Schneider Electric

SYSMAC-WAY Protocol
XBT N/R/RT

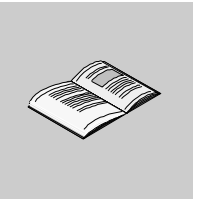
03/2009

33004010.02

www.schneider-electric.com

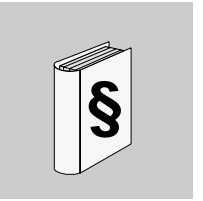
© 2009 Schneider Electric. All rights reserved.

Table of Contents



	Safety Information	**5**
	About the Book	**7**
Chapter 1	**Operating Principle**	**9**
	General Information on Bus Communications	10
	Operating Principle	11
Chapter 2	**Software Configuration**	**13**
	Vijeo-Designer Lite	14
	Protocol - Sysmac-Way Dialog Box	16
	Configuring Equipment Addresses	17
	Equipment Address Dialog Box	19
Chapter 3	**Variable Types Supported**	**21**
	Variable Types Supported	21
Chapter 4	**Cables and Connectors**	**23**
	Cables	24
	SUB-D25 Pin Connections	25
Chapter 5	**Diagnostics**	**27**
	XBT Detected Error Indication	27
Appendices		**31**
Appendix A	**RS232/RS485 Recommendations**	**33**
	RS232 Recommendations	34
	RS485 Recommendations	35
Glossary		**37**
Index		**39**

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.

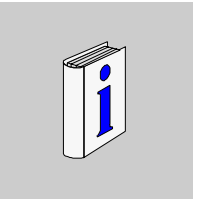
⚠ CAUTION
CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

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.

© 2008 Schneider Electric. All Rights Reserved.

About the Book



At a Glance

Document Scope

This document describes communicationbetween automation systems and the XBT N/R/RT product range using the SYSMAC–WAY 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

Schneider Electric assumes no responsibility for any errors that may appear in this document. If you have any suggestions for improvement or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

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 context.

User Comments

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

Operating Principle

1

Overview

This chapter describes the operating principle of the XBT terminals in applications using the SYSMAC-WAY 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.

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

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

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
General Information on Bus Communications	10
Operating Principle	11

General Information on Bus Communications

Overview

The XBT terminals can be connected to PLCs using different protocols. This document describes the communication using the SYSMAC-WAY 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.

Operating Principle

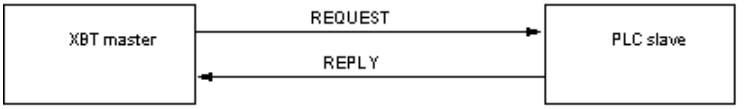
Overview

For connections with OMRON process controllers XBT terminals use the SYSMAC-WAY protocol as communication protocol and act as master.

XBT terminals are connected to the process controller in point-to-point mode via the RS232 connector.

The dialog between the superior processing levels and the XBT terminals consists of request / replies. The requesting station (XBT master) transmits the commands to be executed to the slave (PLC).

In the SYSMAC-WAY protocol the terminal communicates in ASCII mode.



There is a word inside the PLC, and depending on its value, the PLC is in RUN mode or in MONITOR mode. If the application designed by the user with Vijeo-Designer Lite writes in this word (for example if the dialog table is configured at an address that overlaps this word, or if the operator enters directly a value in this word), then the PLC will switch from RUN mode to MONITOR mode.

⚠ WARNING

LOSS OF CONTROL

For an XBT terminal programmed to write into the memory of a PLC:

- Ensure that the XBT program does not write to the PLC control word used for operating either RUN mode or MONITOR mode.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The protocol should only be used by authorized and properly trained personnel because inexperienced users can accidentally initiate operations they did not intend.

