PL7 Micro/Junior/Pro
Communication applications
Volume 2

TLX DS COM PL7 xx eng

Related Documentation

At a Glance

This manual has 3 volumes:

- Volume 1
  - Common communication function
  - Export Nano PLCs
  - Communication by character mode
  - Communication by Uni-telway bus
- Volume 2
  - Communication by Modbus
  - Communication by modem
  - Communication by Modbus plus
  - Communication by FIPIO bus
- Volume 3
  - Communication by FIPWAY network
  - Communication by ETHERNET network
  - Multi-network architecture

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About the book

At a Glance

Document Scope

This manual deals with the software implementation of the communication application.

Validity Note

The update of this publication takes into account the functionalities of the PL7 V4.2.

User Comments

We welcome your comments about this document. You can reach us by e-mail at TECHCOMM@modicon.com

Communication via Modbus

I

Introduction

Subject of this part

This part introduces the principles of configuring and communicating with Modbus via PL7 software.

What's in this part?

This Part contains the following Chapters:

General

1

Introduction

Subject of Chapter

This Chapter introduces Modbus communication and its services.

What's in this Chapter?

This Chapter contains the following Maps:

About Modbus

Introduction

Modbus communication is used to exchange data between all devices connected by the bus. The Modbus protocol is a protocol which creates a hierarchical structure (a master and several slaves).

The master manages all the exchanges according to two types of dialogue:
- the master exchanges with the slave and awaits the response,
- the master exchanges with all the slaves without awaiting a response (general broadcast).

Associated manuals

If you require further information you should consult the following manuals:

Title	Description
Modbus - User guide	Detailed description of the Modbus protocol
TSX Micro PLCs - Installation manual	Hardware installation
Premium TSX PLCs - Installation manual	Hardware installation

Compatibilities

Hardware

This communication type is available for

- Premium PLCs through:
  - a PCMCIA TSX SCP 111 card associated with the RS232 physical layer,
  - a PCMCIA TSX SCP 112 card associated with 20 mA current loops,
  - a PCMCIA TSX SCP 114 card associated with RS422 and RS485 physical layers,
  - a Built-in Link with a TSX SCY 11601/21600 / 21601 module associated with the RS485 physical layer.
- Version V3.3 Micro is configured in slave mode through the terminal port associated with the RS485 physical layer.
- Version V5.0 micro is configured in master mode (TSX 37-10/21/22 only) or in slave mode through the terminal port associated with the RS485 physical layer.
- The micro supports the PCMCIA cards described above.

Software

The maximum frame size is 256 bytes.

PCMCIA cards and the TSX SCY 11601/21600 / 21601 module's built-in link can process 8 communication functions at once in Modbus master mode.

Modbus master mode is only available on the Terminal Port from version V4.2 of the PL7 software. It is not possible to download a Modbus master configured application to a Micro of version V5.0 or below.
The PL7 program's MAST task can, in Modbus master mode, process up to 4 communication functions at once via the Terminal Port. In addition, an error code is sent.

The `READ_VAR` communication function can read up to 1000 consecutive bits in any remote device. To read more than 1000 bits, the `SEND_REQ` communication function must be used.

> **Note:** TSX Nano, TSX Micro and TSX Premium PLCs cannot send more than 1000 bits after a read request.

Compatibility between a TSX 37/57 PLC and a series 1000 PLC

Introduction

The functions `READ_VAR` and `WRITE_VAR` are used to read objects contained in series 1000 PLCs. They are words, double words, floating point and character strings.

Memory addressing

The address of the object in the memory of the series 1000 PLC determines the type of the object to be accessed.

This table shows the access addresses for an APRIL5000 series 1000 PLC with extended memory.

Variable type	**APRIL5000 with extension**	
	PLC address	**Access address (in hexa.)**
%MX internal bits	%MX0 %MX4095	A000 AFFF
%MW data words	%MW0 %MW24999	0 61A7
%MD data words	%MD25000 %MD26998	61A8 6976
%FD data words	%FD27000 %FD28998	6978 7146
%CH data words	%CH29000 %CH43903	7148 AB7F

Programming rules

When you wish to access objects of a series 1000 PLC, the index of the first to be read (or written) is the access address.
Example:
- Reading bit %MX0
  `READ_VAR(ADR#0.1.3, '%M',` **`16#A000`**`, 1, ...)`
- Reading word %MD25000
  `READ_VAR(ADR#0.1.3, '%MW',` **`16#61A8`**`, 2, ...)`

In addition, these communication functions cannot be used to exchange double words or character strings via the Modbus protocol. If needed, transfer in the form of &MW can be used; **the application must determine the storage direction of the words**.

The diagnostic functions are accessible via the function `SEND_REQ`.

Performance

At a Glance

The following tables enable you to evaluate typical exchange times according to different criteria.
The results displayed correspond to an average operation period of the READ_VAR function in ms.

Exchange time for 1 word

Number of objects read: 1 word

Speed in bits/s	T cycle (ms)	Average duration (ms) TSX SCP 114	Average duration (ms) TSX SCY 11601/21600/21601
4800	cyclic	105	120
4800	10	133	140
4800	50	152	172
9600	cyclic	74	90
9600	10	86	110
9600	50	149	172
19200	cyclic	57	75
19200	10	60	90
19200	50	100	118

Exchange time for 100 words

Number of objects read: 100 words

Speed in bits/s	T cycle (ms)	Average duration (ms) TSX SCP 114	Average duration (ms) TSX SCY 11601/21600/21601
4800	cyclic	616	630
4800	10	637	650
4800	50	700	730
9600	cyclic	357	375
9600	10	367	390
9600	50	405	425
19200	cyclic	215	228
19200	10	216	239
19200	50	251	280

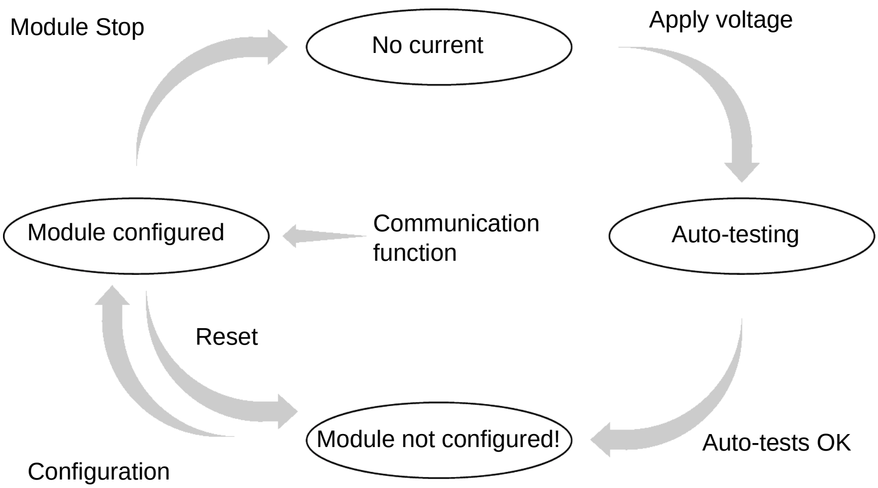
Operating Mode

At a Glance

The following graphics show operating modes for PCMCIA Modbus cards, built-in links in TSX SCY11601/21600/21601 modules and for the Terminal Port.

General Graph

The operating mode is as follows:



Operation

- After applying voltage, the module carries out auto-tests. Display indicators flash during this phase.
- If there is no PL7 application in the PLC, the module awaits configuration.
- If there is a PL7 application in the PLC, the application's configuration is transmitted to the module, and then the module starts up.
- When there is a power outage, the PLC procesor carries out a hot restart. The module then restarts its auto-test procedures.

Configuring Modbus communication

2

Introduction

Subject of Chapter

This Chapter describes the Configuration process during set-up of Modbus communication.

What's in this Chapter?

This Chapter contains the following Maps:

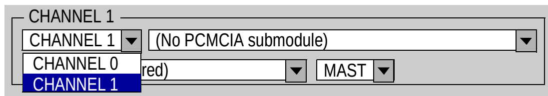
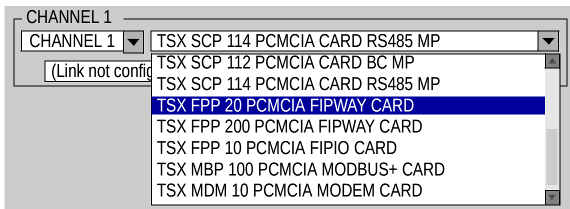
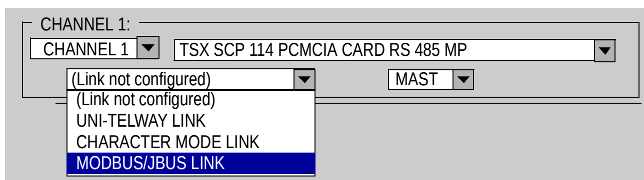
How to access the Modbus PCMCIA card parameters

Introduction

This operation describes how to access the configuration parameters of the Modbus link via the intermediary of PCMCIA cards for TSX Premium PLCs.

How to access the link

The following table shows the procedure for accessing the Modbus link:

Step	Action
1	Access the communication channel configuration screen.
2	Select the communication channel from the drop-down menu **CHANNEL 1** **Example** 
3	Select one of the following PCMCIA cards from the drop-down menu: ● **TSX SCP 111 PCMCIA CARD RS232 MP** ● **TSX SCP 112 PCMCIA CARD BC MP** ● **TSX SCP 114 PCMCIA CARD RS485 MP** **Example** 
4	Select the link from the drop-down menu **MODBUS/JBUS LINK:** **Example** 

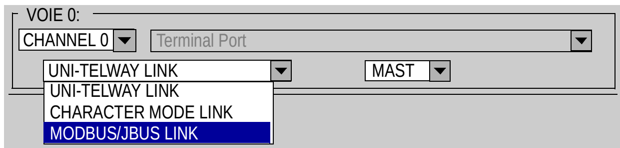
How to access the terminal port parameters

Introduction

This operation describes how to access the configuration parameters of the Modbus link via the intermediary of the terminal port of the TSX Micro PLC.

How to access the link

The following table shows the procedure for accessing the Modbus link:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Access the communication channel configuration screen.</td></tr>
<tr><td>2</td><td>Select the link from the drop-down menu MODBUS/JBUS LINK:
Example

</td></tr>
</table>

How to access the parameters of the TSX SCY 21600/21601 modules

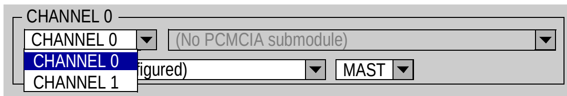
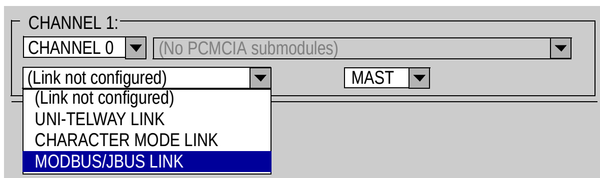
Introduction

This operation describes how to access the configuration parameters of the Modbus link via the intermediary of the TSX SCY 21600/21601 modules intended for TSX Premium.

> **Note:** The parameters for TSX SCY 11601 are unchangeable and configurated by default, given that there is only one channel (CHANNEL 0) and one (MODBUS/JBUS) link.

How to access the link

The following table shows the procedure for accessing the Modbus link:

Step	Action
1	Access the communication channel configuration screen of the chosen module
2	Select the communication channel from the drop-down menu **CHANNEL 0** **Example** 
3	Select the link from the drop-down menu **MODBUS/JBUS LINK:** **Example** 

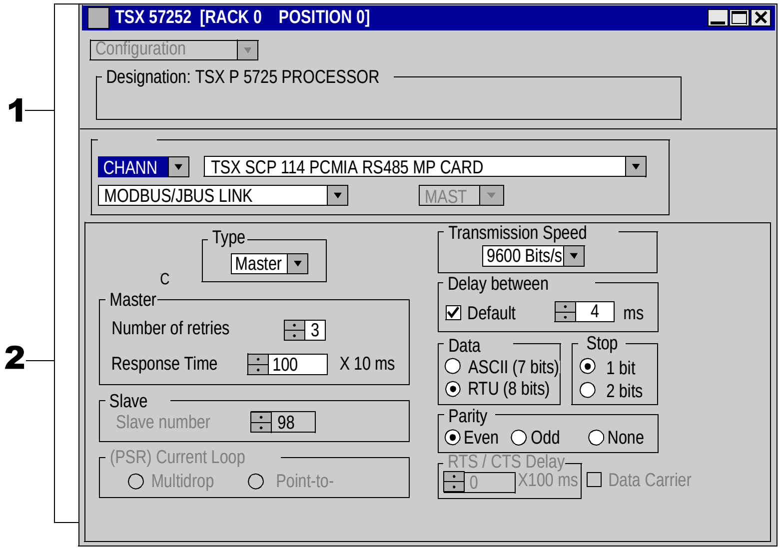
Modbus Configuration Screen

At a Glance

This screen is split into two and enables the declaration of the communication channel and configuration of parameters necessary for a Modbus/Jbus link.

Illustration

The Modbus Communication Screen looks like this:



Nodes and Functions

This table describes the different zones which make up the configuration screen:

Address	Zone	Function
1	common	(See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)
2	specific	allows you to select or complete the parameters of a Modbus link. It is broken down into two types of information: ● application parameters, ● transmission parameters.

Accessible Modbus Functions

At a Glance

Depending on the communication media chosen, certain parameters cannot be modified. These are grayed out.

Accessible Functions

The summary table below shows the various possible choices:

Functions	SCP 111	SCP 112	SCP 114	SCY 11601/21600/21601	Terminal Port
Master	Yes	Yes	Yes	Yes	Yes*
Slave	Yes	Yes	Yes	Yes	Yes
(PSR) Current Loop	No	Yes	No	No	No
Transmission Speed	Yes	Yes	Yes	Yes	Yes
Delay between characters	Yes	Yes	Yes	Yes	Yes
Data	● ASCII ● RTU	● ASCII ● RTU	● ASCII ● RTU	● ASCII ● RTU	RTU only
Stop	● 1 bit ● 2 bits	● 1 bit ● 2 bits	● 1 bit ● 2 bits	● 1 bit ● 2 bits	● 1 bit ● 2 bits
Parity	● odd ● even ● none	● odd ● even ● none	● odd ● even ● none	● odd ● even ● none	● odd ● even ● none
RTS/CTS delay	Yes	No	No	No	No
Data Carrier (DCD) Management	Yes	No	No	No	No
***Only on TSX 37-10/21/22**					

Note: In the **Data**window for the Terminal Port, both options are possible but only the RTU format can function through the Terminal Port.

Specific Functions

The additional **Immediate server** function is only available where a TSX SCP 114 card has been inserted into TSX SCY 21600/21601 modules.

Application linked Modbus Parameters

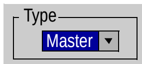
At a Glance

After configuring the communication channel, you need to enter the application parameters.

These are split into four windows:
- the **Type**window,
- the **Master**window,
- the **Slave**window,
- and the **(PSR) Current Loop**window.

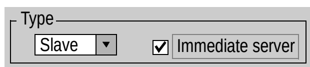
Type Parameter

The window looks like this:



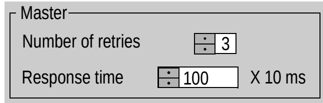
It enables you to select the type of Modbus Protocol the module uses:
- **Master**: selects Modbus Master where the station is master,
- **Slave**: selects Modbus Slave where the station is slave,
- **Immediate Server**: allows UNI-TE requests to be directed to the SERVER function and not to the processor's main server.

Note: The **Immediate Server**parameter requires the SERVER (PL7 Micro/Junior/ Pro ; Communication applications ; Volume 1)communication function to be programmed in PL7.
It is valid until the box is checked.



Master Function

This window is only accessible by selecting**Master**:

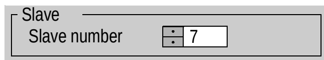


This allows you to enter:

- the **Number of retries**: number of connection attempts made by the master before defining the slave as absent.
  - the default value is 3,
  - values between 0 and 15,
  - value 0 indicates no retries by the Master.
- **Response Time**: time elapsed between the request made by the Master and a repeat attempt if the slave does not respond. It corresponds with the maximum time between the transmission of the last character of the Master's request and receipt of the first character of the request sent back by the slave.
  - the default value is 1s (100*10ms),
  - values between 10ms and 10s,

Slave Function

This window is only accessible by selecting**Slave**:

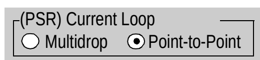


This allows you to fill in the **Slave Number** of the device:

- TSX SCY 21600/21601:
  - the default value is 98,
  - values between 1 and 98,
- TSX SCY 11601:
  - the default value is 247,
  - possible values lie between 1 and 247.

Current Loop Function

The window looks like this:



It allows you to select a:

- **Multidrop** (Current Loop) communication,
- **Point-to-Point** (Current Loop) communication.

Modbus parameters linked to transmission

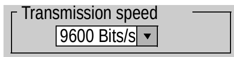
Introduction

Once the communication channel has been configured, complete the parameters dedicated to transmission.

They are split into six windows:
- the **Transmission speed** window,
- the **Delay between characters** window,
- the windows specific to **Data** and **Stop**,
- the **Parity** window,
- the **RTS/CTS delay** window.

Transmission speed

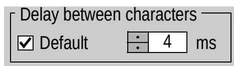
The window looks like this:



It is used to select the transmission speed of the Modbus protocol used by the module; it is compliant with the other devices:
- the default speed is 9600 bits/s,
- the available speeds are 1200, 2400, 9600 and 19200 bits/s,
- the speeds of 300 and 600 bits/s are only available with the TSX SCP 111 PCMCIA card.

Delay between characters

The window looks like this:



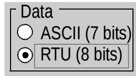
This is the time taken to detect the frame end and the maximum time separating two characters being received. It is managed when the PLC is receiving messages, whether it is master or slave.

It is recommended that you use the default values on configurations without a modem and without intermediary devices. Otherwise, it is necessary to use higher values.

Note: The default value depends on the chosen transmission speed.

Data

The window looks like this:



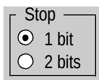
The **Data** field is used to complete the type of encoding used to communicate on Modbus; this field is to be configured depending on the other devices used:

- **RTU** mode:
  - the characters are encoded in 8 bits,
  - the start and the end of the frame are detected by a silence of at least 3.5 characters,
  - the entire frame is monitored using the CRC checksum contained within it.
- **ASCII** mode:
  - the characters are encoded in 7 bits,
  - the start of the frame is detected by reception of the character ':' or by a silence longer than the delay between characters.
    The end of the frame is detected by CR and LF (carriage return and line feed) or by silence greater than the delay between characters.

Note: The value 1000 in ASCII mode corresponds to an infinite delay between characters.

Stop

The window looks like this:

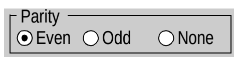


The **Stop** field is used to complete the number of stop bits used to communicate on Modbus. The possible values range from 1 to 2 stop bits. This field is to be configured depending on the other devices used.

Note: The default value is 1 stop bit.

Parity

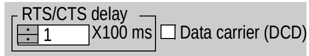
The window looks like this:



This field is used to define the addition or non-addition of a parity bit, and its type. The possible values are Even, Odd or none (Even by default). This field is to be configured depending on the other devices used.

RTS/CTS delay

The window looks like this:



Before each transmission of a character string, the module activates the RTS signal (Request To Send) and awaits the activation of the CTS signal (Clear To Send).
It is used to complete:

- the maximum waiting time between the two signals. If this time has elapsed, the request is not sent onto the bus.
  - the value is expressed in hundreds of milliseconds,
  - the default value is 0ms,
  - The value is between 0s and 10s,
  - the value 0 specifies the absence of delay management between the two signals.
- the carrier management (DCD signal, Data Carrier Detected) is only used in the event of communication with a modem with a controlled carrier:
  - if the option is selected, character reception is only enabled if the DCD carrier signal is detected,
  - if the option is not selected, all the characters received are taken into account.

Programming Modbus communication

3

Introduction

Subject of section

This section describes the Programming process during set-up of Modbus communication.

What's in this Chapter?

This Chapter contains the following Maps:

Modbus master communication function

At a Glance

This page describes the services that are available on the TSX Micro or TSX Premium master stations of a Modbus link. For more information regarding function codes under Modbus, please refer to the Modbus user guide.

Data exchange

The following requests are addressed to the slave device with which you wish to carry out read or write operations of variables.

These requests use the `READ_VAR` and `WRITE_VAR`communication functions. See (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1) and (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).

Modbus request	Function code	Communication function
Read bits	16#01	`READ_VAR`
Read words	16#03	`READ_VAR`
Write one or n bits	16#05 or 16#0F	`WRITE_VAR`
Write one or n words	16#06 or 16#10	`WRITE_VAR`
Read discrete inputs*	16#02	`READ_VAR`
Read input words*	16#04	`READ_VAR`
*** except on Terminal port**		

Note: Write utilities can be sent in transmission. In this case no response is returned to the transmitter. It is therefore recommendable to configure a time-out to acknowledge the activity bit of the function.

Example of reading words

The example applies to the reading of word 4 (%MW4) in the Modbus slave 3.

```
READ_VAR ( ADR#0.1.3, '%MW',4,1,%MW100:1,%MW200:4)
```

Diagnostics and maintenance

The diagnostics and maintenance information of Modbus slaves uses the SEND_REQ communication function. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Modbus request	Function code/ Sub function code	Communication function
Exception status	16#07	SEND_REQ
Diagnostics	16#08/16#xx	SEND_REQ
Event counter	16#0B	SEND_REQ
Connection event	16#0C	SEND_REQ
Slave identification	16#11	SEND_REQ

Note: The SEND_REQ function is not available on the Terminal port. For the diagnostics we will use the reports of the READ_VAR and WRITE_VAR requests, as well as the system words dedicated to the Modbus master mode on the Terminal port.

Modbus slave communication function

Introduction

This page describes the services managed by the slave modules for a Modbus link.

Data exchanges

The slave module manages the following requests:

Modbus request	Function code / sub-function code	PLC object
Read n output bits	16#01	%M
Read n input bits	16#02	%M
Read n output words	16#03	%MW
Read n input bits	16#04	%MW
Write an output bit	16#05	%M
Write an output word	16#06	%MW
Write n output bits	16#0F	%M
Write n output words	16#10	%MW

Diagnostics and maintenance

The diagnostics and maintenance information which are accessible from a Modbus link are shown below:

Designation	Function code / sub-function code
Read exception status	16#07
Echo	16#08 / 16#00
Initialize module	16#08 / 16#01
Read the diagnostic registers of the PLC	16#08 / 16#02
Change end of frame delimiter (ASCII mode)	16#08 / 16#03
Switch to listening mode	16#08 / 16#04
Reset counters	16#08 / 16#0A
Number of messages received without CRC error	16#08 / 16#0B
Number of frames received with CRC error	16#08 / 16#0C
Number of exceptional responses	16#08 / 16#0D
Number of messages addressed to the PLC	16#08 / 16#0E
Number of broadcast messages received	16#08 / 16#0F

Designation	Function code / sub-function code
Number of correct responses	16#08 / 16#10
Number of messages received in listening mode	16#08 / 16#11
Number of invalid characters received	16#08 / 16#12
Read event counter	16#0B
Read connection event	16#0C
Read identification	16#11

Using the SEND_REQ communication function

At a Glance

The UNI-TE Action-object request (request code 16#9F) is used to transmit all Modbus functions. See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).

After executing this request, the report is always **16#CF00**.
To check the exchange, it is also necessary to test the content of the first word in the reception table.

Possible values of the first word:
- 0: indicates that the exchange has been performed,
- 1: indicates that the exchange has not been performed.

The transmission buffer should contain the following information:
- first word:
  - Byte 0: function code,
  - Byte 1: sub-function code,
- second word: Modbus function identifier, which is always 16#0296
- third word = 0: reserved
- fourth word: Modbus function parameters
- fifth word: Modbus function parameters
- n th word: Modbus function parameters

Note: This function is not available in Modbus master mode on the Terminal port.

Example 1 of using the function SEND_REQ

Introduction

The example shows the diagnostic function **Echo**. This function asks the interrogated slave to return in full the message sent by the master.

Question

The communication function is as follows:
`SEND_REQ(ADR#0.1.x,16#9F,%MW10:10,%MW50:30,%MW100:4)`

Before sending the function, it is necessary to reset the following words:

Words	Value	Description
%MW10	:= 16#0008	corresponds to the Echo function (byte 0 = 16#08, byte 1 =16#00)
%MW11	:= 16#0296	corresponds to identification of the Modbus function
%MW12	:= 0	reserved
%MW13	:= 16#1234	corresponds to the parameter of the Echo function. For this example, the slave must send back the value 16#1234
%MW103	:= 8 (bytes)	length of data to be sent in bytes

Response

The response of the slave, contained in the buffer reception memory %MW50:30, is of type:

%MW50	%MW51	Description
:= 0 if action carried out	:= 16#0008	corresponds to the Echo function (byte 0 = 16#08, byte 1 =16#00) %MW52 to %MW79 contains the data of the Modbus response. For this example %MW52:= 1234
:= 1 if action not carried out	:= 16#0007	parameters of request incorrect
	:= 16#0004	parameters of question incorrect
	:= 16#0688	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#06 Modbus error code (the slave is busy)
	:= 16#0188	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#01 Modbus error code (the function is unknown)
	:= 16#0388	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#03 Modbus error code (data invalid)

2nd example of the use of the SEND_REQ function

At a Glance

The example deals with the read of 4 input words at address 10 of a third-party device. These words are then copied in %MW52:5.

Question

The communication function is as follows:
`SEND_REQ(ADR#0.1.x,16#9F,%MW10:10,%MW50:30,%MW100:4)`

Before sending the function it is necessary to initialize the following words:

Words	Value	Description
%MW10	:= 16#0004	corresponds to the read function of n input words (byte 0 = 16#04, byte 1 = 16#00)
%MW11	:= 16#0296	corresponds to the identification of the Modbus function
%MW12	:= 0	reserved
%MW13	:= 16#0A00	address of the first word to read (1)
%MW14	:= 16#0400	number of words to read (1)
%MW103	:=10 (bytes)	length of the data to be transmitted in bytes

Note: (1) the most significant bytes and the least significant bytes must be inverted.

Response The slave response, contained in the %MW50:30 reception buffer, is of type:

%MW50	%MW51	Description

:= 0 if action taken	:= 16#0004	corresponds to the read function of n input words (byte 0 = 16#04, byte 1 = 16#00)
		%MW52 to %MW79 contain the Modbus response data:
		● %MW52:= PF_0 0A
		  ● byte 0 = 16#0A: length received in bytes (10 bytes)
		  ● byte 1 = PF_0: most significant byte of first word
		● %MW53:= PF_1 pf_0
		  ● byte 0 = pf_0: least significant byte of first word
		  ● byte 1 = PF_1: most significant byte of second word
		● %MW53:= PF_2 pf_1
		  ● byte 0 = pf_1: least significant byte of second word
		  ● byte 1 = PF_2: most significant byte of third word

:= 1 if action not taken	:= 16#0007	incorrect request parameters
	:= 16#0004	incorrect question parameters
	:= 16#0688	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#06 Modbus error code (the slave is busy)
	:= 16#0188	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#01 Modbus error code (the function is unknown)
	:= 16#0388	byte 0 =16#80 + function code (16#08 for Echo) byte 1 = 16#03 Modbus error code (the data is invalid)

Note: To recover the words read, it is possible to reiterate the following calculation formula:

```
%MW200 := (%MW52 and 16#FF00) and (%MW53 and 16#00FF)
```

Programming example in Modbus master mode on Terminal port

General

Programming exchanges with Modbus slave devices is done with the help of the READ_VAR and WRITE_VAR communication functions only (the SEND_REQ function is not supported).

Example with READ_VAR

Description of the objects used in the example:

<table>
<tr><th colspan="2">Objet</th><th>Description</th></tr>
<tr><td colspan="2">%MW0:X0</td><td>Transmission demand of the request</td></tr>
<tr><td colspan="2">%M20</td><td>Request in progress</td></tr>
<tr><td colspan="2">%MW100:10</td><td>Reception buffer</td></tr>
<tr><td colspan="2">%MW200..203</td><td>Report zone:</td></tr>
<tr><td rowspan="3"></td><td>%MW200</td><td>Session and activity bit number (X0)</td></tr>
<tr><td>%MW201</td><td>Error code</td></tr>
<tr><td>%MW202</td><td>Time-out in units of 10 ms</td></tr>
<tr><td colspan="2">%M30</td><td>Bit set to 1 after a successful exchange</td></tr>
<tr><td colspan="2">%MW204</td><td>Counter of requests sent</td></tr>
<tr><td colspan="2">%MW205</td><td>Counter of good requests</td></tr>
<tr><td colspan="2">%MW206</td><td>Counter of bad requests</td></tr>
<tr><td colspan="2">%MW207</td><td>Error code of the last bad request</td></tr>
</table>

Programming:

```
!(*Read of the bits %M0 to %M8 from the Nano at address 37 *)

IF %MW0:X0 AND NOT %M20 THEN
%MW200:4:=0;%MW202:=50;SET %M20;
READ_VAR(ADR#0.0.37,'%M',0,8,%MW100:10,%MW200:4);
(*8 bits %M0..%M7 are read in the slave 37 and placed in the
%MW100 word of the master*)
END_IF;

!(*Analysis of the results*)

IF %M20 AND NOT %MW200:X0 THEN
INC %MW204;RESET %M20;RESET %MW0:X0;
IF %MW201=0 THEN INC %MW205;SET %M30;
ELSE INC %MW206;%MW207:=%MW201;RESET %M30;
END_IF;
```

Debugging Modbus communication

4

Introduction

Subject of Chapter

This Chapter describes the Debugging process during set-up of Modbus communication.

What's in this Chapter?

This Chapter contains the following Maps:

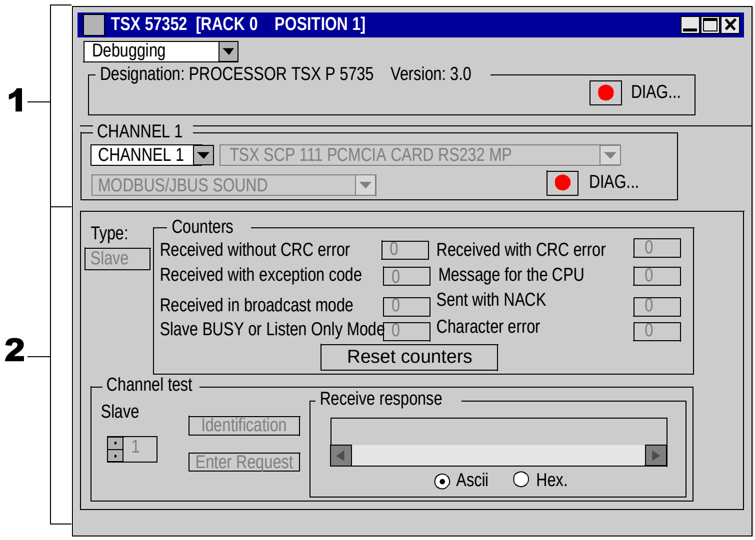
Modbus debugging screen

Introduction

This screen, split into two zones, is used to declare the communication channel and to configure the parameters necessary for a Modbus/Jbus link.

Illustration

The screen dedicated to Modbus communication looks like this:



Elements and functions

This table describes the different zones that make up the debugging screen:

Address	Zone	Function
1	common	(See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)
2	specific	is used to access the debugging parameters of a Modbus link. It is different according to the type of Modbus function which is configured: ● either Modbus master, ● or Modbus slave.

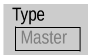
Modbus Master debugging screen

At a Glance

The specific part is divided into three windows:
- the **Type**window,
- the **Counters**window,
- the **Channel test**window.

Type Window

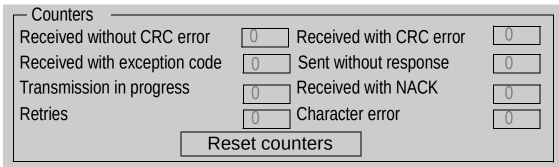
The window looks like this:



It recalls the type of Modbus function configured (master).

Counters Window

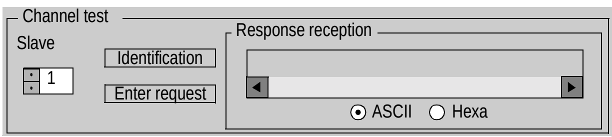
The window looks like this:



This window displays the different counters (in slave configuration).
the **Reset Counters** button resets these counters to zero.
Where Modbus is on the Terminal Port, this window displays the status of the system words (See System objects of the Modbus function on Terminal port, p. 60) used by this function. These may also be viewed with a variables animation table.

Channel Test window

The window looks like this:



This window enables you to test communication channels by transmitting a request to one of the slave stations present on the bus.
For the TSX SCY 11601 module's built in channel, the slave number values to be searched lie between 1 and 247. The values for other channels supporting MODBUS/JBUS Master lie between 1 and 98.

Note: This window is not available when Modbus is in use on the Terminal Port.

Debug screen in Modbus slave type

At a Glance

The specific part is divided into three windows:

- the **Type**window,
- the **Counters**window,
- the **Channel test**window: this window cannot be used in this mode.

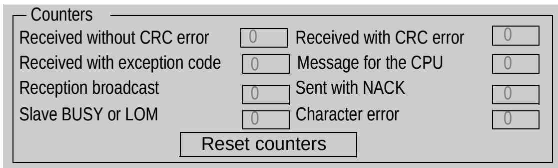
Type Window

The window is as below:

It recalls the type of Modbus function configured (slave).

Counters Window

The window is as below:



This window displays the different counters (in slave configuration).
the **Reset counters** button resets these counters to zero.

Counter Slave Busy or LOM:

- Slave Busy: this counter is incremented by the slave when it receives a request from the master while in the process of processing another request. This happens when the master sends a request. It does not wait for a response from the slave and may send another request,
- Slave LOM: (Listen Only Mode) is the operating mode of a slave which is only in listen mode. It never responds to frames sent by the master. In this case, this counter indicates the number of frames received by the slave.

How to test a communication channel

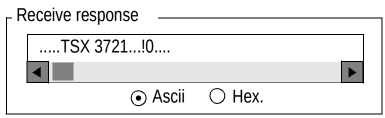
Introduction

This page shows the procedure for testing a communication channel from the debugging screen.

How to identify a station

The following procedure is used to identify a designated station.

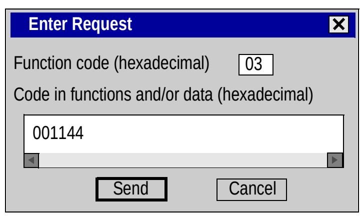
<table>
<tr><th>Step</th><th>Actions</th></tr>
<tr><td>1</td><td>Select the address of the slave to be interrogated using the Slave field.</td></tr>
<tr><td>2</td><td>Click on the Identification button.

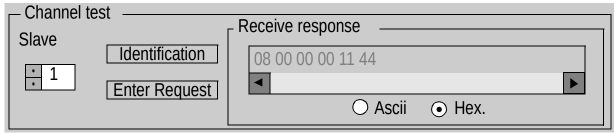
Result
The response appears in the Receive Response window:

</td></tr>
</table>

How to send a request

The following procedure is used to send a request, other than those provided by the command buttons, to a designated station. The example deals with transmission of the Echo request (function code: 08; sub-function code: 00; data to be sent 1144).

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Select the address of the slave to be interrogated using the Slave field.</td></tr>
<tr><td>2</td><td>Click on the Enter Request button.

Result
The following window appears:

</td></tr>
<tr><td>3</td><td>Enter the function code (coded in hexadecimal on one byte), corresponding to the request that you want to send.</td></tr>
<tr><td>4</td><td>Enter the sub-function code (coded in hexadecimal on one byte), corresponding to the request that you want to send.</td></tr>
</table>

Step	Action
5	Enter the data to be sent by encoding all the data in hexadecimal on 2 bytes (4 characters). Enter the data continuously without any intervening spaces.
6	Click on the Send button. **Result** The response appears in the **Receive Response** window:  The response contains: ● the function code on 2 bytes (08 00), ● the sub-function code on 2 bytes (00 00), ● the data on 2 bytes (11 44),

Language objects associated with Modbus communication

5

Introduction

Subject of this Section

This Chapter introduces the language objects linked to Modbus communication.

What's in this Chapter?

This Chapter contains the following Maps:

Implicit exchange language object for a Modbus function

At a Glance

This page describes all implicit exchange language objects for a Modbus function, which can be displayed or modified by the application program. See (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).

Bit Objects

The table below shows the different implicit exchange bit objects.

Object (1)	Function	Meaning
%Ixy.MOD.ERR	Module error bit	When this bit is at 1, it indicates a module error (at least one of the channels is faulty, etc.)
%Ixy.i.ERR	Channel error bit	When this bit is at 1, it indicates a line fault.
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Word objects in Modbus master mode

The table below shows the different implicit exchange word objects.

Object (1)	Function	Meaning
%IWxy.i.0	Input signals	Common signals • x0 = 1: DCD signal • x1 = 1: RI signal • x2 = 1: CTS signal • x3 = 1: DSR signal
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Note: These objects are not available on the Terminal port

Word objects in Modbus slave mode

The language objects are identical to those of the Modbus master function. Only the objects defined in the following tables are different.

The table below shows the different implicit exchange word objects.

Object (1)	**Function**	**Meaning**
%IWxy.i.0	Input signals	Specific data ● x8 = 1: listen only mode
Key		
(1)	xy.i address ● x: corresponds to the rack number ● y: corresponds to the module number ● i: corresponds to the channel number	

Note: These objects are not available on the Terminal port

Explicit exchange language object for a Modbus function

At a Glance

This page describes all explicit exchange language objects for a Modbus master function, which can be displayed or modified by the application program. See (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).

Word objects in master mode

The table below shows the different explicit exchange word objects.

Object (1)	Function	Meaning
%MWxy.MOD.2	Module status	• x0 = 1: faulty module • x1 = 1: functional fault (fault between the processor and the module, adjustment or configuration fault,...) • x2 = 1: terminal strip error (not connected) • x3 = 1: auto-tests in progress • x4 = 1: reserved • x5 = 1: hardware or software configuration error (the module present is not the one declared in the configuration, the sub modules are not compatible) • x6 = 1: module missing • x7 = 1: fault in one of sub modules
%MWxy.i.2	Standard channel status	• x0 = 1: no device is working on the channel • x1 = 1: a device on the channel is faulty • x2 = 1: terminal strip error (not connected) • x3 = 1: timeout error (faulty wiring) • x4 = 1: auto-tests in progress • x5 = 1: hardware or software configuration fault (the channel present is not the one declared in the configuration) • x6 = 1: communication error • x7 = 1: application fault (error in the configuration, adjustment error,...)
%MWxy.i.3	Specific channel status	Byte 0 = **16#06** for the **Modbus master**function
%MWxy.i.4	Error counter (2)	Number of responses received without CRC error
%MWxy.i.5	Error counter (2)	Number of messages received with CRC error
%MWxy.i.6	Error counter (2)	Number of responses received with an exception code
%MWxy.i.7	Error counter (2)	Number of master messages sent without response
%MWxy.i.8	Error counter (2)	Number of transmissions broadcasted
%MWxy.i.9	Error counter (2)	Number of receipts with NACK
%MWxy.i.10	Error counter (2)	Number of master messages repeated
%MWxy.i.11	Error counter (2)	Number of character errors

Object (1)	Function	Meaning
%MWxy.i.15	Command (2)	• x0 = 1: Reset counter • x8 = 1: DTR signal ON • x9 = 1: DTR signal OFF • x14 = 1: Modbus change to character mode (modem) • x15 = 1: character mode (modem) change to Modbus
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	
(2)	These objects are not available on the Terminal port	

Word objects in Modbus slave mode

The language objects for the Modbus slave function are identical to those of the Modbus master function.
Only the objects defined in the following table are different.

