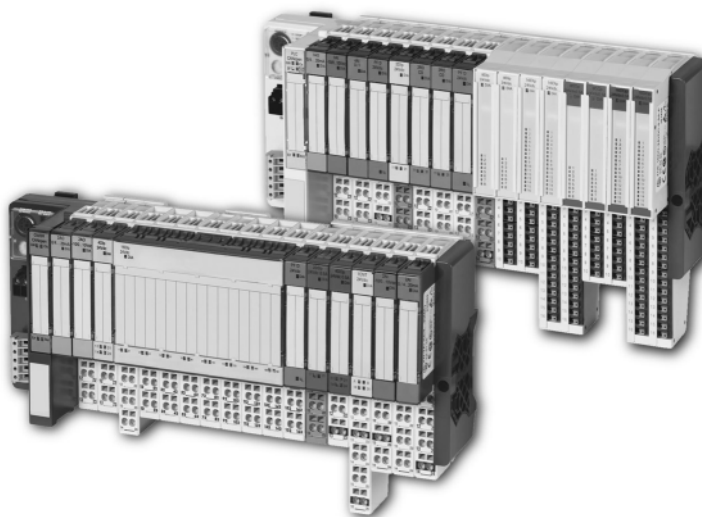


# XN-1RS485/422 Technology Module



**EATON**

*Powering Business Worldwide*

# Imprint

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## **Original manual**

The German version of this document is the original manual.

## **Translations of the original manual**

All non-German editions of this document are translations of the original manual.

## **Editorial department**

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Subject to modifications.

**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 50110-1/-2 (DIN 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/HD 60364-4-41 (DIN 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.).

## Safety regulations

- 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/HD 60364 (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.

