compatible with you

SAS 341

Serial Interface Module for S7-300

700-341-1AH02 / 700-341-1BH02 / 701-341-1CH02

700-341-2AH02 / 700-341-2BH02 / 701-341-2CH02

Manual

Edition 2 / 08.07.2010 HW1 & FW1.06 and higher

Order number of manual: 900-341-1XH02/en

Systeme Helmholz GmbH ● Hannberger Weg 2 ● D-91091 Grossenseebach ● Germany

Phone: +49 9135 7380-0 ● Fax: +49 9135 7380-110 ● E-mail: info@helmholz.de ● Internet: www.helmholz.com

Systeme Helmholz **GmbH**

Hannberger Weg 2, 91091 Grossenseebach, Germany

Note:

We have checked the content of this manual for conformity with the hardware and software described. Nevertheless, because deviations cannot be ruled out, we cannot accept any liability for complete conformity. The information in this manual is regularly updated. When using purchased products, please heed the latest version of the manual, which can be viewed in the Internet at www.helmholz.com, from where it can also be downloaded.

Our customers are important to us. We are always glad to receive suggestions for improvement and ideas.

Revision history of this document:

Edition	Date	Revision
1	30.4.2010	1st version
2	7.7.2010	added 2nd interface for SAS340-2

Contents

1 Safety Information

Please observe the safety information given for your own and other people's safety. The safety information indicates possible hazards and provides information about how you can avoid hazardous situations.

The following symbols are used in this manual.

Caution, indicates hazards and sources of error

Gives information

Hazard, general or specific

*Danger of **electric shock***

1.1 General

The SAS 341 module is only used as part of a complete system.

The operator of a machine system is responsible for observing all safety and accident prevention regulations applicable to the application in question.

During configuration, safety and accident prevention rules specific to the application must be observed.

Emergency OFF facilities according to EN 60204 / IEC 204 must remain active in all modes of the machine system. The system must not enter an undefined restart.

Faults occurring in the machine system that can cause damage to property or injury to persons must be prevented by additional external equipment. Such equipment must also ensure entry into a safe state in the event of a fault. Such equipment includes electromechanical safety buttons, mechanical interlocks, etc. (see EN 954-1, risk assessment).

Never execute or initiate safety-related functions using the operator terminal.

1.2 Restriction of access

Only authorized persons must have access to the modules!

The modules are open equipment and must only be installed in electrical equipment rooms, cabinets, or housings. Access to the electrical equipment rooms, barriers, or housings must only be possible using a tool or key and only permitted to personnel having received instruction or authorization. See also Section 2.

1.3 Information for the user

This manual is addressed to anyone wishing to configure or install the SAS 341 module.

It is intended for use as a programming manual and reference work by the configuring engineer. It provides the installing technician with all the necessary data.

The SAS 341 module is exclusively for use in an S7-300 programmable controller from Siemens. For that reason, the configuring engineer, user, and installing technician must observe the standards, safety and accident prevention rules applicable in the particular application. The operator of the automation system is responsible for observing these rules.

1.4 Use as intended

The SAS 341 module must only be used as a communication system as described in the manual.

1.5 Avoiding use not as intended!

Safety-related functions must not be controlled using the SAS 341 module alone.

2 Installation and Mounting

The SAS 341 module must be installed according to VDE 0100/ IEC 364. Because it is an “OPEN type” module, you must install it in a (switching) cabinet. Ambient temperature: 0 ºC – 60 ºC.

Before you start installation work, all system components must be disconnected from their power source.

*Danger of **electric shock**!*

During installation, application-specific safety and accident prevention rules must be observed.

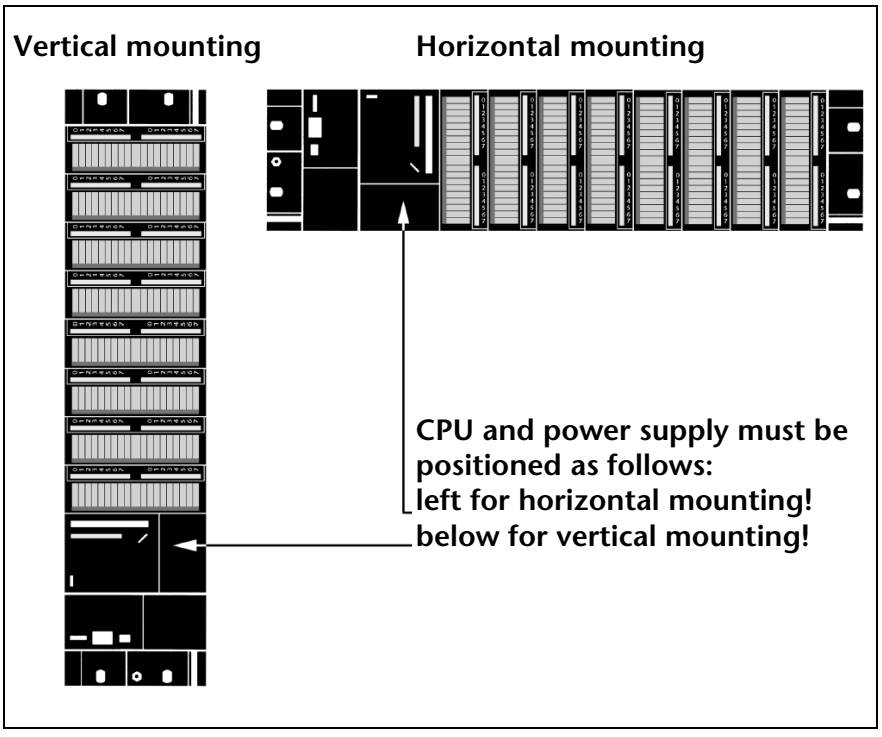
2.1 Vertical and horizontal mounting

The modules can be mounted either vertically or horizontally.

Permissible ambient temperature:

for vertical mounting: from 0 to 40 ºC

for horizontal mounting: from 0 to 60 ºC



2.2 Minimum clearance

Minimum clearances must be observed because

it ensures cooling of the SAS 341 modules

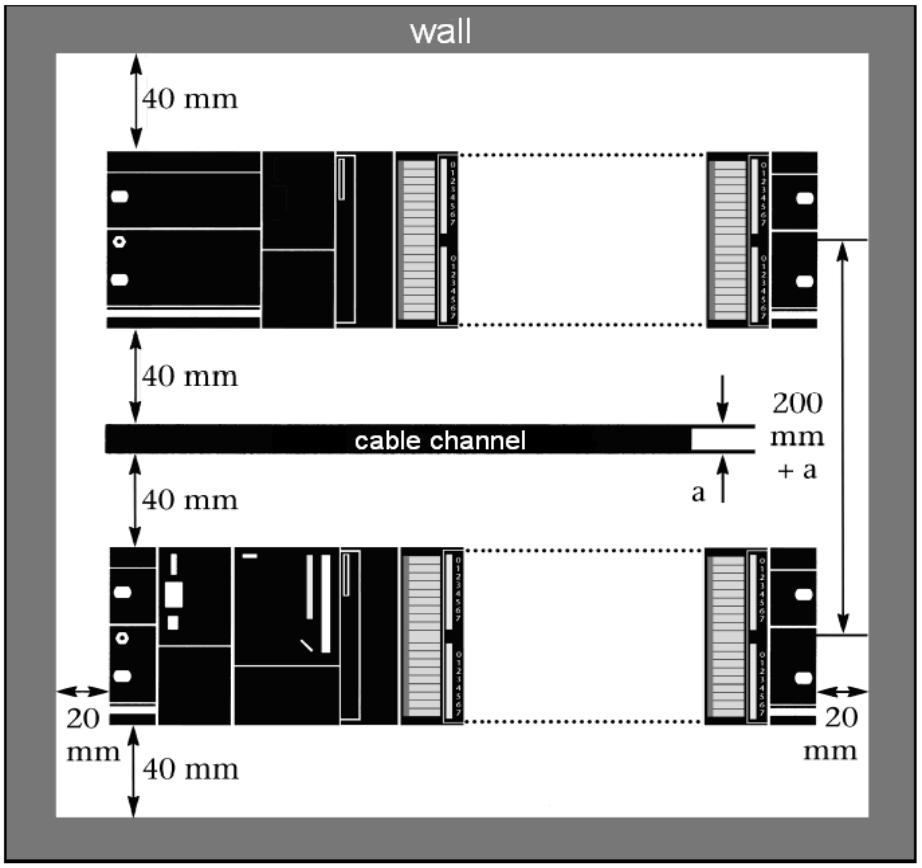
it provides space to insert and remove modules

it provides space to route cables

it increases the mounting height of the module rack to 185 mm, although the minimum spacing of 40 mm must still be observed

The following diagram shows the minimum spacing between the module racks and between these and any adjacent cabinet walls, equipment, cable ducts, etc. for S7-300s mounted in several module racks.

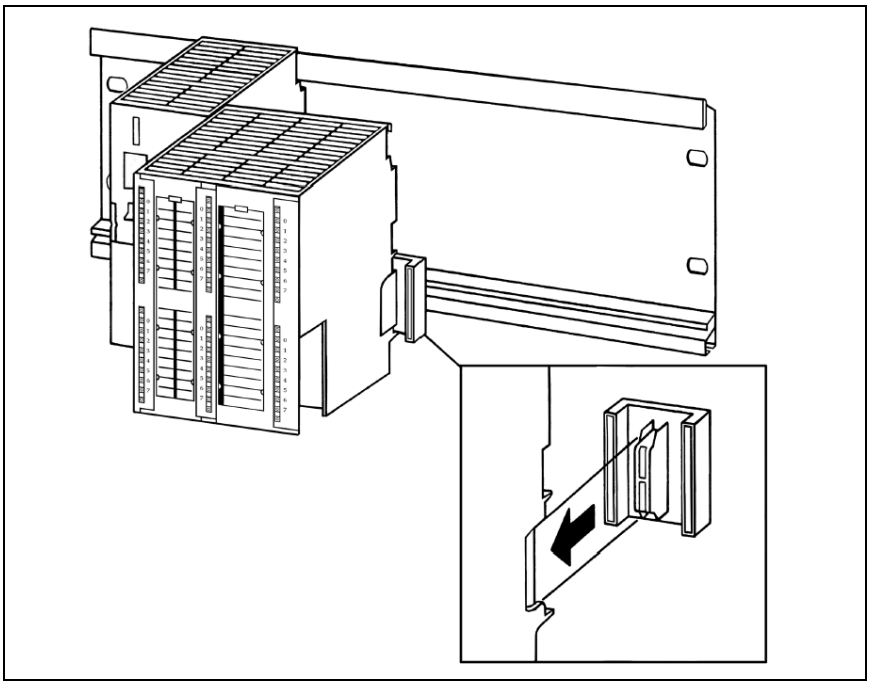
Non-observance of the minimum distances can destroy the module at high ambient temperatures!



