



## Connection of the flowmeter SITRANS FC410 to a CPU S7-1200 via MODBUS RTU

SITRANS FC410, S7-1200

<https://support.industry.siemens.com/cs/ww/en/view/109746404>

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# Table of Contents

|  |           |
|--|-----------|
| <b>Legal information .....</b>                             | <b>2</b>  |
| <b>1 Introduction .....</b>                                | <b>4</b>  |
| 1.1 Overview .....   | 4         |
| 1.2 Mode of operation .....                                | 4         |
| 1.3 Components used.....                                   | 5         |
| <b>2 Engineering .....</b>                                 | <b>6</b>  |
| 2.1 Hardware setup .....                                   | 6         |
| 2.1.1 Connections .....                                    | 6         |
| 2.1.2 Analog output .....                                  | 8         |
| 2.2 Blocks .....   | 8         |
| 2.3 Parameter assignment.....                              | 9         |
| 2.3.1 Parameters for gateway operation .....               | 9         |
| 2.3.2 Parameters of the communication module CM 1241 ..... | 11        |
| <b>3 Appendix.....</b>                                     | <b>12</b> |
| 3.1 Service and Support .....                              | 12        |
| 3.2 Links and Literature .....                             | 13        |
| 3.3 Change documentation.....                              | 13        |

# 1 Introduction

## 1.1 Overview

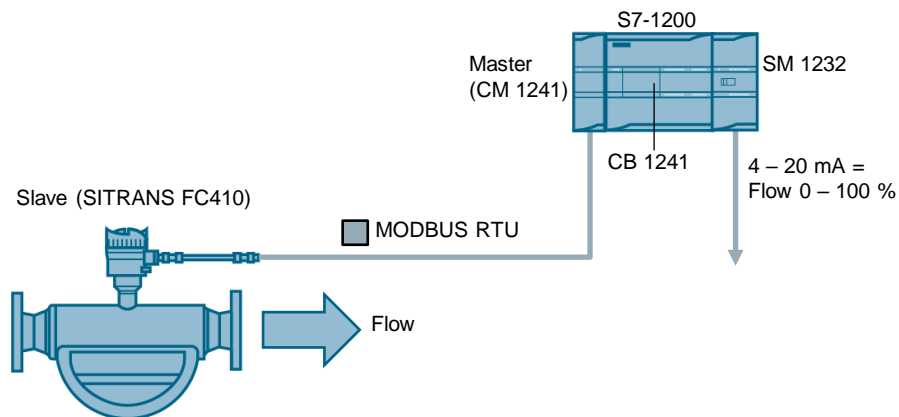
The SITRANS FC410 flowmeter with digital MODBUS RTU interface is connected to a controller. The controller converts the digital input signals to an analog 4-20 mA output signal.

## 1.2 Mode of operation

The application example describes the communication of a MODBUS master with a slave (in this case SITRANS FC410) as a gateway. Independent of the master/slave communication, measured values are read in parallel and made available as 4-20 mA analog signal.

The gateway PLC is set between the MODBUS master and the MODBUS slave, and monitors the data traffic. The current configuration is intended for 1:1 cabling. Incoming telegrams for the slave are forwarded directly. As soon as the slave responds, the response frame is sent back unchanged to the master. The gateway to the MODBUS master is used for reading out the value desired for the analog output. When a request is completed by the higher-level master, the gateway sends its own frame to the slave in order to read the register required for the analog output. The response from the slave is saved and the gateway mode is reactivated. This allows the higher-level master to communicate with the slave again. If there is no communication between master and slave, or if a longer pause is set, the gateway uses this time to regularly update the value for the analog output.

