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Step7 / PCS 7 Gateway for ABB MasterBus 300

Operating manual

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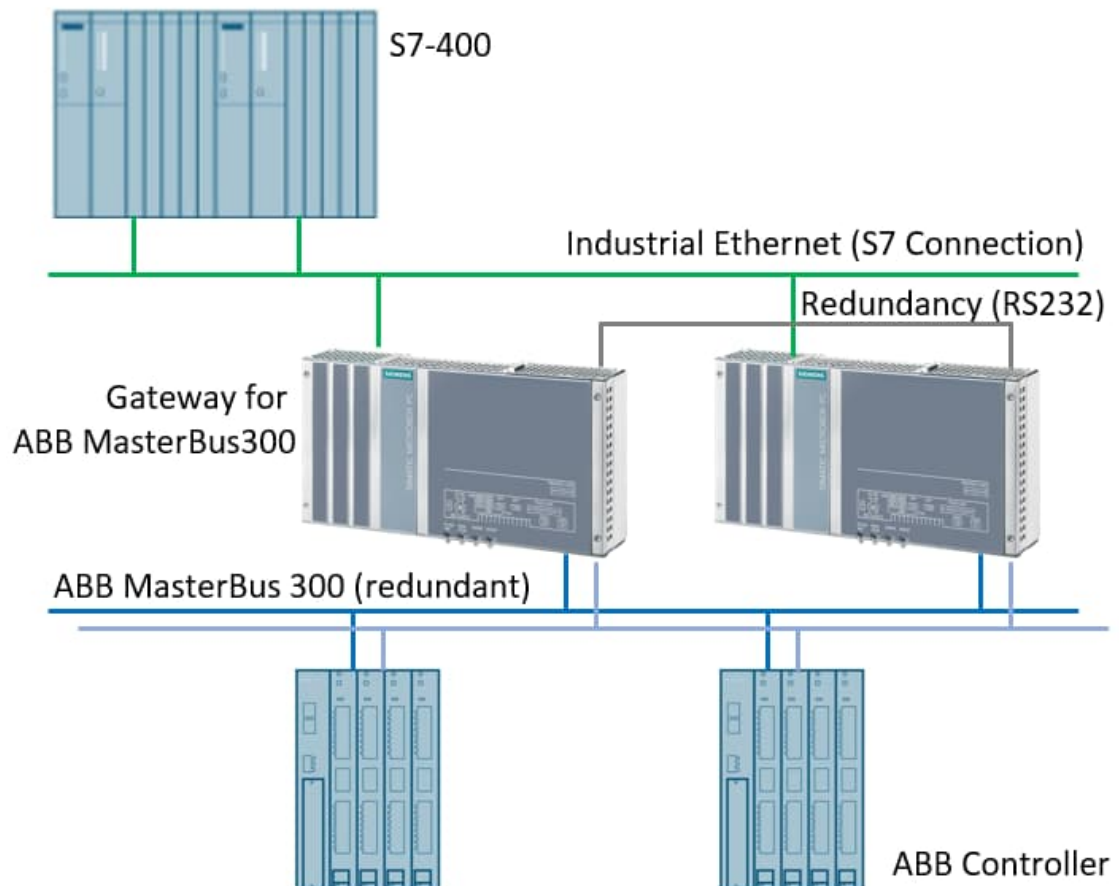
1 Preface

1.1 Overview

This document is only valid for IPC427E 'Step7 / PCS 7 Gateway for ABB MasterBus 300 V1.0 (MLFB 9LA1110-6CG40-0AA0). The Gateway connects Advant stations from ABB via the bus MasterBus 300 with SIEMENS automation systems Step7 / PCS 7.

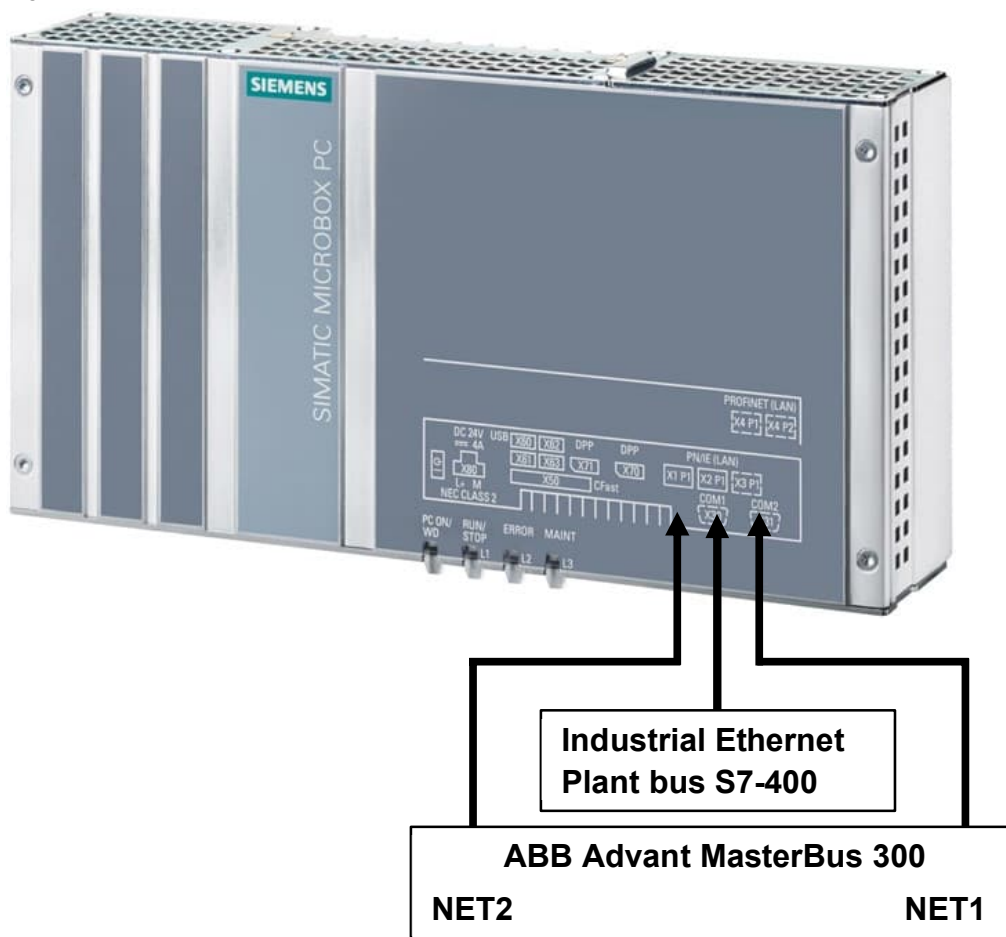
The Gateway is connected to one or two networks of the MasterBus 300 bus system with one or two RJ45 Ethernet ports. On the third RJ45 port the Gateway is connected with S7-400 CPU via the PCS 7 plant bus (Industrial Ethernet). On the PCS 7 plant bus the IP protocol is used with fixed IP addresses for the communication partners.

Figure 1-1



The communication described in this document is designed for the CPU modules S7-410 and S7-410H.

Figure 1-2



1.2 Software environment in PCS 7

The Gateway is delivered with a function block library. This library can be used with Step7 or PCS 7. The Gateway is approved for following PCS 7 versions:

- SIMATIC PCS 7 V9.1 SP2

NOTICE

There libraries are not compatible with the outdated versions (CM104 hardware) of Gateway! For further questions, please contact support.

BSEND and BRCV

The S7 function blocks for the communication with the Gateway require the system function blocks BSEND and BRCV in the S7 CPU.

SFC

SFC programs in PCS 7 are not supported. Signals from a SFC program and commands into a SFC program must be transferred by additional software for the CFC chart, where the communication blocks are placed.