# About This Manual

## Writing conventions



# 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 14

# 1 Product Description

## General product description

### **Transmission procedure**

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

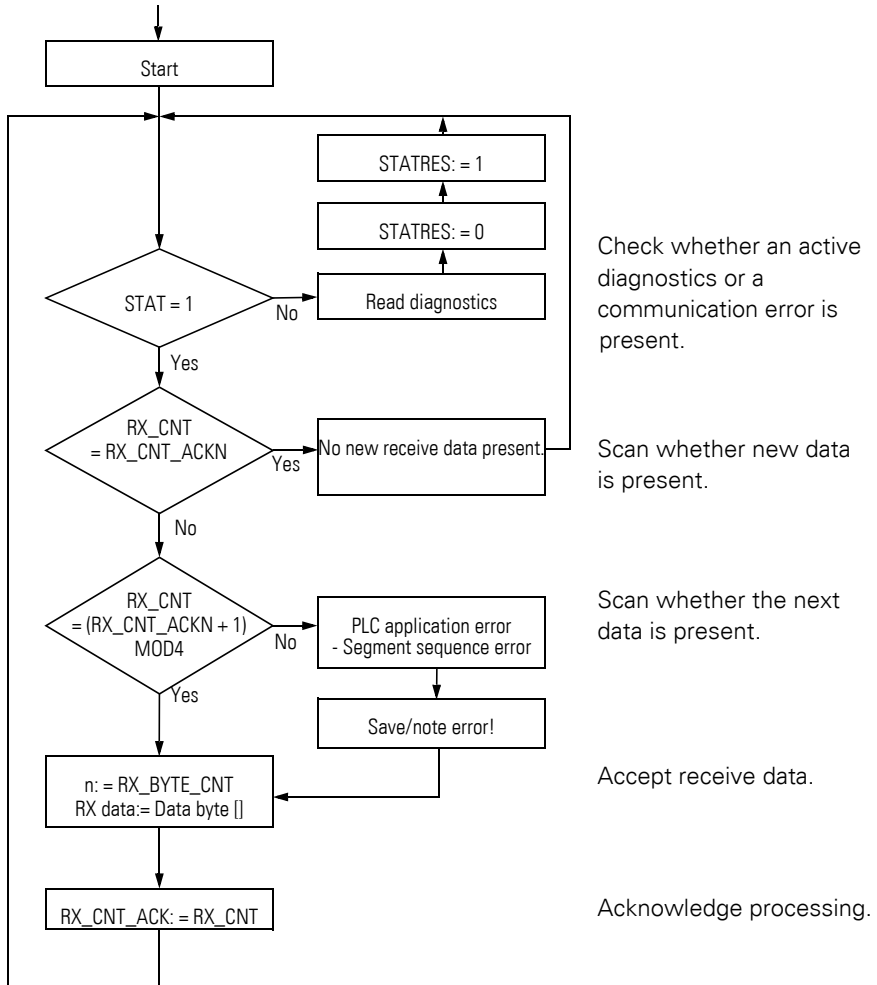
### **Data exchange**

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

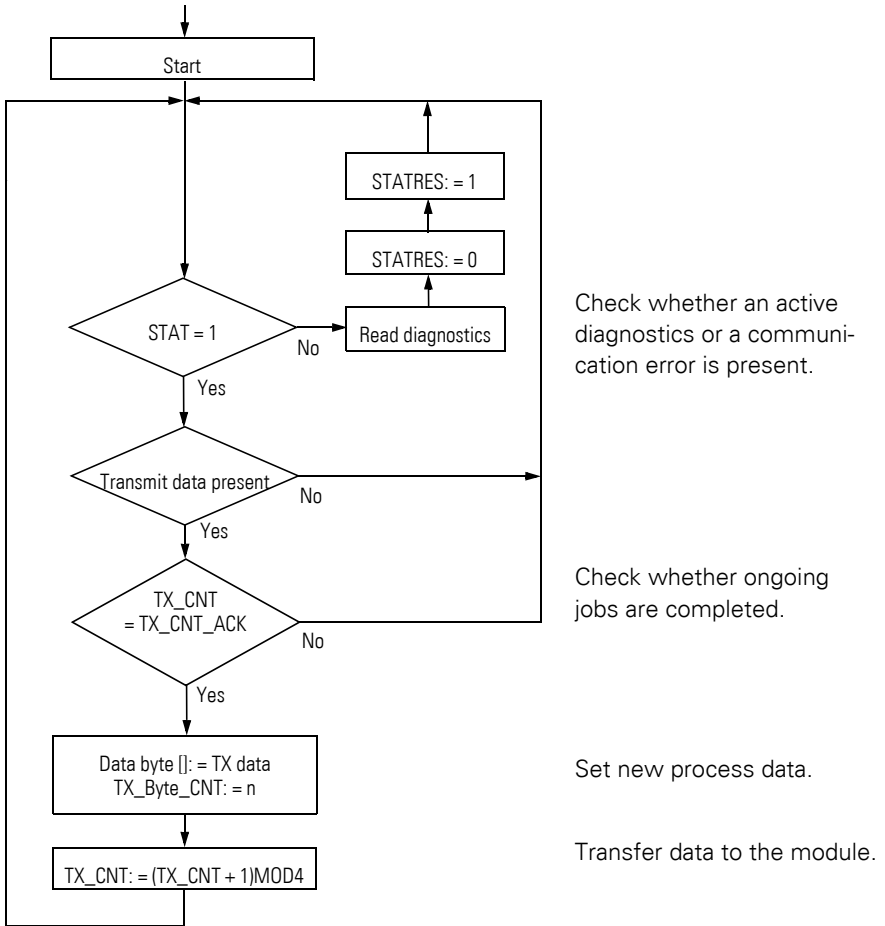
The data transmission from the PLC to the transmit buffer of the XN-1RS485/422 module or from the receive buffer of the XN-1RS485/422 module to the PLC is organised via an 8-byte data channel into process output or input data. One byte of a data packet is used for status information in order to ensure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

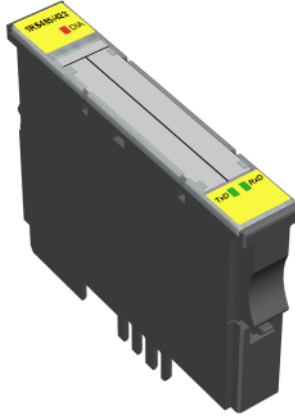


Figure 1: XN-1RS485/422 electronic module

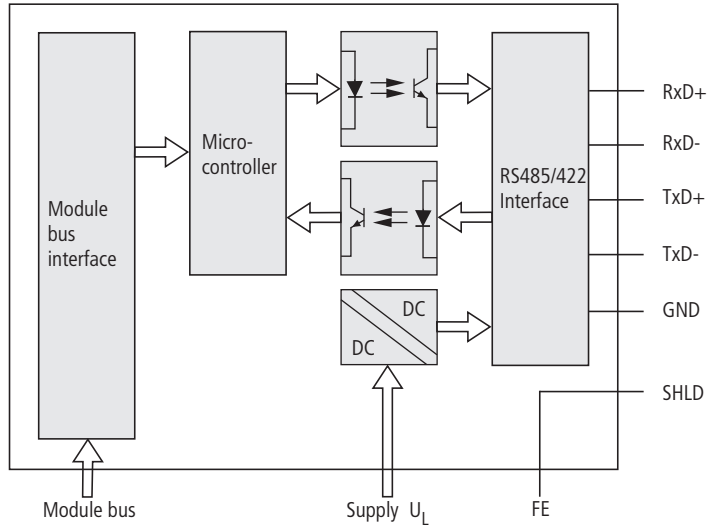


Figure 2: Block diagram of the XN-1RS485/422 module configured for RS422 operation

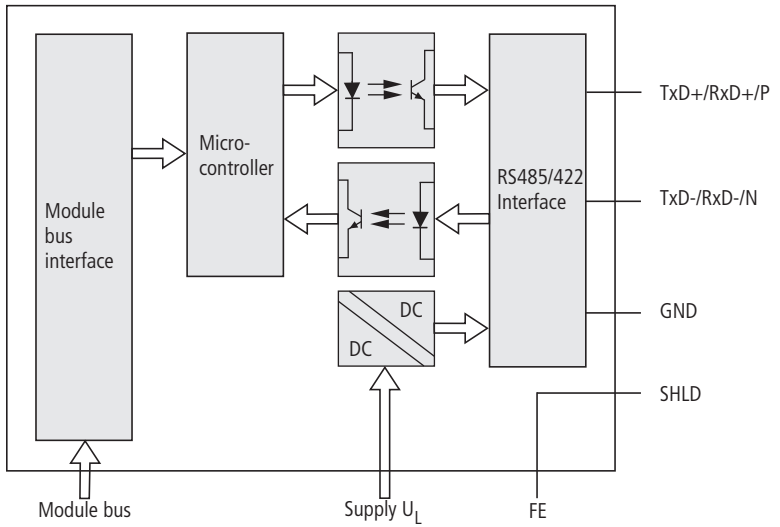


Figure 3: Block diagram of the XN-1RS485/422 module configured for RS485 operation

# 1 Product Description

## Technical features

### 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 half-duplex or four wire full-duplex
RS485 connection type	Two wire half-duplex
Bit transmission rate	$\leq 115200$ bit/s (configurable), Standard: 9600 bits/s, 7 data bits, odd parity and 2 stop bits
Cable impedance	120 $\Omega$
Bus terminating resistors	120 $\Omega$ (external)
RS485/422 cable length	$\leq 30$ m
Nominal supply from supply terminal $U_L$ (range)	24 V DC (18 to 30 V DC)
Nominal current consumption from supply terminal $I_L$	$\leq 25$ mA
Nominal supply from module bus $U_{MB}$ (range)	5 V DC (4.75 to 5.25 V DC)
Nominal current consumption from module bus $I_{MB}$	$\leq 60$ mA
Power loss of the module	normally 1 W
Insulation voltage between interface and module bus/system voltage	500 $V_{rms}$
Insulation voltage between interface and field voltage	500 $V_{rms}$



