Application for Communication between Process Control System PCS 7 and Freelance 800F by ABB

Process Control System SIMATIC PCS 7 / STEP 7

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2.1 Overview of overall solution

1 Automation Task Overview

Introduction

In the case of an expansion or modernization of large plants it is necessary that various process control systems are linked to be able to exchange important data quickly and easily. Linking different process control systems may be very complex due to a big age difference or different manufacturers.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



Description of the automation task

A plant with the process control system "Freelance 800F" by ABB is to be partly renewed.

The "Freelance 800F" process control system was originally designed in 1994 by Hartmann and Braun under the name "Digimatik". Hartmann and Braun was taken over by Elsag Bailey in 1995 and the system was renamed to "Freelance 2000". After takeover by ABB in 1999 the system got its present name "Freelance 800F" in 2001.

The user decides to modernize the main operation of his/her plant. For economic reasons the controllers in ancillary systems will not be exchanged to maintain the infrastructure.

The SIMATIC PCS 7 process control system is used for the main operation of the plant. Therefore the Freelance 800F process control system in the ancillary system has to be linked with PCS 7 in the new section of the plant, i.e. the process control systems of different manufacturers are linked.

2 Automation Solution

2.1 Overview of overall solution

Schematic layout

The following figure displays the most important components of the solution: Figure 2-1



Structure

In the ancillary systems, the old part of the plant, the "Freelance 800F" process control system will be continued to be used with the AC 800F controller.

The main operation of the plant will be modernized with the PCS 7 process control system. The PCS 7 process control system uses a standard automation system with CPU417-4 and CP443-1.

Between the SIMATIC PCS 7 system bus and the Freelance system bus a connection has to be made to realize the data exchange between the AC 800F controller and AS 417-4. Both system buses work on the basis of Industrial Ethernet with TCP/IP or UDP.

For the AC 800F controller ABB offers communication modules, communication and function blocks and variables which are used to connect the AC 800F controller to an Industrial Ethernet network and to exchange data via the Industrial Ethernet.

A CP443-1 communication processer is used to connect the AS 417-4 to an Industrial Ethernet network.

Configuration and programming of the AC 800F controller is via the engineering station with the engineering tool "Control Builder F".

Configuration and programming of AS 417-4 is via the SIMATIC PCS 7 ES/OS 547B IE workstation, which has installed PCS 7.

2.1 Overview of overall solution

Topics not covered by this application

This application does not contain a description regarding set up, commissioning and programming of a complete Freelance 800F process control system.

Required knowledge

Basic knowledge regarding setup, commissioning and programming of the Freelance 800F process control system by ABB is assumed.

2.2 Description of the core functionality

2.2 Description of the core functionality

Sequence of the core functionality

This application example shows how the AC 800F controller has to be configured in the Freelance 800F process control system and the AS 417-4 in PCS 7, to allow a data exchange via UDP protocol between the two process control systems.

The configuration of the AC 800F controller comprises:

- configuring the communication module EI 813F, 10BaseT by ABB, to connect the AC 800F controller to the Industrial Ethernet
- configuring the send and receive interface in the Freelance 800F process control system
- programming the send and receive blocks in the Freelance 800F process control system

The configuration of AS 417-4 comprises:

- configuration of the UDP connection
- calling and configuring the communication function blocks FC50 "AG_LSEND" and FC60 "AG_LRCV"
- calling and configuring the function blocks, to convert the variables received by Freelance into PCS 7 readable values
- calling and configuring function blocks to convert the variables to be sent to Freelance 800F

Advantages of this solution

The solution introduced here offers you the following advantages:

- Process control systems from different manufacturers can be linked so that a data exchange between the controllers is possible.
- Time and cost savings since only part of the entire plant has to be renewed.
- A plant can be expanded by connecting a new process control system to the old existing plant section.
- The infrastructure of the plant remains.

2.3 Hardware and software components used

2.3 Hardware and software components used

The application was generated with the following components:

Hardware components

Table 2-1

Components	No.	MLFB / order number	Note
Standard automation system with CPU417-4 and CP443-1EX20	1	6ES7 654-8CK03-3BB0	
SIMATIC PCS 7 ES/OS 547B	1	6ES7 650-0NF17-0YX0	
Ethernet interface: EI 813F, 10BaseT	1	3BDH000021R1	see: Freelance 800F Product catalog
PM 802F	1	3BDH000002R1	see: Freelance 800F Product catalog
SA 811F	1	3BDH000013R1	see: Freelance 800F Product catalog

Standard software components

Table 2-2

Components	No.	MLFB / order number	Note
Control Builder F Standard	1	3BDS008510R06	see: <u>Freelance 800F</u> <u>Product catalog</u>

Note The PCS 7 software including SIMATIC CFC is included in the delivery of the SIMATIC PCS7 ES/OS 547B IE.

2.4 Basic performance data

2.4 Basic performance data

Via the CP443-1 in AS 417-4 a max. of 2048 bytes can be transferred via UDP protocol.

In this application example a max. of 507 DWORDs user data can be transferred. The max. number of user data transferred is calculated as follows:

max. number of user data = 2048 bytes – 20 bytes Freelance frame header = 2028 bytes = 507 DWORD

2.5 Alternative solutions

PCS 7 Standard automation system

Alternatively to the PCS 7 standard automation system with CPU417-4 and CP443-1EX20 you can use the PCS 7 standard automation system with the following CPU and following CP443-1:

Table 2-3

CPU	CP443-1	Note
CPU414-3	CP443-1EX20	from of PCS 7 V7.1
CPU414-3	CP443-1EX11	up to PCS 7 V7.0
CPU416-2	CP443-1EX20	from PCS 7 V7.1
CPU416-2	CP443-1EX11	up to PCS 7 V7.0
CPU416-3	CP443-1EX20	from PCS 7 V7.1
CPU416-3	CP443-1EX11	up to PCS 7 V7.0
CPU417-4	CP443-1EX11	up to PCS 7 V7.0

2.5 Alternative solutions

SIMATIC S7-400 Station and STEP 7



If you do not have a PCS 7 process control system you can use a S7-400 station with S7-400 CPU and CP443-1 instead of a PCS 7 standard automation system. Use STEP 7 to configure the S7-400 station instead of PCS 7.

In this case you will additionally need SIMATC CFC.

Under the link below you will find the release for delivery of SIMATIC CFC V7.1:

http://support.automation.siemens.com/WW/view/en/36955720

3 Basics

3.1 UDP protocol

Classification of UDP protocol in the ISO OSI reference model

The UDP protocol was introduced to transfer data quickly and easily. The UDP protocol is located on level 4 (transport layer) of the ISO OSI reference model and is therefore also based on the IP layer (layer 3). Thus, the receiver of the data is addressed using IP addresses. The data packet to be sent is only made bigger by minimal administration information so that the data throughput is bigger than compared with TCP or ISO-on-TCP (TCP with RFC 1006).

Figure 3-1



Link types in the configuration of a SIMATIC S7

Table 3-1	
Type of connection	Description
Specified UDP connection	 Local node and connection partner are permanently configured. The connection partner can be located inside or outside the STEP 7 project.
Unspecified UDP connection	 Only the local node is specified in the connection configuration. The partner is addressed via the port and IP address during the block call.
Broadcast	An active node transmits data to all other nodes.
Muticast	An active node sends data to a permanently configured group of nodes.

3.2 Structure of the frame

Basic performance data and quantity framework of the UDP protocol

Table 3-2

Criterion	Basic performance data	Comments
Definition	RFC 768	Independent of manufacturer
Transmission medium	Cable, optical fiber, radio	
Transmission rate	Dependent on net physics up to 1GBit	
Connectable devices and access methods	Point-to-PointBroadcastMulticast	Permissible methods: • CSMA/CD • CSMA/CA
Acknowledgement	The protocol only acknowledges the successful sending of the data into the network and not the arrival of the data at the destination station. The user program has to ensure consistency check and data editing.	
Data volume	1 to 2048 bytes	
Number of possible connections	Up to 16 per S7-300 CP up to 64 per S7-400 CP	

Properties of the UDP protocol

- Very fast data transmission.
- The protocol can be used very flexibly and can be used well with third-party systems.
- The UDP protocol is routing-capable.
- The UDP protocol is multicast- / broadcast-capable.
- Small up to medium-sized data volumes (<=2048 bytes) can be transmitted.
- Lost data packets will not be sent again.
- Data packets with incorrect checksum are rejected and not newly requested.
- Multiple deliveries of individual packets are possible.
- The arrival sequence of the packets at the receiver cannot be predicted.
- The data is transmitted in a packet-oriented way (not stream-oriented).
- The broadcast function can only be used in send direction.

