DIN EN ISO 9001:2000
certified

ADDI-DATA GmbH
Dieselstraße 3
D-77833 OTTERSWEIER

Technical support:
+49 (0)7223 / 9493 – 0

Preliminary version

Technical description

MSX-Box

S7 communication

Edition: 01.01 – 02/2007

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current status before printing.
The content of this manual and the technical product data may be changed without prior notice.
ADDI-DATA GmbH reserves the right to make changes to the technical data and the materials included herein.

Warranty and liability

The user is not permitted to make changes to the product beyond the intended use, or to interfere with the product in any other way.
ADDI-DATA shall not be liable for obvious printing and phrasing errors. In addition, ADDI DATA, if legally permissible, shall not be liable for personal injury or damage to materials caused by improper installation and/or commissioning of the board by the user or improper use, for example, if the board is operated despite faulty safety and protection devices, or if notes in the operating instructions regarding transport, storage, installation, commissioning, operation, thresholds, etc. are not taken into consideration. Liability is further excluded if the operator changes the board or the source code files without authorisation and/or if the operator is guilty of not monitoring the permanent operational capability of working parts and this has led to damage.

Copyright

ADDI-DATA software product licence

Please read this licence carefully before using the standard software. The customer is only granted the right to use this software if he/she agrees with the conditions of this licence.
The software must only be used to set up the ADDI-DATA boards.
Reproduction of the software is forbidden (except for back-up and for exchange of faulty data carriers). Disassembly, decompilation, decryption and reverse engineering of the software are forbidden. This licence and the software may be transferred to a third party if this party has acquired a board by purchase, has agreed to all the conditions in this licence contract and the original owner does not keep any copies of the software.

Trademarks

WARNING

The following risks result from improper implementation and from use of the board contrary to the regulations:

- **Personal injury**

- **Damage to the board, MSX-Box, PC and peripherals**

- **Pollution of the environment**

- **Protect yourself, the others and the environment!**

- **Read carefully the safety precautions (yellow leaflet).**

  If this leaflet is not with the documentation, please contact us and ask for it.

- **Observe the instructions of the manual.**

  Make sure that you do not forget or skip any step. We are not liable for damages resulting from a wrong use of the board.

- **Used symbols:**

IMPORTANT!
Designates hints and other useful information.

WARNING!
It designates a possibly dangerous situation.
If the instructions are ignored the board, PC and/or peripheral may be destroyed.

Figures

Tables

1 INTRODUCTION

1.1 About this documentation

This documentation describes how to control a **MSX-Box** with a Siemens **S7** over Ethernet.

It is based on a sample using the **APCI-1500** (a board with 16 digital inputs and outputs) as hardware to be managed (in the **MSX-Box**) through the **S7**.

The **S7** is reading the status of the 16 digital inputs of the **APCI-1500**.

Hardware:

- **MSX-Box**
- **APCI-1500** (16 digital inputs / outputs)
- **Siemens S7 + CP343-1 Lean**

The Siemens **S7** has to read and write digital inputs from the **APCI-1500** (located in the **MSX-Box**).

1.2 Requirements

Please make sure that the following requirements are fulfilled:

- Siemens CPU313C-2DP (The PLC device)
- Siemens CP343-1 Lean (Ethernet module for the PCL)
- FC5 (AG_SEND) and FC6 (AG_RECV) blocks for S7-300 (asynchrony communication function)
- MSX-Box OPEN MODBUSTCP Slave package
- S7 sample for Step 7

1.3 Description

The Siemens **S7** is used as a master to remote the slave **MSX-Box** by using the OPEN MODBUS TCP protocol. The **MSX-Box** is running an OPEN MODBUS TCP Slave server which is waiting for the master request.

ADDI-DATA provides a **MSX-Box** OPEN MODBUS TCP slave server servicing Class 0 functions.

This class is the minimal set of functions that has to be available on a device providing the OPEN MODBUS TCP protocol.

Class 0 includes a set of 2 functions:

- Read multiple registers
- Write multiple registers

On the **MSX-Box** side, OPEN MODBUS TCP telegrams do not need to be manipulated directly. This is already done by the server. Read and write skeletons functions have to be filled with the code they have to execute once the **S7** asks for reading or writing. On the **S7**, OPEN MODBUS TCP telegrams have to be set (See S7 Program).

2 OPEN MODBUS TCP

2.1 Introduction

The OPEN MODBUS TCP protocol is based on the widely known MODBUS protocol.

OPEN MODBUS TCP is an open protocol and is not manufacturer dependent.

It is mainly used to connect PLC and I/O devices.

The OPEN MODBUS TCP protocol is using the connection oriented TCP protocol in order to ensure security features and simplify the server and client codes. Data are encoded in big-endian (for data larger as bytes, the most significant byte is sent first).

The OPEN MODBUS TCP telegram is composed of two parts, a header and a body.

2.2 Type definition

Please note:
1 x byte = 8-bit
1 x word = 16-bit = 2 x bytes

2.3 Header description

The header is always composed of 6 bytes:

Table 2-1: Open Modbus TCP: Header description

Byte	Signification		Value	Comment
0	Transaction identifier	MSB	0	Copied by server
1	Transaction identifier	LSB	0	
2	Protocol identifier	MSB	0	OPEN MODBUS TCP = 0
3	Protocol identifier	LSB	0	
4	Length field	MSB	0	0 Because messages are smaller than 256
5	Length field	LSB	Number of bytes of the body	

MSB: Most significant byte
LSB: Least significant byte

2.4 Class 0: Read multiple registers (FC3)

2.4.1 Request

Table 2-2: Read multiple registers FC3: Request

Byte	Signification		Value	Comment
0	Unit identifier			Index of the slave to be controlled
1	Function code		3	Code of the function to execute
2	Reference number	MSB		First register to be read
3	Reference number	LSB		
4	Word count	MSB	1-125	Number of words to be read from the reference register
5	Word count	LSB		

MSB: Most significant byte
LSB: Least significant byte

2.4.2 Response

Table 2-3: Read multiple registers FC3: Response

Byte	Signification	Value	Comment
0	Unit identifier		Index of the slave to be controlled
1	Function code	3	Code of the function to execute
2	Byte count of response		Number of words from the response converted in byte.
3 …	Register values		Read words

2.4.3 Exception

Table 2-4: Read multiple registers FC3: Exception

Byte	Signification	Value	Comment
0	Unit identifier		Index of the slave to be controlled
1	Function exception code	83	Function code + Exception modifier
2	Exception code	1 or 2	1: Illegal function 2: Illegal data address

Sample:

Read 2 registers at reference 8 slave 5.

Reference	Register value (Hex)
8	5678
9	4897

Request: **00 00 00 00 00 06** 05 03 00 08 00 02
Response: **00 00 00 00 00 07** 05 03 04 56 78 48 97

OPEN MODBUS TCP Header

2.5 Class 0: Write multiple registers (FC16)

2.5.1 Request

Table 2-5: Write multiple registers FC16: Request

Byte	Signification		Value	Comment
0	Unit identifier			Index of the slave to be controlled
1	Function code		16	Code of the function to execute
2	Reference number	MSB		First register to be written
3	Reference number	LSB		
4	Word count	MSB	1-100	Number of words to be written from the reference register
5	Word count	LSB		
6	Byte count			Number of bytes to be written from the reference register
7 …	Register values			Words to be written from the reference register

MSB: Most significant byte
LSB: Least significant byte

2.5.2 Response

Table 2-6: Write multiple registers FC16: Response

Byte	Signification		Value	Comment
0	Unit identifier			Index of the slave to
1	Function code		16	Code of the function to execute
2	Reference number	MSB		This is the first written register
3	Reference number	LSB		
4	Word count	MSB		The number of written words
5	Word count	LSB		

MSB: Most significant byte
LSB: Least significant byte

2.5.3 Exception

Table 2-7: Read multiple registers FC16: Exception

Byte	Signification	Value	Comment
0	Unit identifier		Index of the slave to
1	Function exception code	90	Function code + Exception modifier
2	Exception code	1 or 2	1: Illegal function 2: Illegal data address

Sample:

Write 2 registers at reference 8 slave 5.