Figure 1-1



## 1.3 Components used

The Application Example has been created with the following hardware and software components:

Table 1-1

| Component   | Number | Article number      | Note |
|---|--------|---------------------|------|
| SITRANS FC410<br>Flowmeter  | 1      | 7ME4611-xxxxx-xDx1  |      |
| S7-1200, 1212C<br>DC/DC/DC<br>Automation system   | 1      | 6ES7 212-1AE40-0XB0 |      |
| CB 1241 (RS485)<br>Communications board<br>with<br>RS485 interface, joint<br>block                                  | 1      | 6ES7 241-1CH30-1XB0 |      |
| CM 1241 (RS422/485):<br>Communication module<br>with RS 422/RS 485<br>interface; 9-Pin Sub-D<br>socket              | 1      | 6ES7 241-1CH32-0XB0 |      |
| SM 1232 AQ2:<br>Analog output module<br>AQ2 x 14 bit; plug-in joint<br>blocks; output:<br>$\pm 10$ V and 0 to 20 mA | 1      | 6ES7 232-4HB32-0XB0 |      |
| SIMATIC STEP 7<br>Professional V15.1  | 1      | 6ES7822-1AA05-0YA5  |      |

The Application Example consists of the following components:

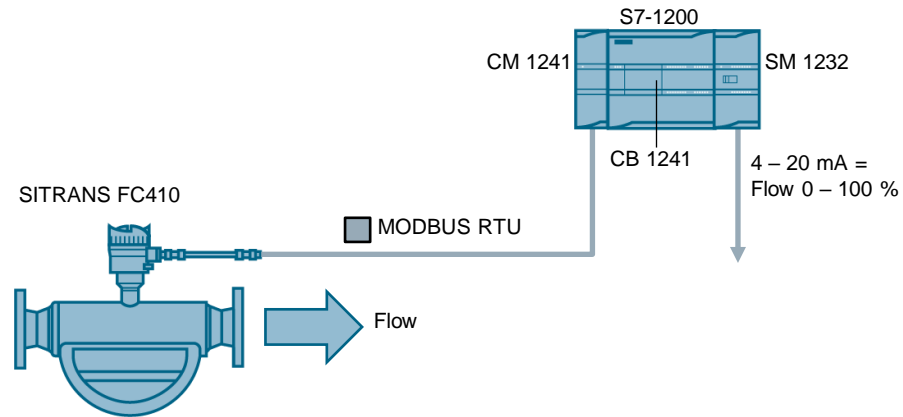
Table 1-2

| Component          | File name                                      | Note |
|--------------------|--|------|
| Documentation      | 109746404_FlowGatewayModbus_DOC_TIAV151_en.pdf |      |
| TIA Portal Project | 109746404_FlowGatewayModbus_PROJ_TIAV151.zip   |      |

## 2 Engineering

### 2.1 Hardware setup

Figure 2-1



#### 2.1.1 Connections

The master is connected to the 9-pin RS interface of the communication module CM 1241.

The slave is connected to the terminal box of the communication board CB 1241.

The analog signal is present at output QW96 of the analog output module SM 1232.

