GPRS/ Modbus Gateway

SIMATIC S7-200, GSM/GPRS Modem MD720-3

Configuration Example CE-X1 • October 2009

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Preface

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http://support.automation.siemens.com/WW/view/en/39026334

Table of Contents

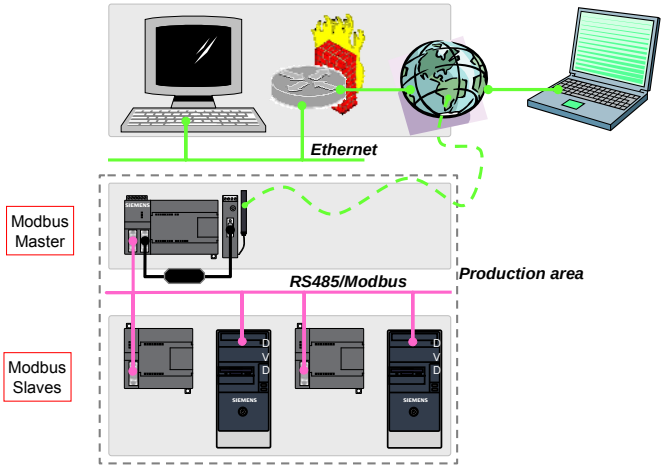
1 Automation Task

Application

Several modbus nodes, consisting of S7-200 controller and PCs, are to communicate with a modbus master in a production area of a plant.

A PC-based control center is to allow visualization and logging of process values of the production area. The decentralized production area is to be analogously linked to the control center with the Micro Automation Set 21, using a GPRS network.

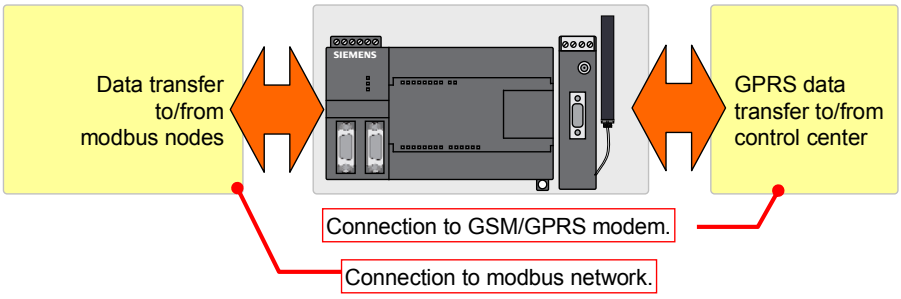
Figure 1-1



1.1 Technical task description

- How can the following services be implemented in a S7-200 CPU:
  - Modbus master
  - GPRS remote station
- How does the data transfer from the control center to modbus slave devices work, using GPRS and visa versa?

Figure 1-2



1.2 Component lists

Products

Table 1-1

Components	No.	MLFB / order number	Note
LOGO! Power 24V/1.3A	1	6EP1331-1SH02	
SIMATIC S7-200 CPU 224XP	1	6ES7214-2AD23-0XB0	DC
SIMATIC S7-200 CPU 221	1	6ES7211-0AA23-0XB0	DC
SINAUT MD720-3	1	6NH9720-3AA00	
Antenna ANT 794-4MR	1	6NH9860-1AA00	

Accessory

Table 1-2

Components	No.	MLFB / order number	Note
PROFIBUS cable 830-2 F	1	6XV1830-2AH30	3 m
PC/PPI cable	1	6ES7901-3CB30-0XA0	COM
Miniature circuit-breaker	1	5SX2116-6	1 pole B, 16A
Top hat rail	1	6ES5710-8MA11	483 mm
Simulator module SIM274	1	6ES7274-1XF00-0XA0	
USB/PPI cable	1	6ES7901-3DB30-0XA0	Only for configuring. The PC/PPI cable can also be used.
SIM card	1	Mobile communications provider	GPRS enabled

Configuration software/tools

Table 1-3

Components	No.	MLFB / order number	Note
STEP 7 Micro/WIN	1	6ES7810-2CC03-0YX0	
STEP 7 Micro/WIN Add On (function libraries)	1	6ES7830-2BC00-0YX0	

Note

On the part of the remote peer of the MD720-3, the components for the SINAUT Micro SC center are still needed.