Reference	Register value (Hex)
8	5678
9	4897

Request: **00 00 00 00 00 0C** 05 10 00 08 00 02 00 04 56 78 48 97
Response: **00 00 00 00 00 06** 05 10 00 08 00 02

OPEN MODBUS TCP Header

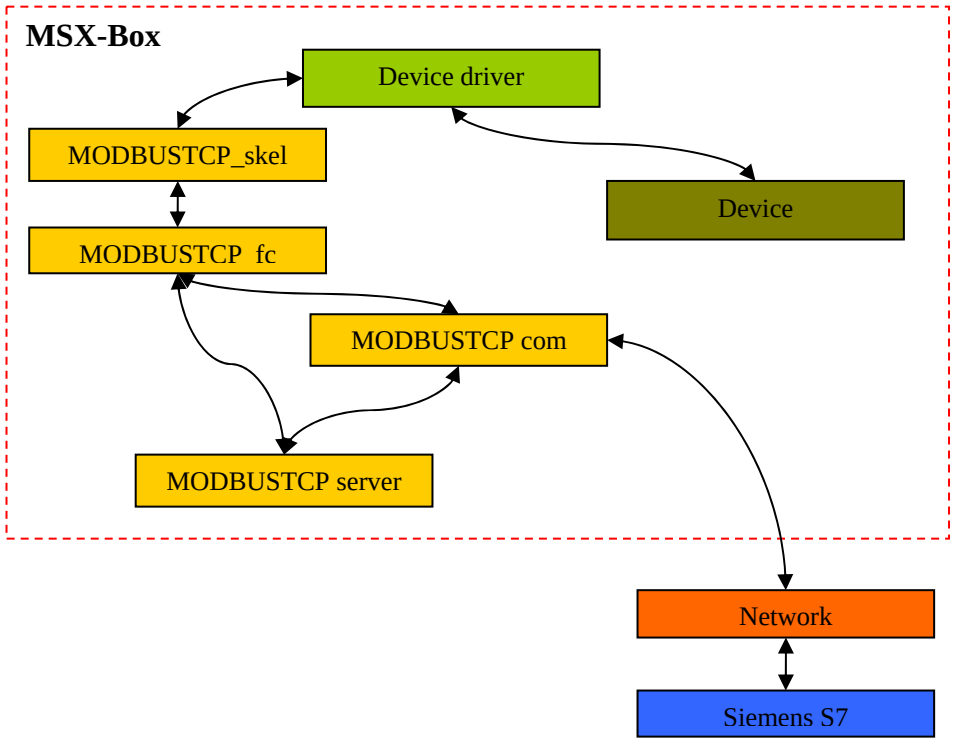
3 MSX-BOX

3.1 OPEN MODBUS TCP Slave package

On the **MSX-Box**, the slave server contains all requested functions for the communication between Siemens **S7**, **MSX-Box** and other peripherals.
It is composed of the following parts:

MODBUSTCP_com.c:	Contains all functions to realise the TCP communication.
MODBUSTCP_com.h:	Header of the previous c file.
MODBUSTCP_fc.c:	Contains MODBUS TCP Class 0 functions and exceptions management.
MODBUSTCP_fc.h:	Header of the previous c file.
MODBUSTCP_server.c:	This is where the main functions are located.
MODBUSTCP_skel.c:	Contains read / write skeletons functions which have to be filled.
MODBUSTCP_skel.h:	Header of the previous c file.
MODBUSTCP.h:	Header for MODBUS TCP specific information.

Relation between the different parts:



Parts running in the user level are in yellow (**yellow**)**.** The device driver kernel level is in green (**green**)**.**

The code is written so that only the skeleton parts of the slave have to be filled.

3.2 Steps to follow

In order to realise a slave server, the following steps have to be done:

1. Fill the hook functions located in MODBUSTCP_skel.c:
   - skel_MODBUSTCPServerStart
   - skel_MODBUSTCPServerStop
   - skel_MODBUSTCPReadMultipleRegisters
   - skel_MODBUSTCPWriteMultipleRegisters

2. Compile the slave server.

3.3 Skeleton functions

3.3.1 Introduction

Skeleton functions are like hook functions which are called when the defined task is done. You have to fill the body of these hook functions as you require.

Four functions are available in this slave version:
- skel_MODBUSTCPServerStart
- skel_MODBUSTCPServerStop
- skel_MODBUSTCPReadMultipleRegisters
- skel_MODBUSTCPWriteMultipleRegisters

3.3.2 skel_MODBUSTCPServerStart

Prototype:

```
int skel_MODBUSTCPServerStart (void)
```

When it is called:

- Once the slave application is started
- Initialization and request waiting.

Has to be used for:

Allows you to make your own initialization before the slave starts. This is a good place to open and/or initialize the hardware that has to be managed by the **S7**.

Parameters:

No parameter.

Return value:

If you return a value different from 0, the server does not start.
E.g.: If the hardware to use is not available, a value different of 0 can be returned. The slave server does not start.

Sample:

In this sample the used hardware is an ADDI-DATA **APCI-1500** board. The apci1500_find_cards functions searches for an **APCI-1500** in the **MSX-Box** and returns the number of boards found.

If no board was found, it returns 1 (error) and the slave server will not go on running.

```
int skel_MODBUSTCPServerStart (void)
{
        /* Search all APCI-1500 boards and return the
number of boards */
        if ((nbr = apci1500_find_cards(&fd)) < 1)
        {
             return 1;
        }

        return 0;

}
```

3.3.3 skel_MODBUSTCPServerStop

Prototype:

```
int skel_MODBUSTCPServerStop (void)
```

When it is called:

Just before the slave server quits (because of error or user has quit it).

Has to be used for:

Allows to release before the slave is quitting. This is a good place to close and/or release the hardware that has to be managed by the **S7**.

Parameters:

No parameter.

Return value:

Not used.

Sample:

In this sample the used hardware is an ADDI-DATA **APCI-1500** board. Set all digital outputs of the APCI-1500 to 0 before quitting the slave server.

```
int skel_MODBUSTCPServerStop (void)
{
        APCI1500_WriteAllDigitalOutput (&fd, 0);

        return 0;

}
```

3.3.4 skel_MODBUSTCPReadMultipleRegisters

Prototype:

```
uint16_t skel_MODBUSTCPReadMultipleRegisters(uint16_t reference, uint16_t
length, uint16_t *value)
```

When it is called:

Once the slave received a valid (valid = the telegram is tested from the slave server) FC3 request telegram. FC3 is reading multiple registers.

Has to be used for:

Read something or do an action.

Parameters:

Input:

Reference	Index of the first register to be read.
Length	Number of words to read from the reference register.

Output:

Value	This is a word array in which you have to return read words. The array size is "length" size!

Return value:

0: No error
1: ILLEGAL_FUNCTION
2: ILLEGAL_DATA_ADDRESS
3: ILLEGAL_DATA_VALUE (Not specified for this FC in the MODBUSTCP specification, but can be useful in some case)

Sample:

In this sample, the reference is used as a function index. Here reference = 0 calls the APCI1500_ReadAllDigitalInput function. Length is used as an index to specify the board to use; it is the minor number of the board. Value will contains the status of the 16 digital inputs of the **APCI-1500**.

Remark: *Data in the value array do not have to be converted in big-endian for the communication. The slave server does this automatically for you.*

```
uint16_t skel_MODBUSTCPReadMultipleRegisters(uint16_t reference, uint16_t
length, uint16_t *value)
{
```

```
		/* "reference" is the index of the function to execute */
		switch (reference)
		{
			/*
			 * Read all digital inputs of the APCI-1500.
			 * There are 16 digital inputs, each input is to see
			 * as a bit, so they can be stored in a word (16 bit).
			 * The length is used to select the board to use.
			 * (length-1) while the board index begins to 0.
			 */
			case 0:
				if ((length > nbr) || (APCI1500_ReadAllDigitalInput
(fd[(length-1)], &value[0]) != 0))
				{
					value = 0;

					/* Fail to read digital inputs, generate an
exception */
					return ILLEGAL_DATA_ADDRESS;
				}
			break;

			default:
				/* Bad function */
				return ILLEGAL_FUNCTION;
			break;
		}

	return 0;

}
```

3.3.5 skel_MODBUSTCPWriteMultipleRegisters

Prototype:

```
uint16_t skel_MODBUSTCPWriteMultipleRegisters(uint16_t reference, uint16_t
length, uint16_t *value)
```

When it is called:

Once the slave receives a valid (valid = the telegram is tested from the slave server) FC16 request telegram. FC16 is writing multiple registers.

Has to be used for:

Write something or do an action.

Parameters:

Input:

reference	Index of the first register to be written.
length	Number of words to write from the reference register.
value	This is a word array in which you will find words to write

The array size is "length" size!

