

Wireless Data Communication via SMS with S7-1200

SIMATIC S7-1200, SINAUT MD720-3

[Library Description](#) • August 2011

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SIMATIC

Wireless Data Communication via SMS with S7-1200

Library Overview

1

Working with the Library

2

**Interface Description of
the Library**

3

**Status Word of the
Library**

4

Reference

5

Warranty and Liability

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Table of Contents

Warranty and Liability	4
1 Library Overview	6
1.1 Program blocks.....	6
1.2 Library resources.....	7
1.3 Required Hardware and Software Components.....	8
1.4 The “com[FB154]” function block in detail.....	9
1.4.1 Initiating SMS communication platform.....	10
1.4.2 Sending text messages.....	12
1.4.3 Receiving text messages.....	15
2 Working with the Library	17
2.1 Integrating the library into STEP 7 V11.....	17
2.2 Using library blocks.....	18
2.3 Checking and updating library version.....	20
3 Interface Description of the Library	22
3.1 Parameters for initialization: <code>_init_</code>	22
3.2 Parameters for SMS sending <code>_send_</code>	23
3.3 Parameters for SMS receiving: <code>_rcv_</code>	24
3.4 Return parameter: <code>return_</code>	25
4 Status Word of the Library	26
5 Reference	28
6 History	28

1 Library Overview

With the help of the library blocks provided, wireless data transmission based on SMS is possible from the S7-1200 to other devices.

This document contains the description for the library provided for download for the S7-1200 based solution.

In any case, as accompanying literature the documents listed from Table 5-1 are recommended.

1.1 Program blocks

Table 1-1

Library	Group	Program block	Number
sms	sms_com	Function block: com	[FB154]
		Instance data block: own name	[DB own number]
	sms_chart	chart_cmd-return	-
		chart_rs232blocks	-

To be able to use the functionalities of the MD720-3 the “com” **function block** has to be called cyclically.

When calling the “com” function block an **instance data block** is generated. It is recommended to assign the name “com_DB” to be able to use the description tables described below.

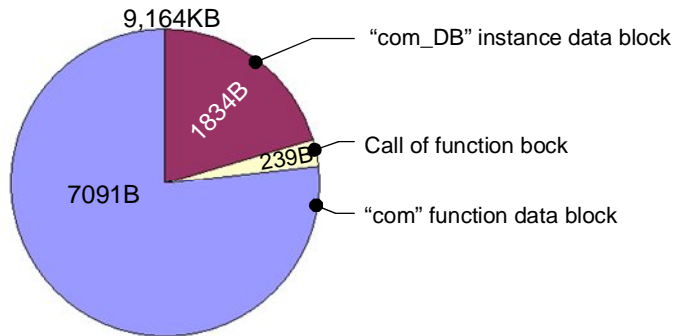
The “chart_cmd-return” **watch table** allows direct access to input and output parameters of the “com” function block.

With the help of the chart_rs232blocks **watch table** point-to-point communication blocks which need the RS232 communication module can be observed.

1.2 Library resources

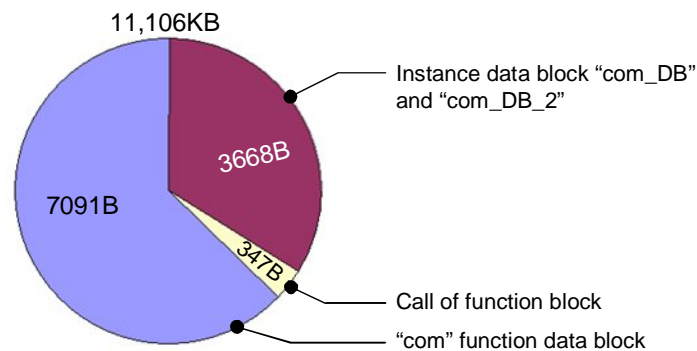
The size of all program blocks in the main memory is approx. 9 Kbytes. There are composed as follows:

Figure 1-1



If the "com" function block is called twice, the size of the user memory is approx. 11 Kbytes.

Figure 1-2



When the "com" function block is called for a second time, the memory of a second instance data block of the "com" type is assigned.

Note

The user memory necessary for calling the "com" function data block varies depending on the length of the input parameters used on the "com" function data block.

1.3 Required Hardware and Software Components

The application was generated with the following components:

Hardware components

Table 1-2

Components	No.	MLFB / order number	Note
SIMATIC S7-1200, PM 1207, 2,5A	1	6EP1332-1SH71	
SIMATIC S7-1200 CPU 1211C	1	6ES7211-1AD30-0XB0	<u>from FW2.1.2</u>
SIMATIC S7-1200 CM 1241, RS232	1	6ES7241-1AH30-0XB0	
SINAUT MD720-3, GSM/GPRS Modem	1	6NH9720-3AA00	<u>from HW3.4, FW1.7.4</u>
SINAUT ANT 794-4MR, antenna	1	6NH9860-1AA00	
SINAUT ST7 connecting cable, RS232, 1:1, or comparable "modem cable" cable	1	6NH7701-5AN	
Ethernet line for configuration, 2 meters or comparable cable	1	6XV1870-3QH20	

