Concept
XXMIT / RTXMIT Transmit (Receive) Function Block

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Table of Contents

About the Book

At a Glance

Document Scope

This manual presents all information neccessary to configure the XXMIT and the RTXMIT function blocks on all PLC platforms supporting the IEC languages.

Validity Note

The information contained in this book is valid for Concept version 2.6 Service release 1 and later.

Related Documents

Title of Documentation	Reference Number
Concept Installation	840 USE 502 00
Concept User Manual	840 USE 503 00
Concept IEC Block Libraries	840 USE 504 00

User Comments

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Introduction to XXMIT and RTXMIT

1

At a Glance

Overview

This chapter gives a general overview on the transmit function block XXMIT and the transmit/receive function block RTXMIT.

What's in this Chapter?

This chapter contains the following topics:

XXMIT Functionality

Function Overview

The XXMIT (Transmit) function block enable the use of the PLCs serial ports for communication under the control of the application program.

The following communication types are supported:

- Modbus as Master
- Simple ASCII Input/Output
- ASCII Input with one or two termination characters
- Modem Communication

Function Description

The Transmit blocks send Modbus messages from a "master" PLC to multiple slave PLCs or sends ASCII character strings from the PLC's Modbus slave port #1 (on Momentum PLCs also port #2 is supported) to ASCII printers and terminals. XXMIT sends these messages over telephone dialup modems, radio modems, or simply direct connections. The Transmit blocks perform general ASCII input functions in the communication mode including simple ASCII and terminated ASCII. You may import and export ASCII or binary data into your PLC. The block has builtin diagnostics that checks to make sure no other Transmit blocks are active in the PLC on the same port. Within the Transmit blocks, control inputs allows you to control the communications link between the PLC and DCE (Data Communication Equipment) devices attached to Modbus port #1 or port #2 of the PLC. The Transmit blocks do NOT activate the port LED when transmitting data.

RTXMIT Functionality

Function Overview

The RTXMIT (Receive/Transmit) function block enable the use of the PLCs serial ports for full duplex communication under the control of the application program.

The following communication types are supported:

- Simple ASCII Input/Output
- ASCII Input with one or two termination characters

Function Description

The RTXMIT Transmit block sends ASCII character strings from the PLC's Modbus slave port#1 (on Momentum PLCs also port#2 is supported) to ASCII printers, terminals or any other serial device. The Transmit blocks perform general ASCII input functions in the communication mode including simple ASCII and terminated ASCII. You may import and export ASCII or binary data into your PLC. The RTXMIT block can send and receive characters at the same time (full duplex). The block has builtin diagnostics that checks to make sure no other Transmit blocks are active in the PLC on the same port. Within the Transmit blocks, control inputs allows you to control the communications link between the PLC and DCE (Data Communication Equipment) devices attached to Modbus port #1 or port#2 of the PLC. The Transmit blocks do NOT activate the port LED when transmitting data.

XXMIT: Transmit (Compact, Momentum, Quantum)

2

At a Glance

Introduction

This chapter describes the XXMIT function block.

What's in this Chapter?

This chapter contains the following topics:

Brief Description

Function Description

The XXMIT (Transmit) function block sends Modbus messages from a "master" PLC to multiple slave PLCs or sends ASCII character strings from the PLC's Modbus slave port#1 (on Momentum PLCs also port#2 is supported) to ASCII printers and terminals. XXMIT sends these messages over telephone dialup modems, radio modems, or simply direct connections. XXMIT performs general ASCII input functions in the communication mode including simple ASCII and terminated ASCII. You may import and export ASCII or binary data into your PLC. The block has builtin diagnostics that checks to make sure no other XXMIT blocks are active in the PLC on the same port. Within the XXMIT block control inputs allows you to control the communications link between the PLC and DCE (Data Communication Equipment) devices attached to Modbus port #1 or port#2 of the PLC. The XXMIT block does NOT activate the port LED when it is transmitting data.

Note: EN and ENO should NOT be used with the XXMIT, otherwise the output parameters may freeze.

Restrictions

The following restrictions apply to the XXMIT function block:
XXMIT does not support::

- ASCII string conversion
- copy and compare functions
- Port Status functions

Note: Momentum only supports one Stopbit.

Note: Port 2 only supported by Momentum PLCs

Software and Hardware Required

Software

The XXMIT function block requires the following software

- A minimum of Concept 2.2 Service Release 2
- IEC exec version

Hardware

The following hardware is **not** supported by the XXMIT function block:

- PLCs which do not support IEC languages
- Soft PLC
- All Atrium PLCs
- IEC Simulator

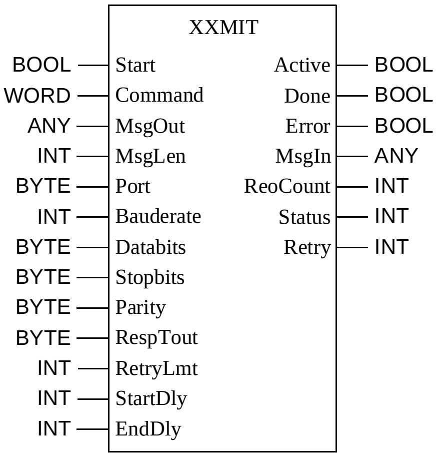
Memory Requirements

The usage of one or more XXMIT EFBs in an IEC application consumes approximately 15.5 KByte program (code) memory.For each instance of this EFB included in the user program, additional data memory between 2.5 and 3 Kbyte is allocated.

Representation

Symbol

Representation of the Block



Parameter Description

Description of the block parameter

Parameters	Data type	Significance
Start	BOOL	Value of 1 starts XXMIT operation
Command	WORD	Specifies the command to be performed
MsgOut	ANY	Message to be sent
MsgLen	INT	Message length of output message
Port	BYTE	Selection of communications interface
Baudrate	INT	Baudrate
Databits	BYTE	Databits
Stopbits	BYTE	Stopbits
Parity	BYTE	Parity
RespTout	INT	Time to wait for a valid response
RetryLmt	INT	Number of retries until receiving a valid response
StartDly	INT	Waiting time before message transmit.
EndDly	INT	Waiting time after message transmit
Active	BOOL	Value of 1 indicates that an XXMIT operation is in progress
Done	BOOL	Value of 1 indicates that the XXMIT operation has been completed successfully
Error	BOOL	Value of 1 indicates that an error has ocured or that the current XXMIT operation is terminated
MsgIn	ANY	Incoming message
RecCount	INT	Displaythe number of received characters
Status	INT	Display a fault code generated by the XXMIT block
Retry	INT	Indicates the current number of retry attempts made by the XXMIT block

Detailed Parameter Description

Start

A value of 1 at Start initiates the XXMIT operation. The value of 1 must be applied until the operation has finished or until an error has occurred.

Command

The XXMIT interprets each bit of the command word as a function to perform. If bit 7 and 8 are on simultaneously or if any two or more of bits 13, 14, 15 or 16 are on simultaneously or if bit 7 is not on when bits 13, 14, 15, or 16 are on error 129 will be generated. For more details refer to *XXMIT Communication Functions, p. 23*. The individual bit definitions are shown in the table below.
Command Word Layout

Bit

1		7	8	9		16

msb lsb

XXMIT Command Word Bit Definitions

Bit	**Definition**
Bit 1 (msb)	Reserved
Bit 2 Enable RTS/ CTS modem control	Set to 1 when a DCE connected to the PLC requires hardware handshaking using RTS/CTS control. This bit may be used in conjunction with values contained in StartDly and EndDly. Start of transmission delay keeps RTS asserted for the time in StartDly (ms) before XXMIT sends a message out of PLC port. Likewise, end of transmission delay keeps RTS asserted for the time in EndDly (ms) after XXMIT has finished sending a message out of the PLC port. Once the end of transmission delay expires XXMIT de-assert RTS.
Bit 3 Enable RS485 mode	Set to 1 when the selected port should operate in RS485 mode. Otherwise it defaults to 0, which is RS232 mode. When using port 2 of a Momentum PLC in RS485 mode with Modbus Messaging, make sure to use exactly the same parameters (baudrate, databits, stopbits, parity) for the XXMIT block as configured for that port.
Bit 4	Reserved
Bit 5 Terminated ASCII input	Set to 1 to remove and discard all characters from FIFO until the starting string is matched, then these starting characters and subsequent characters are written into MsgIn until the terminator sequence is matched. The terminator string is also written into the MsgIn. Refer to *Terminated ASCII Input Function, p. 24* for more details.
Bit 6 Simple ASCII input	Set to 1 to remove the ASCII characters from FIFO for writing into MsgIn array. Refer to *Simple ASCII Input Function, p. 26* for more details.

Bit	Definition
Bit 7 Enable ASCII string messaging	Set to 1 when you want to send ASCII messages out of the PLC. XXMIT sends ASCII strings up to 1024 characters in length. You program the ASCII message into the MsgOut. Only use Bit 7 OR Bit 8, do not try to use both.
Bit 8 Enable Modbus messaging	Set to 1 when you want to send Modbus messages out of the PLC. Modbus messages may be in either RTU or ASCII formats. When data bits=8, XXMIT uses Modbus RTU format. When data bits=7, XXMIT uses Modbus ASCII format. Only use Bit 7 OR Bit 8, do not try to use both.
Bit 9 Enable ASCII receive FIFO	Set to 1 to allow the XXMIT block to take control over the selected port (1 or 2) from the PLC. The block begins to receive ASCII characters into an empty 512 byte circular FIFO. Refer to *ASCII Receive FIFO, p. 34* for more details.
Bit 10 Enable back space	Set to 1 to allow special handling of ASCII back space character (BS, 8Hex) when using either Simple ASCII Input (Bit 6) or Terminated ASCII Input (Bit 5). If Bit 10 is set, each back space character will NOT be stored into MsgIn. Refer to *Enable Back space, p. 34* for more details.
Bit 11 Enable RTS/CTS flow control	Set to 1 to allow full duplex hardware flow control using the RTS and CTS handshaking signals for ASCII massaging. The RTS/CTS operates in both the input and output modes. Refer to *Enable RTS/CTS Flow Control, p. 35* for more details.
Bit 12 Enable Xon/Xoff flow control	Set to 1 to allow full duplex software flow control using the ASCII Xon character (DC1, 11 Hex) and the ASCII Xoff character (DC3, 13 Hex). The Xon/Xoff operates in both the input and output modes. Refer to *Enable Xon/Xoff Flow Control, p. 36* for more details.
Bit 13 Pulse dial modem	Set to 1 when using a Hayes compatible dial-up modem and you wish to pulse dial a telephone number. You program the phone number into the MsgOut. The length of the message must be in MsgLen. Pulse dialed numbers are sent to the modem automatically preceded by ATDP and with carriage return <CR> and line feed <LF> appended. Since the dial message is an ASCII string, bit 7 must be ON prior to sending the number to be dialed.
Bit 14 hangup modem	Set to 1 when using a Hayes compatible dial-up modem and you want to hangup the modem. You must use user logic to turn this bit ON. Since the hangup message is an ASCII string, bit 7 must be ON prior to sending the message. Hang up messages are sent to the modem automatically preceded by +++AT and with carriage return <CR> and line feed <LF> appended. XXMIT looks for a correct disconnect response from the modem before it turns ON the Done output signal, noting a successful completion.

Bit	Definition
Bit 15 Tone dial modem	Set to 1 when using a Hayes compatible dial-up modem and you wish to tone dial a telephone number. You program the phone number into the MsgOut. The length of the message must be in MsgLen. Tone dial numbers are sent to the modem automatically preceded by ATDT and with carriage return <CR> and line feed <LF> appended. Since the dial message is an ASCII string, bit 7 must be ON prior to sending the number to be dialed.
Bit 16 Initialize modem	Set to 1 when using a Hayes compatible dial-up modem and you want to initialize the modem. You program the initialization message into MsgOut and the length of the message into MsgLen. All messages are sent to the modem automatically preceded by AT and with a carriage return <CR> and line feed <LF> appended. Since the initialization message is an ASCII string, bit 7 must be ON prior to sending the message.

MsgOut

MsgOut contains the message data to be transferred, for example, ASCII characters for an ASCII transfer, definition of termination characters for terminated ASCII input or Modbus templates for Modbus master messages.
The data type that must be assigned to the parameter has to match the requirements of the function to be performed. The data type of the MsgOut parameter must be equal to the data type of the MsgIn field.

Note: MsgOut and MsgIn are of Data Type ANY. It is preferrable to use a Byte Array. Different from the XMIT Block, ASCII messages are stored in byte order, allowing for easy handling, for example, through assigning a string as an initial value.

Note: For Modbus Messaging MsgOut must be a field of words. The minimum size of the array is WordArr9

MsgLen

You must enter the length of the current message according to the selected XXMIT function.
The following table gives an overview for Modbus and ASCII functions:

XXMIT function	Subfunction	Message Length
Modbus Messaging	01, 02, 03, 04, 05, 06, 08, 15, 16	5
Modbus Messaging	20, 21	6
Terminated ASCII Input		5
Simple ASCII Input		1...1024.
ASCII String Messaging		1...1024. The selected length must match the size of the array assigned to MsgOut. Otherwise you get error 129.

Port

Port specifies the communications interface. The only authorized values are the values 1 and 2. Port 2 is only available on the Momentum PLC.

Baudrate

XXMIT supports the following data rates: 50, 75, 110, 134, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19200. To configure a data rate, enter its decimal number. When an invalid data rate is entered, the block displays an illegal configuration error (error code 127) in the XXMIT Status element.

Databits

XXMIT supports the following data bits: 7 and 8. To configure a data bit size, enter its decimal number into this element. Modbus messages may be sent in ASCII mode or RTU mode. ASCII mode requires 7 data bits, while RTU mode requires 8 data bits. When sending ASCII character message you may use either 7 or 8 data bits. When an invalid data bit is entered, the block displays an illegal configuration error (error code 127) in the XXMIT Status element. For more details on Modbus message formats refer to *Modicon Modbus Protocol Reference Guide* (PI MBUS 300).

Stopbits

XXMIT supports one or two stop bits. Enter a decimal of either: 1 = one stop bit, or 2 = two stop bits. When an invalid stop bit is entered, the block displays an illegal configuration error (error code 127) in the XXMIT Status element.

Parity

XXMIT supports the following parity: none, odd and even. Enter a decimal of either: 0 = no parity, 1 = odd parity, or 2 = even parity. When an invalid parity is entered, the block displays an illegal configuration error (error code 127) in the XXMIT Status element.

RespTout

You enter the time value in milliseconds (ms) to determine how long XXMIT waits for a valid response message from a slave device (PLC, modem, etc.). In addition, the time applies to ASCII transmissions and flow control operations. When the response message is not completely formed within this specified time, XXMIT issues a fault. The valid range is 0 ... 65535 ms. The timeout is initiated after the last character in the message is sent.

RetryLmt

You enter the quantity of retries to determine how many times XXMIT sends a message to get a valid response from a slave device (PLC, modem, etc.). When the response message is not completely formed within this specified time, XXMIT issues a fault and a fault code. The valid range is 0 ... 65535 # of retries. This field is used in conjunction with RespTout.

StartDly

You enter the time value in milliseconds (ms) when RTS/CTS control is enabled, to determine how long XXMIT waits after CTS is received before it transmits a message out of the PLC port. Also, you may use this register even when RTS/CTS is NOT in control. In this situation, the entered time value determines how long XXMIT waits before it sends a message out of the PLC port. You may use this as a pre message delay timer. The valid range is 0 ... 65535 ms.

EndDly

You enter the time value in milliseconds (ms) when RTS/CTS control is enabled, to determine how long XXMIT keeps RTS asserted once the message is sent out of the PLC port. After the time expires, XXMIT deassert RTS. Also, you may use this register even when RTS/CTS is NOT in control. In this situation, the entered time value determines how long XXMIT waits after it sends a message out of the PLC port. You may use this as a post message delay timer. The valid range is 0 ... 65535 ms.

Note: On RS 485 communication the transmit signal is held to '1' during the EndDly time. On 2-wire connections any characters coming from the communication partner will be lost.Therefore set EndDly to 0 ms if this function is not needed.

Retry

The value displayed here indicates the current number of retry attempts made by the XXMIT block. This element is read only.

Active

A value of 1 indicates that an XXMIT operation is in progress.

Done

A value of 1 indicates that the XXMIT operation has been completed successfully.

Error

A value of 1 indicates that an error has occurred or that the current XXMIT operation is terminated.

MsgIn

MsgIn contains the incoming message data, for terminated ASCII input or simple ASCII input.
The data type that must be assigned to the parameter has to match the requirements of the function to be performed. The data type must be equal to the type of the MsgOut field.

RecCount

This element displays the number of received characters.