Return value:

0: No error
1: ILLEGAL_FUNCTION

2: ILLEGAL_DATA_ADDRESS
3: ILLEGAL_DATA_VALUE (Not specified for this FC in the MODBUSTCP specification, but can be useful in some case)

Sample:

In this sample, the reference is used as a function index. The reference = 0 calls the APCI1500_WriteAllDigitalInput function. Length is used as an index to specify the board to use. It is the minor number of the board. Value contains the status value to write on the 16 digital outputs of the **APCI-1500**.

Comment: *Data in the value array do not have to be converted from big-endian due to the communication. The slave server does it automatically for you.*

```
uint16_t skel_MODBUSTCPWriteMultipleRegisters(uint16_t
reference, uint16_t length, uint16_t *value)
{
          /* "reference" is the index of the function
to execute */
          switch (reference)
          {
               /*
                * Write all digital outputs of the
APCI-1500.
                * There are 16 digital outputs, each
output is to see
                * as a bit, so they can be stored in a
word (16 bit).
                * The length is used to select the
board to use.
                * (length-1) while the board index
begins to 0.
                */
               case 0:
                    if ((length > nbr) ||
(APCI1500_WriteAllDigitalOutput (fd[(length-1)],
value[0]) != 0))
                    {
                         value = 0;

                         /* Fail to write digital
outputs, generate an exception */
                         return ILLEGAL_DATA_ADDRESS;
                    }
               break;

               default:
                    /* Bad function */
                    return ILLEGAL_FUNCTION;
               break;
          }

     return 0;

}
```

3.4 Compilation

Once skeletons functions are ready to work, just use the Makefile to compile the complete slave server.

In the slave server directory type “make”. The resulting executable is called MODBUSTCP_server.exe (compiled under Cygwin) or MODBUSTCP_server (compiled under Linux).

Note:
For more information about compiling with the **MSX-Box** see “Introduction to C Programming for the MSX-Box.pdf”.

3.5 Execution

Transfer the MODBUSTCP_server.exe on the **MSX-Box** (by e.g.: ftp) and use Telnet or the serial connection to open a console on the **MSX-Box**.

The file has to be executable:

```
[root@MSXBOX:/tmp]# chmod +x MODBUSTCP_server.exe
```

Usage: %s <slaveAddress> <deamon>

Parameters:

slaveAddress: This is the Unit ID of slave on which the slave server is running.

deamon : 0 = Start a non deamon, 1 = start as deamon. Deamon means that the slave server is running in background and the console on which it is started is free for key inputs.

Sample:

To start it as daemon with Unit ID 2:

```
[root@MSXBOX:/tmp]# ./MODBUSTCP_server.exe 2 1
```

To stop it:

```
[root@MSXBOX:/tmp]# kill MODBUSTCP_server.exe
```

This daemon logs a big part of the actions that it does. The log is available under /var/log/message:

```
Feb  8 14:16:15 (none) daemon.warn MODBUS_slave: ...
```

Note:
For more information about ftp and telnet connections see **QuickInstallation_e.pdf**.

3.6 Installation

If you want to start the server with the boot script:

- the apci1500.o driver has to be located under:
  /lib/modules/2.4.xx-x/addidata/
- the MODBUSTCP_server.exe server has to be located under:
  /home/MODBUSTCP/

You can modify the boot script for other locations.

3.7 Boot script

It is possible to load automatically the slave server by using a script like the following. This sample script loads in first the driver of the **APCI-1500** board.

```
#!/bin/sh
#
# Starting / Stopping...
#
# (C) ADDI-DATA GmbH 2007
#

# Module to load
modulesload="apci1500"

# auto build unload string from load string
for i in $modulesload ; do
    modulesunload="$i $modulesunload"
done

# Check presence of all kernel module files listed in "modulesload"
for i in $modulesload ; do
       module="/lib/modules/`uname -r`/addidata/$i.o"
       if [ ! -f $module ] ; then
              echo "$0: $module does not exist!"
              exit 11
       fi
done

start() {
       # Load the APCI-1500 driver
       echo -n "Starting MODBUSTCP server: "

       for i in $modulesload ; do
           modprobe $i
       done

       # Start the MODBUSTCP server as a deamon with slave ID 0
       /home/MODBUSTCP/./MODBUSTCP_server.exe 0 1

       echo "done."
}

stop() {
       # Unload the APCI-1500 driver
       echo -n "Stopping FireWire: "
       for i in $modulesunload ; do
           modprobe -r $i
       done

       # Stop the MODBUSTCP server
       killall MODBUSTCP_server.exe

       echo "done."
}

restart() {
       # Restart
       Stopp
```

```
      start
}

case "$1" in
    start)
       start
       ;;
    stop)
       stop
       ;;
    restart|reload)
       restart
       ;;
    *)
       echo $"Usage: $0 {start|stop|restart}"
       exit 1
esac

exit $?
```

3.7.1 Description

When the **MSX-Box** is booting, this script is automatically called with the “start” argument (because the link name is SXX like Start).

The “start” function

- loads the apci1500 driver
- executes the MODBUSTCP_server as a deamon (deamon = is running in background)

To stop manually

```
[root@MSXBOX:/]# MODBUSTCP stop
```

To start manually

```
[root@MSXBOX:/]# MODBUSTCP start
```

3.7.2 Use of the script

The script e.g.: MODBUSTCP has to be copied in /etc/init.scripts (by using ftp and a consol).

A symbolic link has to be created under /etc/init.d/:

```
[root@MSXBOX:/tmp]# ln –s /etc/init.scripts/MODBUSTCP /etc/init.d/S98MODBUSTCP
```

The script will be called and executed at each start of the **MSX-Box**.

Note:
For more information about ftp and telnet connections see **QuickInstallation_e.pdf**.

4 S7 PROGRAM

4.1 Introduction

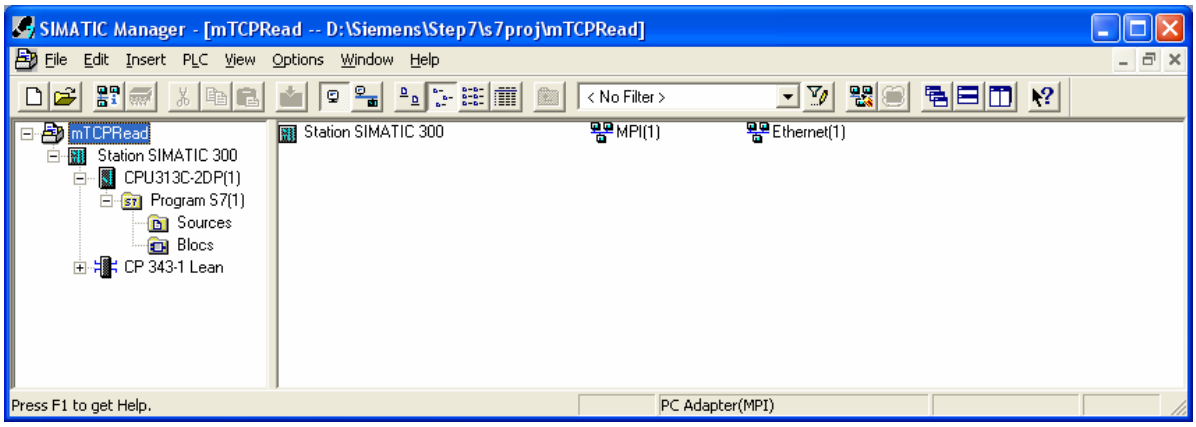
The software package contains a sample to read and write values.
The documentation describes the sample to read values.

4.2 Configuration

Samples are written for the **S7-300** and **CP343-1** for the Ethernet communication.

