SIEMENS

SIMATIC NET

Program blocks for SIMATIC NET S7 CPs

Programming Manual

11/2015

C79000-G8976-C229-08

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Division Process Industries and Drives
Postfach 48 48
90026 NÜRNBERG
GERMANY

C79000-G8976-C229-08
℗ 12/2015 Subject to change

Preface

Target group and motivation

The interface to the communication services is implemented by readymade program blocks (FCs and FBs). This manual provides you with a full description of the program blocks for SIMATIC NET S7 CPs. It extends the descriptions in the online help of the configuration tools for STEP 7.

The manual is intended for programmers of STEP 7 programs and service personnel.

Structure of the manual

The manual is structured according to network types and communications services.

Each program block is described in the following sections:

- Meaning
- Call interface
- Operating principle
- Explanation of the formal parameters
- Condition codes

These sections may included further specific information.

Scope of this manual

The current issue of the manual is valid for the following versions of the configuration software:

- STEP 7 V5.5 + SP4 + HF8

  Note the additions in the section “New in this release”.

- STEP 7 Professional V13.0 SP1

Note

STEP 7 - synonymous names

The term STEP 7 is used in later sections of this manual as a synonym for STEP 7 V5.5 or STEP 7 Professional

---

Note

CP types and communications services

Note that the program blocks each support certain communications services. Their use is therefore linked to the use of the CP types that support the particular communications service.

Meaning of "program block"

The term "program block" is used in the manual as a generic synonym for the following terms:

- FC (function) / FB (function block)

  Names used in STEP 7 V5.5 take into account the specific type of the program block. In STEP 7 Professional, these block types continue to be used unchanged, however, only the symbolic names are displayed in the libraries.

- Instruction

  Name used for system-internal program blocks in STEP 7 Professional.

Note

Component of the products STEP 7 / STEP 7 Professional

The contents of the libraries supplied with STEP 7 V5.5 and STEP 7 Professional may differ from each other.

The program block overviews in this manual specify the availability for the various device families S7-300 and S7-400. The overviews do not, provide information about the availability in the various libraries of STEP 7 V5.5 or STEP 7 Professional.

New in this release

This manual release contains editorial corrections. You will find the essential changes in the following sections:

Section	Change / addition
FTP_CMD - universal program block for FTP services (Page 74)	Functional expansion of the block “FTP_CMD“ for FTP client operation with the addition of the function “Passive FTP (client establishes connection) The function is supported by the CP 443-1 Advanced with firmware version V3.2 in STEP 7 V5. In addition to the configuration software mentioned above STEP 7 V5.5, you also require the HSP 1105 and the program block library “SIMATIC NET CP” version V5.5.4.

You will find the changes to the previous manual information in the section Document history (Page 277).

Replaced manual issue

This manual replaces the manual release 10/2012.

CP documentation in the Manual Collection (article number A5E00069051)

The SIMATIC NET Manual Collection (DVD) with many each S7 CPs. This DVD is regularly updated and contains the manuals valid at the time it is created.

Information on the current program block versions (FCs/FBs)

Always use the latest block versions for new user programs. You will find information on the current block versions and the current program blocks on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/109481127)

When replacing a CP, follow the instructions in the device-specific part of the device manual for your S7 CP.

Version history for program blocks and S7 CPs

The "Version History/Current Downloads for SIMATIC NET S7 CPs" provides information on all CPs available up to now for SIMATIC S7 (Industrial Ethernet, PROFIBUS and IE/PB Link) and the program blocks.

You will find the documents on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

Application examples on the topic of communication

You will a large selection of application examples and other documents on the pages of Siemens Industry Online Support at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/ps/15247/ae)

In the product tree and via the entry type you can further limit the area of application on this Internet page.

SIMATIC NET glossary

Explanations of many of the specialist terms used in this documentation can be found in the SIMATIC NET glossary.

You will find the SIMATIC NET glossary here:

- SIMATIC NET Manual Collection or product DVD

  The DVD ships with certain SIMATIC NET products.

- On the Internet under the following address:

  Link: (https://support.industry.siemens.com/cs/ww/en/view/50305045)

Table of contents

Overview and general information on handling 1

1.1 Program blocks for Industrial Ethernet / PROFINET

How supplied - block library

The SIMATIC NET FCs program blocks are supplied with the STEP 7 configuration software unless indicated otherwise.

Note

Component of the products STEP 7 / STEP 7 Professional

The contents of the libraries supplied with STEP 7 V5.5 and STEP 7 Professional may differ from each other.

The following list shows the block numbers as they are supplied.

Under SIMATIC_NET_CP, you can also see which folders contain blocks. Please note that you must use different program blocks for the S7300 and S7400 (separate libraries).

