Schneider Electric

Mitsubishi FX Protocol
XBT N/R/RT

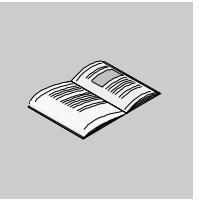
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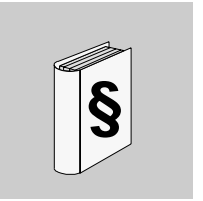
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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

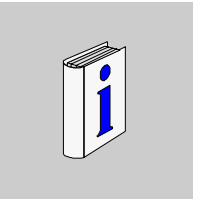
⚠ CAUTION
CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

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About the Book



At a Glance

Document Scope

This document describes communication between automation systems and the XBT N/R/RT product range using the Mitsubishi FX protocol.

Validity Note

The data and illustrations found in this document are not binding. We reserve the right to modify our products in line with our policy of continuous product development. The information in this document is subject to change without notice and should not be construed as a commitment by Schneider Electric.

Related Documents

Title of Documentation	Reference Number
XBT N/R/RT Instruction sheet	W916810140111 A07
XBT N/R/RT User Manual	33003962
Vijeo-Designer Lite	Online help

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

Product Related Information

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All pertinent state, regional and local safety regulations must be observed when installing and using this product. For reasons of safety and to ensure compliance with documented system data, only the manufacturer should perform repairs to components.

Since the XBT N/R/RT terminals are not designed to pilot safety critical processes, no specific instructions apply in this content.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Compatibility

1

Compatibility

Overview

The Mitsubishi CPU-direct protocol available for XBT terminals can be used to communicate with the following Mitsubishi FX process controllers:

- FX0N, FX0S
- FX1N, FX1S
- FX2N, FX2NC, FX2C

Operating Principle

2

Overview

This chapter describes the operating principle of XBT terminals in applications using the Mitsubishi CPU-direct protocol.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.*
- Each implementation of a Magelis XBT N/R/RT must be individually and thoroughly tested for proper operation before being placed into service.

*For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control*

Failure to follow these instructions can result in death, serious injury, or equipment damage.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
General Information on Bus Communications	12
Master / Slave Communication Principle	13
Communication of XBT Terminals with Mitsubishi FX PLCs	14

General Information on Bus Communications

Overview

The XBT terminals can be connected to PLCs using different protocols. This document describes the communication using the Mitsubishi CPU-direct protocol with the XBT terminal acting as master.

Roles of XBT Terminals

The terminals are usually connected to a communication equipment (PLC or other) via a field bus. The XBT and the PLCs work autonomously of each other.

XBT terminals perform the following functions:

- monitoring function: XBT terminals visualize the processes that are active in the PLCs and indicate alarm states
- command function: XBT terminals send information to the PLC upon user request

Roles of Buses

A bus system provides the possibility to connect different devices via a unique cabling.

Roles of Protocols

The protocol defines the language that is spoken by all the equipment connected to the bus.

Master / Slave Communication Principle

Overview

Mitsubishi FX communications are performed according to the master / slave principle that is described in the following.

Characteristics of the Master / Slave Principle

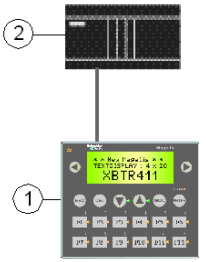
The master / slave principle is characterized as follows:

- Only one master is connected to the bus at a time.
- One or several slaves can be connected to the same serial bus.
- Only the master is allowed to initiate communication, i.e. to send requests to the slaves.
- In Mitsubishi FX communications, the master can only initiate one Mitsubishi FX transaction at the same time.
- The slaves can only answer requests they received from the master.
- The slaves are not allowed to initiate communication, neither to the master nor to any other slaves.
- In Mitsubishi FX communications, the slaves generate an error message and send it as response to the master if an error occurred in receipt of the message or if the slave is unable to perform the requested action.