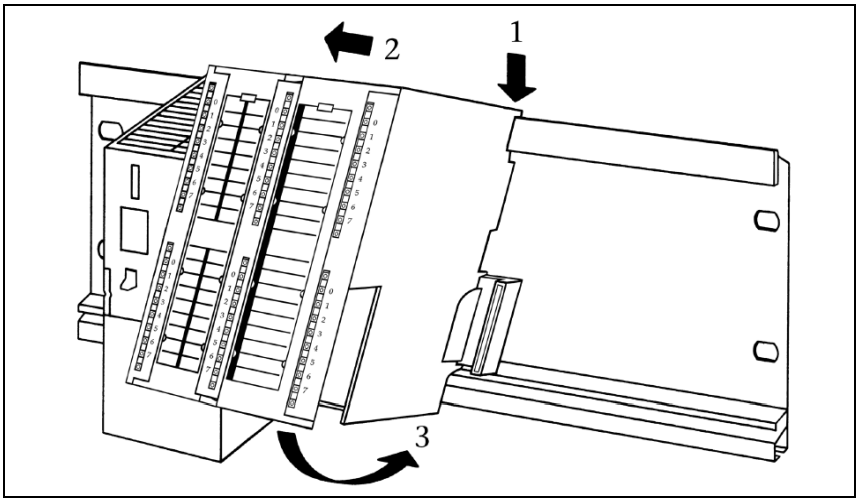
2.3 Mounting of the module on the DIN rail

A bus connector is included with each signal module but not with the CPU. When connecting the bus connector, always start with the CPU.

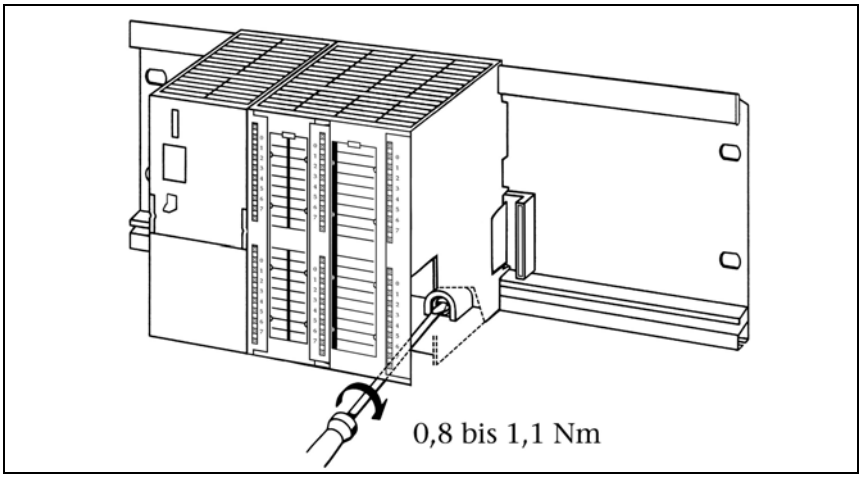
Take the bus connector off the last module and insert it into the CPU. Do not plug a bus connector into the last module of the tier.



Hook on the modules (1), slide them up to the left module, and click them downward (3).



Screw the modules on with a torque of 0.8 to 1.1 Nm.



3 System Overview

3.1 Areas of application

The SAS 341 is a serial communication module for use in Simatic S7-300 systems. The SAS 341 permits the linking to the PLC of serial devices, such as barcode scanners, operator terminals, serial printers, PCs, or PLCs of other manufacturers, and supports the ASCII, 3964R, and RK512 protocols.

The serial devices can be connected via RS232, TTY (20 mA), or RS422/RS485. The 9-way SUB D connector (15-way in the case of RS422/RS485) with standard pin assignment is provided for connecting communicating devices.

The additional USB interface (only in the case of SAS 341 with RS232) permits the connection of the PLC to PC systems, many of which no longer have a conventional RS232 port. A virtual COM port driver enables the use of software that still expects a COM port.

The module is parameterized in the Hardware Configurator of the PLC. Extended functions such as, for example, higher baud rates, can be activated with the data handling blocks without any problem. The data handling blocks supplied enable simple and flexible integration into the PLC.

The 2nd interface of the SAS 340-**2** can be used in full functionality as the first interface.

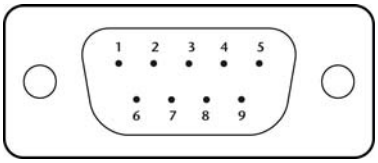
3.2 Differences between SAS 341 and CP 341

- Capacity of receive buffer is 4096 bytes instead of 1024 bytes
- Any number of frames can be received (until the receive buffer is full)
- “Printer” protocol not supported yet
- Diagnostics buffer in Hardware Configurator is not currently supported
- Identification data are currently not supported
- No alarm generation
- Use in the ET 200M is not yet possible

3.3 Interfaces

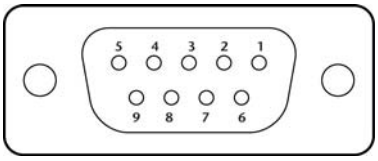
The SUB D connector is located behind the front cover of the SAS 341 module and is implemented as a 9-pin connector for RS232, a nine-way socket for TTY, and 15-way socket for RS422/RS485. The pin assignment is compatible with the Siemens CP 341 modules. The SAS 341 with RS232 interface also has a USB connector which can be used instead of the RS232 SUB D socket. When a USB cable is inserted, communication from the RS232 interface is redirected to the USB. The SUB D and the USB cannot be operated at the same time. A mini USB connector is provided for service tasks (update or diagnostics).

3.3.1 SUB D connector RS232 (700-341-1AH02 / -2AH02)



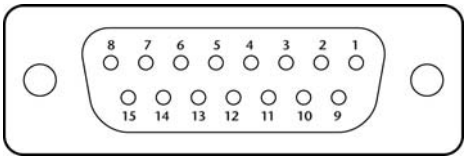
Pin	Designation		Direction	Description
1	DCD	Data Carrier Detect	Input	Carrier signal (modem)
2	RxD	Receive Data	Input	Receive line
3	TxD	Transmit Data	Output	Transmit line
4	DTR	Data Terminal Ready	Output	ON = SAS is ready
5	GND	Signal ground	-	Zero reference level
6	DSR	Data Set Ready	Input	Communication partner ready?
7	RTS	Request to send	Output	ON = SAS ready to transmit, OFF = nothing to transmit
8	CTS	Clear to send	Input	Communication partner ready to receive?
9	RI	Ring indicator	Input	Ring tone (modem)

3.3.2 SUB D socket TTY (700-341-1BH02 / -2BH02)



Pin	Designation	Direction	Description
1	TxD -	Output	Transmit data -
2	20mA -	Input	5V ground
3	20mA + (I1)	Output	20mA current generator 1
4	20mA + (I2)	Output	20mA current generator 2
5	RxD +	Input	Receive data +
6	-	-	-
7	-	-	-
8	RxD -	Output	Receive data -
9	TxD +	Input	Transmit data +

3.3.3 SUB D socket RS422/RS485 (700-341-1CH02 / -2CH02)



Pin	Designation	Direction	Description
1	-	-	
2	T (A)	Output	Transmit data (four-wire operation)
3	-	-	
4	R (A) / T (A)	Input / Input/Output	Receive data (four-wire operation) Receive/Transmit data (two-wire operation)
5	-	-	
6	-	-	
7	-	-	
8	GND	-	
9	T (B)	Output	Transmit data (four-wire operation)
10	-	-	
11	R (B) / T (B)	Input / Input/Output	Receive data (four-wire operation) Receive/Transmit data (two-wire operation)
12	-	-	
13	-	-	
14	-	-	
15	-	-	

3.4 LED displays

The LEDs on the front of the module inform you about the operating state of the SAS 341.

LED "SF" (orange):
System error: indicates incorrect parameterization.

LED "Bus Failure" (red):
This LED indicates an error at the serial interface (e.g. parity, framing, overflow).

LED "RX" (green):
Receive active: indicates that a character is being received at the serial interface.

LED "TX" (orange):
Transmit active: indicates that a character is being transmitted at the serial interface.

LED "CPU" (orange):
Data transmission to the PLC active: indicates transmission of data or commands on the backplane bus (between the S7-CPU and the module).

LED "ON" (green):
indicates that the module is correctly supplied with power and that the operating system is running.

If the PLC is in the stop state, the LED flashes.

The LEDs at the SAS 340-2 right side inform you about the 2nd interface state:

LED "Bus Failure" (red):
This LED indicates an error at the 2nd serial interface (e.g. parity, framing, overflow).

LED "RX" (green):
Receive active: indicates that a character is being received at the 2nd serial interface.

LED "TX" (orange):
Transmit active: indicates that a character is being transmitted at the 2nd serial interface.

3.5 Items supplied

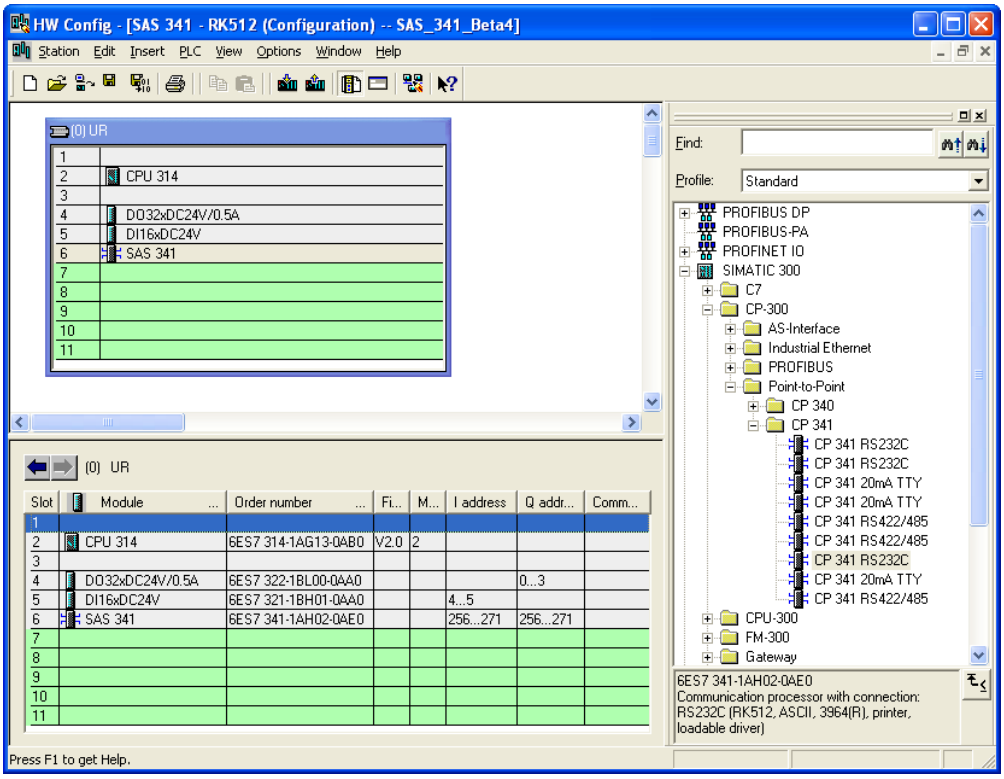
Module SAS 341, CD with data handling blocks, bus connector