3.2 Structure of the frame

The frames exchanged between Freelance 800F and PCS 7 consist of frame header and user data.

The frame header has 10 words = 20 bytes.

Figure 3-2



3.3 Structured data type

The user data of the frame is transferred as structured data type.

When configuring structured data types for the communication with an automation system in PCS 7 the following rules are to be observed:

- the number of consecutive REAL data type variables is of no significance.
- BOOL data type variables always have to be configured in blocks of four. The number of consequtive blocks is of no significance.

This is because it is always one DWORD, consisting of 4 bytes which is to be transferred.

A REAL data type variable occupies 4 bytes whilst a BOOL data type variable only occupies 1 byte.

Figure 3-3

	DWO	ORD		DWORD					DWO	ORD	
HH byte	HL byte	LH byte	LL byte	HH byte	HL byte	LH byte	LL byte	HH byte	HL byte	LH byte	LL byte
	RE	AL		BOOL	BOOL	BOOL	BOOL		RE	AL	

User data

When a BOOL data type variable is to be configured between two variables of the REAL data type, then this changes the assignment within the frame. In this case, it is the REAL data type variable which transfers a DWORD first. Subsequently a WORD is transferred for a BOOL data type variable and again a DWORD for a REAL data type variable.

Figure 3-4

DWORD		WORD		DWORD					
HH byte	HL byte	LH byte	LL byte	H byte	L byte	HH byte	HL byte	LH byte	LL byte
	RE	AL		BO	OL		RE	AL	

User data

This would have to be evaluated in PCS 7 with great effort and can be avoided by the block by block configuration of variables of the BOOL data type.

3.3 Structured data type

4 Function Mechanisms of this Application

General overview



Program Overview



The AC 800F controller and the AS 417-4 are located in the same IP subnet.

Between AC 800F and AS 417-4 the data exchange is carried out via UDP protocol.

In this application example 184 double word user data is transferred via UDP protocol between AS 417-4 and the AC 800F controller.

In each case there are configured two UDP endpoints in the AC 800F controller and in AS 417-4, one to receive data and one to send data.

The frame which transfers the user data has 756 bytes.

Frame length = n * 4 + 20 = 184 * 4 + 20 = 756

n = number of user data (DWORDs)

20 = frame header

4.1 Freelance 800F process control system

4.1 Freelance 800F process control system



4.1.1 Program details of Freelance 800F process control system

In the AC 800F controller you will use the SR_SNDEV send interface with the SR_USEND send block to send data via the communication module EI 813F. In this application example the data is sent via port 10002 to port 20002 of the AS 417-4.

In the AC 800F controller you will use the SR_RNDEV receive interface with the SR_URECV receive block to receive data via the communication module EI 813F. In this application example the data of the AS 417-4 are received via port 10001.

Make the following settings for the send and receive interface:

- a unique name for the send and receive interface has to be assigned.
- activate the UDP protocol
- IP address of the communication partner (destination station)
- local port of send or receive interface
- remote port in communication partner (destination station)

In this application example the following settings are used for the "SR_SNDEV" send interface:

Table 4-	1
----------	---

Setting	Value	Note
Name	UDP_Send	Note down the name since it has to be entered as interface name when configuring the "SR_USEND" send block.
Local port (Own TCP/IP port)	10002	You have to use different local ports for the send and receive interface. The ports have to be > 10000 .
Remote port (TCP/IP port of destination station)	20002	
IP address of the communication partner (Internet address of destination station)	172.20.1.199	IP address of CP443-1 in AS 417-4

4.1 Freelance 800F process control system

In this application example the following settings are used for the "SR_RNDEV" receive interface:

Table 4-2

Setting	Value	Note
Name	UDP_Recive	Note down the name since it has to be entered as interface name when configuring the "SR_URECV" receive block.
Local port (Own TCP/IP port)	10001	You have to use different local ports for the send and receive interface. The ports have to be > 10000 .

In this application example the following settings are used for the "SR_USEND" send block:

Table 4-3

Setting	Value	Note
Name	Sendy_1	use unique name
Interface name	UDP_Send	Name of send interface
Id of remote receive block	1	Connection ID A number between 1 and 255 is requested as ID which clearly assigns the block to the interface.

In this application example the following settings are used for the "SR_URECV" receive block:

Table 4-4

Setting	Value	Note
Name	Recivy	use unique name
Interface name	UDP_Recive	Name of receive interface
Id of receive block	1	Connection ID A number between 1 and 255 is requested as ID which clearly assigns the block to the interface.

4.1 Freelance 800F process control system

In the AC 800F user program the following variables are created as structured data types:

Table 4-5

Name of variable	Data type	Note
Struktur	Struktur_1	to send data
Struktur_R	Struktur_2	to receive data

Summerizing the variables to be transferred in a structured variable type, has the advantage that only one send and receive block is needed. This considerably facilitates the evaluation in the PCS 7 process control system.

In the structured data type "Struktur_1", 184 variables of the REAL data type are summarized. These 184 variables are transferred with the SR_USEND send block. Table 4-6

Name	Туре	Initial value
sREAL1	REAL	1.0
sREAL2	REAL	2.0
sREAL3	REAL	3.0
sREAL4	REAL	4.0
sREAL5	REAL	5.0
sREAL6	REAL	6.0
sREAL7	REAL	7.0
sREAL8	REAL	8.0
sREAL9	REAL	9.0
sREAL10	REAL	10.0
sREAL11	REAL	1.0
sREAL12	REAL	2.0
sREAL184	REAL	4.0

In the structured data type "Struktur_2" 184 variables of the data type REAL are also summarized. A variable of the data type REAL requires a data word. This allows 184 data words to be received via a SR_URECV receive block. Table 4-7

Name	Туре	Initial value
rREAL1	REAL	1.0
rREAL2	REAL	2.0
rREAL3	REAL	3.0
rREAL4	REAL	4.0
rREAL5	REAL	5.0
rREAL6	REAL	6.0
rREAL7	REAL	7.0
rREAL8	REAL	8.0
rREAL9	REAL	9.0
rREAL10	REAL	10.0
rREAL11	REAL	1.0
rREAL184	REAL	4.0

Note

e In this application example only variables of the REAL and BOOL data types are summarized and transferred in a structured data type.

4.2 PCS 7 process control system



Figure 4-4

20

4.2.1 Program details on user program of AS 417-4

Call the FC50 "AG_LSEND" send block in the user program of AS 417-4 to be able to send data via CP443-1.

In this application example the data is send via port 20001 to port 10001 of the AC 800F controller.

Call the FC60 "AG_LRECV" receive block in the user program of AS 417-4 to be able to receive data via CP443-1.

In this application example the data from the AC 800F controller is received via port 10002.

The received data is stored in DB1. The data to be sent is stored in DB2.

To make the frame of the Freelance 800F process control system readable in PCS 7, four function blocks have to be created. They contain conversion functions and convert:

- data received by Freelance 800F into readable data for PCS7
- data to be sent into data readable to Freelance

When converting, attention needs to be paid that a data word (DWORD) may constist of a variable by data type REAL or of 4 variables by data type BOOL.

"RecABBRe" function block

The "RecABBRe" function block converts a received variable of data type REAL. The variable of the REAL data type has the following structure in Freelance 800F and is read at the IN input parameter of the "RecABBRe" function block: Figure 4-5

HH byte	HL byte	LH byte	LL byte

DWORD at inputparameter IN

The variable is converted into a format readable to PCS 7. The converted REAL value is transferred at the OUTREAL output.