NOTICE

Safety program

The communication blocks cannot be located inside a safety program. Signals, that are transferred by Gateway or its blocks must not be used inside safety program

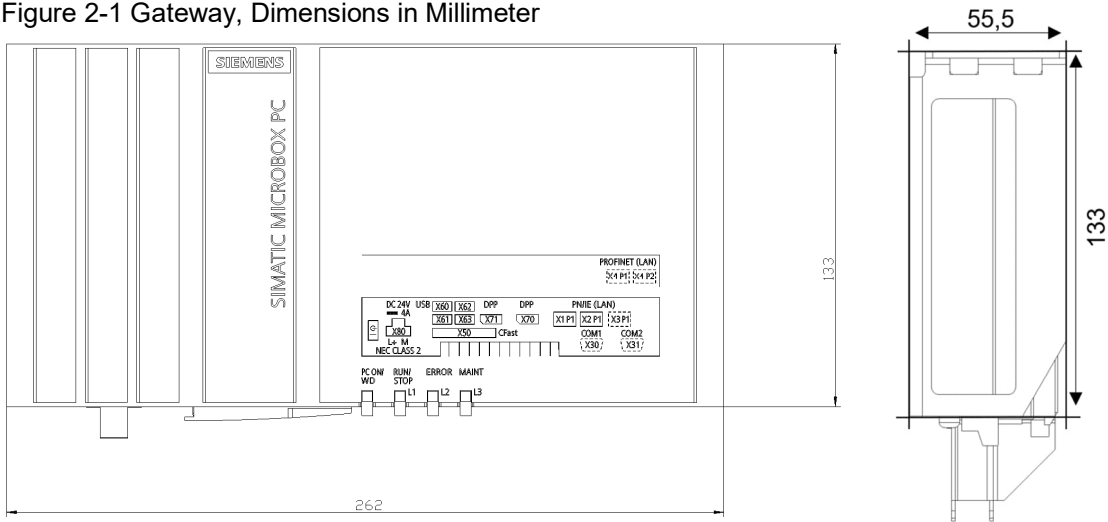
1.3 Gateway Version

The current version of IPC427E Gateway for ABB MasterBus 300 is V1. It contains a firmware V:31.00. The latest block library has version 4.0.

2 Hardware

2.1 Fitting dimensions

Figure 2-1 Gateway, Dimensions in Millimeter



2.2 Interfaces

Figure 2-2 Bottom view of main module

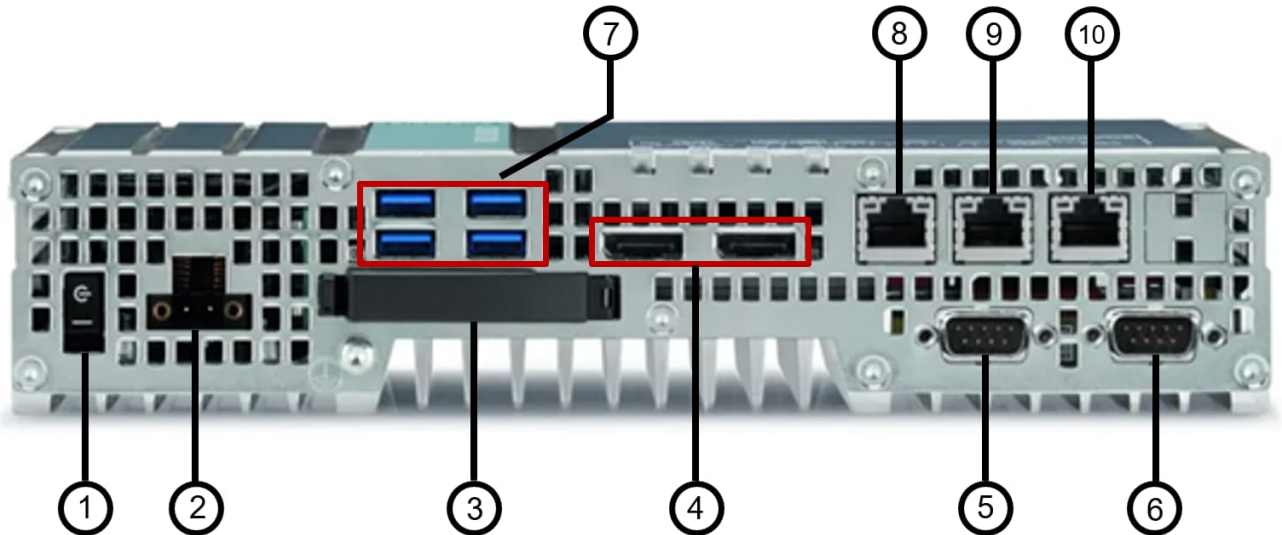


Table 2-1

Number	Interface	Purpose
1	On/off switch	OFF position when the symbol "C-" is pressed in
2	X80	Power supply 24 V DC
3	CFast	CFast with Gateway software and license
4	Monitor, Keyboard, RS232X70 and X71	DisplayPort connection
5	X30 (COM1)	COM (RS 232 / 485 / 422). Used RS232 port for for the connection between two redundant Gateway
6	X31	COM (RS 232 / 485 / 422). Not in use.
7	X60, X61, X62 and X63	USB 3.0, high current
8	X1P1	RJ45 plug, Ethernet Connection to the MasterBus 300 bus (NET_2)
9	X2P1	RJ45 plug, Ethernet. Connection to the SIMATIC plant bus
10	X3P1	RJ45 plug, Ethernet Connection to the MasterBus 300 bus (NET_1)

2.3 Technical Data

Hardware base

IPC427E MLFB 6AG4141-1BF30-2AA0

Aluminium box

Length 133mm, width 262 mm, depth 55,5mm

Without fan, mountable on 35 mm Dim rail

Power supply

24V DC (-20%/+20%) continuous current up to 4A

Weight

2,2 kg without mounting system

Environment

Operating temperature: 0 °C to +45 °C

Humidity from 0 until 30°C; 5% to 80 %, no condensation

Special hardware features

No fan, no mechanical moved parts.

2.4 Gateway Performance

The Gateways single/redundant has the following performance ratings:

Property	Limits
Number of connectable S7-400H	3
Number of connectable ABB CPU	4
Number of maximal usable DataSets per Gateway	160
Maximal usable Signals per Gateway	This depends on the number of values per DataType. The available 160 DataSets would allow: 160 * 32 = 5120 float values Or 160 * 24 * 32 = 122880 bool values
Maximal Block update cycle	0.1Sec
Signal delay (caused by Gateway)	1 - 20mSec (Note: additional delay by MasterBus 300 and S7 cycle)
Recommend S7 cycle	ADV_Link: Faster than the other other Gateway blocks! Recommended 50mSec or 100mSec. Other Gateway FB: Usually 1Sec or 2Sec. (Supported 0.5Sec to 60Sec)
Maximum bus load in per cent caused by sending from the Gateway	Percentage between 0.5 and 3.

These ratings are partly limited by subordinate components (S7, Gateway hardware/software, MasterBus 300). In individual cases (depending on project requirements), these parameters can be adjusted upwards and released after a project-specific test.

2.5 Interruption of the power supply / power down

The flash memory is write-protected during normal operation. The write-protection is only temporarily disabled during configuration. The write protection ensures that after loss of supply power, the Gateway will properly restart again with unchanged system data. In case of a complete system breakdown (if the device is no longer reachable via network interface), it is possible to switch the power off and on again by using the power button. After the system restart, all functionalities will be available again.

2.6 Entering the configuration file in the Gateway

Please refer chapter 5.2 to get information, how to access the device via monitor/keyboard or over SSH.

The configuration parameters are stored in the configuration file:

`/etc/S7_Gtw.conf`

The Gateway can be accessed with a monitor and keyboard directly connected.

There you are prompted to log into the Gateway.

```
localhost login: root
```

The device specific password is attached directly on the device

When the username and password are entered correct, following line will appear

```
root@localhost:~#
```

To access write-permission you need to enter

```
localhost:~# mrw
```

For configuration the editor vi is used. If you are not familiar with vi, please check the internet for detailed instructions.

The configuration file `/etc/S7_Gtw.conf` is opened by calling up the config script

```
localhost:~# vi /etc/S7_Gtw.conf
```

In this configuration file the network settings are configured.

The file opens in read-mode. To edit the file just enter the letter “i” on the keyboard.

After editing press “**ESC**” to leave the edit mode.

To open the command line press “**Shift**” + “:”.

To leave the file without saving enter: `localhost:~# q!`

To leave the file with saving enter: `localhost:~# wq`

Any changes to the configuration file will become effective when the Gateway is restarted. A reboot is done by `localhost:~# reboot`

2.7 The configuration parameters in the Gateway

```
[SIMATIC_NET]
OwnIP=140.80.11.205
NetMask=255.255.0.0
Device = eth0

[ADVANT]
# NET_x = net number z1, z2,...z9 decimal
Net_1 = 11
Device_1 = eth1

Net_2 = 12
Device_2 = eth2

# OwnNode = node number in both networks, 1...255 decimal
OwnNode = 55

# MB300Type 1 = standard, 2= fixed packet size , 3 = E
MB300Type=3

# Byte 18 in the telegram, decimal (default =1)
#Byte_18=17
#BusLoad=0.5
```

The character # disables the parsing of the rest of the line and assigns the beginning of a comment.