<b>Designation</b>	<b>XN-1RS485/422</b>
Electromagnetic compatibility (EMC) according to IEC/EN 61000-6-2 (industrial)	
ESD	IEC/EN 61000-4-2
Electromagnetic fields	IEC/EN 61000-4-3
Burst	IEC/EN 61000-4-4
Surge	IEC/EN 61000-4-5
RFI asymmetrical	IEC/EN 61000-4-6
Line-conducted emission/interference voltage	IEC/EN 61000-6-4
Radiated high frequency emission	IEC/EN 61000-6-4: IEC/CISPR 11 / EN 55011, Class A
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**

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

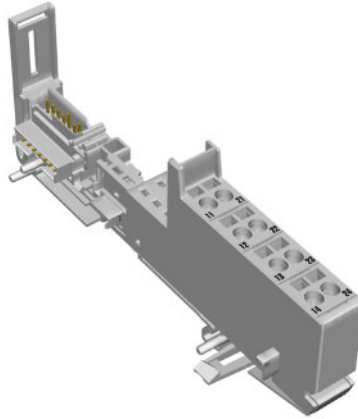


Figure 4: XN-S4x-SBBS base module

<b>Designation</b>	
With tension clamp connectors	XN-S4T-SBBS
With screw terminal	XN-S4S-SBBS

# 1 Product Description

## Base modules

### Technical data of the base modules

Table 3: Technical data of the base modules

Designation	Value
Measurement data	according to VDE 0611 Part 1/8.92 / IEC/EN 60947-7-1
Rated voltage	250 V
Rated current	17.5 A
Rated cross section	1.5 mm <sup>2</sup>
Rated surge voltage	4 kV
Pollution degree	2
TOP connection technology	Tension clamp or screw connection
Protection class	IP20
Insulation stripping length	8.0 to 9.0 mm / 0.32 to 0.36 inch
Max. wire range	0.5 to 2.5 mm <sup>2</sup> / 0.0008 to 0.0039 inch <sup>2</sup> / AWG 24 to AWG 14
Crimpable wire	
"e" solid core H 07V-U	0.5 to 2.5 mm <sup>2</sup> / 0.0008 to 0.0039 inch <sup>2</sup>
"f" flexible core H 07V-K	0.5 to 1.5 mm <sup>2</sup> / 0.0008 to 0.0023 inch <sup>2</sup>
"f" with ferrules according to DIN 46228-1 (ferrules crimped gas-tight)	0.5 to 1.5 mm <sup>2</sup> / 0.0008 to 0.0023 inch <sup>2</sup>
Test finger according to IEC/EN 60947-1	A1

### Wiring diagrams

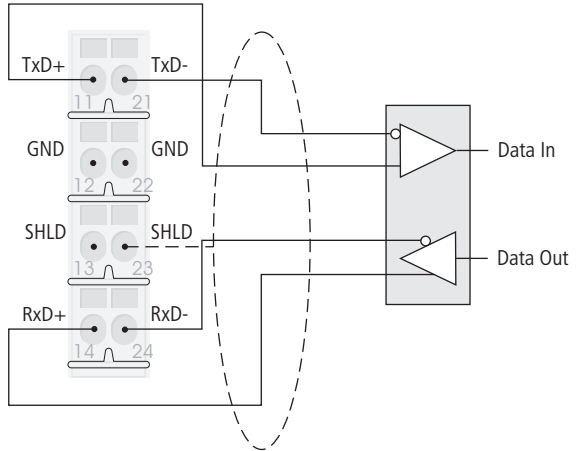


Figure 5: XN-S4x-SBBS wiring diagram in RS422 operation

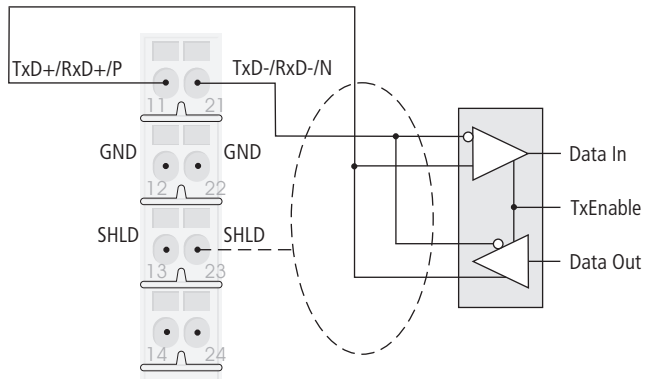


Figure 6: XN-S4x-SBBS wiring diagram in RS485 operation

# 1 Product Description

## Base modules

Table 4: Signal types

<b>Signal designation</b>	
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

PDI <sub>inp</sub>	B7	B6	B5	B4	B3	B2	B1	B0
Byte 0	Data byte 5							
...	...							
Byte 5	Data byte 0							
Byte 6 (Diagnostics)	Buf Ovfl	Frame Err	HndSh Err	Hw Failure	Prm Err	X	X	X
Byte 7 (Status)	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		

X = reserved

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

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.



## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

#### 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

<b>PDOOut</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
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		

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

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

Designation	Value	Description
RXBUF FLUSH	0 - 1	<p>The RXBUF FLUSH bit is used for clearing the receive buffer.</p> <p>If STATRES = 0, 1 or 0-&gt;1: A request with RXBUF FLUSH = 1 will be ignored.</p> <p>When RXBUF FLUSH = 1, the receive buffer is cleared when there is a falling edge from 1-&gt;0 at STATRES.</p>
TXBUF FLUSH	0 - 1	<p>The TXBUF FLUSH bit is used for clearing the transmit buffer.</p> <p>If STATRES = 0, 1 or 0-&gt;1 : A request with TXBUF FLUSH = 1 will be ignored.</p> <p>When TXBUF FLUSH = 1, the transmit buffer is cleared when there is a falling edge from 1-&gt;0 at STATRES.</p>
STATRES	0 - 1	<p>The STATRES bit is used for resetting the STAT bit of the process input data.</p> <p>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 RXBUF FLUSH/TXBUF FLUSH is enabled</p> <p>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 RXBUF FLUSH/TXBUF FLUSH.</p>
RX_CNT_ACK	0 - 3	<p>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.</p> <p>The value RX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using RX_CNT.</p>

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

Designation	Value	Description
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. 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.

