

Flexium I/Os

XI/ON RS485/422

Operator Manual

M00005EN

Edition 12.2008



NUM Standard Material

Module	Commercial reference (NUM)	Consists of (number in this document)	
		Type	Order No.
RS422/485	XION 084 081	8550270322	XN-1RS485/422
		8550225197	XN-S4T-SBBS

Document revisions

Date	Index	Reason for revision
12 - 2008	00	Document creation

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The programming examples described in this manual are intended for guidance only. They must be specially adapted before they can be used in programs with an industrial application, according to the automated system used and the safety levels required.

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**Warning!**

Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that the device cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 501101/-2 (VDE 0105 Part 100) may work on this device.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60364-4-41 or HD 384.4.41 S2 (VDE 0100 Part 410).
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e.g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60364 and HD384 or DIN VDE 0100 and national work safety regulations).

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About This Manual

Writing conventions

Symbols used in this manual have the following meanings:

**Note!**

Warns of a hazardous situation that could result in slight damage to the product or components.

**Caution!**

Warns of the possibility of a hazardous situation that could result in major damage and minor injury.

**Warning!**

Warns of the possibility of a hazardous situation that could result in major damage and serious or fatal injury or even death.



Indicates interesting tips and additional information.

1 Product Description

General product description

The XN-1RS485/422 technology module is an addition to the XI/ON range of components in slice design. It allows the transfer of serial data streams via the RS485/422 interface using the XI/ON system, and therefore enables various devices to be connected, such as printers, scanners or bar code readers that use the RS485/422 interface for communication. The interface transfers the data received from the device to the PLC or transfers data to be sent from the PLC to the device.

The module can be fitted or removed during operation without damaging the module electronics. Once the module is fitted, this is detected with the next telegram, the module list is updated and communication is restored.

Power supply

The XN-1RS485/422 module is fed via the XN-PF-24VDC-D power feeding module and the XN-BR-24VDC-D bus refreshing module. The power supplied by these modules is distributed via the internal rail system. The module bus electronics unit is partly fed by the module bus and partly by the field voltage. → Figure Page 13

Transmission procedure

The XN-1RS485/422 module allows the flexible transfer of serial data. The RS422 connection mode supports two wire simplex or four wire full-duplex transmission. The RS485 connection supports two wire half-duplex transmission.

The parameters of the module can be configured by the user to set up a functional transmission procedure as required.

The following transfer parameters can be configured:

- Bit transmission rate: 300 bit/s to 115200 bit/s.
- Data bits: 7 or 8 user data bits in a data frame.
- Parity: none, even or odd.
- Stop bits: 1 or 2 bits.

The data flow control can be implemented in RS422 operation with a software handshake (XON/XOFF) routine.

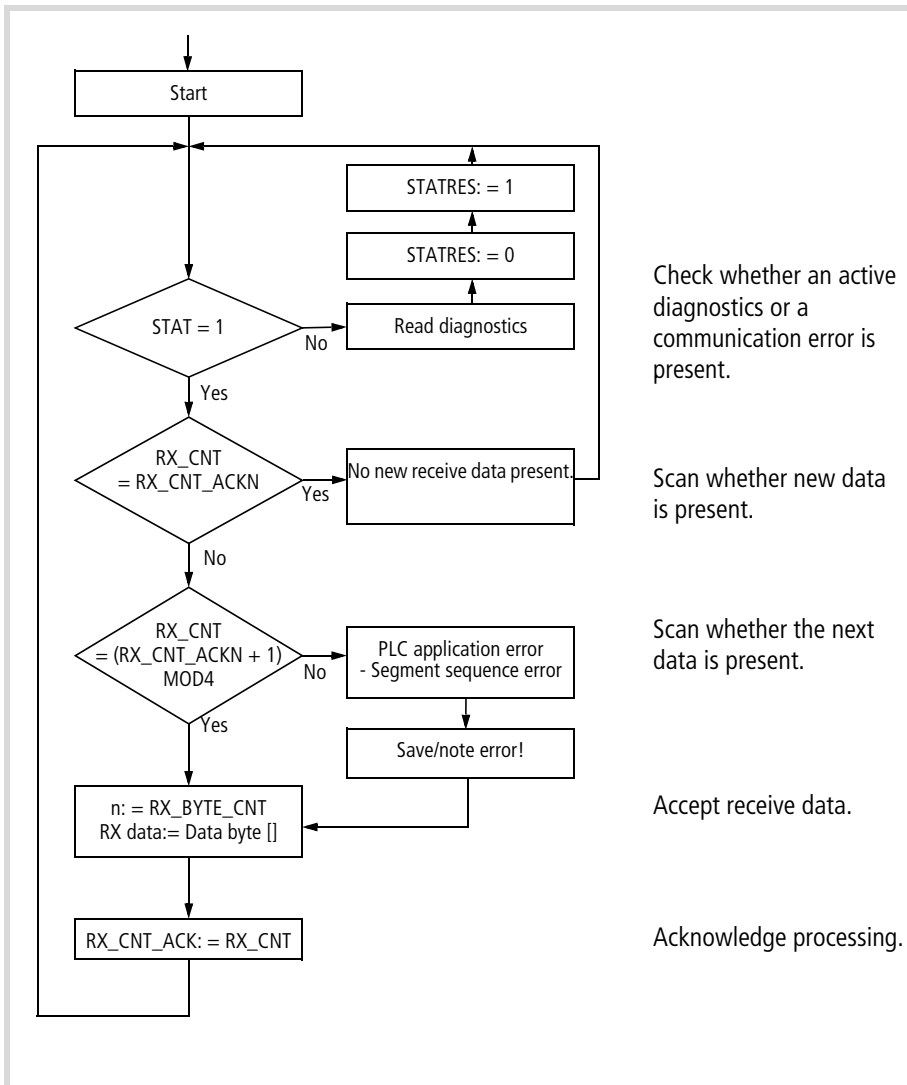
Data exchange

The XN-1RS485/422 module provides a 64 byte transmit buffer and a 128 byte receive buffer for data exchange with the field device.

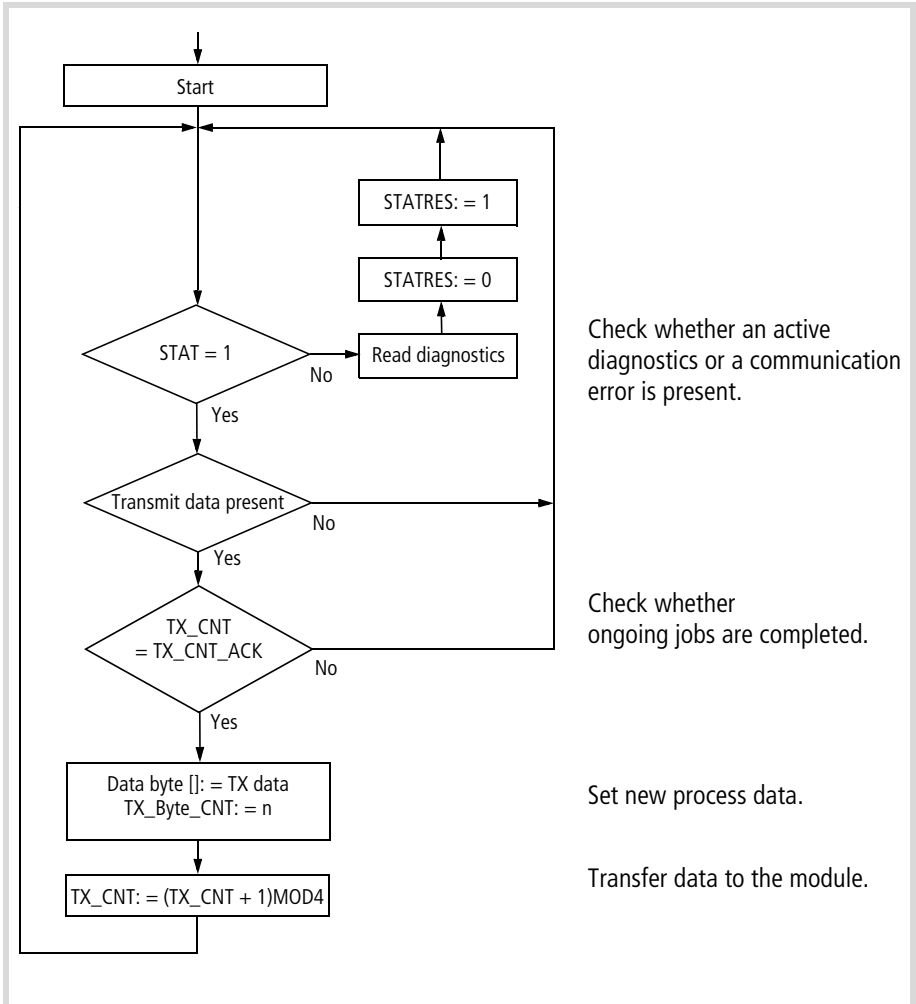
The data transmission from the PLC to the transmit buffer of the XN-1RS485/422 module or from the receive buffer of the XN-1RS485/422 module to the PLC is organised via an 8-byte data channel into process output or input data. One byte of a data packet is used for status information in order to ensure fault-free transmission.