2.7.1 Section [SIMATIC_NET]

Under the section [SIMATIC_NET] the local IP address of the Gateway must be specified with "OwnIP=". If there is no IP address defined, the Gateway stops the operation. The net mask (NetMask=) is needed only if it is not equal 255.255.0.0. Optionally the name of the Ethernet port in the operating system Linux can be specified by "Device=ethx", x=0,1,... The default value for the SIMATIC net is eth0. In the standard hardware configuration LAN X2P1 is assigned to eth0.

Table 2-2

Keywords in the section [SIMATIC_NET]		
Keyword	Description	default value
OwnIP	IP address of the Gateway in the SIMATIC net Example: OwnIP=140.80.11.5	mandatory! no default
NetMask	Net mask for the used IP addresses in the SIMATIC net. Example: NetMask=255.255.0.0	255.255.0.0
DefaultGw	IP address of a router in the network. This address is used if the Gateway and the PCS 7 station are in different networks. The router and the Gateway must be participants of the same network. That means: The IP address of the router must match the IP address of the Gateway in the part, that is marked by the net mask.	0 = no router used
Device	Name of an Ethernet device in the Linux system of the Gateway. This device is used for the communication with IP protocol via the SIMATIC net. In the standard device eth2 is used and need not be parameterized.	eth2

2.7.2 Section [ADVANT]

Under the section [ADVANT] the first net number (Net_1=) and the local node number (OwnNode=) of the Gateway must be specified. If one term is missing, the Gateway stops operation. If the Gateway is connected with two MasterBus 300 networks, the second network is specified with "Net_2=". Optionally the names of the Ethernet ports in the operating system Linux can be specified by "Device_1=ethx" and "Device_2=ethx", x=0,1,... The default value for the first Advant net is eth0 and for the second is eth1.

Table 2-3

Keywords in the section [ADVANT]		
Keyword	Description	default value
OwnNode	Node number of the Gateway in the MasterBus 300 bus system. Example: OwnNode=55	mandatory! no default
Net_1	Net number of the network at the first port for the MasterBus 300 (called LAN2 in the Gateway).	mandatory! no default

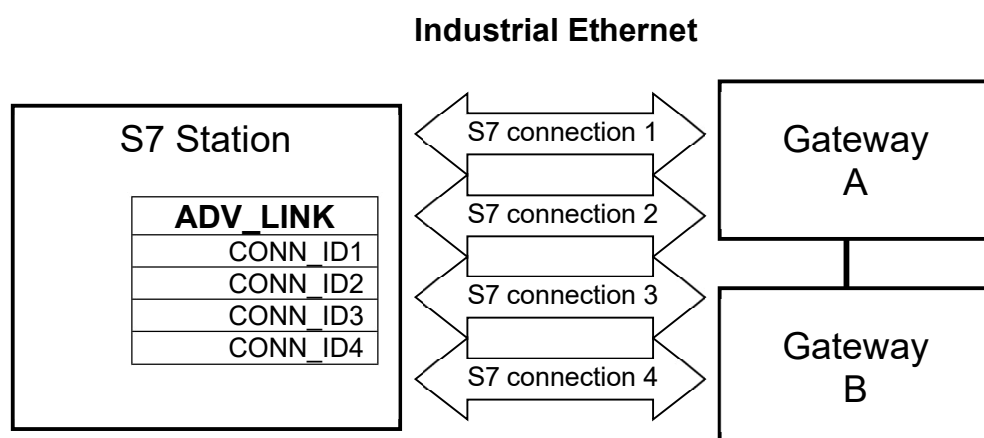
Keywords in the section [ADVANT]		
Net_2	Net number of the network at the second port for the MasterBus 300 (called LAN3 in the Gateway). Net_1 and Net_2 must differ only in the unit position.	0 = no second network
MB300Type	Type of the MasterBus 300 network. 1 =standard, 3 =MB 300E	3
Device_1	Name of an Ethernet device in the Linux system of the Gateway. This device is used for the first MasterBus 300 network with the net number Net_1. Example: Device_1 =eth1	eth0
Device_2	Name of an Ethernet device in the Linux system of the Gateway. This device is used for the second MasterBus 300 network with the net number Net_2. Example: Device_2 =eth2	eth1
BusLoad	Maximum bus load in per cent caused by sending from the Gateway. 100 % is assigned to the maximum data rate of 1.200.000 bytes per second, that the Gateway can send. Range: 0,5 to 3. A full data set with 24 values, sent every second, causes a bus load of 0,012 %. Example: 2 means 160 data set per second	2

3 Communication between the Gateway and the S7 CPU

3.1 S7 Connections

The communication partners (CPU and Gateway) are participants of the common Ethernet network and have fixed IP addresses.

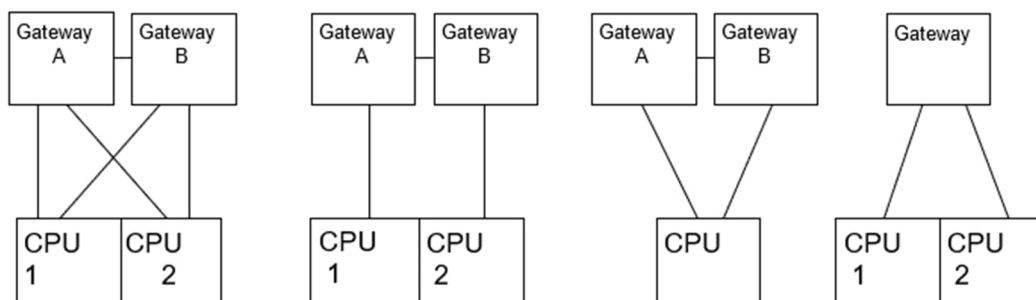
In the Gateway only the Ethernet port and its IP address must be defined for the communication with the S7 CPU. The rest of the necessary communication parameters for a S7 connection is engineered in the system PCS 7, especially in the PCS 7 software tool NetPro. The PCS 7 station establishes active an IP connection and a S7 connection to the designed Gateway. Then the function block ADV_LINK starts the communication sending a BSEND telegram. The function block ADV_LINK uses the S7 connections engineered with NetPro.



One Gateway is able to handle several connections. In order to this one Gateway can be used for up to three S7-400H systems. However, it must be ensured that each DataSet is only written to by one S7 in the write direction.

3.2 Redundancy

The function blocks are running in single and in redundant systems according to the redundancy functions of the host system PCS 7 and the configuration of the Gateway. The function block ADV_LINK manages the redundant communication with up to four S7 connections. Each S7 connection is engineered as a single connection. All S7 connections together constitute a redundant connection. Several redundancy configurations are realizable.



Each S7 connection is watched with live sign telegrams from both systems. One S7 connection is sufficient for the complete data transfer in both directions. If two S7 connections are available, one S7 connection (via one CP443-1 card) is dedicated for sending data only and the other S7 connection (via the other CP443-1 card) for receiving data only.

The data transfer is switched over to another S7 connection to the same Gateway, after a data package is not acknowledged by the receiver. When the partner system acknowledges a data package, the function block ADV_LINK selects a working connection for the further sending.

3.3 PCS 7 Engineering

3.3.1 Engineering of S7 connections

The complete engineering of a connection between the PCS 7 station and the Gateway is in the PCS 7 software tool NetPro. Only the corresponding IP address in the Gateway must be entered in NetPro as the end point of a S7 connection.

The Gateway accepts each request for a connection from the PCS 7 station. The Gateway needs not the connection parameters from PCS 7.