Status

This element displays a fault code generated by the XXMIT block.
A complete list is shown in the table below.
Fault Status

Fault Code	Fault Description
1	Modbus exception - Illegal function
2	Modbus exception - Illegal data address
3	Modbus exception - Illegal data value
4	Modbus exception - Slave device failure
5	Modbus exception - Acknowledge
6	Modbus exception - Slave device busy
7	Modbus exception -Negative acknowledge
8	Modbus exception -Memory parity error
9 ... 99	Reserved
100	Slave PLC data area cannot equal zero
101	Master PLC data area cannot equal zero
102	Coil (0x) not configured
103	Master PLC 4x Holding Register area not configured
104	Data length cannot equal zero
105, 106	Reserved
107	Transmit message time-out (This error is generated when the UART cannot complete a transmission in 10 seconds or less. This error bypasses the retry counter and will activate the error output on the first error).
108	Undefined error
109	Modem returned ERROR
110	Modem returned NO CARRIER
111	Modem returned NO DIALTONE
112	Modem returned BUSY

Fault Code	Fault Description
113	Invalid LRC checksum from the slave PLC
114	Invalid CRC checksum from the slave PLC
115	Invalid Modbus function code
116	Modbus response message time-out
117	Modem reply time-out
118	XXMIT could not gain access to PLC communications port #1 or port #2
119	XXMIT could not enable PLC port receiver
120	XXMIT could not set PLC UART
121	Reserved
122	Invalid Port
123	Reserved
124	Undefined internal state
125	Broadcast mode not allowed with this Modbus function code
126	DCE did not assert CTS
127	Illegal configuration (data rate, data bits, parity, or stop bits)
128	Unexpected response received from Modbus slave
129	Illegal command word setting
130	Command word changed while active
131	Invalid character count
132	Reserved
133	ASCII input FIFO overflow error
134	Invalid number of start characters or termination characters
135...149	Reserved
150	Either configured port already taken by another instance of the XXMIT or the configured port is not supported on that PLC
151	MsgOut is smaller than 12 Byte while ’Modbus Master Messaging’ function is selected
152	Variable connected to MsgOut is smaller than the value of the MsgLen parameter while ’ASCII String Messaging’ is selected
153	Variable connected to MsgIn is smaller than the value of the MsgLen parameter while either ’Terminated ASCII Input’ or ’SimpleASCII Input’ is selected

XXMIT Communication Functions

XXMIT Command Word

The XXMIT communication block performs six functions shown below. For each function certain bits of the Command word must be set.

Command Word Bits

Command Word Functions in Relation to Bits

Function	**Command word bits that may be set to 1**	**Bits that MUST be set to = 0**
Terminated ASCII input (Bit 5=1) [1]	2,3,9,10,11,12	6,7,8,13,14,15,16
Simple ASCII input (Bit 6=1) *	2,3,9,10,11,12	5,7,8,13,14,15,16
Simple ASCII output (Bit 7=1)	2,3,9,10,11,12	5,6,8,13,14,15,16
Modem output (Bit 7=1)	2,3,13,14,15,16	5,6,8,9,10,11,12 (plus one, but ONLY one, of the following bits is set to 1: 13,14,15 or 16, while the other three bits must be set to 0)
Modbus master messaging output (Bit 8=1)	2,3	5,6,7,9,10,11,12,13,14,15,16

Note: [1] When using either of these functions you MUST set Enable ASCII receive FIFO (Bit 9) to 1. Bit 1 (MSB) and Bit 4 are reserved. (See Table *Command, p. 16*)

XXMIT ASCII Functions

At a Glance

The XXMIT function block supports the following ASCII communication functions

- Terminated ASCII Input
- Simple ASCII Input
- ASCII String Messaging

Terminated ASCII Input Function

When Bit 5 of the Command Word is activated for terminated ASCII Input messages, the MsgOut array has to contain the ASCII input definition table. Depending of which datatype you selected for MsgOut, the terminated ASCII definition table consists of three words or 6 byte. The terminated ASCII input definition table is shown in the table below.
Terminated ASCII Input Definition Table (Datatype WordArray)

Word	High Byte	Low Byte
MsgOut[1]	Number of starting characters (allowed content = 0, 1, 2)	Number of terminator characters (allowed content = 1, 2)
MsgOut[2]	First starting character	Second starting character
MsgOut[3]	First terminator character	Second terminator character

Terminated ASCII Input Definition Table (Datatype ByteArray)

Byte	Function
MsgOut[1]	length of termination string (1 or 2)
MsgOut[2]	length of start string (0 or 1 or 2)
MsgOut[3]	2nd start character
MsgOut[4]	1st start character
MsgOut[5]	2nd termination character
MsgOut[6]	1st termination character

During the process, RecCount holds a running count of characters written into the MsgIn array. Once the terminated string is received the Done output on the XXMIT block goes ON and RecCount holds the total length of the received string including the starting and terminator strings. At this point the XXMIT block still owns the port and continues to save newly received characters into the ASCII receive FIFO, because the enable ASCII receive FIFO Command Word, Bit 9 is ON.
Using program logic, you can clear the simple ASCII input Bit before the next scan, while leaving the enable ASCII receive FIFO Bit ON. Thus, MsgIn is NOT over written by newer FIFO data, which is still collected in the FIFO. Using program logic, you can clear both bits for enable ASCII receive FIFO (Bit 9), and terminated ASCII input (Bit 5) to return port control back to the PLC.

When too many characters are written into the MsgIn array with NO terminator detected, or the MsgIn array is outside the allowed range for the configured PLC an error is reported in Status. The character limit is the smaller of 1024 or two times the sizes of the MsgIn array.

Terminated ASCII Example

Assume that XXMIT is activated with the command word Bit 9 and 5 set. Enable ASCII FIFO and terminated ASCII. The following ASCII string is received by the port: "AMScrlf$weight = 1245 GRAMScrlf$wei". Refer to the ASCII Input Definition Table that shows the contents denoted by ( ) used in this example.
Terminated ASCII Input Definition Table (content Datatype Byte Array)

Byte	Content
MsgOut[1]	Number of starting characters (0x01)
MsgOut[2]	Number of terminator characters (0x02)
MsgOut[3]	Second starting character (Not Used)
MsgOut[4]	First starting character ('$')
MsgOut[5]	Second terminator character ('lf')
MsgOut[6]	First terminator character ('cr')

Terminated ASCII Input Definition Table Example (content for Datatype Word Array)

Word	High Byte	Low Byte
MsgOut[1]	Number of starting characters (0x01)	Number of terminator characters (0x02)
MsgOut[2]	First starting character ('$')	Second starting character (Not Used)
MsgOut[3]	First terminator character ('cr')	Second terminator character ('lf')

The XXMIT block becomes ACTIVE and then discards from the input FIFO the initial five characters, "AMScrlf", because they do not match the first starting character set to '$'. On the logic scan after the '$' is received, the XXMIT block remains ACTIVE and it copies the '$' and subsequent characters into the MsgIn array, updating RecCount with the count done so far, as the characters come in. After the final termination character is received the output Done is activated and MsgLen contains the total length equal to 22 characters (0x0016). The MsgIn array contains: "$weight = 1245 GRAMScrlf" as Byte Array (or: "$w", "ei", "gh", "t ", "= ", "12", "45", " G", "RA", "MS", "crlf" if using a Word Array). On the scan that the output Done is activated, the already received characters from the next message, "$wei", that came in after the termination string, remains in the ASCII input FIFO. This gives the program logic the opportunity to turn off the Terminated ASCII input before the next scan solve of XXMIT for this port, keeping those characters in the FIFO until the PLC completes processing the current message, that might take several scans.

Simple ASCII Input Function

All incoming characters are placed into the MsgIn array. If MsgIn is defined as Byte Array (as recommended), the incomming characters are simply stored first character into first array element, second character into second and so on.If MsgIn is defined as WordArray, two characters are stored in each element. The first character is stored in the high byte of the first element. The second character is stored in the low byte of the first element. The third character is stored in the high byte of the second element, and so on. The Message Length variable (MsgLen) contains the length of the message (1 ... 1024 characters).

Note: When Simple ASCII Input (Bit 6) and ASCII Receive FIFO (Bit 9) remain set, new characters are continuously transferred from FIFO into the same MsgIn array thus constantly over writing the previous characters stored into the MsgIn array.

ASCII String Messaging

When Command Word, Bit 7 is activated for String Messaging, the MsgOut array has to contain the ASCII information to be transmitted. The message length MsgLen has to be set to the length of the message to be transmitted.
As mentioned in *Detailed Parameter Description, p. 16*, MsgOut may be of any datatype. For ASCII String Messaging the type ByteArray reflects best the nature of strings: First Byte contains first character and so on. (See *Simple ASCII Send, p. 42*)

XXMIT Modem Functions

At a glance

The XXMIT function block allows you to communicate to a Hayes compatible modem using the functions listed in the following table:

Modem Functions

Bit in Command Word	Function
Bit 13	Pulse dial modem
Bit 14	Hangup modem
Bit 15	Tone dial modem
Bit 16	Initialize modem

Initialize Modem

Set Bit 16 of the command word to 1 when using a Hayes compatible dial-up modem and you want to initialize the modem. You program the initialization message into the MsgOut array and the length of the message into MsgLen. All messages are sent to the modem automatically preceded by AT and with a carriage return <CR> and line feed <LF> appended. Since the initialization message is an ASCII string, bit 7 must be ON prior to sending the message

Pulse Dial Modem

Set Bit 13 of the command word to 1 when using a Hayes compatible dial-up modem and you wish to pulse dial a telephone number. You program the phone number into the MsgOut array. The length of the message must be in MsgLen. Pulse dialed numbers are sent to the modem automatically preceded by ATDP and with carriage return <CR> and line feed <LF> appended. Since the dial message is an ASCII string, bit 7 must be ON prior to sending the number to be dialed.

Tone Dial Modem

Set Bit 15 of the command word to 1 when using a Hayes compatible dial-up modem and you wish to tone dial a telephone number. You program the phone number into the MsgOut array. The length of the message must be in MsgLen. Tone dialed numbers are sent to the modem automatically preceded by ATDT and with carriage return <CR> and line feed <LF> appended. Since the dial message is an ASCII string, bit 7 must be ON prior to sending the number to be dialed.

Hangup Modem

Set Bit 14 of the command word to 1 when using a Hayes compatible dial-up modem if you want to hangup the modem. You must use program logic to turn this bit ON. Since the hangup message is an ASCII string, bit 7 must be ON prior to sending the message. Hang up messages are sent to the modem automatically preceded by +++AT and with carriage return <CR> and line feed <LF> appended. XXMIT looks for a correct disconnect response from the modem before it turns ON the Done output signal, noting a successful completion.

XXMIT Modbus Functions

At a Glance

The XXMIT function block supports the following Modbus function codes:.

- 01 ... 06 and 15 ... 16
- 08
- 20 and 21

Note: When using port 2 of a Momentum PLC in RS485 mode with Modbus Messaging, make sure to use exactly the same parameters (baudrate, databits, stopbits, paritty) for the XXMIT block as configured for that port.

Modbus Function Codes (01 ... 06, 15 and 16)

For Modbus messages, the MsgOut array has to contain the Modbus definition table. This has to be defined as a field of words. The Modbus definition table for Modbus function code: 01, 02, 03, 04, 05, 06, 15 and 16 is five registers long and you must set MsgLen to 5 for successful XXMIT operation. The Modbus definition table is shown in the table below.

Modbus Definition Table Function Codes (01 ... 06, 15 and 16)

Content	Description
Modbus function code (MsgOut[1])	XXMIT supports the following function codes: 01 = Read multiple coils (0x) 02 = Read multiple discrete inputs (1x) 03 = Read multiple holding registers (4x) 04= Read multiple input registers (3x) 05 = Write single coil (0x) 06 = Write single holding registers (4x) 15 = Write multiple coils (0x) 16 = Write multiple holding registers (4x)
Quantity (MsgOut[2])	Enter the amount of data you want written to the slave PLC or read from the slave PLC. For example, enter 100 to read 100 holding registers from the slave PLC or enter 32 to write 32 coils to a slave PLC. There is a size limitation on quantity that is dependent on the PLC model. Refer to Appendix A for complete details on limits.
Slave PLC address (MsgOut[3])	Enter the slave Modbus PLC address. Typically the Modbus address range is 1 ... 247. To send a Modbus message to multiple PLCs, enter 0 for the slave PLC address. This is referred to as Broadcast Mode. Broadcast Mode only supports Modbus function codes that writes data from the master PLC to slave PLCs. Broadcast Mode does NOT support Modbus function codes that read data from slave PLCs.

Content	Description
Slave PLC data area (MsgOut[4])	For a read command, the slave PLC data area is the source of the data. For a write command, the slave PLC data area is the destination for the data. For example, when you want to read coils (00300 ... 00500) from a slave PLC, enter 300 in this field. When you want to write data from a master PLC and place it into register (40100) of a slave PLC, enter 100 in this field. Depending on the type of Modbus command (write or read), the source and destination data areas must be as defined in the Source and Destination Data Areas table below.
Master PLC data area (MsgOut[5])	For a read command, the master PLC data area is the destination for the data returned by the slave. For a write command, the master PLC data area is the source of the data. For example, when you want to write coils (00016 ... 00032) located in the master PLC to a slave PLC, enter 16 in the field. When you want to read input registers (30001 ... 30100) from a slave PLC and place the data into the master PLC data area (40100 ... 40199), enter 100 in this field. Depending on the type of Modbus command (write or read), the source and destination data areas must be as defined in the Source and Destination Data Areas table below.

Source and Destination Data Areas for Function Codes (01 ... 06, 15 and 16)

Function Code	Master PLC Data Area	Slave PLC Data Area
03 (Read multiple 4x)	4x (destination)	4x (source)
04 (Read multiple 3x)	4x (destination)	3x (source)
01 (Read multiple 0x)	0x (destination)	0x (source)
02 (Read multiple 1x)	0x (destination)	1x (source)
16 (Write multiple 4x)	4x (source)	4x (destination)
15 (Write multiple 0x)	0x (source)	0x (destination)
05 (Write single 0x)	0x (source)	0x (destination)
06 (Write single 4x)	4x (source)	4x (destination)

When you want to send 20 Modbus messages out of the PLC, you must transfer 20 Modbus definition tables one after another into MsgOut after each successful operation of XXMIT, or you may program 20 separate XXMIT blocks and then activate them one at a time through user logic.

Modbus Function Code (08)

For Modbus messages, the MsgOut array has to contain the Modbus definition table. This has to be defined as a field of words. The Modbus definition table for Modbus function code: 08 is five registers long and you must set MsgLen to 5 for successful XXMIT operation. The Modbus definition table is shown in the table below.

Modbus Definition Table Function Codes (08)

<table>
<tr><th>Content</th><th colspan="2">Description</th></tr>
<tr><td>Modbus function code (MsgOut[1])</td><td colspan="2">XXMIT supports the following function code:
08 = Diagnostics</td></tr>
<tr><td rowspan="2">Diagnostics (MsgOut[2])</td><td colspan="2">Enter the diagnostics subfunction code decimal value in this field to perform the specific diagnostics function desired. The following diagnostic subfunctions are supported:</td></tr>
<tr><td>Code
00
01
02
03
04
05 ... 09
10

11
12
13
14 ... 15
16
17
18
19 ... 21</td><td>Description
Return query data
Restart comm option
Return diagnostic register
Change ASCII input delimiter
Force listen only mode
Reserved
Clear counters
(& diagnostics registers in 384, 484)
Return bus messages count
Return bus comm error count
Return bus exception error count
Not supported
Return slave NAK count
Return slave busy count
Return bus Char overrun count
Not supported</td></tr>
<tr><td>Slave PLC address (MsgOut[3])</td><td colspan="2">Enter the slave Modbus PLC address. Typically the Modbus address range is 1 ... 247. Function code 8 does NOT support Broadcast Mode (Address 0)</td></tr>
<tr><td>Diagnostics function data field content (MsgOut[4])</td><td colspan="2">You must enter the decimal value needed for the data area of the specific diagnostic subfunction. For subfunctions 02, 04, 10, 11, 12, 13, 16, 17 and 18 this value is automatically set to zero. For subfunctions 00, 01, and 03 you must enter the desired data field value. For more details, refer to <i>Modicon Modbus Protocol Reference Guide (PI-MBUS-300)</i>.</td></tr>
</table>

Content	Description
Master PLC data area (MsgOut[5])	For all subfunctions, the master PLC data area is the destination for the data returned by the slave. You must specify a 4x register that marks the beginning of the data area where the returned data is placed. For example, to place the data into the master PLC data area starting at (40100), enter 100 in this field. Subfunction 04 does NOT return a response. For more details, refer to *Modicon Modbus Protocol Reference Guide (PI-MBUS-300)*.

