogue** menu option. Both options have toggle function: selecting one of them again will close the Device Catalogue.

DTM View Layout

The left view allows selection of specific groups of DTMs to be displayed. The right view lists the DTMs, which are installed on the PC and which are available for setting up a network. A selection of DTMs is made by selecting a specific group in the left view.

Note The list makes no distinction between normal DTMs and GSD files which have been loaded through the Generic Slave Device DTM.

DTM List Window

The list items in the right view are described in the following table.

Column	Description
Device	The Device column contains the names of the DTMs, as provided by the DTM or the GSD file. If the device is defined by a GSD file, the Generic Slave Device DTM reads out the GSD file entry “Model Name”. The string provided by this variable is the name displayed in the list.
Version	The version number defines the revision number of the device. If the device is defined by a GSD file, the Generic Slave Device DTM reads out the GSD file entry “Revision”. The string provided by this variable is the version number displayed in the list.
Date	For DTMs, Date is the date associated with the revision. For GSD file based slaves, the date listed in this column is the date the GSD file was last modified.
Vendor	The Vendor name is provided by the DTM or the GSD files.

DTM Group Selection Window

The left view allows selection of specific groups of device DTMs with common attributes, e.g. Vendor name, Protocol type etc. If a group is selected, all device DTMs which belong to that group will be listed in the right view. The table below lists the possible groups that can be selected.

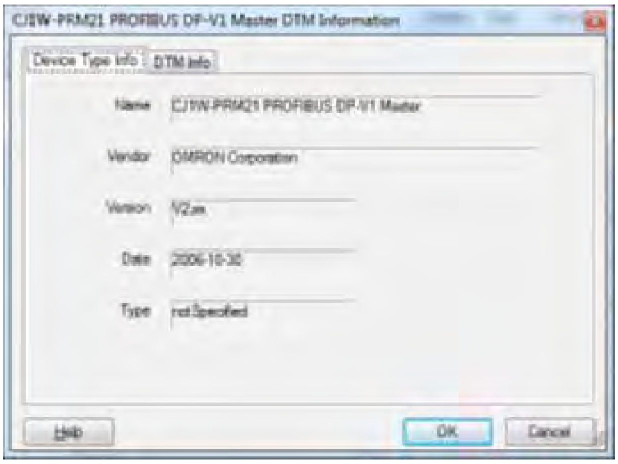
List item	Description
Device Types	Sub groups, which can be selected are: • Communication DTMs, e.g. PROFIBUS Master devices • Gateways, e.g. to another network type • Modular devices • Other devices, e.g. slave devices
Vendors	Sub groups, which can be selected are all available vendors. This information is provided by each DTM. It allows the user to select a group of devices from one vendor.
Groups	Sub groups are the device types, e.g. digital I/O, analog I/O etc.
Protocols	Sub groups which can be selected are all the communication protocols found in the Device Catalogue.

Note **1** The sub groups will be displayed by clicking on the **+** sign next to each main group

2 Selecting the main group displays all devices in the group.

Additional DTM Information

In order to obtain more information of a specific DTM, right-click the DTM in the list. From the pop-up menu, select **DTM Information**. This opens a window with additional DTM information. The figure below provides an example for the CJ1W-PRM21 PROFIBUS Master DTM



3-1-4 Updating the Device Catalogue

If a new DTM has been installed, it will not automatically be included in the Device Catalogue. In order to add newly installed DTMs to the list, the Device Catalogue must be updated by selecting the **Update** button at the bottom of the window.

Updating the Device Catalogue may take some time, depending on the amount of DTMs installed. A dialogue window with a progress bar will be shown during the update process. After updating the Device Catalogue, it will be stored on hard disk. The next time CX-ConfiguratorFDT is started the updated list will be used.

● Installing GSD Files

The Device Catalogue also allows the installation, i.e. copying of new GSD files into the GSD directory for the Generic Slave Device DTM. Selecting the **Install GSD Files...** button displays the standard Windows file selection window. After selecting the GSD file, and selecting the Open button in the File selection window, the GSD file will be copied to the GSD file directory under CX-ConfiguratorFDT.

After copying the GSD file, a warning window will be displayed, indicating that the Device Catalogue needs to be updated. This can be accomplished by selecting the **Yes** button in the warning window.

Note 1 Updating the Device Catalog after copying GSD file can only be done if there is a new project opened, i.e. with no DTMs allocated to the network. This is to prevent corruption of an existing network in case a GSD file is removed or replaced.

2 The **Install Device Description Files...** option allows installation of more than one file at the same time.

3-1-5 Adding Devices to the Network

Setting up a network in CX-ConfiguratorFDT involves adding and configuring single device DTMs. The device DTMs as listed in the Device Catalogue can be added to the network in three ways:

- Using the context menu; A context menu will pop up when selecting the CJ1W-PRM21 PROFIBUS Master DTM and right clicking the mouse. By selecting the menu option **Add Device**, a simplified Device Catalogue is displayed, allowing only a selection of DTMs which can be added to the PROFIBUS Master DTM.
- Using the Drag & Drop function; A Device DTM listed in the standard Device Catalogue window can be dragged and dropped from the Device Catalogue to a desired position in the Network view.
- Using the **Add Device** button; A device DTM selected in the Device Catalogue can be added to a selected Master DTM in the Network view by clicking the Add Device button in the Device Catalogue window.

3-1-6 Saving and Opening Projects

A project, containing various DTMs can be saved and opened to and from hard disk. Saving a project file is accomplished by selecting the **File - Save** or **File - Save As...** menu option. This will display the standard Windows file selection window, allowing the user to enter a file name.

The Project File is saved with the extension *.CPR.

Saving the data is initiated from CX-ConfiguratorFDT, but every DTM must support the save function as well. The settings of each DTM are added to the Project file by the DTM itself.

A Project file can be opened using the **File - Open** menu option. This will open the standard Windows File selection window, after which the Project file can be selected and opened.

When opening a Project file, the network tree view is constructed. However, for performance reasons, the DTMs are not directly instantiated. The advantage is that the tree view is constructed fast, but opening a DTM from the tree view may take longer, depending on the performance of the PC used.

A Project File can also be opened from Windows Explorer. Double-clicking a file with extension *.CPR will invoke CX-ConfiguratorFDT and open the selected file if the proper file associations are set.

3-1-7 Exporting to HTML

CX-ConfiguratorFDT provides automatic generation of project documentation upon command of the user. The documentation is generated in HTML format, and can cover either single DTMs or the whole project. After generation of the HTML document, it will automatically launch the default Internet browser, to display the result.

● Exporting Project to HTML

Exporting the project information to HTML can be achieved in two ways.

- Select the main menu **File - Export Project as HTML** option. A window will pop up displaying the progress of the export process.
- Select **Export to HTML** option from the context menu. First select the project level in the Network view, then right click the mouse to display the context menu. A window will pop up displaying the progress of the export process.

After exporting the information, the default browser is launched, showing the result of the export process. Links are available to open the information pages for the individual DTMs.

The extent of the information made available depends on the individual DTMs. This can range from device type and version information up to all settings and selections made for the device.

● Exporting DTM Information to HTML

Exporting single DTM information to HTML is achieved by the following sequence.

1. Select the DTM in the Network view.
2. Right click the mouse to bring up the context menu.
3. Select the **Export to HTML** option from the context menu.

A window will pop up displaying the progress of the export process. When finished, CX-ConfiguratorFDT will launch the default browser to display the result. In this case however, no links will be available to other DTMs in the network.

3-1-8 Error Logging and FDT Monitoring

CX-ConfiguratorFDT provides two logging windows at the bottom of the application window. Both windows are used for displaying events.

● Error Log View

The Error Log view displays error messages reported by the DTMs and by the CX-ConfiguratorFDT container application. All messages include the Time and Date of occurrence, as well as the DTM Name, as shown in the Network view.

● Purpose of the Error Log

The purpose of the Error Log view is error reporting as well as troubleshooting. The contents of the window can be copied to the clipboard, to allow it to be pasted into another document or into an email. The errors themselves as well as the sequence of errors may hold additional clues in case of problems.

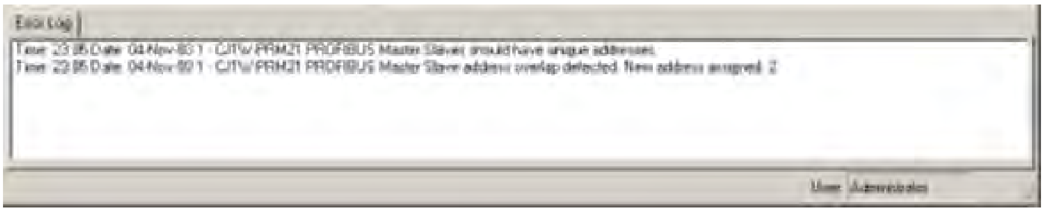
● Error Log Format

The format used in the Error Log view is

Time: *<Time> Date: <Date> - <DTM name> <message>*

The message displayed, originates from the DTM in which the error occurred.

The figure below shows an example of an error message sequence. This example sequence is generated after attempting to change a slave address to that of another slave already assigned to the same Master Unit.



By right-clicking the mouse cursor in the Error Log view, a context menu is displayed. This context menu provides the options listed below.

● Error Log View Context Menu

Menu item	Description	Equivalent menu command
Clear all entries	Clears the entire Error Log view.	---
Copy to clipboard	Copies the entire contents of the Error Log view to the clipboard.	---
Hide	Hides the Error Log view.	View - Error Logging

● FDT Monitoring View

The FDT Monitoring view displays the communication between the FDT Container application (i.e. CX-ConfiguratorFDT) and any of the DTMs. The communication is listed as a sequence of function calls from the CX-ConfiguratorFDT to a DTM and vice versa.

Note The FDT Monitoring view is hidden by default. After starting CX-ConfiguratorFDT, the window will be displayed, by selecting the **View - FDT Monitoring** option from the main menu.

The purpose of the FDT Monitoring view is troubleshooting in case problems occur with third party DTMs. The contents of the window can be copied to the clipboard, to allow it to be pasted into another document or into an email. The messages themselves as well as the sequence of messages may hold additional clues in case of problems.

The format used in the FDT Monitoring view is

Time: *<Time> Date: <Date> - <Information Type> <message>*

The message may include the name of the DTM involved in the communication.

The figure below shows an example of an FDT Monitoring message sequence. This example sequence is generated when opening a CJ1W-PRM21 PROFIBUS Master Unit DTM.

By right-clicking the mouse cursor in the FDT Monitoring view, a context menu is displayed. This context menu provides the options listed below.

● FDT Monitoring View Context Menu

Menu item	Description	Equivalent menu command
Clear all entries	Clears the entire FDT Monitoring view.	---
Copy to clipboard	Copies the entire contents of the FDT Monitoring view to the clip-board.	---
Hide	Hides the FDT Monitoring view.	View - FDT Monitoring

3-1-9 Access Control and User Management

The FDT Standard defines four access levels and two attributes for FDT Container applications, which can be used to restrict access to the program or certain features thereof for unauthorized personnel. The actual use of the restrictions also depends on the application.

CX-ConfiguratorFDT implements the five levels as well as one of the attributes. These levels are listed below.

- Observer
- Operator
- Maintenance
- Planning Engineer
- Administrator

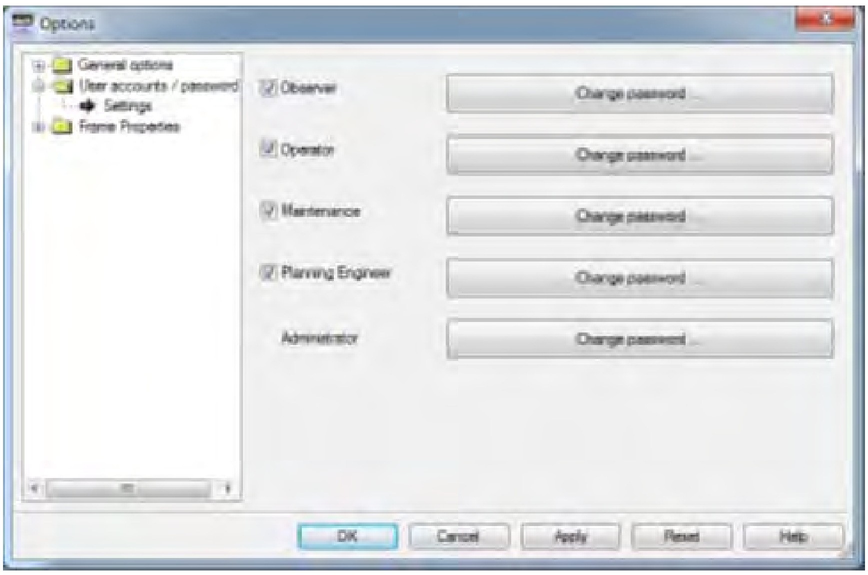
The access rights per level are defined in the table below.

Function		Observer	Operator	Maintenance	Planning Engineer	Administrator
Project File access	New file	Allowed	Allowed	Allowed	Allowed	Allowed
	Open file	Allowed	Allowed	Allowed	Allowed	Allowed
	Save File	Not allowed	Not allowed	Not Allowed	Allowed	Allowed
	Save As...	Not allowed	Not allowed	Allowed	Allowed	Allowed
	Properties	View only	View only	Edit	Edit	Edit
	Export to HTML	Allowed	Allowed	Allowed	Allowed	Allowed
Device Catalogue	Open	Allowed	Allowed	Allowed	Allowed	Allowed
	Add GSD files	Not allowed	Not allowed	Not allowed	Allowed	Allowed
	Update	Not allowed	Not allowed	Not allowed	Allowed	Allowed

	Function	Observer	Operator	Maintenance	Planning Engineer	Administrator
PROFIBUS Master DTM	Open	Allowed	Allowed	Allowed	Allowed	Allowed
	Master settings	View only	View only	Edit	Edit	Edit
	Communication settings	View only	View only	Edit	Edit	Edit
	Go online	Allowed	Allowed	Allowed	Allowed	Allowed
	Monitoring	Allowed	Allowed	Allowed	Allowed	Allowed
	Change state and send commands	Not allowed	Not allowed	Allowed	Allowed	Allowed
	Export to HTML	Allowed	Allowed	Allowed	Allowed	Allowed
	Properties	View only	View only	Edit	Edit	Edit
Generic Slave DTM	Open	Allowed	Allowed	Allowed	Allowed	Allowed
	Device settings	View only	View only	Edit	Edit	Edit
	Go online	Allowed	Allowed	Allowed	Allowed	Allowed
	Monitoring	Allowed	Allowed	Allowed	Allowed	Allowed
Network	Add DTMs	Not allowed	Not allowed	Not allowed	Allowed	Allowed
	Delete DTMs	Not allowed	Not allowed	Not allowed	Allowed	Allowed
	Properties	View only	View only	Edit	Edit	Edit
	Export to HTML	Allowed	Allowed	Allowed	Allowed	Allowed
User Management	Change password	Not allowed	Not allowed	Not allowed	Not allowed	Allowed

● User Management

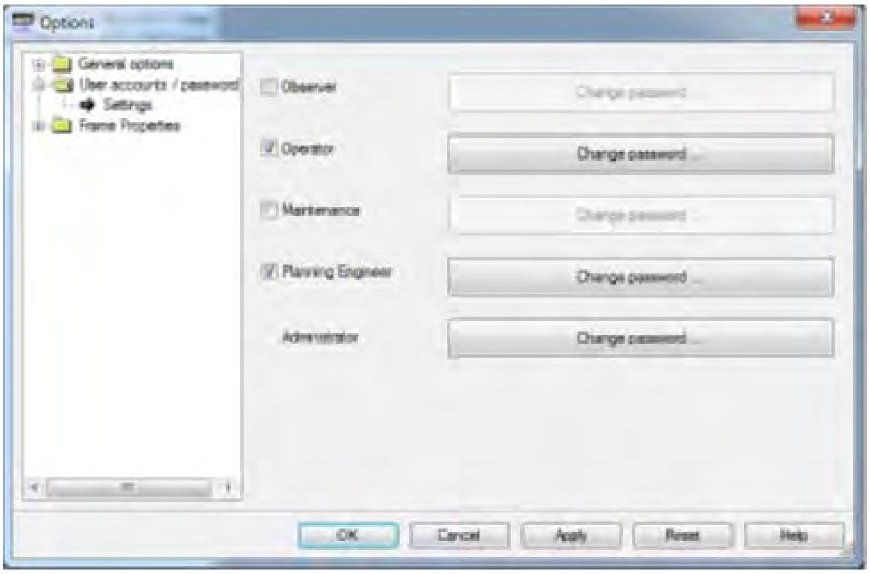
To change access rights or to change the passwords for the various access levels, first login into the Administrator level. This allows you to select the **Tools - User Management** option from the main menu in CX-ConfiguratorFDT. Other access levels do not have access to this menu option. The selection opens the User Accounts window, as shown below.



● Changing Access Rights

By selecting the check box next to a level, the administrator can grant access rights to CX-ConfiguratorFDT, i.e. the checked levels can start and access CX-ConfiguratorFDT. If a check box is not selected, the corresponding level can not be used to start CX-ConfiguratorFDT, and it will not appear in the drop down list in the login window.

For example, in the window below the Observer and Maintenance levels are unchecked.



The next time CX-ConfiguratorFDT is started, the Observer and Maintenance access levels are not available in the login window, as shown below.

The Administrator level has always access and can not be disabled in the User Accounts window.

● Changing the Passwords

In order to change a specific password, select the **Change password** button in the User Account window, next to the related access level. The level must be enabled by selecting the check box to the left of it. Pressing the **Change password** button opens a window allowing the entry of a new password. As an example the window below shows the Change password window for the Planning Engineer. You can now enter the new password, confirm it by re-typing the password and select the **OK** button to activate the new password.

Note If access protection is not important for the application, you can define an empty string as a password, i.e. when entering the new password, simply press the return button on your PC. When starting CX-ConfiguratorFDT, the login window can be passed by pressing the return button on your PC, without entering a password.

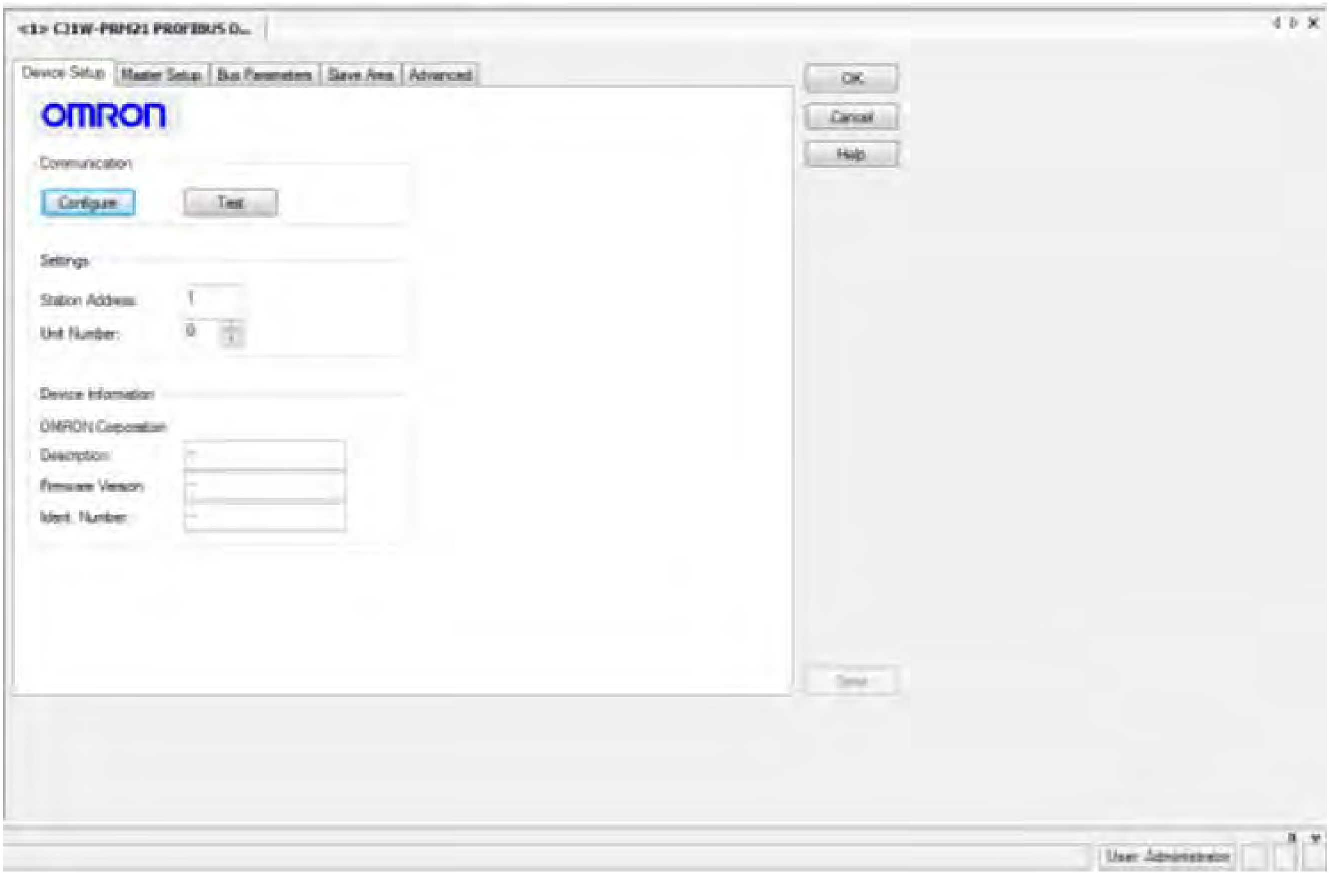
3-2 CJ1W-PRM21 PROFIBUS Master DTM

3-2-1 Configuration User Interface

● Opening the Configuration DTM

The configuration DTM is opened by

- Selecting the **Master DTM** in the Network view, and double-clicking the left mouse button.
- Selecting the **Master DTM** in the Network view, and right-clicking the mouse. From the context menu, select **Configuration**. The Master DTM Configuration User Interface, which is displayed in the CX-ConfiguratorFDT DTM view is shown below.



● Master DTM Configuration User Interface

The Master DTM Configuration User Interface contains five tabs:

- Device Setup tab
- Master Setup tab
- Bus Parameters tab
- Slave Area tab
- Advanced

The five tabs are discussed below.

Configuration Interface Buttons

The Master DTM Configuration User Interface contains four general buttons. They are listed in the table below, together with the action taken when pressing them.

Button	Action
OK	Evaluate, and save the changes made (if any) and close the user interface. If any invalid settings have been made, a warning message will be displayed, allowing cancellation of the command.
Cancel	Close the user interface without saving. If any changes were made, a warning message is displayed, allowing cancellation of the command.
Help	Launch context sensitive Help for the Active tab.
Save	Evaluate changes and save them.

Precautions for Correct Use

Save in the context of the buttons means that the changes made by the user are saved in the DTM only, i.e. the changes are not permanently saved in the Project yet. This is indicated by the asterisk next to the DTM in the Network view. The next time in the same session the GUI is opened, the changes will still be there. In order to save the changes permanently, e.g. to hard disk, Click the **File - Save** option from the main menu of CX-ConfiguratorFDT.

Device Setup Tab

The Device setup tab (see figure above) provides the controls to achieve communication between the PC and the PROFIBUS Master Unit. It allows setting of the unit number to identify it on the NJ-series control unit and the device address to identify it on the PROFIBUS network. It also will invoke the CX-Server interface to setup and test the communication between the PC and the CPU to which the Unit is attached.

The Device Setup tab has the following components.

Settings Box

The Settings box contains the setting the user must make before setting up the communication and before testing the communication.

Control	Description
Station Address	Address of the Unit in the PROFIBUS network. Default value is 1, but it should be changed if there is already another device with that number.
Unit Number	This number must be the same as the number selected with the Unit Number Selector switch on the front of the Unit (refer to *2-1-3 Switch Settings*). This number is used in the communication between the PC and the CPU to transmit the messages to the targeted PROFIBUS Master Unit

Configure Button

The Configure button invokes the CX-Server communications settings dialog. CX-Server is the driver software, providing the communication functionality between a PC and the CPU.

CX-Server is provided with CX-ConfiguratorFDT, but it may already be installed on the PC, if other programs such as CX-Programmer have been installed.

Section *3-2-3 Connecting to the CJ1W-PRM21* will provide more details on how to configure CX-Server.

● Test Button

The purpose of the **Test** button is to test the communication setup, after CX-Server has been configured. If the PC and the CPU are connected, selecting the **Test** button, will invoke a request message to the PROFIBUS Master Unit via the CPU, to read its name and firmware version. If the request succeeds, both will be displayed in the Device Information Box.

If the request fails (no response), an error message will be displayed in the Error Log view. In this case the Firmware version field will revert back to its default contents, i.e. “--- “.

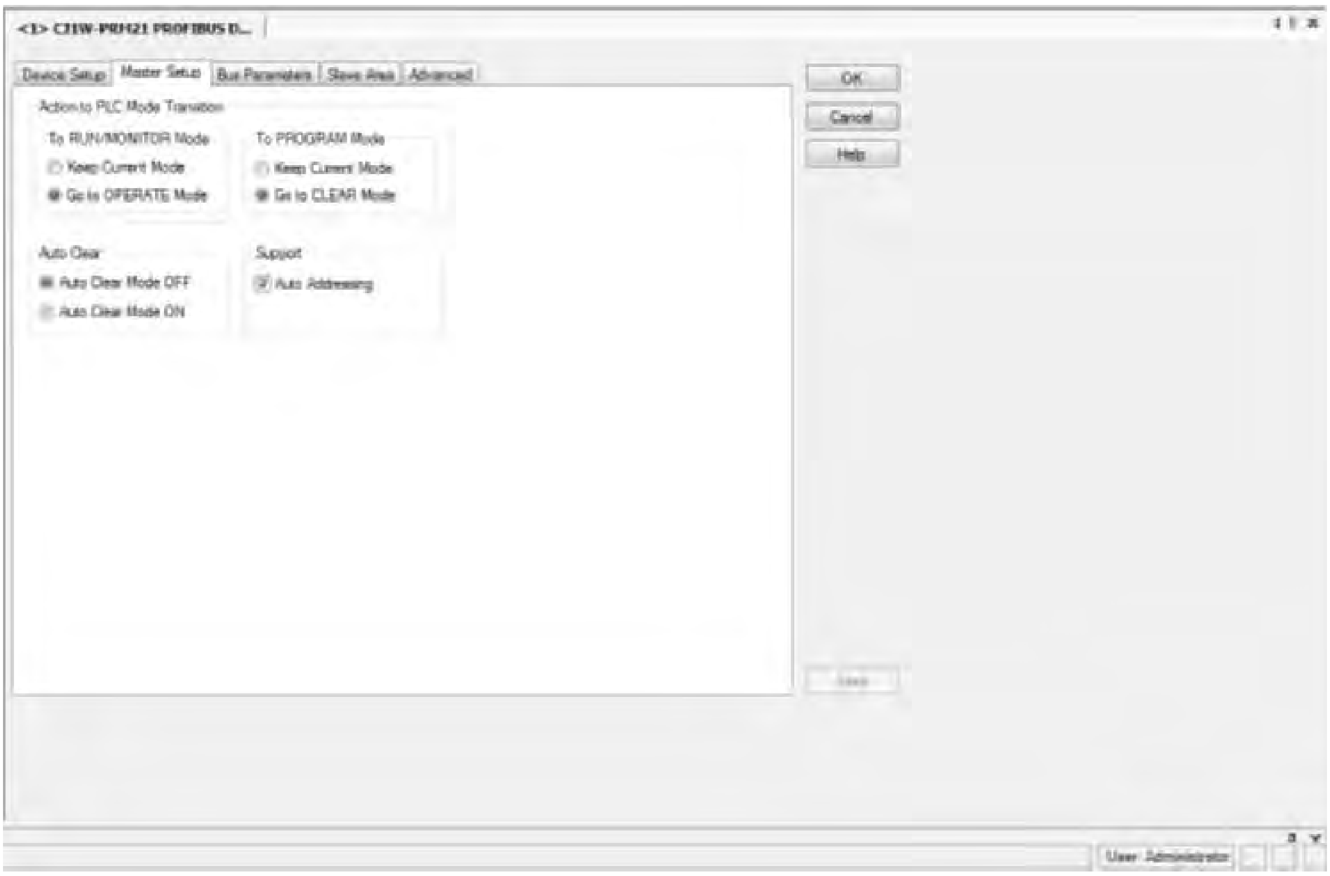
● Device Information Box

The Device Information Box contains information obtained from the PROFIBUS Master Unit, through the communication.

Item	Description
OMRON Corporation	This is fixed text, indicating the Manufacturer of the PROFIBUS Master Unit.
Description	This string will contain the name of the Unit, i.e. CJ1W-PRM21.
Firmware Version	This string displays the firmware version, currently in the PROFIBUS Master Unit.
Ident number	The PROFIBUS Ident number (Hex) for the Unit: CJ1W-PRM21: 07C4

Master SetupTab

The Master Setup tab contains settings regarding the behavior of the PROFIBUS Master Unit itself. The Master Setup tab is shown below.



Action to PLC Mode Transition Box

The Action to PLC Mode Transition Box defines the behavior of the Unit on the PROFIBUS network, in case a CPU mode change occurs. The check boxes define how the Unit should behave in case the CPU mode is changed from RUN mode to PROGRAM mode, or vice versa. Refer to section *1-1-7 Network Operation Modes* for more information on PROFIBUS operational modes.

Change CPU to RUN Mode

The table below defines the behavior in case the CPU changes to RUN mode.

Control	Description
Keep Current Mode	Unit keeps the current mode if the CPU goes to RUN mode (e.g. stay in CLEAR mode).
Go to OPER-ATE Mode (default setting)	The Unit goes to the OPERATE mode whenever the CPU goes to the RUN mode.

Change CPU to PROGRAM Mode

The table below defines the behavior in case the CPU changes to PROGRAM mode.

Control	Description
Keep Current Mode	Unit keeps the current mode if the CPU goes to PROGRAM modem (e.g. stay in OPERATE mode).
Go to CLEAR Mode (default setting)	The Unit goes to the CLEAR mode whenever the CPU goes to the PRO-GRAM mode.

Auto-CLEAR Box

Auto-CLEAR defines the Unit’s behavior in case an error occurs in one of the allocated slave devices, which causes it to stop data exchange with the Master Unit. If Auto-CLEAR is enabled, the Unit will automatically transition to the CLEAR state and force all its allocated slave devices to the ‘safe’ state, i.e. all outputs are set to 0, using the Global-Control CLEAR command.

Control	Description
Auto-CLEAR Mode ON	Selected Unit transitions to the CLEAR mode in the event of a network error, e.g. because one or more configured slaves are not in the Data Exchange mode.
Auto-CLEAR Mode OFF (default setting)	Selected Unit does not transition to CLEAR mode, but attempts to re-param-eterize the slave device.

Support Box

The Auto Addressing in the Support Box defines the I/O Mapping process when adding/removing I/O modules or when editing an existing I/O Mapping. Refer to section *5-5-2 Mapping I/O Data* for more details on I/O mapping.

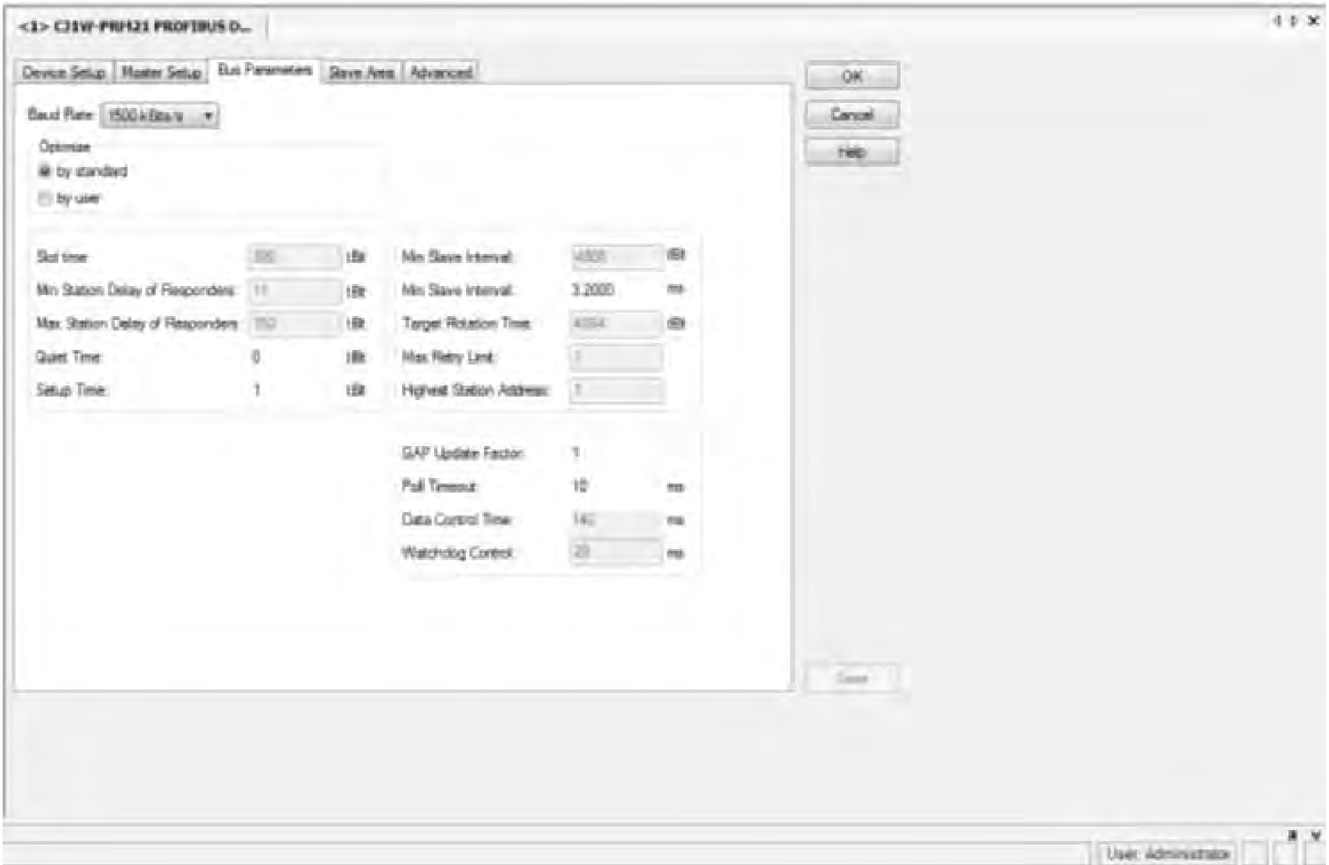
Control	Description
Auto Addressing enabled	I/O data mapping will be done by the Master DTM by allocating the I/O data in ascending order of slave device address and selected I/O modules. No memory allocation gaps are left behind.
Auto Addressing disabled	New I/O modules are appended to the existing mapping. Changed I/O mod-ules will be re-allocated to the end of the list. Memory allocation gaps can be left behind.

Bus Parameters Tab

The Bus Parameters tab contains the parameters for the communication on the PROFIBUS network. The Bus Parameters tab is shown below.

The Bus Parameters are a number of settings which define the communication behavior and timing on the PROFIBUS network. The Bus Parameters depend on the selected baud rate, certain slave communication parameters as well as the number of I/O data bytes exchanged between the Master Unit and each of the slave devices.

The required combination of Bus Parameters is calculated by the program, based on the dependencies mentioned above. However, the user can change selected Bus Parameter manually if the application requires this.



Precautions for Correct Use

Changing the calculated Bus Parameters manually is not recommended and should only be performed if this is absolutely necessary. Changing the Bus Parameters to an invalid combination, may result in Unit malfunctioning and unexpected behavior.

Note When making changes to Bus Parameters, selecting the Optimize buttons allows toggling between the optimized values and the changed values. Selecting another baud rate after changing parameters will reset the Bus Parameters to default values for the new baud rate. The table below lists the parameters, shown in the Bus Parameter tab.

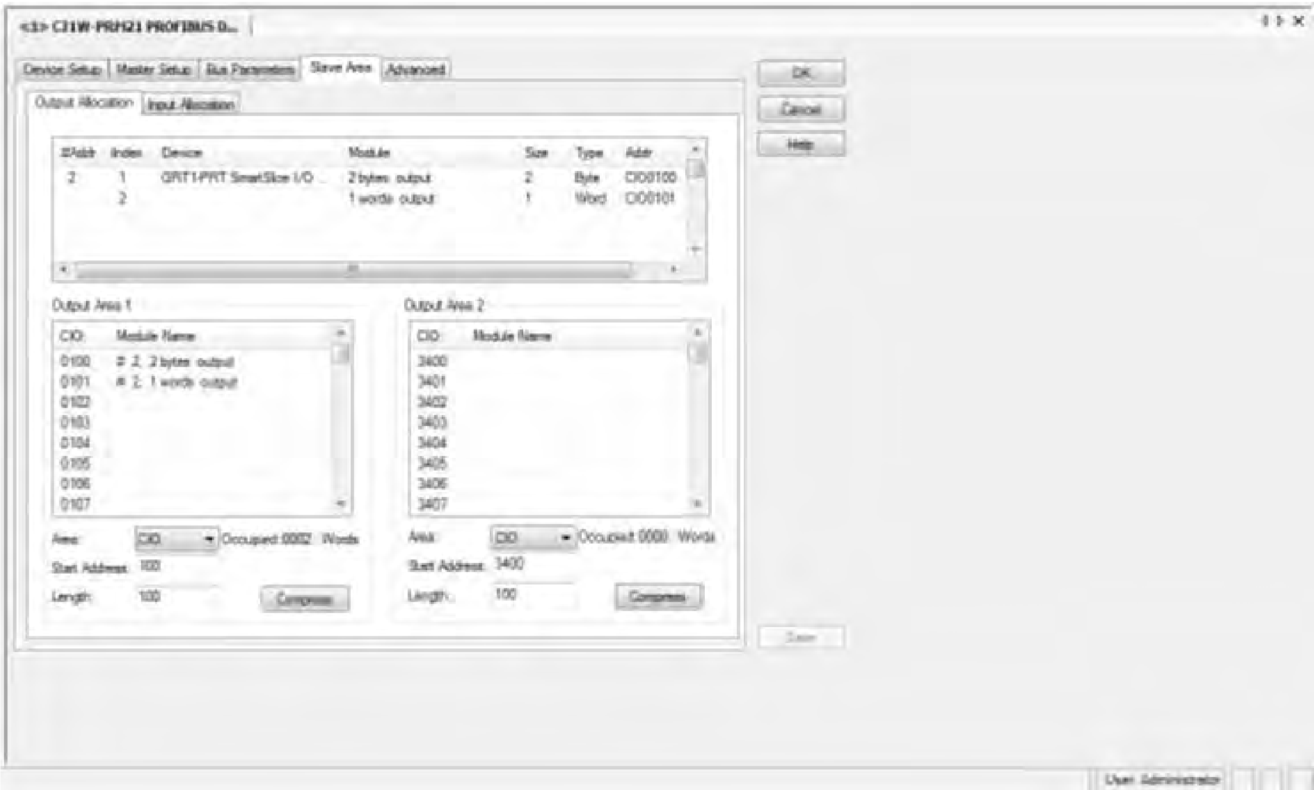
Item	Description	Unit	Editable by User
Baud rate	Defines the transmission rate on the PROFIBUS DP Network. The following baud rate values are defined by the PROFIBUS DP standard: • 9.6 Kbps • 19.2 Kbps • 45.45 Kbps • 93.75 Kbps • 187.5 Kbps • 500 Kbps • 1.5 Mbps(default value) • 3.0 Mbps • 6.0 Mbps • 12 Mbps	--	Yes
Optimize	The Optimize setting defines whether parameters can be changed by the user. • By Standard: Forces the user to use the default (optimized) settings. • By User: Makes selected fields editable. Note: 1. If the By User option is selected and changes have been made, it is still possible to switch between Optimize settings, without the changes being lost. 2. If the By User option is selected and the baud rate is changed, the parameters will be optimized to the new baud rate.	--	Yes
Slot Time	The maximum time a Master Unit must wait for a response to a request message.	t_{BIT}	Yes
Min. Station Delay of Responders	The minimum allowed time for a slave device before it will generate a response to a request message.	t_{BIT}	Yes
Max. Station Delay of Responders	The maximum allowed time for a slave device to generate a response to a request message.	t_{BIT}	Yes
Quiet Time	The time a transmitting device must wait after the end of a message frame, before enabling its receiver.	t_{BIT}	No
Setup Time	The time between an event and the necessary reaction.	t_{BIT}	No
Min. Slave Interval	The Minimum Slave Interval defines the poll cycle, i.e. the minimum time between two consecutive Data_Exchange Cycles to the same slave device. The Minimum Slave Interval must be smaller than the Target Rotation Time.	t_{BIT}	Yes
	Calculated Minimum Slave Interval in milliseconds.	ms	No
Target Rotation Time	The anticipated time for one token cycle, including allowances for high and low priority transactions, errors and GAP maintenance. Do not change the value below the calculated value, to avoid bus communication interruptions.	t_{BIT}	Yes
Max Retry Limit	Maximum number of request transmission retries by this master if a device does not reply to a request.	--	Yes
Highest Station Address	The HSA defines the Highest Station Address of Master devices on the network, of which the Master device will request the FDL status, when updating the active device list (See GAP Update Factor). If new slaves are added to the network, this field shows the highest device address. The Master will periodically check whether new active devices have been added between its own address and the Highest Station Address. If any devices are detected, GAP is updated. Permissible values are in the range of 0 to 126.	--	Yes
GAP Update Factor	The GAP update factor defines the amount of updates of the active devices (i.e. Master devices) list times during one token rotation cycle. To update the list, the Master device will transmit FDL_Status_request messages to ascending device addresses until it finds a next Master device, or until it reaches the Highest Station Address (See HSA above). The GAP Update Factor is fixed to 1.	--	No
Poll Timeout	The maximum time interval that this master device may need for the execution of a master-master function.	ms	No

Item	Description	Unit	Editable by User
Data Control Time	The cycle time in which the master updates its Data Transfer List, in which it keeps an overview of all slave states. Data Control Time is based on the Watchdog time T_{WD}: Data Control Time = 7*T_{WD}.	ms	No
Watchdog Control	The Watchdog Control Time defines the time for a slave device to set its outputs to a fail-safe state, if during that time no communication between the Master device and that slave device was detected. The Watchdog is automatically set for all configured slaves, based on the value of T_{TR}.	ms	Yes

Slave Area Tab

The Slave Area tab displays the mapping of the I/O data from/to the allocated slave devices on to the CPU memory areas. The mapping can be made automatically, but can also be changed by the user, before downloading.

The Slave Area tab is shown below. Only the Output Allocation tab is shown.



● Allocation Areas

The Slave Area allocation tabs define how the I/O data of each of the slave devices is mapped on to the CPU memory. The Slave area tab contains two tabs, one for Output Allocation and one for Input Allocation. Each tab contains an overall module list, showing all the output or input data per slave, along with the Module names, sizes, data types and start addresses. This data has been transferred to the Master DTM by each of the allocated slave DTMs. If no slave devices have been allocated or configured, the list will be empty.

● Module List Box

The Module List Box list contains the following information (refer to figure above, the table applies to the lists in the Input and Output Allocation tabs).

Column	Description
#Addr.	Station address on the network, obtained from the slave DTM.
Index	Index number of the I/O module.
Device	Device name, obtained from DTM.
Module	System generated name.
Size	Module data size, unit of type mentioned in next column.
Type	Module data type, e.g. Byte, Word etc.
Addr	Mapped address area in CPU memory. For example: CIO3200, equals CIO Area, start address 3200.

● I/O Mapping Areas

Each Output/Input Allocation tab also contains two areas on to which the I/O data can be mapped. The areas will in turn be mapped to the CPU memory. By default all data is mapped to Area 1, in order of ascending slave device address.

Note 1 When mapping, the modules are copied from the module list to the mapping Area and not moved. This means that the module list acts as a resource for the two Mapping Areas, below the module list.

2 When adding/removing slaves/modules, and Auto Addressing has been enabled, the modules in the Areas will be remapped. This usually results in I/O data being re-mapped. Therefore it is recommended to select all slaves and modules, before setting up the CPU memory mapping configuration.

Precautions for Correct Use

The default mapping of areas on to the CPU memory is the same default mapping as used in the CJ1W-DRM21 Devicenet Master/Slave Unit. Care should be taken to avoid data overlap, if such a Unit is part of the same CPU system as the CJ1W-PRM21 PROFIBUS Master Unit.

● Mapping Area Controls

Each mapping Area in the Allocation tab is equipped with four controls and an information field located below the area. The controls and information field are listed and explained in the table below.

Column	Description
Area	Selects the CPU memory area to which the associated I/O Area will be mapped. Possible options are: • Not Used (List must be empty). • CIO • DM • Work • HR • EM Bank 0 to 12 (Decimal)
Start Address	In this field the user can enter the start address in the CPU memory of the mapped data block.
Length	The length box allows you to select the number of visible rows. The minimum and the default value is 100 words. If more than 100 words are configured, the minimum Length value will be that number. The user can set the Length value to up to 7168 words.
Occupied	This field display the actual length of the data block (not necessarily the same as the amount of data in it). This length includes both data and any gaps between modules. Gaps may only be there if Auto-Addressing option in the Master Setup tab is disabled (See also Note 1).
Compress button	Pressing the **Compress** button will compress the Area list associated with it, i.e. this action will remove all gaps from the mapping list by moving all mapped I/O modules as close to the start of the memory area as possible. (See Notes 2 and 3).

Note 1 If an invalid setting is made the Occupied length value will change its color to red, indicating an invalid setting. In addition, a warning message will be displayed, upon saving the changes. Invalid settings are for example

- The start address and length definitions of the data block will cause it to exceed the area in the CPU.
- The data mapping of two or more I/O Areas (Output and/or Input) will be overlapping each other partly or totally in the CPU memory.

2 The **Compress** button will be disabled, i.e. grayed out, when Auto-Addressing (see section *5-4-1 Setting the Master Parameters*) has been enabled.

3 Before compressing, the Master DTM will display a warning message prompting the user for confirmation of the action.

● Changing Mapped Data Allocations

By default, the data is mapped to area 1 in both the Output and Input Allocation tabs. It is however possible to map a part of the data to the second area in the same tab. For example, an application may require to store all byte data in one location and all word data in another.

Moving data mapped in one area to another area is done from the module list. The procedure is as follows.

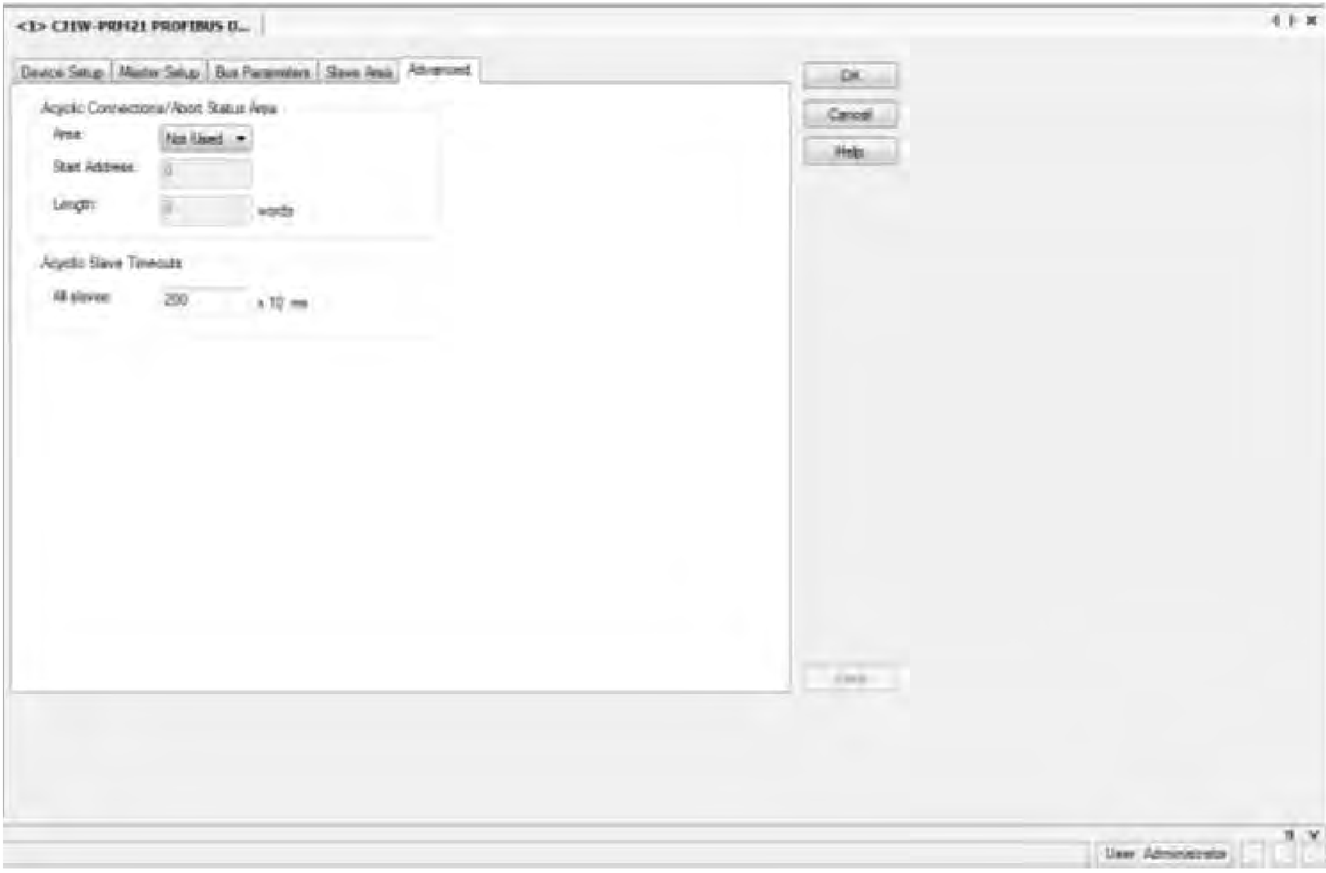
1. Find the module which must be mapped to a desired Area in the module list, and select it.
2. Left-click the module and drag it, while holding the Left mouse button, to the desired Area. This can be the end of the list or any empty space in the list in which it will fit (See Note).
3. Release the mouse button. The module data is copied in the desired Area and appended to the already existing list. The same entry in the other list is now deleted.
4. Finally, the CPU memory address to which the module is mapped is now updated in the module list.

Note 1 If Auto-Addressing is enabled (see Master Setup tab in this section), any empty spaces resulting from moving of modules to another Area will be removed by compressing the list. Modules located to a higher address will be moved to a lower address to fill up the gap.

2 If Auto-Addressing is disabled, compressing the list can be accomplished by pressing the **Compress** button, after all modifications to the mapping have been made.

Advanced Tab

The Advanced tab displays the settings required for PROFIBUS DP-V1 Class 2 communication with Slave devices. The Advanced tab is shown below.



Acyclic Connection/Abort Status Box

The Acyclic Connection/Abort status box contains settings, which allow the user to define where in the CPU memory the Connection/Abort status bit fields must be mapped. These bits indicated the open/closed PROFIBUS DP-V1 Class 2 connections between the Master Unit and individual slave devices.

The Acyclic Connection/Abort status box contains the following information

Control	Description
Area	Selects the CPU memory area to which the Acyclic Connection/Abort status bits will be mapped. Possible options are (See Note): Not Used (Default setting, Start Address and Length will be set to 0). • CIO • DM • Work • HR • EM Bank 0 to 12 (Decimal)
Start Address	In this field the user can enter the start address in the CPU memory of the mapped data block.
Length	The length value is a fixed number. The total number of words is 16.

Note 1 If an invalid setting is made the Length value will change its color to red, indicating an invalid setting. In addition, a warning message will be displayed, upon saving the changes. Invalid settings are for example

- The start address and length definitions of the data block will cause it to exceed the area in the CPU.
- The mapping overlaps with one or more of the I/O Areas (Output and/or Input) mappings.

● Acyclic Connection Status Flags

The 8 word Acyclic Connection bit flags are shown below.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Word n	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Slave station 00 to 15
Word n+1	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Slave station 16 to 31
Word n+2	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	Slave station 32 to 47
Word n+3	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	Slave station 48 to 63
Word n+4	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	Slave station 64 to 79
Word n+5	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	Slave station 80 to 95
Word n+6	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	Slave station 96 to 111
Word n+7			125	124	123	122	121	120	119	118	117	116	115	114	113	112	Slave station 112 to 125

Note In the above figure, n is the start address of the memory locations, defined by the Area and Start Address setting in the Acyclic Connection/Abort Status Box.

Bit	Name	Status	Controlled by	Unit operation
–	Acyclic Connection flags	TRUE	Unit	If the bit corresponding to a slave device address is TRUE, it indicates that the PROFIBUS Master Unit has established a PROFIBUS DP-V1 Class 2 type connection.
		FALSE	Unit	If the bit corresponding to a slave device address is FALSE it indicates that there is no open PROFIBUS DP-V1 Class 2 type connection with the specific slave device.

● Acyclic Connection Abort Status Flags

The 8 word Acyclic Abort bit flags are shown below.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Word n+8	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Slave station 00 to 15
Word n+9	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Slave station 16 to 31
Word n+10	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	Slave station 32 to 47
Word n+11	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	Slave station 48 to 63
Word n+12	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	Slave station 64 to 79
Word n+13	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	Slave station 80 to 95
Word n+14	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	Slave station 96 to 111
Word n+15			125	124	123	122	121	120	119	118	117	116	115	114	113	112	Slave station 112 to 125

Note In the above figure, n is the start address of the memory locations, defined by the Area and Start Address setting in the Acyclic Connection/Abort Status Box

Bit	Name	Status	Controlled by	Unit operation
–	Acyclic Connection Abort flags	TRUE	Unit	If the bit corresponding to a slave device address is TRUE, it indicates that the PROFIBUS Master Unit has aborted a PROFIBUS DP-V1 Class 2 type connection.
		FALSE	Unit	If the bit corresponding to a slave device address is FALSE, it indicates that there is no abort action of a PROFIBUS DP-V1 Class 2 type connection has been performed.

Slave Timeouts

The Acyclic Slave Timeout defines the timeout value for PROFIBUS DP-V1 Class 2 connections to slave devices. If a PROFIBUS DP-V1 message is sent to a specific slave device, the timeout is used to monitor the response from the slave device. If a response is not received with the specified time-out interval, the connection will be aborted by the Master unit.

The value can be set in the range of 1 to 32767, and is expressed in units of 10 ms.

Additional functions

Two additional functions are provided to the user, via the DTM context menu:

- Slave DTM Address Assignment.
- Set Device Station Address (only available on DTM version 0.2.0.0 or higher and for CJ1W-PRM21 Unit versions 2.0 or higher).

To select these options perform the following steps:

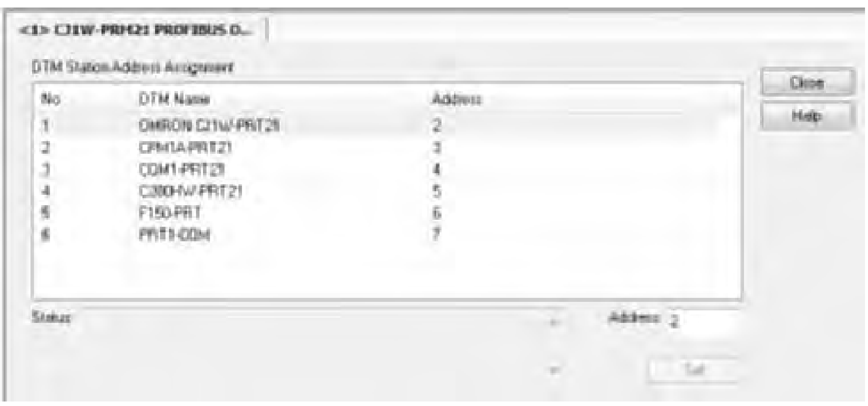
1 Select the Master DTM in the Network view.

2 Right click the mouse, and select the **Additional functions** entry from the context menu.

3 Select the desired function.

Slave DTM Address Assignment

Selecting the Slave DTM Address Assignment displays a list of DTMs assigned to the PROFIBUS Master DTM, together with their Station address:



When assembling the network, the PROFIBUS Master DTM will automatically assign a station address to each new slave DTM. The purpose of the Slave DTM Address Assignment function is to allow the user to change the DTM address of one or more devices, to make it the same as the actual physical address of the device on the network.

In order to change an address perform the following steps:

1 Select the slave device in the list.

2 Enter the new address in the field Address in the lower right corner of the window.

3 Press the **Set** button. The Status field will display the status of this service, i.e. whether or not the slave device responded without error.

● Set Device Station Address

The Set Device Station Address function is provided for slave devices of which the PROFIBUS address is not set through switches, but by using the PROFIBUS DP Set Slave Address service. Slave devices which support this service also provide a means to store the address in internal non-volatile memory. In case this non-volatile memory does not contain an entry, the slave device will assume the default address 126.

Note 1 The PROFIBUS DP Set Slave Address service is supported by the CJ1W-PRM21 Units as of Unit version 2.0.

2 In order to be able to change a device’s address, the CJ1W-PRM21 PROFIBUS Master DTM must be on-line.

Selecting the **Set Device Station Address** displays the window shown below:

In order to change the address of a slave device perform the following steps (Make sure that the DTM is on-line with the CJ1W-PRM21 Unit):

1 Enter the device’s current address and its PROFIBUS Ident Number. The PROFIBUS Ident Number can be found in the Generic Slave DTM or through the device’s documentation. By default the device’s current address will be 126. If necessary, change this to the actual current address.

2 Enter the new device address in the **New Address** field.

3 Optionally, select the **Lock** checkbox, if the address change must be made permanent.

4 Press the **Set** button to invoke the PROFIBUS DP Set Slave Address service. The Status field will display the status of this service, i.e. whether or not the slave device responded without error.

Precautions for Correct Use

Selecting the **Lock** option makes any future changes of the address impossible, even after power-down/power-up of the slave device.

Note After successful completion of the address change, the device DTM address in the Network view has to be changed as well.

3-2-2 Diagnostic User Interface

● Diagnostics User Interface

The PROFIBUS Master DTM provides a second user interface to display the Diagnostics information available in the PROFIBUS Master Unit. This information concerns:

- Unit and PROFIBUS DP Interface status flags.
- Slave status flags and common slave diagnostics.
- The Unit's Error Log.

Furthermore, the Diagnostics User Interface allows changing the Master's PROFIBUS operational mode and the transmission of Global-Control commands.

In order to access the Diagnostics User Interface, the DTM has to be on-line, i.e. a communication channel between the DTM and the PROFIBUS Master Unit must have been established.

● Opening the DTM Diagnostics User Interface

In order to open the DTM Diagnostics User Interface perform the following sequence.

1 To go on line, perform one of the following actions.

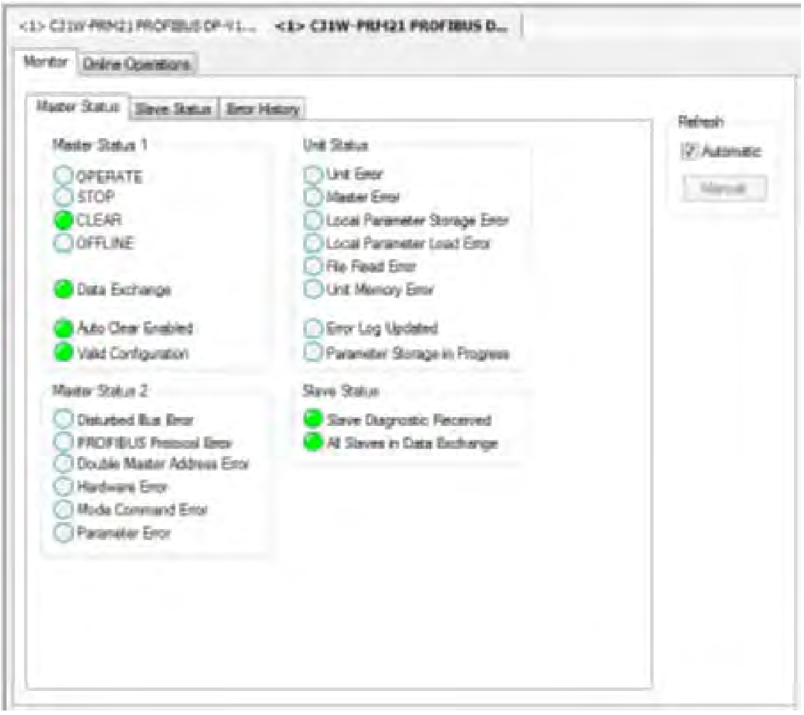
- Select the DTM in the Network view.
- Select the **Device - Go Online** option from the main menu, or from the DTM context menu, or

Select the  button from the Tool Bar.