The diagnostics messages can also be embedded in the process input data depending on the fieldbus used. In this case, the process output data contains 1 byte for triggering the clearing of the receive and transmit buffer. This therefore reduces the user data part of a data packet to 6 bytes.

Schematic diagram of the receive sequence



Schematic diagram of the transmit sequence



Technical features

Block diagram of the XN-1RS485/422



Figure 1: XN-1RS485/422 electronic module

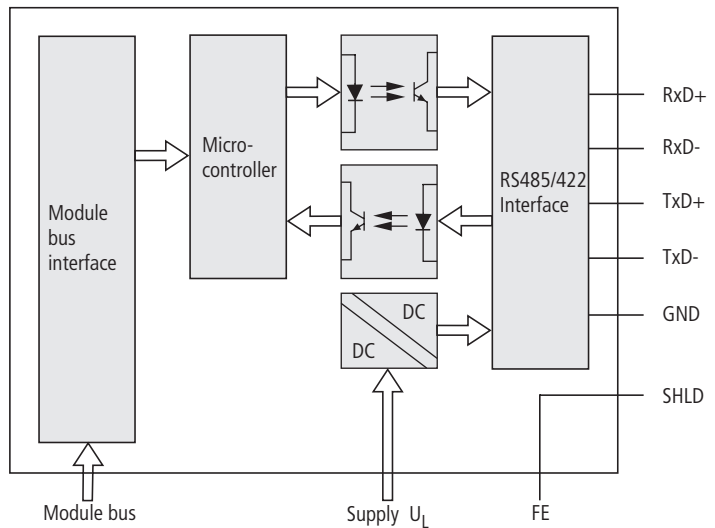


Figure 2: Block diagram of the XN-1RS485/422 module configured for RS422 operation

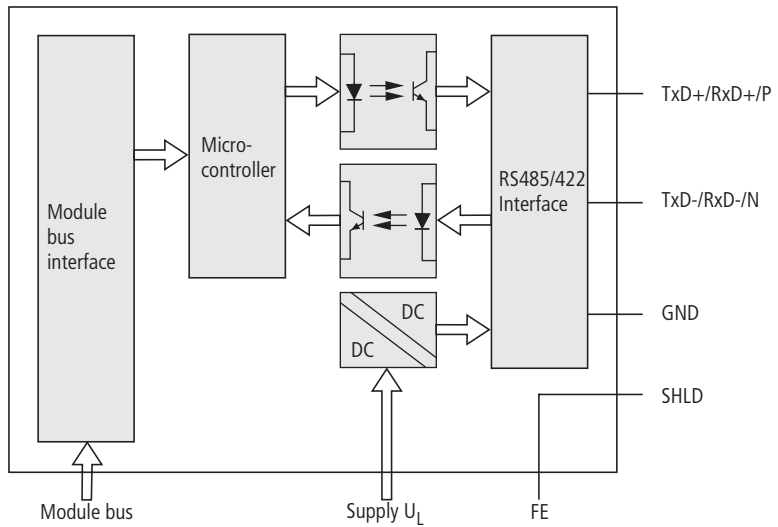


Figure 3: Block diagram of the XN-1RS485/422 module configured for RS485 operation

Technical data of the XN-1RS485/422 module

Table 1: Technical data of the XN-1RS485/422 module

Designation	XN-1RS485/422
Number of RS485/422 interfaces	1
Transmission channels	RxD, TxD
Data buffer	
Receive buffer	128 bytes
Transmit buffer	64 bytes
RS422 connection type	Two wire simplex or four wire full-duplex
RS485 connection type	Two wire half-duplex
Bit transmission rate	Max. 115200 bit/s (configurable)
Cable impedance	120 Ω
Bus terminating resistors	120 Ω (external)
RS485/422 cable length	Max. 30 m
Rated voltage via supply terminals	18 to 30 V DC
Rated current from supply terminals	25 mA
Voltage from module bus	4.75 to 5.25 V DC
Rated current from module bus	60 mA
Heat dissipation of the module	< 1 W
Insulation voltage between the channels and the bus	500 V _{rms}
Insulation voltage between the channels and the field voltage	500 V _{rms}
EMC	
ESD	EN 61131-2
Electromagnetic fields	EN 61131-2
Burst	EN 61131-2

Designation	XN-1RS485/422
Surge	EN 61000-6-2
RFI asymmetrical	EN 61000-6-2
Line-conducted emission/interference voltage	EN 61000-6-4
Radiated high frequency emission	EN 61000-6-4
Degree of protection	IP 20
Ambient conditions	
Operating temperature	0 to +55 °C
Storage temperature	-25 to +85 °C
Relative humidity	15 to 95 % non-condensing

Indication elements

Table 2: Meaning of the LEDs



LED	Display	Meaning	Solution
DIA	Red	Failure of module bus communication.	Check whether more than two adjacent electronics modules have been removed. This applies to modules that are located between the gateway and this module. Check the power supply of the module bus.
	Red flashing (approx. 0.5 Hz)	Diagnostics message present. Only if diagnostics are enabled by the parameters and a diagnostics message is active.	Specific information on diagnostics messages is provided in the chapter on integrating the module in the fieldbus systems.
	OFF	No error message or diagnostics message.	–
TxD	Green	Data is currently being transmitted.	–
	OFF	Data is not currently being transmitted.	–
RxD	Green	Data is currently being received.	–
	OFF	Data is not currently being received.	–

Base modules and terminal assignment

Technical data of the base modules

The following base modules can be used as terminals for connecting the XN-1RS485/422:

Table 3: Technical data of XN-S4T-SBBS and XN-S4S-SBBS

Designation	
With tension clamp terminal	XN-S4T-SBBS
With screw terminal	XN-S4S-SBBS
Rating data in accordance with VDE 0611 Part 1/8.92/IEC 947-7-1/1989	
Rated voltage	250 V
Rated current	17.5 A
Rated cross section	1.5 mm ²
Rated surge voltage	4 kV
Pollution degree	2
TOP connection system	Tension clamp and screw terminal
Degree of protection	
	IP 20
Stripping length	
	8 mm
Max. terminal capacity	
	0.5 to 2.5 mm ²
Suitable cables	
"e" solid H 07V-U	0.5 to 2.5 mm ²
"f" solid H 07V-K	0.5 to 1.5 mm ²
"f" with ferrules to DIN 46228/1 (ferrules crimped on gas tight)	0.5 to 1.5 mm ²
Gauge plug to IEC 947-1/1988	A1

Wiring diagram for RS422

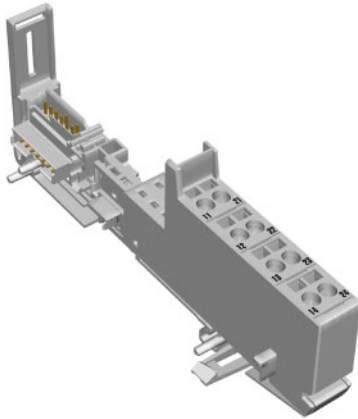


Figure 4: XN-S4x-SBBS base module

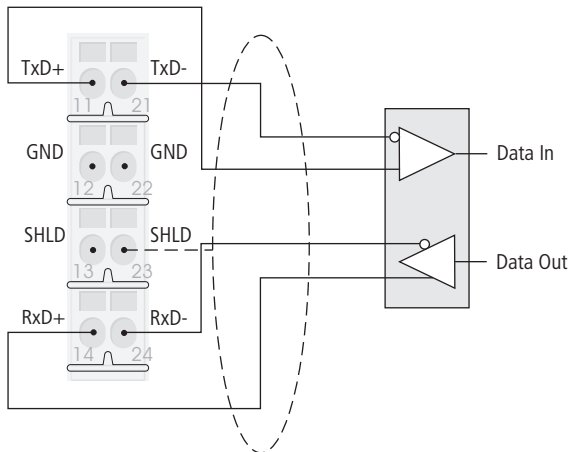


Figure 5: XN-S4x-SBBS wiring diagram in RS422 operation

RS485 wiring diagram

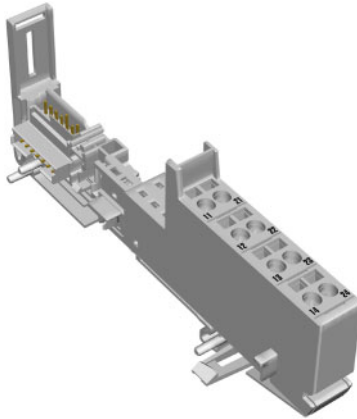


Figure 6: XN-S4x-SBBS base module

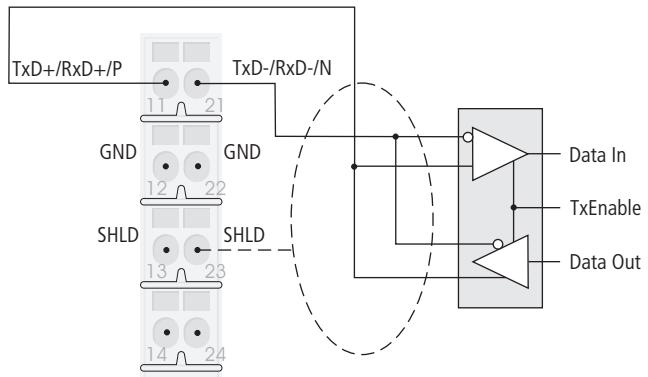


Figure 7: XN-S4x-SBBS wiring diagram in RS485 operation

Table 4: Signal types

Signal designation	
RxD	Receive Data
TxD	Transmit Data
GND	Ground

2 Integrating the Module in PROFIBUS-DP

PROFIBUS-DP data image Process input

Process input data is data from the connected field device that is transmitted via the XN-1RS485/422 module to the PLC. The data received from the device by the XN-1RS485/422 module is entered in a 128 byte receive memory and then transferred in segments to the PLC via the module bus and the gateway.