Terminals acting as Master in Mitsubishi FX Applications

In Mitsubishi FX applications, the XBT terminal acts as master device, i.e. it provides the client role, whereas the slave devices act as servers.

Application example of XBT R411



1 XBT N200 (master)
2 Mitsubishi FX PLC

Communication of XBT Terminals with Mitsubishi FX PLCs

Overview

In communications with Mitsubishi FX PLCs the XBT terminal has the status of master.

The Mitsubishi CPU-direct protocol is the communication protocol for Mitsubishi FX PLCs.

The XBT can be connected in point-to-point mode to Mitsubishi FX PLCs.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The protocol should only be used by authorized and properly trained personnel.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Software Configuration

3

Vijeo-Designer Lite

Overview

Vijeo-Designer Lite does not provide dialog boxes for Mitsubishi CPU direct protocol applications because no configuration settings are required.

Variable Types Supported

4

Variable Types Supported

Table of Variable Types Supported by the XBT

The following table lists all Mitsubishi FX variables XBT terminals can access.

Variable Type Supported	Mitsubishi FX Syntax
Output Bits	%Yi
Input Bits	%Xi
Bits of Word	%Di:j
Word	%Di
Double Word	= word
Floating	= word
String	= word

Identifiers

- i : 0...65535
- j : 0...15

Depending on the Mitsubishi FX PLC type connected, the width of the memory is different:

Variable Type	Type of Variable	Symbol	Limits				
			FX0N	FX1S	FX2C	FX1N	FX2N, FX2NC
Bit	Inputs	X	X0000 - X0127	X0000 - X0015	X0000 - X0223	X0000 - X0127	X0000 - X0183
	Outputs	Y	Y0000 - Y0127	Y0000 - Y0013	Y0000 - Y0223	Y0000 - Y0127	Y0000 - Y0183

Variable Type	Type of Variable	Symbol	Limits				
			FX0N	**FX1S**	**FX2C**	**FX1N**	**FX2N, FX2NC**
Word	Data Registers	D	D0000 -- D0255		D0000 - D0999	D0000 -- D7999	
	File Registers		D1000 - D2499	N/A	D1000 - D2999	N/A	
	RAM File Registers		N/A		D6000 - D7999	N/A	
	Special Data Registers		D8000 - D8255				

The HMI application designer must use only those variables that are supported by the equipment he connects the XBT terminal to. Vijeo-Designer Lite cannot verify whether the configured variables are correct because the software does not know which equipment the terminal will finally be connected to.

Cables and Connectors

5

Cables

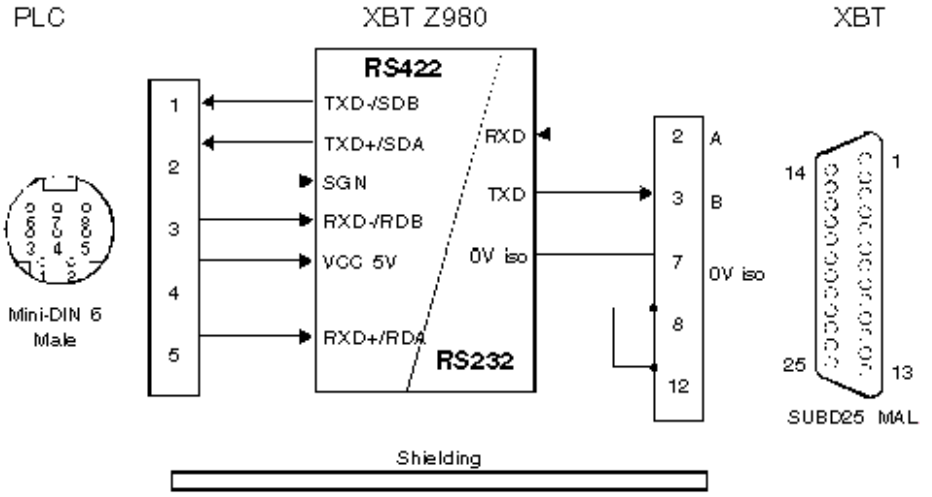
Technical Data

The following table lists the cables required to connect XBT terminals to the different Mitsubishi FX PLCs.