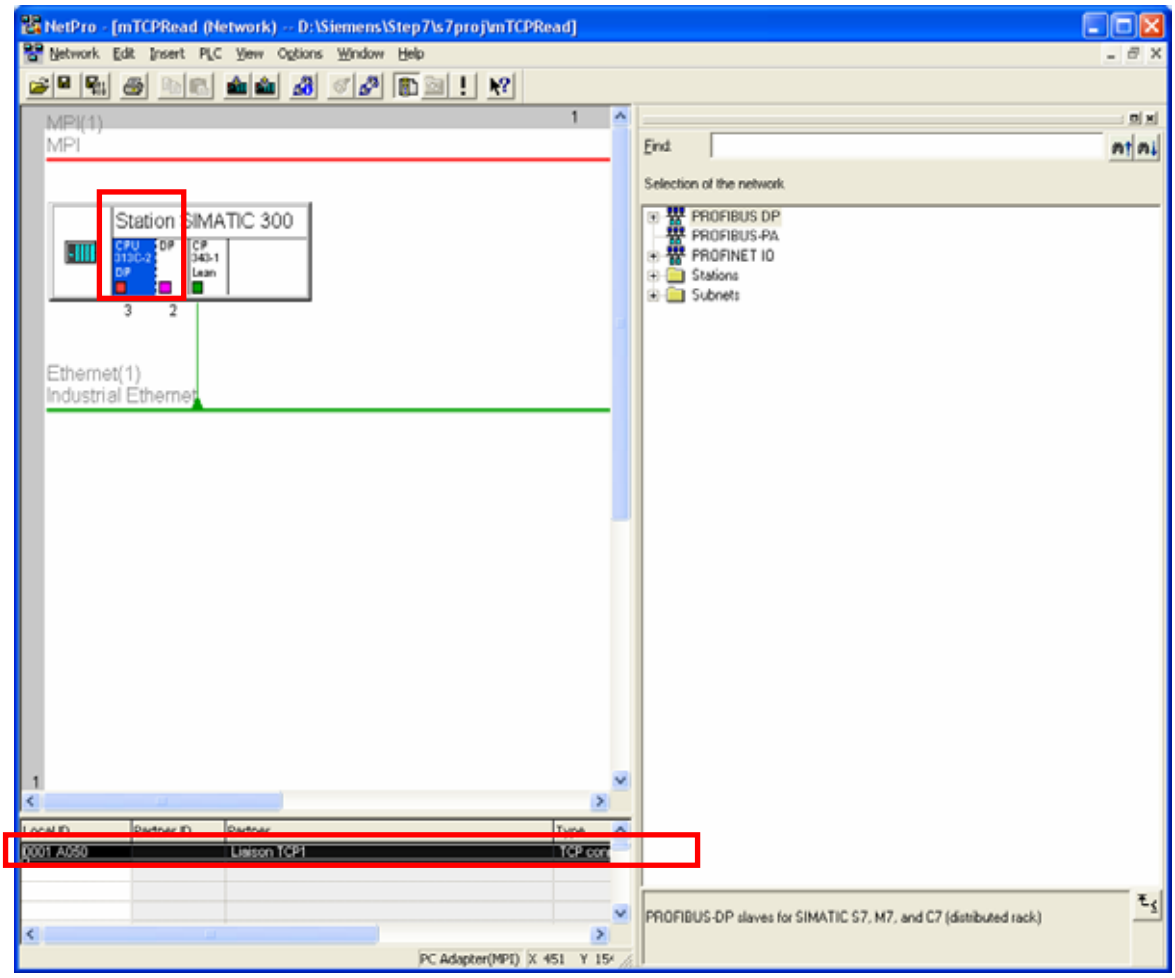
Open the SIMATIC Manager, open the mTCPRead Project.

Fig. 4-1: SIMATIC Manager



♦ **Double-click on Ethernet.**

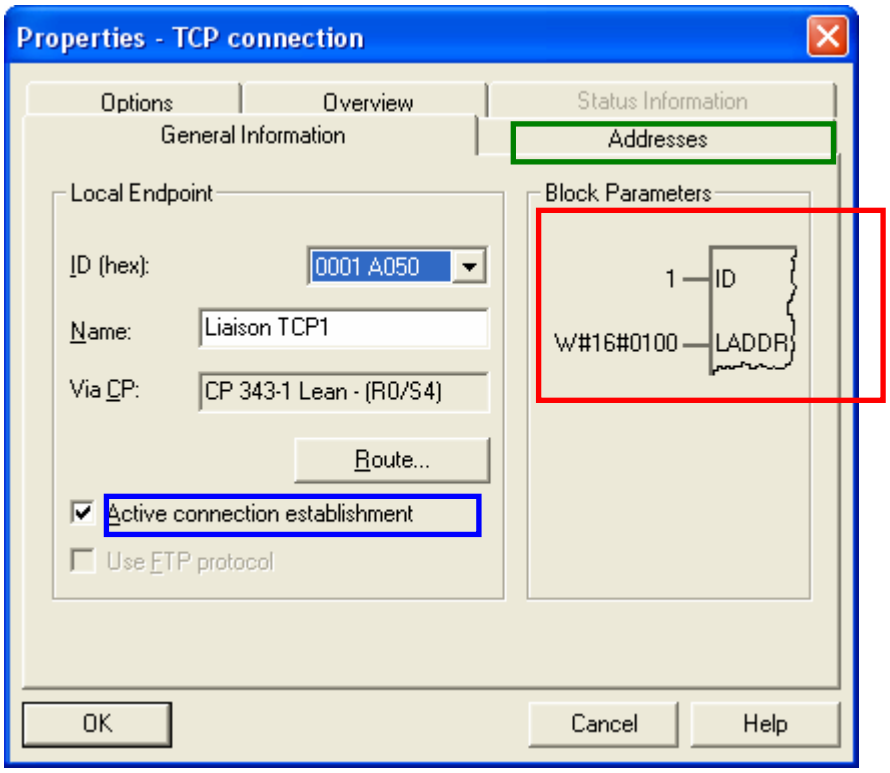
Fig. 4-2: NetPro



Click the CPU313C-2DP. In the table, double-click on the marked line (here in black).

Content: The Ethernet connection is a **TCP connection**.

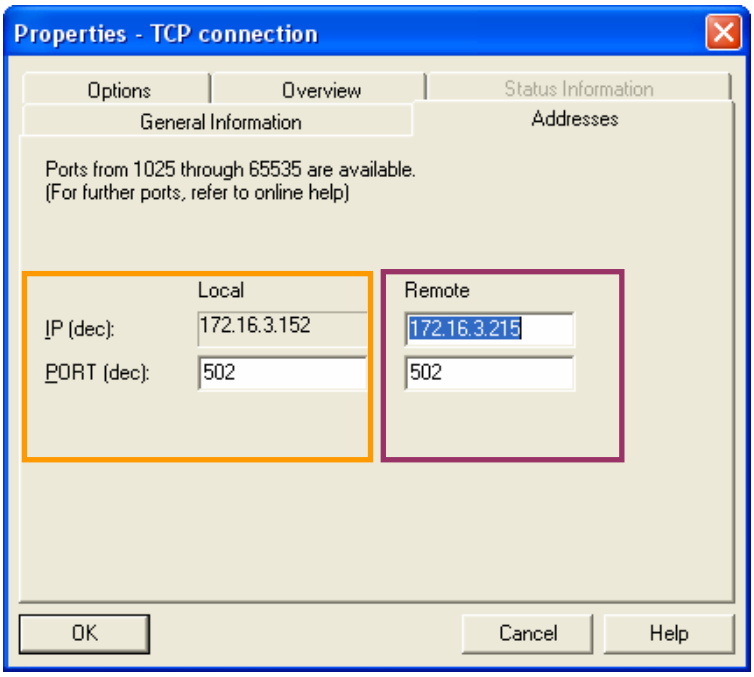
Fig. 4-3: Properties – TCP connection



Active connection establishment has to be selected so that the **S7** does the connection on the slave.

You can see right over the **Block Parameters** that has to be used with the FC5 and FC6 block functions.

Click on **Addresses**.

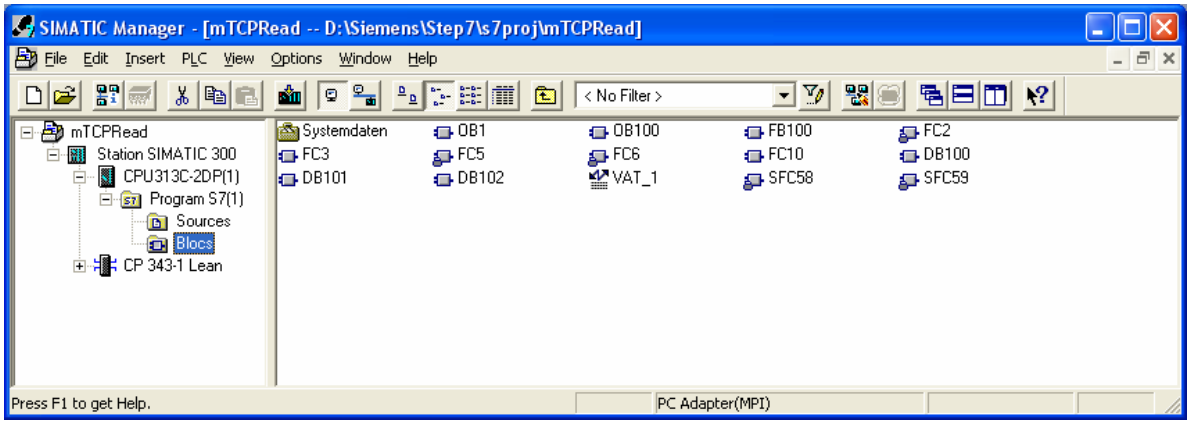


IP and PORT Local are parameters of the **S7**. 502 is the right port number for OPEN MODBUS TCP.