Modbus Function Codes (20, 21)

For Modbus messages, the MsgOut array has to contain the Modbus definition table. This has to be defined as a field of words. The Modbus definition table for Modbus function codes: 20 and 21 is six registers long and you must set MsgLen to 6 for successful XXMIT operation. The Modbus definition table is shown in the table below.

Modbus Definition Table Function Codes (20, 21)

Content	Description
Modbus function code (MsgOut[1])	XXMIT supports the following function codes: 20 = Read general reference (6x) 21 = Write general reference (6x)
Quantity (MsgOut[2])	Enter the amount of data you want written to the slave PLC or read from the slave PLC. For example, enter 100 to read 100 holding registers from the slave PLC or enter 32 to write 32 coils to a slave PLC. There is a size limitation on quantity that is dependent on the PLC model.
Slave PLC address (MsgOut[3])	Enter the slave Modbus PLC address. Typically the Modbus address range is 1 ... 247. Function code 20 and 21 do NOT support Broadcast Mode (Address 0).
Slave PLC data area (MsgOut[4])	For a read command, the slave PLC data area is the source of the data. For a write command, the slave PLC data area is the destination for the data. For example, when you want to read registers (600300 ... 600399) from a slave PLC, enter 300 in this field. When you want to write data from a master PLC and place it into register (600100) of a slave PLC, enter 100 in this field. Depending on the type of Modbus command (write or read), the source and destination data areas must be as defined in the Source and Destination Data Areas table below. The lowest extended register is addressed as register "zero" (600000). The lowest holding register is addressed as register "one" (400001).
Master PLC data area (MsgOut[5])	For a read command, the master PLC data area is the destination for the data returned by the slave. For a write command, the master PLC data area is the source of the data. For example, when you want to write registers (40016 ... 40032) located in the master PLC to 6x registers in a slave PLC, enter 16 in the field. When you want to read 6x registers (600001 ... 600100) from a slave PLC and place the data into the master PLC data area (40100 ... 40199), enter 100 in this field. Depending on the type of Modbus command (write or read), the source and destination data areas must be as defined in the Source and Destination Data Areas table below. The lowest extended register is addressed as register "zero" (600000). The lowest holding register is addressed as register "one" (400001).

Content	Description
File number (MsgOut[6])	Enter the file number for the 6x registers to be written to or read from. (1 ... 10) depending on the size of the extended register data area. 600001 is 60001 file 1 and 69 0001 is 60001 file 10 as viewed by the Reference Data Editor.

Source and Destination Data Areas for Function Codes (20, 21)

Function Code	Master PLC Data Area	Slave PLC Data Area
20 (Read general reference 6x)	4x (destination)	6x (source)
21 (Write general reference 6x)	4x (source)	6x (destination)

When you want to send 20 Modbus messages out of the PLC, you must transfer 20 Modbus definition tables one after another into MsgOut after each successful operation of XXMIT, or you may program 20 separate XXMIT blocks and then activate them one at a time through user logic.

FIFO and Flow Control

At a glance

The XXMIT function block allows the the user to define the use of a receive FIFO buffer, flow control and the function of received back spaces.

ASCII Receive FIFO

Setting Bit 9 of the command word to 0 ends this function. When the FIFO receives 512 characters an internal overflow is set. When this occurs all subsequent characters are discarded, all ASCII input operations (simple and terminated) are ended, and the block returns an error until you toggle (Bit 9). When (Bit 9) is toggled, all data in the FIFO is discarded, both ASCII input control bits are ignored (Simple ASCII (Bit 6), Terminated ASCII (Bit 5)), and when no ASCII output controls are selected then the control of the serial port (1 or 2) is returned back to the PLC.

You need to set either Terminated ASCII (Bit 5) or Simple ASCII (Bit 6) to remove the ASCII characters from FIFO for processing. No more than one of the following three bits can be set simultaneously: Terminated ASCII (Bit 5), Simple ASCII (Bit 6), or ASCII Output (Bit 7).

Full duplex operation may be achieved by setting both ASCII Receive FIFO (BIT 9), and ASCII Output (Bit 7). This allows simple ASCII transmission out of the PLC while still receiving ASCII characters into FIFO. This is useful when working with dumb terminals. When ASCII Receive FIFO (Bit 9) is set none of the following ASCII output controls are allowed: Modbus Master Messaging (Bit 8), Pulse Dial Modem (Bit 13), Hangup Modem (Bit 14), Tone Dial Modem (Bit 15) and Initialize Modem (Bit 16).

Enable Back space

When a backspace (BS) is detected it is NOT stored into the MsgIn array, in fact it deletes the previous character and thus decreases the RecCount Character Counter. In contrast, when a regular ASCII character is detected it is stored in the MsgIn array and the RecCount Character Counter is increased.

Note: Back spaces CANNOT delete characters from an empty MsgIn array, thus the RecCount Character Counter never goes below 0.

This special back space functionality along with internal echo enabled at the terminal are very useful for dealing with dumb terminals. A single Terminated ASCII Input XXMIT block searching for "cr" is activated with ASCII Receive FIFO (Bit 9) and back space (Bit 10) set. No additional program logic is required while you type and edit characters using the back space on the fly. When you type "cr" XXMIT activates the Done output, and the corrected data is all lined up properly in the MsgIn array.

Enable RTS/CTS Flow Control

The following pertains to the output mode. The XXMIT state goes to BLOCKED receiving when the receiving device indicates it cannot process additional characters by setting CTS to OFF. Likewise, The XXMIT state goes to UNBLOCKED when CTS is ON and the receiving devices indicates it CAN process additional characters.

When transmission is UNBLOCKED and Simple ASCII Output (Bit 7) and RTS/CTS Flow Control (Bit 11) are set then the transmit output data is sent out in 16 byte packets. After all output packets are sent then the Done output on the XXMIT block goes ON to indicate "Operation Successful".

If during a transmission it suddenly becomes BLOCKED, only the remaining characters in the current output packet are sent, never exceeding 16 characters, and the XXMIT block remains ACTIVE indefinitely. Only when the CTS in ON will the ASCII output resume sending all remaining output packets.

The following pertains to the input mode. Since RTS is an output signal, it can be used independently of the ASCII output transmit process, to BLOCK or UNBLOCK sending devices. When ASCII Receive FIFO (Bit 9) is set the RTS/CTS Flow Control works in the input mode. When ASCII Receive FIFO (Bit 9) is set and neither of the two ASCII inputs are set, Simple ASCII Input (Bit 6) or Terminated ASCII Input (Bit 5), the received characters will fill the FIFO in which they are inserted. In the mean time, the RTS Flow Control (Bit 11) is ON allowing the sending device to proceed.

When the FIFO (512 characters) is more than three quarters full with characters the RTS Control Flow (Bit 11) is cleared to BLOCK the sending device. The RTS Control Flow (Bit 11) remains cleared until either Simple ASCII Input (Bit 6) or Terminated ASCII Input (Bit 5) have removed enough characters from the FIFO whereby reducing it to less than one quarter full of characters at which point the RTS Control Flow (Bit 11) is turned ON.

Note: The RTS/CTS Flow Control algorithm is different from RTS/CTS Modem Control. The former is related to full duplex receive buffer overflow. The latter deals with the transmit process gaining access to a shared transmission medium. Therefore, it is illegal to simultaneously request both of these RTS/CTS algorithms.

Note: You CANNOT select any type of RTS/CTS Flow Control (Bit 11) handshaking when the port is in RS 485 Mode (Bit 3) because these signals do NOT exist in RS 485 mode.

Enable Xon/Xoff Flow Control

The following pertains to the output mode. The XXMIT state goes to BLOCKED when an Xoff character is received. Likewise the XXMIT state goes to UNBLOCKED when an Xon character is received. In neither case will Xon or Xoff be inserted into the FIFO.

When transmission is UNBLOCKED and Simple ASCII Output (Bit 7) and Xon/Xoff Flow Control (Bit 12) are set then the transmit output data is sent out in 16 byte packets. After all output packets are sent the Done output on the XXMIT block goes ON.

If during a transmission it suddenly becomes BLOCKED, only the remaining characters in the current output packet are sent, never exceeding 16 characters, and the XXMIT block remains ACTIVE indefinitely. Only when the next Xon character is received will the ASCII output resume sending all remaining output packets.

The following pertains to the input mode. Xon/Xoff may be used to BLOCK or UNBLOCK sending devices. When ASCII Receive FIFO (Bit 9) is set the Xon/Xoff Control Flow (Bit 12) works in the input mode. When ASCII Receive FIFO (Bit 9) is set and neither of the two ASCII inputs are set, Simple ASCII Input (Bit 6) or Terminated ASCII Input (Bit 5), the received characters will fill the FIFO in which they are inserted.

When the FIFO is more than three quarter full with characters and additional characters are received the FIFO state variable is set to send XOFF characters out the serial port after a delay of up to 16 character times BLOCKING the sender and clearing the FIFO state variable.

When all ASCII output functions (Bits 8,13,14,15, and 16) are OFF and the Xon/Xoff Flow Control (Bit 12) is ON the delay time defaults to 1 character time. In contrast, when all ASCII output functions (Bits 8,13,14,15, and 16) are ON and the Xon/Xoff Flow Control (Bit 12) is ON then the ASCII output is broken up into 16 byte packets. Thus, pending Xoff characters DO NOT have to wait more than 16 character times before BLOCKING the sender.

Once the sender has stopped transmission, the PLC eventually removes the characters from the FIFO using either Simple ASCII Input (Bit 6) or Terminated ASCII Input (Bit 7).

When FIFO becomes less than one quarter full with characters the FIFO state variable is set to send XON, thus, sending an Xon character out the serial port to UNBLOCK the sender.

Note: To prevent lockup due to a disconnected cable or other intermittent communication errors, when the sender is BLOCKED and did NOT receive the Xon character correctly we use the following algorithm. When FIFO becomes empty and no characters are subsequently received, then a steady stream of Xon characters are transmitted at the rate of once every 5 seconds.

Note: The Xon/Xoff Flow Control (Bit 12) is different from the RTS/CTS Control Flow (Bit 11). The former uses transmitted Xon and Xoff characters to prevent receive buffer overflow in full duplex mode. The latter uses hardware hand-shaking signals to accomplish the same goal. Therefore, it is illegal to simultaneously request both of these flow control algorithms because RTS/CTS Flow Control (Bit 11) Modem Control implies a half duplex network while Xon/Xoff Flow Control (Bit 12) implies a full duplex network.

Run Time Errors

Error Messages

In case of error, the XXMIT function block will generate the following runtime error:
`E_EFB_WORLD_INTERFACE`
This will be displayed in the **Online Event** dialog.
Subject to the value of the first error message parameter, the error message may have various origins.

- An invalid communications interface was selected.
  An invalid value for the communications interface was selected at the Port input. Authorized values are "1" and "2" for Momentum PLCs, all other platforms only "1".
- Selected port is already taken by another instance of XXMIT.
- Either an invalid value for Baudrate/Stopbits/Databits has been used or the variables connected to MsgIn or MsgOut do not provide enough memory for the configured XXMIT operation.

Application Example

Description

The following program is a short demo application with four instances of the XXMIT block showing the four main functions:

- Modbus Master
- Simple ASCII In
- ASCII Message Out
- Terminated ASCII In

Modbus Master

The following Modbus Master operation is a read request to a slave device connected to port 1 of the master:

- Read slave's 4:0001 to 4:00010
- into local 4:00011 to 4:00020

The Slave must be set up with the following port parameters:

- 9600 baud
- 8 data bits
- 1 stop bit
- even parity (2)

The Master uses settings from the XXMIT function block

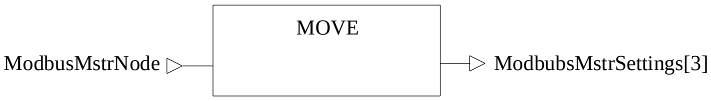
Variable declaration for Modbus Master

The following table shows the variables used in the Modbus Master example:

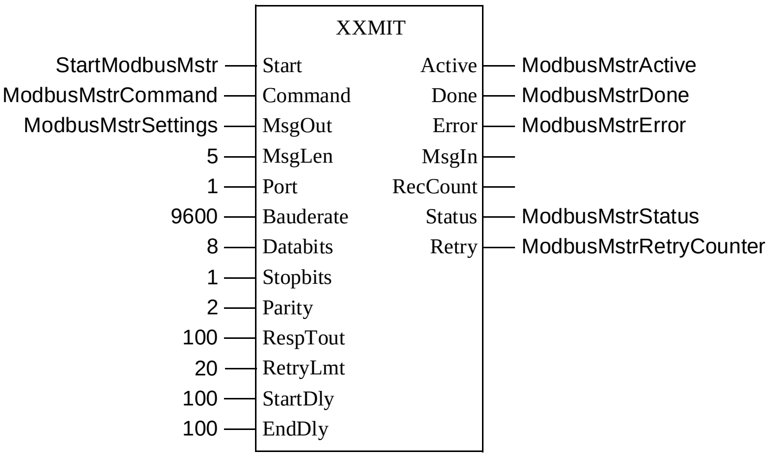
Variable Name	Data Type	Initial Value	Comment
StartModbusMstr	BOOL		
ModbusMstrActive	BOOL		
ModbusMstrCommand	WORD	16#0100	Bit 8 set
ModbusMstrDone	BOOL		
ModbusMstrError	BOOL		
ModbusMstrNode	WORD		
ModbusMstrSettings	WordArr9		
ModbusMstrSettings[1]		3	Modbus Code: Read multiple registers
ModbusMstrSettings[2]		10	Amount of Registers to read
ModbusMstrSettings[3]			Slave Modbus address
ModbusMstrSettings[4]		1	Source register
ModbusMstrSettings[5]		11	Destination Register
ModbusMstrSettings[6]			not used
...			
ModbusMstrStatus	INT		
ModbusMstrNode	WORD		Enter Slave address
ModbusMstrErrorCounter	INT		
ModbusMstrDoneCounter	INT		

IEC Section for Modbus Master

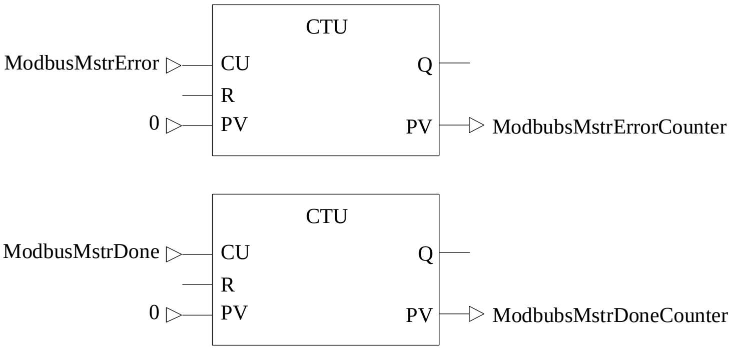
Program the following in an FBD section:
Slave node address assignment



Assignments to the XXMIT function block:



Count errors and successes



Simple ASCII Receive

Receives whatever comes into port 1. The receive buffer’s length is assigned as ’SimpleReceiveLength’, which has an initial value of 10.
Received characters are in MsgIn array, number of received characters in RecCount.

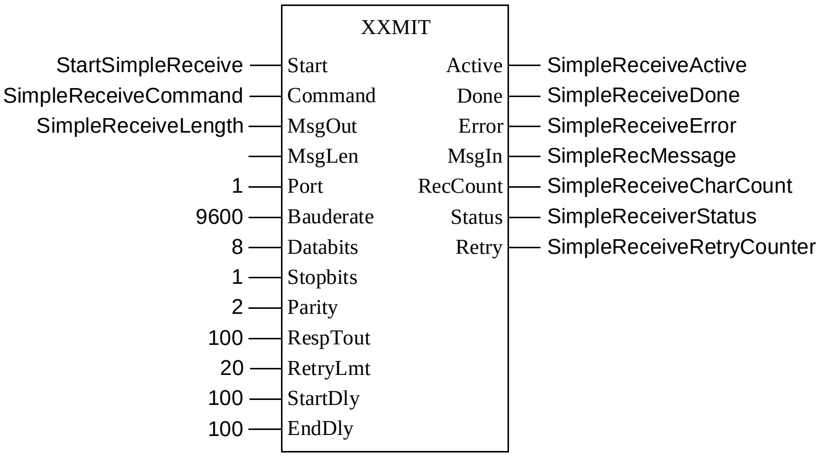
Variable declaration for Simple ASCII Receive

The following table shows the variables used in the Simple ASCII Receive example:

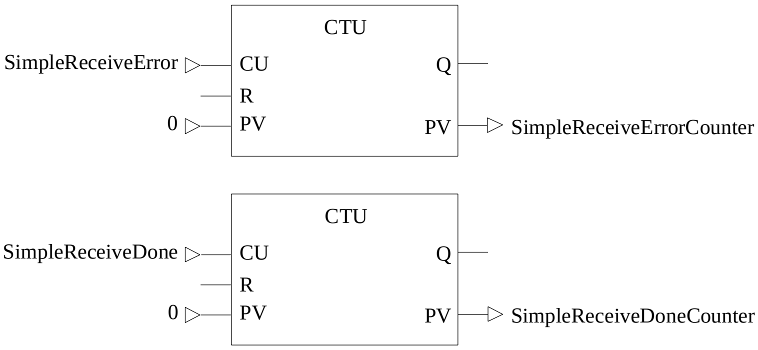
Variable Name	Data Type	Initial Value	Comment
StartSimpleReceive	BOOL		
SimpleReceiveActive	BOOL		
SimpleReceiveCharCounter	INT		
SimpleReceiveCommand	WORD	16#0480	Bits 6 and 9 set. FIFO enabled
SimpleReceiveDone	BOOL		
SimpleReceiveError	BOOL		
SimpleReceiveLength	INT	10	
SimpleReceiveRetryCounter	INT		
SimpleReceiveStatus	INT		
SimpleRecMessage	ByteArr12		
SimpleReceiveDoneCounter	INT		
SimpleReceiveErrorCounter	INT		

IEC Section for Simple ASCII Receive

Program the following in an FBD section:



Count errors and successes



Simple ASCII Send

Sends a simple ASCII message out off port 1, the message is ’Hello World!!’