Communication service / functional area	Program block		Library for SIMATIC NET	
			SIMATIC_NET_CP	
			CP 300	CP 400
SEND / RECEIVE (open communications services)	AG_SEND	FC5	x	x
	AG_LSEND	FC50	x 2)	x
	AG_SSEND	FC53		x3)
	AG_RECV	FC6	x	x
	AG_LRECV	FC60	x 2)	x
	AG_SRECV	FC63		x3)
	AG_LOCK	FC7	x	x
	AG_UNLOCK	FC8	x	x
	AG_CNTRL	FC10	x 3)	x 3)
	AG_CNTEX	FB10	x 3)	x 3)
Programmed communications connections and IP configuration	IP_CONFIG	FB55	x	x
S7 communication 4)	BSEND	FB12	x	
	BRCV	FB13	x	
	PUT	FB15	x	
	GET	FB14	x	
	USEND	FB8	x	
	URCV	FB9	x	
	C_CNTRL	FC62	x	

Communication service / functional area	Program block		Library for SIMATIC NET	
			SIMATIC_NET_CP	
			CP 300	CP 400
FTP (advanced CPs)	FTP_CMD	FB40	x	x
	FTP_CONNECT	FC40	x	x
	FTP_STORE	FC41	x	x
	FTP_RETRIEVE	FC42	x	x
	FTP_DELETE	FC43	x	x
	FTP_QUIT	FC44	x	x
PROFINET CBA	PN_InOut [1)]	FB88 [1)]	x [1)]	x [1)]
	PN_InOut_Fast [1)]	FB90 [1)]		x [1)]
PROFINET IO	PNIO_SEND	FC11	x	
	PNIO_RECV	FC12	x	
	PNIO_RW_REC	FB52	x	
	PNIO_ALARM	FB54	x	
	PE_START_END_CP	FB85	x	
	PE_CMD_CP	FB86	x	
	PE_I_DEV_CP	FB87	x	
	DS3_WRITE_CP (STEP 7 V5.5) PE_DS3_Write_ET200S_CP [5)] (STEP 7 Professional)	FB53 FB88	x x	

Legend:

1) FB88/FB90 is supplied along with the engineering tool SIMATIC iMap and is entered in the PROFINET system library when you install the STEP 7 addon.
2) Not to be used with the current CPs and no longer part of the current "SIMATIC_NET_CP" library.
3) Depending on the CP type
4) Described in the STEP 7 documentation
5) You will find the description of the program block PE_DS3_Write_ET200S_CP for STEP 7 Professional later in this document with the description of the program block DS3_WRITE_CP for STEP 7 V5.5 that has the same functionality.

Which block version should I use?

The following descriptions also include information on differences in behavior between the various block versions. Please check and note the version identifiers of the blocks you are using.

The SIMATIC NET block libraries installed with STEP 7 contain the block versions that were current at the time of the STEP 7 release.

Note

We recommend that you always use the latest block versions for all module types.

You will find information on the current block versions and the current blocks to download from the Internet in Siemens Industry Online Support at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/8797900)

This recommendation assumes that you are using the latest firmware for the particular module type.

Program blocks when modules are replaced

Module replacement means the replacement of a module with another module that may be a more recent version.

Note

Remember that if you replace a module, you must only use the blocks permitted for the configured CP type in the user program.

We recommend that you always use the latest block versions for all module types.

This recommendation assumes that you are using the latest firmware for the particular module type.

The specific manuals contain information on the compatibility of the S7-CPs and the corresponding program blocks.

1.2 Program blocks for PROFIBUS

How supplied - block library

The SIMATIC NET FCs program blocks are supplied with the STEP 7 configuration software unless indicated otherwise.

Note

Component of the products STEP 7 / STEP 7 Professional

The contents of the libraries supplied with STEP 7 V5.5 and STEP 7 Professional may differ from each other.

The following list shows the block numbers as they are supplied.

Under SIMATIC_NET_CP, you can also see which folders contain blocks. Please note that you must use different program blocks for the S7300 and S7400 (separate libraries).

Communication service / functional area	Program block		Library for SIMATIC NET	
			SIMATIC_NET_CP	
			CP 300	CP 400
PROFIBUS DP	DP_SEND	FC1	x	
	DP_RECV	FC2	x	
	DP_DIAG	FC3	x	
	DP_CTRL	FC4	x	
SEND / RECEIVE (open communications services)	AG_SEND	FC5	x	x
	AG_LSEND	FC50		x [2)]
	AG_RECV	FC6	x	x
	AG_LRECV	FC60		x [2)]

Communication service / functional area	Program block		Library for SIMATIC NET	
			SIMATIC_NET_CP	
			CP 300	CP 400
S7 communication [1]	BSEND	FB12	x	[1]
	BRCV	FB13	x	[1]
	PUT	FB15	x	[1]
	GET	FB14	x	[1]
	USEND	FB8	x	[1]
	URCV	FB9	x	[1]
	C_CNTRL	FC62	x	[1]
PROFIBUS FMS	IDENTIFY	FB2	x	x
	READ	FB3	x	x
	REPORT	FB4	x	x
	STATUS	FB5	x	x
	WRITE	FB6	x	x

1) Described in the STEP 7 documentation. Accordingly, SFBs to be used for the S7-400 are available in the STEP 7 library.

2) Can be used but has no special function with PROFIBUS.

Which block version should I use?

The following descriptions also include information on differences in behavior between the various block versions. Please check and note the version identifiers of the blocks you are using.

The SIMATIC NET block libraries installed with STEP 7 contain the block versions that were current at the time of the STEP 7 release.

Note

We recommend that you always use the latest block versions for all module types.

You will find information on the current block versions and the current blocks to download from the Internet in Customer Support under entry ID:

Link: (https://support.industry.siemens.com/cs/ww/en/view/8797900)

This recommendation assumes that you are using the latest firmware for the particular module type.

Program blocks when modules are replaced

Module replacement means the replacement of a module with another module that may be a more recent version.

Note

Remember that if you replace a module, you must only use the blocks permitted for the configured CP type in the user program.