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

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.
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.

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

<b>Parameter designation</b>	<b>Value</b>	<b>Name of the values</b>	<b>Description</b>
data 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	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.

## 2 Integrating the Module in PROFIBUS-DP

### PROFIBUS-DP data image

Parameter designation	Value	Name of the values	Description
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.
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 FBSENDRSXXX, 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.

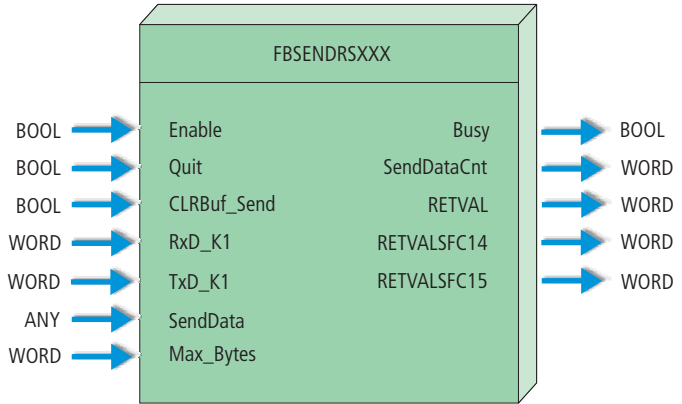


Figure 7: Transmit function block for the SIMATIC S7 software

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.

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

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

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

Table 12: Output variables of FBSENDRSXXX

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.

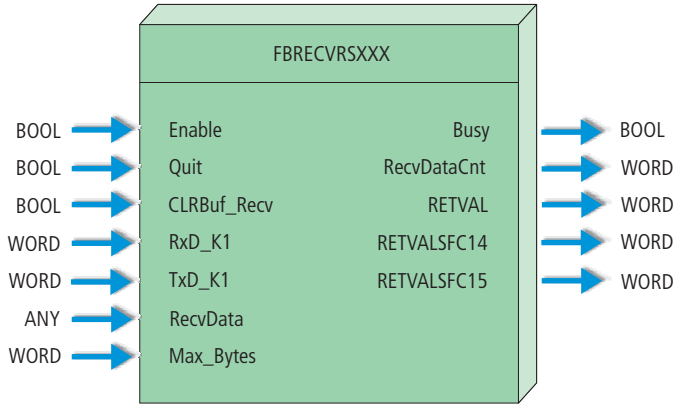


Figure 8: Receive function block for the SIMATIC S7 software

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

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.

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

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 <sub>hex</sub> Communication error: Hardware error 8020 <sub>hex</sub> Communication error: Data flow control error 8040 <sub>hex</sub> Communication error: Frame error 8080 <sub>hex</sub> Communication error: Module buffer overflow 8300 <sub>hex</sub> Variable error: Incorrect "RecvData" parameter 8301 <sub>hex</sub> Variable error: Incorrect "RecvData" parameter data type 8302 <sub>hex</sub> 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"

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

#### **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.

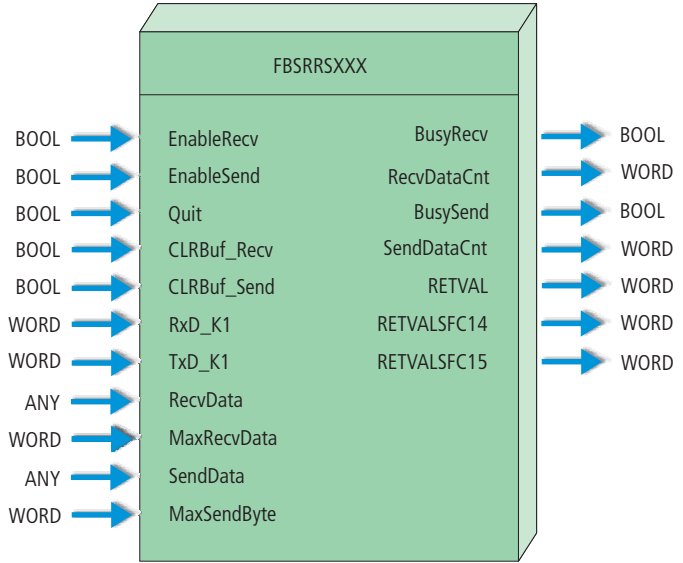


Figure 9: Send/receive function block for the SIMATIC S7 software



## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

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.
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.

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

Variable	Meaning
TxD_K1	<p>Start address for the 8-byte output address range of the XN-1RS485/422 module.</p> <p>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.</p> <p>WORD format is used for the addresses and therefore consists of 2 bytes.</p> <p>Example: The decimal value 258 must be transferred in hexadecimal code as W#16#102.</p>
RecvData	<p>Start address for storing receive data. This is permissible for inputs, outputs, markers and data function blocks.</p>
MaxRecvBytes	<p>Maximum number of bytes to be received. A maximum of 65536 bytes is possible.</p>
SendData	<p>Start address for storing transmit data. This is permissible for inputs, outputs, markers and data function blocks.</p>
MaxSendBytes	<p>Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.</p>