In **Remote,** set the IP address of the **MSX-Box** and the port. Note that the port is always 502, and the IP address has to be compatible with the **S7** IP address.

4.3 Program description

The program is located under the CPU and Blocks.

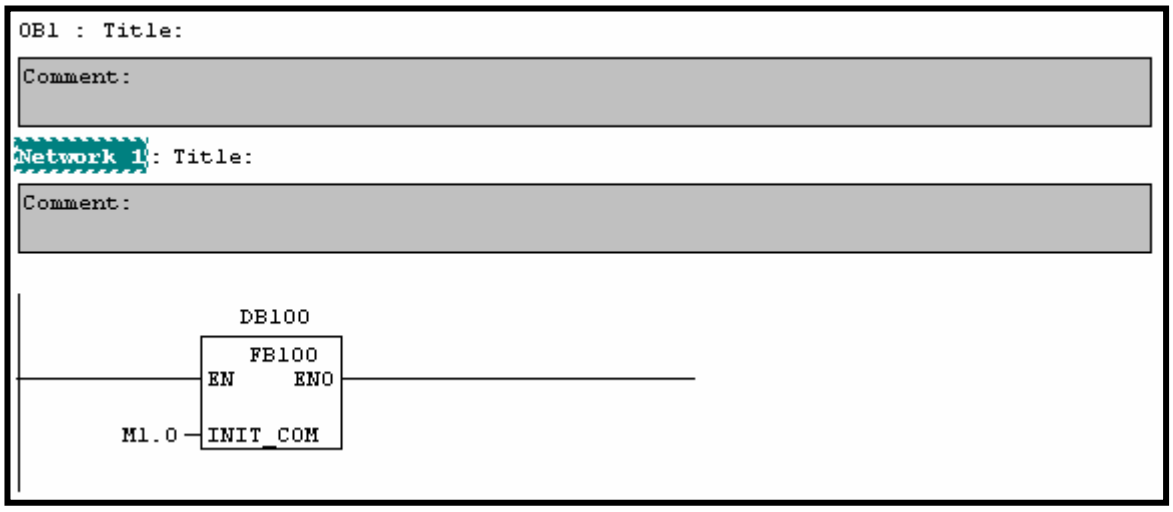


4.3.1 OB1

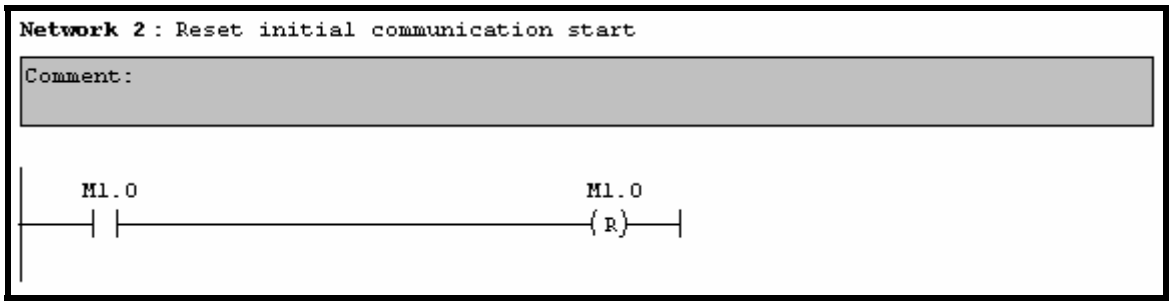
What is OB1: OB1 is executed periodically. Once finished it starts again. OB1 is started after the start-up has been completed.

Task: OB1 call the FB100. FB100 (Function Block 100) contains other function calls. M1.0 is here as a flag to test if connection has been initialized once.

Fig. 4-4: OB1



Task: When FB100 returns, it resets M1.0, connection is already initialized!
It has not to be initialised for the next execution of OB1.

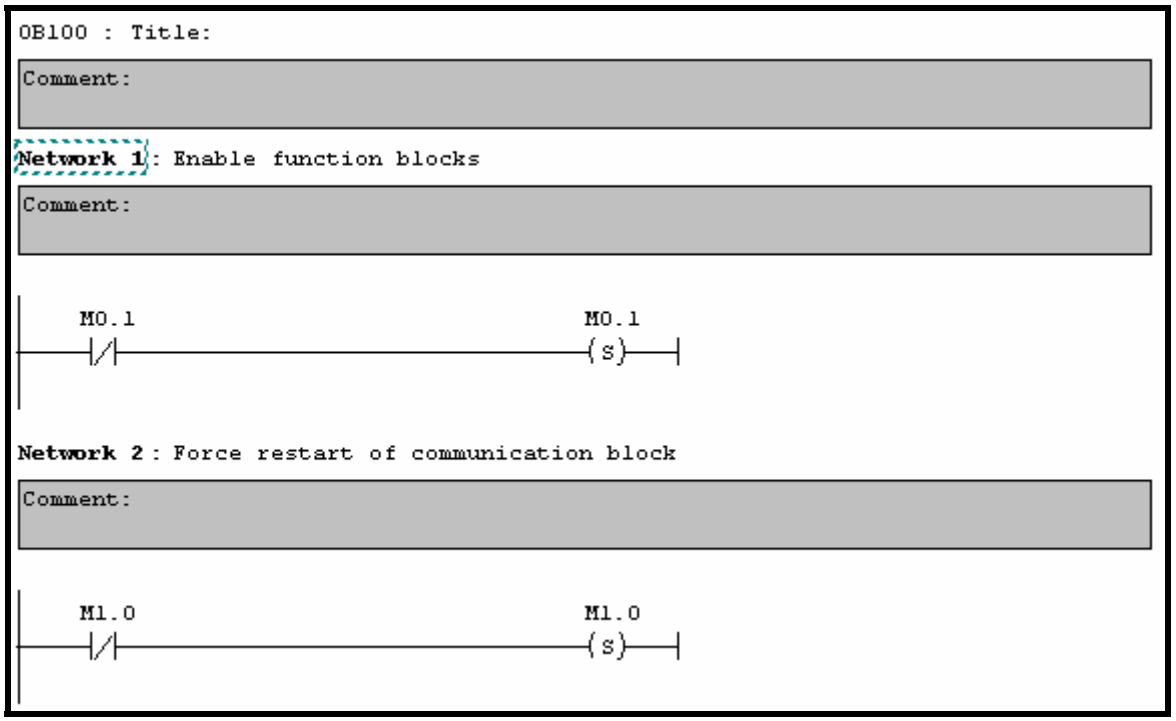


4.3.2 OB100

What is OB100: It is called when the CPU is restarted (Warm restart).

Task: The code of OB100 forces the communication blocks to be restarted after a CPU restart. It sets M1.0 so that OB1 initializes the connection.