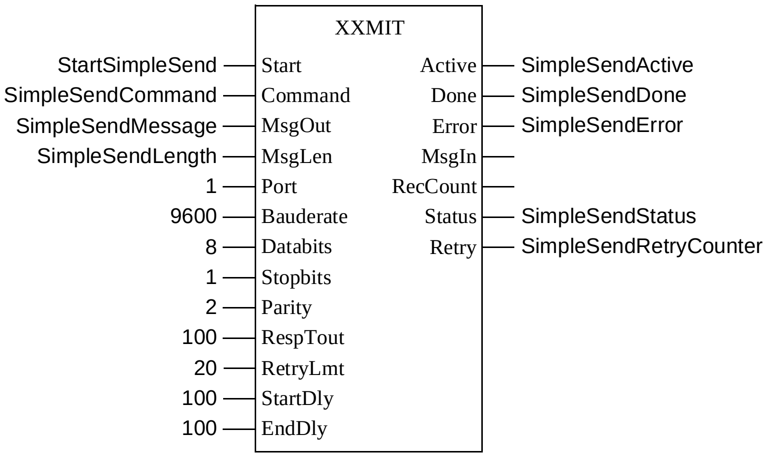
Variable declaration for Simple ASCII Send

The following table shows the variables used in the Simple ASCII Send example:

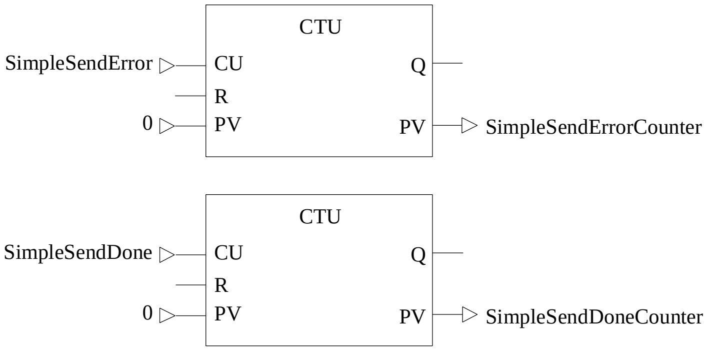
Variable Name	Data Type	Initial Value	Comment
StartSimpleSend	BOOL		
SimpleSendActive	BOOL		
SimpleSendCommand	WORD	16#0200	Bit 7 set
SimpleSendDone	BOOL		
SimpleSendError	BOOL		
SimpleSendLength	INT	14	Number of characters to send
SimpleSendMessage	ByteArr36		’Hello World !!’
SimpleSendMessage[1]		16#48	
SimpleSendMessage[2]		16#65	
SimpleSendMessage[3]		16#6C	
SimpleSendMessage[4]		16#6C	
SimpleSendMessage[5]		16#6F	
SimpleSendMessage[6]		16#20	
SimpleSendMessage[7]		16#57	
SimpleSendMessage[8]		16#6F	
SimpleSendMessage[9]		16#72	
SimpleSendMessage[10]		16#6C	
SimpleSendMessage[11]		16#64	
SimpleSendMessage[12]		16#20	
SimpleSendMessage[13]		16#21	
SimpleSendMessage[14]		16#21	
SimpleSendRetryCounter	INT		
SimpleSendStatus	INT		
SimpleSendDoneCounter	INT		
SimpleSendErrorCounter	INT		

IEC Section for Simple ASCII Send

Program the following in an FBD section:



Count errors and successes



Terminated ASCII Receive

After receiving the ’starting characters’ "AB", the function block puts all received characters into the receive buffer MsgIn. The receiver will stop when the ’finishing characters’ "CD" are received, whereby the "Done" output will be set, to indicate the successfull completion. The max. length of the receive buffer is assigned as "TermReceiveLength", which is set to an initial value of 20 in this example.

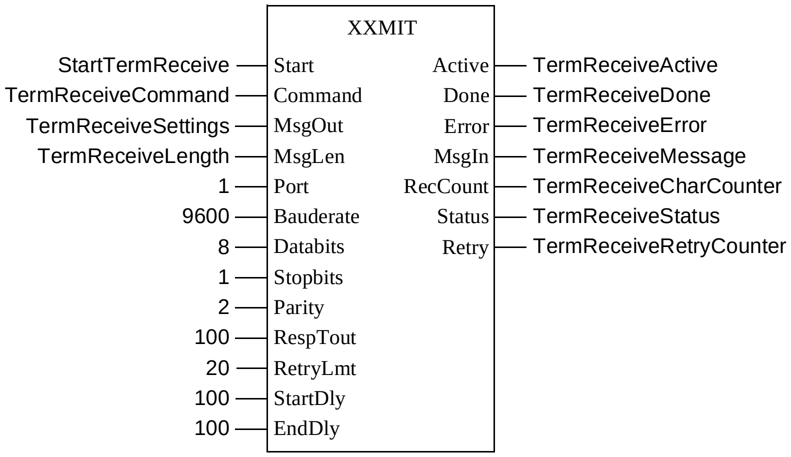
Variable declaration for Terminated ASCII Receive

The following table shows the variables used in the Terminated ASCII Receive example:

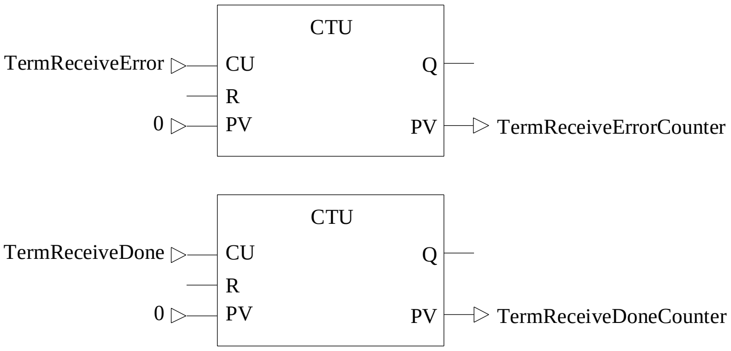
Variable Name	Data Type	Initial Value	Comment
StartTermReceive	BOOL		
TermReceiveActive	BOOL		
TermReceiveCharCounter	INT		
TermReceiveCommand	WORD	16#0880	Bits 5 and 9 set. FIFO enabled
TermReceiveDone	BOOL		
TermReceiveError	BOOL		
TermReceiveLength	INT	20	
TermReceiveMessage	ByteArr36		Received characters
TermReceiveRetryCounter	INT		
TermReceiveSettings TermReceiveSettings[1] TermReceiveSettings[2] TermReceiveSettings[3] TermReceiveSettings[4] TermReceiveSettings[5] TermReceiveSettings[6]	ByteArr36	 16#02 16#02 16#41 16#42 16#43 16#44	 length of termination string (1 or 2) length of start string (0, 1 or 2) 2nd start character 1st start character 2nd termination character 1st termination character
TermReceiveStatus	INT		
TermReceiveDoneCounter	INT		
TermReceiveErrorCounter	INT		

IEC Section for Terminated ASCII Receive

Program the following in an FBD section:



Count errors and successes



Entering Strings as initial values

The Variable Editor of Concept allows you to easily enter Strings as initial values into byte arrays.

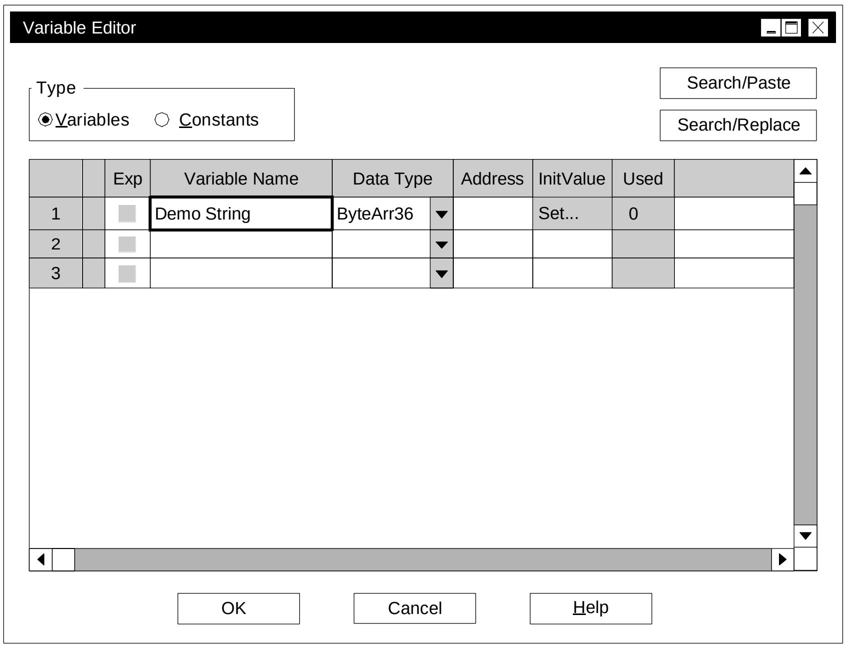
The following part gives a short describtion of how to define a variable 'DemoString' as 'ByteArr36' and enter a string 'My Text ! ' as initial value.

Open the Variable Editor

From the main menu select:

`Project -> Variable Editor.`

Variable Editor



		Exp	Variable Name	Data Type	Address	InitValue	Used
1			Demo String	ByteArr36		Set...	0
2							
3							

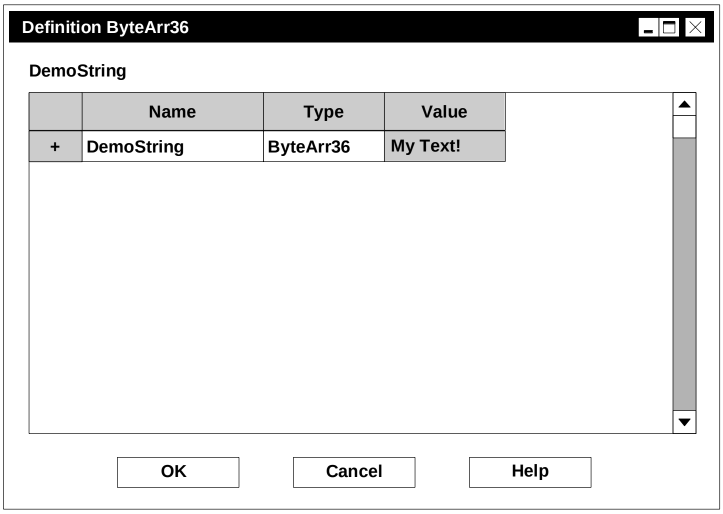
Define new variable

Enter the new variables name in the 'Variable Name' field. As data type select 'ByteArrxx' (xx depends on the size of your message). In the 'InitValue' field a 'Set...' button appears.

Enter text as initial value

Click on the 'Set...' button and open the definition window. Double clicking into the value field brings up a cursor and allows you to enter your text.

Definition ByteArr



Definition ByteArr36

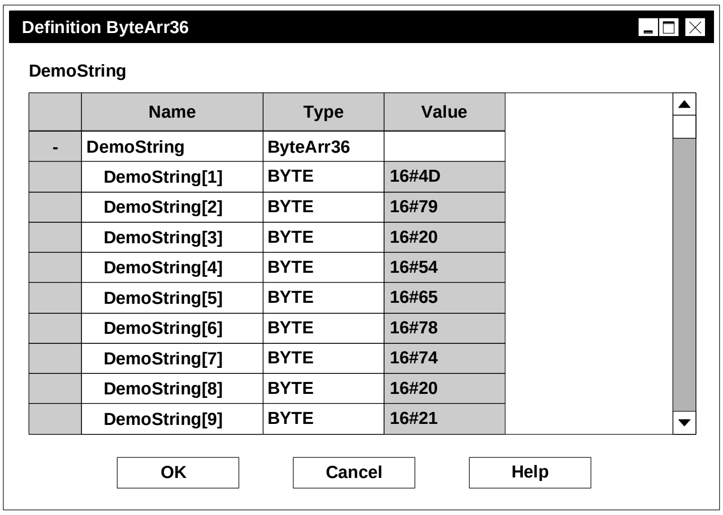
DemoString

	Name	Type	Value
+	DemoString	ByteArr36	My Text!

Look at Array Elements

Click on the '+' button in front of the variables name and open the view onto all array elements. The value column shows the ASCII code representation of the entered characters as hexadecimal numbers.

Elements of the Byte Array



Definition ByteArr36

DemoString

	Name	Type	Value
-	DemoString	ByteArr36	
	DemoString[1]	BYTE	16#4D
	DemoString[2]	BYTE	16#79
	DemoString[3]	BYTE	16#20
	DemoString[4]	BYTE	16#54
	DemoString[5]	BYTE	16#65
	DemoString[6]	BYTE	16#78
	DemoString[7]	BYTE	16#74
	DemoString[8]	BYTE	16#20
	DemoString[9]	BYTE	16#21

RTXMIT: Full Duplex Transmit (Compact, Momentum, Quantum)

3

At a Glance

Introduction

This chapter describes the RTXMIT function block.

What’s in this Chapter?

This chapter contains the following topics:

Brief Description

Function Description

The function block provides full duplex communication through the local Modbus port. On Momentum PLCs the second local Modbus port is supported as well.
The function block combines two main functions into one, these are simple message reception and simple message transmission.

Note: EN and ENO should NOT be used with the RTXMIT, otherwise the output parameters may freeze.

Restrictions

The RTXMIT does **not** support Modbus protocol or modem functions.

Software and Hardware Required

Software
The RTXMIT function block requires the following software

- A minimum of Concept 2.5 Service Release 2
- IEC exec (delivered with Concept V2.5 SR2 or later)

Hardware
The following hardware is **not** supported by the RTXMIT function block:

- PLCs which do not support IEC languages
- Soft PLC
- All Atrium PLCs
- IEC Simulator

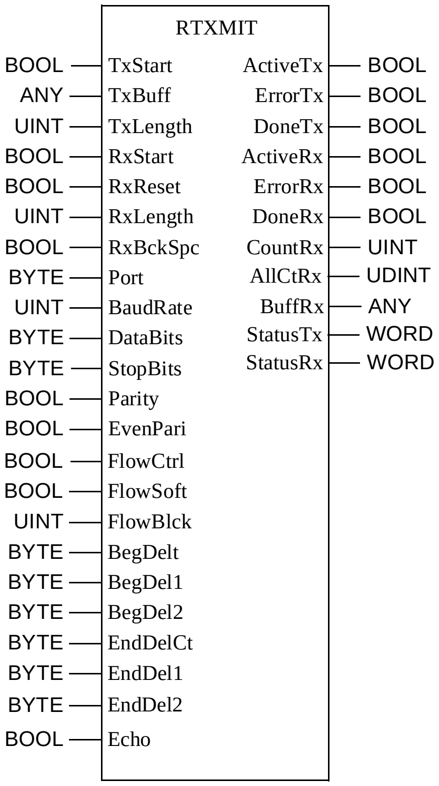
Memory Requirements

The usage of one or more RTXMIT EFBs in an IEC application consumes approximately 5KByte program (code) memory. For each instance of this EFB included in the user program, additional data memory of 200 byte is allocated.