2 A communication channel will be opened through CX-Server. The name of the DTM in the Network view will turn to Italic font to indicate that the Unit is online.

3 Select the **Device - Diagnosis** option from the main menu, or from the DTM context menu. The Diagnostics User Interface will now be displayed.

The figure below shows an example of the DTM Diagnostics User Interface.



The DTM Diagnostics User Interface contains two tabs:

- The Monitor tab: This tab displays all Master Unit status and error information as well the overall slave status information, which resides in the Master Unit.
- The Online Operations tab: This tab contains controls to initiate state changes in the Master Unit as well as transmit Global-Control commands over the PROFIBUS network.

● Monitor Tab

The DTM Diagnostics User Interface - Monitor tab contains three sub-tabs:

- Master Status tab.
- Slave Status tab.
- Error History tab.

Also, the Diagnostics data refreshing mode can be selected.

- Automatic: The Diagnostics data is constantly retrieved from the Unit.
- Manual: The Diagnostics data is retrieved only once from the Unit, when pressing the **Manual** button.

● Master Status Tab

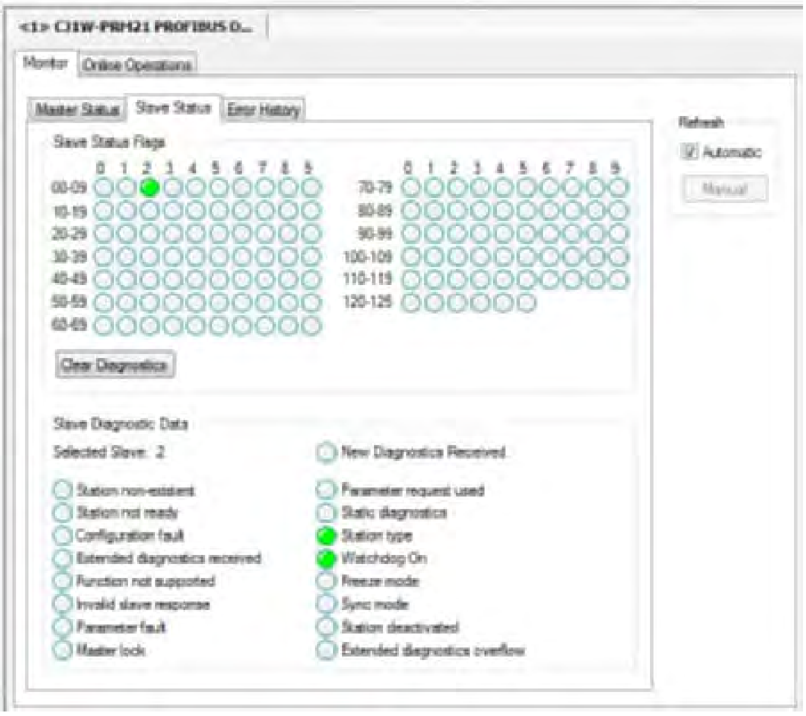
The Master Status tab (shown in the figure above) contains Diagnostics information regarding the Master Status. Each of the four status boxes, is related to one of the Unit’s status words in the CPU memory (see *4-2-3 Unit Status (*_UnitSta)* to *4-2-6 Slave Status (*_SlvSta)*).

The status is indicated by red or green indicators. Red indicates an error situation, green indicates a status indication. The indicators are listed in the table below.

Indicator		Description
Master Status	OPERATE	Master Unit is in OPERATE mode.
	STOP	Master Unit is in STOP mode.
	CLEAR	Master Unit is in CLEAR mode.
	OFFLINE	Master Unit is in OFFLINE mode.
	Data Exchange	When set to TRUE, it indicates that the Master Unit is in Data Exchange with all its allocated and enabled slave devices.
	Auto-Clear enabled	Auto-Clear function has been enabled in the downloaded configuration.
	Valid Configuration	The Master Unit contains a valid configuration.
Master Errors	Disturbed Bus error	When set to TRUE, the Disturbed Bus error indicates that distorted messages have been received by the Unit. This may occur if the network is not properly terminated or a cable is used, which is too long for the selected baud rate.
	PROFIBUS Protocol Error	When set to TRUE, the PROFIBUS Protocol Error indicates that an error has occurred in the protocol handling, e.g. a transmitted token frame could not be read back. The Master Unit has switched to OFFLINE.
	Master Address Duplication Error	Indicates that a second Master with the same address has been detected on the Bus. The Master Unit has switched to OFFLINE.
	Hardware error	When set to TRUE, the Hardware Error indicates that an error has occurred on the bus, e.g. message exceeding 256 bytes, broken messages, faulty bus timing, or devices beyond the HSA have been detected. The Master Unit has switched to OFFLINE.
	Mode Command Error	When set to TRUE, it indicates that two switches in the CIO switch word (see section *4-2-1 Software Switches (*_SwCmd)*) were set simultaneously.
	Parameter error	The Parameter set error indicates if an error has been detected in the contents of the Parameters set while configuring the PROFIBUS interface, using these parameters.
Unit Status	Unit Error	A Unit error indicates that a new error has been set in the Unit Status word (see section *4-2-3 Unit Status (*_UnitSta)*).
	Master Error	A Master Error indicates that a new error has been set in the Master Errors word (see *4-2-5 Master Errors (*_MstrErrSta)*).
	Local Parameter Storage Error	An error has occurred when storing the configuration to non-volatile memory.
	Local Parameter Load Error	An error has occurred when loading the configuration from non-volatile memory.
	File Read error	When set to TRUE, this indicates that a transfer from Memory Card to the Unit has failed. The Unit must be re-configured.
	Unit Memory error	When set to TRUE, it indicates that an error has occurred when writing the Error Log to the Non-volatile memory.
	Error Log Updated	The Error Log contains new entries, since the last time it was read or cleared.
	Parameter Storage in Progress	Configuration Parameters are being transferred to or from the Unit.
Slave Status	Slave Diagnostics Received	When set to TRUE, it indicates that new slave diagnostics have been received.
	All Slaves in Data Exchange	When set to TRUE, it indicates that all slaves are in data exchange with the Master Unit.

Slave Status Tab

The Slave Status tab displays a comprehensive overview of the status of the allocated slaves. An example of the Slave Status tab is shown below.



● Indicator colors

The indicators in the Slave Status Flags box, indicate per slave its status, using colors. Five colors are associated with status conditions. The indicator colors are listed below.

Indicator color	Slave Status
Grey	Associated device does not exchange Diagnostics with this Master Unit, i.e. • Slave not allocated to this Master Unit, or • Device is this Master Unit, or • Device is another master device.
Red	The slave device is not communicating with the Master Unit. It may be dis-connected, or the Master is in OFFLINE or STOP mode.
Orange	The slave device is communicating with the PROFIBUS Master Unit, but it is not in Data Exchange, due to incorrect parameter settings. See the slave diagnostics for more information.
Yellow	The slave device is in data exchange with the PROFIBUS Master Unit, but it has reported diagnostics data. See the slave diagnostics for more informa-tion.
Green	The slave device is in data exchange with the PROFIBUS Master Unit. No diagnostics reported.

● Clear Diagnostics Button

Pressing the **Clear Diagnostics** button will clear all new diagnostics data flags in the Unit. If all slaves are in data exchange, pressing the button will result in all indicators turning green.

● Retrieving Slave Diagnostics

Provided that the Master Unit is not in OFFLINE or STOP mode, the diagnostics of a specific slave device can be obtained from the indicators. Moving the mouse cursor over the indicator will change the cursor from a normal arrow pointer to a hand. Left clicking the mouse will then transmit messages to retrieve the diagnostics data of the specified slave device.

The retrieved information is displayed in the Slave Diagnostics Data area.

The data displayed is the same as displayed with in the Diagnostics User Interface of the Generic Slave DTM. Refer to section *3-3-2 Diagnostic User Interface*, for an explanation of the indicators.

● Error History Tab

The Error History tab lists the contents of the Error Log stored in the PROFIBUS Master Unit. The Error History tab is shown below.

The Error Log entries are described in section *7-5-2 Error Codes and Detailed Codes*. Refer to this section for details.

● Clear Button

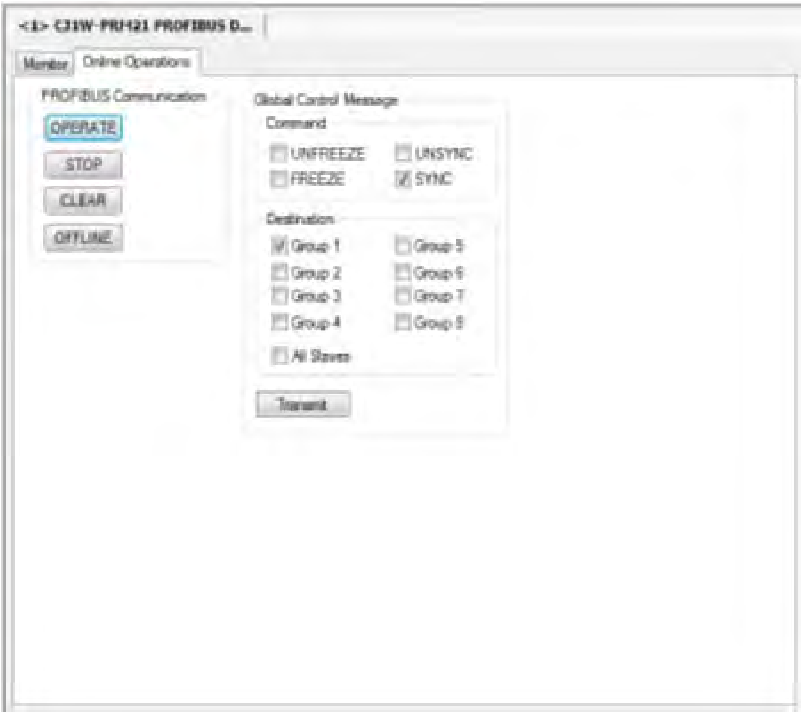
Pressing the **Clear** Button, initiates an error log clear command. All error messages in the Unit and the displayed list will be cleared.

Online Operations Tab

The Online Operations tab is the second main tab in the DTM Diagnostics User Interface. It contains the necessary controls to:

- Switch the Master Unit to PROFIBUS Operational modes
- Select one or more groups, Global-Control Message Commands and transmit Global-Control command over the PROFIBUS network.

The Online Operations tab is shown below.



● PROFIBUS Communication Group

These buttons can be used to force the Unit to change its operating mode. The four operational modes are:

- **OFFLINE** mode.
- **STOP** mode.
- **CLEAR** mode.
- **OPERATE** mode.

The mode changes are implemented through messages to the Unit's software switches in the CPU Memory Area (see *4-2-1 Software Switches (*_SwCmd)*).

Precautions for Correct Use

When initiating a mode change, it may interfere with attempts from the CPU Program to write to the same software switches. Care should be taken to avoid these situations.

● Global-Control Commands

Global-Control commands (See section *5-6-3 Transmitting Global-Control Commands*) can be initiated by the user from the Online Operations tab. The user can select the Global-Control commands:

- Freeze.
- Unfreeze.
- Sync.
- UnSync.

All commands can be transmitted independent from each other, i.e. all can be send at the same time. However, their effects are not independent, as for example sending Freeze and Unfreeze at the same time results in an Unfreeze command at the slaves.

- **Selecting the Groups**

Specific groups to send the Global-Control command to, can be defined by selecting the appropriate checkbox. Selecting the All Slaves checkbox will disable the individual checkboxes and result in a Global-Control command to all slave devices.

- **Transmit Global-Control Command**

In order to transmit the Global-Control, press the **Transmit** button. The command will be transmitted only once. Both the Global-Control command contents, group select and the transmit command are transferred to the Unit through its device variables (see section *4-2-1 Software Switches (*_SwCmd)* and section *4-2-2 Global-Control Command (*_GlobCtlCmd)*).

Precautions for Correct Use

When transmitting a Global-Control command, it may interfere with attempts from the CPU Program to write to the same software switches. Care should be taken to avoid these situations.

3-2-3 Connecting to the CJ1W-PRM21

- **Configuring Communication**

The PROFIBUS Master DTM uses CX-Server to connect to the Unit for both downloading a configuration as well as monitoring the Master Unit. To setup the communication to the Unit, perform the following procedure.

1 Open the Master DTM Configuration Interface, Device Setup tab (see section *3-3-1 Configuration User Interface*).

2 Select the **Unit Number**. It must match the unit number set on the PROFIBUS Master Unit, through the rotary switch on the front.

3 Select the Configure button to start CX-Server.

- **CX-Server**

Up on pressing the Configure button, CX-Server is launched and displays the CX-Server User Interface as shown below.

● Configuring CX-Server

In order to configure CX-Server for communication with the Unit, perform the following procedure.

1 Select the type of CPU to which the Unit is attached, from the Device Type drop down selection box.

2 Press the Settings button next to the CPU type selected. The CPU settings window (see figure below) is displayed.

3 In this window make the proper adjustments if necessary. The selections made, must match the physical configuration of the CPU system. When done, press the **OK** button.

4 Select the Network Type to be used as connection between the PC and the Unit. The available options may include other CPU systems or Communication Units, which are setup to act as a gateway. Refer to *CX-Server Runtime User Manual* (Cat. No. W391) for details on configuring CX-Server.

Note 1 For further explanation, only the direct connections between the PC and the CPU on which the Unit is attached are considered.

2 Select the **Settings** button next to the Network Type selected, to display the Network settings window, and select the Driver tab (USB is shown as example below).

5 Make the necessary selections to facilitate communication between the PC and the CPU to which the PROFIBUS Master Unit is attached and press the **OK** button.

● Testing CX-Server Setup

After making the settings, press the **OK** button to close the CX-Server interface. In order to verify that the communication has been setup correctly, press the **Test** button in the Device Setup tab of the DTM Configuration User Interface. This will initiate a command to read the Unit’s profile, i.e. the name of the Unit and the firmware version.

If the communication has been setup correctly, the response of the command will yield the required information, which will be displayed in the Device Information box, in the Description and Firmware Version fields. If the communication is not setup correctly, the two fields will contain three dashes, i.e. “---”, and an Error message will be displayed in the Error Log view of CX-ConfiguratorFDT. The communication settings must be changed to the correct value first.

When CX-Server has been setup correctly, it can be used for

- Configuration download
- Monitoring purposes

● Downloading Parameters

In order to download the parameter sets to the PROFIBUS Master Unit, perform the following sequence.

1 Select the **DTM** in the Network view and right-click the mouse to display the context menu.

2 Select **Download Parameters** from the menu, to initiate a download. A communication channel through CX-Server will be opened automatically.

Alternatively, the following can be done.

- Select the **DTM** in the Network view and press the **Download** button  in the toolbar to start the download process.

● Monitoring

For monitoring, an online connection with the Unit must be made first. To achieve this perform the following sequence.

1 To go online, perform one of the following actions.

- Select the **DTM** in the Network view.
- Select the **Device - Go Online** option from the main menu, or the DTM context menu, or
- Select the  button from the Tool Bar.

2 A communication channel will be opened through CX-Server. The name of the DTM in the Network view, will turn to Italic font, to indicate that the Unit is online.

3 From the context menu, select the **Diagnosis** option. The DTM’s Diagnostics User Interface will be displayed.

3-3 Generic Slave Device DTM

Most of the current PROFIBUS DP slave devices are supplied with a GSD file in order to allow a configurator to setup a configuration for that particular slave device. OMRON's Generic Slave Device DTM is provided to allow integration of the GSD file based configuration options into an FDT Container application, like CX-ConfiguratorFDT.

The GSD files are stored in a separate sub-directory under CX-ConfiguratorFDT. Upon updating the Device Catalogue, the Generic Slave Device DTM will scan this sub-directory and present an entry in the Device Catalogue for each of the GSD files found.

Upon adding the GSD based slave device to the network, an instance of the Generic Slave Device DTM will be made in the PC memory, which will read the GSD file contents. The instance of the Generic Slave Device DTM will provide the user interface necessary to make the settings for the associated slave device.

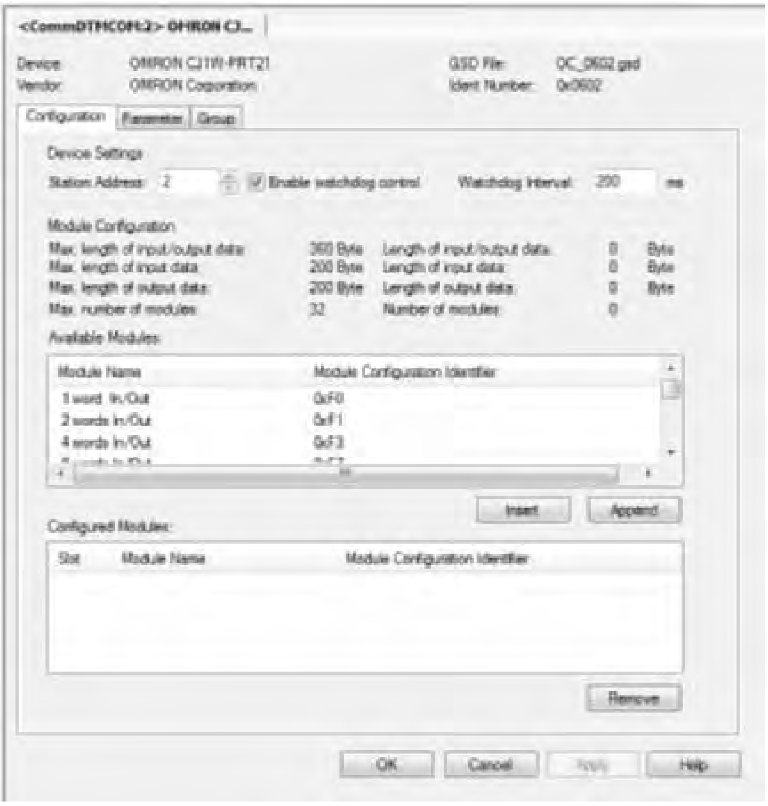
3-3-1 Configuration User Interface

● Opening the Configuration DTM

The configuration DTM is opened by

- Selecting the slave DTM entry in the Network view, and double-clicking the left mouse button.
- Selecting the slave DTM in the Network view, and right-clicking the mouse. From the context menu, select Configuration.

The slave DTM Configuration User Interface, which is displayed in the CX-ConfiguratorFDT DTM view is shown below. The figure shows the user interface for an OMRON CJ1W-PRT21 PROFIBUS DP Slave Unit. By default the Configuration tab is opened



In general, the Configuration User Interface for the Generic Slave Device DTM contains three tabs. Above these tabs the Device, the Manufacturer, the GSD file and the Unit's PROFIBUS Ident number are displayed.

The three tabs allow the user to set the slave parameters and configure the I/O for a standard PROFIBUS DP slave device. For slave devices which support the extension PROFIBUS DP-V1, two additional tabs will be displayed. These tabs are discussed later.

Configuration Tab

The Configuration tab contains the Device settings and the I/O module configuration.

● Device Settings

The Device Settings contain the device address, i.e. the Unit's PROFIBUS address and the Watchdog time for the Unit. The device address is normally set automatically by the Master DTM, when the slave DTM is added to its tree. However, the user has the opportunity to change the address. The changed address will be transferred to the Master DTM.

Note In case a changed address is invalid, for example if there is already another slave device with the same new address, the Master DTM will set the number back to its old value. The Watchdog value is the value used by the slave device to monitor communication from the Master Unit. If no messages are sent to the slave by its Master within the Watchdog timeout time, the slave device will stop data exchange and switch back to the fail safe mode.

Note In the current version of CX-ConfiguratorFDT, the Watchdog setting made in the Generic Slave DTM is overruled by the Watchdog setting in the Master DTM (refer to section *Setting the Bus Parameters* on page 19).

● Module Configuration

The I/O module configuration defines the I/O Data which the slave will be exchanging with the Master Unit, when it is in data exchange mode. The upper window in the Configuration tab contains all possible modules, which are in the GSD file. The lower window holds all selected I/O modules.

The user has to select the modules, which are associated with the physical configuration of the slave device. Selecting, i.e. copying the module from the upper window to the lower window can be done in several ways.

- Double-click the left mouse button on the selected module in the upper window.
- Select the module in the upper window and click the Insert button or **Append** button. Insert will insert the module above the row selected in the lower window. Append will add the module to the end of the selected module list.

1 The user can select multiple rows (in both windows) by simultaneously holding the SHIFT or CTRL key on the keyboard and selecting the rows using the left mouse button.

2 The amount of I/O modules and data which can be selected depends on the slave device. The four rows of information above the module display the maximum amounts as well as the selected totals.

Removing one or more selected modules from the list is done by

- double-clicking the left mouse button on the module in the lower window.
- selecting the module in the lower window and click the **Remove** button. In this case selecting multiple modules is also possible.

Parameter Tab

The Parameter tab lists all settings to be made for the Parameter message. The Parameter tab is shown below (Example shown is the Parameter tab for an OMRON CJ1W-PRT21 PROFIBUS DP Slave Unit).

- **Common Parameters**

The PROFIBUS DP parameter message contains a number of settings for the slave device. It is transmitted to the slave device before the I/O configuration message. In most cases a slave device requires a block of Common Parameter settings, i.e. settings which apply to the whole device.

- **Module Parameters**

However, there are also more sophisticated (modular) devices which require parameter settings per I/O module selected. The specific parameters blocks can be selected from the drop-down list at the top of the Parameter tab. In the figure above, the Common parameters are shown. This particular device does not support module parameters, so the parameters shown are the only ones shown.

The Parameter list consist of a left column containing the name of the parameter and a right column containing the settings options. In order to change the parameter setting, double-click the row with the left mouse button. Depending on the type of parameter and the selection options, either the field can be edited directly or a drop-down list with options will appear.

Note The parameter settings must be performed carefully. In general, the slave device will reject the parameter message if it contains any faulty parameter. Consequently, the slave device will not reach I/O data exchange with the PROFIBUS Master.

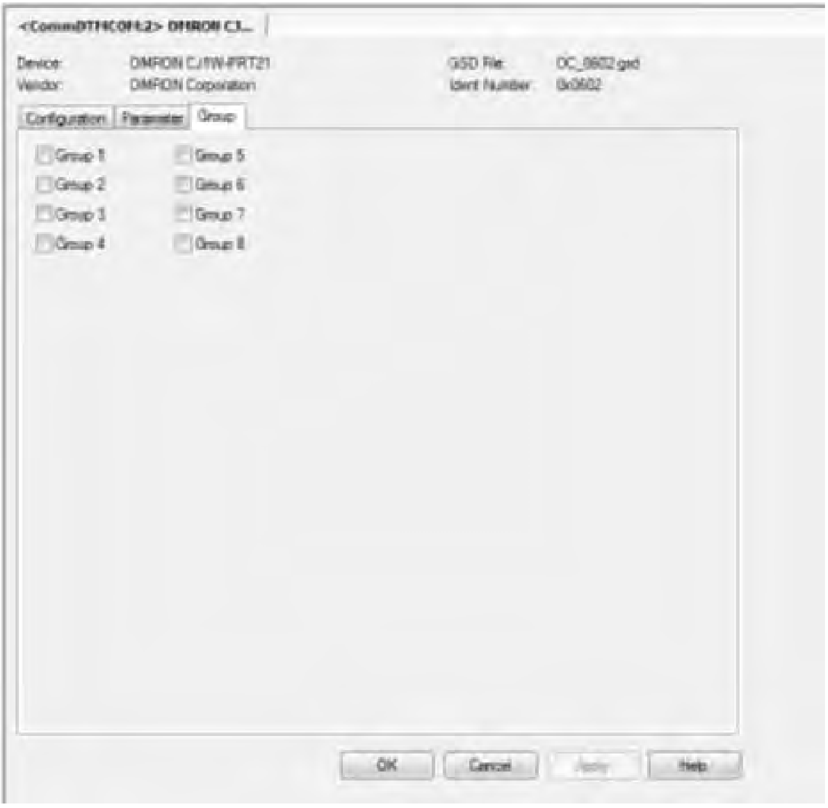
The parameter values are by default displayed in hexadecimal format. By checking the check box at the bottom the values are converted to decimal values.

Group Tab

In the Group tab the user can define to which group the slave device will belong. This group definition is used to define multi-cast groups of slave device to which a Global-Control command can be transmitted. The window is shown below.

● Selecting the Groups

The user can check the check boxes for each group the slave device will belong to. The group setting is transferred to the slave device as part of the parameter message.



The three tabs discussed above, allow for making all the standard PROFIBUS DP settings for a slave device. For slave devices supporting PROFIBUS DP-V1, two additional tabs will show up. These tabs will appear, if the GSD file parameter GSD_Revision is set to 3 or higher. The additional tabs are discussed below.

Extensions Tab

The Extensions tab contains a number of settings, which define additional behavior of the CJ1W-PRM21 PROFIBUS Master Unit with respect to a particular PROFIBUS DP-V1 slave device. Although this specific behavior is defined in the PROFIBUS DP extensions standard (PROFIBUS DP-V1) it does not necessarily require PROFIBUS DP-V1 capabilities from the PROFIBUS Master Units. The Extension tab is shown below.

● Auto-Clear Processing

The Auto-Clear processing box defines whether or not the PROFIBUS Master Unit should ignore a failure of this particular slave, when Auto-CLEAR has been enabled in the Master Unit (See Auto-CLEAR Box on page 69 in section *3-3-1 Configuration User Interface*). When **Ignore Auto-CLEAR** has been selected, a failure of this particular slave device (i.e. the slave device requests new parameters, or fails to respond) will not activate the Auto-CLEAR mode. The Master Unit will however, service the slave device.

This feature can be used with slaves which can fail during operation, but for which failure it is not necessary to switch the entire network to Auto-CLEAR mode.

Control	Description
Process Auto-CLEAR	When Auto-CLEAR has been enabled in the PROFIBUS Master Unit, a failure of this particular slave will cause an Auto-CLEAR event.
Ignore Auto-CLEAR	When Auto-CLEAR has been enabled in the PROFIBUS Master Unit, a failure of this particular slave will not cause an Auto-CLEAR event. The Master will however service the slave device (e.g. send new parameters).

● Configuration Data Convention

The Configuration Data Convention setting defines how the slave device will handle the special identifier format data parts of the Check I/O configuration message. The slave can perform the check either according to the original PROFIBUS DP standard, or according to the PROFIBUS DP-V1 standard. This allows PROFIBUS DP slaves to use either standard PROFIBUS DP data types or extended PROFIBUS DP-V1 data types.

Control	Description
DPV1 Compliant	The Check I/O configuration message will contain PROFIBUS DP-V1 Data type definitions in the special identifier format data parts and the slave device will perform the check on this assumption.

Control	Description
EN50170 Compliant	The Check I/O configuration message will contain standard PROFIBUS DP Data type definitions as well as vendor specific data types and the slave device will perform the check on this assumption.

● Fail-Safe behavior

The Fail-Safe behavior box defines whether or not the PROFIBUS Master Unit will in CLEAR mode send an empty output data message to the slave device or a data message containing zeros. Depending on the slave device, an empty data message, may be required, if the slave device performs user specific functions in CLEAR mode, and during which the outputs can not be set to zero.

Note If the selected setting is not supported by the slave device, a parameter error will be returned by the device.

Control	Description
Send zeros in Clear mode	When in CLEAR mode, the PROFIBUS Master Unit will send a full output data message to the slave device, but the message will contain all zeros.
Send no data in Clear mode	When in CLEAR mode, the PROFIBUS Master Unit will send an empty output data message (i.e. no data bytes, only the message header) to the slave device.

● Error on Cyclic Data Exchange

The Error on Cyclic Data Exchange settings box, defines the behavior of the PROFIBUS Master Units on the PROFIBUS network with respect to this particular slave device, in case it fails to respond during I/O data exchange. Depending on the setting, the Master Unit will either continue sending I/O data exchange messages to the slave device or abort I/O data exchange and continue with requesting the slave diagnostics data. When continuing sending I/O data exchange data the slave's diagnostics data will not be updated.

Control	Description
Continue if slave not responding	The PROFIBUS Master Unit will continue to send I/O data exchange messages, when the slave device fails to respond. The diagnostics data of the slave will not be updated.
Abort if slave not responding	The PROFIBUS Master Unit will abort the data exchange with the slave device, and continue to send diagnostics request message to the slave, until it responds. The diagnostics data of the slave will be updated accordingly.

Note A slave's failure to respond during I/O data exchange will always be reported to the CPU, by resetting the corresponding Slave Data Exchange Active flags in the CPU memory (see section *4-2-8 Slave Data Exchange Active Flags (*_SlvDatXchg, *_SlvDatXchgL, *_SlvDatXchgH)*). If Auto-CLEAR has been enabled, the failure to respond will result in the PROFIBUS Master Unit switching to CLEAR mode, based on this device variable flag.

● Diagnostics Update Delay

The Diagnostics Update Delay defines the number of PROFIBUS DP cycles during which the PROFIBUS Master Unit will ignore diagnostics message returned from the slave containing the Prm_Req flag. This flag indicates that the Master Unit should re-parameterize the slave, but in the case of reduced performance of the slave devices, the returned flag also indicates that the slave device is still processing the last received parameter message and has as yet not approved nor rejected that message.

During the Diagnostics Update Delay period the PROFIBUS Master Unit will continue requesting its diagnostics data. Also during this period, the diagnostics data received from this slave will not be updated in the CPU.

DPVI Tab

PROFIBUS DP-V1 defines extended communication functions between a PROFIBUS DP-V1 master and a PROFIBUS DP-V1 slave device. These extensions include:

- Acyclic communications between master and slave to allow re-parameterization during I/O data exchange.
- Extended alarm reporting and acknowledgement.

Settings related to these extensions are sent to the slave device through the Set_Prm message.

Note **1** The PROFIBUS DP-V1 settings in this tab refer to PROFIBUS DP-V1 Class 1 communication only. For PROFIBUS DP-V1 Class 2 communication no specific settings are required.

2 The CJ1W-PRM21 PROFIBUS DP Master units will automatically disable the DP-V1 settings to avoid the slave devices to use PROFIBUS DP-V1 functions. Only the CJ1W-PRM21 PROFIBUS DP-V1 Master Units will use the settings below.

The DPV1 settings window is shown below.

● Enable DPV1

This checkbox enables or disables the DPV1 functions for the specific slave device. The Master DTM will clear this setting prior to download.

● Max. Channel Data Length

This parameter defines the maximum size in bytes of the acyclic message exchanged with the PROFIBUS DP-V1 Master Unit. The size ranges from 4 bytes to 244 bytes. The actual upper limit of the number is defined by the buffer capacity of the slave device.

Max. Alarm PDU Length

This parameter defines the maximum size of an Alarm message sent from the slave device to the PROFIBUS DP-V1 Master Unit. The Master Unit uses this number to reserve buffers to handle the alarms. The maximum alarm message size ranges from 4 bytes to 63 bytes.

Alarms

The Alarms box defines the types of alarms the slave device will report as well as the alarm handling capacity of the master device. The settings in this box are conveyed to the slave device through the Set_Prm message sent by the PROFIBUS DP-V1 Master Unit.

Control	Description
Alarm mode	The Alarm mode indicates to the slave device the amount of alarms the PROFIBUS DP-V1 Master Unit can process simultaneously. The following standard selections are available: • 1 alarm of each selected type • 2 alarms in total • 4 alarms in total • 8 alarms in total • 12 alarms in total • 16 alarms in total • 24 alarms in total • 32 alarms in total
Pull Plug alarm	When set, this checkbox enables the signaling of a pull/plug alarm type, i.e. the removal/insertion of a hardware I/O module.
Process alarm	When set, this checkbox enables the signaling of a process alarm type, i.e. an alarm related to the process connected to the I/O. Example: Upper Limit exceeded alarm.
Diagnostic alarm	When set, this checkbox enables the signaling of a diagnostic alarm, i.e. an alarm related to the functioning of a specific I/O module in a slot. Example: Short circuit detected.
Manufacturer specific alarm	When set, this checkbox enables the signaling of a Manufacturer specific alarm.
Status alarm	When set, this checkbox enables the signaling of a Status alarm, i.e. an alarm related to an internal state change in a module. Example: Change to Run state, Stop state.
Update alarm	When set, this checkbox enables the signaling of an Update alarm, i.e. an alarm indicating a change in the parameters related to a specific module, either by local or remote access.

Extra Alarm SAP

For acyclic data exchange between a PROFIBUS DP-V1 Master Unit (Class 1) and a PROFIBUS DP-V1 slave device one specific SAP (Service Access Point, the PROFIBUS definition for a message identifier) is defined by the PROFIBUS DP Extension standard. By default SAP 51 is used for acyclic data exchange with the PROFIBUS DP-V1 Master Unit (Class 1).

For efficiency reasons however, acknowledgement of alarms can be performed using a different, dedicated SAP or message identifier; SAP50. This will allow other acyclic communication (e.g. re-parameterization of the slave device) to continue without interference.

Control	Description
Alarm acknowledge via SAP 51	When selected, the PROFIBUS DP-V1 Master Unit will acknowledge each received alarm using SAP 51 message identifier (default).
Alarm acknowledge via SAP 50	When selected, the PROFIBUS DP-V1 Master Unit will acknowledge each received alarm using SAP 50 message identifier.

3-3-2 Diagnostic User Interface

The Generic Slave Device DTM provides a Diagnostics User Interface to display diagnostics data sent by the slave device to the PROFIBUS Master Unit. In general a slave device can send two type of diagnostics.

● Basic Diagnostics

Basic Diagnostics: The first six bytes of each diagnostic message sent by a slave device contain mandatory status and error flags. The flags are defined by the PROFIBUS standard. The basic diagnostics information is displayed in the Diagnostic tab of the Diagnostics User Interface.

● Extended Diagnostics

Extended Diagnostics: Depending on the type of slave device, it may additionally send extended diagnostic bytes in a format defined in the PROFIBUS standard. The extended diagnostics usually contain device specific diagnostics information. The extended diagnostics information is displayed in the extended Diagnostics tab of the Diagnostics User Interface.

● Updating the Diagnostics

The Diagnostics User Interface contains two tabs. It also contains an **Update** button, which will, when pressed, refresh the diagnostics data by retrieving it from the PROFIBUS Master Unit. A Green indicator in the lower left corner will indicate whether or not the device is online.

Diagnostics Tab

The Diagnostics tab displays basic diagnostics for the slave. An example of the Diagnostic tab is shown below. The diagnostics information is displayed as red and green indicators. Red indicators refer to error events. Green indicators refer to status situations.

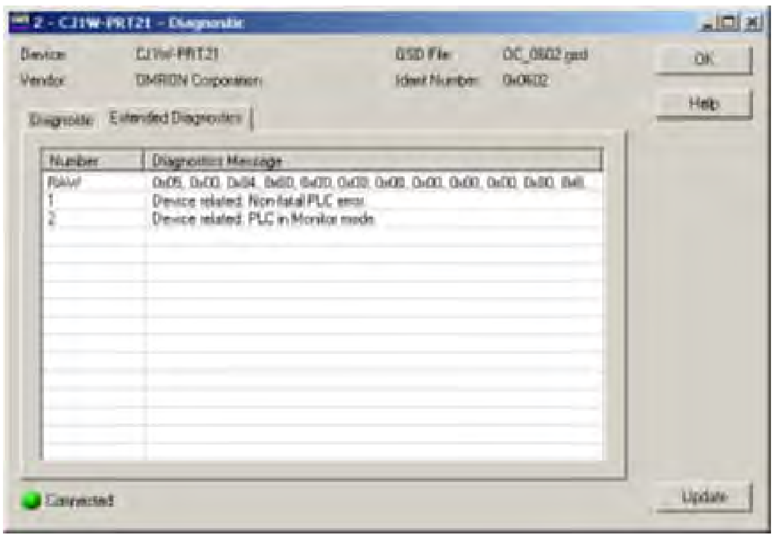
The indicators are listed in the table below.

Name	Description
Master lock	The slave device has been parameterized by another master.
Parameter fault	The last received parameter data from the Master Unit have been rejected. The parameter data in the slave device differ from the parameter sent by the Master Unit.

Name	Description
Invalid slave response	The slave has returned an invalid response to a Master request message.
Function Not supported	The Master Unit has sent a message to the slave device, which is not supported by the device.
Extended diagnostics	The diagnostics message returned by the slave device contains extended diagnostics, i.e. it contains more than the mandatory 6 bytes.
Configuration fault	The last received configuration data from the Master Unit have been rejected. The configuration data in the slave device differ from the configuration sent by the Master Unit.
Station not ready	The slave device is not yet ready for data transfer (the parameters data and the configuration data have been accepted).
Station not existent	The slave does not respond to any of the request messages sent by the master. If set the diagnostic bits contains the state of the last diagnostic message or the initial value.
Slave deactivated	When set to TRUE, it indicates that the slave device has been disabled. The slave device is allocated to the Master Unit, but removed from cyclic processing.
Sync mode	When set to TRUE, the slave device has been set to the Sync mode, using the global command.
Freeze mode	When set to TRUE, the slave device has been set to the Freeze mode, using the global command.
Watchdog on	The watchdog has been enabled at the slave device (through the appropriate setting in the parameterization message).
Slave device	Indicates that the device is a slave device.
Static diagnostics	When set, the slave device reports static diagnostics, i.e. the error event is serious enough that the diagnostics is continuously reported. No data exchange will be performed.
Re-parameterization requested	When set, the slave indicates that it requires a new parameter setting. The slave device is not in Data Exchange with the Master Unit. The indicator remains ON as long as the slave device has not been parameterized successfully.
Extended diagnostics overflow	The slave device has more diagnostics to report than it can fit into its transmission buffer. Diagnostics information is being lost.

Extended Diagnostics Tab

The Extended Diagnostic tab contains any extended diagnostics reported by the slave device. The figure below shows an example of Extended diagnostics.



The first row of the Extended diagnostics window contains the raw data as received from the slave device. Depending on the GSD file, it may provide text strings for each Extended diagnostics events entry, i.e. if the event occurs and the diagnostics information is received by the DTM it can display a text string in stead of only the raw bytes.

If the strings are not supported, the user must determine the event from the raw data bytes.

4

Data Exchange with the CPU Unit

This section describes the words allocated to the PROFIBUS Unit in the CIO Area and DM Area. These words both enable controlling the PROFIBUS Unit and accessing Unit and network status.

4-1 Data Exchange with the CPU Unit

Data exchange between this Unit and the CPU Units uses the I/O port and memory for CJ-series Unit allocated to the PROFIBUS Master Unit.

4-1-1 Data Flow

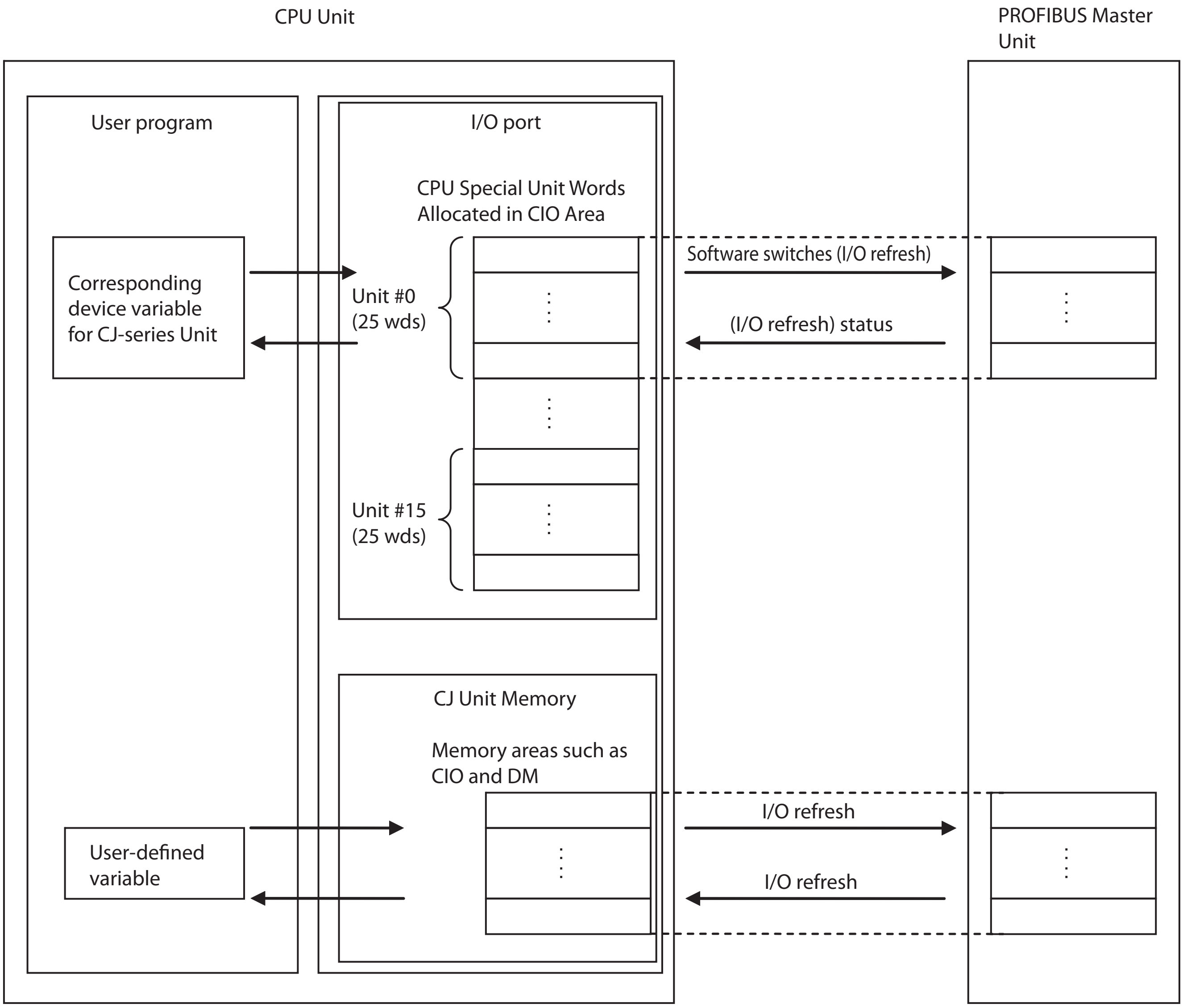
The CPU Unit and CJ-series PROFIBUS Master Unit exchange various types of information at each I/O refresh via the memory for CJ-series Units within the CPU Unit.

From the user program, various types of information are exchanged using device variables and user-defined variables. Device Variables are positioned internally in the CPU Bus Unit words allocated in CIO and DM areas. User-defined variables are created by the user and can be allocated to specific memory areas used for CJ-series Units allocated to slaves.

Access methods from the user program	AT specification destination	Data exchange timing	Unit data type
Device variable for CJ-series Unit	I/O port	During I/O refresh	Software switch
			Status
User-defined variable	Memory used for CJ-series Unit	During I/O refresh	Slave area I/O data
		At I/O refresh after instruction execution	Message send/receive data for communications instructions
System-defined variable	None	During I/O refresh	Unit Restart Flag, Communications Port Enabled Flags, etc.

Additional Information

By using these variables, the user can program without the need to be aware of the configuration of the memory used for CJ-series Units.



Device Variables for CJ-series Unit

Device variables for CJ-series Units are variables for which AT is specified for the I/O port explained below. The user program uses device variables for CJ-series Units to access the Configuration for a unit such as the CJ1W-PRM21.

For allocation of the device variables for CJ-series Unit to the I/O port, refer to *How to Create Device Variables for CJ-series Unit* (P. 4-5).

These variables are used to set this Unit and reference statuses from a user program.

Device Variables for CJ-series Unit are positioned internally in the CPU Bus Unit words allocated in CIO/DM areas shown below.

- CPU Bus Unit words allocated in CIO area (software switches, statuses)
- CPU Bus Unit words allocated in DM area (Reserved for future use)

● I/O Port

An "I/O port" is a logical interface for data exchange by a CPU Unit with a PROFIBUS Master Unit or other Configuration Unit.

An I/O port has a unique pre-defined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

For details on the I/O ports defined for PROFIBUS Master Unit, refer to *4-2 Device Variables for CJ-series Unit (Software Switches, Statuses)*.

● Software Switches / Status data

Software switches (execution instructions of each function from the CPU Unit to the PROFIBUS Master Unit), PROFIBUS Master Unit statuses and error data are allocated.

They are allocated in the memory used for CJ-series Unit according to the unit number as shown below.

Unit number	Allocated words	Unit number	Allocated words
0	1500 to 1524	8	1700 to 1724
1	1525 to 1549	9	1725 to 1749
2	1550 to 1574	10	1750 to 1774
3	1575 to 1599	11	1775 to 1799
4	1600 to 1624	12	1800 to 1824
5	1625 to 1649	13	1825 to 1849
6	1650 to 1674	14	1850 to 1874
7	1675 to 1699	15	1875 to 1899

● Other Allocation (Reserved)

The DM area words shown below which are allocated for the PROFIBUS Master Unit are not used, i.e. no data is exchanged between an allocated DM area and the Unit. However, the allocated area is reserved for use in a future extension of the Unit. Therefore, using this area for user data is not recommended.

Unit number	Allocated words	Unit number	Allocated words
0	D30000 to D30099	8	D30800 to D30899
1	D30100 to D30199	9	D30900 to D30999
2	D30200 to D30299	10	D31000 to D31099
3	D30300 to D30399	11	D31100 to D31199
4	D30400 to D30499	12	D31200 to D31299
5	D30500 to D30599	13	D31300 to D31399
6	D30600 to D30699	14	D31400 to D31499
7	D30700 to D30799	15	D31500 to D31599

User-defined Variable

These variables are defined by the user and can be used to exchange data with PROFIBUS slave devices from a user program. User-defined Variables are specified to access user-allocated areas designated with CX-ConfiguratorFDT for slave devices.

To use this area from the user program, you need to create user-defined variables of AT specification.

4-1-2 Accessing From the User Program

From the user program, various types of information are exchanged using AT specified device variables for CJ-series Unit that are allocated to the I/O ports, and AT specified user-defined variables that are allocated to slave allocation areas.

How to Create Device Variables for CJ-series Unit

Use I/O Map in Sysmac Studio to allocate device variables for CJ-series Unit to the I/O port. Specify variable names using one of the methods shown below.

1. Select and allocate existing variables.
2. Input a new variable name.
3. Automatically create with "Device variable creation".

The following shows the structure of a variable name created automatically with method 3.

*_MstrOperateCmd

This is the I/O port name. The name indicates unit functions, statuses and parameters

This is the device name when this unit is registered in the Unit Configuration (by default, a device name is assigned “J01” in the order of registration in the Unit Configuration). This identifies the individual unit.

For details on Device Variables for CJ-series Unit, refer to the following:

4-2 Device Variables for CJ-series Unit (Software Switches, Statuses)

In the explanations throughout this manual, the default device name automatically created is used as the device variable name for CJ-series Unit, for example *_MstrOperateCmd.

For details on the CJ Unit memory, refer to *NJ-series CPU Unit Software User’s Manual* (Cat. No. W501)

How to Create User-defined Variables

Sysmac Studio is used to register user-defined variables to the variable table. Specify the user-defined variables in memory used for CJ-series Unit to which slaves can be allocated.

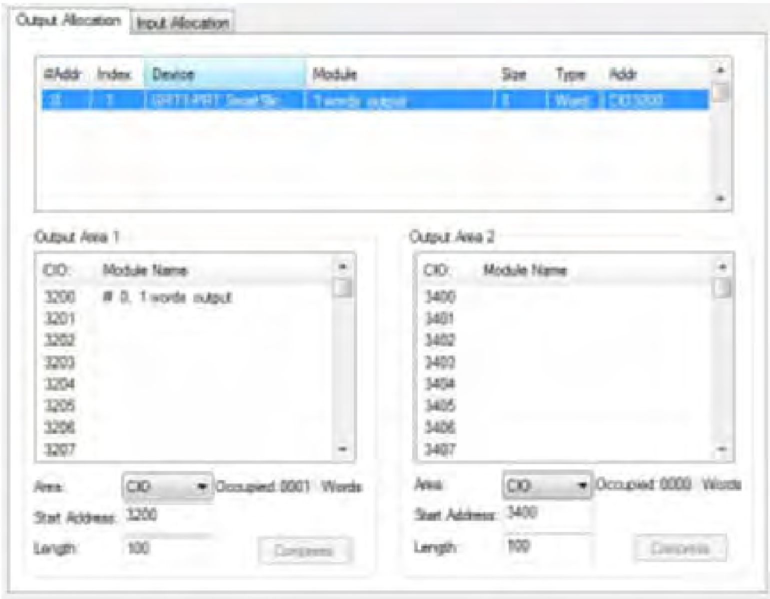
Generally, array variables are created.

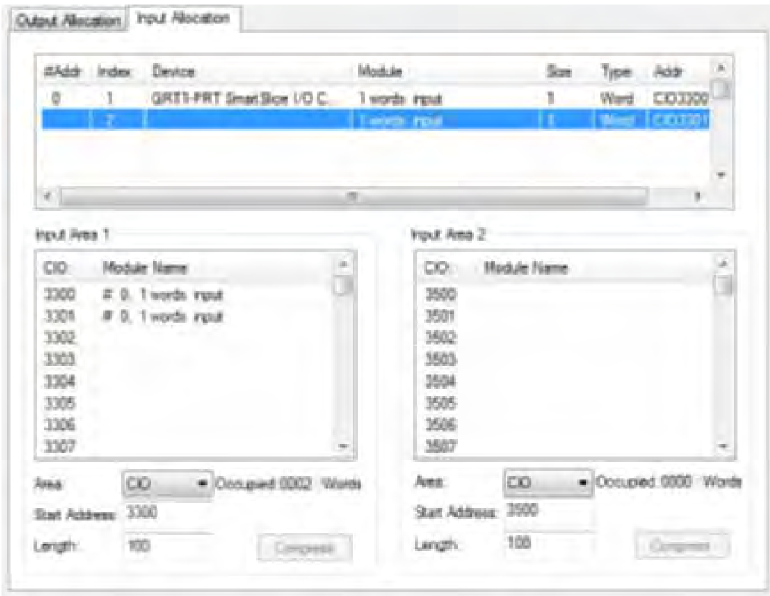
Below is an example of allocation to user-defined variables.

Used slaves: 16 I/O points; 1 slave

In this case, I/O data of the slave are allocated as follows using CX-ConfiguratorFDT:

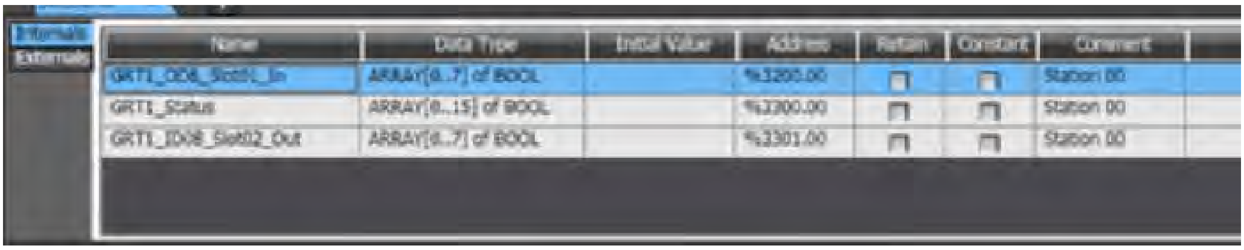
An 8 point Input Unit and 8 point Output unit are configured for use with the SmartSlice GRT1-PRT I/O Coupler as shown above.





Words allocated	I/O data
CIO 3200	Output Allocation for slave data (station address 0)
CIO 3300	Input Allocation for slave data (station address 0)
CIO 3301	Input Allocation for slave data (station address 0)

Allocate the I/O data to the user-defined variables as shown in the example below.



Additional Information

For details on CJ Unit memory, variable allocation and user-defined variable registration, refer to section *5-5-3 Assigning User-defined Variables* and *Sysmac Studio (Ver. 1.0) Operation Manual* (Cat. No. W504).

4-2 Device Variables for CJ-series Unit (Software Switches, Statuses)

When you operate and reference software switches and statuses use the following Device Variables for CJ-series Unit allocated to the I/O port of this Unit.

Name of Device Variable for CJ-series Unit	Type	R/W	Description
*_SwCmd	WORD	RW	Software Switches (*Section 4-2-1*)
*_MstrOperateCmd	BOOL	RW	Bit 00: Switch master to OPERATE mode
*_MstrStopCmd	BOOL	RW	Bit 01: Switch master to STOP mode
*_MstrClearCmd	BOOL	RW	Bit 02: Switch master to CLEAR mode
*_MstrOfflineCmd	BOOL	RW	Bit 03: Switch master to OFFLINE mode
*_GlobCtlTxCmd	BOOL	RW	Bit 04: Transmit Global-Control command
*_ClrNewDiagCmd	BOOL	RW	Bit 08: Clear new diagnostics bits
*_GlobCtlCmd	WORD	RW	Global-Control Command (*Section 4-2-2*)
*_GlobCtlGrp1	BOOL	RW	Bit 00: Send command to slaves of Group 1
*_GlobCtlGrp2	BOOL	RW	Bit 01: Send Command to slaves of Group 2
*_GlobCtlGrp3	BOOL	RW	Bit 02: Send Command to slaves of Group 3
*_GlobCtlGrp4	BOOL	RW	Bit 03: Send Command to slaves of Group 4
*_GlobCtlGrp5	BOOL	RW	Bit 04: Send Command to slaves of Group 5
*_GlobCtlGrp6	BOOL	RW	Bit 05: Send Command to slaves of Group 6
*_GlobCtlGrp7	BOOL	RW	Bit 06: Send Command to slaves of Group 7
*_GlobCtlGrp8	BOOL	RW	Bit 07: Send Command to slaves of Group 8
*_GlobCtlUnfreezeCmd	BOOL	RW	Bit 10: Unfreeze
*_GlobCtlFreezeCmd	BOOL	RW	Bit 11: Freeze
*_GlobCtlUnsyncCmd	BOOL	RW	Bit 12: Unsync
*_GlobCtlSyncCmd	BOOL	RW	Bit 13: Sync
*_UnitSta	WORD	R	Unit Status (*Section 4-2-3*)
*_UnitErr	BOOL	R	Bit 00: Unit error flag
*_MstrErr	BOOL	R	Bit 01: Master error flag
*_NewErrLogSta	BOOL	R	Bit 03: Error log contains new errors
*_ParamTxSta	BOOL	R	Bit 04: Parameter transfer In progress
*_ParamStorErr	BOOL	R	Bit 06: Local parameter storage error
*_ParamLoadErr	BOOL	R	Bit 07: Local parameter load error
*_FileRdErr	BOOL	R	Bit 09: File read error
*_LogStorErr	BOOL	R	Bit 13: Error log storage error
*_MstrSta	WORD	R	Master Status (*Section 4-2-4*)
*_MstrOperateSta	BOOL	R	Bit 00: Unit in OPERATE mode
*_MstrStopSta	BOOL	R	Bit 01: Unit in STOP mode
*_MstrClearSta	BOOL	R	Bit 02: Unit in CLEAR mode
*_MstrOfflineSta	BOOL	R	Bit 03: Unit in OFFLINE mode
*_MstrDatXchgSta	BOOL	R	Bit 04: Unit in data exchange
*_MstrAutoClrEnblSta	BOOL	R	Bit 05: Auto-CLEAR enabled
*_MstrValidCfgSta	BOOL	R	Bit 07: Unit contains a valid configuration
*_MstrErrSta	WORD	R	Master Errors (*Section 4-2-5*)
*_MstrBusErr	BOOL	R	Bit 00: Disturbed bus error
*_MstrProtErr	BOOL	R	Bit 01: PROFIBUS protocol error
*_MstrAdrErr	BOOL	R	Bit 02: Master address duplication error

Name of Device Variable for CJ-series Unit	Type	R/W	Description
*_MstrHwErr	BOOL	R	Bit 03: Hardware error
*_MstrMdCmdErr	BOOL	R	Bit 12: Mode command error
*_MstrParamErr	BOOL	R	Bit 13: Parameter error
*_SlvSta	WORD	R	Slave Status (*Section 4-2-6*)
*_AllDatXchgSta	BOOL	R	Bit 00: All slaves in data exchange mode
*_SlvDiagRcvSta	BOOL	R	Bit 04: New slave diagnostics received
*_ActCycleTm	WORD	R	Actual Bus Cycle Time
*_SlvDatXchg	BOOL	R	Slave data exchange active flag
*_SlavDatXchgL	LWORD	R	Slave data exchange active flags 0-63
*_SlavDatXchgH	LWORD	R	Slave data exchange active flags 64-125
*_SlvNewDiag	BOOL	R	Slave new diagnostics flags
*_SlavNewDiagL	LWORD	R	Slave new diagnostics flags 0-63
*_SlavNewDiagH	LWORD	R	Slave new diagnostics flags 64-125

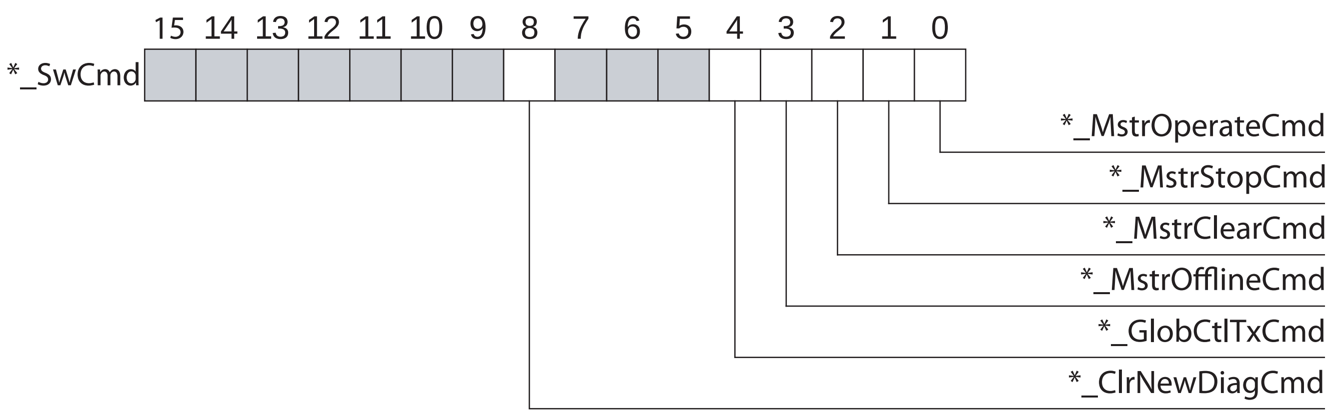
4-2-1 Software Switches (*_SwCmd)

One of the following Device Variables for CJ-series Unit is used to operate Software Switches from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Software Switches.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Software Switches.

All the switches of Software Switches execute a function when changed to TRUE by the user (in any CPU mode). The Unit will change the switch to FALSE after the command has been executed. All flags are set to FALSE at Power-ON/Reset. The Unit state is not restored after a Power-Down of the Unit.

Note 1 If multiple bits (*_MstrOperateCmd, *_MstrStopCmd, *_MstrClearCmd, *_MstrOfflineCmd) are set simultaneously, the command is ignored. The bits are set to FALSE again and the mode command error flag in Master Errors (*_MstrErrSta) word is set, see *4-2-5 Master Errors (*_MstrErrSta)*.



Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrOperateCmd	BOOL	RW	Switch master to OPERATE mode	FALSE→TRUE: Switches the Unit to the OPERATE mode. if the Unit is already in this mode, no action will be taken. In OPERATE mode the PROFIBUS Master Unit will parameterize all allocated slave devices, and commence I/O Data-Exchange. See Note 1 and 2. FALSE: If the PROFIBUS Master Unit has entered the OPERATE mode, the Unit will change this bit to FALSE again.
*_MstrStopCmd	BOOL	RW	Switch master to STOP mode	FALSE→TRUE: Switches the Unit to the STOP mode. If the Unit is already in this mode, no acction will be taken. In STOP mode, the Unit will be online, connected to the network, but not ccmmunicate with its slave devices. See Note 1 and 2. FALSE: If the PROFIBUS Master Unit has entered the STOP mode, the Unit will change this bit to FALSE again.
*_MstrClearCmd	BOOL	RW	Switch master to CLEAR mode	FALSE→TRUE: Switches the Unit to the CLEAR mode. If the Unit is already in this mode, no action will be taken. In CLEAR mode the PROFIBUS Master Unit will parameterize all allocated slave devices, and it will read the input data of the slave devices, but it will send zeros or empty output messages to slave devices. See note 1 and 2. FALSE: If the PROFIBUS Master Unit has entered the CLEAR mode, the Unit will change this bit to FALSE again.

Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrOfflineCmd	BOOL	RW	Switch master to OFFLINE mode	FALSE→TRUE: Switches the Unit to the OFFLINE mode. If the Unit is already in this mode, no action will be taken. In the OFFLINE mode the Unit will be disconnected from the network. See Note 1 and 2. FALSE: If the PROFIBUS Master Unit has entered the OFFLINE mode, the Unit will change this bit to FALSE again.
*_GlobCtlTxCmd	BOOL	RW	Transmit Global-Control command	FALSE→TRUE: Upon setting this switch the Unit will transmit one Global-Control command over the network. The contents of the message is defined in *_GlobCtlCmd, see *4-2-2 Global-Control Command (*_GlobCtlCmd)* See Note 3. FALSE: The bit will be changed to FALSE if the Global-Control command has been transmitted.
*_ClrNewDiagCmd	BOOL	RW	Clear new diagnostics bits	FALSE→TRUE: Upon setting this switch the Unit will clear all new diagnostics bit in the Slave New Diagnostics flags, see *4-2-9 Slave New Diagnostics Flags (*_SlvNewDiagL, *_SlvNewDiagH, *_SlvNewDiag)*. These bits indicate reception of new slave diagnostics data. Clearing the bit flags provides a clear indication for new messages to arrive. FALSE: If the bit flags have been cleared, the Unit will reset this bit to FALSE.

Note 1 When switching the PROFIBUS Master Unit from one mode to another, it will internally implement the mode transition via the intermediate modes, e.g. from OFFLINE to OPERATE, will be performed as OFFLINE - STOP - CLEAR - OPERATE. See *1-1-7 Network Operation Modes*.

2 If two or more mode switches, i.e. *_MstrOperateCmd, *_MstrStopCmd, *_MstrClearCmd, *_MstrOfflineCmd, have been set at the same time, or the Unit can not implement the mode change due to an invalid configuration, the command will be ignored and the Mode command error flag in the Master Errors word (*_MstrErrSta) will be TRUE. See *4-2-5 Master Errors (*_MstrErrSta)*.

3 If the PROFIBUS Master Unit is not in the correct mode, i.e. the Unit is in OFFLINE or STOP mode, the Transmit Global-Control command will be ignored, but the bit will remain TRUE. The command will be sent when the Unit transitions to the correct mode, unless the user clears the Bit. No error indication will be generated.

4-2-2 Global-Control Command (*_GlobCtlCmd)

One of the following Device Variables for CJ-series Unit is used to operate the Global-Control Command from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Global-Control Command.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Global-Control Command.

A PROFIBUS Global-Control command can be transmitted by the Unit on user demand to either:

Global-Control Multicast Command

One or more groups of slave devices allocated to the PROFIBUS Master Unit (Multicast command).

Global-Control Broadcast Command

All slave devices allocated to the PROFIBUS Master Unit (Broadcast command).

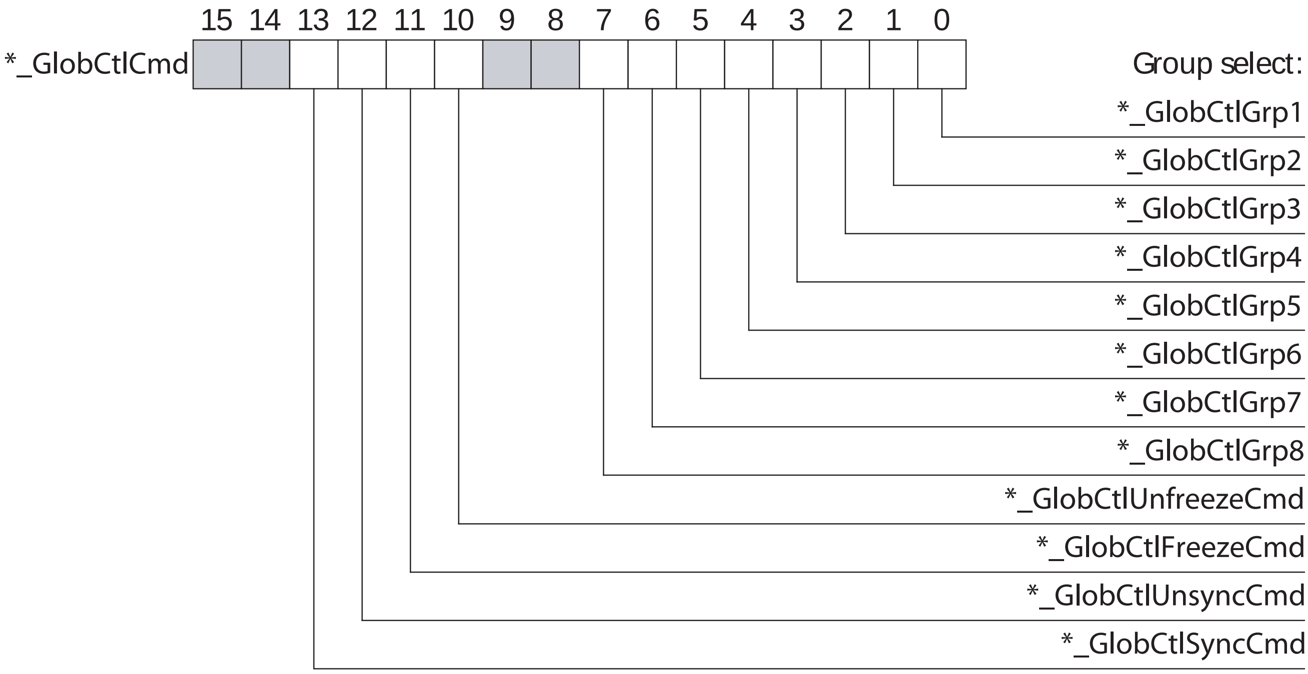
The number of the group to which each slave device belongs, is defined in its parameterization message. Only the slave devices assigned to the groups to which the Global-Control command is addressed will process the command.

Group Address Setting

The group address to send the message to is specified in *_GlobCtlGrp1 through *_GlobCtlGrp8. Selecting specific groups of slave devices (i.e. a Multicast command), requires setting of one or more bits in this range to TRUE. Selecting all slaves (i.e. a Broadcast command) requires all bits in this range to be set to FALSE. The Global-Control command flags are specified in *_GlobCtlUnfreezeCmd, *_GlobCtlFreezeCmd, *_GlobCtlUnsyncCmd and *_GlobCtlSyncCmd.

Transmitting the message is done by setting the Transmit Global-Control command switch,*_GlobCtlTxCmd, see *4-2-1 Software Switches (*_SwCmd)*.

Device Variables for CJ-series Unit separating functions per each switch contained in Global-Control command are shown below.



Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_GlobCtlGrp1	BOOL	RW	Send command to slaves of Group 1	TRUE: Slaves devices assigned to the specific group will process the global-control command. FALSE: Slave devices assigned to the specific group will not process the global-control command. Selecting all slaves (i.e. a Broadcast command) requires all bits in this range to be set to FALSE.
*_GlobCtlGrp2	BOOL	RW	Send command to slaves of Group 2	
*_GlobCtlGrp3	BOOL	RW	Send command to slaves of Group 3	
*_GlobCtlGrp4	BOOL	RW	Send command to slaves of Group 4	
*_GlobCtlGrp5	BOOL	RW	Send command to slaves of Group 5	
*_GlobCtlGrp6	BOOL	RW	Send command to slaves of Group 6	
*_GlobCtlGrp7	BOOL	RW	Send command to slaves of Group 7	
*_GlobCtlGrp8	BOOL	RW	Send command to slaves of Group 8	
*_GlobCtlUnfreezeCmd	BOOL	RW	Unfreeze	TRUE: The Unfreeze command will be send to the targeted slave devices. The Unfreeze command releases the targeted slave devices from the Freeze mode (see below). FALSE: The Unfreeze command will not be transferred to the slave devices.

Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_GlobCtlFreezeCmd	BOOL	RW	Freeze	TRUE: The Freeze command forces the slave devices into the Freeze mode. In this mode a slave device will not update its inputs to the Master and continue to transmit the input data acquired before the Freeze command. If the slave device is already in the Freeze mode, a new Freeze command will force the slave to update its inputs only once and continue to transmit the new input data to the Master. FALSE: The Freeze command will not be transferred to the slave devices.
*_GlobCtlUnsyncCmd	BOOL	RW	Unsync	TRUE: The Unsync command will be send to the targeted slave devices. The Unsync command releases the targeted slave devices from the Sync mode (see below). FALSE: The Unsync command will not be transferred to the slave devices.
*_GlobCtlSyncCmd	BOOL	RW	Sync	TRUE: The Sync command forces the slave devices into the Sync mode. In this mode the slave device will not update its outputs and continues to use the output data received before the Sync command. If the slave device is already in the Sync mode, a new Sync command will force the slave to update its outputs only once, with the most recent output data received from the Master. FALSE: The Sync command will not be transferred to the slave devices.

● Freeze Mode

The user can set the Freeze and Unfreeze bits at the same time and both will be transmitted to the targeted slave devices at the same time but the resulting action at the slave device is defined in the PROFIBUS standards.

*_GlobCtlUnfreezeCmd	*_GlobCtlFreezeCmd	Resulting action at slave
FALSE	FALSE	No change in function
FALSE	TRUE	Slave device will be in Freeze mode
TRUE	FALSE	Slave device will be in Unfreeze mode
TRUE	TRUE	Slave device will be in Unfreeze mode

● Sync Mode

The user can set the Sync and Unsync bits at the same time, and both will be transmitted to the targeted slave devices at the same time, but the resulting action at the slave device is defined in the PROFIBUS standards.

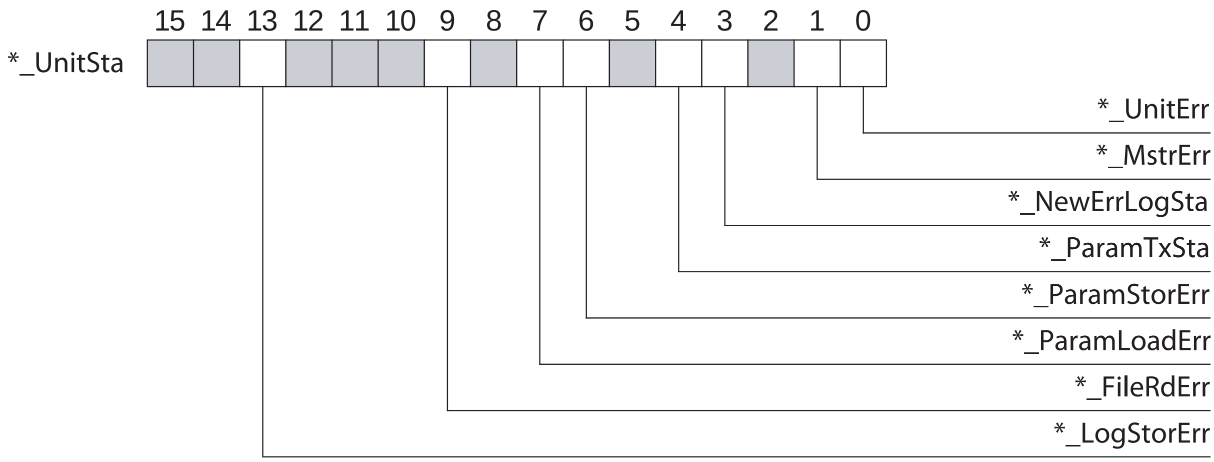
*_GlobCtlUnsyncCmd	*_GlobCtlSyncCmd	Resulting action at slave
FALSE	FALSE	No change in function
FALSE	TRUE	Slave device will be in Sync mode
TRUE	FALSE	Slave device will be in Unsync mode
TRUE	TRUE	Slave device will be in Unsync mode

4-2-3 Unit Status (*_UnitSta)

One of the following Device Variables for CJ-series Unit is used to monitor the Unit Status from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Unit Status.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Unit Status.

The Unit status word contains all the status and error flags concerning the Unit itself, as well as error flags, which indicate the presence of error flags in the Master and Slave Status Words. All bits are controlled by the Unit.



Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_UnitErr	BOOL	R	Unit error flag	The Unit error flag collects the status of all error flags in the *_UnitSta area. TRUE: Changed to TRUE by the Unit if *_MstrErr, *_NewErrLogSta, *_ParamStorErr, *_ParamLoadErr, *_FileRdErr, or *_LogStorErr are set to TRUE. FALSE: Changed to FALSE by the Unit if *_MstrErr, *_NewErrLogSta, *_ParamStorErr, *_ParamLoadErr, *_FileRdErr, or *_LogStorErr are FALSE.
*_MstrErr	BOOL	R	Master error flag	The master error flag collects the error flags in the master errors word, i.e.*_MstrErrSta. The Master Errors word contains all error flags related to the PROFIBUS Master functions. TRUE: *_MstrErr is TRUE if any of the flags in the Master Errors word, i.e. *_MstrErrSta are TRUE, see *4-2-5 Master Errors (*_MstrErrSta)*. FALSE: *_MstrErr is FALSE if none of the flags in master errrors, i.e. *_MstrErrSta are FALSE.
*_NewErrLogSta	BOOL	R	Error log contains new errors	The Error log contains new errors bit indicates new errors in the error log since the last time the error log was cleared or read. TRUE: If the error log contains one or more new errors. FALSE: Indicates the error log is cleared or read.
*_ParamTxSta	BOOL	R	Parameter transfer In progress	TRUE: Indicates transfer of Configuration and setup data • from the PC to the Unit's internal volatile memory, or • from the Unit's internal volatile memory to non-volatile memory, or • from the flash card to the Unit's internal volatile memory. During this transfer no other transfer of data can be started in parallel. FALSE: Indicates that no Configuration data transfer is in progress.
*_ParamStorErr	BOOL	R	Local parameter storage error	TRUE: Indicates an error occurred during an attempt to write the Configuration and setup data to internal non-volatile memory. If the error occurred, the data in the non-volatile memory may be corrupted and a new Configuration must be downloaded to the Unit. FALSE: Indicates that the Configuration and setup data has been transferred to the non-volatile memory successfully.

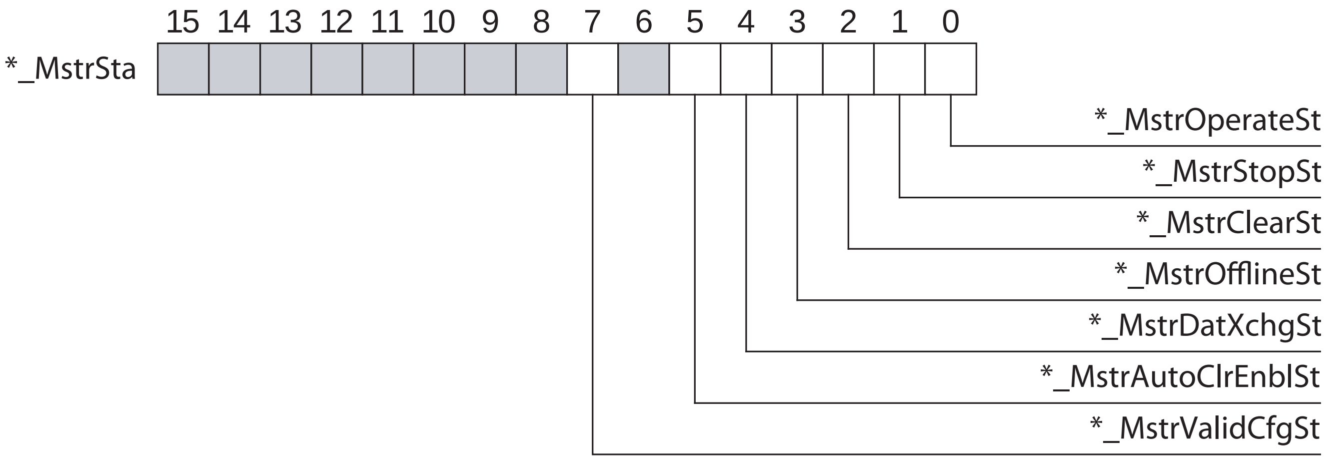
Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_ParamLoadErr	BOOL	R	Local parameter load error	TRUE: Indicates an error occurred during an attempt to transfer the Configuration and setup data from non-volatile to volatile memory. FALSE: Indicates a successful load attempt is made.
*_FileRdErr	BOOL	R	File read error	TRUE: Indicates an error occurred during an attempt to transfer the Configuration and setup data from a memory card in the CPU to the Unit's non-volatile memory. The error can be caused by an error in the File or an error during transfer. FALSE: Indicates a successful load from a memory card is made. • Limited memory card functionality based on CPU version. Check specification details for more information.
*_LogStorErr	BOOL	R	Error log storage error	TRUE: Indicates an error occurred during an attempt to write the Error log to internal non-volatile memory. If the error occurred, the Error log data in the non-volatile memory may be corrupted. Upon a restart the Unit will attempt to repair the Error log. FALSE: Indicates that the Error log has been transferred to the non-volatile memory successfully.

4-2-4 Master Status (*_MstrSta)

One of the following Device Variables for CJ-series Unit is used to monitor the Master Status from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Master Status.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Master Status.

The Master Status word collects all status information related to the PROFIBUS Master function. Any errors related to the PROFIBUS Master function are collected in the Master Errors (*_MstrErrSta) variable.



Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrOperateSta	BOOL	R	Unit in OPER-ATE mode	TRUE: Indicates the Unit is in OPERATE mode. In OPERATE mode the PROFIBUS Master Unit will parameterize all allocated slave devices, and commence I/O Data-Exchange. FALSE: Indicates the Unit is not in OPERATE mode.
*_MstrStopSta	BOOL	R	Unit in STOP mode	TRUE : Indicates the Unit is in STOP mode. In STOP mode, the Unit will be ONLINE, connected to the network, but not communicate with its slave devices. FALSE: Indicates the Unit is not in STOP mode.
*_MstrClearSta	BOOL	R	Unit in CLEAR mode	TRUE: Indicates the Unit is in CLEAR mode. In CLEAR mode the PROFIBUS Master Unit will parameterize all allocated slave devices. If this is accomplished successfully, it will read all input data of the allocated slave devices, but it will send zeros or empty output messages to all slave devices. FALSE: Indicates the Unit is not in CLEAR mode.
*_MstrOfflineSta	BOOL	R	Unit in OFFLINE mode	TRUE: Indicates the Unit is in OFFLINE mode. In the OFFLINE mode the Unit will be discon-nected from the network. FALSE: Indicates the Unit is not in OFFLINE mode.

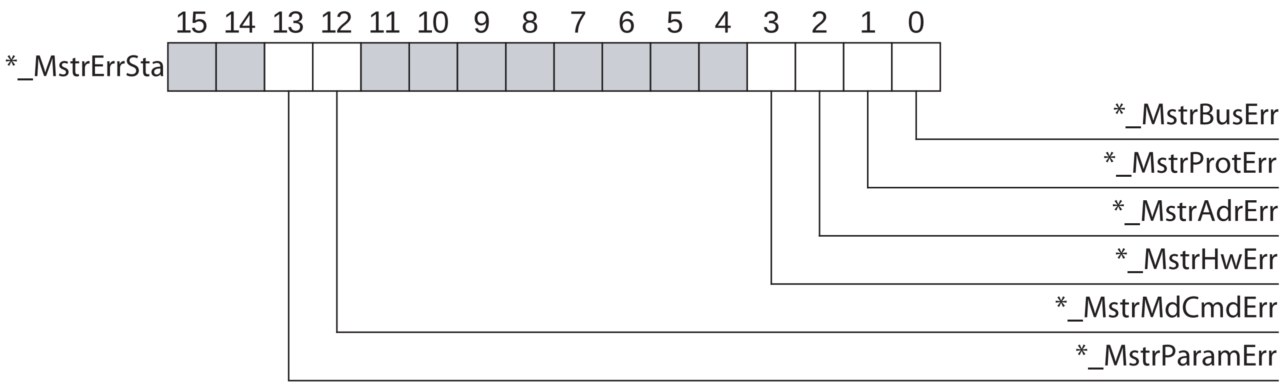
Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrDatXchgSta	BOOL	R	Unit in Data Exchange	TRUE: Indicates that the Unit is in Data Exchange with at least one allocated and enabled slave device. FALSE: Indicates that the Unit is not in Data Exchange with at any of the allocated and enabled slave devices.
*_MstrAutoClrEnblSta	BOOL	R	Auto-CLEAR enabled	TRUE: Indicates that the Auto-CLEAR function has been enabled. In case an error occurs in one of the allocated slave devices during Data Exchange, this function forces the Unit to the CLEAR mode, in which it will force all allocated slave devices to a Fail Safe mode. FALSE: Indicates the Auto-CLEAR function has been disabled. If in this case an error occurs in an allocated slave device, the PROFIBUS Master Unit will continue Data Exchange with the remaining slave devices.
*_MstrValidCfgSta	BOOL	R	Unit contains a valid configuration	TRUE: Indicates that the Unit contains a valid Configuration. With this Configuration it can parameterize the allocated slave devices and achieve Data Exchange. FALSE: Indicates the Unit does not contain a valid Configuration or transfer of a new Configuration is in progress.

4-2-5 Master Errors (*_MstrErrSta)

One of the following Device Variables for CJ-series Unit is used to monitor the Master Errors from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Master Errors.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Master Errors.

The Master Errors word collects all error information on the Unit master function. The status information is collected in the Master Status word.



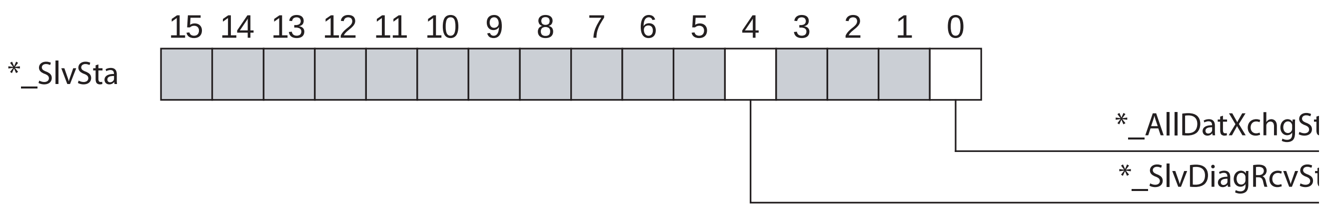
Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrBusErr	BOOL	R	Disturbed Bus error	TRUE: Indicates that distorted messages have been received by the Unit. This may occur if the network is not properly terminated or a cable is used, which is too long for the selected baud rate. FALSE: Indicates that no Disturbed Bus error has occurred.
*_MstrProtErr	BOOL	R	PROFIBUS protocol error	TRUE: Indicates an error has occurred in the protocol handling, e.g. a transmitted token frame could not be read back. **Note:** In case this error occurs, the Unit will automatically switch to OFFLINE mode. FALSE: Indicates that no PROFIBUS protocol error has occurred.
*_MstrAdrErr	BOOL	R	Master address duplication error	TRUE: Indicates there is another master on the bus with the same with the same device address as the CJ1W-PRM21. **Note** In case this error occurs, the Unit will automatically switch to OFFLINE mode. FALSE: Indicates that no Master Address Duplication Error has occured.

Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_MstrHwErr	BOOL	R	Hardware error	TRUE: Indicates an error has occurred on the bus, e.g. message exceeding 256 bytes, broken messages, faulty bus timing or devices beyond the HSA have been detected. **Note** In case this error occurs, the Unit will automatically switch to OFFLINE mode. FALSE: Indicates that no Hardware error has occurred.
*_MstrMdCmdErr	BOOL	R	Mode command error	TRUE: Indicates: • more than one command mode switch has been set. • a mode command switch is set while the previous command is in progress, or • a mode transition command is given and the Unit has detected that it does not (yet) have a valid configuration or it detected an internal error, either of which prevented it from reaching that mode, e.g. Invalid Parameter set and transition to OPERATE mode. If this bit is changed to TRUE, it will remain so until a valid command is sent to the Unit. The invalid mode command will be ignored. FALSE: If the bit flags have been cleared, the Unit will reset this bit to FALSE.
*_MstrParamErr	BOOL	R	Parameter error	TRUE: Indicates an error has been detected in the contents of the Parameters set while configuring the PROFIBUS interface, using these parameters. FALSE: These bits will be set to FALSE by the Unit if the error bit flags have been cleared.

4-2-6 Slave Status (*_SlvSta)

One of the following Device Variables for CJ-series Unit is used to monitor the Slave Status from the user program:

- WORD-type Device Variable for CJ-series Unit holding all switch functions contained in Slave Status.
- BOOL-type Device Variable for CJ-series Unit separating functions per each switch contained in Slave Status.



Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_AllDatXchgSta	BOOL	R	All slaves in Data Exchange mode	TRUE: Indicates all slave devices which are allocated to the PROFIBUS Master Unit are enabled and are in Data Exchange with the PROFIBUS Master Unit. All slaves which are in Data exchange are indicated in *_SlvDatXchgL and *_SlvDatXchgH or *_SlvDatXchg, see *4-2-8 Slave Data Exchange Active Flags (*_SlvDatXchg, *_SlvDatXchgL, *_SlvDatXchgH)*. FALSE: Indicates that at least one slave device is not in Data_Exchange with the PROFIBUS Master Unit.
*_SlvDiagRcvSta	BOOL	R	Slave diagnostics received	TRUE: At least one of the slave devices, allocated to the PROFIBUS Master Unit indicates that new Diagnostics data is available. The slaves which indicate this data are indicated in *_SlvNewDiagL and *_SlvNewDiagH or *_SlvNewDiag, see *4-2-9 Slave New Diagnostics Flags (*_SlvNewDiagL, *_SlvNewDiagH, *_SlvNewDiag)*. FALSE: Indicates that none of the slave device has returned new diagnostics messages, since the last time the flags were cleared.

4-2-7 Actual Bus Cycle Time (*_ActCycleTm)

The actual bus cycle time word indicates the current bus cycle time expressed in BCD in 0.1 ms units. The maximum value is, therefore, 999.9 ms. Values larger than 999.9 ms are set at 9999.

4-2-8 Slave Data Exchange Active Flags (*_SlvDatXchg, *_SlvDatXchgL, *_SlvDatXchgH)

The Slave Data Exchange Active flags indicate if each slave device is in Data Exchange mode with the PROFIBUS Master Unit.

An Array data type is used to access individual slave status with the Device Variable *_SlvDatXchg.

The flags are also allocated to a block of eight CIO words and each bit in the block corresponds to a device address.

Bits 00 to 63 of LWORD-type *_SlvDatXchgL and bits 00 to 61 of LWORD-type *_SlvDatXchgH Device Variable for CJ-series Unit correspond to slaves at node addresses.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
*_SlvDatXchgL	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Slave station 00 to 15
*_SlvDatXchgL	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Slave station 16 to 31
*_SlvDatXchgL	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	Slave station 32 to 47
*_SlvDatXchgL	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	Slave station 48 to 63
*_SlvDatXchgH	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	Slave station 64 to 79
*_SlvDatXchgH	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	Slave station 80 to 95
*_SlvDatXchgH	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	Slave station 96 to 111
*_SlvDatXchgH			125	124	123	122	121	120	119	118	117	116	115	114	113	112	Slave station 112 to 125

When a slave device is in Data_Exchange with the PROFIBUS Master Unit to which it has been allocated, it is exchanging I/O Data with the PROFIBUS Master Unit.

If the PROFIBUS Master Unit is in CLEAR mode, it will read the slave's input data, but send zeros or an empty message as output data.

If the PROFIBUS Master Unit is in OPERATE mode, it will read the slave's input data and send any output data provided by the CPU

Name of Device Variable for CJ-series Unit	Type	R/W	Description	Function
*_SlvDatXchg	BOOL	R	Slave Data Exchange Active Flags (Array)	TRUE: Indicates that this slave device is allocated to the PROFIBUS Master Unit and is exchanging I/O Data with PROFIBUS Master Unit. In this case, the PROFIBUS Master Unit must be in the CLEAR mode or the OPERATE mode. FALSE: Indicates that the slave is not in Data Exchange with this PROFIBUS Master Unit due to one or more of the following conditions: • the slave device is not allocated to this PROFIBUS Master Unit • the slave device has been allocated to this PROFIBUS Master Unit, but is forced out of Data_Exchange mode due to a communication error • the slave device has been allocated to this PROFIBUS Master Unit but is not responding • the slave device has been allocated to this PROFIBUS Master Unit but is it has temporarily been disabled • the PROFIBUS Master Unit is not in CLEAR or OPERATE mode
*_SlvDatXchgL *_SlvDatXchgH	LWORD	R	Slave Data Exchange Active Flags	

4-2-9 Slave New Diagnostics Flags (*_SlvNewDiagL, *_SlvNewDiagH, *_SlvNewDiag)

The Slave New Diagnostics flags indicate for each slave device that it sent a new diagnostics message to the PROFIBUS Master Unit since the last time it was read or cleared by the NJ-series controller unit.

An Array data type is used to access individual slave diagnostic status with the Device Variable *_SlvNewDiag.

The flags are also allocated to a block of eight CIO words and each bit in the block corresponds to a device address. The flags are allocated to a block of eight CIO words and each bit in the block corresponds to a device address.

Bits 00 to 63 of LWORD-type *_SlvNewDiagL and bits 0 to 61 of LWORD-type *_SlvNewDiagH Device Variable for CJ-series Unit correspond to slaves at node addresses.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
*_SlvNewDiagL	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Slave station 00 to 15
*_SlvNewDiagL	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	Slave station 16 to 31
*_SlvNewDiagL	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	Slave station 32 to 47
*_SlvNewDiagL	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	Slave station 48 to 63
*_SlvNewDiagH	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	Slave station 64 to 79
*_SlvNewDiagH	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	Slave station 80 to 95
*_SlvNewDiagH	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	Slave station 96 to 111
*_SlvNewDiagH			125	124	123	122	121	120	119	118	117	116	115	114	113	112	Slave station 112 to 125

<table>
<tr><th>Name of Device Variable for CJ-series Unit</th><th>Type</th><th>R/W</th><th>Description</th><th>Function</th></tr>
<tr><td>*_SlvNewDiag</td><td>BOOL</td><td>R</td><td>Slave New Diagnostics flags (Array)</td><td rowspan="2">TRUE:
Indicates that this slave device is allocated to the PROFIBUS Master Unit, and has sent new diagnostics message to the PROFIBUS Master Unit.
In this case the PROFIBUS Master Unit must be in CLEAR mode or OPERATE mode.
FALSE:
Indicates that one or more of the following conditions is present:
• the slave device has not sent a new diagnostics message to the PROFIBUS Master Unit, since the last time it was read or cleared
• the slave device has not been allocated to this PROFIBUS Master Unit
• the PROFIBUS Master Unit is not in CLEAR or OPERATE mode
Note In case an allocated slave device is not responding and therefore
not sending a diagnostics message, the PROFIBUS Master Unit itself will provide a diagnostics message to the CPU containing the mandatory first 6 bytes. This diagnostics message will then indicate that the slave is not responding.</td></tr>
<tr><td>*_SlvNewDiagL, *_SlvNewDiagH</td><td>LWORD</td><td>R</td><td>Slave New Diagnostics flags</td></tr>
</table>

5

Operation

This section describes how to operate the CJ1W-PRM21 PROFIBUS Master Unit in a Network. It will discuss setting up a network, configuring all the connected devices and starting the network. Furthermore, it provides information on the I/O data exchange performance and it also provides information on how to monitor a network using the Unit and CX-ConfiguratorFDT.

5-1 Introduction

This section discusses the operational aspects of using the PROFIBUS Master Unit and the configuration software. The section has been setup to follow the general process flow of setting up and configuring a network, downloading the configuration and operating the PROFIBUS network.

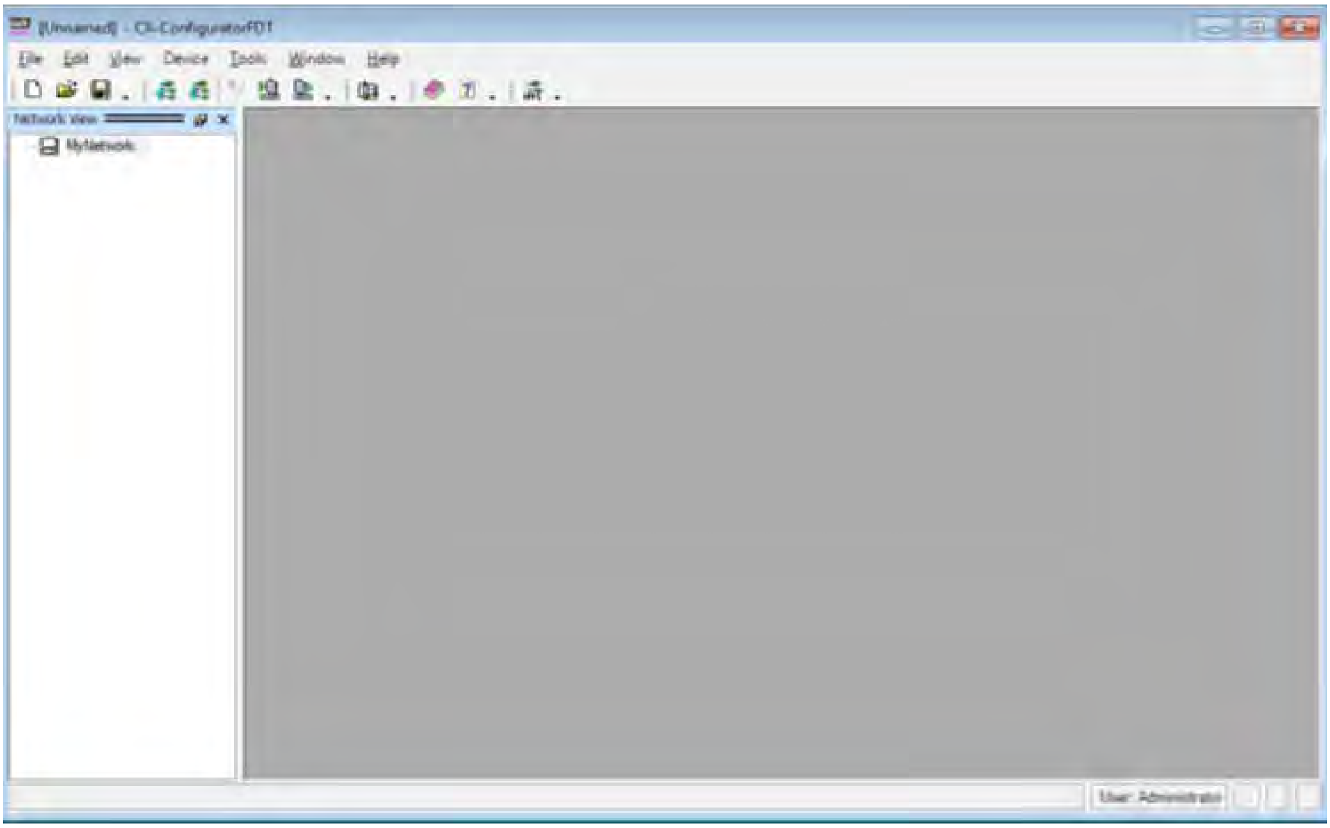
Note In case Error messages are displayed while using CX-ConfiguratorFDT, refer to *A-5 CX-ConfiguratorFDT Warning and Error Messages* for more information on errors.

5-2 Setting Up a Network

● Starting CX-ConfiguratorFDT

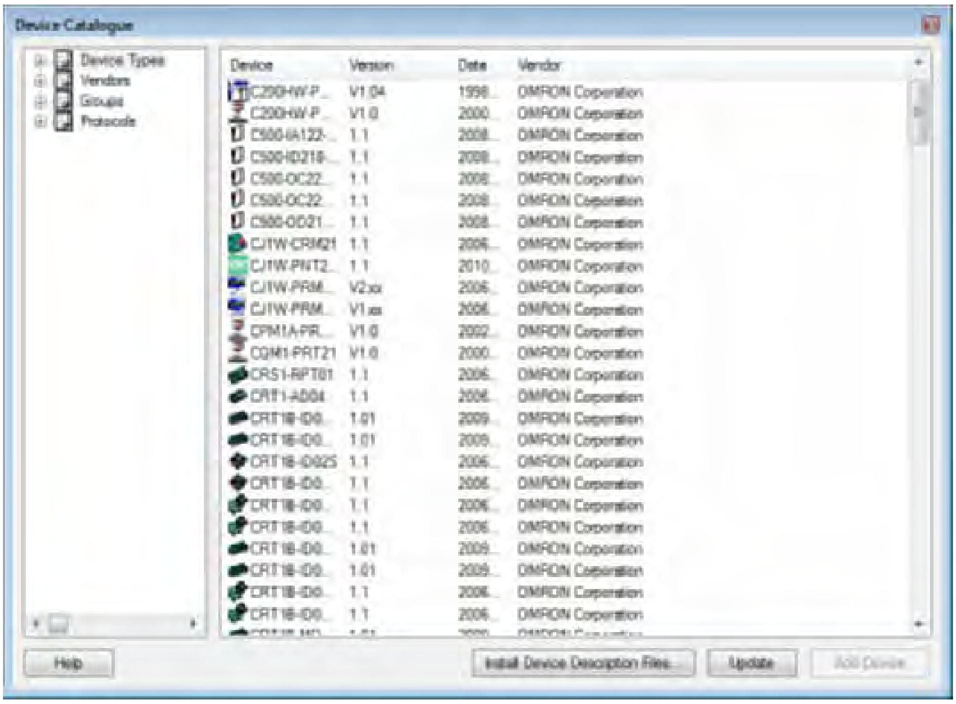
Setting up a network involves setting up a configuration in CX-ConfiguratorFDT and downloading it to the PROFIBUS Master Unit. To start CX-ConfiguratorFDT, select Program, OMRON, and CX-ConfiguratorFDT, from the Start Menu if the default program folder name is used.

CX-ConfiguratorFDT will now start, displaying the main window, as shown below.



Before starting the assembly of the network in CX-ConfiguratorFDT, make the following preparation steps.

1 Open the Device Catalogue: Either select the **View - Device Catalogue** menu option, or press the  button in the Tool Bar. The opened Device Catalogue is shown below.



2 Check the list of available DTMs, and verify that all the devices that need to be added to the Network - both master and slave devices - are among the DTMs in the list.

3 If one or more of the DTMs is missing, these DTMs must first be installed and the Device Catalogue updated.

Note 1 Non-GSD file based DTMs are usually provided with their own setup program. Installation of these DTMs must be performed outside CX-ConfiguratorFDT, e.g. from Windows Explorer.

2 In case of DTM installations outside CX-ConfiguratorFDT, always initiate an update of the Device Catalogue, before assembling a network. Without this update the newly installed DTM will not appear in the list of devices. To update the Device Catalogue, press the **Update** button in the Device Catalogue main window.

3 An update must also be performed when an already existing DTM is upgraded. Without the update, the old version number will still be shown in the list. Failure to update the Device Catalogue in this case may also result in undesired behavior, when adding these DTMs to the Network.

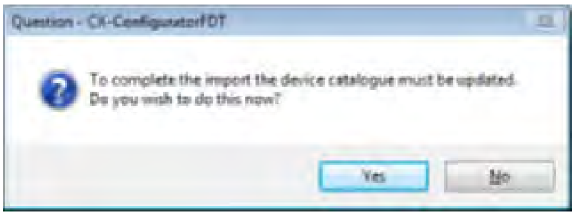
● Installing New GSD Files

GSD file based DTMs can be installed from within the Device Catalogue main window. To do so, follow the procedure below.

1 Press the **Install GSD File**... button at the bottom of the Device Catalogue main window (refer to figure above). The standard windows **File - Open** window will be displayed.

2 In the **File - Open** window browse to the sub-directory containing the GSD file, select the (one or more) GSD file(s) and press the **Open** button in the window. The GSD file(s) will be copied to a sub-directory of the CX-ConfiguratorFDT directory.

3 After completing the copy, a window will be displayed, asking the user permission for an update of the Device Catalogue (see figure below). If more GSD files need to be installed, select the **No** button and continue with installation of GSD file. Otherwise, select the **Yes** button.



Note Updating the Device Catalogue may take several minutes, depending on the number of installed GSD files.

5-2-1 Adding Devices to the Network

If the Device Catalogue is up to date, it can be used to setup the network. Setting up a network in CX-ConfiguratorFDT starts with adding single device DTMs to the Network view. First the CJ1W-PRM21 Master DTM must be added to the main branch of the project Network. To do so, one of three procedures as outlined below must be used to add the DTM.

● Using the Context Menu

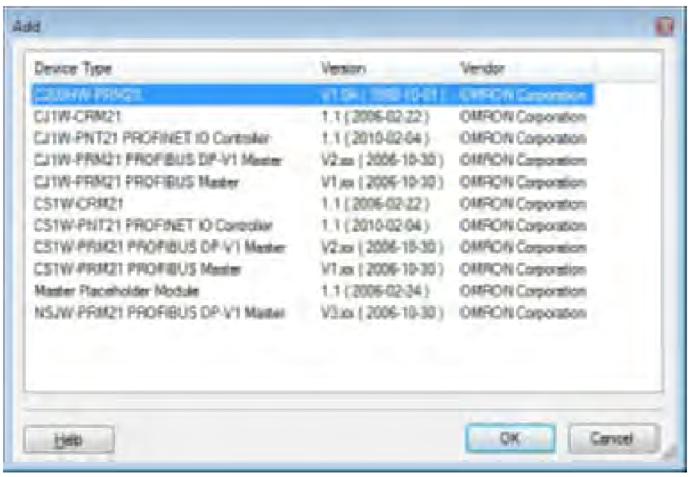
1 Select the top of the network to which the DTM must be added, i.e. select **MyNetwork** in the Network view.

2 Right click the mouse and a context menu will be displayed.

3 From the menu select **Add...**

4 A simplified Device Catalogue is displayed. The list only contains the devices which can be inserted at the selected network location (see figure below, only Master devices are listed).

5 From the displayed list, select the device DTM to be added and select the **OK** button. The Device DTM will be added to the network.



● Using Drag & Drop

1 Open the Device Catalogue: Either select the **View - Device Catalogue** menu option, or press the button  in the Tool Bar.

2 Select a device DTM in the Device Catalogue.

3 Left click the mouse and Drag the mouse pointer to the desired location in the network, i.e. **MyNetwork** in the Network view.

4 Release the mouse button and the device DTM will be added to that location.

Master DTMs can only be added to the main branch of the Network. Slave Device DTMs can only be added to Master DTMs. Whether or not a DTM can be added to the branch is indicated by the cursor: indicates no addition, indicates that addition is allowed.

● Using the Add Device Button

1 Select the top of the network to which the DTM must be added, i.e. select **MyNetwork** in the Network view.

2 Open the device Catalogue: Either select the **View - Device Catalogue** menu option, or press the button in the Tool Bar.

3 Select the device that must be added to the network.

4 Select the **Add Device** button at the bottom of the Device Catalogue window. The device DTM is added to the network.

- If a DTM is selected in the Device Catalogue, which can not be added to the current location in the network, the **Add Device** button will be disabled, which is shown as a grayed out button.

Note 1 When adding a CJ1W-PRM21 Master DTM to the network, it is automatically assigned the PROFIBUS network address 1. This address can be changed, after opening the CJ1W-PRM21 Master DTM.

2 After adding the Master DTM to the Network view, repeat (one of) the procedures as outlined above to add slave DTMs to the Master DTM. In the procedures above, the highest level for adding slave DTMs is the Master DTM.

3 When adding slave DTMs to the CJ1W-PRM21 Master DTM, they are automatically assigned their PROFIBUS network addresses, in ascending order, i.e. the first slave is assigned address 2, the second address 3, etc. The addresses can be changed in the slave DTM User Interface.

The figure below shows an example network consisting of a CJ1W-PRM21 PROFIBUS Master and three OMRON slave devices.

5-2-2 Changing Device and DTM Addresses

In order to achieve communication between the Master Unit and its allocated slave devices, the latter must have the same physical network address as set in the configuration. The network address on the slave devices are usually set

- through dip switches or rotary switches on the device, or
- remotely, using the dedicated Set_Slave_Add PROFIBUS service and stored in the device.

The physical address setting may differ from the slave DTM address, which was automatically assigned by the Master DTM.

● Changing the Slave Device Address

Slave devices which are not equipped with switches to set the address, must support the Set_Slave_Add PROFIBUS service. Typical device types supporting this address setting method are PROFIBUS PA devices or IP65 devices.

The default address for these devices is 126. This allows them to communicate with a Master unit, with the purpose of changing the address. I/O data exchange with slave address 126 is not allowed. Usually, these slave devices also provide a means to store the remotely set address in local non-volatile memory.

As of Unit version 2.0, the CJ1W-PRM21 PROFIBUS Master Units support the Set_Slave_Add PROFIBUS service, which can be initiated from the Master DTM. This service can be sent to any slave on the network, even if it is not allocated to the Master DTM.

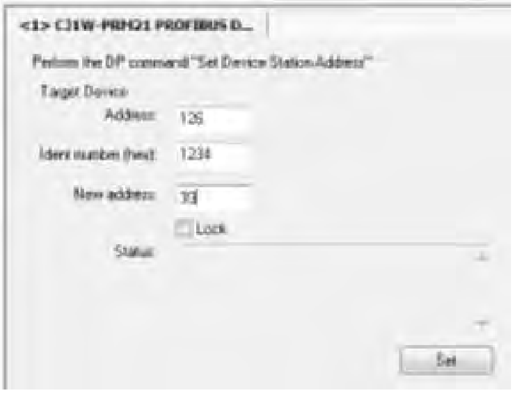
In order to change a slave device's address remotely, first make sure that the Master DTM is on-line with the Master. Next, open the Set Device Station Address window:

1 Select the DTM in the Network view.

2 Right click the mouse, and select the **Additional functions** entry from the context menu.

3 Select the **Set Device Station Address** option.

The window as shown below is displayed:



In order to change the address of a slave device perform the following steps:

1 Enter the device's current address and its PROFIBUS Ident Number.

2 The PROFIBUS Ident Number can be found in the Generic Slave DTM or through the device's documentation. By default the device's current address will be 126. If necessary, change this to the actual current address.

3 Enter the new device address in the **New Address** field.

4 Optionally, select the **Lock** checkbox if the address change must be made permanent.

5 Press the **Set** button to invoke the PROFIBUS DP Set Slave Address service. The Status field will display the status of this service.

Precautions for Correct Use

Selecting the **Lock** option makes any future changes of the address impossible, even after power-down/power-up of the slave device.

Note After successful completion of the address change, the device DTM address in the Network view has to be changed as well.

Changing the Slave DTM Address

When assembling the PROFIBUS configuration in the Network view, the Master DTM automatically assigns addresses in ascending order to the slave DTMs. If the physical address on the slave device differs from the DTM address, the DTM address must be changed to match that setting.

Changing the DTM address can be done in two ways.

- Change the DTM address through the Generic Slave DTM
- Change the DTM address through the Slave DTM Address Assignment table via the Master DTM.

Changing the DTM address via the Generic Slave DTM

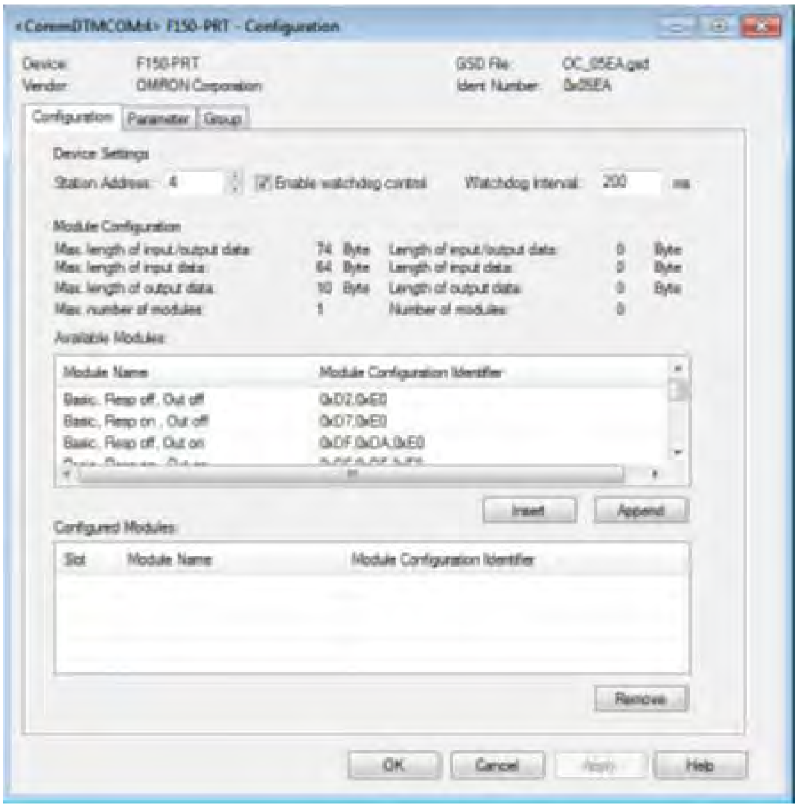
The first option, using the Generic Slave DTM is illustrated in the example below.

Assume that the F150-PRT Vision system in the previous example, has an actual network address of 10, instead of 4, which was automatically assigned. In order to change the network address of the F150-PRT (or any other slave device), perform the procedure outlined below.

1 Open the **Configuration User Interface** for the slave device, by selecting it in the Network view, and double-clicking the left mouse button.

2 Select the **Station Address** field at the top of the Configuration tab (see figure below) and change the value to 10.

3 Select the **OK** or **Apply** button at the bottom of the window. The **OK** button will close the DTM Configuration User Interface.



Note If, when pressing the **Apply** or **OK** button, no I/O modules have been selected as yet, a warning message will be displayed. The I/O modules can be selected later. Pressing the **OK** button with the warning, will apply the changed device address.

After changing the address in the slave DTM Configuration User Interface, the updated address will be shown in the Network view, next to the device name.

● Changing the DTM address via the Master DTM

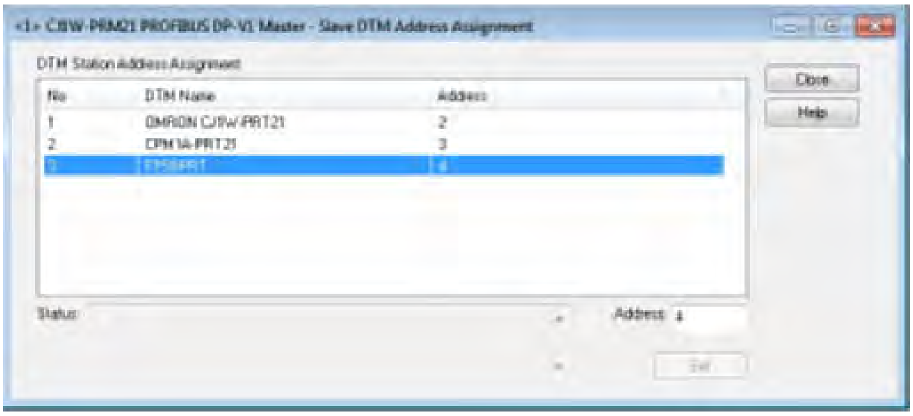
The slave DTM address can also be changed via the Master DTM. To accomplish this, first open the Slave DTM Address Assignment table.

1 Select the Master DTM in the Network view.

2 Right click the mouse, and select the **Additional functions** entry from the context menu.

3 Select the **Slave DTM Address Assignment** function.

The window shown below will be displayed.



In order to change the slave DTM address perform the following steps.

1 Select the slave device in the list.

2 Enter the new address in the field Address in the lower right corner of the window.

Press the **Set** button. The Status field will display the status of this service

After changing the slave DTM address, the new address will also be shown in the Network view.

5-3 Configuring the Slave Devices

After adding each of the slave DTMs to the network, configurations have to be selected for each of them. Setting up a configuration involves

- Selecting the proper I/O modules, which define the I/O data to be exchanged when operational.
- Setting up the device parameters, which will be send to the device to make or verify its settings.
- Selecting the group assignment, which defines the group of slave devices each slave belongs to and to allow sending Global-Control commands to this particular group.

All these settings will be downloaded to the Master Unit, which will send the data to the individual slave devices over the PROFIBUS network.

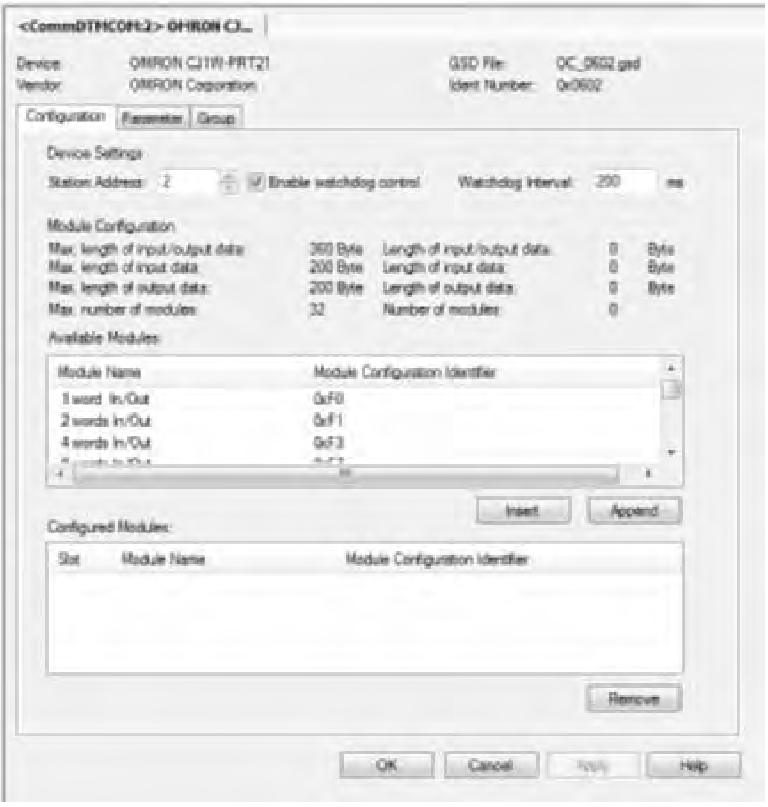
5-3-1 Defining the I/O Configuration

Opening the DTM Configuration User Interface

In order to define the I/O configuration, the DTM Configuration User Interface must be opened. To do this, either

- select the device in the Network view and double-click the left mouse button.
- select the device in the Network view, right click the mouse and select **Configuration** from the context menu.

The figure below, shows the DTM User Interface for the CJ1W-PRT21 PROFIBUS DP slave device



The DTM Configuration User Interface displays two lists.

- The Available Modules list, which contains the I/O modules the user can select.
- The Configured Modules list, which contains all the I/O modules selected by the user.

Adding/Inserting I/O Modules

To select the I/O modules, perform one of the following procedures.

- Select the I/O module that needs to be added in the Available Modules list, and double-click it with the left mouse button. If more than one module must be added, repeat this step for the other modules.
- Select the I/O module that needs to be added in the Available Modules list, and press either the **Insert** or **Append** button. This method allows selection of more than one module, by pressing either the **Shift** or the **Ctrl** key on the keyboard, while selecting the modules.

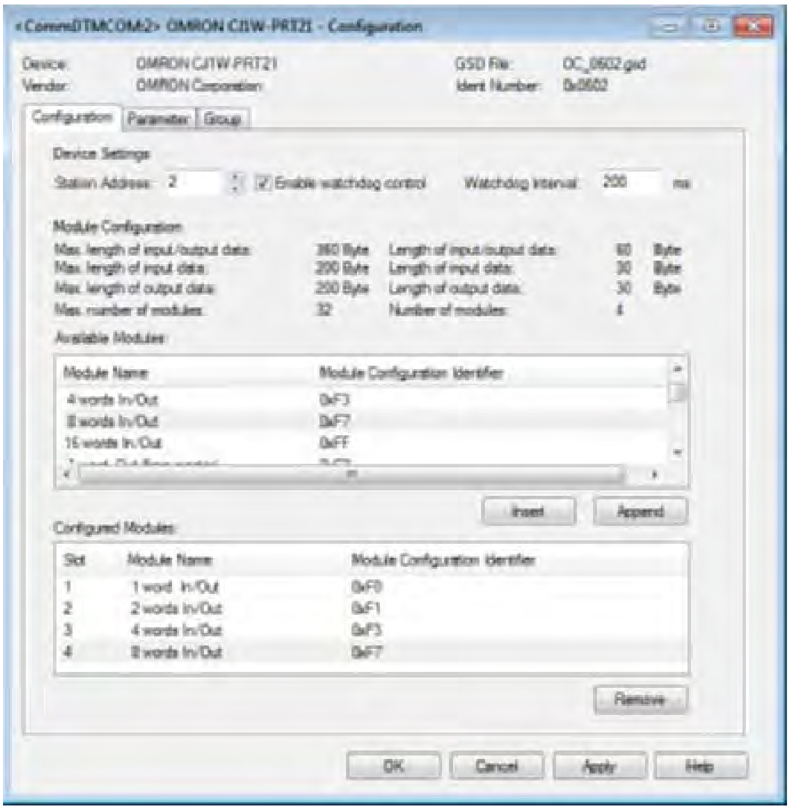
Note **1** When pressing the **Insert** button, the selected I/O module will be inserted above the selected module in the Configured Modules list.

2 The selected I/O modules are sent to the slave device, in the same sequence as selected in the user interface. Depending on the device, the sequence may be checked by the slave device. If an incorrect sequence is sent, the I/O configuration is rejected. This is for example the case with the OMRON PRT1-COM Multiple I/O PROFIBUS DP Interface.

3 A mandatory I/O module sequence is sometimes indicated in the GSD file, by using non-PROFIBUS standard GSD file keywords (i.e. only interpreted by a specific configurator). The Generic Slave DTM does not check such keywords. In this case, refer to the manual of the specific device for details.

4 Also in this window are the maximum values, which can be set, and the totals of I/O data that actually have been set. If, while selecting I/O modules one of the maximum values is exceeded, a warning message will be displayed.

For the CJ1W-PRT21, the first four I/O modules have been selected. See figure below.



Removing I/O Modules

To remove I/O modules from the Configured Modules list, perform one of the following procedures.

- Select the I/O module that needs to be removed from the Configured Modules list, and double-click it with the left mouse button. If more than one module must be added, repeat this step for the other modules.

- Select the I/O module that needs to be removed from the Configured Modules list, and press either the **Remove** button. This method allows selection of more than one module, by pressing either the **Shift** or the **Ctrl** key on the keyboard, while selecting the modules.

● Watchdog Settings

Apart from the I/O module selection, the Configuration tab also contains the settings for two other parameters.

1 Enable Watchdog Control: This parameter will enable/disable the monitoring of the Master-Slave communication in the slave device. If enabled, the slave will stop I/O data exchange with the Master if the Master has not send any request message to the slave within the configured Watchdog time. Furthermore, the slave will

- switch its outputs to a known state.
- signal its change of state in a diagnostics message, the next time the Master addresses the slave.
- request re-parameterization from the Master, before resuming I/O data exchange.

Note If disabled, the slave will remain in data exchange even if the Master is not communicating, thus maintaining its outputs in the latest known state based on the last I/O data exchange message.

2 Watchdog Interval: This value is the watchdog timeout related to the Master-Slave communication time out.

Note Enabling the Watchdog Control is highly recommended for safe operation of the network.

Precautions for Correct Use

In the current version of CX-ConfiguratorFDT, the watchdog value for each of the slave devices is overruled by the value determined by the Master DTM. Therefore, changing the value in the Generic Slave DTM has no effect.

