Technical Information

SICK
CoLa Communication Block

CCOM_TCP_CP Function Block for
Siemens S7 Controllers

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SICK
Sensor Intelligence.

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1 About this document

Please read this chapter carefully before you begin working with these operating instructions and the SICK CoLa communication block.

1.1 Purpose of this document

These operating instructions describe how to use the SICK CCOM_TCP_CP function block. They are intended to guide technical personnel working for the machine manufacturer/operator through the processes of configuring and commissioning the function block.

1.2 Target group

These operating instructions are aimed at specialist personnel such as technicians and engineers.

2 General information

The CCOM_TCP_CP function block facilitates data exchange between SICK devices and S7 controllers. The block supports a TCP connection via a Simatic CP module (communication processor). Controllers with an integrated Ethernet interface are not supported.

This block can be used to operate the following SICK sensors:
- CLV6xx
- LECTOR62x
- RFH62x
- RFU63x

The following figure shows how the function block is represented in the function block diagram (FBD) view.

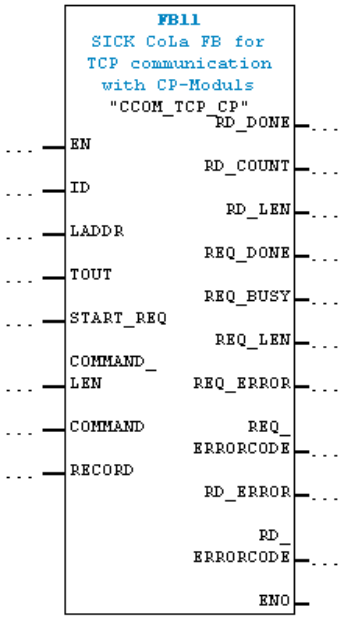

Figure 1: Representation of function block in FBD view

Optional functions:
- Send CoLa[1] commands to a SICK sensor
- Receive CoLa responses from a SICK sensor
- Receive telegrams sent by devices (can be configured in SOPAS[2] output format)

[1] The command language (CoLa) is a protocol internal to SICK for communicating with SOPAS devices.
[2] SOPAS-ET is an engineering tool for configuring SICK sensors.

3 Hardware configuration

3.1 Supported PLC controllers

The function block may only be operated with Simatic S7-300 and S7-400 controllers. Only controllers that use a CP module for TCP communication are supported. Controllers with an integrated Ethernet interface are not supported.

3.2 Configuration in Step7

A TPC connection to the sensor must be established before the function block can be used. To do this, open the NetPro connection tool in the Simatic Manager (Simatic Manager → Options → Configure network).

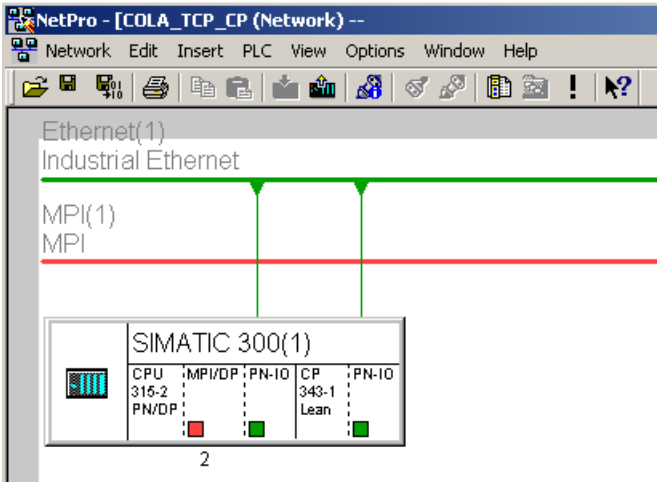

Figure 2: NetPro (Step7)

Select the CPU in your S7 station and use "Insert → New Connection" to create a new unspecified TCP connection.