Standard software components

Table 1-3

Components	No.	MLFB / order number	Note
SIMATIC STEP 7 Basic V11	1	6ES7822-0AA01-0YA0	

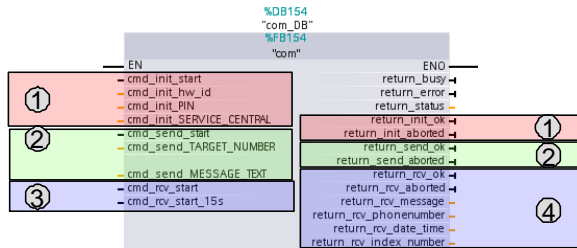
Sample files and projects

Table 1-4

Components	Note
sms.al11	Zip-file: CE-X25_S7-1200_SMS_library.zip Folder name: CE-X25_S7-1200_SMS_library_Vxx

1.4 The “com[FB154]” function block in detail

Figure 1-3



Below is detailed description of the significance of the parameter groups

Table 1-5

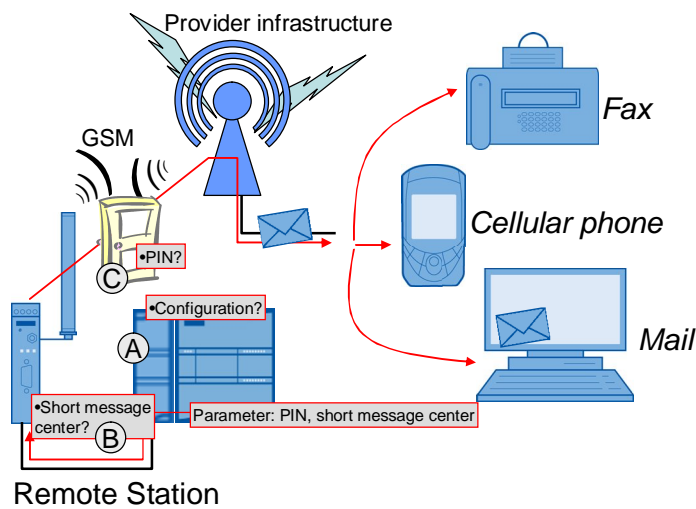
Group	Chapter
①	Chapter 1.4.1
②	Chapter 1.4.2
③	Chapter 1.4.3

1.4.1 Initiating SMS communication platform

The SIMATIC controller and the SINAUT modem have to be configured before text messages can be sent or received from this remote station¹. This is performed with the help of the input and output parameters see Figure 1-3 (1). How to select the parameters in detail can be found out in chapter 3.1.

Note Reset the MD720-3 modem to default to be able to enable the suitable settings for the library. Hold the SET button down until the C-LED lights up and then release the SET button.

Figure 1-4



Configuration of the SIMATIC controller and modem registration on the GSM network

Table 1-6

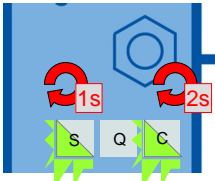
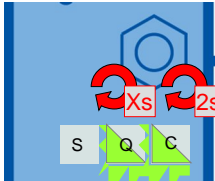
Digit	Description
A	During initialization the RS232 communication module is configured for ASCII based communication with the SINAUT modem. After the configuration the RS232 communication module is set as follows: <ul style="list-style-type: none"> • Communication protocol: Point-to-Point communication protocol • Transmission speed: 19.2 Kbit/s • 8 data bits per character • Parity: No parity • Stop bit: One stop bit
B	The short message center of the provider is stored in the modem. This is done once during initialization and all following routines for sending SMS automatically use this center in the provider infrastructure for SMS messaging.
C	The modem automatically logs onto the provider's GSM network, provided the PIN number of the inserted SIM card was validated.

¹ (RS) indicates the SIMATIC PLC with the connected MD720-3 modem

Note The settings for the RS232 communication module are permanently stored in the library. Therefore all settings in the device configuration are overwritten.

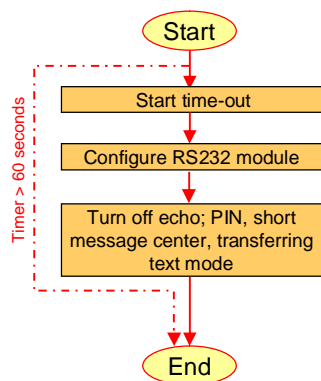
Monitoring registration process of the remote station with the help of the LED of the MD720-3

Table 1-7

No.	Description	Comment
1.	After activating the power supply, the S and C LED will each flash every second or once every two seconds	
2.	Once initialization was started the modem signals successful login to the GSM network of the provider with the help of the Q-LED. The flashing of the C-LED remains unchanged. <ul style="list-style-type: none"> • 1 x flashing with interval: Field intensity not sufficient • 2 x flashing with interval: Field intensity sufficient • 3 x flashing with interval: Field intensity good • Always ON: Field intensity very good 	