Object (1)	Function	Meaning
%MWxy.MOD.2	Module status	• x0 = 1: faulty module • x1 = 1: functional fault (fault between the processor and the module, adjustment or configuration fault,...) • x2 = 1: terminal strip error (not connected) • x3 = 1: auto-tests in progress • x4 = 1: reserved • x5 = 1: hardware or software configuration error (the module present is not the one declared in the configuration, the sub modules are not compatible) • x6 = 1: module missing • x7 = 1: fault in one of sub modules

Object (1)	Function	Meaning
%MWxy.i.2	Standard channel status	• x0 = 1: no device is working on the channel • x1 = 1: a device on the channel is faulty • x2 = 1: terminal strip error (not connected) • x3 = 1: timeout error (faulty wiring) • x4 = 1: auto-tests in progress • x5 = 1: hardware or software configuration fault (the channel present is not the one declared in the configuration) • x6 = 1: communication error • x7 = 1: application fault (error in the configuration, adjustment error,...)
%MWxy.i.3	Specific channel status	Byte 0 = **16#07** for the **Modbus slave**function
%MWxy.i.7	Error counter	Number of messages for the CPU
%MWxy.i.8	Error counter	Number of receipts broadcast
%MWxy.i.10	Error counter	Number of messages received during Slave busy or LOM
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Explicit exchange management and reports

Introduction

This page describes all the language objects that manage explicit exchanges. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for the management of explicit exchanges.

Object (1)	Function	Meaning
%MWxy.MOD.0	Module exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication module • x2 = 1: sending of adjustment parameters to the communication module
%MWxy.MOD.1	Module report	• x1 = 0: command parameters received and accepted by the module • x2 = 0: adjustment parameters received and accepted by the module
%MWxy.i.0	Channel exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication channel • x2 = 1: sending of adjustment parameters to the communication channel
%MWxy.i.1	Channel report	• x1 = 0: command parameters received and accepted by the communication channel • x2 = 0: adjustment parameters received and accepted by the communication channel
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Language objects associated with the configuration

At a Glance

This page describes all configuration language objects enabling Modbus communication which can be displayed by the application program.

Objects for the Modbus master function (where Terminal Port is inoperative)

The following table describes internal constants for the Modbus master function, (except on the Terminal Port):

Object	Function	Meaning
%KWxy.i.0	Type	Byte 0 = 16#06 for Modbus master function
%KWxy.i.1	Speed / Format	Byte 0 = speed ● 128 = 300 bits/sec, 129 = 600 bits/s TSX SCP 111 only ● 00 = 1200 bits/sec, ..., 04 = 19200 bits/s Byte 1 = format ● x8: bit number (1 = 8 bits, 0 = 7 bits) ● x9: parity management (1 = with, 0 = without) ● x10: Parity Type (1 = odd, 0 = even) ● x11: stop bit (1 = 1 bit, 0 = 2 bits)
%KWxy.i.2	Delay between characters	Value in ms from 2ms to 10,000ms
%KWxy.i.3	Wait Time	Wait Time in ms from 10ms to 10,000ms
%KWxy.i.4	Retries and Signal Management	Byte 0 = number of retries (default being 3) Byte 1 = Signal Management ● x8 = 1 if PSR signal management (TSX SCP 112) ● x10 = 1 if DCD Data Carrier management (TSX SCP 111)
%KWxy.i.5	RTS / CTS Delay	Delay time in hundredths of ms (default value 0ms)

Objects for Modbus master function on Terminal Port

The following table describes internal constants for the Modbus master function on the Terminal Port:

Object	Function	Meaning
%KW0.0.0	Type/Speed	Byte 0 = 16#06 for Modbus master function Byte 1 = Transmission Speed: • 00 = 1200 bits/s, ..., 04 = 19200 bits/s
%KW0.0.1	Format/delay between characters	Byte 0 = format • x0: bit number (1 = 8 bits, 0 = 7 bits) • x1: parity management (1 = with, 0 = without) • x2: Parity Type (1 = odd, 0 = even) • x3: stop bit (1 = 1 bit, 0 = 2 bits) Byte 1 = delay between characters depending on the speed: • 1200: from 29 ms to 255 ms • 2400: from 15 ms to 255 ms • 4800: from 7 ms to 255 ms • 9600: from 4 ms to 255 ms • 19200: from 2 ms to 255 ms
%KW0.0.2	Number of retries/ response time	Byte 0 = number of retries (0 to 15) Byte 1 - response time (200ms to 10 s)

Objects for Modbus slave function (where Terminal Port is inoperative)

The language objects for the Modbus slave function are identical to those of the Modbus master function.
Only the objects in the following table differ:

Object	Function	Meaning
%KWxy.I.0	Type	Byte 0 = 16#7 for Modbus slave function

%KWxy.i.3	Slave Addresses	Byte 0: slave number value (0 to 98)
		• Byte 0:
		  • for TSX SCY21600/21601, the slave number value lies between 0 and 98.
		  • for TSX SCY 11601, the slave number value lies between 0 and 247.

Objects for Modbus slave function on Terminal Port

The language objects for the Modbus slave function are identical to those of the Modbus master function on the Terminal Port.
Only the objects in the following table differ:

Object	Function	Meaning
%KWxy.I.0	Type	Byte 0 = 16#7 for Modbus slave function
%KW0.0.2	Slave Number	Byte 0: slave number value (1 to 98)

System objects of the Modbus function on Terminal port

At a Glance

In Modbus mode on the Terminal port, the Micro uses the system objects below for the communication diagnostics.

Bit objects

Table of bit objects

Object	Description
%S80	Global reset to 0 of the communication counters
%S81	Reset to 0 of the Modbus system words on Terminal port This system bit is set to 1 by the application and reset to 0 by the system

Note: The system words are also reset to 0 when there is a cold start (%S0 =1).

Word objects

Table of word objects

Objects	Description
%SW100	Number of messages received without CRC error
%SW101	Number of messages received with CRC error
%SW102	Number of messages received with an exception code
%SW103	Number of master messages sent without response
%SW104	Number of transmissions broadcast
%SW102	Number of receipts with NACK
%SW106	Number of master messages repeated
%SW107	Number of character errors

Communication via Modem

II

Introduction

Subject of this part

This part introduces the principles of configuring and communicating using a TSX MDM 10 modem via PL7 software.

What's in this part?

This Part contains the following Chapters:

Communication via Modem

6

Introduction

Subject of this Chapter

This Chapter introduces communication using a TSX MDM 10 modem and its services.

What's in this Chapter?

This Chapter contains the following Sections:

6.1 Introduction to communication via Modem

Introduction

Subject of Section

This Section presents a summary description of communication using a TSX MDM 10 modem and its associated services.

What's in this Section?

This Section contains the following Maps:

Modems

Introduction

A large number of applications use communication via modem.

Communication via the TSX MDM 10 modem can be used to access remote stations using the switched public telephone network in order to carry out checks, diagnostics or long distance control.

Associated manuals

If you require further information you should consult the following manuals:

Title	Description
TSX Micro PLCs - Installation manual	Hardware installation
Premium TSX PLCs - Installation manual	Hardware installation

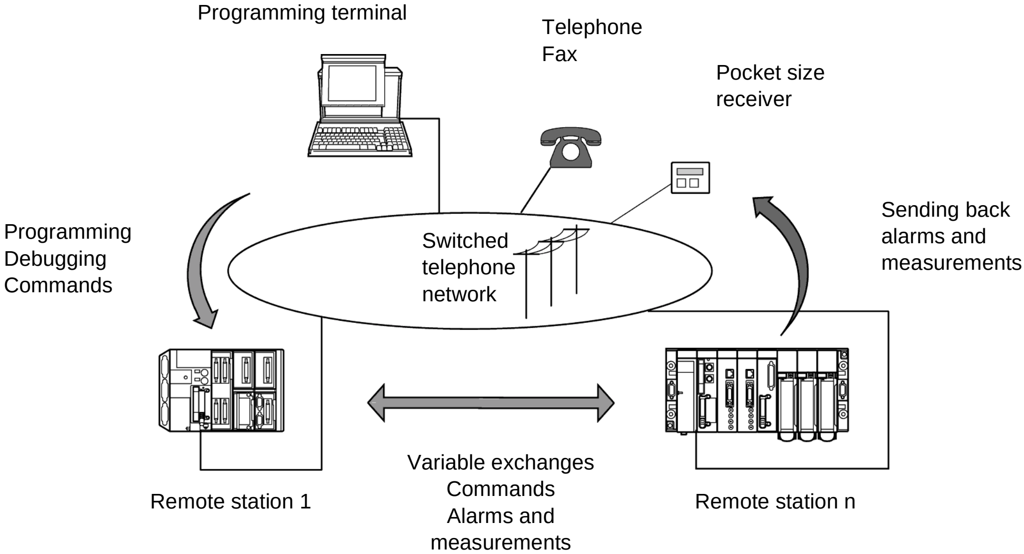
Standard configuration for communication via modem

Introduction

The standard configuration allows for communication between stations or other devices connected to a switched telephone network.

Configuration and services

The following diagram shows the standard configuration for communication via modem and the different services.



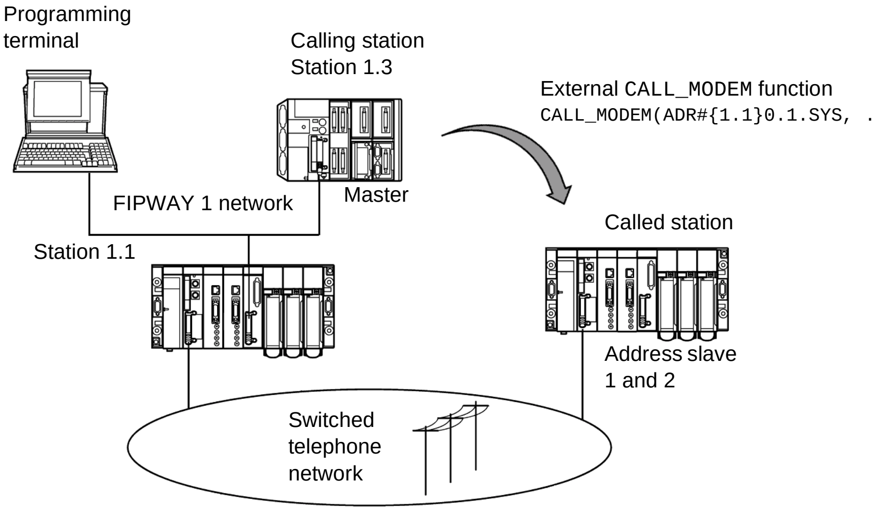
Other configurations for communication via modem

Introduction

From a local network station, it is possible to call a remote station on the switched telephone network via another station with a modem connection.

External CALL_MODEM function

A `CALL_MODEM` communication function is sent by a network station.

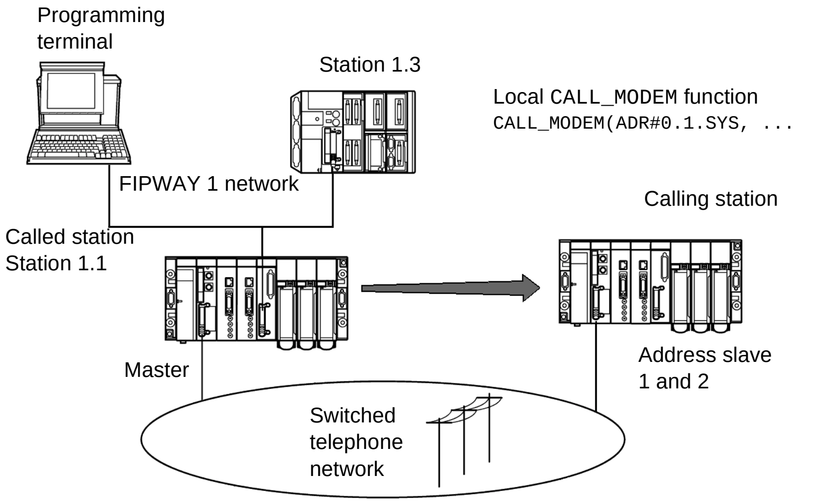


Once a link has been established, communication is possible in both directions while respecting transparency rules.

Moreover, a slave station on the switched telephone network can access the entire network architecture while respecting addressing rules.

Local CALL_MODEM function

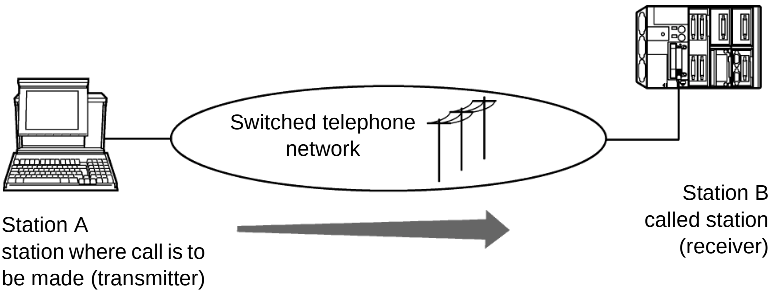
A `CALL_MODEM` communication function is sent by the station supporting the TSX MDM 10 card.



Principles of communication between two stations

Introduction

The call direction is from station A to station B:



Operation

The following table describes the different stages of communication between two stations:

Phase	Description
1	While idle, all modems are by default awaiting a possible connection request.
2	Station A sends a call request to number X on station B using AT commands (or using the CALL_MODEM communication function in the case of a PLC).
3	An exchange procedure between the modems results in the line being established point by point between station A and station B. Connection is established if the correct password is used (if password management is employed).
4	Stations A and B then dialog according to the **protocol** chosen on calling, whether **Uni-telway** or character mode. Communication is carried out using the standard communication functions. Each station can initiate exchanges. In Uni-telway mode, by default, the calling station is the slave and the station called is the master. To ensure compatibility with existing applications, it is possible to set the parameters of the `CALL_MODEM` communication function so that the local station remains in master Uni-telway mode.
5	Station A sends a request for disconnection to its local modem.
6	Stations A and B return to their initial state, and are able to initiate another call.

6.2 Characteristics

Introduction

Subject of Section

This Section introduces the characteristics and constraints of communicating using a TSX MDM 10 modem.

What's in this Section?

This Section contains the following Maps:

Hardware Compatibility

About PLCs

This type of communication is available for PLCs that are at least version V3.3.
- TSX Premium via the PMMCIA TSX MDM 10 card,
- TSX Micro accepting the PCMCIA described below.

The card can also be inserted in PCs that have type 3 PCMCIA card slots.

> **Note:** For certain types of CPU, it is recommended that a PCMCIA memory card (`CALL_MODEM` communication function occupying 25 Kb of program memory space) is used.

Networks and Devices

The TSX MDM 10 communication card only connects to the STN - (Switched Telephonic Network).
It cannot be connected:
- to specialized links,
- to NNIS (Numerical Network for Integrating Services) networks,
- to the GSM (Global System for Mobile) network.

Third-party modem compatibility is guaranteed for modems that are designed for COM 1 switched telephonic network. See Communication between PLCs using an external modem, p. 77.

About Protocols

The TSX MDM 10 card supports the two character formats 10 or 11 bits.
For 11 bit communication between modems, compatibility is only guaranteed with modems designed for the COM 1 telephone network.

The TSX MDM 10 is incompatible with configured third-party modems:
- with parity,
- with data compression and error correction.

In ASCII, the TSX MDM 10 card allows:
- in called mode:
  - transmission of data coded on 7 bits
  - reception of data coded on 8 bits.
- in calling mode:
  - transmission of data coded on 7 or 8 bits,
  - reception of data coded on 7 or 8 bits.

Software compatibility

X-WAY transparency

The modem card provides X-WAY transparency, and supports two types of protocol:
- Uni-telway master or slave protocol,
- character mode protocol.

When a local network station communicates with a remote station on the switched telephone network, the calling station must be in master mode, and the called station in slave mode.

Transmission

The speed of transmission varies between 4800 bits/s and 9600 bits/s. The size of the frames sent is 256 bytes in total (240 bytes usable in Uni-telway mode, and 200 bytes in character mode).
Only one communication function can be active at a time on the TSX MDM 10 card.

The application must manage line disconnection. Only the station which initiated connection using External CALL_MODEM (See External CALL_MODEM function, p. 68) has the right to disconnect the line.
The `CALL_MODEM` communication function ensures disconnection.
The TSX MDM 10 card defines a set operation for the **INPUT_CHAR** instruction.
When the **INPUT_CHAR** function is activated, the frame end character must be received before the end of the task cycle.
If several cycles are needed to receive this character, the character string is lost.

The application

Modem configuration requires PL7 software from version V3.3 onwards.

CAUTION

Downloading the application

The modem card cannot be used to up- or download a PL7 application. If loading is initiated by mistake, a failure message will appear on connection and the PLC application will be lost.
However, it is always possible to load an application via the terminal port.

Failure to observe this precaution can result in injury or equipment damage.

The station called can recognize a maximum of 8 calling stations for TSX Micro PLCs, and 16 for TSX Premium PLCs where the password service is used. Only the TSX MDM 10 card ensures the management of passwords. For third party devices, passwords are managed according to the coding protocol for password exchanges. See Exchange coding, p. 100.

6.3 Setting up communication via Modem

Introduction

Subject of Section

This Section introduces a summary description of setting up communication via a TSX MDM 10 modem.

What's in this Section?

This Section contains the following Maps:

Set up methodology

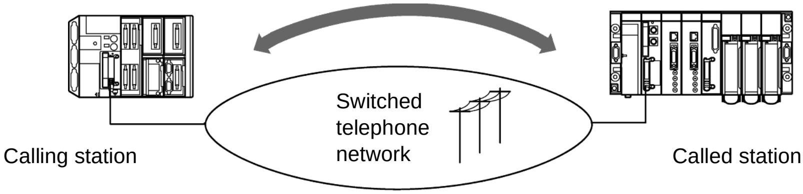
Introduction

Functions supported by the TSX MDM 10 card can immediately process, without prior configuration, the most common operations as follows:
- communication between PLCs with a TSX MDM modem card,
- communication from PL7 software to a PLC with a TSX MDM 10 modem card.

Setting up UNI-TELWAY communication between PLCs via the TSX MDM 10 card

Introduction

The two stations are connected to the switched telephone network by TSX MDM 10 cards.



Calling station

The calling station is a PLC with a TSX MDM 10 card.

Step	Action
1	Declare the TSX MDM 10 card by default. Default values: ● Uni-telway protocol ● transmission speed of 9600 bits/s ● automatic switch to slave mode on addresses 1 and 2 ● no password management
2	Confirm configuration.
3	Program the CALL_MODEM communication function to call the remote station. `CALL_MODEM(ADR#0.1.SYS, 1, %MB100:20, 0, 0, %MW256:4)` Values: ● address: ADR#0.1.SYS ● command: 1 ● connection option: 0 ● slave mode: 0 ● report: %MWx:4

Called station

The called station is a PLC with a TSX MDM 10 card.

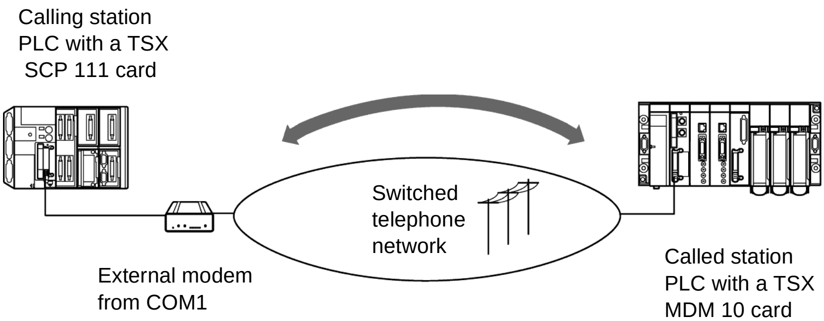
Step	Action
1	Declare the TSX MDM 10 card by default. Default values: ● Uni-telway protocol ● transmission speed of 9600 bits/s ● automatic switch to master mode on addresses 1 and 2 ● no password management
2	Confirm configuration.

Communication between PLCs using an external modem

Introduction

One of the stations is a PLC connected to the telephone network via an external modem.
The other station is a PLC connected to the telephone network via the TSX MDM 10 card.

Description of the hardware configuration:



TSX MDM 10 card end

The TSX MDM 10 card is configured with the default values from the configuration screen in Uni-telway mode.

TSX SCP 111 card end

The TSX SCP 111 is configured with the default values from the configuration screen in Uni-telway master mode, where the number of slaves is equal to 2 and the wait timeout must be set to the default value (2 s).

The external modem from COM1 is configured with the following AT commands:
- `AT&F&K%C0` where:
  - &F: sends the default configuration,
  - &K: flow control deactivated,
  - `%C0`: data compression deactivated
- `ATS0=2`: sets 2 rings before automatic reply
- `AT&D0`: if the DTR signal has not been set to 1 in the TSX SCP 111 card
- `AT&D2`: if the DTR signal has been set to 1 in the TSX SCP 111 card

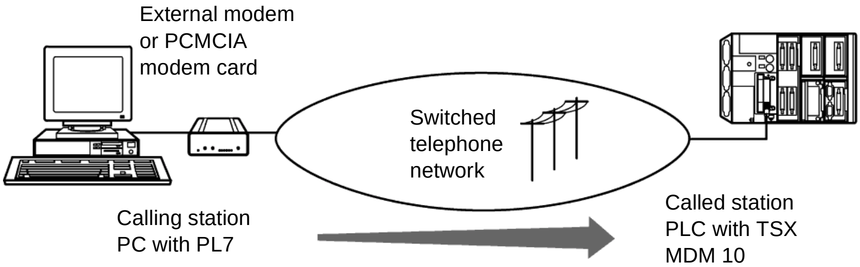
Setting up communication from PL7

Introduction

One of the stations is a PC with PL7 software, and is connected to the telephone network either by:

- an external modem from COM1,
- a PCMCIA card from COM1,
- or the TSX MDM 10 card if the PC has three PCMCIA slots.

The other station is a PLC connected to the telephone network via the TSX MDM 10 card.



Note: The two stations communicate in Uni-telway mode only.

Calling station

The calling station is a PC with PL7 software.

Step	Action
1	Declare the Uni-telway driver with the following values. See How to configure the Uni-telway driver with a modem, p. 80. ● slave mode ● addresses 1 and 2 ● transmission speed of 9600 bits/s ● modem option selected ● without parity

Called station

The called station is a PLC with a TSX MDM 10 card.

Step	Action
1	Declare the TSX MDM 10 card by default: ● Uni-telway protocol ● transmission speed of 9600 bits/s ● automatic switch to master mode on addresses 1 and 2 ● no password management
2	Confirm configuration.

Operation from the calling station

The following table describes the how the calling station operates from the PL7 application:

Phase	Description
1	When the PL7 application is started in online mode, the external modem or the PCMCIA modem card automatically dials the telephone number of the remote station, establishes the link, then responds to prompts.
2	Operation is then identical to how PL7 functions when directly connected to a terminal port. All functions are available, except for application downloading.

How to configure the Uni-telway driver with a modem

At a Glance

This procedure is used to configure the Uni-telway driver on Windows 95, 98 and NT systems for communication via modem.

Procedure

This procedure describes the different steps of the configuration:

Step	Action
1	Click on the **Drivers XWAY** icon in the Windows Control Panel.
2	In the **UNITELWAY DRIVER** tab, click on the **Configuration** button
3	Select the Communications Port and click on **Modify**.
4	In the **Modem Communication** box of the **Uni-Telway** tab, check the **Use Modem** box and configure the modem connection. See How to Configure Modem Connection, p. 81.
5	Where necessary, modify the link parameters. See How to modify modem configuration parameters, p. 82.
6	Click on the **OK**, **OK**, **OK** buttons.

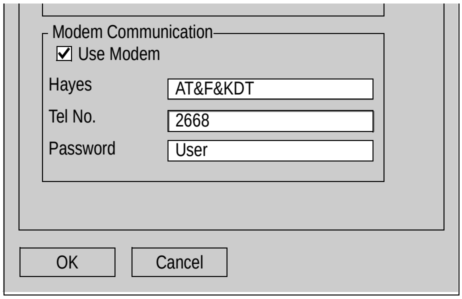
How to Configure Modem Connection

At a Glance

This procedure is used to configure modem connection on Windows 95, 98 and NT systems to initialize communication.

Procedure

This procedure describes the different steps of the configuration:

Step	Action
1	Once the **Use Modem** box is checked, **Result** 
2	Enter the parameters of the **Telephone Number** fields, the **Hayes Initialization** string and the password. **Note:** The initialization AT command to be entered is **AT&F&KDT** for modems from COM1 (where &F: default configuration, &K: flow control deactivated, DT: dialing). The telephone number is that of the station to be called (in example 2668). The password is the one to be sent to the remote equipment, where this is configured with a list of callers with passwords (See List of passwords, p. 91).
3	Confirm with the **OK** button.

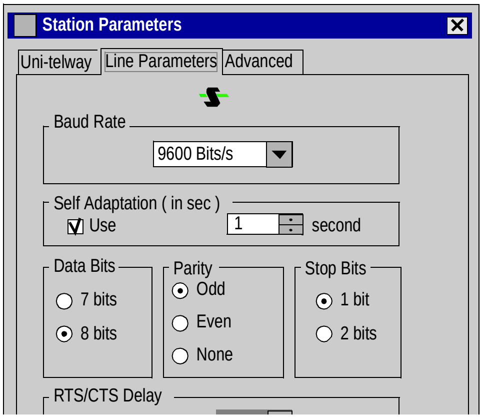
How to modify modem configuration parameters

Introduction

This procedure is used to configure the send parameters on Windows 95, 98 and NT systems for communication via modem.

Procedure

This procedure describes the different steps of the configuration:

Step	Action
1	Select the **Line Parameters** tab **Result** 
2	Configure the send parameters: ● **Parity**: none ● **Data bits** and **Stop bits**: identical to the parameters of the called station ● other parameters: not modified
3	Confirm with the **Ok** button.

Configuring Modem communication

7

Introduction

Subject of this Chapter

This Chapter describes the Configuration process when setting up a TSX MDM 10 modem.

What's in this Chapter?

This Chapter contains the following Maps:

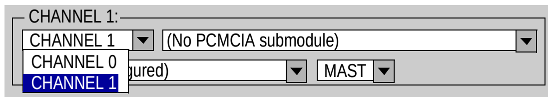
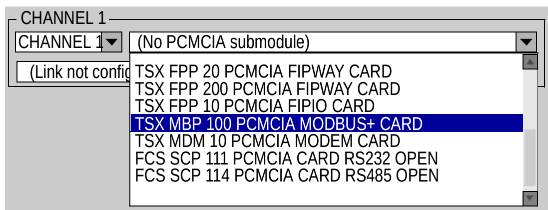
How to access PCMCIA modem card parameters

Introduction

This operation describes how to access configuration parameters for the modem link via PCMCIA cards.

How to access the link

The following table shows the procedure for accessing the modem link:

Step	Action
1	Access the communication channel configuration screen.
2	Select the communication channel from the drop-down menu **CHANNEL 1** **Example** 
3	Select the PCMCIA card from the drop-down menu **TSX MDM 10 PCMCIA MODEM CARD** **Example** 

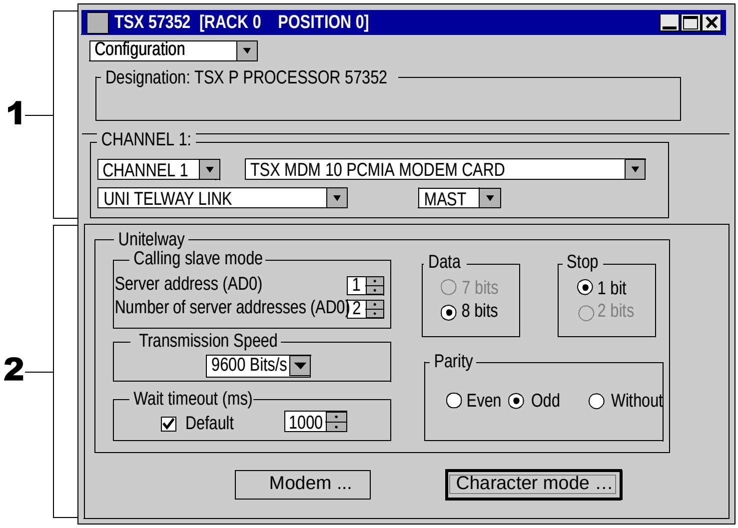
Modem configuration screen

Introduction

This screen, split into two zones, is used to declare the communication channel and to configure the parameters necessary for a modem link.

Illustration

The screen dedicated to modem communication looks like this:



Elements and functions

This table describes the different zones that make up the configuration screen:

Address	Zone	Function
1	common	See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).
2	specific	is used to select or complete modem link parameters. It is split into three different types of information: ● parameters concerning communication using Uni-telway protocol, ● parameters concerning communication using character mode protocol ● parameters concerning the modem

Parameters in Uni-telway mode

Introduction

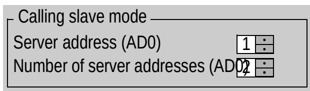
The Uni-telway protocol is proposed by default.

To use a modem with the Uni-telway protocol, the Uni-telway transmission parameters must be completed.

They are split into six windows:
- the **Calling slave mode** window
- the **Transmission speed** window
- the **Wait timeout** window
- the **Data** window
- the **Stop** window
- the **Parity** window

Calling slave mode parameters

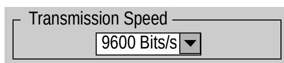
The window looks like this:



It is used to select card addresses:
- **Server address (AD0)**: selects the standard address used in Uni-telway slave mode
- **Number of addresses**: selects the address number used in Uni-telway mode:
  - the default value is 2.
  - if it is a calling station , you are advised to leave 2 as the value in this field.

Transmission speed

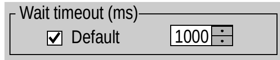
The window looks like this:



It is used to set the transmission speed:
- possible values are 4800 bits/s and 9600 bits/s.
- you are advised to adjust transmission speed according to the remote devices.

Wait timeout

The window looks like this:



Wait timeout is the maximum waiting time for a link acknowledgment message from a remote device (not to be confused with the application response to READ_VAR, for example):

- possible values are 30 ms and 30 s.
- the default value is 1 s.
- you are advised to adjust the transmission time to the transmission speed, and to increase the timeout over long distances (e.g. inter-continental links) or in the event of a poor quality telephone link.

Data

The field cannot be modified. The Uni-telway protocol imposes use of 8 data bits per character.

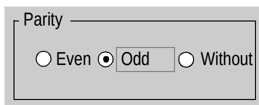
Stop

You are advised to adjust this field according to the remote device. Generally the Uni-telway protocol imposes use of 1 data bit per character.

Note: This field becomes unmodifiable if parity is odd or even.

Parity

The window looks like this:



This field is used to define the addition or non-addition of a parity bit, and its type.

- Possible values are Even, Odd, or none.
- The default value is odd. Generally, parity is odd
- You are advised to adjust this field according to the remote device. Generally, parity is odd for Uni-telway protocol.

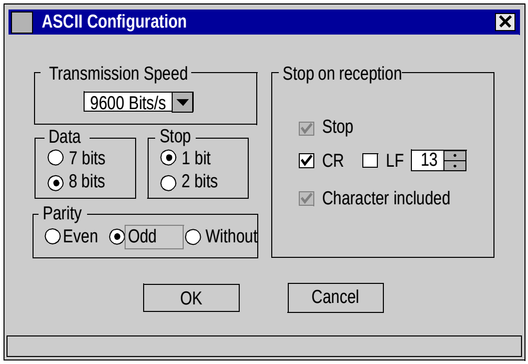
Parameters in character mode

Introduction

Parameters in character mode are used to configure the character mode protocol if the PL7 application uses this type of communication.

Illustration

The configuration screen appears when **Character mode** is selected:



Transmission speed

It is used to set the transmission speed:

- the default speed is 9600 bits/s.
- possible values are 4800 bits/s and 9600 bits/s.
- you are advised to adjust transmission speed according to the remote devices.

Data

The **Data** field is used to enter the number of data bits for coding a character:

- characters are coded on 7 or 8 bits.
- the default value is 8 bits.
- you are advised to adjust the number of data bits according to the remote devices.

Stop

The **Stop** field is used to set the number of stop bits employed for detecting the end of a frame:

- possible values are 1 or 2 bits.
- the default value is 1 bit.
- you are advised to adjust the number of stop bits according to the remote devices.

Parity

This field is used to define the addition or non-addition of a parity bit, and its type.

- Possible values are Even, Odd, or none.
- The default value is odd.
- You are advised to adjust the parity according to the remote devices.

Stop on reception

The following parameters are used to define the end of message character(s):

- **Stop** (cannot be modified): is used to activate stop on reception by an end character,
- **CR**: is used to detect the end of a message by a carriage return,
- **LF**: is used to detect the end of a message by a line feed,
- an entry field: is used to identify an end character which is different from a CR or LF character, using a decimal value.
  The possible values are:
  - 0 to 255 if the data is coded onto 8 bits,
  - 0 to 127 if the data is coded onto 7 bits,
- **Character included** (cannot be modified): is used to include the character at the end of the reception table for the PL7 PLC application.

Modem parameters

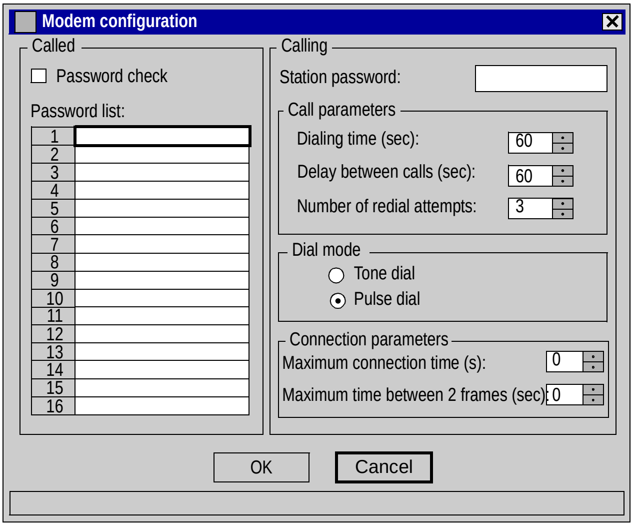
Introduction

The modem configuration screen is used to configure:

- password management,
- dialing mode,
- call parameters,
- connection parameters.

Illustration

The configuration screen appears when the **Modem** button is selected:



Modem configuration is split into two windows:

- a**Called** window
- a**Calling** window

Modem parameters for a called station

Introduction

They are split into two parts:
- a **Verify password** field
- a**Password list**

Verifying the password

If the box is checked, password management by the called station is enabled.
By default, password testing is disabled.

List of passwords

If password management is used, each called station has a list of a maximum of 8 or 16 passwords which can be used to identify 8 or 16 separate devices (only authorizes connection for these 8 or 16 devices).
The size of a word must not exceed 8 characters max. (characters = upper and lower case letters, numbers or special characters).

Modem parameters for a calling station

Introduction

They are split into two parts:
- a**Station password** field
- a**Call parameters** window
- a**Dial mode** window
- a**Connection parameters** window

Station password

Each station has its own password. It is used to identify the station. During a connection request, the calling station sends its password so that the called station can identify it and then authorize the connection.
For communication with other devices, the exchange protocol, described in exchange coding (See Exchange coding, p. 100), must be supported by the remote device.

Call parameters

These include all the parameters necessary in order to make a call:
- **Dialing time** (60 seconds by default): corresponds to the duration of a call in seconds.
- **Delay between calls** (60 seconds by default): corresponds to the calling station waiting time, in seconds, between two connection attempts. If a connection attempt fails, the PLC attempts another call after the waiting time if the number of redials has not been exceeded.
- **Number of redial attempts** (3 redial attempts by default): is used to set the number of call attempts in the event of failed connection attempts. If the last call fails, the CALL_MODEM function, which launched the connection attempts, sends back an error report. If the number of redial attempts configured is 0, no redial attempts will be made.

Dial mode

The dial modes are:
- either tone dial,
- or dialing.

Connection parameters

These include all the necessary parameters for a connection:

- **Maximum connection time** (0 seconds by default):
  - is used to define the connection time in seconds. After this time has elapsed, the current connection will be stopped. This control is necessary if the sender station is not able to disconnect from the line following an application error switching to STOP, or a system error.
  - if the number of redial attempts configured is 0, this control will not be active.
- **Maximum time between two frames** (0 seconds by default):
  - if the time between two frames (in seconds) is greater than this maximum time, the connection will be broken off. This control is necessary in the event of an unused connection.
  - if the configured value is equal to 0 or greater than 360 seconds, communication will be broken off after 360 seconds.

Programming Modem communication

8

Introduction

Subject of this Chapter

This chapter describes the Programming process for the setting up communication via a TSX MDM 10 modem.

What's in this Chapter?

This Chapter contains the following Maps:

CALL_MODEM communication function

Introduction

The `CALL_MODEM` communication function is used to manage connection with the TSX MDM 10 card.

It provides the option to:
- connect a line between a TSX MDM 10 card and another TSX MDM 10 card, or a remote third party modem,
- disconnect a line which has been established or is in the process of being established,
- reset the TSX MDM 10 card if necessary (following a protocol error, for example),
- send AT commands.

Syntax

The syntax of the `CALL_MODEM` communication function is presented in the following format:

```
CALL_MODEM (ADR#0.1.SYS, 1, %MB100:20, 0, 0, %MW256:4)
```

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.SYS	Broadcast address: ● processor slot: 0 or 1, ● PCMCIA channel: 1, ● system channel.
1	Command
%MB100:20	These bytes can contain two types of information: ● either a telephone number for the station called, ● or an AT command to be sent.
0	Connection options
0	Choice between Uni-telway master or slave mode
%MW256:4	Activity bit, exchange report, length

Description of parameters

See the following table:

Parameter	Type	Meaning
Command	Word	• value = 1: connection command, • value = 2: disconnection command, • value = 3: reset modem command, • value = 4: AT command to be sent.
Telephone number or AT command	Byte table	The table's maximum size of **24 bytes** is given by the last %MWk+3 management parameter (as shown in the example for %MW259 below). If %MWk+3 = 0, the size is 24 bytes.
Connection option	word	• value = 0: connection in Uni-telway mode, with password, • value = 1: connection in ASCII mode, with password, • value = 2: connection in Uni-telway mode, without password, • value = 3: connection in ASCII mode, without password, • value = 4: connection in Uni-telway mode without character string transmission on connection request, • value = 5: connection in ASCII mode without character string transmission on connection request.