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

Software Configuration

2

Overview

This chapter contains the protocol parameters you must configure in the Vijeo-Designer Lite software for operating XBT terminals in applications using the SYSMAC-WAY protocol.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Vijeo-Designer Lite	14
Protocol - Sysmac-Way Dialog Box	16
Configuring Equipment Addresses	17
Equipment Address Dialog Box	19

Vijeo-Designer Lite

Overview

Use the Vijeo-Designer Lite software to configure your XBT terminal for SYSMAC-WAY protocol applications.

⚠ WARNING

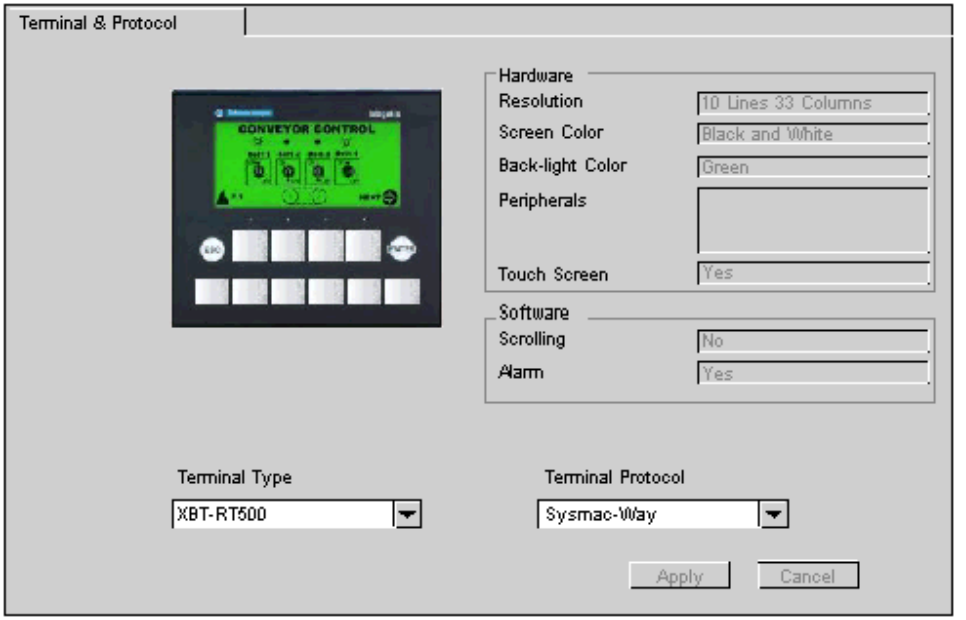
INCOMPATIBLE SOFTWARE

Use only Schneider Electric manufactured or approved software to program hardware.

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

Opening the Protocol - Sysmac-Way Dialog Box

To open the **Protocol - Sysmac-Way** dialog box in Vijeo-Designer Lite for setting the protocol parameters, proceed as follows:

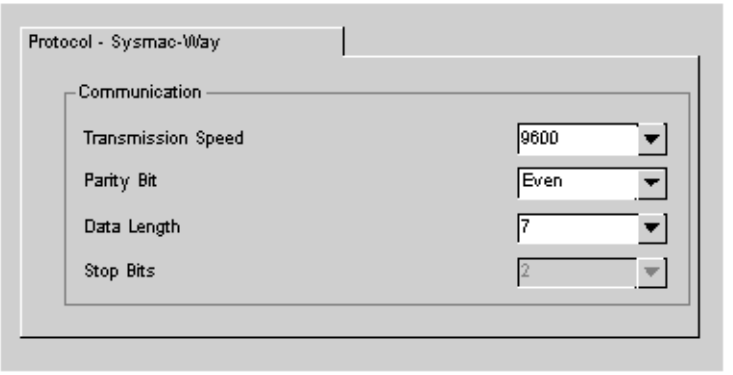
Step	Action
1	Start Vijeo-Designer Lite. To create a new application, continue with step 2, if you have already created a SYSMAC-WAY application, skip steps 2 and 3 and execute step 4.
2	From the application browser on the left-hand side of the Vijeo-Designer Lite window select the item **Configuration** → **Terminal & Protocol**. **Result**: The following dialog box will be displayed on the right-hand side of the Vijeo-Designer Lite window. 
3	From the **Terminal Protocol** list in the lower right corner select the item **Sysmac-Way** and click **Apply**.
4	Select from the application browser the item **Protocol - Sysmac-Way**. **Result**: The dialog box **Protocol - Sysmac-Way** will be displayed on the right-hand side of the Vijeo-Designer Lite window where you can configure the protocol parameters for SYSMAC-WAY communication.