For more information, please refer to Micro Automation Set 21:

http://support.automation.siemens.com/WW/view/en/22537809

2 Automation Solution

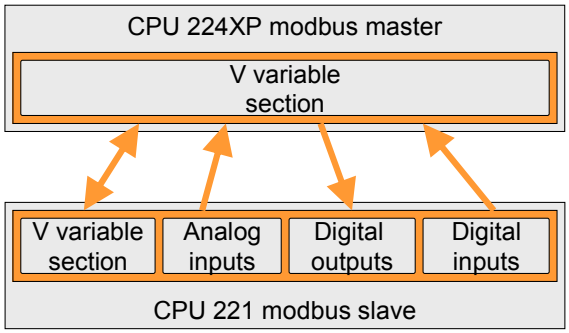
2.1 Modbus communication

For the S7-200, modbus master and modbus slave library blocks are offered for port 0 and port 1.

Using these blocks, communication is from S7-200 CPU 224XP (modbus master) to S7-200 CPU 221 (representative for all modbus slaves).

In this automation solution the modbus master functionality is to be operated via port 1 of the CPU 224XP.

Figure 2-1



Modbus master devices can actively access (read and/or write) different areas of modbus slave devices. The sections from the view of the slave consist of:

- digital outputs
- digital inputs
- analog inputs
- holding register (V variable memory area)

This division does not exist for the modbus master. All information read is stored in a section in the own V memory.

All information to be written is taken from a section in the own V memory.

The modbus slave cannot actively trigger actions.

Note Further explanations can be found in the S7-200 manual from chapter 12 onwards. http://support.automation.siemens.com/WW/view/en/1109582

2.2 GPRS communication

For the S7-200 WDC library blocks are available for port 0.

Using these blocks, the communication of the S7-200 CPU 224XP is realized in combination with the GSM/GPRS modem MD720-3 to the control room.

Note

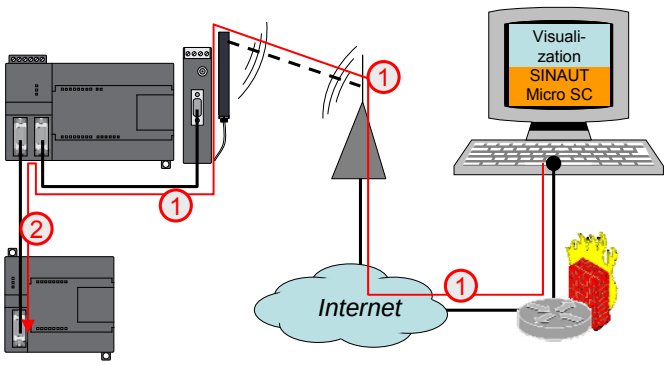
Further explanations of the system can be found in Micro Automation Set 21.

http://support.automation.siemens.com/WW/view/en/22537809

2.3 Data transmission

Function Principle

Figure 2-2



In this automation solution data transmission is divided and monitored in the following subareas:

- GPRS data transfer (1)
- modbus data transfer (2)

However, there is no mechanism for the entire communication path that automatically guarantees the complete data transmission and which informs the nodes if there are data transmission errors.

Data transmission in subarea GPRS tranfer (1)

The GPRS data transmission is monitored by acknowledgement routines in both directions (CPU → SINAUT Micro SC and visa versa).

Data transmission in the subarea modbus transfer (2)

The modbus data transmission is monitored by acknowledgement routine for read and write jobs.

In addition there is a CRC checksum calculation which helps detect data corruption.

Reliability of data transmission over the entire communication path

To ensure data transmission over the entire communication path, the acknowledgement routines have to be evaluated on the part of the GPRS system and the modbus network. This done in the modbus master CPU 224XP.