## 2 Integrating the Module in PROFIBUS-DP

### Function blocks for SIMATIC S7

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 <sub>hex</sub> Everything OK. No error 8010 <sub>hex</sub> Communication error: Hardware error 8020 <sub>hex</sub> Communication error: Data flow control error 8040 <sub>hex</sub> Communication error: Frame error 8080 <sub>hex</sub> Communication error: Module buffer overflow 8100 <sub>hex</sub> Variable error: Incorrect "RecvData" parameter 8101 <sub>hex</sub> Variable error: Incorrect "RecvData" parameter data type 8102 <sub>hex</sub> Variable error: Incorrect "RecvData" parameter length 8200 <sub>hex</sub> Variable error: Incorrect "SendData" parameter 8201 <sub>hex</sub> Variable error: Incorrect "SendData" parameter data type 8202 <sub>hex</sub> 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"

## 2 Integrating the Module in PROFIBUS-DP Function blocks for SIMATIC S7

### 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							

### 3 Integrating the Module in DeviceNet

#### Process image

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

<b>PDInp</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte0 (Status)	STATUS	TX COUNT ACKNOWLEDGE		RX COUNT		RX BYTE COUNT		
Byte 1 (Diagnosis- tics)	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"

<b>PDOOut</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte 0 (Control)	STATUS RESET CON- TROL	RX COUNT ACKNOWLEDGE		TX COUNT		TX BYTE COUNT		
Byte1	Data byte 0							
...	...							
Byte 7	Data byte 6							

### 3 Integrating the Module in DeviceNet

#### Process image

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

<b>PDOOut</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte 0 (Control)	STATUS RESET CON- TROL	RX COUNT ACKNOWL- EDGE		TX COUNT				TX BYTE COUNT
Byte 1	reserved						<b>RXBUF FLUSH 1)</b>	<b>TXBUF FLUSH 2)</b>
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.



### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

#### RS485/422 Module Class (VSC115)

This class contains all the parameters and information relating to the XN-1RS485/422 module.

Table 21: Class Instance

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

### 3 Integrating the Module in DeviceNet

#### RS485/422 Module Class (VSC115)

Table 22: Object Instances

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
100 (64 <sub>hex</sub> )	MAX OBJECT ATTRIBUTE	G	USINT	Contains the number of the last object attribute implemented.
101 (65 <sub>hex</sub> )	MODULE PRESENT	G	BOOL	0: XI/ON module is not plugged in, empty base module. 1: XI/ON module is plugged in
102 (66 <sub>hex</sub> )	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 <sub>hex</sub> )	MODULE ID	G	DWORD	Contains the module ID.
104 (68 <sub>hex</sub> )	MODULE ORDER NUMBER	G	UDINT	Contains the order number of the module.
105 (69 <sub>hex</sub> )	MODULE ORDER NAME	G	SHORT_STRING	Contains the module name, e.g. XN-1RS485/422.
106 (6A <sub>hex</sub> )	MODULE REVISION NUMBER	G	USINT	Contains the revision number of the module firmware.

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
107 (6B <sub>hex</sub> )	MODULE TYPE ID	G	ENUM USINT	Gives information about the module type: 0 (00 <sub>hex</sub> ) unknown module type 1 (01 <sub>hex</sub> ) digital I/O module 17 (11 <sub>hex</sub> ) analog module I/O voltage 18 (12 <sub>hex</sub> ) analog module I/O current 19 (13 <sub>hex</sub> ) analog module PT temperature 20 (14 <sub>hex</sub> ) analog module Thermo temperature 33 (21 <sub>hex</sub> ) 16-bit counter module 34 (22 <sub>hex</sub> ) 32-bit counter module 40 (28 <sub>hex</sub> ) SSI module 49 (31 <sub>hex</sub> ) motor starter module as DOL or reversing starter 50 (32 <sub>hex</sub> ) electronic motor starter 65 (41 <sub>hex</sub> ) RS232 module 66 (42 <sub>hex</sub> ) RS485/422 module 67 (43 <sub>hex</sub> ) TTY module
108 (6C <sub>hex</sub> )	MODULE COMMAND INTERFACE	G/S	ARRAY OF BYTE	Command interface of the XI/ON module. ARRAY OF: BYTE: Command byte sequence
109 (6D <sub>hex</sub> )	MODULE RESPONSE INTERFACE	G	ARRAY OF BYTE	Signal interface of the XI/ON module. ARRAY OF: BYTE: Signal byte sequence
110 (6E <sub>hex</sub> )	MODULE REGISTERED INDEX	G	ENUM USINT	Contains the index number registered in all module lists.

### 3 Integrating the Module in DeviceNet

#### RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
111 (6F <sub>hex</sub> )	NUMBER OF SUPPORTED CHANNELS	G	USINT	Indicates the number of channels supported by this module instance.
112 (70 <sub>hex</sub> )	RX BYTE COUNT	G	USINT	Number (0 to 7) of valid bytes in this data segment of the process input.
113 (71 <sub>hex</sub> )	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 <sub>hex</sub> )	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.

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

Attr. no.  dec. (hex.)	Attribute name	Access	Type	Description
115 (73 <sub>hex</sub> )	STATUS	G	BOOL	<p>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.</p> <p>1 = "OK" Communication with the data terminal device is not faulty.</p>
116 (74 <sub>hex</sub> )	PROCESS DIAGNOSTICS DATA	G	BYTE	<p>Diagnostics information: The diagnostics data is part of the process input data if ACTIVE MODE = 1 and "2bytes ctrl/status header" have been set.</p> <p>Diagnostics messages: Bit 0 to 2: "&lt;reserved&gt;" Bit 3: 0 = "OK" 1 = "parameter error": The set parameter values are not supported.</p> <p>Bit 4: 0 = "OK" 1 = "hardware failure": The module must be exchanged as the EEPROM or UART, for example, may be faulty.</p> <p>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.</p>