Figure 2-2: Allocation of plug-in connection CM 1241

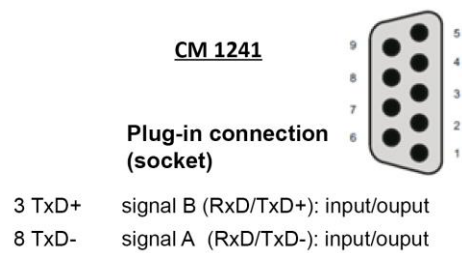


Figure 2-3: Connecting terminals CB1241

**CB 1241 RS485 (6ES7 241-1CH30-1XB0)**

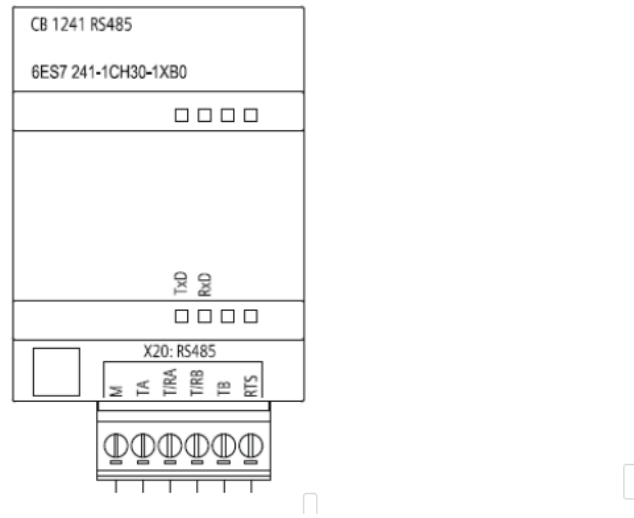
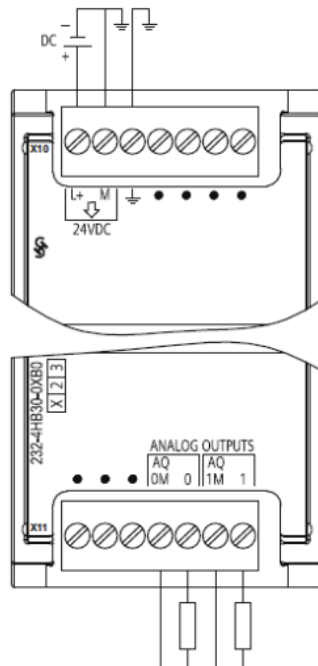


Figure 2-4: Analog output terminal assignment

**SM 1232 AO 2 x 14 Bit (6ES7 232-4HB30-0XB0)**



### 2.1.2 Analog output

The analog output scales the measured value to 4 – 20 mA.

- 4 mA for the lower limit
- 20 mA for the upper limit
- 0 mA if the value is invalid

**Note** The controller connected to the analog output should never be set to 0 - 20 mA.

## 2.2 Blocks

Table 2-1

| Block | Description  |
|-------|--|
| FC1   | ParameterSetting:<br>Define the parameter of the gateway (explanation below) |
| FB1   | CrcCalc:<br>Calculation of the Cyclic Redundancy Check (CRC)                 |
| FB2   | OwnJob:<br>Generation of the frame for the analog value query                |
| FB3   | AnalogValueGeneration:<br>Conversion of the value to 4 – 20 mA output        |
| FB7   | Gateway<br>Gateway control and analog value query                            |

**Note** You can download the blocks from the Download page of the TIA portal project.



## 2.3 Parameter assignment

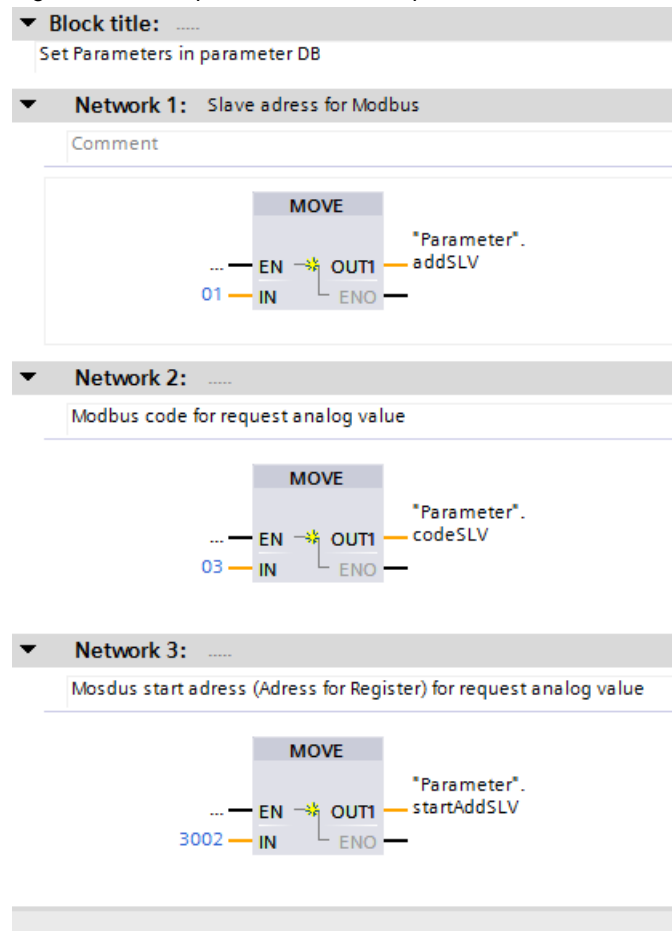
### 2.3.1 Parameters for gateway operation

In the FC block "ParameterSetting", you must specify the gateway operation parameters.