The initialization routine in detail

Figure 1-5



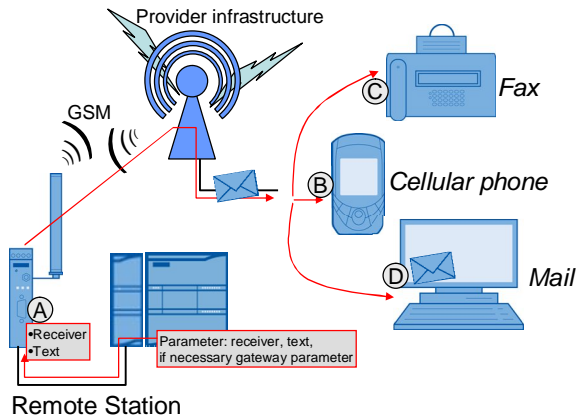
During this initialization phase, each step is monitored. If a step cannot be performed, this leads to a respective comment in the status word. The initialization routine is cancelled.

If the above step chain terminates neither positive nor negative after a maximum of 60 seconds, the routine is canceled.

1.4.2 Sending text messages

With the help of the “com[FB154]” function data block, text messages can be send provided the appropriate parameters are set as described in chapter 0.

Figure 1-6

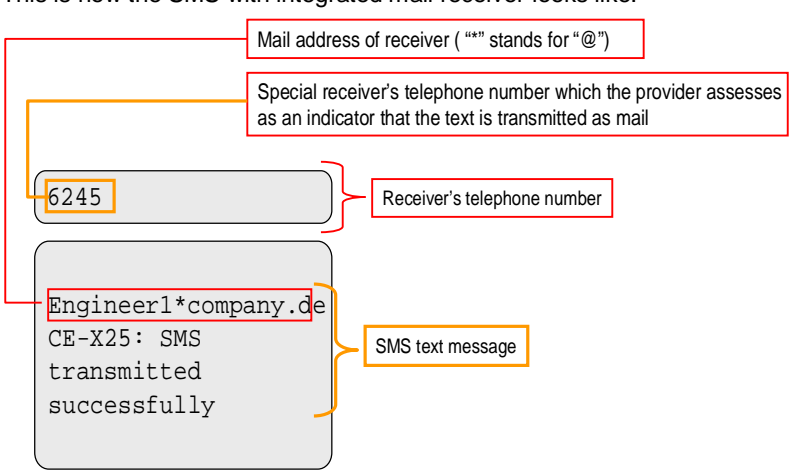


The following steps are executed when sending text messages.

Sending SMS to various nodes

Table 1-8

Digit	Description
A	During the send routine the SMS text and the receiver's telephone number are transmitted to the modem. The modem passes this SMS to the short message center of the provider.
B	If no additional gateway information is indicated in the receiver's telephone number, the text is sent to the receiver's telephone number. This can be, for example, a cellular phone or another remote station.
C	<p>If additional information was added in the SMS gateway <u>for fax sending</u>, then the digit sequence after this additional gateway information is interpreted as fax number. The text is sent to this fax machine. The SMS with additional gateway information may look like this:</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">990911123456</p> <p style="text-align: center;">CE-X25: SMS transmitted successfully</p> </div> <p style="text-align: center;">This example was based on the T-Mobile provider in Germany.</p>

Digit	Description
D	<p>If the receiver's telephone number is considered a special telephone number for sending mails, then the SMS text is checked for an integrated mail receiver address. The text is now passed on to the appropriate mail server.</p> <p>This is how the SMS with integrated mail receiver looks like:</p>  <p>For the "@" special character, there is often provider-specific character. In this case it is an "*" asterisk. The receiver's telephone number is also provider-specific. This example was based on the o2 provider in Germany.</p>

Note

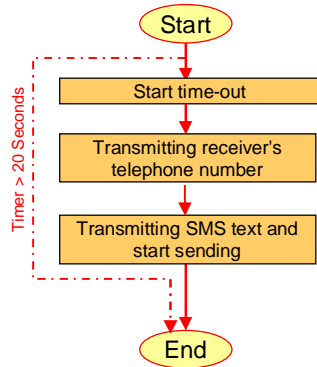
The MD720-3 does not allow additional gateway information in the receiver's telephone number. SMS sending to fax machines or mail servers is therefore not possible. The TC65T from the SIPLUS GSM-Kit TC65T is recommended as alternative device. <http://www.siemens.com/siplus>

In that case, the devices from Table 1-2 no. 4 and 5 are omitted.

It needs to be checked that the interface settings Table 1-6 digit A, match those of the library and if necessary they have to be adjust manually with the help of hyperterminal.