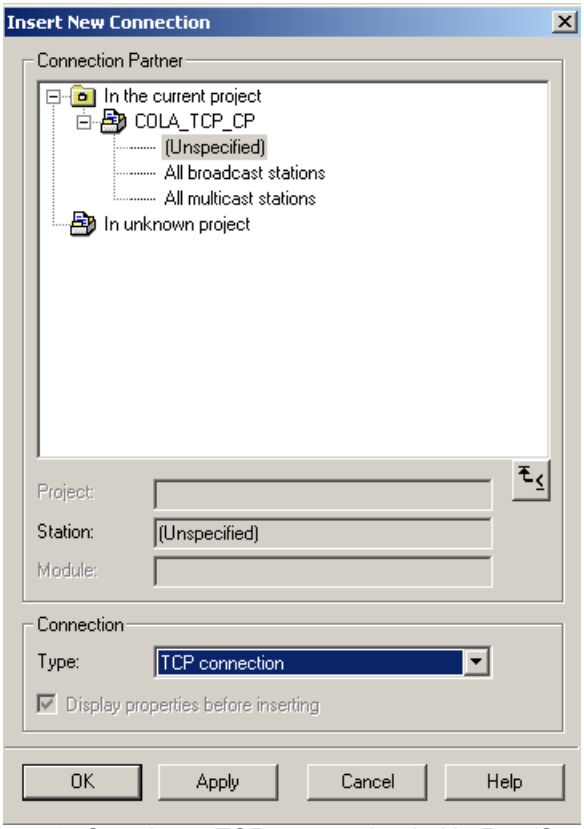

Figure 3: Creating a TCP connection in NetPro (Step7)

The "Active connection establishment" checkbox must be activated on the "General Information" tab in the properties dialog box of the TCP connection. The connection parameters for the TCP connection are displayed on the right-hand side of the dialog box. These parameter values must be transferred to the CCOM_TCP_CP function block when the block is called (parameters: ID/LADDR).

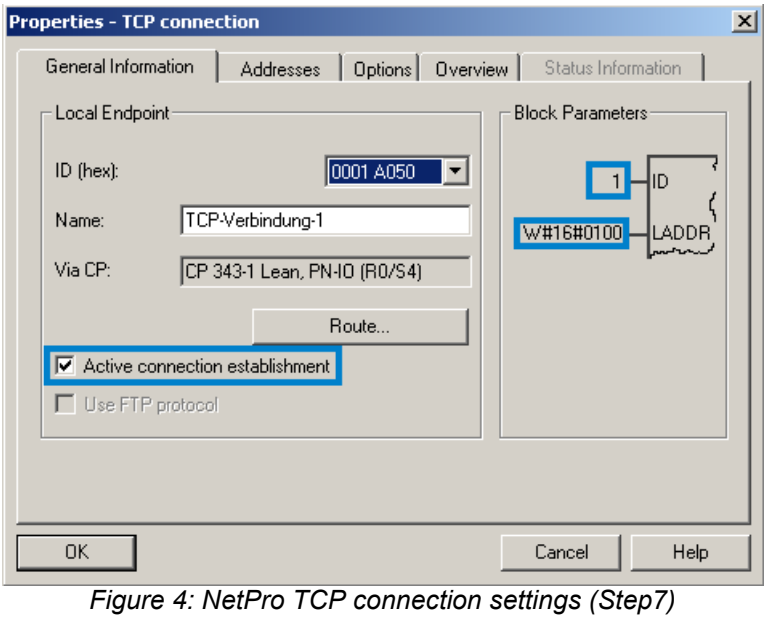

Figure 4: NetPro TCP connection settings (Step7)

The IP address and port used for the SICK sensor must be specified on the "Addresses" tab. By default, SICK sensors use port 2112 for communication.