We recommend that you always use the latest block versions for all module types.

This recommendation assumes that you are using the latest firmware for the particular module type.

The manuals contain information on the compatibility of the S7-CPs and the corresponding program blocks.

1.3 Parameters for calling the program blocks

General notes on calling and assigning parameters

Before describing the program blocks in detail, a few general comments on calling and setting parameters for program blocks will be useful at this point.

The general information below applies to the following parameter groups that exist for all program blocks:

- Parameters for CP and connection assignment (input parameters)
- Parameters for specifying a CPU data area (input parameters)
- Status information (output parameters)

NOTICE
Calling communication blocks for an S7300
The communication blocks for S7-300 (SIMATIC NET block libraries for S7300 in STEP 7) must not be called in more than one priority class! If, for example, you call a communication block in OB1 and in OB35, block execution could be interrupted by the higherpriority OB.
If you call blocks in more than one OB, you must write your program so that a communication block that is currently executing cannot be interrupted by another communication block (for example by disabling/enabling SFC interrupts).

1.4 Parameters for CP and connection assignment (input parameters)

When you call a program block, you transfer the module start address of the S7 CP in the CPLADDR or LADDR parameter. You will find the module start address of the S7 CP in the configuration of the CP in "Address/Input" parameter.

With connectionoriented jobs, you must also reference the connection to be used by its connection ID. You will find this in the properties dialog of the connection under "Block parameters" (refer to the information in NetPro).

Automatically adopting block parameters (described here for STEP 7 V5.5)

To ensure correct parameter settings for the block calls, The LAD/STL/FBD editor in STEP 7 provides you with the option of accepting all the relevant parameters automatically from the hardware configuration (HW Config) and from the connection configuration (NetPro).

When assigning the parameters for the block in the user program, follow the steps outlined below:

1. Select the block call and its block parameters;
2. Rightclick and select the menu command "**Connections...**".
3. Depending on the block type, you can now select the connection and/or module intended for the block from a list.
4. Confirm your selection; as far as possible, the available parameter values are entered in the block call.

Response to incorrect addresses

If the S7CPU cannot communicate with the PROFIBUS CP using the specified module start address or cannot identify it as a CP, the errors described below result.

Cause	Reaction / code
No module can be addressed or identified at the specified CP address.	The CPU remains in STOP with system error state; in this case, evaluate the diagnostic buffer of the CPU.
The CP address points to a different module type.	Possible error code in the STATUS parameter of the communication block: 8184_H System error $80B0_H$ The module does not recognize the data record. $80C0_H$ The data record cannot be read. $80C3_H$ Resources (memory) occupied. $80D2_H$ Logical base address is wrong.

Note

If you inadvertently address not a CP but another module type, errors occur that cannot be indicated by the error messages of the program blocks themselves.

1.5 Parameters for specifying a CPU data area (input parameters)

Specifying the data area on the CPU

When you call a program block, you transfer the address and length of the data area on the CPU in which the user data is available or will be stored or which can contain further parameter information

The ANY pointer data type is used to address this area. You will find more detailed information on this data type in the STEP 7 online help.

1.6 Status information (output parameters)

Evaluating status codes

For status evaluation, the following parameters must be evaluated in the user program:

- DONE or NDR
  These parameters (DONE with send jobs and NDR with receive jobs) signal (successful) completion of the job.
- ERROR
  This indicates that the job could not be executed errorfree.
- STATUS
  This parameter supplies detailed information about the execution of the job. Status codes can be returned during execution of the job (DONE=0 and ERROR=0).

Note

Remember that the status codes DONE, NDR, ERROR, STATUS are updated at each block call.

Status codes during CP startup

With a complete restart or restart of the Ethernet CP (for example after activating a switch on the module), the output parameters of the FC are reset as follows:

- DONE = 0
- NDR = 0
- ERROR = 0
- STATUS =
  - 8180_H for AG_RECV / AG_LRECV
  - 8181_H for AG_SRECV
  - 8181_H for AG_SEND /AG_LSEND / AG_SSEND

Program blocks for Industrial Ethernet 2

2.1 Program blocks for open communications services (SEND/RECEIVE interface)

2.1.1 Overview of program blocks and their use

Overview

The following program blocks are available for transferring data on the SEND/RECEIVE interface:

Program block	Can be used with 1)		Meaning
	S7-300	S7-400	
AG_SEND (FC5)	x	x	for sending data
AG_RECV (FC6)	x	x	for receiving data
AG_LSEND (FC50)		x	for sending data
AG_LRECV (FC60)		x	for receiving data
AG_SSEND (FC53)		x	for sending data
AG_SRECV (FC63)		x	for receiving data