Uni-telway slave or master mode	word	• value = 0: connection in Uni-telway slave mode,
		• value not equal to 0: connection in Uni-telway master mode
		  • byte 0 (least significant) corresponds to the number of slave addresses
		    value = 1: for Ad0
		    value = 2: for Ad0 and Ad1
		  • byte 1 (most significant) corresponds to address Ad0 for the Uni-telway slave (from 1 to 98)

Modem specific management parameters

Introduction

A detailed description of these parameters is available in the common section. See (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).

This document only describes parameters specific to communication via a modem. These parameters are:
- Timeout,
- operation report.

CALL_MODEM function timeout

Timeout of the function is a time used to check for the absence of response to the `CALL_MODEM` function.
This time, (increment of a 100 ms time base), is a combination of different parameters configured via the **Modem Configuration** screen.
It is advisable to allocate the following minimum value to this parameter:

Minimum timeout = the number of redial attempts * dialing time + (number of redial attempts - 1) * delay between redial attempts

Operation report

Operation reports are specific to the modem and only significant if the communication report has the following values:
- 16#00,
- 16#FF.

Communication report = 16#00

In this case, the exchange is correct.
In this case, the operation report (most significant byte) is:

Value	Meaning
16#00	Command executed
16#01	Non processed request
16#02	Incorrect response
16#03	Connection in progress by a remote modem
16#04	Connection in progress by a local `CALL_MODEM` function
16#05	Connection in progress by an external `CALL_MODEM` function
16#06	Connection request by a local `CALL_MODEM` function
16#07	Connection request by an external `CALL_MODEM` function
16#09	Remote station busy
16#0A	Disconnection by a remote modem
16#0B	Disconnection due to protocol error
16#0C	Disconnection by timeout

Communication report = 16#FF

In this case, the message is refused.
In this case, the operation report (most significant byte) is:

Value	Meaning
16#01	Lack of resources on connection to processor
16#02	Lack of line resources
16#03	Device missing on line
16#04	Line error
16#05	Length error
16#06	Communication channel faulty
16#07	Addressing error
16#08	Application fault
16#0B	No system resources
16#0C	Inactive communication function
16#0D	Destination missing
16#0F	Intra-station routing problem or non configured channel
16#11	Address format not handled
16#12	Lack of destination resource
16#14	Non operational connection
16#15	Absence of resource on the local channel
16#16	Non-authorized access
16#17	Incompatible network configuration

Exchange coding

Introduction

During a connection request, a character string of 11 useful bytes can be sent onto the line by the calling station to initialize the connection.

String format

The character string which can be sent onto the line follows the format shown below:

- **Password** field; 8 bytes containing the value FFFFFFFF in hexadecimal or the value of the station password,
- **Type** field (protocol type); 1 byte containing 0 for Uni-telway mode or 1 for character mode,
- **Number** field: for slave; 1 byte containing a value from 1 to 98,
- **Address number** field for slaves, 1 byte,
- Additional field of 20 bytes (not used).

> **Note:** Coding of this string depends on the following parameters:
> - **Station password** on the modem configuration screen,
> - **Mode** and **Options** for the communication function.

String processing

The following table summarizes the different processing scenarios:

Calling station (TSX MDM 10)	Called station (TSX MDM 10)

• if the station is configured by default, the modem does not send a character string onto the line:
  • connection without password (`CALL_MODEM` function with option 4),
  • Uni-telway slave protocol with addresses Ad0 = 1 and Ad1 = 2.
• in all other cases, the station sends a character string.
	When password management is not configured.
	• if no character string is received from the line, after 5 seconds wait the station switches to Uni-telway master mode and scans slave addresses Ad0 = 1 and Ad1 = 2,
	• if not the station tests the Password field equal to FFFFFFFF in hexadecimal:
	  • if the test is valid, the station tests the Type, Mode and Number of Addresses field, and switches to the corresponding mode,
	  • if the test is invalid, the line is closed.
	
	When password management is configured.
	• the station tests the password received:
	  • if the password does not match any password on the list, then the line is closed,
	  • if the test is valid, the station tests the Type, Mode and Number of Addresses field, and switches to the corresponding mode.

Guide to choosing connection parameters in Uni-telway mode

Introduction

The Uni-telway master or slave mode, as well as the addresses used, depend on the following parameters:
- the parameters of the **Calling mode** field in the configuration screen,
- the **Mode** parameter for the `CALL_MODEM` communication function.

Communication between two TSX MDM 10 cards

Usage parameters for the calling station:

Calling: TSX MDM 10	**Case 1**	**Case 2**	**Case 3**
Screen parameters	By default: Ad0 = 1 and address number = 2	Ad0 = n and address number = 2	By default: Ad0 = 1 and address number = 2
CALL_MODEM mode	By default: value 0	By default: value 0	Value xx Byte 0 = 02 Byte 1 = 50 Slave to be scanned at address 50 to 51
Designation	Becomes Uni-telway slave with addresses Ad0 = 1 and Ad1 = 2	Becomes Uni-telway slave with addresses Ad0 = n and Ad1 = n+1	Becomes Uni-telway master and scans addresses 50 and 51

Usage parameters for the called station:

Called: TSX MDM 10	**Case 1**	**Case 2**	**Case 3**
Screen parameters	By default: Ad0 = 1 and address number = 2	Immaterial	Immaterial
Designation	Becomes Uni-telway master and scans addresses 1 and 2	Becomes Uni-telway master and scans addresses n and n+1	Becomes slave which responds on addresses 50 and 51

The following is a list of comments relating to the various possible cases:
- case 1 is the most common (for communication between two TSX MDM 10 devices),
- case two is used to attribute a different slave address to each calling station (useful in multi-station architecture),
- case 3 is used to communicate with devices configured in Uni-telway slave mode.

Communication with a third party device

Usage parameters for the calling station (TSX MDM 10 card):

Calling: TSX MDM 10	Case 1	Case 2	Case 3
Screen parameters	By default: Ad0 = 1 and address number = 2	Ad0 = n and address number = 2	By default: Ad0 = 1 and address number = 2
CALL_MODEM mode	By default: value 0	By default: value 0	Value xx Byte 0 = 02 Byte 1 = 50 Slave to be scanned at address 50 to 51
Designation	Becomes Uni-telway slave with addresses Ad0 = 1 and Ad1 = 2	Becomes Uni-telway slave with addresses Ad0 = n and Ad1 = n+1	Becomes Uni-telway master and scans addresses 50 and 51

Usage parameters for the called station (third party device):

Called: third party device	Case 1	Case 2	Case 3
Designation	Becomes Uni-telway master and scans addresses 1 and 2	Becomes Uni-telway master and scans addresses n and n+1	Becomes slave which responds on addresses 50 and 51

The following is a list of comments relating to the various possible cases:
- case 1 is not significant,
- for case 2, the initialization protocol must be implemented (exchange coding),
- for case 3, the initialization protocol must be implemented (exchange coding).

Communication from a third party device

Usage parameters for the calling station (third party device):

Calling: third party device	Case 1	Case 2	Case 3
Designation	Becomes slave which responds on addresses 1 and 2	Becomes slave which responds on addresses n and n+1	Becomes a Uni-telway master and scans addresses configured on the TSX MDM 10 card

Usage parameters for the called station (TSX MDM 10 card):

Called: TSX MDM 10	Case 1	Case 2	Case 3
Screen parameters	By default: Ad0 = 1 and address number = 2	Requires the configuration Ad0 = n and address number = 2	Immaterial
Designation	Becomes Uni-telway master and scans addresses Ad0 = 1 and Ad1 = 2	Becomes Uni-telway master and scans addresses Ad0 = n and Ad1 = n+1	Becomes a Uni-telway slave with the configured addresses

The following is a list of comments relating to the various possible cases:
- cases 1 and 2 are not significant,
- for case 3, the initialization protocol must be implemented (exchange coding).

Guide to choosing connection parameters in character mode

Introduction

The character mode depends on the following parameters:
- the configuration screen parameters,
- the **Option** parameter for the `CALL_MODEM` communication function.

Communication between two TSX MDM 10 cards

Usage parameters for the calling station:

Calling: TSX MDM 10	
Screen parameters	Configuration in character mode (data coded on 8 bits)
CALL_MODEM option	Character mode protocol

Usage parameters for the called station:

Called: TSX MDM 10	
Screen parameters	Configuration in character mode is identical to that of calling station

Note: In this configuration, the character string, described in the exchange coding, is transmitted on the line.

Communication with a third party device

Usage parameters for the calling station (TSX MDM 10 card):

Calling: TSX MDM 10	
Screen parameters	Configuration in character mode (data coded on 8 bits)
CALL_MODEM option	Character mode protocol

Usage parameters for the called station (third party device):

Called: third party device	
Screen parameters	Implementation of initialization protocol (exchange coding)

Note: In this configuration, the character string, described in the exchange coding, is transmitted on the line.

Communication from a third party device

Usage parameters for the calling station (third party device):

Calling: third party device	
Screen parameters	Configuration in character mode (data coded on 8 bits)
Designation	Implementation of initialization protocol (exchange coding) for sending the character string

Usage parameters for the called station (TSX MDM 10 card):

Called: TSX MDM 10	
Screen parameters	Configuration in character mode is identical to that of calling station

Note: In this configuration, the character string, described in the exchange coding, is transmitted on the line.

Examples of connection, disconnection, and reset with a remote station

Introduction

The following examples are to assist with installation of the various `CALL_MODEM` services.

Example 1

Connection in Uni-telway slave mode, without password:

`CALL_MODEM(ADR#0.1.SYS, 1, %MB100:20, 2, 0, %MW256:4)`

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.SYS	Modem address
1	Connection
%MB100:20	Telephone number of called station
2	Uni-telway mode, without password
0	Uni-telway slave mode
%MW256:4	Activity bit, exchange report, length

Example 2

Connection in Uni-telway slave mode, with password:

`CALL_MODEM(ADR#0.1.SYS, 1, %MB100:20, 0, 0, %MW256:4)`

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.SYS	Modem address
1	Connection
%MB100:20	Telephone number of called station
0	Uni-telway mode, with password
0	Uni-telway slave mode
%MW256:4	Activity bit, exchange report, length

Example 3

Disconnection request:

```
CALL_MODEM(ADR#0.1.SYS, 2, %MB100:20, 2, 0, %MW256:4)
```

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.SYS	Modem address
2	Disconnection
%MW256:4	Activity bit, exchange report, length

Note: In this example details of the telephone number, the Uni-telway slave mode and password are unnecessary. The line is interrupted.

Example 4

Request to reset modem:

```
CALL_MODEM(ADR#0.1.SYS, 3, %MB100:20, 2, 0, %MW256:4)
```

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.SYS	Modem address
3	Modem reset
%MW256:4	Activity bit, exchange report, length

Note: In this example details of the telephone number, the Uni-telway slave mode and password are unnecessary. The modem is reset.
A reset does not interrupt a connection request in progress

Examples of communication between two PLCs

Introduction

The following example describes the different phases of a communication between two TSX Micro PLCs linked by the telephone network:
- the connection phase,
- the data exchange phase,
- the disconnection phase.

Connection phase

The calling station makes the call in Uni-telway slave mode without password management:

```
CALL_MODEM(ADR#0.1.SYS, 1, %MB50:4, 2, 0, %MW1024:4)
```

The following table describes the different parameters of the function:

Parameter	Variable	Description
Address	ADR#0.1.SYS	Modem address Processor slot: 0 or 1 PCMCIA channel: 1 System server: SYS
Command	1	Connection command
Telephone number	%MB50:4	Telephone number of called station (in bytes)
Option	2	Connection in Uni-telway mode, without password
Mode	0	Connection in Uni-telway slave mode
Report	%MW1024:4	%MW1026 = 300, corresponds to a 30 second time-out. %MW 1027 = 4, corresponds to the length in bytes of the telephone number to call (4 bytes in the example).

Data exchange phase

The calling station reads the called station's internal words, %MW100 to %MW199. This latter station is considered the Uni-telway master:

```
READ_VAR(ADR#0.1.1, '%MW', 100, 100, %MW200:100, %MW1094:4)
```

The following table describes the different parameters of the function:

Parameter	Variable	Description
Address	ADR#0.1.1	Address of the Uni-telway master station to be scanned
Type of object	'%MW'	Internal words
Number of first object	100	Shows the index of the first internal word to be read (%MW100)
Consecutive numbers	100	Specifies the number of internal words to be read (100 words)
Content of response	%MW200:100	Table of words containing the value of objects read
Report	%MW1094:4	

Disconnection phase

The calling station disconnects the line:

```
CALL_MODEM(ADR#0.1.SYS, 2, %MB50:4, 2, 0, %MW1028:4)
```

The following table describes the different parameters of the function:

Parameter	Variable	Description
Address	ADR#0.1.SYS	Modem address Processor slot: 0 or 1 PCMCIA channel: 1 System server: SYS
Command	2	Disconnection command
Telephone number	%MB50:4	Telephone number of called station (in bytes)
Option	2	Connection in Uni-telway mode, without password
Mode	0	Connection in Uni-telway slave mode
Report	%MW1028:4	%MW1030 = 300, corresponds to a 30 second time-out. %MW 1031 = 4, corresponds to the length in bytes of the telephone number to call (4 bytes in the example).

Debugging Modem communication

9

Introduction

Subject of this Chapter

This Chapter describes the Debugging process when setting up a TSX MDM 10 modem.

What's in this Chapter?

This Chapter contains the following Maps:

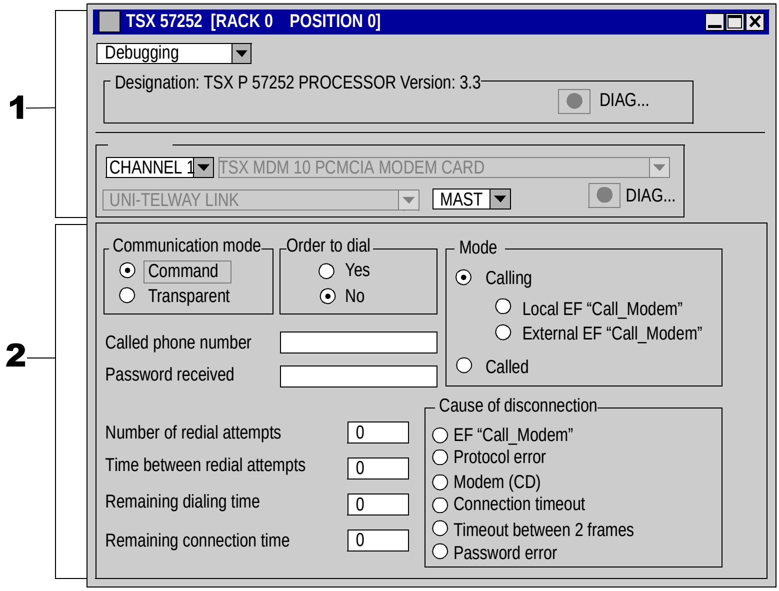
Modem debugging screen

Introduction

This screen, split into two zones, is used to declare the communication channel and to configure the necessary parameters for a modem link.

Illustration

The screen dedicated to Modbus communication looks like this:



Elements and functions

This table describes the different zones that make up the configuration screen:

Address	Zone	Function
1	common	See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).
2	specific	is used to access the debugging parameters for a Modem link.

Debugging parameters

Introduction

The specific part is split into several windows:
- the **Communication mode** window,
- the **Order to dial** window,
- the **Mode** window,
- the **Cause of disconnection** window,
- a field grouping.

Communication mode

This is used to identify the state of connection:
- command: connection request in progress (connection being established),
- transparent: connection established.

Order to dial

This indicates if a `CALL_MODEM` communication function has been received by the TSX MDM 10 card and is being processed.

Mode

This is used to specify the connection mode:
- calling: the station initiated the call. The screen shows whether the `CALL_MODEM` communication function has been sent by the local station or by a remote station via a network,
- called: the station is the call receiver.

Cause of disconnection

This indicates the causes of a line disconnection:
- EF CALL_MODEM: the local station has initiated the disconnection using the `CALL_MODEM` function,
- protocol error: a protocol error is the cause of the disconnection,
- modem (CD): the remote modem has initiated the disconnection,
- connection timeout: the duration of the connection has overrun,
- timeout between 2 frames: the delay between 2 frames has overrun,
- password error: the password received is invalid - it does not appear in the local station list.

Additional fields

They provide the following information:
- number of redial attempts: indicates the number of redial attempts remaining,
- time between redial attempts: indicates the time remaining between redial attempts,
- remaining dialing time: indicates the remaining dialing time,
- remaining connection time: indicates the remaining connection time (if the local station is connected).

Language objects associated with Modem communication

10

Introduction

Subject of this Section

This Chapter introduces language objects associated with communication via a TSX MDM 10 modem.

What's in this Chapter?

This Chapter contains the following Maps:

Language objects in implicit exchange

Introduction

This page describes all the language objects for implicit exchange in modem communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Bit objects

The table below shows the different bit objects for implicit exchange.

Object (1)	Function	Meaning
%Ixy.MOD.ERR	Module error bit	This bit set to 1, indicates a module error (at least one of the channels is faulty,…)
%Ixy.i.ERR	Channel error bit	This bit set at 1 indicates a faulty channel.
Key		
(1)	Address xy.i ● x: corresponds to the rack number, ● y: corresponds to the module number, ● i: corresponds to the channel number.	

Word objects

The table below shows the different word objects for implicit exchange.

Object (1)	Function	Meaning
%IWxy.i.0	Not used	-
%IWxy.i.1	General status of slaves	x0 = 1: if at least one slave does not respond
Key		
(1)	Address xy.i ● x: corresponds to the rack number, ● y: corresponds to the module number, ● i: corresponds to the channel number.	

Language objects for explicit exchange

Introduction

This page describes all the language objects for explicit exchange in Modem communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for explicit exchange.

Object (1)	Function	Meaning
%MWxy.MOD.2	Module status	• x0 = 1: defective module, • x1 = 1: functional error (error between the processor and the module, adjustment or configuration error, …), • x2 = 1: terminal block fault (not connected), • x3 = 1: self-tests running, • x4 = 1: reserved, • x5 = 1: error in hardware or software configuration (the module present is not that declared in the configuration, the sub-modules are not compatible), • x6 = 1: missing module, • x7 = 1: error in one of the sub-modules.
%MWxy.i.2	Standard channel status	• x0 = 1: single station on the network, • x1 = 1: not used, • x2 = 1: transmission line error, • x3 = 1: not used, • x4 = 1: internal software fault, • x5 = 1: error in hard- or software configuration, or configuration missing, • x6 = 1: communication error with the processor, • x7 = 1: application fault (double address station).
%MWxy.i.3	Specific channel status	0 for Uni-telway master mode 1 for Uni-telway slave mode
%MWxy.i.4 to %MWxy.i.7	Not used	-
%MWxy.i.8	Slave address	Standard address of calling slave

Object (1)	Function	Meaning
%MWxy.i.12	Modem status	• x0 = 0: command mode (to establish a connection), • x0 = 1: transparent mode (connection established), • x1 = 0: calling mode (transmitter station), • x1 = 1: called mode (receiver station), • x2 = 1: connection request, • x3 = 1: dialing request, • x4 = 1: disconnection request, • x5 = 1: connection via CALL_MODEM local function, • x6 = 1: connection via CALL_MODEM external function, • x7 = 1: connection via a remote modem, • x2 = 0: disconnection via CALL_MODEM local function, • x9 = 1: disconnection via CALL_MODEM external function, • x10 = 1: disconnection using timeout, • x11 = 1: disconnection due to protocol error, • x12 = 1: disconnection via a remote modem, • x13 = 1: disconnection following password error, • x14 = 1: disconnection caused by configured timeout, • x15 = 1: modem error.
%MWxy.i.13 to %MWxy.i.16	Current password	Transmitter (calling) station password
%MWxy.i.17	Modem state	• x0 = 1: initialization of the card active, • x1 = 1: command mode active, • x2 = 1: transparent mode active, • x3 = 1: dialing in progress, • x4 = 1: disconnecting, • x5 = 1: call in progress, • x6 = 1: busy, • x12 = 1: card initialization error, • x13 = 1: card initialization request.

Object (1)	Function	Meaning
%MWxy.i.18	Dialing state	• x0 = 1: dialing in progress, • x1 = 1: AT D command transmission (dialing), • x2 = 1: connection received, • x3 = 1: password test running, • x4 = 1: valid password received, • x5 = 1: protocol mode can be activated, • x6 :not used, • x7 = 1:Carriage Return not detected, • x8 = 1: DCD signal missing, • x9 = 1: dialing time overrun, • x10 = 1: general input/output error, • x11 = 1: illegal command, • x12 = 1: disconnection while dialing.
%MWxy.i.19	State of called unit	• x0 = 1: call in progress, • x1 = 1: AT A command transmission (answer), • x2 = 1: connection received, • x3 = 1: password test running, • x4 = 1: password received, • x5 = 1: password not received, • x6 = 1: Carriage Return not detected, • x10 = 1: general input/output error, • x11 = 1: illegal command.
%MWxy.i.20	Connection state	• x0 = 1: DTR signal active, • x1 = 1: AT H command transmission (hang up), • x2 = 1: awaiting disconnection.
%MWxy.i.21 to %MWxy.i.32	Telephone number	Telephone number of called station
%MWxy.i.33	Remaining number of redial attempts	Remaining number of calls to be made
%MWxy.i.34	Delay between remaining calls	Remaining delay value between calls is between 0 and 255 (between 30 s and 180 s)
%MWxy.i.35	Remaining dialing time	Remaining dialing time value is between 40 and 255 seconds
%MWxy.i.36	Remaining time between 2 messages	Remaining time value between two frames
%MWxy.i.37	Remaining connection time	Display of remaining connection time
%MWxy.i.38	Input character trace	Offset of last character received, between 0 and 99 bytes

Object (1)	Function	Meaning
%MWxy.i.39 to %MWxy.i.88	Input character trace	Trace of 100 input characters
%MWxy.i.89	Output character trace	Offset of last character transmitted, between 0 and 99 bytes
%MWxy.i.90 to %MWxy.i.139	Output character trace	Trace of 100 output characters
Key		
(1)	Address xy.i ● x: corresponds to the rack number, ● y: corresponds to the module number, ● i: corresponds to the channel number.	

Explicit exchange management and reports

Introduction

This page describes all the language objects that manage explicit exchanges. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for the management of explicit exchanges.

Object (1)	Function	Meaning
%MWxy.MOD.0	Module exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication module • x2 = 1: sending of adjustment parameters to the communication module
%MWxy.MOD.1	Module report	• x1 = 0: command parameters received and accepted by the module • x2 = 0: adjustment parameters received and accepted by the module
%MWxy.i.0	Channel exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication channel • x2 = 1: sending of adjustment parameters to the communication channel
%MWxy.i.1	Channel report	• x1 = 0: command parameters received and accepted by the communication channel • x2 = 0: adjustment parameters received and accepted by the communication channel
Key		
(1)	Address xy.i • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Language objects associated with configuration

Introduction

This page describes all the configuration language objects for Modem communication that can be displayed by the application program.

Internal constants

The following table describes the internal constants:

Object	Function	Meaning
%KWxy.i.0	Type	0 for Uni-telway mode
%KWxy.i.1	Speed / format	Byte 0 = speed ● 16#00 = 1200 bits/s, ..., 16#03 = 9600 bits/s Byte 1: format ● x8: bit number (1 = 8 bits, 0 = 7 bits) ● x9 = 1: parity management ● x10: Parity type (1 = odd, 0 = even) ● x11: stop bit (1 = 1 bit, 0 = 2 bits)
%KWxy.i.2	Timeout	Value of timeout
%KWxy.i.3	Slave address	Byte 0: standard slave address Byte 1: number of consecutive addresses (from 1 to 3)
%KWxy.i.4	Not used	
%KWxy.i.5	RTS/CTS delay	Value of delay in hundredths of a millisecond
%KWxy.i.6	Speed / Format in ASCII mode	Byte 0 = speed in ASCII mode ● 16#00 = 1200 bits/s, ...,16#03 = 9600 bits/s Byte 1: format in ASCII mode ● x8: bit number (1 = 8 bits, 0 = 7 bits) ● x9 = 1: parity management ● x10: Parity type (1 = odd, 0 = even) ● x11: stop bit (1 = 1 bit, 0 = 2 bits)
%KWxy.i.7	Stop Bits received	Byte 0 ● x0 = 1: end character enabled ● x1 = 1: end character included Byte 1: value of frame end character
%KWxy.i.8	Not used	
%KWxy.i.9	Number of redial attempts	Value between 0 and 10 redial attempts
%KWxy.i.10	Delay between redial attempts	Byte 0: delay between redial attempts in seconds, value between 30 and 180 seconds in increments of 30 s

Object	Function	Meaning
%KWxy.i.11	Dial mode	Byte 0: type of dialing ● x0 = 0: tone dial ● x0 = 1: pulse dial ● x1 = 0: password test ● x1 = 1: no password test Byte 1: dialing time value between 30 and 180 seconds in increments of 30 s
%KWxy.i.12	Maximum time between 2 messages	Message transfer check, value in seconds between 0 and 32767 seconds
%KWxy.i.13	Maximum connection time	Value between 0 and 32767 seconds ● = 0: no connection time control ● > 0: connection time control
%KWxy.i.14 to 17	Passwords	148 byte string

TSX Micro internal constants

The following table describes internal constants for TSX Micro PLCs:

Object	Function	Meaning
%KWxy.i.18 to 49	List of passwords	List of 8 passwords, with a maximum of 8 characters per password
%KWxy.i.50 to 123	Modem string	148 byte string

TSX Premium internal constants

The following table describes internal constants for TSX Premium PLCs:

Object	Function	Meaning
%KWxy.i.18 to 81	List of passwords	List of 16 passwords, with a maximum of 8 characters per password
%KWxy.i.82 to 155	Modem string	148 byte string

Appendices

11

Introduction

Subject of this Chapter

This Chapter introduces AT commands associated with the TSX MDM 10 modem.

What's in this Chapter?

This Chapter contains the following Maps:

AT commands

Introduction

The modem will respond to the commands described below. The parameters which can be associated with each command are given in the command description. The default values indicated for each configuration command are those used by the Rockwell factory profile.

Available commands

The following table recapitulates the AT commands supported by the TSX MDM 10:

Command	Description
A/	Command re-execution
AT = x	Write to the selected S register
AT?	Read the selected S register
A	Answer
Cn	Checking for carrier
Dn	Dialing
En	Local command echo
Hn	Disconnection (hang up)
In	Identification
Ln	Loudspeaker volume
Mn	Loudspeaker command
Nn	Loudspeaker activation
On	Return to on-line data mode
P	Default adjustment of pulse dialing
Qn	Activation / deactivation of result codes
Sn	S register read / write
T	Default adjustment of tone dialing
Vn	Form of the result codes
Wn	Error correction messages control
Xn	Extended result codes
Yn	Disconnection after prolonged inactivity
Zn	Software reset of modem and restoration of profile
&Cn	RLSD Option (detection of DCD carrier)
&Dn	DTR Option (Data Terminal Ready)
&Fn	Restoration of the factory configuration (profile)
&Gn	Selection of guard tone

Command	Description
&Kn	Flow control
&Pn	Selection of pulse dialing close/open report
&Qn	Synchronous/asynchronous mode
&Rn	RTS/CTS option
&Sn	DSR check (Data Station Ready)
&V	Display of current configuration and stored profiles
&v1	Display of statistics from last connection)
&Wn	Storage of current configuration
&Yn	Designation of a default profile on reset
&Zn	Storage of telephone numbers
%Cn	Activation / deactivation of data compression
%En	Activation/deactivation of line quality monitoring and automatic resynchronization attempt or of fallback/increase of transfer rate
%L	Level of line signal
%Q	Quality of line signal
\Kn	"Break" control
\Nn	Operating mode
\Vn	Validation of single line connection messages

A/ - Command re-execution

Introduction

The modem behaves as though the last command line had been returned by the DTE. "A/" repeats all the commands contained in the command buffer.
The principal use of this command is to be able to renew a call (using the dial command) which has not finished following an engaged signal or no reply. This command must appear alone on the command line and must finish with the character "/". It must not finish with a carriage return.

AT = x - Write to the selected S register

Introduction

This command writes the value x in the S register which is currently selected. It is possible to select an S register with the ATSn command.

Result codes

All S registers will send back an OK if x is a number.

Code	Description
OK	For all arguments

AT? - Read the selected S register

Introduction

This command reads and displays the selected S register. It is possible to select an S register with the ATSn command.

Result codes

All S registers will send back an OK if x is a number.

Code	Description
OK	For all arguments

A - Answer

Introduction

The modem connects and attempts to answer the call received if all the necessary conditions have been fulfilled.
Once contact has been made, the modem connects in answer mode.

Cn - Checking for carrier

Introduction

This command is included solely for reasons of compatibility; its only effect is to return a result code. The only valid parameter is 1.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 1
ERROR	If n is not equal to 1

Dn - Dialing

Introduction

This command asks the modem to unhook, to dial the number corresponding to the dialing string entered and to attempt to establish a connection. In the absence of a dialing string, the modem unhooks and attempts to make contact in send mode.

Dialing Modifiers

The valid parameters for the dialing string are described in the following table: For reasons of clarity, it is possible to use certain punctuation symbols such as brackets, hyphens or spaces. These symbols are not processed by the command.

Code	Description
0 - 9	Numbers 0 to 9 in MFDT
*****	The "asterisk" symbol (tone dialing only)
#	The "hash" symbol (tone dialing only)
A - D	Letters A, B, C and D in MFDT. In certain countries, these letters cannot be sent during dialing.
L	Redial the last number: the modem redials the last valid telephone number. The L must come immediately after the D and all subsequent characters are ignored.
P	Selects pulse dialing: pulse dialing dials the numbers which follow until a 'T' is reached. This applies to current and subsequent dialing. In certain countries, the dialing mode cannot be changed once the first number has been dialed.
T	Selects tone dialing: tone dialing dials the numbers which follow until a 'P' is reached. This applies to current and subsequent dialing. In certain countries, the dialing mode cannot be changed once the first number has been dialed.
R	This command will be accepted but it will have no effect.
S = n	Dialing of number stored in directory (n = 0 to 19) (see command &Z).
!	Quick hang up: the modem hangs up during the period defined by the value of S29. In certain countries, a limit may be imposed on this period.
W	Waiting for tone: the modem waits for the tone before dialing the digits which come after the 'W'.
@	Waiting for silence: the modem waits until there are at least 5 seconds of silence in the call frequency band before dialing the dialing string. If the modem does not detect these 5 seconds of silence after a period defined by the call abandon timer (S7), the modem ends the call attempt with a NO ANSWER message. If the detection of an engaged line is validated, the modem can end the call with the result code BUSY. If the answer tone comes while this parameter is being carried out, the modem makes contact.
,	Dialing pause: the modem pauses for the period indicated by S8 before dialing the digits which come after the ','.

Code	Description
`;`	Returns to command mode. Added to the end of the dialing string, this parameter returns the modem to command mode once it has processed the part of the string which precedes ','. This enables new AT commands to be sent while off-hook. The new AT commands can be set on the source command line after ',' or entered on new command lines. The modem does not attempt to establish the connection until the new dial command is sent without the end symbol ','. Use 'H' to abandon dialing in progress and hang up.
`^`	Switch call tone: only applies to the dialing attempt in progress.
`( )`	Ignored: can be used to format the dialing string.
`-`	Ignored: can be used to format the dialing string.
<space>	Ignored: can be used to format the dialing string.
<i>	Invalid symbol: will be ignored.

En - Local command echo

Introduction

According to the parameter indicated, the modem activates or deactivates the appearance of the characters on the DTE. The parameter value, if valid, is written in the S14 bit.

Parameters

The parameters are.

Code	Description
E0	Deactivates command echo.
E1	Activates command echo (default value)

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 or 1.
ERROR	If n is not equal to 0 or 1.

Hn - Disconnection (hang up)

Introduction

This command launches a hanging up sequence; it is possible that it is not available in certain countries.

Parameters

The parameters are:

Code	Description
H0	The modem frees the line if it is currently connected, and ends all attempts (AT&T) in progress. Any processing which is particular to a country, to the modulation or to the error correction protocol (S38) is carried out outside the H0 command.
H1	Only in STN mode; if the modem is on-hook, it unhooks and goes into command mode. The modem hangs up at the end of the time period defined by S7.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 or 1.
ERROR	If n is not equal to 0 or 1.

In - Identification

Introduction

The modem reports the result corresponding to the entered command parameter to the DTE.

Parameters

The parameters are:

Code	Description
I0	Gives the product code (e.g. '14400').
I1	Gives the pre-calculated checksum of the read-only memory ROM (e.g. '007').
I3	Gives the firmware revision level (e.g. 'V1.000S').
I4	Gives the identification string defined by the OEM (e.g. 'RC96ACL').
I5	Gives the country code (e.g. '022').
I6	Gives the model of the modem data pumping device.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 6.
ERROR	If n is not in the range 0 to 6.

Ln - Loudspeaker volume

Introduction

The modem adjusts the loudspeaker volume control according to the parameter entered. The parameter value, if valid, is written in bits 0 and 1 of S22.

Parameters

The parameters are:

Code	Description
L0	Low or deactivated volume.
L1	Low volume (default value).
L2	Medium volume.
L3	High volume.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 3.
ERROR	If n is not in the range 0 to 3.

Mn - Loudspeaker command

Introduction

This command controls the moment at which the loudspeaker is active or deactivated. The parameter value, if valid, is written in bits 2 and 3 of S22.

Parameters

The parameters are:

Code	Description
M0	The loudspeaker is always deactivated.
M1	The loudspeaker is activated during establishment of the call but deactivated during reception of the carrier (default value).
M2	The loudspeaker is always activated.
M3	The loudspeaker is deactivated during reception of the carrier and during dialing.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 3.
ERROR	If n is not in the range 0 to 3.

Nn - Activation of automatic mode.

Introduction

This command activates or deactivates detection of automatic mode. The parameter value, if valid, is written in bit 1 of S31.

Parameters

The parameters are:

Code	Description
N0	Detection of automatic mode is deactivated (equivalent to giving the 0 value to the sub-parameter +MS). The handshaking which follows is made according to the content of S37 or, if S37 is at 0, according to the most recently detected DTE baud rate.
N1	Detection of automatic mode is activated (equivalent to giving the value 1 to the sub-parameter +MS). The handshaking which follows is made according to the automatic mode algorithm supported by the modem, in other words according to the content of S37 or, if S37 is 0, by starting at 28800 b/s V.34 (RC288). This command also equates to F0 (RC144) (default value).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

Observations

1. The Nn and S37=x commands have priority over the values of the +MS command. When the N0 or N1 command is sent, the sub-parameters of +MS are updated to reflect the values of Nn and S37 (see descriptions of the +MS command and of the S37 register).
   For example:
   - N1S37=10 updates the sub-parameters of the +MS command as follows: +MS=10,1,300,12000
   - N037=10 updates the sub-parameters of the +MS command as follows: +MS=10,0,12000,12000
2. It is recommended to use the +MS command rather than the Nn and S37=x commands. The Nn and S37=x commands are supported to ensure compatibility with the existing communication software.

On- Return to on-line data mode

Introduction

This command determines the way in which the modem sets in on-line data mode.
If the modem is in the on-line command mode, this command sets it in on-line data mode with or without a resynchronization attempt.
If the modem is in off-line command mode (no connection), ERROR is displayed as the response.

Parameters

The parameters are:

Code	Description
00	Switches to on-line data mode without resynchronization attempt. The processing is determined by the call establishment task. In general, if there is a connection, this command reconnects the DTE to the remote modem after an escape (+++).
01	In STN mode only; switches to on-line data mode after a resynchronization attempt.

Result codes

The following table lists the possible command responses.

Code	Description
CONNECT	n = 0 to 3.
ERROR	If n is not in the range 0 to 3.

P - Default adjustment of pulse dialing

Introduction

This command imposes pulse dialing until the receives the next 'T' dialing modifier or the next 'T' command. It sets bit 5 of S14. On execution of a dialing command which expressly indicates the dialing mode of the call in question (e.g. ATDT…), this command is canceled so that all subsequent dialing will be tone dialing (see 'T' command).
In certain countries, this command may not be authorized.

Result codes

The following table lists the possible command responses.

Code	Description
OK	-

Qn - Activation / deactivation of result codes

Introduction

According to the parameter indicated, the command activates or deactivates sending of result codes to the DTE. The parameter value, if valid, is written in S14.

Parameters

The parameters are:

Code	Description
Q0	Sends the result codes to the DTE (default value).
Q1	Does not send result codes to the DTE.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

Sn - S register read / write

Introduction

The modem selects an S register, performs a read or write operation on an S register or reports the value of an S register.

Parameters

The parameters are:

Code	Description
n	Sets the S register as the default register.
n = v	Attributes the value v to the S register n.
n?	Indicates the value of the register S n. The n parameter can be omitted, in which case it is the value of S0 which is read. S can be omitted, in which case it is the value of the last consulted S register (default register) which is read.

Examples

- ATS7 sets S7 as the default register.
- ATS38 sets S38 as the default register.
- AT=40 gives the default register the value of 40.
- ATS=20 gives the value 20 to S0.

Result codes

If the number n is outside the range of available S registers, the modem sends back an ERROR message. The value 'v' is rollover 256. If the result is outside the permitted range for a given S register, the values are still stored but from a functional point of view, it is the upper and lower limits which are used.

The input and output values are always in decimal format. Note that some S registers are read-only. In these cases, a write operation to an S register appears to be accepted but the value is in fact not written.

T - Default adjustment of tone dialing

Introduction

This command imposes MFDT dialing until the next 'P' dialing modifier or the next 'P' command is received. The modem sets an S register bit to '1' to indicate that all subsequent dialing will be tone dialing. Note that the DP command has priority over this command. It clears bit 5 of S14. In certain countries, this command may not be used (see P command).

Result codes

The following table lists the possible command responses.

Code	Description
0K	-

Vn - Form of the result codes

Introduction

This command chooses to send the result codes to the DTE in abbreviated form or in complete form. The parameter value, if valid, is written in bit 3 of S14.

Parameters

The parameters are:

Code	Description
V0	Presents the result codes in abbreviated form (numerical). There is no line change before the result code given in abbreviated form.
V1	Presents the result codes in complete form (text) (default value).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

Wn - Error correction messages control

Introduction

This command controls the format of CONNECT messages. The parameter value, if valid, is written in bits 2 and 3 of S31 (also see description of S95).