The Parameters in PCS 7 NetPro for each connection to a Gateway

Fixed parameters

- - S7 connection
- - unspecified partner
- - active role in the PCS 7 station
- - TCP/IP used

Specific parameters

- - Via a CP443-1 card of the PCS 7 Station
- - IP address of the used Gateway interface

Arbitrary parameters (set by NetPro automatically)

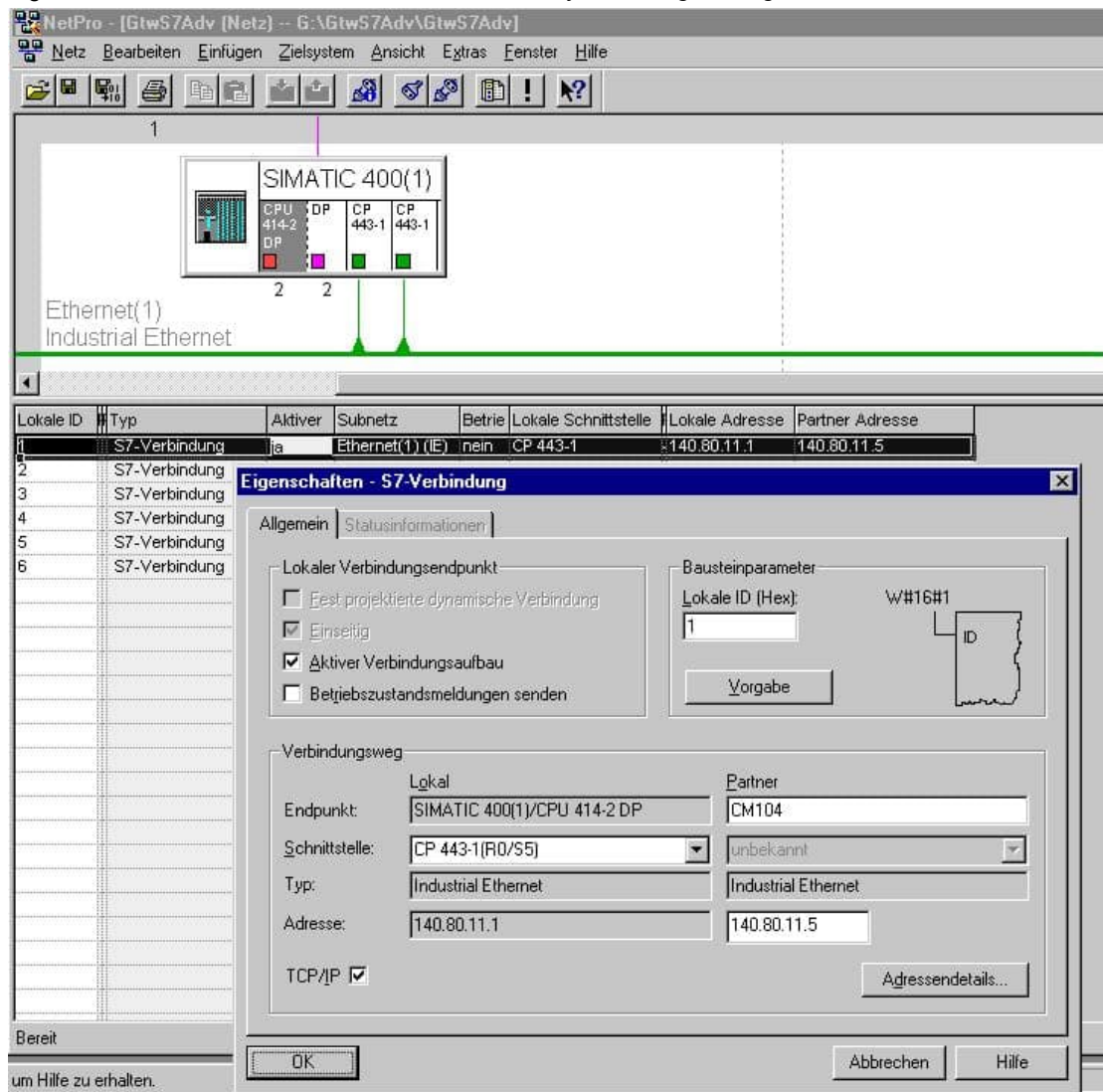
- - RTSAP and LTSAP

NOTICE

Usage of communication interface

A connection from the AS to the gateway is possible via the CPU interface X5/X8 or an external Ethernet CP.

Figure 3-1 Parameter for a connection to the Gateway in the engineering tool NetPro



3.3.2 Engineering of the function block ADV_LINK

The S7 function blocks ADV_LINK for S7-410 is the gate to the Gateway for the specific function blocks ADV_DSR_HCIR and ADV_DSS_HCIR. It coordinates and executes the data exchange between the PCS 7 function blocks and the Gateway. The specific PCS 7 function blocks are connected with a Gateway by binding the input element CONNECT to the output element CONNECT in the ADV_LINK block. In the configuration program CFC, the connections are graphically established by mouse-clicking on the output and the input.

NOTICE

Each link block needs its own S7 connections for exclusive usage. Therefore, a S7 connection can be used for one input CONN_IDx in one link block.

S7-410

The ADV_LINK function block uses up to four configured S7 connections between the S7 station and the Gateway. The cycle time for the cyclic operation in the S7 CPU should be shorter than 1 second.

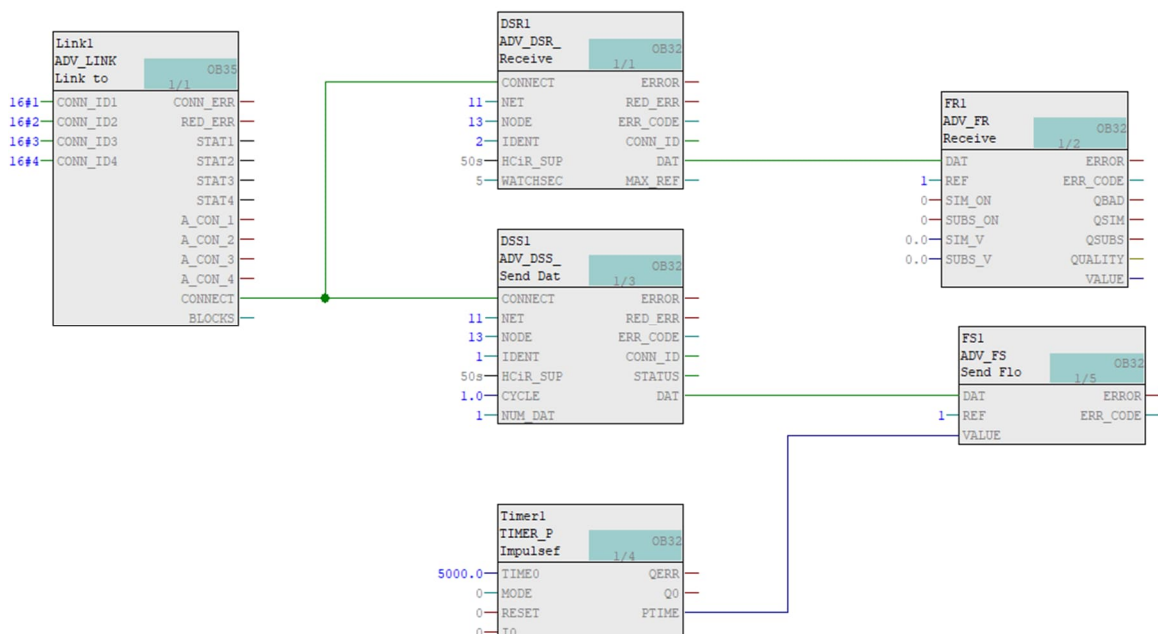
3.3.2.1 Registration of the connected blocks in OB100

Each specific function block (ADV_DSR_HCiR, ADV_DSS_HCiR) needs a registration in the connected function block ADV_LINK. While the registration is not finished, the function block consumes additional operation time for managing the registration. For avoiding an operation time overflow the additional operation time in each cycle is limited. Therefore, the registration of all function blocks needs many cycles. The registration can be accelerated by using the OB 100. The function blocks have the property "S7_tasklist := OB100". According to this property they are inserted in OB100 automatically by the engineering tool CFC. When the CPU starts up, all function blocks in OB100 perform their registration before the cyclic operation is started. But this is only successful, if the function block ADV_LINK is placed in OB100 at top of the specific function blocks.