Figure 4-6

LL byte	LH byte	HL byte	HH byte
)

REAL at output parameter OUTREAL

In the "RecABBRe" function block, the following variables are defined:

Table 4-8

Interface	Name	Data type
IN	IN	DWord
OUT	OUTREAL	Real
STAT	WORD1	Word
	WORD2	Word
	LL_Byte	Byte
	LH_Byte	Byte
	HL_Byte	Byte
	HH_Byte	Byte
The received DWORD, a for further processing.	variable of the REAL data type	e, is divided into four bytes
L #IN	// load DWORD at IN input pa	arameter
T #LL_Byte	// store LL byte of DWORD	
L DW#16#FFFFFF00		
UD		
SRD 8		
T #LH_Byte	// store LH byte of DWORD	
L #IN		
L DW#16#FFFF0000		
UD		
SRD 16		
T #HL_Byte	// store HL byte of DWORD	
L #IN		
L DW#16#FF000000		
UD		
SRD 24		
T #HH_Byte	// store HH byte of DWORD	
The received DWORD is	converted into a format readab	le to PCS 7.
L #LL_Byte		
SLD 8		
L #LH_Byte		
OW		
T #WORD1	// LL byte and LH byte are st	ored in WORD1
L #HL_Byte		
SLD 8		
L #HH_Byte		
OW		

T #WORD2

// HL byte and HH byte are stored in WORD2

L #WORD1

SLD 16

L #WORD2

OD

T #OUTREAL

BEA

The REAL value of the OUTREAL output parameter is now composed as follows: LL byte, LH byte, HL byte, HH byte.

"RecABBBo" function block

Four variables of the BOOL data type are transferred as DWORD. The "RecABBBo" function block converts the DWORD into PCS 7 readable BOOL values.

In Freelance 800F the DWORD is structured as follows. The DWORD is read at the IN input parameter of the "RecABBBo" function block:

Figure 4-7



The BOOL values filtered out of the DWORD are transmitted at the OUTBL_1, OUTBL_2, OUTBL_3 and OUTBL_4 outputs.

In the "RecABBBo" function block, the following variables are defined: Table 4-9

Interface	Name	Data type
IN	IN	DWord
OUT	OUTBL_1	Bool
	OUTBL_2	Bool
	OUTBL_3	Bool
	OUTBL_4	Bool
STAT	WORD1	Word
	WORD2	Word
	LL_Byte	Byte
	LH_Byte	Byte
	HL_Byte	Byte
	HH_Byte	Byte

The DWORD, in which four variables of the BOOL data type are transferred byte by byte, is divided into four bytes for further processing. L #IN // load DWORD at input parameter T #LL_Byte // store LL byte of DWORD L DW#16#FFFFF00 UD SRD 8 // store LH byte of DWORD T #LH_Byte L #IN L DW#16#FFF0000 UD **SRD 16** // store HL byte of DWORD T #HL_Byte L #IN L DW#16#FF000000 UD SRD 24 T #HH_Byte // store HH byte of DWORD The received DWORD is converted into PCS 7 readable BOOL values. L 1 L #LL_Byte ==| =OUTBL 1 L 1 L #LH_Byte ==| =OUTBL 2 L 1 L #HL_Byte ==| =OUTBL 3 L 1 L #HH_Byte ==| =OUTBL_4

BEA

"SndABBRe" function block

The "SndABBRe" function block converts a variable of the REAL data type, which is sent to Freelance 800F.

The variable of the REAL data type has the following structure in Freelance 800F and is read at the input parameter IN of the "SndABBRe" function block: Figure 4-8

HH byte	HL byte	LH byte	LL byte
		\sim	

REAL at input parameter IN

The variable is converted into a format readable to PCS 7. The converted REAL value is transferred at the OUTWORD output.

LL byte	LH byte	HL byte	HH byte

DWORD at output parameter OUTDWORD

In the "SndABBRe" function block, the following variables are defined: Table 4-10

Interface	Name	Data type
IN	IN	Real
OUT	OUTDWORD	DWord
STAT	WORD1	Word
	WORD2	Word
	LL_Byte	Byte
	LH_Byte	Byte
	HL_Byte	Byte
	HH_Byte	Byte

The REAL value to be sent is divided into four bytes for further processing.

L	#IN	// load REAL at input parameter IN	
Т	#LL_Byte	// LL byte of REAL value is stored	
L	DW#16#FFFFF00		
U	0		
SF	RD 8		
Т	#LH_Byte	// LH byte of REAL value is stored	
L	#IN		
L	DW#16#FFFF0000		
UD			
SRD 16			
Т	#HL_Byte	// HL byte of REAL value is stored	

L #IN L DW#16#FF000000 UD SRD 24	
T #HH_Byte	// HH byte of REAL value is stored
The REAL value to be ser L #LL_Byte SLD 8 L #LH_Byte OW	nt is converted into a format readable to PCS 7.
T #WORD1	// LL byte and LH byte are stored in WORD1
L #HL_Byte SLD 8 L #HH_Byte OW T #WORD2	// HL byte and HH byte are stored in WORD2
L #WORD1 SLD 16 L #WORD2 OD T #OUTREAL BEA	
The DEAL value of OUTD	WORD output parameter is now compared as fo

The REAL value of OUTDWORD output parameter is now composed as follows: LL byte, LH byte, HL byte, HH byte.

"SndABBBo" function block

The "SndABBBo" function block converts four variables of the BOOL data type into a PCS 7 readable format. The variables of the BOOL data type are read at the input parameters INBL_1, INBL_2, INBL_3, INBL_4 of the function block and are each transferred as byte in output parameter OUTDWORD. Four variables of the BOOL data type are altogether summarized as byte and transferred together in the output parameter OUTDWORD as DWORD.

Figure 4-9

DWORD at output OUTDWORD



In the "SndABBBo" function block, the following variables are defined: Table 4-11

Interface	Name	Data type
IN	INBL_1	Bool
	INBL_2	Bool
	INBL_3	Bool
	INBL_4	Bool
OUT	OUTDWORD	DWord
STAT	WORD1	Word
	WORD2	Word
	Byte_1	Byte
	Byte_2	Byte
	Byte_3	Byte
	Byte_4	Byte

// Initialization

- L B#16#10
- T #Byte_1
- T #Byte_2
- T #Byte_3
- T #Byte_4

When the input has the value "false" the initial value remains.

When the input has the value "true" the new value is set.

UN	#INBL_	_4
SPB JMP1		
L	DW#16	#1
Т	#Byte_	1
JMP1:	UN	#INBL_3
	SPB JN	/IP2
	L	DW#16#1
	Т	#Byte_2
JMP2:	UN	#INBL_2
	SPB JN	/IP3
	L	DW#16#1
	Т	#Byte_3
JMP3:	UN	#INBL_1
	SPB JN	/IP4
	L	DW#16#1
	Т	#Byte_4

4 Function Mechanisms of this Application

4.2 PCS 7 process control system

JMP4:	L	#Byte_1	
	SLD 8		
	L	#Byte_2	
	OW		
	Т	#WORD1	// Byte_1 and Byte_2 are stored in WORD1
	L	#Byte_3	
	SLD 8		
	L	#Byte_4	
	OW		
	Т	#WORD2	// Byte_3 and Byte_4 are stored in WORD2
	L	#WORD1	
	SLD 16		
	L	#WORD2	
	OD		
	Т	#OUTDWORD OUTD	// WORD1 and WORD2 are stored in output WORD

BEA

The OUTDWORD output parameter is now composed as follows: Byte_1, Byte_2, Byte_3, Byte_4.

5.1 Configuration of the AC 800F controller

5 Configuration Process

5.1 Configuration of the AC 800F controller

Configuring of the EI 813F communication module

Open the project that contains the configuration of the AC 800F controller in the "Control Builder F" engineering tool.

The EI 813F communication module is configured with the following settings at slot E1 of the AC 800F controller.