Figure 2-3

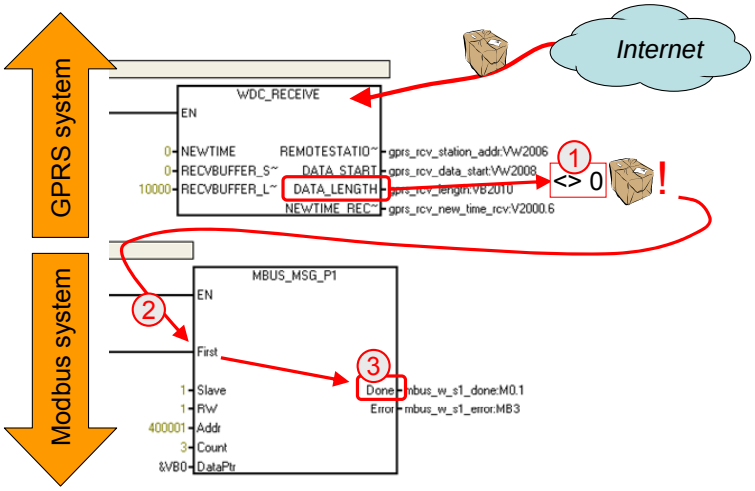


Table 2-1

No.	Explanation
1.	The incoming GPRS data traffic is recognized with the aid of the WDC_RECEIVE block. This information is present for only one CPU cycle after receipt of the message and is therefore monitored and evaluated instantly in each CPU cycle.
2.	After confirmed receipt of the message (incoming data packet length > 0), the data can be passed on to the modbus slaves, using the MBUS_MSG_P1 block.
3.	Successful processing of the modbus data transmission is also signaled in the MBUS_MSG_P1 block. This information is available for only one CPU cycle after receipt of the acknowledgement from the node.
n.	This is where a message can be sent to the control center (SINAUT Micro SC) if the sending of data via modbus (output "Error" > 0) was faulty. This is not implemented in this automation solution.

2.4 Plausibility and data consistency

In addition, to the secure data transmission it is necessary to check the incoming values for completeness and plausibility. Inconsistent data can no longer be recognized by modbus slaves and may cause undesired system statuses.

Figure 2-4

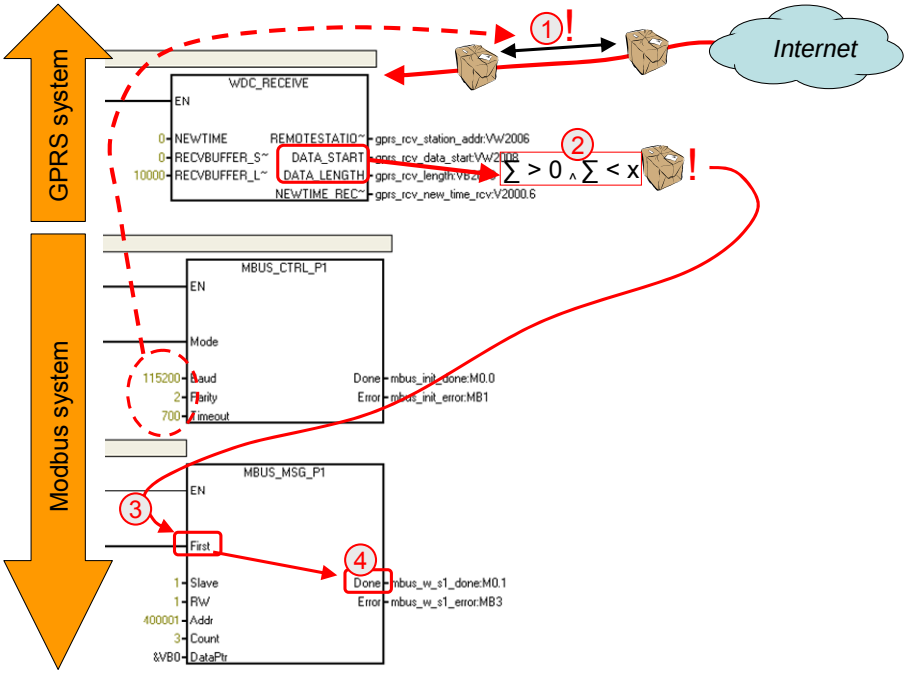


Table 2-2

No.	Explanation
4.	It has to be ensured that the time between two successively incoming GPRS data packets is never shorter that the processing of the thus triggered modbus command. **Transmission time of modbus system** The net transmission time between modbus master and modbus slave can be controlled via the "MBUS_CTRL_P1" block ("Baud"). **Processing time of modbus system** Information on the actual process time of modbus commands (reading or writing/master and slave) can be found in the S7-200 manual chapter 12). http://support.automation.siemens.com/WW/view/en/1109582 **Comparison value of GPRS system** As comparison value on the side of the GPRS communication a minimal value of 1000ms is to be assumed. This value represents the transmission time from control room to GPRS remote station.
5.	Apart from the actual detection of GPRS data packets that have been received, the "WDC_RECEIVE" block will check whether the received data is plausible. To do this, the size of the send buffer "x" for the modbus write job is

No.	Explanation
	compared with the size of the received GPRS data packet. "x" stands for the precise number of bytes to by sent (via modbus).
6.	The actual modbus job will be triggered if the plausibility check produces a positive result.
7.	Successful processing of the modbus data transmission is signaled in the MBUS_MSG_P1 block. This information is available for only one CPU cycle after receipt of the acknowledgement from the node.