Representation

Symbol

Representation of the Block



Parameter Description

Parameter Description

Description of the block parameter

Parameters	Data type	Significance
TxStart	BOOL	On a rising edge (FALSE->TRUE) the EFB begins with the send operation. This operation would work concurrently to an ongoing reception. If this parameter transitions from TRUE to FALSE an ongoing transmission will be aborted without any error being generated. After a transmission process completed (with or without success) a new process won't be triggered before the next rising edge happening to TxStart.
TxBuff	ANY	A variable of any datatype, it contains the 'to be sent' character stream in Intel format.
TxLength	UINT	This parameter specifies the full amount of characters to be sent from TxBuff. Without the use of data flowcontrol (RTS/CTS or XON/XOFF), the amount of characters to be sent from TxBuff may not exceed 1024. With data flow control being activated TxLength may go as high as 2^16, as FlowBlck specifies the number of characters being transmitted with one message frame.
RxStart	BOOL	On a rising edge (FALSE->TRUE) the EFB begins with the receive operation. This operation would work concurrently to an ongoing transmission. In case this parameter carries the value TRUE after the reception process completed (DoneTx = TRUE), following characters being received won't be stored in RxBuff anymore. A new reception process won't be triggerd before the next rising edge happing to RxStart.
RxReset	BOOL	If TRUE, the following stream of characters being received will be stored at the begin of BuffRx. Also output parameter CountRx will be set to zero. At the same time current values of input parameters RxLength, Strt_Cnt, Strt_Dl1, Strt_Dl2, End_Cnt, End_Dl1, End_Dl2, RxBckSpc will be used from then on.
RxLength	UINT	Max. number of characters to be received. In case this value exceeds the size of BuffRx no error will be generated, but the size of BuffRx will be used instead. After the given number of characters has been received the output parameter DoneRx transitions to TRUE, and the receive operation will end at that time.

Parameters	Data type	Significance
RxBckSpc	BOOL	While this parameter is being set to TRUE a received character of value 8 (backspace) will cause the one character being received before the backspace to be overwritten by the character being received after the backspace. Also, in this mode the output CountRx will decrease its value with each backspace being received, till it's 0. The EFB will consider the value of RxBckSpc only while RxStart transitions from FALSE to TRUE or while RxReset is TRUE (whereby RxStart needs to be TRUE at that time).
Port	BYTE	Local port number (1 or 2) The 2nd port is supported on Momentum PLCs only. **Note:** On Momentum PLCs the EFB will switch to RS485 if the assigned port has been configured as such, otherwise the port will be run in RS232 mode.
Baudrate	UINT	Bits per second for transmission and reception, allowed values are: 50, 75, 110, 134, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 19200
DataBits	BYTE	Databits per transmitted and received character (8 or 7)
StopBits	BYTE	Stopbits per transmitted and received character (1 or 2)
Parity	BOOL	If TRUE, parity check will be enabled (odd or even depends on EvenPari). If FALSE no parity check will be used.
EvenPari	BOOL	If TRUE and Parity = TRUE, even parity check will be used. If FALSE and Parity = TRUE, odd parity check will be used.
FlowCtrl	BOOL	If TRUE, the next triggered transmission will consider either RTS/CTS or XON/XOFF (depends on FlowSoft)for data flow control. Receive operations won't use data flow control, since the PLC internal buffer is big enough (512 byte) to avoid losing any character between two PLC scans.
FlowSoft	BOOL	If TRUE, the data flow of transmissions will be controled by using the XON/XOFF handshaking method.

Parameters	**Data type**	**Significance**
FlowBlck	UINT	Used only if FlowCtrl equals TRUE! This parameter specifies the number of characters being sent as one frame as soon as the transmitter obtains permission to sent through the selected data flow control mechanism. If FlowBlck is set to 0 the EFB will internally use 1 instead, as this is the minimum amount of characters to be sent in one frame. If FlowBlck is set to a higher value than TxLength the EFB will internally use TxLength instead, as this is the maximum amount of characters to be sent in one frame. In order to increase data throughput (only one frame can be transmitted per PLC scan) the value assigned to FlowBlck needs to be increased.
BegDelCt	BYTE	Number of start delimiter. This parameter assigns how many characters are being used for the start delimiter. Allowed values are: 0, 1, 2. In case the value exceeds 2 the EFB won't generate an error, but would use the max. of 2 instead.
BegDel1	BYTE	This is the first (of max. 2) character of the start delimiter.
BegDel2	BYTE	This is the second (of max. 2) character of the start delimiter.
EndDelCt	BYTE	Number of end delimiter. This parameter assigns how many characters are being used for the end delimiter. Allowed values are: 0, 1, 2. In case the value exceeds 2 the EFB won't generate an error, but would use the max. of 2 instead.
EndDel1	BYTE	This is the first (of max. 2) character of the end delimiter.
EndDel2	BYTE	This is the second (of max. 2) character of the end delimiter.
Echo	BOOL	If TRUE, all characters being received during transmission will be discarded. In RS485 2-wire mode this parameter would need to be set TRUE, otherwise each just-transmitted character would be received immediately afterwards.
ActiveTx	BOOL	If TRUE, a previously initiated send operation is still ongoing.
ErrorTx	BOOL	If TRUE, a previously initiated send operation failed, StatusTx. In such case StatusTx will carry an error code that helps to identify the reason for a failure.
DoneTx	BOOL	If TRUE, a previously initiated send operation finsihed with success.
ActiveRx	BOOL	If TRUE, a previously initiated receive operation is still ongoing.
ErrorRx	BOOL	If TRUE, a previously initiated receive operation failed. In such case StatusRx will carry an error code that helps to identify the reason for a failure.

Parameters	Data type	Significance
DoneRx	BOOL	If TRUE, a previously initiated receive operation finsihed with success.
CountRx	UINT	Number of characters being received since last initiated receive operation. This output parameter will be set back to 0 after RxReset has been set to TRUE. Also this number does decrease upon reception of a backspace character in case RxBckSpc is set to TRUE.
AllCtRx	UDINT	Number of ALL characters being received since the last rising edge happened at RxStart. This output will also stay at its value after RxReset has been set to TRUE.
BuffRx	ANY	A variable of any datatype, it is used to store the received characters in Intel format.
StatusTx	WORD	Will be 0 if there’s no error for the send operation, otherwise error code (See *Runtime Errors, p. 56*).
StatusRx	WORD	Will be 0 if there’s no error for the receive operation, otherwise error code (See *Runtime Errors, p. 56*).

Port-Parameters

New port parameters being assigned to input parameters Port, Baudrate, DataBits, StopBits, Parity and EvenPari will only be used after both parts of the EFB (receiver and transmitter) have been shutdown (TxStart = FALSE and RxStart = FALSE) and at least one of them has been (re-)started again.

Runtime Errors

Error code (at StatusTx and StatusRx)

Error code (at StatusTx and StatusRx)

Error Code	Description
0	No error, either EFB is turned off completely (TxStart and RxStart are FALSE) or the ongoing process works properly.
8003 (hex)	The assigned Modbus port does not exist (>1 on Quantum and Compact, >2 on Momentum). or Another EFB is using the assigned Modbus port already.
8304 (hex)	The assigned Modbus port is used by a 984-Loadable (like XXMIT).
8305 (hex)	Illegal baudrate being assigned.
8307 (hex)	Illegal number of data bits being assigned.
8308 (hex)	Illegal number of stop bits being assigned.

Application Example

Description

The following program is a short demo application which shows the implementation of a full duplex transmission with RTXMIT in the Structured Text language. The message to be transmitted has to be in `TxBuff`, the received message is in `BuffRx`.

Full Duplex Transfer

Declaration of function block:

```
VAR
send_receive  : RTXMIT;
END_VAR;
```

Call of function block:

```
send_receive (TxStart      := TX_start,      (* start of sending *)
              TxBuff       := tx_buffer,     (* send buffer *)
              TxLength     := TX_length,     (* length of a complete send telegram *)
              RxStart      := Rx_start,      (* start of receiving *)
              RxReset      := FALSE,         (* reset mode not activated *)
              RxLength     := 40,            (* max length of a received telegram, inclusing STX/CR *
              RxBckSpc     := FALSE,         (* no backspaces allowed *)
              Port         := port_number,   (* caution: for Quantum PLC only port 1 may be used! *
              Baudrate     := BAUDRATE,      (* baudrate is fixed *)
              Databits     := 8,             (* data format is fixed *)
              Stopbits     := 1,             (* number of stop bits is fixed *)
              Parity       := FALSE,         (* no parity *)
              EvenPari     := FALSE,
              FlowCtrl      := TRUE,         (* activate flow control *)
              FlowSoft     := FALSE,         (* flow control by RTS/CTS *)
              FlowBlck     := 40,            (* when flow control is active up to 40 character
                                                per cycle will be sent *)
              BegDelCt     := 0,
              BegDel1      := 0,
              BegDel2      := 0,
              EndDelCt     := 0,
              EndDel1      := 0,
              EndDel2      := 0,
              Echo         := FALSE,         (* only required in mode RS485-2 wire mode *)
              BuffRx       => rx_buffer);    (* special operator for allocation of RX_BUFF *)
              TX_active    := send_receive.ActiveTx;
              TX_error     := send_receive.ErrorTx;
              TX_done      := send_receive.DoneTx;
              RX_active    := send_receive.ActiveRx;
              RX_error     := send_receive.ErrorRx;
              RX_done      := send_receive.DoneRx;
              rx_cnt_uint  := send_receive.CountRx;
              rx_cnt_udint := send_receive.AllCtRx;
              TX_status    := send_receive.StatusTx;
              RX_status    := send_receive.StatusRx;
```

Conversion of number of received characters from UDINT to UINT format:

```
RX_count    := UDINT_TO_UINT (IN := rx_cnt_udint);
```

Technical References for XXMIT function block

4

At a glance

Overview

This chapter describes the Technical References for the XXMIT function block.

What's in this Chapter?

This chapter contains the following topics:

Modbus Query/Response Parameter Limits

Parameter Limits Based on PLC Type

The query/response parameters are limited based upon the type of PLC you are using. Refer to the applicable table below.
Quantum PLC Maximum Parameters table:

Function Code	Description	Query	Response
1	Read Coil Status	2000 Coils	2000 Coils
2	Read Input Status	2000 Inputs	2000 Inputs
3	Read Holding Registers	125 Registers	125 Registers
4	Read Input Registers	125 Registers	125 Registers
5	Force Single Coil	1 Coil	1 Coil
6	Force Single Register	1 Register	1 Register
15	Force Multiple Coil	800 Coils	800 Coils
16	Force Multiple Register	100 Registers	100 Registers
20	Read General References	Maximum length of the entire message can NOT exceed 256 bytes	Maximum length of the entire message can NOT exceed 256 bytes
21	Write General References	Maximum length of the entire message can NOT exceed 256 bytes	Maximum length of the entire message can NOT exceed 256 bytes

Note: The 140 CPU 113 02 and the 140 CPU 113 03 do not support General References.

884 PLC Maximum Parameters table:

Function Code	Description	Response
1	Read Coil Status	2000 Coils
2	Read Input Status	2000 Inputs
3	Read Holding Registers	125 Registers
4	Read Input Registers	125 Registers
5	Force Single Coil	1 Coil
6	Force Single Register	1 Register
15	Force Multiple Coil	800 Coils
16	Force Multiple Register	100 Registers
20	Read General References	NOT Supported
21	Write General References	NOT Supported

584/984 PLC Maximum Parameters table:

Function Code	Description	Response
1	Read Coil Status	2000 Coils
2	Read Input Status	2000 Inputs
3	Read Holding Registers	125 Registers
4	Read Input Registers	125 Registers
5	Force Single Coil	1 Coil
6	Force Single Register	1 Register
15	Force Multiple Coil	800 Coils
16	Force Multiple Register	100 Registers
20	Read General Refer ences (6x)	Maximum length of the entire message can NOT exceed 256 bytes
21	Write General Refer ences (6x)	Maximum length of the entire message can NOT exceed 256 bytes

484 PLC Maximum Parameters table:

Function Code	Description	Response
1	Read Coil Status	512 Coils
2	Read Input Status	512 Inputs
3	Read Holding Registers	254 Registers
4	Read Input Registers	32 Registers
5	Force Single Coil	1 Coil
6	Force Single Register	1 Register
15	Force Multiple Coil	800 Coils
16	Force Multiple Register	60 Registers
20	Read General Refer ences	NOT Supported
21	Write General Refer ences	NOT Supported

184/384 PLC Maximum Parameters table:

Function Code	Description	Response
1	Read Coil Status	800 Coils
2	Read Input Status	800 Inputs
3	Read Holding Registers	100 Registers
4	Read Input Registers	100 Registers
5	Force Single Coil	1 Coil
6	Force Single Register	1 Register
15	Force Multiple Coil	800 Coils
16	Force Multiple Register	100 Registers
20	Read General Refer ences	NOT Supported
21	Write General Refer ences	NOT Supported

M84 PLC Maximum Parameters table:

Function Code	Description	Response
1	Read Coil Status	64 Coils
2	Read Input Status	64 Inputs
3	Read Holding Registers	32 Registers
4	Read Input Registers	4 Registers
5	Force Single Coil	1 Coil
6	Force Single Register	1 Register
15	Force Multiple Coil	64 Coils
16	Force Multiple Register	32 Registers

XXMIT Configuration using Hayes Compatible Dial-Up Modems (Only)

Description

There are three commands that you need to become familiar with when interfacing dial-up modems to XXMIT.

These commands are:

- Initialize modem
- Dial modem
- Hangup modem.

Before an ASCII message or a Modbus message goes through the modem, you must first send an initialization string and then a dial string to the modem. Once the modem has dialed the telephone number and made a connection to the remote modem, you may send an unlimited number of ASCII messages or Modbus messages through the modem. To send multiple messages, you increment the message pointer to the next message after each successful XXMIT operation. When all messages are sent, you may then send the hangup string to the modem.

Initialization Message

The initialization message is just like any other ASCII message and may be a maximum of 512 characters long, although 50 characters is usually more than enough to initialize a modem. You may implement any Hayes AT command as part of the initialization string. We recommend the following commands when initializing a modem for use with XXMIT.

Initialization Message for Dial-Up Modem

Initialization Message =	**AT&F&K0&Q0&D0V1Q0X0E1**
AT=	Self-calibrate Modem [1]
&F=	Recall factory configuration as active configuration [1]
&K0=	Disable local flow control [2]
&Q0=	Communicate in asynchronous mode [2]
&D0=	Ignore status of DTR signal [1]
V1=	Display result codes as words [1] If V1 is not used or if modem is not capable of returning verbose responses the XXMIT block returns error 117 (modem replay time out).
Q0=	Return result codes [1]
X4=	Provide basic call progress result codes: Connect, No Carrier, and Ring [1]
E1=	Echo characters from the keyboard to the screen in command state [1]

1 These parameters must always be part of the initialization string for XXMIT to function properly.

2 These parameters should be part of the initialization string for XXMIT to transmit a message to remote modem properly. Only a experienced modem user should change or not use these parameters.

Note: While some modem manufacturers state full compatibility with Hayes, they may still be slightly different. Therefore, we recommend using only those commands that have the same definition as those stated above.

The initialization message must always start with Hayes standard AT command. The XXMIT block automatically precedes modem command messages with AT and appends the message with carriage return (0x0D) and line feed (0x0A) characters since these are required by all modem control messages. Other (non controlling) ASCII messages do not have to end with a carriage return and line feed.
For example, a typical initialization message that XXMIT sends to the modem.

Message	Length
(AT)&F&K0&Q0&D0V1X0Q0 (<CR><LF>) [1]	17 characters
1 Characters within parentheses are automatically sent.	

For example, the initialization message may also be used to set S-registers of the modem.

Message	Length
(AT)S0=1 (<CR><LF>) [1]	4 characters
1 Characters within parentheses are automatically sent.	

To have XXMIT send an initialization message to the modem, bit 7 and bit 16 of the command word must be ON. When bit 16 is ON, bits 15 and 14 must not be ON or XXMIT will not complete the operation successfully. To actually send the message, Start input of XXMIT must come ON and stays ON until the operation is complete or an error occurs. When XXMIT determines the message was successfully sent to the modem, it turns ON the Done output. When an error occurs, the Error output comes ON. The Active output is ON while the message is being sent to the modem.

Note: To eliminate some user logic programming, you may initialize the modem with parameters via a terminal program and not use XXMIT. Once the parameters are in the modem memory they may be saved to non-memory with an AT command, usually &W.

Dial Message

The dial message is used to send a telephone number to the modem. Only AT commands related to dialing a number should be included with the message. Examples of typical dial messages used with XXMIT are shown below.
For example, dial telephone number using tone dialing.

Message	Length
(AT)DT)6800326 (<CR><LF>)[1]	7 characters
1 Characters within parentheses are automatically sent.	

For example, dial telephone number using pulse dialing.

Message	Length
(AT)DP)6800326 (<CR><LF>)[1]	7 characters
1 Characters within parentheses are automatically sent.	

For example, dial telephone number using tone dialing, wait to hear dial tone before dialing number, and pause before dialing the rest of the number.

Message	Length
(AT)DT)W,6800326 (<CR><LF>)[1]	9 characters
1 Characters within parentheses are automatically sent.	