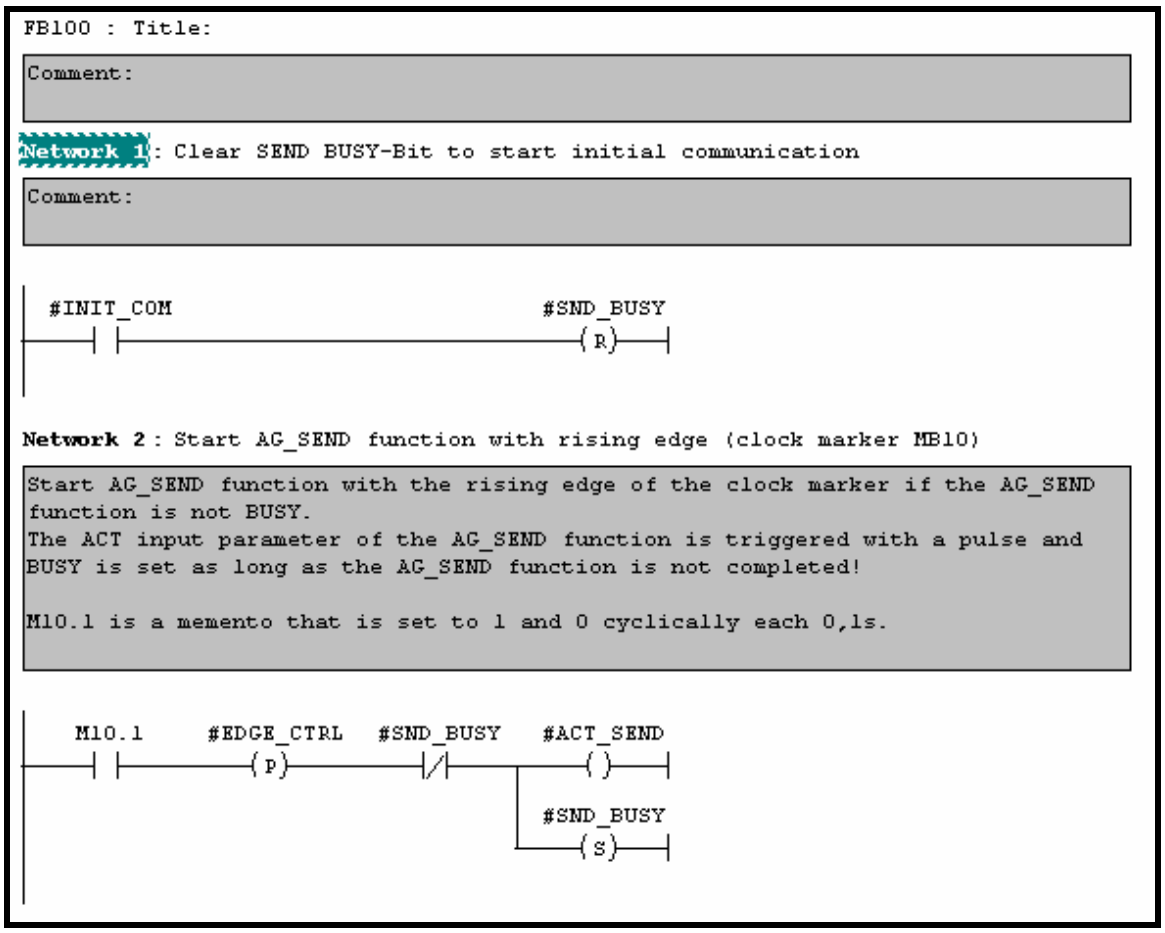
Fig. 4-5: OB100



4.3.3 FB100

What is FB100? This is a function block.

Fig. 4-6: FB100



Task: The first network tests if the connection is initialized and resets the SND_BUSY flag so that no communication action can be done.

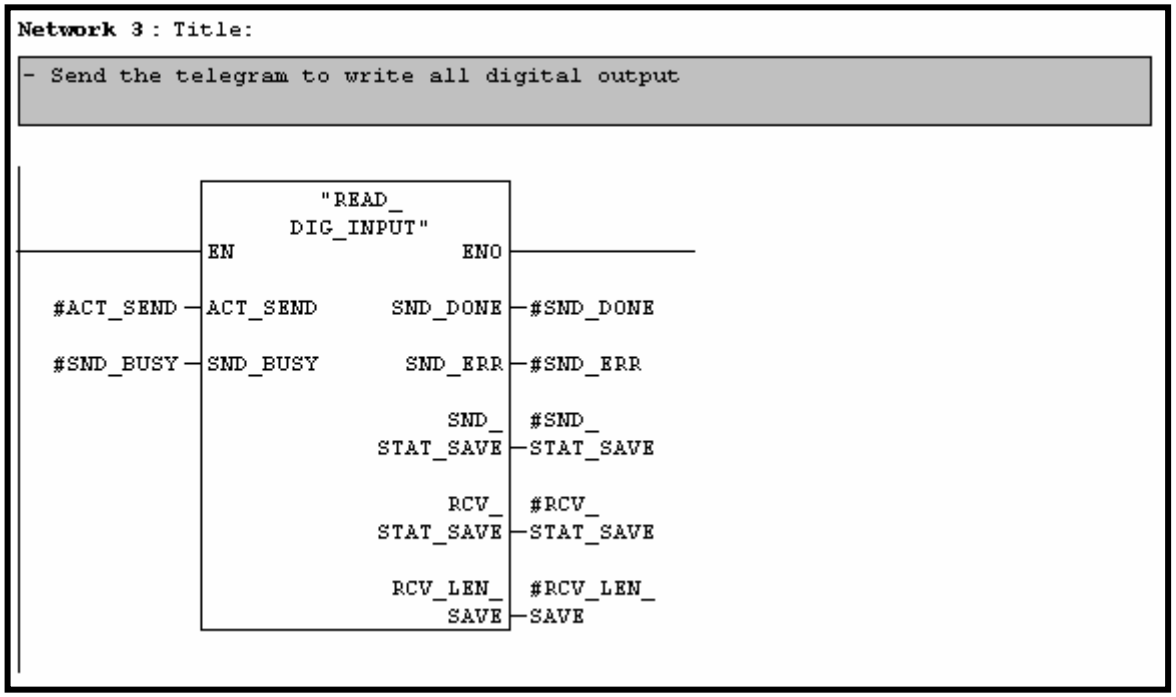
The second network tests the M10.1.

M10.1 is a clock memory. M10.**1** stands for 100 ms. Each 100 ms the status of M10 bit 1 is changing (0/1).

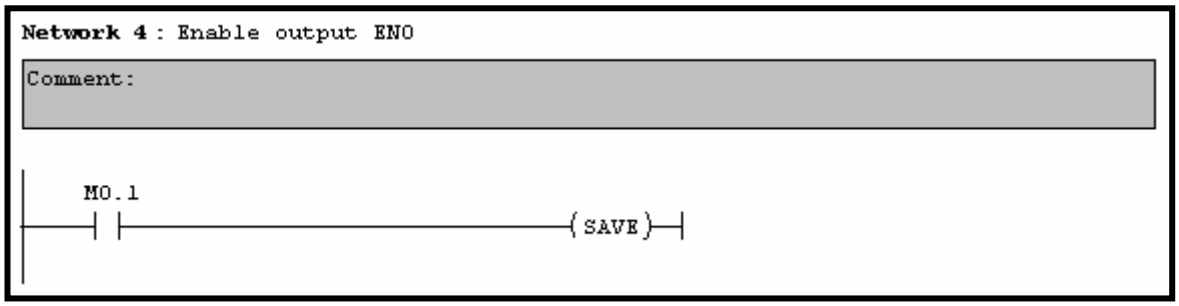
So this network is determining the cycle of the communication between the **S7** and the **MSX-Box**.

I M10.1 is equal to 1, communication can be done because SND_BUSY and ACT_SEND are set.

Task: Is seen in the previous network, ACT_SEND and SND_BUSY are set. Both are the input parameters of the FC10 (READ_DIG_INPUT). Here FC10 is called.



Task: Once FC10 returns, FB100 return value is saved.