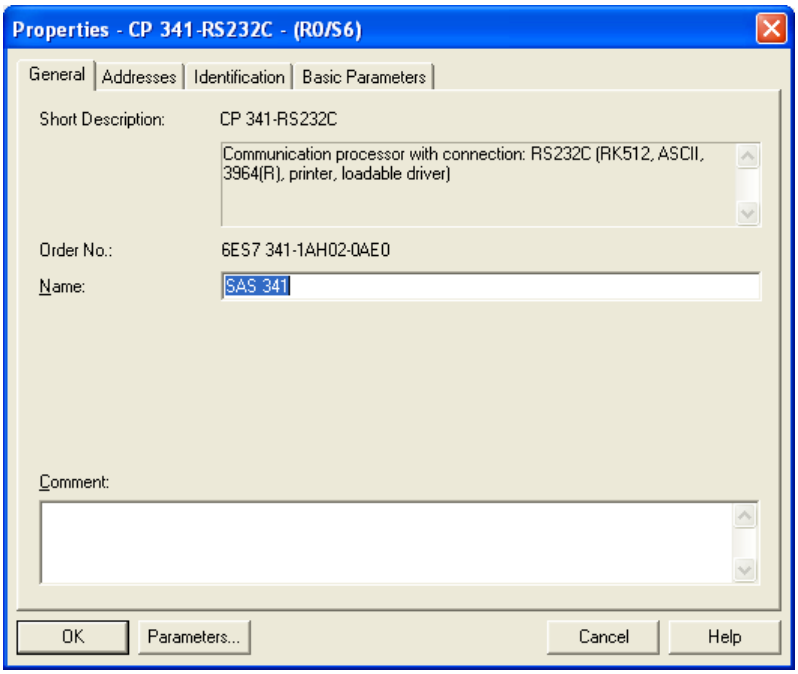
3.6 Accessories

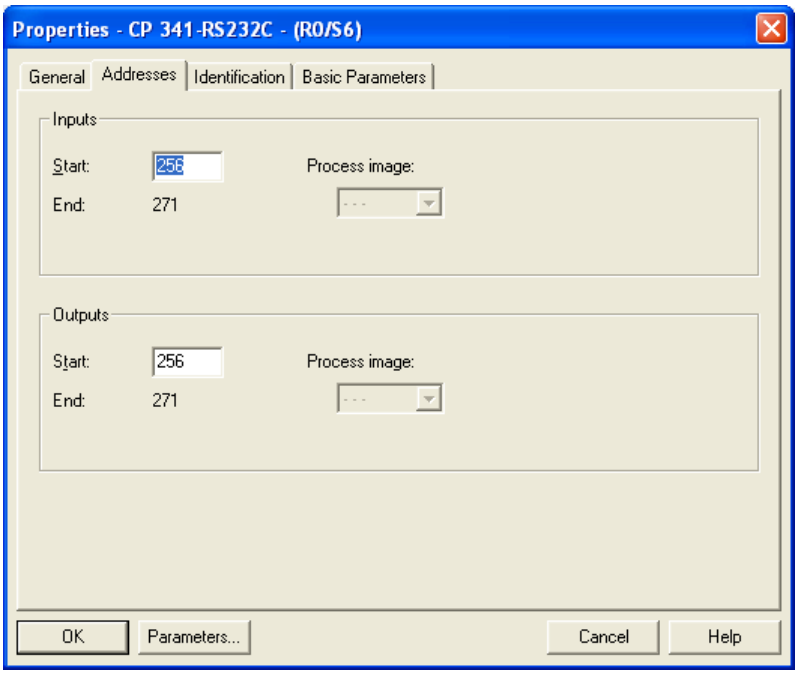
Manual, German/English	900-341-1XH02

4 Configuring the module

The SAS 341 module is configured in the programming software of the PLC as a CP 341 communication module (6ES7-341-1AH02, -1BH02, -1CH02). Use the same CP modules for the SAS 341-2.





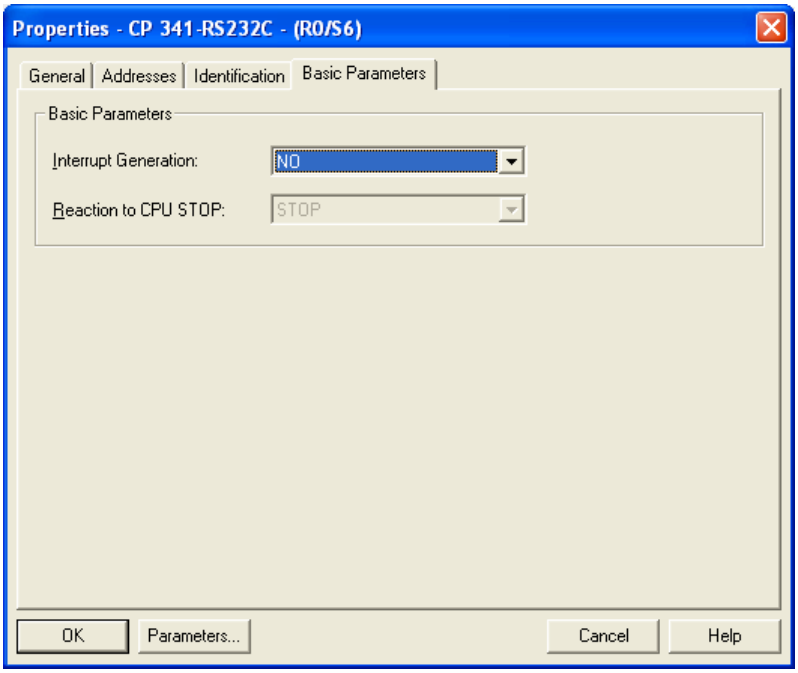


Only the input addresses are used in the data handling blocks; the output addresses have no relevance to the function.

Access to the input I/Os can only be performed with the I/O direct access commands: L PIB, L PIW.

In the case of the CPU 318, the I/O addresses must be outside the cyclic process image.

The settings on the “Identification” and “Basic Parameters” tab cards have no meaning as these functions are not supported.



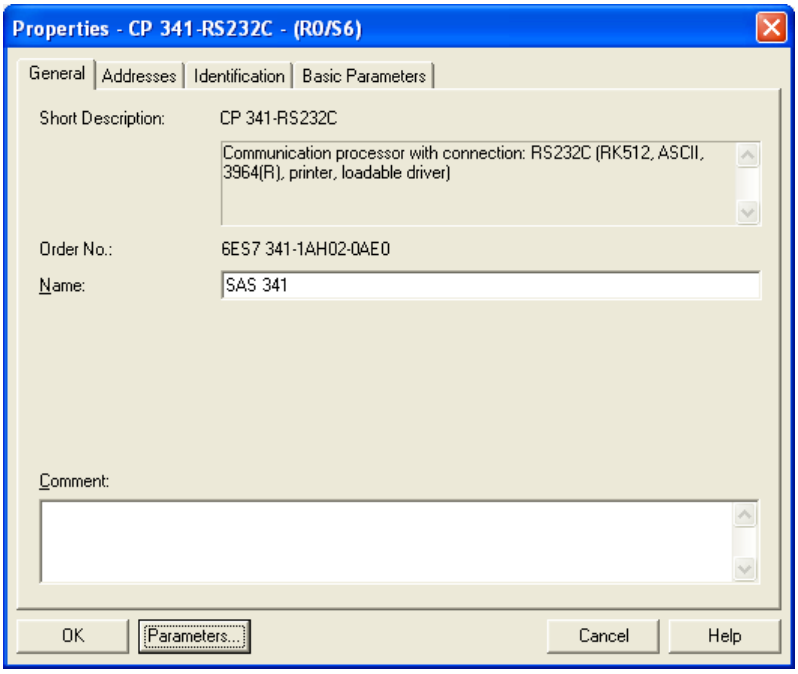
5 Setting the parameters of the module

To continue setting the parameters of the procedures, the parameterization interface “CP341: Parameterize point-to-point link” (PtP Param V5.1 SP10 and higher) in STEP 7 must first be installed.

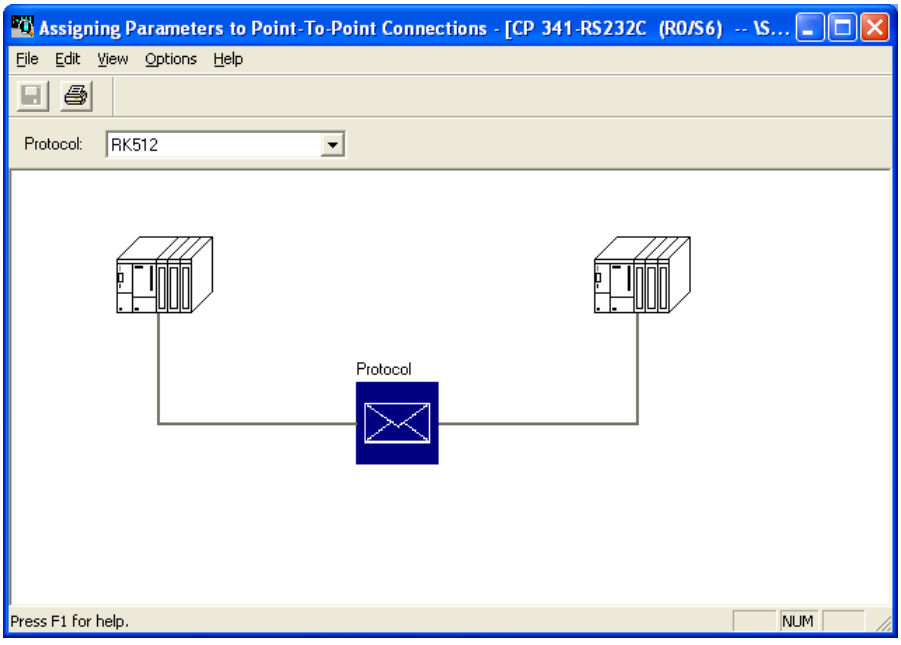
The software can be downloaded from Siemens here:

http://support.automation.siemens.com/WW/view/de/27013524

Once the software has been installed, the “Parameter...” button in the “Properties” dialog box of the hardware manager is activated, which takes you to the parameterization of the module.



Click the “Parameter…” button to open the separate parameterization interface.



All the settings you make on the parameterization interface are stored in the project and transferred to the CPU for the SAS 341 during the hardware download.

The “Firmware Update” function in the “Options” menu of the parameterization interface is not supported. Please use the supplied SHTools software to update the firmware of the SAS 341.

5.1 Specifics using the second interface (SAS 340-2)

The parameterization is generally carried out for both interfaces, i.e. the second interface is set to the same protocol and the same parameters as the first interface.