To have XXMIT send a tone dial message to the modem, bit 7 and bit 15 of the command word must be ON. When bit 15 is ON, bits 16 and 14 must not be ON or XXMIT will not complete the operation successfully. To actually send the message, the Start input of XXMIT must come ON and stays ON until the operation is complete or an error occurs. When XXMIT determines the message was successfully sent to the modem, it turns ON the Done output. When an error occurs, the Error output comes ON. The Active output is ON while the message is being sent to the modem.

Note: Because it takes so long for a local modem to make a connection to a remote modem, the timeout value, in RespTout should be quite long when sending a dial message to a modem. For example, set the timeout for 30,000 mS when sending a dial message. When the timeout value is too short, XXMIT issues a message timeout. You may have to try several settings before finding the optimal time.

Hangup Message

The hangup message is used to hangup the modem. Only AT commands related to hanging up the modem should be used in this message. An example of a typical hangup message is shown below.
For example, hangup modem message.

Message	Length
(+++AT)H0 (<CR><LF>)[1]	2 characters
1 Characters within parentheses are automatically sent.	

When the hangup message is sent to a modem that is already connected to a remote modem, XXMIT must first set the local modem in command mode. XXMIT does this by sending a escape sequence +++ to the modem. XXMIT assumes that +++ sets the modem in command mode. Some modem manufactures let the owner change this default escape sequence. For XXMIT to function properly the modem should be set to accept the +++ escape sequence.
To have XXMIT send a hangup message to the modem, bit 7 and bit 14 of the command word must be ON. When bit 14 is ON, bits 16 and 15 must not be ON or XXMIT will not complete the operation successfully. To actually send the message, the Start input of XXMIT must come ON and stays ON until the operation is complete or an error occurs. When XXMIT determines the message was successfully sent to the modem, it turns ON the Done output. When an error occurs, the Error output comes ON. The Done output is ON while the message is being sent to the modem.

Note: Expert: Because it takes so long for a local modem to hangup once it receives the hangup command, the timeout value, in RespTout should quite long when sending a dial message to a modem. For example, set the timeout for 30,000 mS when sending a dial message. When the timeout value is too short, XXMIT issues a message timeout. You may have to try several settings before finding the optimal time.

Cabling Information

5

At a Glance

Overview

This chapter describes cables and pinouts for the hardware components used with the Transmit function blocks..

What's in this Chapter?

This chapter contains the following topics:

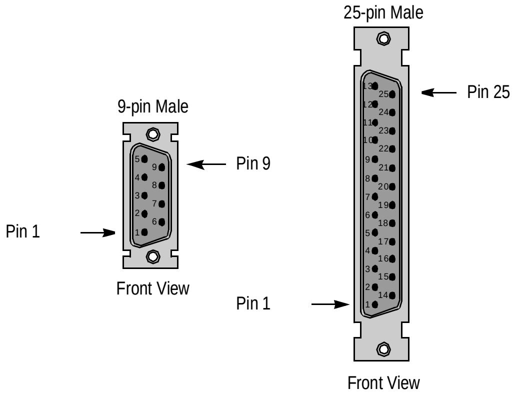
Cable Pinouts

Interface Cable Pinouts

You need to build an interface cable between your PLC and the modem or printer. The actual cable is connected to the Port which is supported by the PLC and to the RS232 port of the modem or printer, or direct to another PLC's Modbus port. Because the XXMIT supports many modems and printers the pinouts are going to vary. Some pinouts are provided below.
For information on Momentum communication connections see TSX Momentum M1 Processor Adapter and Option Adapter User Guide.

9-pin (RS-232) to 25-pin (Modem) with no RTS/CTS Control

Refer to the figure for Front Views of Connectors.

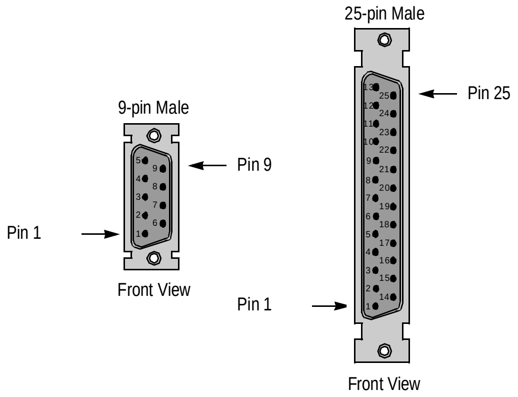


Refer to the Connector Pinouts table.

Connector Pinouts				
9-Pin Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	2	Yes	3	RXD
TXD	3	Yes	2	TXD
RTS	7 Jumpered 8 Jumpered		4 Jumpered 5 Jumpered	RTS
CTS				CTS
DSR	4 Jumpered 6 Jumpered		6 Jumpered 20 Jumpered	DSR
DTR				DTR
GND	5	Yes	7	GND

9-pin (RS-232) to 25-pin (Modem) with RTS/CTS Control

Refer to the figure for Front Views of Connectors.

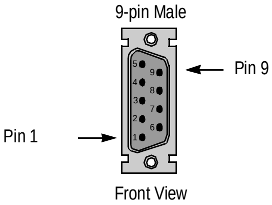


Refer to the Connector Pinouts table.

Connector Pinouts				
9-Pin Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	2	Yes	3	RXD
TXD	3	Yes	2	TXD
RTS	7	Yes	4	RTS
CTS	8	Yes	5	CTS
DSR	4 Jumpered 6 Jumpered		6 Jumpered 20 Jumpered	DSR
DTR				DTR
GND	5	Yes	7	GND

9-pin to 9-pin (Null Modem)

Refer to the figure for Front Views of Connectors.

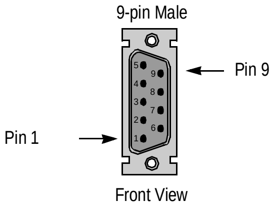


Refer to the Connector Pinouts table.

Connector Pinouts				
9-Pin Connector			9-Pin Connector	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	2	Yes	3	TXD
TXD	3	Yes	2	RXD
RTS	7 Jumpered 8 Jumpered		7 Jumpered 8 Jumpered	RTS
CTS				CTS
DSR	4 Jumpered 6 Jumpered		4 Jumpered 6 Jumpered	DSR
DTR				DTR
GND	5	Yes	5	GND

9-pin to 9-pin (Modem)

Refer to the figure for Front Views of Connectors.

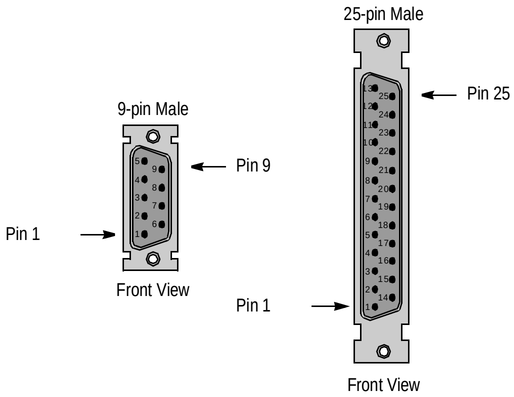


Refer to the Connector Pinouts table.

Connector Pinouts				
9-Pin Connector			9-Pin Connector	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
TXD	2	Yes	2	TXD
RXD	3	Yes	3	RXD
RTS	7	Yes	7	RTS
CTS	8	Yes	8	CTS
DSR	4 Jumpered 6 Jumpered		4 Jumpered 6 Jumpered	DSR
DTR				DTR
GND	5	Yes	5	GND

9-pin to 25-pin (Null Modem)

Refer to the figure for Front Views of Connectors.

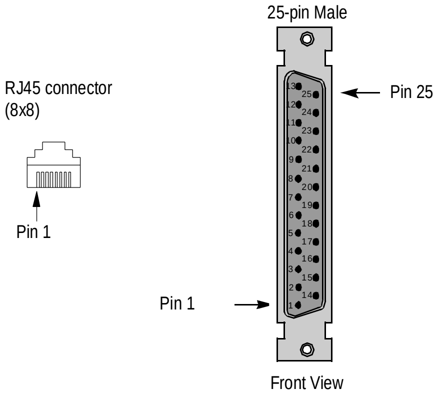


Refer to the Connector Pinouts table.

Connector Pinouts				
9-Pin Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Siignal Name
RXD	2	Yes	2	TXD
TXD	3	Yes	3	RXD
RTS	7 Jumpered 8 Jumpered		4 Jumpered 5 Jumpered	RTS
CTS				CTS
DSR	4 Jumpered 6 Jumpered		6 Jumpered 20 Jumpered	DSR
DTR				DTR
GND	5	Yes	7	GND

RJ45-(8x8) to 25-pin (Null Modem) 110XCA20401

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	2	TXD
TXD	3	Yes	3	RXD
RTS	6 Jumpered		4 Jumpered	RTS
CTS	7 Jumpered		5 Jumpered	CTS
GND	5	Yes	7	GND
DSR	2	Yes	6	DSR
			20	DTR
Chassis Ground	8	Yes	1	Chassis Ground

CAUTION

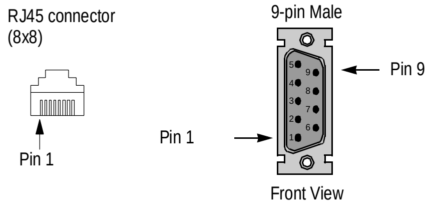
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

RJ45-(8x8) to 9-pin (Null Modem) 110XCA20301

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			9-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	3	TXD
TXD	3	Yes	2	RXD
RTS	6 Jumpered 7 Jumpered		7 Jumpered 8 Jumpered	RTS
CTS				CTS
GND	5	Yes	5	GND
DSR	2	Yes	4 6	DTR
				DSR
Chassis Ground	8	Yes		Case of the Connector

CAUTION

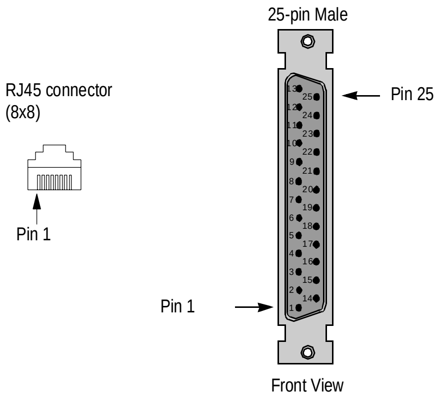
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

RJ45-(8x8) to 25-pin (Modem) 110XCA20401

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	3	RXD
TXD	3	Yes	2	TXD
RTS	6 Jumpered		4 Jumpered	RTS
CTS	7 Jumpered		5 Jumpered	CTS
GND	5	Yes	7	GND
DSR	2	Yes	6	DSR
			20	DTR
Chassis Ground	8	Yes	1	Chassis Ground

⚠ **CAUTION**

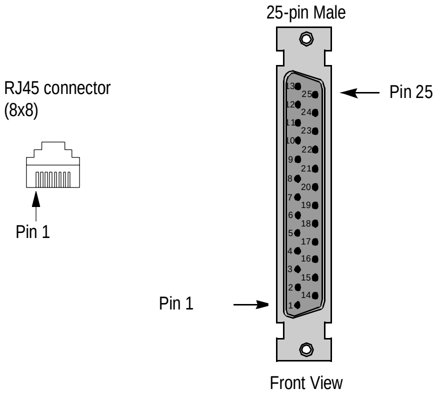
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

RJ45-(8x8) to 25-pin (Modem) 110XCA20401

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			25-Pin D-shell	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	3	RXD
TXD	3	Yes	2	TXD
RTS	6	Yes	4	RTS
CTS	7	Yes	5	CTS
GND	5	Yes	7	GND
			6 Jumpered	DSR
			20 Jumpered	DTR
Chassis Ground	8	Yes	1	Chassis Ground

CAUTION

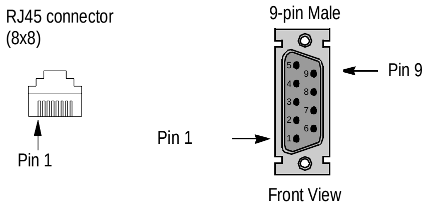
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

RJ45-(8x8) to RJ45-(8x8) (Modem)

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			RJ45 Connector	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	4	RXD
TXD	3	Yes	3	TXD
RTS	6	Yes	6	RTS
CTS	7	Yes	7	CTS
GND	5	Yes	5	GND
DSR	2	Yes	2	DSR
Chassis Ground	8	Yes	8	Chassis Ground

CAUTION

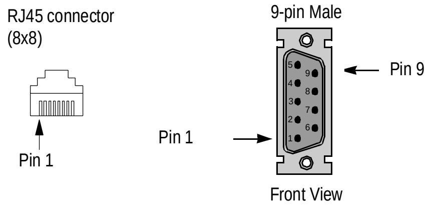
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

9-pin to RJ45-(8x8) (Modem) 110XCA20301

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			9-Pin Connector	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	2	RXD
TXD	3	Yes	3	TXD
RTS	6 Jumpered 7 Jumpered		7 Jumpered 8 Jumpered	RTS
CTS				CTS
GND	5	Yes	5	GND
DSR	2	Yes	6 4	DSR
				DTR
Chassis Ground	8	Yes	Case of the Connector	

CAUTION

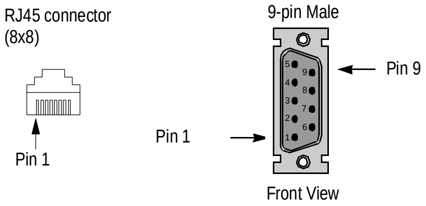
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

9-pin to RJ45-(8x8) (Modem) 110XCA20301

Refer to the figure for Front Views of Connectors.



Refer to the Connector Pinouts table.

Connector Pinouts				
RJ45 Connector			9-Pin Connector	
Signal Name	Pinout	Pinout Connected To ...	Pinout	Signal Name
RXD	4	Yes	2	RXD
TXD	3	Yes	3	TXD
RTS	6	Yes	7	RTS
CTS	7	Yes	8	CTS
GND	5	Yes	5	GND
			6 Jumpered	DSR
			4 Jumpered	DTR
Chassis Ground	8	Yes	Case of the Connector	

CAUTION

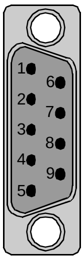
Danger of 5 V short circuit.

Pin1 of the RJ45 receives 5V from the PLC.

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

9-pin Momentum RS 485

Refer to the figure for Front Views of Connectors.

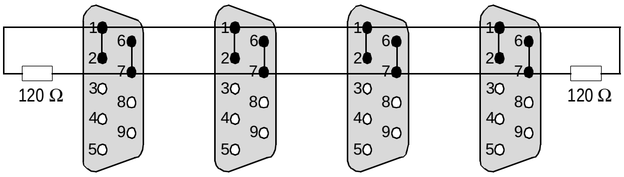


Pinouts table for the 9-pin D-Sub female Momentum RS 485 connector.

Pin	Signal Name
1	TXD +
2	RXD +
3	Signal Ground
4	reserved
5	reserved
6	TXD -
7	RXD -
8	reserved
9	reserved

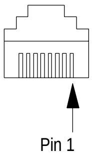
RS 485 Multidrop Example

The following illustration shows a RS 485 2-wire multidrop wiring example



RJ 45 Momentum RS 485

Refer to the figure for Front Views of Connectors.



Pinouts table for the RJ 45 Momentum RS 485 connector.

Pin	**Signal Name**
1	RXD -
2	RXD +
3	TXD +
4	reserved
5	Signal Ground
6	TXD -
7	reserved
8	screen

Cable Adapter Kits

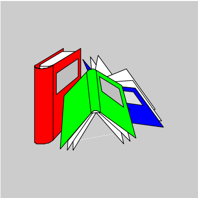
Cable Adapter Kits for RJ45

You may want to purchase Cable Adapter Kits for your RJ45 (8x8) requirements rather than make them. The table below provides a list of available kits.

Available Cable Adapter Kids

Description	Part Number
RJ45-(8x8) to 25-Pin (Male)	110XCA20401
RJ45-(8x8) to 9-Pin (Male)	110XCA20301
RJ45-(8x8) to 9-Pin (Female)	110XCA20302
RJ45-(8x8) to 25-Pin (Female)	110XCA20402

Glossary



A

active Window The window, which is currently selected. Only one window can be active at any given time. When a window is active, the color of the title bar changes, so that it is distinguishable from the other windows. Unselected windows are inactive.

Actual Parameters Current connected Input / Output Parameters.

Addresses (Direct) addresses are memory ranges in the PLC. They are located in the State RAM and can be assigned Input/Output modules.
The display/entry of direct addresses is possible in the following formats:

- Standard Format (400001)
- Separator Format (4:00001)
- Compact format (4:1)
- IEC Format (QW1)

ANL_IN ANL_IN stands for the "Analog Input" data type and is used when processing analog values. The 3x-References for the configured analog input module, which were specified in the I/O component list, are automatically assigned data types and should therefore only be occupied with Unlocated Variables.