The send routine in detail

Figure 1-7

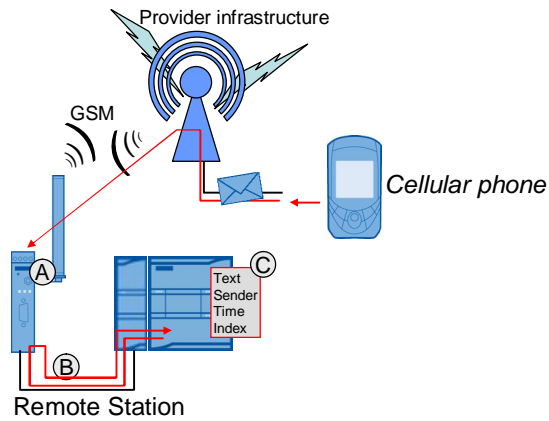


During this routine for sending SMS, every step is monitored. If a step cannot be performed, this leads to a respective comment in the status word. The routine is interrupted.

If the above step chain terminates neither positive nor negative after a maximum of 20 seconds, the routine is canceled.

1.4.3 Receiving text messages

Figure 1-8



The following steps are executed when receiving text messages.

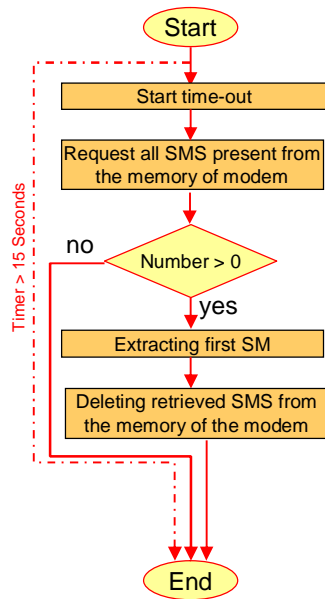
Receiving text messages and displaying information

Table 1-9

Digit	Description
A	If a SMS is received by the MD720-3 modem from a cellular phone or another remote station, this SMS is stored non-volatile in the internal memory of the modem. In the process, the SMS is assigned an index number with which this SMS can be identified. A max. of 100 SMS can be stored.
B	The S7-1200 controller checks the modem's memory, whether SMS are present and transfers <u>one</u> SMS in the memory of the S7-1200 controller.
C	In the S7-1200 controller the different information of the SMS is extracted and provided separately. This is <ul style="list-style-type: none"> • SMS text • Send number • Date and time (this time stamp was assigned by the provider) • Index number

The receive routine in detail

Figure 1-9



During this routine for receiving SMS, every step is monitored. If a step cannot be performed, this leads to a respective comment in the status word. The routine is interrupted.

If the above step chain is terminated neither positive nor negative after a maximum of 15 seconds, the routine is interrupted.

Always only one SMS is retrieved and this SMS is immediately deleted from the modem's memory after transmission to the S7-1200 controller. It therefore has to be made sure that the content of the previous SMS was successfully processed between two receive routines.

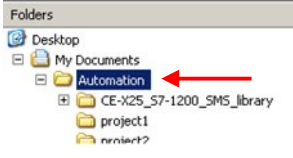
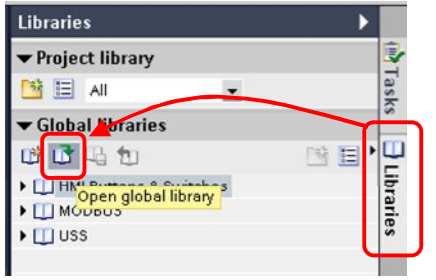
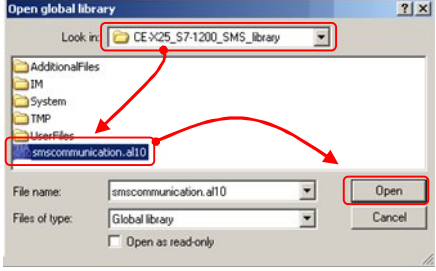
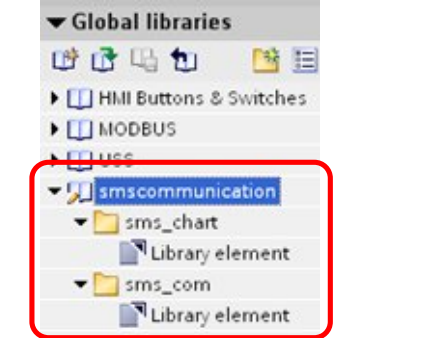
It cannot be ensured that the SMS is stored in the modem's memory in the correct time sequence and is retrieved from there accordingly.