Protocol - Sysmac-Way Dialog Box

Purpose

Use this dialog box to configure the protocol parameters for SYSMAC-WAY communication.

Representation



Elements of the dialog box

Element	Description
Communication	
Transmission Speed	Select the transmission speed (in bit/s) on your SYSMAC-WAY bus from the list. Make sure to configure the same transmission speed for all devices connected to the bus.
Parity Bit	Select either even, odd or no parity. Make sure to configure the same parity value for all devices connected to the bus.
Data Length	Select a length of 7 or 8 bits for your transmission data. Make sure to configure the same data length for all devices connected to the bus.
Stop Bits	You cannot edit this parameter because in SYSMAC-WAY communications always 2 stop bits are used.

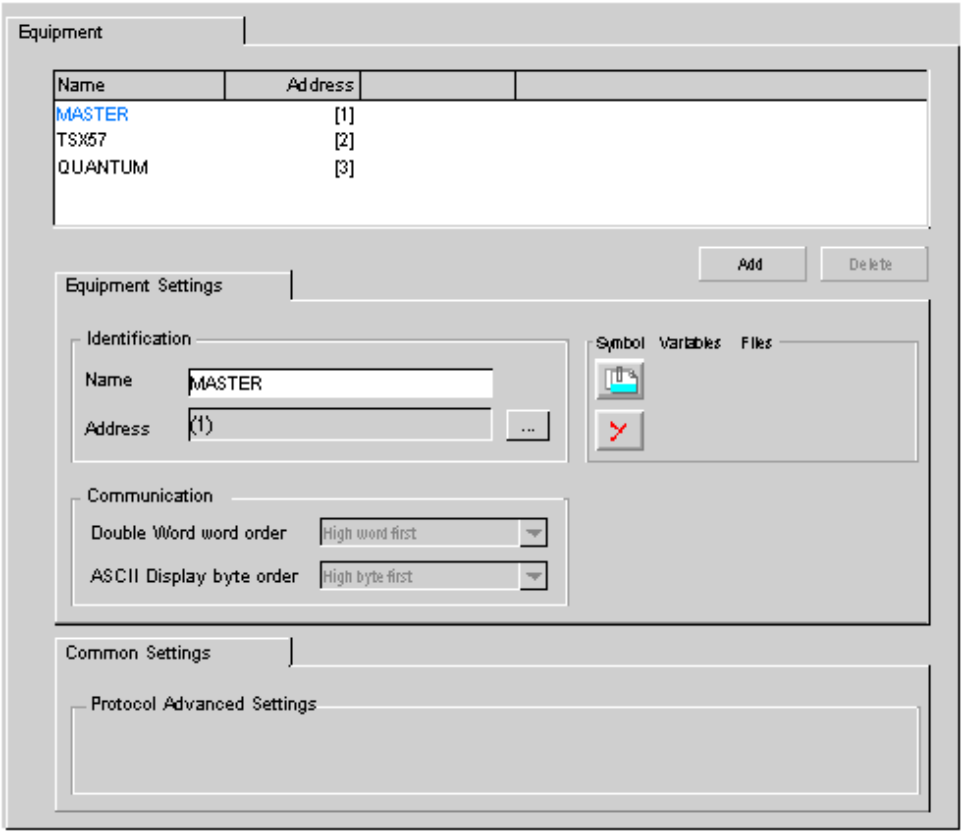
Configuring Equipment Addresses

Overview

Use the Vijeo-Designer Lite software to configure addresses for the equipment your XBT terminal should communicate with.