This is transferred in an 8-byte format as follows:

- 6 bytes are used to contain the user data.
- 1 byte contains the diagnostics data.
- 1 status byte is required to ensure trouble-free transmission of the data.

Table 5: Structure of the data bytes in the PROFIBUS-DP fieldbus

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Data byte 5							
...	...							
Byte 5	Data byte 0							
Byte 6 (Diagnostics)	BufOvfl	FrameErr	HndShErr	HwFailure	PrmErr	X	X	X
Byte 7 (Status)	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		

X = reserved

Table 6: Meaning of the data bits (process input):

Designation	Value	Description
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostics data (identical to the content of the diagnostics telegram).→ chapter " " This diagnostics data is always shown, irrespective of the Diagnostics parameter.→ chapter "Parameters"
STAT	0-1	1: Communication with the data terminal device is not faulty. 0: Communication with the data terminal device is faulty. A diagnostics signal is sent if Diagnostics = enabled/0 (→ chapter "Parameters"). The diagnostics data indicates the cause of the communication fault. → chapter " " This bit must be reset by the user program with STATRES in the process output data field.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using TX_CNT.
RX_CNT	0-3	The value RX_CNT is linked and transferred together with every data segment of the process input data. The sequence of the RX_CNT values is: 00->01->10->11->00... (decimal: 0->1->2->3->0...) A faulty sequence indicates that data segments are missing.
RX_BYTE_CNT	0-7	Number of valid bytes in this data segment. In the Profibus-DP fieldbus, a data segment consists of up to 6 user data bytes.

Process output

The process output data is the data that is output from the PLC to a field device via the gateway and the XN-1RS485/422 module.

The data received from the PLC in the XN-1RS485/422 module is entered in a 64 byte transmit buffer.

The PROFIBUS-DP fieldbus transmission is carried out in the following 8-byte format:

- 6 bytes are used to contain the user data.
- 1 byte contains signals for triggering the clearing of the transmit and receive buffers.
- 1 control byte is required to ensure trouble-free transmission of the data.

Table 7: Structure of the data bytes in the PROFIBUS-DP fieldbus

PDOutp	B7	B6	B5	B4	B3	B2	B1	B0
Byte0	Data byte 5							
...	...							
Byte 5	Data byte 0							
Byte 6	reserved						RXBUF FLUSH	TXBUF FLUSH
Byte 7 (Control)	STATRES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		

Table 8: Meaning of the data bits (process output):

Designation	Value	Description
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If $\text{STATRES} = 0, 1$ or $0 \rightarrow 1$: A request with $\text{RXBUF FLUSH} = 1$ will be ignored. When $\text{RXBUF FLUSH} = 1$, the receive buffer is cleared when there is a falling edge from $1 \rightarrow 0$ at STATRES .
TXBUF FLUSH	0 - 1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If $\text{STATRES} = 0, 1$ or $0 \rightarrow 1$: A request with $\text{TXBUF FLUSH} = 1$ will be ignored. When $\text{TXBUF FLUSH} = 1$, the transmit buffer is cleared when there is a falling edge from $1 \rightarrow 0$ at STATRES .
STATRES	0 - 1	The STATRES bit is used for resetting the STAT bit of the process input data. The STAT bit is reset (from 0 to 1) with the transition from 1 to 0 (falling edge). The clearing of the receive and transmit buffer by $\text{RXBUF FLUSH}/\text{TXBUF FLUSH}$ is enabled. If this bit is 0, all changes in the data fields TX_BYTE_CNT , TX_CNT and RX_CNT_ACK are ignored. The constant values 1,0 or the transition from 0 to 1 disables the clearing of the receive and transmit buffers by the $\text{RXBUF FLUSH}/\text{TXBUF FLUSH}$.
RX_CNT_ACK	0 - 3	The value RX_CNT_ACK is a copy of the value RX_CNT . The value RX_CNT was transferred together with the last data segment of the process input data. The value RX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using RX_CNT .
TX_CNT	0 - 3	The value TX_CNT is linked and transferred together with every data segment of the process output data. The sequence of the TX_CNT values is: $00 \rightarrow 01 \rightarrow 10 \rightarrow 11 \rightarrow 00 \dots$ (decimal: $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 0 \dots$) A faulty sequence indicates that data segments are missing.
TX_BYTE_CNT	0 - 7	Number of valid user data bytes in this data segment. In the Profibus-DP fieldbus, a data segment consists of up to 6 user data bytes.

Diagnostics

The parameter setting for the PROFIBUS-DP gateway provides the Gateway Diagnostics parameter for selecting between two different diagnostics displays. Choose "Devices, ID, Channel Diagnostics" to select more detailed diagnostics indication. The diagnostics message will then consist of the following elements:

- 2 bytes of gateway diagnostics (device-related diagnostics)
- 64 bits of ID-specific diagnostics
- $n \times 3$ bytes of channel-specific diagnostics (n : number of channels with active diagnostics)

With channel-specific diagnostics, the use of an error number enables the type of error to be indicated in plain text (e.g. Parameter error).

When "Device-related Diagnostics" is selected, an abbreviated diagnostics message is generated that simply shows the gateway diagnostics (device-related diagnostics). The diagnostics bytes of all station modules are attached that support diagnostics.

Table 9: Meaning of the data bits (diagnostics)

Name of error type	Position	Value	Description
buffer overflow	Bit 7	0	o.k.
		1	The receive buffer (RX buffer) has overflowed.
frame error	Bit 6	0	o.k.
		1	The XN-1RS485/422 module must be configured in order for it to be adapted to the data structure of the DTE. A frame error is output if the parameter setting (number of data bits, stop bits, type of parity) is incorrect.

Name of error type	Position	Value	Description
data flow control error	Bit 5	0	o.k.
		1	The data terminal device connected to the XN-1RS485/422 module is not responding to XOFF (only possible in RS422 mode). The internal receive buffer can overflow (buffer overflow = 1).
hardware failure	Bit 4	0	o.k.
		1	The module must be exchanged as the EEPROM or UART may, for example, be faulty.
parameterization error	Bit 3	0	o.k.
		1	The set parameter values are not supported. Possible values are listed in the chapter "Parameter data". → chapter "Parameters"

Parameters

The parameter setting of the XN-1RS485/422 module enables communication with different data terminal devices. A software handshake procedure can be selected in RS422 mode. The number of data bits embedded in the telegram, the type of parity, the number of stop bits, the bit transmission rate and the XON/XOFF character used must be configured in the module with the appropriate parameters in order to adapt it to the data format of the data terminal device.

4 bytes are used for the module parameters.

Table 10: Meaning of the data bits (parameters):

Parameter designation	Value	Name of the values	Description
diagnostic	0	release	Diagnostics activated/Diagnostics deactivated: This controls the separate fieldbus-specific diagnostics signal - not the diagnostics signal embedded in the process input data.
	1*	block	
DisableReducedCtrl:	1		Constant setting: The diagnostics signals are contained in byte 6 of the process input data (irrespective of "Diagnostics"). Byte 6 of the process output data contains two bytes for triggering the clearing of the receive and transmit buffer. Byte 7 contains the status byte. Bytes 0 - 5 contain user bytes.
data rate	0	reserved	
	1	300 bps	
	2	600 bps	
	3	1200 bps	
	4	2400 bps	
	5	4800 bps	
	6*	9600 bps	

Parameter designation	Value	Name of the values	Description
	7	14400 bps	
	8	19200 bps	
	9	28800 bps	
	10	38400 bps	
	11	57600 bps	
	12	115200 bps	
	13	reserved	
	14	reserved	
	15	reserved	
software data flow control	0*	None	The data flow control is deactivated.
	1	XON/XOFF	Software handshake (XON/XOFF) activated. (this function is only available for RS422 operation.)
data bits	0*	7	The number of data bits is 7.
	1	8	The number of data bits is 8.
parity	0	None	
	1*	Odd	The parity bit is set so that the number of bits set to 1 (data and parity bit together) is odd.
	2	Even	The parity bit is set so that the number of bits set to 1 (data and parity bit together) is even.
stop bits	0	1	Number of stop bits.
	1*	2	
XON character (RS422)	0 – 255 (17*)		XON character for RS422 operation. This character is used to start the data transfer of the data terminal device with the software handshake activated.