When done, making the I/O configuration settings, press the **Apply** button at the bottom of the window. Next, select the Parameter tab, to make the necessary parameter selections.

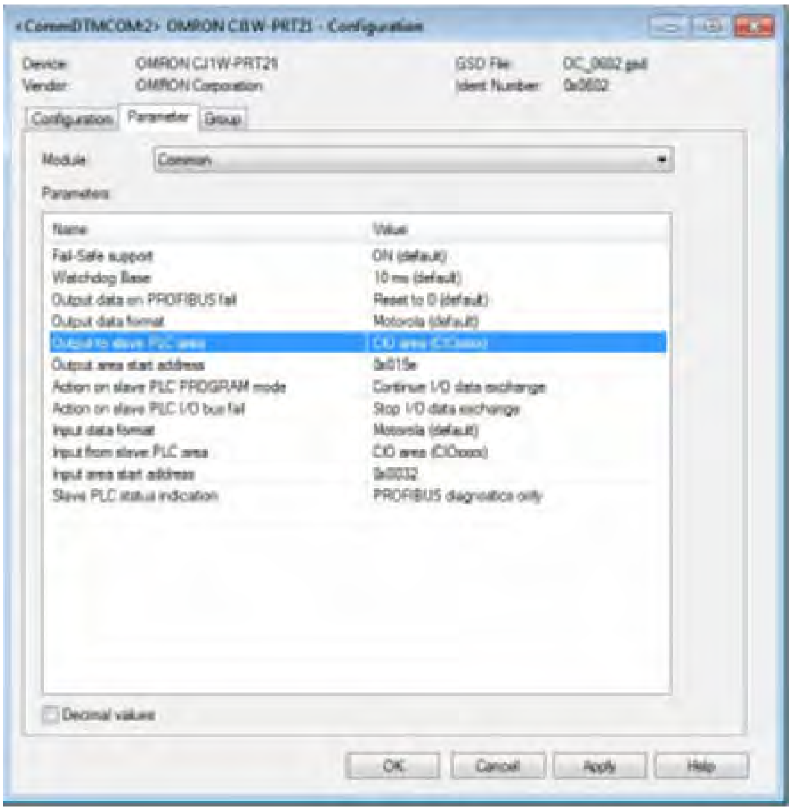
5-3-2 Setting Parameters

The parameters are sent by the Master Unit to the slave device prior to establishing I/O data exchange. The slave device will reject incorrect parameters and not establish I/O data exchange, unless the parameters are changed.

In general there will be two types of parameters.

- Common Parameters: Most of the slave devices require at least the common parameters. These parameters apply to the whole slave device.
- Module Parameters: Modular slaves often apply parameters related to a specific I/O module, e.g. the physical slave device consists of a number of hardware modules, each defining an amount of I/O data, requiring its I/O module selection and requiring its own parameters.

The Parameter tab of the CJ1W-PRT21 is shown in the figure below. It lists the common parameters for the CJ1W-PRT21.



In the figure above, the parameter captions are listed in the left column and the options can be set in the right column. In order to change settings, double-click the required parameter row with the left mouse button. Depending on the parameter type, either a drop-down lists will become available for selection or a value can be entered.

In the figure above, the parameter setting allowing the user to define the target location of the output data in the CPU memory has been selected.

Note Readable captions and/or convenient selection items are not always provided with the parameters. Depending on the slave device and the GSD file implementation, setting the parameter values may require the help of the user documentation for that slave.

5-3-3 Selecting the Group Assignment

The group assignment is sent to the slave devices as part of the parameter message. The group assignment is used as an address within the Global-Control command message (see *5-6-3 Transmitting Global-Control Commands*), to address a specific group of slaves, or all slaves. To set a slave device's group address, perform the following steps.

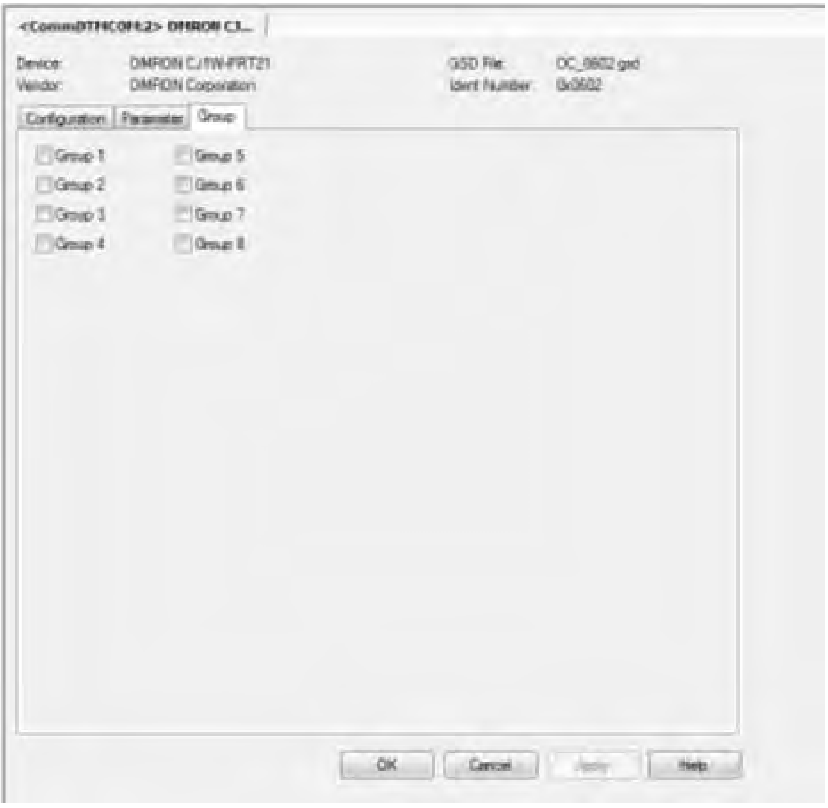
1 Open the Configuration User Interface of the Generic Slave DTM the specific slave device.

2 Select the Group tab.

3 Select the checkbox next to the group numbers for all the groups to which the slave device will belong.

4 Select the **Apply** button at the bottom of the User Interface.

Assigning slave devices to groups is application dependent. The figure below shows the Group selection tab for the CJ1W-PRT21, which has been assigned to groups 1, 2 and 4.



After making the group assignment, press the **OK** button to save the changes and close the DTM Configuration User Interface.

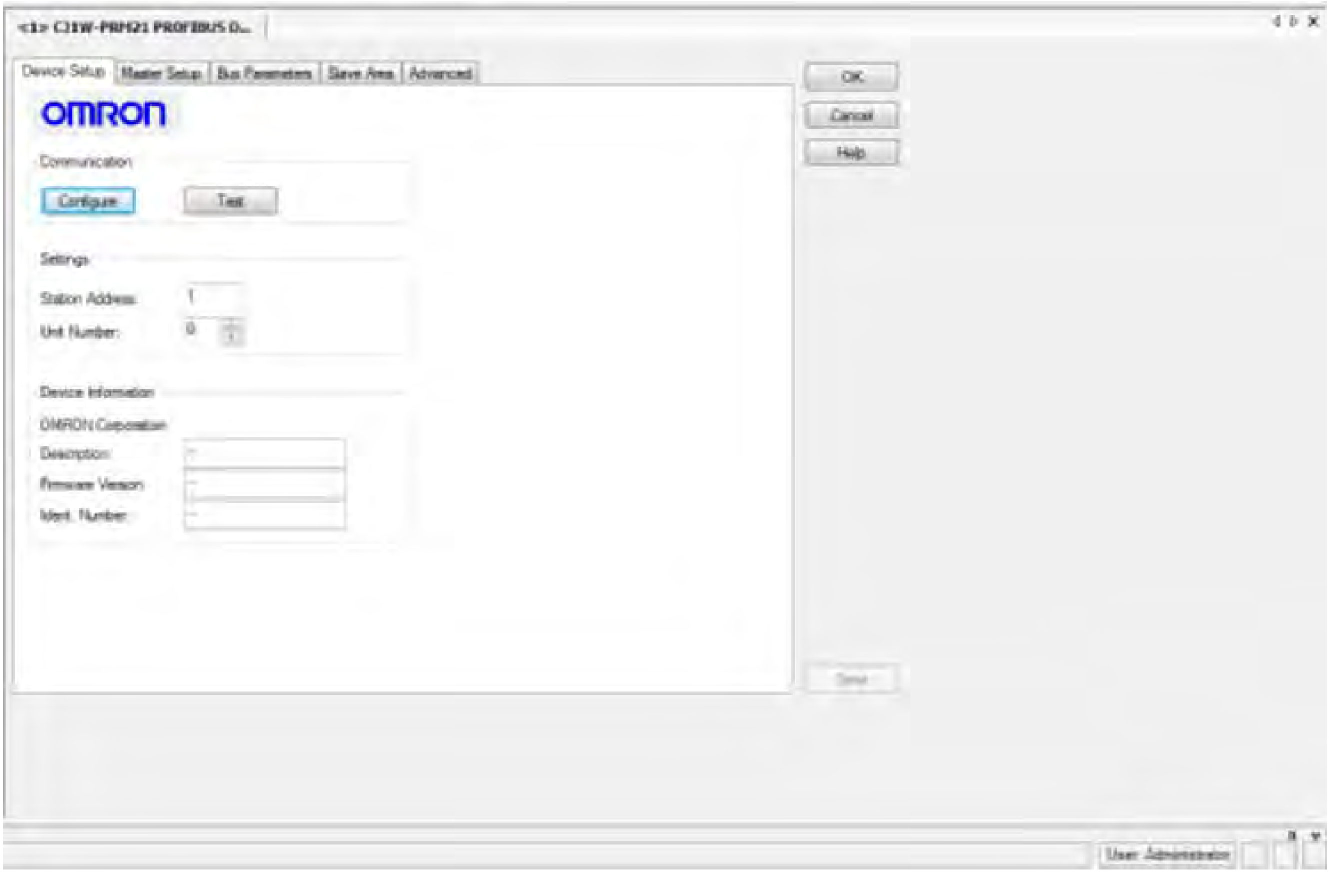
5-4 Configuring the Master

● Opening the Master DTM Configuration Interface

After configuring all the slave DTMs, the CJ1W-PRM21 Master DTM must be configured. In order to open the Master DTM Configuration Interface do either one of the following.

- Select the CJ1W-PRM21 Master DTM in the Network view and double-click the left mouse button.
- Select the CJ1W-PRM21 Master DTM in the Network view, and right-click the mouse. From the context menu, select Configuration.

The DTM Configuration User Interface is shown below.



● Master Address

In the first tab, the device address and the unit number must be set. The device address can be set in the range from 0 to 125.

● Unit Number

The setting of the unit number is required to setup communication with the Unit through CX-Server. The setting in the user interface must match the setting made with the rotary switch on the front of the Unit.

Note The device address is normally assigned automatically. Only in the case where there are other devices in the network which have the same address, the device address of the CJ1W-PRM21 Master DTM may need to be changed.

After making the changes, select the **Save** button in the lower right corner of the user interface to accept the changes. Next select the Master Setup tab, to display the Master Setup options.

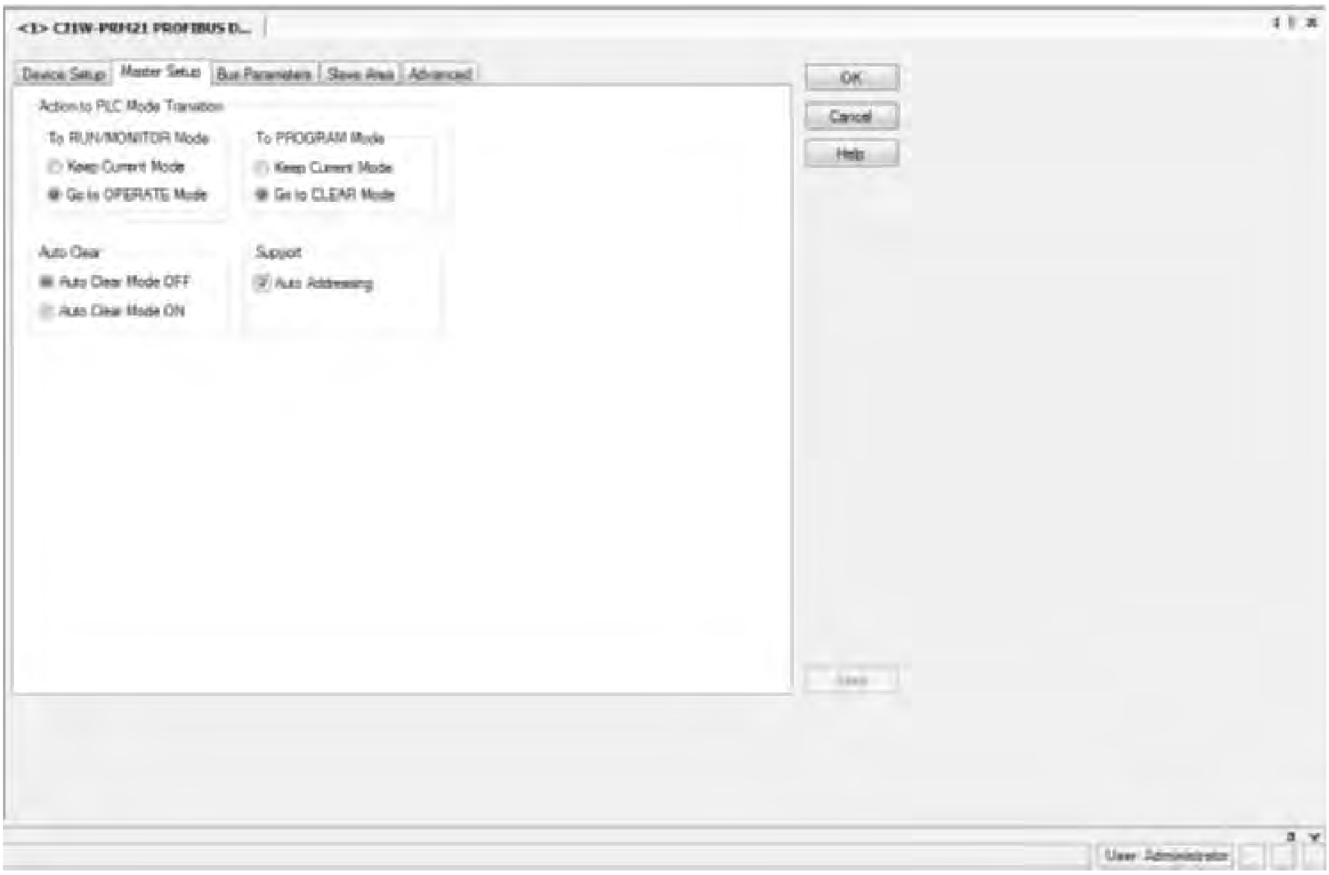
5-4-1 Setting the Master Parameters

Master Setup Tab

The Master Setup tab defines

- the behavior of the Master Unit, when the CPU switches its mode between RUN and PROGRAM mode.
- The behavior of the Master Unit in case an error occurs in one of the slave devices allocated to the Master Unit.
- The method of I/O data mapping.

The figure below shows the Master Setup tab



Unit behavior upon CPU Mode Changes

The user can select the way the Unit will behave if the CPU mode is changed. The default settings are shown below.

- Set the Unit’s operational mode to CLEAR (i.e. set all outputs to a safe state), when switching the CPU to PROGRAM mode.
- Set the Unit’s operational mode to OPERATE (i.e. start I/O data exchange with the slave devices), when switching the CPU to RUN mode.

Note **1** The advantage of this setting is that the user does not have to program the starting of the network. The disadvantage is that the moment at which the network is started is out of direct control of the CPU user program. I/O data exchange is started, while the program may still be initializing its memory. Depending on the application this may have unexpected effects.

2 To avoid potential problems at startup, it is recommended to set the network operational mode to ‘keep current mode’ in case the CPU mode changes to RUN and to set the operational mode to CLEAR in case the CPU mode changes to PROGRAM. This requires the CPU user program to switch the network to OPERATE, after startup. Refer to *5-6-2 Changing PROFIUS Mode of the Master Unit* for a programming example.

3 A side effect of the default settings can be that the network is started right after downloading the parameters to the CJ1W-PRM21 PROFIBUS Master Unit. After downloading the parameters, the CJ1W-PRM21 Master DTM will restart the Unit and switch the CPU mode back from PROGRAM mode to the mode it had before downloading. This can be RUN mode.

● Auto-CLEAR behavior

The Auto-CLEAR behavior defines how the CJ1W-PRM21 PROFIBUS Master Unit will behave in case one of its allocated slave devices fails during I/O data exchange. This option can be enabled if the application in which the Master Unit is used warrants safety precautions to be taken to prevent unexpected behavior of the application.

If Auto-CLEAR has been enabled, the Master Unit will automatically transition to the CLEAR state and set the allocated slave device outputs to the safe state. Refer to section *5-6-4 Using Auto-CLEAR*, for a description of how to use the Auto-CLEAR function.

● Auto-Addressing

Auto-Addressing defines whether or not the CJ1W-PRM21 Master DTM will automatically map the I/O data in such a way that no gaps exist in the I/O data. If enabled, the user does not need to handle the exact mapping of I/O data on to the CPU memory areas. Refer to section *5-4-3 Defining and Changing the I/O Mapping* for more information on I/O data mapping.

After making the changes, select the **Save** button in the lower right corner of the user interface to accept the changes. Next select the Bus Parameter tab to display the Bus Parameters.

5-4-2 Setting the Bus Parameters

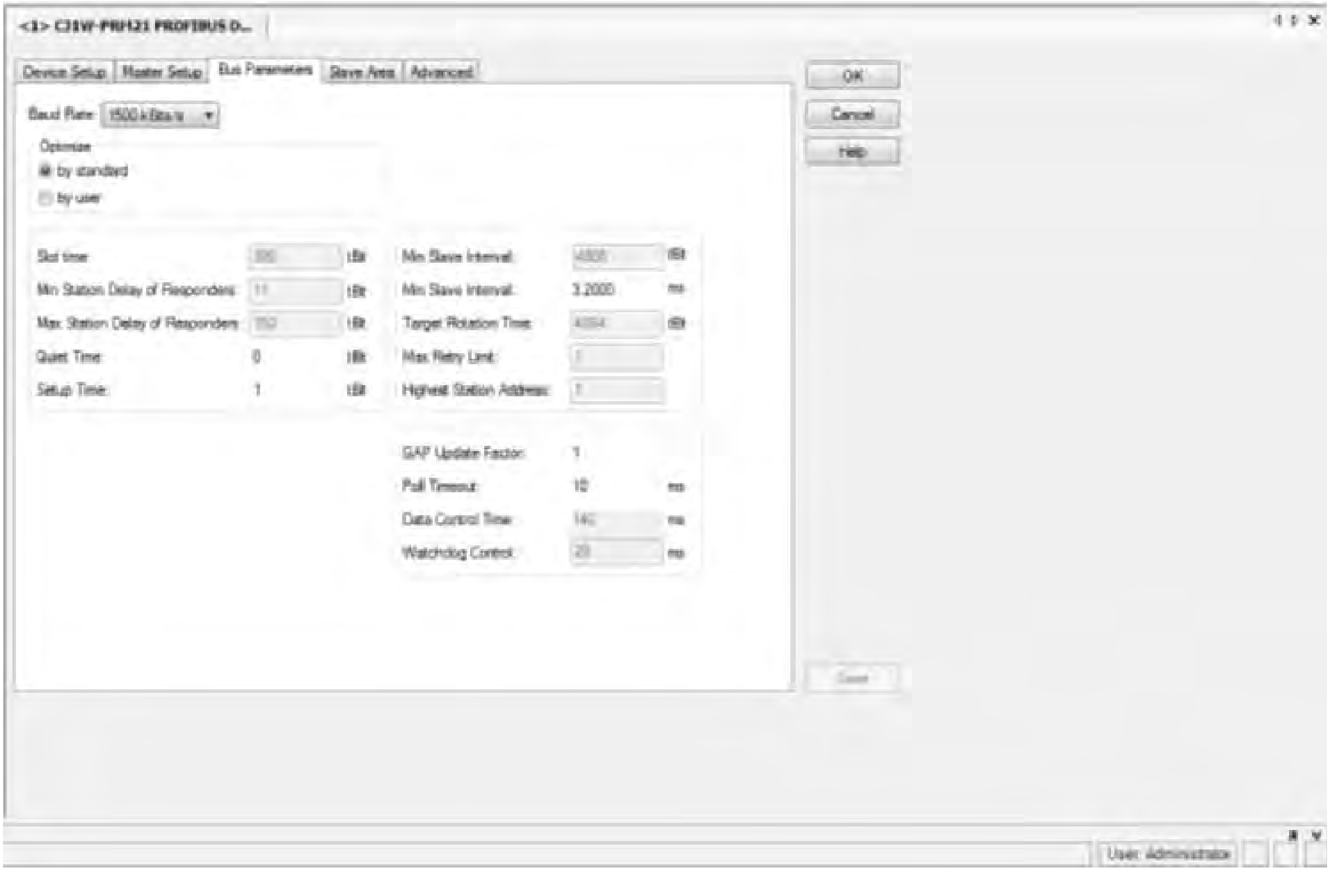
The Bus Parameter Setup tab contains all the settings required to setup the communication cycles on the network. The settings depend on the selected baud rate, the number of slaves, the amount of I/O data per slave, etc.

By default, the CJ1W-PRM21 Master DTM will calculate the bus parameters, based on this information.

Precautions for Correct Use

Although the user can decide to modify some of these parameters, it is not recommended. Making the wrong configuration may lead to unexpected behavior.

An example of the Bus Parameter tab is shown below.



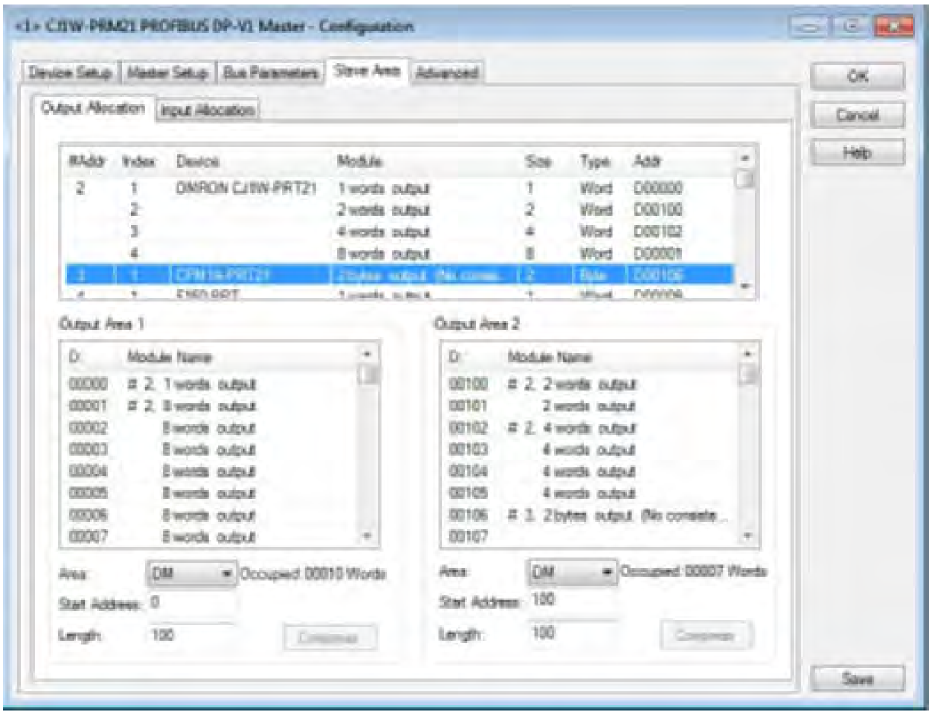
The baud rate has been set to 1500 kbps. The amount of slaves and the amount of I/O data, results in a poll cycle time of approximately 5.2 ms (Min Slave Interval).

After making the changes, select the **Save** button in the lower right corner of the user interface to accept the changes. Next select the Slave Area tab to display the I/O Mapping.

5-4-3 Defining and Changing the I/O Mapping

The I/O data of all slaves can be mapped on to the CPU memory areas through two Output Areas and two Input Areas. The Output data can be distributed over two Output Areas, each of which can be mapped on to CPU memory. Similarly, the Input data can be distributed over two Input Areas, each of which can be mapped on to CPU memory.

The figure below shows the CJ1W-PRM21 Master DTM’s Slave Area tab for an example network with a CJ1W-PRT21, a CPM1A-PRT21, and an F150-PRT Vision system.



By default all Output data is mapped on to Output Area 1 and all Input data is mapped on to Input Area 1. Each of these Areas can be mapped on to CPU memory independently of each other.

Changing the mapping can be achieved using drag & drop. The module which is mapped to Area 1 and which must be mapped to Area 2, can be copied there by dragging it from the overall module list on top to Area 2.

The I/O mapping concept is discussed in section *5-5-2 Mapping I/O Data*.

Note 1 By default the Auto-Addressing option will be enabled (see section *5-4-1 Setting the Master Parameters*). If any I/O modules are moved from one Area to another, the I/O modules in first Area are re-mapped to close all the gaps between mappings.

Precautions for Correct Use

When mapping the I/O Areas, make sure that the I/O data will not overlap the Unit's own CIO Area or one or more of the I/O data areas of any other CPU or I/O Unit. The CJ1W-PRM21 Master DTM does not check this. Failure to avoid this, will lead to unpredictable behavior of the Unit.

5-4-4 Configuring CX-Server

● Configuring Communication

The CJ1W-PRM21 Master DTM uses CX-Server to connect to the Unit for downloading a configuration as well as monitoring the Master Unit. To setup the communication to the Unit, perform the following procedure.

1 Open the CJ1W-PRM21 Master DTM Configuration Interface, Device Setup tab.

2 Make sure that the Unit Number has been set to the unit number set on the PROFIBUS Master Unit, through the rotary switch on the front.

3 Select the **Configure** button to start CX-Server.

● CX-Server

Upon pressing the **Configure** button, CX-Server is launched and displays the CX-Server User Interface as shown below

In order to configure CX-Server for communication with the Unit, perform the following procedure.

1 Select the type of CPU to which the Unit is attached, from the **Device Type** drop down selection box.

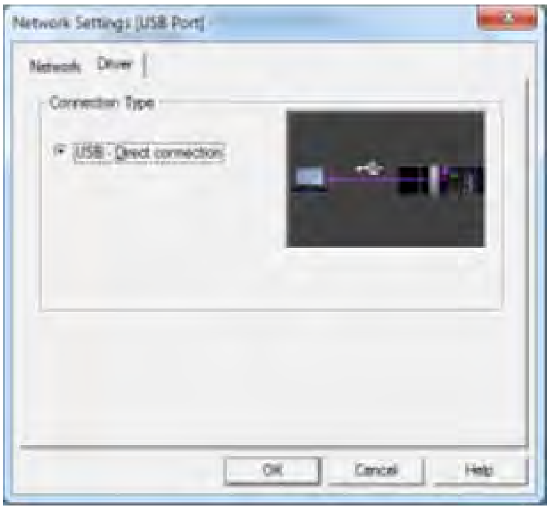
2 Press the **Settings** button next to the CPU type selected. The CPU settings window (see figure below) is displayed.

3 In this window make the proper adjustments if necessary. The selections made, must match the physical configuration of the CPU system. When done, press the **OK** button.

4 Select the **Network Type** to be used as connection between the PC and the Unit. The available options may include other CPU systems or Communication Units, which are setup to act as a gateway. Refer to *CX-Server Runtime User Manual* (Cat. No. W391) for details on configuring CX-Server.

Note 1 Only the direct connections between the PC and the CPU on which the Unit is attached are considered. These include Ethernet and USB.

2 Select the **Settings** button next to the Network Type selected, to display the Network settings window, and select the Driver tab (USB is shown as the example below).



3 Make the necessary selections to facilitate communication between the PC and the CPU to which the PROFIBUS Master Unit is attached, and press the **OK** button.

● Testing CX-Server setup

After making the settings, press the **OK** button to close the CX-Server interface. In order to verify that the communication has been setup correctly, press the **Test** button in the Device Setup tab of the DTM Configuration User Interface. This will initiate a command to read the Unit's profile, i.e. the name of the Unit and the firmware version.

If the communication has been setup correctly, the response of the command will yield the required information which will be displayed in the Device Information box in the **Description** and **Firmware Version** fields. If the communication is not setup correctly, the two fields will contain three dashes, i.e. "---", and an Error message will be displayed in the Error Log view of CX-ConfiguratorFDT. The communication settings must be changed to the correct value first. Refer to *A-5 CX-ConfiguratorFDT Warning and Error Messages* for more information on communication and download errors.

5-4-5 Downloading the Configuration

● Downloading Parameters

In order to download the parameter sets to the CJ1W-PRM21 PROFIBUS Master Unit, the following sequence must be performed.

1 Select the CJ1W-PRM21 Master DTM in the Network view and right-click the mouse to display the context menu.

2 Select **Download Parameters** from the menu, to initiate a download. A communication channel through CX-Server will be opened automatically.

3 When communication is achieved with the CPU, a warning window will be displayed, notifying the user that the CPU will be switched to PROGRAM mode. If the user confirms this, the download will continue.

4 The downloading process is handled by the CJ1W-PRM21 Master DTM. The CJ1W-PRM21 Master DTM will switch the Master Unit to OFFLINE, commence the download, and after successful download, issue a command to the Master Unit to store the parameter sets in the Unit. A window is displayed to show the progress of the download.

5 After storage has been completed, the CJ1W-PRM21 Master DTM will issue a command to restart the CJ1W-PRM21 PROFIBUS Master Unit. The new parameter sets will then become effective.

6 After restarting the Unit, a warning window will be displayed, allowing the user to switch the CPU back to its original mode.

Note 1 When switching the CPU back to its original mode, after download, the PROFIBUS Master Unit will behave according to the setting made in the Master Setup Tab (see section *5-4-1 Setting the Master Parameters*) If the Action to CPU mode change has been set to go to OPERATE mode when the CPU switches to RUN mode, the last action of the download process may start up the network. Therefore, if this is not desired, care must be taken to select the right setting.

2 In case of a failure in the download process, refer to *7-4-1 Troubleshooting Parameter Download* to establish the cause and the remedy.

5-5 I/O Communication Characteristics

5-5-1 I/O Data Configuration

I/O Data Configuration

Each slave device defines its I/O data size, sequence and format by means of I/O modules, each of which consists of one or more bytes, containing a PROFIBUS defined coding scheme. The I/O modules can define input data, or output data or both input and output data. The I/O modules are used to configure the I/O data exchange process in the Master Unit and also to verify the amount of I/O data to be exchanged with the slave device.

For modular slave devices the I/O modules are selected by the user from a list of available modules. The modules usually have to be consistent with the physical I/O of the slave device. For non-modular slave devices there is only one I/O module, and can therefore not be selected by a user.

The selected I/O module bytes are sent over the PROFIBUS network to the slave device at startup, using a Chk_Cfg message. The slave device has to check and approve the I/O modules sent by the Master Unit, before I/O data exchange can be established.

I/O Data Range Supported

TheCJ1W-PRM21 PROFIBUS Master Unit supports up to 4000 I/O modules, which can define a total of up to 7168 words of input data and/or output data. The I/O module selection made per slave by the user is also used to setup the I/O mapping, i.e. the definition of which I/O modules are mapped to which CPU memory location.

This section discusses the aspects of I/O data exchange between the CJ1W-PRM21 PROFIBUS Master Unit and the CPU.

5-5-2 Mapping I/O Data

I/O Mapping Concept

The CJ1W-PRM21 PROFIBUS Master Unit provides an I/O mapping concept, based on the I/O module selection for each slave device. Each selected I/O module can - depending on whether it defines input and/or output data - be mapped to one of two input and/or output areas. Each of the two input and output areas can be mapped to any CPU memory area location, independent of each other. The I/O mapping must be setup using the CJ1W-PRM21 Master DTM, as provided with CX-ConfiguratorFDT.

Mapping the I/O modules involves three steps:

- Allocate each I/O module to one or more of the Input/Output areas.
- Allocate each Input/Output area to CPU memory.
- Assigning user-defined variables to allocated Input/Output areas as required for the user program.

Default I/O Mapping Algorithm

When setting up the network, i.e. selecting the slave devices and I/O modules per slave, all input modules will - by default - be allocated to Input area 1, all output modules will be allocated to Output area 1. The following rules apply when allocating the I/O modules to the areas:

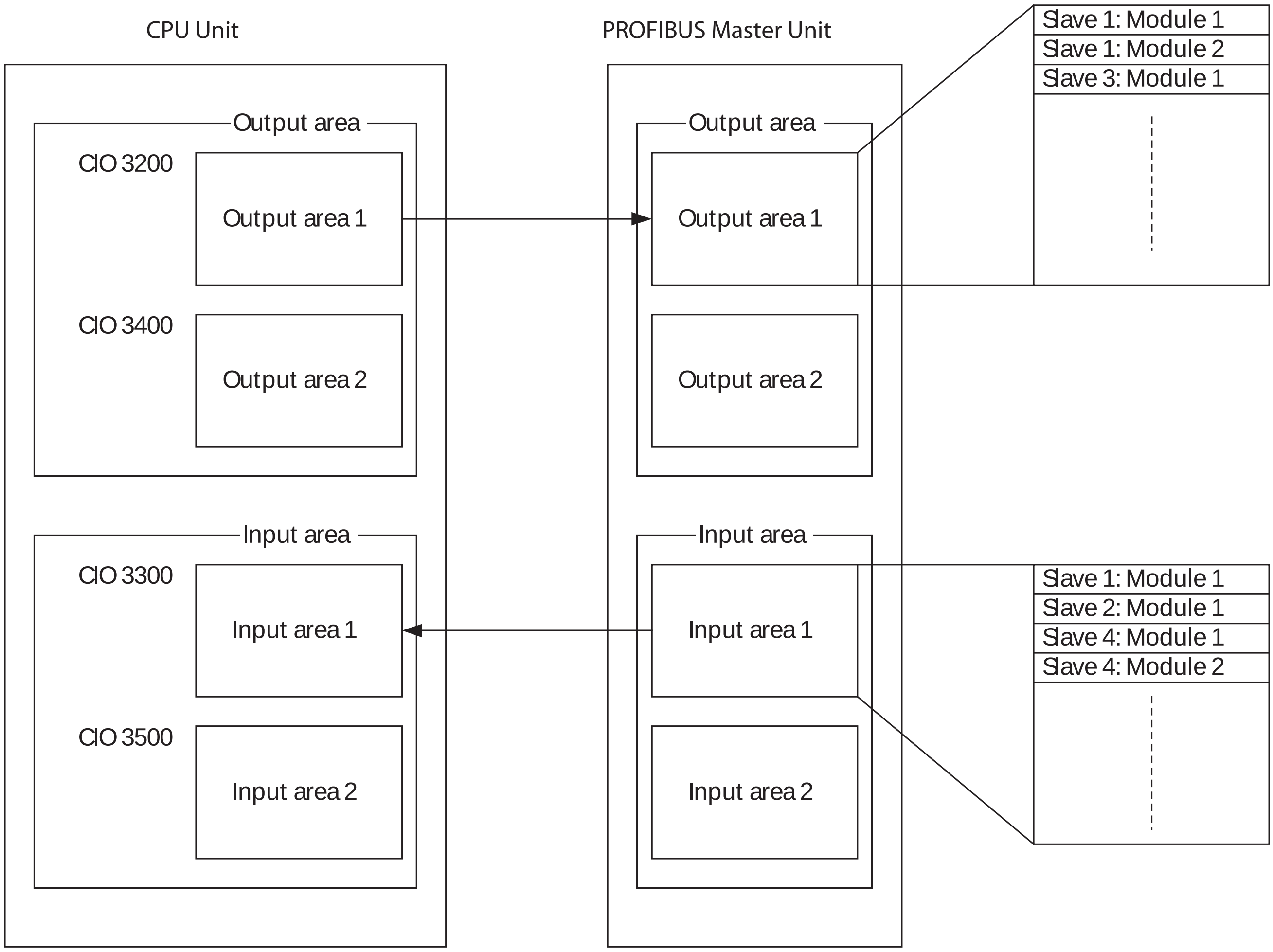
- I/O modules are mapped starting at the lowest address of an Input/Output area.
- I/O modules are mapped in ascending order according to slave device address.

- I/O modules per slave device, are mapped in the order in which they were selected, when setting up the slave device.

Furthermore, Input area 1 is by default mapped to CIO 3300, whereas Output area 1 is by default mapped to CIO 3200.

The default mapping algorithm is illustrated in the figure below, with the following configuration:

- Slave device 1: One input/output module, one output modules.
- Slave device 2: One input module.
- Slave device 3: One output module.
- Slave device 4: Two input modules.



Note 1 The end address of each Input/Output area in the CPU memory, depends on the size of the allocated I/O data.

2 If more than 100 words of input or output have been configured for the slave, overlap of memory areas will occur in the CPU if default I/O mapping is used as shown above.

Precautions for Correct Use

The default mapping of areas on to the CPU memory is the same default mapping as used in the CJ1W-DRM21 Devicenet Master/Slave Unit. Care should be taken to avoid data overlap if such a Unit is part of the same CPU system as the CJ1W-PRM21 PROFIBUS Master Unit.

The CJ1W-PRM21 PROFIBUS Master Unit, will assemble the correct PROFIBUS data messages from the storage order in the Input and Output memory areas.

Auto Addressing

The default allocation of I/O modules, i.e. I/O modules are mapped in ascending order of slave addresses and module selection, uses the concept of Auto Addressing of the CJ1W-PRM21 Master DTM. Auto Addressing will (re)allocate I/O modules according to the algorithm explained above in each area.

If a configuration has been selected, which is changed later by adding an I/O module to one of the slaves, the Auto Addressing feature will add that module to the default area between the already selected modules of that particular slave device.

Precautions for Correct Use

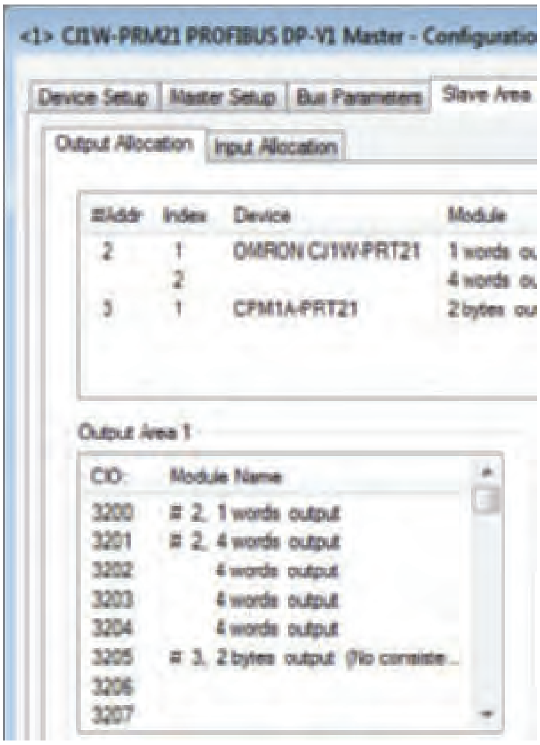
When an I/O module is added to or deleted from a configuration at a later point in time, Auto Addressing will cause a change in the addresses of subsequent I/O modules in an Input/Output area. This will cause I/O data of (a part of the) slave devices to be re-mapped to different locations in the CPU memory. In order to avoid unexpected results, the CPU user program and User Defined Variables may have to be adapted as well.

Note **1** Auto Addressing will not change the allocation of I/O modules to a certain area, i.e. a module allocated to Input/Output area 2 will not be re-allocated to area 1 if Auto Addressing is enabled.

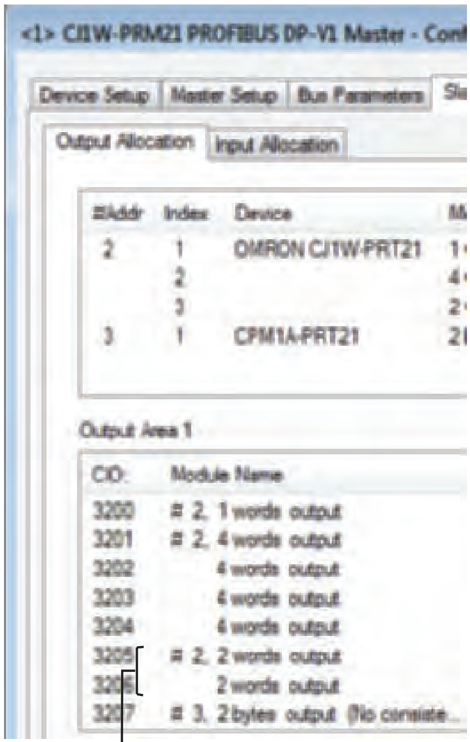
2 Auto Addressing will not change the start address of the areas.

3 Auto Addressing is by default enabled, when starting a new project. It is however, disabled for existing projects to avoid unwanted re-mapping.

The figure below shows an example of the effects of Auto Addressing on (re)allocation of I/O modules. In the original I/O configuration on the left, the first slave - an OMRON CJ1W-PRT21 - consisted of two I/O modules. In new configuration one I/O module was inserted, and subsequent modules were re-allocated in the process.



Initial I/O Configuration



One I/O module of two output words was inserted, and re-allocated subsequent I/O modules.

Note The start address of Output area 1 in the example remains the same after adding an I/O module.

● Re-allocating I/O Modules

After setting up the initial I/O configuration the I/O modules can be re-mapped to the second Input/Output area. This can be accomplished by using drag & drop to move the I/O modules. To accomplish this, perform the following sequence.

1 Open the CJ1W-PRM21 Master DTM - Configuration User Interface.

2 Select the Slave Area tab. The window shows two sub tabs: One for Output Allocation and one for Input Allocation. The following points apply to each of these tabs.

3 After setting up the initial I/O configuration, all I/O modules will be shown in the overall list in the upper half of the Slave Area tab. This is a pick list from which modules can be selected. The allocated I/O modules are listed in area 1, the column on the left of the lower half of the window.

4 The I/O modules in the pick list, all remain there. The allocated I/O modules are copies of the modules selected from the pick list.

5 In order to move an I/O module from one area to another, select the module in the pick list.

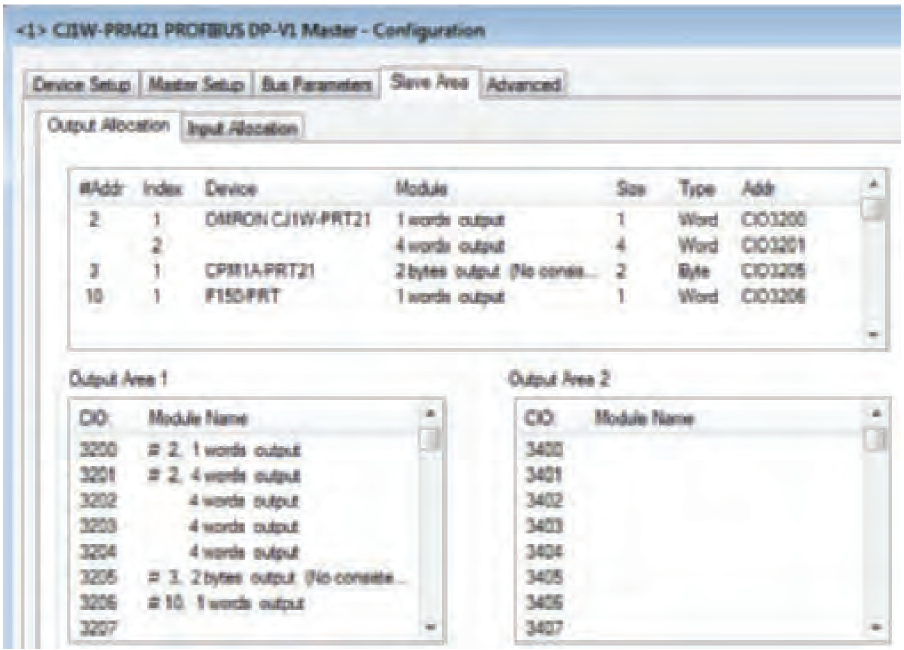
6 Hold the left mouse button and drag the I/O module to the Input/Output area of choice. Release the left mouse button to drop the module in place.

Note The area to place the module in must be empty. The area to put the modules in does not need to be selected first.

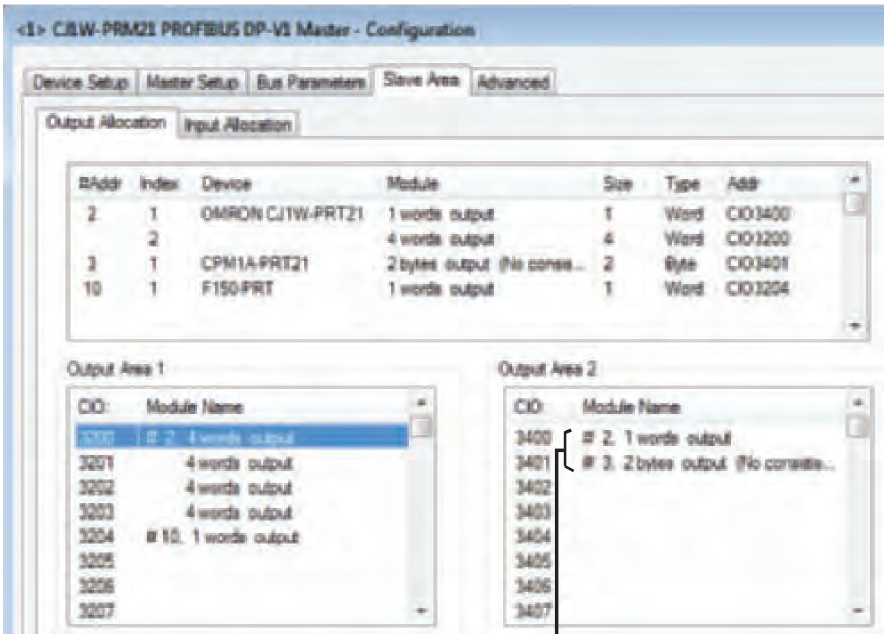
● Auto Addressing and Re-allocating I/O Modules

Auto Addressing (re)allocates I/O modules in all Input/Output areas. If after setting up the initial I/O configuration two or more I/O modules are moved from one area to another, Auto Addressing maintains the same sequence, i.e. the slave device with the lowest address and its I/O modules in the selected sequence are allocated before a slave device with a higher address.

In the figure below two output modules from the initial I/O configuration (top window) have been re-allocated to Output area 2 (bottom window).



Initial I/O configuration



The first Output modules
of slave device #2 and #3
were moved to Output area 2.

The example shows that the sequence of slave addresses is maintained, the sequence of I/O modules selected is maintained and the I/O modules are allocated to the lowest address of the area.

Enable/Disable Auto Addressing

The Auto Addressing feature can be disabled in the CJ1W-PRM21 Master DTM. Perform the following sequence to control Auto Addressing.

1. Open the CJ1W-PRM21 Master DTM - Configuration User Interface.
2. Select the Master Setup tab.
3. Enable/Disable Auto Addressing by selecting/deselecting the **Auto Addressing** checkbox in the Support box.
4. When Auto Addressing is being enabled, a warning message is displayed, informing the user of the effects of enabling Auto Addressing.

Precautions for Correct Use

Enabling Auto Addressing has the immediate effect of re-allocating I/O modules of an existing configuration, within each Input/Output area. The I/O modules are re-mapped according to the algorithm described above.

Note Disabling Auto Addressing has no immediate effect on an existing I/O mapping.

I/O Mapping Without Auto Addressing

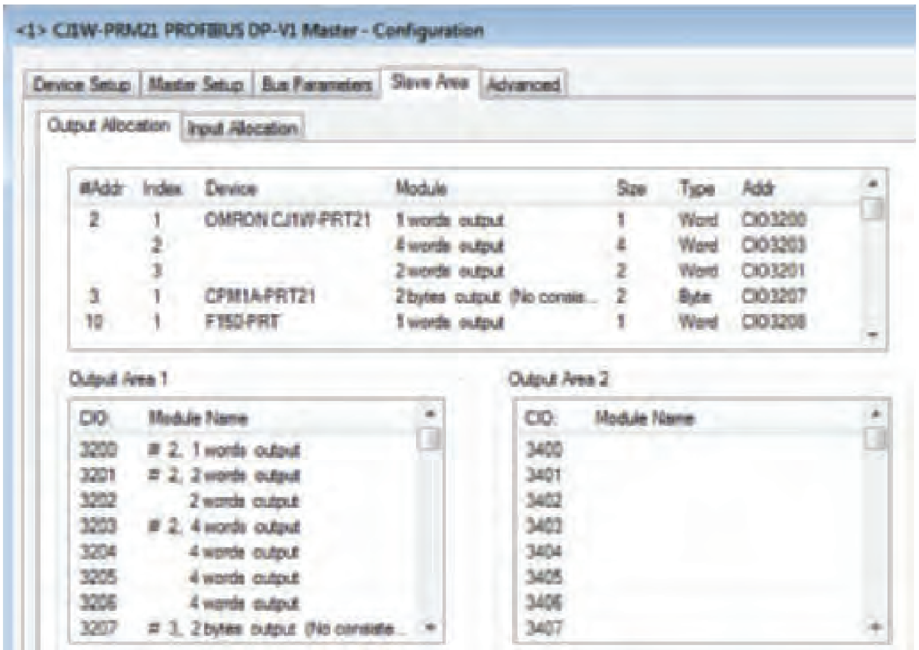
A disabled Auto Addressing feature has the following effects on I/O mapping:

- When adding new slave devices or new I/O modules to an existing slave configuration, the I/O modules will be mapped to the first I/O areas, but the modules will be appended to the existing I/O mapping.
- When deleting a slave device from the network configuration, or deleting I/O modules from a slave device, the deleted I/O modules will leave gaps behind in the already existing I/O mapping. If after deleting an I/O module a slave device still has more than one module configured and these modules are not in the same place, the DTM will attempt to remap them together.
- Changing the address of a slave device, of which already an I/O mapping exists, has no effect on the existing mapping.
- Selecting an additional I/O module for a slave device, in the presence of already allocated I/O modules, will cause a complete re-map of all existing modules if the total I/O does not fit within the space it is already occupying. The modules are re-mapped to the next available location in the area, leaving behind a gap in the existing I/O mapping. Subsequent I/O modules of other slave device will remain mapped as before the module addition.
- When moving an I/O module from one area to another, they can be located anywhere with in the target area. They are not re-mapped to the start of that.
- When moving an I/O module from one area to another, the module leaves behind a gap in the I/O mapping of the first area.

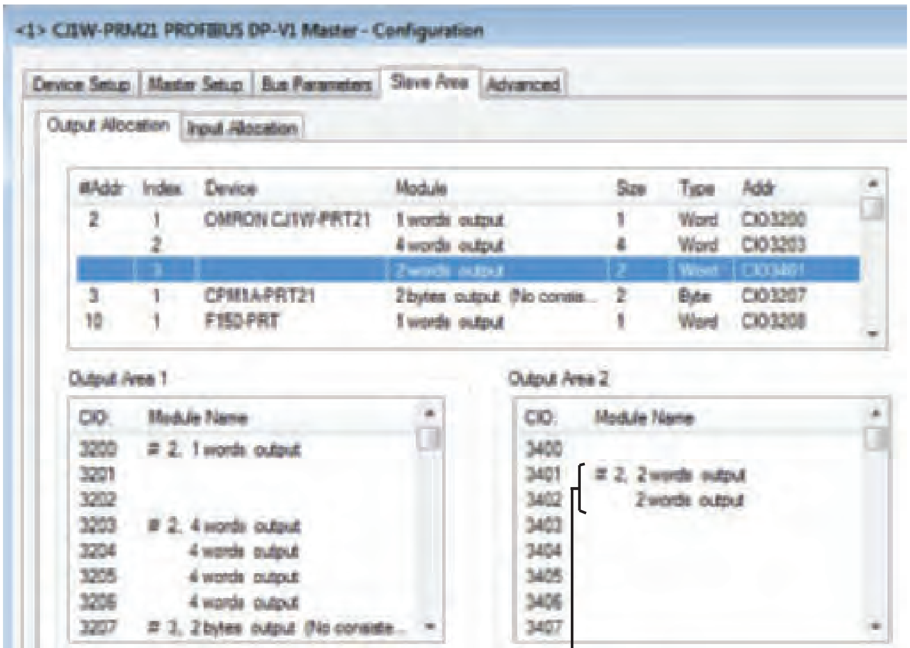
Note **1** Gaps in the I/O mapping still contribute to the total size of an area, although they do not contain valuable data. They therefore decrease the total I/O capacity of the CJ1W-PRM21 PROFIBUS Master Unit, and unnecessarily occupy CPU memory.

2 In the I/O data exchange with the CPU, these gaps will contain zeros.

The figure below illustrates the effects of re-allocating I/O modules, when Auto Addressing has been disabled.



Initial I/O Configuration



Note: Auto-addressing is disabled

Output module 2 of slave device #2 was moved to Output area 2, location CIO 3401, leaving behind a gap in Output area 1.

● Removing Gaps from the I/O Mapping

Since gaps in the I/O mapping are generally undesirable, the CJ1W-PRM21 Master DTM provides a means to remove all gaps, after finalizing the I/O mapping procedure. This removal is accomplished by compressing the I/O modules in a particular area.

Compressing the I/O Mapping

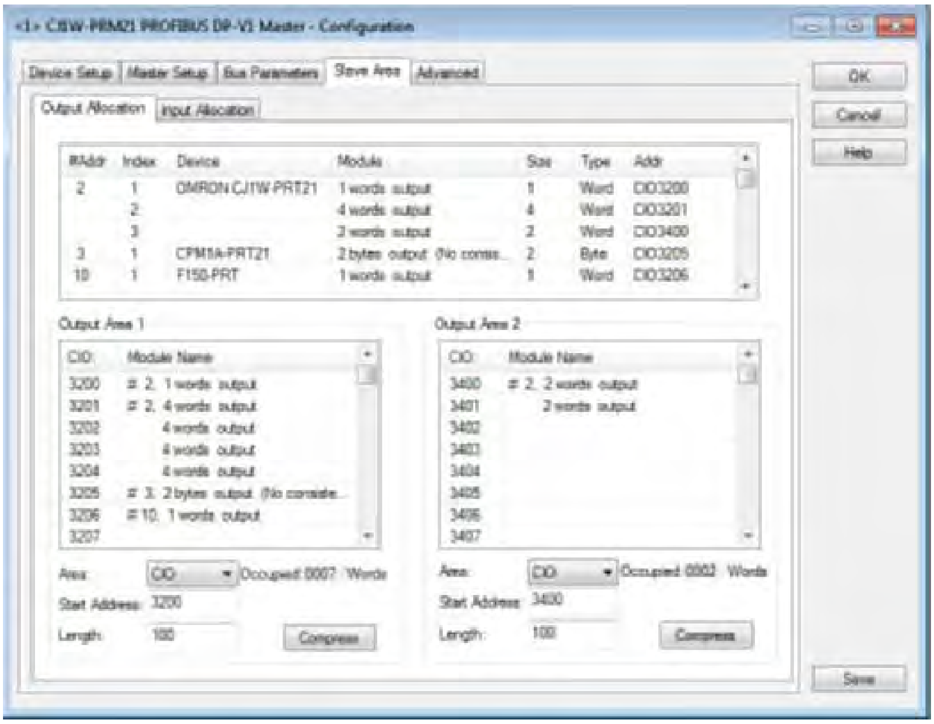
Compressing re-allocates all I/O modules in an area as close to the start of the area as possible. Compressing an area does not change the sequence of the slave devices and/or the I/O modules. It only removes the unused memory gaps. Compressing can be initiated for each area individually.

In order to compress an area, perform the following sequence.

1. Open the CJ1W-PRM21 Master DTM - Configuration User Interface, and select the Slave Area tab.
2. Select the Output Allocation tab or the Input Allocation tab, to display the areas to compress.
3. To compress the area, press the **Compress** button at the bottom.
4. After finalizing the compress action, select the **Save** button at the lower right corner, to save the changes made.

Note Compressing an Input/Output area has no effect on the start address of the area.

The figure below, shows the effects on the previous example, after pressing the **Compress** button in both Output areas.



Selecting the I/O Area Start Address

After finalizing the mapping of the I/O modules on to the various I/O areas, the addresses to which the areas will be mapped in the CPU memory need to be defined. To define the area mapping, perform the following settings.

1. For each area, which contains I/O modules, select the CPU memory area.
2. For that area, set the address to which the first location of the Input/Output area will be mapped.
   The Input/Output area will occupy the CPU memory area from this start address to ascending memory locations.

3 The total size per Input/Output area can be found for each area, next to the CPU memory area selection box (for example, the figure above; Output area 1 occupies 7 words).

Note 1 The CJ1W-PRM21 Master DTM will check whether two or more selected mappings in the CPU memory will be overlapping. In that case, the start address set, will be shown in red.

2 If any mapping error is discovered by the Master DTM, an error message is displayed and download is terminated.

5-5-3 Supported Data Types

The CJ1W-PRM21 PROFIBUS Master Units perform an interface function between a PROFIBUS network and the NJ-series controller unit. On both sides of the interface different formats for data and data storages are used.

To ensure that I/O data transferred through the interface can be used on both sides of the interface without additional formatting, the CJ1W-PRM21 PROFIBUS Master Units perform the necessary data formatting. This ensures that I/O data in the CPU memory can be processed by standard CPU functions and that the I/O data transferred to/from the PROFIBUS DP slaves over the network is compliant with the PROFIBUS DP definitions.

The table below lists the I/O data formats supported by both the PROFIBUS network and CPU. See *A-6 I/O Data Type Definitions* for more information about the conversion of I/O data.

Data Type	Size [bytes]	PROFIBUS DP	NJ-series Controller Unit
Single 8-bit Integer signed/unsigned	1	Supported. Data is transmitted on a byte-by-byte basis.	Not supported Minimum is 16-bit words. Two bytes will be formatted in one word. Words containing odd bytes will be padded with zeros.
Single 16-bit Integer signed/unsigned	2	Supported. Data is transmitted on a Most-Significant-Byte First basis.	Supported. Single 16-bit integers are transferred to memory words in CPU memory.
Single 32-bit Integer signed/unsigned	4	Supported. Data is transmitted on a Most-Significant-Byte First basis.	Supported. Data is stored with the Least-Significant-Word at the lowest address.
Floating point	4	Supported. Data is transmitted on a Most-Significant-Byte First basis.	Supported. Data is stored with the Least-Significant-Word at the lowest address.
Visible string	--	Supported. Length of string is fixed by I/O configuration. Data is transmitted on a left-to-right basis (i.e. first character is transmitted first).	Supported. First characters are stored at the lowest address. String is padded with a zero byte or a zero word, depending on the number of characters.
Byte string	--	Supported. Length of string is fixed by I/O configuration. Data is transmitted on a left-to-right basis (i.e. first character is transmitted first).	Supported. First bytes are stored at the lowest address. String is padded with a zero byte or a zero word, depending on the number of characters.
Date / Clock time	7	Supported. Date/Time format contains absolute time with respect to start of century. Date/Time is coded in individual bytes.	Not Supported. Date/Time format is transferred to CPU memory as string of words.

Data Type	Size [bytes]	PROFIBUS DP	NJ-series Controller Unit
Time of day	6	Supported. Time of day format contains time since midnight.	Not Supported. Time of day format is transferred to CPU memory as string of words.
Time difference	6	Supported. Time difference format is the same as Time of day format, but contains a time difference.	Not Supported. Time difference format is transferred to CPU memory as string of words.

5-5-4 Exchanging I/O Data Over PROFIBUS

The cyclic refresh cycles of the CPU and the I/O data exchange cycles of the PROFIBUS network are two asynchronous processes for which the CJ1W-PRM21 PROFIBUS Master Unit performs the interface function.

● CPU Cyclic Refresh vs. PROFIBUS I/O Exchange Cycle

In general, all I/O data exchanged during a PROFIBUS I/O data exchange cycle must be exchanged with the CPU as soon as possible after the end of each PROFIBUS DP I/O data exchange cycle is signalled.

In order to transfer I/O data between the Unit and the CPU, the Unit has to request a transfer of I/O data. The actual transfer of I/O data will then be performed during the next CPU cyclic refresh which depends on the CPU user program.