### 3 Integrating the Module in DeviceNet

#### RS485/422 Module Class (VSC115)

Attr. no.  dec. (hex.)	Attribute name	Access	Type	Description
116 (74 <sub>hex</sub> )				<p>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.</p> <p>Bit 7: 0 = "OK" 1 = "buffer overflow": The receive buffer (RX buffer) has overflowed.</p> <p>Bit 8 to 15: "&lt;reserved&gt;"</p>
117 (75 <sub>hex</sub> )	RX DATA	G	ARRAY OF BYTE	Receive data Number: 0 to 7 bytes.
118 (76 <sub>hex</sub> )	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 <sub>hex</sub> )	TX BYTE COUNT	G/S	USINT	Number (0 to 7) of valid user bytes in this data segment.
120 (78 <sub>hex</sub> )	TX COUNT	G/S	USINT	<p>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-&gt;01-&gt;10-&gt;11-&gt;00... (decimal: 0-&gt;1-&gt;2-&gt;3-&gt;0...)</p> <p>A faulty sequence indicates that data segments are missing.</p>

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
121 (79 <sub>hex</sub> )	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 <sub>hex</sub> )	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.
123 (7B <sub>hex</sub> )	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 <sub>hex</sub> )	TX DATA	G/S	ARRAY OF BYTE	Transmit data Number: 0 to 7 bytes.

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
125 (7D <sub>hex</sub> )	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 <sub>hex</sub> )	reserved			



### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

Attr. no.  dec. (hex.)	Attribute name	Access	Type	Description
127 (7F <sub>hex</sub> )	DIAGNOSTICS	G	WORD	<p>Diagnostics messages (Low Byte):</p> <p>Bit 0 to 2: "&lt;reserved&gt;"</p> <p>Bit 3: 0 = ok 1 = "parameter error": The set parameter values are not supported.</p> <p>Bit 4: 0 = ok 1 = "hardware failure": The module must be exchanged as the EEPROM or UART may, for example, be faulty.</p> <p>Bit 5: 0 = ok 1 = "handshake error": The data terminal device connected to the XN-1RS485/422 module is not responding to XOFF.</p> <p>The internal receive buffer can overflow.</p> <p>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.</p> <p>Bit 7: 0 = ok 1 = "buffer overflow": The receive buffer (RX buffer) has overflowed.</p> <p>High Byte: "&lt;reserved&gt;"</p>

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
128 (80 <sub>hex</sub> )	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.
129 (81 <sub>hex</sub> )	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 <sub>hex</sub> )	DISABLE DIAGNOSTICS	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.

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

<b>Attr. no.</b>  <b>dec. (hex.)</b>	<b>Attribute name</b>	<b>Access</b>	<b>Type</b>	<b>Description</b>
131 (83 <sub>hex</sub> )	FLOW CONTROL	G/S	ENUM USINT	0 = "off": The data flow control is deactivated. 1 = "XON/OFF": Software handshake activated. (only with 422 operation) 2 to 3 = "<reserved>"
132 (84 <sub>hex</sub> )	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 <sub>hex</sub> )	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.
134 (86 <sub>hex</sub> )	STOP	G/S	ENUM USINT	Number of stop bits: 0: 1 bit 1: 2 bits
135 (87 <sub>hex</sub> )	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 <sub>hex</sub> )	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 <sub>hex</sub> )	RSXX Mode	G/S	ENUM USINT	0 = "RS422": 422 operation 1 = "RS485": 485 operation

### 3 Integrating the Module in DeviceNet RS485/422 Module Class (VSC115)

## 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 <sub>hex</sub>	Array	RS232/RS4xx parameters	4 bytes, RS232/RS4xx parameters	Unsigned 32
5601 <sub>hex</sub>	Array	RS232/RS4xx RxD	8 bytes, RS232/RS4xx receive data (process input data).	Unsigned 64
5602 <sub>hex</sub>	Array	RS232/RS4xx TxD	8 bytes, RS232/RS4xx transmit data (process output data).	Unsigned 64

## 4 Integrating the Module in CANopen

### Object description

#### Object description

#### Object 5600<sub>hex</sub> – 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<sub>hex</sub> Description

INDEX	5600 <sub>hex</sub>
Name	RS232/RS4xx parameters
Object Code	ARRAY
Data type	Unsigned32
Access	rw
Default value	No
PDO Mapping	No

## 4 Integrating the Module in CANopen Object description

Table 25: Structure of the data bytes

	<b>Bit 7</b>	<b>Bit 6</b>	<b>Bit 5</b>	<b>Bit 4</b>	<b>Bit 3</b>	<b>Bit 2</b>	<b>Bit 1</b>	<b>Bit 0</b>
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							

## 4 Integrating the Module in CANopen

### Object description

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 <sub>hex</sub> ).
DisableReducedControl	0	The diagnostics messages are not part of the process input data (object 5601 <sub>hex</sub> ). Bytes1 to 7 can therefore be used for the user data.
	1	The diagnostics messages are contained in byte 1 of the object 5601 <sub>hex</sub> (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 <sub>hex</sub> is also changed by this setting. At the location of the first data byte, byte 1 of the object 5602 <sub>hex</sub> 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



Parameter designation	Value	Description
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
	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.

## 4 Integrating the Module in CANopen

### Object description

<b>Parameter designation</b>	<b>Value</b>	<b>Description</b>
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<sub>hex</sub> – 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<sub>hex</sub> Description

INDEX	5601 <sub>hex</sub>
Name	RS232/RS4xx RxD
Object Code	ARRAY
Data type	Unsigned64
Access	ro
Default value	No
PDO Mapping	Yes

## 4 Integrating the Module in CANopen

### Object description

Table 28: Structure of the data bytes with  
DisableReducedControl = 1 (in object  
5600<sub>hex</sub>)

<b>PDInp</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte 0 (Status)	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		
Byte 1 (Diagnos- tics)	Buf Ovfl	Frame Err	HndSh Err	Hw Failure	Prm Err	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<sub>hex</sub>)