Parameter designation	Value	Name of the values	Description
XOFF character (RS422)	0 – 255 (19*)		XOFF character for RS422 operation. This character is used to stop the data transfer of the data terminal device with the software handshake activated.

* Factory setting

**Function blocks for
SIMATIC S7**

The FBSEDRSXXX, FBRECVRSXXX and FBSRRSXXX function blocks are designed for the SIMATIC S7 (Siemens) PLC system and PROFIBUS-DP. The function blocks control the data exchange between the PLC and the XN-1RS485/422 module. The transfer format is 8 bytes in length, consisting of 2 bytes of control data and 6 bytes of user data.

The data range of the data bytes to be transmitted or received within the Siemens S7 PLC is optional.

Data sets of up to 65526 data bytes can be transferred, depending on the capability of the PLC.

The system function blocks SFC14 and SFC15 from Siemens are used in order to ensure consistent data exchange. The return values are transferred transparently, and the meaning of the error numbers can be obtained from the manual "System software for S7-300/400".

Transmit data FBSENDERXXXX

The FBSENDERXXXX software function block is a data handling function block exclusively for transmitting data to the XN-1RS485/422 module.

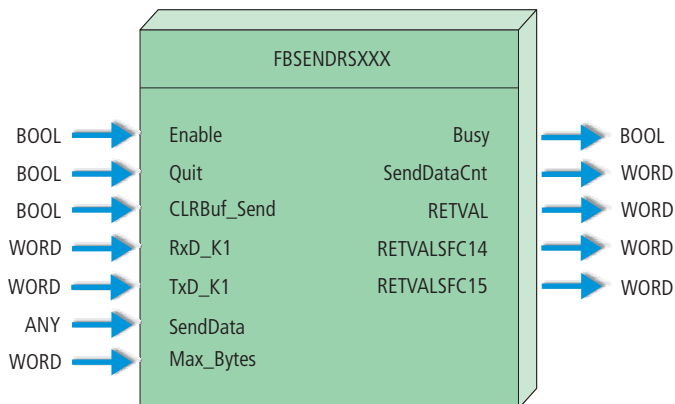


Figure 8: Transmit function block for the SIMATIC S7 software

Table 11: Input variables of FBSENDERXXXX

Variable	Meaning
Enable	1: Transmit data enabled. 0: Transmit data disabled.
Quit	1: Error messages are reset (acknowledgement of errors). Communication is stopped. 0: These are retained if error messages are present.
CLRBuf_Send	1: The clearing of the transmit buffer is preset. The buffer is always successfully cleared if: Enable = 0 and Quit = 1 0: No influence on the module function.

Variable	Meaning
RxD_K1	Start address for the 8-byte input address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
TxD_K1	Start address for the 8-byte output address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
SendData	Start address for storing transmit data. This is permissible for inputs, outputs, markers and data function blocks.
Max_Bytes	Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.

Table 12: Output variables of FBSENDXXXX

Variable	Meaning
Busy	1: Data is currently being transmitted. 0: No data is currently being transmitted.
SendDataCnt	Number of transmitted data bytes. A maximum of 65536 bytes is possible.
RETVAL	Return values of the function (status or error code) 0 Everything OK. No error 8010h Communication error: Hardware error 8020h Communication error: Data flow control error 8040h Communication error: Frame error 8080h Communication error: Module buffer overflow 8300h Variable error: Incorrect "SendData" parameter 8301h Variable error: Incorrect "SendData" parameter data type 8302h Variable error: Incorrect "SendData" parameter length
RETVALSFC14	See manual "System software for S7-300/400, SFC14"
RETVALSFC15	See manual "System software for S7-300/400, SFC14"

FBRECVRSXXX receive data

The FBRECVRSXXX function block is a data handling function block exclusively for receiving data from the XN-1RS485/422 module.

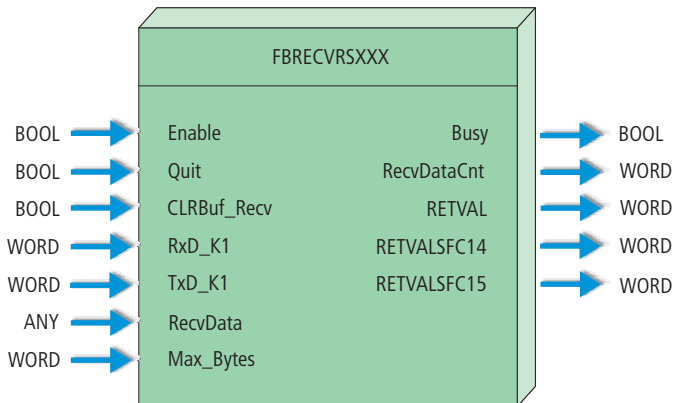


Figure 9: Receive function block for the SIMATIC S7 software

Table 13: Input variables of the FBRECVRSXXX

Variable	Meaning
Enable	1: Receiving of data enabled. 0: Receiving of data disabled.
Quit	1: Error messages are reset (acknowledgement of errors). Communication is stopped. 0: These are retained if error messages are present.
CLRBuf_Recv	1: The clearing of the receive buffer is preset. The buffer is always successfully cleared if: Enable = 0 Quit = 1 0: No influence on the module function.
RxD_K1	Start address for the 8-byte input address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
TxD_K1	Start address for the 8-byte output address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
RecvData	Start address for storing receive data. This is permissible for inputs, outputs, markers and data function blocks.
Max_Bytes	Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.

Table 14: Output variables of FBRECVRSXXX

Variable	Meaning
Busy	1: Data is currently being received. 0: No data is currently being received.
RecvDataCnt	Number of received data bytes. A maximum of 65536 bytes is possible.
RETVAL	Return values of the function (status or error code) 0 Everything OK. No error 8010 _{hex} Communication error: Hardware error 8020 _{hex} Communication error: Data flow control error 8040 _{hex} Communication error: Frame error 8080 _{hex} Communication error: Module buffer overflow 8300 _{hex} Variable error: Incorrect "RecvData" parameter 8301 _{hex} Variable error: Incorrect "RecvData" parameter data type 8302 _{hex} Variable error: Incorrect "RecvData" parameter length
RETVALSFC14	See manual "System software for S7-300/400, SFC14"
RETVALSFC15	See manual "System software for S7-300/400, SFC14"

FBSRRSXXX send and receive data

The FBSRRSXXX function block is a data handling function block for simultaneously transmitting data to and receiving data from the XN-1RS485/422 module.

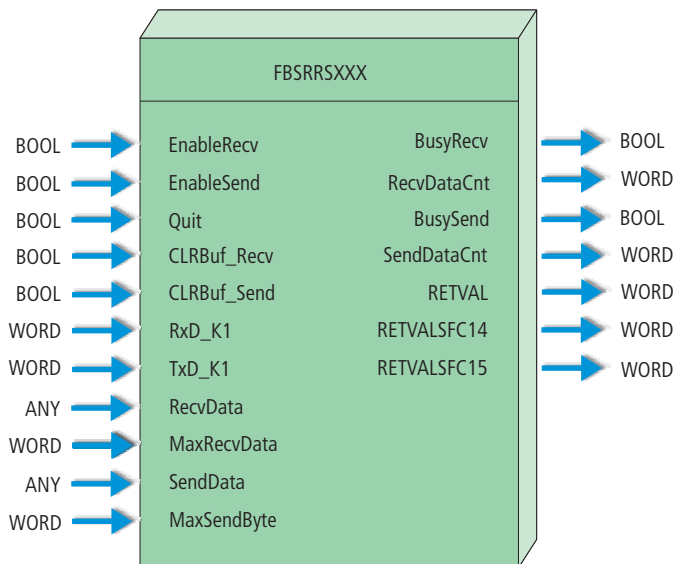


Figure 10: Send/receive function block for the SIMATIC S7 software

Table 15: Input variables of FBSRRSXXX

Variable	Meaning
EnableRecv	1: Receiving of data enabled. 0: Receiving of data disabled.
EnableSend	1: Transmit data enabled. 0: Transmit data disabled.
Quit	1: Error messages are reset (acknowledgement of errors). Communication is stopped. 0: These are retained if error messages are present.