2 Working with the Library

2.1 Integrating the library into STEP 7 V11

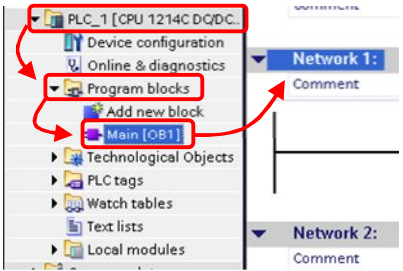
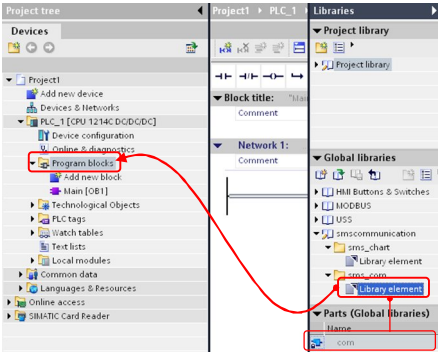
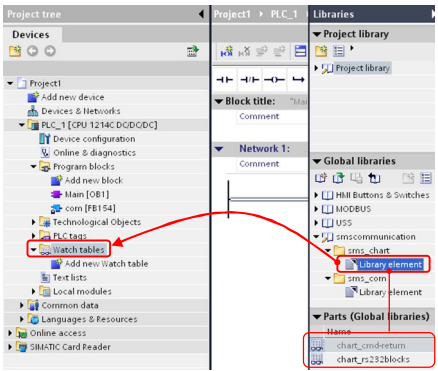
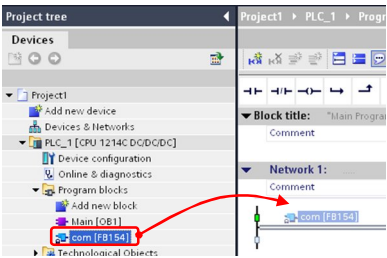
In order to use the previously described library functions, they have to be integrated into the configuration software first. The necessary steps are listed in the following table.

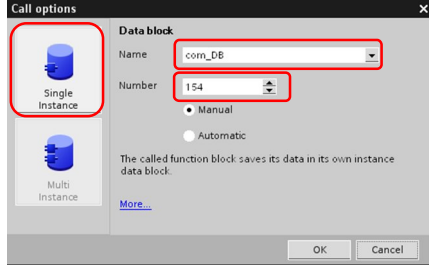

Table 2-1

Step	Function	Figure/remark
1.	The library is available on the HTML page from which you have downloaded this document. Save the library to your hard disk. Table 1-4	It is recommended to file all STEP 7 V11 projects and libraries in the "Automation" directory. 
2.	Open STEP 7 V11.	
3.	<ul style="list-style-type: none"> Enable the "Library" tab Click the "Open global library" button 	
4.	<ul style="list-style-type: none"> Navigate into the folder in which the library file with ending *.al10 is located Mark the file and confirm with "Open" 	
5.	<ul style="list-style-type: none"> The library is now loaded and is instantly available under "Global libraries" 	

2.2 Using library blocks

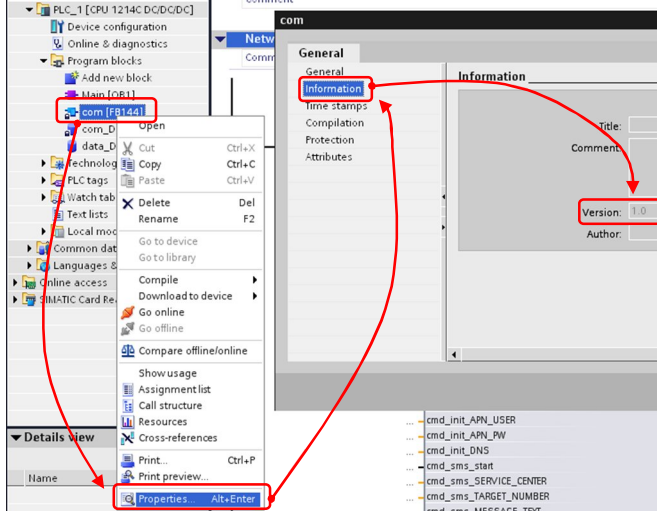

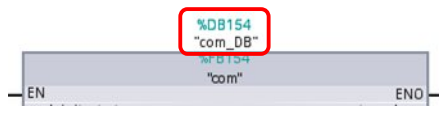
Table 2-2

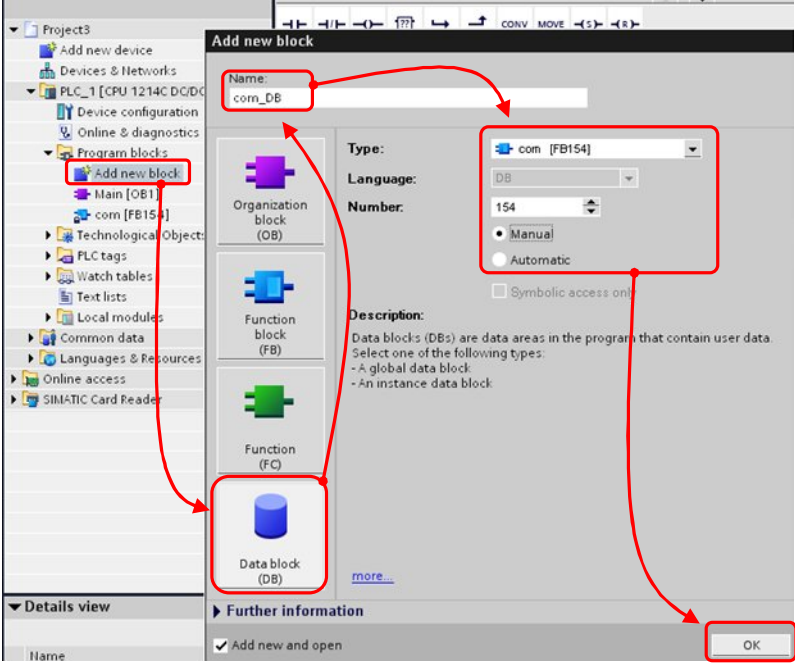
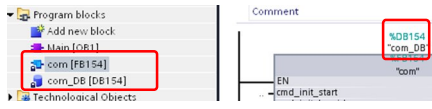
Step	Function	Figure/remark
1.	<ul style="list-style-type: none"> Open STEP 7 V11 to create a new project Add the desired S7-1200 controller with the help of "Add new device" 	All controller types of the S7-1200 series can be used in combination with this library
2.	<ul style="list-style-type: none"> Navigate into the "Program blocks" folder Open the OB1 "Organization block" 	
3.	<ul style="list-style-type: none"> From the opened "smscommunication" library, navigate into the "sms_com" library group Add the "Library elements" of this group to the "Program blocks" folder via Drag&Drop 	
4.	<ul style="list-style-type: none"> From the opened "smscommunication" library, navigate into the "sms_chart" library group Add the "Library elements" of this group to the "Watch tables" folder via Drag&Drop 	
5.	<ul style="list-style-type: none"> Now drag the "com[FB144]" function block via Drag&Drop into any network in the previously opened OB1 	