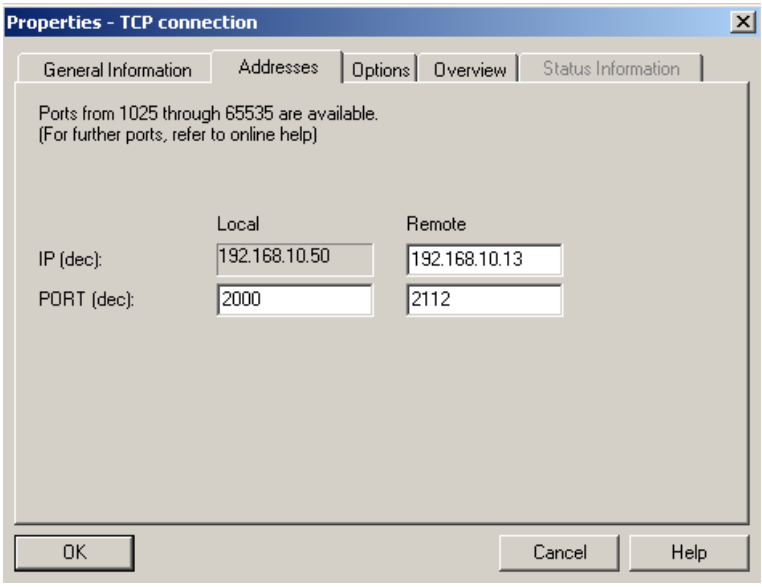

Figure 5: TCP connection addresses (Step7)

Set the "Send/Recv" mode on the "Options" tab.

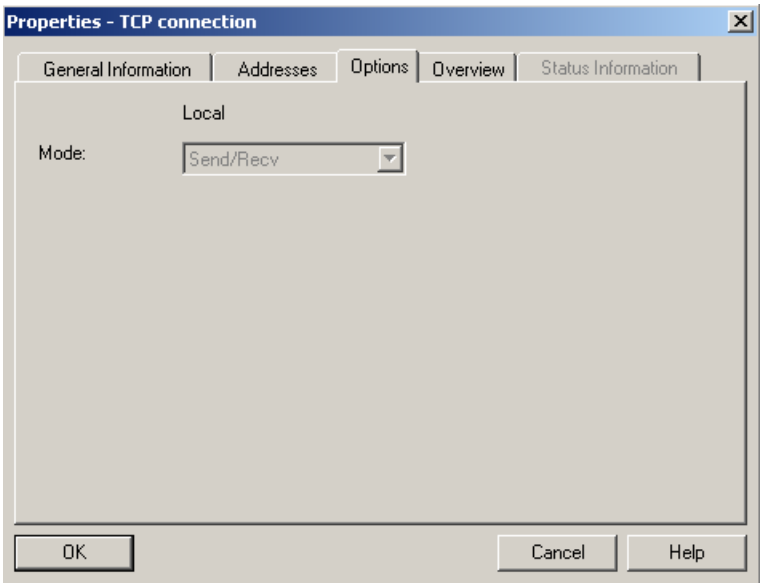

Figure 6: Operating mode of the TCP connection (Step7)

After you close the properties dialog box by clicking "OK", a TCP connection is displayed automatically in the connection table. Save and compile the station and then load the connection to your S7 controller. It may be necessary to restart the sensor in order to establish the TCP connection.

For the purpose of diagnosing the configured TCP connection, you can view the connection status under "Target system → Activate connection status".