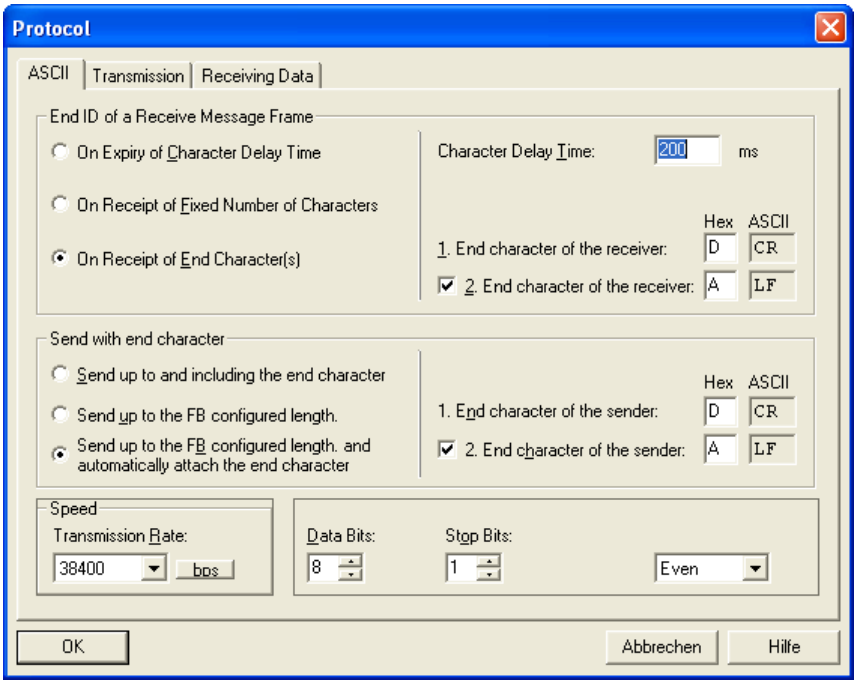
Using the function block FB 10 „Config“ (chapter 6.3.5) in the Restart OB 100 in the PLC the parameters of each interface can be changed selectively.

Different protocols on the two interfaces are currently not supported.

5.2 ASCII procedure

5.2.1 Procedure settings

The SAS 341 uses three methods for detecting that a frame is complete (“end of frame ID”).



1. On expiry of character delay time:

A data frame is considered complete if a receive gap occurs after a character. The time of the receive gap can be parameterized. It must also be ensured that the communication partner reliably observes the time between two frames.

2. On receipt of fixed number of characters:

This receive method can be used if the communication partner always sends frames of the same length. Here, too, the character delay time can be used for monitoring interrupted transmission.

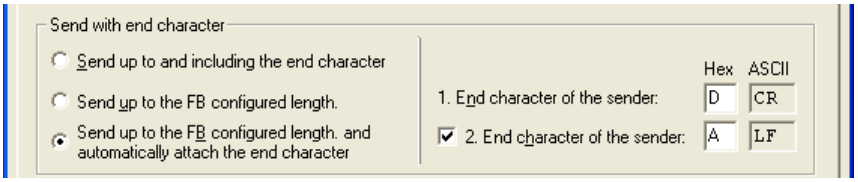
The character delay time can also be used for monitoring interruption of transmission.

3. On receipt of the end-of-frame character(s):

A data frame is considered complete as soon as one or two particular characters are received. Any characters can be parameterized as end characters. However, these end characters must not occur in the data as otherwise transmission will be terminated prematurely.

This receive method is useful, for example, for the serial transmission of texts that end a line with CR+LF (Carriage Return+Line Feed). Here, each line is read into the PLC as a separate frame. The character delay time can also be used for monitoring interruption of transmission.

There are also three methods of transmitting:



1. Send up to and including the end-of-frame character:

All characters that are transferred with the FB from the PLC to the SAS 341 are transmitted when the end-of-frame character or characters are detected. The end-of-frame character or characters are also transmitted.

2. Send up to the length configured on the FB:

All characters that are transferred with the FB from the PLC to the SAS 341 are transmitted.

3. Send up to the length configured on the FB and automatic attach the end-of-frame character:

All characters that are transferred with the FB from the PLC to the SAS 341 are transmitted. Following this, the SAS 341 will automatically append the end-of-frame character or characters.

Speed/transmission rate/character frame: Definition of the transmission rate (300 bauds to 115 Kbauds) and the character frame (data bits/stop bits/parity).

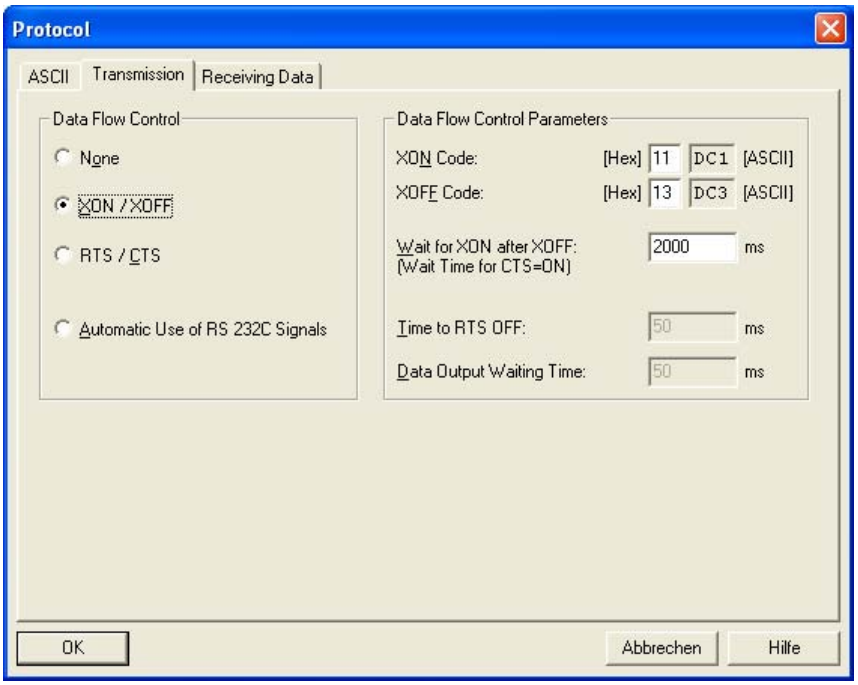
These settings can also be set in the restart OB with the PLC with the FB 10 “CONFIG” (see Sec. 6.3.5). The setting in this dialog box is then ignored.

5.2.2 Data flow control

In order to signal that a communication partner is ready for operation or to receive, the following mechanisms for data flow control can be activated, if necessary:

XON/XOFF:

With the XON/XOFF method, two freely definable control characters to stop and enable readiness to receive data are used.



The XON/XOFF characters used must not occur in the data stream. This procedure is therefore only suitable for transmission of ASCII data. The procedure is frequently used to address printers.

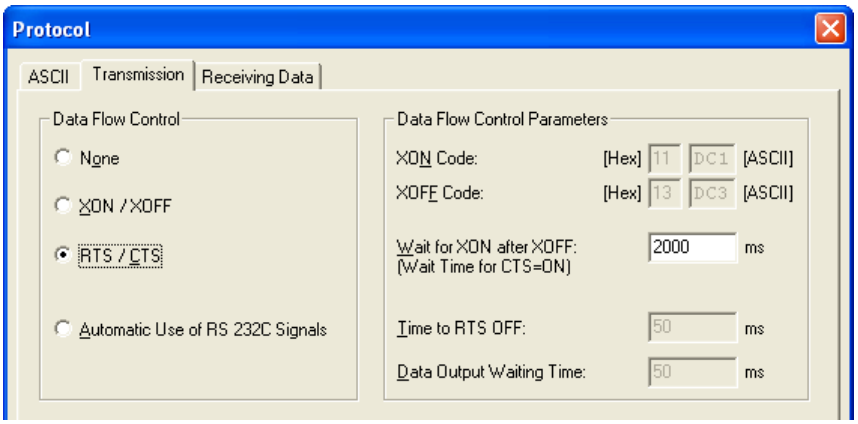
A monitoring time for enabling transmission after XOFF can be parameterized. If the delay time elapses, the transmit request is acknowledged to the PLC with an error and aborted.

RTS/CTS:

In this procedure, the RS232 C (V24) status signals RTS (“request to send”) and CTS (“clear to send”) are used. A communication partner signals that it is ready to send by setting an RTS output, which is than detected via the CTS input.

The RTS signal can be controlled by the PLC with FB 6 “V24_SET” (see also Section 6.3.4). The CTS input status can be monitored in the I/O image.

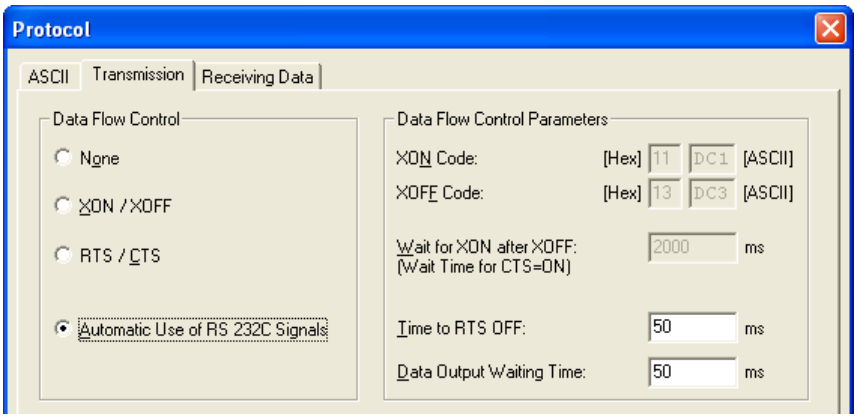
In this mode, the SAS 341 waits for a CTS to be set (RTS of the communication partner) before sending data.



A monitoring time for enabling transmission after setting the RTS can be parameterized. If the delay time elapses, the transmit request is acknowledged to the PLC with an error and aborted.

Automatic operation of the RS232 C (V24) signals:

This method uses the RS232 C (V24) status signals RTS/CTS and DTR/DSR, which are controlled by the SAS 341 fully automatically.

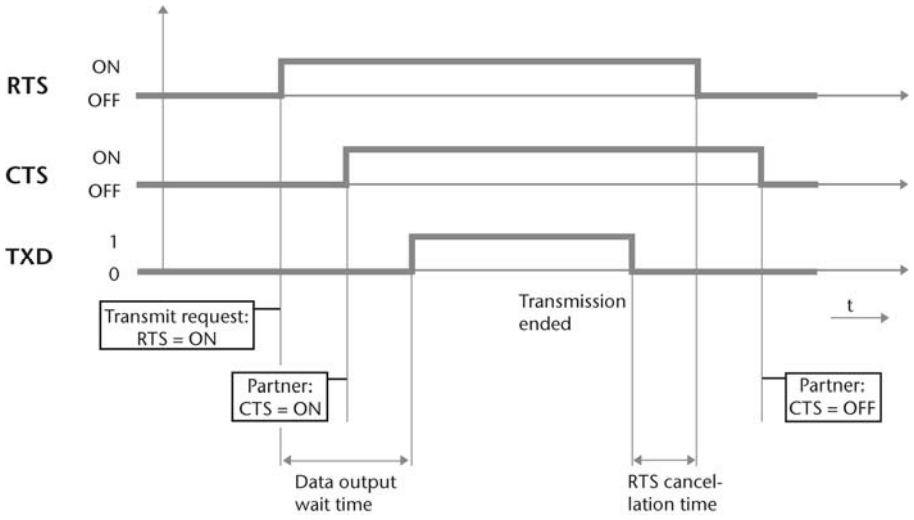


As soon as the SAS 341 is ready, the DTR output (“data terminal ready”) is set. The RTS output remains switched off. The SAS 341 waits for a positive signal from the communication partner at the DSR input ("data set ready") to detect that it is ready.

Once data have been transmitted, an RTS/CTS handshake is executed for this data transmission.

The RTS output is switched on by the sender, which waits for the parameterized “data output delay time.” If the ready to receive state of the partner is detected at the CTS input during this time, the data are transmitted. The CTS input is permanently monitored

As soon as data transmission is complete, the sender waits for the “RTS cancel time” and then switches off the RTS output. The communication partner now also switches off its RTS, which the SAS 341 waits for.