NOTICE

In the sequence of the function blocks in the OB100 the function block ADV_LINK must be on top of the specific blocks (ADV_DSR_HCiR, ADV_DSS_HCiR)

Figure 3-2 Function blocks connected with an ADV_LINK block in the engineering tool CFC



3.3.2.2 Code for the status of the S7 connections

The string outputs STAT1, STA2, STA3 and STAT4 display the actual status of the S7 connections, that are entered in the inputs CONN_ID1, CONN_ID2, CONN_ID3 and CONN_ID4. A connection fault is displayed with a negative number. The error free states are displayed with several symbols. Example: A1>

Table 3-1 Symbols

Symbol in STATn	Meaning
X	Connection to a single Gateway established (Gateway always active)
A	Connection to Gateway A established. Gateway A is in state active
B	Connection to Gateway B established. Gateway B is in state active
a	Connection to Gateway A established. Gateway A is in state stand by
b	Connection to Gateway B established. Gateway B is in state stand by
1	Connection via the Ethernet CP (CP443-1) with the lower IP address
2	Connection via the Ethernet CP (CP443-1) with the higher IP address
>	Connection is used for sending data only
>	Connection is used for receiving data only
*	Connection is used for sending and receiving data
--	No connection has been configured (CONN_IDx = 0)
-"Number"	Error code

Table 3-2 Error codes

Error codes STATn	Meaning
-11	Error indication from the BSEND function
-12	Timeout while sending to the Gateway
-13	Error indication from the BRCV function
-14	Timeout while receiving from the Gateway
-20 ... -29	Gateway not accepting the ADV_LINK
-30	Configuration of the redundant connections to the Gateway is inconsistent
-50	Gateway not responding
-51... - 69	Formal error in the data telegram from the Gateway

3.4 Communication via the MasterBus 300

The Gateway is connected to the MasterBus 300 with one or two Ethernet ports. The signals of an Ethernet port have to be transformed by a fitting adapter to the physical layer of the MasterBus 300. (ABB Communications Conn. Unit, DSTC190) The Gateway can operate with one or two MasterBus 300 networks.

3.5 Redundant MasterBus 300 networks

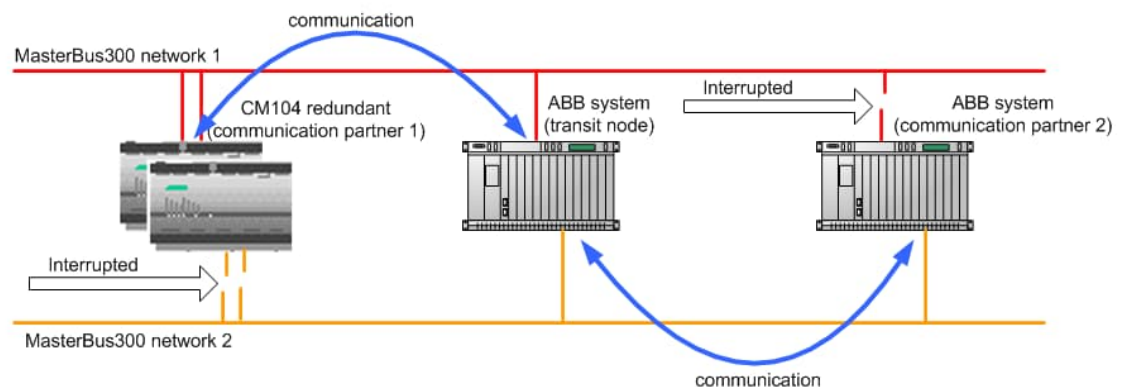
In the case of two connected MasterBus 300 networks, the networks must be sub-networks of a common main network. That means: The network number must differ only in the unit position (ones).

The Gateway can use each connected network for the communication with each participating station. If two networks are available, the Gateway uses for sending the data of an ADV_DSS_HCiR block the network, which has the same net number as the parameterized net number in the function block ADV_DSS_HCiR.

3.5.1 Transit node

If a station is not addressable directly in a network, another station can transfer data between two networks as a transit node.

Figure 3-3 Data transfer over a transit node



The Gateway can use transit nodes for transferring data into another sub network but does not serve as a transit node itself. To prevent other stations from sending data through the Gateway, the Gateway issues cleaned net information telegram for all foreign sub networks. The network information, that the Gateway issues in one sub network, does not show any other station from foreign sub networks except the Gateway itself. In other words: Only the Gateway itself appears in the list of stations for a foreign network, if this network is also connected with the Gateway. This feature does not reduce the redundancy capacities of the Gateway.

3.6 Redundant Gateway

Two Gateway can operate as a redundant pair. The configuration parameters must be the same in both Gateway except the own IP address in the SIMATIC network. In particular the node number for the MasterBus 300 network is the same in both Gateway. Therefore only one Gateway can be active in the same MasterBus 300 network at the same time.

No special parameterization is necessary to enable the redundant operation. Only a cable is needed connecting the 9-pin ports SERIAL 1 of both Gateway. A shielded cable with three wires and crossed data lines is sufficient (connected pins: 2-3, 3-2, 5-5). For example, 6ES7902-1AB00-0AA0 fits the needed requirements.

The Gateway coordinate automatically themselves via the common cable at SERIAL 1. One Gateway becomes active, the other passive. The passive Gateway is listening all telegrams on the MasterBus 300 and can continue the communication if the active Gateway fails.

NOTICE

The link between the Gateway and the MasterBus 300 network must not have an 'usual' Ethernet switch. An Ethernet switch transfers only multicast telegrams to both Gateway. But the passive Gateway must see all telegrams that are addressed to the active Gateway for the internal synchronization. Without this synchronization the activated Gateway cannot continue an existing connection to the Advant system.

Therefore, MasterBus 300 network requires a network HUB or a switch with special configuration is required.

After a switchover a synchronized connection between the Gateway and a node is continued in the new activated Gateway. If the connection is not synchronized, the remote node will cancel the connection after 15 seconds without a valid response and will establish a new connection.

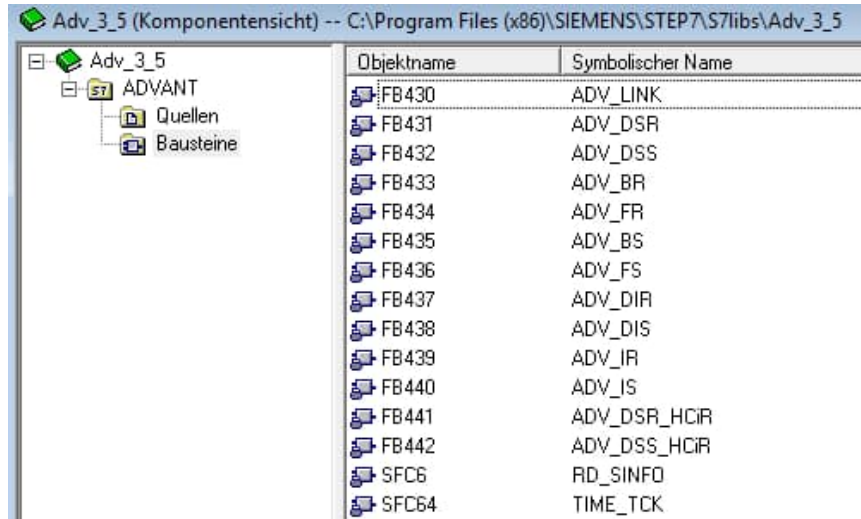
Even if the connecting cable between the two Gateway is broken, always one Gateway and only one Gateway will become active. The other Gateway recognizes the telegrams of its redundant partner and keeps quiet on the MasterBus 300.

If the Gateway cannot coordinate the activity because of a broken wire, it becomes passive.

4 S7 Function blocks

4.1 Overview of library

Figure 4-1 Overview of library



Objektname	Symbolischer Name
FB430	ADV_LINK
FB431	ADV_DSR
FB432	ADV_DSS
FB433	ADV_BR
FB434	ADV_FR
FB435	ADV_BS
FB436	ADV_FS
FB437	ADV_DIR
FB438	ADV_DIS
FB439	ADV_IR
FB440	ADV_IS
FB441	ADV_DSR_HCiR
FB442	ADV_DSS_HCiR
SFC6	RD_SINFO
SFC64	TIME_TCK

4.2 Common features of the function blocks



WARNING

PCS 7 HCiR

HCiR means, that the hardware configuration of an S7-410H CPU can be loaded in runtime. During this procedure, all connection between S7 CPU and Gateway are interrupted for some seconds. After HCiR is finished, all connections are established again.

During HCiR the QBAD output is suppressed.

It is absolute recommended that a HCiR call is only be done in a safe state of the plant. Due to the system characteristics, short signal changes during the HCiR death-time may be lost.

The function blocks in S7 library for the communication with ABB Advant are designed for CFC charts but can also be engineered in the software tool KOP/AWL/FUP.

The function block ADV_DSR_HCiR receives a data set from Advant. The function block ADV_DSS_HCiR sends a data set to Advant. For the communication with Advant the function blocks need a connection with an ADV_LINK block at their input CONNECT.