1) Notes on the program blocks for an S7300 and S7400

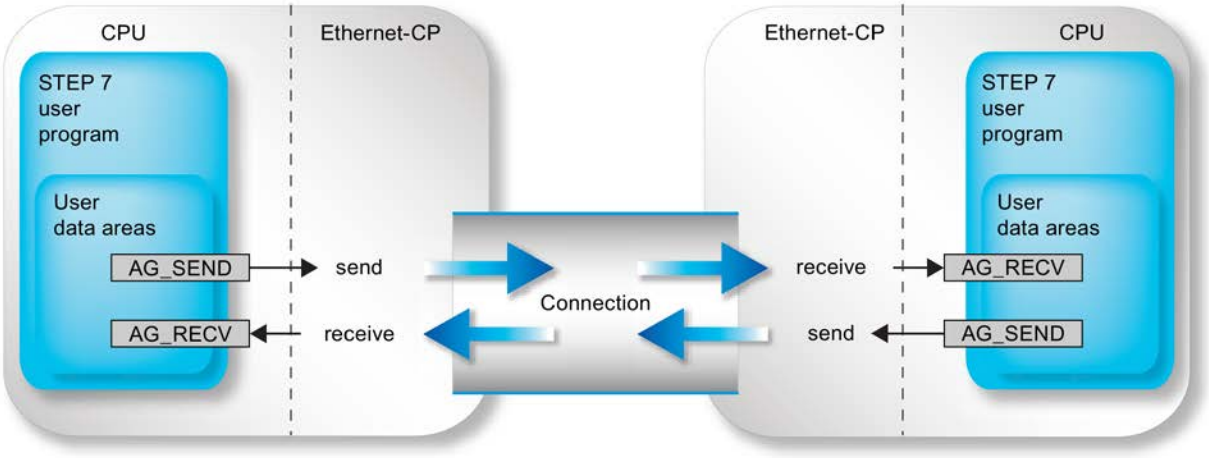
- S7300:
  - With the latest versions of the Ethernet CPs, only program blocks AG_SEND and AG_RECV are used; data with a length of up to 8192 bytes can be transferred.
  - With S7-300 CPs (up to 6GK7 343-1EX10-0XE0 with firmware version V2.2), use FC60 on TCP connections instead of FC6. For the CP 343-1 (EX10), you can use FC5/FC6 up to block version V3.0.
- S7-400:
  - With AG_SEND / AG_RECV program blocks, the data length per job is restricted to <=240 bytes.
    Longer data records (up to 8192 bytes) can be transferred with FCs AG_LSEND or AG_LRECV.
  - The AG_SSEND and AG_SRECV program blocks are for accelerated transfer of data by using optimized block communication between CPU and CP in the S7 station. The fast communication has no effect on LAN communication.
  - On an S7-400, FC6 cannot be used on TCP connections but only FC60 or FC63.

Further information

Please check the supported data area for the S7-CP you are using in the manual for the specific device. You will find an overview of the versions of the FCs/FBs in the SIMATIC NET block history.

Application

The following diagram illustrates the use of the program blocks described here for bi-directional data transfer on a configured connection.



Note

Unless specifically stated otherwise, the information on this and the following pages refers to the AG_SEND / AG_LSEND / AG_SSEND or AG_RECV / AG_LRECV / AG_SRECV blocks.

Sample programs

Please note that the following sample programs are also available on the Internet under the following entry ID

- Sample program for the SEND/RECEIVE interface with the blocks FC5 (AG_SEND) and FC6 (AG_RECV) for S7-300:

  17853532 (https://support.industry.siemens.com/cs/ww/en/view/17853532)

- Sample program for the SEND/RECEIVE interface with the functions FC50 (AG_LSEND) and FC60 (AG_LRECV) for S7-400:

  18513371 (https://support.industry.siemens.com/cs/ww/en/view/18513371)

Specifying the data area on the CPU

When you call an FC, you transfer the address and length of the data area in the CPU. Remember, that the maximum length of the data area depends on the block type and block version being used.

- AG_SEND and AG_RECV
  Up to version V3.0 of these blocks, a maximum of 240 bytes can be sent or received. The current block versions allow a data area of up to 8192 bytes for an S7-300. With an S7-400, the FCs AG_LSEND / AG_LRECV must still be used for larger data areas.
- AG_LSEND / AG_LRECV
  Using the CPs of the S7400 and with earlier versions of the S7300, larger data areas can only be transferred with the FCs AG_LSEND or AG_LRECV. Please check the length of the data area in the product information of the CP.
- AG_SSEND / AG_SRECV
  With CPs of the S7−400 that support PROFINET communication in conjunction with CPUs as of version 5.1, data can be transferred at higher transmission speeds with the FCs AG_SSEND or AG_SRECV (does not apply to the CP 443−1 Advanced 6GK7 443–1EX41–0XE0).
  You can check which CP types are supported by CPUs as of version 5.1 in the manual of your CP (Section "Requirements for use").

The following table shows the limit values of the various connection types.

FC	ISO transport	ISO-on-TCP	TCP	UDP
AG_LSEND (S7-400) AG_SEND (S7-300)	8192 bytes	8192 bytes	8192 bytes	2048 bytes
AG_SEND (S7-400)	240 bytes	240 bytes	240 bytes	240 bytes
AG_LRECV (S7-400) AG_RECV (S7-300)	8192 bytes	8192 bytes	8192 bytes	2048 bytes
AG_RECV (S7-400)	240 bytes	240 bytes	240 bytes	240 bytes
AG_SSEND (S7-400) AG_SRECV (S7-400)	1452 bytes	1452 bytes	1452 bytes	1452 bytes

Note

For information on the length of the data area you can transfer with older versions of the Ethernet CPs, refer to the product information / manual of the Ethernet CP you are using.

Use without job header

On specified connections, the address and job parameters are specified by the connection configuration. The user program only provides the user data in the UDP data area when sending with AG_SEND / AG_LSEND / AG_SSEND or receives the data with AG_RECV / AG_LRECV / AG_SRECV.

Use with header

Free UDP connections require a job header in the user data area.