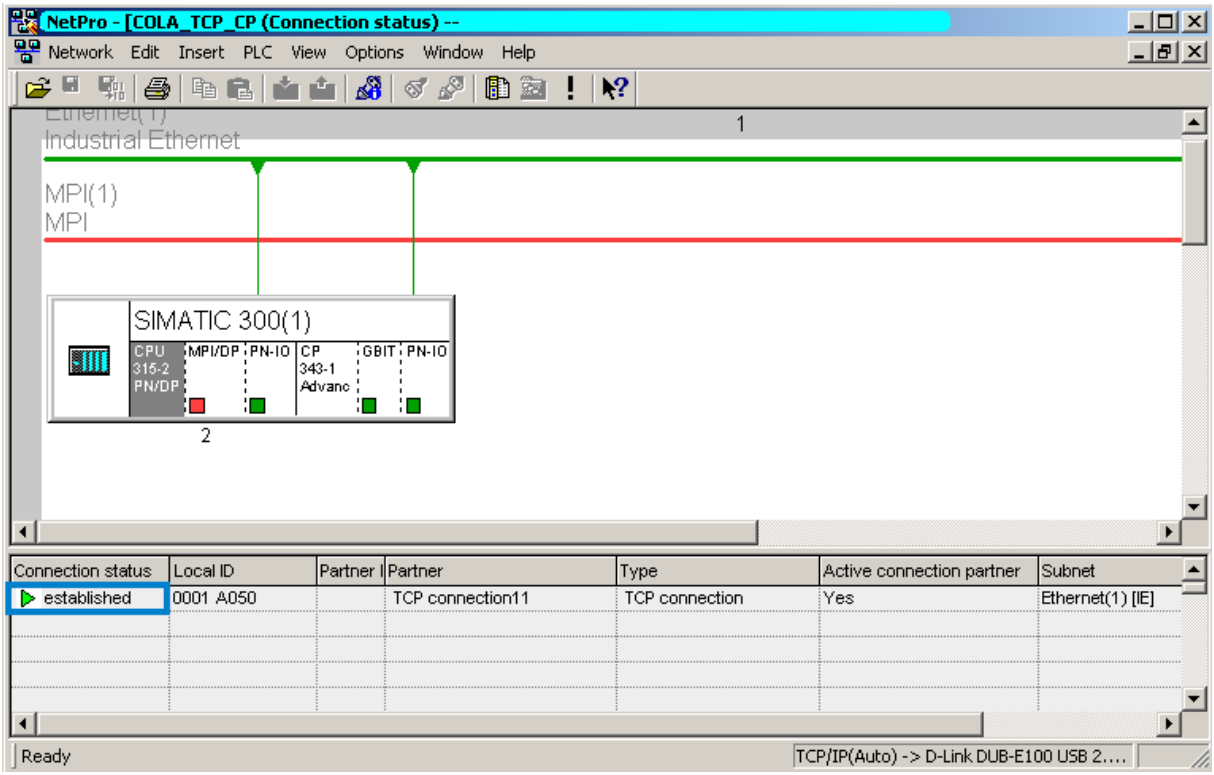

Figure 7: Connection status of the TCP connection (Step7)

4 Block description

The CCOM_TCP_CP (FB11) function block makes it easier to use SICK sensors with S7 controllers. The block enables you to send and receive CoLa commands via a TCP connection that has been configured in NetPro.

The block can be used for the following tasks:
- Send CoLa commands to a SICK sensor
- Receive CoLa responses from a SICK sensor
- Receive telegrams sent by devices (can be configured in SOPAS output format)

The function block is an asynchronous FB, i.e., processing encompasses several function block calls. Therefore, the function block must be called cyclically in the user program.

The CCOM_TCP_CP block (FB11) encapsulates Siemens function block AG_RECV_TCP_xVar (FB103) as well as the AG_SEND (FC5)/AG_RECV (FC6) functions, which are used for communication between the PLC and sensor.

4.1 Block specifications

Block number:	FB11
Block name:	CCOM_TCP_CP
Version:	1.0
Blocks called:	FC5 (AG_SEND) FC6 (AG_RECV) FB103 (AG_RECV_TCP_xVAR) SFB4 (TON)
Data blocks used:	-
Block call:	Cyclical
Flags used:	None
Counters used:	None
Registers used:	AR1, AR2 (for multi-instances)
Language used for block creation:	Step7 STL

Blocks FC5, FC6, and FB103 are provided by the Siemens library.

4.2 Operating principle

The following parameters must be specified before the CCOM_TCP_CP block can be used.

ID: Connection ID of the TCP connection. This parameter is specified in the NetPro connection properties (see Figure 4).

LADDR: Module start address. The module start address is specified in the configuration table when configuring the CP module with the Step7 hardware configuration. The parameter is also displayed in the NetPro connection properties (see Figure 4).

COMMAND: The pointer references the data area in which the CoLa command is stored. The data area must be created by the programmer (e.g., data block with an array of CHAR).

COMMAND_LEN: Character length of the CoLa command to be transmitted

RECORD: The pointer references the data area in which the telegrams sent by the device are stored. The data area must be created by the programmer (e.g., data block with an array of BYTE).

4.2.1 Receiving reading results (RD)

Data sent by the device (RD) is written to the record as soon as the function block receives new data. For one PLC cycle, the RD_DONE bit indicates that new data has been received. The RD_COUNT counter is incremented as soon as new data has been received. The RD_LEN parameter indicates the byte length of the telegram last received.

4.2.2 Device communication via CoLa commands (REQ)

When communication takes place via CoLa commands, the command defined in COMMAND is transmitted to the device. The resulting response is stored in the area defined by the RECORD pointer. CoLa commands are always sent with control characters ([ETX], [STX] framing).