PLC Type	Terminal Type	Cable References	Length
• FX0N • FX1N • FX1S • FX2N • FX2NC • FX2C	XBT N401/410 XBT R410/411	XBT Z980 mini-Din <--> SUB-D25	2.5 m (8.2 ft.)
	XBT RT	XBT Z980 + XBT ZG939 (+ XBT ZRTPW for XBT RT 500)	

XBT Z980 Wiring Diagram

The XBT Z980 cable used to connect XBT terminals to Mitsubishi FX PLCs includes an RS422-RS232 converter.



Diagnostics

6

Detected Error Indication

Overview

XBT terminals indicate detected errors in different ways

- by displaying question marks `??????` in alphanumerical fields
- by displaying crosses for graphic objects
- by displaying hash characters in alphanumerical fields
- by blinking alphanumerical fields
- by issuing system error messages

The following paragraphs list these detected errors and their possible reasons.

Question Marks and Crosses

When question marks `??????` and crosses `XXXXXX` are displayed on the display of your XBT terminal, a transmission error has occurred. To correct this, check the following:

If...	Then ...
question marks are displayed	verify that all cables are correctly connected.
question marks are displayed	the XBT terminal may have received no response from the PLC.
question marks are displayed	the XBT terminal may have received an exception response from the PLC.

Hash Characters

Hash characters displayed in alphanumerical fields on your XBT terminal indicate that the value to be displayed is too long for this alphanumerical field and cannot completely be displayed. The value `100` can, for example, not be displayed in a 2-digit alphanumerical field. To correct this, enter a shorter value or adapt the size of the alphanumerical field so that it can display any of the possible values of the PLC variable.

Blinking Alphanumerical Fields

Blinking alphanumerical fields on your XBT terminal indicate that the value of this field has exceeded or fallen below a user-defined threshold.

System Error Messages

A variety of system error messages is by default configured for the terminals. All these standard system messages are assigned a panel number 200+x. A distinction is made between detected error messages indicating communication interruptions and status messages provoked by inputs at the terminal.

These 2 message types differ by the numbers they are assigned and by the way they are displayed at the terminal as shown in the list below:

Error Message Caused by:	Error Message Numbers	Display Mode
Communication Interruptions	201– 204	To indicate that a communicaton interruption has occurred, the message is displayed in a popup dialog box every 10 seconds.
Input at Terminal	241 – 258	The status message is displayed as a response to user input at the terminal.

Messages Caused by Communication Interruptions

Messages 201 to 204 are issued by the terminal to indicate that a communication interruption has occurred. They are displayed in a popup dialog every 10 seconds.

If...	Then ...
message `201: DIALOG TABLE AUTHORIZATION INCORRECT` is displayed	the authorization word in the dialog table does not have the expected value. (Refer to the Vijeo-Designer Lite online help for information on how this word is working.) To correct this verify that:. • you are connected to the right PLC • the memory of your PLC is not corrupted • the correct value is saved on the PLC
message `202: DIALOG TABLE WRITING IMPOSSIBLE` is displayed	the write cycle to the dialog table of the PLC could not be ended. This condition may have the following causes: • too much load on the communication bus • EMC disturbances on the communication bus
message `203: DIALOG TABLE READING IMPOSSIBLE` is displayed	the read cycle from the dialog table of the PLC could not be ended. This condition may have the following causes: • too much load on the communication bus • EMC disturbances on the communication bus

Messages Caused by Input at the Terminal

Messages 242 to 254 are issued by the XBT as a response to user input at the terminal. These messages are displayed directly after the operator has sent an incorrect command to the terminal and will persist until the user has corrected the entered command or value. Messages 255 to 258 are status messages displayed after the user has initiated an operation at the terminal to indicate that it has (or has not) been accepted and is in progress.