Table 5-1

Setting	Value
Brief Description	Ethernet module 10BaseT
Module type	El813F
Tag name	EI813F_2_E1 (Default tag name)
Station position	2
Slot	E1

Inserting and configuring send and receive interface

Table 5-2

No.	Instruction	Comment
1.	When you have opened the project with the configuration of the AC 800F controller in the "Control Builder F" engineering tool, then right click the El 813F communication module and select the Insert menu. The Insert New Object dialog is opened.	Industrial IT Control System Freelance 800F Control Builder Finne Hardware structure Search! Edit I/O editor! System Cross references! Image: System Cross references! Image: System Cross references! Image: System Cross references! System Cross references! Image: System Cross references! Image: System

5 Configuration Process

5.1 Configuration of the AC 800F controller

No.	Instruction	Comment
2.	Select the "SR_SNDEV" Ethernet send interface. Confirm your selection with "OK".	Insert New Object X SR_ENDEV_Ethemet Receive Module SR_SNDEV_Ethemet Send Module SR_SRTCP Ethemet TCP Module DK_Cancel
3.	Right click the EI 813F communication module and select the Insert menu. The dialog "Insert New Object" is opened.	Industrial II Control System Freelance 800F Control Builder F inno Hardware structure Search! Edit I/O editor! System Cross references! Image: Structure Search! Edit I/O editor! System Cross references! Image: Structure Search! EMULATOR (EMULATOR1) Image: Structure Image: Structure Image: Structure Image: Structure Sister (Elistic = 2 est) Image: Structure Image: Structure Image: Structure Image: Structure Sister (Elistic = 2 est) Image: Structure Image: Structure Image: Structure Image: Structure Eth12 Parameters Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure Structure Image: Structure Image: Structure Image: Structure Image: Structure Image: Structure <t< td=""></t<>
4.	Select the "SR_RNDEV" Ethernet receive interface. Confirm your selection with "OK".	Insert New Object SR_SNDEV_Ethernet Receive Module SR_SRICP_Ethernet TCP Module DK_Cancel

5.1 Configuration of the AC 800F controller

No.	Instruction	Comment
5.	Configure the send interface. Enter the values according to Table 4-1 and activate the UDP protocol. Click the Save button to accept the settings and exit the configuration with OK.	Parameters: send master module SR_SNDEV X General data Name: UDP_Send Short text: UDP_Send Name: UDP_Sendebaustein OK OK Protocol Own TCPIP-Port : 10002 OK C UDP Remgte TCPIP-Port : 20002 Cancel Internet address of destination station : Save Save IZZ 20 I 199 Reset Connection Internet address of redundant destination Check Image: Imag
6.	Configure the receive interface. Enter the values according to Table 4-2 and activate the UDP protocol. Click the Save button to accept the settings and exit the configuration with OK.	Parameters: receive master module SR_RNDEV X General data Name: UDP_Recive Long text: UDP Empfangsbaustein OK © UDP Local port: 18001 © UDP Local port: 18001 © UDP K Cancel Save Reset Check Help K >>

Note The input fields shaded in red are "required entry fields". Those fields have to be filled in.

The settings in the hardware are completed once you have inserted and configured the send and receive interface.

5 Configuration Process

5.1 Configuration of the AC 800F controller

Creating and configuring send and receive block

Table 5-3

No	Instruction	Comment
1.	Create a plan in the FBS program (function block).	
2.	Create a SR_USEND send block via Blocks menu → TCP/IP Send and Receive → Send module.	Industrial IT Control System Freelance 800F Control Builder Finnovtour Configuration: Fit FBD program Blocks FBD elements Edit System Cross references Options Backl Help Image: Struktur Analog Image: Struktur
3.	Configure the send block. Enter the values according to Table 4-3 and activate the Autorequest function (automatic processing). In addition, you can configure an alarm message. Click the Save button to accept the settings and exit the configuration with OK.	Farameters: Net Send Module SR_USEND X General data Short text: Processing: Name: Sendy_1 Short text: Long text: Sequence: 1 Error notification OK Gancel Prio. Hint Message text Interface name: DF_Send Save Id gf remote receive module [1-255] : Check Help Sx
4.	Create a SR_URECV receive block via Blocks menu → TCP/IP Send and Receive → Receive module.	Industrial IT Control System Freelance 800F Control Builder F innovtour Configuration: Fi FBD program Blocks FBD elements Edit System Cross references Options Backl Help Image: Standard Image: Standar

5.1 Configuration of the AC 800F controller

No	Instruction	Comment	
5.	Configure the send block. Enter the values according to Table 4-4. In addition, you can configure an alarm message. Click the Save button to accept the settings and exit the configuration with OK.	Parameters: Net Receive Module SR_URECV General data Name: Recivy Long text: Short text: Prio. Hint Message text 3 Image: Interface name: UP_Recive Id of this receive module (1-255): Image: Receive timeout Redundancy enabled 10 Image:	x cesssing: quence: Check Help K Source

Creating structured data types

Table 5-4

No.	Instruction	Comment
1.	Create a structured data type to send values. Click the Structured data types button in the menu bar.	Industrial IT Control System Freelance 800F Control Builder Finnovtour Configuration: Function Bloc FBD program Blocks FBD elements Edit System Cross references Options Backi Help P ロ ロ の よ 動 配 米 原 電 算匠 見 金 登 1 金 読 道 Structured data types
2.	Right click an empty field and select the menu entry Insert a new data type.	Industrial IT Control System Freelance 800F Control Builder F innovto Data types Search Edit Define! System Options Back! Help Image: Search Imag
3.	Subsequently select the Define menu entry and configure the values in the structure.	Name Type Connent Initial value SREAL115 REAL 5.0 SREAL116 REAL 5.0 SREAL116 REAL 5.0 SREAL116 REAL 5.0 SREAL116 SREAL 7.0 SREAL117 REAL S.0 SREAL117 SREAL SREAL S.0 SREAL117 SREAL S.0 SREAL117 SREAL S.0 SREAL S.0 SREAL118 S.0 S.0 S.0

5 Configuration Process

5.1 Configuration of the AC 800F controller

No.	Instruction	Comment
4.	Define a variable in the plan of the FBS program and interconnect it with the "IN" pin of the "SR_USEND" send block. Doubleclick the variable to open the Insert New Variable dialog. Here you enter a name for the variable and assign the variable to the already specified data type "Struktur_1". Apply the settings with OK.	Insert New Variable X Name: Data type: Struktur STR8 Besource: STR16 AS01 Image: Process image Struktur Export Struktur_2 Comment: OK OK Cancel
5.	Now the structured data type is transferred via the send block.	Struktur

Note Creating and assigning a structured data type for the receive block is carried out the same way as for the send block. The variable is interconnected with the "OUT" pin of the "SR_URECV" receive block.

5.2 Configuration of the AS 417-4 in PCS 7

5.2.1 Configuring an UDP connection

In AS 417-4 you configure two UDP connections. Data is received via the first UDP connection. Via the second UDP connection the data is sent. For the configuration of the UDP connections, proceed as laid down below:

Table	5_5
Iable	J-J

No.	Instruction	Comment
1.	Open the project in the SIMATIC PCS7 OS/ES 547B IE workstation in the SIMATIC Manager which contains the configuration of the AS 417-4. Click the Configure Network button to open NetPro.	SIMATIC Manager - (UDP_A88 C\Program File\$\Siemens\Step7\s7proj\Test] Bie Edt Insert PLC Vew Options Window Help Bie Edt Insert Vew Options Window Help
2.	In Netpro you select the CPU 417-4 in object "AS11" and via the Insert menu → New Connection you insert a new connection. The dialog box "Insert New Connection" appears.	Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network Image: Selection of the network

5 Configuration Process

No.	Instruction	Comment
3.	Add an unspecified UDP connection by selecting "Unspecified" as connection partner and "UDP connection" as connection type. Click the "Apply" button to accept the settings and to open the properties dialog of the unspecified UDP connection.	Insert New Connection In the current project Unspecified] All broadcast stations All multicast stations In unknown project Project: Station: [Unspecified] Module: Connection Upe: UDP connection Upe: Upe:
4.	Go to the "General Information" tab in the properties dialog of the UDP connection. Enter the name for the UDP connection, e.g. UDP_conn_recv_from_ABB The values of the block parameters "ID" and "LADDR" are specified later at the input parameters of the "AG_LSEND" communication function block. Subsequently go to the "Addresses" tab.	Properties - UDP connection X General Information Addresses Options Overview Status Information Local Endpoint Block Parameters I I I I I Name: UDP_conn_recv_from_ABB Via <u>CP</u> CP 443-1, PN-IO (R0/S5) W#16#3FFD LADDR Via <u>CP</u> CP 443-1, PN-IO (R0/S5) Boute I Help