To start transmission, you must trigger the START_REQ parameter with a rising edge. Until a valid response is received in reply to the CoLa command sent, the REQ_BUSY parameter signals that a response is still pending. If no response is received within the timeout period (TOUT), the function is terminated with a timeout error (REQ_ERRORCODE). The REQ_DONE output parameter indicates that a response to a CoLa command has been received (REQ_DONE = TRUE).

4.2.3 Timing

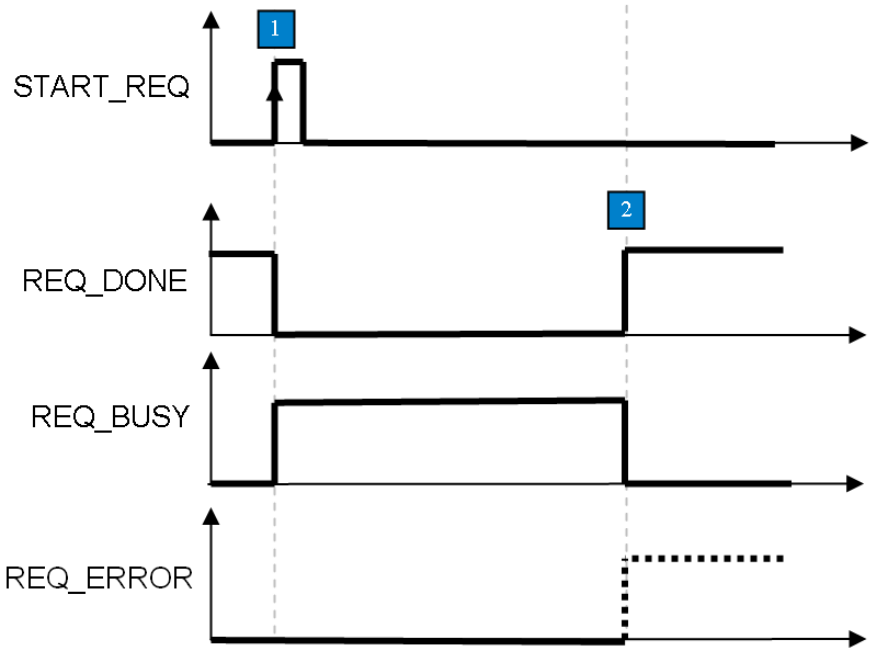

Figure 8: Timing diagram

1: Request triggered by rising edge at START_REQ. The CoLa command referenced by the COMMAND parameter is sent to the sensor. Only one command can be sent at a time.

2: Once the command has been sent and the response received, the function is terminated with "REQ_DONE". If an error occurred during the function, the function is terminated with "REQ_ERROR". "REQ_ERRORCODE" contains the error code that occurred if the function is aborted with "REQ_ERROR".

4.3 Response to errors

The REQ_ERROR or RD_ERROR bits signal that an error has occurred. In this case, an error code is output via the REQ_ERRORCODE or RD_ERRORCODE parameters. The REQ_ERROR bit remains set until a new command is started. The RD_ERROR parameter is only ever active for one PLC cycle and is then reset unless the error remains.

4.4 Parameters

Parameter	Declaration	Data type	Memory area	Description
EN	INPUT	BOOL	I,M,D,L, const.	Enable input (LD and FBD)
ID	INPUT	INT	I,M,D,L, const.	Connection ID for the configured TCP connection (see NetPro connection settings Figure 4)
LADDR	INPUT	WORD	I,M,D,L, const.	Module start address of the configured CP module (see NetPro connection settings Figure 4)
TOUT	INPUT	TIME	I,M,D,L, const.	Period of time, after which a timeout error is triggered If this parameter is not connected, the timeout period is set to 5 seconds by default. Please note that some CoLa commands require longer processing periods (e.g., save commands).
START_REQ	INPUT	BOOL	I,M,D,L	Rising edge: System sends CoLa command and waits for corresponding response
COMMAND	INPUT	ANY	D	Pointer referencing the area containing the CoLa command to be sent. Only the BYTE data type is permitted. Note: Please be aware that the DB parameter data always has to be specified in its entirety for the parameter (e.g.: P#DB13.DBX0.0 BYTE 100). An explicit DB number cannot be omitted; otherwise a block error will occur.
COMMAND_ LEN	INPUT	INT	I,M,D,L, const.	Number of bytes in the CoLa command to be sent, which is referenced by the #COMMAND pointer
RECORD	INPUT	ANY	D	Pointer referencing the area in which the telegrams sent by the device are stored. Only the BYTE data type is permitted. Note: Please be aware that the DB parameter data always has to be specified in its entirety for the parameter (e.g.: P#DB13.DBX0.0 BYTE 100). An explicit DB number cannot be omitted; otherwise a block error will occur.