● CPU Cyclic Refresh Rules

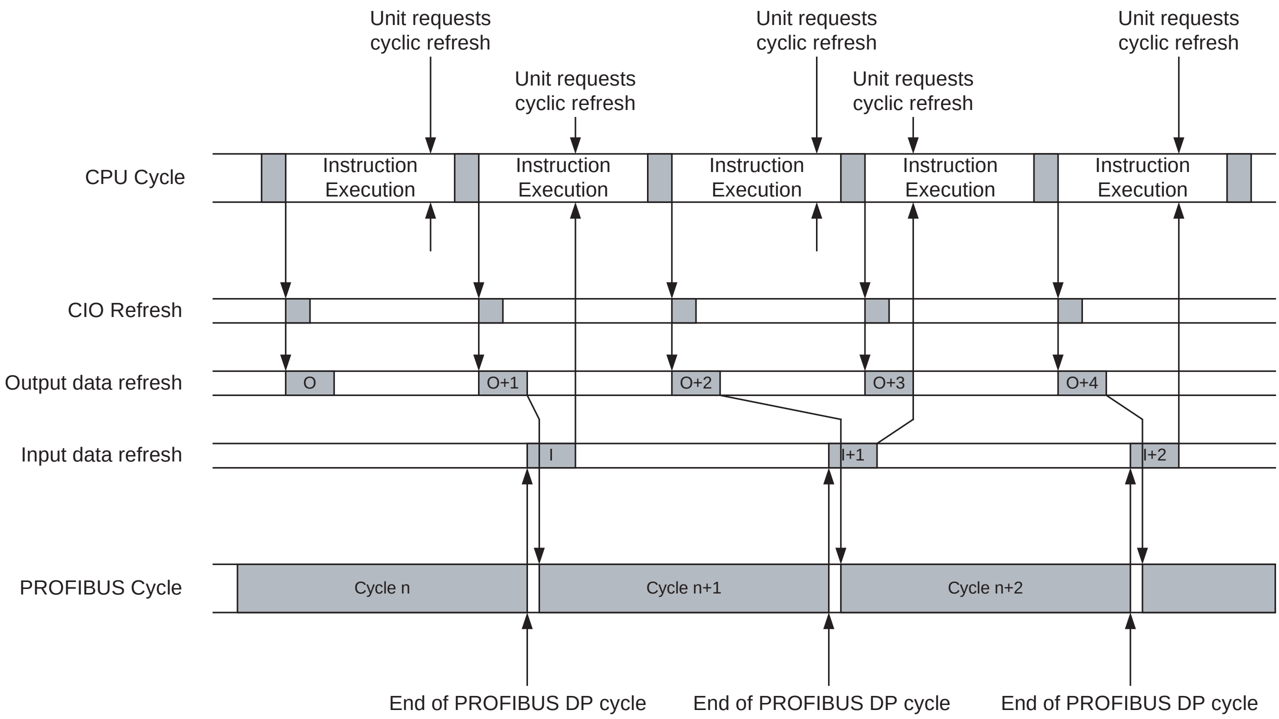
To avoid missing I/O data as much as possible the CJ1W-PRM21 uses the following rules for cyclic refresh with the CPU.

- The PROFIBUS Master Unit estimates (based on the actual CPU cycle and the last cyclic refresh) when a new cyclic refresh from the CPU can be expected and requests a refresh of I/O data before the next refresh event.
- If the end of PROFIBUS DP I/O data exchange is signalled before the request based on the estimation is issued, the PROFIBUS Master Unit will immediately request a cyclic refresh.
- If the end of PROFIBUS DP I/O data exchange is signalled after the request has been issued or during the cyclic refresh, the PROFIBUS Master Unit will request a cyclic refresh as soon as the requested cyclic refresh has been finished.

The implementation of these rules are illustrated in the figures below for two distinctive cases.

● PROFIBUS DP Cycle > CPU Cyclic Refresh

The figure below shows the effects of these rules for the case in which the PROFIBUS DP I/O data exchange cycle > CPU cyclic refresh



PROFIBUS DP I/O data exchange cycle > CPU cyclic refresh results in the following I/O transfer characteristics.

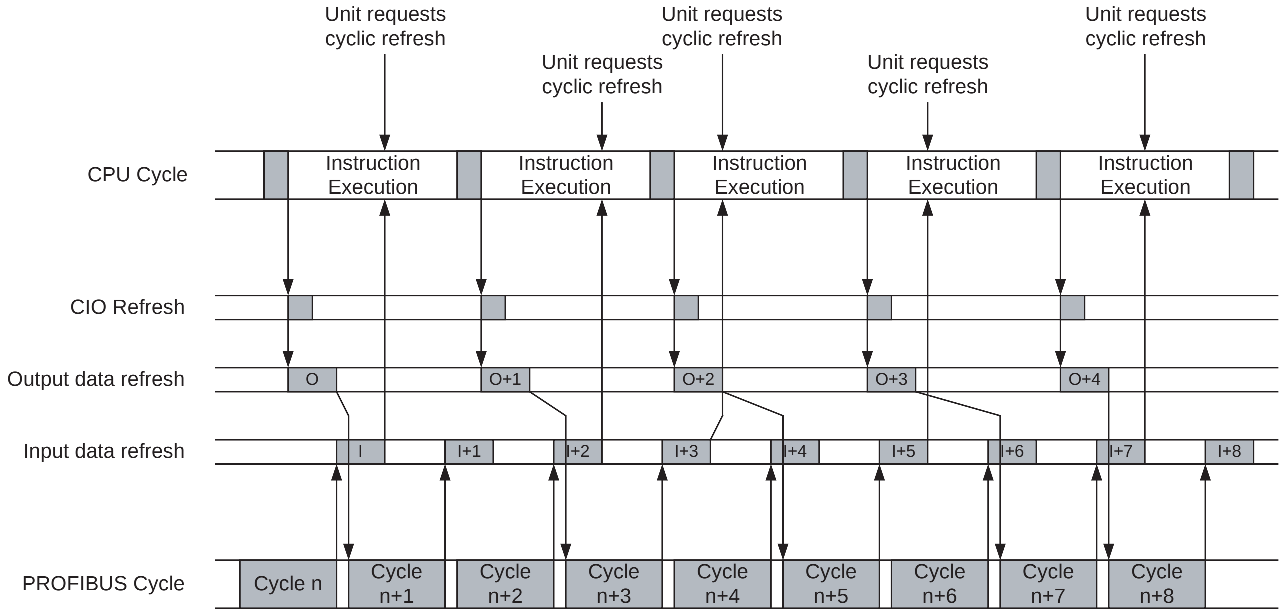
- Not all output data is guaranteed to be transmitted over the PROFIBUS network (referring to the figure above: Output data marked with “O” is overwritten by “O+1” and therefore lost).
- Input data is always sent to the CPU.

Note **1** CPU cyclic refresh times may vary, depending on the execution of the user program. If variation is too large, this may result in I/O data being lost.

2 To prevent output data not being transmitted over the PROFIBUS network the PROFIBUS DP cycle time must made at least two times the CPU cyclic refresh time. This can be accomplished by changing the Target Token Rotation time in the Master DTM Configuration User Interface (see section *5-4-2 Setting the Bus Parameters*).

● PROFIBUS DP Cycle < CPU Cyclic Refresh

The figure below shows the effects of the cyclic refresh rules for the case in which the PROFIBUS DP I/O data exchange cycle < CPU cyclic refresh



PROFIBUS DP I/O data exchange cycle < CPU cyclic refresh results in the following I/O transfer characteristics.

- All output data sent by the CPU is transmitted over the PROFIBUS network.
- Not all Input data is transferred to the CPU (referring to the figure above: Input data marked with I+1, I+4, I+6 and I+8 are lost).

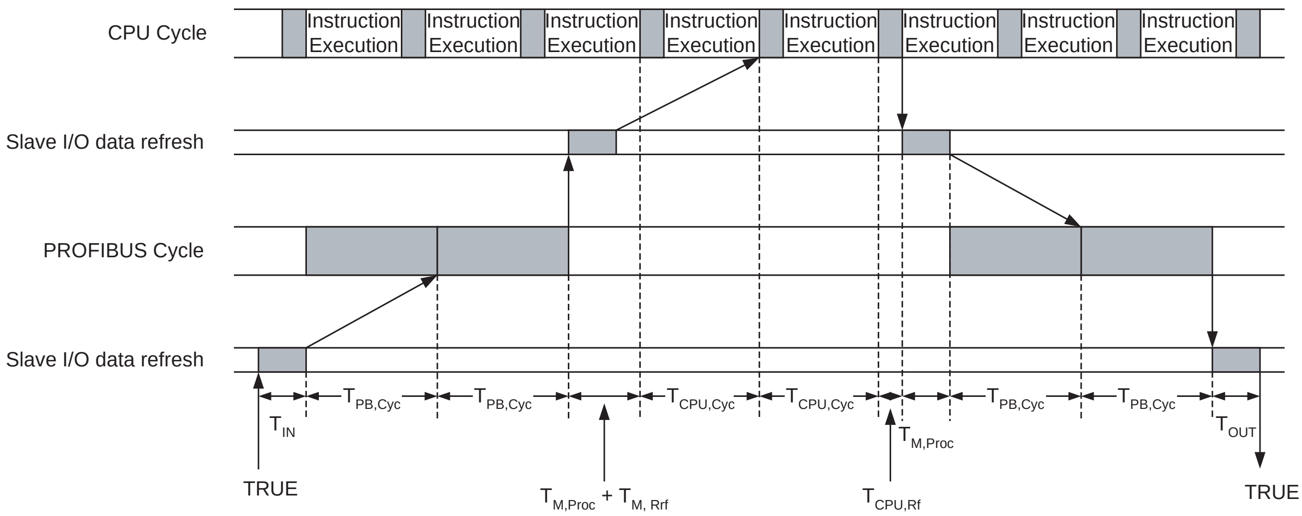
Note To prevent input data not being transferred to the CPU, the CPU cyclic refresh time must be at least two times the PROFIBUS DP cycle time.

5-5-5 I/O Response Time

The maximum I/O response time is defined as the time from the moment an input on a slave device with the lowest PROFIBUS address is switched TRUE (FALSE) until the moment the output on a slave device with the highest PROFIBUS address is switched TRUE (FALSE).

● PROFIBUS DP Cycle > CPU Cyclic Refresh

The figure below shows the timing in case the PROFIBUS DP cycle > CPU cyclic refresh.



T_{IN}	Slave device Input TRUE (FALSE) delay.
$T_{PB,Cyc}$	PROFIBUS I/O data exchange cycle time (See Appendix A Bus Parameters)
$T_{M,Proc}$	I/O Processing time in the Master Unit. Minimum value is 430 μs but may increase with increasing I/O data size.
$T_{M,Rrf}$	Master request cyclic refresh until actual start of cyclic refresh.
$T_{CPU,Cyc}$	CPU cycle time.
$T_{CPU,Rf}$	CPU cyclic refresh time.
T_{OUT}	Slave device Output TRUE (FALSE) delay.

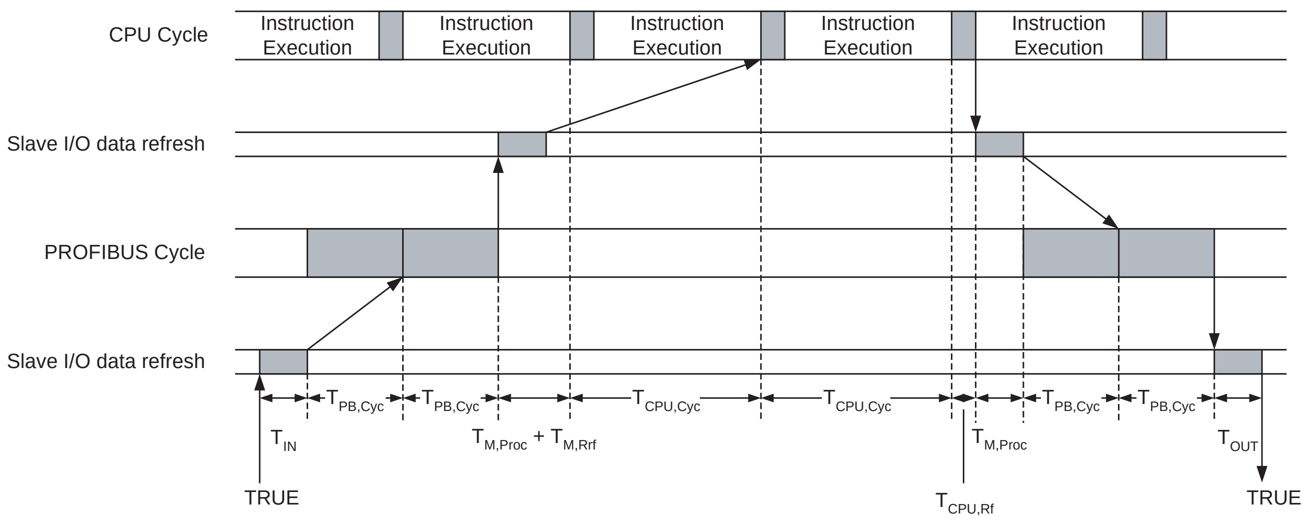
The total I/O response time is the sum of all components:

$T_{IO} = T_{IN} + 4{*}T_{PB,Cyc} + 2{*}T_{M,Proc} + T_{M,Rrf} + 2{*}T_{CPU,Cyc} + T_{CPU,Rf} + T_{OUT}$

Note The calculation assumes the presence of only one Master Unit on the PROFIBUS network.

● PROFIBUS DP Cycle < CPU Cyclic Refresh

The figure below shows the timing in case the PROFIBUS DP cycle < CPU cyclic refresh.



T_{IN}	Slave device Input TRUE (FALSE) delay.
$T_{PB,Cyc}$	PROFIBUS I/O data exchange cycle time (See Appendix A, Bus Parameters)
$T_{M,Proc}$	I/O Processing time in the Master Unit.
$T_{M,Rrf}$	Master request cyclic refresh until actual start of cyclic refresh.
$T_{CPU,Cyc}$	CPU cycle time.
$T_{CPU,Rf}$	CPU cyclic refresh time.
T_{OUT}	Slave device Output TRUE (FALSE) delay.

The total I/O response time is the sum of all components:

$$T_{IO} = T_{IN} + 4*T_{PB,Cyc} + 2*T_{M,Proc} + T_{M,Rrf} + 2*T_{CPU,Cyc} + T_{CPU,Rf} + T_{OUT}$$

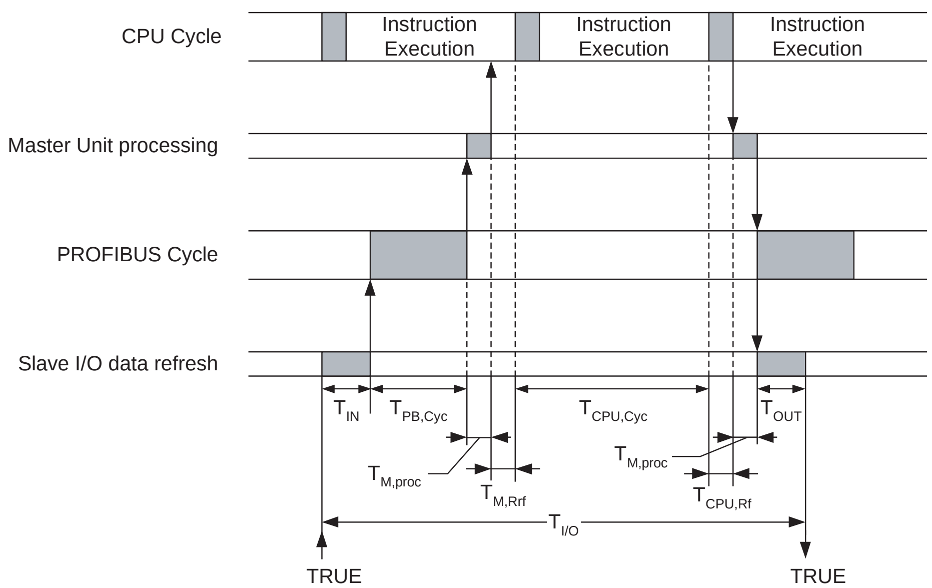
Note The calculation assumes the presence of only one Master Unit on the PROFIBUS network.

● Minimum I/O Response Time

The minimum response time, i.e. the time from an input on a slave device being set to the time the output on the same slave device is set is calculated, based on the figure below. The following assumptions are made:

The slave device is the first one in the PROFIBUS I/O data exchange.

The input data is available right before the internally generated cyclic refresh request is set. In this case, a complete cyclic refresh will take place (See section *5-5-4 Exchanging I/O Data Over PROFI-BUS*).



T_{IN}	Slave device Input TRUE (FALSE) delay.
$T_{PB,Cyc}$	PROFIBUS I/O data exchange cycle time (See Appendix A, Bus Parameters)
$T_{M,Proc}$	I/O Processing time in the Master Unit.
$T_{M,Rrf}$	Master request cyclic refresh until actual start of cyclic refresh.
$T_{CPU,Cyc}$	CPU cycle time.
$T_{CPU,Rf}$	CPU cyclic refresh cycle time.
T_{OUT}	Slave device Output TRUE (FALSE) delay.

The total I/O response time is the sum of all components:

$T_{IO} = T_{IN} + T_{PB,Cyc} + 2*T_{M,Proc} + T_{M,Rrf} + T_{CPU,Cyc} + T_{CPU,Rf} + T_{OUT}$

5-5-6 System Startup Time

● Startup Time Definition

The system startup time is the delay from the time the CJ1W-PRM21 PROFIBUS Master Unit is turned ON, or reset, until I/O data exchange with all slave devices has been established. For this, the following is assumed:

- The Master Unit has been configured to go to OPERATE mode if the CPU mode is set to RUN mode.
- All slave devices are powered up and initialized before the Master Unit is turned ON.
- All slave devices are assumed to go to I/O data exchange without delays.

The total system startup time is the sum of the following components:

- Master Unit startup checking.
- Initialization of communication with CPU CPU.
- Master Unit I/O configuration initialization after which the Master Unit goes to OPERATE.
- One PROFIBUS DP cycle to request slave diagnostics.
- One PROFIBUS DP cycle to transmit parameter messages to all slave devices.
- One PROFIBUS DP cycle to transmit the I/O configuration messages to all slave devices.
- One PROFIBUS DP cycle to request slave diagnostics.

The average time for the first three actions - assuming a maximum I/O configuration - is approximately 2 seconds. The remaining time depends on the PROFIBUS settings.

For a maximum I/O configuration, with 125 slave devices, 56 words I/O each, (i.e. the total I/O size amounts up to 7000 words) one PROFIBUS DP cycle lasts approximately 70 ms. A complete start up cycle will then last approximately 280 ms.

The total system start up time, from Unit reset until I/O data exchange, will then be 2.3 seconds.

Additional Information

- The NJ-series Controller CPU requires 10 to 20 seconds to start.
- It is recommended to program fail-safe circuits or use effective flags.

5-6 Operating the Network

5-6-1 User Access to the Network

There are several ways through which a user can have access to and control over the PROFIBUS network.

- Through a CPU user program: A CPU user program can set the operational mode of the Unit, send Global-Control commands, read Master and slave status/diagnostics information and access the Unit’s Error Log. Furthermore, the I/O data transferred between the PROFIBUS network and the CPU memory can be used by the user program via user-defined variables.
- Through CX-ConfiguratorFDT: The CJ1W-PRM21 Master DTM Diagnosis User Interface provides the user with buttons to set the operational mode of the Unit, send Global-Control commands, read Master and slave status information and access the Unit’s Error Log.

This section will explore both means to control the CJ1W-PRM21 PROFIBUS Master Unit.

The CJ1W-PRM21 Master DTM Diagnosis User Interface provides the means to control the Master Unit directly from CX-ConfiguratorFDT, running on a PC.

● Access to the Unit

To access to the Unit’s controls an online connection with the Unit has to be established. To achieve this perform the following sequence.

1 To go on line, select the DTM in the Network view and perform one of the following actions.

- Select the **Device - Go Online** option from the main menu, or the DTM context menu, or
- Select the button from the Tool Bar.

2 A communication channel will be opened through CX-Server. The name of the DTM in the Network view will turn to Italic font to indicate that the Unit is on-line.

3 From the context menu select the Diagnosis option. The DTM’s Diagnostics User Interface will be displayed.

4 Select the Online Operations tab for the Units controls.

Precautions for Correct Use

Controlling the CJ1W-PRM21 PROFIBUS Master Unit from the CJ1W-PRM21 Master DTM Diagnosis User Interface may interfere with a CPU user program running at the same time. This can result in unexpected behavior. It is recommended to change the CPU mode to PROGRAM mode to avoid this interference during the use of the CJ1W-PRM21 Master DTM Diagnosis User interface.

5-6-2 Changing PROFIUS Mode of the Master Unit

● PROFIBUS DP Network Modes

The PROFIBUS standard defines four different network modes, in which a Master Unit can operate. The modes are:

- **OFFLINE**: The PROFIBUS Master Unit does not access the network, nor does it respond to messages.
- **STOP**: The PROFIBUS Master Unit is on-line, but does not communicate with its slave devices. It does communicate with other Master Units, in that it passes the token message.
- **CLEAR**: The PROFIBUS Master Unit is on-line and communicates with its slave devices. It will parameterize all allocated slave devices but only read their input data. The Master Unit does not send valid output data to the slave devices. Instead it will send empty output data messages or messages containing zeros.
- **OPERATE**: The PROFIBUS Master Unit is on-line and communicates with its slave devices. It will parameterize all allocated slave devices and exchange all I/O data for which it has been configured.

● Normal Operating Modes

The OPERATE mode is the mode used for normal network operation. The CLEAR mode is the mode used for situations which require a safety state to fall back to (see section *5-6-4 Using Auto-CLEAR*).

● Changing the Mode from the CJ1W-PRM21 Master DTM

In order to change the Unit’s operational mode open the CJ1W-PRM21 Master DTM Diagnosis User Interface. The figure below shows this Online Operations tab. Press the desired mode button in the upper left corner of the window.

In order to change the network to OPERATE mode, i.e. start I/O data exchange, press the **OPERATE** button. The OPERATE status of the Master Unit can be retrieved from the Monitor - Master status tab in the same user interface.

Changing the Mode Using the CPU Program

The Unit's operational mode can also be changed from the CPU user program by setting the appropriate bit in the Software Switches word (see section *4-2-1 Software Switches (*_SwCmd)*).

Note If an attempt is made to change the operational mode while a previous change command is still being processed, the new command is ignored and the mode command error bit flag (*_MstrMdCmdErr) in the Master Errors word (see section *4-2-5 Master Errors (*_MstrErrSta)*) will be set.

Indirect Mode Changes

The Unit's operational mode can also be changed in indirect ways, i.e. without direct user or program interference.

- Mode changes caused by Auto-CLEAR: When the Auto-CLEAR function has been enabled and one or more of the slave devices on the network stop I/O data exchange the Master Unit's operational mode will automatically change from OPERATE to CLEAR. This is discussed in section *5-6-4 Using Auto-CLEAR*.
- Mode changes caused by CPU mode changes: An operational mode change will take place if the PROFIBUS Master Unit has been configured to change its operational mode together with the CPU mode, i.e. OPERATE when the CPU mode is set to RUN and CLEAR mode when the CPU mode is changed to PROGRAM mode. Refer to section *5-4-1 Setting the Master Parameters* for more information.

5-6-3 Transmitting Global-Control Commands

Global-Control commands

The CJ1W-PRM21 PROFIBUS Master Units support the transmission of Global-Control commands. These messages are unconfirmed broadcast messages (i.e. the slave devices do not send a response message), which can be used to synchronize I/O data related events two more slave devices.

I/O Data Synchronization

Two types of synchronization can be achieved.

- Synchronization of input data: The inputs on one or more slave devices are read at the same time. The synchronized data is transferred to the Master Unit during the next I/O data exchange cycle. The commands are defined as Freeze and Unfreeze.
- Synchronization of output data: The outputs on one or more slave devices are set at the same time. The synchronized data has been transferred to the slave devices during the previous I/O data exchange cycle. The commands are defined as Sync and Unsync.

Note **1** The CJ1W-PRM21 PROFIBUS Master Unit also uses Global-Control commands to broadcast its own operational mode to other devices on the network. These Global-Control commands are sent automatically, without user interference
- to all devices on the network (i.e. not to specific groups),
- always at the start of every I/O data exchange cycle, and
- only when the Master Unit is either in OPERATE or in CLEAR mode.

2 The user can only initiate transmission of Freeze/Unfreeze and Sync/Unsync to either all slave devices or specific groups of slave devices. These Global-Control commands are transmitted separately from the automatically transmitted messages, at the end of the PROFIBUS I/O data exchange cycle.

Group Address Setting

User initiated Global-Control commands can be transmitted to either all slave devices allocated to a Master Unit, or to one or more of up to eight groups of slave devices. The group addresses are defined by up to eight bits in a group address byte, which is part of the Global-Control command.

Note If a Global-Control command is targeted to all slave devices, all the group bits in the group address bytes are set to 0.

Setting the Group Address of a Slave Device

In order for a specific slave device to belong to a certain group, the group assignment for the slave has to be defined through the Generic Slave DTM Configuration User Interface. A slave device can belong to one or more groups at the same time, or to no specific group at all. The group assignment is sent to the slave devices as part of the parameter message.

To define the group assignment of a slave device, through the Generic Slave DTM, refer to section *5-3-3 Selecting the Group Assignment*.

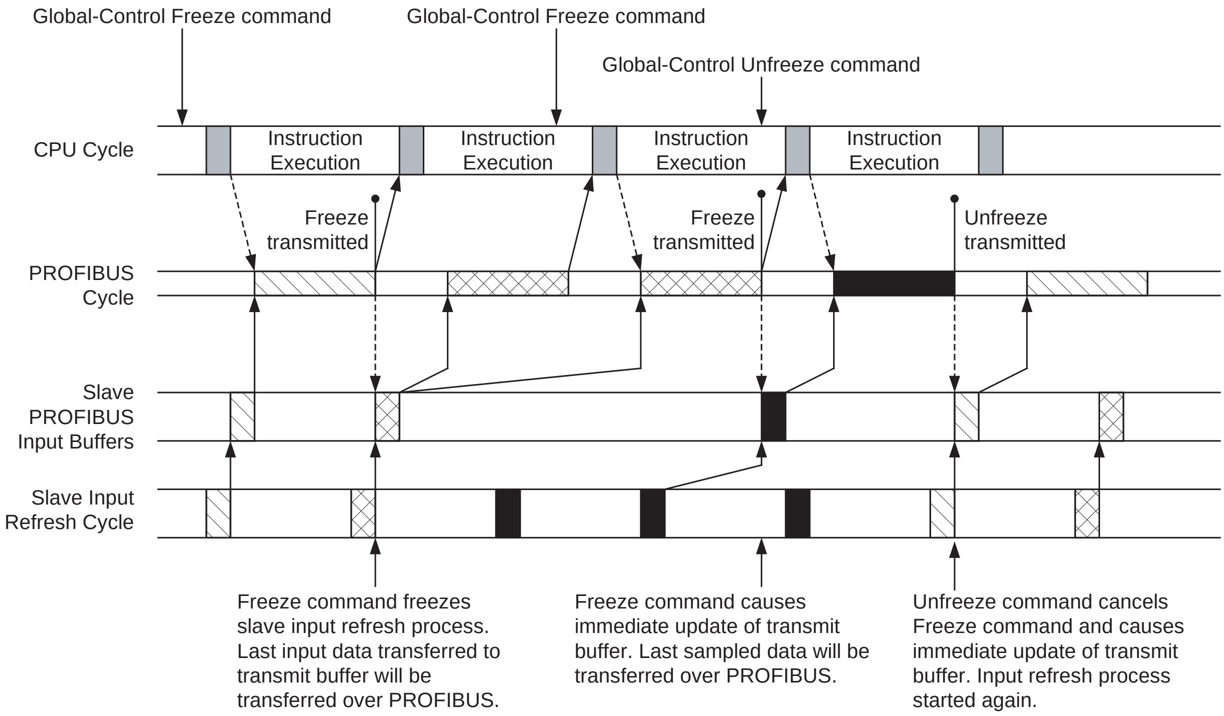
Freeze / Unfreeze commands

Sending a Global-Control - Freeze command to a slave device has the following effect

- The slave device will continue to read its physical inputs, but not send this data to the PROFIBUS Master Unit.
- Instead, it will continue to transfer the input data to the Master Unit from the moment the Global-Control - Freeze command was received.
- If a new Global-Control - Freeze command is sent, the slave device will update its PROFIBUS input buffers only once with the most recent physical input data and continue to transfer this data to the Master Unit with subsequent I/O data exchange messages.
- If a Global-Control - Unfreeze command is sent, the slave device will revert back to its original situation and transfer updated input information to the Master Unit with subsequent I/O data exchange messages.

Note If a Global-Control command contains both a Freeze and an Unfreeze command, the Unfreeze will prevail.

The figure shown below illustrates the Freeze / Unfreeze feature as implemented by the CJ1W-PRM21 PROFIBUS Master Unit.



Note The Global-Control command as set in the CIO words is transferred to the Unit together with the I/O data, but the Global-Control command is sent over the PROFIBUS network, following the I/O data. The Freeze command forces an immediate update of the PROFIBUS transmission buffers in the slave device, with the last input value sampled. This input data is then transferred to the PROFIBUS Master Unit, with the next I/O data exchange cycle.

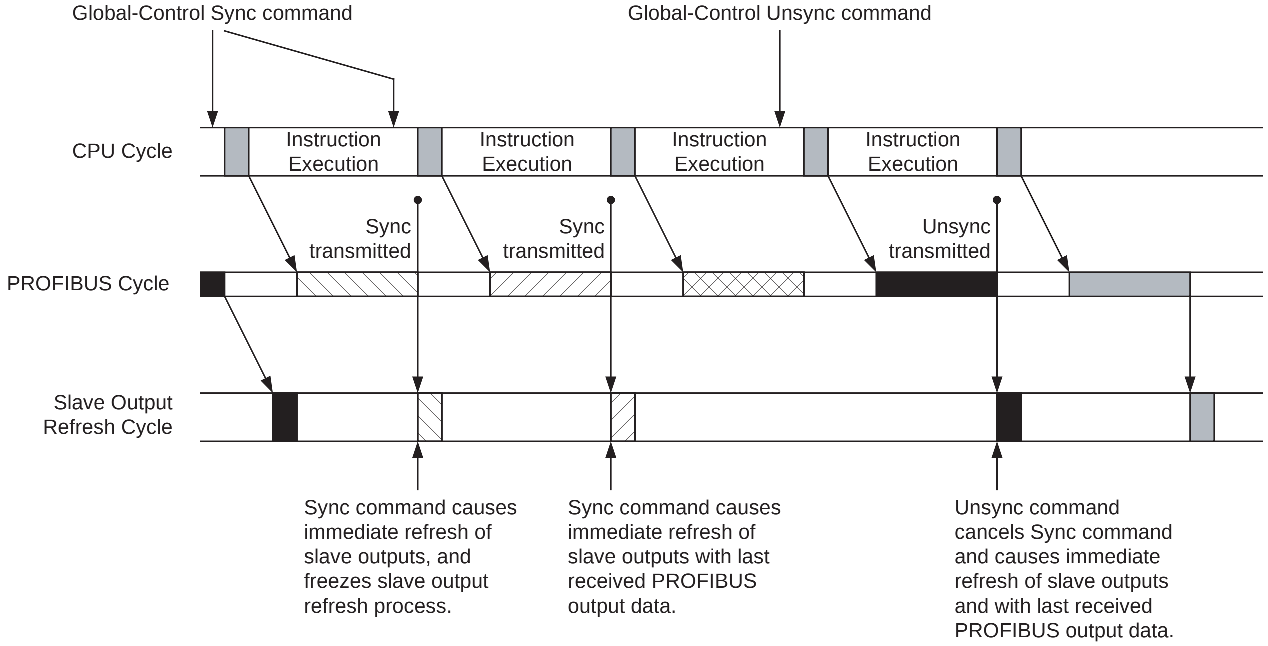
● Sync / Unsync commands

Sending a Global-Control - Sync command to a slave device has the following effect

- The slave device will update its physical outputs only once with the last received PROFIBUS output data despite new output data being received from the PROFIBUS Master Unit.
- If a new Global-Control - Sync command is sent, the slave device will update its physical outputs only once with the most recently received output data.
- If a Global-Control - Unsync command is sent, the slave device will revert back to its original situation and transfer updated output information to the Master Unit with each subsequent I/O data exchange message.

Note If a Global-Control command contains both a Sync and an Unsync command, the Unsync will prevail.

The figure shown below illustrates the Sync/Unsync feature as implemented by the CJ1W-PRM21 PROFIBUS Master Unit.



Note The Global-Control command as set in the CIO words is transferred to the Unit together with the I/O data, but the Global-Control command is sent over the PROFIBUS network, following the I/O data. This means that the outputs of the targeted slave device will be updated with the values sent to the slave prior to the Global-Control command.

● Transmitting Global-Control Commands

In order to transmit a Global-Control command the user has to define the group address and the command (e.g. Freeze, Sync). These two parameters must be entered in Global-Control command word, see section *4-2-2 Global-Control Command (*_GlobCtlCmd)*.

After setting these parameters, the Global-Control command must be transmitted over the PROFIBUS network. This is accomplished by setting the Transmit Global-Control command bit (*_GlobCtlTxCmd) in the Software Switches word (*_SwCmd, see section *4-2-1 Software Switches (*_SwCmd)*). Setting this bit will transmit the message only once. After transmission has been completed, *_GlobCtlTxCmd in the Software Switches word will be reset again.

● CX-ConfiguratorFDT

CX-ConfiguratorFDT also provides a means to transmit Global-Control commands from the PC, through the CJ1W-PRM21 Master DTM Diagnosis User Interface - Online Operations tab. This means uses the same words as described above.

To accomplish a Global-Control command transmission, perform the following sequence.

1 Make sure the CJ1W-PRM21 Master DTM is online with the PROFIBUS Master Unit.

2 Open the CJ1W-PRM21 Master DTM Diagnosis User Interface.

3 Select the Online Operations tab.

4 Select the commands to be transmitted (e.g. Freeze, Sync) using the checkboxes.

5 Select the groups to transmit the Global-Control command to.

6 Press the **Transmit** button to transfer the command to the Unit's CIO area, and to set bit *_GlobCtlTxCmd in the Software Switches word.

7 The **Transmit** button will be disabled until the command has been transmitted.

The time between pressing the Transmit button in the CJ1W-PRM21 Master DTM user interface and the Global-Control command actually being transmitted over the PROFIBUS network will be significantly longer than when the Global-Control command is initiated from a CPU user program due to the additional communication between the PC and the CPU.

5-6-4 Using Auto-CLEAR

Auto-CLEAR Feature

The CJ1W-PRM21 PROFIBUS Master Units support the Auto-CLEAR function as defined in the PROFIBUS standard. This feature - when enabled - will switch the PROFIBUS Master Unit to CLEAR mode automatically, in case one of the slave devices fails on the network. The purpose of this, is to force the PROFIBUS network to a safe state.

When in CLEAR mode, the PROFIBUS Master Unit will read each slave's input data, but not send output data. Depending on the slave device, the Master will instead send either empty output data messages or output data messages containing all zeros.

Enabling Auto-CLEAR

The Auto-CLEAR function can only be enabled through CX-ConfiguratorFDT. The controls to enable it can be found in the CJ1W-PRM21 Master DTM - Master Setup tab (see section *5-4-1 Setting the Master Parameters*).

The Auto-CLEAR function will only be active if the Master Unit has been switched to OPERATE mode.

Transition Conditions

An automatic transition to CLEAR mode will take place in the following situations.

During network startup at least one slave device rejects its parameter or I/O configuration message or fails to respond. All slave devices which have already reached data exchange with the Master will be switched to CLEAR mode again. Also, slave device which remain in not ready state during a time period which exceeds the Data Control Time (See section *5-4-2 Setting the Bus Parameters*), will cause the Master Unit to switch to CLEAR mode.

After successful network start up, there is no I/O data exchange with at least one slave device for a period of time which exceeds the Data Control Time.

Slave devices which have either been disabled in the Master Unit, or slave devices for which the Ignore Auto-CLEAR flag has been set (see section *3-3-1 Configuration User Interface*, Extensions Tab), will not cause a transition to Auto-CLEAR, not even when they fail on the network.

In case a slave device requires more time than the Data Control Time to validate its parameter or configuration message, premature triggering of Auto-CLEAR can be avoided by increasing the Watchdog Control Time in the Bus parameter set (see *5-4-2 Setting the Bus Parameters*). Increasing the Watchdog time will consequently increase the Data Control Time.

Resume OPERATE mode after Auto-CLEAR

The CJ1W-PRM21 PROFIBUS DP does not automatically resume normal operation after an Auto-CLEAR has been initiated. In order to resume normal I/O data exchange, perform the following sequence.

Determine which slave device failed during network startup or data exchange. To do this, use the CJ1W-PRM21 Master DTM Monitoring User Interface or the slave DTM (see *5-7-1 Monitoring the Master Unit and the Network* and *5-7-2 Monitoring Slave Status*) to determine the slave and its type of failure.

Remove the cause of the failure.

Press the **OPERATE** Button in the Master Units Monitoring window.

Alternatively, the Master can also be switched to OPERATE from the CPU program.

5-7 Monitoring the Network

5-7-1 Monitoring the Master Unit and the Network

Both the CJ1W-PRM21 Master DTM and the Generic Slave DTM provide special user interfaces to facilitate status debugging and diagnostics determination. This section and the next will discuss the use and the features of these diagnosis user interfaces.

● CJ1W-PRM21 Master DTM Diagnosis User interface

The CJ1W-PRM21 Master DTM Diagnosis - Monitor User Interface provides a means to

- Monitor the CJ1W-PRM21 Master Unit status.
- Monitor an overview of the status of all allocated slave devices.
- Monitor standard slave diagnostics.
- Monitor the Unit’s Error Log (The Error Log is discussed in section *5-7-3 Using the Error Log*).

The information is obtained directly from the Master Unit. The Master DTM reads the Unit’s words from the CPU memory as well as the standard slave device diagnostics bytes as received by the Master Unit.

To open the CJ1W-PRM21 Master DTM Diagnosis - Monitor User Interface, perform the following steps.

1 Make sure the Master DTM is online with the Master Unit. To go online, select the DTM in the Network view and perform one of the following actions.

- Select the **Device - Go Online** option from the main menu or the DTM context menu
- Select the  button from the Tool Bar.

2 A communication channel will be opened through CX-Server. The name of the DTM in the Network view will turn to italic font to indicate that the Unit is online.

3 From the context menu select the **Diagnosis** option. The DTM’s Diagnostics User Interface will be displayed.

4 Select the Monitor tab for status monitoring.

● Using Auto-Update or Manual Refresh

The information displayed in the CJ1W-PRM21 Master DTM Diagnosis - Monitor User Interface can be updated either Automatically or Manually.

- Automatic update: Select the Automatic checkbox in the upper right corner of the Monitor tab. The refresh cycle will be approximately 0.5 to 1 second depending on the PC System. The Manual button will be disabled.
- Manual update: Press the **Manual** button in the upper right corner of the Monitor tab to force a refresh of the window contents.

● Reading the Master Unit’s Status

The Master status sub-tab displays the status of the Master Unit itself. The indicators are directly related to the four status words of the Unit (see sections 4-2-3 to 4-2-6). They can be used to

- Obtain the status of the Master Unit and the network.

- Determine errors in the unit or the network.
- Troubleshoot the Master Unit and the network.

The Master Status tab indicates the Master Unit's status. The Master Status 2 box and the Unit Status box all indicate errors. These indicators are discussed in section *7-4-2 Troubleshooting the Network using CX-ConfiguratorFDT*.

The Slave Status box indicates the overall status of the allocated slave devices.

Master Status

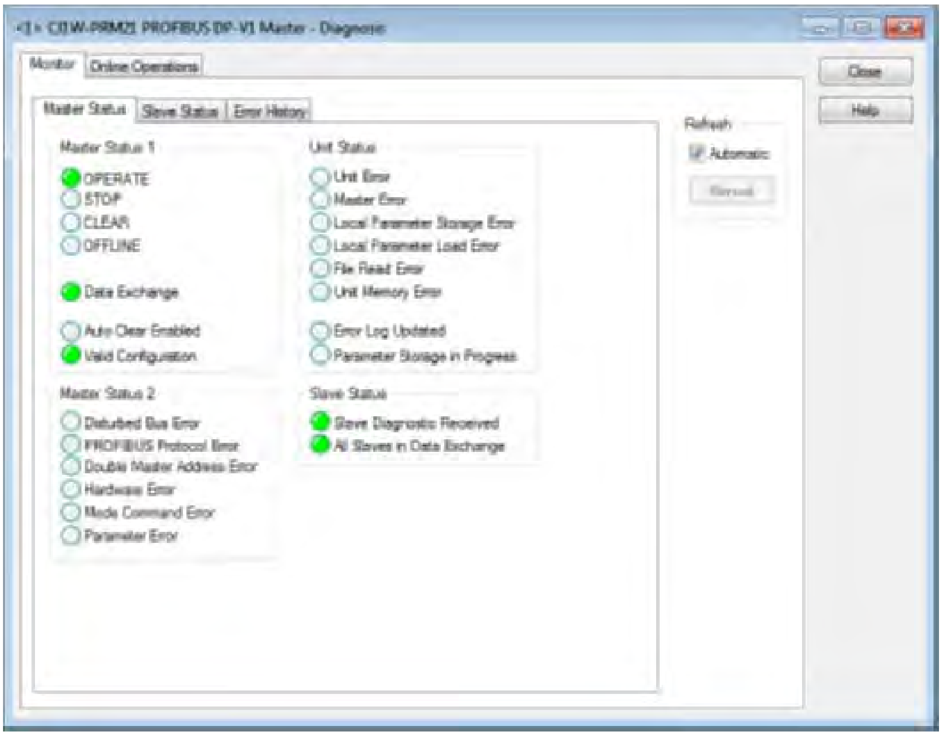
Main indicators in this box are the indicators for operational status of the Master Unit. They indicate whether the Master Unit is in

- OFFLINE mode,
- STOP mode,
- CLEAR mode, or in
- OPERATE mode

The Data Exchange indicates if I/O data exchange is taking place with at least one slave device.

The Auto Clear enabled indicator and Valid Configuration indicator provide feedback on the I/O configuration downloaded to the Unit.

The figure below shows an example of the Master Status tab in the case of a fully functional network, i.e. there are no errors and all slave devices are exchanging I/O data with the Master Unit.



Slave Status

If any of the allocated slave devices have returned diagnostic information to the Master Unit, the Slave Diagnostics Received indicator will be lit. In order to determine which slave reported diagnostics, select the Slave Status tab next to the Master status tab.

● Slave Status Overview

The CJ1W-PRM21 Master DTM Diagnosis User Interface provides a comprehensive overview of the slave device status without having the user to open all the slave DTMs. The overview is presented in the Monitoring - Slave Status tab of the user interface and displays only the standard PROFIBUS diagnostics flags. An example is shown in the figure below. For the extended, non-standard diagnostics see section *5-7-2 Monitoring Slave Status*.

The upper half of the window - the Slave Status Flags box - presents the status of each slave device using colored indicators. The colors are listed in the table below.

Indicator color	Slave Status
Grey	Associated device does not exchange Diagnostics with this Master Unit, i.e. • Slave not allocated to this Master Unit, or • Device is this Master Unit, or • Device is another master device. Example figure: Slave device 0 is not allocated.
Red	The slave device is not communicating with the PROFIBUS Master Unit. It may be disconnected or the Master is in OFFLINE or STOP mode. Example figure: Slave device 6 is not responding.
Orange	The slave device is communicating with the PROFIBUS Master Unit, but it is not in Data Exchange, due to incorrect parameter settings. See the slave diagnostics for more information.
Yellow	The slave device is in data exchange with the PROFIBUS Master Unit, but it has reported diagnostics data. See the slave diagnostics for more information. Example figure: Slave device 14 has returned diagnostics.
Green	The slave device is in data exchange with the PROFIBUS Master Unit. No diagnostics reported. Example figure: Slave device 2 is in I/O data exchange.

Any other color than green or grey indicates that new diagnostics have been received from the associated slave device since the last time the diagnostics was monitored.

The newly received diagnostics can be viewed by clicking with the left mouse button on the indicator. The mouse pointer will change in to a hand icon when positioned over the indicator.

● Reading Standard Slave Diagnostics

Clicking the indicator with the left mouse button has the following effects

- The address of the associated slave device will be displayed in the Slave Diagnostics Data box in the lower half of the window.
- The standard diagnostics flags of the associated slave device will be displayed. Indicators representing a status are colored green. Indicators representing a potential problem are colored red.
- The color of the indicator for the specific slave device in the Slave Status Flags box will change color if no new diagnostics are available, i.e. a yellow indicator will turn to green.
- The New Diagnostics Received indicator in the Slave Diagnostics Data box will be set to ON.

If the Auto-Update refresh mode has been selected, the New Diagnostics Received indicator will be ON only during one update cycle provided no new diagnostics are received after displaying.

The standard diagnostics for a slave device displayed in the Slave Diagnostics Data box can be used to

- Troubleshoot the device, the configuration or the network connection
  Troubleshooting the device and the connection is discussed in section *7-4-2 Troubleshooting the Network using CX-ConfiguratorFDT*.
- Determine the status of the slave device
- Determine if the slave device has reported extended diagnostics
  If extended diagnostics have been reported to the Master Unit, the Extended diagnostics received indicator will be on.

Refer to section *7-4-2 Troubleshooting the Network using CX-ConfiguratorFDT* the Network using CX-ConfiguratorFDT for a discussion on the errors reported by the slave and how to correct them.

● Clearing Diagnostics Flags

All slave devices will have to return their status in the diagnostics message after parameterization therefore all the indicators associated with the slave devices allocated to the Master Unit will indicate received diagnostics immediately after network startup.

If all slave devices have established, I/O data exchange with the Master Unit this information may be less relevant. To detect new diagnostics received during I/O data exchange the user can clear all current new diagnostics flags by pressing the **Clear Diagnostics** button in the window thus making it easy to see newly received and more relevant diagnostics information.

Pressing **Clear Diagnostics** button will cause all yellow indicators to turn green.

5-7-2 Monitoring Slave Status

The Generic Slave DTM provides a Diagnosis User Interface with two tabs:

- Standard diagnostics tab displays the same information for the associated slave device as in the Slave Diagnostics Data box in the Master DTM Monitoring User Interface.
- The Extended Diagnostics tab, displaying the extended diagnostics reported by the slave device. The interpretation of this diagnostics information depends on the type of slave device.

● Standard Slave Diagnostics Example

As an example the standard slave device diagnostics information window is shown below. For more information regarding interpretation of the indicators, refer to section *5-7-1 Monitoring the Master Unit and the Network*.

● Extended Slave Diagnostics

Extended diagnostics data are often provided by a slave device to indicate additional slave specific diagnostics, error and alarm information which cannot be contained in the standard data part of the diagnostics message. These extended diagnostics data bytes are sent by the slave in a diagnostics message following the standard data part.

For slave devices supporting extended diagnostics data the associated GSD files often provide language dependent text strings to facilitate interpretation of the diagnostics codes sent by the slave device.

The Generic Slave DTM provides for a simple interface which facilitates the displaying of such extended diagnostics data strings.

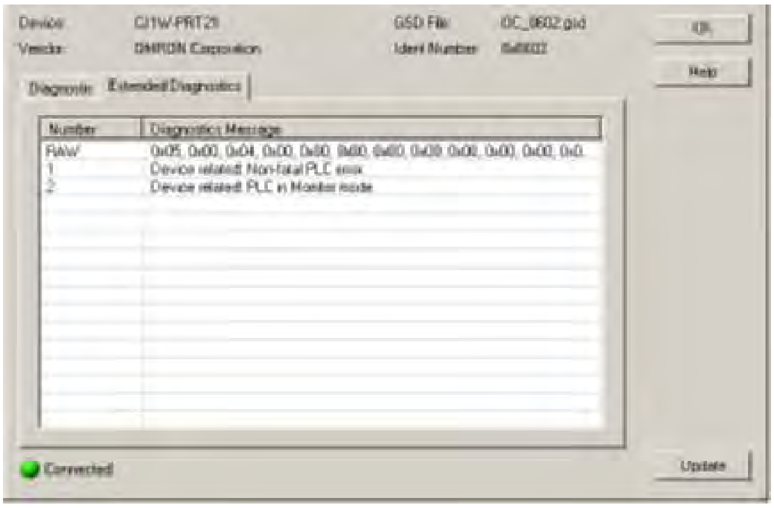
The presence of extended diagnostics as part of the diagnostics data message is indicated by

- the indicator marked Extended Diagnostics received in the Master DTM - Monitor tab, Slave Status tab (refer to section *5-7-1 Monitoring the Master Unit and the Network*).
- the indicator in the Diagnostics tab of the slave Diagnostics User Interface (see for example, the figure above).

Also, if no extended diagnostics are available, the Extended Diagnostics tab will be disabled and inaccessible.

To display the extended diagnostics click on the Extended diagnostics tab in the Slave Diagnostics User Interface.

The figure below shows an example of the extended diagnostics window containing extended diagnostics data. The first row in the diagnostics window shows the raw data bytes. The second and third row show the actual message contained within the extended diagnostics message.



5-7-3 Using the Error Log

Error Log Concept

The CJ1W-PRM21 PROFIBUS Master Units are equipped with an error logging mechanism which will internally store error events. Most of the errors which are stored in the Unit's Error Log are stored in volatile memory, i.e. when power to the Unit is switched off the errors are lost.

Severe errors however are also stored in non-volatile memory, i.e. these error reports are still available after cycling the power down and up again. The errors which can be logged are listed in section *7-5-2 Error Codes and Detailed Codes*. The CJ1W-PRM21 PROFIBUS Master Units can log up to 80 error events, 16 of which can be logged in non-volatile memory.

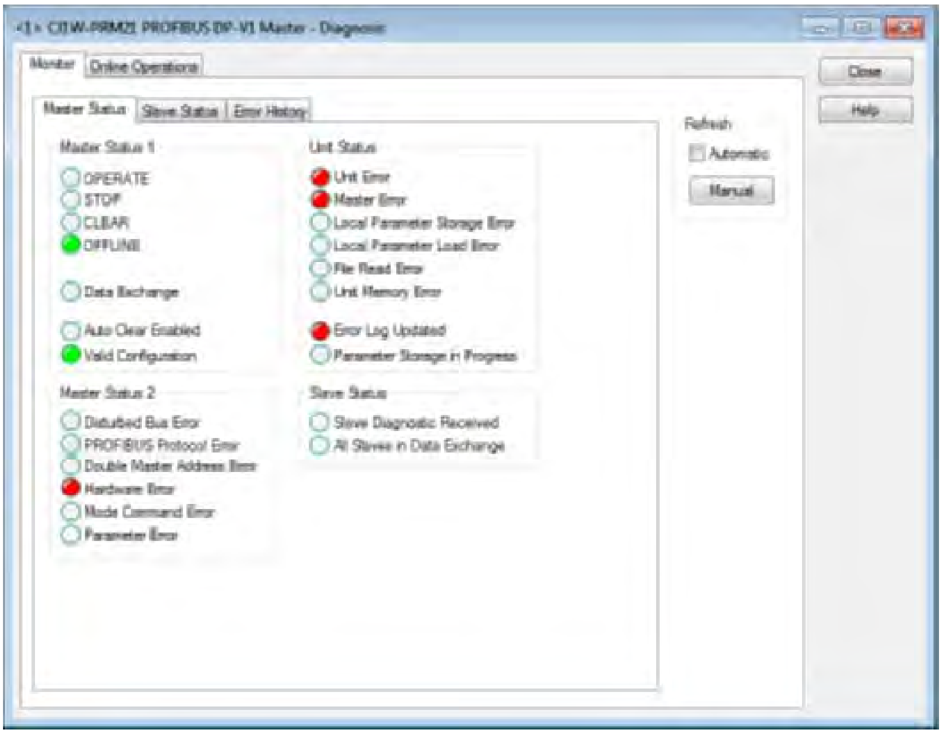
Detecting New Errors in the Error Log

If a new error event is logged in the Error Log of the Unit, the bit *_NewErrLogSta is set in the Unit Status Word (*_UnitSta, see section *4-2-3 Unit Status (*_UnitSta)*).

This bit flag can be evaluated by the user, through the CJ1W-PRM21 Master DTM Diagnosis User Interface. In order to view the bit flag perform the following actions.

1. Open the CJ1W-PRM21 Master DTM Diagnosis User Interface,
2. Select the **Monitor - Master Status** tab
3. If the Automatic checkbox in the Refresh box has not been selected, press the **Manual** button to refresh the status.

The figure below shows this Error Log Updated bit flag indicating that a new error event has been logged.



● Reading the Error Log

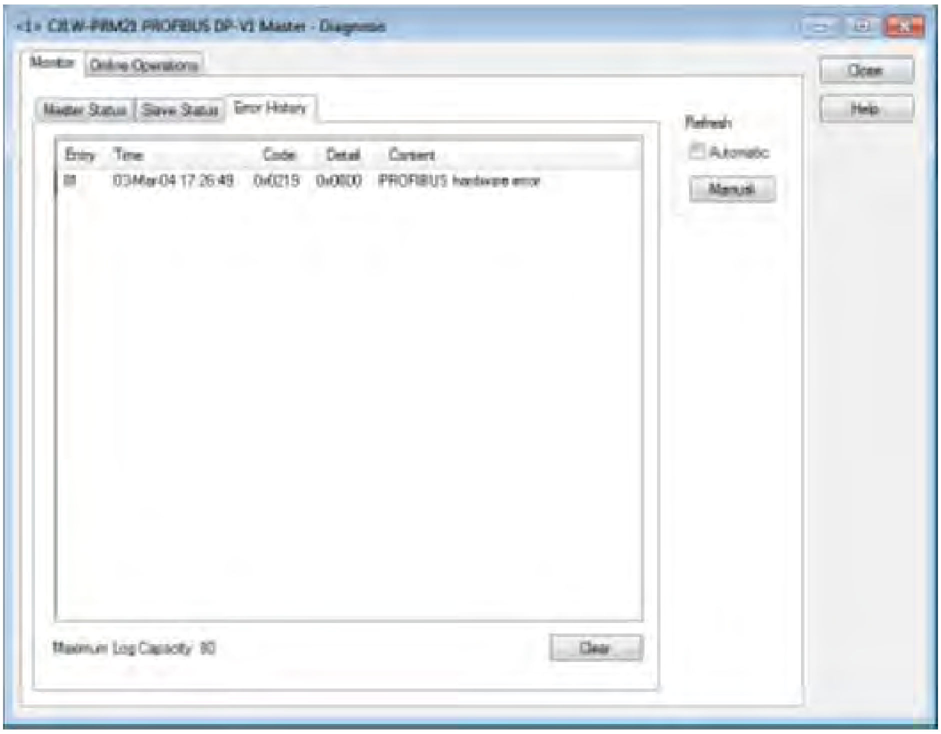
The Error Log can now be retrieved from the Unit, and displayed through the CJ1W-PRM21 Master DTM Diagnosis User Interface. To retrieve and view the Unit's Error Log,

1 Open the CJ1W-PRM21 Master DTM Diagnosis User Interface.

2 Select the **Monitor - Error History** tab**.**

3 If the Automatic checkbox in the Refresh box has not been selected, press the **Manual** button to retrieve the Error Log contents from the Unit.

As an example, the contents of the Error Log as it is displayed is shown in the figure below. In this case a Hardware Error has been detected on the PROFIBUS network.



Note Reading the Error Log contents will not clear it.

● Clearing the Error Log

In order to clear the Error Log, perform the following actions.

1 Open the CJ1W-PRM21 Master DTM Diagnosis User Interface.

2 Select the **Monitor - Error History** Tab.

3 Press the **Clear** button in the lower right corner of the window.

This will clear not only the Error Log stored in volatile memory but also the error log events stored in the non-volatile memory.

Note Clearing the Error Log is not possible if an error which was just added to the Error Log is still active. The cause of the active error has to be removed first before the Error Log can be cleared. Attempting to clear the Error Log while an error is still active does not result in an Error message from the CJ1W-PRM21 Master DTM.

● Accessing the Error Log from the CPU

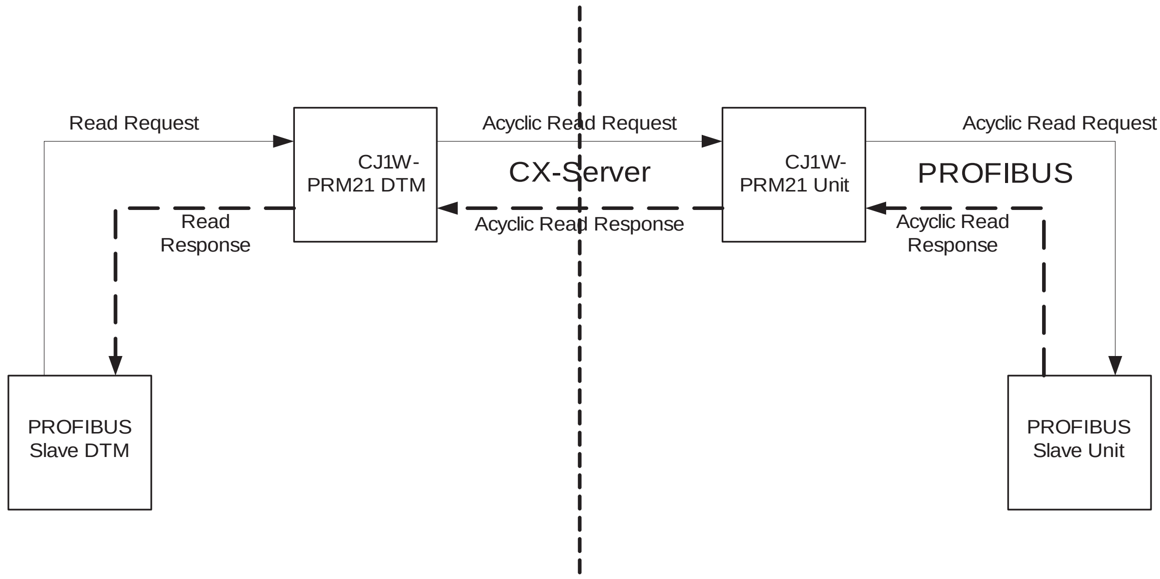
The CJ1W-PRM21 Master DTM Diagnosis User Interface uses messages to read the bit flags and access/clear the Error Log contents.

5-8 PROFIBUS DP-V1 Services

Next to the cyclic I/O data exchange, the CJ1W-PRM21 PROFIBUS Master Units are capable of communicating using acyclic DP-V1 messages. The following section explains the basic operation of DP-V1 functionality.

5-8-1 Configuring and Monitoring Slaves using DTMs

The FDT/DTM framework enables the configuration and monitoring of specific parameters of PROFIBUS slaves. The DTMs support sending PROFIBUS DP-V1 Class 1 (MSAC1) and Class 2 (MSAC2) messages directly to the slaves. The slave DTMs, provided by the Slave's manufacturer, can therefore perform application related configuration and monitoring.