For each data type in a data set a special function block is provided. The receiving function blocks (ADV_xxR) fetch a value from the connected ADV_DSR_HCiR block. The sending function blocks (ADV_xxS) put a value into the connected ADV_DSS_HCiR block. The connection between the function blocks is established by connecting the output DAT of an ADV_DSR_HCiR or ADV_DSS_HCiR block with the input DAT of one or more function blocks for a single value.

The function blocks for receiving values:

- ADV_BR : 32 binary values
- ADV_DIR : double integer (32 bits)
- ADV_FR : float (32 bits)
- ADV_IR : integer (16 bits, low or high word in a double word of 32 bits)

The function blocks for sending values:

- ADV_BS : 32 binary values
- ADV_DIS : double integer (32 bits)
- ADV_FS : float (32 bits)
- ADV_IS : integer (16 bits, low or high word in a double word of 32 bits)

The function blocks for receiving data have common functions. The output ERROR is set, if no valid value from Advant is available. The output ERR_CODE displays a reason of the error.

Table 4-1 ERR_CODE in the function blocks ADV_xxR

ERR_CODE	Meaning
1	No connection at the input DAT
2	DAT is not connected with an ADV_DSR_HCiR block
3	REF is invalid (not within 1...24)
4	REF exceeds the number of received values in the ADV_DSR_HCiR block
100	No valid value available in the ADV_DSR_HCiR block (timeout receiving)

The output QBAD contains the same value as the output ERROR, if no simulation is activated. If simulation is activated by SIM_OM=1,

- the output QSIM is set
- the output QBAD is zero
- the output QSUBS is zero
- the output VALUE contains the input SIM_V
- the output QUALITY contains the value 16#60 (0x60)

If simulation is not activated (QSIM is zero) and no valid value is available, then QBAD is set. The other outputs depend on the input SUBS_ON.

If SUBS_ON is set,

- the output QSUBS is set
- the output VALUE contains the input SUBS_V
- the output QUALITY contains the value 16#48 (0x48)

If SUBS_ON is zero,

- the output QSUBS is zero
- the output VALUE remains the last displayed value
- the output QUALITY contains the value 16#44 (0x44), if the value was valid before and the value 16#00 (0x00) else.

Table 4-2 QUALITY in the function blocks ADV_xxR

QUALITY	Meaning
0x00	invalid
0x80	valid
0x60	simulated
0x44	old: no newer value available
0x48	substituted: no valid value available

4.3 ADV_DSR_HCiR

The function block ADV_DSR_HCiR receives a data set from Advant with maximum 24 reference (raw values). Each reference is a bit string with 32 bits = 4 bytes. The data set is specified by the address parameters NODE and IDENT. The parameter NET in the S7 function block must match the parameter NET of the data set in the Advant system. The values in the data set are displayed by other function blocks, that are connected with the output DAT.

Using of correct function block

NOTICE

The library includes also an ADV_DSR function block (FB431). The FB431 is only internally used.

The function block ADV_DSR_HCiR displays an error code in the output ERR_CODE, if a communication error is indicated in the output ERROR.

Table 4-3 ERR_CODE in the function block ADV_DSR_HCiR

ERR_CODE	Meaning
1	No connection at the input CONNECT
2	CONNECT is not connected with an ADV_LINK block
3	ADV_LINK does not accept the connected function block (too many FBs)
4	ADV_LINK has no communication with a Gateway
5	Parameter error (NODE, IDENT invalid)
6	Data transfer overloaded in ADV_LINK
7	Gateway not available
10	Waiting for the registration in the Gateway
100	Timeout receiving valid data from MasterBus 300

4.3.1 Inputs and outputs of the function block

Table 4-4 ADV_DSR_HCiR inputs and outputs

ADV_DSR_HCiR		
Name	Type	Function
Inputs		
CONNECT	ANY	Connection with the output CONNECT of an ADV_LINK block
NET	INT	MasterBus 300 network number
NODE	INT	Node number of the Advant station (range 1...255)
IDENT	INT	Number of the dataset in Advant (range 1...255)
WATCHSEC	INT	Time of waiting for cyclic receiving data in seconds
HCiR_SUP	INT	Suppression time for HCiR in seconds (range 0...80)
Outputs		
ERROR	BOOL	No communication with the Advant station
RED_ERR	BOOL	Redundancy lost
ERR_CODE	INT	Error code
CONN_ID	WORD	The active CONN_ID in the ADV_LINK block for receiving
DAT	DWORD	Connection with the input DAT of a receiving function block for a single reference and a special data type. (ADV_BR, ADV_DIR, ADV_FR, ADV_IR)
MAX_REF	INT	Highest allocated reference in the received data set. (1...24) Maximum value for the parameter REF in a connected function block for a single reference.

4.4 ADV_DSS_HCiR

The function block ADV_DSR_HCiR sends a data set to Advant with maximum 24 references (raw values). Each reference is a bit string with 32 bits = 4 bytes. The data set is specified by the address parameters NODE and IDENT. The parameter NET in the S7 function block must match the parameter NET of the data set in the Advant system. The values in the data set come from other function blocks, that are connected with the output DAT.

NOTICE

Using of correct function block

The library includes also an ADV_DSS function block (FB432). The FB432 is only internally used.

The function block ADV_DSS_HCiR displays an error code in the output ERR_CODE, if a communication error is indicated in the output ERROR.

Table 4-5 ERR_CODE in the function block and ADV_DSS_HCiR

ERR_CODE	Meaning
1	No connection at the input CONNECT
2	CONNECT is not connected with an ADV_LINK block
3	ADV_LINK does not accept the connected function block (too many FBs)
4	ADV_LINK has no communication with a Gateway
5	Parameter error (NODE, IDENT invalid)
6	Data transfer overloaded in ADV_LINK
7	Gateway not available
10	Waiting for the registration in the Gateway
100	Timeout receiving acknowledge from MasterBus 300
101	No Gateway is active on the MasterBus 300

4.4.1 Inputs and outputs of the function block

Table 4-6 ADV_DSS_HCiR inputs and outputs

ADV_DSS_HCiR		
Name	Type	Function
Inputs		
CONNECT	ANY	Connection with the output CONNECT of a ADV_LINK block
NET	INT	MasterBus 300 network number (range 1 ... 99)
NODE	INT	Node number of the Advant station (range 1...255)
IDENT	INT	Number of the dataset in Advant (range 1...255)
CYCLE	REAL	Cycle time in seconds for sending (range 0.5 ... 60)
NUM_DAT	INT	Number of references (range 1 ... 24)
HCiR_SUP	INT	Suppression time for HCiR in seconds (range 0...80)
Outputs		
ERROR	BOOL	Connection to the Gateway lost
RED_ERR	BOOL	Redundancy lost
ERR_CODE	INT	Error code
CONN_ID	WORD	The CONN_ID in the ADV_LINK block for receiving

4.5 ADV_BR

Function: Receiving 32 boolean values from Advant.

4.5.1 Inputs and outputs of the function block

Table 4-7 ADV_BR inputs and outputs

ADV_BR		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSR_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
SIM_ON	BOOL	Activation of the simulation: VALUE contains SIM_V
SUBS_ON	BOOL	Activation of error substitution: VALUE contains SUBS_V, if QBAD=1
SIM_V	DWORD	Source for VALUE01 - VALUE32, if SIM_ON=1 Bit 2^0 = VALUE01, ..., 2^{31} = VALUE32
SUBS_V	DWORD	Source for VALUE01 - VALUE32 if QBAD=1 and SUBS_ON=1. Bit 2^0 = VALUE01, ..., 2^{31} = VALUE32
Outputs		
ERROR	BOOL	No valid value from Advant available
ERR_CODE	INT	Error code, 0= no error
QBAD	BOOL	VALUE is invalid
QSIM	BOOL	VALUE contains SIM_V because of SIM_ON = 1
QSUBS	BOOL	VALUE contains SUBS_V because of QBAD=1 and SUBS_ON=1
QUALITY	BYTE	Code for the quality of VALUE
VALUE01	BOOL	Process value from Advant if ERROR=0
VALUE02	BOOL	Process value from Advant if ERROR=0
VALUE03	BOOL	Process value from Advant if ERROR=0
:	:	:
VALUE32	BOOL	Process value from Advant if ERROR=0

4.6 ADV_DIR

Function: Receiving a double integer value from Advant.