Parameter	Declaration	Data type	Memory area	Description
RD_DONE	OUTPUT	BOOL	Q,M,D,L	Rising edge: A reading result sent by the device has been received (for formatting details, see SOPAS output format). Whenever a reading result is received, the bit is set for one PLC cycle. The reading result is available in the memory area referenced by the #RECORD parameter.
RD_COUNT	OUTPUT	BYTE	Q,M,D,L	Counts the number of reading results received. The counter goes from 0 to 255 (decimal). The counter restarts at 0 once 255 has been exceeded.
RD_LEN	OUTPUT	INT	Q,M,D,L	Indicates the byte length of the reading result received
REQ_DONE	OUTPUT	BOOL	Q,M,D,L	Indicates whether a CoLa command has been sent and a response received TRUE: Successfully completed FALSE: Not yet completed The command response is available in the memory area referenced by the #RECORD parameter.
REQ_BUSY	OUTPUT	BOOL	Q,M,D,L	REQ command in progress
REQ_LEN	OUTPUT	INT	Q,M,D,L	Length of a response telegram in BYTES
REQ_ ERROR	OUTPUT	BOOL	Q,M,D,L	REQ error status: 0: No error 1: Aborted with error
RD_ERROR	OUTPUT	BOOL	Q,M,D,L	RD error status: 0: No error 1: Aborted with error
REQ_ERROR CODE	OUTPUT	WORD	Q,M,D,L	REQ error status (see "Error codes")
RD_ERROR CODE	OUTPUT	WORD	Q,M,D,L	RD error status (see "Error codes")
ENO	OUTPUT	BOOL	Q,M,D,L	Enable output (LD and FBD)

4.5 Error codes

The REQ_ERRORCODE and RD_ERRORCODE parameters contain the following error information:

Error code	Brief description	Description
W#16#0000	No error	No error
W#16#0001	Invalid memory area specified for #RECORD pointer	Invalid memory area for specified ANY pointer. A DB must be assigned to the pointer.
W#16#0002	Invalid pointer length specified for #RECORD pointer	The referenced data block is shorter than the length defined by the pointer.
W#16#0003	Invalid memory area specified for #COMMAND pointer	Invalid memory area for specified ANY pointer. A DB must be assigned to the pointer.
W#16#0004	Invalid pointer length specified for #COMMAND pointer	The referenced data block is shorter than the length defined by the pointer.
W#16#0005	Timeout	The command could not be executed within the selected timeout period. Possible causes: - Device is not connected to the PLC - Incorrect communication parameters - CoLa commands have been used that do not send back responses (echo). - Command processing time > timeout period
W#16#0006	Invalid command length	The command being sent is longer than the specified command length (COMMAND_LEN).
W#16#0007	Invalid CoLa command	There is no [STX] [ETX] framing for the specified CoLa command.
W#16#000A	Telegram received > #RECORD length	The received telegram is longer than the specified #RECORD length.
W#16#000B	Telegram received without control characters	- A telegram was received without [STX] [ETX] framing. - The received telegram is longer than the specified #RECORD length.
W#16#8XXX	AG_RECV_TCP_xVAR / AG_SEND error	For a description of the error, see the Step7 help system.

5 Example

Figure 9 shows an example of a connected CCOM_TCP_CP function block. The TCP connection to the SICK sensor has been configured in advance using NetPro and the (ID) and (LADDR) connection parameters transferred to the function block.