If...	Then ...
message `241: IMPOSSIBLE TO READ VARIABLE` is displayed	the terminal has attempted to read a variable but could not retrieve its value. This condition may have the following causes: • too much load on the communication bus • EMC disturbances on the communication bus
message `242: IMPOSSIBLE TO WRITE VARIABLE` is displayed	the terminal has attempted to write in a memory area of the equipment and has received a negative acknowledgement or no acknowledgement at all. This condition may have the following causes: • too much load on the communication bus • EMC disturbances on the communication bus
messages `243` to `249` are displayed	correct the value or command you have entered as indicated by the message.
message `250: LANGUAGE IMPOSED BY PLC` is displayed	the PLC forces the terminal to use a language. This language cannot be changed by the operator. For more information see the Vijeo-Designer Lite online help, functions of the dialog table.
messages `251` or `252` are displayed	correct the value or command you have entered as indicated by the message.
message `253: PASSWORD IMPOSED BY PLC` is displayed	you cannot change the password at the terminal because it is forced by the PLC. For more information see the Vijeo-Designer Lite online help, functions of the dialog table.
message `254: PROTECTED ACCESS PAGE` is displayed	you are trying to access a page that is password protected but you do not have the required authorization level.
messages `255` to `258` are displayed	the commands you entered at the terminal are executed or not executed, as indicated in these status messages.

Diagnosis Counters

3 diagnosis counters can be displayed on the protocol's system page (line parameters):

Counter	Meaning
1	number of responses received without any FCS error
2	number of responses received with any FCS error
3	number of requests that have not been answered

NOTE: The counters no. 4...8 are not used and remain at `0`.

Appendices



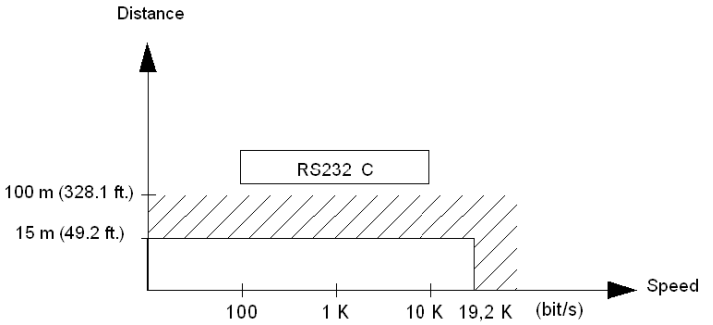
RS232 Recommendations

A

RS232 Recommendations

Diagrams for RS232C Link

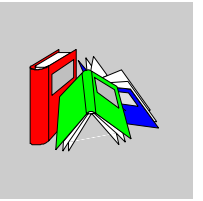
RS232C link



- Maximum length for the link is 15 m (49.2 ft.).
- Wiring = 3 shielded wires with a minimum cross-section of 0.6 mm^2 (AWG22)

NOTE: The maximum length including the RS232 link is 15 m (49.21 ft.), provided that the equipment connected to the XBT terminal is not subject to more stringent restrictions (refer to connected devices instruction sheet) and for XBT RT500 provided that the length of the cable is below 10 m (32.8 ft.) (because power is also supplied by this cable).

Glossary



A

AWG

American wire gauge (wire diameter)

F

FCS

frame check sequence

M

Magelis

Generic commercial name of the range of Schneider HMI terminals.

P

PLC

programmable logic controller

R

RS232

recommended standard for connecting serial devices = EIA/TIA 232

RS422

recommended standard for connecting serial devices = EIA/TIA 422

V

Vijeo-Designer Lite

Configuration software for the low end Magelis range. It replaces the XBT-L1000 software.

X

XBT

Any HMI terminal (when it is not necessary to make a distinction).

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