Variable	Meaning
CLRBuf_Recv	1: The clearing of the receive buffer is preset. The buffer is always successfully cleared if: EnableRecv = 0 Quit = 1 0: No influence on the module function.
CLRBuf_Send	1: The clearing of the transmit buffer is preset. The buffer is always successfully cleared if: EnableSend = 0 Quit = 1 0: No influence on the module function.
RxD_K1	Start address for the 8-byte input address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
TxD_K1	Start address for the 8-byte output address range of the XN-1RS485/422 module. The SIMATIC STEP 7 software assigns the address ranges to the appropriate modules. The address ranges are selected and displayed in the hardware configurator of the software. WORD format is used for the addresses and therefore consists of 2 bytes. Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.
RecvData	Start address for storing receive data. This is permissible for inputs, outputs, markers and data function blocks.
MaxRecvBytes	Maximum number of bytes to be received. A maximum of 65536 bytes is possible.
SendData	Start address for storing transmit data. This is permissible for inputs, outputs, markers and data function blocks.
MaxSendBytes	Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.

Table 16: Output variables of FBSRRSXXX

Variable	Meaning
BusyRecv	1: Data is currently being received. 0: No data is currently being received.
RecvDataCnt	Number of received data bytes. A maximum of 65536 bytes is possible.
BusySend	1: Data is currently being transmitted. 0: No data is currently being transmitted.
SendDataCnt	Number of transmitted data bytes. A maximum of 65536 bytes is possible.
RETVAL	Return values of the function (status or error code) 0000 _{hex} Everything OK. No error 8010 _{hex} Communication error: Hardware error 8020 _{hex} Communication error: Data flow control error 8040 _{hex} Communication error: Frame error 8080 _{hex} Communication error: Module buffer overflow 8100 _{hex} Variable error: Incorrect "RecvData" parameter 8101 _{hex} Variable error: Incorrect "RecvData" parameter data type 8102 _{hex} Variable error: Incorrect "RecvData" parameter length 8200 _{hex} Variable error: Incorrect "SendData" parameter 8201 _{hex} Variable error: Incorrect "SendData" parameter data type 8202 _{hex} Variable error: Incorrect "SendData" parameter length
RETVALSFC14	See manual "System software for S7-300/400, SFC14"
RETVALSFC15	See manual "System software for S7-300/400, SFC14"

3 Integrating the Module in DeviceNet

Process image

The structure of the process image is represented with symbolic names. These correspond to the attribute names which also correspond to the relevant functions.

The bits and bit groups assigned to the names indicate numerical values.

The meaning of the numerical values is explained in the description of the attributes.

Process input

Table 17: Structure of the data bytes in the DeviceNet
ACTIVE MODE = "1byte ctrl/status header"

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Status)	STATUS	TX COUNT ACKNOWLEDGE		RX COUNT		RX BYTE COUNT		
Byte 1	Data byte 0							
...	...							
Byte 7	Data byte 6							

Table 18: Structure of the data bytes in the DeviceNet
ACTIVE MODE = "2byte ctrl/status header"

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte0 (Status)	STATUS	TX COUNT ACKNOWLEDGE		RX COUNT		RX BYTE COUNT		
Byte 1 (Diagnostics)	PROCESS DIAGNOSTICS DATA							
Byte 2	Data byte 0							
...	...							
Byte 7	Data byte 5							

Process output

The individual bits and bit groups represent numerical values.

The meaning of the numerical values is explained in the description of the attributes.

Table 19: Structure of the data bytes in the DeviceNet with ACTIVE MODE = "1byte ctrl/status header"

PDOOutp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Control)	STATUS RESET CONTROL	RX COUNT ACKNOWLEDGE		TX COUNT		TX BYTE COUNT		
Byte1	Data byte 0							
...	...							
Byte 7	Data byte 6							

Table 20: Structure of the data bytes in the DeviceNet with ACTIVE MODE = "2byte ctrl/status header"

PDOOutp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Control)	STATUS RESET CONTROL	RX COUNT ACKNOWLEDGE		TX COUNT		TX BYTE COUNT		
Byte 1	reserved						RXBUF FLUSH ¹⁾	TXBUF FLUSH ²⁾
Byte2	Data byte 0							
...	...							
Byte 7	Data byte 5							

1) RXBUF FLUSH:

The RXBUF FLUSH bit is used for clearing the receive buffer.

If STATUS RESET CONTROL = 1:

A request with RXBUF FLUSH = 1 will be ignored.

If STATUS RESET CONTROL = 0:

With RXBUF FLUSH = 1 The receive buffer is cleared.

2) TXBUF FLUSH:

The TXBUF FLUSH bit is used for clearing the transmit buffer.

If STATUS RESET CONTROL = 1:

A request with TXBUF FLUSH = 1 will be ignored.

If STATUS RESET CONTROL = 0:

With TXBUF FLUSH = 1 The receive buffer is cleared.

RS485/422 Module Class (VSC115) This class contains all the parameters and information relating to the XN-1RS485/422 module.

Table 21: Class Instance

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
100 (64 _{hex})	CLASS REVISION	G	UINT	Contains the revision number of this class (Maj. Rel. x 1000 + Min. Rel.).
101 (65 _{hex})	MAX INSTANCE	G	USINT	Contains the number of the highest instance of an object created on this level in the class hierarchy.
102 (66 _{hex})	# OF INSTANCES	G	USINT	Contains the number of object instances created on this class level.
103 (67 _{hex})	MAX CLASS ATTR	G	USINT	Contains the number of the last class attribute implemented.

Table 22: Object Instances

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
100 (64 _{hex})	MAX OBJECT ATTRIBUTE	G	USINT	Contains the number of the last object attribute implemented.
101 (65 _{hex})	MODULE PRESENT	G	BOOL	0: XI/ON module is not plugged in, empty base module. 1: XI/ON module is plugged in
102 (66 _{hex})	TERMINAL SLOT NUMBER	G	USINT	The slot number of the base module (base module to the right of the gateway = No. 1) belonging to the module. Corresponds to the instance number within the TERMINAL SLOT CLASS.
103 (67 _{hex})	MODULE ID	G	DWORD	Contains the module ID.
104 (68 _{hex})	MODULE ORDER NUMBER	G	UDINT	Contains the order number of the module.
105 (69 _{hex})	MODULE ORDER NAME	G	SHORT_STRING	Contains the module name, e.g. XN-1RS485/422.
106 (6A _{hex})	MODULE REVISION NUMBER	G	USINT	Contains the revision number of the module firmware.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
107 (6B _{hex})	MODULE TYPE ID	G	ENUM USINT	Gives information about the module type: 0 (00 _{hex}) unknown module type 1 (01 _{hex}) digital I/O module 17 (11 _{hex}) analog module I/O voltage 18 (12 _{hex}) analog module I/O current 19 (13 _{hex}) analog module PT temperature 20 (14 _{hex}) analog module Thermo temperature 33 (21 _{hex}) 16-bit counter module 34 (22 _{hex}) 32-bit counter module 40 (28 _{hex}) SSI module 49 (31 _{hex}) motor starter module as DOL or reversing starter 50 (32 _{hex}) electronic motor starter 65 (41 _{hex}) RS232 module 66 (42 _{hex}) RS485/422 module 67 (43 _{hex}) TTY module
108 (6C _{hex})	MODULE COMMAND INTERFACE	G/S	ARRAY OF BYTE	Command interface of the XI/ON module. ARRAY OF: BYTE: Command byte sequence
109 (6D _{hex})	MODULE RESPONSE INTERFACE	G	ARRAY OF BYTE	Signal interface of the XI/ON module. ARRAY OF: BYTE: Signal byte sequence
110 (6E _{hex})	MODULE REGISTERED INDEX	G	ENUM USINT	Contains the index number registered in all module lists.
111 (6F _{hex})	NUMBER OF SUPPORTED CHANNELS	G	USINT	Indicates the number of channels supported by this module instance.
112 (70 _{hex})	RX BYTE COUNT	G	USINT	Number (0 to 7) of valid bytes in this data segment of the process input.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
113 (71 _{hex})	RX COUNT	G	USINT	The value RX COUNT is linked and transferred together with every data segment of the process input data. The sequence of the RX COUNT values is: 00->01->10->11->00... (decimal: 0->1->2->3->0...) A faulty sequence indicates that data segments are missing.
114 (72 _{hex})	TX COUNT ACKNOWLEDGE	G	USINT	The value TX COUNT ACKNOWLEDGE is a copy of the value TX COUNT. The value TX COUNT was transferred together with the last data segment of the process output data. The value TX COUNT ACKNOWLEDGE is an acknowledgement of successful acceptance of the data segment using TX COUNT.
115 (73 _{hex})	STATUS	G	BOOL	0 = "diag/error" Communication with the data terminal device is faulty. A diagnostics signal is sent if DISABLE DIAGNOSTICS = 0. The diagnostics data indicates the cause of the communication fault. This bit is reset by the user together with STATUS RESET CONTROL. 1 = "OK" Communication with the data terminal device is not faulty.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
116 (74 _{hex})	PROCESS DIAGNOS- TICS DATA	G	BYTE	Diagnostics information: The diagnostics data is part of the process input data if ACTIVE MODE = 1 and "2bytes ctrl/status header" have been set. Diagnostics messages: Bit 0 to 2: "<reserved>" Bit 3: 0 = "OK" 1 = "parameter error": The set parameter values are not supported. Bit 4: 0 = "OK" 1 = "hardware failure": The module must be exchanged as the EEPROM or UART, for example, may be faulty. Bit 5: 0 = "OK" 1 = "handshake error": The data terminal device connected to the XN-1RS485/422 module is not responding to XOFF. The internal receive buffer can overflow. Bit 6: 0 = "OK" 1 = "frame error": The XN-1RS485/422 module parameters must be defined in order for it to be adapted to the data structure of the DTE. A frame error is output if the parameter setting (number of data bits, stop bits, type of parity) is not suitable. Bit 7: 0 = "OK" 1 = "buffer overflow": The receive buffer (RX buffer) has overflowed. Bit 8 to 15: "<reserved>"
117 (75 _{hex})	RX DATA	G	ARRAY OF BYTE	Receive data Number: 0 to 7 bytes.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
118 (76 _{hex})	RX DATA AND RELEASE	G	ARRAY OF BYTE	Receive data and an acknowledgement of successful receipt. The receive buffer is immediately enabled again. Number: 0 to 7 bytes.
119 (77 _{hex})	TX BYTE COUNT	G/S	USINT	Number (0 to 7) of valid user bytes in this data segment.
120 (78 _{hex})	TX COUNT	G/S	USINT	The value TX COUNT is linked and transferred together with every data segment of the process output data. The sequence of the TX COUNT values is: 00->01->10->11->00... (decimal: 0->1->2->3->0...) A faulty sequence indicates that data segments are missing.
121 (79 _{hex})	RX COUNT ACKNOWLEDGE	G/S	USINT	The value RX COUNT ACKNOWLEDGE is a copy of the value RX COUNT. The value RX COUNT was transferred together with the last data segment of the process input data. The value RX COUNT ACKNOWLEDGE is an acknowledgement of successful acceptance of the data segment using RX COUNT.
122 (7A _{hex})	STATUS RESET CONTROL	G/S	BOOL	This bit is used for resetting the STATUS bit of the process input data. The STATUS bit is reset (from 0 to 1) with the transition from 1 to 0 (falling edge). If this bit is 0, all changes in the data fields TX BYTE CNT, TX CNT and RX CNT ACKNOWLEDGE are ignored. The clearing of the receive and transmit buffer by PROCESS CONTROL DATA is enabled. The value 1 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the PROCESS CONTROL DATA.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
123 (7B _{hex})	PROCESS CONTROL DATA	G/S	BYTE	Bit 0: 0 = ok 1 = flush TX buffer" Clear transmit buffer Bit 1: 0 = ok 1 = "flush RX buffer" Clear receive buffer Bit 2 to 7: "<reserved>"
124 (7C _{hex})	TX DATA	G/S	ARRAY OF BYTE	Transmit data Number: 0 to 7 bytes.
125 (7D _{hex})	TX DATA AND RELEASE	S	ARRAY OF BYTE	Transmit data. The transfer is initiated immediately. The transmit buffer is immediately released again. Number: 0 to 7 bytes.
126 (7E _{hex})	reserved			