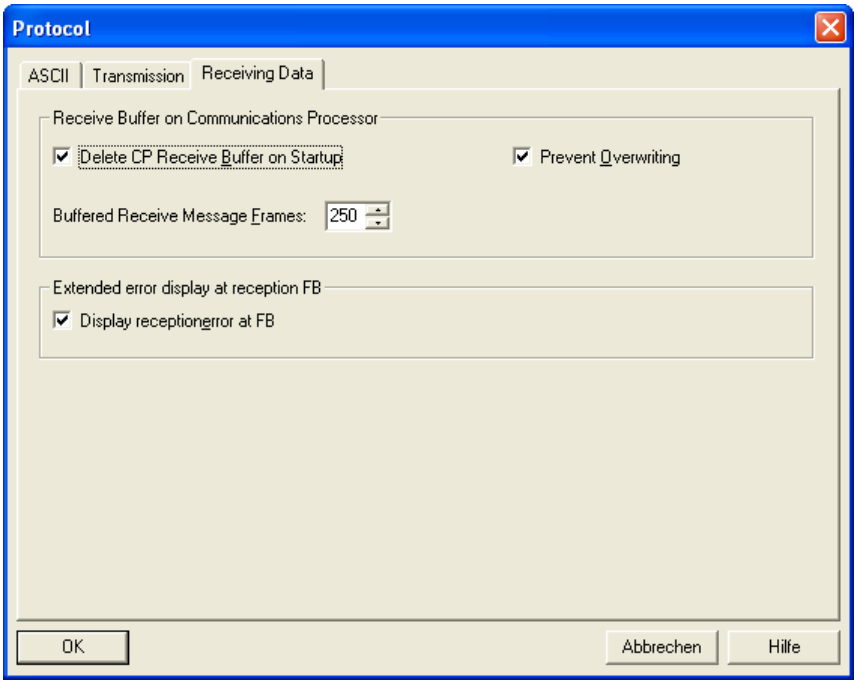


This data flow check mechanism is used in both directions and assumes that both communications partners support it in the same way.

Unlike the XON/XOFF procedure, if RS232 C (V24) status signals are used for data flow control, it is possible to transmit data transparently.

5.2.3 Receiving Data receipt

The SAS 341 has a receive buffer of 4096 bytes. The SAS 341 can continue receiving frames until the buffer is full.



An exception to this rule is the setting “Buffered receive message frames = 1.” In this case only one frame is received irrespective of the buffer size. Using the setting "Prevent overwriting" it is possible to define whether the received frame or the old frame is rejected.

Even if the setting "Buffered receive message frames = 1," more frames can still be transmitted to the PLC!

Note: Option setting “Buffered receive message frames = 1” could mean that one frame is still being transmitted to the PLC (backplane bus) and one frame is in the ring buffer. As soon as reception is enabled again in the PLC program it is possible that 2 frames will be transferred.

The “Delete CP receive buffer on start-up” option has no effect. The SAS 341 always clears the receive buffer during start-up. The transmit buffer is also always cleared on start-up.

The transmit and receive buffer is always cleared on start-up!

The “Show receive errors on the FB” option has no effect. The SAS 341 always passes receive errors to the FBs.

5.3 3964R procedure

5.3.1 Description of procedure

Procedure 3964R uses a data link layer with control characters to transfer data (frames) between two communication partners.

The following control characters are used:

STX (0x02) = Start of Text - Beginning of the frame to be transmitted

DLE (0x10) = Data Link Escape – Special character for switching between control character and data character

ETX (0x03) = End of Text – End of the frame being transmitted

BCC (0x*XX*) = Block check Character – checksum of the frame

NAK (0x15) = Negative Acknowledge – negative acknowledgment

5.3.2 Sequence of the protocol

Active partner	Character	Passive partner
	STX	→
	Monitor acknowledgment delay time	
←	DLE	
	Frame data	→
	DLE	→
	ETX	→
	BCC	with 3964R only →
	Monitor acknowledgment delay time	
←	DLE	

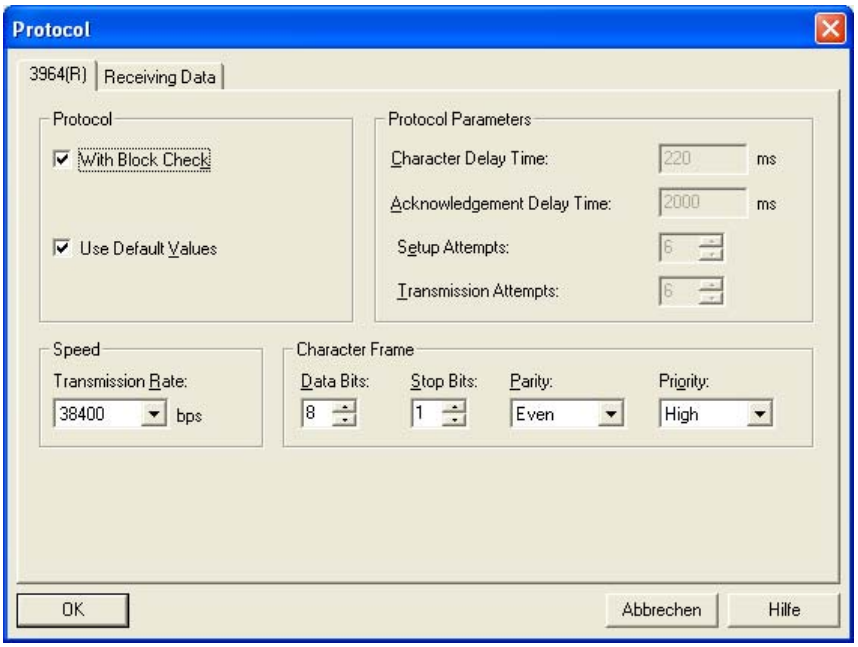
Note:

If the character DLE (0x10) is contained in the data in the frame, it is sent twice (DLE duplication). This allows it to detect whether a connection is being established or disconnected!

5.3.3 Block Check Character (BCC)

The checksum BCC is the result of EOR-gating all data bytes of the frame including end of frame (DLE, ETX).

5.3.4 Parameterization



With block check: A block check character is appended to the end of a frame so that the receiving partner can check the frame for transmission errors.

Use default values: The protocol parameters are set to default values

Character delay time: While frame data are being received (after connecting), the character delay time between two characters is monitored.

Acknowledgment Dely: The acknowledgment time is monitored while a connection is being established (after character STX) and at the end of the frame.

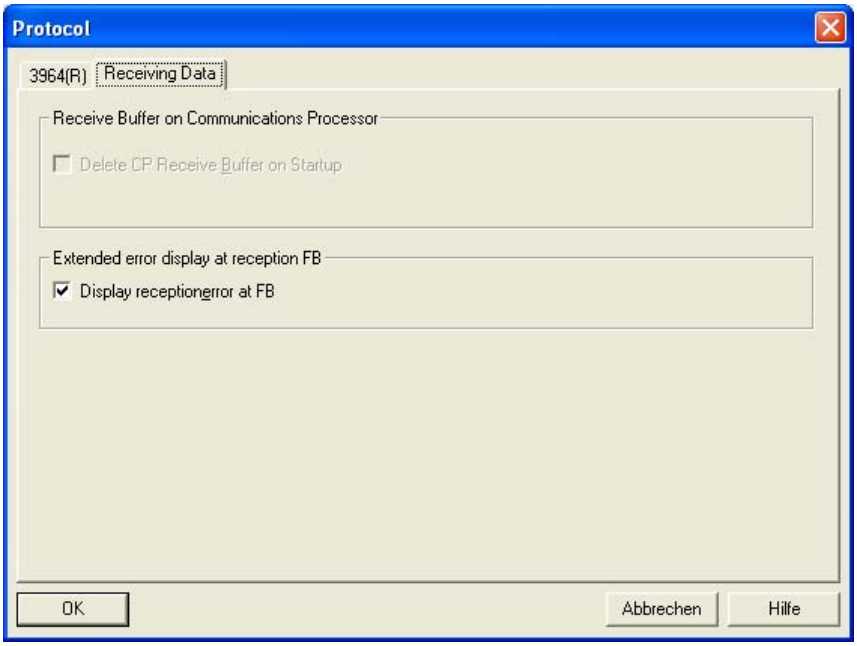
Setup attempts: Number of attempts to establish a connection with the communication partner, i.e. number of times character STX is transmitted.

Transmission attempts: Number of attempts to repeat transmission when a fault occurs during transmission.

Speed/transmission rate/character frame: Definition of the transmission rate (300 bauds to 115 Kbauds) and the character frame (data bits/stop bits/parity).

These settings can also be set in the restart OB with the PLC with the FB 10 “CONFIG” (see Sec. 6.3.5). The setting in this dialog box is then ignored.

5.3.5 Receive buffer for 3964R



The SAS 341 has a receive buffer of 4096 bytes. The SAS 341 can continue receiving frames until this buffer is full.

The transmit and receive buffer is always cleared on start-up!

The transmit and receive buffer is always cleared on start-up.

The “Displaya receptionerror at FB” option has no effect. The SAS 341 always passes receive errors to the FBs.

5.4 RK512 protocol

5.4.1 Protocol description

The RK512 protocol is used for computer linking between an SAS 341 and a communication partner. It controls the direct transmission of PLC data, such as inputs, outputs, flags, data words. As the data link layer, the 3964R protocol is always used on the RK512.

The RK512 protocol uses different types of frame:

Command frame:

The command frame is the beginning of a data transmission. It contains a frame header and, when data are transmitted, also the data. The frame header contains the type of request (SEND, FETCH), the destination address and the data length.

Response frame:

The communication partner must respond to each command frame with a response frame. The response frame contains a 4-byte header in which an error number may be contained (0x00 = no error). If data are requested from the communication partner, the response frame will contain the requested data.

Follow-up frame / follow-up response frame:

With the RK512 protocol, only 128 bytes useful data (gross) can be transmitted per frame. If more than 128 bytes have to be transmitted in a request, follow-up frames will be transmitted.

5.4.2 Structure of SEND frames

The RK512 frame header of a **SEND command frame** consists of 10 bytes with the following structure:

Byte	Contents		Description	Special aspects
1	0x00		Command frame	
2	0x00		Frame identifier	
3	'A'		SEND request with a destination DB	
	'O'		SEND request with a destination DX	
4	'D'		SEND to data block	
5	DB number		Data destination data block number	
6	DW number		Data destination offset data word	FB "offset" is a byte offset, it is rounded down to a word
7	Length		Length in numbers of words	FB is bytes: Only an even number of bytes can be transmitted, it is rounded up
8				
9	Interprocessor communication flag byte		Byte number of the interprocessor communication flag	0xFF for deactivate
10	CPU	KM bit	Bit 0..3: Interprocessor communication bit, Bit 4..7: Destination CPU number	0x0F for deactivate
11…	Data		Up to 128 bytes (gross) useful data	

Special case:
A SEND request can only be sent to a data block (DB) or extended data block (DX).