Parameters

The parameters are:

Code	Description
W0	On connection, the modem only indicates the baud rate of the DTE (e.g. CONNECT 9600). Subsequent responses are deactivated (default value).
W1	On connection, the modem indicates the line baud rate, the error correction protocol and the baud rate of the DTE respectively. Subsequent responses are deactivated.
W2	On connection, the modem indicates the baud rate of the DCE (e.g. CONNECT 2400). Subsequent responses are deactivated.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 2.
ERROR	If n is not in the range 0 to 2.

Xn - Extended result codes

Introduction

This command selects the set of messages that the modem will use to inform the DTE of the command results. The table indicates the messages which are activated for each value of X.
If the modem is in fax mode (+FCLASS=1 or 2), the only message sent to indicate that a connection has been made is CONNECT without any indication of baud rate.

Parameters

The parameters are:

Code	Description
X0	Deactivates detection of engaged tones except if this is imposed by the national requirements; only sends the result codes OK, CONNECT, RING, NO CARRIER, ERROR and NO ANSWER.The blind dialing mode is activated/ deactivated by the national parameters. If detection of the engaged tone is in use and if such a tone is detected, it is the response NO CARRIER which is sent back instead of BUSY.If dial tone detection is in use or selected and if no such tone is detected, it is the response NO CARRIER which is sent back instead of NO DIAL TONE.The binary value 000 is written in bits 6, 5 and 4 of S22 respectively.
X1	Deactivates detection of engaged tones except if this is imposed by the national requirments; only sends the result codes OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER and CONNECT XXXX (XXXX = baud rate). Blind dialing mode is activated/deactivated by the national parameters. If detection of the engaged tone is in use and if such a tone is detected, it is the response NO CARRIER which is sent back instead of BUSY.If dial tone detection is in use or selected and if no such tone is detected, it is the response NO CARRIER which is sent back instead of NO DIAL TONE.The binary value 100 is written in bits 6, 5 and 4 of S22 respectively.
X2	Deactivates detection of engaged tones except if this is imposed by national requirements; only sends the result codes OK, CONNECT, RING, NO CARRIER, ERROR, NO DIAL TONE, NO ANSWER and CONNECT XXXX.If detection of the engaged tone is in use and if such a tone is detected, it is the response NO CARRIER which is sent back instead of BUSY.If dial tone detection is in use or selected and if no such tone is detected, it is the response NO CARRIER which is sent back instead of NO DIAL TONE.The binary value 101 is written in bits 6, 5 and 4 of S22 respectively.

Code	Description
X3	Activates detection of engaged tones; only sends the result codes OK, CONNECT, RING, NO CARRIER, ERROR, NO DIAL TONE, NO ANSWER et CONNECT XXXX.Blind dialing mode is activated/deactivated by the national parameters.If dial tone detection is in use and if no such tone is detected, it is the reply NO CARRIER which is sent instead of NO DIAL TONE.The binary value 110 is written in bits 6, 5 and 4 of S22 respectively.
X4	Activates detection of engaged tones; sends all messages. The binary value 111 is written in bits 6, 5 and 4 of S22 (default value) respectively.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 4.
ERROR	If n is not in the range 0 to 4.

Table of result codes

The n value

Abbreviated form	Complete form	n = 0	n = 1	n = 2	n = 3	n = 4	Note
0	OK	X	X	X	X	X	-
1	CONNECT	X	X	X	X	X	-
2	RING	X	X	X	X	X	-
3	NO CARRIER	X	X	X	X	X	-
4	ERROR	X	X	X	X	X	-
5	CONNECT 1200	1	X	X	X	X	-
6	NO DIAL TONE	3	3	X	X	X	-
7	BUSY	3	3	3	X	X	-
8	NO ANSWER	X	X	X	X	X	-
9	CONNECT 0600	1	X	X	X	X	-
10	CONNECT 2400	1	X	X	X	X	-
11	CONNECT 4800	1	X	X	X	X	-
12	CONNECT 9600	1	X	X	X	X	-
13	CONNECT 7200	1	X	X	X	X	-
14	CONNECT 12000	1	X	X	X	X	-
15	CONNECT 14400	1	X	X	X	X	-
16	CONNECT 19200	1	X	X	X	X	-
17	CONNECT 38400	1	X	X	X	X	-
18	CONNECT 57600	1	X	X	X	X	-
19	CONNECT 115200	1	X	X	X	X	-
20	CONNECT 230400	X	X	X	X	X	Note 4
22	CONNECT 75RTX / 1200RX	1	X	X	X	X	-
23	CONNECT 1200TX / 75RX	1	X	X	X	X	-
24	DELAYED	4	4	4	4	X	-
32	BLACKLISTED	4	4	4	4	X	-
33	FAX	X	X	X	X	X	-
35	DATA	X	X	X	X	X	-
40	CARRIER 300	X	X	X	X	X	-
44	CARRIER 1200 / 75	X	X	X	X	X	-
45	CARRIER 75 / 1200	X	X	X	X	X	-
46	CARRIER 1200	X	X	X	X	X	-
47	CARRIER 2400	X	X	X	X	X	-

Abbreviated form	Complete form	n = 0	n = 1	n = 2	n = 3	n = 4	Note
48	CARRIER 4800	X	X	X	X	X	-
49	CARRIER 7200	X	X	X	X	X	-
50	CARRIER 9600	X	X	X	X	X	-
51	CARRIER 12000	X	X	X	X	X	-
52	CARRIER 14400	X	X	X	X	X	-
53	CARRIER 16800	X	X	X	X	X	Note 2
54	CARRIER 19200	X	X	X	X	X	Note 2
55	CARRIER 21600	X	X	X	X	X	Note 2
56	CARRIER 24000	X	X	X	X	X	Note 2
57	CARRIER 26400	X	X	X	X	X	Note 2
58	CARRIER 28800	X	X	X	X	X	Note 2
59	CONNECT 16800	1	X	X	X	X	Note 2
61	CONNECT 21600	1	X	X	X	X	Note 2
62	CONNECT 24000	1	X	X	X	X	Note 2
63	CONNECT 26400	1	X	X	X	X	Note 2
64	CONNECT 28800	1	X	X	X	X	Note 2
66	COMPRESSION: CLASS 5	X	X	X	X	X	-
67	COMPRESSION: V.24 bis	X	X	X	X	X	-
69	COMPRESSION: NONE	X	X	X	X	X	-
70	PROTOCOL: NONE	X	X	X	X	X	-
77	PROTOCOL: LAPM	X	X	X	X	X	-
78	CARRIER 31200	X	X	X	X	X	Note 3
79	CARRIER 33600	X	X	X	X	X	Note 3
80	PROTOCOL: ALT	X	X	X	X	X	-
81	PROTOCOL: ALT-CELLULAR	X	X	X	X	X	-
84	CONNECT 33600	1	X	X	X	X	Note 3
91	CONNECT 31200	1	X	X	X	X	Note 3
150	CARRIER 32000	X	X	X	X	X	Note 4
151	CARRIER 34000	X	X	X	X	X	Note 4
152	CARRIER 36000	X	X	X	X	X	Note 4
153	CARRIER 38000	X	X	X	X	X	Note 4
154	CARRIER 40000	X	X	X	X	X	Note 4
155	CARRIER 42000	X	X	X	X	X	Note 4
156	CARRIER 44000	X	X	X	X	X	Note 4

Abbreviated form	**Complete form**	**n = 0**	**n = 1**	**n = 2**	**n = 3**	**n = 4**	**Note**
48	CARRIER 4800	X	X	X	X	X	-
49	CARRIER 7200	X	X	X	X	X	-
50	CARRIER 9600	X	X	X	X	X	-
51	CARRIER 12000	X	X	X	X	X	-
52	CARRIER 14400	X	X	X	X	X	-
53	CARRIER 16800	X	X	X	X	X	Note 2
54	CARRIER 19200	X	X	X	X	X	Note 2
55	CARRIER 21600	X	X	X	X	X	Note 2
56	CARRIER 24000	X	X	X	X	X	Note 2
57	CARRIER 26400	X	X	X	X	X	Note 2
58	CARRIER 28800	X	X	X	X	X	Note 2
59	CONNECT 16800	1	X	X	X	X	Note 2
61	CONNECT 21600	1	X	X	X	X	Note 2
62	CONNECT 24000	1	X	X	X	X	Note 2
63	CONNECT 26400	1	X	X	X	X	Note 2
64	CONNECT 28800	1	X	X	X	X	Note 2
66	COMPRESSION: CLASS 5	X	X	X	X	X	-
67	COMPRESSION: V.24 bis	X	X	X	X	X	-
69	COMPRESSION: NONE	X	X	X	X	X	-
70	PROTOCOL: NONE	X	X	X	X	X	-
77	PROTOCOL: LAPM	X	X	X	X	X	-
78	CARRIER 31200	X	X	X	X	X	Note 3
79	CARRIER 33600	X	X	X	X	X	Note 3
80	PROTOCOL: ALT	X	X	X	X	X	-
81	PROTOCOL: ALT-CELLULAR	X	X	X	X	X	-
84	CONNECT 33600	1	X	X	X	X	Note 3
91	CONNECT 31200	1	X	X	X	X	Note 3
150	CARRIER 32000	X	X	X	X	X	Note 4
151	CARRIER 34000	X	X	X	X	X	Note 4
152	CARRIER 36000	X	X	X	X	X	Note 4
153	CARRIER 38000	X	X	X	X	X	Note 4
154	CARRIER 40000	X	X	X	X	X	Note 4
155	CARRIER 42000	X	X	X	X	X	Note 4
156	CARRIER 44000	X	X	X	X	X	Note 4

Abbreviated form	Complete form	n = 0	n = 1	n = 2	n = 3	n = 4	Note
157	CARRIER 46000	X	X	X	X	X	Note 4
158	CARRIER 48000	X	X	X	X	X	Note 4
159	CARRIER 50000	X	X	X	X	X	Note 4
160	CARRIER 52000	X	X	X	X	X	Note 4
161	CARRIER 54000	X	X	X	X	X	Note 4
162	CARRIER 56000	X	X	X	X	X	Note 4
165	CONNECT 32000	X	X	X	X	X	Note 4
166	CONNECT 34000	X	X	X	X	X	Note 4
167	CONNECT 36000	X	X	X	X	X	Note 4
168	CONNECT 38000	X	X	X	X	X	Note 4
169	CONNECT 40000	X	X	X	X	X	Note 4
170	CONNECT 42000	X	X	X	X	X	Note 4
171	CONNECT 44000	X	X	X	X	X	Note 4
172	CONNECT 46000	X	X	X	X	X	Note 4
173	CONNECT 48000	X	X	X	X	X	Note 4
174	CONNECT 50000	X	X	X	X	X	Note 4
175	CONNECT 52000	X	X	X	X	X	Note 4
176	CONNECT 54000	X	X	X	X	X	Note 4
177	CONNECT 56000	X	X	X	X	X	Note 4
+ F4	+FCERROR	X	X	X	X	X	-

Observations	
1	An ‘X’ in the column means that the message in question (in its text form or only numerical) is generated when the corresponding value ‘n’ (indicated at the top of column) has been selected with the ATXn command. If the column is blank, no message is generated for this table slot. A number sends back a less explicit message (in complete or abbreviated form) which will be sent to the table slot in question.
2	RC288 modems and higher.
3	RC336 modems and higher.
4	RC56 modems.

Yn - Disconnection after prolonged inactivity

Introduction

This command activates/deactivates generation and response to a disconnection after prolonged inactivity. The parameter value, if valid, is written in bit 7 of S21.

Parameters

The parameters are:

Code	Description
Y0	Deactivates disconnection after prolonged inactivity.
Y1	Activates disconnection after prolonged inactivity. In error correction mode, the modem sends an inactivity signal of four seconds before hanging up. In the same mode, the modem responds to the receipt of a prolonged inactivity signal (for example a 'break' signal of more than 1.6 seconds) by hanging up.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

Zn - Software reset of modem and restoration of profile

Introduction

The modem executes a software reset and reestablishes the configuration profile defined by the parameter.
In the absence of a parameter, zero is assumed.

Parameters

The parameters are:

Code	Description
Z0	Software reset of modem and reestablishment of stored profile 0.
Z1	Software reset of modem and reestablishment of stored profile 1.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&Cn - RLSD Option (detection of DCD carrier)

Introduction

The modem monitors the carrier detection output according to the parameter entered. The parameter value, if valid, is written in bit 5 of S21.

Parameters

The parameters are:

Code	Description
&C0	Carrier detection is active all the time (default value).
&C1	Carrier detection depends on the carrier status.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&Dn - DTR Option (Data Terminal Ready)

Introduction

This command interprets loss of the DTR signal sent by the DTE, according to the parameter entered. The parameter value, if valid, is written in bits 3 and 4 of S21.

Parameters

The parameters are:

Code	Description
&D0	Loss of the DTR signal is interpreted as follows according to the &Q value in progress (default value): • &Q0,&Q5, &Q6: ignores the DTR signal (assumed activated) and enables operation with DTEs which do not support DTR signals. • &Q1, &Q4: loss of the DTR signal causes the modem to hang up. There is no repercussion on automatic answer. • &Q2, &Q3: loss of the DTR signal causes the modem to hang up. Automatic answer is inhibited.
&D1	Loss of the DTR signal is interpreted as follows according to the &Q value in progress: • &Q0, &Q1, &Q4, &Q5, &Q6: loss of the DTR signal is interpreted by the modem as though the synchronous escape sequence had been entered. The modem returns to asynchronous command mode without disconnection. • &Q2, &Q3: loss of the DTR signal causes the modem to hang up. Automatic answer is inhibited.
&D2	Loss of the DTR signal is interpreted as follows according to the &Q value in progress: • &Q0 to &Q6: loss of the DTR signal causes the modem to hang up. Automatic answer is inhibited.
&D3	Loss of the DTR signal is interpreted as follows according to the &Q value in progress: • &Q0, &Q1, &Q4, &Q5, &Q6: loss of the DTR signal causes the modem to reset the software as though it had received the Z command. The value of &Y defines the profile which is loaded. • &Q2, &Q3: loss of the DTR signal causes the modem to hang up. Automatic answer is inhibited.

Note: If &Q5, &Q6, +FCLASS=1 is in use, the result is identical to the &Q0 command.

&Fn - Restoration of the factory configuration (profile)

Introduction

The modem loads the defined factory default configuration according to the parameter entered. The default Rockwell values corresponding to the 0 (&F0) profile are used for each command and in the S register descriptions. Two profiles are available. A configuration profile is made up of a sub-set of S registers.

Parameters

The parameters are:

Code	Description
`&F0`	Reestablishes the factory profile 0 (default value).
`&F1`	Reestablishes the factory profile 1.

&Gn - Selection of guard tone

Introduction

The modem generates the guard tone selected by this command according to the parameter entered (differential phase shift modulation modes only). The parameter value, if valid, is written in bits 6 and 7 of S23.

Parameters

The parameters are:

Code	Description
&G0	Deactivates the guard tone (default value for US models).
&G1	Deactivates the guard tone.
&G2	Selects a guard tone of 1800 Hz (default value for W-class models).

Note: In certain countries, this command may not be authorized.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 2.
ERROR	If n is not in the range 0 to 2.

&Kn – Flow control

Introduction

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written in bits 0, 1 and 2 of S39.

Parameters

The parameters are:

Code	Description
&K0	Deactivates flow control.
&K3	Activates RTS/CTS flow control - hardware flow control (default value for data modem modes).
&K4	Activates XON/XOFF flow control – software flow control.
&K5	Activates transparent XON/XOFF flow control.
&K6	Activates RTS/CTS flow control and XON/XOFF flow control at the same time (default value for fax-modem modes).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0, 3 to 6.
ERROR	If n is not equal to 0 or 3 to 6.

&Pn - Selection of pulse dialing close/open report

Introduction

This command determines the close/open report used during pulse dialing. It only has an effect if the appropriate bit activating this command is set by the program ConfigurACE.
If the command is activated, it has priority over the close/open reports defined by the OEM parameters in ConfigurACE. The default value depends on the country. The parameter value, if valid, is written in bits 3 and 4 of S28.

Parameters

The parameters are:

Code	Description
&P0	Selection of 39%-61% as close/open report at 10 pulses per second (default value).
&P1	Selection of 33%-67% as close/open report at 10 pulses per second.
&P2	Selection of 39%-61% as close/open report at 20 pulses per second.
&P3	Selection of 33%-67% as close/open report at 20 pulses per second.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 3.
ERROR	If n is not in the range 0 to 3.

&Qn - Synchronous/asynchronous mode

Introduction

This command monitors the authorized connection modes. It is used in association with S36 and S48 (see also command \N).

Parameters

The parameters are:

Code	Description
&Q0	Selects direct asynchronous mode.
&Q1	Selects
&Q2	Selects
&Q4	Selects automatic synchronous mode. The binary value 100 is written in bits 3, 1 and 0 of S27 respectively.
&Q5	The modem attempts to establish a link with error correction. The mode can be configured with S36 to determine if, in case of failure, the modem hangs up or if it falls back to an asynchronous connection. The binary value 101 is written in bits 3, 1 and 0 of S27 (default value) respectively.
&Q6	Selects normal asynchronous mode (with baud rate buffer). The binary value 110 is written in bits 3, 1 and 0 of S27 respectively.

Result codes

The following table lists the possible command responses.

Code	Description
`OK`	n = 0, 1, 2, ,4, 5, 6.
`ERROR`	If n is not equal to 0, 1, 2, 4, 5, or 6.

&Rn - RTS/CTS option

Introduction

This command selects the mode for monitoring of the ready to send signal (Clear to Send - CTS) by the modem. The operation of the CTS signal is modified if hardware flow control is selected (see command &K).

Parameters

The parameters are:

Code	Description
&R0	In synchronous mode, the CTS signal follows the RTS status (request to send); the RTS-CTS delay is defined by S26. In asynchronous mode, CTS operates according to V.25 handshaking.
&R1	In synchronous mode, CTS is always active (the RTS transitions are ignored). In asynchronous mode, CTS does not become inactive unless it is imposed by flow control (default value).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&Sn - DSR Monitoring (Data Station Ready)

Introduction

This command selects the way in which the modem monitors the DSR signal (Data Station Ready). The parameter value, if valid, is written in bit 6 of S21.

Parameters

The parameters are:

Code	Description
&S0	The DSR signal is always active (default value).
&S1	The DSR signal becomes active after the detection of an answer tone and inactive after the loss of the carrier.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&V - Display of current configuration and stored profiles

Introduction

This command gives the current configuration (active), the profiles (defined by the user) and the first four stored telephone numbers.
The profiles and the stored telephone numbers are not displayed if the NVRAM memory is not installed or if it is detected as being non operational by the NVRAM test during the reset process.

Result codes

The following table lists the possible command responses.

Code	Description
OK	-

Example

The example
AT&V

```
ACTIVE PROFILE:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1
&S0 &T4 &X0 &Y0
S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002
S07:030 S08:002 S09:006S10:014 S11:255 S12:050 S18:000 S25:005
S26:001 S36:007 S37:000 S38:020 S46:138
S48:007 S95:000

PROFILE 0 STORED:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1
&S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014
S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

PROFILE 1 STORED:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1
&S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014
S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

TELEPHONE NUMBERS:
0 =      1 =
2 =      3 =
OK
```

&Wn – Storage of the current configuration

Introduction

Saves the current configuration (active profile), including the S registers, in one of the two user profiles in NVRAM memory, according to the value of the parameter. This command will result in an ERROR response if the NVRAM memory is not installed or if it is detected as being non operational by the test.
The current configuration is made up of a list of storable parameters, as illustrated by the &V command. These values are reassigned to the active configuration on receipt of a Zn command or on power-up (see &Yn command).

Parameters

The parameters are:

Code	Description
&W0	Stores the active configuration as profile 0.
&W1	Stores the active configuration as profile 1.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&Yn - Designation of a default profile on reset

Introduction

Selects the user profile to be loaded after a hardware reset.

Parameters

The parameters are:

Code	Description
&Y0	The modem uses profile 0.
&Y1	The modem uses profile 1.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 1.
ERROR	If n is not in the range 0 to 1.

&Zn – Storage of telephone numbers

Introduction

The modem can store a maximum of 20 telephone numbers. Each telephone number can be up to 45 digits.

Parameters

The parameters are:

Code	Description
&Zn = x	n = 0 to 19 (W-class) and x = number string (needs 2048 bytes of NVRAM).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 19 and x less than or equal to 45 digits.
ERROR	If n is greater than 19 or x greater than 45 digits.

%Cn - Activation / deactivation of data compression

Introduction

Activates / deactivates data compression The parameter value, if valid, is written in bits 0 and 1 of S41.

Parameters

The parameters are:

Code	Description
%C0	Deactivates data compression.
%C1	Activates MNP 5 data compression.
%E2	Activates V.42 bis data compression.
%E3	Activates V.42 bis and MNP 5 data compression.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 3.
ERROR	If n is not in the range 0 to 3.

%En - Activation/deactivation of line quality monitoring or automatic resynchronization or fallback/increase of transfer rate

Introduction

Determines whether or not the modem automatically monitors the line quality and requests resynchronization (%E1) or a fallback when the line quality is insufficient or an increase in the transfer rate when the line quality is sufficient (%E2). This only applies to switched lines. The parameter value, if valid, is written in bits 2 and 6 of S41.
The resynchronization attempt, if it is activated, lasts a maximum of 30 seconds.

Parameters

The parameters are:

Code	Description
%E0	Deactivates line quality monitoring and automatic resynchronization attempt (default value).
%E1	Activates line quality monitoring and automatic resynchronization attempt.
%E2	Activates line quality monitoring and transfer rate fallback/increase.

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 2.
ERROR	If n is not in the range 0 to 2.

%L - Level of line signal

Introduction

Sends back a value which indicates the level of signal received. The returned value is a direct indication of the level of reception at the modem data pumping device, and not at the telephone line connector.
For example, 009 = -9 dBm, 043 = -43 dBm, and so on.

Result codes

The following table lists the possible command responses.

Code	Description
0K	n = 0 to 1.

%Q - Quality of line signal

Introduction

Indicates the line quality (DAA function, network access connector). Sends back most significant byte of EQM value. Depending on the EQM value, there can be a resynchronization attempt or a fallback/increase of transfer rate, triggered by &E1 or %E23.

Result codes

The following table lists the possible command responses.

Code	Description
OK	If connected.
ERROR	If not connected or connected at 300 b/s, in V.23 or in fax mode.

Example

AT&Q
015

\Kn - BREAK control

Introduction

According to the parameter entered, controls the modem response to a break signal received from the DTE, from the remote modem or from the \B command. The value of the parameter, if valid, is written in bits 3, 4 and 5 of S40. The response is different according to the case.

Parameters of case 1

The first case is that of the modem which receives a break from the DTE when it is in data transfer mode:

Code	Description
\K0	Switches to on-line command mode, no break sent to the remote modem.
\K1	Empties the data buffers and sends a break to the remote modem.
\K2	As \K0.
\K3	Immediately sends a break to the remote modem.
\K4	As \K0.
\K5	Sends a break to the remote modem in sequence with the transmitted data (default value).

Parameters of case 2

The second case is that of the modem which is in on-line command mode (awaiting AT commands) during a connection, and which receives a \B command for it to send a break to the remote modem:

Code	Description
\K0	Empties the data buffers and sends a break to the remote modem.
\K1	Empties the data buffers and sends a break to the remote modem.
\K2	Immediately sends a break to the remote modem.
\K3	Immediately sends a break to the remote modem.
\K4	Sends a break to the remote modem in sequence with the data.
\K5	Sends a break to the remote modem in sequence with the data.

Parameters of case 3

The third case is that of the modem which receives a break from the remote modem during a connection without error correction:

Code	Description
\K0	Empties the data buffers and sends a break to the DTE.
\K1	Empties the data buffers and sends a break to the DTE.
\K2	Immediately sends a break to the DTE.
\K3	Immediately sends a break to the DTE.
\K4	Sends a break to the DTE in sequence with the received data.
\K5	Sends a break to the DTE in sequence with the received data (default value).

Result codes

The following table lists the possible command responses.

Code	Description
OK	n = 0 to 5.
ERROR	If n is not in the range 0 to 5.

\Nn - Operating mode

Introduction

This command defines the preferred error correction mode to negotiate during a subsequent connection. It is assigned by the configuration of the OEM firmware.

Parameters

The parameters are:

Code	Description
`\N0`	Selects normal mode with baud rate buffer (without error correction mode) (equivalent to &Q6).
`\N1`	Serial interface selected – selects direct mode and is equivalent to the operating mode (equivalent to &Q0). Parallel interface selected – as \N0.
`\N2`	Select reliable mode (with error correction). The modem attempts first to establish an LAPM correction then an MNP connection. If it fails, the modem hangs up (equivalent to &Q5, S36=4 and S48=7).
`\N3`	Selects automatic reliable mode. This mode is identical to \N2 mode apart from the fact that if the modem does not manage to establish a reliable connection, it falls back to normal mode (equivalent to &Q5, S36=7 and S48=7).
`\N4`	Selects LAPM error correction mode. If it fails, the modem hangs up (equivalent to &Q5, and S48=0).
`\N5`	Selects MNP error correction mode. If it fails, the modem hangs up (equivalent to &Q5, S36=4 et S48=128).

Result codes

The following table lists the possible command responses.

Code	Description
`OK`	n = 0 to 5.
`ERROR`	If n is not in the range 0 to 5.

Values of the registers of the TSX MDM 10 card in a PLC

Introduction

The default values of the TSX MDM 10 card are stored in ROM memory and loaded during power-up or by the ATZn command.

Registers

The default values are shown in the following table:

Register	Function	Values
S00	Rings to auto-answer	000
S01	Ring counter	000
S02	Escape character	043
S03	Carriage Return character	013
S04	Line Feed Character	010
S05	Backspace character	008
S06	Wait time for dial tone	005
S07	Wait time for carrier	050
S08	Pause time for dial delay modifier	002
S09	Carrier detect response time	006
S10	Carrier loss disconnect time	014
S11	DTMF tone duration	070
S12	Escape code guard time	050
S18	Test timer	000
S25	Delay to DTR off	005
S26	RTS to CTS delay	000
S36	LAPM failure control	007
S37	Line connection speed	000
S38	Delay before forced hangup	020
S46	Data compression control	136
S48	V.42 negotiation control	007
S95	Result code messages control	000

Communication via Modbus Plus

III

Introduction

Subject of this part

This part introduces the principles of configuring and communicating with Modbus Plus via PL7 software.

What's in this part?

This Part contains the following Chapters:

General

12

Introduction

Subject of Chapter

This Chapter introduces Modbus Plus communication and its services.

What's in this Chapter?

This Chapter contains the following Maps:

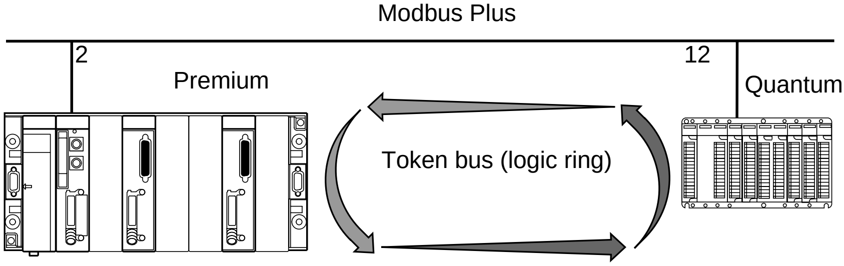
Introduction

Introduction

Modbus Plus communication is used to exchange data between all devices connected by the bus.

The Modbus Plus protocol is based on the principle of a logical token bus (Logical Token passing). Each station of one network is identified by an address between 1 and 64 and each station accesses the network after reception of a token. Duplicated addresses are not valid.

Network example



A Modbus Plus communication channel comprises three main functions:
- point to point data exchanges via the messaging service, using the Modbus protocol,
- broadcast exchanges of global data between all the stations participating in this exchange,
- multidrop exchanges of specific data via the Peer Cop services.

Associated manuals

If you require further information you should consult the following manuals:

Title	Description
Modbus Plus Network - Installation and planning manual	Detailed description of the set-up procedure for the Modbus Plus network
TSX Micro PLCs - Installation manual	Hardware installation
Premium TSX PLCs - Installation manual	Hardware installation

Compatibility

Hardware

This type of communication is available for PLCs of at least version V3.0:
- TSX Premium via the intermediary of the TSX MBP100 PCMCIA card,
- TSX Micro accepting the PCMCIA card described below.

Note: This type of communication is not available with TSX SCY 21601 modules.

TSX Premium and Micro PLCs do not support redundancy with the TSX MBP 100 card.

Software

The PCMCIA TSX MBP 100 card can process 4 communication functions at the same time.

The maximum size of the number of objects per communication function is 125 useful data words (maximum frame of 256 bytes).

In the event of communication of a TSX Premium and Micro PLC with a TSX Quantum PLC, it is necessary to shift addressing. To access a Quantum object with address n, the communication function on the Premium side must have the address n-1.

The Peer Cop service is only supported by TSX Premium PLCs.
During configuration of inputs and outputs for the Peer Cop service, it is possible to allocate up to 32 internal words to each connection point in the local bus. The total number of words must not exceed 500 internal words.

Integration into an X-WAY architecture

Introduction

A Modbus Plus segment can be integrated into an X-WAY network architecture. Communications between stations on the different networks are possible under certain conditions of use.

Communication to a Modbus Plus network

A client application connected to a FIPWAY or ETHERNET TCP/IP network can communicate with a Modbus Plus station via the Modbus protocol.
In this case, you must indicate the X-WAY network address of the TSX Premium PLC which is connected on the Modbus Plus segment as well as on the FIPWAY network, and the number of the destination Modbus Plus station.

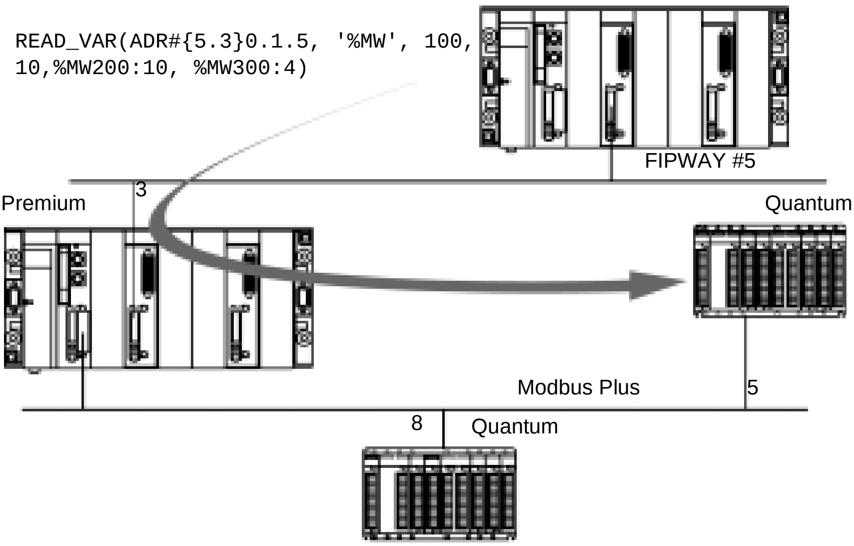
The syntax is as follows:
{network number, station number} 0.1. Modbus Plus station number

Example

In this example, the FIPWAY station {5.3} has a Modbus Plus connection and therefore, any remote FIPWAY station which wishes to communicate with a Modbus Plus station (for example station 5) must use this address.

```
READ_VAR(ADR#{5.3}0.1.5, '%MW', 100, 10,%MW200:10, %MW300:4)
```

Configuration example



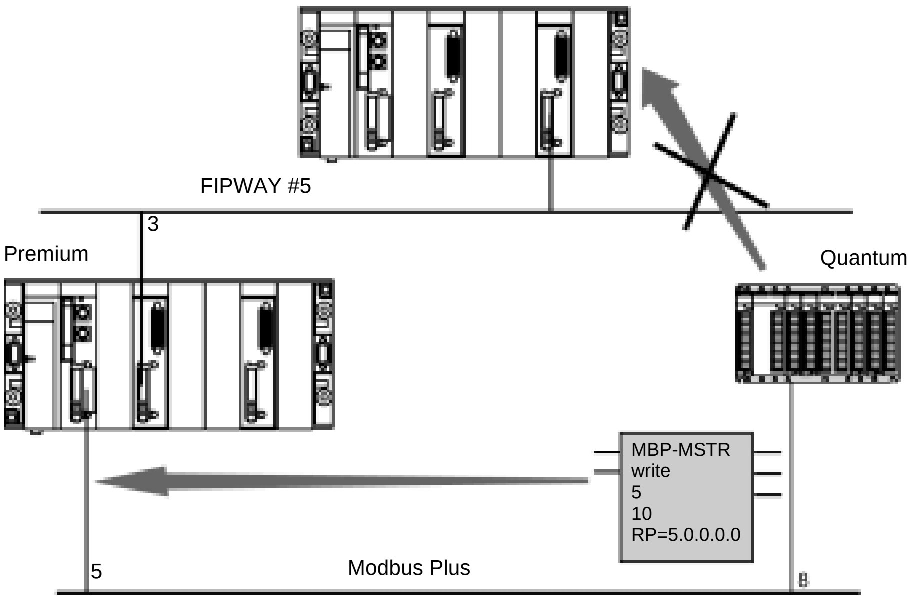
> **Note:** Routing between FIPWAY and Modbus Plus is carried out by the automatic system. In a network architecture, it is not necessary to declare a bridge station.

Communication from a Modbus Plus network

If a Modbus Plus segment is integrated into an X-WAY architecture, a Quantum station cannot communicate with stations connected to another network in this architecture (for example FIPWAY or ETHERNET TCP/IP). Communication is only possible with the local Premium.

Example

The Quantum PLC sends a write request to modify 5 words in the PL7 application (%MW10, .etc.), but it does not have access to the other stations on Fipway.



Integration into a Modbus Plus architecture

Introduction

In a Modbus Plus architecture, a TSX Quantum PLC application can communicate with a TSX Premium PLC and vice versa.

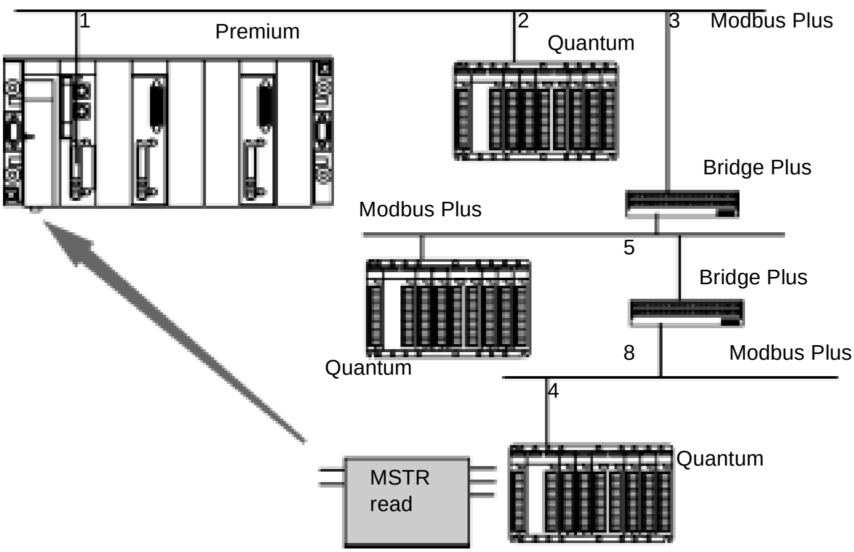
Premium to Quantum

Communication from a TSX Premium PLC to a remote station is described in the exchange service on remote networks.

Quantum to Premium

Communication from a TSX Quantum PLC to a TSX Premium PLC is available via MSTR blocks.
In this case, the TSX Premium or Micro are servers; therefore, all Modbus Plus stations connected to a network architecture, up to a maximum of 5 levels, can communicate with them.

Example



The Quantum station sends a read request to the Premium station using an address path: 8.5.1.0.0 (routing path).
The MSTR function block is used to read or write internal words of a Premium or Micro station. The parameter of the slave register of the MSTR function block directly indicates the address of the internal word %MW of the PL7 application. This function block is also used to read or reset the statistics counters of a Premium or Micro station. This request is executed directly by the PCMCIA card which responds directly.

Peer Cop service

13

Peer Cop service

Introduction

The Peer Cop service is an automatic exchange mechanism between stations connected to the same local Modbus Plus segment.
This service is used to maintain constant control over inputs / outputs which have been remoted by implicit exchanges.

The TSX Premium PLCs support two types of Peer Cop transfer.

- specific inputs,
- specific outputs.

Specific inputs and outputs

The specific inputs and outputs are point to point services which use the multicast protocol (multistations). Each message contains one or several destination addresses for sending the data. This function is used to exchange data to several stations without repetition.

Report

Three types of report are associated with the specific inputs and outputs:

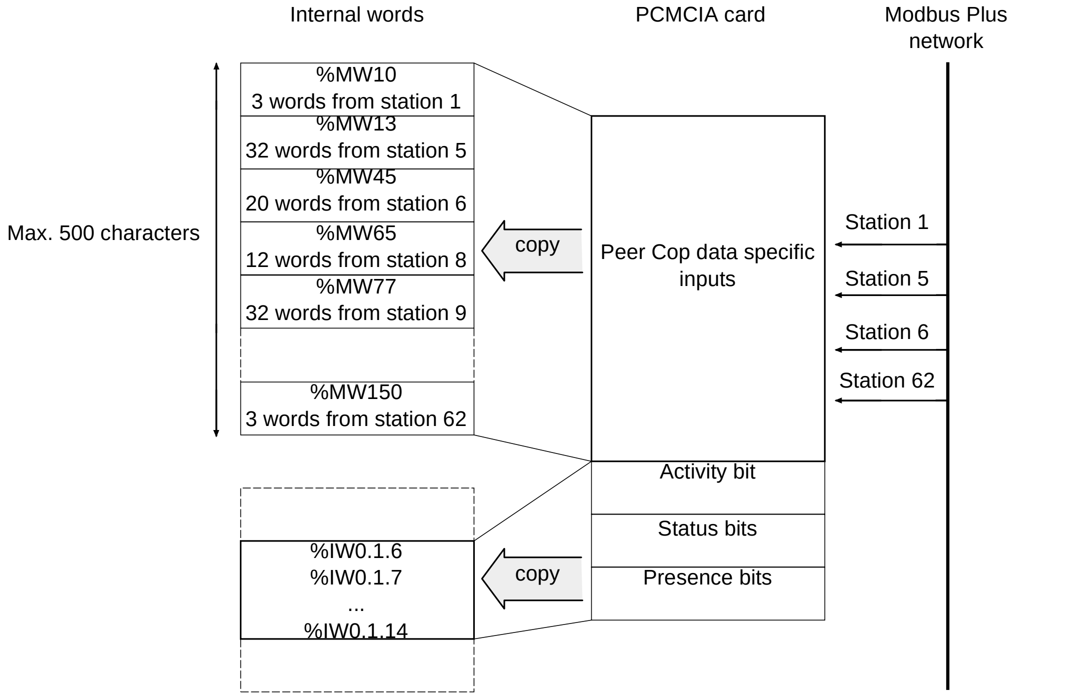
- activity bit: provides information on the availability and validity of the status bits,
- status bits (to the number of one bit per station):
  - ensure coherence between the number of specific inputs configured and the number of specific inputs received,
  - indicate if the specific inputs have been received during the Timeout,
- presence bits (to the number of one bit per station): indicate if the specific inputs have been refreshed.