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
127 (7F _{hex})	DIAGNOS-TICS	G	WORD	Diagnostics messages (Low Byte): Bit 0 to 2: "<reserved>" Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported. Bit 4: 0 = ok 1 = "hardware failure": The module must be exchanged as the EEPROM or UART may, for example, be faulty. Bit 5: 0 = ok 1 = "handshake error": The data terminal device connected to the XN-1RS485/422 module is not responding to XOFF. The internal receive buffer can overflow. Bit 6: 0 = ok 1 = "frame error": The XN-1RS485/422 module parameters must be defined in order for it to be adapted to the data structure of the DTE. A frame error is output if the parameter setting (number of data bits, stop bits, type of parity) is not suitable. Bit 7: 0 = ok 1 = "buffer overflow": The receive buffer (RX buffer) has overflowed. High Byte : "<reserved>"
128 (80 _{hex})	ACTIVE MODE	G/S	BOOL	0 = "1byte ctrl/status header": The diagnostics data is not part of the process input data. The user data section is 7 bytes. 1 = "2bytes ctrl/status header": The diagnostics data is part of the process input data. The user data section is 6 bytes.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
129 (81 _{hex})	BIT RATE	G/S	ENUM USINT	Bit transmission rate 0 = "<reserved>" 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 14400 bps 8 = 19200 bps 9 = 28800 bps 10 = 38400 bps 11 = 57600 bps 12 = 115200 bps 13 to 15 = "<reserved>"
130 (82 _{hex})	DISABLE DIAGNOS- TICS	G/S	BOOL	0 = "released": Diagnostics activated. 1 = "blocked": Diagnostics deactivated: This controls the separate fieldbus-specific diagnostics signal - not the diagnostics signal embedded in the process input data.
131 (83 _{hex})	FLOW CONTROL	G/S	ENUM USINT	0 = "off": The data flow control is deactivated. 1 = "XON/OFF": Software handshake acti- vated. (only with 422 operation) 2 to 3 = "<reserved>"
132 (84 _{hex})	DATA WIDTH	G/S	ENUM USINT	0 = "7bits": The number of data bits is 7. 1 = "8bits": The number of data bits is 8.
133 (85 _{hex})	PARITY	G/S	ENUM USINT	0 = "none": No parity 1 = "odd": The parity bit is set so that the number of bits set to 1 (data and parity bit together) is odd. 2 = "even": The parity bit is set so that the number of bits set to 1 (data and parity bit together) is even.

Attr. no. dec. (hex.)	Attribute name	Access	Type	Description
134 (86 _{hex})	STOP	G/S	ENUM USINT	Number of stop bits: 0: 1 bit 1: 2 bits
135 (87 _{hex})	XON CHARACTER	G/S	USINT	XON character This character is used to start the data transfer of the data terminal device with the software handshake activated.
136 (88 _{hex})	XOFF CHARACTER	G/S	USINT	XOFF character This character is used to stop the data transfer of the data terminal device with the software handshake activated.
137 (89 _{hex})	RSXX Mode	G/S	ENUM USINT	0 = "RS422": 422 operation 1 = "RS485": 485 operation

4 Integrating the Module in CANopen

Introduction

The support of XN-1RS485/422 modules has been implemented from firmware version V3.00 of XN-GW-CANOPEN.

General description

XN-1RS485/422 modules are detected as such by the gateway and treated in CANopen as a separate module group together with the XN1RS232 modules. As there is not a corresponding device profile for this module group, all objects created for addressing these modules are stored in the manufacturer-specific range of the object dictionary.

Table 23: New manufacturer-specific CANopen objects for the XN-1RS485/422

Index	Object	Name	Meaning	Type
5600 _{hex}	Array	RS232/RS4xx parameters	4 bytes, RS232/RS4xx parameters	Unsigned32
5601 _{hex}	Array	RS232/RS4xx RxD	8 bytes, RS232/RS4xx receive data (process input data).	Unsigned64
5602 _{hex}	Array	RS232/RS4xx TxD	8 bytes, RS232/RS4xx transmit data (process output data).	Unsigned64

Object description

Object 5600_{hex} – RS232/RS4xx parameters

The parameter setting of the XN-1RS485/422 module enables communication with different data terminal devices. The handshake procedure (software) can be selected. The number of data bits embedded in the telegram, the type of parity, the number of stop bits, the bit transmission rate and the XON/XOFF character used must be configured in the module with the appropriate parameters in order to adapt it to the data format of the data terminal device.

4 bytes are used for the module parameters.