ANL_OUT ANL_OUT stands for the "Analog Output" data type and is used when processing analog values. The 4x-References for the configured analog input module, which were specified in the I/O component list, are automatically assigned data types and should therefore only be occupied with Unlocated Variables.

ANY In the above version "ANY" covers the BOOL, BYTE, DINT, INT, REAL, UDINT, UINT, TIME and WORD elementary data types and related Derived Data Types.

ANY_BIT In the above version "ANY_BIT" covers the BOOL, BYTE and WORD data types.

ANY_ELEM In the above version "ANY_ELEM" covers the BOOL, BYTE, DINT, INT, REAL, UDINT, UINT, TIME and WORD data types.

ANY_INT In the above version "ANY_INT" covers the DINT, INT, UDINT and UINT data types.

ANY_NUM In the above version "ANY_NUM" covers the DINT, INT, REAL, UDINT and UINT data types.

ANY_REAL In the above version "ANY_REAL" covers the REAL data type.

Application Window The window containing the workspace, menu bar and the tool bar for the application program. The name of the application program appears in the title bar. An application window can contain several Document windows. In Concept the application window corresponds to a Project.

Argument Synonymous with Actual parameters.

ASCII-Mode The ASCII (American Standard Code for Information Interchange) mode is used to communicate with various host devices. ASCII works with 7 data bits.

Atrium The PC based Controller is located on a standard AT board, and can be operated within a host computer in an ISA bus slot. The module has a motherboard (requiring SA85 driver) with two slots for PC104 daughter-boards. In this way, one PC104 daughter-board is used as a CPU and the other as the INTERBUS controller.

B

Backup file (Concept-EFB) The backup file is a copy of the last Source coding file. The name of this backup file is "backup??.c" (this is assuming that you never have more than 100 copies of the source coding file). The first backup file has the name "backup00.c". If you have made alterations to the Definitions file, which do not cause any changes to the EFB interface, the generation of a backup file can be stopped by editing the source coding file (**Objects** → **Source**). If a backup file is created, the source file can be entered as the name.

Base 16 literals Base 16 literals are used to input whole number values into the hexadecimalsystem. The base must be denoted using the prefix 16#. The values can not have any signs (+/-). Single underscores (_) between numbers are not significant.

Example
16#F_F or 16#FF (decimal 255)
16#E_0 or 16#E0 (decimal 224)

Base 2 literals Base 2 literals are used to input whole number values into the dualsystem. The base must be denoted using the prefix 2#. The values can not have any signs (+/-). Single underscores (_) between numbers are not significant.

Example
2#1111_1111 or 2#11111111 (decimal 255)
2#1110_0000 or 2#11100000 (decimal 224)

Base 8 literals Base 8 literals are used to input whole number values into the octosystem. The base must be denoted using the prefix 8#. The values can not have any signs (+/-). Single underscores (_) between numbers are not significant.

Example
8#3_77 or 8#377 (decimal 255)
8#34_0 or 8#340 (decimal 224)

Binary Connections Connections between FFB outputs and inputs with the data type BOOL.

Bitsequence A data element, which consists of one or more bits.

BOOL BOOL stands for the data type "boolean". The length of the data element is 1 bit (occupies 1 byte in the memory). The value range for the variables of this data type is 0 (FALSE) and 1 (TRUE).

Bridge A bridge is a device, which connects networks. It enables communication between nodes on two networks. Each network has its own token rotation sequence - the token is not transmitted via the bridge.

BYTE BYTE stands for the data type "bit sequence 8". Entries are made as base 2 literal, base 8 literal or base 16 literal. The length of the data element is 8 bits. A numerical value range can not be assigned to this data type.

C

Clipboard The clipboard is a temporary memory for cut or copied objects. These objects can be entered in sections. The contents of the clipboard are overwritten with each new cut or copy.

Coil A coil is a LD element which transfers the status of the horizontal short on its left side, unchanged, to the horizontal short on its right side. In doing this, the status is saved in the relevant variable/direct address.

Compact format (4:1) The first digit (the Reference) is separated from the address that follows by a colon (:) where the leading zeros are not specified.

Constants Constants are Unlocated variables, which are allocated a value that cannot be modified by the logic program (write protected).

Contact A contact is a LD element, which transfers a status on the horizontal link to its right side. This status comes from the boolean AND link of the status of the horizontal link on the left side, with the status of the relevant variable/direct address. A contact does not change the value of the relevant variable/direct address.

D

Data transfer settings Settings which determine how information is transferred from your programming device to the PLC.

Data Types The overview shows the data type hierarchy, as used for inputs and outputs of functions and function blocks. Generic data types are denoted using the prefix "ANY".

- ANY_ELEM
  - ANY_NUM
    ANY_REAL (REAL)
    ANY_INT (DINT, INT, UDINT, UINT)
  - ANY_BIT (BOOL, BYTE, WORD)
  - TIME
- System Data types (IEC Extensions)
- Derived (from "ANY" data types)

DCP I/O drop

A remote network with a super-ordinate PLC can be controlled using a Distributed Control Processor (D908). When using a D908 with remote PLC, the super-ordinate PLC considers the remote PLC as a remote I/O drop. The D908 and the remote PLC communicate via the system bus, whereby a high performance is achieved with minimum effect on the cycle time. The data exchange between the D908 and the super-ordinate PLC takes place via the remote I/O bus at 1.5Mb per second. A super-ordinate PLC can support up to 31 D908 processors (addresses 2-32).

DDE (Dynamic Data Exchange)

The DDE interface enables a dynamic data exchange between two programs in Windows. The user can also use the DDE interface in the extended monitor to invoke their own display applications. With this interface, the user (i.e. the DDE client) can not only read data from the extended monitor (DDE server), but also write data to the PLC via the server. The user can therefore alter data directly in the PLC, while monitoring and analyzing results. When using this interface, the user can create their own "Graphic Tool", "Face Plate" or "Tuning Tool" and integrate into the system. The tools can be written in any language, i.e. Visual Basic, Visual C++, which supports DDE. The tools are invoked, when the user presses one of the buttons in the Extended Monitor dialog field. Concept Graphic Tool: Configuration signals can be displayed as a timing diagram using the DDE connection between Concept and Concept Graphic Tool.

Declaration

Mechanism for specifying the definition of a language element. A declaration usually covers the connection of an identifier to a language element and the assignment of attributes such as data types and algorithms.

Definitions file (Concept-EFB)

The definitions file contains general descriptive information on the selected EFB and its formal parameters.

Derived Data Type

Derived data types are data types, which are derived from Elementary Data Types and/or other derived data types. The definition of derived data types is found in the Concept data type editor.
A distinction is made between global data types and local data types.

Derived Function Block (DFB)

A derived function block represents the invocation of a derived function block type. Details of the graphic form of the invocation can be found in the "Functional block (instance)". In contrast to the invocation of EFB types, invocations of DFB types are denoted by double vertical lines on the left and right hand side of the rectangular block symbol.
The body of a derived function block type is designed using FBD language, LD language, ST language, IL language, however, this is only the case in the current version of the programming system. Furthermore, derived functions can not yet be defined in the current version.
A distinction is made between local and global DFBs.

Device Address The device address is used to uniquely denote a network device in the routing path. The address is set on the device directly, e.g. using the rotary switch on the back of the modules.

DFB Code The DFB code is the section’s DFB code, which can be executed. The size of the DFB code is mainly dependant upon the number of blocks in the section.

DFB instance data The DFB instance data is internal data from the derived function block used in the program.

DINT DINT stands for the data type "double length whole number (double integer)". Entries are made as integer literal, base 2 literal, basis 8 literal or base 16 literal. The length of the data element is 32 bits. The value range for variables of this datatype reaches from -2 exp (31) to 2 exp (31) -1.

Direct Representation A method of displaying variables in the PLC program, from which the assignment to the logical memory can be directly - and indirectly to the physical memory - derived.

Document Window A window within an application window. Several document windows can be open at the same time in an application window. However, only one document window can ever be active. Document windows in Concept are, for example, sections, the message window, the reference data editor and the PLC configuration.

DP (PROFIBUS) DP = Remote Peripheral

Dummy An empty file, which consists of a text heading with general file information, such as author, date of creation, EFB designation etc. The user must complete this dummy file with further entries.

DX Zoom This property enables the user to connect to a programming object, to monitor and, if necessary change, its data value.

E

EFB code The EFB code is the section’s EFB code, which can be executed. In addition the used EFBs count in DFBs.

Elementary functions/ function blocks (EFB) Identifier for Functions or Function blocks, whose type definitions are not formulated in one of the IEC languages, i.e. whose body for example can not be modified with the DFB editor (Concept-DFB). EFB types are programmed in "C" and are prepared in a pre-compiled form using libraries.

EN / ENO (Enable / Error signal) If the value of EN is equal to "0" when the FFB is invoked, the algorithms that are defined by the FFB will not be executed and all outputs keep their previous values. The value of ENO is in this case automatically set to "0". If the value of EN is equal to "1", when the FFB is invoked, the algorithms which are defined by the FFD will be executed. After the error-free execution of these algorithms, the value of ENO is automatically set to "1". If an error occurs during the execution of these algorithms, ENO is automatically set to "0". The output behavior of the FFB is independent of whether the FFBs are invoked without EN/ENO or with EN=1. If the EN/ENO display is switched on, it is imperative that the EN input is switched on. Otherwise, the FFB is not executed. The configuration of EN and ENO is switched on or off in the Block Properties dialog box. The dialog box can be invoked with the **Objects** → **Properties...** menu command or by double-clicking on the FFB.

Error If an error is recognized during the processing of a FFB or a step (e.g. unauthorized input values or a time error), an error message appears, which can be seen using the **Online** → **Online events...** menu command. For FFBs, the ENO output is now set to "0".

Evaluation The process, through which a value is transmitted for a Function or for the output of a Function block during Program execution.

F

FFB (Functions/ Function blocks) Collective term for EFB (elementary functions/function blocks) and DFB (Derived function blocks)

Field variables A variable, which is allocated a defined derived data type with the key word ARRAY (field). A field is a collection of data elements with the same data type.

FIR Filter (Finite Impulse Response Filter) a filter with finite impulse answer

Formal parameters Input / Output parameters, which are used within the logic of a FFB and led out of the FFB as inputs/outputs.

Function (FUNC)

A program organization unit, which supplies an exact data element when processing. a function has no internal status information. Multiple invocations of the same function using the same input parameters always supply the same output values.
Details of the graphic form of the function invocation can be found in the "Functional block (instance)". In contrast to the invocation of the function blocks, function invocations only have a single unnamed output, whose name is the same as the function. In FBD each invocation is denoted by a unique number via the graphic block, this number is automatically generated and can not be altered.

Function block (Instance) (FB)

A function block is a program organization unit, which correspondingly calculates the functionality values that were defined in the function block type description, for the outputs and internal variable(s), if it is invoked as a certain instance. All internal variable and output values for a certain function block instance remain from one function block invocation to the next. Multiple invocations of the same function block instance with the same arguments (input parameter values) do not therefore necessarily supply the same output value(s).
Each function block instance is displayed graphically using a rectangular block symbol. The name of the function block type is stated in the top center of the rectangle. The name of the function block instance is also stated at the top, but outside of the rectangle. It is automatically generated when creating an instance, but, depending on the user's requirements, it can be altered by the user. Inputs are displayed on the left side of the block and outputs are displayed on the right side. The names of the formal input/output parameters are shown inside the rectangle in the corresponding places.
The above description of the graphic display is especially applicable to the function invocation and to DFB invocations. Differences are outlined in the corresponding definitions.

Function Block Dialog (FBD)

One or more sections, which contain graphically displayed networks from Functions, Function blocks and Connections.

Function block type

A language element, consisting of: 1. the definition of a data structure, divided into input, output and internal variables; 2. a set of operations, which are performed with elements of the data structure, when a function block type instance is invoked. This set of operations can either be formulated in one of the IEC languages (DFB type) or in "C" (EFB type). A function block type can be instanced (invoked) several times.

Function Number The function number is used to uniquely denote a function in a program or DFB. The function number can not be edited and is automatically assigned. The function number is always formed as follows: .n.m

n = section number (current number)
m = Number of the FFB object in the section (current number)

G

Generic Data Type A data type, which stands in place of several other data types.

Generic literals If the literal's data type is not relevant, simply specify the value for the literal. If this is the case, Concept automatically assigns the literal a suitable data type.

Global Data Global data are Unlocated variables.

Global derived data types Global derived data types are available in each Concept project and are occupied in the DFB directory directly under the Concept directory.

Global DFBs Global DFBs are available in each Concept project. The storage of the global DFBs is dependant upon the settings in the CONCEPT.INI file.

Global macros Global macros are available in each Concept project and are occupied in the DFB directory directly under the Concept directory.

Groups (EFBs) Some EFB libraries (e.g. the IEC library) are divided into groups. This facilitates EFB location especially in expansive libraries.

H

Host Computer Hardware and software, which support programming, configuring, testing, operating and error searching in the PLC application as well as in a remote system application, in order to enable source documentation and archiving. The programming device can also be possibly used for the display of the process.

I

I/O Map The I/O and expert modules from the various CPUs are configured in the I/O map.

Icon Graphical representation of different objects in Windows, e.g. drives, application programs and document windows.

IEC 61131-3 International standard: Programmable Logic Controls - Part 3: Programming languages.

IEC Format (QW1) There is an IEC type designation in initial position of the address, followed by the five-figure address.
- %0x12345 = %Q12345
- %1x12345 = %I12345
- %3x12345 = %IW12345
- %4x12345 = %QW12345

IEC name conventions (identifier) An identifier is a sequence of letters, numbers and underscores, which must begin with either a letter or underscore (i.e. the name of a function block type, an instance, a variable or a section). Letters of a national typeface (i.e.: ö,ü, é, õ) can be used, except in project and DFB names.
Underscores are significant in identifiers; e.g. "A_BCD" and "AB_CD" are interpreted as two separate identifiers. Several leading and multiple successive underscores are not allowed.
Identifiers should not contain any spaces. No differentiation is made between upper and lower case, e.g. "ABCD" and "abcd" are interpreted as the same identifier.
Identifiers should not be Keywords.

IEC Program Memory The IEC memory consists of the program code, EFB code, the section data and the DFB instance data.

IIR Filter (Infinite Impulse Response Filter) a filter with infinite impulse answer

Initial step The first step in a sequence. A step must be defined as an initial step for each sequence. The sequence is started with the initial step when first invoked.

Initial value The value, which is allocated to a variable when the program is started. The values are assigned in the form of literals.

Input bits (1x references)

The 1/0 status of the input bits is controlled via the process data, which reaches from an input device to the CPU.

> **Note:** The x, which follows the initial reference type number, represents a five-figure storage location in the user data memory, i.e. the reference 100201 signifies an output or marker bit at the address 201 in the State RAM.

Input parameter (Input)

Upon invocation of a FFB, this transfers the corresponding argument.

Input words (3x references)

An input word contains information, which originates from an external source and is represented by a 16 bit number. A 3x register can also contain 16 sequential input bits, which were read into the register in binary or BCD (binary coded decimal) format. Note: The x, which follows the initial reference type number, represents a five-figure storage location in the user data memory, i.e. the reference 300201 signifies an input word at the address 201 in the State RAM.

Input/output marker bits (0x references)

An input/output marker bit can be used to control real output data using an output unit of the control system, or to define one or more discrete outputs in the state RAM. Note: The x, which follows the initial reference type number, represents a five-figure storage location in the user data memory, i.e. the reference 000201 signifies an output or marker bit at the address 201 in the State RAM.

Instance Name

An identifier, which belongs to a certain function block instance. The instance name is used to clearly denote a function block within a program organization unit. The instance name is automatically generated, but it can be edited. The instance name must be unique throughout the whole program organization unit, and is not case sensitive. If the name entered already exists, you will be warned and you will have to choose another name. The instance name must comply with the IEC name conventions otherwise an error message appears. The automatically generated instance name is always formed as follows: FBI_n_m

FBI = Function Block Instance
n = section number (current number)
m = Number of the FFB object in the section (current number)

Instancing

Generating an Instance.

Instruction (IL)

Instructions are the "commands" of the IL programming language. Each instruction begins on a new line and is performed by an operator with a modifier if necessary, and if required for the current operation, by one or more operands. If several operands are used, they are separated by commas. A character can come before the instruction, which is then followed by a colon. The commentary must, where available, be the last element of the line.

Instruction (LL984)

When programming electrical controls, the user should implement operation-coded instructions in the form of picture objects, which are divided into a recognizable contact form. The designed program objects are, on a user level, converted to computer usable OP codes during the download process. The OP codes are decoded in the CPU and processed by the firmware functions of the controller in a way that the required control is implemented.