The following schematic illustrates the structure of the job buffer and the meaning and location (high byte / low byte) of the parameters in the job header.

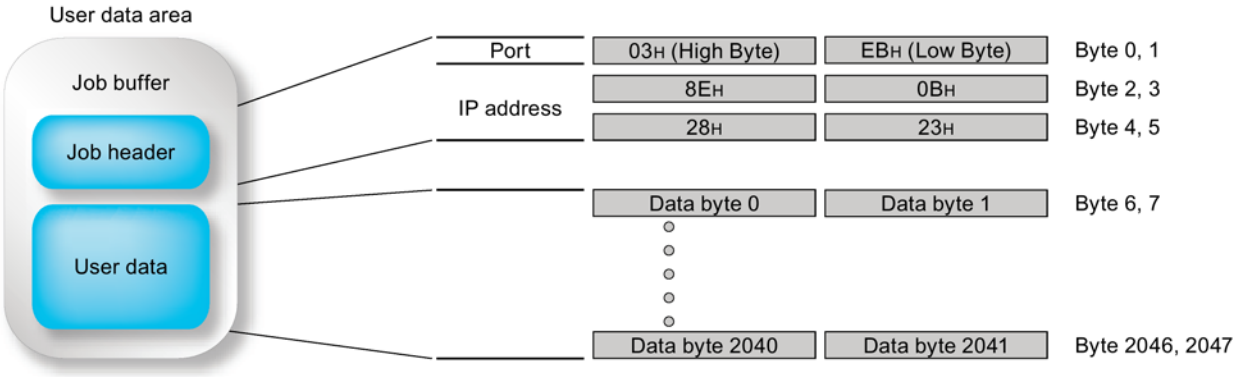


Image 2-1 Sending and receiving on a free UDP connection with programmed addresses

- In the diagram (entries in hexadecimal) the following IP address is assumed as an example: 142.11.40.35;
- For the port address 1003, the following would be entered: For high byte: 03_H; For low byte: EB_H.
- The user data area can be up to 2048 bytes. Up to 2042 bytes of user data can be transferred. 6 bytes are reserved for the job header.
  Please note that the data length specified in the block call (LEN parameter) must include the header and the user data!

Change call parameters only after job confirmation

Note

Once the job has been triggered, you can only change the call parameters of the call interface of the AG_SEND or AG_RECV program blocks after the FC has confirmed completion of the job with DONE=1 or with ERROR=1.

If you do not keep to this rule, it is possible that the job will be aborted with an error.

Status display on the FC call interface; Special case with FC versions (only for S7-300) *)

With the FCs AG_SEND (FC5) and AG_RECV (FC6), you will receive the codes shown below in the following situations:

- CP is in STOP;
- Connection is not configured;

- Connection is not established
- Connection is aborted;

Codes:

- AG_SEND:
  DONE=0; ERROR=1; Status=8183$_H$
- AG_RECV:
  DONE=0; ERROR=0; Status=8180$_H$
  or
  DONE=0; ERROR=1; Status=8183$_H$

*) applies to FCs as of version 4.0

2.1.2 AG_SEND / AG_LSEND / AG_SSEND

2.1.2.1 Meaning and call - AG_SEND / AG_LSEND / AG_SSEND

Meaning of the block

The program block AG_SEND / AG_LSEND / AG_SSEND passes data to the Ethernet CP for transfer over a configured connection.

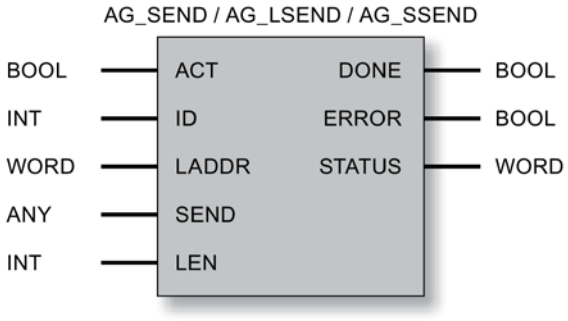
The selected data area can be a memory bit area or a data block area.

Errorfree execution of the function is indicated when the entire user data area could be sent over Ethernet.

Note:
Unless otherwise stated, all the following information applies equally to the FCs AG_SEND, AG_LSEND and AG_SSEND.

Call interface

Call interface in FBD representation



Example in STL representation

```
STL                                     Explanation
call fc 5 (                             //Block call
ACT := M 10.0,                          //Job triggered by memory bit
ID := MW 12,                            //Connection ID acc. to configuration
LADDR := W#16#0100,                     //=LADDR 256 dec. in HW Config
SEND := P#db99.dbx10.0 byte 240,        //Buffer with send data
LEN := MW 14,                           //Length for send data
DONE := M 10.1,                         //Execution code
ERROR := M 10.2,                        //Error code
STATUS := MW 16 );                      //Status code
```

Note

If you want to use FC53 AG_SSEND, you will need to select the "SPEED SEND/RECV" mode in the connection properties during configuration of the connection.

2.1.2.2 How AG_SEND / AG_LSEND / AG_SSEND work

How It works

The following diagrams illustrate the normal sequence of data transmission triggered in the user program using AG_SEND.