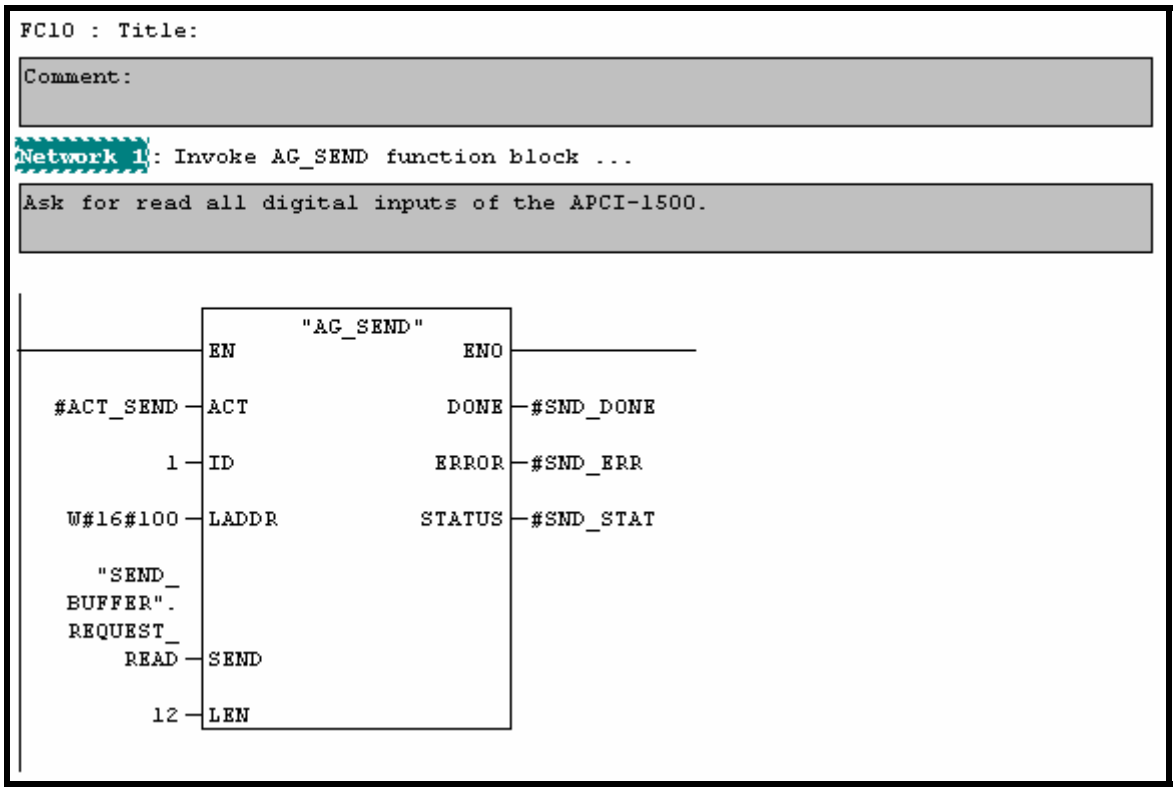
4.3.4 FC10

What is FC10: In our sample, FC10 is the function to read all digital input status.

Task: At first the **S7** sends the MODBUS telegram to call MODBUS TCP function FC3 (Read multiple registers).

The telegram to send is predefined in a DB structure. Here DB101.

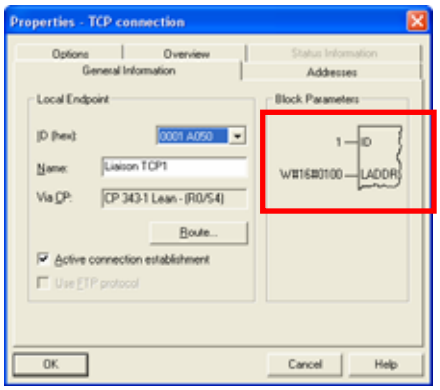
Fig. 4-7: FC10



ACT: ACT_SEND is an input parameter of the FC10 function. It was previously set. This enables sending data, it has to be seen as a trigger.

ID: 1 is the number of the communication identifier.

LADDR: This value W#16#100 is the value of the TCP Properties window:



SEND: This is a pointer on the data to send. Here "SEND_BUFFER".REQUEST_READ. In fact "SEND_BUFFER".REQUEST_READ is another name for an array defined in DB101.

This array contains the telegram to send.

DB101, REQUEST_READ_Array:

DB101

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	REQUEST_READ	ARRAY[0..11]		ModbusTCP request: Read all digital inputs on the fisrt board.
*1.0		BYTE		
+12.0	REQUEST_WRITE	ARRAY[0..14]		ModbusTCP request: Write all digital outputs on the fisrt board.
*1.0		BYTE		
+28.0	BUFF	INT	0	Temp value.
=30.0		END_STRUCT		

REQUEST_READ Array

Address	Name	Type	Initial value	Actual value	Comment
0.0	REQUEST_READ[0]	BYTE	B#16#0	B#16#0	ModbusTCP request: Read all digital inpu
1.0	REQUEST_READ[1]	BYTE	B#16#0	B#16#0	
2.0	REQUEST_READ[2]	BYTE	B#16#0	B#16#0	
3.0	REQUEST_READ[3]	BYTE	B#16#0	B#16#0	
4.0	REQUEST_READ[4]	BYTE	B#16#0	B#16#0	
5.0	REQUEST_READ[5]	BYTE	B#16#0	B#16#6	
6.0	REQUEST_READ[6]	BYTE	B#16#0	B#16#0	
7.0	REQUEST_READ[7]	BYTE	B#16#0	B#16#3	
8.0	REQUEST_READ[8]	BYTE	B#16#0	B#16#0	
9.0	REQUEST_READ[9]	BYTE	B#16#0	B#16#0	
10.0	REQUEST_READ[10]	BYTE	B#16#0	B#16#0	
11.0	REQUEST_READ[11]	BYTE	B#16#0	B#16#1	

Telegram description

B#16# stand for a hexadecimal byte value.

B#16#0

B#16#0

B#16#0

B#16#0

B#16#0

B#16#6

B#16#0

B#16#3

B#16#0

B#16#0

B#16#0

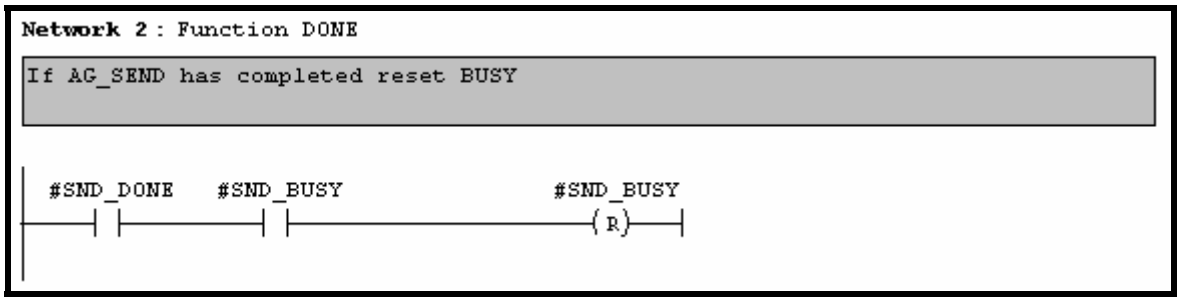
B#16#1

00 00 06	is the header. 06 indicate that the body is 6 bytes length.
0	is the slave ID.
3	function code.
00	reference number.
01	word count.

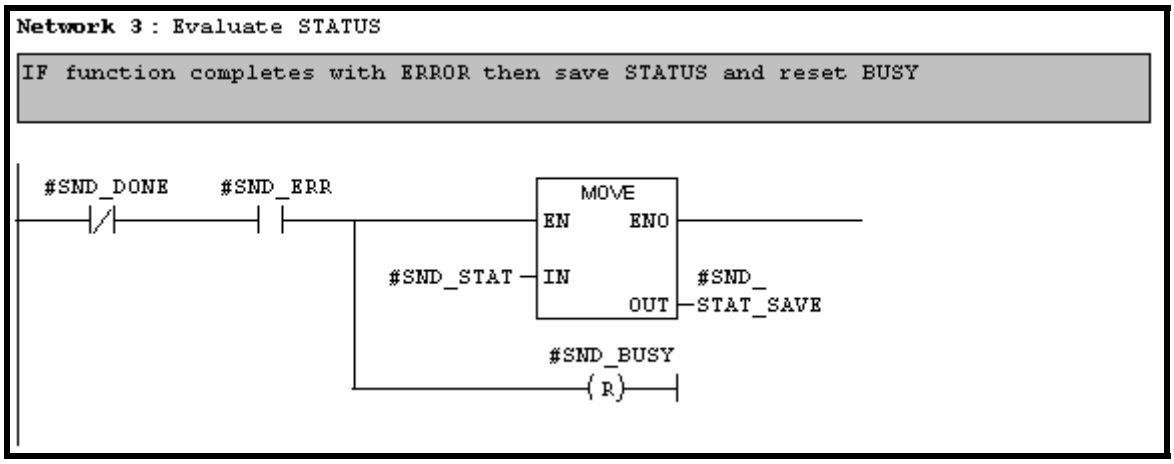
Mean: Read 1 word up reference 0 in the slave 0.

LEN: 12 is the number of byte to send. The telegram in *REQUEST_READ* means 12 byte length.