Step	Function	Figure/remark
6.	<ul style="list-style-type: none"> Select an instance data block, indicating a "Name" and "Number" Confirm with "OK" 	
7.	<p>The numbers and symbolic names of the library blocks can be freely assigned. However, please note that the watch tables included will then only have limited function.</p>	

2.3 Checking and updating library version

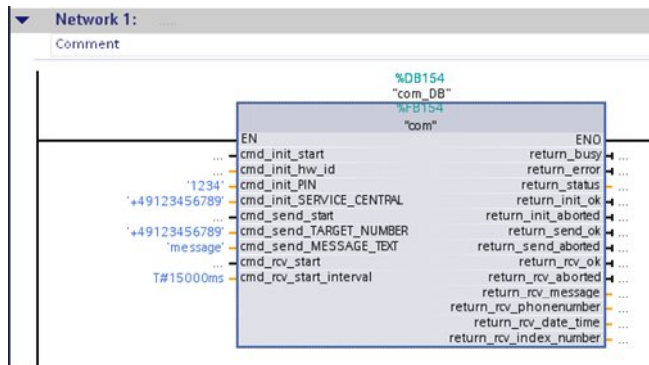
Table 2-3

Step	Function	Figure/remark
1.		
2.	<p>"</p> <ul style="list-style-type: none"> • Right-click the function or the data block and select the “Properties” option in the context menu • In the displayed “Properties” window select the “Information” menu <p>Compare the current version number in the “Version” output field with the latest status from the Service&Support portal</p>	
3.		<p>If you wish to update the library, add the most current library now as described under chapter #.</p>
4.	<ul style="list-style-type: none"> • Delete all relevant elements under the “Program blocks” folder • Do <u>not</u> delete the function block call in OB1 	
5.		<p>Add the “sms_com” elements of the library group to the program block as described in Table 2-1 up to step 3.</p>
6.	<p>The updated block elements are now available in the program block. However, the original call of the “com[FB154]” function block still displays one missing instance data block.</p>	

Step	Function	Figure/remark
7.		
8.	<p>Add the instance data block manually</p> <ul style="list-style-type: none"> • Double-click the “Add new block” button • Mark the “Data block” block type and select “Name” • The “com[FB154]” instance data block is selected as data block type <p>Confirm with “OK”</p>	
9.	<p>The library update is now completed.</p>	

3 Interface Description of the Library

Figure 3-1



3.1 Parameters for initialization: _init_

Figure 3-2



Table 3-1

No.	Designation	Transmission	Data type	Description/note
1.	cmd_init_start	IN	Bool	<ul style="list-style-type: none"> Enables the initialization process Reacts to a positive edge The start command is stored as long as the "com" function block is already in process. The block always saves <u>only one</u> start command provided it cannot be processed instantly.
2.	cmd_init_hw_id	IN	PORT	<ul style="list-style-type: none"> Hardware ID of the RS232 communication module Default value: 11; input not necessary, provided the RS232 CM was inserted in the first slot on the left of the S7-1200 and no expansion modules were inserted on the right Check hardware ID in device information/RS232_1-Properties/RS232 interface/IO addresses/HW identifier
3.	cmd_init_PIN	IN	String	<ul style="list-style-type: none"> PIN number of the SIM card inserted in the modem If the PIN number is disabled, "0000" has to be entered Permissible value: Maximum 4 characters