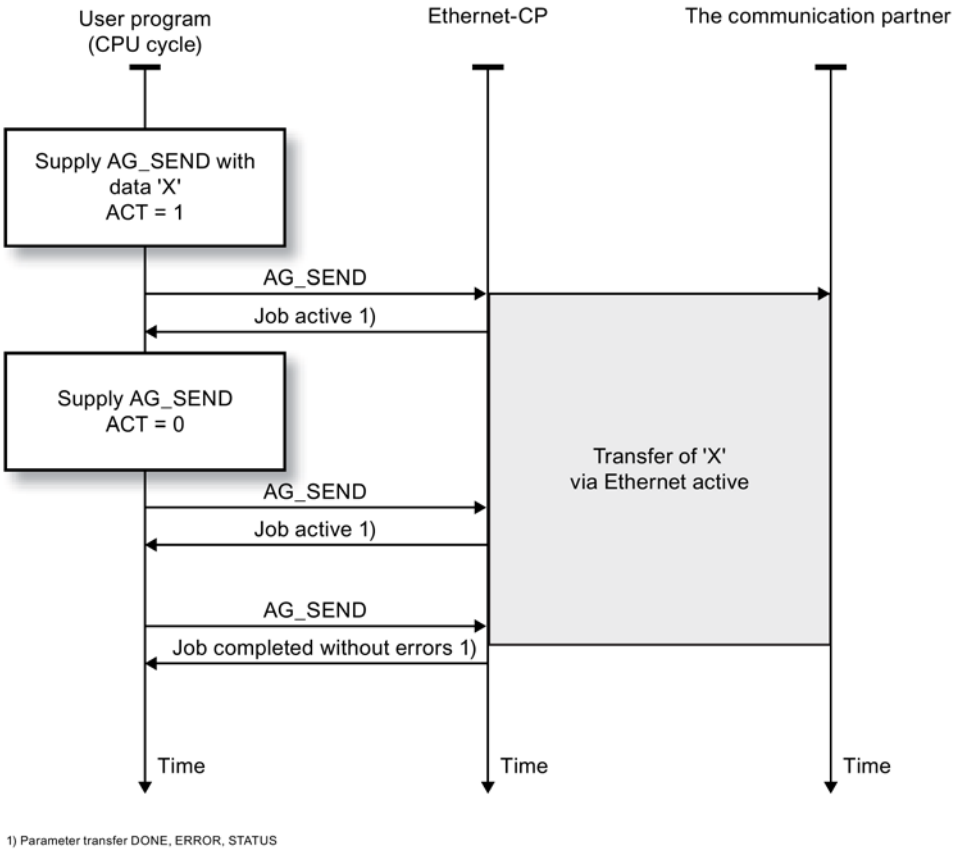
The way in which the FC functions depends on the CP type you are using.

- Case 1: Sequence with FC5, FC50, FC53 in S7-400 CPs
  In the S7–400, the transfer of the entire data area regardless of its length is handled by the CP after the first block call.
- Case 2: Sequence with FC5 in S7–300 CPs
  In the S7-300, the transfer takes place several data segments (each with 240 bytes of user data) and requires several FC calls to transfer the entire data.

Case 1: Sequence with FC5, FC50, FC53 in S7–400 CPs

The send job is executed as soon as the parameter ACT = 1 is passed.
Following this, the parameter ACT = 0 must be passed in at least one further call.

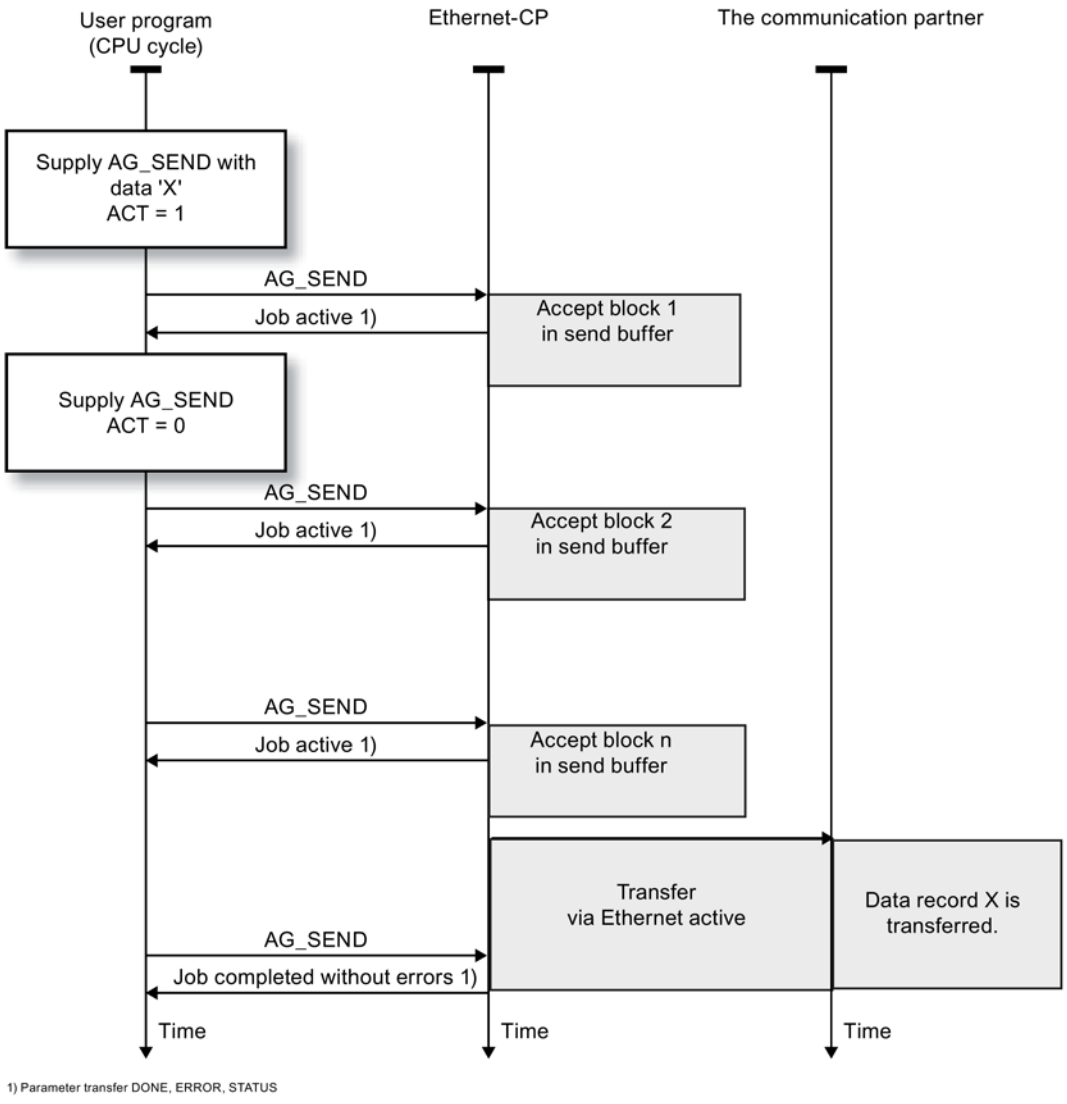
The status code in the output parameters DONE, ERROR and STATUS is updated in each block call and can be evaluated. To update the status code without starting a new send job, start a new block call with the parameter ACT = 0.