4.6.1 Inputs and outputs of the function block

Table 4-8 ADV_DIR inputs and outputs

ADV_DIR		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSR_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
SIM_ON	BOOL	Activation of the simulation: VALUE contains SIM_V
SUBS_ON	BOOL	Activation of error substitution: VALUE contains SUBS_V, if QBAD=1
SIM_V	DINT	Source for VALUE, if SIM_ON=1
SUBS_V	DINT	Source for VALUE if QBAD=1 and SUBS_ON=1
Outputs		
ERROR	BOOL	No valid value from Advant available
ERR_CODE	INT	Error code, 0= no error
QBAD	BOOL	VALUE is invalid
QSIM	BOOL	VALUE contains SIM_V because of SIM_ON = 1
QSUBS	BOOL	VALUE contains SUBS_V because of QBAD=1 and SUBS_ON=1
QUALITY	BYTE	Code for the quality of VALUE
VALUE	DINT	Process value from Advant if ERROR=0

4.7 ADV_IR

Function: Receiving an integer value (16 Bit) from Advant.

4.7.1 Inputs and outputs of the function block

Table 4-9 ADV_IR inputs and outputs

ADV_IR		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of a ADV_DSR_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
HIGH	BOOL	Selection of the high (HIGH=1) or low word in the raw value
SIM_ON	BOOL	Activation of the simulation: VALUE contains SIM_V
SUBS_ON	BOOL	Activation of error substitution: VALUE contains SUBS_V, if QBAD=1
SIM_V	INT	Source for VALUE, if SIM_ON=1
SUBS_V	INT	Source for VALUE if QBAD=1 and SUBS_ON=1
Outputs		
ERROR	BOOL	No valid value from Advant available
ERR_CODE	INT	Error code, 0= no error
QBAD	BOOL	VALUE is invalid
QSIM	BOOL	VALUE contains SIM_V because of SIM_ON = 1
QSUBS	BOOL	VALUE contains SUBS_V because of QBAD=1 and SUBS_ON=1
QUALITY	BYTE	Code for the quality of VALUE
VALUE	INT	Process value from Advant if ERROR=0

4.8 ADV_FR

Function: Receiving a float value from Advant.

4.8.1 Inputs and outputs of the function block

Table 4-10 ADV_FR inputs and outputs

ADV_FR		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSR_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
SIM_ON	BOOL	Activation of the simulation: VALUE contains SIM_V
SUBS_ON	BOOL	Activation of error substitution: VALUE contains SUBS_V, if QBAD=1
SIM_V	REAL	Source for VALUE, if SIM_ON=1
SUBS_V	REAL	Source for VALUE if QBAD=1 and SUBS_ON=1
Outputs		
ERROR	BOOL	No valid value from Advant available
ERR_CODE	INT	Error code, 0= no error
QBAD	BOOL	VALUE is invalid
QSIM	BOOL	VALUE contains SIM_V because of SIM_ON = 1
QSUBS	BOOL	VALUE contains SUBS_V because of QBAD=1 and SUBS_ON=1
QUALITY	BYTE	Code for the quality of VALUE
VALUE	REAL	Process value from Advant if ERROR=0

4.9 ADV_BS

Function: Sending 32 float values to Advant.

4.9.1 Inputs and outputs of the function block

Table 4-11 ADV_BS inputs and outputs

ADV_BS		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSS_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
VALUE01	BOOL	Process value to Advant if ERROR=0
VALUE02	BOOL	Process value to Advant if ERROR=0
VALUE03	BOOL	Process value to Advant if ERROR=0
:	:	:
VALUE32	BOOL	Process value to Advant if ERROR=0
Outputs		
ERROR	BOOL	Communication error indication, 0 = o.k.
ERR_CODE	INT	Error code, 0= no error

4.10 ADV_DIS

Function: Sending a double integer value to Advant.

4.10.1 Inputs and outputs of the function block

Table 4-12 ADV_DIS inputs and outputs

ADV_DIS		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSS_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
VALUE	DINT	Process value to Advant if ERROR=0
Outputs		
ERROR	BOOL	Communication error indication, 0 = o.k.
ERR_CODE	INT	Error code, 0= no error

4.11 ADV_IS

Function: Sending an integer value to Advant.

4.11.1 Inputs and outputs of the function block

Table 4-13 ADV_IS inputs and outputs

ADV_IS		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSS_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
VALUE	BOOL	Process value to Advant if ERROR=0
Outputs		
ERROR	BOOL	Communication error indication, 0 = o.k.
ERR_CODE	INT	Error code, 0= no error

4.12 ADV_FS

Function: Sending a float value to Advant.

4.12.1 Inputs and outputs of the function block

Table 4-14 ADV_FS inputs and outputs

ADV_FS		
Name	Type	Function
Inputs		
DAT	ANY	Connection with the output DAT of an ADV_DSS_HCIR block
REF	INT	Reference for a value in a data set. Range 1...24
VALUE	BOOL	Process value to Advant if ERROR=0
Outputs		
ERROR	BOOL	Communication error indication, 0 = o.k.
ERR_CODE	INT	Error code, 0= no error

5 Maintenance and Diagnostics

5.1 Maintenance

Under normal usage conditions, the Gateway doesn't need maintenance. If the communication between S7 and the IED runs reliably, and no error indications (LEDs, CFC block alarm) are active, no manual maintenance is needed.

5.2 Direct connection to Gateway

Local monitor/keyboard

If a DP monitor and a USB keyboard are connected, the user 'root' can log in to change the root password. To connect a monitor, a DP/DP cable is recommended. Other cables (like DP/DVI), adapters or KVM switches are not 100% compatible to the interface.

Secure Shell (SSH)

An SSH-session can be started with any SSH client. Please use user 'root' and the individual delivered password to connect.

5.3 Assignment of the LED

The following list describes the LED status during the online operation.

Table 5-1 Assignment of the LED

LED	Action	Description
PC ON/ WD	Green continuous light	Power supply well
L1	Yellow continuous light	Communication with MasterBus 300 port over NET2 active
	No light	No communication with MasterBus 300 over NET2 active Or Gateway is redundant (slave) Or NET2 not connected
L3	Yellow continuous light	Communication with MasterBus 300 port over NET1 active
	No light	No Communication with MasterBus 300 over NET1 active Or Gateway is redundant (slave) Or NET1 not connected

NOTE

LED status is not updated during shutdown of Gateway

5.4 Replacement Gateway

This chapter covers the replacement of a damaged ABB Advant Gateway by a new and unconfigured Gateway. The following cases are covered by this chapter:

- a singular Gateway needs to be replaced. The communication between Gateway and S7 is broken.
- one device of a redundant Gateway needs to be replaced. The Communication between S7 is still running.

For replacing the following steps have to be performed:

1. Disconnect the damaged Gateway from all plugs (e.g., power, network, redundancy)
2. Connect the new unconfigured Gateway to all plugs
3. Configure the Gateway like described in the [chapter 2.5 "The configuration parameters in the Gateway"](#)

NOTE

The ABB Advant Gateway has a license key on the CFast card. This is bound to the device and is not transferable. In case of technical damage, contact Siemens customer Support.

5.5 Update of the Software in the Gateway

To update the Gateway following steps are necessary:

1. Note the Gateway configuration to a piece of paper
2. Load the firmware update file (called with extension .tar) on an empty USB-Stick.
3. Make sure that no other USB drive is or was connected to the Gateway.
If another USB-Stick is or was connected to the Gateway, then you must unmount them.
If the unmount commands are not known or unclear, then unplug every USB drive and reboot the Gateway with
localhost:~# **reboot**
4. Make sure the Gateway is ready and the right user (root) is logged in.
5. Execute following command
localhost:~# **UpdateGW.sh**

The UpdateGW.sh is a bash file located in the Gateway, which will automatically proceed following steps:

- Mount the USB drive
- Copy and install the update file from USB-Stick to the Gateway
- Unmount the USB-Stick
- Reboot the Gateway
- Please ensure that the configuration is still correct

NOTE

Contact your Siemens partner (contact mailto:function.blocks.industry@siemens.com) to find out if there is an update for the Gateway available.

5.5.1 Logfiles

The device generates logfiles. These logfiles are in a RAM driver under folder /var/log/s7diag/

5.6 Reading the software version in the Gateway

After restarting the gateway, the version number is output in the last lines.

For example, the format for version V31.00 is output as followed.

```
CONBOX V_31_00
```

5.7 Optional System Hardening

We highly recommend doing a system hardening overall system components. The system hardening should be considered in combination with all project specific requirements and security guidelines. Due to the multiple project dependencies, required functionality and requested ergonomics/comfort, we can't provide a general statement.