3 Configuration

3.1 Structure

Figure 3-1

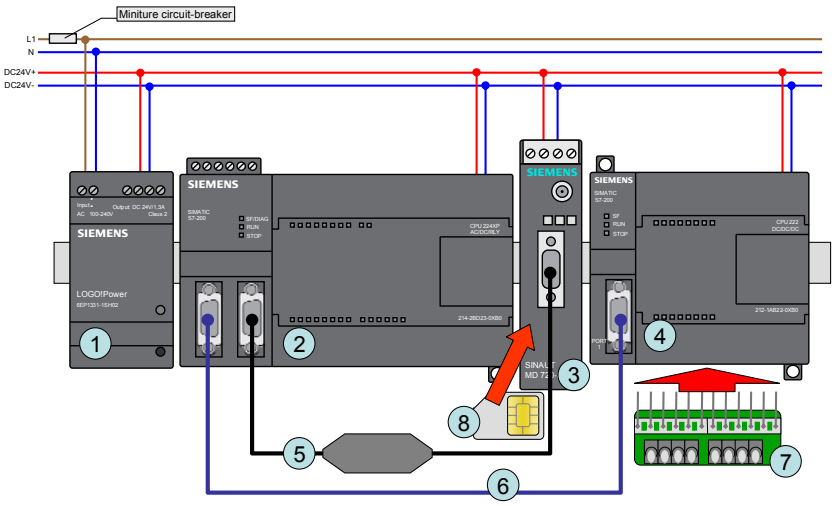


Table 3-1

No.	Device
1.	LOGO! Power 24V/1.3A
2.	SIMATIC S7-200 CPU 224XP
3.	SINAUT MD720-3
4.	SIMATIC S7-200 CPU 221
5.	PC/PPI cable
6.	PROFIBUS cable 830-2 F
7.	Simulator module SIM274
8.	SIM card of your provider

Note

On the part of the remote peer of the MD720-3 a functional SINAUT Micro SC system is assumed.

For more information, please refer to Micro Automation Set 21:

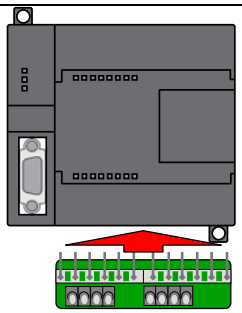
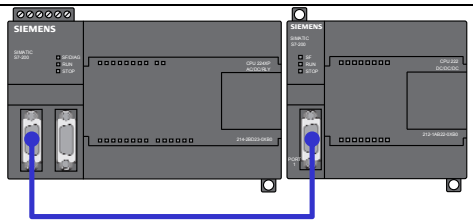
http://support.automation.siemens.com/WW/view/en/22537809

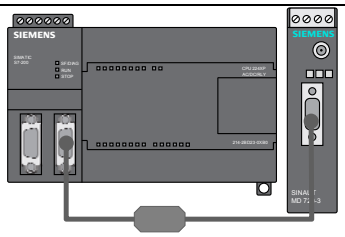
Note

The interfaces of the controllers are switched to "Freeport mode", as described below, by uploading the code elements. In order to access the controller again via PG/PC the CPU in to be set to "STOP".

3.2 Installing and wiring hardware

Table 3-2

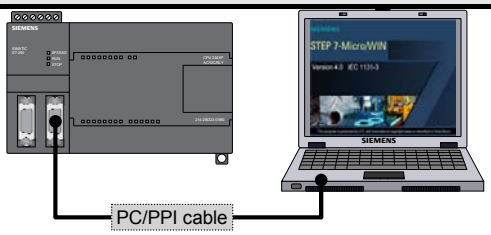
<table>
<tr><th>No.</th><th>Instruction</th><th>Note/picture</th></tr>
<tr><td>1.</td><td>Mount all necessary components on the top-hat rail.</td><td></td></tr>
<tr><td>2.</td><td>Attach the simulator for the digital inputs at the S7-200 CPU 221.</td><td>  </td></tr>
<tr><td>3.</td><td>Connect the S7-200 CPU 224XP with the S7-200 CPU 221; using the PROFIBUS cable.
<table>
<tr><td>CPU 224XP</td><td>CPU 221</td></tr>
<tr><td>Port 1</td><td>Port 0</td></tr>
<tr><td>Terminating resistor: on</td><td>Terminating resistor: on</td></tr>
</table></td><td> 