Table 24: Object 5600_{hex} Description

INDEX	5600 _{hex}
Name	RS232/RS4xx parameters
Object Code	ARRAY
Data type	Unsigned32
Access	rw
Default value	No
PDO Mapping	No

Table 25: Structure of the data bytes

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Disable Diagnostics	Disable Reduced Control	X	Select RS485	BitRate			
Byte 1	X	X	Flow Control		Data	Parity		Stop
Byte 2	XONChar							
Byte 3	XOFFChar							

Table 26: Meaning of the data bits

Parameter designation	Value	Description
DisableDiagnostics	0	Diagnostics activated = 0
	1*	Diagnostics deactivated = 1 This controls the separate fieldbus-specific diagnostics signal - not the diagnostics signal embedded in the process input data (object 5601 _{hex}).
DisableReduced-Control	0	The diagnostics messages are not part of the process input data (object 5601 _{hex}). Bytes 1 to 7 can therefore be used for the user data.
	1	The diagnostics messages are contained in byte 1 of the object 5601 _{hex} (irrespective of "DisableDiagnostics"). Byte 0 contains the status and control byte. Bytes 2 to 7 are available for the user data. The structure of the object 5602 _{hex} is also changed by this setting. At the location of the first data byte, byte 1 of the object 5602 _{hex} contains a byte with two control bits. These can initiate a clearing of the receive and transmit buffer.
Select RS485	0*	RS422 operation
	1	RS485 operation
BitRate (Bit transmission rate)	0	reserved
	1	300 bps
	2	600 bps
	3	1200 bps
	4	2400 bps
	5	4800 bps
	6*	9600 bps
	7	14400 bps
	8	19200 bps
	9	28800 bps
	10	38400 bps
	11	57600 bps
	12	115200 bps

Parameter designation	Value	Description
	13	reserved
	14	reserved
	15	reserved
FlowControl	0*	The data flow control is deactivated.
	1	Software handshake (XON/XOFF) activated.
	2 to 3	reserved
Data	0*	The number of data bits is 7.
	1	The number of data bits is 8.
Parity	0	No parity.
	1*	The parity bit is set so that the number of bits set to 1 (data and parity bit together) is odd.
	2	The parity bit is set so that the number of bits set to 1 (data and parity bit together) is even.
Stop	0	The number of Stop bits is 1.
	1*	The number of Stop bits is 2.
XONChar	0 – 255 (17*)	XON character for RS422 operation. This character is used to start the data transfer of the data terminal device with the software handshake activated.
XOFFChar	0 – 255 (19*)	XOFF character for RS422 operation. This character is used to stop the data transfer of the data terminal device with the software handshake activated.

* Factory setting

Object 5601_{hex} – RS232/RS4xx RxD

Process input data is data that is transmitted from the connected field device via the XN-1RS485/422 module to the communication partner (e.g. PLC). The data received from the device by the XN-1RS485/422 module is entered in a 128 byte receive buffer and then transferred in segments to the communication partner via the module bus and the gateway.

This is transferred in an 8-byte format as follows:

- 6 bytes or 7 bytes are used to contain the user data.
- 1 byte contains the diagnostics data depending on the parameter setting.
- 1 status byte is required to ensure trouble-free transmission of the data.

Table 27: Object 5601_{hex} Description

INDEX	5601 _{hex}
Name	RS232/RS4xx RxD
Object Code	ARRAY
Data type	Unsigned64
Access	ro
Default value	No
PDO Mapping	Yes

Table 28: Structure of the data bytes with
DisableReducedControl = 1 (in object 5600_{hex})

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Status)	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		
Byte 1 (Diagnostics)	BufOvfl	FrameErr	HndShErr	HwFailure	PrmErr	X	X	X
Byte 2	Data byte 0							
...	...							
Byte 7	Data byte 5							

Table 29: Structure of the data bytes with
DisableReducedControl = 0 (in object 5600_{hex})

PDInp	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Status)	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		
Byte 1	Data byte 0							
...	...							
Byte 7	Data byte 6							

Table 30: Meaning of the data bits

Designation	Value	Description
STAT	0-1	1: Communication with the data terminal device is not faulty. 0: Communication with the data terminal device is faulty. A diagnostics signal is sent if DisableDiagnostics = 0 (diagnostics activated). The diagnostics data indicates the cause of the communication fault. This bit must be reset by the user with STATRES in the process output data field (object 5602 _{hex}).
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using TX_CNT.
RX_CNT	0-3	The value RX_CNT is linked and transferred together with every data segment of the process input data. The sequence of the RX_CNT values is: 00->01->10->11->00... (decimal: 0->1->2->3->0...) A faulty sequence indicates that data segments are missing.
RX_BYTE_CNT	0-7	Number of valid bytes in this data segment.
BufOvfl	Bit 7	0 = ok 1 = Buffer overflow The receive buffer (RX buffer) has overflowed.
FrameErr	Bit 6	0 = ok 1 = Frame error The XN-1RS485/422 module parameters must be defined in order for it to be adapted to the data structure of the DTE. A frame error is output if the parameter setting (number of data bits, stop bits, type of parity) is incorrect.
HndShErr	Bit 5	0 = ok 1 = Error in the data flow control The data terminal device connected to the XN-1RS485/422 module is not responding to the XOFF. The internal receive buffer can overflow (buffer overflow = 1).

Designation	Value	Description
HwFailure	Bit 4	0 = ok
		1 = Hardware error The module must be exchanged as the EEPROM or UART may, for example, be faulty.
PrmErr	Bit 5	0 = ok
		1 = Parameter error The set parameter values are not supported. Possible values are shown with the description of object 5600 _{hex} .

Object 5602_{hex} – RS232/RS4xx TxD

Process output data is data that is output from the communication partner (e.g. PLC) via the gateway and the XN-1RS485/422 module to the field device.

The data received from the communication partner in the XN-1RS485/422 module is entered in a 64 byte transmit buffer.

This is transferred in an 8-byte format as follows:

- 6 bytes or 7 bytes are used to contain the user data.
- With the corresponding parameters, 1 byte contains signals for triggering the clearing of the transmit and receive buffer.
- 1 control byte is required to ensure trouble-free transmission of the data.

Table 31: Object 5602_{hex} Description

INDEX	5602 _{hex}
Name	RS232/RS4xx RxD
Object Code	ARRAY
Data type	Unsigned64
Access	rww
Default value	No
PDO Mapping	Yes

Table 32: Structure of the data bytes with
DisableReducedControl = 1 (in object 5600_{hex})

PDO _{Outp}	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Control)	STATRES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		
Byte 1	reserved						RXBUF FLUSH	TXBUF FLUSH
Byte 2	Data byte 0							
...	...							
Byte 7	Data byte 5							

Table 33: Structure of the data bytes with
DisableReducedControl = 0 (in object 5600_{hex})

PDO _{Outp}	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0 (Control)	STATRES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		
Byte 1	Data byte 0							
...	...							
Byte 7	Data byte 5							

Table 34: Meaning of the data bits

Designation	Value	Description
STATRES	0 - 1	The STATRES bit is used for resetting the STAT bit of the process input data (object 5601_{hex}). The STAT bit is reset (from 0 to 1) with the transition from 1 to 0 (falling edge). If this bit is 0, all changes in the data fields TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. The clearing of the receive and transmit buffer by RXBUF FLUSH/TXBUF FLUSH is enabled The value 1 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the RXBUF FLUSH/TXBUF FLUSH.
RX_CNT_ACK	0 - 3	The value RX_CNT_ACK is a copy of the value RX_CNT. The value RX_CNT was transferred together with the last data segment of the process input data (object 5601_{hex}). The value RX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using RX_CNT.
TX_CNT	0 - 3	The value TX_CNT is linked and transferred together with every data segment of the process output data. The sequence of the TX_CNT values is: 00->01->10->11->00... (decimal: 0->1->2->3->0...) A faulty sequence indicates that data segments are missing.
TX_BYTE_CNT	0 - 7	Number of valid user data bytes in this data segment.
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If STATRES = 1: A request with RXBUF FLUSH = 1 will be ignored. If STATRES = 0: RXBUF FLUSH = 1 will clear the receive buffer.
TXBUF FLUSH	0 - 1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If STATRES = 1: A request with TXBUF FLUSH = 1 will be ignored. If STATRES = 0: TXBUF FLUSH = 1 will clear the receive buffer.

CANopen process data

The data objects of the XN-1RS485/422 modules cannot be mapped in default PDOs (PDOs1 to 4) as they are not treated as I/O modules, in accordance with DS401 (1st Device Profile in XN-GW-CANopen).

PDO18 and PDO19 (RPDO18/19 + TPDO18/19) are therefore prepared for use as RS232/4xx PDOs in order to enable PDO communication with XN-1RS485/422 modules with little configuration required.

The first XN-1RS485/422 module generates in the TPDO18 a mapping entry object 5601_{hex}/Si 1 and in RPDO18 a mapping entry object 5602_{hex}/Si 1. The second XN-1RS485/422 module generates in TPDO19 a mapping entry object 5601_{hex}/Si 2 and in RPDO19 a mapping entry object 5602_{hex}/Si 2. The PDOs must however only be enabled by a valid COB-Id.

Other XN-1RS485/422 modules can be mapped by the user to free PDOs or addressed with SDO communication.