No.	Instruction	Comment
5.	Under Remote IP address enter the IP address 172.20.1.112 of the EI 813F communication module in Freelance 800F. Under Remote port, enter port 10002 that you have defined for the send interface of the EI 813F communication module under "Own TCP/IP-Port". As local port, enter port 20002 which you have already defined for the send interface of the EI 813F communication module under "TCP/IP port of destination station". Confirm the input with OK.	Properties - UDP connection Image: Connection General Information Addresses Options Overview Status Information Ports from 1025 through 65535 are available. (For further ports, refer to online help) Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 172.20.1.112 Image: Connection Image: Connection [P (dec): 20002 Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 172.20.1.112 Image: Connection Image: Connection [P (dec): 20002 Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 Image: Connection Image: Connection Image: Connection [P (dec): 20002 Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 Image: Connection Image: Connection Image: Connection [P (dec): 172.20.1.193 Image: Connection Image: Connection Image: Connection Image: Connection <td< td=""></td<>
6.	Mark the CPU 417-4 in object "AS11". In the connection table you will see the UDP connection "UDP_conn_recv_from_ABB" to receive the data.	B (Network) C:\Program Files\\Step7\s7pro\\Test] sert PLC Yew Options Window Help Image: Step 1 Image: Step 1 <t< td=""></t<>
7.	Add another unspecified UDP connection. Go to the "General Information" tab in the properties dialog of the UDP connection. Enter a sensible name for the UDP connection, e.g. UDP_conn_send_to_ABB The values of the block parameters "ID" and "LADDR" are specified later at the input parameters of the FC60 "AG_LRECV" communication function block. Subsequently go to the "Addresses" tab.	Properties - UDP connection X General Information Addresses Options Overview Status Information Local Endpoint ID Block Parameters ID Name: UDP_conn_send_to_ABB Via <u>CP</u> : CP 443-1, PN-10 (R0/S5) Name: ID Boute ID OK Cancel Help

5 Configuration Process

No.	Instruction	Comment
8.	Under Remote IP address enter the IP address 172.20.1.112 of the EI 813F communication module in Freelance 800F. Under Remote port, enter port 10001 which you defined for the receive interface of the EI 813F communication module under "Own TCP/IP-Port". Enter port 20001 as local port. Confirm the entry by clicking "OK".	Properties - UDP connection X General Information Addresses Options Overview Status Information Potts from 1025 through 65535 are available. (For further ports, refer to online help) Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.199 172.20.1.112 Image: Constant online help) IP (dec): 172.20.1.199 Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.199 Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.199 Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.199 Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.199 Image: Constant online help) Image: Constant online help) IP (dec): 10001 Image: Constant online help) Image: Constant online help) IP (dec): 172.20.1.112 Image: Constant online help) Image: Constant online help) IP (dec): 20001 Image: Constant online help) Image: Constant online help) IP (dec): 20001 Image: Constant online help) Image: Constant online help) IP (
9.	 Mark the CPU 417-4 in object "AS11". In the connection table you will see two UDP connections: UDP_conn_recv_from_ABB to receive data UDP_conn_send_to_ABB to send data 	INctwork) - C:Program Files\\Stcp7\s7proj\Test] et FLC yew Option Window Help Image: State of the state of th
10.	Mark the "AS11" object and click the "Save and Compile" button. Subsequently click the "Download" button to load the configuration of the AS 417-4 including the UDP connections into the CPU.	Image: Arrow of the second

5.2.2 Inserting data blocks

Table 5-6

No.	Instruction	Comment
1.	Open the project of the AS 417- 4. In the "AS11" object, navigate to the "Block" entry and select it. Add a new data block (DB) in the user program of AS 417-4 via the Insert menu → S7 Block → Data Block.	SIMATIC Manager - [UDP_ABB C:\Program Files\Stemens\Step7\s File Edit Insert PLC View Options Window Help Station Subnet Subnet piect name Program Symbolic name S7 Software Insert M7 Software Inorganization Block Symbol Table 2 Function TextLibrary S Data Type External Source 6 Variable Table
2.	Enter a free number and a sensible symbolic name in the properties dialog of the DB. e.g.: DB1 "FROM_ABB"	Properties - Data Block X General - Part 1 General - Part 2 Calls Attributes Name and type: DB1 Shared DB Y Symbolic Name: FROM_ABB Y Y Symbol Comment: Image: DB Y Project path: Storage location C:VProgram Files/Siemens/Step7\s7proj/Test Image: Storage location C:VProgram Files/Siemens/Step7\s7proj/Test Image: Image: Date created: 11/02/2009 04:00:47 PM 11/02/2009 04:00:47 PM Last modified: 11/02/2009 04:00:47 PM Cgmment: Image: Image: Image: Image: Image: OK Cancel Help Image: Image: Image: Image:
3.	Emulate the frame header in bytes 0-19 of the DB. From byte 20 the user data received by PCS 7 will be saved.	ILAD/STL/F6D - [D81 "FROM_A88" UDP_A88\AS11\(PU 417-4\\D81] Image: Image

5 Configuration Process

No.	Instruction	Comment		
4.	The volume of user data that is received by PCS 7 is determined by the number of variables in the structured data of the Freelance 800F process control system.	Image: Struct		
5.	Add another DB in the AS 417-4 user program. Enter a free number and a sensible symbolic name in the properties dialog of the DB. e.g.: DB2 "TO_ABB"	Properties - Data Block General - Part 1 General - Part 1 General - Part 1 General - Part 2 Calls Attributes Name and type: DB2 Symbolic Name: TO_ABB Symbol Comment: Created in Language: DB Project path: Storage location of project: Code Interface Date created: 11/02/2009 04:13:03 PM Last modified: 11/02/2009 04:13:03 PM Comment: ØK		
6.	Emulate the frame header in bytes 0-19 of the DB. From byte 20 the user data that is to be sent from PCS 7 to Freelance 800F will be saved.	MAD/STL/FED - [D82 "TO_A88" UOP_A88\AS11\CPU 417-4\\D82] Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2" Image: Colspan="2">Image: Colspan="2">Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2" Image: Colspan="2"		

No.	Instruction			Commen	t	
No. 7.	Instruction The volume of user data that is sent from PCS 7 to Freelance 800F is determined by the number of variables in PCS 7. The structured data type of the Freelance 800F process control system has to be adjusted accordingly.	Ad/stl.	FBD - [DB2 "TD_ABB" Incert PLC Debug Yew WORD_1 WORD_2 WORD_3 WORD_4 WORD_6 WORD_6 WORD_6 WORD_7 WORD_8 WORD_8 WORD_9	Comment UDP_ABB\AS11\CT y Options Window C C C C C C C C C C C C C C C C C C C	U 417-4\\DB2] Help 5	
		+16.0 +18.0 =20.0 +20.0 +24.0 +24.0 +28.0 +32.0	WORD_3 WORD_10 OUTWORD_3 OUTWORD_3 OUTWORD_3 OUTWORD_4	WORD WORD END_STRUCT DWORD DWORD DWORD DWORD DWORD	W#16#0 DW#16#0 DW#16#0 DW#16#0 DW#16#0 DW#16#0	

Note Copy the frame header of the receive data block in Online mode into the frame header of the send block. Doing this updates the send and receive interface of ABB and it does not have to be updated manually.

5.2.3 Calling and configuring the communication function blocks FC50 "AG_LSEND" and FC60 "AG_LRECV"

Overview FC60 "AG_LRECV"

Figure 5-1



Input parameters FC60 "AG_LRECV"

Table 5-7

Input parameters	Data type	Description	
ID	INT	The parameter ID specifies the connection number of the configured communication connection.	
LADDR	WORD	Module start address	
RECV	ANY	Specifying address and length of receive data area The address of the data area alternatively refers to:	
		data areamemory area	

Output parameters FC60 "AG_LRECV"

Table 5-8			
Output parameters	Data type	Description	
NDR	BOOL	The parameter indicates whether new data has been accepted 0: - 1: New data	
ERROR	BOOL	Error display 0: - 1: Error when receiving the data	
STATUS	WORD	Status display	
LEN	INT	Indicates the number of bytes which were adopted in the receive data area.	