PROFIBUS cable 830-2 F</td></tr>
<tr><td>4.</td><td>Connect the S7-200 CPU 224XP with the MD720-3, using the PC/PPI cable.
<table>
<tr><td>CPU 224XP</td><td>Modem MD720-3</td></tr>
<tr><td>Port 0</td><td>RS232 Interface</td></tr>
</table>
Use the following switch positions:
<table>
<tr><td>1 2 3 4 5 6 7 8</td></tr>
<tr><td>1 1 1 0 0 1 1 0</td></tr>
</table></td><td> 

PC/PPI cable</td></tr>
<tr><td>5.</td><td>Connect the controllers and the MD720-3 modem to the DC 24V supply voltage of LOGO! Power</td><td>See chapter 3.1.</td></tr>
<tr><td>6.</td><td>Connect all ground connections to earth and install the voltage supply of LOGO! Power</td><td>See chapter 3.1.</td></tr>
</table>

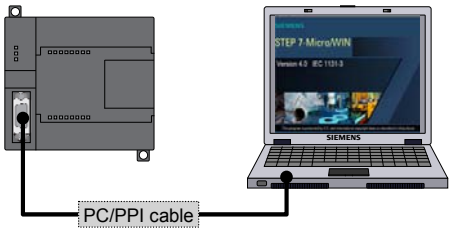
3.3 Configuring the S7-200 CPU 224XP and downloading the user program

Table 3-3

No.	Instruction	Note/picture
1.	Connect a free COM port of the PC to port 0 of the S7-200 controller CPU 224XP, using a PC/PPI cable. Use the following switch positions: **1 2 3 4 5 6 7 8** **0 0 0 0 1 0 0 0**	
2.	Make the following settings in the “PG/PC Interface” under “Start/Settings/Control Panel”. • Access point of the application Micro/WIN -> PC/PPI cable (PPI) • Transmission rate: 19.2 Kbit/s • Local connection: COM • Advanced PPI disabled • Multi Master network deactivated	
3.	Open the file from Table 4-1 no. 1 using STEP 7 Micro/WIN.	
4.	Navigate to the "GPRSparam" data block and adjust your settings to your SINAUT Micro SC system.	
5.	Transfer the project via "File/Load to CPU" to S7-200	
6.	Set the S7-200 controller to “RUN” mode	

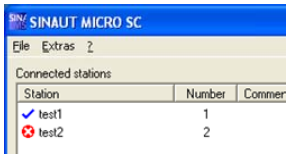
3.4 Configuring the S7-221 CPU and downloading the user program

Table 3-4

No.	Instruction	Note/picture
1.	Connect a free COM port of the PC to port 0 of the S7-200 controller CPU 221, using a PC/PPI cable. Use the following switch positions: **1 2 3 4 5 6 7 8** **0 0 0 0 1 0 0 0**	
2.	Make the following settings in the “PG/PC Interface” under “Start/Settings/Control Panel”. • Access point of the application Micro/WIN -> PC/PPI cable (PPI) • Transmission rate: 19.2 Kbit/s • Local connection: COM • Advanced PPI disabled • Multi Master network deactivated	
3.	Open the file from Table 4-1 no. 2 using STEP 7 Micro/WIN.	
4.	Transfer the project to the S7-200 controller via "File/Load to CPU".	
5.	Set the S7-200 controller to the “RUN“ mode.	

3.5 Start WinCC flexible configuration

Table 3-5

No.	Instruction	Note/picture
1.	Make sure that the CPU 224XP controller is connected to the SINAUT Micro SC system via GPRS.	
2.	Exit all running WinCC flexible runtime projects.	
3.	Open file from Table 4-1 no 1 using WinCC flexible.	

4 Code Elements

The software examples are available on the HTML page from which you have downloaded this document.

Table 4-1

No.	File name	Contents
1.	Modbus_Master_GPRS_VxDy_en.mwp	STEP 7 Micro/WIN project for CPU 224XP.
2.	Modbus_Slave_VxDy_en.mwp	STEP 7 Micro/WIN project for CPU 221.
3.	Modbus_GPRS_VxDy_en.**hmi**	WinCC flexible project
4.	Modbus_GPRS_VxDy_en.**fwx**	WinCC flexible runtime
5.	m2mopc.xml	Configuration file for SINAUT MICRO SC C:\Program Files\Siemens\SINAUT MICRO SC.

5 History

Table 5-1 History

Version	Date	Modifications
V1.0	27.09.2009	First version