Response frame to a SEND request:

Byte	Contents	Description	Special aspects
1	0x00 / 0xFF	Response (follow-up) frame	
2	0x00	Frame identifier	
3	0x00	Identification response frame	
4	0x00 / 0xXX	Acknowledgment / error number	0x00 = no error

Follow-up frame for more than 128 bytes of useful data:

Byte	Contents	Description	Special aspects
1	0xFF	Follow-up frame identification	
2	0x00	Frame identifier	
3	'A' / 'O'	SEND request	
4	'D'	SEND to data block	
5…	Further data	Up to 128 bytes (gross) useful data	

5.4.3 Structure of FETCH frames

The RK512 frame header of a **FETCH command frame** consists of 10 bytes with the following structure:

Byte	Contents		Description		Special aspects
1	0x00		Command frame		
2	0x00		Frame identifier		
3	'E'		FETCH request		
4	'D'		FETCH data block		
	'X'		FETCH extended data block		
	'M'		FETCH flag		
	'E'		FETCH inputs		
	'A'		FETCH outputs		
	'T'		FETCH timer cells		
	'Z'		FETCH counter		
5	DB number	0x00	Data block number	0x00	
6	DW number	Offset	Offset data word	Byte offset (M,E,A), number (T,Z)	FB "offset" is a byte offset in the case of data blocks; it is rounded down to a word
7 8	Length		Length in number of words (DB, DX, T, Z) or number of bytes (M, E, A)		
9	Interprocessor communication flag byte		Byte number of the interprocessor communication flag		0xFF for deactivate
10	CPU	KM bit	Bit 0..3: Interprocessor communication bit, Bit 4..7: Destination CPU number		0x0F for deactivate

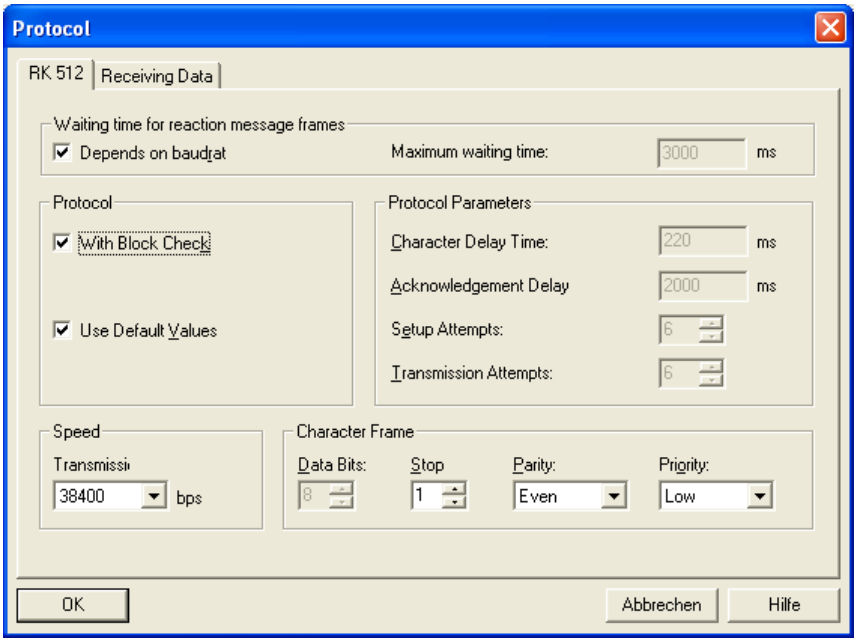
Response frame to a FETCH request:

Byte	Contents	Description	Special aspects
1	0x00 / 0xFF	Response (follow-up) frame	
2	0x00	Frame identifier	
3	0x00	Identification response frame	
4	0x00 / 0xXX	Acknowledgment / error number	0x00 = no error
5…	Data	Up to 128 bytes (gross) useful data	

Follow-up frame (request) for more than 128 bytes of useful data:

Byte	Contents	Description	Special aspects
1	0xFF	Follow-up frame identification	
2	0x00	Frame identifier	
3	'E'	FETCH request	
4	D, X ,M, E, A, T ,Z	FETCH source	

5.4.4 Parameterization



Waiting time for response frame:

With block check: A block check character is appended to the end of a frame so that the receiving partner can check the frame for transmission errors.

Use default values: The protocol parameters are set to default values

Character delay time: While frame data are being received (after connecting), the character delay time between two characters is monitored.

Acknowledgment delay: The acknowledgment time is monitored while a connection is being established (after character STX) and at the end of the frame.

Setup attempts: Number of attempts to establish a connection with the communication partner, i.e. number of times character STX is transmitted.

Transmission attempts: Number of attempts to repeat transmission when a fault occurs during transmission.

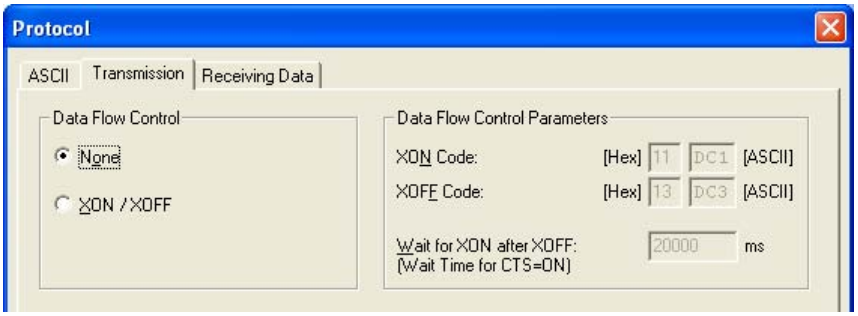
Speed/transmission rate/character frame: Definition of the transmission rate (300 bauds to 115 Kbauds) and the character frame (data bits/stop bits/parity).

These settings can also be set in the restart OB with the PLC with the FB 10 “CONFIG” (see Sec. 6.3.5). The setting in this dialog box is then ignored.

Priority: If both communication partners start transmission at the same time, the priority decides which is permitted to execute its request immediately (priority = high) and which must postpone its request (priority = low).

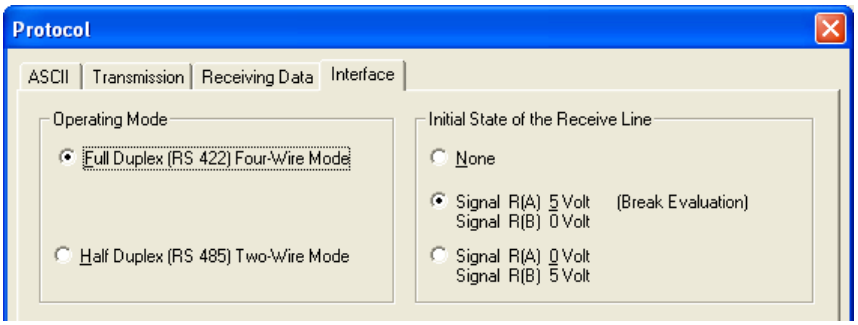
5.5 Special aspects of TTY parameterization

The SAS 341 with TTY does not support any status signals for flow control.

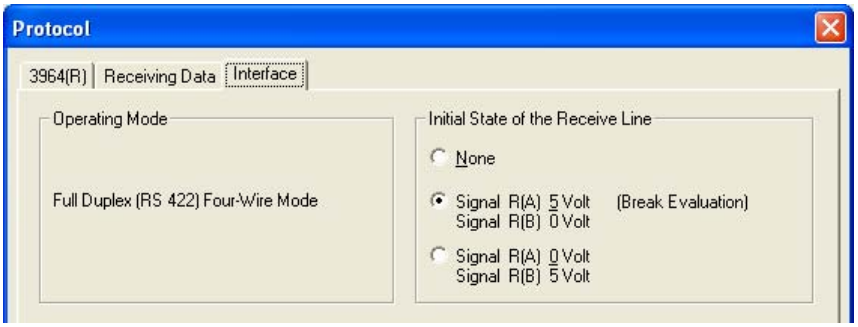


5.6 Special aspects of RS422/485 parameterization

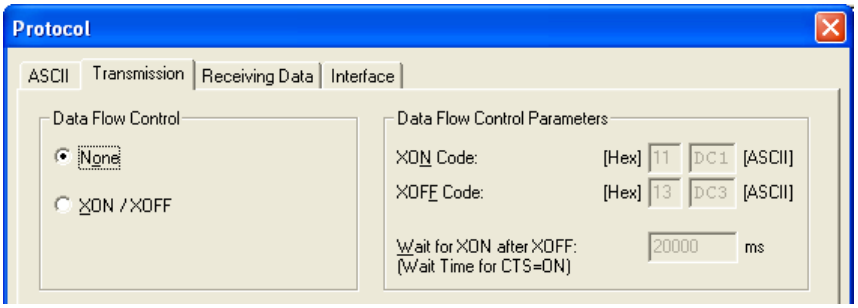
The SAS 341 with RS422/485 can neither be operated in RS 422 four-wire or in RS485 two-wire operation with the ASCII protocol.



Only four-wire operation is supported by the 3964R and RK512 protocol.



The SAS 341 with RS422/485 does not support any status signals for flow control.



6 Programming in the PLC

6.1 Overview

The SAS 341 module is programmed in the PLC using the data handling blocks contained in the software package.

The functions and call parameters of the data handling blocks are based on the Siemens CP341 data handling blocks.

The following blocks are available for communication:

FB 7	**Receive_RK**	Receive data
FB 8	**Send_RK**	Transmit data
FC 5	**V24_STAT**	Query status signals for RS232
FB 6	**V24_SET**	Set status signals for RS232
FB 10	**CONFIG**	Set interface parameters

The FBs Receive_RK and Send_RK must only be called once per SAS module in the user program!

Requests that can be processed simultaneously:

In the user program only one FB Receive_RK and one FB Send_RK may be programmed and only one instance DB may be used for each SAS 341 used.

6.2 I/O data in the PLC

The SAS 341 module occupies 16 bytes in the input and output I/O area of the PLC. The content of the output range is not used.

The content of the input range can be used for information purposes by the user in the application.

Byte	Meaning
0	General module status, group error display
1	Status signals channel 1
2	FIFO status channel 1
3	Error bits channel 1
4	Active protocol channel 1
5	Status signals channel 2
6	FIFO status channel 2
7	Error bits channel 2
8	Active protocol channel 2
9	*reserved*
10	*reserved*
11…15	*used internally*

The input image can only be accessed with the I/O direct access commands: L PIB, L PIW.

Bytes 5, 6, and 7 are only assigned data that can be evaluated on SAS modules with two interfaces (SAS 341-2).

6.2.1 Byte 0: Module status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 1 = module present	0 = SAS 340 1 = SAS 341	0 = 1 port 1 = 2 ports	0	0	Group error channel 2	Group error channel 1	Module parameterized and running

Bit 0: The SAS 341 module is ready for operation.

Bit 1+2: Group error of the channels.

Bit 5: Number of channels (0 = 1 channel, 1 = 2 channels)

Bit 6: Type ID of module (0 = SAS 340 / 1 = SAS 341)

Bit 7: Bit is always set for detection of the module if the SAS 341 has started correctly.