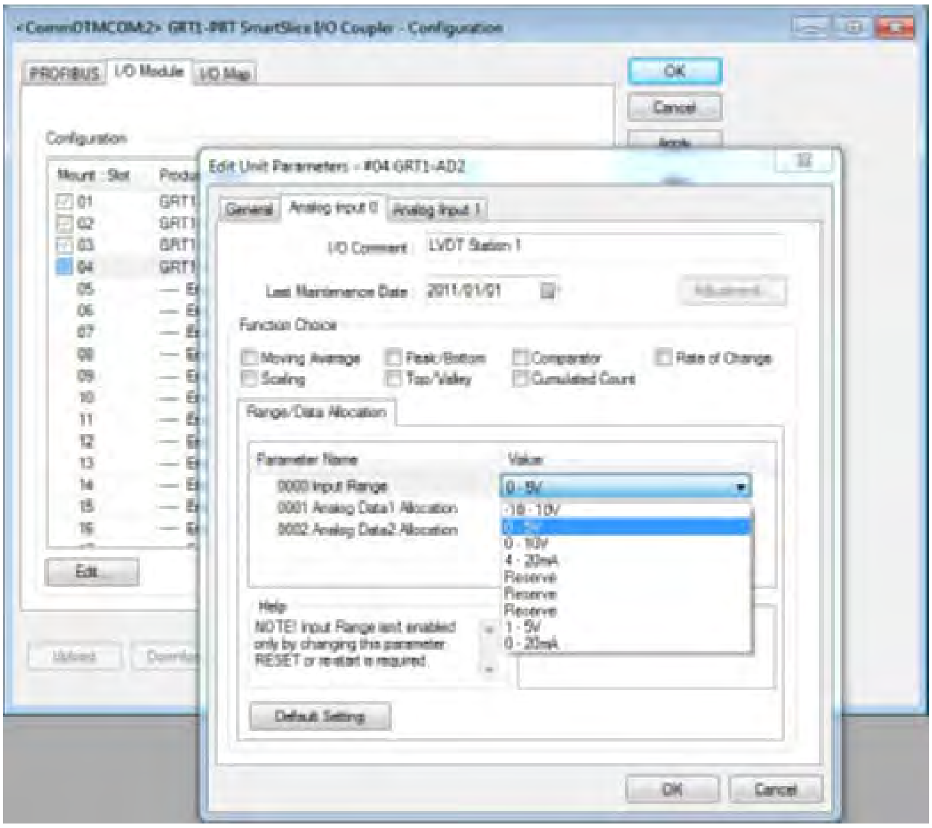


Note The CJ1W-PRM21 master (communication) DTM will determine which connection is initiated with the slave Unit. The default connection is PROFIBUS DP-V1 Class 2. If this is not supported by the slave, PROFIBUS DP-V1 Class 1 messages will be sent.

Precautions for Safe Use

Since using PROFIBUS DP-V1 Class 2 messages are by definition aimed at setting parameters in a slave device. It is highly recommended to make those settings with the PROFIBUS Master Unit in CLEAR mode to prevent undesirable effects on I/O data.

As an example, the figure below shows the DTM of the GRT1-PRT PROFIBUS Communication for SmartSlice I/O Units (see Operation Manual W04E-EN-□). The DTM is used to configure and monitor the GRT1-Series SmartSlice I/O Units.



5-8-2 PROFIBUS Services From CPU

CIP Messaging

The CJ1W-PRM21 PROFIBUS Master Units support sending Explicit DeviceNet (CIP) messages to their slaves (as of Unit version 3.0). Like the DeviceNet master this is done by using the EXPLICIT MESSAGE SEND (see section *6-3-1 EXPLICIT MESSAGE SEND (2801)* for more details on this command).

PROFIBUS MSAC1

As of Unit version 2.0, the CJ1W-PRM21 PROFIBUS Master units provide a means to initiate PROFIBUS DP-V1 services from the CPU. These services allow for reading and writing (parameter) data from and to PROFIBUS DP-V1 slave devices. This data exchange is performed acyclically, i.e. only once, in between the cyclic I/O data exchange messages.

The services are initiated using the PROFIBUS MESSAGE SEND command (see section *6-3-2 PROFIBUS MESSAGE SEND (2809)*).

6

Message Communications

This section describes the message service communications commands concept sent from the user program in the CPU Unit.

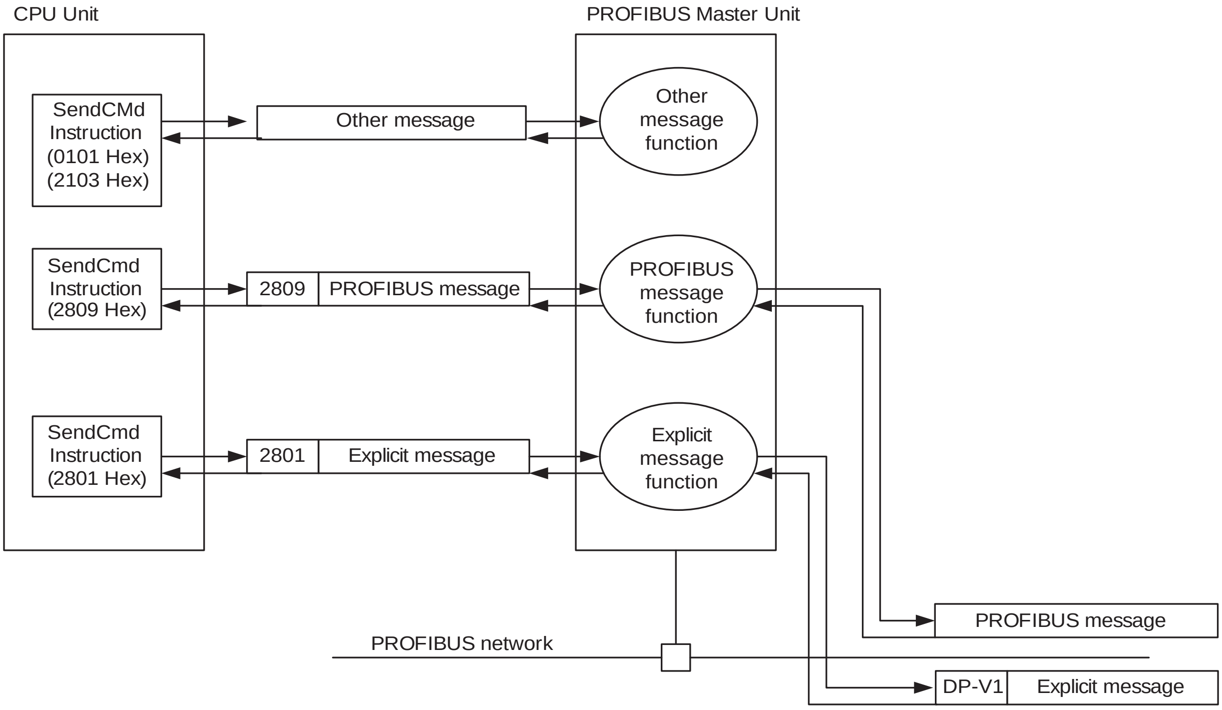
6-1 Overview

Message communications enable messages to be sent between nodes on a PROFIBUS network when required by system conditions. It is possible for messages to be sent between a CPU and a PROFIBUS Master or Slave Unit. You can use them to send/receive data; read time data, error logs, and other data; or control specific operation, e.g., clearing the error log.

There are three types of messages:

- Explicit
- PROFIBUS
- Other

The figure below depicts the command structure for the CJ1W-PRM21 PROFIBUS Master units

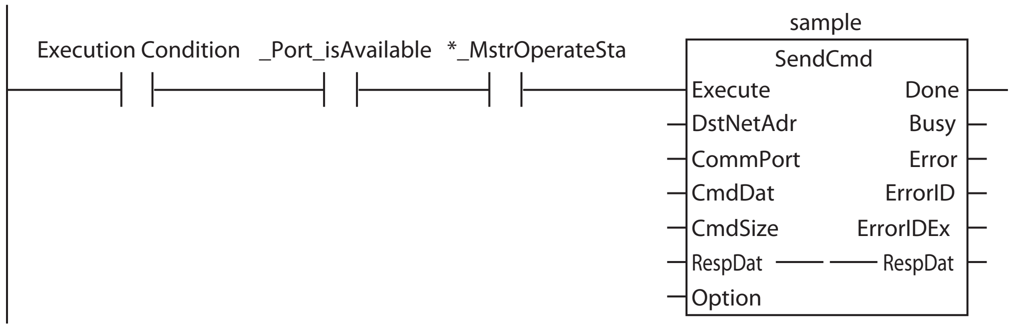


6-2 Sending Acyclic Messages Using SendCmd Instructions

The SendCmd (send command) instruction can be used in the CPU Unit user program of the CJ-series PROFIBUS Unit to send acyclic messages.

In a program that issues acyclic messages, the following execution conditions are generally used based on the AND gate:

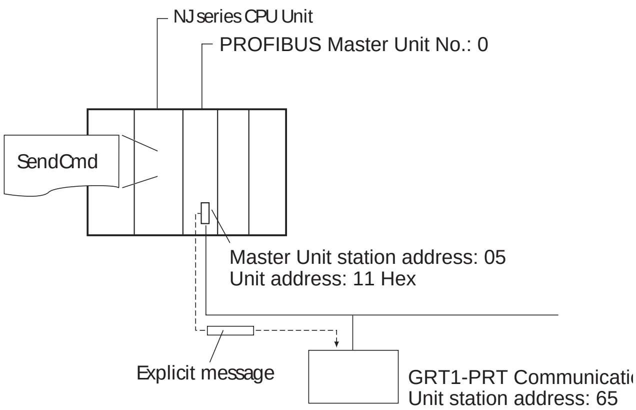
- Network Enabled Flag on the CPU Unit side
- **_MstrOperateSta*; the PROFIBUS Master Unit is in Operate mode and commencing I/O data exchange.

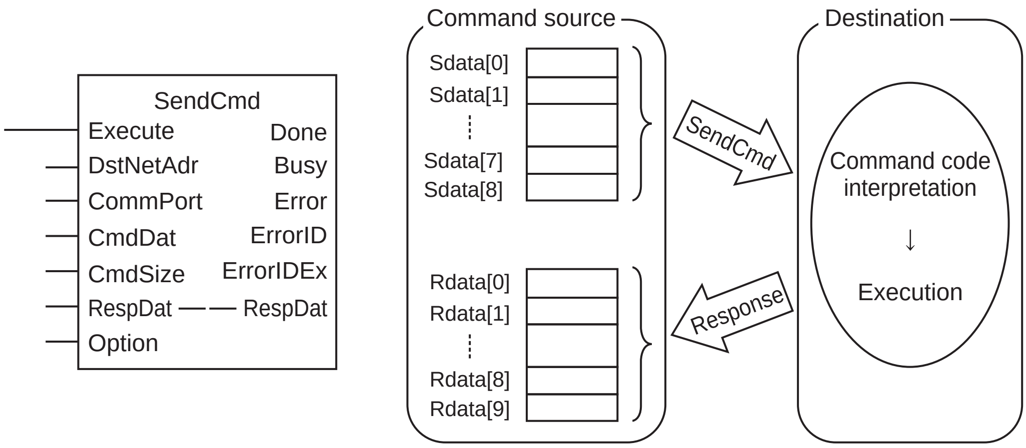


Example of Sending Acyclic Messages Using SendCmd Instruction

Below is an example of reading alarm information using the EXPLICIT MESSAGE SEND command (2801) from the PROFIBUS Communication Unit with the following system configuration:

- PROFIBUS Master Unit's station address: 05
- Unit number: 0
- Unit address: 11 Hex
- GRT1-PRT Communication Unit's station address: 65





Input Variable	Function		Example Details
Execute	The operation SendCmd is executed when TRUE is set.		---
DstNetAdr	The destination network address is specified with the use of the network address/node address/unit address.		Network address: 0 Node address: 0 Unit address: 16#11
CommPort	The destination port is specified.		NONE (Default)
CmdDat	Sdata[0]	Command code	16#28
	Sdata[1]		16#01
	Sdata[2]	Slave node address (65)	16#41
	Sdata[3]	ServiceCode	16#0E
	Sdata[4]	ClassID	16#00
	Sdata[5]		16#9C
	Sdata[6]	InstanceID	16#00
	Sdata[7]		16#01
	Sdata[8]	AttributeID	16#73
CmdSize		The number of bytes corresponding to the command data to be sent is specified.	9
RespDat	Rdata[0]	Command code	16#28
	Rdata[1]		16#01
	Rdata[2]	End code	16#00
	Rdata[3]		16#00
	Rdata[4]	Number of bytes received	16#00
	Rdata[5]		16#2A
	Rdata[6]	Slave node address (65)	16#41
	Rdata[7]	ServiceCode (when completed normally)	16#8E
	Rdata[8]	Number of slave alarm data: 32 (20 Hex)	16#20
	Rdata[9]	Status of slave #4, slave #3 (2 bits each)	16#00
	Rdata[10]	Status of slave #8, slave #7 (2 bits each)	16#00
	Rdata[11]	Status of slave #1, slave #2 (2 bits each)	16#00
	Rdata[12 to 41]	--	(continue)
Option	Response monitoring, and number of resends, are specified.		ResponseTime = 3C Retry = 0

Additional Information

You can send acyclic messages to OMRON slaves by setting the command code to 28 01.
In this case, set the response monitoring time to at least the value set for the message monitoring timer (default: 2s). If it is set to less than the value, communications may be busy even if the next command is executed after the first one times out.

● Unit Settings

Name	Setting target	Settings
Unit Configuration	CPU/Expansion Racks under Controller Configurations and Setup of Sysmac Studio	Mount CJ1W-PRM21 in slot 0 of the CPU Rack.
Device name of this unit		"PRM21"
Unit number	Unit No. Switch and Unit Configuration and Setup (CPU/Expansion Racks under Controller Configurations and Setup of Sysmac Studio)	Unit number 0

● Program Example

System-defined variable

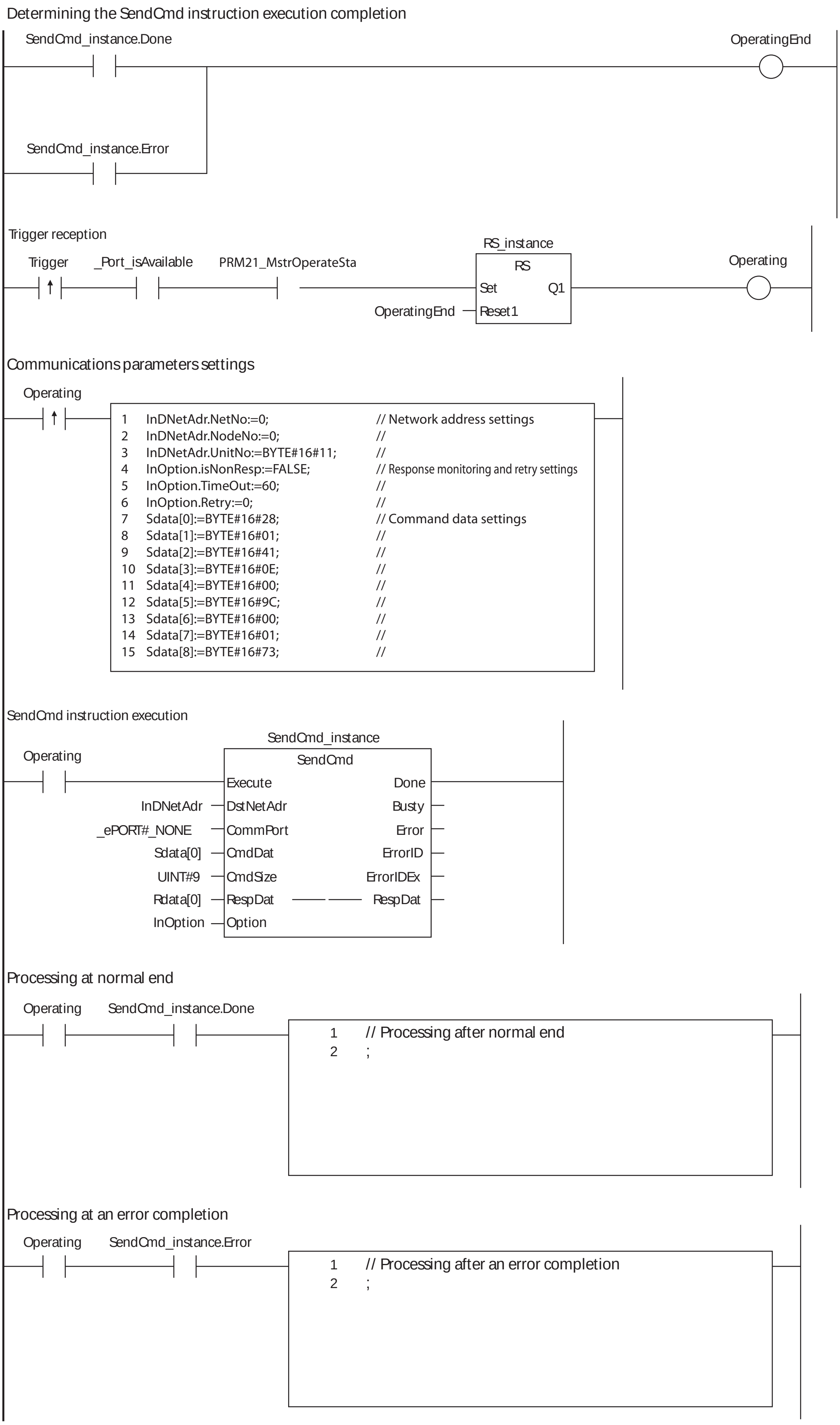
Name	Data type	Default	Comments	Details
_Port_isAvailable	BOOL	---	Communications Port Enabled Flags	TRUE when there are internal logical ports available, FALSE when there is no internal logical port available.

User-defined variables (Define before or when creating a program)

Name	Data type	Default	Details
Trigger	BOOL	False	Execution conditions
OperatingEnd	BOOL	False	Process completed
Operating	BOOL	False	Processing
InDNetAdr	_sDNET_ADR	(NetNo := 0, NodeNo := 0, UnitNo := 16#0)	Destination network address
InOption	_sRESPONSE	(isNonResp := False, TimeOut := 0, Retry := 0)	Response monitoring and retry setting
Sdata	ARRAY[0..8] OF BYTE	[9(16#0)]	Send data
Rdata	ARRAY[0..9] OF BYTE	[10(16#0)]	Receive data
RS_instance	RS	---	---
SendCmd_instance	SendCmd	---	---

Device variables for CJ-series Unit (Create on the I/O Map View window after the unit configuration is created)

Name	Data type	Default	Allocated address (AT)	Comments	Details
PRM21_MstrOperateSta	BOOL	---	IOBus://rack#0/slot#0/MstrSta/MstrOperateSta	Online Status	TRUE when the Unit is in Operate mode and commencing I/O Data-Exchange.


Determining the SendCmd instruction execution completion
SendCmd_instance.Done
OperatingEnd
SendCmd_instance.Error
Trigger reception
Trigger
_Port_isAvailable
PRM21_MstrOperateSta
RS_instance
RS
Set
Q1
OperatingEnd
Reset1
Operating
Communications parameters settings
Operating
1 InDNetAdr.NetNo:=0; // Network address settings
2 InDNetAdr.NodeNo:=0; //
3 InDNetAdr.UnitNo:=BYTE#16#11; //
4 InOption.isNonResp:=FALSE; // Response monitoring and retry settings
5 InOption.TimeOut:=60; //
6 InOption.Retry:=0; //
7 Sdata[0]:=BYTE#16#28; // Command data settings
8 Sdata[1]:=BYTE#16#01; //
9 Sdata[2]:=BYTE#16#41; //
10 Sdata[3]:=BYTE#16#0E; //
11 Sdata[4]:=BYTE#16#00; //
12 Sdata[5]:=BYTE#16#9C; //
13 Sdata[6]:=BYTE#16#00; //
14 Sdata[7]:=BYTE#16#01; //
15 Sdata[8]:=BYTE#16#73; //
SendCmd instruction execution
SendCmd_instance
SendCmd
Operating
Execute
Done
InDNetAdr
DstNetAdr
Busty
_ePORT#_NONE
CommPort
Error
Sdata[0]
CmdDat
ErrorID
UINT#9
CmdSize
ErrorIDEx
Rdata[0]
RespDat
RespDat
InOption
Option
Processing at normal end
Operating
SendCmd_instance.Done
1 // Processing after normal end
2 ;
Processing at an error completion
Operating
SendCmd_instance.Error
1 // Processing after an error completion
2 ;

6-3 Acyclic Messages

Acyclic message services allow exchange of extended information between a PROFIBUS DP-V1 Master and a PROFIBUS DP-V1 slave device during regular I/O data exchange.

6-3-1 EXPLICIT MESSAGE SEND (2801)

Sends an explicit message over the PROFIBUS network to an OMRON slave device (GRT1 SmartSlice for example) and receives a response.

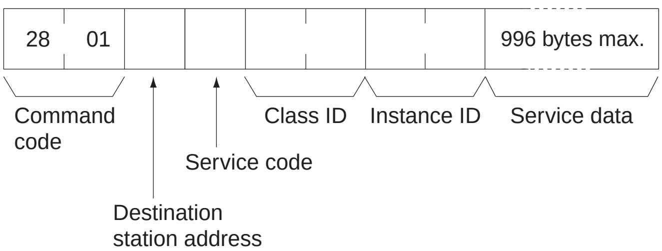
Explanation

The Explicit Message Send command sends a CIP-defined explicit message to an OMRON PROFIBUS Slave device supporting CIP messages.

Note 1 For information on explicit messages for OMRON slave, refer to *SmartSlice GRT1-Series GRT1-PRT PROFIBUS Communication Unit Operation Manual* (Cat No. W04E-EN-□).

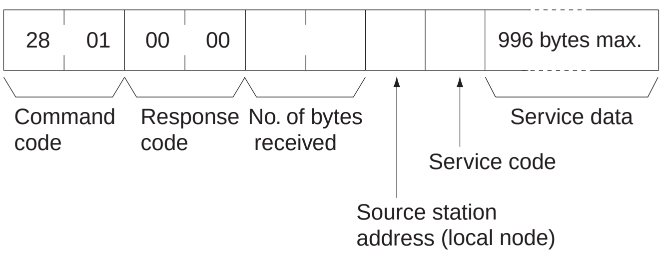
2 The Explicit Message Send command is wrapped in a PROFIBUS DP-V1 Class 2 message. The handling of this message, i.e. establishing a connection, transferring data and aborting a connection is done automatically by the PROFIBUS Master unit.

Command Format

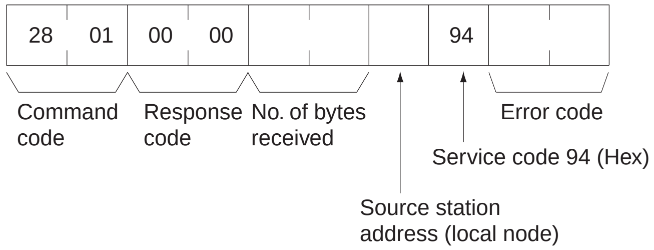


Response Format

If a normal response has been returned by the targeted device, the response format for the executed explicit message is as follows:



If transmission of the Explicit message was successful, but the execution was not, the response message will still contain response code 0000 as well as return data. However, an error code, indicating the failure will be part of the data block. The response format for this case is shown below.



For the definition of the error codes for unsuccessful execution of CIP messages, refer to the *Smart-Slice GRT1-Series GRT1-PRT PROFIBUS Communication Unit Operation Manual* (Cat. No. W04E-EN-□).

If transmission of the message was unsuccessful, the response frame will only contain a response code and no data block.

● Response Codes

The table below lists the response codes for the message transmission itself.

Response code	Description
0000	Normal completion.
1001	Command too large, i.e. > 1004 bytes.
1002	Command too short, i.e. < 8 bytes.
110C	Device Address Invalid, i.e. > 7E (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
220F	• The connection was rejected, i.e. the Master Unit could not establish connection to send the requested message. • A timeout has occurred, i.e. the Master Unit did not transmit the message in time, or the slave device did not respond in time. An open connection will be aborted. • The slave device does not support this message.

● Parameters

Send Destination Station Address (Command)

Specifies the station address of device to send the explicit message to over the PROFIBUS network.

Service Code (Command, response)

The service code defines the action to be implemented with the data sent to the slave device, e.g. Read, Write, Save. The service codes are listed in the Operation manual of the targeted slave device.

For normal responses, the service code is returned within the response data block, with bit 15 of the service code set to ON. For error responses, 94 hex, which indicates an error, is returned.

Class ID (Command)

Specifies the class ID for the explicit message destination. The supported Class ID values are specified in the Operation manual of the targeted slave device.

Instance ID (Command)

Specifies the instance ID for the explicit message destination. The supported Instance ID values are specified in the Operation manual of the targeted slave device.

Service Data (Command, response)

For commands, specifies the data defined by the service code.

For responses, returns the reception data defined by the service code.

No. of Bytes Received (Response)

Returns the number of data bytes received in the rest of the message.

Source Station Address (local node) (Response)

Returns the Station Address of the responder.

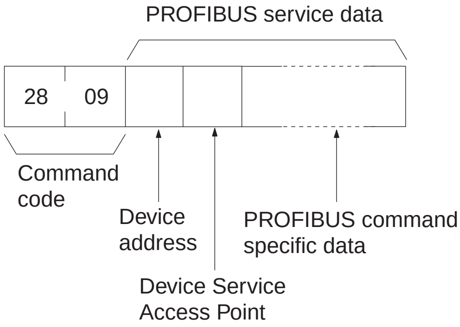
Error Code (Response)

Returns the error code defined by the slave device.

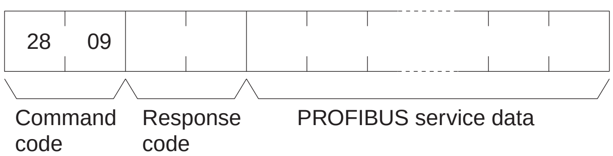
6-3-2 PROFIBUS MESSAGE SEND (2809)

The PROFIBUS MESSAGE SEND command provides a means to initiate transmission and reception of standard PROFIBUS DP and DP-V1 Class 1 services over the PROFIBUS network via the CJ1W-PRM21 PROFIBUS Master Unit. The general command/response structures are shown below.

● Command Format



● Response Format



● Parameters

The PROFIBUS service data part in both the command and response depends on the PROFIBUS service to be transmitted / received, and will therefore be different in length and contents for every service. Also, the response error codes will depend on the services requested. The common parameters are described below. Each supported service will be described separately after the common parameters.

Destination Address (Command)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex).

Device Service Access Point (Command)

The Device Service Access Point is a 1 byte number, identifying the PROFIBUS service to the slave device, as defined by the PROFIBUS standard.

The table below lists the PROFIBUS services supported using the PROFIBUS MESSAGE SEND command

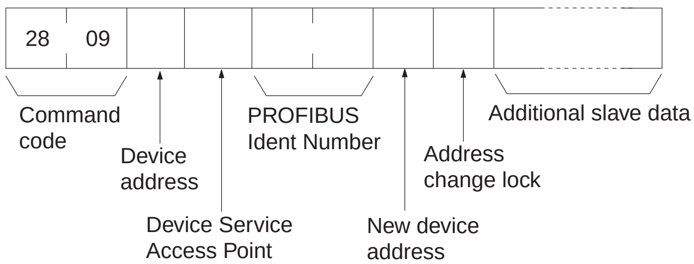
PROFIBUS Service	D SAP (Hex)	Description	Page
Set_Slave_Add	37	Change the address of a slave device.	10
Rd_Inp	38	Read the Input data of a slave device.	11
Rd_Outp	39	Read the Output data of a slave device.	12
Get_Cfg	3B	Read the PROFIBUS DP I/O Configuration of a slave device.	13
MSAC1_Read	33	PROFIBUS DP-V1 (Class 1) Acyclic Data Read from a slave device.	14
MSAC1_Write	33	PROFIBUS DP-V1 (Class 1) Acyclic Data Write to a slave device.	18

Set_Slave_Add Service

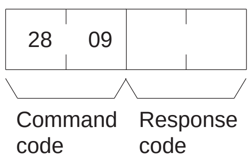
The PROFIBUS DP Set_Slave_Add service allows a PROFIBUS Master Unit to change the address of a remote slave device. It is defined for slave devices of which the PROFIBUS address cannot be set through switches. Slave devices which support this service also provide a means to store the address in internal non-volatile memory. In case this non-volatile memory does not contain an entry, the slave device will assume the default address 126.

The figures below show the command and response message formats.

● Command Format



● Response Format



● Parameters

Destination Address (Command)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex).

Device Service Access Point (Command)

The Device Service Access Point for the Set_Slave_Add PROFIBUS service must be set to 37 (Hex).

PROFIBUS Ident Number (Command)

The PROFIBUS Ident Number is a 1 word identifier, issued by PROFIBUS International, which identifies the slave device type and model. The number can be obtained form the slave device GSD file or from the slave documentation.

New Device Address (Command)

Contains the new address of the device. The valid address range is 0 to 7E (Hex).

Address Change Lock (Command)

Enables address lock, after changing it. Valid range:

- 00 Disable Address Lock
- 01: Enable Address Lock

Precautions for Correct Use

Enabling Address Lock makes any future changes of the address impossible, even after power-down/power-up of the slave device.

Response Codes

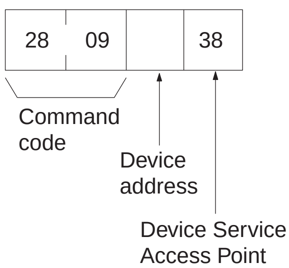
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 124 words
1002	Command too short, i.e. < 4 words.
110C	• Device Address Invalid, i.e. > 7E (Hex) • New Device Address Invalid, i.e. > 7E (Hex) • Address change lock invalid, i.e. not equal to 00 or 01. • Invalid target slave address (exceeds 125).
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • New Address is same as current master address.
0402	Service is not supported: Device Service Access Point is invalid.

Rd_Inp Service

The PROFIBUS DP Rd_Inp service allows a PROFIBUS Master Unit to read the current input data of any slave device, even if it is not allocated to the Master Unit.

The figures below show the command and response message formats.

Command Format



● Response Format

Command code	Response code	Device address	Data length (Bytes)	Input data
28 09				

● Parameters

Destination Address (Command, Response)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex). The most significant byte in the Response Format is set to 00.

Device Service Access Point (Command)

The Device Service Access Point for the Rd_Inp PROFIBUS service must be set to 38 (Hex).

Data length (Bytes) (Response)

This parameter defines the number of Input data bytes returned by the slave device. The number ranges from 0 to 244 bytes. The most significant byte is set to 00.

Input data (Response)

Input data returned by the slave device.

● Response Codes

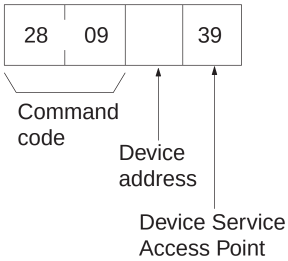
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 2 words
1002	Command too short, i.e. < 2 words.
110C	Device Address Invalid, i.e. > 7E (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • Destination address is same as current master address.
0402	Service is not supported: Device Service Access Point is invalid.

Rd_Outp Service

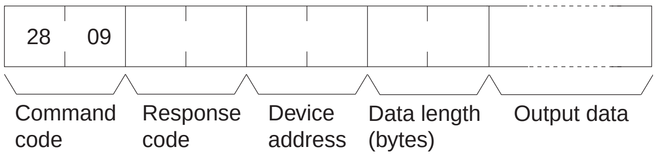
The PROFIBUS DP Rd_Outp service allows a PROFIBUS Master Unit to read the current output data of any slave device, even if it is not allocated to the Master Unit.

The figures below show the command and response message formats.

Command Format



Response Format



Parameters

Destination Address (Command, Response): The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex). The most significant byte in the Response Format is set to 00.

Device Service Access Point (Command): The Device Service Access Point for the Rd_Outp PROFIBUS service must be set to 39 (Hex).

Data length (Bytes) (Response): This parameter defines the number of Output data bytes returned by the slave device. The number ranges from 0 to 244 bytes. The most significant byte is set to 00.

Output Data (Response): Output data returned by the slave device.

Response Codes

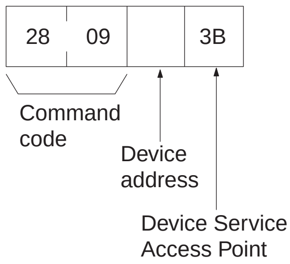
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 2 words
1002	Command too short, i.e. < 2 words.
110C	Device Address Invalid, i.e. > 7E (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • Destination address is same as current master address.
0402	Service is not supported: Device Service Access Point is invalid.

Get_Cfg Service

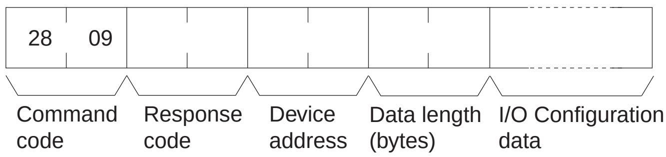
The PROFIBUS DP Get_Cfg service allows a PROFIBUS Master Unit to read the I/O Configuration data of any slave device, even if it is not allocated to the Master Unit.

The figures below show the command and response message formats.

● Command Format



● Response Format



● Parameters

Destination Address (Command, Response)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex). The most significant byte in the Response Format is set to 00.

Device Service Access Point (Command)

The Device Service Access Point for the Get_Cfg PROFIBUS service must be set to 3B (Hex).

Data length (Bytes) (Response)

This parameter defines the number of I/O Configuration bytes returned by the slave device. The number ranges from 0 to 244 bytes. The most significant byte is set to 00.

I/O Configuration data (Response)

I/O Configuration data returned by the slave device. The I/O Configuration bytes are coded according to the PROFIBUS standard.

● Response Codes

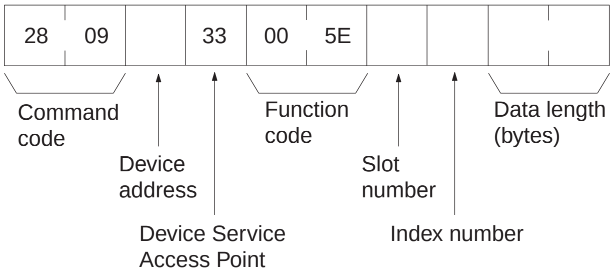
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 2 words
1002	Command too short, i.e. < 2 words.
110C	Device Address Invalid, i.e. > 7E (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • Destination address is same as current master address.
0402	Service is not supported: Device Service Access Point is invalid.

MSAC1_Read Service

The PROFIBUS DP-V1 MSAC1_Read service allows a PROFIBUS DP-V1 Master Unit to read (parameter) data acyclically from a PROFIBUS DP-V1 slave device, which is allocated to that Master unit.

The figures below show the command and response message formats.

Command Format

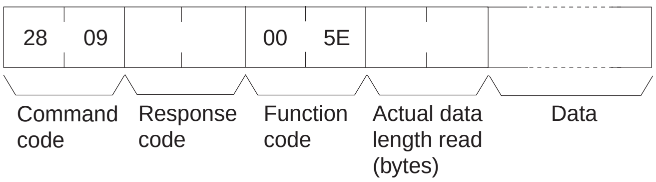


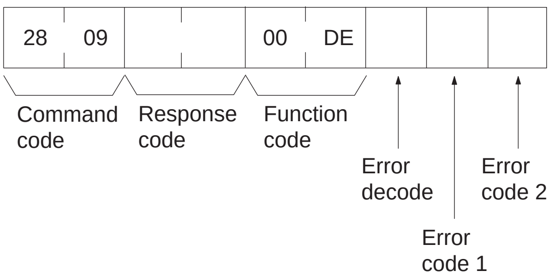
Response Format

Upon normal completion of the MSAC1_Read command service two types of response frames can be returned:

- A normal data response frame containing the requested data.
- A normal response frame containing PROFIBUS error codes, indicating that the PROFIBUS service was not completed correctly, although the message was completed normally.

Both response frames are shown below.





Parameters

Destination address (Command, Response)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex). The most significant byte in the Response Format is set to 00.

Device Service Access Point (Command)

The Device Service Access Point for the MSAC1_Read PROFIBUS service must be set to 33 (Hex).

6-3 Acyclic Messages

6

6-3-2 PROFIBUS MESSAGE SEND (2809)

Function code (Command, Response)

The function code is defined by the PROFIBUS standard and defines the type of MSAC1 message. In the command it must be fixed to 005E (Hex). The response will contain either 005E (Hex) indicating a normal PROFIBUS completion, or 00DE (Hex), indicating PROFIBUS errors.

Slot number (Command)

The parameter Slot_Number is used in the destination device for addressing the desired data slot (typically an I/O module). The number ranges from 0 to 254.

Index number (Command)

The parameter Index is used in the destination device for addressing the desired data block within a specified slot. The number ranges from 0 to 254.

Data length (Bytes) (Command)

The Data length indicates the number of bytes, which have to be read. If the actual data block length is less than requested, the length in the response will be the actual length of the data block. If the actual data block length is greater or equal than requested, the response will contain the requested length of data. The number ranges from 0 to 240.

Data (Response)

Requested data block as retrieved from the PROFIBUS DP-V1 slave device.

Error decode (Response)

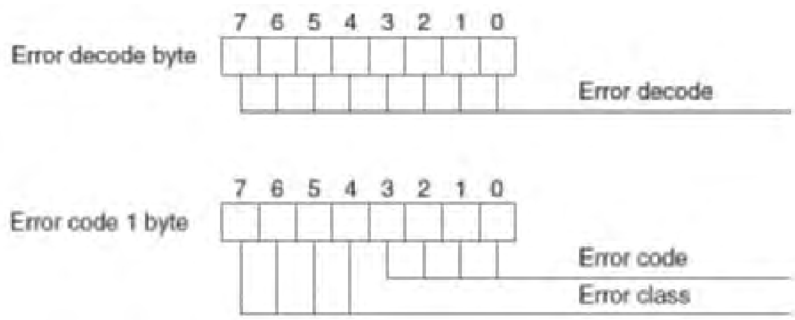
The Error decode byte defines the type of errors reported in the Error code 1 and Error code 2, e.g. a PROFIBUS DP-V1 error.This response will only be returned if the message was delivered successfully, but the PROFIBUS service returned an error. Refer to *A-7-4 PROFIBUS DP-V1 Error Codes* for more information.

Error code 1, Error code 2 (Response)

The contents of the Error code bytes depends on the contents of the Error decode byte and the slave device.

The Error codes returned by a PROFIBUS DP-V1 slave device are defined in the PROFIBUS DP-V1 Extension to the PROFIBUS standard. This section lists the Error codes, which can be returned as a result of a PROFIBUS DP-V1 MSAC1 services. From these codes, the user can determine the cause of the failure.

The figure below shows the two of the three Error code bytes, returned by a PROFIBUS DP-V1 slave device, in case an MSAC1 service resulted in an error. The third byte, Error code 2, which is not shown below will always contain user specific error codes.



Error Decode Byte

Bit		Description
00 to 07	Error Decode	The code determines the protocol type of the slave which returned the error code. Since this error scheme can also be used in network applications containing protocol converters (i.e. gateways), non-PROFIBUS protocols are also defined in this list. • 0 to 127: Reserved • 128: PROFIBUS DP-V1 • 129 to 253: Reserved • 254: PROFIBUS FMS • 255: HART®

In case the Error decode byte is 128, i.e. PROFIBUS DP-V1, the Error code 1 byte can have the possible values defined in the table below.

Error Code 1 Byte

Error Class Code		Error Code	Description
0 to 9	Reserved	--	
10	Application	• 0: Read error • 1: Write error • 2: Module failure • 3 to 7: Reserved • 8: Version conflict • 9: Feature not supported • 10 to 15: User specific	Error codes related to the application, i.e. the slave device it self or I/O modules connected to this device.
11	Access	• 0: Invalid index • 1: Write length error • 2: Invalid slot • 3: Type conflict • 4: Invalid area • 5: State conflict • 6: Access denied • 7: Invalid range • 8: Invalid parameter • 9: Invalid type • 10 to 15: User specific	Error codes related to accessing the requested data area in the slave device or I/O modules connected to the slave device.
12	Resource	• 0: Read constrain conflict • 1: Write constrain conflict • 2: Resource busy • 3: Resource unavailable • 4 to 7: Reserved • 8 to 15: User specific	Error codes related to resources inside the slave device which are required to process the requested data, e.g. functions required to implement a requested action.
13 to 15	User Specific	--	

Error Code 2 Byte

This error code will always contain user specific error codes. If necessary, refer to the slave device's documentation for decoding the returned byte.

Response Codes

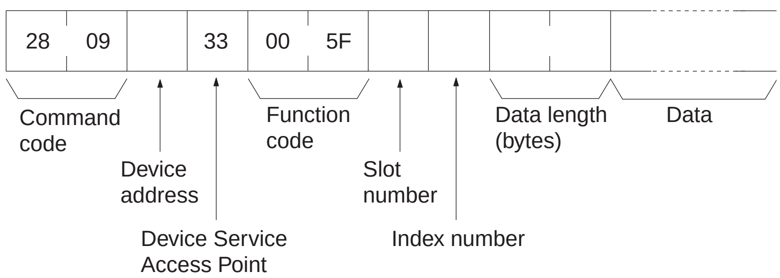
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 5 words
1002	Command too short, i.e. < 5 words.
110C	• Device Address Invalid, i.e. > 7E (Hex). • The slot number is invalid, i.e. > FE (Hex). • The Index number is invalid, i.e. > FE (Hex). • The Data Length is invalid, i.e. > F0 (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • Destination address is same as current master address.
0402	Service is not supported: • Device Service Access Point is invalid. • The Function code is invalid

MSAC1_Write Service

The PROFIBUS DP-V1 MSAC1_Write service allows a PROFIBUS DP-V1 Master Unit to write (parameter) data acyclically to a PROFIBUS DP-V1 slave device, which is allocated to that Master unit.

The figures below show the command and response message formats.

Command Format

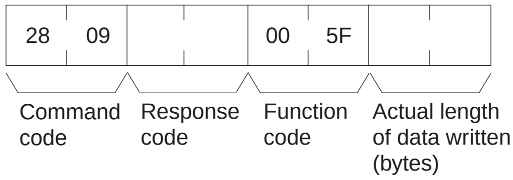


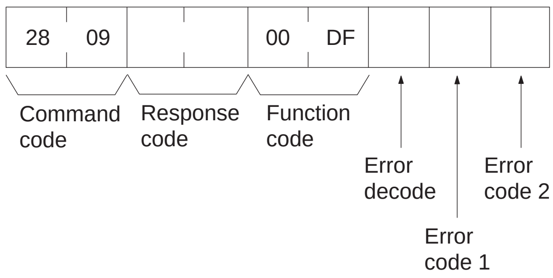
Response Format

Upon normal completion of the MSAC1_Write command service two types of response frames can be returned:

- A normal data response frame, signalling successful completion of both the command and the PROFIBUS service.
- A normal response frame containing PROFIBUS error codes, indicating that the PROFIBUS service was not completed correctly, although the message was completed normally.

Both response frames are shown below.





● Parameters

Destination address (Command, Response)

The address of the device on the PROFIBUS network, to which the PROFIBUS message will be sent. The valid address range is 0 to 7E (Hex). The most significant byte in the Response Format is set to 00.

Device Service Access Point (Command)

The Device Service Access Point for MSAC1 PROFIBUS services must be set to 33 (Hex).

Function code (Command, Response)

The Function code is defined by the PROFIBUS standard and specifies the type of MSAC1 message. For the MSAC1_Read service it must be fixed to 005F (Hex). The Response Format will contain either 005F (Hex) indicating a normal PROFIBUS completion, or 00DF (Hex), indicating PROFIBUS errors.

Slot number (Command)

The parameter Slot number is used in the destination device for addressing the desired data slot (typically an I/O module). The number ranges from 0 to 254.

Index number (Command)

The parameter Index is used in the destination device for addressing the data block within a specified slot to which the data must be written. The number ranges from 0 to 254.

Data length (Bytes) (Command, Response)

The Data length indicates the number of bytes, which must be written. If the actual data block length is less than the length of the data written, the response will contain an error code in the Error code 1 byte. If the actual data block length is greater or equal than the length of the data block written, the response will contain the actual number of bytes written. The data length number ranges from 0 to 240.

Data (Command)

Data to be written to the PROFIBUS DP-V1 slave device.

Error decode (Response)

The Error decode byte defines the type of errors reported in the Error code 1 and Error code 2, e.g. PROFIBUS DP-V1 error. This response will only be returned if the message was delivered successfully, but the PROFIBUS service returned an error. Refer to *A-7-4 PROFIBUS DP-V1 Error Codes* for more information.

Error code 1, Error code 2 (Response)

The contents of the Error code bytes depends on the contents of the Error decode byte and the slave device. Refer to *A-7-4 PROFIBUS DP-V1 Error Codes* for more information.

● Response Codes

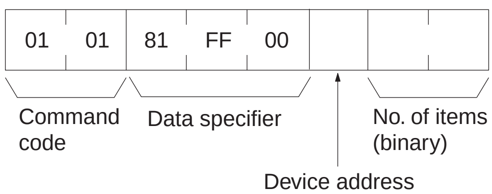
Response code	Description
0000	Normal completion
1001	Command too large, i.e. > 125 words
1002	Command too short, i.e. < 5 words.
110C	• Device Address Invalid, i.e. > 7E (Hex). • The slot number is invalid, i.e. > FE (Hex). • The Index number is invalid, i.e. > FE (Hex). • The Data Length is invalid, i.e. > F0 (Hex)
2208	PROFIBUS Master unit not in correct mode, i.e. it is in OFFLINE mode.
0001	• The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data. • Destination address is same as current master address.
0402	Service is not supported: • Device Service Access Point is invalid. • The Function code is invalid

6-3-3 MEMORY AREA READ (0101)

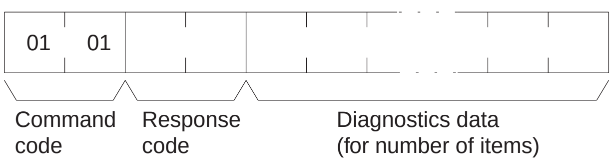
The MEMORY AREA READ command is used to read the last diagnostics data message the PROFIBUS Master Unit received from the specified slave device. The command frame requires three byte data type specifier, specifying the information and one byte specifying the slave device address.

The number of items to read must be 244 - the maximum data size of the PROFIBUS DP diagnostics message - or less.

● Command Format



● Response Format



● Parameters

Data specifier code (command)

Defines the data to be retrieved from the Unit. Always set to 81 FF 00 (Hex).

Slave device address (command)

Defines the slave device network address. Set to 00 to 7D (Hex).

Number of items to read (command)

Defines the number of bytes to read. Set to 1 to F4 (Hex).

● Response Codes

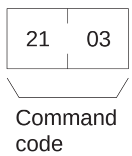
The following end codes can be returned by the Unit in response to the MEMORY AREA READ command:

Response code	Description
0000	Normal completion.
0203	Slave device not allocated to the PROFIBUS Master.
0402	Service not supported by Unit model / version.
1001	Command too large.
1002	Command too short.
110C	• Invalid start address code word (non-specified code used). • Invalid target slave address (exceeds 125).
2208	Unit is not in correct mode, e.g. it is in OFFLINE or STOP mode.

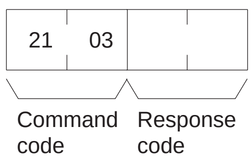
6-3-4 ERROR LOG CLEAR (2103)

The ERROR LOG CLEAR command clears the number of records stored in the PROFIBUS Master Unit error log.

● Command Format



● Response Format



● Response Codes

Response code	Description
0000	Normal completion.
250F	Memory writing error. Error Log was not cleared normally.
260B	Cannot Clear the Error Log. The error cause still exists.

7

Troubleshooting and Maintenance

This section describes the troubleshooting procedures and maintenance operations for the CJ1W-PRM21 PROFIBUS Master Unit. Utilize indicators, Error Status, CX-ConfiguratorFDT, Error Log and Event Log features to identify and correct errors quickly.

7-1 Overview

The CJ1W-PRM21 PROFIBUS Master Unit and CX-ConfiguratorFDT provide extensive means for troubleshooting which can be used to quickly determine errors in the Unit, in the configuration, in the network, and/or in remote slave devices allocated to the Unit.

Troubleshooting on the Master Unit

For troubleshooting purposes, the following error indicators can be used:

- Indicators on the front of the Unit
- Three red error indicators and four status indicators show Unit and network status and errors.
- Device Variables: Unit Status (*_UnitSta) containing status and error flags of the Unit and Master Errors (*_MstrErrSta) containing error information about the PROFIBUS network and the PROFIBUS functions of the Unit.
- The Error Log collects error codes for various error events. Serious errors are stored in non-volatile memory and can be retrieved even after a Unit power down.
- Event Logs in the CPU

This section provides a number of procedures for troubleshooting based on the error indicating methods listed above.

Troubleshooting the Configuration Software

The Configuration software, i.e. CX-ConfiguratorFDT, the PROFIBUS Master DTM and the Generic Slave DTM provide several mechanisms for error detection and correction:

- Errors occurring in CX-ConfiguratorFDT are displayed in pop-up message windows and/or the error log window. The contents of the error log window can be copied to the clipboard to allow analysis afterwards.
- CX-ConfiguratorFDT provides a FDT communication log window which can be copied to the clipboard. Analysis of this communication may provide additional information in case errors occur.

Troubleshooting the network

The PROFIBUS Master DTM and the Generic Slave DTM diagnostics information windows which can display:

- Indications of errors in the PROFIBUS interface of the Unit
- Indications of errors in the communication between the PROFIBUS Master Unit and remote slave devices.
- Indications of errors in the remote slave devices, allocated to the PROFIBUS Master Unit.

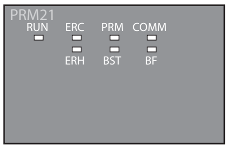
The CX-ConfiguratorFDT and DTM capabilities for troubleshooting are extensively discussed in section 6.

7-2 Troubleshooting with the PROFIBUS Master Unit Indicators

7-2-1 Indicators

This section presents a number of easy to use procedures to troubleshoot possible errors using the indicators on the front of the Unit (see figure below).

CJ1W-PRM21



The possible errors which could occur have been categorized and for each category a group of two or three indicators can be used to troubleshoot the problem:

- Unit start-up errors: These include errors in the CPU as well as errors in the Unit which prevents the combination from starting up correctly. Use RUN, ERC and ERH indicators to troubleshoot the errors.
- Operational errors: These include CPU errors, CPU Bus errors and error log problems all during operations. Use RUN, ERC and ERH indicators to troubleshoot the errors.
- Configuration problems: These include errors during or after downloading a new configuration as well as errors in the configuration after startup. Use ERC and PRM indicators to troubleshoot the errors.
- I/O data communication errors: These include errors in the PROFIBUS interface or on the network. Use BST, COMM and BF indicators to troubleshoot the errors.

7-2-2 Unit Startup Errors

Unit start-up errors are errors which occur at starting up the system and which prevent the Unit from functioning correctly in the CPU system. Usually these errors also cause the NJ-series controller unit ERROR indicator to be lit or flashing. Refer to the *NJ-Series CPU Unit Hardware User's Manual* (Cat. No. W500) and *NJ-Series CPU Unit Software User's Manual* (Cat. No. W501) for more details on these errors.

The error determination procedure uses the table below. To determine the error

- First find the status of the RUN indicator (left column).
- Move one column to the right and find the ERH indicator status.
- Move one column to the right and find the ERC indicator status.

The probable error causes are then listed to the right of the third column.

RUN	ERH	ERC	Probable Cause	Correction
Not lit	Not lit	Not lit	Power is not being supplied to the CPU Unit or the power supply voltage is too low.	Supply power. Make sure that the correct voltage is being supplied.
			The CPU Unit is faulty.	Replace the CPU Unit.
			The sliders are not properly locked into place.	Lock the sliders into place .
			The PROFIBUS Master Unit is faulty.	Replace the PROFIBUS Master Unit.
		Lit	The PROFIBUS Master Unit is faulty (COMM indicator is also flashing).	Replace the PROFIBUS Master Unit.
	Lit	Not lit	The I/O tables are not registered in the CPU Unit.	Register the I/O tables.
			The same unit number is being used on another Unit as well.	Correct the unit number. Make sure that all unit numbers used in the system are unique.
			The CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
		Lit	Not a valid combination at startup.	
Lit	Not lit	Not lit	Unit is functionally correct. If there are still problems, check on the other indicators.	
		Lit	During startup the checksum of the Error Log stored in non-volatile memory was found to be corrupted.	Send a ERROR LOG CLEAR command to the Unit. Restart the Unit.
			During startup the checksum of the Parameter sets stored in non-volatile memory was found to be corrupted.	Re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists, replace the PROFIBUS Master Unit.
			During startup the Parameter set stored in non-volatile memory was correct, but the contents contains errors preventing the PROFIBUS interface to be initialized correctly.	Check the Parameter set in CX-ConfiguratorFDT and re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists, replace the PROFIBUS Master Unit.
	Lit	---	There is an error in the CPU Bus Unit Setup or routing tables.	Read the error history and correct the data that is causing the error. If the problem persists, replace the CPU Unit.
			Memory in the CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
			The CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
			A Fatal error occurred in the CPU system.	Verify that the CPU and all Units are working correctly. Restart the CPU Unit. If the problem persists, replace the CPU Unit.

Note If startup errors prevent the Unit from functioning correctly, the PRM, BST and BF indicators will remain OFF.

7-2-3 Unit Operational Errors

Unit Operational errors are errors which can occur during normal operation, i.e. after normal startup.

The error determination procedure uses the table below. To determine the error, first find the status of the RUN indicator (left column). Then move one column to the right and find the status of the ERH indicator. Then move again one column to the right and find the status of the ERC indicator. The probable error causes are listed to the right of the third column.

RUN	ERH	ERC	Probable Cause	Correction
Not lit	Not lit	Not lit	Power is not being supplied to the CPU Unit or the power supply voltage is too low.	Supply power. Make sure that the correct voltage is being supplied.
			The CPU Unit is faulty.	Replace the CPU Unit.
			The sliders are not properly locked into place.	Lock the sliders into place.
			A fatal error has occurred in the Unit, preventing it from running any program.	Restart the CPU Unit. If the problem persists, replace the PROFIBUS Master Unit.
		Lit	A fatal error has occurred in the Unit's program. The appropriate error code is stored in the error log.error	Restart the CPU Unit. If the problem persists, replace the PROFIBUS Master Unit.
	Lit	Not lit	Not a valid combination during operation.	
		Lit	Not a valid combination during operation.	
Lit	Not lit	Not lit	Unit is functionally correct. If there are still problems, proceed to check on the other indicators.	
		Lit	A write-verify check failed, while writing the error log to the non-volatile memory.	Send a ERROR LOG CLEAR command to the Unit. Restart the Unit.
			A write-verify check failed, while writing the (new) configuration to the non-volatile memory.	Check the Parameter set in CX-ConfiguratorFDT and re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists, replace the PROFIBUS Master Unit.
	Lit	Not Lit	Memory in the CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
			The CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
			A cyclic Monitor time out has occurred, i.e a timeout on exchange of data between the Unit and the CPU.	Restart the CPU Unit. If the problem persists, replace the PROFIBUS Master Unit.
		Lit	Not a valid combination during operation.	

Note If operational errors prevent the Unit from functioning correctly, the PRM, BST, COMM and BF indicators will remain OFF.

7-2-4 Unit Configuration Errors

Unit configuration errors are errors which occur during download of the new configuration or after restarting the Unit following a download. The error can be determined by examining the ERC and the PRM indicators.

The error determination procedure uses the table below. To determine the error

- First find the status of the ERC indicator (left column).
- Move one column to the right and find the PRM indicator status.

The probable error causes are then listed to the right of the third column.

ERC	PRM	Probable Cause	Correction
Not lit	Not lit	Not a valid combination.	
	Lit	No errors. The PROFIBUS DP Parameter set is ready for use.	
	Flashing	No errors. A new configuration is being downloaded from the configurator.	

ERC	PRM	Probable Cause	Correction
Lit	Not lit	An error has occurred while writing the Parameter sets to the non-volatile memory.	Re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists, replace the PROFIBUS Master Unit.
		During startup the checksum of the Parameter sets stored in non-volatile memory was found to be corrupted.	Re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists, replace the PROFIBUS Master Unit.
		During startup the Parameter set stored in non-volatile memory was correct but the contents contains errors preventing the PROFIBUS interface to be initialized correctly.	Check the Parameter set in CX-ConfiguratorFDT and re-download the Parameter sets from CX-ConfiguratorFDT. If the problem persists replace the PROFIBUS Master Unit.
	Lit	Not a valid combination.	

Note 1 The table above assumes that the RUN indicator is ON and the ERH indicator is OFF. Otherwise, refer to section *7-2-2 Unit Startup Errors*, or section *7-2-3 Unit Operational Errors*.

2 If the PRM indicator is OFF or Flashing, the BST, COMM and BF indicators remain OFF.

7-2-5 Network Errors

Network errors are errors which occur when attempting to startup a network, i.e. the PROFIBUS Master Unit has been switched to CLEAR or OPERATE mode. The Unit will parameterize the slave devices and start data exchange. An error in this process can be determined by examining the BST, COMM and BF indicators.

- The error determination procedure uses the table below. To determine the error
- First find the status of the BST indicator (left column).
- Move one column to the right and find the COMM indicator status.
- Move one column to the right and find the BF indicator status.

The probable error causes are then listed to the right of the third column.

BST	COMM	BF	Probable Cause	Correction
Not lit	Not lit	Not lit	The PROFIBUS Master Unit is in OFFLINE or STOP mode. No communication over the network.	Switch the Unit to either CLEAR or OPERATE mode.
		Lit	A hardware error has occurred in the PROFIBUS interface of the Unit or a master device has been detected beyond the Highest Station Address. The Unit has switched to OFFLINE. This indicates faulty wiring, broken message, short-circuits, faulty bus timings or an active device has been detected beyond the Highest Station Address setting (HSA).	• Check the network wiring, and make sure it is correct (not too long, long stub lines, etc.) • Check for short-circuits. • Check the bus timing set in CX-ConfiguratorFDT. • Check the HSA setting in the DTM's Bus Parameter tab. Set it to the highest master address which is on the network. • Check if any other faulty devices are on the same network. • Switch the Unit to CLEAR / OPERATE mode again.
			A protocol error has occurred in the PROFIBUS interface of the Unit, the Unit has switched to OFFLINE. This indicates lost tokens.	• Check the network wiring, and other master devices on the network. Make sure they are all correct. • Check if any other faulty devices are on the same network. • Switch the Unit to CLEAR / OPERATE mode again.
			A Double-Address error has occurred on the network, i.e. there is a second master device with the same PROFIBUS address on the network. the Unit has switched to OFFLINE.	• Check the master devices on the network. Make sure they all have unique network addresses. • After correction, switch the Unit to CLEAR / OPERATE mode again.
	Lit	Not lit	Not a valid combination.	
		Lit	Not a valid combination.	

<table>
<tr><th>BST</th><th>COMM</th><th>BF</th><th>Probable Cause</th><th>Correction</th></tr>
<tr><td rowspan="6">Flashing/Lit</td><td rowspan="3">Not lit</td><td>Not lit</td><td colspan="2">Not a valid combination.</td></tr>
<tr><td>Lit</td><td>A Bus disturbance error has been detected.
This indicates a termination error (termination resistors are missing or inductors are not used) or two slave devices with the same address.</td><td>• Switch the Unit to OFFLINE mode.
• Terminate the network at the appropriate places (see section 2-3-2 Bus Termination).
• Check if any other faulty devices are on the same network.
• Switch the Unit to CLEAR / OPERATE mode again.</td></tr>
<tr><td>Flashing</td><td>None of the allocated slave devices responds to the master’s request messages.
None of the slaves is in I/O data exchange with the Master Unit.
This may indicate a loose network connector on the Master Unit, or a broken cable.</td><td>• Switch the Unit to OFFLINE mode.
• Check the network wiring.
• Check if any other faulty devices are on the same network.
• Check if actual slave addresses match the configured addresses.
• Check if the slave parameter settings are correct. If necessary change them, and download them again.
• Switch the Unit to CLEAR / OPERATE mode again.</td></tr>
<tr><td rowspan="3">Lit</td><td>Not-Lit</td><td colspan="2">There are no errors. The Unit is in CLEAR or OPERATE mode and exchanging data.</td></tr>
<tr><td>Lit</td><td colspan="2">Not a valid combination.</td></tr>
<tr><td>Flashing</td><td>At least one slave device has responded to the master’s request messages and is not in Data Exchange. There is also at least one slave which has either
• not responded to the master’s requests messages, or
• been parameterized incorrectly.</td><td>• Switch the Unit to OFFLINE mode.
• Check the network wiring.
• Check if any other faulty devices are on the same network.
• Check if the slave parameter settings are correct. Re-download after correction.
• Switch the Unit to CLEAR / OPERATE mode again.</td></tr>
</table>

Note The table above assumes that the RUN and the PRM indicators are ON and the ERH indicator is OFF. Otherwise, refer to section *7-2-2 Unit Startup Errors*, section *7-2-3 Unit Operational Errors* or section *7-2-4 Unit Configuration Errors*.