Note: The presence bits are only valid for the specific inputs.

Example for the inputs

The data blocks are copied in full from the PCMCIA card to the internal word space, reserved during configuration.

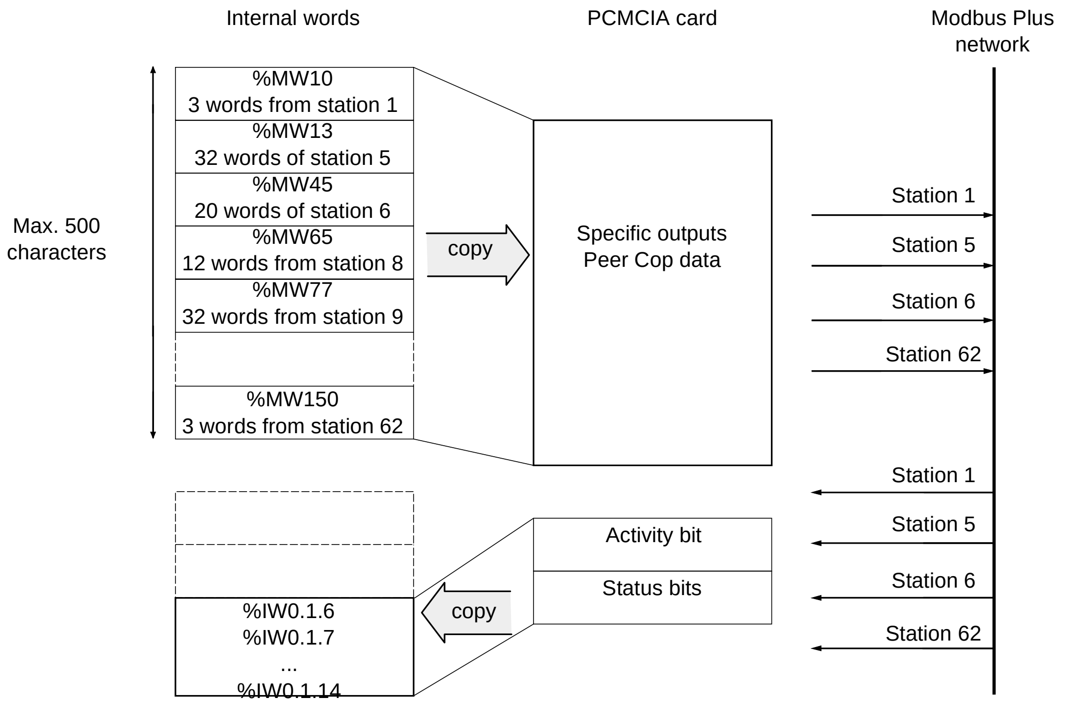
In the following example, the address of the first internal word is %MW10:



Example for the outputs

The data blocks are copied in full from the internal word space, reserved during configuration, to the PCMCIA card. The reports are copied from the PCMCIA card to the language objects.

In the following example, the address of the first internal word is %MW10:



Configuring Modbus Plus communication

14

Introduction

Subject of Chapter

This Chapter describes the Configuration process during set-up of Modbus Plus communication.

What's in this Chapter?

This Chapter contains the following Maps:

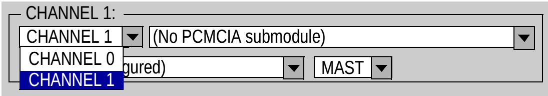
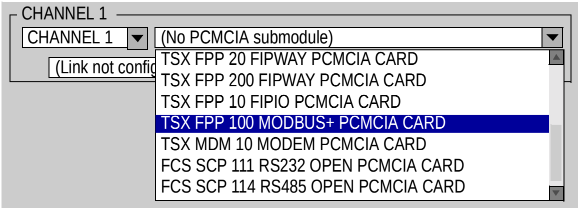
How to access the Modbus Plus PCMCIA card parameters

Introduction

This operation describes how to access the configuration parameters of the Modbus Plus link via the intermediary of the PCMCIA cards for TSX Premium PLCs.

How to access the link

The following table shows the procedure for accessing the Modbus Plus link:

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Access the communication channel configuration screen.</td></tr>
<tr><td>2</td><td>Select the communication channel from the drop-down menu CHANNEL 1
Example

</td></tr>
<tr><td>3</td><td>Select the PCMCIA card from the drop-down menu TSX MBP 100 MODBUS+ PCMCIA CARD :
Example

</td></tr>
</table>

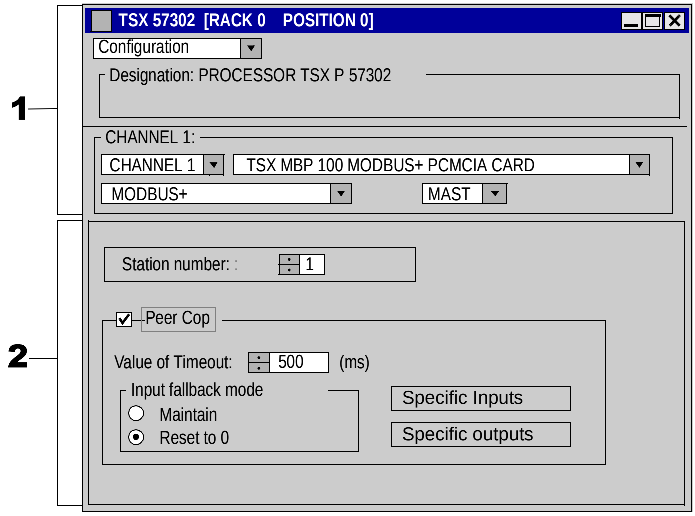
Modbus Plus configuration screen

Introduction

This screen, split into two zones, is used to declare the communication channel and to configure the parameters necessary for a Modbus Plus link.

Illustration

The screen dedicated to Modbus Plus communication looks like this:



Elements and functions

This table describes the different zones that make up the configuration screen:

Address	Zone	Function
1	common	(See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)
2	specific	is used to select or complete the parameters of a Modbus Plus link. It is split into two types of information: ● station addressing, ● the parameters concerning the Peer Cop service.

Functions accessible from Modbus Plus

Introduction

Depending on the chosen communication supports, some parameters cannot be modified. They appear grayed out.

Accessible functions

The summary table below shows the various choices possible:

Functions	TSX MPB 100
Station number	For processors of at least version V3.0
Peer Cop	For processors of at least version V3.3
Input fallback mode	Accessible if the Peer Cop box is checked
Specific inputs	Accessible if the Peer Cop box is checked
Specific outputs	Accessible if the Peer Cop box is checked

Modbus Plus configuration parameters

Introduction

Once the communication channel has been configured, complete the parameters dedicated to the Modbus Plus link.

They are split into two windows:
- the **Station number** window,
- the **Peer Cop** window,

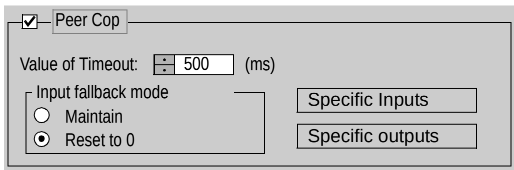
Addressing parameter

The window looks like this:

This parameter is used to define the address (or connection point) of the station on the Modbus Plus network.

Peer Cop parameters

The window is only accessible by checking the box **Peer Cop**:



It can be used to:
- complete the **Timeout value**: Input refresh time in milliseconds. It is used to specify the maximum time during which the inputs from remote stations must be updated in the PCMCIA card. In the event that data is not refreshed within the time allowed, an error is detected.
  - the default value is 20 ms,
  - the values range from 20 ms to 2 s,
  - the increment is 20 ms.
- define the **Input Fallback mode**:
  - maintained,
  - cleared.
- access the values of the **specific inputs** and **specific outputs**. Peer Cop service, p. 187

Configuring the specific inputs and outputs

Introduction

If you have checked the box **Peer Cop**, you must specify the start address and the size of the data to be exchanged.

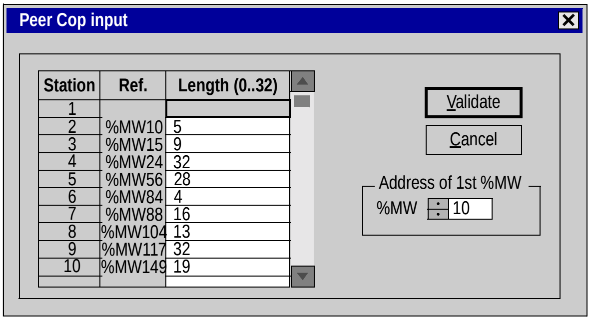
These data are stored in the internal words of the application. Peer Cop service, p. 187

Configuration rules

The input words zone cannot be superimposed on the output words zone.
The internal words corresponding to the specific inputs or outputs are stored continuously.
The maximum size of the specific data must not exceed 1000 words (max. 500 words for the inputs and max. 500 words for the outputs).

Specific inputs

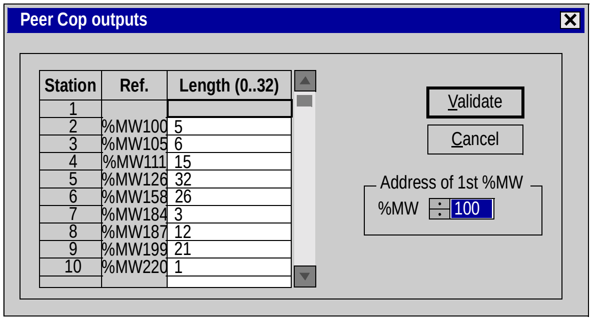
After selection of the button **Specific inputs**, the following window will appear:



For each connection point of the local bus segment, the user must define:
- the start address in the table of internal words (%MW),
- The size of the exchanges from 0 to 32 words per station on the local bus segment.

Specific outputs

After selection of the button **Specific outputs**, the following window will appear:



For each connection point of the local bus segment, the user must define:

- the start address in the table of internal words (%MW),
- The size of the exchanges from 0 to 32 words per station on the local bus segment.

Programming Modbus Plus communication

15

Introduction

Subject of Chapter

This Chapter describes the Programming process during set-up of Modbus Plus communication.

What's in this Chapter?

This Chapter contains the following Maps:

Read and write service on local segment

Introduction

A TSX Micro or Premium PLC can exchange data with stations connected to the local Modbus Plus network.

Data exchanges

The functions `READ_VAR` and `WRITE_VAR` are used to access remote stations on the same local segment, bits, internal words or input and output words in read / write mode.
These exchanges are explicit exchanges managed by the application.

The addressing from a TSX Premium station will be for example:
- in read mode
  `READ_VAR (ADR#0.1.10, '%MW', 10, 20, %MW10:20, %MW100:4)`
- in write mode
  `WRITE_VAR (ADR#0.1.10, '%MW', 10, 20, %MW10:20, %MW100:4)`

The following table describes the different parameters of the function:

Parameter	Description
ADR#0.1.10	Address of destination device for the message: ● processor slot: 0 or 1 ● PCMCIA channel: 1 ● destination station number: 10
'%MW'	Type of object to be read or written, for example: internal words
10	Address of first word to be read or written
20	Number of words to be read or written
%MW10:20	For reading: content of response For writing: value of words to be written
%MW100:4	Activity bit, exchange report, length

Correspondence of object type

The tables describe the correspondence of object types between the TSX Premium and TSX Quantum PLCs.

The TSX Premium PLC is the sender of the request and the TSX Quantum PLC replies:

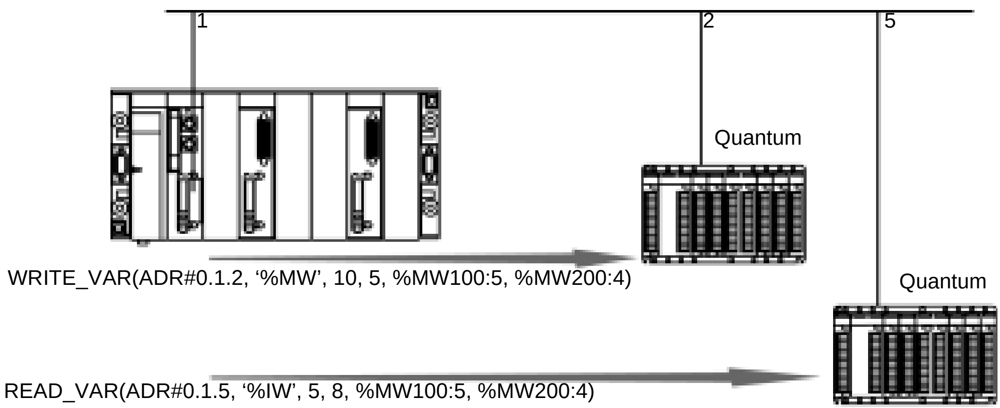
`READ_VAR` or `WRITE_VAR` function	Type of PL7 object	Responding Quantum object
'%MW'	internal words	4x... memory area
'%M'	internal bits	0x... memory area
'%IW'	input words	3x... memory area
'%I'	input bits	1x... memory area

The TSX Quantum PLC is the sender via an MSTR function block and the TSX Premium PLC replies:

MSTR function block	Responding Premium object
READ	%MW
WRITE	%MW

Example

The TSX Premium PLC application writes 10 internal words in the TSX Quantum PLC at address 2 and reads 5 input words in the TSX Quantum PLC at address 5:



The internal words to be written in station 2 are at address 10.
The internal words to be read in station 5 are at address 5.

Exchange service on remote Modbus Plus networks

Introduction

A TSX Micro or Premium PLC can exchange data with stations connected to other Modbus Plus segments via BP85 Bridge Plus bridges.

Access to a remote station.

To access a station connected to another network segment, it is necessary to indicate the full address path (routing path) in the information sent.
Beforehand, indicate, in the request, the address of the first destination connection point on the local bus.
Next, clarify, in the data to be sent, each address of the devices which will allow the passage of the exchanges to the destination station.

Data exchanges

This type of exchange is accessible via the function `SEND_REQ`. To differentiate the reading and writing of data from a remote station, a request code is associated to the function `SEND_REQ`. These exchanges are explicit exchanges managed by the application.

The addressing from a TSX Premium station will be for example:
- in read mode
  `SEND_REQ (ADR#0.1.61, 16#36, %MW300:50, %MW450:150, %MW600:4)`
- in write mode
  `SEND_REQ (ADR#0.1.61, 16#37, %MW300:50, %MW450:150, %MW600:4)`

The following table describes the different parameters of the function:

Parameters	Description
ADR#0.1.61	Address of destination device for the message: • processor slot: 0 or 1 • PCMCIA channel: 1 • number of the destination connection point on the local bus: 61
16#36 16#37	Request code for reading objects Request code for writing objects
%MW300:50	Address path, length, data to be sent
%MW450:150	Address, length of data to be received
%MW600:4	Activity bit, exchange report, length

Data coding

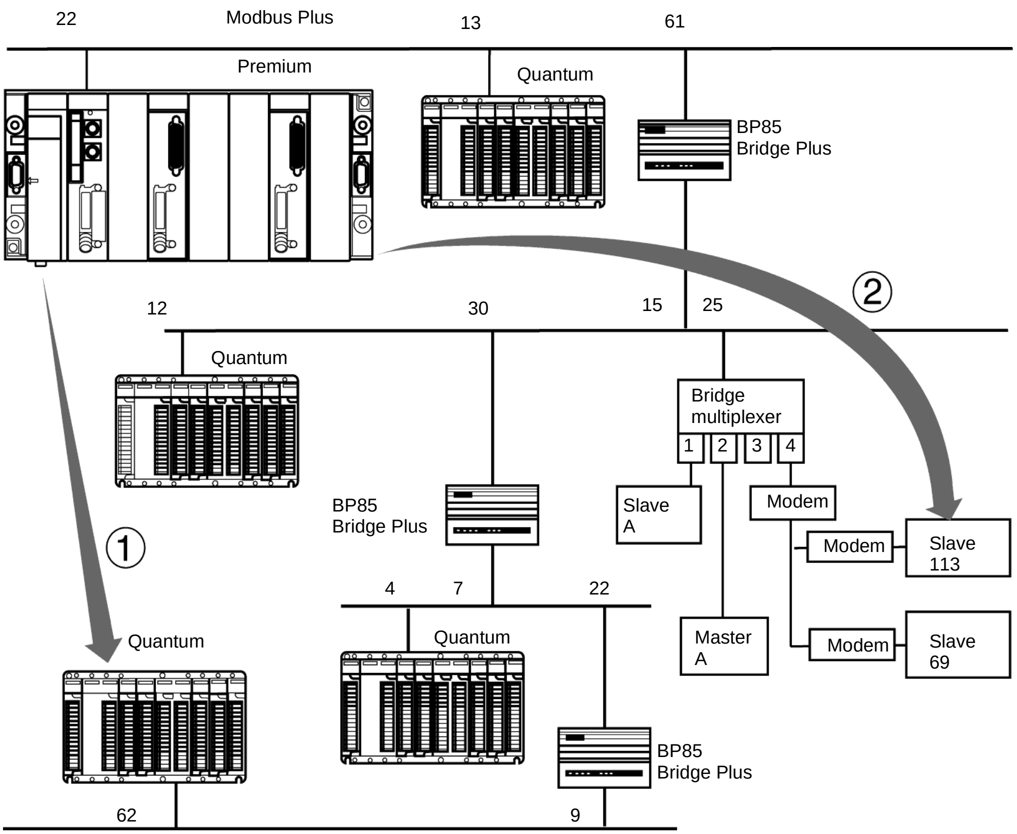
The data of read / write requests are encoded in internal words, to be sent in the following way:

%MW300		%MW301		%MW302		%MW303	%MW304	%MW306 to %MW349
Third address	Second address	Fifth address	Fourth address	Type	Segment	Address of first word	Size of data	Data

Examples of Exchanges on Offset Networks

At a Glance

The following illustration shows the two types, which are processed subsequently:



Example 1

Reading 120 internal words to address 80 of the Quantum station at the local address of 62 using a TSX Premium requires:

- the routing path to access the Quantum station: 61, 30, 22, 62, 0.
- the reading request code: 16#36.
- the actual size of data to be transferred (memorized in %MW603): 10 bytes.

```
SEND_REQ(ADR#0.1.61, 16#36, %MW300:5, %MW450:120, %MW600:4)
```

Coding of the data to be transferred:

Parameters	**Values**	**Description**
%MW300	0x161E	Second and third changeover addresses (30, 22)
%MW301	0x003E	Fourth and fifth changeover addresses (62, 0)
%MW302	0x0768	Segment 104 and type 7 (depends on the type of variable to be read or written)
%MW303	80	Address of the first internal word to be read in the Quantum station
%MW304	120	Size of data to be read (in words)
No data		

Note: After the execution of the SEND_REQ function, it is necessary to reclassify the bytes in the correct order.

Example 2

Writing 50 internal words to address 560 of slave 113 connected to port 4 on the multiplexer bridge using a TSX Premium requires:

- the routing path to access the slave: 61, 25, 4, 113, 0.
- the reading request code: 16#37.
- the actual size of data to be transferred (memorized in %MW603): 110 bytes.
- the values of the data to be written (memorized in %MX306 to %MW354).
- the response (memorized in %MW450:1): does not contain any data to be received, but should have a minimum length of a word.

```
SEND_REQ(ADR#0.1.61, 16#36, %MW300:5, %MW450:120, %MW600:4)
```

Coding of the data to be transferred:

Parameters	**Values**	**Description**
%MW300	0x0419	Second and third changeover addresses (25, 4)
%MW301	0x0071	Fourth and fifth changeover addresses (113, 0)
%MW302	0x0768	Segment 104 and type 7 (depends on the type of variable to be read or written)
%MW303	560	Address of the first internal word to be written in the Quantum station
%MW304	50	Size of the data to be written (in words)
%MW305 to %MW354		Data to be written
%MW603	110	Actual size of the data to be transmitted with this function (in bytes)

diagnostic service

Introduction

A TSX Micro or Premium PLC can read or reset local or remote default counters on a local Modbus Plus network.

Data exchanges

This type of exchange is accessible via the function `SEND_REQ`. To differentiate the reading and writing of data from a remote station, a request code is associated to the function `SEND_REQ`.

The addressing from a TSX Premium station will be for example:
- Reading counters
  `SEND_REQ (ADR#0.1.5, 16#A2, %MW100:1, %MW200:20, %MW300:4)`
- resetting counters
  `SEND_REQ (ADR#0.1.5, 16#A4, %MW100:1, %MW200:1, %MW300:4)`

The following table describes the different parameters of the function:

Parameters	Description
ADR#0.1.5	Address of destination device for the message: ● processor slot: 0 or 1 ● PCMCIA channel: 1 ● number of the destination connection point on the local bus: 5
16#A2 16#A4	Request code for reading counters Request code for resetting counters
%MW100:1	No data to send
%MW200:20 %MW200:1	No response on reception Content of error counters
%MW300:4	Activity bit, exchange report, length

Note: The length parameter in the report words is initialized at 0 before the request is sent.

Counter list

The following table shows the counters.

Number of the counter	Meaning
1	Retransmit deferral error counter
2	Receive buffer DMA overrun error counter
3	Repeated command received counter
4	Frame size error counter
5	Receiver collision abort error counter
6	Receiver alignment error counter
7	Receiver CRC error counter
8	Bad-packet-length error counter
9	Bad link address error counter
10	Transmit buffer DMA underrun error counter
11	Bad internal packet length error counter
12	Bad mac function code error counter
13	Communication retry counter
14	Communication failed error counter
15	Good receive packet success counter
16	No response received error counter
17	Exception response received error counter
18	Unexpected path error counter
19	Unexpected response error counter
20	Forgotten transaction error counter

Global data exchange service

Introduction

The global data exchange service is a simple exchange mechanism which is used to send broadcast messages between stations connected on the same Modbus Plus network.

During an exchange, a station which has the token can broadcast words destined for other stations connected on the network. A receiving station takes the content of words transmitted by the sending station, stores them in its PCMCIA card and sends them back to the network. The same applies to each station when the token is passed.

> **Note:** Data transfer from one station to another is automatic.

To read the global data which is sent, the application of the receiving station must read its PCMCIA card.

Precautions for use

For TSX Premium and Micro PLCs, this service is provided by particular communication functions (`WRITE_GDATA` and `READ_GDATA`) periodically taken on by the application. It is not integrated in the Peer Cop transactions.

A TSX Premium or TSX Micro PLC can broadcast a maximum of 32 words.

Writing global data

This type of exchange is accessible via the function `WRITE_GDATA`.

The addressing from a TSX Premium station will be for example:
`WRITE_GDATA (ADR#0.1.SYS, %MW100:x, %MW200:4)`

The following table describes the different parameters of the function:

Parameters	Description
ADR#0.1.SYS	Broadcast address: • processor slot: 0 or 1 • PCMCIA channel: 1 • system channel: transmission for all the stations on the network
%MW100:x	Content of the global data to be transmitted (x = 1 to 32 words)
%MW200:4	Activity bit, exchange report, length

Reading global data

This type of exchange is accessible via the function `READ_GDATA`.

The addressing from a TSX Premium station will be for example:
`READ_GDATA (ADR#0.1.10, %MW30:32, %MW300:4)`

The following table describes the different parameters of the function:

Parameters	Description
ADR#0.1.10	Address of device sending the message: ● processor slot: 0 or 1 ● PCMCIA channel: 1 ● number of station sending data: 10
%MW30:32	Content of global data
%MW300:4	Activity bit, exchange report, length

Note: The length of the global data actually read is contained in the activity report length word (e.g.: %MW304). One length = 0 means that there is no new global data available in the station specified in the request.

Debugging Modbus Plus communication

16

Introduction

Subject of Chapter

This Chapter describes the Debugging process during set-up of Modbus Plus communication.

What's in this Chapter?

This Chapter contains the following Maps:

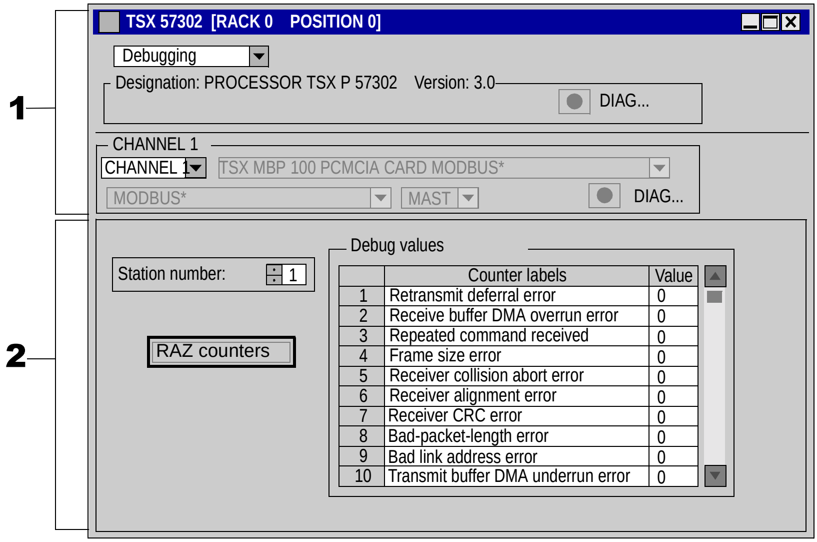
Modbus Plus debugging screen

Introduction

This screen, split into two zones, is used to declare the communication channel and to access the debugging parameters for a Modbus Plus link.

Illustration

The screen dedicated to Modbus Plus communication looks like this:



Elements and functions

This table describes the different zones that make up the configuration screen:

Address	Zone	Function
1	common	(See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)
2	specific	is used to access the debugging parameters of a Modbus Plus link.

Modbus Plus debugging screen

Introduction

The specific part is split into two windows:
- the **Station numbering** window,
- the **Debugging value** window.

Station numbering

The window, identical to that in configuration, is used to select:
- either the local station,
- or the remote station.

Debugging value

The window looks like this:

Debug values

	Counter labels	Value
1	Retransmit deferral error	0
2	Receive buffer DMA overrun error	0
3	Repeated command received	0
4	Frame size error	0
5	Receiver collision abort error	0
6	Receiver alignment error	0
7	Receiver CRC error	0
8	Bad-packet-length error	0
9	Bad link address error	0
10	Transmit buffer DMA underrun error	0

This window displays the different fault counters of a station connected to the Modbus Plus network.

By default, the screen proposes the default counters of the local station. It is possible to view the fault counters of a local station or of a remote station.

Note: To access the fault counters of a remote station, you must first select the number of the remote station.

the **Reset Counters** button resets the counters.

Language objects associated with Modbus Plus communication

17

Introduction

Subject of this section

This Chapter introduces the language objects associated with Modbus Plus communication.

What's in this Chapter?

This Chapter contains the following Maps:

Implicit Exchange Language Object

At a Glance

This page describes all implicit exchange language objects for Modbus Plus communication, which can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Bit Objects

The table below shows the different implicit exchange bit objects.

Object (1)	**Function**	**Meaning**
%Ixy.MOD.ERR	Error bit module	When this bit is at 1, it indicates a module fault (at least one of the paths is faulty, etc.)
%Ixy.i.ERR	Error bit path	When this bit is at 1, it indicates a line fault.
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the path number	

Word Objects

The table below shows the different implicit exchange word objects.

Object (1)	Function	Meaning
%IWxy.i.0	Requests	Status of communication paths Byte 0: number of communication functions processed simultaneously in client mode • x0 = 1: communication function 1 • x0 = 1: communication function 2 • x2 = 1: communication function 3 • x3 = 1: communication function 4 Byte 1: number of communication functions processed simultaneously in server mode • x8 = 1: communication function 1 • x9 = 1: communication function 2 • x10 = 1: communication function 3 • x11 = 1: communication function 4
%IWxy.i.1	reserved	-
%IWxy.i.2 to %IWxy.i.5	Stations present	A bit at 1 indicates the presence of a station (01 to 64).
%IWxy.i.6	Status bit availability	Byte 0: the specific inputs of all remote stations are available • x0 = 0: the specific inputs are not available • x0 = 1: the specific inputs are available • x1 to x7: reserved
	Status of the specific inputs	Byte 1: a bit at 1 indicates the presence of a station that is transmitting specific inputs. Stations 1 to 8.
%IWxy.i.7 to %IWxy.i.9	Status of the specific inputs	A bit at 1 indicates the presence of a station that is transmitting specific inputs. Stations 9 to 56.
%IWxy.i.10	Status of the specific inputs	Byte 0: a bit at 1 indicates the presence of a station that is transmitting specific inputs. Stations 57 to 64.
	New presence of specific inputs	Byte 1: a bit at 1 indicates the presence of new specific inputs. Stations 1 to 8.
%IWxy.i.11 à %IWxy.i.13	New presence of specific inputs	A bit at 1 indicates the presence of new specific inputs. Stations 9 to 56.
%IWxy.i.14	New presence of specific inputs	Byte 0: a bit at 1 indicates the presence of new specific inputs. Stations 57 to 64. Byte 1: not used

Object (1)	Function	Meaning
%IWxy.i.15	Status bit availability	Byte 0: the specific outputs are available for all remote stations • x0 = 0: the specific outputs are not available • x0 = 1: the specific outputs are available • x1 to x7: reserved
	Status of the specific outputs	Byte 1: a bit at 1 indicates the presence of a station that is receiving specific outputs. Stations 1 to 8.
%IWxy.i.16 à %IWxy.i.18	Status of the specific inputs	A bit at 1 indicates the presence of a station that is receiving specific outputs. Stations 9 to 56.
%IWxy.i.19	Status of the specific inputs	Byte 0: a bit at 1 indicates the presence of a station that is receiving specific outputs. Stations 57 to 64. Byte 1: not used
Key		
(1)	xy.i address • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the path number	

Explicit exchange language object

Introduction

This page describes all the language objects for explicit exchange in Modbus Plus communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for explicit exchange.

Object (1)	Function	Meaning
%MWxy.MOD.2	Module status	• x0 = 1: defective module • x1 = 1: functional error (error between the processor and the module, adjustment or configuration error, …) • x2 = 1: terminal block fault (not connected) • x3 = 1: self-tests running • x4 = 1: reserved • x5 = 1: error in hardware or software configuration (the module present is not the one declared in the configuration, the sub-modules are not compatible) • x6 = 1: module missing • x7 = 1: error in one of the sub-modules
%MWxy.i.2	Standard channel status	• x0 = 1: only station on the network • x1 = 1: not used • x2 = 1: transmission line error • x3 = 1: not used • x4 = 1: internal software fault • x5 = 1: hardware or software error or no configuration • x6 = 1: processor communication error • x7 = 1: application fault (double station address)
%MWxy.i.3	Specific channel status Status of link layer	Byte 0 • = 0: initialization phase • = 3: awaiting token phase • = 4..10: normal status
%MWxy.i.4	Specific channel status Peer Cop	Byte 0 • = 0: station being tested • = 32: normal status • = 64: no token • = 96: only station (idem x0 of %MWxy.i.2) • = 128: two stations have the same number (idem x7 of %MWxy.i.2)

Object (1)	Function	Meaning
Key		
(1)	Address xy.i ● x: corresponds to the rack number ● y: corresponds to the module number ● i: corresponds to the channel number	

Explicit exchange management and report

Introduction

This page describes all the language objects that manage explicit exchanges. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for the management of explicit exchanges.

Object (1)	**Function**	**Meaning**
%MWxy.MOD.0	Module exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication module • x2 = 1: sending of adjustment parameters to the communication module
%MWxy.MOD.1	Module report	• x1 = 0: command parameters received and accepted by the module • x2 = 0: adjustment parameters received and accepted by the module
%MWxy.i.0	Channel exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication channel • x2 = 1: sending of adjustment parameters to the communication channel
%MWxy.i.1	Channel report	• x1 = 0: command parameters received and accepted by the communication channel • x2 = 0: adjustment parameters received and accepted by the communication channel
Key		
(1)	Address xy.i • x: corresponds to the rack number • y: corresponds to the module number • i: corresponds to the channel number	

Language objects associated with configuration

Introduction

This page describes all the configuration language objects in Modbus Plus communication that can be displayed by the application program.

Internal constants

The following table describes the internal constants:

Object	Function	Meaning
%KWxy.i.0	Type	Byte 0 = 14 for Modbus PLUS communication
%KWxy.i.1	Station Address	Byte 0: station address
%KWxy.i.2	Peer Cop	Byte 0 = 1: no Peer Cop service Byte 0 = 2: Peer Cop service
	Timeout behavior	Byte 1 = 1: cleared inputs Byte 1 = 2: inputs maintained at the last value
%KWxy.i.3	Destination address for specific inputs	Address of first internal word %MW used for receiving specific inputs
%KWxy.i.4	Source address of specific outputs	Address of first internal word %MW used for sending specific outputs
%KWxy.i.5	Size of specific outputs for nodes 1 and 2	Number of specific output words to be sent to connection point 1 and 2 • byte 0: connection point 1 • byte 1: connection point 2
%KWxy.i.6	Size of specific outputs for nodes 3 and 4	Number of specific output words to be sent to connection points 3 and 4 • byte 0: connection point 3 • byte 1: connection point 4
...	...	...
%KWxy.i.36	Size of specific outputs for nodes 63 and 64	Number of specific output words to be sent to connection points 63 and 64 • byte 0: connection point 63 • byte 1: connection point 64
%KWxy.i.37	Size of specific inputs for nodes 1 and 2	Number of specific input words to be received by connection points 1 and 2 • byte 0: connection point 1 • byte 1: connection point 2
%KWxy.i.38	Size of specific inputs for nodes 3 and 4	Number of specific input words to be received by connection points 3 and 4 • byte 0: connection point 3 • byte 1: connection point 4
...	...	...

Object	Function	Meaning
%KWxy.i.68	Size of specific inputs for nodes 63 and 64	Number of specific input words to be received by connection points 63 and 64 ● byte 0: connection point 63 ● byte 1: connection point 64
%KWxy.i.69	Timeout of Peer Cop service	Time interval of Timeout ● byte 0 = 1 to 100: from 20 ms to 2 s

Communication via FIPIO bus

IV

Introduction

Subject of this part

This part introduces the principles of configuring and using FIPIO bus communication via PL7 software.

What's in this part?

This Part contains the following Chapters:

Communication via FIPIO bus

18

Introduction

Subject of this Chapter

This Chapter introduces communication via the FIPIO bus and its services.

What's in this Chapter?

This Chapter contains the following Sections:

18.1 Introduction to FIPIO communication

Introduction

Subject of Section

This Section provides a summary description of the FIPIO bus and its associated services.

What's in this Section?

This Section contains the following Maps:

Introduction

Introduction

Communication via FIPIO is part of Schneider Automation's global WORLDFIP package.

FIPIO is a field bus used to delocalize the inputs/outputs of a PLC station and its industrial periphery to be as close as possible to the working part.

The FIPIO protocol uses producer/consumer exchanges (e.g.: common words) and the bus is managed via a bus arbiter.

Associated manuals

If you require further information you should consult the following manuals:

Title	Description
FIPIO bus - Reference manual	Detailed description of the FIPWAY bus and hardware installation
TSX Micro PLCs - Installation manual	Hardware installation
Premium TSX PLCs - Installation manual	Hardware installation

Note: Refer to the separate documentation pertaining to each device connected to the FIPIO bus for details on their installation.

Addressing of language objects for modules remoted on the FIPIO bus

Presentation

Addressing for the main bit and word objects for modules remoted on the FIPIO bus is geographical. This means that it depends on:
- the connection point,
- the module type (base or extension),
- the channel number.

Illustration

Addressing is defined as follows:

%	I, Q, M, K	X, W, D, F	\	p.2.c	\	m	.	i	.	r
Symbol	Object type	Format		Module/channel address and connection point		Module number		Channel number		Rank

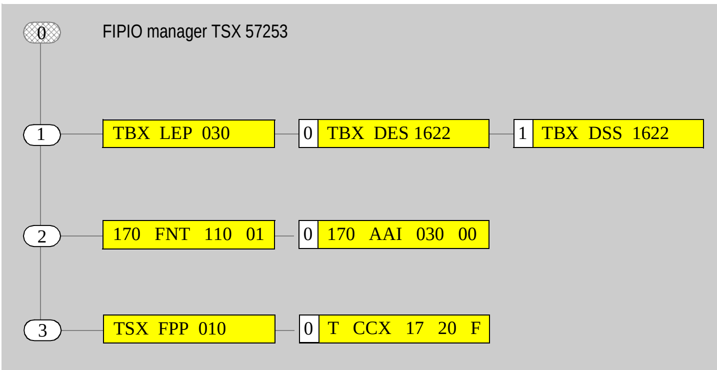
Syntax The table below shows the different elements which constitute addressing.

Family	Element	Values	Meaning
Symbol	%	-	-
Object type	I Q	- -	Image of the module's physical input, Image of the module's physical output, This information is exchanged automatically on each cycle of the task to which it is connected.
	M	-	Internal variable This read or write information is exchanged at the request of the application.
	K	-	Internal constant This configuration information is only accessible in read-only.
Format (size)	X	-	Boolean For boolean-type objects, the X may be omitted.
	W	16 bits	Single length.
	D	32 bits	Double length
	F	32 bits	Floating. The floating format used is that of IEEE standard 754-1985 (equivalent IEC 559).
Module/channel address and connection point	p	0 or 1	Number of the processor's position in the rack.
	2	-	Channel number of the processor's built-in FIPIO link.
	c	1 to 127	Number of the connection point.
Module position	m	0 or 1	0 : base module, 1: extension module.
Channel no.	i	0 to 127 or MOD	MOD: channel reserved for management of the module and the parameters shared by all channels.
Position	r	0 to 255 or ERR	ERR: indicates a module or channel fault.

Examples

The table below gives some examples of object addressing.

Object	Meaning
%MW\0.2.1\0.5.2	Position 2 status word for the image bit of input 5 of the remote input base module located at connection point 1 of the FIPIO bus.
%I\0.2.1\0.7	image bit of input 7 of the remote input base module located at connection point 1 of the FIPIO bus.
%Q\0.2.1\1.2	image bit of output 2 of the remote output extension module located at connection point 1 of the FIPIO bus.
%I\0.2.2\0.MOD.ERR	Fault information for the Momentum module located at connection point 2 of the FIPIO bus.
%Q\1.2.3\0.0.ERR	Fault information for channel 0 of module CCX17 located at connection point 3 of the FIPIO bus.