Case 2: Sequence with FC5 in S7–300 CPs

The send job is started as soon as the parameter ACT = 1 is passed.
In contrast to case 1, the protocol used here to transfer the data segments (each 240 bytes of user data) requires the FC to be called again for each segment.
Depending on the length of the user data, you must therefore continue to call the FC with ACT=0 until transfer of the entire data record is indicated; at least one further call is necessary. The data is transferred to the communication partner in segments of 240 bytes.

The status code in the output parameters DONE, ERROR and STATUS is updated in each block call and can be evaluated.



Note

In principle, it is possible to call the FC more than once within the CPU cycle to speed up the handling of the job. Do not forget, however, that this increases the load during the CPU cycle (the load differs depending on the CPU type)!

2.1.2.3 Explanation of the formal parameters - AG_SEND / AG_LSEND / AG_SSEND

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_SEND / AG_LSEND / AG_SSEND functions:

Parameter	Declaration	Data type	Range of values	Description
ACT	INPUT	BOOL	0,1	If an FC is called with ACT=1, LEN bytes are sent from the ISO transport data area specified with the SEND parameter. If an FC is called with ACT = 0, the status codes DONE, ERROR and STATUS are updated.
ID	INPUT	INT	1, 2...64 (S7-400) 1, 2...16 (S7-300)	The connection number of the connection is specified in the parameter ID.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
SEND	INPUT	ANY		Specifies the address and length The address of the data area points to one of the alternatives: • Memory bit area • Data block area
LEN	INPUT	INT	On ISO transport and ISOonTCP / TCP: 1, 2...8192 (or up to "length specified for SEND parameter") On UDP: 1, 2...2048 (or up to "length specified for SEND parameter")	Number of bytes to be sent from the data area with this job. The possible values range from 1 to length specified for the SEND parameter. • Note the block type: – For S7-300 The current versions of FC AG_SEND allow up to 8192 bytes (2048 bytes for UDP) to be transferred. – For S7-400 With FC AG_SEND, the data area is restricted to a maximum of 240 bytes. Note the following with an S7-400: • Improved performance with shorter data records: Transfer of data records up to 240 bytes results in better performance! This applies regardless of the block type used (AG_SEND/AG_LSEND). • With AG_SSEND, the data area is restricted to a maximum of 1452 bytes.

Parameter	Declaration	Data type	Range of values	Description
DONE	OUTPUT	BOOL	0: Job active 1: Job done	The status parameter indicates whether or not the job was completed without errors. As long as DONE = 0, no further job can be triggered. DONE is set to 0 by the CP when it accepts a new job. For the meaning in conjunction with the ERROR and STATUS parameters, refer to AG_SEND, AG_LSEND and AG_SSEND status codes (Page 30)
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the DONE and STATUS parameters, refer to AG_SEND, AG_LSEND and AG_SSEND status codes (Page 30)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the DONE and ERROR parameters, refer to AG_SEND, AG_LSEND and AG_SSEND status codes (Page 30)

2.1.2.4 AG_SEND, AG_LSEND and AG_SSEND status codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

DONE	ERROR	STATUS	Meaning
1	0	0000_H	Job completed without errors.
0	0	0000_H	No job being executed.
0	0	8181_H	Job active.
0	1	7000_H	The condition code is possible only with S7-400: The FC was called with ACT=0; the job has not yet been processed.
0	1	8183_H	No configuration or the ISO/TCP service has not yet started on the Ethernet CP.
0	1	8184_H	• Illegal data type specified for the SEND parameter. • System error (the source data area is incorrect).
0	1	8185_H	LEN parameter longer than SEND source area.
0	1	8186_H	ID parameter invalid. • ID != 1, 2....16 (S7-300) • ID != 1, 2....64.(S7-400)