Overview FC50 "AG_SEND"





Input parameters FC50 "AG_LSEND"

Table 5-9

Input parameters	Data type	Description	
ACT	BOOL	Job trigger 1: Data is sent from the send buffer indicated 0: Status displays DONE, ERROR and STATUS are updated	
ID	INT	The parameter ID specifies the connection number of the configured communication connection.	
LADDR	WORD	Module start address	
SEND	ANY	Specifying address and length of send data area The address of the data area alternatively refers to: • data area • memory area	
		• memory area	
LEN	INT	Number of bytes which are to be transmitted by the job from the indicated send data area.	

Output parameters FC50 "AG_LSEND"

Table 5-10

Output parameters	Data type	Description
DONE	BOOL	The parameter indicates whether the job has been processed without errors. No other job can be triggered as long as DONE=0 0: Job running 1: Job completed
ERROR	BOOL	Error display 0: - 1: Error when sending the data
STATUS	WORD	Status display

Calling and configuring the communication function blocks

Open the project in the SIMATIC PCS7 ES/OS 547B IE workstation in the SIMATIC Manager which contains the configuration of AS 417-4.

Create a plan folder and a CFC plan in program S7.

Open the CFC plan with the CFC editor.

On the first sheet of the CFC plan add the communication function blocks FC50 "AG_LSEND" and FC60 "AG_LRECV" with drag & drop.

Figure 5-3



Enter the following values for the input parameters of FC60 "AG_LRECV". Table 5-11

Input parameters	Value	Note
ID	1 (dez)	Take the value for the input parameter "ID" in NetPro from the properties dialog of the UDP connection \rightarrow tab "General information".
LADDR	3FFD (hex)	Take the value for the "LADDR" input parameter in NetPro from the properties dialog of the UDP connection \rightarrow "General information" tab.
RECV	-	Interconnect the RECV input parameter of FC60 "AG_LRECV" with the already created DB1 "FROM_ABB . In this block the received data is saved.

Enter the following values for the input parameters of FC50 "AG_LSEND". Table 5-12

Input parameters	Value	Note
ACT	true	true = Trigger of send job
ID	2 (dez)	Take the value for the input parameter "ID" in NetPro from the properties dialog of the UDP connection \rightarrow "General information" tab.
LADDR	3FFD (hex)	Take the value for the "LADDR" input parameter in NetPro from the properties dialog of the UDP connection \rightarrow "General information" tab.
LEN	756 (dez)	The value of the LEN input parameter is determined as follows: LEN = n * 4 + 20 n = number of data (DWORDs) to be sent 20 = frame header
SEND	-	Interconnect the SEND input parameter of FC50 "AG_LSEND" with the already created DB2 "TO_ABB". The data is read and sent from this block.

Example for calculating the LEN input parameter

184 DWORDs are sent to Freelance 800F by PCS 7. LEN = 184 * 4 + 20 = 756

5.2.4 Calling the function blocks for converting the data

Call the "RecABBRe" function block for converting the received variables of the REAL data type in a CFC plan. Interconnect the IN input parameter with the data source in DB1, where the

Interconnect the IN input parameter with the data source in DB1, where the received data is stored.

Figure 5-4



Call the "RecABBRo" function block for converting the received variables from the BOOL data type in a CFC plan.

Interconnect the following input parameters with the data source in DB1, where the received data is stored.

- INBL_1
- INBL_2
- INBL_3
- INBL_4

Figure 5-5



Call the "SndABBRe" function block for converting the received variables from the REAL data type in a CFC plan.

Interconnect the IN input parameter with the data source in DB2 where the data to be sent to Freelance 800F, is stored.

Figure 5-6



Call the "SndABBRo" function block for converting the received variables from the REAL data type in a CFC plan.

Interconnect the IN input parameter with the data source in DB2 where the data to be sent to Freelance 800F, is stored.

Figure 5-7

11	
SndABBBo Konvert	0B35 1/24
1-INBL_1	OUTDWORD
0-INBL_2	
1-INBL_3	
1-INBL_4	

6 Installation

6.1 Installation of the hardware

The figure below shows the hardware configuration of the application: Figure 6-1



For details on the hardware components, please refer to chapter 2.3 Hardware and software components used.

The table below gives an overview of the IP addresses as well as the devices which are used in the hardware setup of the application.

Device	IP Address
CP443-1 in AS 417-4	172.20.1.199
EI 813F in AC 800F controller	172.20.1.112
SIMATIC PCS 7 OS/ES 547B IE	172.20.1.200
Engineering Station Freelance 800F	172.20.1.100

Note The setup guidelines for PCS 7 must always be followed. Further information on installation guidelines for PCS 7 can be found in the "SIMATIC Process Control System PCS 7 Compendium Part A - Configuration Guidelines" manual. This is available as a download via the following link:

http://support.automation.siemens.com/WW/view/en/35016996

6.2 Installation of the software

In the manual "SIMATIC Process Control System PCS 7 V7.0 SP1 PC Configuration and Authorization" you will find information on installing PCS 7. This is available as a download via the following link:

http://support.automation.siemens.com/WW/view/en/27002558

7 Startup of the Application

7.1 Commissioning the application in PCS 7

When commissioning the application in PCS 7 proceed as follows.

Set IP address and PG/PC interface of the SIMATIC PCS7 OS/ES 547B IE workstation

Table 7-1

No.	Instruction	Comment
1.	Open the properties dialog of the Local Area Networks (LAN) in the Windows network setting of the SIMATIC PCS7 OS/ES 547B IE workstation to assign the IP address. Enter the IP address 172.20.1.200 and the subnet mask und confirm the entry with "OK".	Internet Protocol (TCP/IP) Properties ? × General You can get IP settings assigned automatically if your network supports this capability. Utherwise, you need to ask your network administrator for the appropriate IP settings. © @btain an IP address automatically © @btain an IP address automatically © @btain an IP address: [IP address: [172.20.1.200 Sybnet mask: [255.255.255.0 Default gateway: . © @btain DNS server address automatically © @btain DNS server addresses: Preferred DNS server: . Adternate DNS server: . Adternate DNS server: . DK Cancel
2.	Open the SIMATIC Manager via Start → SIMATIC → SIMATIC Manager. Open the "Set PG/PC Interface" dialog in the SIMATIC Manager via the Options menu → Set PG/PC Interface	SIMATIC Manager - [UDP_ABB C:\Program Files\Siemens\Step7\s7proj\ File Edit Insert PLC View Options Window Help Image: Similar

No.	Instruction	Comment
3.	Under "Interface Parameter Assignment Used" select the following entry: TCP/IP → <network card=""> Confirm your selection by clicking OK.</network>	Set PG/PC Interface X Access Path LDP Access Point of the Application: S70NLINE S70NLINE (STEP 7) Interface Barameter Assignment Used: TCP/IP >> Broadcom NetXtreme Gig TCP/IP >> Broadcom NetXtreme Gig Diagnostics IDISD Ind. Ethernet >> Broadcom NetXtreme Gig Copy IDE/IP/IP/Autol >> Broadcom NetXtreme Gig Copy IDE/IP/IP/Autol >> Broadcom NetXtreme Gig Dejete Interfaces Add/Remove: Selegt INterfaces Add/Remove: Selegt IDK Cancel Help

Setting IP address of CP443-1 in AS 417-4

Table 7-2

No.	Instruction	Comment	
1.	Open the "Set PG/PC interface" dialog in the SIMATIC Manager via the PLC menu → Edit Ethenet Node	SIMATIC Manager - [UDP_ABB C:\Program Files\Siemens\Step7\s' File Edit Inset PLC View Options Window Help Configure Ctrl+L Outp-ABB Configure CTrl+X Configure Configure Ctrl+K Copy RAM to PG Upload station to PG Copy RAM to ROM Download User Program to Memory Card Save to Memory Card Retrieve from Memory Card Manage M7 System Display Accessible Nodes Change Module Identification CPU Messages Display Force Values Monitor/Modify Variables Diagnostic/Setting PROFIBUS PROFIBUS Edt Ethernet Node Assign PG/PC Cancel PG/PC Assignment Update the Operating System Save Service Data	
2.	Click the "Browse" button to search your network for accessible nodes. Select the MAC address of the CP443-1 and enter the IP address 172.20.1.199 and subnet mask 255.255.255.0 for the CP443-1 in the "Edit Ethernet Node" dialog. Click the "Assign IP Configuration" button to assign the IP address and the subnet mask just entered to the CP443-1. Click the "Close" button to exit the "Edit Ethernet Node" dialog.	Edit Ethernet Node X Ethernet node Nodes accessible online MAC gddress: 00.0E-8C.A4.AA-98 Browse Browse Set IP configuration © Dg not use router © Use IP parameters Gateway IP address: 172.20.1.199 Subnet marks: 255.255.255.0 Que router Address:	