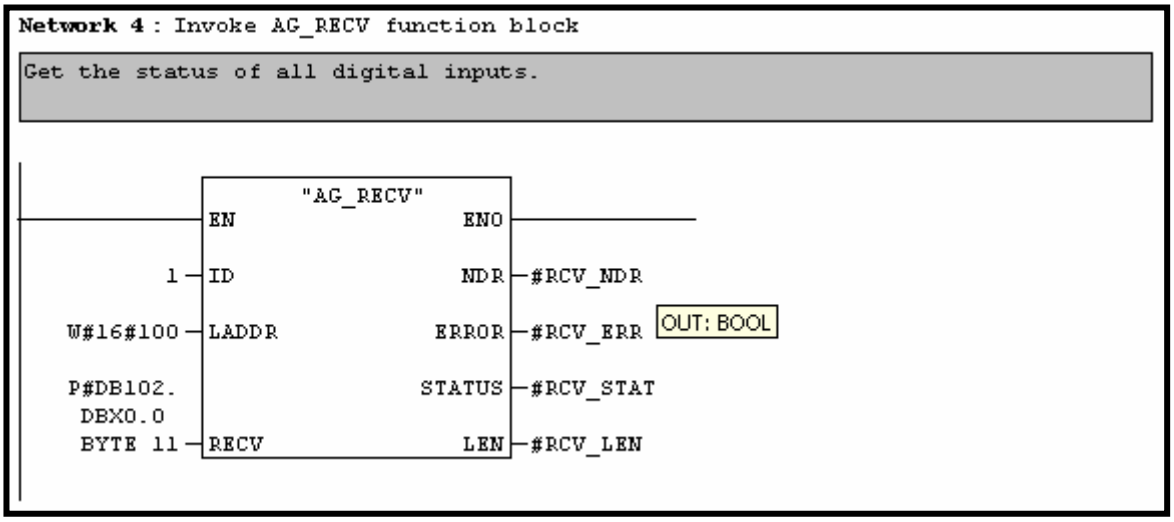
Task: If the communication succeeds, reset the SND_BUSY flag to enable a future communication. Here the telegram was sent without errors.



Task: If an error occurred, save the error status and the SND_BUSY flag to enable a future communication.

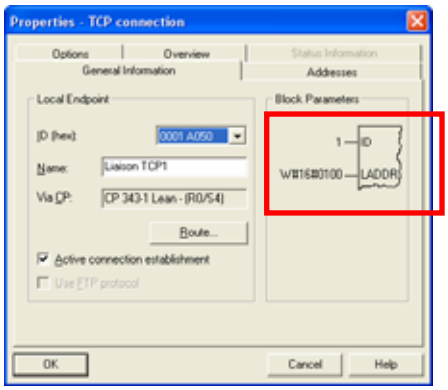


Task: Before an FC3 MODBUS request has been done. Now it is time to get reading values!



ID: 1 the communication ID like the AG_SEND function.

LADDR: This value W#16#100 is the value of the TCP Properties window:



RECV: This is a pointer on the place in which the response has to be saved, and the number of byte to read. Here the place used to save data is an array of 11 byte located in DB102.

DB102

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	RESPONSE	ARRAY[0..10]		
*1.0		BYTE		
=12.0		END_STRUCT		

As you can find it in the OPEN MODBUS TCP description, the response telegram is:

Telegram description

B#16# stand for a hexadecimal byte value.

B#16#0

B#16#0

B#16#0

B#16#0

B#16#0

B#16#6

B#16#0

B#16#3

B#16#2

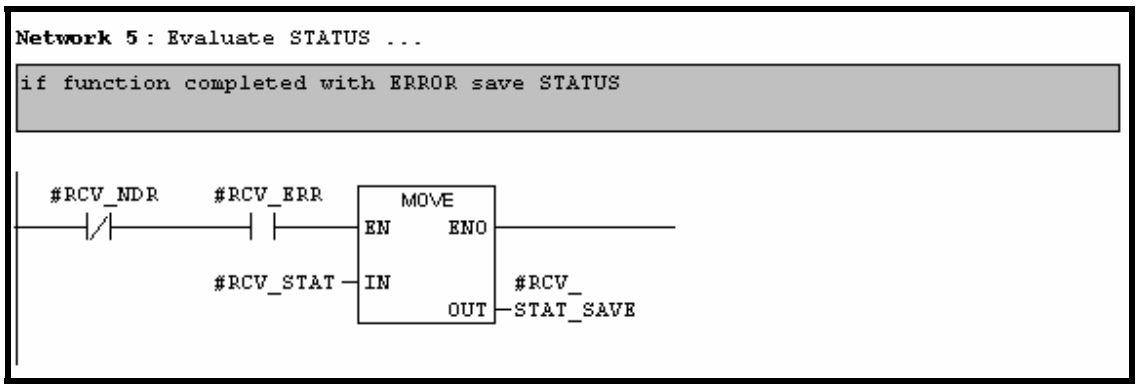
B#16#X

B#16#X

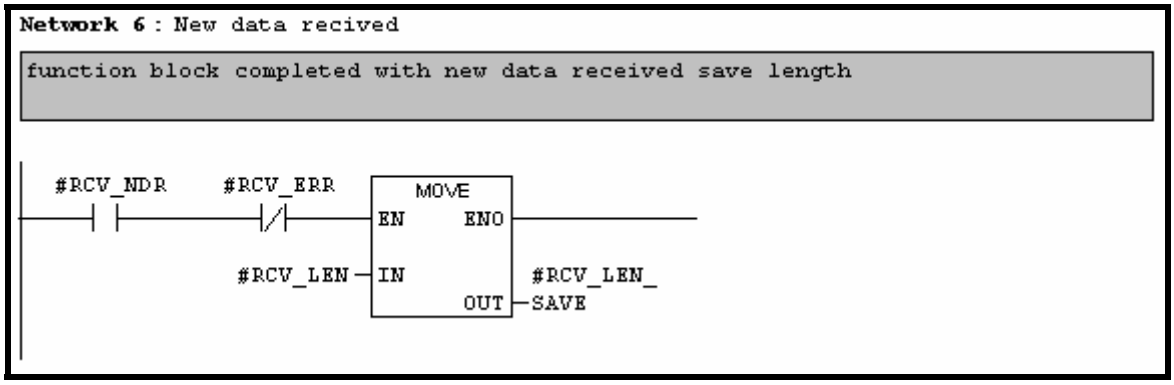
00 00 06	is the header. 06 indicate that the body is 6 bytes length.
0	is the slave ID.
3	function code.
2	number of byte constituting the data words.
XX	one word. XX is the value of the read reference.

Mean: Read 1 word (value XX) in reference 0 in the slave 0.

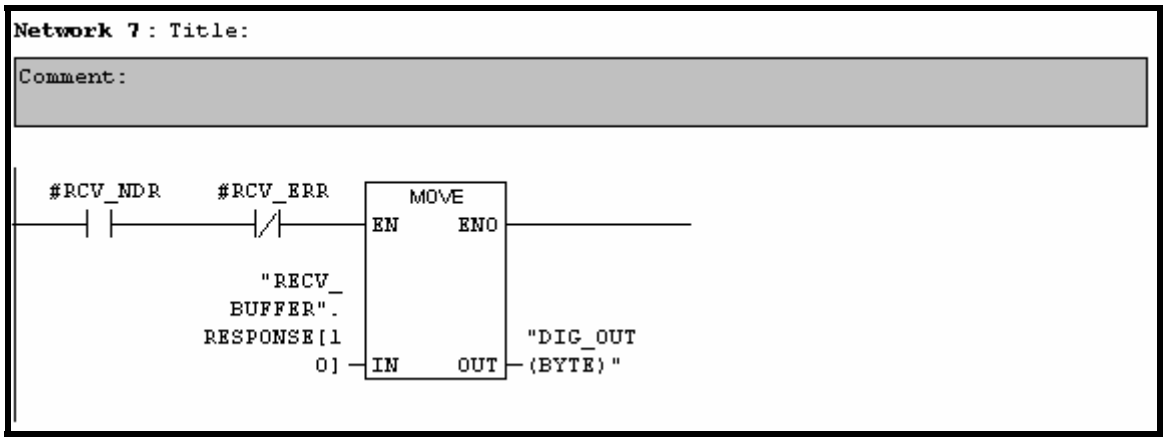
Task: If errors by receiving the telegram save the error status. Please note that in this sample, the telegram viability is NOT tested. But you are free to do so.



Task: If no errors by receiving the telegram save the number of reading data. Please note that in this sample, the telegram viability is NOT tested. But you are free to do so.



Task: In order to see the reading value, the first 8 byte of this value is written on the digital output of the **S7**. So when no error has occurred in the communication, the status of the 8 first digital inputs of the **APCI-1500** can be seen on the **S7** digital outputs LEDs.



“RECV_BUFFER”.RESPONSE[10] is byte 11 of the reading telegram. As you can see it above, this byte is the LSB of the word corresponding of the read value.

5 COMMENTS

5.1 S7 programs

5.1.1 Program execution speed

- It is defined by the M10.1 “Clock memory byte” (memento). This clock memory is used to define an execution cycle. It is set on 100 ms. This is the minimal cyclic time that can be set with this memento. Please refer to Step7 that helps to know how to change the “Clock memory byte” cycle.
- A **S7** has no real cycle time that can be set. The cycle can be defined with a memento like in samples.