Program call:

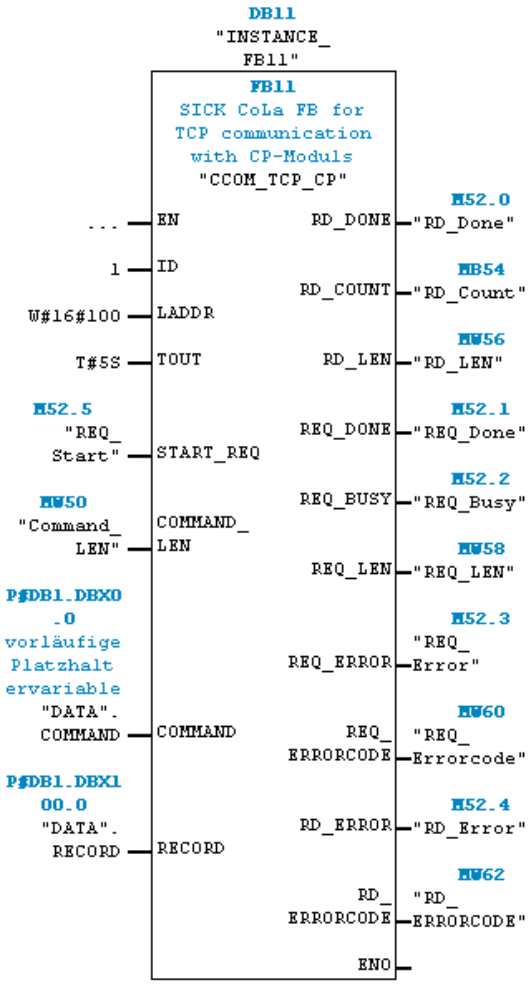

Figure 9: Example of a connected CCOM_TCP_CP function block

Table of variables for executing a CoLa command:

// CCOM TCP CP function block				
M 10.0	"REQ_Start"	BOOL	true	
// Reading Result Status				
M 12.0	"RD_Done"	BOOL	false	
MB 16	"RD_Count"	DEC	23	
M 12.3	"RD_Error"	BOOL	false	
MW 24	"RD_Errorcode"	HEX	W#16#0000	
// Requesting Result Status				
M 12.4	"REQ_Done"	BOOL	true	
M 12.1	"REQ_Busy"	BOOL	false	
M 12.2	"REQ_Error"	BOOL	false	
MW 22	"REQ_Errorcode"	HEX	W#16#0000	
// Command				
MW 14	"Command_Len"	DEC	15	15
DB1.DBB 0	"DATA".COMMAND[1]	CHARACTER	'ך'	'ך'
DB1.DBB 1	"DATA".COMMAND[2]	CHARACTER	's'	's'
DB1.DBB 2	"DATA".COMMAND[3]	CHARACTER	'M'	'M'
DB1.DBB 3	"DATA".COMMAND[4]	CHARACTER	'N'	'N'
DB1.DBB 4	"DATA".COMMAND[5]	CHARACTER	' '	' '
DB1.DBB 5	"DATA".COMMAND[6]	CHARACTER	'm'	'm'
DB1.DBB 6	"DATA".COMMAND[7]	CHARACTER	'T'	'T'
DB1.DBB 7	"DATA".COMMAND[8]	CHARACTER	'C'	'C'
DB1.DBB 8	"DATA".COMMAND[9]	CHARACTER	'g'	'g'
DB1.DBB 9	"DATA".COMMAND[10]	CHARACTER	'a'	'a'
DB1.DBB 10	"DATA".COMMAND[11]	CHARACTER	't'	't'
DB1.DBB 11	"DATA".COMMAND[12]	CHARACTER	'e'	'e'
DB1.DBB 12	"DATA".COMMAND[13]	CHARACTER	'o'	'o'
DB1.DBB 13	"DATA".COMMAND[14]	CHARACTER	'n'	'n'
DB1.DBB 14	"DATA".COMMAND[15]	CHARACTER	'ט'	'ט'
DB1.DBB 15	"DATA".COMMAND[16]	CHARACTER	B#16#00	
DB1.DBB 16	"DATA".COMMAND[17]	CHARACTER	B#16#00	
DB1.DBB 17	"DATA".COMMAND[18]	CHARACTER	B#16#00	
DB1.DBB 18	"DATA".COMMAND[19]	CHARACTER	B#16#00	
DB1.DBB 19	"DATA".COMMAND[20]	CHARACTER	B#16#00	

The CoLa command ("[STX]sMN mTCgateon[ETX]" in this case) is executed as soon as the "START_REQ" bit is triggered with a rising edge.