6.2.2 Byte 1/5: Status signals channel 1/2

Bit 7	Bit 6	Bit 5	Bit 4
0	BREAK detected (In)	RI Ring Indicator (In)	DCD Data Carrier Detect (In)

Bit 3	Bit 2	Bit 1	Bit 0
DTR (Out)	DTR (Out)	CTS (In)	RTS (Out)

6.2.3 Byte 2/6: FIFO status bits channel 1/2

Bit 7	Bit 6	Bit 5	Bit 4
0	0	Send FIFO half full	Send FIFOs completely empty

Bit 3	Bit 2	Bit 1	Bit 0
0	0	Receive FIFO half full	Receive FIFOs completely empty

6.2.4 Byte 3/7: Error bits channel 1/2

Bit 7	Bit 6	Bit 5	Bit 4
Protocol CRC error	0	Send FIFO overflow	Receive FIFOs overflow

Bit 3	Bit 2	Bit 1	Bit 0
0	Interface overflow	Parity error	Framing error

6.2.5 Byte 4/8: Active protocol channel 1/2

0x30 = ASCII

0x31 = 3964R

0x20 = RK512

6.3 Data handling blocks

6.3.1 FB 7 Receive_RK

The function block FB 7 – Receive_RK fetches received frames from the SAS 341 into the PLC. On each call, a frame or an error message is fetched from the module.

Parameter	Direction	Type	Function
EN_R	IN	BOOL	Enable for reading data
R	IN	BOOL	Reset the receive function
LADDR	IN	INT	Base address of SAS 341
Chan	IN	INT	Channel number (1 or 2)
Dest	IN	ANY	Pointer to data range for received frames
L_TYP	OUT	CHAR	Destination/source on local CPU: 'D' = data block; 'M' = marker; 'E' = inputs; 'A'=outputs
L_NO	OUT	INT	Data block number source/destination (for type 'D' only)
L_OFFSET	OUT	INT	Data byte number source/destination
L_CF_BYT	OUT	INT	Interprocessor flag byte on local CPU
L_CF_BIT	OUT	INT	Interprocessor flag bit on local CPU
NDR	OUT	BOOL	Request completed without errors, data available
Error	OUT	BOOL	Request complete with errors
Len	OUT	INT	Length of received frame
Status	OUT	INT	Error number on *Error* (see Section 6.6)

To allow reception, parameter, **EN_R** must be statically set to 1. Parameter **EN_R** must be set permanently to 1 for as long as the receiving is desired.

The receive bit **NDR**, the length information **Len**, the error bit **Error,** and the error number **Status** are only available for one cycle and must therefore be evaluated immediately.

Setting the **R** operand resets any current and completed receive operations, the receive buffer of the SAS 341 is cleared.

The parameters **L_TYP, L_NO, L_OFFSET, L_CF_BYT, L_CF_BIT** contain the information from the RK512 frame header. The parameters are output only if a RK512 frame is processed completely for one cycle. If the SAS 341 is used with the ASCII or 3964(R) protocol, these parameters have no function.

Call example for RK512:

```
RCV:  CALL  FB     7 , DB7
       EN_R    :=M11.0
       R       :=M11.6
       LADDR   :=256
       Chan    :=1
       Dest    :=P#DB21.DBX0.0 BYTE 500
       L_TYP   :=MB31
       L_NO    :=MW32
       L_OFFSET:=MW34
       L_CF_BYT:=MW36
       L_CF_BIT:=MW38
       NDR     :=M11.1
       Error   :=M11.7
       Len     :=MW12
       Status  :=MW24

      A     M     11.1
      JC    NDR            // Process receipt
```

Call example for ASCII and 3964(R):

```
RCV:  CALL  FB     7 , DB7
       EN_R    :=M11.0
       R       :=M11.6
       LADDR   :=256
       Chan    :=1
       Dest    :=P#DB21.DBX0.0 BYTE 500
       L_TYP   :=
       L_NO    :=
       L_OFFSET:=
       L_CF_BYT:=
       L_CF_BIT:=
       NDR     :=M11.1
       Error   :=M11.7
       Len     :=MW12
       Status  :=MW24

      A     M     11.1
      JC    NDR            // Process receipt
```

Examples of the ANY pointer:

P#DB 21.DBX 0.0 BYTE 200 copies the data into the data block 21 from DBB 2 to max. DBB 199 (200 bytes).

P#M 100.0 BYTE 50 Copies the data into the marker memory area from MB 100 to max. MB 149 (50 bytes). For this purpose, the maximum memory size of the marker memory of the selected PLC must be taken into consideration.

6.3.2 FB 8 Send_RK

The FB 8 – Send_RK function block can be used both for the RK512 protocol and for the ASCII or 3964(R) procedures.

If the SAS 341 is used with the RK512 protocol, a send request (**SF = 'S'**) or a fetch request (**SF = 'F'**) can be executed with FB 8. If used in ASCII or 3964R mode, **SF** has to be set to ' ' (Space).

Parameter	Direction	Type	Function
SF	IN	CHAR	Direction Send 'S' or Fetch 'F'
REQ	IN	BOOL	Request initiated on positive edge
R	IN	BOOL	Reset transmit function
LADDR	IN	INT	Base address of SAS 341
Chan	IN	INT	Channel number (1 or 2)
Src	IN	ANY	Pointer to data range for frame to be transmitted
Len	IN	INT	Length of frame to be transmitted (1 - 4096)
R_CPU_NO	IN	INT	CPU number of the partner CPU
R_TYP	IN	CHAR	Destination/source on partner CPU: 'D' = data block; 'X' = extended data block
R_NO	IN	INT	Data block number on the partner CPU
R_OFFSET	IN	INT	Data byte number on the partner CPU
R_CF_BYT	IN	INT	Interprocessor flag byte on the partner CPU
R_CF_BIT	IN	INT	Interprocessor flag bit on the partner CPU
Busy	OUT	BOOL	Transmission of frame to module still in progress
Done	OUT	BOOL	Request complete without errors
Error	OUT	BOOL	Request complete with errors
Status	OUT	INT	Error number on *Error* (see Section 6.6)

To activate transmission, parameter **REQ** must have a positive edge. Depending on its length, transmission of the frame may require several PLC cycles. The bit **Busy** indicates the current operation.

The bit **Done** indicates that the frame of the module was correctly transferred. The frame is entered in the transmit buffer and automatically transmitted.

The finished bit **Done**, the error bit **Error** and the error number **Status** are only available for one cycle and must therefore be evaluated immediately.

Setting the **R** operand resets any current and any transmit operations already sent, the transmit buffer of the SAS 341 is cleared.

The parameters **R_CPU_NO, R_TYP, R_NO, R_OFFSET, R_CF_BYT, R_CF_BIT** define the RK512 request. If the SAS 341 is used with the ASCII or 3964(R) protocol, these parameters have no function.

Call example for RK512:

```
      S     M     10.0               // Initiate request

SEND: CALL  FB     8 , DB8
       SF      :='S'
       Req     :=M10.0
       R       :=M10.6
       LADDR   :=256
       Chan    :=1
       Src     :=P#DB20.DBX0.0 BYTE 500
       Len     :=50
       R_CPU_NO:=1
       R_TYP   :='D'
       R_NO    :=21
       R_OFFSET:=0
       R_CF_BYT:=W#16#FF
       R_CF_BIT:=W#16#FF
       Busy    :=M10.1
       Done    :=M10.2
       Error   :=M10.7
       Status  :=MW20

      A     M    10.1              // Transmission still in progress
      JC    next

      A     M     10.2             // Transmission completed?
      R     M     10.0             // Reset send bit
```

Call example for ASCII and 3964(R) protocols:

```
      S     M     10.0               // Initiate request

SEND: CALL  FB     8 , DB8
       SF      :=' '
       Req     :=M10.0
       R       :=M10.6
       LADDR   :=256
       Chan    :=1
       Src     :=P#DB20.DBX0.0 BYTE 500
       Len     :=50
       R_CPU_NO:=
       R_TYP   :=
       R_NO    :=
       R_OFFSET:=
       R_CF_BYT:=
       R_CF_BIT:=
       Busy    :=M10.1
       Done    :=M10.2
       Error   :=M10.7
       Status  :=MW20

      A     M    10.1              // Transmission still in progress
      JC    next

      A     M     10.2             // Transmission completed?
      R     M     10.0             // Reset send bit
```

6.3.3 FC 5 V24_STAT

Function block FC 5 – V24_STAT outputs the current status of the RS232 status signals.

Parameter	Direction	Type	Function
LADDR	IN	INT	Base address of SAS 341
Chan	IN	INT	Channel number (1 or 2)
DTR_OUT	OUT	BOOL	Status of the DTR signal
DSR_IN	OUT	BOOL	Status of the DSR signal
RTS_OUT	OUT	BOOL	Status of the RTS signal
CTS_IN	OUT	BOOL	Status of the CTS signal
DCD_IN	OUT	BOOL	Status of the DCD signal
RI_IN	OUT	BOOL	Status of the RI signal
BREAK	OUT	BOOL	Display BREAK status

The block exists for compatibility reasons. The status signals can also be more simply evaluated without calling the FC 5 via the I/O image of the SAS 341 (see also Section 6.2.2).

Example of call:

```
CALL  FC    5
 LADDR  :=256
 Chan   :=1
 DTR_OUT:=M16.3
 DSR_IN :=M16.2
 RTS_OUT:=M16.0
 CTS_IN :=M16.1
 DCD_IN :=M16.4
 RI_IN  :=M16.5
 BREAK  :=M16.6
```

6.3.4 FB 6 V24_SET

The status signals of the RS232 interface of the SAS 341 can be controlled with function block FB 6 – V24_SET. This function block should only be used with ASCII or 3964R protocols.

Parameter	Direction	Type	Function
LADDR	IN	INT	Base address of SAS 341
Chan	IN	INT	Channel number (1 or 2)
RTS	IN	BOOL	Set/reset RTS
DTR	IN	BOOL	Set/reset DTS
BREAK	IN	BOOL	Activate BREAK
Error	OUT	BOOL	Error
Status	OUT	INT	Error number on *Error* (see Section 6.6)

The error bit **Error** and the error number **Status** are only available for one cycle and must therefore be evaluated immediately.

Example of call:

```
CALL  FB     6 , DB6
 LADDR :=256
 Chan  :=1
 RTS   :=I5.1
 DTR   :=I5.2
 BREAK :=I5.3
 Error :=
 Status:=MW18
```

6.3.5 FB 10 Config

The settings of the interface of the SAS 341 can be changed with function block FB 10 – CONFIG. FB 10 can be used, for example, in OB 100 (start-up).

Parameter	Direction	Type	Function
LADDR	IN	INT	Base address of SAS 341
Chan	IN	INT	Channel number (1 or 2)
Baud	IN	INT	Baud rate (3…13)
Parity	IN	INT	Parity (none, odd, even, any)
Data bits	IN	INT	Number of data bits
Stop bits	IN	INT	Number of stop bits
Flow control	IN	INT	Data flow control
Break check	IN	INT	BREAK monitoring
Error	OUT	BOOL	Error
Status	OUT	INT	Error number on *Error* (see Section 6.6)

The SAS 341 modules with TTY interface can only work up to 19200 Baud!

Baud 3 = 300, 4 = 600, 5 = 1200, 6 = 2400, 7 = 4800, 8 = 9600, 9 = 19200, 10 = 38400, 11 = 57600, 12 = 76800, 13 = 115200

Parity 0 = none, 1 = odd, 2 = even, 3 = any

Data bits 7 or 8

Stop bits 1 or 2

Flow control Data flow control:
0= none, 1 = XON/XOFF, 2 = RTS/CTS,
3= automatic operation of RS232 C signals

Break check BREAK monitoring deactivated/activated

The error bit **Error** and the error number **Status** are only available for one cycle and must therefore be evaluated immediately.