Opening the Equipment Address Dialog Box

To open the **Equipment Address** dialog box in Vijeo-Designer Lite for configuring equipment addresses, proceed as follows:

Step	Action
1	Start Vijeo-Designer Lite.
2	From the application browser on the left-hand side of the Vijeo-Designer Lite window select the item **Equipments**. **Result**: The following dialog box will be displayed on the right-hand side of the Vijeo-Designer Lite window. 
3	In the **Equipments** table select a slave device from the list.
4	In the **Equipment Settings** → **Identification** box below click the **...** button right to the **Address** text box. **Result**: The **Equipment Address** dialog box will be displayed where you can configure an address for the selected equipment.

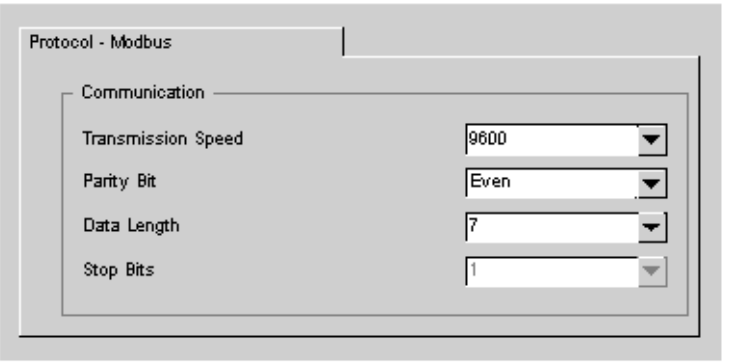
Equipment Address Dialog Box

Purpose

Use this dialog box to configure the address of equipments connected to the network.

Representation

SYSMAC-WAY equipment address

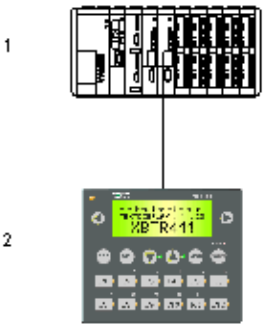


Elements of the dialog

Element	Description
Communication	
Transmission Speed	Select the transmission speed (in bit/s) on your Sysmac-Way bus from the list. Make sure to configure the same transmission speed for all devices connected to the bus.
Parity Bit	Select either even, odd or no parity. Make sure to configure the same parity value for all devices connected to the bus.
Data Length	Enter a value for the length of the frame (in bits). Make sure to configure the same transmission speed for all devices connected to the bus.
Stop Bits	You cannot edit this parameter because the XBT terminals only support 1 stop bit. The combination of no parity with only 1 stop bit is therefore possible, even though this is not conform to the Modbus standard.

Wiring Example

SYSMAC-WAY wiring example



1 Slave
2 XBT R

Variable Types Supported

3

Variable Types Supported

Table of Variable Types Supported by the XBT

The following table lists all SYSMAC-WAY variables XBT terminals can access.

Variable Type Supported	SYSMAC-WAY Syntax
Bit	DMi.j
Word	DMi
Double Word	= word
Floating	= word
String	= word

Identifiers

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

NOTE: The addresses of the objects must belong to the accessible memory zones that are specific to each type of PLC.

Cables and Connectors

4

Overview

This chapter specifies the cables and connectors required for XBT terminals in SYSMAC-WAY applications.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Cables	24
SUB-D25 Pin Connections	25

Cables

Technical Data

The following table lists the cables required to connect XBT terminals to the different SYSMAC-WAY PLCs.