Instruction (ST)

Instructions are the "commands" of the ST programming language. Instructions must be concluded by semicolons. Several instructions can be entered in one line (separated by semicolons).

Instruction list (IL)

IL is a text language according to IEC 1131, which is shown in operations, i.e. conditional or unconditional invocations of Functions blocks and Functions, conditional or unconditional jumps etc. through instructions.

INT

INT stands for the data type "whole number (integer)". Entries are made as integer literal, base 2 literal, basis 8 literal or base 16 literal. The length of the data element is 16 bits. The value range for variables of this datatype reaches from -2 exp (15) to 2 exp (15) -1.

Integer literals

Integer literals are used to input whole number values into the decimalsystem. The values can have a preceding sign (+/-). Single underscores (_) between numbers are not significant.

Example
-12, 0, 123_456, +986

INTERBUS (PCP)

The new INTERBUS (PCP) I/O drop type is entered into the Concept configurator, to allow use of the INTERBUS PCP channel and the INTERBUS process data preprocessing (PDV). This I/O drop type is assigned the INTERBUS switching module 180-CRP-660-01.
The 180-CRP-660-01 differs from the 180-CRP-660-00 only in the fact that it has a clearly larger I/O range in the control state RAM.

Invocation

The process, through which an operation is carried out.

J

Jump Element of the SFC language. Jumps are used to skip zones in the sequence.

K

Keywords Keywords are unique combinations of characters, which are used as special syntactical components, as defined in Appendix B of the IEC 1131-3. All keywords which are used in the IEC 1131-3 and therefore in Concept, are listed in Appendix C of the IEC 1131-3. These keywords may not be used for any other purpose, i.e. not as variable names, section names, instance names etc.

L

Ladder Diagram (LD) Ladder Diagram is a graphic programming dialog according to IEC1131, which is optically oriented to the "rung" of a relay contact plan.

Ladder Logic 984 (LL) The terms Ladder Logic and Ladder Diagram refer to the word Ladder being executed. In contrast to a circuit diagram, a ladder diagram is used by electrotechnicians to display an electrical circuit (using electrical symbols), which should show the course of events and not the existing wires, which connect the parts with each other. A usual user interface for controlling the actions of automation devices permits a Ladder Diagram interface, so that electrotechnicians do not have to learn new programming languages to be able to implement a control program.

The structure of the actual Ladder Diagram enables the connection of electric elements in such a way that generates a control output, which is dependant upon a logical power flow through used electrical objects, which displays the previously requested condition of a physical electrical device.

In simple form, the user interface is a video display processed by the PLC programming application, which sets up vertical and horizontal grid, in which programming objects are classified. The diagram contains the power grid on the left side, and when connected to activated objects, the power shifts from left to right.

Landscape Landscape means that when looking at the printed text, the page is wider than it is high.

Language Element

Every basic element in one of the IEC programming languages, e.g. a step in SFC, a function block instance in FBD or the initial value of a variable.

Library

Collection of software objects, which are intended for re-use when programming new projects, or even building new libraries. Examples are the libraries of the Elementary function block types.
EFB libraries can be divided up into Groups.

Link

A control or data flow connection between graphical objects (e.g. steps in the SFC Editor, function blocks in the FBD Editor) within a section, represented graphically as a line.

Literals

Literals are used to provide FFB inputs, and transition conditions etc using direct values. These values can not be overwritten by the program logic (read only). A distinction is made between generic and standardized literals.
Literals are also used to allocate a constant, a value or a variable an initial value. Entries are made as base 2 literal, base 8 literal, basis 16 literal, integer literal, real literal or real literal with exponent.

Local derived data types

Local derived data types are only available in a single Concept project and the local DFBs and are placed in the DFB directory under the project directory.

Local DFBs

Local DFBs are only available in a single Concept project and are placed in the DFB directory under the project directory.

Local Link

The local network is the network, which connects the local nodes with other nodes either directly or through bus repeaters.

Local macros

Local macros are only available in a single Concept project and are placed in the DFB directory under the project directory.

Local network nodes

The local node is the one, which is currently being configured.

Located variable

A state RAM address (reference addresses 0x, 1x, 3x,4x) is allocated to located variables. The value of these variables is saved in the state RAM and can be modified online using the reference data editor. These variables can be addresses using their symbolic names or their reference addresses.

All inputs and outputs of the PLC are connected to the state RAM. The program can only access peripheral signals attached to the PLC via located variables. External access via Modbus or Modbus Plus interfaces of the PLC, e.g. from visualization systems, is also possible via located variables.

M

Macro

Macros are created with the help of the Concept DFB software.
Macros are used to duplicate frequently used sections and networks (including their logic, variables and variable declaration).
A distinction is made between local and global macros.

Macros have the following properties:

- Macros can only be created in the FBD and LD programming languages.
- Macros only contain one section.
- Macros can contain a section of any complexity.
- In programming terms, there is no difference between an instanced macro, i.e. a macro inserted into a section and a conventionally created section.
- DFB invocation in a macro
- Declaring variables
- Using macro-specific data structures
- Automatic transfer of the variables declared in the macro.
- Initial value for variables
- Multiple instancing of a macro in the entire program with differing variables
- The name of the section, variable names and data structure names can contain up to 10 different exchange marks (@0 to @9).

MMI

Man-Machine-Interface

Multi element variables

Variables to which a Derived data type defined with STRUCT or ARRAY is allocated.
A distinction is made here between field variables and structured variables.

N

Network

A network is the collective switching of devices to a common data path, which then communicate with each other using a common protocol.

Network node

A node is a device with an address (1...64) on the Modbus Plus network.

Node

Node is a programming cell in a LL984 network. A cell/node consists of a 7x11 matrix, i.e. 7 rows of 11 elements.

O

Operand An operand is a literal, a variable, a function invocation or an expression.

Operator An operator is a symbol for an arithmetic or boolean operation, which is to be carried out.

Output parameter (outputs): A parameter, through which the result(s) of the evaluation of a FFB is/are returned.

Output/marker words (4x references) An output / marker word can be used to save numerical data (binary or decimal) in the state RAM, or to send data from the CPU to an output unit in the control system. Note: The x, which follows the initial reference type number, represents a five-figure storage location in the user data memory, i.e. the reference 400201 signifies a 16 bit output or marker word at the address 201 in the State RAM.

P

Peer CPU The Peer CPU processes the token execution and the data flow between the Modbus Plus network and the PLC user logic.

PLC Memory programmable controller

Portrait Portrait means that the sides are larger than the width when printed.

Print-out Expressions consist of operators and operands.

Program The uppermost program organization unit. A program is closed on a single PLC download.

Program organization unit A function, a function block, or a Program. This term can refer to either a type or an instance.

Program redundancy system (Hot Standby) A redundancy system consists of two identically configured PLC machines, which communicate with one another via redundancy processors. In the case of a breakdown of the primary PLC, the secondary PLC takes over the control check. Under normal conditions, the secondary PLC does not take over the control function, but checks the status information, in order to detect errors.

Project

General description for the highest level of a software tree structure, which specifies the super-ordinate project name of a PLC application. After specifying the project name you can save your system configuration and your control program under this name. All data that is created whilst setting up the configuration and program, belongs to this super-ordinate project for this specific automation task.
General description for the complete set of programming and configuration information in the project database, which represents the source code that describes the automation of a system.

Project database

The database in the host computer, which contains the configuration information for a project.

Prototype file (Concept-EFB)

The prototype file contains all the prototypes of the assigned functions. In addition, if one exists, a type definition of the internal status structure is specified.

R

REAL

REAL stands for the data type "floating point number". The entry can be real-literal or real-literal with an exponent. The length of the data element is 32 bits. The value range for variables of this data type extends from +/- 3.402823E+38.

> **Note:** Dependent on the mathematical processor type of the CPU, different ranges within this permissable value range cannot be represented. This applies to values that are approaching ZERO and for values that approach INFINITY. In these cases NAN (**N**ot **A** **N**umber) or INF (**INF**inite will be displayed in the animation mode instead of a number value.

Real literals

Real literals are used to input floating point values into the decimal system. Real literals are denoted by a decimal point. The values can have a preceding sign (+/-). Single underscores (_) between numbers are not significant.

Example
-12.0, 0.0, +0.456, 3.14159_26

Real literals with exponents

Real literals with exponents are used to input floating point values into the decimal system. Real literals with exponents are identifiable by a decimal point. The exponent indicates the power of ten, with which the existing number needs to be multiplied in order to obtain the value to be represented. The base can have a preceding negative sign (-). The exponent can have a preceding positive or negative sign (+/-). Single underscores (_) between numbers are not significant. (Only between numbers, not before or after the decimal point and not before or after "E", "E+" or "E-")

Example
-1.34E-12 or -1.34e-12
1.0E+6 or 1.0e+6
1.234E6 or 1.234e6

Reference

Every direct address is a reference that begins with an indicator, which specifies whether it is an input or an output and whether it is a bit or a word. References that begin with the code 6, represent registers in the extended memory of the state RAM.
0x range = Coils
1x range = Discrete inputs
3x range = Input registers
4x range = Output registers
6x range = Register in the extended memory

Note: The x, which follows each initial reference type number, represents a five-figure storage location in the user data memory, i.e. the reference 400201 signifies a 16 bit output or marker word at the address 201 in the State RAM.

Register in the extended memory (6x-reference)

6x references are holding registers in the extended memory of the PLC. They can only be used with LL984 user programs and only with a CPU 213 04 or CPU 424 02.

Remote Network (DIO)

Remote programming in the Modbus Plus network enables maximum performance when transferring data and dispenses of the need for connections. Programming a remote network is simple. Setting up a network does not require any additional ladder logic to be created. All requirements for data transfer are fulfilled via corresponding entries in the Peer Cop Processor.

RIO (Remote I/O)

Remote I/O indicates a physical location of the I/O point controlling devices with regard to the CPU controlling them. Remote inp./outputs are connected to the controlling device via a twisted communication cable.

RTU-Mode Remote Terminal Unit
The RTU mode is used for communication between the PLC and an IBM compatible personal computer. RTU works with 8 data bits.

Runtime error Errors, which appear during program processing on the PLC, in SFC objects (e.g. Steps) or FFBs. These are, for example, value range overflows with figures or timing errors with steps.

S

SA85 module The SA85 module is a Modbus Plus adapter for IBM-AT or compatible computers.

Scan A scan consists of reading the inputs, processing the program logic and outputting the outputs.

Section A section can for example be used to describe the mode of functioning of a technological unit such as a motor.
A program or DFB consists of one or more sections. Sections can be programmed with the IEC programming languages FBD and SFC. Only one of the named programming languages may be used within a section at any one time.
Each section has its own document window in Concept. For reasons of clarity, it is however useful to divide a very large section into several small ones. The scroll bar is used for scrolling within a section.

Section Code Section Code is the executable code of a section. The size of the Section Code is mainly dependent upon the number of blocks in the section.

Section Data Section data is the local data in a section such as e.g. literals, connections between blocks, non-connected block inputs and outputs, internal status memory of EFBs.

Note: Data which appears in the DFBs of this section is not section data.

Separator Format (4:00001) The first digit (the reference) is separated from the five figure address that follows by a colon (:).

Sequence language (SFC) The SFC Language Elements enable a PLC program organization unit to be divided up into a number of Steps and Transitions, which are connected using directional Links. A number of actions belong to each step, and transition conditions are attached to each transition.

Serial Connections

With serial connections (COM) the information is transferred bit by bit.

Source code file (Concept-EFB)

The source code file is a normal C++ source file. After executing the **Library** → **Create files** menu command, this file contains an EFB-code frame, in which you have to enter a specific code for the EFB selected. To do this invoke the **Objects** → **Source** menu command.

Standard Format (400001)

The five figure address comes directly after the first digit (the reference).

Standardized literals

If you would like to manually determine a literal's data type, this may be done using the following construction: 'Data type name'#'value of the literal'.

Example
INT#15 (Data type: integer, value: 15),
BYTE#00001111 (Data type: byte, value: 00001111)
REAL#23.0 (Data type: real, value: 23.0)

To assign the data type REAL, the value may also be specified in the following manner: 23.0.
Entering a comma will automatically assign the data type REAL.

State RAM

The state RAM is the memory space for all variables, which are accessed via References (Direct representation) in the user program. For example, discrete inputs, coils, input registers, and output registers are situated in the state RAM.

Status Bits

For every device with global inputs or specific inp./outputs of Peer Cop data, there is a status bit. If a defined group of data has been successfully transferred within the timeout that has been set, the corresponding status bit is set to 1. If this is not the case, this bit is set to 0 and all the data belonging to this group is deleted (to 0).

Step

SFC-language element: Situation, in which the behavior of a program occurs, regarding its inputs and outputs of those operations which are defined by the actions belonging to the step.

Step name

The step name is used to uniquely denote a step in a program organization unit. The step name is generated automatically, but it can be edited. The step name must be unique within the entire program organization unit, otherwise an error message will appear.
The automatically generated step name is always formed as follows: S_n_m

S = step
n = section number (current number)
m = Number of the step in the section (current number)

Structured text (ST) ST is a text language according to IEC 1131, in which operations, e.g. invocations of Function blocks and Functions, conditional execution of instructions, repetitions of instructions etc. are represented by instructions.

Structured variables Variables to which a Derived data type defined with STRUCT (structure) is allocated. A structure is a collection of data elements with generally different data types (elementary data types and/or derived data types).

SY/MAX In Quantum control devices, Concept includes the providing of I/O-map SY/MAX-I/O modules for remote contolling by the Quantum PLC. The SY/MAX remote backplane has a remote I/O adapter in slot 1, which communicates via a Modicon S908 R I/O System. The SY/MAX-I/O modules are executed for you for labelling and inclusion in the I/O map of the Concept configuration.

T

Template file (Concept-EFB) The template file is an ASCII file with layout information for the Concept FBD Editor, and the parameters for code creation.

TIME TIME stands for the data type "time". The entry is time literal. The length of the data element is 32 bits. The value range for variables of this data type extends from 0 to 2exp(32)-1. The unit for the TIME data type is 1 ms.

Time literals Permissable units for times (TIME) are days (D), hours (H), minutes (M), seconds (S) and milliseconds (MS) or combinations of these. The time must be marked with the prefix t#, T#, time# or TIME#. The "overflow" of the unit with the highest value is permissible, e.g. the entry T#25H15M is allowed.

Example
t#14MS, T#14.7S, time#18M, TIME#19.9H, t#20.4D, T#25H15M, time#5D14H12M18S3.5MS

Token The network "token" controls the temporary possession of the transfer right via a single device. The token passes round the devices in a rotating (increasing) address sequence. All devices follow the token rotation and can receive all the possible data that is sent with it.

Total IEC memory The total IEC memory consists of the IEC program memory and the global data.

Traffic Cop

The traffic cop is an IO map, which is generated from the user-IO map. The traffic cop is managed in the PLC and in addition to the user IO map, contains e.g. status information on the I/O stations and modules.

Transition

The condition, in which the control of one or more predecessor steps passes to one or more successor steps along a directed link.

U

UDEFB

User-defined elementary functions/function blocks
Functions or function blocks, which were created in the C programming language, and which Concept provides in libraries.

UDINT

UDINT stands for the data type "unsigned double integer". Entries are made as integer literal, base 2 literal, basis 8 literal or base 16 literal. The length of the data element is 32 bits. The value range for variables of this data type extends from 0 to 2exp(32)-1.

UINT

UINT stands for the data type "unsigned integer". Entries are made as integer literal, base 2 literal, basis 8 literal or base 16 literal. The length of the data element is 16 bits. The value range for variables of this data type extends from 0 to (2exp 16)-1.

Unlocated variable

Unlocated variables are not allocated a state RAM address. They therefore do not occupy any state RAM addresses. The value of these variables is saved in the internal system and can be changed using the reference data editor. These variables are only addressed using their symbolic names.

Signals requiring no peripheral access, e.g. intermediate results, system tags etc., should be primarily declared as unlocated variables.

V

Variables

Variables are used to exchange data within a section, between several sections and between the program and the PLC.
Variables consist of at least one variable name and one data type.
If a variable is assigned a direct address (reference), it is called a located variable.
If the variable has no direct address assigned to it, it is called an unlocated variable.
If the variable is assigned with a derived data type, it is called a multi element variable.
There are also constants and literals.

W

Warning

If a critical status is detected during the processing of a FFB or a step (e.g. critical input values or an exceeded time limit), a warning appears, which can be seen using the **Online** → **Event Viewer...** menu command. For FFBs, the ENO remains set to "1".

WORD

WORD stands for the data type "bit sequence 16". Entries are made as base 2 literal, base 8 literal or base 16 literal. The length of the data element is 16 bits. A numerical value range can not be assigned to this data type.

Index