Load hardware	configuration	and user	program	of AS 417-4

Table 7-3

No.	Instruction	Comment
1.	Open the properties dialog of the Industrial Ethernet Interface of the CP443-1 in the hardware configuration of the AS 417-4. In the "General" tab, click the "Properties" button. The "Properties – Ethernet interface PN-IO" dialog is opened.	Properties - PN-10 (80/55.1) 2 General Addresses PR0FINET Synchronization Media Redundancy Short description: Short description: PN-10 Device name: PN-10 Support device replacement without exchangeable medium Interface Type: Ethernet Device number: 0 Address: 172:201.199 Networked: yes Properties Comment: Image: Cancel Help
2.	In the "Properties – Ethernet interface PN- IO" dialog → "General" tab enter the IP address 172.20.1.199 and the subnet mask 255.255.255.0 which you have already assigned to CP443-1. Assign a subnet to CP443-1. If there is no subnet yet, click the "New" button and create a new subnet. Apply the settings with OK.	Properties - Ethernet interface: PN-10 (R0/\$5.1) X General Parameters Set MAC address Set MAC address: IF IP protocol is being used IP address: 172.20.1.199 Subnet: 255.255.0 Gateway © Do not use router Address: 172.20.1.199 Subnet: Properties Betway Properties Dejete OK
3.	Save and compile the configuration of AS 417-4. Subsequently load the configuration in the CPU of the AS 417-4.	HW Config - [AS11 (Configuration) UDP_ABB] Station Edit Insert PLC View Options Window Help Image: Station Edit Insert PLC View Option Edit Insert PLC View Option Help Image: Station Edit Insert PLC View Option Edit Insert PLC View Opti

Once the configuration of the AS 417-4 is completed, load the user program into the CPU of the AS 417-4.

7.2 Commissioning the application in the Freelance 800F process control system

7.2 Commissioning the application in the Freelance 800F process control system

When commissioning the application in the Freelance 800F process control system proceed as follows.

Setting IP address and PG/PC interface of the engineering station

No.	Instruction	Comment
1.	Open the properties dialog of the Local Area Networks (LAN), to set the IP address of the engineering station in the Windows network settings of the engineering station in the Freelance 800F process control system. Enter the IP address 172.20.1.100 and the subnet mask.	Internet Protocol (TCP/IP) Properties ? × General You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings. ① Dotain an IP address automatically ② Uge the following IP address: [IP addre
2.	Select the Start menu → Programs → ABB Industrial IT → Freelance 800F Vx.x → Configure. In the General Settings menu enter the IP address 172.20.1.100 and the subnet mask 255.255.255.0 of the engineering station in the Freelance 800F process control system.	Configure Configure

No.	Instruction	Comment
3.	Open the engineering tool "Control Builder F" via Start → Programs → ABB Industrial IT → Freelance 800F Vx.x. Select the Project menu → Network to open the Network Configuration dialog.	Industrial IT Control System Creating Project Search Edit System Options Help Save Documentation OB [CONF] 1 AS01 (AC800F] Show error list Headeron OI AS01.USRTask [TASKLIST] Image: Commont in the image: Common in the image: Commont in the image: Commont in the image: Common in the im
4.	Selet type AC800F. Click the Edit button to open the Network Configuration AC800F2 dialog.	Network Configuration X Type Name Res. type Res. nome Res. ID IP-oddress 1 IP-oddress 2 DV/ GW/2 D-65 21 172.20.1180 ID DV/ GW/2 D-65 DPC1 15 172.20.1180 VM VM D-65 DPC1 15 172.20.1180 MAXONE VM DPC3 DV01 2.5 172.20.1180 EMULATOR EMULATOR1 1 172.20.1100 172.20.1100
5.	Enter the IP address 172.20.1.112 of the AC 800F controller.	Network Configuration AC800F2 Function Block Name: AC800F2 Type: AC800F Network Resource ID: 2 IP address 1: 172.20.1.112 IP address 2: 0K

7.2 Commissioning the application in the Freelance 800F process control system

7 Startup of the Application

No.	Instruction	Comment
6.	Verify all settings made in Project menu → Check all.	Industrial IT Control System Freelance 800F Control Builder F innovtour Configuration Project Search Edit System Options Help Save Documentation Image: Save
7.	Right click the AC800F controller in the engineering tool "Control Builder F" and select the Load menu → Changed objects, to load the settings.	Industrial IT Control System Freelance 800F Control Builder F innovtour Commissioning: Proj Project Search Edit Load System Windows Options Help Image: Search Edit Load System H

8.1 Operation of the application in PCS 7

8 Operation of the Application

8.1 Operation of the application in PCS 7

Monitoring receive data in the variable table

Table 8-1

No.	Instruction	Comment
1.	Add another variable table in the AS 417-4 user program.	SIMATIC Manager - [UDP_ABB C:\Program Files\Siemens\Step7\s File Edit Insert PLC View Options Window Help Station Subnet Program System data ST Software System data ST Software Symbol Table Text Library External Source 6 Variable Table
2.	Add the receive data area for monitoring via the Insert menu → Range of Variables	War - [VAT_recv UDP_ABB\AS11\CPU 417-4\S7 Program(29)] Table Edit Insert PLC Variable View Options Window Help Help Row Comment Line Variable Table Parallel Table Nodify value Address Symbol Ctrl+K Modify value
3.	756 bytes are defined as receive data area in DB1 from address 0 onward. Via the variable table you can monitor the receive data area and therefore the data received by ABB (header frame and user data). The user data received is saved in DB1 from address 20 onwards.	War - [VAT_recv UDP_ABB\AS11\CPU 417-4\\S7 Program(29)] Table Edit Insert PLC Variable View Options Window Help →

8 Operation of the Application

8.1 Operation of the application in PCS 7

Controlling send data via the variable table

Table 8-2

No.	Instruction	Comment
1.	Set the input parameter ACT=1 at FC50 "AG_LSEND".	The send job is triggered or excecuted.
2.	Add another variable table in the AS 417-4 user program.	SIMATIC Manager - [UDP_ABB C:\Program Files\Siemens\Step7] Prile Edit Insert PLC View Options Window Help Station Subnet Program System data OF AS S7 Software M7 Software Symboli Table Text: Library External Source 6 Variable Table
3.	Add the send data area for controlling the send data via the Insert menu → Range of Variables	Image: Symbol Ctrl+J
4.	756 bytes are defined as send data area in DB2 from address 0 onward. Via the variable table you can control the data (header frame and user data) to be sent to ABB. The user data to be sent is saved in DB2 from address 20.	War - [VAT_send UDP_ABB\ASI1\CPU 417-4\S7 Program(29)] Table Edit Insert PLC Variable Yew Options Window Help Help Help Help Help Help Help Address Symbol Display format Status value Modify value Address Symbol Display format Status value Modify value 2 DB2 DBW 0 TO_ABB" Header WORD_1 HEX 3 DB2 DBW TO_ABB" Header WORD_2 HEX 4 DB2 DBW TO_ABB" Header WORD_4 HEX 5 DB2 DBW TO_ABB" Header WORD_6 HEX 6 DB2 DBW TO_ABB" Header WORD_6 HEX 7 DB2 DBW TO_ABB" Header WORD_6 HEX 9 DB2 DBW TO_ABB" Header WORD_7 HEX 10 DD2 DBW TO_ABB" Header WORD_10 HEX 11 DB2 DBW TO_ABB" Header WORD_10 HEX 12 DB2 DBW TO_ABB" Option HEX 11 DB2 DBW TO_ABB" Option HEX 1