In order for the parameters to be written to the DB at each cycle, the values are written to the data block "DataGlobal" in the FC using the MOVE operation.

You must write the values for the corresponding MOVE operation:

Figure 2-5: Examples for the MOVE operation



### The following parameters can be predefined

Table 2-2

| Parameter        | Data type | Unit | Note   |
|------------------|-----------|------|--|
| addSLV           | Integer   | -    | MODBUS slave address   |
| codeSLV          | Integer   | -    | Query code, 3 for read value / register.   |
| startAddSLV      | Integer   | -    | Address of the register for the value to be output at the analog output (e. g., in this case 3002 for the volume flow).                                      |
| lengthSLV        | Integer   | -    | Number of registers to be read (e.g. 2 for the two registers that contain the REAL value of the volume flow).  |
| timeoutAO        | Time      | ms   | Maximum validity of the analog value in milliseconds [ms]. The value is regarded as invalid if no update is made after this time (analog output gives 0 mA). |
| timeoutMasterJob | Time      | ms   | Maximum timeframe for the slave to send the response to the master.  |
| timeoutOwnJob    | Time      | ms   | Maximum timeframe for the slave to send the response to the gateway (reading the registers for the analog value).  |
| conversionFactor | Real      | -    | Conversion factor for the analog value with regards the unit used in the register (e.g. 3,600,000 for the conversion of m <sup>3</sup> /h into l/s)          |
| valueLimitLowAO  | Real      | -    | Lower limit for the analog value scaling (this value is 4 mA)  |
| valueLimitHighAO | Real      | -    | Upper limit for the analog value scaling (this value is 20 mA)   |

**Note****TIMEOUT**

The TIMEOUT of the higher-level master should not be set smaller than the TIMEOUT of the gateway, as this may lead to irregular responses.

**Note****SLAVE ADDRESS**

The gateway regularly monitors the slave's response to the higher-level master and checks the address returned by slave itself. This is then applied. It is therefore sufficient if the correct slave address is stored on the master. The gateway evaluates this information for itself

### 2.3.2 Parameters of the communication module CM 1241

1. Open the communication module's properties.
2. Choose the RS 422/485 interface
3. Choose I/O link

You can set the following parameters:

- Operating mode
- Receive line initial state
- Baud rate
- Parity
- Data bits
- Stop bits
- Wait time

Figure 2-6: Communication module parameters

The screenshot shows the 'IO-Link' configuration window. It is divided into three main sections for radio button selection:

- Operating mode:**
  - Full duplex (RS422) 4-wire operation point to point
  - Full duplex (RS422) 4-wire operation multipoint master
  - Full duplex (RS422) 4-wire operation multipoint slave
  - Half duplex (RS485) 2-wire operation
- Receive line initial state:**
  - None
  - Bias with R(B)>R(A)>=0V
- Wire break:**
  - No wire-break check
  - Enable wire-break check

Below these sections are several input fields:

- Baud rate: 19.2 kbps
- Parity: Even parity
- Data bits: 8 bits per character
- Stop bits: 1
- Flow control: None
- XON character (HEX): 0 (ASCII: NUL)
- XOFF character (HEX): 0 (ASCII: NUL)
- Wait time: 20000 ms

## 3 Appendix

### 3.1 Service and Support

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<https://support.industry.siemens.com/cs/ww/en/sc/2067>

## 3.2 Links and Literature

Table 3-1

|     | Topic   |
|-----|---|
| \1\ | Siemens Industry Online Support<br><a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a>                                    |
| \2\ | Link to this entry<br><a href="https://support.industry.siemens.com/cs/ww/en/view/109746404">https://support.industry.siemens.com/cs/ww/en/view/109746404</a> |
| \3\ |   |

## 3.3 Change documentation

Table 3-2

| Version | Date    | Modifications           |
|---------|---------|-------------------------|
| V1.0    | 06/2017 | First version           |
| V1.1    | 07/2019 | Update TIA Portal V15.1 |
|         |         |                         |