18.2 Characteristics

Introduction

Subject of Section

This Section introduces the characteristics and constraints of using FIPIO communication.

What's in this Section?

This Section contains the following Maps:

Hardware compatibility relating to the bus manager

General

The binary flow of the bus is 1 Mbits/s and it can extend to a length of up to 15 Km, with four optical or electric repeaters (TSX FP ACC 6).

The FIPIO bus links up to Hirshmann optical transmitters, which allows medium redundancy architectures to be created.

Availability

This type of communication is available via built-in links on TSX Premium PLCs from version V3.0 onwards.

The PLCs with built-in FIPIO links are the following:
- TSX type processors:
  - TSX 57153,
  - TSX 57252, TSX 57253,
  - TSX 57352, TSX 57353,
  - TSX 57452, TSX 57453.
- PMX type processors:
  - PMX 57352,
  - PMX 57452.
- PCX type processors:
  - PCX573512, PCX57353.

The bus manager can also be a PLC of the following type:
- TSX 47-107 version 5.3 minimum,
- S1000.

Capacity

Processors with built-in FIPIO links are used to manage 128 connection points (TSX P57 153 = 64) on the bus (addresses 0 to 127).
The bus manager is connected to address 0, and address 63 is reserved for the programming and diagnostics terminal.

These processors have a RAM memory for saving the configurations of devices connected to the bus. This memory has a maximum capacity of 93,320 bytes.

Software compatibility relating to the bus manager

Explicit exchange limits

Processors with a built-in FIPIO link can simultaneously activate 24 explicit exchange functions.

An exchange request addressed to a FIPIO device can take several MAST task cycles. Thus, it is absolutely necessary to manage the exchange management parameter words for all exchanges of explicit variables including `READ_STS %CH@channel` and `READ_STS %CH@MOD`.

For example, if 24 functions are being processed simultaneously or if 25 functions are triggered in the same task cycle, the 25th, or any new function, will not be served and will terminate in error.

For a `READ_STS` exchange, if the twenty-fifth exchange is impossible, the report signals a communication fault in the word: %MW\p.2.c\m.v.2.

For `WRITE_CMD`, `READ_PARAM`, `WRITE_PARAM`, `RESTORE_PARAM` exchanges, the report signals a communication fault in the word %MW\p.2.c\m.v.1. A likely cause is a lack of system resources to provide the service.

Reminders

The system word %SW155 contains the number of explicit exchanges in progress. Bit %SW116: x2 switches to 1 if the maximum number of simultaneous explicit exchanges is reached or exceeded.

X-TEL software

When the bus manager is a series 7 PLC (TSX 47-107), the configuration of the bus and the manager is performed by the X-TEL software workbench, of version 6.0 or later.

Software compatibility: Network transparency

Introduction

Exchanges from a remote station to the FIPIO bus or vice versa are possible under certain conditions.

Transparency restrictions

Inter-station communication with FIPIO is only available if the bus arbiter is a TSX Premium PLC, of at least version V3.3.

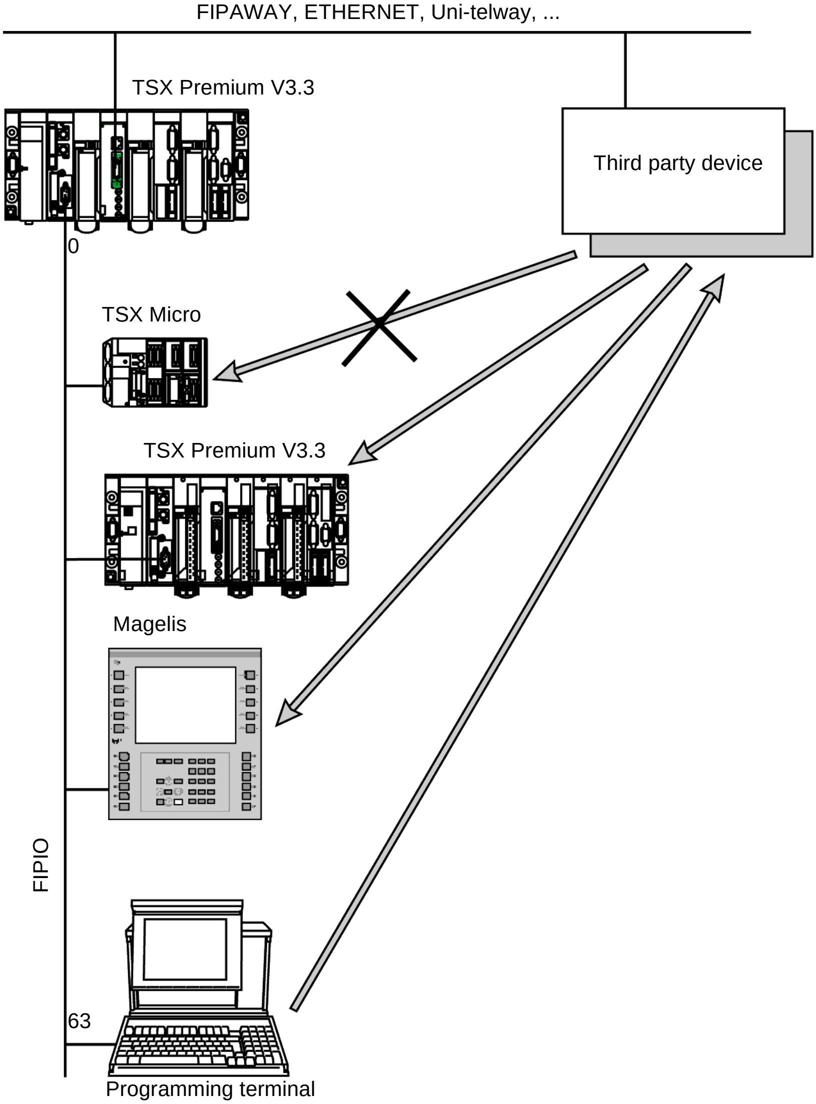
Exchanges from a third-party device to a PLC connected as a FIPIO slave are only possible if the PLC is a TSX Premium of V3.3 at least. Communication with a TSX Micro PLC is not possible.

A FIPIO agent does not communicate with the exterior.

Only one programming terminal can be connected to the FIPIO bus. If it is present in the configuration, it must be connected to the default connection port (63).
This programming terminal cannot be used to load the application onto the FIPIO bus arbiter.

Illustration

The following illustration shows the different exchanges possible between a FIPIO bus and a network or another bus.



Software compatibility: communication with the exterior

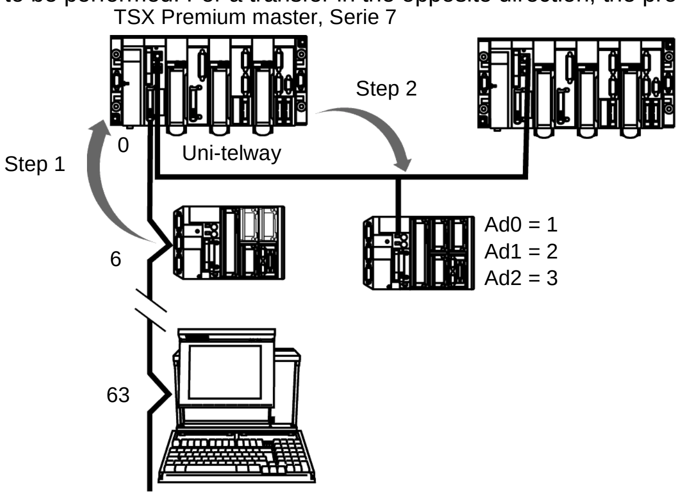
Introduction

To communicate from a station connected to the FIPIO bus to an outside device, the transmitter station must address the master PLC and not the destination device (requests are not routed directly).

Note: The master PLC application transfers these requests to the destination device.

Example

In the following example, an exchange from the FIPIO bus to the Uni-telway bus has to be performed. For a transfer in the opposite direction, the procedure is identical.



Step 1

The transmitter station, connected to connection port 6 on FIPIO, sends the request to the master PLC. The destination address is the master PLC address.

```
WRITE_VAR (ADR#\6.1.0\SYS, %MW,0,10, %MW:10, %MW100:4)
```

The master PLC generates the report.

Step 2

When the master PLC application receives the request from the transmitter station, it directs it to the destination device in accordance with the Uni-telway protocol.

```
WRITE_VAR (ADR#0.0.1, '%MW', 100, 10, %MW10:10, %MW40:4)
```

The report is sent to the master PLC.

Compatibility information relating to TBX devices

Introduction

The following compatibility information relates to:
- the addressing supported by the different connectable devices,
- the memory space that the devices take up in the configuration RAM.

Rules of use

If a device linked to a connection port is modular, it must be homogeneous at an application-specific level. Discrete base and extension or analog base and extension (not a mixture of discrete and analog).

The device is only controlled by one PL7 task (FAST or MAST) (no assigning of channel groups of the same TBX to different tasks).

Addressing

The FIPIO addressing depends on the type of device:

Types of device	FIPIO addresses	Comments
Compact TBXs	1...31	TBX C•
Sealed TBXs	1...62, 64...127	TBX E•
Modular TBXs	1...62, 64...127	TBX LEP 020, TBX LEP 030
TBX SAP 10	1...62, 64...127	AS-i gateway

Maximum configuration

The number of modules of the same reference connected to the FIPIO bus in a configuration is limited. The values in the table below are expressed in bytes.

Module	**Base**	**Extension**	**Maximum number of connection points**		
			TSX P57 153	TSX P57 253/353	TSX P57 453
AES 200, ASS 400	1332	272	For 2 or 4 channels		
			62	70	125
AMS 620	1332	528	For 8 channels		
			59	59	126
			For 10 or 12 channels		
			50	50	114
CEP 1622, CSP 1622, CSP 1625	1152	-	31	31	31
DES •••, DMS •••, DSS •••	1152	144	62	81	126
SAP 10	1088	-	52	52	117

Compatibility information relating to Momentum devices

Introduction

The following compatibility information relates to:
- the addressing supported by the different connectable devices,
- the memory space that the devices take up in the configuration RAM.

Rules of use

installing Momentum devices on FIPIO is only possible with the communication module: 170 FNT 110 01.

Addressing

A Momentum device can have addresses from 1 to 62 or 64 to 127.

Maximum configuration

The number of modules of the same reference connected to the FIPIO bus in a configuration is limited. The values in the table below are expressed in bytes.

Module	**Base**	**Extension**	**Maximum number of connection points**		
			TSX P57 153	TSX P57 253/353	TSX P57 453
ADI, ADM, ADO	832	-	62	98	98
ARM 370 30	832	-	62	98	98
ANR 120 90	832	-	62	98	98
AAI 520 40 00	1808	-	52	52	98
AMM 090 00, AAI 030 00, AAO 120 00, AAO 921 00	1808	-	52	52	98
AAI 140 00	2304	-	40	40	92
FED C32	1280	-	62	73	126
FED C32P	2304	-	40	40	92
FED M32	1424	-	62	66	126
FED M32P	2448	-	38	38	87
FRD C2	832	-	62	113	126
FSD C8	896	-	62	105	126
FSD C8P	1808	-	52	52	117
FSD M8	1040	-	62	90	126
FSD M8P	1952	-	48	48	109

Compatibility information relating to the programming terminal

Introduction

The following compatibility information relates to:
- the addressing supported by the different connectable devices,
- the memory space that the devices take up in the configuration RAM.

Rules of use

A programming terminal fitted with the TSX FPC 10 card or the PCMCIA card TSX FPP 20 must be connected to the FIPIO address 63.

PL7 operates in connected mode with the FIPIO manager PLC.
If the manager PLC has an application in which one or several agent devices are configured:
- PL7 communicates with the TSX Micro/Premium FIPIO agent PLCs.
- MMI 17 communicates with the CCX-17.

It is not possible to download a PL7 application to the manager from a programming terminal. However, it is possible to download a PL7 application to a FIPIO agent PLC.

Compatibility information relating to other devices

Introduction

The following compatibility information relates to:
- the addressing supported by the different connectable devices,
- the memory space that the devices take up in the configuration RAM.

Addressing

The FIPIO addressing depends on the type of device:

Types of device	FIPIO addresses	Comments
ATV-16/58/66	1...62	The speed controllers are fitted with a TSX FPP 10 card, of version V1.8 or later.
CCX 17	1...62	The consoles have to be of version V2.4 or later and are fitted with the TSX FPP 10 card of version V1.8 or later.
Magelis	1...62	The consoles are fitted with a TSX FPP 10 card of version V1.8 or later.
FipConnect products	1...62, 64...127	apart from limitations specific to the product used

Maximum configuration

The number of modules of the same reference connected to the FIPIO bus in a configuration is limited. The values in the table below are expressed in bytes.

Module	Base	Extension	aximum number of connection points		
			TSX P57 153	TSX P57 253/353	TSX P57 453
ATV 16, ATV 58, ATV 66	1952	-	48	48	62
CCX 17	1952	-	4	4	4
EEF 08D2, EEF 16D2	832	-	62	98	98
ESF 08T22 EMF 16DT2	1808	-	52	52	98
FED C32	1280	-	62	73	126
FED C32P	2304	-	40	40	92
FED M32	1424	-	62	66	126
FED M32P	2448	-	38	38	87
FRD C2	832	-	62	113	126
FSD C8	896	-	62	105	126
FSD C8P	1808	-	52	52	117
FSD M8	1040	-	62	90	126
FSD M8P	1952	-	48	48	109
Micro Premium	1424	-	62	62	62

FIPIO bus operating mode

Introduction

The FIPIO bus operating mode is linked to the processor operating mode and to the physical state of the bus.
If the number of physical errors detected by the processor is endangering the nominal operation of the devices connected to the bus, the processor stops all bus activity. In this case, the devices connected apply the fallback values to the inputs/outputs.

Operating mode

The operating mode is as follows:

Phase	Description
1	Cold restart of the processor with a FIPIO application: the bus is started automatically; the I/Os are monitored and commanded.
2	Downloading an FIPIO application: the bus is started automatically; the inputs/outputs are monitored and commanded.
3	If the processor detects serious physical errors, the FIPIO bus is stopped automatically. The connected devices apply the fallback values; the processor no longer monitors the inputs/outputs. A serious physical error is for example the disconnection of the line plug, the disconnection of the FIPIO terminal block on the processor, etc…
4	Following an automatic stop (serious errors detected by the processor): ● the bit %SW144:x2 is set; the processor periodically carries out a restart attempt, trying to monitor and command the inputs/outputs of the connected devices. This is automatic mode. ● the bit %SW144:x2 is cleared; to restart the bus, there a user action must be performed via the program or via the programming terminal. Set bits %SW144:x0 and %SW144:x1 to 1. This is manual mode.
5	Warm restart: the bus is restarted automatically if it has not been stopped voluntarily by an action on the system word %SW144 bits 0 and 1. The bus is returned to the state it was in before the power outage.
6	If %S0 = 1 the system words are initialized, and if the bus had been stopped, it is restarted.

Information on manual mode

If %SW144:x0 is set to 0 (via the programming terminal or via the program) the production/consumer function (PC) stops. No more variables or messages are exchanged on the bus.

If %SW144:x1 is set to 0 (via the programming terminal or via the program) the bus arbiter function (BA) stops. There is no more scanning of variables or messages on the bus.

To completely and voluntarily stop the activity on the FIPIO bus, it is necessary to simultaneously set bits 0 and 1 of the system word %SW144 to 0 via the programming terminal or via the program.

Information on automatic mode

If the FIPIO bus is stopped without a voluntary action on the system word %SW144, this means that the processor has detected physical errors which prevent the nominal operation of the bus and the connected devices.

In this case, and only in this case, , if bit %SW144:x2 is set to 1 (automatic start), the processor will make periodic and automatic attempts to restart the exchanges on the bus.

If bit %SW144:x2 is at 0 following the stopping of the bus owing to physical errors, it is necessary to reset bits %SW144 x:0 and %SW144 x:1 via the program or via the programming terminal in order to restart the FIPIO bus. In this case, the bus will restart **if, and only if, the physical error which caused the stop has disappeared**.

Example

if bit %SW144 x:2 = 1 on disconnection/reconnection of the processor FIPIO terminal block, the bus will be restarted automatically.
The devices will be monitored once again and will be able to apply the program values.

if bit %SW144 x:2 = 1 on disconnection/reconnection of the processor FIPIO bus, the connected devices on the bus will be neither monitored, nor will they be able to apply the program values.
The devices will be monitored once again if the user sets bits %SW144:x0 and %SW144:x1 = 1.

Network cycle time: mono task application

Introduction

The network cycle time for a mono task application is calculated for the following configuration:

- the length of the bus is 1 Km,
- the values corresponding to the reversal and silence times and the bandwidths are default values (automatic mode).

Calculation of the network cycle time

For an application which has all the devices configured in the same task, the value of the network cycle time of the task, in milliseconds, is obtained, for information purposes only, by the following formula:

$$\text{TCR\_TASK} = 1{,}45 + \Sigma(\text{K x number of equipments of the same family})$$

Value of coefficient K

Coefficient K will be defined as follows:

Coefficient K	Family	Device
0,5	TBX	Discrete
0,9	TBX	Analog
0,4	Momentum	Discrete
0,6	Momentum	Analog
0,6	ATV-16	All
0,6	ATV-58	All
0,6	CCX 17	All
1,5	CCX 17-32	All
1,5	TSX 37/57	All
0,6	AS-i gateway	TSX SAP 10
1,5	Magelis	All
0,4	STD_P	FRD
0,6	STD_P	FSP
1,5	STD_P	FED

Example

The configuration of the example is as follows:

- All the elements are configured in the MAST task in the application.
- The configuration comprises:
  - 10 discrete TBXs,
  - 11 analog TBXs,
  - 12 discrete Momentums.

The calculation of the cycle time for the Mast task is as follows:
TCR_MAST = 1.45 + ((0.5 x 10) + (0.9 x 11) + (0.4 x 12)) = 21.15 ms

The network cycle time is about 21 ms.

Network cycle time: multitasking application

Introduction

For a multitasking application with two periodic tasks, and if the devices are configured in each of the tasks, the value of the network cycle times depends on the configuration of the different tasks.

The cycle time values calculated with the following algorithm are the maximum values. The actual values are less than or equal to these values.

Convention

The following table shows all the parameters involved in the calculation of the network cycle time.

Parameter	Definition
P_{max}	Value of the largest task period (MAST or FAST)
P_{min}	Value of the smallest task period (MAST or FAST)
T_{max}	Task with period P_{max}
T_{min}	Task with period P_{min}
R	Ratio between the periods (This ratio must be a whole number; it will be rounded off to the nearest whole number if necessary).
NE_{max}	Number of devices from the same family configured in T_{max}
NE_{min}	Number of devices from the same family configured in T_{min}
NE_Equip	Equivalent number of devices from the same family
TCR_T_{max}	Network cycle time for the task T_{max}
TCR_T_{min}	Network cycle time for the task T_{min}

Calculation algorithm

To calculate the network cycle time, the algorithm is as follows:

Stage	Description
1	Calculation of R $$R = \frac{Pmax}{Pmin}$$
2	Calculation of NE_Equip (for each device family) $$NE\_Equip = ((R \times NEmin) + NEmax)$$
3	Calculation of TCR_T_{max} $$TCR\_Tmax = 1{,}45 + \sum(K \times NE\_Equip)$$
4	Calculation of TCR_T_{min} $$TCR\_Tmin = \frac{TCR\_Tmax}{R}$$

Value of coefficient K

Coefficient K will be defined as follows:

Coefficient K	Family	Device
0,5	TBX	Discrete
0,9	TBX	Analog
0,4	Momentum	Discrete
0,6	Momentum	Analog
0,6	ATV-16	All
0,6	ATV-58	All
0,6	CCX 17	All
1,5	CCX 17-32	All
1,5	TSX 37/57	All
0,6	AS-i gateway	TSX SAP 10
1,5	Magelis	All
0,4	STD_P	FRD
0,6	STD_P	FSP
1,5	STD_P	FED

Interpretation of the results

To refresh the inputs/outputs on the bus, the following constraints are imposed:
- For the periodic tasks in controlled mode, the network cycle time of the task must be less than the task period.
- For the periodic tasks in free mode, the network cycle time of the task must be less than the task watchdog.

Example of calculating the network cycle times of a multitasking application

Introduction

The configuration of the example is as follows:

- Task periods:
  - MAST: 60 ms
  - FAST: 15 ms
- The configuration comprises:
  - 6 discrete TBXs configured in the MAST task and 4 discrete TBXs configured in the FAST task,
  - 6 analog TBXs configured in the MAST task and 4 analog TBXs configured in the FAST task,
  - 6 discrete Momentums configured in the MAST task and 4 discrete Momentums configured in the FAST task,
  - 6 analog Momentums configured in the MAST task and 4 analog Momentums configured in the FAST task,

Convention

Depending on the configuration, the application of conventions involves:

- $P_{max} = 60$ and $P_{min} = 15$
- $T_{max} = T_{MAST}$ and $T_{min} = T_{FAST}$
- $TCR\_T_{max} = TCR\_T_{MAST}$ and $TCR\_T_{min} = TCR\_T_{FAST}$

Algorithm

The following table shows the algorithm:

Stage	Description
1	Calculation of R R = 60 / 15 = 4
2	Calculation of the equivalent number of devices NE_TBX_TOR = (R * 4 + 6) = 22 NE_TBX_ANA = (R * 4 + 6) = 22 NE_MOMENTUM_TOR = (R * 4 + 6) = 22 NE_MOMENTUM_ANA = (R * 4 + 6) = 22
3	Calculation of the network cycle times TCR_T_{MAST} $TCR\_T_{MAST} = 1.45 + ((0.5 * 22) + (0.9 * 22) + (0.4 * 22) + (0.6 * 22))$ $TCR\_T_{MAST} = 54.25$ ms
4	Calculation of the network cycle times TCR_T_{FAST} $TCR\_T_{FAST} = 54.25 / 4$ $TCR\_T_{FAST} = 13.56$ ms

Conclusions

The network cycle times of each equal:

- TCR_T_{MAST} = 55 ms,
- TCR_T_{FAST} = 14 ms.

The time period for MAST and FAST tasks are sufficient to refresh the inputs/ outputs.

Configuring FIPIO communication

19

Introduction

Subject of this Chapter

This chapter describes the Configuration process during set-up of FIPIO communication.

What's in this Chapter?

This Chapter contains the following Sections:

19.1 General information on configuration

Configuration mode

Introduction

The creation of an application to implement a FIPIO bus requires the configuration of several elements via the PL7 software.

Methodology

The following methodology reviews the different phases involved in configuring the FIPIO bus:

Configuring points of connection and bus properties	This phase is used to define the type of device connected to the bus, bus management (e.g.: length, bandwidth, etc.).
↓	
Configuring each device connected to the bus.	This phase is used to configure each device (e.g.: PLC task managing devices, inputs, outputs, etc.).
↓	
Adapting PL7 tasks according to the bus topology.	This phase is used to define the management of input/outputs on the bus by PL7 tasks (e.g.: cyclic or periodic task, controlled or free mode, etc.).

19.2 FIPIO bus configuration

Introduction

Subject of Section

This section introduces the FIPIO bus configuration principles.

What's in this Section?

This Section contains the following Maps:

How to access the FIPIO configuration screen

Introduction

This operation describes how to access the configuration via the the TSX Premium PLCs provided with a built-in link.

How to access the link

The following table shows the procedure for accessing the FIPIO link:

Step	Action
1	Access the hardware configuration screen
2	Double click on the **FIPIO** connector.

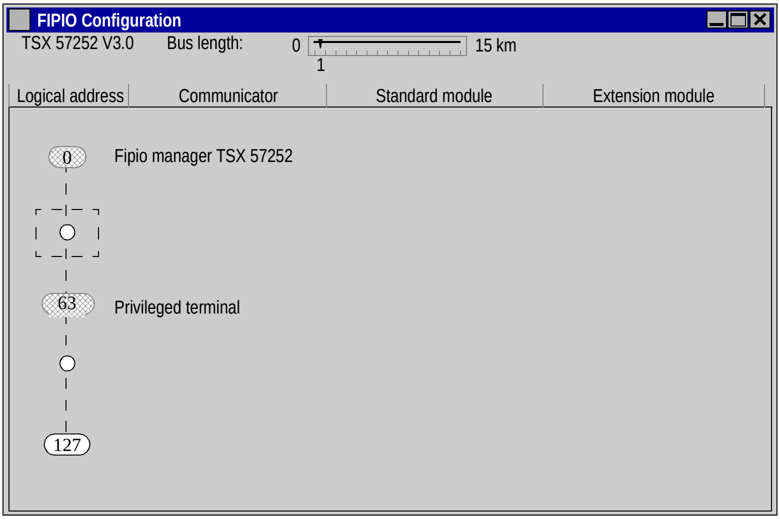
FIPIO bus configuration screen

Introduction

This screen is used:
- to register devices which are connected to the bus,
- to parameter the bus properties.

Illustration

The screen dedicated to FIPIO communication looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Zone	Function
Bus length	This cursor is used to adjust the bus length. The default value is 1 Km.
Logical address	This zone defines the address for each device.
Communicator	This zone specifies the type of device which enables communication between the manager and the standard device. Where the standard device has no need for a communicator, this zone is empty.
Standard module	This zone specifies the standard device connected to the bus.
Extension module	This zone gives information on whether an extension is associated to the standard device.

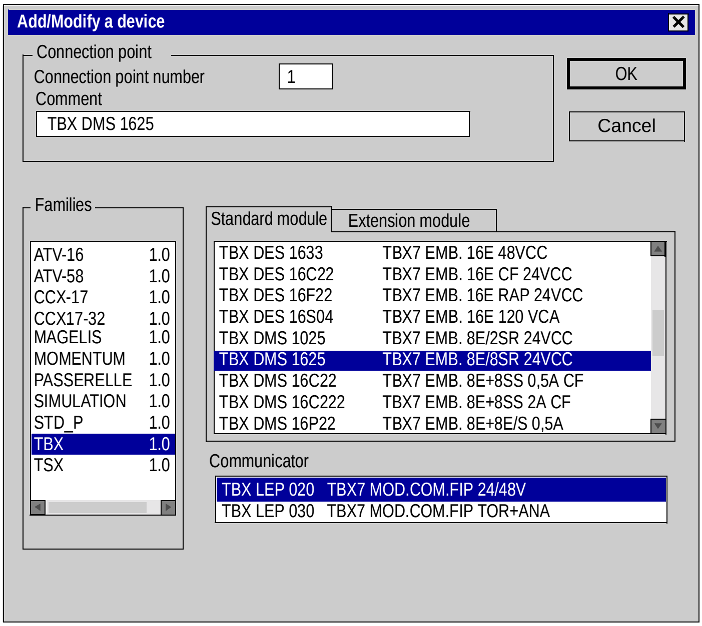
Grayed out rectangles on the bus indicate the two reserved addresses:
- 0 for the bus manager,
- 63 for the privileged terminal.

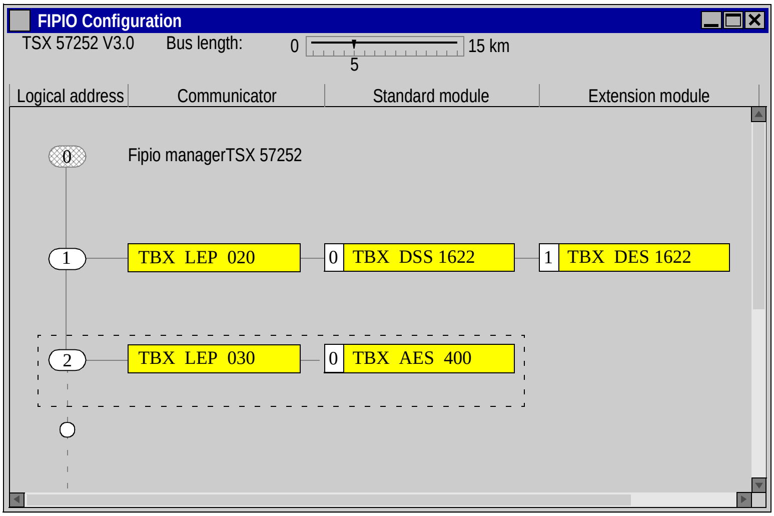
The available connection points are indicated by a small circle and dotted lines.

How to add a device on to the bus

Procedure

This operation is used to logically add a device connected to the FIPIO bus.

Step	Action
1	Access the FIPIO configuration screen.
2	Double click on the logic address of the connection point at the place where the module must be connected (available addresses ranging from 1 to 62 and from 64 to 127, addresses 0 and 63 being reserved by the system). **Result**: the **Add/Modify a device** screen appears. 
3	Enter the connection point number which corresponds to the address. By default, the PL7 software offers the first consecutive address which is free
4	Add a comment to the device connected to the connection point. This field has a maximum length of 80 characters and is optional.
5	In the **Family** field, select the type of equipment to be connected to the bus.
6	Select the standard module and/or the extension module.
7	In the **Communicator** field, select the type of element enabling communication on the FIPIO bus. For certain types of device, this window does not appear.

Step	Action
8	Confirm with **Ok**. **Result:** the module is registered. 

How to modify/delete/move/duplicate a bus device

Procedure for modifying a device

This operation is used to logically modify a device connected to the FIPIO bus.

Step	Action
1	Access the FIPIO configuration screen.
2	Double click on connection point corresponding to the device which is to be modified.
3	Modify the component parts of the device: ● standard module, ● extension module, ● the communicator, ● the comment. It is not possible to modify the family or the connection point number.
4	Confirm with **Ok**.

Procedure for deleting a device

This operation is used to logically delete a device connected to the FIPIO bus.

Step	Action
1	Access the FIPIO configuration screen.
2	Select the connection point to be deleted. A dotted line square surrounds the selected connection point.
3	Select the **Edit** → **Delete the device** command.
4	Confirm the deletion with **Yes**.

Procedure for moving a device

Moving a device is not a physical move on the bus but a logic change of the device address. This involves modifying the address of I/O objects in the program and moving variables associated to these objects. On global confirmation of the configuration, the application program will be modified automatically to match the move.

Step	Action
1	Access the FIPIO configuration screen.
2	Select the connection point to be moved. A dotted line square surrounds the selected connection point.
3	Select the **Edit** → **Move a device** command.
4	Supply the destination connection point number.
5	Confirm the move with the **Ok** button.

Procedure for duplicating a device

This function is similar to the function to move a device.

Step	Action
1	Access the FIPIO configuration screen.
2	Select the connection point to be moved. A dotted line square surrounds the selected connection point.
3	Select the **Edit** → **Duplicate a device** command.
4	Supply the destination connection point number.
5	Confirm the move with the **Ok** button.

How to access the FIPIO bus properties screen

Introduction

This operation describes how to access the bus properties screen via TSX Premium PLCs with an integral link.

How to access the link

The following table shows the procedure:

Step	Action
1	Access the FIPIO configuration screen.
2	Right-click at the bottom of the FIPIO configuration screen.
3	Select the command **FIPIO Bus Properties** from the contextual menu.

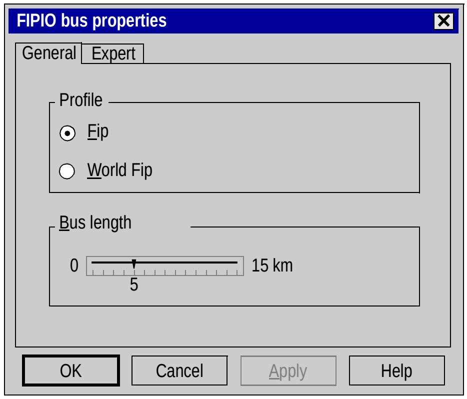
FIPIO bus properties configuration screen

Introduction

On a FIPIO bus, a single PLC allows the exchange of inputs/outputs; this is the bus arbiter. It manages the bus accesses of each connected device.
The screen attached to the properties therefore allows you to adapt the management parameters according to the devices which are connected.

Illustration

The screen dedicated to the properties of the FIPIO bus looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Tab	Function
General	This tab is used to: ● choose the type of profile managed by the bus arbiter, ● adjust the bus length.
Expert	This tab is used for choosing the management mode. In the case where the management is manual, it is used to further adjust the management parameters according to the devices which are connected.

Properties of the FIPIO bus: General tab

Introduction

With this tab, you can access two types of information:
- the profile,
- the bus length.

The profile

The profile is chosen according to the devices which are connected to the FIPIO bus. It can be in either of two versions:
- FIP:
  - This profile is chosen by default.
  - It is compatible with all the devices of Schneider and partners.
- WorldFip:
  - The selection of this mode allows you to operate the FIPIO bus in accordance with the EN 50170 standard.

Note: The WorldFip profile mode can be used with the following restrictions:
- no TSX FP ACC6 or TSX FP ACC8 repeaters,
- use of TBX LEP 020 version 1.4 minimum and TBX LEP 030 version 1.2 minimum,
- use of the PCMCIA TSX FPP 10 card, version 1.8 minimum.

The bus length

With this cursor you can increase or decrease the bus length. The default value is 1 Km and the adjustment increment is 1 Km.

This length must be adjusted because it is taken into account in the calculation of the propagation time for the signals on the bus and consequently in the calculation of the network cycle times.

Note: At each modification of the length of the FIPIO bus, all the connected devices must be powered off, then on after the new application has been downloaded (in the PLC).

Properties of the FIPIO bus: Expert tab

Introduction

With this tab, you have access to the management mode concerning the calculation of:

- reversal and silence time,
- bandwidths.

> **Note:** At each modification of the parameters below, all the connected devices must be powered off, then on after the new application has been downloaded (in the PLC).

The automatic mode

> **Note:** This mode is advocated.

The reversal and silence times and the bandwidths cannot be modified. They are calculated according to the bus parameters and device configuration data.

The manual mode

CAUTION

No monitoring is carried out in manual mode. Modifying these parameters can cause the device connected to the bus not to work.

Failure to observe this precaution can result in injury or equipment damage.

This mode is used to enter the reversal and silence times and the bandwidths.
It is mainly reserved for specific applications requiring these values to be modified (example: use of Hirschmann transmittors).

Expert tab: manual mode

Introduction

By selecting the manual mode, you have access to the following information:
- the reversal and silence times,
- the aperiodic bandwidths.

Aperiodic variables

The following table gives a description of the times:

Parameters	Description
Silence time delay T0	This defines the maximum time between the transmission of the last byte of a frame and the transmission of the first byte of the following frame. This time is expressed in micro-seconds. Its value must be greater than the reversal time TR and less than 255.
Reversal time TR	This defines the minimum time between the transmission of the last byte of a frame and the transmission of the first byte of the following frame. This time is expressed in micro-seconds. Its value must be greater than or equal to 1 and less than the silence time T0.

Aperiodic bandwidths

There are two types of exchange on a FIPIO bus:
- exchanges of cyclic variables which are reserved for the process data,
- exchanges of aperiodic variables which concern the configuration of connected devices, the adjustment and the messaging.

A decrease or increase of the bandwidth of the aperiodic exchanges (Variables and Messages) slows down or accelerates the output of the configuration or adjustment variables which can circulate on the bus. The same applies to a decrease or increase of the aperiodic bandwidth of the messaging facility.
The following table gives a description of the aperiodic bandwidths:

Parameters	Description
Aperiodic variables	This defines the output of the aperiodic variables which can circulate on the bus. This bandwidth is expressed in Kbits/s. Its value can be adjusted from 1 to 200 Kbits/s.
Messaging	This defines the output of the aperiodic messages which can circulate on the bus. This bandwidth is expressed in Kbits/s. Its value can be adjusted from 1 to 200 Kbits/s.

Note: An increase in the aperiodic bandwidth increases the network cycle time.

19.3 Configuration of devices on the FIPIO bus

Introduction

Subject of Section

This section introduces the configuration principles for FIPIO bus devices.

What's in this Section?

This Section contains the following Maps:

How to access the FIPIO configuration screen

Introduction

When a device has been registered, it is possible to access its configuration as in the case of a rack module.

This screen is used to select the task which exchanges the inputs/outputs: FAST or MAST, to modify the configuration or adjustment parameters specific to the module.

How to access the link

The following table shows the procedure for accessing the configuration of a device on FIPIO:

Step	Action
1	Access the FIPIO configuration screen
2	Double click on the standard module to be configured.

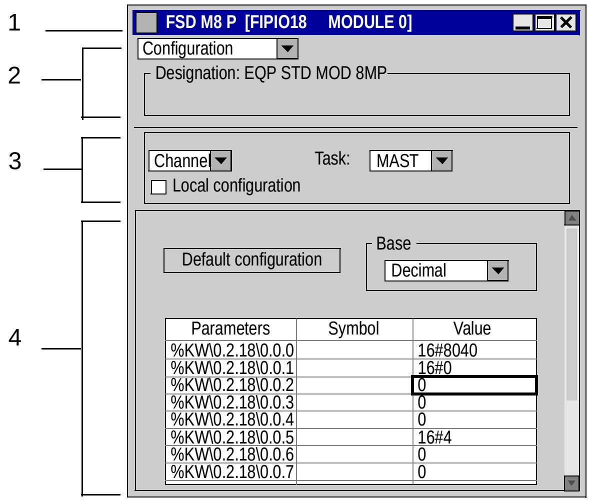
Configuration screen of a FIPIO device

Introduction

This screen, split into several areas, is used to register the communication channel and to configure the parameters of the device selected for a FIPIO communication.

Illustration

The screen looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Zone	Description
1	Title bar	This zone defines the module reference and its physical position in the module.
2	Module	This zone is used to input information with the aid of dropdown lists: ● parameter type: ● the **Configuration** mode, ● the **Adjustment** mode (which can be accessed by certain device types), ● the **Debugging** mode (can only be accessed in online mode). ● channel type (inputs or outputs) when the designated device has inputs and outputs.
3	Communication channel	This zone is used to assign devices to either the MAST task or the FAST task, with the aid of a dropdown list. Some device types have access to a **Local configuration** check box. If the box is checked off, the channel parameters can not be accessed.
4	Channel parameters	This zone is used for device parametering. According to certain device types, this zone can not be accessed.

Note: For further information on configuration parameters, adjustment parameters and debugging parameters, refer to the documentation specific to each device.

How to access the different parameters according to device type

How to access the inputs/outputs

The following procedure provides information on how to access the input or output parameters of a module. It is enabled in both offline and online mode.

Step	Action
1	Access the configuration screen of a FIPIO device.
2	Select **input part** or **output part** from the module zone's dropdown list.

How to adjust the configuration parameters

The following procedure describes how to modify the adjustment parameters of a module. It is enabled in both offline and online mode.

Step	Action
1	Access the configuration screen of a FIPIO device.
2	Select adjustment mode from the module zone's dropdown list.
3	Select the cell relating to the entry parameter.
4	Enter the parameter.
5	Enable by clicking on **Input**.
6	Enable the assignment.

How to assign a module to a PL7 task

The following procedure describes how to assign a module to a PL7 task. It is only enabled in offline mode.