Table of variables for incoming command responses:

// Record			
MW 18	"RD_Len"	DEC	50
MW 20	"REQ_Len"	DEC	17
DB1.DBB 100	"DATA".RECORD[1]	CHARACTER	'┐'
DB1.DBB 101	"DATA".RECORD[2]	CHARACTER	's'
DB1.DBB 102	"DATA".RECORD[3]	CHARACTER	'A'
DB1.DBB 103	"DATA".RECORD[4]	CHARACTER	'N'
DB1.DBB 104	"DATA".RECORD[5]	CHARACTER	' '
DB1.DBB 105	"DATA".RECORD[6]	CHARACTER	'm'
DB1.DBB 106	"DATA".RECORD[7]	CHARACTER	'T'
DB1.DBB 107	"DATA".RECORD[8]	CHARACTER	'C'
DB1.DBB 108	"DATA".RECORD[9]	CHARACTER	'g'
DB1.DBB 109	"DATA".RECORD[10]	CHARACTER	'a'
DB1.DBB 110	"DATA".RECORD[11]	CHARACTER	't'
DB1.DBB 111	"DATA".RECORD[12]	CHARACTER	'e'
DB1.DBB 112	"DATA".RECORD[13]	CHARACTER	'o'
DB1.DBB 113	"DATA".RECORD[14]	CHARACTER	'n'
DB1.DBB 114	"DATA".RECORD[15]	CHARACTER	' '
DB1.DBB 115	"DATA".RECORD[16]	CHARACTER	'1'
DB1.DBB 116	"DATA".RECORD[17]	CHARACTER	'└'
DB1.DBB 117	"DATA".RECORD[18]	CHARACTER	B#16#00
DB1.DBB 118	"DATA".RECORD[19]	CHARACTER	B#16#00
DB1.DBB 119	"DATA".RECORD[20]	CHARACTER	B#16#00

The response (REQ) to a sent command (in this case: "[STX]sAN mTCgateon 1[ETX]") becomes available in the record area when the value of the "REQ_DONE" output bit changes from FALSE to TRUE (rising edge). The "REQ_LEN" parameter indicates how many bytes were received and are valid.

Table of variables for incoming reading results:

// Record			
MW 18	"RD_Len"	DEC	11
MW 20	"REQ_Len"	DEC	17
DB1.DBB 100	"DATA".RECORD[1]	CHARACTER	'ך'
DB1.DBB 101	"DATA".RECORD[2]	CHARACTER	'1'
DB1.DBB 102	"DATA".RECORD[3]	CHARACTER	'2'
DB1.DBB 103	"DATA".RECORD[4]	CHARACTER	'3'
DB1.DBB 104	"DATA".RECORD[5]	CHARACTER	'4'
DB1.DBB 105	"DATA".RECORD[6]	CHARACTER	'5'
DB1.DBB 106	"DATA".RECORD[7]	CHARACTER	'6'
DB1.DBB 107	"DATA".RECORD[8]	CHARACTER	'7'
DB1.DBB 108	"DATA".RECORD[9]	CHARACTER	'8'
DB1.DBB 109	"DATA".RECORD[10]	CHARACTER	'9'
DB1.DBB 110	"DATA".RECORD[11]	CHARACTER	'ט'
DB1.DBB 111	"DATA".RECORD[12]	CHARACTER	'e'
DB1.DBB 112	"DATA".RECORD[13]	CHARACTER	'o'
DB1.DBB 113	"DATA".RECORD[14]	CHARACTER	'n'
DB1.DBB 114	"DATA".RECORD[15]	CHARACTER	' '
DB1.DBB 115	"DATA".RECORD[16]	CHARACTER	'1'
DB1.DBB 116	"DATA".RECORD[17]	CHARACTER	'ט'
DB1.DBB 117	"DATA".RECORD[18]	CHARACTER	B#16#00
DB1.DBB 118	"DATA".RECORD[19]	CHARACTER	B#16#00

Data sent by the device (RD) is written to the record as soon as the function block receives new data. For one PLC cycle, the "RD_DONE" bit indicates that new data has been received (signal changes from FALSE to TRUE). The RD_COUNT counter is incremented as soon as new data has been received. The "RD_LEN" parameter indicates how many bytes were received and are valid.