No.	Designation	Transmission	Data type	Description/note
4.	cmd_init_SERVICE_CENTRAL	IN	String	<ul style="list-style-type: none"> The short message center of your provider is to be entered here (Example: +49123456789) Permissible value: Maximum 20 characters
5.	return_init_ok	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when initialization of the modem was <u>successful</u> and the modem is therefore ready to operate Stays TRUE until initialization is triggered again Default value: FALSE
6.	return_init_aborted	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when initialization of modem terminated <u>incorrectly</u> Relevant in combination with Table 3-4 no. 3 Stays TRUE until initialization is triggered again Default value: TRUE

3.2 Parameters for SMS sending `_send_`

Figure 3-3



Table 3-2

No.	Designation	Transmission	Data type	Description/note
1.	cmd_send_start	IN	Bool	<ul style="list-style-type: none"> Starts the procedure for sending SMS Reacts to a positive edge The start command is stored as long as the "com" function block is already in process. The block always saves <u>only one</u> start command provided it cannot be processed instantly.
2.	cmd_send_TARGET_NUMBER	IN	String	<ul style="list-style-type: none"> Receiver's telephone number of the device to which the SMS is to be sent Example: +49123456789 Permissible value: Maximum 20 characters
3.	cmd_send_MESSAGE_TEXT	IN	String	<ul style="list-style-type: none"> Text content of the SMS which is to be sent Permissible value: Maximum 160 characters Process values can be embedded with the "VAL_STRING" command
4.	return_send_ok	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when the last job for sending SMS was terminated <u>successfully</u> Stays TRUE until next job is triggered again Default value: FALSE

No.	Designation	Transmission	Data type	Description/note
5.	return_send_aborted	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when the last job for sending SMS was <u>not successfully</u> terminated Relevant in combination with Table 3-4 no. 3 Stays TRUE until next job is triggered again Default value: TRUE

3.3 Parameters for SMS receiving: `_rcv_`

Figure 3-4

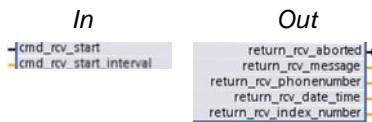


Table 3-3

No.	Designation	Transmission	Data type	Description/note
1.	cmd_rcv_start	IN	Bool	<ul style="list-style-type: none"> Starts the process for receiving (retrieving) of a SMS from the modem Reacts to a positive edge The start command is stored as long as the "com" function block is already in process. The block always saves <u>only one</u> start command provided it cannot be processed instantly.
2.	cmd_rcv_start_interval	IN	Time	<ul style="list-style-type: none"> Indicates an interval in which the process for receiving (retrieving) a SMS from the modem is started automatically Input in milliseconds Permissible value: >= 5000 (ms) Interval can be ended by setting the value to < 5000 (ms)
3.	return_rcv_ok	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when the last job for retrieving SMS was <u>successfully</u> terminated Stays TRUE until next job is triggered again Default value: FALSE
4.	return_rcv_aborted	OUT	Bool	<ul style="list-style-type: none"> Gives feedback when the last job for retrieving SMS was <u>not successfully</u> terminated Relevant in combination with Table 3-4 no. 3 In combination with the 7030 status it is signaled that no SMS was present in the memory of the modem Stays TRUE until next job is triggered again Default value: TRUE
5.	return_rcv_message	OUT	String	<ul style="list-style-type: none"> Displays the SMS text content

No.	Designation	Transmission	Data type	Description/note
6.	return_rcv_phonenumber	OUT	String	<ul style="list-style-type: none"> Indicates the number of the device from which the SMS was sent
7.	return_rcv_date_time	OUT	DTL	<ul style="list-style-type: none"> Indicates the time stamp which is saved in the SMS This is the time stamp which the provider provides at the time of delivery. This is not the time stamp at the time of sending the SMS from the cellular phone or remote station. The elements "Nanosecond" and "Weekday" of the DTL time format are not present
8.	return_rcv_index_number	OUT	Int	<ul style="list-style-type: none"> Indicates the index number of the SMS from the modem memory of the modem

3.4 Return parameter: return_

Figure 4-7

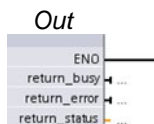


Table 3-4

No.	Designation	Transmission	Data type	Description/note
1.	return_busy	OUT	Bool	<ul style="list-style-type: none"> Signals when the "com[FB154]" block is busy with processing a routing Takes on the TRUE state once a "cmd_" command was triggered. Can also take on the TRUE state when the RCV routine is called cyclically with the help of the "cmd_rcv_start_interval" parameter. Takes on the FALSE state as soon the routine is terminated
2.	return_error	OUT	Bool	<ul style="list-style-type: none"> Gives feedback if an error occurred during the processing of a routine Always relevant in combination with Table 3-4 no. 3
3.	return_status	OUT	Int	<ul style="list-style-type: none"> In the case of an error, returns the status to be able to localize the cause of the error Always to be noted in combination with the status list from Table 4-1

4 Status Word of the Library

Every routine of the “com[FB154]” function data block indicates the cause of the error via a joint status word if terminating the respective routine was not successful. The symbolic address of the variable is “return_status”.

The status word is output in form of a decimal number and can be assigned as displayed in the following table.