Step	Action
1	Access the configuration screen of a FIPIO device.
2	Select **MAST** → **or** FAST**Task** from the dropdown list.
3	Enable the assignment.

19.4 Input/output management by the PL7 tasks

Introduction

Subject of Section

This Section introduces the configuration principles for PL7 tasks in FIPIO mode.

What's in this Section?

This Section contains the following Maps:

How to access PL7 task configuration in FIPIO mode.

Introduction

FIPIO Bus and device configuration modifies the task network cycle times in accordance with the input/output updating of each PL7 task.

These modifications can result in constraints on:
- task type (cyclic or periodic), as well as its execution time and watchdog,
- FIPIO input/output processing in relation to the task cycle (controlled or free).

The PL7 software is used then to manage the inputs/outputs according to the MAST or FAST tasks and their network cycle time.

Procedure

The following table shows the procedure for accessing the MAST and FAST tasks in FIPIO mode:

Step	Action
1	Access the hardware configuration screen
2	Double click on the processor.

Configuration screen of a FIPIO processor

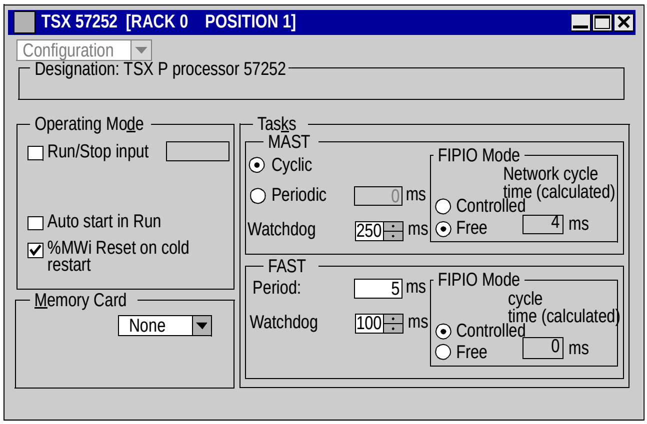
Introduction

This screen, split into various areas, is used to manage the FIPIO inputs/outputs according to:
- task type (MAST or FAST),
- use type (cyclic or periodic) and duration,
- watchdog,
- task network cycle time.

Only the section relating to FIPIO mode is presented below.

Illustration

The screen looks like this:



The FIPIO Mode window

You can access two types of information via the **FIPIO Mode** window:
- Mode (controlled or free): is used to link input/output updating to the task cycle.
- Network cycle time (calculated): this time represents the network cycle time associated with a task.

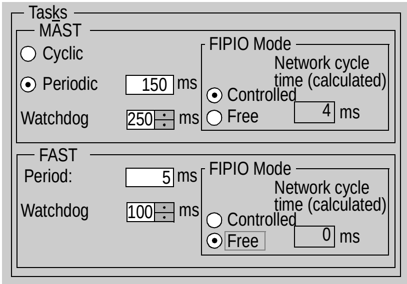
FIPIO input/output management using PL7 tasks

Introduction

The FIPIO input/output management modes are dependent upon the type of task execution (cyclic or periodic).

Controlled FIPIO mode

This mode can only be accessed via a PL7 task declared as periodic.

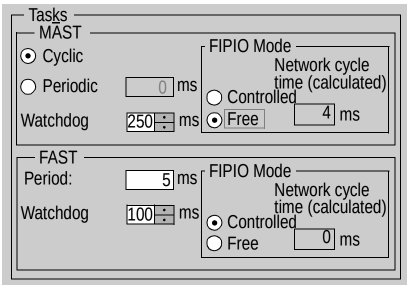


In this mode, input/output refreshing is correlated with the task period. The system guarantees input/output updating during one period only. Only the inputs/outputs associated with this task are refreshed.

Choosing this mode imposes the following constraint:
The PLC task period (MAST or FAST) must be greater than or equal to the network cycle time

Free FIPIO mode

This mode can be accessed via a periodic or cyclic declared PL7 task.



In this mode, no constraints are imposed on the task period. The PLC task period (MAST or FAST) can be less than the network cycle time.
In this case, the task can be carried out without updating the inputs/outputs.

Selecting this mode provides the possibility of having the shortest possible task times for an application where the rate is critical.

19.5 Confirmation of the FIPIO bus configuration

Introduction

Subject of Section

This Section introduces the main instances of FIPIO bus configuration refusal.

What's in this Section?

This Section contains the following Maps:

Confirming the configuration

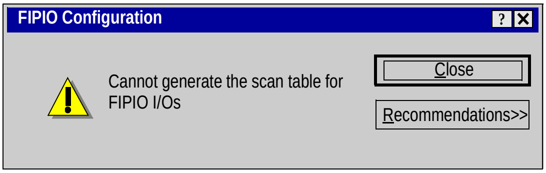
Introduction

On completion of the FIPIO bus configuration, and in order to be recognized in the new application, the global bus configuration must be confirmed.

Confirmation refused

The PL7 then checks the constraints associated with this new application. If the imposed constraints are not respected, no scanning table is created.

A message window opens in this case.



The configuration remains unconfirmed (Bus X physical configuration and FIPIO physical configuration) as long as the problem is not corrected by the user. This configuration can not be transferred into the PLC.

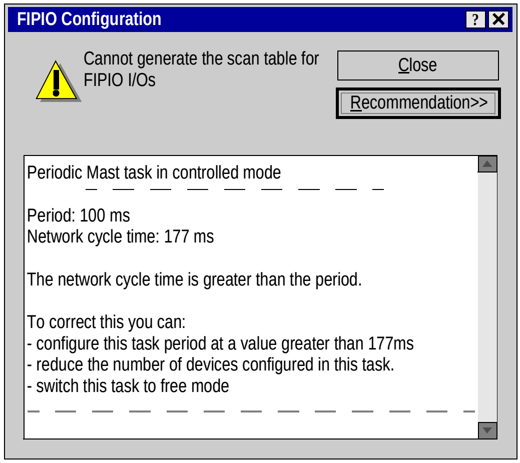
How to access the recommen-dations

The **Recommendations** button enlarges the dialogue box where the reasons for refusal as well as useful corrective measures are located.

Step	Action
1	Select the **Recommendations** button.

Result

The characteristics of each configured task (MAST and FAST) are displayed.



If a task's constraints are not respected, the cause of the failure and corrective recommendations complete the characteristics.

Depending on the recommendations, there are two possible measures for correcting the configuration, these are as follows:

- Access the configuration screen of the processor to modify the PL7 task management parameters.
- Access the FIPIO configuration screen to modify device distribution in the MAST or FAST tasks.

Confirmation refused, examples

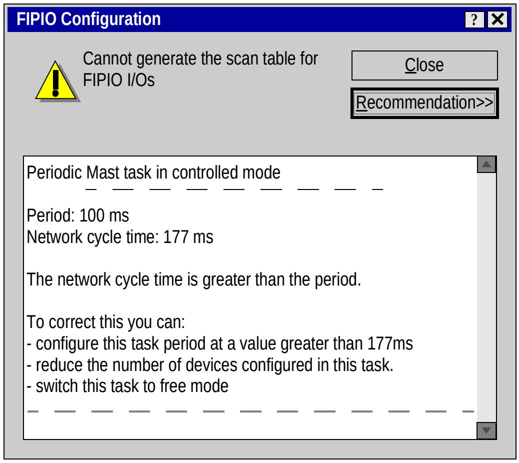
Introduction

The following examples concern the main refusals encountered.

Example 1

The MAST or FAST task has been configured in controlled periodic mode.

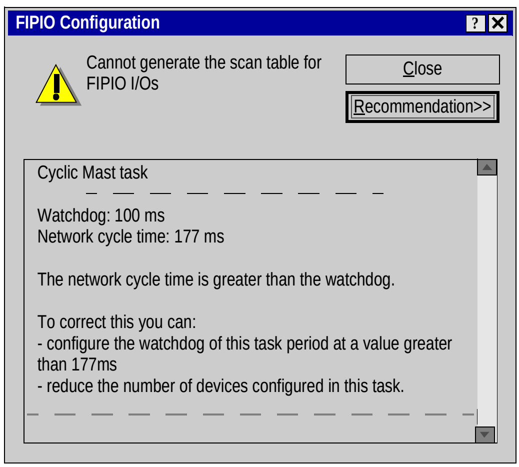
The network cycle time is greater than the period.



Example 2

The MAST task has been configured in cyclic mode.

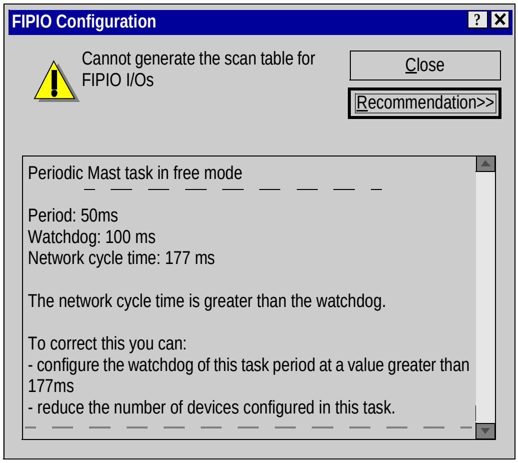
The network cycle time is greater than the watchdog.



Example 3

The MAST or FAST task has been configured in free periodic mode.

The network cycle time is greater than the watchdog.



Programming FIPIO communication

20

Introduction

Subject of this Chapter

This Chapter describes the Programming process during set-up FIPIO communication.

What's in this Chapter?

This Chapter contains the following Maps:

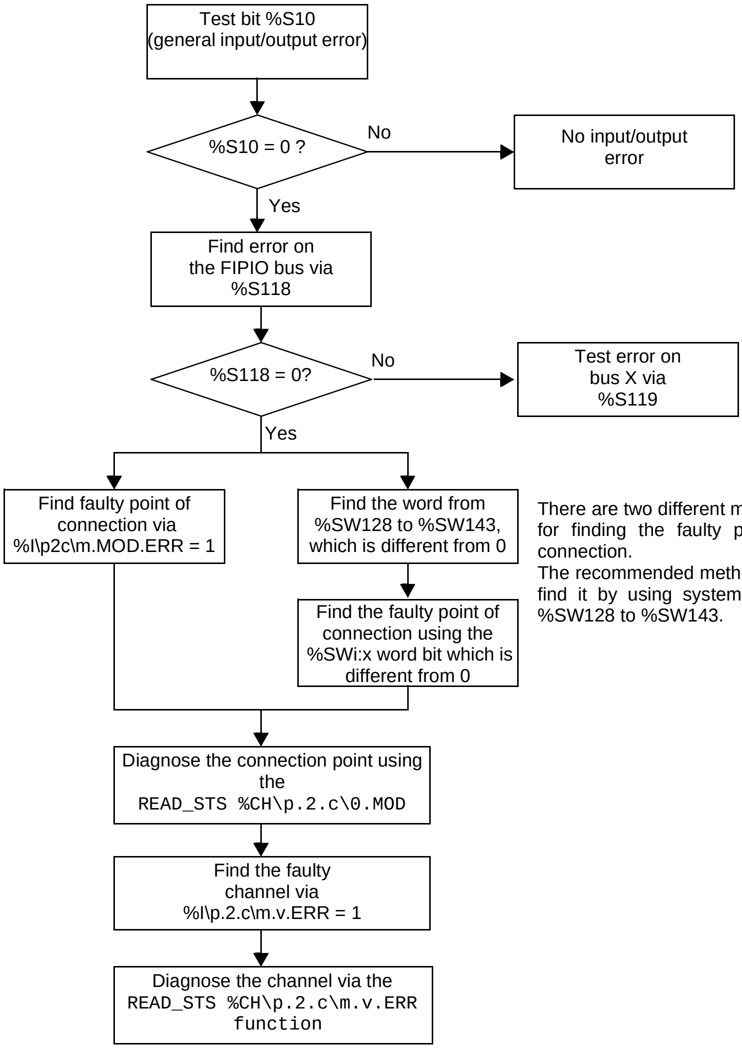
FIPIO error processing

Introduction

FIPIO error processing can be performed with the debugging and diagnostics screens.
It can however be useful to perform this processing using a program.

Algorithm

The algorithm shown is an example of a FIPIO bus error detection and management application algorithm



There are two different methods for finding the faulty point of connection.
The recommended method is to find it by using system words %SW128 to %SW143.

Examples of explicit exchange saturation detection

Introduction

The following examples are given in structured text language, but they can be translated into all the PL7 languages.

They only have to be taken into account if the PL7 application may activate more that 24 explicit functions at the same time and if you want to reiterate a request in the event of explicit exchange saturation.

Management of the READ_STS module

```
IF (NOT (%MW\0.2.1\0.MOD:x0)) THEN (*no request in progress*)
   SET %M0; (*request latch*)
   (*bit reset to 0 indicating saturation of explicit
   exchanges*)
   %SW116:=%SW116 AND 2#1111111111111011;
   READ_STS %CH\0.2.1\0.MOD;
   IF (%SW116:x2) THEN
      RESET %M0; (*READ_STS retried, saturation has
      occurred*)
      (*%MW\0.2.1\0.MOD.2:x1 signals a functional error*)
   END_IF;
END_IF;
IF(%M0 AND NOT (%MW\0.2.1\0.MOD:x0)) THEN
   (*%MW\0.2.1\0.MOD.2 can be used*)
   RESET %M0;
END_IF;
```

Management of the READ_STS channel

```
IF (NOT (%MW\0.2.1\0.0:x0)) THEN (*no request in progress*)
   SET %M1; (*request latch from channels 0 to 7*)
   (*bit reset to 0 indicating saturation of explicit
   exchanges*)
   %SW116:=%SW116 AND 2#1111111111111011;
   READ_STS %CH\0.2.1\0.0;
   IF (%SW116:x2) THEN
      RESET %M1; (*READ_STS retried, saturation has
      occurred*)
      (*%MW\0.2.1\0.0.2:x6 signals a communication error*)
   END_IF;
END_IF;
IF(%M1 AND NOT (%MW\0.2.1\0.0:x0)) THEN
   (*%MW\0.2.1\0.0.2 can be used*)
   RESET %M1;
END_IF;
```

READ_PARAM at connection point 02

```
IF (NOT (%MW\0.2.2\0.0:x2)) THEN (*no request in progress*)
   SET %M2; (*request latch from channels 0 to 7*)
   (*bit reset to 0 indicating saturation of explicit
   exchanges*)
   %SW116:=%SW116 AND 2#1111111111111011;
   READ_PARAM %CH\0.2.2\0.0; (*request from the parameters*)
   IF ((%MW\0.2.2\0.0.1:x) AND (%SW116:x2)) THEN
      (*exchange refused*)
      RESET %M2; (*saturation of explicit exchanges*)
   END_IF;
END_IF;
IF(%M2 AND NOT (%MW\0.2.2\0.0:x2)) THEN
   (*reading finished parameters*)
   RESET %M2;
END_IF;
```

WRITE_PARAM at connection point 02

```
IF (NOT (%MW\0.2.2\0.0:x2)) THEN (*no request in progress*)
   SET %M3; (*request latch from channels 0 to 7*)
   (*bit  reset  to  0  indicating  saturation  of  explicit
   exchanges*)
   %SW116:=%SW116 AND 2#1111111111111011;
   WRITE_PARAM %CH\0.2.2\0.0, (*parameter transmitting*)
   IF ((%MW\0.2.2\0.0.1:x2) AND (%SW116:x2)) THEN
      (*exchange refused*)
      RESET %M3; (*saturation of explicit exchanges*)
   END_IF;
END_IF;
IF(%M3 AND NOT (%MW\0.2.2\0.0:x2)) THEN
   (*end of parameter transmission*)
   RESET %M3;
END_IF;
```

WRITE_CMD at connection point 02

```
IF (NOT (%MW\0.2.2\0.0:x1)) THEN (*no request in progress*)
   SET %M3; (*request latch from channels 0 to 7*)
   (*bit  reset  to  0  indicating  saturation  of  explicit
   exchanges*)
   %SW116:=%SW116 AND 2#1111111111111011;
   WRITE_CMD %CH\0.2.2\0.0; (*command transmitting*)
   IF ((%MW\0.2.2\0.0.1:x1) AND (%SW116:x2)) THEN
      (*exchange refused*)
      RESET %M3; (*saturation of explicit exchanges*)
   END_IF;
END_IF;
IF(%M3 AND NOT (%MW\0.2.2\0.0:x1)) THEN
   (*end of command transmission*)
   RESET %M3;
END_IF;
```

Debugging a FIPIO communication

21

Introduction

Subject of this Chapter

This Chapter describes the Debugging process during set-up of FIPIO communication.

What's in this Chapter?

This Chapter contains the following Maps:

Debugging mode

Introduction

Debugging mode can only be accessed in online mode.

This mode:
- uses a red square to display when a device is faulty from the FIPIO configuration screen,
- and adjusts and debugs the devices connected to the FIPIO bus from their application screen.

Inaccessible functions

The following functions can not be accessed from the FIPIO configuration screen in online mode:
- adding on a device in online mode,
- duplicating or moving a device,
- modifying a device,
- deleting a device.

A message displayed in the status bar of the PL7 window gives the reason why access is denied.

How to access the remote device debugging screens

Introduction

This operation describes how to access the debugging screen of a device connected to the FIPIO bus.

Procedure

The following table shows the procedure:

Step	Action
1	Connect with the manager PLC.
2	Access the hardware configuration screen
3	Double click on the **FIPIO** connector.
4	Double click on the standard module to debug.

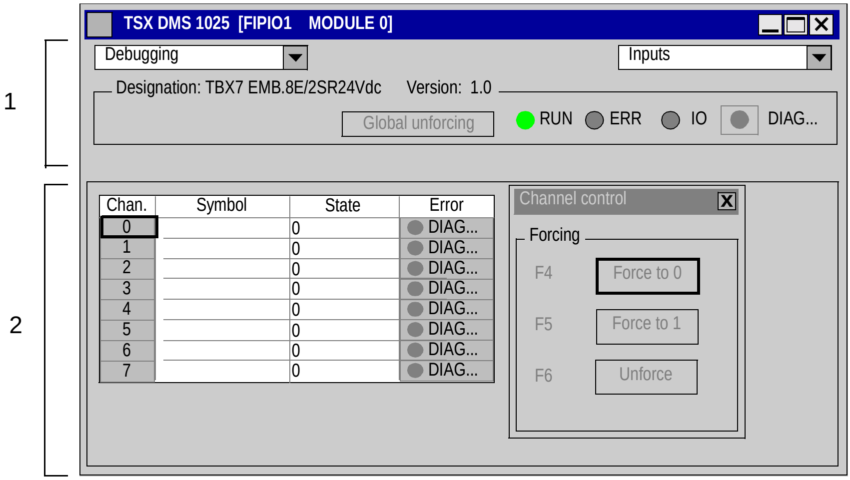
FIPIO bus device debugging screen

Introduction

By opening the application screen of a device in debugging mode, the following functions can be accessed:
- parameter display module configuration,
- reading, writing, and saving adjustment parameters,
- reading, writing, and forcing the inputs/outputs,
- aperiodic status data reading,
- command word writing,

Illustration

The screen dedicated to devices looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Zone	Function
1	common	See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).
2	specific	is used to access device debugging or device adjustment parameters. The accessible parameters are device type functions.

Specific parameters

For input/output type modules, the specific zone displays the value and state of each of the module channels in real time and provides access to the commands from one channel.

For the other module types, the specific zone displays the bus management periodic exchange data.

FIPIO communication diagnostics

22

Introduction

Subject of this Chapter

This Chapter describes the Diagnostics process during set-up of FIPIO communication.

What's in this Chapter?

This Chapter contains the following Maps:

Diagnostics mode

Introduction

In online mode it is possible to perform general diagnostics on the bus errors and device faults.

This diagnostic is possible by using screens available in the PL7 or the bits and system words managed by the application software.

Two modes are available:
- FIPIO bus monitoring,
- device monitoring with or without a fault history.

Communication counters

Every configured connection point (including connection points 0 and 63) has a **report** variable. This variable contains the communication counter and performance values.

This variable has:
- the activity counters numbered from 16#00 to 16#20 and standardized as WORLDFIP,
- the error counters numbered from 16#21 to 16#7F and standardized as WORLDFIP,
- the manufacturer counters numbered 16#80 to 16#FF these counters are not standardized as WORLDFIP.

The error counters change when there are communication errors on the FIPIO bus.

Diagnostics screens

Four screens display the status of the various counters and thus the communication errors:
- The **FIPIO bus monitoring** screen provides a global view of the FIPIO bus, it displays the communication errors on the whole bus.
- The **Device monitoring** screen provides a synthesis per connection point; it features all the connection points and indicates the status of the error counters per connection point.
- The **Device monitoring at connection point n** screen shows all the counters and their status at a given connection point.
- The **Communication fault history** screen is a fault history, which dates and retains the fault counter statuses to provide a trace.

Only one screen of each type can be open (one per connection point for the third type). If you try to open a screen which is already open, it will appear instantaneously.

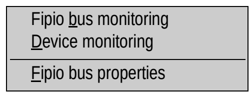
How to access the FIPIO bus monitoring screen

Introduction

This operation describes how to access the FIPIO bus monitoring screen. It only applies to online mode.

Procedure

The following table shows the procedure:

Step	Action
1	Connect with the manager PLC.
2	Access the hardware configuration screen
3	Double click on the **FIPIO** connector.
4	Right click on the screen background. **Result**: a contextual menu appears. 
5	Select the **FIPIO bus monitoring** command.

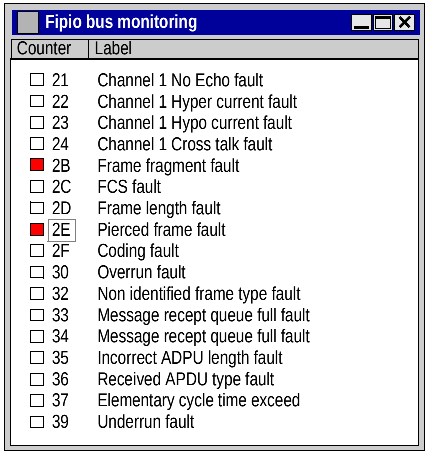
Diagnostics screen: FIPIO bus monitoring

Introduction

This screen gives the user a global view of the bus and indicates the communication faults on the bus.
The screen has a list of all the bus communication error counters and indicates their status.

Illustration

The screen dedicated to devices looks like this:



Elements and functions

Each line has:

- an icon representing the state of the error counter (the reference state being the state at screen opening):
  - white for normal state,
  - red for a faulty counter having changed since the reference state,
- the hexadecimal counter number,
- the counter labels (given by the WORLDFIP standard).

Diagnostics

On screen opening or on reset request, the **report** variables from all the connection points are read by a cyclic communication (one per second).

The counter values from each **report** variable are stored to create a reference state. The time between reading and rereading the same variable is equal to the number of configured devices + 2 (0 and 63) in seconds.

As soon as the error counter value becomes different from its reference value, the counter icon goes red, regardless of the connection point. Reading the counter labels provides the type of error detected.

Example
Counter 21 goes red. This means that at least one counter 21 from all the counter 21s has changed.

Bus monitoring via the application

In PL7, the %SW150 and %SW151 system words indicate the number of frames sent and received by the channel manager.
If one of these two counters stops, it indicates that the FIPIO channel manager function has stopped.
The user is made aware of this stop in the configuration screen in online mode, when the background of connection point 0 goes red.

How to reset the reference state

The following procedure shows how to reset the reference state

Step	Action
1	Right click on the screen background. **Result**: a contextual menu appears. 
2	Select the **Reset** command.

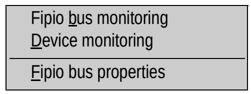
How to access the device monitoring screen

Introduction

This operation describes how to access the FIPIO bus device monitoring screen. It only applies to online mode.

Procedure

The following table shows the procedure:

Step	Action
1	Connect with the manager PLC.
2	Access the hardware configuration screen
3	Double click on the **FIPIO** connector.
4	Right click on the screen background. **Result**: a contextual menu appears. 
5	Select the **Device monitoring** command.

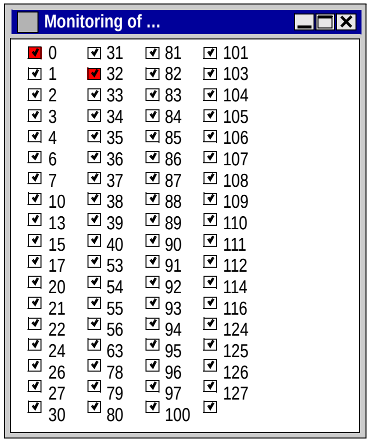
Diagnostics screens: device monitoring

Introduction

This screen is used to access the monitoring of all the configured devices.
The screen has a list of all the configured connection points as well as points 0 and 63.

Illustration

The screen dedicated to devices looks like this:



Elements and functions

The following elements are associated with each connection point:

- one icon showing:
  - whether the connection point needs to be monitored. If the box is checked, the device is monitored.
  - whether the connection point is faulty. The icon goes red if an error is detected.
- the connection point number.

Diagnostics

On screen opening or on reset request, the **report** variables from all the connection points are read by a cyclic communication (one per second).

The counter values from each **report** variable are stored to create a reference state. The time between reading and rereading the same variable is equal to the number of configured devices + 2 (0 and 63) in seconds.

A connection point is considered faulty if the value of one of the error counters has changed since the reference state. When the point is faulty, the icon turns red.

Diagnostics are only sent back if there is a communication between the bus manager and the faulty connection point. Errors correspond to the WORLDFIP standard defined error counters.

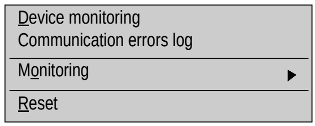
How to disable device monitoring

The following procedure describes how to disable the device monitoring on the bus.

Step	Action
1	Click on the checkbox belonging to the connection point to be disabled. **Result**: The box is no longer checked. In this case this connection's report variable is no longer read and its reference state is reset.

How to reset the reference state

The following procedure shows how to reset the reference state

Step	Action
1	Right click on the screen background. **Result**: a contextual menu appears. 
2	Select the **Reset** command.

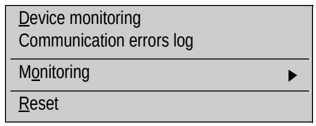
How to access the monitoring screen for one device

Introduction

This operation describes how to access the monitoring screen for a single FIPIO bus device and how to display its error counters.
It only applies to online mode.

Procedure

The following table shows the procedure:

Step	Action
1	Access the **Device monitoring** screen.
2	Select the connection point number to be accessed. **Result**: the number is highlighted.
3	Right click on the screen background. **Result**: a contextual menu appears. 
4	Select the **Single device monitoring** command.

Diagnostics screen: single device monitoring

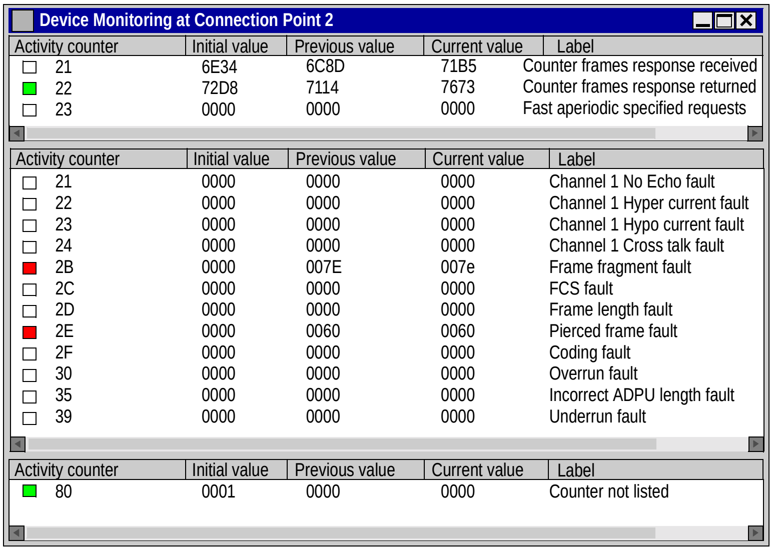
Introduction

This screen is used to display the status details of all the counters from a particular connection point.
It features all three zones corresponding to each type of counter:

- activity,
- error,
- manufacturer

Illustration

The screen dedicated to devices looks like this:



Device Monitoring at Connection Point 2

Activity counter	Initial value	Previous value	Current value	Label
21	6E34	6C8D	71B5	Counter frames response received
22	72D8	7114	7673	Counter frames response returned
23	0000	0000	0000	Fast aperiodic specified requests

Activity counter	Initial value	Previous value	Current value	Label
21	0000	0000	0000	Channel 1 No Echo fault
22	0000	0000	0000	Channel 1 Hyper current fault
23	0000	0000	0000	Channel 1 Hypo current fault
24	0000	0000	0000	Channel 1 Cross talk fault
2B	0000	007E	007e	Frame fragment fault
2C	0000	0000	0000	FCS fault
2D	0000	0000	0000	Frame length fault
2E	0000	0060	0060	Pierced frame fault
2F	0000	0000	0000	Coding fault
30	0000	0000	0000	Overrun fault
35	0000	0000	0000	Incorrect ADPU length fault
39	0000	0000	0000	Underrun fault

Activity counter	Initial value	Previous value	Current value	Label
80	0001	0000	0000	Counter not listed

Elements and functions

The following elements are associated with each counter:

- one icon indicating the state of the counter since the reference state:
  - white: no change,
  - green: change in the activity or manufacturer counters,
  - red: change in the error counters (the current value is different from the reference state).
- the hexadecimal counter number,
- its hexadecimal reference value,
- its hexadecimal value during the last read,
- its current hexadecimal value,
- its label according to the WORLDFIP standard or the **Counter not listed** label for the manufacturer part.

Diagnostics

On screen opening or on reset request, the **report** variables from all the connection points are read by a cyclic communication (one per second).

The counter values from each **report** variable are stored to create a reference state.

A connection point is considered faulty if the value of one of the error counters has changed since the reference state. When the point is faulty, the icon turns red.

Diagnostics are only sent back if there is a communication between the bus manager and the faulty connection point. Errors correspond to the WORLDFIP standard defined error counters.

How to reset the reference state

The following procedure shows how to reset the reference state

Step	Action
1	Right click on the screen background. **Result**: a contextual menu appears. 
2	Select the **Reset** command.

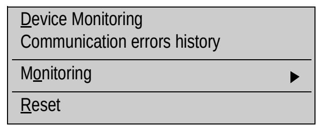
How to access the communication error history screen

Introduction

This operation describes how to access the FIPIO bus communication error history screen.
It only applies to online mode.

Procedure

The following table shows the procedure:

Step	Action
1	Access the **Device monitoring** screen.
2	Right click on the screen background. **Result**: a contextual menu appears. 
3	Select the **Communication error history** command.

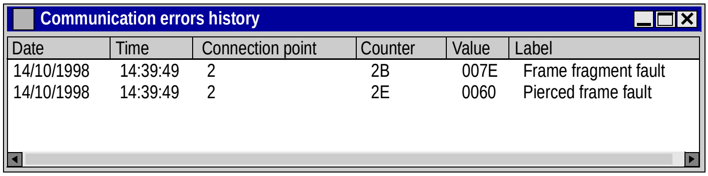
Diagnostics screen: communication error history

Introduction

This screen has a list of the communication errors from the connection points (plus 0 and 63), which are configured and declared monitored in the **Device monitoring** screen.

Illustration

The screen dedicated to devices looks like this:



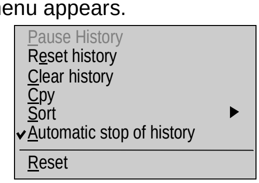
Elements and functions

Every time an error counter from a connection point changes, a line is added. It features:

- the current date and time of the programming terminal,
- the decimal connection point number,
- the hexadecimal error counter number,
- the hexadecimal counter value,
- the counter label according to the WORLDFIP standard.

How to pause/ resume the history

This command is used to stop and resume screen updating.

Step	Action
1	Right click on the screen background. **Result**: a contextual menu appears. 
2	Select the **Pause history** command or **Resume history** command.

How to clear history

This command can be accessed if the **Pause history** function is confirmed. It is used to delete all the lines from the screen.

Step	Action
1	Access the contextual menu.
2	Select the **Clear history** command

How to sort the history

This command can be accessed if the **Pause history** function is confirmed. It is used to sort all the history lines either by date and time or by connection point or counter.

Step	Action
1	Access the contextual menu.
2	Select the **Sort** → **by date and time** command.

How to copy the history

This command can be accessed if the **Pause history** function is confirmed. It is used to copy lines selected in text format onto the clipboard.

Step	Action
1	Access the contextual menu.
2	Select the **Sort** → **by date and time** command.

How to automatically stop the history

When this function is selected, it is used to stop the history when it has reached a maximum number of lines (4000 lines). A message pops up to indicate that this stop has occurred. When the function is not selected and when the maximum number has been reached, new added lines replace the first ones (turning mode).

Step	Action
1	Access the contextual menu.
2	Select the **Automatic history stop** command **Result**: selecting the command checks the function.

How to reset the reference state

The following procedure shows how to reset the reference state

Step	Action
1	Access the contextual menu.
2	Select the **Reset** command.

Language objects associated with FIPIO communication

23

Introduction

Subject of this Section

This Chapter introduces language objects associated with FIPIO communication.

What's in this Chapter?

This Chapter contains the following Maps:

Language objects in implicit exchange

Introduction

This page describes all the language objects for implicit exchange in FIPIO communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Bit objects

The table below shows the different bit objects for implicit exchange.

Object (1)	**Function**	**Meaning**
%I\p.2.c\0.MOD.ERR	Module error bit	This bit set to 1, indicates a module error (at least one of the channels is faulty,…)
%I\p.2.c\m.i.ERR	Channel error bit	This bit set at 1 indicates a faulty channel.
%I\p.2.c\m.i.r	Bit exchange	Image of the module’s physical inputs (input acquisition)
%Q\p.2.c\m.i.r	Bit exchange	Image of the module’s physical outputs (output command)
Key		
(1)	p.2.c\m.i.r Address • p: corresponds to the processor’s slot • c: corresponds to the connection point number • m: corresponds to the module position number • i: corresponds to the channel number	

Word objects

The table below shows the different word objects for implicit exchange.

Object (1)	**Function**	**Meaning**
%IW\p.2.c\m.i.r	Word exchange	Image of the module’s physical inputs (input acquisition)
%QW\p.2.c\m.i.r	Word exchange	Image of the module’s physical outputs (output command)
Key		
(1)	p.2.c\m.i.r Address • p: corresponds to the processor’s slot • c: corresponds to the connection point number • m: corresponds to the module position number • i: corresponds to the channel number	

Language object for explicit exchange

Introduction

This page describes all the language objects for explicit exchange in a FIPIO communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for explicit exchange.

Object (1)	Function	Meaning
%MW\p.2.c\0.MOD.2	Module status	Least significant byte: corresponds to standard. ● x0 = 1: internal error ● x1 = 1: functional error ● x2 = 1: terminal block fault ● x3 = 1: standard module self-testing ● x4 = 1: reserved (= 0) ● x5 = 1: configuration error ● x6 = 1: missing module ● x7 = 1: extension module error Most significant byte: corresponds to extension ● x8 = 1: internal error ● x9 = 1: functional error ● x10 = 1: terminal block fault ● x11 = 1: extension module self-testing ● x12 = 1: reserved (= 0) ● x13 = 1: configuration error ● x14 = 1: missing module ● x15 = 1: reserved (= 0)
%MW\p.2.c\0.i.2	Standard module channel status	Least significant byte: corresponding to standard ● x0 = 1: external error 4 ● x1 = 1: external error 3 ● x2 = 1: external error 2 ● x3 = 1: external error 1 ● x4 = 1: internal error ● x5 = 1: hardware configuration error ● x6 = 1: communication error ● x7 = 1: application error

Object (1)	Function	Meaning
%MW\p.2.c\1.i.2	Extension module channel status	Least significant byte: corresponding to extension • x0 = 1: external error 4 • x1 = 1: external error 3 • x2 = 1: external error 2 • x3 = 1: external error 1 • x4 = 1: internal error • x5 = 1: hardware configuration error • x6 = 1: communication error • x7 = 1: application error
Key		
(1)	p.2.c\m.i.r Address • p: corresponds to the processor's slot • c: corresponds to the connection point number • m: corresponds to the module position number • i: corresponds to the channel number	

Note: For each connected device, refer to the corresponding documentation for details of task status words.

Example

The example focuses on the channel level diagnostics for a TBX TOR device:

Object	Function	Meaning
%MW\p.2.c\0.i.2 %MW\p.2.c\1.i.2	Channel status	Least significant byte: • x0 = 1: tripped output • x1 = 1: globally tripped • x2 = 1: terminal block fault • x3 = 1: external supply fault • x4 = 1: channel configured but not physically present • x5 = 1: channel present but different from that configured • x6 = 1: communication error • x7 = 1: application error

Explicit exchange management and reports

Introduction

This page describes all the language objects that manage explicit exchanges. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for the management of explicit exchanges.

Object (1)	**Function**	**Meaning**
%MW\p.2.c\0.MOD.0	Module exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication module • x2 = 1: sending of adjustment parameters to the communication module
%MW\p.2.c\0.MOD.0	Module report	• x1 = 0: command parameters received and accepted by the module • x2 = 0: adjustment parameters received and accepted by the module
%MW\p.2.c\0.i.0	Channel exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters in progress • x2 = 1: sending of adjustment parameters in progress • x3 to x14: reserved (= 0) • x15 = 1: sending of configuration parameters in progress
%MW\p.2.c\0.i.1	Channel report	• x0 = 0: status reading OK • x1 = 0: command parameters received and accepted by the device • x2 = 0: adjustment parameters received and accepted by the device • x3 to x14: reserved (= 0) • x15 = 0: configuration parameters received and accepted by the device
Key		
(1)	p.2.c\m.i.r Address • p: corresponds to the processor's slot • c: corresponds to the connection point number • m: corresponds to the module position number • i: corresponds to the channel number	

FIPIO communication standard profiles

24

Introduction

Subject of this Chapter

This chapter introduces devices compatible with the standard communication profiles for use with the FIPIO bus and its services.

What's in this Chapter?

This Chapter contains the following Sections:

24.1 Introduction to standard FIPIO communication profiles

Introduction

Subject of Section

This Section provides a summary description of the standard profiles of the FIPIO bus and its associated services.

What's in this Section?

This Section contains the following Maps:

Standard profiles: general

Introduction

A device conforming to the standard FIPIO communication profiles can be linked to a FIPIO bus, to exchange the input/output variables.

Data exchanges with devices are used to:
- exchange inputs/outputs,
- write configuration or adjustment parameters,
- diagnose a connected device.

There are three types of standard profile:
- FRDP: FIPIO Reduced Device Profile
- FSDP: FIPIO Simple Device Profile
- FEDP: FIPIO Extended Device Profile

Volume of data exchanged

The device profiles, which conform to a standard profile are a function of the number of inputs and outputs to be exchanged.