<b>PDInp</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
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	<p>1: Communication with the data terminal device is not faulty.</p> <p>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.</p> <p>This bit must be reset by the user with STATRES in the process output data field (object 5602<sub>hex</sub>).</p>
TX_CNT_ACK	0-3	<p>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.</p> <p>The value TX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using TX_CNT.</p>
RX_CNT	0-3	<p>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-&gt;01-&gt;10-&gt;11-&gt;00...</p> <p>(decimal: 0-&gt;1-&gt;2-&gt;3-&gt;0...)</p> <p>A faulty sequence indicates that data segments are missing.</p>
RX_BYTE_CNT	0-7	Number of valid bytes in this data segment.
BufOvfl	Bit 7	<p>0 = ok</p> <p>1 = Buffer overflow</p> <p>The receive buffer (RX buffer) has overflowed.</p>
FrameErr	Bit 6	<p>0 = ok</p> <p>1 = Frame error</p> <p>The XN-1RS485/422 module parameters must be defined in order for it to be adapted to the data structure of the DTE.</p> <p>A frame error is output if the parameter setting (number of data bits, stop bits, type of parity) is incorrect.</p>

## 4 Integrating the Module in CANopen

### Object description

Designation	Value	Description
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).
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 <sub>hex</sub> .

**Object 5602<sub>hex</sub> – 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<sub>hex</sub> Description

<b>INDEX</b>	<b>5602<sub>hex</sub></b>
Name	RS232/RS4xx RxD
Object Code	ARRAY
Data type	Unsigned64
Access	rww
Default value	No
PDO Mapping	Yes

## 4 Integrating the Module in CANopen

### Object description

Table 32: Structure of the data bytes with  
DisableReducedControl = 1 (in object  
5600<sub>hex</sub>)

<b>PDOOutp</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte 0 (Control)	STAT RES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		
Byte 1	reserved						<b>RXBUF FLUSH</b>	<b>TXBUF FLUSH</b>
Byte 2	Data byte 0							
...	...							
Byte 7	Data byte 5							

Table 33: Structure of the data bytes with  
DisableReducedControl = 0 (in object  
5600<sub>hex</sub>)

<b>PDOOutp</b>	<b>B7</b>	<b>B6</b>	<b>B5</b>	<b>B4</b>	<b>B3</b>	<b>B2</b>	<b>B1</b>	<b>B0</b>
Byte 0 (Control)	STAT RES	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	<p>The STATRES bit is used for resetting the STAT bit of the process input data (object 5601<sub>hex</sub>). The STAT bit is reset (from 0 to 1) with the transition from 1 to 0 (falling edge).</p> <p>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</p> <p>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.</p>
RX_CNT_ACK	0 - 3	<p>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<sub>hex</sub>).</p> <p>The value RX_CNT_ACK is an acknowledgement of successful acceptance of the data segment using RX_CNT.</p>
TX_CNT	0 - 3	<p>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-&gt;01-&gt;10-&gt;11-&gt;00... (decimal: 0-&gt;1-&gt;2-&gt;3-&gt;0...)</p> <p>A faulty sequence indicates that data segments are missing.</p>
TX_BYTE_CNT	0 - 7	<p>Number of valid user data bytes in this data segment.</p>
RXBUF FLUSH	0 - 1	<p>The RXBUF FLUSH bit is used for clearing the receive buffer.</p> <p>If STATRES = 1: A request with RXBUF FLUSH = 1 will be ignored.</p> <p>If STATRES = 0: RXBUF FLUSH = 1 will clear the receive buffer.</p>

## 4 Integrating the Module in CANopen

### CANopen process data

Designation	Value	Description
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<sub>hex</sub>/Si 1 and in RPDO18 a mapping entry object 5602<sub>hex</sub>/Si 1. The second XN-1RS485/422 module generates in TPDO19 a mapping entry object 5601<sub>hex</sub> Si 2 and in RPDO19 a mapping entry object 5602<sub>hex</sub>/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.

## 4 Integrating the Module in CANopen Additional emergencies

### 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 <sub>hex</sub>	Additional modules	Module no.	Channel no. (always 1)	08 <sub>hex</sub>	Parameter error
7000 <sub>hex</sub>	Additional modules	Module no.	1	10 <sub>hex</sub>	Hardware failure
7000 <sub>hex</sub>	Additional modules	Module no.	1	20 <sub>hex</sub>	Handshake error
7000 <sub>hex</sub>	Additional modules	Module no.	1	40 <sub>hex</sub>	Frame error
7000 <sub>hex</sub>	Additional modules	Module no.	1	80 <sub>hex</sub>	RX buffer overflow

## 4 Integrating the Module in CANopen

### XION\_INIT\_4CAN\_RSXXX initialisation function block

#### **XION\_INIT\_4CAN\_RSXXX** initialisation function block

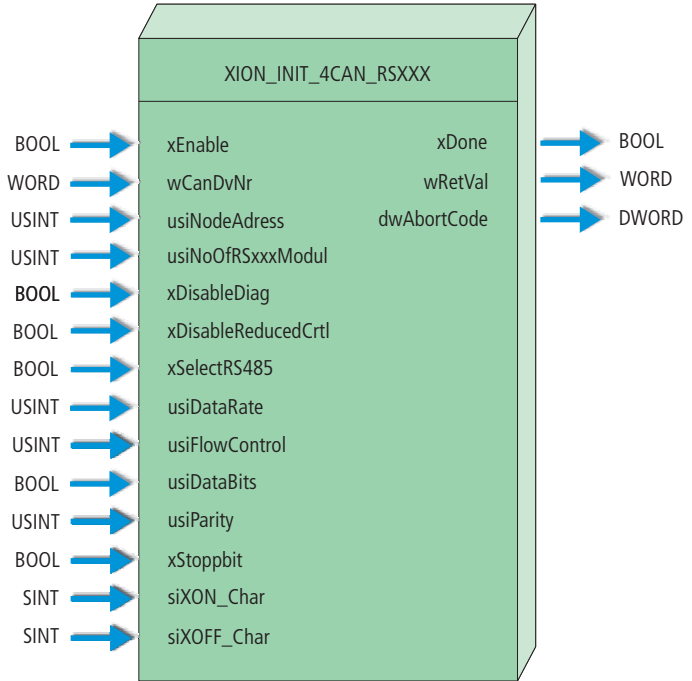


Figure 10: Initialisation function block of the CoDeSys software MXpro for the CANopen fieldbus system

## 4 Integrating the Module in CANopen

### XION\_INIT\_4CAN\_RSXXX initialisation function block

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.	
xDisableDiag	Detailed description of the structure and content of these parameters → Chapter "Object 5600hex – RS232/RS4xx parameters"	
xDisableReducedCrtl		
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.