Table 4-1

Status	Description	Support/Remark
1000	Buffer in the RS232 communication module could not be deleted	<ul style="list-style-type: none"> Read out diagnostic buffer of the controller Read out the “com_DB[DB154].rst_rcv_status” variable and compare it with \2\ chapter 8.6.7
1010	The currently relevant AT command could not be sent from the RS232 communication module to the MD720-3	<ul style="list-style-type: none"> Read out diagnostic buffer of the controller Check cabling between RS232 communication module and MD720-3 (Use a modem cable, <u>not</u> a null modem cable) Read out the “com_DB[DB154].ptp_send_status” variable and compare it with \2\ chapter 8.6.5.
3000	The port configuration was finished incorrectly: PORT_CFG	<ul style="list-style-type: none"> Read out the “com_DB[DB154].cfg_port_status” variable and compare it with \2\ chapter 8.6.2
3010	The configuration for receiving the characters was finished incorrectly: RCV_CFG	<ul style="list-style-type: none"> Read out the “com_DB[DB154].cfg_rcv_status” variable and compare it with \2\ chapter 8.6.4
3020	The configuration for sending the characters was finished incorrectly: SEND_CFG	<ul style="list-style-type: none"> Read out the “com_DB[DB154].cfg_send_status” variable and compare it with \2\ chapter 8.6.3
3999	A time-out occurred during the configuration of the RS232 module.	<ul style="list-style-type: none"> Incorrect hardware ID transferred on the input of the “com[FB154]” block (see Table 3-1 no. 2)
4120	PIN could not be transferred	<ul style="list-style-type: none"> Check appropriate parameter on the inputs of the “com[FB154]” function block Indicate parameters by using an apostrophe ', <u>not</u> inverted commas “ Always specify cellular telephone numbers in syntax +<country code><area/provider><number>
4160 /4200	The short message center could not be transferred	
4999	A time-out occurred during the modem initialization	<ul style="list-style-type: none"> Check connectivity between S7-1200 controller and MD720-3 Check whether the used cable is a modem cable (serial standard cable) and <u>not</u> a null modem cable (cf. http://en.wikipedia.org/wiki/Null_modem)
7030	No SMS in the MD720-3 modem memory	<ul style="list-style-type: none"> This is a valid termination of the RCV routine if there is no SMS in the memory of the modem If you receive this status although there should be one or more SMS in the modem, check the memory of the modem manually with hyperterminal and with the AT+CMGL command If the SMS is really present in the memory of the modem, then save the “com_DB[DB154].compare_string” variable at

Status	Description	Support/Remark
		the time after a RCV routine. Post this string in the forum of the Service&Support portal in combination with the used modem, hardware status and firmware status
7080	The SMS just retrieved could not be deleted from the memory of the MD720-3 modem.	
7999	The telegram which was to be sent from this station was not accepted by the modem	<ul style="list-style-type: none"> • Check connectivity between S7-1200 controller and MD720-3 • Check whether the used cable is a modem cable (serial standard cable) and <u>not</u> a null modem cable (cf. http://en.wikipedia.org/wiki/Null_modem)
8030	The routine for sending a SMS could not transfer the receiver number	<ul style="list-style-type: none"> • Check appropriate parameter on the inputs of the "com[FB154]" function block
8070	The message of the SMS could not be transferred	<ul style="list-style-type: none"> • Indicate parameters by using an apostrophe ', <u>not</u> inverted commas " • Always specify cellular telephone numbers in syntax +<country code><area/provider><number> • The MD720-3 cannot receive gateway addresses (fax or mail sending) without "+" in front of it
8999	Whilst the function block executed the sending of a SMS, a time-out occurred	<ul style="list-style-type: none"> • Check connectivity between S7-1200 controller and MD720-3 • Check whether the used cable is a modem cable (serial standard cable) and <u>not</u> a null modem cable (cf. http://en.wikipedia.org/wiki/Null_modem)

Note Also use the Service&Support portal forum to solve problems.

<http://www.siemens.com/forum-applications>

Note If the support does not lead to the desired result it may be helpful to load the MD720-3 factory settings. For this purpose use a paper-clip. Press the SET button until the "C" LED lights up and then remove the paper-clip. Once booting has completed, the modem will assume the state as shown in Table 1-7 no. 1.

5 Reference

Table 5-1

No.	Document/Link
\1\	MD720-3 device handbook http://support.automation.siemens.com/WW/view/en/23117745
\2\	SIMATIC S7-1200 System Manual http://support.automation.siemens.com/WW/view/en/36932465
\3\	S7-200 based telecontrol solution with SMS http://support.automation.siemens.com/WW/view/en/21063345
\4\	S7-300 based telecontrol solution with SMS http://support.automation.siemens.com/WW/view/en/25545680

6 History

Table 6-1

Version	Date	Modification
V1.2	09.08.2011	New library version V1.2 is now adapted to STEP 7 V11. Some Default values of the library changed here in the documentation.
V1.1	01.11.2010	New library version V1.1: Problems with TC65T and TC35i solved, TC65T now as substitute device, Timeouts of all routines modified
V1.0	21.05.2010	First issue