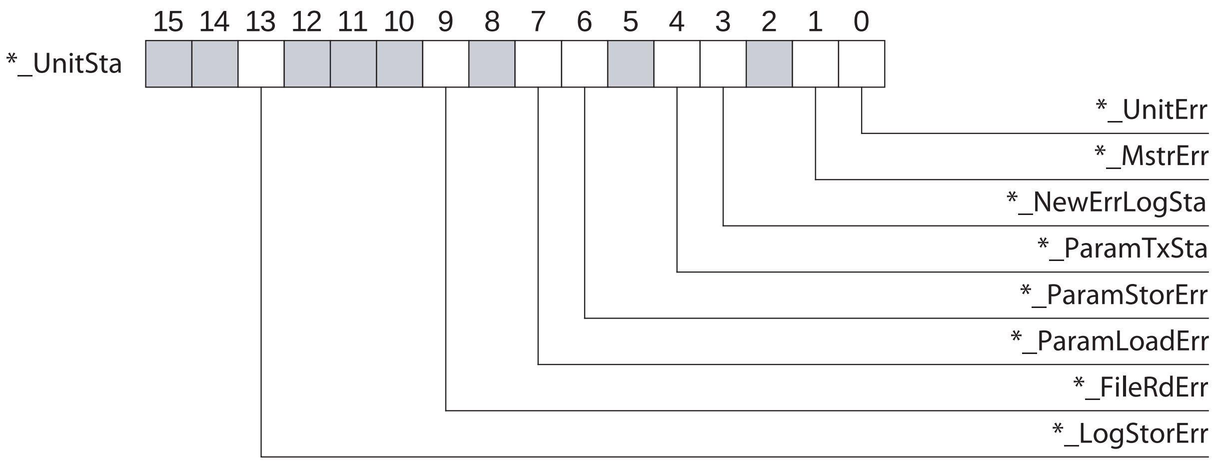
7-3 Troubleshooting Using Error Status

Error status in Device Variables

The PROFIBUS Master Unit provides error status indications to the CPU Unit in the Unit Status Word and the Master Errors which are allocated to CPU Bus Units (see *4-2-3 Unit Status (*_UnitSta)* and *4-2-5 Master Errors (*_MstrErrSta)*).

7-3-1 Unit Status Word

The Unit Status word (*_UnitSta) contains status and error indications on the Unit itself. The corresponding bit flag will change to TRUE if an error event has occurred.



Bit	Name	Description/Correction
*_UnitErr	Unit error flag	If this bit is set, one of the other error flags in the Unit Status Word is set. Refer to the following bits for error determination.
*_MstrErr	Master error flag	If this bit is set, one of the error flags in the Master Errors word is set. Refer to these bits for error determination.
*_NewErrLogSta	Error Log contains new errors	There are new errors available in the Error Log since the last time the error log was read. Reading the error log will clear this bit flag.
*_ParamTxSta	Parameter transfer in progress	A Parameter transfer is in progress either from the configurator to the Unit.
*_ParamStorErr	Local parameter storage error	An error has occurred when writing the configuration to the non-volatile memory. To correct this: • Restart the Unit. • Re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.

Bit	Name	Description/Correction
*_ParamLoadErr	Local parameter load error	An error has occurred when loading the configuration from the non-volatile memory to the volatile memory at start up. Most likely causes: • A failure or interruption during the writing process. • A faulty parameter setting which makes initialization of the PROFIBUS interface impossible. To correct this: • Check the parameter settings for incorrect values. • Restart the Unit. • Re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.
*_FileRdErr	File read error	An error has occurred, when loading the configuration from the non-volatile memory to the volatile memory at start up. Most likely cause is a failure or interruption during the writing process. Most likely causes: • A failure or interruption during the writing process. • A failure during the reading process. To correct this: • Restart the CPU Unit, to re-download the configuration. • If the problem persists, use CX-ConfiguratorFDT to re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.
*_LogStorErr	Error Log storage error	An error has occurred, when writing the error log to the non-volatile memory, or when reading the error log from non-volatile memory during start up. Most likely causes: A failure or interruption during the writing process. To correct this: • Send an ERROR LOG CLEAR command to the Unit. • Restart the Unit. • If the problem persists, replace the PROFIBUS Master Unit.

7-3-2 Master Errors Word

The Master Errors word (*_MstrErrSta) contains error indications on the PROFIBUS interface and network. The corresponding bit flag will change to TRUE if an error event has occurred.

Bit	Name	Description/Correction
*_MstrBusErr	Disturbed bus Error	An error has occurred in the PROFIBUS interface with distorted messages received by the PROFIBUS Master Unit. Most likely causes: • No or invalid termination or no inductors used at high baud rates. • Faulty wiring. To correct this: • Check the termination on the appropriate devices. • Restart the CPU Unit to re-download the configuration. • If the problem persists, use CX-ConfiguratorFDT to re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.
*_MstrProtErr	PROFIBUS protocol error	An error has occurred in the PROFIBUS interface with distorted messages received by the PROFIBUS Master Unit. Most likely causes: • Lost token messages (the token is not returned). To correct this: • Check the master devices on the network, and make sure they are all working correctly. • After correction, switch the Unit to CLEAR / OPERATE mode again.
*_MstrAdrErr	Master Address Duplication Error	A second master device with the same network address has been detected on the PROFIBUS network. The PROFIBUS Master Unit has switched to OFFLINE. To correct this: • Check the master devices on the network and ensure that they have unique device addresses. • After correction, switch the Unit to CLEAR / OPERATE mode again.
*_MstrHwErr	Hardware error	A hardware error has occurred in the PROFIBUS interface of the Unit. The PROFIBUS Master Unit has switched to OFFLINE. Most likely causes: • Faulty wiring, • Broken messages, • Short-circuits, or • Faulty bus timings. • A master device has been detected beyond the Highest Station Address (HSA). To correct this: • Check the network wiring, and make sure it is correct. • Check for short-circuits. • Check the bus timing set through CX-ConfiguratorFDT. • Check if any other faulty devices are on the same network. • After correction, switch the Unit to CLEAR / OPERATE mode again.

Bit	Name	Description/Correction
*_MstrMdCmdErr	Mode command error	An error has occurred when setting two or more mode switches in Switch Word (*_SwCmd). The flag will be set to TRUE until the correct command, i.e. one mode switch has been issued.
*_MstrParamErr	Parameter error	An error has occurred initializing the PROFIBUS interface, after reading the parameter sets from the non-volatile memory to the volatile memory. Most likely cause: A faulty parameters has been downloaded to the Unit. To correct this: Check the parameter settings in CX-ConfiguratorFDT and correct them if necessary. After correction perform a download of the new parameters to the Unit.

7-4 Troubleshooting the Network

7-4-1 Troubleshooting Parameter Download

The PROFIBUS Master DTM provides clear error messages if downloading of the parameters to the PROFIBUS Master Unit fails. Failure can be due to any of the following:

- Errors or inconsistencies in the slave parameter sets, which are checked prior to download.
- The Master DTM being unable to establish communication with the CJ1W-PRM21 PROFIBUS Master Unit.
- A communication interruption of the process during download.

Errors in Slave Parameter Sets

The error messages displayed will provide a clear indication of the problem.

A download initiated by the user starts with a check on the slave parameter sets. The Master DTM will check

- The total number of slave devices assigned which must be at least one slave device.
- The total number of I/O modules per slave which must be at least one I/O module per slave.
- The maximum size of the I/O data size which must not exceed 7168 words.
- The maximum number of I/O modules which must not exceed 4000.
- Any existing overlap in the I/O Areas configured.
- Any existing overlap in the allocated CPU memory areas.

Any of these errors will abort the download process without consequences for the CJ1W-PRM21 PROFIBUS Master Unit.

The error messages associated with these failures are listed in *A-5 CX-ConfiguratorFDT Warning and Error Messages*. The list also provides remedies.

Errors when Establishing Communication

If no errors occurred during the checking phase, the Master DTM will try to establish communication with the CJ1W-PRM21 PROFIBUS Master Unit through CX-Server. If this fails, an error message will be displayed indicating a communication problem (see *A-5 CX-ConfiguratorFDT Warning and Error Messages*). A failure to establish communication prior to download will have no consequences for the CJ1W-PRM21 PROFIBUS Master Unit. The list provided in *A-5 CX-ConfiguratorFDT Warning and Error Messages* also provides possible remedies.

Errors During Download

If none of the first two processes result in a failure, downloading will commence. As soon as downloading has started the data in the volatile memory of the CJ1W-PRM21 PROFIBUS Master Unit will be overwritten.

Recovery After Failing Download

If a failure occurs during the download process which prevents the Master DTM from completing the process, the user must restart the Unit manually. Restarting the Master Unit will abort the download process in the Master Unit and recover the previous configuration from its non-volatile memory.

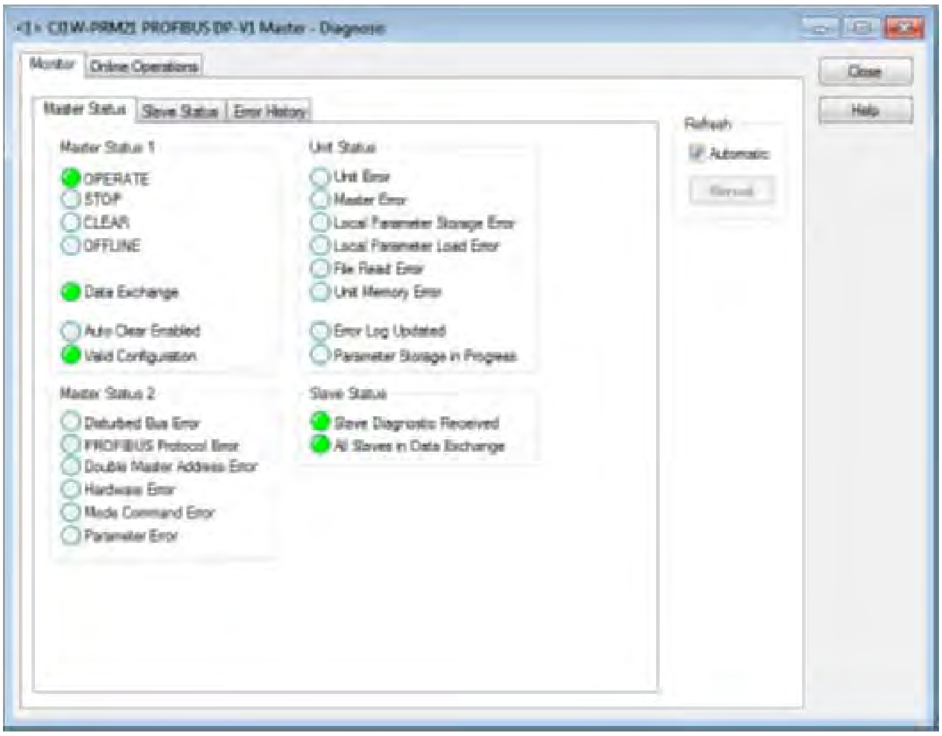
7-4-2 Troubleshooting the Network using CX-ConfiguratorFDT

● CX-ConfiguratorFDT Troubleshooting

CX-ConfiguratorFDT provides several means to troubleshoot either the CJ1W-PRM21 PROFIBUS Master Unit, the slave devices or the network. The means all rely on features discussed in the previous section.

● Troubleshooting the Master Unit

To troubleshoot the Master Unit or the network the Master DTM Diagnosis User Interface provides a help in determining problems. The figure below shows the Monitor - Master Status tab of the Master DTM Diagnosis User Interface.



The indicators shown in the (example) figure above are all related to bit flags in the Unit Status Word, the Master Status Word 1, the Master Status Word 2, and the Slave Status Word (see section *4-2 Device Variables for CJ-series Unit (Software Switches, Statuses)*).

The table below lists combinations of indicators with information on possible problems.

Indicators	Description/Correction
Local Parameter Storage Error (Valid Configuration Indicator will be OFF)	An error has occurred, when writing the configuration to the non-volatile memory. To correct this: • Restart the Unit. • Re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.

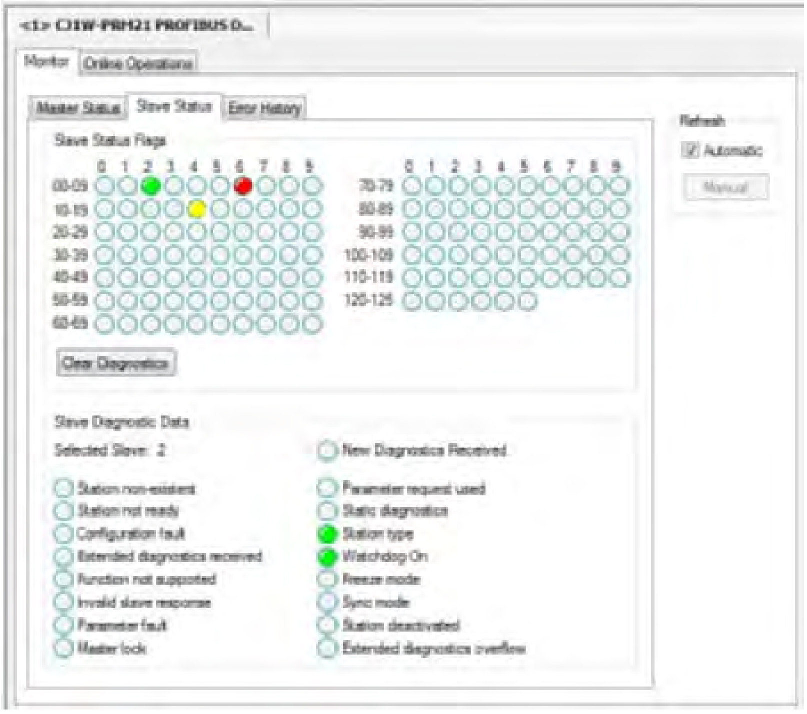
Indicators	Description/Correction
Local Parameter Load Error (Valid Configuration Indicator will be OFF)	An error has occurred, when loading the configuration from the non-volatile memory to the volatile memory at start up. Most likely causes: • A failure or interruption during the writing process. • A faulty parameter setting which makes initialization of the PROFIBUS interface impossible. To correct this: • Check the parameter settings for incorrect values. • Restart the Unit. • Re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.
File read error is TRUE (Valid Configuration Indicator will be OFF)	An error has occurred, when loading the configuration from the non-volatile memory to the volatile memory at start up. Most likely causes: • A failure or interruption during the writing process. • A failure during the reading process. To correct this: • Restart the CPU Unit, to re-download the configuration. • If the problem persists, use CX-ConfiguratorFDT to re-download the configuration.
Parameter error: TRUE (Valid Configuration Indicator will be OFF)	An error has occurred initializing the PROFIBUS interface after reading the parameter sets from the non-volatile memory to the volatile memory. Most likely cause: • A faulty parameters has been downloaded to the Unit. To correct this: • Check the parameter settings in CX-ConfiguratorFDT and correct them if necessary. After correction, perform a download of the new parameters to the Unit.
Disturbed bus Error: TRUE	An error has occurred in the PROFIBUS interface, with distorted messages received by the PROFIBUS Master Unit. Most likely causes: • No or invalid termination or no inductors used at high baud rates. • Faulty wiring. To correct this: • Check the termination on the appropriate devices. • Restart the CPU Unit, to re-download the configuration. • If the problem persists, use CX-ConfiguratorFDT to re-download the configuration. • If the problem persists, replace the PROFIBUS Master Unit.
PROFIBUS protocol error: TRUE (OFFLINE indicator will be ON)	An error has occurred in the PROFIBUS interface with distorted messages received by the PROFIBUS Master Unit. Most likely causes: • Lost token messages (the token is not returned). To correct this: • Check the master devices on the network, and make sure they are all working correctly. • After correction, switch the Unit to CLEAR / OPERATE mode again.

<table>
<tr><th>Indicators</th><th>Description/Correction</th></tr>
<tr><td>Master Address Duplication Error: TRUE
(OFFLINE indicator will be ON)</td><td>A second master device with the same network address has been detected on the PROFIBUS network. The PROFIBUS Master Unit has switched to OFFLINE.
To correct this:
• Check the master devices on the network and ensure that they have unique device addresses.
• After correction, switch the Unit to CLEAR / OPERATE mode again.</td></tr>
<tr><td>Hardware error: TRUE
(OFFLINE indicator will be ON)</td><td>A hardware error has occurred in the PROFIBUS interface of the Unit. The PROFIBUS Master Unit has switched to OFFLINE.
• Most likely causes:
• Faulty wiring,
• Broken messages,
• Short-circuits, or
• Faulty bus timings.
• A master device has been detected beyond the Highest Station Address (HSA).

To correct this:
• Check the network wiring, and make sure it is correct.
• Check for short-circuits.
• Check the bus timing set through CX-ConfiguratorFDT.
• Check if any other faulty devices are on the same network.
• After correction, switch the Unit to CLEAR / OPERATE mode again.</td></tr>
<tr><td>• Auto-Clear enabled: TRUE
• CLEAR: TRUE
• Slave Diagnostics received: TRUE</td><td>This combination indicates that one of the slave devices on the network failed causing an automatic transition to the CLEAR mode.
Check the Monitor - Slave Status tab to see which slave failed.</td></tr>
<tr><td>• OPERATE: TRUE
• Slave Diagnostics received is: TRUE
• Data Exchange: FALSE
• Auto-Clear enabled: FALSE</td><td>The Master Unit is still in OPERATE mode but not exchanging data with all its slave devices. One or more of the slave devices on the network failed.
Check the Monitor - Slave Status tab to see which slave failed.</td></tr>
</table>

● Troubleshooting the Slave Devices

If the Master Status tab indicates problems related to slave devices, their status can be obtained by checking the Slave Status tab. The figure below shows this tab. As an example a failure of slave device 2 is shown.



The indicators in the upper half of the Slave Status tab shown in the figure above indicates the status of the slave devices by using different colors (see sections *5-7-1 Monitoring the Master Unit and the Network*, *5-7-2 Monitoring Slave Status*).

In case an indicator is either Red or Orange, additional information can be obtained from the PROFIBUS Master Unit by using the mouse pointer to click on the colored indicator. The basic diagnostics information for the selected slave device is retrieved from the Master Unit and displayed in the lower half of the Slave Status tab. The table below lists the indicators which are of interest for troubleshooting.

Indicator	Description/Correction
Station non-existent	The slave device does not respond to any of the request messages sent by the Master Unit. • Make sure that the slave device is powered correctly. • Check the wiring and make sure that the slave device and the Master Unit are connected.
Station not ready	The slave is communicating, but not ready for data transfer. • Check the slave device and make sure that it is working properly. • Check any loose modules, in case the slave device is a modular device. • Consult the operation manual of the slave device. Check if additional action must be taken to initiate I/O data exchange (e.g. reset the device after a malfunction).
Configuration fault	The I/O configuration sent by the Master Unit is rejected by the slave device. The Parameter request used indicator will also be ON. • Check the selected I/O modules in the Slave DTM. Make sure they match the expected total I/O number and sequence. • Consult the operation manual of the slave device. Check if additional modules must be selected (e.g. empty i/O modules for power modules in a modular slave).
Extended diagnostics received	The slave device has returned extended diagnostics information. This does not necessarily indicate a malfunction. The Master DTM does not display the extended diagnostics returned by a slave device. Open the associated Slave DTM to check on the contents of the extended diagnostis.
Function not supported	The Master Unit has sent a message to the slave device which is not supported by that device.
Invalid slave response	This bit is set by the Master Unit if the slave has returned an invalid response to a master request message.

Indicator	Description/Correction
Parameter fault	The parameters sent by the Master Unit are rejected by the slave device. The Parameter request used indicator will also be ON. • Check the common parameter settings in the Slave DTM. Make sure the parameters are within range, and match the physical configuration of the slave device. • Consult the operation manual of the slave device. Check if additional parameters must be selected (e.g. parameters associated with selected I/O modules).
Master lock	The slave device is parameterized and locked by another Master Unit on the network. The Parameter request used indicator will also be ON. • Remove the slave device from either one of the two Master Units on the network. • Switch off the other Master Unit.
Parameter request used	The slave device is not in I/O data exchange with the Master Unit and has requested new parameters. • Check the parameters and the I/O configuration for the slave device and make sure they are correct (Check the Parameter fault, Configuration fault and Master Lock indicators).
Static diagnostics	The slave device is sending static diagnostics and is not exchanging I/O data. This usually indicates a problem at the slave device which prevents it from reading its inputs or setting its outputs. • Check the slave device and make sure that it is working properly. • Check any loose modules, in case the slave device is a modular device. • Check the wiring of the I/O at the slave device. Slaves can often detect short-circuits on their physical I/O. • Consult the operation manual of the slave device. Check if additional action must be taken to initiate I/O data exchange (e.g. reset the device after a malfunction).
Station type	This indicator only indicates the device type (i.e. slave device) and does not indicate a problem.
Watchdog On	This indicator only indicates that the Watchdog has been enabled at the slave device and does not indicate a problem.
Freeze mode	This indicator only indicates the slave device has received a Global-Control Freeze command and does not indicate a problem.
Sync mode	This indicator only indicates the slave device has received a Global-Control Sync command and does not indicate a problem.
Slave deactivated	This indicator indicates the slave device has been disabled in the Master Unit and does not indicate a problem.
Extended diagnostics overflow	The slave device has more diagnostics to report than it can hold in its buffer. This is usually an indication for problems. • Check the slave device’s extended diagnostics information. Open the associated Slave DTM to check on the contents of the extended diagnostics, if this has been returned. • Check the slave device and make sure that it is working properly. • Check any loose modules, in case the slave device is a modular device. • Check the wiring of the I/O at the slave device. Slaves can often detect short-circuits on their physical I/O. • Consult the operation manual of the slave device. Check if additional action must be taken to initiate I/O data exchange (e.g. reset the device after a malfunction).

7-4-3 Troubleshooting I/O Communication

This section deals with troubleshooting the I/O communication on the network. The tables below describe the general perceived problem to the user, probable causes and probable remedies.

Problem	Probable Cause	Correction
PROFIBUS Master Unit is configured, but none of the slaves are exchanging data.	No power is supplied to the system. All indicators on the system are OFF.	• Verify that power is supplied to the system.
	A CPU (startup) error occurred. • The ERH indicator is ON, the other indicators are OFF. • The ERR/ALM indicator on the CPU is ON.	• Determine error in the CPU. Refer to the *NJ Series CPU Unit Hardware User's Manual (Cat. No. W500)* and *NJ-series CPU Unit Software User's Manual (Cat No. W501)* for more details on these errors.
	The stored configuration contains a checksum error (storing configuration was interrupted or failed). • After restarting the Unit, the ERC indicator is ON and the PRM indicator is OFF. • Unit Status error flag may provide more information (*_UnitSta, *_ParamStorErr, *_ParamLoadErr, *_FileRdErr).	• Re-download the configuration. • If the problem persists, replace the Unit.
	The configuration contains timing errors. • After restarting the Unit, the ERC indicator is ON, and the PRM indicator is OFF.	• Verify that the Bus parameter sets are correct. • Re-download the configuration. • If the problem persists, replace the Unit.
	The PROFIBUS Master Unit is in either OFFLINE or STOP mode. • The BST indicator is OFF. • The Unit may have been configured to maintain its current mode (last mode was OFFLINE, during download). • The BF indicator is ON: A PROFIBUS interface error has occurred: see Master Errors flags (*_MstrBusErr, *_MstrProtErr, *_MstrAdrErr, *_MstrHwErr).	Determine the mode of the Unit: Check the Master Status word (*_MstrOperateSta, *_MstrStopSta, *_MstrClearSta, *_MstrOfflineSta). If Unit is in OFFLINE or STOP mode: • Verify that the master does not use the same address as another Master Unit on the network. Otherwise, correct the Master Unit's PROFIBUS address. • Verify that all Master Units on the network use the same baud rate setting. Otherwise, correct the baud rate settings. • Set CLEAR or OPERATE switch in CIO Word n (see Note). • Change the configuration to set the Unit OPERATE mode when switching the CPU to RUN mode (see Master DTM, Master Setup Tab). Download the configuration, and switch the CPU to RUN mode.
	Network cabling is not correct. • BF indicator is ON. • Master Errors flag may provide more information (*_MstrBusErr, *_MstrProtErr, *_MstrAdrErr, *_MstrHwErr). • Slave Data Exchange Ative Flags show which slaves have problems.	Verify that the network installation is correct: • Verify that all slaves are powered up and functioning correctly. • Verify that all slave devices are correctly connected to the network. • Verify that any repeaters used are functioning correctly. • Check the cable length versus the selected baud rate. • Verify that any stubs used are not too long. • Verify that termination (resistors and inductors) are properly set and used.

Problem	Probable Cause	Correction
PROFIBUS Master Unit is configured. Some, but not all slaves exchange data.	Network cabling is not correct. • BF indicator is ON or Flashing. • Master Errors flag may provide more information (*_MstrBusErr, *_MstrProtErr, *_MstrAdrErr, *_MstrHwErr). • Slave Data Exchange Active Flags show which slaves have problems.	Verify that the network installation is correct: • Verify that all slaves are powered up and functioning correctly. • Verify that all slave devices are correctly connected to the network. • Verify that any repeaters used are functioning correctly. • Check the cable length versus the selected baud rate. • Verify that any stubs used are not too long. • Verify that termination (resistors and inductors) are properly set and used.
	Configuration is not correct. • BF indicator is Flashing. • Slave Data Exchange Active Flags show which slaves have problems. • Use CX-ConfiguratorFDT and DTMs to determine slave diagnostics.	Verify that the configuration is correct: • Verify that address of targeted slave device matches the configured address. • Verify that the slave parameter and configuration settings are correct. • Verify that the watchdog setting for the slave device is not too low.
	The configuration contains timing errors. • BF indicator is Flashing. • Slaves are sometimes briefly in and out of data exchange.	• Increase slave Watchdog Control value in the Master Unit Bus parameter set. • Verify that the Bus parameter sets are correct. If necessary, increase Target Rotation Time and/or Min. Slave Interval parameters. • Re-download the configuration. • If the problem persists, replace the Unit.
	A second master device (with its own slave devices) is on the same network, interfering with this Master Unit. • The baud rate settings of both masters is different. • The total Target Rotation Time set to both masters is too small (i.e. not the sum of both individual time values).	• Verify that all masters on the network are set to the same baud rate. • Verify that the total Target Rotation Time for all masters on the network is set to the sum of all individual masters.
	Specific slave devices are configured and allocated to the Master Unit, but the slave which is not exchanging data may have been disabled.	Enable the slave devices.

Problem	Probable Cause	Correction
PROFIBUS Master Unit is configured. All slaves were in data exchange, but it has now stopped.	No power is supplied to the system. All indicators on the system are OFF.	Verify that power is supplied to the system.
	A CPU error occurred. • The ERH indicator is ON, the other indicators are OFF. • The ERR/ALM indicator on the CPU is ON.	Determine error in the CPU. Refer to the *NJ Series CPU Unit Hardware User's Manual (Cat. No. W500)* and *NJ-series CPU Unit Software User's Manual (Cat No. W501)* for more details on these errors.
	A Unit error occurred. • The ERC indicator is ON, the other indicators are OFF. • The ERR/ALM indicator on the CPU is ON.	Restart the Unit, and read the error log to determine the type of error.
	The PROFIBUS Master Unit is in either OFFLINE or STOP mode. • The BST indicator is OFF • The BF indicator is ON: A PROFIBUS interface error has occurred: see Master Errors flags (*_MstrBusErr, *_MstrProtErr, *_MstrAdrErr, *_MstrHwErr).	Determine the mode of the Unit: Check the Master Status word (*_MstrOperateSta, *_MstrStopSta, *_MstrClearSta, *_MstrOfflineSta). If Unit is in OFFLINE or STOP mode: • Verify that the master does not use the same address as another Master Unit on the network. Otherwise, correct the Master Unit's PROFIBUS address. • Set CLEAR or OPERATE switch in *_SwCmd.
	Network cabling is not correct. BF indicator is ON. • Master Errors flag may provide more information (*_MstrBusErr, *_MstrProtErr, *_MstrAdrErr, *_MstrHwErr).	Verify that the network installation is correct: • Verify that the network is still in tact, and connected to the Unit. • Verify that any repeaters used are functioning correctly.
PROFIBUS Master Unit is configured. After switching the Master Unit to OPERATE, the Unit itself or other Units on the CPU showed unexpected behavior.	The I/O data mapping of the Master Unit may overwrite either its own or other Unit CIO/DM Areas settings: • Master Unit operational mode changes unexpectedly. • Global-Control commands are transmitted unexpectedly. • Other Special I/O Units or Special Bus Units change behavior unexpectedly.	Verify the I/O Mapping of the Master Unit: • Ensure that the I/O data of the Master Unit does not overwrite its own CIO words. • Ensure that the I/O data of the Master Unit does not overwrite CIO words or DM words of other Special I/O or Special CPU Units (e.g. Ethernet Units)
	The bus parameter used on the network are wrong. • I/O data exchange between the Master Unit and the CPU stops.	Verify that the correct bus parameters have been used. • (If necessary) Restart the Unit and force it to OFFLINE immediately, or • Disconnect the network cable first and restart the Unit. • Download the correct Bus parameters.
PROFIBUS Master Unit is configured. All slaves were in data exchange, but all outputs are now set to zeros. Inputs can still be read.	The Master Unit is in CLEAR mode. • The BST indicator is Flashing. • The CLEAR switch has been set in the Switch word 1 (*_MstrClearCmd). • The Unit has been configured for Auto-CLEAR and an error occurred on the Network with one or more slave devices.	• If Auto-CLEAR is enabled, correct the network problem first. • Set OPERATE switch (*_MstrOperateCmd) to force the Unit to the OPERATE mode.

Problem	Probable Cause	Correction
PROFIBUS Master Unit is configured. All slaves are in data exchange, but the outputs of some slave devices are not updated.	The specified slave devices may be in Sync mode.	Send a Global-Control Unsync command to the targeted slave or group of slaves. Refer to *4-2-2 Global-Control Command (*_GlobCtlCmd)*.
	The specified slave device may have its watchdog disabled and is disconnected from the network, due to a cabling problem. • BF indicator is Flashing. • Slave Data Exchange Active Flags show which slaves have problems. • Use CX-ConfiguratorFDT and DTMs to determine slave diagnostics.	Verify that the specified slave device is still connected to the network.
PROFIBUS Master Unit is configured. All slaves are in data exchange, but the inputs of some slave devices are not updated.	The specified slave devices may be in Freeze mode.	Send a Global-Control Unfreeze command to the targeted slave or group of slaves. Refer to *4-2-2 Global-Control Command (*_GlobCtlCmd)*
	The specified slave device may have its watchdog disabled and is disconnected from the network, due to a cabling problem. BF indicator is Flashing. Slave Data Exchange Active Flags show which slaves have problems. Use CX-ConfiguratorFDT and DTMs to determine slave diagnostics.	Verify that the specified slave device is still connected to the network.

7-4-4 Troubleshooting PROFIBUS DP-V1 Communication

This section deals with troubleshooting the PROFIBUS DP-V1 Communication on the network from a behavior point of view. The column on the left describes the general perceived problem to the user. The columns on the right list the possible causes and their remedies.

Problem	Probable Cause	Correction
PROFIBUS Master Unit is configured. Both the I/O Communication and the PROFIBUS DP-V1 Communication fail.	A possible problem with the network.	Please refer to sections *7-4-2 Troubleshooting the Network using CX-ConfiguratorFDT* and/or *7-4-3 Troubleshooting I/O Communication*.
	The I/O Configuration is incorrect and the slave device is not in data exchange with the PROFIBUS Master Unit.	Correct the I/O Configuration if required.
PROFIBUS Master Unit is configured and the I/O Communication is operatiional. The PROFIBUS DP-V1 Communication fails.	Commands can not be send to a PROFIBUS Slave which has address value zero.	Change the address of the PROFIBUS Slave and the PROFIBUS configuration if required.
	When communicating with the DTM or from the CPU program, the previous PROFIBUS DP-V1 communication session may not have been ended correctly. Corresponding PROFIBUS DP-V1 Connection bit (refer to *I Acyclic Connection/Abort Status Box*) is still set.	Put the DTM offline and online again to initiate communication. If this does not clear the problem, put the master in OFFLINE mode and back into the original state.
	The PROFIBUS Slave may not support PROFIBUS DP-V1 (class 1 or class 2).	Please check the Slave's Operation manual or GSD file.

7-5 Error Log Functions

Errors detected by the PROFIBUS Master Unit are stored in the error log along with the date and time of their occurrence. You can monitor the error log by using the CX-ConfiguratorFDT.

Refer to sections *3-1-8 Error Logging and FDT Monitoring* and *5-7-3 Using the Error Log* for error log monitoring operations.

7-5-1 Overview of the Error Log

The PROFIBUS Master Unit maintains an Error Log, which contains the reports on specific error events.

Logged Errors

The following errors are recorded in the error log.

- Errors in network operation
- Errors in data transfers
- Error in the CPU Unit

Error Log Records

Each error is recorded as one record in an error log table. Each record contains:

- A main error code (see *7-5-2 Error Codes and Detailed Codes*)
- A detailed error code (see *7-5-2 Error Codes and Detailed Codes*)
- A time stamp (from the clock in the CPU Unit)

Error Log Location

When an error is detected, the error codes and time stamp are recorded in an error log record, which is stored in the error login volatile memory (i.e. RAM memory) inside the PROFIBUS Master Unit. Serious errors are also recorded in non-volatile memory (i.e. Flash ROM).

A total of 80 error records can be logged in volatile memory.

Up to 16 more serious system errors are also copied to non-volatile memory.

Adding Error Records to the Error Log

When adding a new record to the error log and the error log is full the latest error will replace the oldest error in the log. At power up/reset the non-volatile error log will first be copied to the volatile error log.

The contents of the non-volatile error log will be corrupted if the Unit is interrupted (i.e. power-down/reset), while writing to the error log.

If an error in the non-volatile error log is detected at power up/reset, the Unit:

- Will try to repair the contents of the error log.
- If the log remains corrupted, the Error Log Storage Error bit in the Unit Status Word (*_LogStorErr) will be set. In this case the error and the flag can only be cleared through the command ERROR LOG CLEAR (see *6-3-4 ERROR LOG CLEAR (2103)*). The start-up procedure will be completed normally.

If, during normal operation, writing errors to the error log fails, the Unit will set the Error Log Storage Error bit in the Unit Status Word (*_LogStorErr).

● Reading and Clearing the Error Log

The error log can be read from the CPU and via CX-ConfiguratorFDT.

Sending the command ERROR LOG CLEAR to the Unit clears both the non-volatile and the volatile error logs. (See *6-3-4 ERROR LOG CLEAR (2103)*).

Additional Information

The CPU Unit's time information is used for the time stamps in the PROFIBUS Master Unit's error log records. If the time information cannot be read from the CPU Unit, the time stamp will contain all zeroes.

Moreover, if the battery is replaced in an NJ-series controller, the time of the CPU Unit's built-in clock must be set again the next time that power is turned ON. If the built-in clock time is not set, the correct time information will not be recorded. If this error log is read from the CPU Unit, the time information will not be consistent.

7-5-2 Error Codes and Detailed Codes

The error codes are described in the following table. The detailed error code will provide detailed information on an error.

<table>
<tr><th rowspan="2">Error Code</th><th rowspan="2">Meaning</th><th colspan="2">Detailed Codes</th><th rowspan="2">Correction</th><th rowspan="2">Non-volatile</th></tr>
<tr><th>First byte</th><th>Second byte</th></tr>
<tr><td>0001</td><td>Watchdog timer error in CPU Unit</td><td>00</td><td>00</td><td>Replace the CPU Unit.</td><td>Saved</td></tr>
<tr><td>0002</td><td>CPU Unit service monitor error</td><td colspan="2">Actual monitoring time ms (Hex)</td><td>Check the operating environment.</td><td>Saved</td></tr>
<tr><td>000E</td><td>CPU Bus error</td><td>00</td><td>00</td><td>Replace the CPU Unit.</td><td>Saved</td></tr>
<tr><td>0011</td><td>Event time out</td><td>MRC</td><td>SRC</td><td>Replace the CPU Unit.</td><td>Saved</td></tr>
<tr><td>0012</td><td>CPU Unit memory error</td><td>01: Read error
02: Write error</td><td>03: Routing table</td><td>01: Recreate the data specified by the 2nd byte of the detailed error code.
02: Clear memory using procedure in the CPU operation manual.</td><td>Saved</td></tr>
<tr><td>010D</td><td>Destination address not in routing tables (send failed)</td><td colspan="2" rowspan="6">Commands
Bit 15: FALSE
Bits 08 to 14: SNA
Bits 00 to 07 SA1
Responses
Bit 15: TRUE
Bits 08 to 14: DNA
Bits 00 to 07 DA1</td><td>Set the destination address in the routing tables.</td><td>---</td></tr>
<tr><td>010E</td><td>No routing table entry (send failed)</td><td>Set the local node, remote node and relay nodes in the routing tables.</td><td>---</td></tr>
<tr><td>010F</td><td>Routing table error (send failed)</td><td>Create the routing tables correctly.</td><td>---</td></tr>
<tr><td>0110</td><td>Too many relay points (send failed)</td><td>Reconstruct the network or correct the routing tables so that commands are set to within a 3-level network range.</td><td>---</td></tr>
<tr><td>0112</td><td>Header error (send failed)</td><td>Check the command format and set the correct command data.</td><td>---</td></tr>
<tr><td>0120</td><td>Unexpected routing error</td><td>Check the routing tables.</td><td>---</td></tr>
<tr><td>0202</td><td>PROFIBUS parameter set invalid</td><td>00</td><td>80: Bus parameter error
00 to 7D: Slave parameter error</td><td>• Check the parameter settings.
• Re-download the configuration if necessary.</td><td></td></tr>
<tr><td>020C</td><td>Protocol error</td><td>00</td><td>00 to 7D: Failing Master Address</td><td>Check the master devices on the network, and make sure they are all working correctly.</td><td></td></tr>
</table>

Error Code	Meaning	Detailed Codes		Correction	Non-volatile
		First byte	Second byte		
0211	Duplicate master address	00	00 to 7D: Failing Master Address	Check the master devices on the network and ensure that they have unique device addresses.	
0219	Hardware error	00	00	• Check the network wiring, and make sure it is correct. • Check for short-circuits. • Check the bus timing set through CX-ConfiguratorFDT. • Check the HSA setting in CX-ConfiguratorFDT and make sure it is set to the master device with the highest address on the network. • Check if any other faulty devices are on the same network. • Verify that the Highest Station Address setting includes any other master address on the bus.	
021A	Logic error in setting table	00	03: Routing tables	Recreate the data specified by the 2nd byte of the detailed error code.	Saved
0601	CPU Bus Unit fatal error	Error address in program.		Restart the CPU Unit. If the problem persists, replace the PROFIBUS Master Unit.	Saved
0602	CPU Bus Unit memory error	01: Read error. 02: Write error.	02: Network Parameter. 06: Error log.	Restart the CPU Unit. If the problem persists, replace the PROFIBUS Master Unit.	Saved

Note **1** The time information from the CPU Unit is used in the PROFIBUS Master Unit.

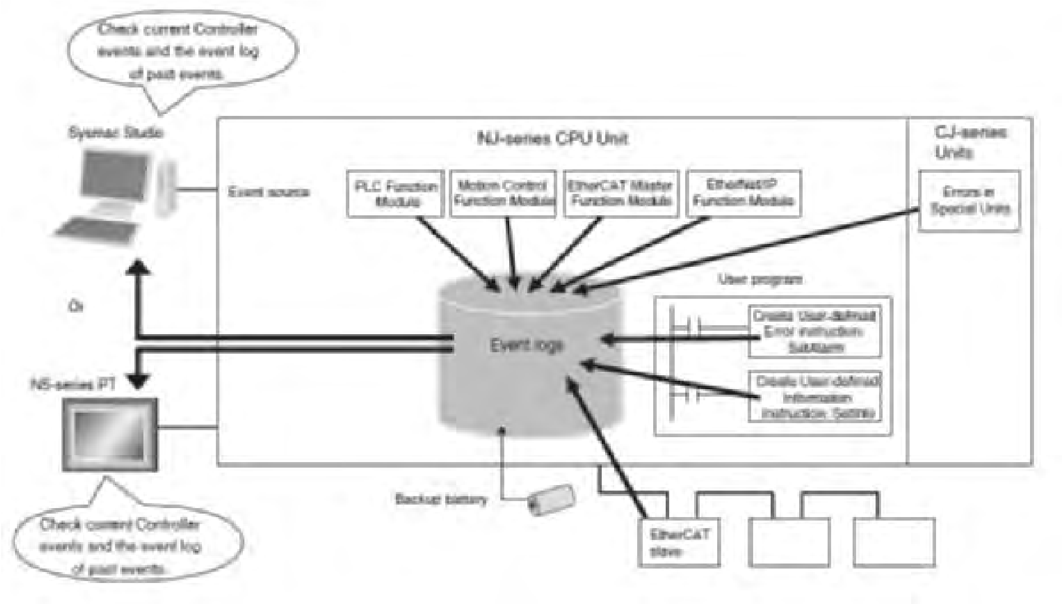
2 An error record is not created in non-volatile memory when the error concerns an Error Log Write error.

7-6 Event Logs

7-6-1 Overview of the Event Logs

The Event Log allows the user to access all of the events that occur on the NJ-series Controller including errors and information. You can use the Sysmac Studio or an NS-series PT to confirm current Controller events and the logs of events that have occurred. These logs are called event logs. Controller errors that occur for this Unit are also reported as events in the NJ-series CPU Unit.

Refer to the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501) for details on the event logs in an NJ-series CPU Unit. Refer to the *NJ-series Troubleshooting Manual* (Cat. No. W503) for details on Controller errors, confirmation methods and corrections.



7-6-2 Error Table

The errors that may occur for this Unit are listed below. Event levels are given in the table as follows:

Maj: Major fault level

Prt: Partial fault level

Min: Minor fault level

Obs: Observation

Info: Information

Refer to the *NJ-series Troubleshooting Manual* (Cat. No. W503) for all of the event codes that may occur in an NJ-series Controller.

Event code	Event name	Meaning	Assumed cause	Level				
				Maj	Prt	Min	Obs	Info
38110000 hex	Double Master Address Error	There is a Master address duplication setting.	• A second Master with the same address has been detected on the Bus.			X		
38120000 hex	Parameter Error	There is a problem with the contents of the parameters.	• An error has been detected in the contents of the Parameter set while configuring the PROFIBUS interface.			X		
58010000 hex	Mode Command Error	There is a problem with the Mode setting of the Unit.	• More than one command mode switch has been set. • A mode command switch is set while the previous command is in progress. • A mode transition command is given and the Unit has detected that it does not (yet) have a valid configuration or it detected an internal error, either of which prevented it from reaching that mode, e.g. Invalid Parameter set and transition to OPERATE mode.			X		
88040000 hex	Disturbed Bus Error	Distorted messages may have been received by the Unit.	• The network is not properly terminated. • A cable has been used which is too long for the selected baud rate.			X		
88050000 hex	PROFIBUS Protocol Error	A PROFIBUS protocol error has occurred and tokens have been lost.	• Network wiring. • Other faulty devices on the Network.			X		
88060000 hex	Hardware Error	An error has occurred on the bus.	• Faulty wiring, broken message, short circuits, faulty bus timings or an active device has been detected beyond the Highest Station Address setting (HSA).			X		

7-6-3 Error Descriptions

This section describes the information that is given for individual errors.

Controller Error Descriptions

The items that are used to describe individual errors (events) are described in the following copy of an error table.

<table>
<tr><td>Event name</td><td colspan="3">Gives the name of the error.</td><td>Event code</td><td colspan="2">Gives the code of the error.</td></tr>
<tr><td>Meaning</td><td colspan="6">Gives a short description of the error.</td></tr>
<tr><td>Source</td><td colspan="2">Gives the source of the error.</td><td>Source details</td><td>Gives details on the source of the error.</td><td>Detection timing</td><td>Tells when the error is detected.</td></tr>
<tr><td>Error attributes</td><td>Level</td><td>Tells the level of influence on control.*1</td><td>Recovery</td><td>Gives the recovery method.*2</td><td>Log category</td><td>Tells which log the error is saved in.*3</td></tr>
<tr><td>Effects</td><td>User program</td><td>Tells what will happen to execution of the user program.*4</td><td>Operation</td><td colspan="3">Provides special information on the operation that results from the error.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="6">Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">Lists the possible causes, corrections, and preventive measures for the error.</td></tr>
<tr><td>Attached information</td><td colspan="6">This is the attached information that is displayed by the Sysmac Studio or an NS-series PT.</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">Provides precautions, restrictions, and supplemental information.</td></tr>
</table>

*1 One of the following:
Major fault: Major fault level
Partial fault: Partial fault level
Minor fault: Minor fault level
Observation
Information

*2 One of the following:
Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
Error reset: Normal status is restored when the error is reset after the cause of the error is removed.
Cycle the power supply: Normal status is restored when the power supply to the Controller is turned OFF and then back ON after the cause of the error is removed.
Controller reset: Normal status is restored when the Controller is reset after the cause of the error is removed.
Depends on cause: The recovery method depends on the cause of the error.

*3 One of the following:
System: System event log
Access: Access event log

*4 One of the following:
Continues: Execution of the user program will continue.
Stops: Execution of the user program stops.
Starts: Execution of the user program starts.

Error Descriptions

Event name	Double Master Address Error			Event code	38110000 hex	
Meaning	There is a Master address duplication setting.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At startup of network
Error attributes	Level	Minor	Recovery	Switch the Unit to CLEAR/OPERATE mode again	Log category	System
Effects	User program	Continues	Operation	The PROFIBUS Master Unit will not start the network operation and will remain offline		
System-defined variables	Variable		Data type		Name	
	*_MstrAdrErr		BOOL		Master address duplication error	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a Master address duplication setting.		Check the master devices on the network and ensure that they have unique device addresses.		Do not set the same device address for more than one Master Unit on the same network.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Parameter Error			Event code	38120000 hex	
Meaning	There is a problem with the contents of the parameters.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At startup of network
Error attributes	Level	Minor	Recovery	Automatic recovery	Log category	System
Effects	User program	Continues	Operation	The PROFIBUS Master Unit will not start the network operation and will remain offline.		
System-defined variables	Variable		Data type		Name	
	*_MstrParamErr		BOOL		Parameter Error	
Cause and correction	Assumed cause		Correction		Prevention	
	A faulty parameter(s) have been downloaded to the Unit. After reading the faulty parameter sets from the non-volatile to volatile memory during intialization, this error can occur.		Check the parameter settings in CX-ConfiguratorFDT and correct them if necessary. Then perform a download of the new parameters to the Unit.		Check correct values of the parameters in CX-ConfiguratorFDT before download.	
Attached information	None					
Precautions/ Remarks	None					

Event name	Mode Command Error			Event code	58010000 hex	
Meaning	There is a problem with the Mode setting of the Unit.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At execution of Mode Command
Error attributes	Level	Minor	Recovery	Automatic recovery	Log category	System
Effects	User program	Continues	Operation	The PROFIBUS Master Unit detects a problem when Mode Command is executed and will remain offline.		

System-defined variables	Variable	Data type	Name
	*_MstrMdCmdErr	BOOL	Mode Command Error
Cause and correction	Assumed cause	Correction	Prevention
	More than one command mode switch has been set.	Control only one command mode switch.	Do not attempt to control multiple command mode switches simultaneously or prevent with User Program.
	A mode command switch is set while the previous command is in progress.	Wait until the Unit has finished switching modes before attempting to set a new command mode switch.	Do not issue a mode change while the Unit is in transition. Check that the commanded operating mode has successfully completed before issuing a new mode change.
	A mode transition command is given and the Unit has detected that it does not (yet) have a valid configuration or it detected an internal error, either of which prevented it from reaching that mode, e.g. Invalid Parameter set and transition to OPERATE mode.	Correct the invalid configuration and/or internal error and re-issue the required command mode switch.	Do not attempt to change modes when an invalid configuration or internal error is present.
Attached information	None		
Precautions/ Remarks	None		

Event name	Disturbed Bus Error			Event code	88040000 hex	
Meaning	Distorted messages may have been received by the Unit.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At network operation
Error attributes	Level	Minor	Recovery	Cycle the Power Supply	Log category	System
Effects	User program	Continues	Operation	During network operation the Unit detects distorted messages and will switch to OFFLINE mode.		
System-defined variables	Variable		Data type		Name	
	*_MstrBusErr		BOOL		Disturbed Bus Error	
Cause and correction	Assumed cause		Correction		Prevention	
	Missing or invalid termination		Check the termination on the appropriate devices.		Follow specific termination resistance requirements set in this manual.	
	Faulty wiring		Check the wiring.		Follow specific wiring guidelines set in this manual.	
	A cable has been used which is too long for the selected baud rate.		• Correct the baud rate setting to reflect the actual length of cable or change the cable length based on the required baud rate. • Install repeater(s) if a longer cable is needed.		Follow maximum cable length specifications set in this manual.	
Attached information	None					
Precautions/ Remarks	None					

Event name	PROFIBUS Protocol Error			Event code	88050000 hex	
Meaning	A PROFIBUS protocol error has occurred and tokens have been lost.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At network operation
Error attributes	Level	Minor	Recovery	Switch the Unit to CLEAR/OPERATE mode again	Log category	System

Effects	User program	Continues	Operation	During network operation the Unit detectsprotocol errors and will switch to OFFLINE mode.		
System-defined variables	Variable		Data type		Name	
	*_MstrProtErr		BOOL		PROFIBUS Protocol error	
Cause and correction	Assumed cause		Correction		Prevention	
	Network wiring problems.		Check the wiring.		Follow specific wiring guidelines set in this manual.	
	Other faulty devices on the network.		Isolate and remove the faulty device.		---	
Attached information	None					
Precautions/ Remarks	When a PROFIBUS Protocol Error is present, the Master Unit is switched to OFFLINE mode.					

Event name	Hardware Error			Event code	88060000 hex	
Meaning	An error has occurred on the bus.					
Source	Function Module		Source details	CJ-series Unit	Detection timing	At network operation
Error attributes	Level	Minor	Recovery	Switch the Unit to CLEAR/OPERATE mode again	Log category	System
Effects	User program	Continues	Operation	During network operation the Unit detects Hardware Errors and will switch to OFFLINE mode.		
System-defined variables	Variable		Data type		Name	
	*_MstrHwErr		BOOL		Hardware Error	
Cause and correction	Assumed cause		Correction		Prevention	
	Faulty wiring, broken message, short circuits, faulty bus timings or an active device has been detected beyond the Highest Station Address setting (HSA).		• Check the network wiring. • Check for short-circuits. • Check the bus timing set in CX-ConfiguratorFDT • Check the HSA setting in the DTM's Bus Parameter tab. • Check if any faulty devices are on the network.		--	
Attached information	None					
Precautions/ Remarks	None					

7-7 Maintenance and Replacement

This section describes the routine cleaning and inspection recommended as regular maintenance as well as the Unit replacement procedure.

7-7-1 Cleaning

Clean the PROFIBUS Master Units regularly as described below in order to keep the network in its optimal operating condition.

- Wipe the Unit daily with a dry, soft cloth.
- When a spot can't be removed with a dry cloth, dampen the cloth with a neutral cleanser (2% sol tion), wring out the cloth and wipe the Unit.

Precautions for Correct Use

Never use volatile solvents such as paint thinner, benzine or chemical wipes. These substances could damage the surface of the Unit.

7-7-2 Inspection

Be sure to inspect the system periodically to keep it in optimum operating condition. In general, inspect the system once or twice a year, but more frequently if the system is used in high temperature or high humidity environments or dirty/dusty conditions.

Inspection Equipment

Prepare the following equipment before inspecting the system.

Required Equipment

Philips type screwdriver, multimeter, alcohol and a clean cloth.

Optional Test Equipment

Depending on system conditions, a synchroscope, oscilloscope, thermometer or hygrometer (to measure humidity) might be needed.

Inspection Procedure

Check the items in the following table and correct any that are below standard.

Item		Standard	Equipment
Environmental conditions	Ambient temperature	0° C to 55° C	Thermometer
	Ambient humidity	10% to 90%	Hygrometer
	Dust/dirt accumulation	None	Check visually

Item		Standard	Equipment
Installation	Are the units installed securely?	No looseness	Phillips head screwdriver
	Are the communications connectors fully inserted?	No looseness	Phillips head screwdriver
	Are the external wiring screws tight?	No looseness	Phillips head screwdriver
	Are the connecting cables undamaged?	No damage	Check visually

7-7-3 Replacing Faulty Units

The PROFIBUS Master Unit is a Network device. If the Unit is damaged, it will effect the entire Network, so always ensure repairs are undertaken immediately. It is recommended to have a spare PROFIBUS Master Unit on hand so that repairs may be conducted quickly.

Precautions

Observe the following precautions when replacing the Unit.

- Always turn OFF the power before replacing the Unit.
- Ensure that the new Unit is not faulty.
- If a poor connection is suspected of causing the malfunction, clean the connectors using a clean, soft cloth and industrial-grade alcohol. Remove any lint or threads left from the cloth, and remount the Unit.
- When returning a faulty Unit for repair, always attach a detailed fault report to the Unit and return it to the nearest OMRON dealer.

Precautions for Safe Use

In order to prevent faulty operation be sure to turn off the power to all master and slave devices before replacing the Unit.

When replacing the Unit, do not reconnect it to the Network before carrying out the procedures listed below.

Settings After Replacing PROFIBUS Master Units

After replacing a PROFIBUS Master Unit (before applying power) set the unit number to the same unit number as the previous Unit.

After applying the power, the configuration settings present in the previous Unit must also be transferred to the new Unit. Use CX-ConfiguratorFDT to download the original project from the stored location and to the new Unit.

Additional Information

*_Sw2FileBkupCmd and *_Sw2FileRestoreCmd (Unit Setup File Backup and Restore Switches) are not supported with the CJ1W-PRM21 when used with the NJ-series Controller Unit.

After configuring the new Unit, re-connect it to the network, and restart operation.

7-7-4 Addition/Replacement of Units on the PROFIBUS Network

The PROFIBUS network allows to connect and disconnect devices while in operation.

- **Connecting / Disconnecting Devices**

Connecting/disconnecting any device in a PROFIBUS network is liable to result in a temporary increase of the communication cycle time. An existing slave device can only be replaced by the same type of device with the same configuration. Any change to this configuration is likely to require a new configuration. Changing a device with a different device (type and/or configuration) will have a significant influence on the performance on the PROFIBUS network.

- **Adding a Device**

The addition of a new device to an existing configuration will require a new configuration file to be downloaded in the PROFIBUS Master Unit, which will temporarily disable all communication by this Unit on PROFIBUS.

App

Appendices

A-1 Differences in Available Functions Depending on the CPU Unit (NJ/CJ series) to be Connected

A-1-1 Differences in Available Functions

Some functions available to the CJ series may be unavailable when you operate this Unit with the NJ series.

The following table lists the differences between the NJ and CJ series emerging on each function that this Unit provides.

Item	Function available with CJ series	Function available with NJ series
Unit Control and Status	Available	Available
I/O data	Available	Available
PROFIBUS DP Class 1 Services	Available	Available
PROFIBUS DP Class 2 Services	Available	Available
Configuration	Available	Available
Troubleshooting Functions	Available	Available
Explicit/acyclic messages	Available	Available
Simple backup function	Available	Unavailable
Setup information backup to memory card	Available	Unavailable

A-1-2 Differences in Accessing from User Program

When this Unit is operated with an NJ-series device, a user program accesses various functions provided by the PROFIBUS Master Unit through device variables for CJ-series Unit that specifies AT specification for the memory used for CJ-series Unit.

The device variables for CJ-series Unit in the NJ-series CPU Unit's memory for CJ series Unit that correspond to the addresses and bit positions in CJ-series CPU Unit's I/O memory are listed below.

- First word of Special I/O Unit CIO Area: n = CIO 1,500 + Unit number × 25 (Unit number: 0 to 15)
- First word of Special I/O Unit DM Area: m = D30,000 + Unit number × 100 (Unit number: 0 to 15)

Additional Information

The DM area words which are allocated for the PROFIBUS Master Unit are not used, i.e. no data is exchanged between an allocated DM area and the Unit. However, the allocated area is reserved for use in a future extension of the Unit. Therefore, using this area for user data is not recommended.

CPU Bus Unit Words Allocated in CIO Area

● CIO n (Software Switches)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n	0 to 15	*_SwCmd	Software Switches (The functions of bits 0 to 15 of a word starting with CIO n correspond to those of bits 0 to 15 of the device variable for CJ series Unit below.)

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n	0	*_MstrOperateCmd	Switch master to OPERATE mode
	1	*_MstrStopCmd	Switch master to STOP mode
	2	*_MstrClearCmd	Switch master to CLEAR mode
	3	*_MstrOfflineCmd	Switch master to OFFLINE mode
	4	*_GlobCtlTxCmd	Transmit Global-Control command
	5 to 7	--	Reserved by system
	8	*_ClrNewDiagCmd	Clear new diagnostics bits
	9 to 15	--	Reserved by system

● CIO n+2 (Global-Control Command)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n+2 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+2	0 to 15	*_GlobCtlCmd	Global-Control Command

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n+2 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+2	0	*_GlobCtlGrp1	Send command to slaves of Group 1
	1	*_GlobCtlGrp2	Send command to slaves of Group 2
	2	*_GlobCtlGrp3	Send command to slaves of Group 3
	3	*_GlobCtlGrp4	Send command to slaves of Group 4
	4	*_GlobCtlGrp5	Send command to slaves of Group 5
	5	*_GlobCtlGrp6	Send command to slaves of Group 6
	6	*_GlobCtlGrp7	Send command to slaves of Group 7
	7	*_GlobCtlGrp8	Send command to slaves of Group 8
	8	--	Reserved by system
	9	--	Reserved by system
	10	*_GlobCtlUnfreezeCmd	Unfreeze
	11	*_GlobCtlFreezeCmd	Freeze
	12	*_GlobCtlUnsyncCmd	Unsync
	13	*_GlobCtlSyncCmd	Sync
	14	--	Reserved by system
	15	--	Reserved by system

● CIO n+4 (Unit Status)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n+4 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+4	0 to 15	*_UnitSta	Unit Status

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n+4 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+4	0	*_UnitErr	Unit error flag
	1	*_MstrErr	Master error flag
	2	--	Reserved by system
	3	*_NewErrLogSta	Error log contains new errors
	4	*_ParamTxSta	Parameter transfer In progress
	5	--	Reserved by system
	6	*_ParamStorErr	Local parameter storage error
	7	*_ParamLoadErr	Local parameter load error
	8	--	Reserved by system
	9	*_FileRdErr	File read error
	10 to 12	--	Reserved by system
	13	*_LogStorErr	Error log storage error
	14	--	Reserved by system
	15	--	Reserved by system

● CIO n+5 (Master Status)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n+5 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+5	0 to 15	*_MstrSta	Master Status

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n+5 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+5	0	*_MstrOperateSta	Unit in OPERATE mode
	1	*_MstrStopSta	Unit in STOP mode
	2	*_MstrClearSta	Unit in CLEAR mode
	3	*_MstrOfflineSta	Unit in OFFLINE mode
	4	*_MstrDatXchgSta	Unit in data exchange
	5	*_MstrAutoClrEnblSta	Auto-CLEAR enabled
	6	--	Reserved by System
	7	*_MstrValidCfgSta	Unit contains a valid configuration
	8 to 15		

● CIO n+6 (Master Errors)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n+6 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+6	0 to 15	*_MstrErrSta	Master Errors

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n+6 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+6	0	*_MstrBusErr	Disturbed bus error
	1	*_MstrProtErr	PROFIBUS protocol error
	2	*_MstrAdrErr	Master address duplication error
	3	*_MstrHwErr	Hardware error
	4 to 11	--	Reserved by system
	12	*_MstrMdCmdErr	Mode command error
	13	*_MstrParamErr	Parameter error
	14	--	Reserved by system
	15	--	Reserved by system

● CIO n+7 (Slave Status)

The device variable for CJ-series Unit that corresponds to all bits of a word in CIO n+7 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+7	0 to 15	*_SlvSta	Slave Status

The device variables for CJ-series Units that correspond to bits 0 to 15 of a word in CIO n+7 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+7	0	*_AllDatXchgSta	All slaves in data exchange mode
	1 to 3	--	Reserved by system
	4	*_SlvDiagRcvSta	New slave diagnostics received
	5 to 15	--	Reserved by system

● CIO n+8 (Actual Bus Cycle Time)

The device variable for CJ-series Unit that corresponds to the value of a word in CIO n+8 is as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Words occupied**	**Variable name**	**Description**
CIO n+8	1	*_ActCycleTm	Actual Bus Cycle Time

● CIO n+9 to n+16 (Slave Data Exchange Active Flags)

The device variables for CJ-series Unit that correspond to all bits of the 8 words in CIO n+9 to n+16 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+9 to n+16	0 to 15 for each word	*_SlvDatXchgL, *_SlvDatXchgH	Actual Bus Cycle Time

The device variables for CJ-series Units that correspond to all bits 0 to 127 in words CIO n+9 to n+16 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Bit**	**Variable name**	**Description**
CIO n+9	0 to 15	*_SlavDatXchgL	Slave station 00 to 15
CIO n+10	16 to 31	*_SlavDatXchgL	Slave station 16 to 31
CIO n+11	32 to 47	*_SlavDatXchgL	Slave station 32 to 47
CIO n+12	48 to 63	*_SlavDatXchgL	Slave station 48 to 63
CIO n+13	64 to 79	*_SlavDatXchgH	Slave station 64 to 79
CIO n+14	80 to 95	*_SlavDatXchgH	Slave station 80 to 95
CIO n+15	96 to 111	*_SlavDatXchgH	Slave station 96 to 111
CIO n+16	112 to 125	*_SlavDatXchgH	Slave station 112 to 125 (bits 126 and 127 are reserved by system)

● CIO n+17 to n+24 (Slave New Diagnostics Flags)

The device variables for CJ-series Unit that correspond to all bits of the words in CIO n+17 to n+24 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	**Words occupied**	**Variable name**	**Description**
CIO n+17 to n+24	8	*_SlvNewDiagL, *_SlvNewDiagH	Slave New Diagnostics Flags

The device variables for CJ-series Units that correspond to all bits 0 to 127 in words CIO n+17 to n+24 are as follows:

CJ-series I/O memory address		NJ-series device variables for CJ-series Unit	
Word address	Bit	Variable name	Description
CIO n+17	0 to 15	*_SlavNewDiagL	Slave station 00 to 15
CIO n+18	16 to 31	*_SlavNewDiagL	Slave station 16 to 31
CIO n+19	32 to 47	*_SlavNewDiagL	Slave station 32 to 47
CIO n+20	48 to 63	*_SlavNewDiagL	Slave station 48 to 63
CIO n+21	64 to 79	*_SlavNewDiagH	Slave station 64 to 79
CIO n+22	80 to 95	*_SlavNewDiagH	Slave station 80 to 95
CIO n+23	96 to 111	*_SlavNewDiagH	Slave station 96 to 111
CIO n+24	112 to 125	*_SlavNewDiagH	Slave station 112 to 125 (bits 126 and 127 are reserved by system)

A-2 Bus Parameters

The PROFIBUS Bus Parameters define both the baud rate and the bus timing settings, necessary to perform the exchange of messages over PROFIBUS. The Bus Parameters settings must be determined for each and every Master device on the bus, and usually depend on

- the number of I/O data bytes per slave device,
- the number of slave devices connected to the master,
- the number of other masters on the bus.