## 4 Integrating the Module in CANopen

### XION\_INIT\_4CAN\_RSXXX initialisation function block

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 <sub>hex</sub> --> fault 8010 <sub>hex</sub> Incorrect CAN driver number 8011 <sub>hex</sub> Incorrect node address 8012 <sub>hex</sub> Incorrect slot number 8013 <sub>hex</sub> Value for the data rate (DataRate) not defined → Chapter "Object 5600hex – RS232/RS4xx parameters" 8014 <sub>hex</sub> Value for the parity (Parity) not defined → Chapter "Object 5600hex – RS232/RS4xx parameters" 8015 <sub>hex</sub> 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

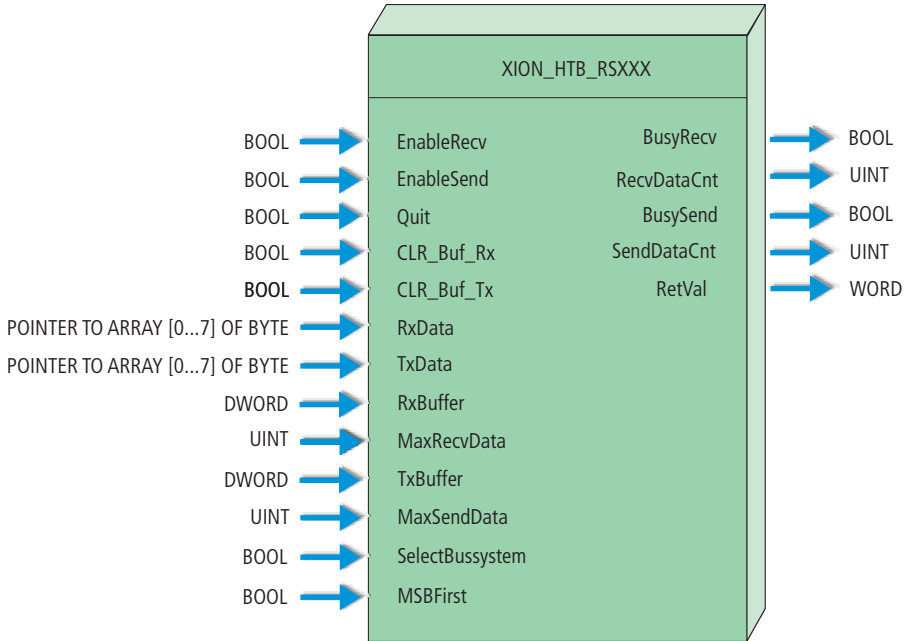


Figure 11: Transmit/receive function block for the CoDeSys software MXpro

## 5 Commissioning the Module in xSystem

### XION\_HTB\_RSXXX data handling function block

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.



## 5 Commissioning the Module in xSystem XION\_HTB\_RSXXX data handling function block

Variable	Meaning
TxData	<p>Pointer to the transmit address range of the XN-1RS485/422 module.</p> <p>The address to this address range is generated and displayed when an XN-1RS485/422 module is added to the "PLC configuration" area.</p> <p>This address, such as % IB22 can be converted directly or via a variable to the TxData pointer:</p> <p>TxData:=ADR(% IB22) TxData:=ADR(&lt;Variable&gt;)</p> <p>The variable must be declared with the same type as %IB22.</p>
RxBuffer	<p>Start address for storing receive data.</p> <p>RxBuffer: = ADR(&lt;Variable&gt;)</p> <p>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.</p> <p>Possible data types are inputs, outputs, markers and data function blocks.</p>
MaxRecvData	<p>Maximum number of bytes to be received. A maximum of 65536 bytes is possible.</p>
TxBuffer	<p>Start address for storing transmit data.</p> <p>TxBuffer: = ADR(&lt;Variable&gt;)</p> <p>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.</p> <p>Possible data types are inputs, outputs, markers and data function blocks.</p>
MaxSendData	<p>Maximum number of bytes to be transmitted. A maximum of 65536 bytes is possible.</p>
SelectBussystem	<p>1: The data handling function block works for the Profibus-DP fieldbus system.</p> <p>0: The data handling function block works for the CANopen fieldbus system</p>
MSBFirst	<p>Byte-swap</p> <p>1: LSB first</p> <p>0: MSB first</p>

## 5 Commissioning the Module in xSystem

### XION\_HTB\_RSXXX data handling function block

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 <sub>hex</sub> Everything OK. No error 8008 <sub>hex</sub> Parameter error 8010 <sub>hex</sub> Communication error: Hardware error 8020 <sub>hex</sub> Communication error: Data flow control error 8040 <sub>hex</sub> Communication error: Frame error 8080 <sub>hex</sub> Communication error: Module buffer overflow 8101 <sub>hex</sub> Size of the receive data telegram is greater than MaxRecvData. ==> Abort the data handling function block 8103 <sub>hex</sub> Size of the receive data packet does not equal 8. ==> Abort of the data handling function block 8201 <sub>hex</sub> Size of the transmit data telegram is greater than MaxSendData. ==> Abort the data handling function block 8203 <sub>hex</sub> Size of the transmit data packet does not equal 8. ==> Abort of the data handling function block

## 5 Commissioning the Module in xSystem XION\_HTB\_RSXXX 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.

## 5 Commissioning the Module in xSystem

### XION\_HTB\_RSXXX data handling function block

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