8.2 Operation of the application in the Freelance 800F process control system

8.2 Operation of the application in the Freelance 800F process control system

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No.	Instruction	Comment
1.	In the engineering tool "Control Builder F" go to the commissioning mode via Project menu → Commissioning.	Industrial IT Control System Freelance 800F Control Builder F innovtour Configure Project Search1 Edit System Options Help Save Source Documentation Check Check all D8 [CONF] AS01 [AC800F] 01 AS011USRTask [TASKLIST] Header Comment. Comment 01 AS01ET200M [TASK] (Cyclic, T#500ms) Exit 03 Task_1 [TASK] (Cyclic, T#500ms) Exit 03 NK113 [FBD] 04 NK112 [FBD] 05 NK111 [FBD] 05 NK111 [FBD] 06 FC111 [FBD]
2.	Select the FBS program with a send or receive block in project tree. Subsequently open the Define Debug Windows dialog via the Windows menu → Define debug windows	Industrial IT Control System Freelance 800F Control Builder F innovtour. Commissioning: Project Searchi Edit Load System Windows Options Help Image:
3.	At first the dialog is empty. Doubleclick the respective variable in the plan which you would like to add.	Define Debug Windows X 21 Recivy_11.rReal_18 A 22 Recivy_11.rReal_19 A 23 Recivy_11.rReal_20 Float 24 Recivy_11.rReal_21 Float 25 Hectvy_11.rReal_22 Float 26 Recivy_11.rReal_22 Float 27 Recivy_11.rReal_24 Float 28 Recivy_11.rReal_24 Float 29 Recivy_11.rReal_24 Float 29 Recivy_11.rReal_24 Float 29 Recivy_11.rReal_26 Up 30 Recivy_11.rReal_36 Display 31 Recivy_11.rReal_33 Delete All 32 Recivy_11.rReal_33 Trend window 33 Recivy_11.rReal_34 Save Conf.

8.2 Operation of the application in the Freelance 800F process control system

No.	Instruction	Comment			
4.	In this application example a single variable of a structure is controlled. Once you have selected the structure the Select Component dialog will be opened. Mark the variable you need for operation and apply the settings with OK.	Select Component X Variable name: Struktur Type: Struktur_1 Comp name: Comment: Type: SPEAL0 REAL REAL sPEAL12 REAL REAL sPEAL2 REAL REAL sPEAL3 REAL REAL sPEAL4 REAL REAL sPEAL5 REAL REAL sPEAL6 REAL REAL sPEAL9 REAL REAL sPEAL10 REAL REAL sPEAL111 REAL REAL sPEAL12 REAL REAL sPEAL13 REAL REAL			
5.	The Define Debug Windows dialog will display the desired variable. Add other variables according to the same procedure, if other variables are to be operated. Once you have defined all variables exit the Define Debug Windows dialog with OK.	Define Debug Windows X 21 Recivy_11.rReal_18 A 22 Recivy_11.rReal_20 A 23 Recivy_11.rReal_21 Fixed-point 1 24 Recivy_11.rReal_22 Fixed-point 2 26 Recivy_11.rReal_23 Fixed-point 4 27 Recivy_11.rReal_26 Dup 30 Recivy_11.rReal_28 Dup 31 Recivy_11.rReal_28 Dup 32 Recivy_11.rReal_31 Fixed-point 4 33 Recivy_11.rReal_28 Dup 34 Recivy_11.rReal_31 Display 35 Recivy_11.rReal_31 Trend window 36 Recivy_11.rReal_34 Staty_00 39 Staty_00 Trend window Load Conf.			
6.	Open the Value window dialog via the Windows menu → Show value window to display and control the values of the defined variables.	Industrial IT Control System Freelance 800F Control Builder F innovtour Commissioning: Project Searchi Edit Load System Windows: Options Help Image:			

NI -				0		
NO.	Instruction				omment	
7.	The defined variables are displayed	₩¥a	lue win	dow		
	with the current value. Doubleclick the	No.	Data	. Variable name	Value	Comment
	variable to change the value	3	REAL	Recivy_11.rReal_1	0.0	Wert 3
	variable to change the value.	5	REAL	Recivy_11.rReal_2	0.0	Wert 3
		6	REAL	Recivy_11.rReal_3	0.0	Wert 3
		7	REAL	Recivy_11.rReal_4	0.0	Wert 3
		8	REAL	Recivy_11.rReal_5	0.0	Wert 3
		9	REAL	Recivy_11.rReal_6	0.0	Wert 3
		10	DEAL	Recivy_11.rReal_/	0.0	Wert 3
		12	REAL	Recivy_11.rReal_9	0.0	Wert 3
		13	REAL	Recivy_11.rReal_10	0.0	Wert 3
		14	REAL	Recivy 11.rReal 11	0.0	Wert 3
		15	REAL	Recivy_11.rReal_12	0.0	Wert 3
		16	REAL	Recivy_11.rReal_13	0.0	Wert 3
		17	REAL	Recivy_11.rReal_14	0.0	Wert 3
		18	REAL	Recivy_11.rReal_15	0.0	Wert 3
		19	REAL	Recivy_11.rReal_16	0.0	Wert 3
		20	REAL	Recivy_11.rReal_17	0.0	Wert 3
		21	REAL	Recivy_11.rReal_18	0.0	Wert 3
		22	REAL	Recivy_11.rReal_19	0.0	Wert 3
		23	REAL	Recivy_11.rReal_20	0.0	Wert 3
		24	REAL	Recivy_11.rReal_21	0.0	Wert 3
		25	REAL	Recivy_11.rReal_22	0.0	Wert 3
		20	REAL	Recivy_11.rReal_23	0.0	Wert 3
		28	REAL	Recivy_11.Real_25	0.0	Wert 3
		29	REAL	Recivy_11.rReal_26	0.0	Wert 3
		30	REAL	Recivy_11.rReal_27	0.0	Wert 3
		31	REAL	Recivy 11.rReal 28	0.0	Wert 3
		32	REAL	Recivy_11.rReal_29	0.0	Wert 3
		33	REAL	Recivy_11.rReal_30	0.0	Wert 3
		34	REAL	Recivy_11.rReal_31	0.0	Wert 1
		35	REAL	Recivy_11.rReal_32	0.0	Wert 2
		36	REAL	Recivy_11.rReal_33	0.0	Wert 3
		37	REAL	Recivy_11.rReal_34	0.0	Wert 3
		38	BOOL	Error_00	TRUE	
		39	INT	Staty_00	23	
		1	KEAL	SCRUKCUP.SKEALU	0.5	
8	Enter the new value and apply the	Name		6		V
0.	Enter the new value and apply the	New	value	for		X
	settings with OK.					
		BEA	М	Struktur «BEALO	0.5	
		TIC/		o don dan of here ed	Jana	
				OK	Cancel	

8.2 Operation of the application in the Freelance 800F process control system

9 Related Literature

9.1 Bibliography

This list is not complete and only represents a selection of relevant literature. Table 9-1 Bibliographic references

	Торіс	Title	
/1/	STEP7	Automating with STEP7 in STL and SCL	
		Hans Berger	
		Publisher: Vch Pub	
		ISBN-10 3895783412	
		ISBN-13 9783895783418	
/2/	CFC	SIMATIC Process Control System PCS 7 CFC for SIMATIC S7	
		http://support.automation.siemens.com/WW/view/en/27002752	
/3/	Installation	SIMATIC Process Control System PCS 7 V7.0 SP1 PC	
	PCS7	Configuration and Autorization	
		http://support.automation.siemens.com/WW/view/en/27002558	
/4/	Configuration	SIMATIC Process Control System PCS 7 Compendium Part A –	
	with PCS 7	Configuration Guidelines	
		http://support.automation.siemens.com/WW/view/en/35016996	
/5/	Commissioning	S7-CPs for Industrial Ethernet Configuring and Commissioning	
	/ Configuration	Part A - General Application	
	CP443-1	http://support.automation.siemens.com/WW/view/en/31526062	

9.2 Internet Links

This list is not complete and only represents a selection of relevant information.

Table 9-2 Internet links

	Торіс	Title
\1\	UDP protocol	http://support.automation.siemens.com/WW/view/en/26484229
121	Siemens I IA/DT Customer Support	http://support.automation.siemens.com
\3\	ABB	http://www.abb.com/

10 History

Table 10-1 History

Version	Date	Modifications
V1.0	27.11.2009	First version