Connected Device	XBT Type	Physical Link	Cable Reference	Length
CVM1/CQM1	XBT N401/N410 XBT R410/R411	RS232	XBT Z9740 (SUB-D25 <--> SUB-D9)	2.5 m (8.20 ft.)
	XBT RT500/RT511		XBT Z9743 (+ XBT ZRTPW for XBT RT500) (RJ45 <--> SUB-D9)	

NOTE: To connect to another PLC, first power off the XBT terminal, change the PLC and power on the XBT terminal again.

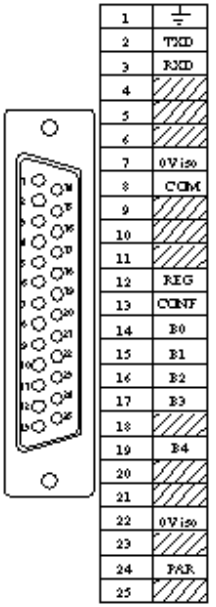
SUB-D25 Pin Connections

Overview

The following XBT terminals provide a SUB-D25 connector on their rear panels:

- XBT N401
- XBT N410
- XBT R410
- XBT R411

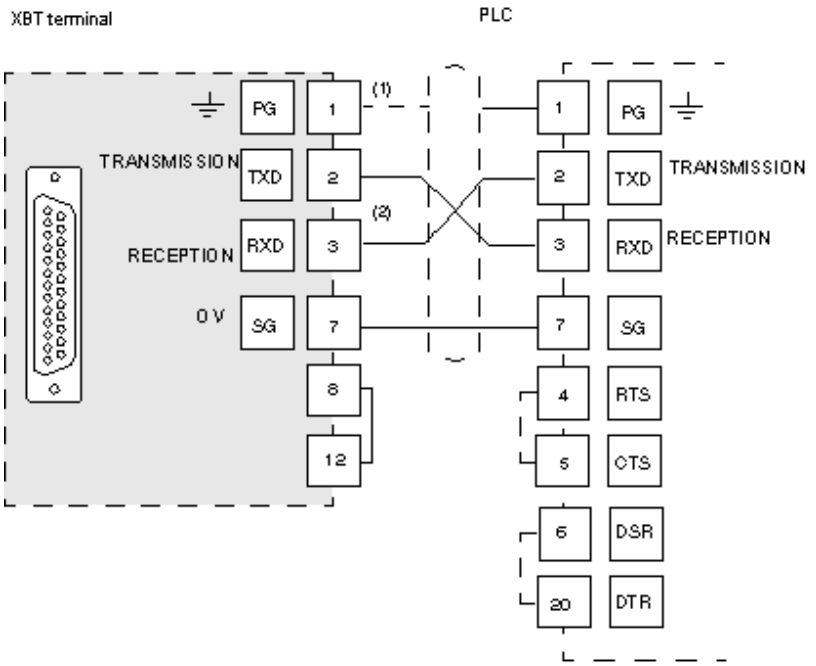
The SUB-D25 connector supports RS232. The pin assignment is shown in the following figure.



RS232 Cabling

The illustration below shows the cabling for RS232C equipment.

RS232C link example



Legend

(1)	Connection of the shielding at both ends depends on any electrical restrictions affecting the installation.
(2)	In some configurations, it is not necessary to invert pins 2 and 3. Please refer to the documentation for the equipment being used.

NOTE: RP resistors are integrated into the XBT and feature:

- 4.7 kΩ for XBT N
- 470 Ω for XBT R
- 600 Ω for XBT RT

Diagnostics

5

XBT Detected Error Indication

Overview

XBT terminals indicate detected errors in different ways

- by displaying question marks ?????? on 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 three 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	verify that the communication parameters set in the **Protocol - Sysmac-Way** dialog box are identical for all equipment connected to the bus i.e. same transmission speed, same use of parity.
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 system error messages indicating communication interruption 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:

System Error Message Caused by:	System 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 XBT to indicate that a communication error 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 terminal as a response to user input at the XBT 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

If...	Then ...
messages 243 to 249 are displayed	correct the value or command you have entered as indicated by the message.
error 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 error message.
error 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/RS485 Recommendations

A

Overview

This chapter decribes the RS232/RS485 recommendations.