NOTE

Custom system hardening and aftereffects from system hardening isn't covered by the technical support.

5.7.1 Changing root password

NOTE

Please refer to "PCS 7 compendium part f" regarding password requirements (password age, history or complexity). Inside this document, a recommendation from BSI (German Federal Office for Information Security) is listened.

Due to security aspects, it is recommended to change the root default password. To change the root password, please execute the following steps:

- connect via SSH or local monitor/keyboard to your Station Gateway
- log in with username 'root' and password
- change the password using the script
`root_password.sh [new password] [new password]`
 - the new password must meet some complexity requirements (see below)
 - note the US keyboard layout
 - apply the password by typing 'YES'
- Store and memorize the new password in a secure place.

The new password must contain the following:

- at least 8 characters
- capital character
- lower character
- number
- special character

NOTE

Due to security guidelines, a lost password can't be restored. If a password is lost, please contact <mailto:function.blocks.industry@siemens.com>

5.7.2 Disabling / Enabling SSH Service

Please consider that after disabling SSH service, the following inconveniences will occur

- Remote connections via SSH aren't possible any longer
- Maintenance/troubleshooting must be done via local monitor/keyboard

To change the startup behavior of SSH service, please perform the following steps:

1. Logon as root (local or via SSH)
2. Type the following command:
 - a. To enable SSH: `/bin/sshEnable.sh` and press enter
 - b. To disable SSH: `/bin/sshDisable.sh` and press enter

Reboot the device by command `"reboot"` and press

6 Appendix

6.1 Some general instructions for the administration of the Gateway

cd /name	: Change directory: Absolute address including path.
cd name	: Change directory: Directory under the working directory.
cp file1 file2	: Copy file1 to file2
df	: Display free memory
dir	: Display all files in the directory including attributes
dir Gt*	: Display the files with "Gt" at the beginning of their name
killall name	: Termination of the process "name"
less file1	: Display content of the text file "file1". Terminated by „q“
ls	: Display all file names in the directory without attributes
mrw	: Disable the write protection of the flash memory
mro	: Enable the write protection of the flash memory
ps -x	: Display the current processes
top	: Display processes and resources. Terminated by „q“.
pwd	: Display the actual working directory
rm file1	: Remove "file1"
logout	: End of the session started with login "username"

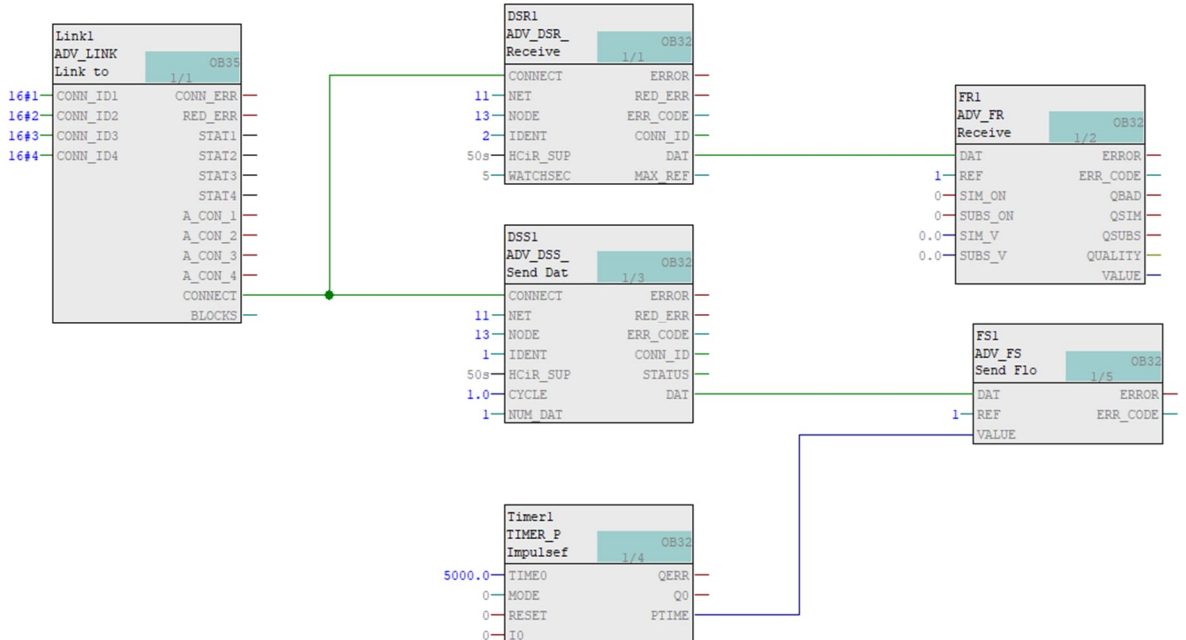
A restart of the Gateway is activated by switching the power off and on or by pressing the button or by entering following command:

localhost:~# **reboot**

6.2 Example SIMATIC PCS 7 engineering

The following description will provide an example SIMATIC PCS 7 engineering.

Figure 6-1CFC plan with ADV_DSR_HCiR and ADV_DSS_HCiR

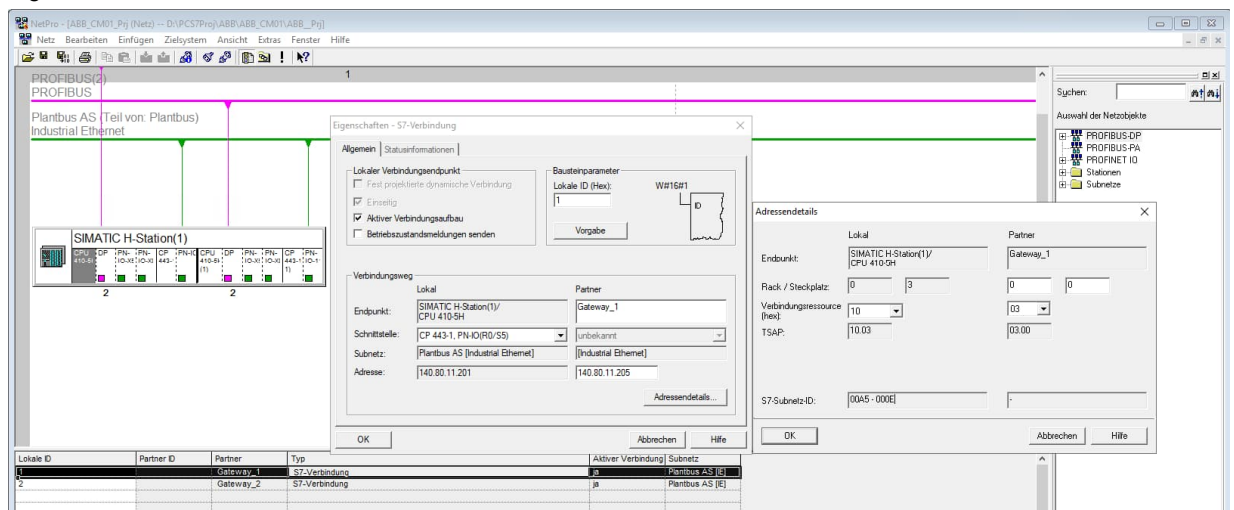


The Figure 6-1 shows an example of how to send and receive data with an ADV_DSR_HCiR and ADV_DSS_HCiR. Both blocks are connected to the ADV_LINK block, which handles the communication with the Gateway. The ADV_LINK uses for the inputs CONN_ID1 – CONN_ID4 which are S7-Connections and defined in NetPro. The Figure 6-2 shows two connections with the local ID 1 and 2. The Local ID 3 and 4 are defined in the second PLC.

In this example a TIMER_P is used to simulate a changing float value.

The ADV_FS (Float Sending) transports the “VALUE” parameter over the “DAT” Anypointer connection to the destination using ADV_DSS_HCiR and ADV_LINK block.

Figure 6-2 S7-Connection in NetPro



6.3 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers

– ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

siemens.com/SupportRequest

SITRAIN – Digital Industry Academy

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

6.4 Industry Mall



The Siemens Industry Mall is the platform on which the entire Siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:

mall.industry.siemens.com

6.5 Links and literature

Table 6-1

Nr.	Thema
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Siemens ICGS – Industrial Communication Gateway Services http://www.siemens.com/icgs-sios
\3\	

6.6 Change documentation

Table 6-2

Version	Date	Modifications
V1.0	05/2023	First version