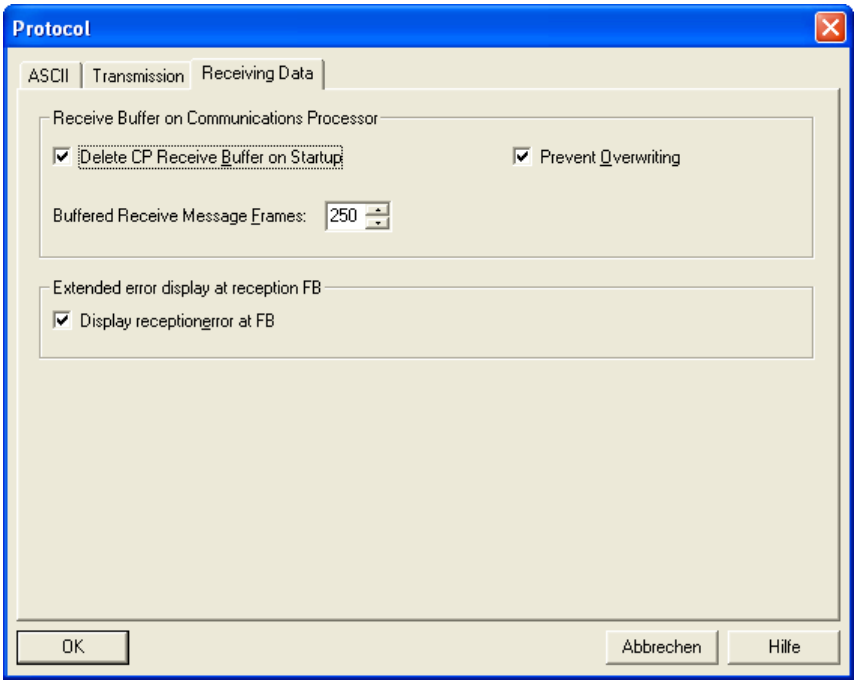
Example of call:

```
CALL  FB    10 , DB10
 LADDR       :=256
 Chan        :=1
 Baud        :=10                  // 10 = 38400 baud
 Parity      :=2                   // 2 = even parity
 Data bits   :=8
 Stop bits   :=1
 Flow control:=0                   // 0 = no flow control
 Break check :=0
 Error       :=M1.7
 Status      :=MW8
```

6.4 Receive and transmit buffer management

The SAS 341 has a receive buffer of 4096 bytes and a separate transmit buffer of 4096 bytes.

The SAS 341 can continue to receive frames or take in frames to transmit until the buffer is full.



An exception to this rule is the setting "Buffered receive message frames = 1" on the receive buffer. Hierbei wird unabhängig von der Puffergröße nur ein Telegramm empfangen. Using the setting "Prevent overwriting" it is possible to define whether the received frame or the old frame is rejected.

Even if the setting "Buffered receive message frames = 1," 2 frames can still be transmitted to the PLC!

Note: If the option “Buffered receive message frames = 1”, one frame may still be in the buffer waiting to be transmitted to the PLC and one frame in the ring buffer, depending when reception was stopped in the PLC. As soon as reception is enabled again in the PLC program it is possible that 2 frames will be transferred.

The transmit buffer can always be filled up to full capacity with frames.

If the SAS 341 may only contain one transmit frame before the next frame is transmitted, bit 4 of the FIFO status byte can be evaluated before transmission.

The transmit buffer is always cleared on start-up!

The transmit buffer is always cleared on start-up.

The receive buffer is cleared depending on the setting of option “Clear CP receive buffer during start-up”.

6.5 Data consistency

Data consistency is limited to 240 bytes by transmission on the backplane bus between the CPU and the SAS 341. For consistent data transmission of more than 240 bytes, please observe the following:

Transmit: Access to the transmit DB is not possible again until all data have been transmitted (**Done** = 1).

Receive: Access to the receive DB is not possible again until all data have been received (**NDR** = 1). After that, disable the receive DB (**EN_R** = 0) until the data have been processed.

6.6 Error numbers

Error during processing of the function blocks is usually indicated by a set **error bit**. The cause of the error is indicated in the **status** output operand.

03xx Errors during parameterization of the FBs

0301 Error on FB parameters

05xx Errors during CPU request

0501 Request interrupted by restart

0502 Module not (yet) ready for operation

050I Transmit frame too long

06xx Errors in partner request (RK512)

0601 Error in the 1st command byte (not 00 or FF)

0602 Error in the 3rd byte of the command frame; incorrect command

0603 Error in the 3rd byte of the following frame

0604 Error in the 4th byte of the command frame; incorrect data type

0605 Error in the 4th byte of the following frame

0609 Coordination flag not permissible

060E Sequence of command/response frames not correct

060F Access blocked by coordination flags

0611 Frame length not correct

06F0 Storage access error

07xx Transmit errors

0702 *3964R:* Error while establishing connection, STX followed by NAK or any other character

0703 *3964R:* QVZ expired during connection build-up

0704 *3964R:* Transmission interrupted by partner

0706 *3964R:* NAK received by partner

0707 *3964R:* QVZ expired at end of frame

0708 *ASCII:* No CTS=ON or XON after delay time

0709 *3964R:* Too many attempts to establish connection

070A *3964R:* Too many transmission attempts

07E0 Transmit buffer in module full

07F0 SRC buffer length < LEN parameter

07F1 Channel number incorrect (1,2)

07F2 LEN > 4096

07F3 LEN < 1

07F4 FPGA transmit buffer *(internal error)*

08xx Receive errors

0801 *3964R:* Repetition of receive frame requested

0802 *3964R:* Error during connection build-up

0805 *3964R:* Illegal character in DLE

0806	Character delay time expired
0807	Frame length illegal
0808	*3964R:* BCC incorrect
080A	No free receive buffer
080C	Interface error (parity, framing, overrun)
080D	BREAK detected
0810	*ASCII:* Parity error
0811	*ASCII:* Character frame error
0812	*ASCII:* Partner does not respond to XOFF/RTS
0816	Receive frame too long
0818	*ASCII:* DSR or CTS OFF during transmission
08F0	Data detection by SAS wrong (*internal error*)
08F1	Channel number incorrect (1,2)
08F2	Receive buffer (ANY pointer "Dest") not large enough for received frame
09xx	**Errors in the response frame/from the partner (RK512)**
0902	Storage access error in the partner PLC
0903	DB/DX access error in the partner PLC
0904	Partner PLC: Request type not permitted
0905	Error in the partner: Source/destination type not permitted, storage error, partner PLC in the stop condition
0909	Coordination flag in the partner PLC blocks access
0Axx	**Errors in the response frame of the partner (RK512)**
0A02	Error in Header of received response frame
0A04	Response frame with unexpected data
0A05	No response frame from the partner arrived within the monitoring time
1Exx	**System errors**
1E0E	Error is RETVAL of SFC58, SFC 59 or SFC 20. The value of RETVAL is in the instance data block of the called FB.
1E41	LEN < 1 or LEN > 4096
1Fxx	**RK512 Response frame with unknown error code**
1Fxx	xx = Error code from RK512 response frame

7 Appendix

7.1 Technical data

Order number	SAS 341-1, 1xRS232+USB	700-341-1AH02
	SAS 341-1, 1xTTY	700-341-1BH02
	SAS 341-1, 1xRS422/485	700-341-1CH02
	SAS 341-2, 2xRS232+USB	700-341-2AH02
	SAS 341-2, 2xTTY	700-341-2BH02
	SAS 341-2, 2xRS422/485	700-341-2CH02
Dimensions	116 x 40 x 125 mm (LxWxH)	
Weight	Approx. 200g	

Communications interface

Type:	RS 232 (V.24), SubD 9pol. male, TTY (20mA), SubD 9pol. male RS422/485 (X27), SubD 15pol. male USB 1.1 *(only for 700-341-1AH02 / -2AH02)*
Transmission rate:	300 baud to 115 Kbaud (TTY max. 19200 baud)
Protocols:	ASCII 3964R RK512

Service interface (update/diagnostics)

Type:	USB 1.1
Transmission rate:	Fullspeed 12Mbps
Connector:	Mini USB

Power supply

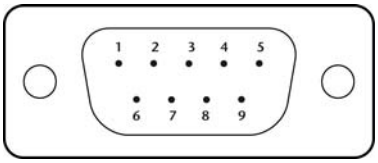
Voltage:	+5V DC via backplane bus
Current consumption:	160mA (typ.) / 190mA (max.)

Special features

Quality assurance:	According to ISO 9001:2008
Maintenance:	Maintenance-free (no battery, rechargeable or non-rechargeable)

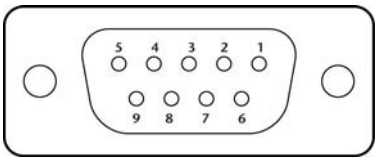
7.2 Pin assignment

7.2.1 SUB D connector RS232 (700-341-1AH02 / -2AH02)



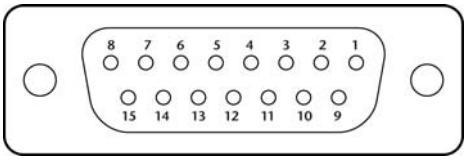
Pin	Designation		Direction	Description
1	DCD	Data Carrier Detect	Input	Carrier signal (modem)
2	RxD	Receive Data	Input	Empfangfleitung
3	TxD	Transmit Data	Output	Transmit line
4	DTR	Data Terminal Ready	Output	ON = SAS is ready
5	GND	Signal ground	-	Zero reference level
6	DSR	Data Set Ready	Input	Communication partner ready?
7	RTS	Request to send	Output	ON = SAS ready to transmit, OFF = nothing to transmit
8	CTS	Clear to send	Input	Communication partner ready to receive?
9	RI	Ring indicator	Input	Ring tone (modem)

7.2.2 SUB D socket TTY (700-341-1BH02 / -2BH02)



Pin	Designation	Direction	Description
1	TxD -	Output	Transmit data -
2	20mA -	Input	5V ground
3	20mA + (I1)	Output	20mA current generator 1
4	20mA + (I2)	Output	20mA current generator 2
5	RxD +	Input	Receive data +
6	-	-	
7	-	-	
8	RxD -	Output	Receive data -
9	TxD +	Input	Transmit data +

7.2.3 SUB D socket RS422/RS485 (700-341-1CH02 / -2CH02)



Pin	Designation	Direction	Description
1	-	-	
2	T (A)	Output	Transmit data (four-wire operation)
3	-	-	
4	R (A) / T (A)	Input / Input/Output	Receive data (four-wire operation) Receive/Transmit data (two-wire operation)
5	-	-	
6	-	-	
7	-	-	
8	GND	-	
9	T (B)	Output	Transmit data (four-wire operation)
10	-	-	
11	R (B) / T B)	Input / Input/Output	Receive data (four-wire operation) Receive/Transmit data (two-wire operation)
12	-	-	
13	-	-	
14	-	-	
15	-	-	

Notes