What's in this Chapter?

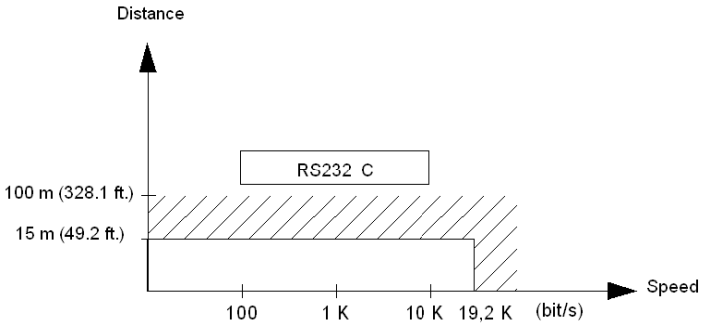
This chapter contains the following topics:

Topic	Page
RS232 Recommendations	34
RS485 Recommendations	35

RS232 Recommendations

Diagrams for RS232C Link

RS232C link



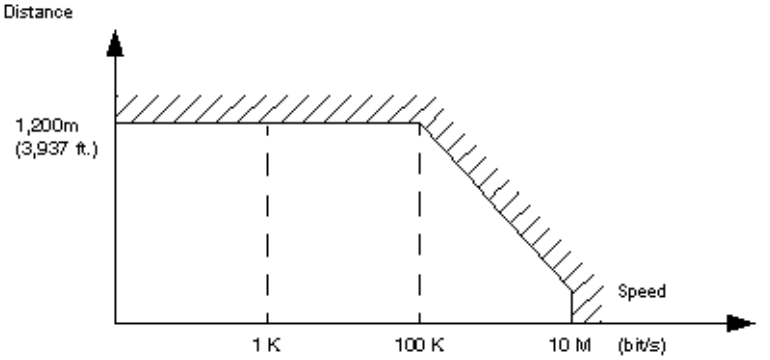
- Maximum length for the link is 15 m (49.2 ft.).
- Wiring = 3 shielded wires with a minimum cross-section of 0.6 mm^2 (AWG22)

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).

RS485 Recommendations

Diagrams for RS485 Link

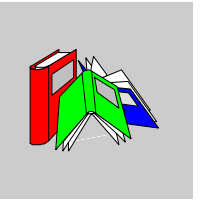
RS485 link



- Maximum length for the link is 1,200 m (3,937 ft.).
- Wiring = 2 shielded twisted wires with a minimum cross-section of 0.6 mm^2 (AWG22) and one 0 V wire

NOTE: The maximum length including the RS485 link is 1,200 m (3,937 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

ASCII

American standard code for information interchange = data transmission mode in SYSMAC-WAY communications

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).

Index



A

address
  configuring equipment address, *17*
addressing
  SYSMAC-WAY protocol, *19*

C

cables
  SYSMAC-WAY protocol, *24*
configuration
  SYSMAC-WAY, *16*

D

data types
  SYSMAC-WAY protocol, *21*
diagnostics
  SYSMAC-WAY protocol, *27*

E

equipment address, *17*

O

objects
  SYSMAC-WAY protocol, *21*
operating principles
  SYSMAC-WAY protocol, *10*, *11*

P

pin connections
  SUB-D25, *25*
protocol configuration, *16*

R

RS232
  recommendations, *34*
RS232 cabling, *25*
RS485
  recommendations, *35*

S

SUB-D25
  pin connections, *25*
SYSMAC-WAY protocol
  addressing, *19*
  cables, *24*
  data types, *21*
  diagnostics, *27*
  operating principles, *10*, *11*

V

variable types
  SYSMAC-WAY protocol, *21*
Vijeo-Designer Lite, *14*