Additional emergencies

The following CANopen emergencies can be triggered by an XN-1RS485/422 module:

Error code	Name	Byte 3	Byte 4	Byte 5	Meaning
7000 _{hex}	Additional modules	Module no.	Channel no. (always 1)	08 _{hex}	Parameter error
7000 _{hex}	Additional modules	Module no.	1	10 _{hex}	Hardware failure
7000 _{hex}	Additional modules	Module no.	1	20 _{hex}	Handshake error
7000 _{hex}	Additional modules	Module no.	1	40 _{hex}	Frame error
7000 _{hex}	Additional modules	Module no.	1	80 _{hex}	RX buffer overflow

XION_INIT_4CAN_RSXXX
initialisation function
block

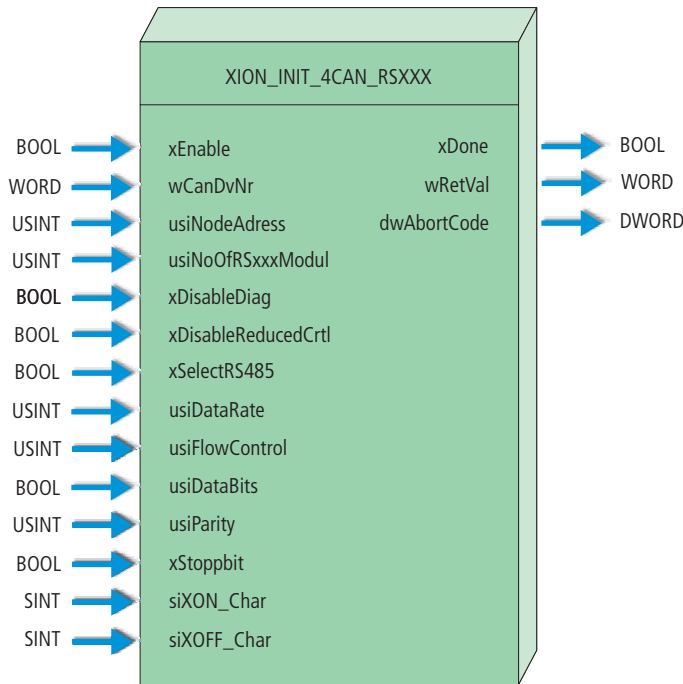


Figure 11: Initialisation function block of the CoDeSys software MXpro for the CANopen fieldbus system

Table 35: Input variables of the XION_INIT_4CAN_RSXXX

Variable	Meaning
xEnable	0 → 1 (rising edge): The initialisation for the selected module is started. 0: Initialisation for the selected module is disabled.
wCanDvNr	This CAN driver number is typically 0.
usiNodeAdress	Node address 0 to 127.
usiNoOfRSxxxModul	This number selects the nth RSXXX_module.

Variable	Meaning
xDisableDiag	Detailed description of the structure and content of these parameters → chapter "Object 5600hex – RS232/RS4xx parameters"
xDisableReducedCtrl	
xDataRate	
usiFlowControl	
usiDataBits	
usiParity	
xStoppbit	
siXON_Char	
siXOFF_Char	
xSelectRS485	For the XN-1RS485/422 module the following applies: 0: The module operates in RS422 mode. 1: The module operates in RS485 mode.

Table 36: Output variables of the XION_INIT_4CAN_RSXXX

Variable	Meaning
xDone	1: Initialisation completed successfully 0: Initialisation not yet completed or failed.
wRetVal	FB return variable: Value > 8000 _{hex} --> fault 8010 _{hex} Incorrect CAN driver number 8011 _{hex} Incorrect node address 8012 _{hex} Incorrect slot number 8013 _{hex} Value for the data rate (DataRate) not defined → chapter "Object 5600hex – RS232/RS4xx parameters" 8014 _{hex} Value for the parity (Parity) not defined → chapter "Object 5600hex – RS232/RS4xx parameters" 8015 _{hex} Value for the flow control (FlowControl) not defined → chapter "Object 5600hex – RS232/RS4xx parameters"
dwAbortCode	This error code is described in CIA DS301.

5 Commissioning the Module in xSystem

XION_HTB_RSXXX data handling function block

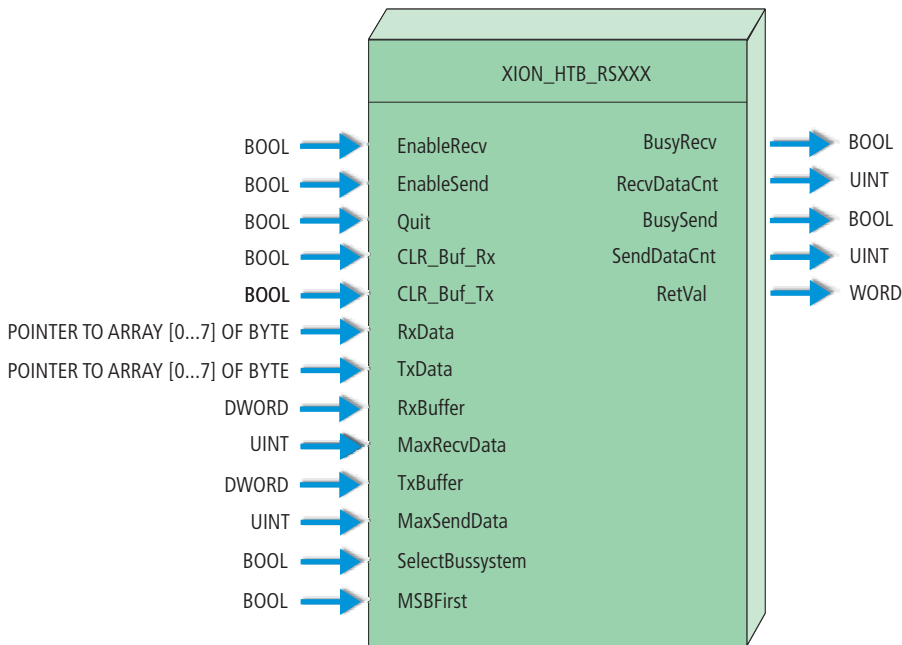


Figure 12: Transmit/receive function block for the CoDeSys software MXpro

Table 37: Input variables of the XION_HTB_RSXXX

Variable	Meaning
EnableRecv	1: Receiving of data enabled. 0: Receiving of data disabled.
EnableSend	1: Transmit data enabled. 0: Transmit data disabled.
Quit	1: Error messages are reset (acknowledgement of errors). Communication is stopped. 0: These are retained if error messages are present.
CLR_Buf_Rx	1: The clearing of the receive buffer is preset. The buffer is always successfully cleared if: EnableRecv = 0 Quit = 1 0: No influence on the module function.
CLR_Buf_Tx	1: The clearing of the transmit buffer is preset. The buffer is always successfully cleared if: EnableSend = 0 Quit = 1 0: No influence on the module function.
RxData	Pointer to the receive address range of the XN-1RS485/422 module. The address for this address range is generated and displayed when an XN-1RS485/422 module is added to the "PLC configuration" area. This address, such as % IB22 can be converted directly or via a variable to the RxData pointer: RxData:=ADR(% IB22) RxData:=ADR(<Variable>) The variable must be declared with the same type as %IB22.
TxData	Pointer to the transmit address range of the XN-1RS485/422 module. The address to this address range is generated and displayed when an XN-1RS485/422 module is added to the "PLC configuration" area. This address, such as % IB22 can be converted directly or via a variable to the TxData pointer: TxData:=ADR(% IB22) TxData:=ADR(<Variable>) The variable must be declared with the same type as %IB22.

Variable	Meaning
RxBuffer	Start address for storing receive data. RxBuffer: = ADR(<Variable>) The variable must be of type ARRAY[0 ... n] OF BYTE. A suitable value for "n" corresponds to the number of bytes in the message telegram and can be up to 65535. Possible data types are inputs, outputs, markers and data function blocks.
MaxRecvData	Maximum number of bytes to be received. A maximum of 65536 bytes is possible.
TxBuffer	Start address for storing transmit data. TxBuffer: = ADR(<Variable>) The variable must be of type ARRAY[0 ... n] OF BYTE. A suitable value for "n" corresponds to the number of bytes in the message telegram and can be up to 65535. Possible data types are inputs, outputs, markers and data function blocks.
MaxSendData	Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.
SelectBussystem	1: The data handling function block works for the Profibus-DP fieldbus system. 0: The data handling function block works for the CANopen fieldbus system
MSBFirst	Byte-swap 1: LSB first 0: MSB first

Table 38: Output variables of the XION_HTB_RSXXX

Variable	Meaning
BusyRecv	1: Data is currently being received. 0: No data is currently being received.
RecvDataCnt	Number of received data bytes. A maximum of 65536 bytes is possible.
BusySend	1: Data is currently being transmitted. 0: No data is currently being transmitted.
SendDataCnt	Number of transmitted data bytes. A maximum of 65536 bytes is possible.
RETVAL	Return values of the function (status or error code) 0000 _{hex} Everything OK. No error 8008 _{hex} Parameter error 8010 _{hex} Communication error: Hardware error 8020 _{hex} Communication error: Data flow control error 8040 _{hex} Communication error: Frame error 8080 _{hex} Communication error: Module buffer overflow 8101 _{hex} Size of the receive data telegram is greater than MaxRecvData. ==> Abort the data handling function block 8103 _{hex} Size of the receive data packet does not equal 8. ==> Abort of the data handling function block 8201 _{hex} Size of the transmit data telegram is greater than MaxSendData. ==> Abort the data handling function block 8203 _{hex} Size of the transmit data packet does not equal 8. ==> Abort of the data handling function block

**Note!**

It should be ensured without fail that the memory provided with RxBuffer and TxBuffer is enough (or more than enough) for the possible data volume defined by MaxSendData and MaxRecvData.

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