The table below describes the words managed by the different standard profiles:

Profile	**FRD**	**FSD**	**FED**
Process data input acquisition output control	 2 words 2 words	 8 words 8 words	 32 words 32 words
Configuration (optional)	-	16 words	30 words
Adjust (optional)	-	32 words	30 words
Commands specific command	 -	 -	 8 words
Diagnostics input validity specific status	 1 byte -	 1 byte -	 1 byte 8 words

Designation of a standard profile

Introduction

A device conforming to the standard FIPIO communication profiles is defined by assigning one of the STD_P family standard profiles to it at the FIPIO connection point.

The family consists of a standard profile reference list.

How the reference is made up

Each reference is made up of several significant codes:
- the standard profile used:
  - FRD
  - FSD
  - FED
- the connected device structure:
  - C: Compact
  - M: Modular
- the number and type of objects exchanged with the manager: corresponds to the input/output exchange volume in 16 bit words
  - 2 words
  - 8 words
  - 32 words
- P: corresponds to the presence of configuration or adjustment parameters (chosen).

FRD profile

the reference is made up of the following:

Profile	Structure	Number of objects	Parameter
FRD	C	2	-
			P

FSD profile

the reference is made up of the following:

Profile	Structure	Number of objects	Parameter
FSD	C	8	-
	M		P

FED profile

the reference is made up of the following:

Profile	Structure	Number of objects	Parameter
FED	C	32	-
	M		P

List of the standard profiles proposed in catalog by PL7

Introduction

During FIPIO configuration, you can connect standard profiles in accordance with device type.

Compact device

The following table gives a list of the compact standard profiles:

Reference	Designation	Language interface
FRD C2	EQP RED CMPCT 2M	32 bits %I, 32 bits %Q
FRD C2 P	EQP STD CMPCT 2M P	32 bits %I, 32 bits %Q
	STD DEV CMPCT 2W P	16 configuration words, 32 adjustment words
FSD C8	EQP STD CMPCT 8M	8 words %IW, 8 words %QW
	STD DEV CMPCT 8W	
FSD C8 P	EQP STD CMPCT 8M P	8 words %IW, 8 words %QW
	STD DEV CMPCT 8W P	16 configuration words, 32 adjustment words
FED C32	EQP STD CMPCT 32M	32 words %IW, 32 words %QW
	STD DEV CMPCT 32W	
FED C32 P	EQP STD CMPCT 32M P	32 words %IW, 32 words %QW
	STD DEV CMPCT 328W P	30 configuration words, 30 adjustment words

Modular device

The following table gives a list of the modular standard profiles:

Reference	Designation	Language interface
FSD M8	EQP STD MOD 8M	8 words %IW, 8 words %QW
	STD DEV MOD 8W	
FSD M8 P	EQP STD MOD 8M P	8 words %IW, 8 words %QW
	STD DEV MOD 8W P	16 configuration words, 32 adjustment words
FED M32	EQP STD MOD 32M	32 words %IW, 32 words %QW
	EXTENDED DEV MOD 32W	
FED M32 P	EQP STD MOD 32M P	32 words %IW, 32 words %QW
	EXTENDED DEV MOD 328W P	30 configuration words, 30 adjustment words

Momentum Device

In the Momentum family, where an analog input/output base is not available in the catalog, it is then necessary to select one of the OTHER_FxD_[P] standard profile references.
The choice criteria are as follows:

Reference	Language interface
OTHER_FRD	32 bits %I, 32 bits %Q
OTHER_FRDP	
OTHER_FSD	8 words %IW, 8 words %QW
OTHER_FSDP	
OTHER_FED	32 words %IW, 32 words %QW
OTHER_FEDP	

Communicator

The communicators are as follows:

Reference	Language interface
OTHER	other communication module
TSX FPP10	FIPIO TSX communication module
170 FNT 110 01	FIPIO TSX communication module for the TS Momentum

24.2 Configuration of the FIPIO bus standard profiles

Introduction

Subject of Section

This Section introduces the configuration principles for the FIPIO bus standard profiles.

What's in this Section?

This Section contains the following Maps:

Configuration screen of a standard profile

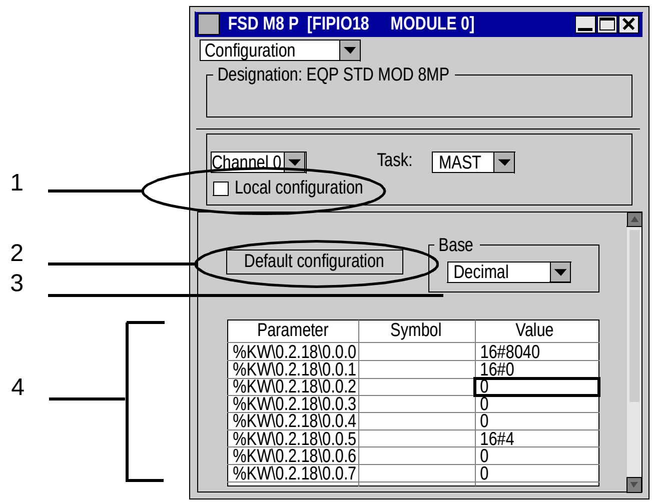
Introduction

The configuration screen of a standard profile reuses the parameters of all other devices configured on the FIPIO bus (see Configuration screen of an FIPIO device).

However, some parameters are exclusive to it. In the rest of this document, only the part specific to the standard profiles is explained.

Illustration

The screen dedicated to the device looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Description
1	The **Local configuration** check box is only available for the FSD C8 P and FSD M8 P profiles. If the box is checked, the configuration and adjustment parameters are not sent to the device connected to the bus (to ensure rapid start-up of the device). The device starts up or initializes with its own parameters. In the configuration screen, if the box is checked, the parameters of the channel cannot be accessed.
2	The **Default configuration** button is used to return to the original configuration.
3	The **Standard** is used to select the display standard of the value of the selected word. Three types are available: ● Decimal ● Hexadecimal ● Binary
4	This list displays the configuration words %KW or the adjustment words %MW which correspond to the registered standard profile. For each word, there is an associated **Symbol** and a **Value**.

How to modify the parameters of a standard profile

Introduction

The following procedures apply to the configuration or adjustment parameters.

How to modify the display standard

The following procedure shows the selection of the display standard. For the example, the chosen standard is binary.

Step	Action
1	Select the cell **Value** of the word to be modified.
2	Select from the dropdown menu **Standard** → **Binary**. **Result**: the cell displays `2#1011`.

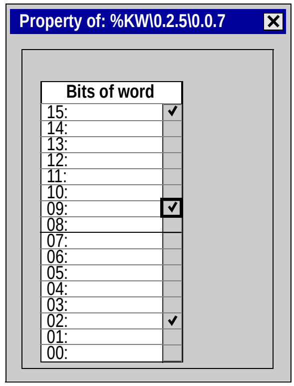
How to enter a value on the keyboard

The following procedure shows how to key a value into a cell.

Step	Action
1	Select the **Value** cell of the word to be modified.
2	How to enter a value on the keyboard. **Note:** Keyboard entry depends on the display standard.

How to enter a value in binary form

The following procedure shows how to enter a value in binary form.

Step	Action
1	Double click on the Value cell of the word to be modified. **Result**: the following window appears. 
2	Select the bits which must be set to 1.
3	Close the window **Property of: ...** by selecting the cross in the left-hand corner. **Result**: The closure validates the entered value and displays it according to the standard.

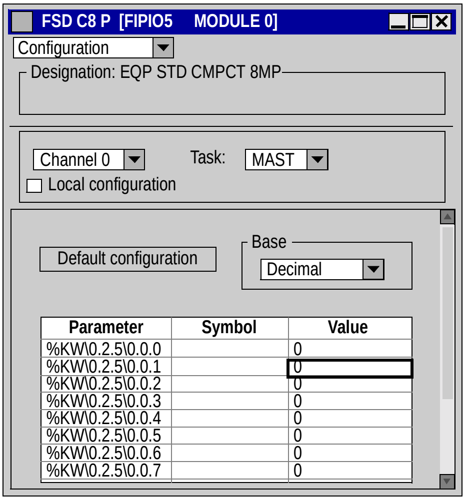
Adjustment mode

Introduction

Adjustment mode is accessed from the hardware configuration menu of the application browser. The principal is the same as for configuration mode, and the adjustment words are %MW.
There are 32 possible words for the FSD and FRD profiles and 30 words for the FED profiles.

Illustration

The adjustment screen dedicated to the device looks like this:



24.3 Debugging the FIPIO bus standard profiles

Introduction

Subject of Section

This Section introduces the debugging principles FIPIO bus standard profiles.

What's in this Section?

This Section contains the following Maps:

Debugging screen of a standard profile

Introduction

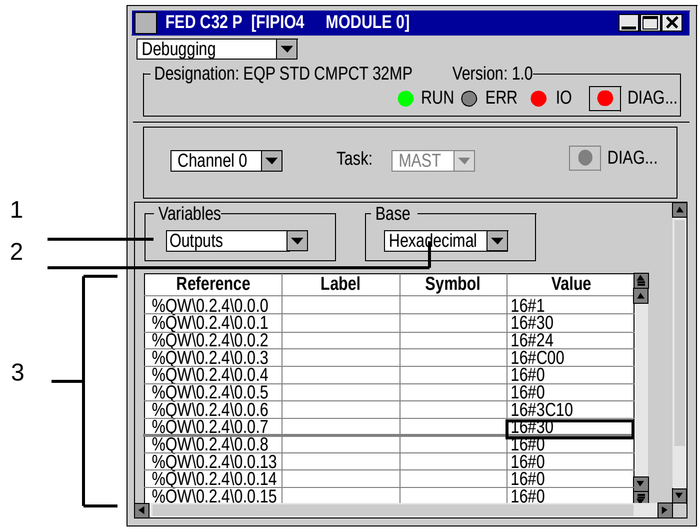
The debugging screen of a standard profile reuses the parameters of all other devices configured on the FIPIO bus (see Debugging screen of an FIPIO device).

However, some parameters are exclusive to it. In the rest of this document, only the part specific to the standard profiles is explained.

Note: The adjustment parameters cannot be accessed.

Illustration

The screen dedicated to the device looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Description
1	This dropdown list allows the choice of periodic exchange: ● of the input parts, ● of the output parts.
2	The **Standard** window is used to select the display standard of the value of the selected word. Three types are available: ● Decimal ● Hexadecimal ● Binary
3	This list displays the input words %IW or the output words %QW which correspond to the registered standard profile. For each word there is an associated **Wording**, a **Symbol** and a **Value**.

How to modify the debugging parameters of a standard profile

Introduction

The following procedures apply to the debugging parameters.

How to modify the display standard

The following procedure shows the selection of the display standard. For the example, the chosen standard is binary.

Step	Action
1	Select the **Value** cell of the word to be modified.
2	Select from the dropdown menu **Standard** → **Binary**. **Result**: the cell displays `2#1011`.

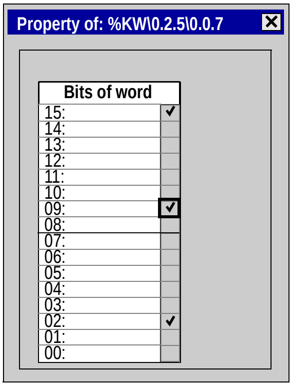
How to enter a value on the keyboard

The following procedure shows how to key a value into a cell.

Step	Action
1	Select the **Value** cell of the word to be modified.
2	How to enter a value on the keyboard. **Note:** Keyboard entry depends on the display standard.

How to enter a value in binary form

The following procedure shows how to enter a value in binary form. It is only valid for the output parts.

Step	Action
1	Double click on the Value cell of the word to be modified. **Result**: the following window appears. 
2	Select the bits which must be set to 1.
3	Close the window **Property of: ...** by selecting the cross in the left-hand corner. **Result**: The closure validates the entered value and displays it according to the standard.

24.4 Language objects associated with the FIPIO bus standard profiles

Introduction

Subject of Section

This section introduces the language objects associated with the FIPIO bus standard profiles.

What's in this Section?

This Section contains the following Maps:

Summary of the objects which can be accessed via the standard profiles

Introduction

The following tables show the language objects associated with each profile contained in the PL7 catalogue.

FRD profile

The following table relates to the FRD profiles

	FRD C2	**FRD C2 P**
Input acquisition	%I\p.2.c\0.0 %I\p.2.c\0.31	%I\p.2.c\0.0 %I\p.2.c\0.31
Output command	%Q\p.2.c\0.0 %Q\p.2.c\0.31	%Q\p.2.c\0.0 %Q\p.2.c\0.31
Configuration words	-	%KW\p.2.c\0.i.0 %KW\p.2.c\0.i.15
Status: management of exchanges	%MW\p.2.c\0.i.0	%MW\p.2.c\0.i.0
Exchange report	%MW\p.2.c\0.i.1	%MW\p.2.c\0.i.1
Status: channel standard	%MW\p.2.c\0.i.2	%MW\p.2.c\0.i.2
Validity of inputs	%MW\p.2.c\0.i.3	%MW\p.2.c\0.i.3
Status: channel specific	-	-
Command words	-	-
Adjustment words	-	%MW\p.2.c\0.i.4 %MW\p.2.c\0.i.35

FSD profile

The following table relates to the FSD profiles

	FSD C/M8	**FSD C/M8 P**
Input acquisition	%IW\p.2.c\0.0 %IW\p.2.c\0.7	%IW\p.2.c\0.0 %IW\p.2.c\0.7
Output command	%QW\p.2.c\0.0 %QW\p.2.c\0.7	%QW\p.2.c\0.0 %QW\p.2.c\0.7
Configuration words	-	%KW\p.2.c\0.i.0 %KW\p.2.c\0.i.15
Status: management of exchanges	%MW\p.2.c\0.i.0	%MW\p.2.c\0.i.0
Exchange report	%MW\p.2.c\0.i.1	%MW\p.2.c\0.i.1
Status: channel standard	%MW\p.2.c\0.i.2	%MW\p.2.c\0.i.2
Validity of inputs	%MW\p.2.c\0.i.3	%MW\p.2.c\0.i.3
Status: channel specific	-	-
Command words	-	-
Adjustment words	-	%MW\p.2.c\0.i.4 %MW\p.2.c\0.i.35

FED profile

The following table relates to the FSD profiles

	FSD C/M32	**FSD C/M32 P**
Input acquisition	%IW\p.2.c\0.0 %IW\p.2.c\0.31	%IW\p.2.c\0.0 %IW\p.2.c\0.31
Output command	%QW\p.2.c\0.0 %QW\p.2.c\0.31	%QW\p.2.c\0.0 %QW\p.2.c\0.31
Configuration words	-	%KW\p.2.c\0.i.0 %KW\p.2.c\0.i.29
Status: management of exchanges	%MW\p.2.c\0.i.0	%MW\p.2.c\0.i.0
Exchange report	%MW\p.2.c\0.i.1	%MW\p.2.c\0.i.1
Status: channel standard	%MW\p.2.c\0.i.2	%MW\p.2.c\0.i.2
Validity of inputs	%MW\p.2.c\0.i.3	%MW\p.2.c\0.i.3
Status: channel specific	%MW\p.2.c\0.i.4 %MW\p.2.c\0.i.11	%MW\p.2.c\0.i.4 %MW\p.2.c\0.i.11
Command words	%MW\p.2.c\0.i.12 %MW\p.2.c\0.i.19	%MW\p.2.c\0.i.12 %MW\p.2.c\0.i.19
Adjustment words	-	%MW\p.2.c\0.i.20 %MW\p.2.c\0.i.49

Language objects in implicit exchange

Introduction

This page describes all the language objects for implicit exchange associated with the standard profiles for FIPIO communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Bit objects

The table below shows the different bit objects for implicit exchange.

Object (1)	Function	Meaning
%I\p.2.c\0.MOD.ERR	Module error bit	This bit set to 1, indicates a module error (at least one of the channels is faulty,…)
%I\p.2.c\m.i.ERR	Channel error bit	This bit set at 1 indicates a faulty channel.
%I\p.2.c\0.0 to %I\p.2.c\0.31	Bit exchange	Acquiring input bits for FRD profiles
%Q\p.2.c\0.0 to %Q\p.2.c\0.31	Bit exchange	Acquiring output bits for FRD profiles
Key		
(1)	p.2.c Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number	

Word objects

The table below shows the different word objects for implicit exchange.

Object (1)	Function	Meaning
%IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.7	FSD word exchange	Acquiring input words for FSD profiles
%QW\p.2.c\0.0.0 to %QW\p.2.c\0.0.7	FSD word exchange	Acquiring output words for FSD profiles
%IW\p.2.c\0.0.0 to %IW\p.2.c\0.0.31	FED word exchange	Acquiring input words for FED profiles
%QW\p.2.c\0.0.0 to %QW\p.2.c\0.0.31	FED word exchange	Acquiring output words for FED profiles
Key		
(1)	p.2.c\m.i.r Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number ● m: corresponds to the module position number ● i: corresponds to the channel number	

Language object for explicit exchange

Introduction

This page describes all the language objects for explicit exchange associated with the standard profiles for FIPIO communication that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects common to all the profiles

The table below shows the different word objects for explicit exchange.

Object (1)	Function	Meaning
%MW\p.2.c\0.MOD.2	Module status	Least significant byte: corresponds to standard. ● x0 = 1: internal error ● x1 = 1: functional error ● x2 = 1: terminal block fault ● x3 = 1: standard module self-testing ● x4 = 1: reserved (= 0) ● x5 = 1: configuration error ● x6 = 1: missing module ● x7 = 1: extension module error Most significant byte: corresponds to extension ● x8 = 1: internal error ● x9 = 1: functional error ● x10 = 1: terminal block fault ● x11 = 1: extension module self-testing ● x12 = 1: reserved (= 0) ● x13 = 1: configuration error ● x14 = 1: missing module ● x15 = 1: reserved (= 0)
%MW\p.2.c\0.i.2	Standard module channel status	Least significant byte: corresponding to standard ● x0 = 1: external error 4 ● x1 = 1: external error 3 ● x2 = 1: external error 2 ● x3 = 1: external error 1 ● x4 = 1: internal error ● x5 = 1: hardware configuration error ● x6 = 1: communication error ● x7 = 1: application error
Key		
(1)	p.2.c\m.i.r Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number ● m: corresponds to the module position number ● i: corresponds to the channel number	

Object (1)	Function	Meaning
%MW\p.2.c\0.i.3	Validity of inputs	For FRD, FSD and FED profiles the least significant byte is specific to the connected device. Refer to the documentation for the device.
Key		
(1)	p.2.c\m.i.r Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number ● m: corresponds to the module position number ● i: corresponds to the channel number	

Note: For each connected device, refer to the corresponding documentation for details of task status words.

Internal words for FRD and FSD profiles

The following table shows the internal words specific to FRD and FSD profiles:

Object	Function	Meaning
%MW\p.2.c\0.i.4 to %MW\p.2.c\0.i.35	Adjustment parameters	32 specific adjustment words. Parameters which can be accessed in read and write format via the `WRITE_PARAM`, `READ_PARAM`, `SAVE_PARAM` and `RESTORE_PARAM` functions.
Key		
(1)	p.2.c\m.i.r Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number ● m: corresponds to the module position number ● i: corresponds to the channel number	

Internal words for the FED profiles

The following table shows the internal words specific to the FED profiles:

Object	Function	Meaning
%MW\p.2.c\0.i.4 to %MW\p.2.c\0.i.11	Specific status	8 specific status words. Parameters which can be accessed in read format via the `READ_STATUS` function.
%MW\p.2.c\0.i.12 to %MW\p.2.c\0.i.19	Specific channel level command	8 specific command words. Parameters which can be accessed in write format by the `WRITE_CMD` function.

Object	Function	Meaning
%MW\p.2.c\0.i.20 to %MW\p.2.c\0.i.49	Adjustment parameters	32 specific adjustment words. Parameters which can be accessed in read and write format via the `WRITE_PARAM`, `READ_PARAM`, `SAVE_PARAM` and `RESTORE_PARAM` functions.
Key		
(1)	p.2.c\m.i.r Address ● p: corresponds to the processor's slot ● c: corresponds to the connection point number ● m: corresponds to the module position number ● i: corresponds to the channel number	

Language objects associated with configuration

Introduction

This page describes all the configuration language objects associated with the FIPIO communication agents that can be displayed by the agent application program.

Internal constants

The following table describes the internal constants:

Object	Function	Meaning
%KW\p.2.c\0.0.0 to %KW\p.2.c\0.15	Configuration words at channel level	They contain channel parameters set via the configuration editor for FRD and FSD profiles.
%KW\p.2.c\0.0.0 to %KW\p.2.c\0.29	Configuration words at channel level	They contain channel parameters set via the configuration editor for FED profiles.

FIPIO Agent

25

Introduction

Subject of this Chapter

This Chapter introduces the Agent devices on the FIPIO bus and its services.

What's in this Chapter?

This Chapter contains the following Sections:

25.1 Introduction to FIPIO Agents

Introduction

Subject of Section

This section provides a summary description of the agents on the FIPIO bus and their associated services.

What's in this Section?

This Section contains the following Maps:

FIPIO Agent: General

Introduction

The TSX Micro or TSX Premium PLCs, equipped with the PCMCIA TSX FPP 10 card on their built-in communication channel, are agents on the FIPIO bus.

The FIPIO function agent is used to perform two types of data exchange:
- periodic exchanges of information with the manager (shared variables type),
- aperiodic exchanges of messages with the manager, from CCX 17 devices or with other agents.

Note: This function is available with the TSX FPP 10 card, minimum version V1.8.

Periodic data exchange

Introduction

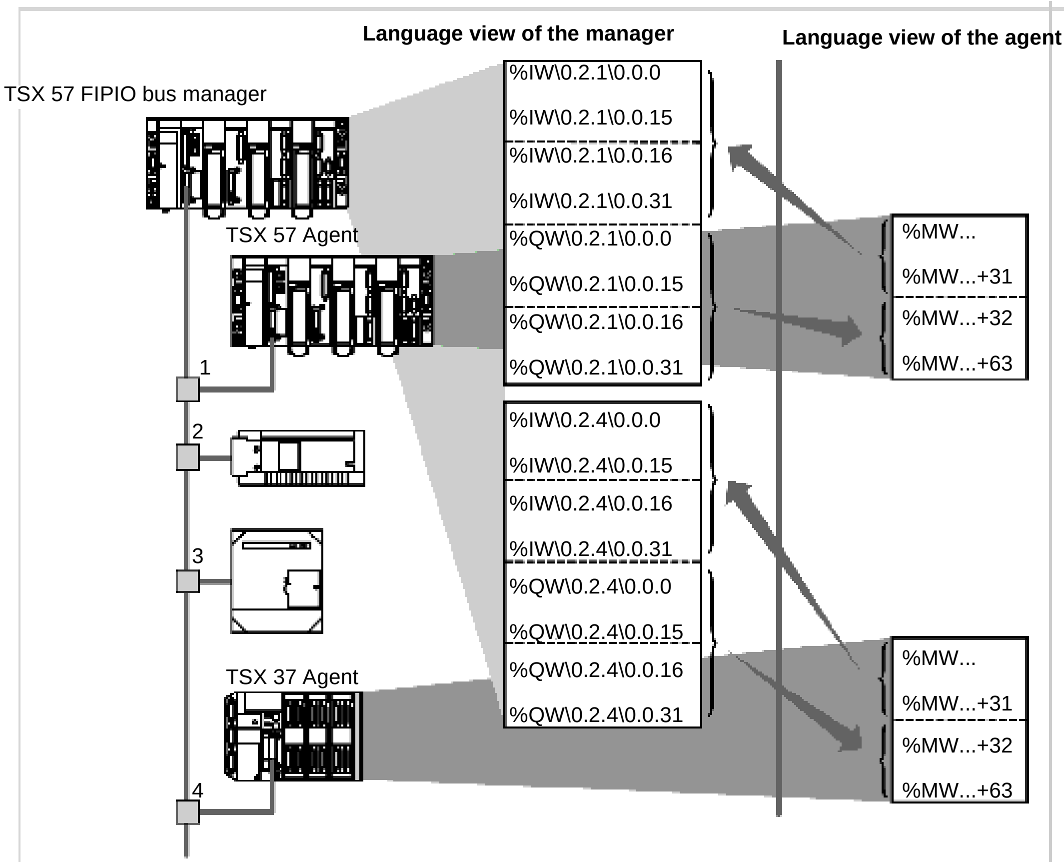
Each FIPIO Agent PLC uses 64 consecutive %MW words to exchange the periodic data.

- The 32 first words are reserved for transmitting the information to the manager.
- The 32 remaining words are reserved for receiving the information.

> **Note:** The status %MW words and the command %MW are not significant.

Viewing the exchanges

The following chart illustrates the exchanges between an FIPIO Agent and a TSX Premium manager.



Special cases

Introduction

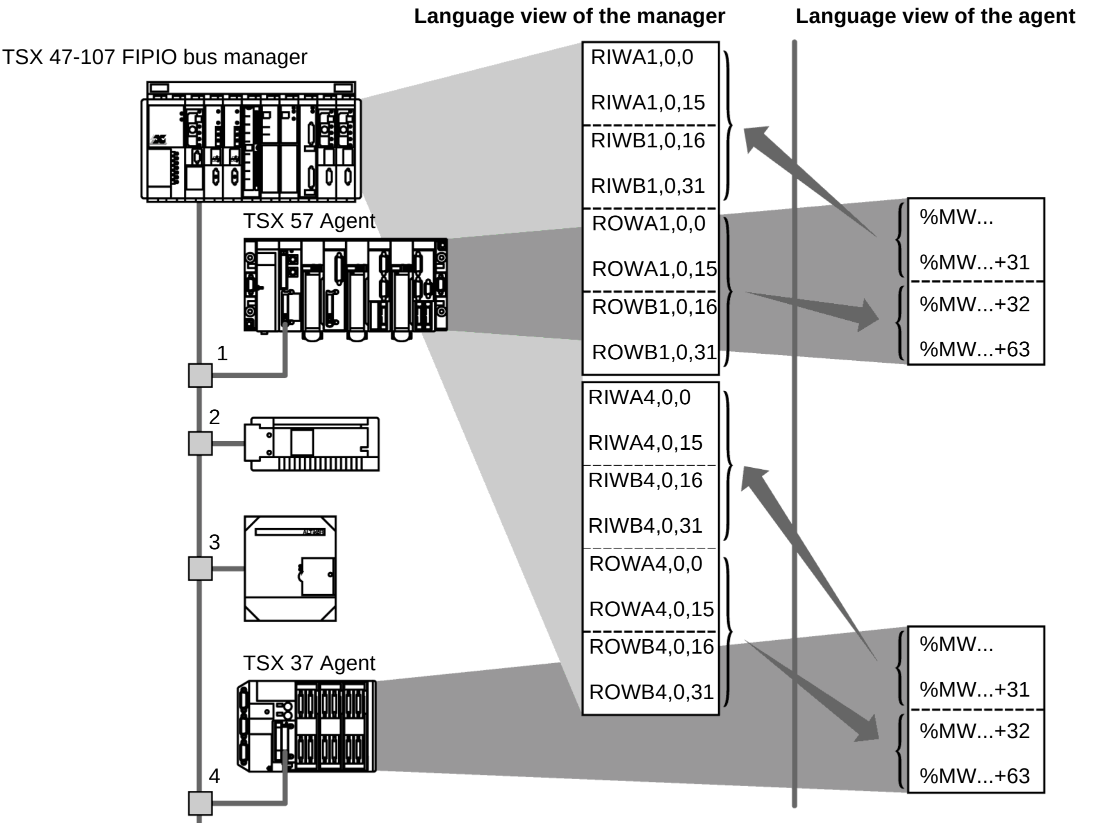
A TSX Premium PLC which is registered as an FIPIO Agent can communicate with a TSX 47-107 or APRIL 5000 manager.

For these uses, an FIPIO Agent is registered on the bus by registering a standard profile to the connection point.

The registered standard profile is as follows:
- Device family: STD_P
- Standard: FED M32
- Communicator: TSX FPP 10

Exchanges with a TSX 47-107

The following chart illustrates the exchanges between an FIPIO Agent and a TSX 47-107 manager.



Communication from an FIPIO Agent

Introduction

A PLC registered as an FIPIO Agent can communicate:
- with the server of the bus manager,
- with the server of another FIPIO Agent.

Addressing

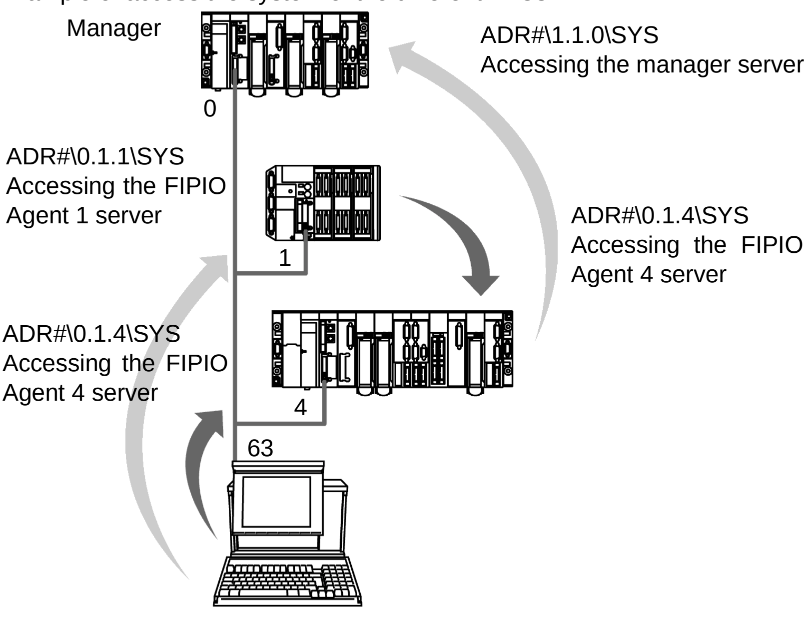
The syntax of an address is as follows:
`ADR#\0.1.4\SYS`

The following table describes the addressing parameters:

Parameter	Description
0.1.4	• 0: corresponds to the module sending the request • 1: corresponds to the channel sending the request • 4: corresponds to the destination connection point
SYS	corresponds to the server address.

Example

Example of access the system of the different PLCs



The FIPIO Agent PLC at address 1 reads 10 words in the FIPIO Agent PLC at address 4.

```
READ_VAR(ADR#\0.1.4\SYS, '%MW', 0, 10, %MW10:10, %MW100:4)
```

25.2 Configuration of FIPIO Agents

Introduction

Subject of Section

This Section introduces the configuration principles for FIPIO Agents.

What's in this Section?

This Section contains the following Maps:

How to access the FIPIO Agent parameters via PCMCIA cards

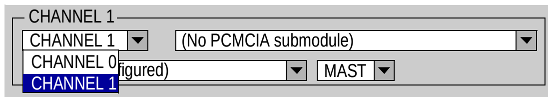
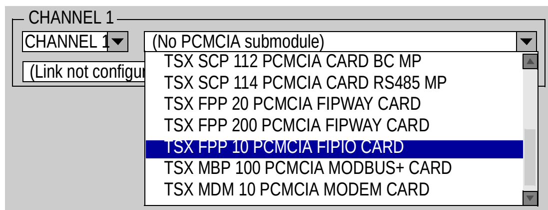
Introduction

The creation of an application setting up FIPIO Agents requires the configuration of the communication channel of the PLC registered as an FIPIO Agent.

This operation describes how to access the configuration parameters of the FIPIO Agent link via the PCMCIA TSX FPP card for TSX Micro/Premium PLCs.

How to access the link

The following table shows the procedure for accessing the FIPIO link:

Step	Action
1	Access the communication channel configuration screen.
2	From the dropdown menu, select the communication channel **CHANNEL 1** **Example** 
3	Select one of the following PCMCIA cards from the dropdown menu: ● **TSX FPP 10 PCMCIA CARD FIPIO** **Example** 

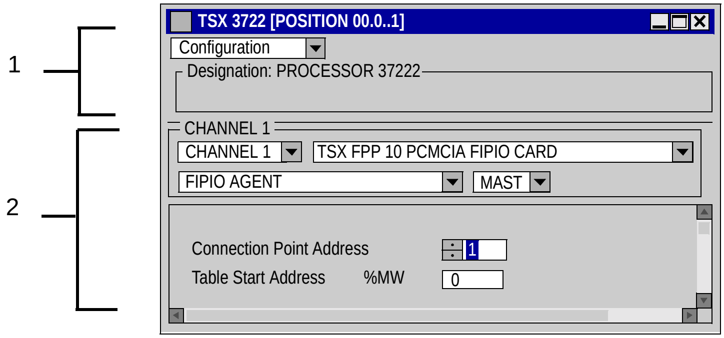
FIPIO Agent configuration screen

Introduction

This screen, split into two areas, is used to register the communication channel and to configure the necessary parameters for a FIPIO Agent link.

Illustration

The screen dedicated to communication looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Zone	Function
1	common	See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).
2	specific	is used to select and complete the following parameters: ● connection point address ● the beginning address of the table.

the beginning address of the table.

This parameter indicates the address of the table to be reserved for the periodic data exchanges between the bus manager and the FIPIO Agent.

The table has 64 words:
- 32 words for the inputs (%IW\p.2.c\m.i.r),
- 32 words for the outputs (%QW\p.2.c\m.i.r).

25.3 Debugging FIPIO Agents

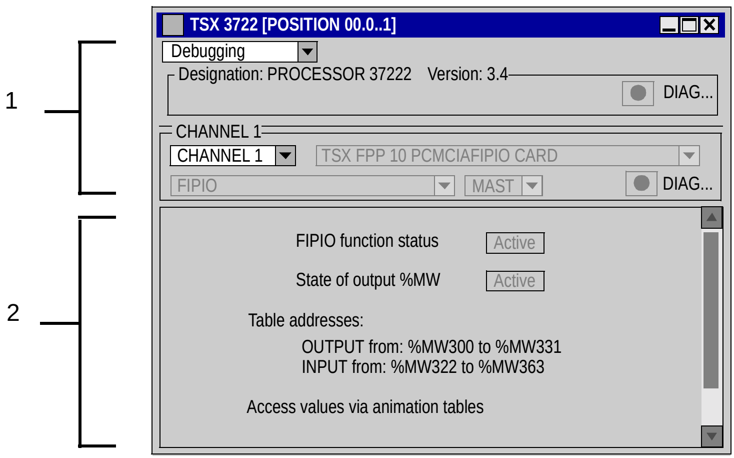
FIPIO Agent debugging screen

Introduction

This screen, split into two areas, is used to debug a FIPIO Agent.

Illustration

The screen dedicated to debugging looks like this:



Elements and functions

This table describes the different areas that make up the configuration screen:

Address	Zone	Function
1	common	See (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1).
2	specific	is used to access the debugging parameters of a FIPIO Agent. No data can be accessed from this screen.

25.4 Language objects associated with the FIPIO Agents

Introduction

Subject of Section

This Section introduces the language objects associated with FIPIO Agents.

What's in this Section?

This Section contains the following Maps:

Language objects in implicit exchange

Introduction

This page describes all the language objects for implicit exchange associated with the FIPIO communication agents that can be displayed or modified by the agent's application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Bit objects

The table below shows the different bit objects for implicit exchange.

Object (1)	Function	Meaning
%Ixy.MOD.ERR	Module error bit	This bit set to 1, indicates a module error (at least one of the channels is faulty,…)
%Ixy.i.ERR	Channel error bit	This bit set to 1, indicates a line fault.
Key		
(1)	xy.i Address ● x: corresponds to the rack number (-) ● y: corresponds to the module number (0/1) ● i: corresponds to the channel number (1)	

Word objects

The table below shows the different word objects for implicit exchange.

Object (1)	Function	Meaning
%IWxy.i.0	Agent function status	Byte 0: ● = 16#01: IDLE function ● = 16#02: RUN function ● = 16 #03: STOP function
	Strategy to be applied to outputs	Byte 1: ● = 16#01: safety ● = 16#02: %MW value valid ● = 16 #03: fallback
Key		
(1)	xy.i Address ● x: corresponds to the rack number (-) ● y: corresponds to the module number (0/1) ● i: corresponds to the channel number (1)	

Language object for explicit exchange

Introduction

This page describes all the language objects for explicit exchange associated with the FIPIO communication agents that can be displayed or modified by the application program. (PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for explicit exchange.

Object (1)	Function	Meaning
%MWxy.MOD.2	Module status	• x0 = 1: defective module • x1 = 1: functional error (error between the processor and the module, adjustment or configuration error, …) • x2 = 1: terminal block fault (not connected) • x3 = 1: self-tests running • x4 = 1: reserved • x5 = 1: error in hardware or software configuration (the module present is not that declared in the configuration, the sub-modules are not compatible) • x6 = 1: missing module • x7 = 1: error in one of the sub-modules
%MWxy.i.2	Standard channel status	Byte 0: • x0 = 1: input words are disabled when the manager is in RUN • x1 = 1: output words are disabled when the agent is in RUN • x4 = 1: internal error of TSX FPP 10 card or card not yet started by the manager • x5 = 1: configuration error (the configured data module is different from that present) • x6 = 1: communication error on FIPIO • x7 = 1: application error (%MW table overrun) Byte 1: reserved
Key		
(1)	xy.i Address • x: corresponds to the rack number (-) • y: corresponds to the module number (0/1) • i: corresponds to the channel number (1)	

Explicit exchange management and reports

Introduction

This page describes all the language objects that manage explicit exchanges. (See : PL7 Micro/Junior/Pro ; Communication applications ; Volume 1)

Word objects

The table below shows the different word objects for the management of explicit exchanges.

Object (1)	Function	Meaning
%MWxy.MOD.0	Module exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication module • x2 = 1: sending of adjustment parameters to the communication module
%MWxy.MOD.1	Module report	• x1 = 0: command parameters received and accepted by the module • x2 = 0: adjustment parameters received and accepted by the module
%MWxy.i.0	Channel exchanges in progress	• x0 = 1: reading status in progress • x1 = 1: sending of command parameters to the communication channel • x2 = 1: sending of adjustment parameters to the communication channel
%MWxy.i.1	Channel report	• x1 = 0: command parameters received and accepted by the communication channel • x2 = 0: adjustment parameters received and accepted by the communication channel
Key		
(1)	xy.i address • x: corresponds to the rack number (-) • y: corresponds to the module number (0/1) • i: corresponds to the channel number (1)	

Language objects associated with configuration

Introduction

This page describes all the configuration language objects associated with the FIPIO communication agents that can be displayed by the agent application program.

Internal constants

The following table describes the internal constants:

Object	Function	Meaning
%KWxy.i.0	Type	Byte 0 = 16#09: for the FIPIO Agent function
%KWxy.i.1	Reserved	-
%KWxy.i.2	Connection point address	Byte 0 = 16#01 to 16#7F: corresponds to addresses 1 to 127
%KWxy.i.3	Table start address	Byte 0: least significant byte of the address Byte 1: most significant byte of the address

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