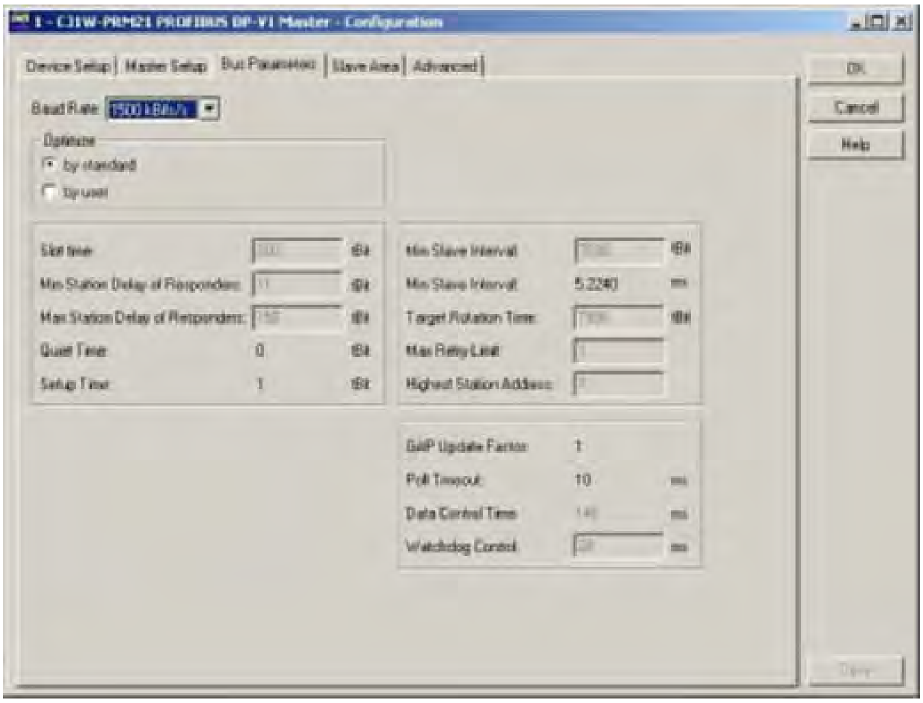
The Bus Parameter settings consist for one part of a number of settings, which are directly entered into the PROFIBUS interface hardware registers. These settings implement the necessary timing to enable the transfer of a single message between the PROFIBUS Master Unit and a slave device. The other part of the Bus Parameters must be calculated. These parameters implement the overall cyclic timing as well as the watchdog time to monitor the communication.

The calculation is performed by the PROFIBUS Master Unit DTM. The software implements a formula to calculate the settings which will be downloaded to the PROFIBUS Master Unit. Most of the parameters have baud rate dependent default values. Some of the parameters can be tuned by the user. However, this is not recommended, since the communication may not function correctly, due to incorrect settings or too small timing margins.

This appendix defines the parameters which are shown by the PROFIBUS Master Unit DTM, and provides the formula used for the timing calculations.

Bus Parameter Definitions

The figure below shows the PROFIBUS Master Unit DTM, Bus Parameter tab, in which the bus parameter settings can be made.



The table below defines the bus parameter settings options, shown in the figure. The Unit t_{BIT} is defined as the transmission time for one bit at the selected baud rate.

Item	Description	Unit	Editable by User
Baud rate	Defines the transmission rate on the PROFIBUS DP Network. The following baud rate values are defined by the PROFIBUS DP standard: • 9.6 kBits/s • 19.2 kBits/s • 45.45 kBits/s • 93.75 kBits/s • 187.5 kBits/s • 500 kBits/s • 1500 kBits/s (default value) • 3000 kBits/s • 6000 kBits/s • 12000 kBits/s	--	Yes
Optimize	The Optimize setting defines whether parameters can be changed by the user. • By Standard: Forces the user to use the default (optimized) settings. • By User: Makes selected fields editable. Note: 1. If the By User option is selected and changes have been made, it is still possible to switch between Optimize settings, without the changes being lost. 2. If the By User option is selected and the baud rate is changed, the parameters will be optimized to the new baud rate.	--	Yes
Slot Time	The maximum time a Master Unit must wait for a response to a request message.	t_{BIT}	Yes
Min. Station Delay of Responders	The minimum allowed time for a slave device before it will generate a response to a request message.	t_{BIT}	Yes
Max. Station Delay of Responders	The maximum allowed time for a slave device to generate a response to a request message.	t_{BIT}	Yes
Quiet Time	The time a transmitting device must wait after the end of a message frame, before enabling its receiver.	t_{BIT}	No
Setup Time	The time between an event and the necessary reaction.	t_{BIT}	No
Min. Slave Interval	The Minimum Slave Interval defines the poll cycle, i.e. the minimum time between two consecutive Data_Exchange Cycles to the same slave device. The Minimum Slave Interval must be smaller than the Target Rotation Time.	t_{BIT}	Yes
	Calculated Minimum Slave Interval in milliseconds.	ms	No
Target Rotation Time	The anticipated time for one token cycle, including allowances for high and low priority transactions, errors and GAP maintenance. Do not change the value below the calculated value, to avoid bus communication interruptions.	t_{BIT}	Yes
Max Retry Limit	Maximum number of request transmission retries by this master if a device does not reply to a request.	--	Yes
Highest Station Address	The HSA defines the Highest Station Address of Master devices on the network, of which the Master device will request the FDL status, when updating the active device list (See GAP Update Factor). If new slaves are added to the network, this field shows the highest device address. The Master will periodically check whether new active devices have been added between its own address and the Highest Station Address. If any devices are detected, GAP is updated. Permissible values are in the range of 0 to 126.	--	Yes
GAP Update Factor	The GAP update factor defines the amount of updates of the active devices (i.e. Master devices) list times during one token rotation cycle. To update the list, the Master device will transmit FDL_Status_request messages to ascending device addresses until it finds a next Master device, or until it reaches the Highest Station Address (See HSA above). The GAP Update Factor is fixed to 1.	--	No

Item	Description	Unit	Editable by User
Poll Timeout	The maximum time interval that this master device may need for the execution of a master-master function.	ms	No
Data Control Time	The cycle time in which the master updates its Data Transfer List, in which it keeps an overview of all slave states. Data Control Time is based on the Watchdog time T_{WD}: Data Control Time = 7*T_{WD}.	ms	No
Watchdog Control	The Watchdog Control Time defines the time for a slave device to set its outputs to a fail-safe state, if during that time no communication between the Master device and that slave device was detected. The Watchdog is automatically set for all configured slaves, based on the value of T_{TR}.	ms	Yes

Determining the Bus Parameters

The bus parameters defined in the previous paragraph are used to configure the PROFIBUS DP hardware interface and to calculate the cycle time for I/O data exchange as well as the watchdog value. Most of the parameters, set in the Bus Parameter Tab are directly transferred to the interface hardware registers. The table below, lists these parameters, along with their default value for the available baud rates. These values are also the minimum values for each parameter at a given baud rate.

Baud rate [kBits/s]	T_{QUI} [t_{BIT}]	T_{SET} [t_{BIT}]	T_{SL} [t_{BIT}]	G	Retry Limit	Poll Timeout [ms]	min T_{SDR} [t_{BIT}]	max T_{SDR} [t_{BIT}]
9.6	0	1	100	1	1	10	11	60
19.2	0	1	100	1	1	10	11	60
45.45	0	95	640	1	1	10	11	400
93.75	0	1	100	1	1	10	11	60
187.5	0	1	100	1	1	10	11	60
500	0	1	200	1	1	10	11	100
1500	0	1	300	1	1	10	11	150
3000	3	4	400	1	2	10	11	250
6000	6	8	600	1	3	10	11	450
12000	9	43	1000	1	4	10	11	1600

The parameters to calculate are:

- Min. Slave Interval (t_{BIT})
- Target Rotation Time (t_{BIT})
- Watchdog timeout (ms)
- Data Control Time (ms)

These four values depend on the number of slave devices allocated to the PROFIBUS Master Unit, the number of I/O bytes each of the slave devices will exchange with the Master Unit, and how many other Master Units are on the PROFIBUS network at the same time. Furthermore, the Unit will require additional time to process the PROFIBUS I/O data and exchange this with the CPU.

Based on this, the Min. Slave Interval value for one Master Unit can be calculated as follows:

Min. Slave Interval = A_1 + (B_1 * slave devices) + (C_1 * bytes to transfer) +

(bits per µs)*((A_2 * slave devices) + B_2 * modules) + (C_2 * Words to exchange)[1]

in which: A_1, B_1, C_1 are constants (t_{BIT}) determining the PROFIBUS DP cycle time on the bus,

A_2, B_2, C_2 are constants (in µs), determining the cycle time between the Unit and the CPU, slave devices are the devices allocated to this Master Unit only, modules are the total number of I/O modules, selected for the slave devices.

$T_{TR} = \sum$ (Min. Slave Interval$_{Master}$) [2]

The total Target Rotation Time is calculated as the sum of all individual Min. Slave Interval values for each Master Unit on the PROFIBUS network.

From the total Target Rotation Time the Watchdog time for each slave device is calculated as follows:

T_{WD} = 3 * T_{TR} / Baud rate [3]

in which: T_{TR} is the total Target Rotation Time in t_{BIT},

Baud rate is the selected baud rate value.

The Watchdog Time value is in turn used to calculate the total Data Control Time:

Data Control Time = 7 * T_{WD} [4]

Based on measurements, the following values have been determined for the 6 factors in equation [1]:

Baud rate [kBits/s]	A1 [t_{BIT}]	B1 [t_{BIT}]	C1 [t_{BIT}]	Minimum Min. Slave Interval	
				[t_{BIT}]	[ms]
9.6	414	280	11	1250	130
19.2	418	280	11	1250	65.1
45.45	1942	361	11	1250	27.5
93.75	450	280	11	1250	13.3
187.5	1390	310	10	1250	6.67
500	2183	310	10	1850	3.7
1500	4339	310	11	4800	3.2
3000	11578	410	5	9600	3.2
6000	23556	800	10	19200	3.2
12000	47112	1600	20	38400	3.2

A2: 65.1 µs, B2: 2 µs, C2: 0.5 µs

A-3 Application Notes

This appendix contains an application note regarding the use of a special ladder program to detect any CJ1W-PRM21 PROFIBUS Master Unit failures. This programs specifically covers failures due to faulty bus parameters, set by the user.

Application Note Background

The CJ1W-PRM21 Master DTM allows the user to change certain bus parameter, in order to further optimize the PROFIBUS network performance. The risk however in doing this is that certain combinations may lead to failures in the communication, either direct, or at a later point in time. The direct result of this failure is that communication between the Master Unit and the CPU - the CPU I/O refresh cycle - will take longer than anticipated.

A ladder program can now be used to detect this, if the application warrants this safety measure. It relies on the fact that non-used software switches (see section *4-2-1 Software Switches (*_SwCmd)*) when set by the user program, are always reset by the Master Unit.

A-4 Application Program

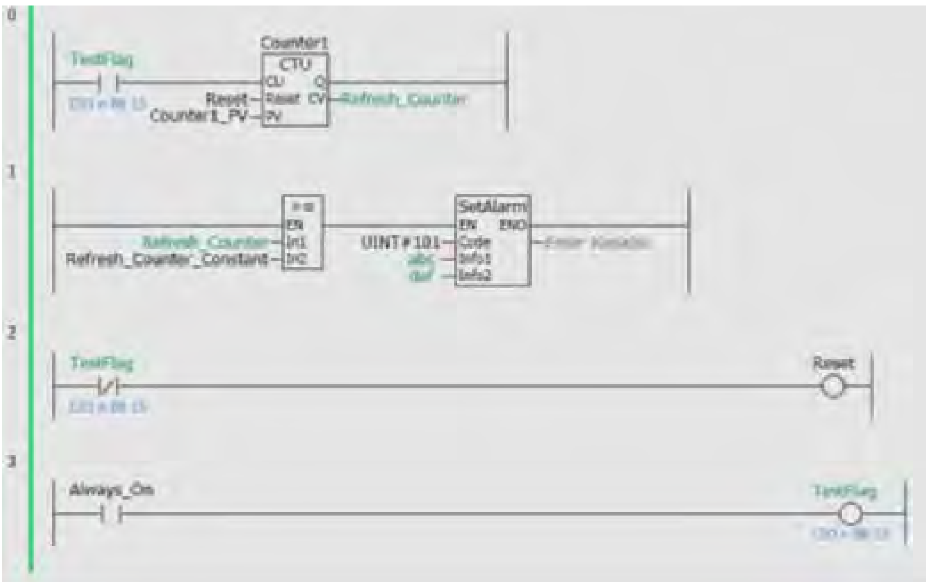
The ladder program, as shown in the figure below, will regularly set switch number 15 in the Software Switches word (*_SwCmd, where n in the example is 1500), and start a counter. The counter will count the amount of CPU I/O refresh cycles, before the Master Unit resets the switch. If the counter reaches the maximum value (e.g. 40 as in the example ladder program), without the switch being reset, a CPU error will be generated.

The counter must be configured by the user, and depends on the PROFIBUS cycle. The longer that cycle is, the longer the counter has to count up. It is recommended to include a safety margin to avoid the CPU error being generated too soon. An estimate for the value can be made using the formula below.

$$\text{Timer value} = \text{Max}\left(40, \frac{2*T_{TR}}{\text{min. CPU Cycle}} \right)$$

(T_{TR} = Target Rotation Time)

In the ladder program shown as example below, the minimum value of 40 has been used. The unit number for the example Unit is 0.



A-5 CX-ConfiguratorFDT Warning and Error Messages

Warning Messages

The table below lists the Warning messages which can be displayed by the PROFIBUS Master Unit DTM. These messages usually indicate that the user is about to perform an action, which will have significant impact, or an action which is only partly supported by the Unit. The user is given a chance to abort the function if the impact is undesirable.

Number	Message	Description	When occurring
00	Change the CPU to PROGRAM mode?	In order to start downloading a configuration, the CPU must be set to PROGRAM mode, to prevent I/O data being exchanged with the Unit, during the change of the configuration. • Yes: Change state and download configuration. • No: Stop download.	At the start of downloading, in case the CPU is in RUN mode.
01	PROFIBUS DP-V1 Slave/slaves is assigned to master. PROFIBUS DP-V1 slaves are not fully supported.	The PROFIBUS Master Unit supports only basic DPV0 functions. This means that the PROFIBUS DP-V1 slave can still be operated, but the PROFIBUS DP-V1 functionality is not possible: • OK: Close message box.	At the start of downloading, in case one of the slaves is a PROFIBUS DP-V1 slave.
02	Return the CPU to [mode] mode?	After download with CPU previously in RUN mode, the CPU can be returned to RUN • Yes: Change state. • No: CPU remains in PROGRAM mode. • Cancel: CPU remains in PROGRAM mode.	After completing the download.
03	CPU Memory "area overlapping" and/or "exceeding memory range" Save anyway?	One or more of the CPU Memory mappings is incorrect. The I/O data, a part of the I/O data or the PROFIBUS DP-V1 Status Monitoring table is mapped beyond an existing memory area, or two or more mappings are overlapping in memory. • Yes: Save settings. • No: Do not save settings. • Cancel: Do not save settings.	Closing the Configuration User Interface with invalid configuration or saving invalid settings
04	Settings have been changed. Would you like to save?	One or more settings have been changed, but not yet saved. • Yes: Save data and close DTM. • No: Do not save data and close DTM. • Cancel: Do not close the DTM.	Closing the Configuration User Interface without saving the changes.
05	Settings have been changed. Would you like to leave without saving?	Closing the GUI without saving the configuration. • Yes: Do not save data and close DTM. • No: Do not save data and do not close DTM.	Closing the Configuration User Interface without saving the changes.
06	Compressing will re-allocate slave configuration in [memory area]. Continue? • [Memory Area] = Input Area 1/ Input Area 2/ Output Area 1/ Output Area 2	Each of the slave I/O data mapping areas can be compressed, by pressing the **Compress** button. This will result in the DTM filling up all the gaps in the mapping, by moving I/O data from higher addresses closer to the start address of the mapping area. • Yes: Compress memory area. • NoDo nothing.	When pressing the Compress button in the Slave Area tab, I/O Allocation.

Number	Message	Description	When occurring
07	[IO area] must be empty. Move all modules into other area • [IO area] = output area1/ output area2/ input area1/ input area2	"Not used" item in the start address combo box in output/input allocation tabs can only be selected if there are no I/O module mapped in that area. • OKClose message box. Move modules to other I/O area first.	When selecting the "Not Used" item from the memory area box.
08	Slave_User_data part of the PROFIBUS slave parameter set will be ignored. See slave [no]-[name] [no] = slave address [name] = slave DTM name	Slave_User_data part of the slave parameter set will not be used. The additional user parameters in the slave parameter set are not supported by the PROFIBUS Master Unit. • OK: Close message box	When adding a slave DTM to the network, which defines additional user parameters.
09	Auto addressing will reallocate slave I/O mapping. Would you like to proceed?	When selecting the Auto-Addressing check box in the Master Setup tab, all slave I/O data mappings will be compressed in each of the I/O mappings. The slave I/O mapping will be changed. • Yes: Update slave I/O module mapping and check checkbox. • No: Do not update slave I/O module mapping and uncheck checkbox.	When checking the Auto-Addressing checkbox on the Master Setup tab.
10	Settings cannot be uploaded, unit must be restarted. Would you like to continue?	The settings uploaded were not used by stack • Yes: Restart the unit and upload the settings. • No: Do nothing.	When attempting to upload settings.
11	Upload is not supported.	Upload is not supported OK: Close message box.	When attempting to upload settings.
12	After locking address it cannot be changed any more. Would you like to proceed?	When sending Set Device Station Address command with 'Lock' check box is checked, the address will be stored permanently in the Slave device and can not be changed anymore. • Yes: Lock option is checked. • No: Lock option is unchecked.	When 'Lock' check box in the Set Device Station Address GUI is checked.
13	PROFIBUS DP-V1 alarms are not supported by the Master Unit and will be disabled.	Alarm settings set by the Slave DTM are not supported and will be reset. • OK: Close message box.	Downloading settings and one of the alarm bits are set in Slave Parameter Set.
14	Publisher functionality is not supported by the Master Unit and will be disabled.	Publisher functionality set by the Slave DTM is not supported and will be reset. • OK: Close message box.	Downloading settings and the Publisher bit is set in Slave Parameter Set.
15	Isochronous mode is not supported by the Master Unit and will be disabled.	Isochronous mode set by the Slave DTM is not supported and will be reset. • OK: Close message box.	Downloading settings and the Isochronous mode bit is set in Slave Parameter Set.
16	Acyclic Connection / Abort Status Area and Acyclic Slave Timeout settings are not supported by the Master Unit and will be disabled.	The connected Master Unit has version V2.00. The new features for version V3.00 (and up) are not supported by the Master Unit.	Downloading settings to Master Unit V2.00 with Master DTM V3.00 (or higher).

Configuration Error Messages

The table below lists the Error messages which can be displayed by the PROFIBUS Master Unit DTM in case there are configuration errors. Usually, these are detected either when entering, or up on download. The table suggests corrections to the problems in the right most column.

Number	Message	Description	Correction
00	Total I/O area size exceeds maximum	The I/O configuration exceeds the maximum limit of 7168 (or 7k) words).	Change configuration to reduce the amount of I/O data to 7168 words maximum or less.
01	CPU Memory overlapping	Input/Output areas and/or PROFIBUS DP-V1 Status table are overlapping within the current configuration.	Check the Input/Output areas and make sure they are not overlapping. Retry download.
02	CPU Memory exceeds memory range	Input/Output areas and/or PROFIBUS DP-V1 Status table exceeds memory range (combination of start address and length).	Change the configuration to be within the memory area and retry download.
03	Slaves should have unique addresses	Unique bus addresses must be assigned for each slave.	Change the addresses of the slaves and ensure no duplicates are present. Retry download.
04	DTM cannot be added to the network, it is not a PROFIBUS device DTM	The slave DTM cannot be connected, e.g. if adding HART device DTM.	Avoid using non-PROFIBUS DP DTMs.
05	Max. number of slaves configured. New slave cannot be added	DTM can not be added, since the master has already the maximum number of slaves (125) assigned.	Do not add any more DTMs. If more are still needed, a second PROFIBUS Master Unit on the same CPU system may be solution.
06	Slave address overlap detected. New address assigned: [new address]	Changing the address of an existing slave results in an address overlap.	Automatically recovers.
07	Invalid data set received from a slave DTM. Slave parameter changes ignored	An internal error has occurred preventing the master DTM to obtain the slave's parameter set.	Add a new slave DTM into the network (or change the modules of the existing slave) with correct slave parameter set.
08	Set Parameters failed. Slave cannot be configured	An internal error has occurred preventing the master DTM from setting/changing the slave's bus address.	Non recoverable. Master DTM tries to assign a new bus address to the slave DTM, but the slave DTM’s database is locked.
09	No slaves assigned. Download aborted	No slaves have been assigned to the master. At least one slave must be assigned.	Retry download when at least one slave has been assigned.
10	Slave(s) has no modules. Download aborted	A slave (or slaves) has no modules.	Retry download when modules have been added to the slave(s) having no modules.
11	Configured EM bank (banks) is not available in the connected CPU.Download aborted	The configured EM bank (banks) are not available in the connected CPU.	Change the configuration to use only memory areas available in the CPU and retry download.
12	Connected unit is busy. Download aborted	Unit is busy with parameter storage.	Retry download when parameter storage has finished.
13	Slave configuration too big	The total number of configured parameter bytes and configuration bytes does not fit into the message for downloading.	Reduce the configuration.
14	Maximum number of modules exceeded	The total number of configured I/O modules over all allocated slave devices can not exceed 4000.	Do not add any more modules to the configuration.
15	PROFIBUS Master is not in correct mode. Please set the PROFIBUS Master in one of the following modes: STOP, CLEAR or OPERATE.	The Set Device Station Address command can not be executed because the PROFIBUS Master is not in correct mode, i.e. the Master Unit is OFFLINE.	Set the PROFIBUS Master into one of the following modes: STOP, CLEAR or OPERATE.

Number	Message	Description	Correction
16	Master Unit indicated failure of Set Device Station Address.	When sending Set Device Station Address command, one of the following problems occurred: • The slave has deactivated this service. • The slave has not responded to the request. • The slave does not have sufficient memory space for the request data.	• Check target Slave device on the PROFIBUS network. • Check specified Slave address. • Check Slave timeout parameter
17	'New address' and/or 'Ident number (hex)' are/is empty.	No data is entered in the New Address and Ident Number fields.	Fill-in both the 'New address' and the 'Ident number (hex)' fields.
18	Slave/Master DTM does not accept the specified address.	The DTM has not accepted the new address setting. Possible cause is that the slave DTM data set has been locked for parameter changes.	
19	Master Unit version and DTM version do not match. Please select DTM that can be used with the connected device (refer to section *1-2-2 Specifications*).	The selected DTM is not suitable to configure the connected PROFIBUS Master.	Please use the DTM as specified in the error message.

Communication Error Messages

The table below lists the Error messages related to CX-Server communication between the PROFIBUS Master Unit DTM and the CPU.

Number	Message	Description	Correction
50	Communication Failure with Unit	The communication between the PC and the Unit on the CPU could not be achieved.	• Ensure there are no problems with the connection between the Personal Computer and the CPU. • Ensure the Master Unit has been correctly mounted - Refer to section *2-2 Installing the PROFIBUS Master Unit* for detailed information. • Make sure the Device settings are correct. • Perform one of the following successfully to confirm the problem has been solved: * Download configuration * Communication Test in Device Settings tab * Update monitoring data (Slave Diagnostics, clearing error log).

Number	Message	Description	Correction
51	Communication Failure with CPU	The communication between the PC and the CPU could not be achieved.	• Ensure there are no problems with the connection between the Personal Computer and the CPU. • Make sure the Device Settings are correct. • When problem has been removed, disconnect and re-connect. Perform one of the following successfully to confirm the problem has been solved: * Update monitoring data (Slave Diagnostics, clearing error log). * Changing the master state
52	CX-Server could not be configured	Configuration of CX-Server failed.	• Make sure the settings within the Device Set-up tab are correct. Select the Test Button to check this. • Make sure the Personal Computer COM port selected within the Device Set-up Configuration is not in use by another application. If it is close the connection from within the other application. • Restart CX-ConfiguratorFDT. • Restart Personal Computer to ensure COM port is released. • Ensure the correct version of CX-Server is installed on the Personal Computer. Refer to the Master Manual for installation details. When the problem has been removed, perform one of the following successfully to confirm the problem has been solved: * Select the Configure Button in the Device Set-up tab * Select the Test Button in the Device Set-up tab
53	CX-Server could not be initialized	Initialization of CX-Server was not possible.	Ensure the correct version of CX-Server is installed on the Personal Computer. Refer to the Master Manual for installation details.

System Error Messages

The table below lists the Error messages related to the System on which the DTM is installed.

Number	Message	Description	Correction
100	Connected device can not be configured with this DTM	Incorrect firmware type.	Make sure the unit connected is a CJ1W-PRM21. Make sure the Unit number in the Device set-up corresponds to the physical unit.
101	Incorrect version of CX-Server.	Incorrect version of CX-Server.	Make sure the correct CX-Server version is installed. Version must be 1.7 and up.
102	[Name of the function] called with improper parameters	Container called a function with NULL pointer.	There must be problem in the container. Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.

Number	Message	Description	Correction
103	Received XML Document does not fit its XML schema	Container called a function with an improper XML document.	There must be a problem in container program. Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.
104	Ole Register Drop Target Failed	An internal error has occurred.	Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.
105	Undefined control type	An internal error has occurred.	Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.
106	Communication failure with the DTM	An internal error has occurred.	Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.
107	GUI could not be closed	An internal error has occurred.	Reinstall CX-ConfiguratorFDT, if problem persists contact supplier.

A-6 I/O Data Type Definitions

Standard PROFIBUS DP defines two types of I/O data.

- 8-bit bytes sized data.
- 16-bit word sized data.

The standard for PROFIBUS extension, also referred to as PROFIBUS DP-V1, defines the following additional data types:

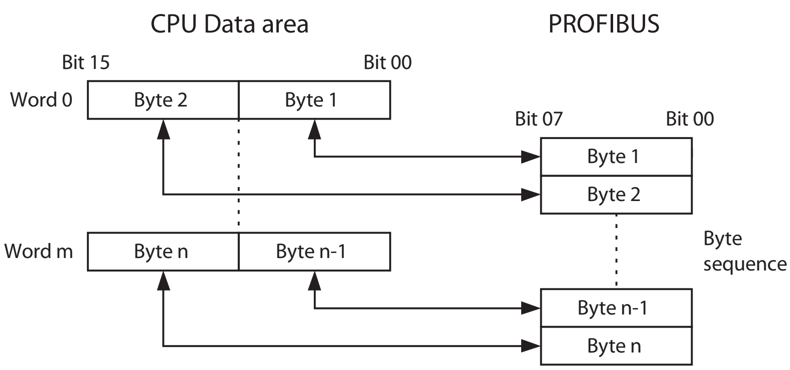
- 8-bit byte signed / unsigned Integer data.
- 16-bit word signed / unsigned Integer data.
- 32-bit double word signed / unsigned Integer data.
- 32-bit single precision floating point (IEEE754 format).
- ASCII Text strings of indeterminate length (in 8-bit bytes).
- 7 byte Date format.
- 6 byte Time of Day format.
- 6 byte Time Difference format.

The NJ-series controller unit defines similar data types, which however differ in size and/or storage format in the CPU memory. Since the PROFIBUS Master Units provides an interface between a PROFIBUS network and the NJ-series controller unit, the Unit will provide the necessary conversions to ensure that the I/O data on the PROFIBUS network is transferred to the CPU memory in the correct format. This Appendix explains the conversions in detail.

A-6-1 Integer Data Conversions

● 8-bit Byte Data

The NJ-series controller unit memory layout is word oriented. The PROFIBUS Master will therefore convert a stream consisting of one or more bytes of data into words. The figure below shows the conversion in graphic format.



Note m = (n-1)/2, rounded to the next lowest integer.

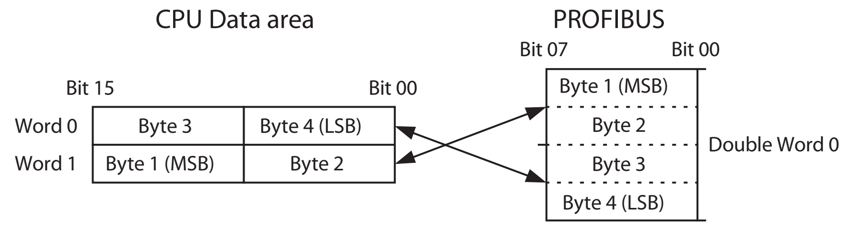
A sequence of bytes transmitted over the PROFIBUS network is copied to the CPU memory in the following procedure.

- The first two bytes are stored in the lowest word of the destination data block in CPU memory word. Every consecutive two bytes are stored in the next higher words.
- Odd byte numbers are copied to the Least Significant byte of a CPU memory word.
- Even byte numbers are copied to the Most Significant Byte of a CPU memory word.

- If the total number of bytes is an odd number, the Most Significant Byte of the last word is filled with 0.

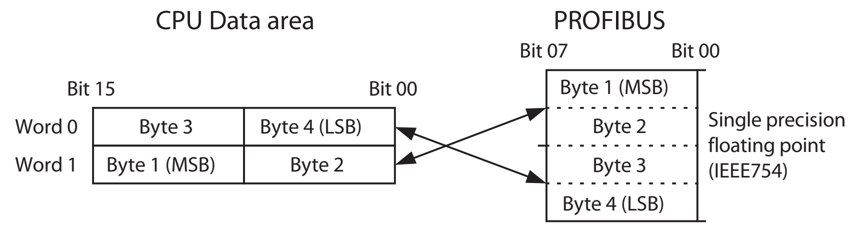
● 32-bit Double Word Data

32-bit double word data is transferred over PROFIBUS with the Most Significant Byte first. The PROFIBUS Master Unit will ensure that a double word transmitted or received over PROFIBUS is mapped on to NJ-series controller double word format in the CPU memory area. The figure below shows the conversion in graphic format.



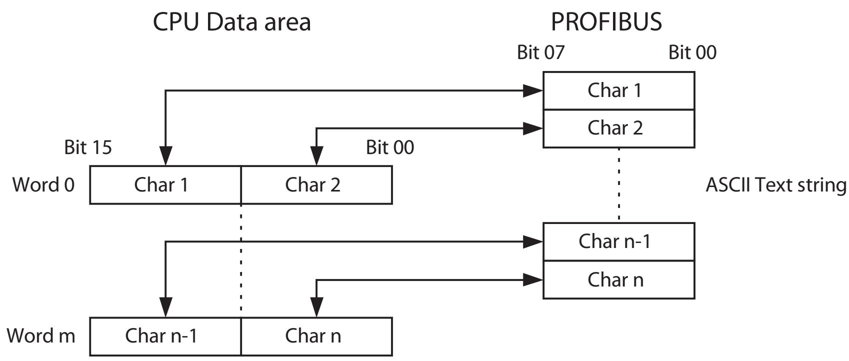
A-6-2 Floating Point Data Conversions

PROFIBUS defines the IEEE 754 format single precision floating point data type. It is transferred over the network as a 4 byte data, Most Significant Byte first. In the CPU memory area the same data type and size is defined, but data of this type is stored with the Most Significant bytes on the higher memory location and the Least Significant Bytes on the lower memory location. The figure below shows the conversion in graphic format.



A-6-3 Text String Data Conversion

PROFIBUS defines ASCII text strings data type. It is transferred over the network as a string of characters. In order to maintain a readable string in the CPU memory, the data is converted to fit the odd character in the Most Significant Byte of the words, and the even characters in the Least Significant Byte of the words. The string is stored on ascending word addresses in CPU memory. The figure below illustrates the conversion

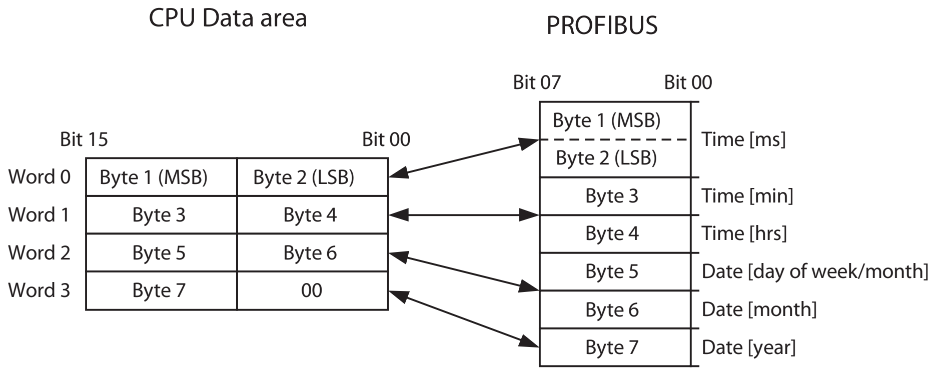


Note m = (n-1)/2, rounded to the next lowest integer.

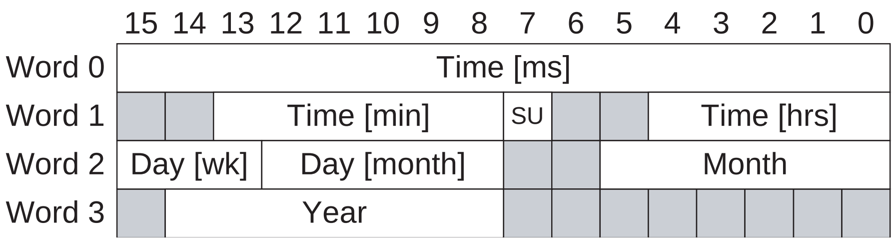
If the number of text characters is even, all bytes will fit in the words, but one additional word will be set to 0000. If the number of bytes is odd, the last byte of the sequence will be mapped to the high-byte of the last word. The low-byte of the last word will be padded with a 0.

A-6-4 Date/Clock Time Data Conversions

Date, Time and Time Difference data types as defined in PROFIBUS are not supported by the NJ-series controller unit. To ensure that workable data is transferred from PROFIBUS to the CPU memory, these data types are treated as 16-bit word data. The figure below illustrates the conversion.



Date and Time information is coded as defined by the PROFIBUS DP standard. The figure and the table below define the format as it is stored in the CPU memory.



Note The grey areas in the figure above denote reserved bits, which are always set to 0.

Word	Bits	Type	Description	Range
0	00 to 15	Time	Milliseconds	0 to 59999
1	00 to 04		Hours	0 to 23
	07		Daylight saving time indication	0: Standard time 1: Daylight saving time
	08 to 13		Minutes	0 to 59
2	00 to 05	Date	Month of the year	0 to 12
	08 to 12		Day of the month	0 to 31
	13 to 15		Day of the week	0 to 7
3	08 to 14		Year	0 to 99

A-7 Slave Diagnostics Message

A-7-1 Slave Diagnostics Data Message

Every PROFIBUS DP slave device has to support the transfer of acyclic diagnostics message. The contents of these messages allow a PROFIBUS Master Unit to assess the status of the slave device in every state of the communication. The diagnostics message format is defined in the PROFIBUS standard.

The slave diagnostics message consists of at least 6 mandatory bytes. If supported, the slave can send additional extended diagnostics bytes in the same message. The extended diagnostics format is defined in the PROFIBUS standard. The extended bytes are usually only included in the diagnostics message if an event has occurred, which results in extended diagnostics.

In some cases the PROFIBUS Master Unit will itself form a slave Diagnostics message. This is the case if the slave device is not responding to any request sent by the Master Unit. The format of the message will be the same as a message sent by a slave device, but the contents has been sent by the Master Unit.

The last received diagnostics message for each slave device allocated to the PROFIBUS Master Unit can at any time be retrieved from the Unit through the MEMORY AREA READ command (see *6-3-3 MEMORY AREA READ (0101)*).

The diagnostics message is returned from the slave device as a sequence of bytes. When transferred to the CPU memory, the format is converted to words. The format is shown in the figure below. The location in the CPU memory, designated as D is the Destination location as specified in the MEMORY AREA READ command.

D	Byte 1	Byte 2
D + 1	Byte 3	Byte 4
D + 2	Byte 5	Byte 6
D + 3	Byte 7	Byte 8
D + 4	Byte 9	Byte 10

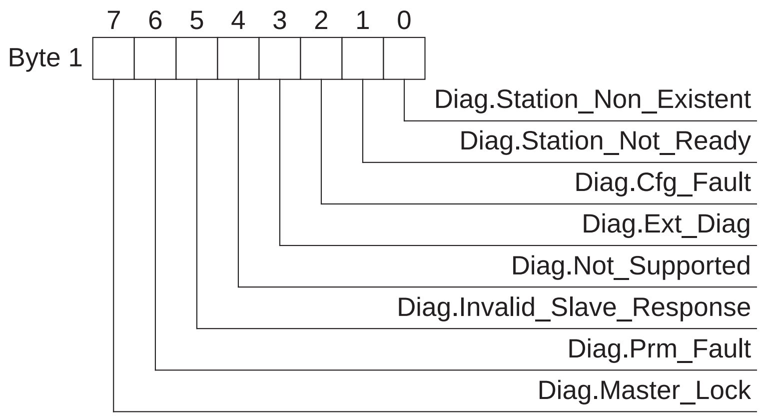
The first 6 bytes or 3 words (Word D to Word D+2) are mandatory bytes, which will always be sent by the slave device. Any additional, i.e. extended diagnostics bytes start at Word D+3. The contents of the first six bytes is defined by the PROFIBUS standard. The contents of the extended diagnostics information is slave device dependent, but the format is defined in the PROFIBUS standard.

The first 6 bytes and the Extended diagnostics format are explained below.

A-7-2 Standard Diagnostics Data Bytes

● Slave Diagnostics Byte 1

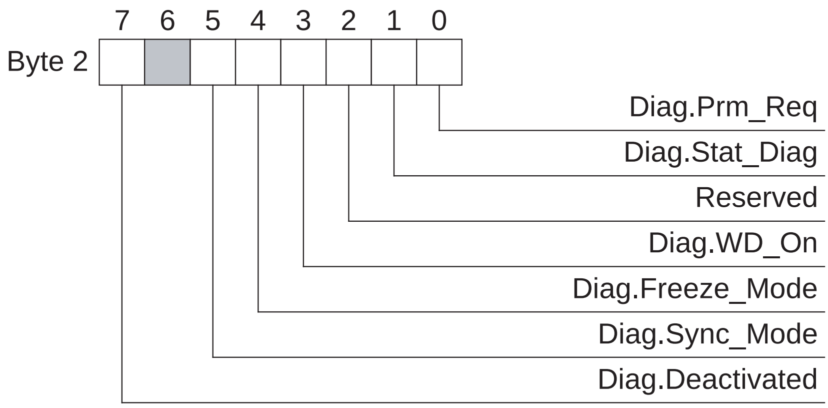
A layout of Byte 1 is shown below. This byte is mapped to the high-byte of Word D.



Bit	Name	Description
00	Diag.Station_Non_Existent	This bit is set by the Master Unit if the slave does not respond to any of the request messages sent by the master. If this bit is set the diagnostic bits contains the state of the last diagnostic message or the initial value. The slave device sets this bit to zero in case of a correct response.
01	Diag.Station_Not_Ready	This bit indicates that the slave device is not yet ready for data transfer.
02	Diag.Cfg_Fault	Set by the slave device, this bit indicates that the last received configuration data from the Master Unit are rejected. The configuration data in the slave device differ from the configuration sent by the Master Unit.
03	Diag.Ext_Diag	This bit indicates that the diagnostics message returned by the slave device contains extended diagnostics, i.e. it contains more than the mandatory 6 bytes.
04	Diag.Not_Supported	In case the Master Unit sent a message to the slave device, which is not supported by that device, this bit will be set by the slave device.
05	Diag.Invalid_Slave_Response	This bit is set by the Master Unit if the slave has returned an invalid response to a Master request message. The slave device will set this bit to 0.
06	Diag.Prm_Fault	Set by the slave device, this bit indicates that the last received parameter data from the Master Unit have been rejected. The parameter data in the slave device differ from the parameter sent by the Master Unit.
07	Diag.Master_Lock	This bit indicates that the slave device has been parameterized by another master. The bit is set by the Master Unit, if the address in byte 4 differs from 255 and from the Master Unit's own address. The slave device sets this bit to zero.

Slave Diagnostics Byte 2

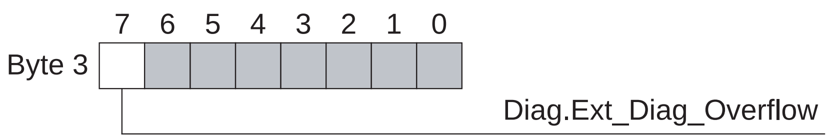
A layout of Byte 2 is shown below. This byte is mapped to the low-byte of Word D.



Bit	Name	Description
00	Diag.Prm_Req	This bit is set by the slave device and indicates that it needs to be (re-)aparameterized. The slave device is not in Data_Exchange with the Master Unit. The bit remains on as long as it has not been parameterized successfully.
01	Diag.Stat_Diag	This bit indicates static diagnostics at the slave device. The Master Unit will repeatedly request diagnostics data. As long as this bit is set, Data_Exchange with the Master Unit is not being performed.
02	Reserved	This bit is reserved and always set to 1 by the slave device.
03	Diag.WD_On	If the watchdog has been enabled at the slave device (through the appropriate setting in the parameterization message) this bit will be set.
04	Diag.Freeze_Mode	If the slave device has been set to the Freeze mode, using the global command, this bit will be set to on. The bit will be set to off, if an Unfreeze command has been received.
05	Diag.Sync_Mode	If the slave device has been set to the Sync mode, using the global command, this bit will be set to on. The bit will be set to off, if an Unsync command has been received.
06	Reserved	This bit is reserved.
07	Diag.Deactivated	This bit is set by the Master Unit, indicating that the slave device has been disabled. The slave device is allocated to the Master Unit, but removed from cyclic processing.

Slave Diagnostics Byte 3

A layout of Byte 3 is shown below. This byte is mapped to the high-byte of Word D + 1.



Bit	Name	Description
00 to 06	Reserved	These bits are reserved and always set to 0 by the slave device.
07	Diag.Ext_Diag_Overflow	If set, this bit indicates that there exists more diagnostic information than specified in Ext_Diag_Data. This bit will, for example, be set if the slave device has more diagnostics available than it can enter in its send buffer. This bit will also be set if the Master Unit receives more diagnostic information than it can enter in its diagnostic buffer.

● Slave Diagnostics Byte 4

Slave Diagnostics Byte 4 is mapped to the low byte of Word D+1. This byte contains the PROFIBUS address of the Master Unit, which parameterized the slave. If the slave is not parameterized correctly, the byte contains FF (Hex) or 255 (Decimal).

● Slave Diagnostics Bytes 5 to 6

Slave Diagnostics Bytes 5 and 6 are mapped to Word D+2. They contain the PROFIBUS Ident Number of the slave device. The Ident number uniquely identifies the type of device. The Ident Number is a 16-bit code issued by the PROFIBUS Organization. For example, the Ident number of the CJ1W-PRT21 PROFIBUS DP slave is 0602 (Hex).

A-7-3 Extended Diagnostics Data Bytes

The aforementioned 6 diagnostics bytes are a mandatory minimum, which is supported by every PROFIBUS DP slave device. Depending on the device however, it may also support extended diagnostics information, which is coded into the bytes following the first 6 mandatory bytes. The number of extended bytes depends on the coding and the events that have occurred in the slave device. Normally, they will not be added to the standard diagnostics message, i.e. the first 6 mandatory bytes, if no event occurred.

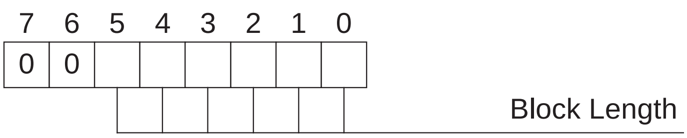
There are three types of extended diagnostics information:

- Device related diagnostics
- Module related diagnostics
- Channel related diagnostics

The Module related diagnostics, are usually followed by the Channel related diagnostics. Both the Device related diagnostics and the Module / Channel related diagnostics can occur in one message.

● Device Related Diagnostics

The Device related diagnostics data block consist of a header byte followed by one or more device dependent diagnostics data bytes. The header byte indicates the type of diagnostics data and the total length of the data block. The header byte layout is shown below.



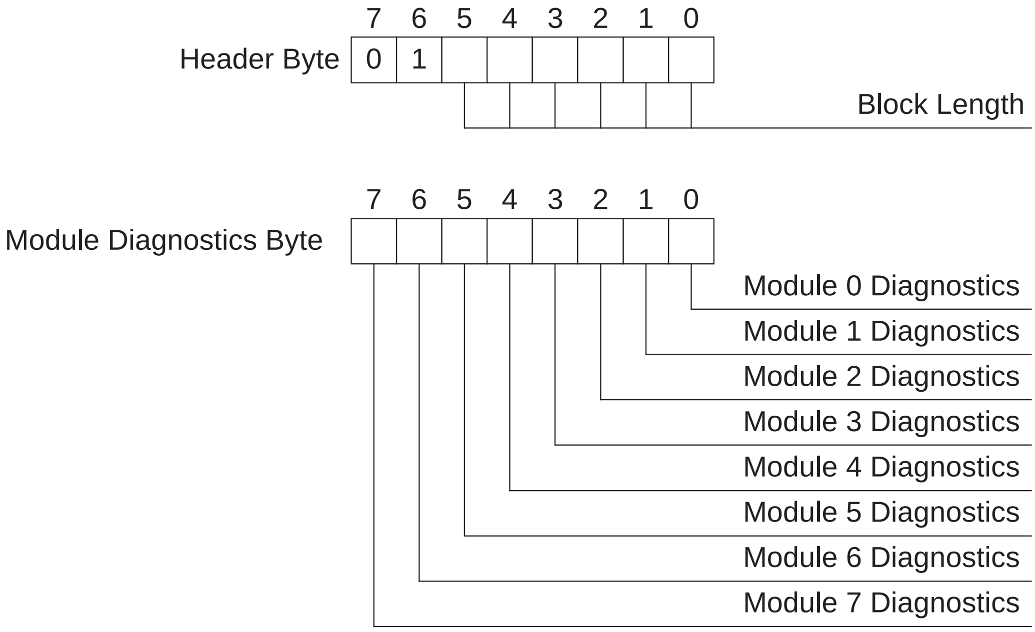
Bit	Name	Description
00 to 05	Block length	These bits contain the length of the Device related diagnostics data block, including the header byte. The Device diagnostics will follow this header byte. Maximum length of the block, including the header is 63 bytes. Interpretation of the diagnostics bytes in this block is device dependent.
06 to 07	Reserved	Fixed to 00. The combination of bit 6 and 7 indicate the type of diagnostics, i.e. 00 indicates Device related diagnostics data.

Note The Device related diagnostics as defined above is according to the PROFIBUS-DP standard. With the release of the PROFIBUS DP-V1 standard, the Device related diagnostics contents has been re-defined to accommodate diagnostics from slave devices supporting PROFIBUS DP-V1.

Module related Diagnostics

The Module or Identifier related diagnostics data block consist of a header byte followed by one or more bytes containing flags, which indicate if there is diagnostics pending related to the I/O configuration modules. Each flag is related to the corresponding I/O module, defined during configuration. Non-used flags are always set to 0.

The figure below shows the header byte, and one module diagnostics byte. Depending on the number of I/O modules configured, there may be more bytes.



Header Byte

Bit	Name	Description
00 to 05	Block length	These bits contain the length of the Module related diagnostics data block, including the header byte. The Module diagnostics flags will follow this header byte. Maximum length of the block, including the header is 63 bytes.
06 to 07	Reserved	Fixed to 01. The combination of bit 6 and 7 indicate the type of diagnostics, i.e. 01 indicates Module related diagnostics data.

Module Diagnostics Byte

Bit	Name	Description
00	Module 0 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 0, i.e. the first configuration module.
01	Module 1 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 1.
02	Module 2 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 2.
03	Module 3 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 3.
04	Module 4 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 4.

Bit	Name	Description
05	Module 5 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 5.
06	Module 6 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 6.
07	Module 7 Diagnostics	When set, this bit indicates that there is Diagnostics information pending related to configuration module 7.

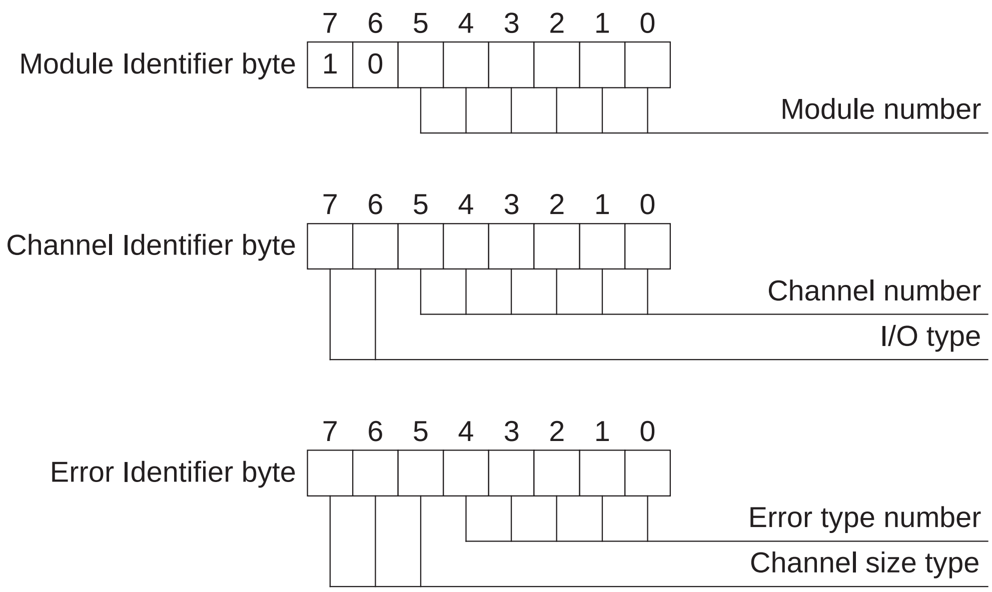
Consecutive bytes contain the diagnostics flags for Module 8 through 15, 16 through 23, etc.

The Module related diagnostics information is usually followed by the Channel related diagnostics, which contain the actual diagnostics data per module.

● Channel Related Diagnostics

Channel related diagnostics contain diagnostics information related to a specific channel in a configured I/O module, e.g. over peak current detected on current input channel 2, module 0.

The Channel related diagnostics information entry in the diagnostics message, always consists of three bytes, which are outlined below. From these bytes the actual event can be deducted.



● Module Identifier Byte

Bit	Name	Description
00 to 05	Module number	These bits contain the number of the configuration module, to which the channel, reporting diagnostics belongs. The module number ranges from 0 to 63.
06 to 07	Reserved	Fixed to 10. The combination of bit 6 and 7 indicate the type of diagnostics, i.e. 10 indicates Channel related diagnostics data.

Channel Identifier Byte

Bit	Name	Description
00 to 05	Channel number	These bits contain the number of the channel, which reports the diagnostics. The channel number ranges from 0 to 63.
06 to 07	I/O type	Bit 6 and 7 indicate the type of I/O channel, from which the diagnostics data is sent. • 00: Reserved • 01: Input • 10: Output • 11: Input/Output

Error Identifier Byte

Bit	Name	Description
00 to 04	Error number	These bits contain the number of the error which occurred at the channel. The error number ranges from 0 to 31, and can have the following meaning: • 0: Reserved • 1: Short circuit • 2: Under voltage • 3: Over voltage • 4: Overload • 5: Over temperature • 6: Line break • 7: Upper limit value exceeded • 8: Lower limit value exceeded • 9: Error • 10 to 15: Reserved • 16 to 31: Manufacturer specific
05 to 07	Channel size type	Bit 5, 6 and 7 indicate the size of the channel, from which the diagnostics data is sent. • 000: Reserved • 001: Bit • 010: 2 Bit • 011: 4 Bit • 100: Byte • 101: Word • 110: 2 Words • 111: Reserved

● Example of Extended Diagnostics

Below an example of Extended diagnostics data is given, using the definitions above. The 6 mandatory bytes preceding them are not shown.

	7	6	5	4	3	2	1	0	
	0	0	0	0	0	1	0	0	Header byte
Device related diagnostics:	Device specific								
	diagnostics field								Device specific contents
	of length 3								
	0	1	0	0	0	1	0	1	Header byte
							1		Module 1 has diagnostics
Module related diagnostics:		1							Module 14 has diagnostics
	1	0	0	0	0	0	0	1	Module 1
Channel related diagnostics:	0	1	0	0	0	1	0	0	Channel 4 (Input)
	0	1	1	0	0	1	0	0	Overload, bit oriented
	1	0	0	0	1	1	1	0	Module 14
Channel related diagnostics:	0	0	0	0	1	0	0	0	Channel 8
	1	0	0	0	0	1	1	1	High Limit exceeded, byte oriented

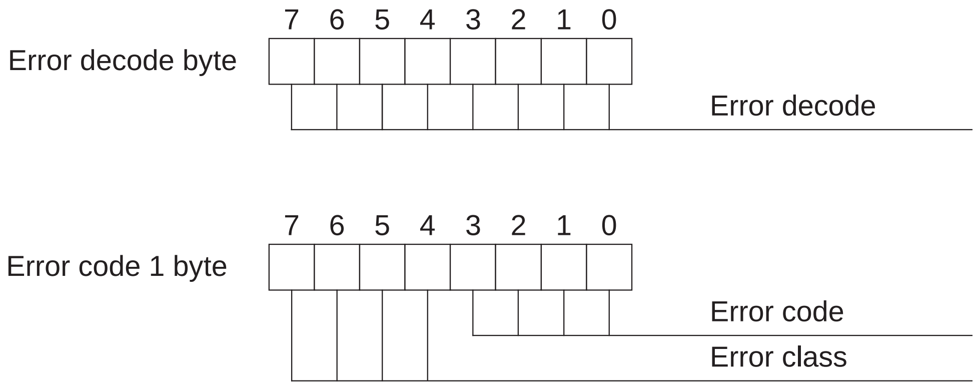
The figure above shows the extended diagnostics of a slave device, which contains:

- Device related diagnostics: One header byte and three device specific diagnostics bytes are shown in this example. The contents of the diagnostics is device specific.
- Module related diagnostics: One header byte and three module diagnostics bytes. The first of three bytes indicates pending diagnostics in module1, the next byte indicates pending diagnostics in module14.
- Channel related diagnostics: Two channel related diagnostics entries are shown: One for module 1 and one for module 14. In module 1, Input channel 4, has detected an overload. In module 14, channel 8, has detected an high-limit exceeded event.

A-7-4 PROFIBUS DP-V1 Error Codes

The Error codes returned by a PROFIBUS DP-V1 slave device are defined in the PROFIBUS DP-V1 Extension to the PROFIBUS standard. This section lists the Error codes, which can be returned as a result of a PROFIBUS DP-V1 MSAC1 services. From these codes, the user can determine the cause of the failure.

The figure below shows the two of the three Error code bytes, returned by a PROFIBUS DP-V1 slave device, in case an MSAC1 service resulted in an error. The third byte, Error code 2, which is not shown below will always contain user specific error codes.



Bit	Name	Description
00 to 07	Error decode	The code determines the protocol type of the slave which returned the error code. Since this error scheme can also be used in network applications containing protocol converters (i.e. gateways), non-PROFIBUS protocols are also defined in this list. • 0 to 127: Reserved • 128: PROFIBUS DP-V1 • 129 to 253: Reserved • 254: PROFIBUS FMS • 255: HART®

In case the Error decode byte is 128, i.e. PROFIBUS DP-V1, the Error code 1 byte can have the possible values defined in the table below.

Error Code 1 Byte

Error Class Code		Error Code	Description
0 to 9	Reserved	---	
10	Application	• 0: Read error • 1: Write error • 2: Module failure • 3 to 7: Reserved • 8: Version conflict • 9: Feature not supported • 10 to 15: User specific	Error codes related to the application, i.e. the slave device it self or I/O modules connected to this device.
11	Access	• 0: Invalid index • 1: Write length error • 2: Invalid slot • 3: Type conflict • 4: Invalid area • 5: State conflict • 6: Access denied • 7: Invalid range • 8: Invalid parameter • 9: Invalid type • 10 to 15: User specific	Error codes related to accessing the requested data area in the slave device or I/O modules connected to the slave device.
12	Resource	• 0: Read constrain conflict • 1: Write constrain conflict • 2: Resource busy • 3: Resource unavailable • 4 to 7: Reserved • 8 to 15: User specific	Error codes related to resources inside the slave device which are required to process the requested data, e.g. functions required to implement a requested action.
13 to 15	User specific	--	

Error code 2 byte

This error code will always contain user specific error codes. If necessary, refer to the slave device's documentation for decoding the returned byte.

I

Index

I

Index

P

R

S

T

U

V

Authorized Distributor:

Note: Specifications subject to change without notice.

Printed in Europe