DONE	ERROR	STATUS	Meaning
0	1	8302_H	No receive resources on the destination station; the receiving station cannot process received data quickly enough or has not prepared any receive resources.
0	1	8304_H	The connection is not established. The send job should only be attempted again after waiting for at least 100 ms.
0	1	8311_H	The destination station cannot be obtained under the specified Ethernet address.
0	1	8312_H	Ethernet error on the CP.
0	1	$8F22_H$	Source area invalid, e.g.: Area does not exist in the DB LEN parameter < 0
0	1	$8F24_H$	Area error when reading a parameter.
0	1	$8F28_H$	Alignment error reading a parameter.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Area not loaded (DB).
0	1	$8F42_H$	Acknowledgment timeout reading a parameter from the I/O area.
0	1	$8F44_H$	Access to a parameter to be read during block execution is prevented.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference e.g. parameter LEN=0
0	1	8090_H	• Module with this module start address does not exist; • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary.
0	1	8092_H	In the ANY reference, a type other than BYTE is specified. (S7-400 only)
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established. (With newer CPU versions)
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	The specified length (in the LEN parameter) is incorrect.
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	CPU resources (memory) occupied.
0	1	$80C4_H$	Communication error (occurs temporarily and a repetition in the user program will often remedy the problem)
0	1	$80D2_H$	Module start address incorrect.

See also

/5/ (Page 282)

2.1.3 AG_RECV / AG_LRECV / AG_SRECV

2.1.3.1 Meaning and call - AG_RECV / AG_LRECV / AG_SRECV

Meaning of the block

The AG_RECV / AG_LRECV / AG_SRECV program block receives the data transferred on a configured connection from the Ethernet CP.

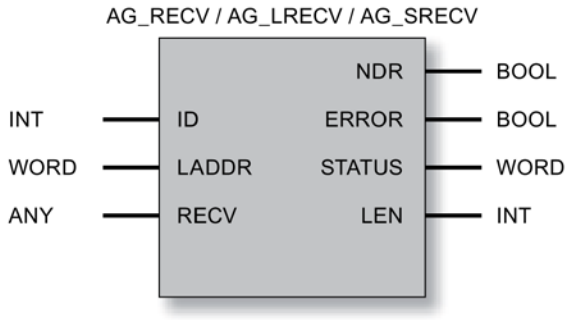
The data area specified for the receive data can be a memory bit area or a data block area.

Errorfree execution is indicated when the data could be received from the Ethernet CP.

Note:
Unless otherwise stated, all the following information applies to both the FCs AG_RECV and AG_LRECV / AG_SRECV.

Call

Call interface in FBD representation



Example in STL representation

STL	Explanations
`call fc 6 (`	`//Block call`
`ID := MW 40,`	`//Connection ID acc. to configuration`
`LADDR := W#16#0100,`	`//=LADDR 256 dec. in HW Config`
`RECV := P#M 0.0 BYTE 100,`	`//Buffer for received data`
`NDR := DB 110.DBX 0.6,`	`//Receive code`
`ERROR := DB 110.DBX 0.7,`	`//Error code`
`STATUS := DB 110.DBW 2,`	`//Status code`
`LEN := DB 110.DBW 4 );`	`//Received data length`

Note

If you want to use FC63 AG_SRECV, you will need to select the "SPEED SEND/RECV" mode in the connection properties during configuration of the connection.

2.1.3.2 How AG_RECV / AG_LRECV / AG_SRECV work

How It works

The following diagrams illustrate the normal sequence of data acceptance triggered by an AG_RECV in the user program.

Each AG_RECV job in the user program is acknowledged by the Ethernet CP with an entry in the output parameters NDR, ERROR and STATUS.

The way in which the FC functions depends on the CP type you are using and the connection types.

- Case 1: Sequence with FC6 in S7-300 CPs

  With the newer CP types, optimized data transfer on the SEND/RECEIVE interface is available. In particular with longer data records, this allows a much higher data throughput on the interface between the CPU and CP.

- Case 2: Sequence with FC6 and FC60 in S7-400 CPs

  With FC6 / FC60 AG_RECV, the response on the S7-400 depends on the protocol used.

  – Case 2a: Sequence with ISO transport, ISO-on-TCP, UDP connections

    Wit these connection types, the transfer is handled by the CP with one or more FC6 /FC60 calls depending on the length of the data area.

  – Case 2b: Sequence with TCP connections

    On a TCP connection, the length specified in the ANY pointer of the RECV parameter is the deciding factor. An FC6 /FC60 job is completed with the condition code NDR=1, as soon as an amount of data corresponding to the specified length has been written to the receive buffer.

- Case 3: Sequence with FC63 in S7-400 CPs

  With FC63 AG_SRECV, the response on the S7-400 depends on the protocol used.

  – Case 3a: Sequence with ISO transport, ISO-on-TCP, UDP connections

    With these connection types, the transfer of the entire data area regardless of its length is started by the CP after the first block call.

  – Case 3b: Sequence with TCP connections

    On a TCP connection, the data on the CP is accepted up to the maximum specified job length with every call.

    The call must be repeated until a data record has been entered completely and consistently in the receive buffer. The reception of the completed data record is indicated in one of the later FC calls with the parameter NDR=1.

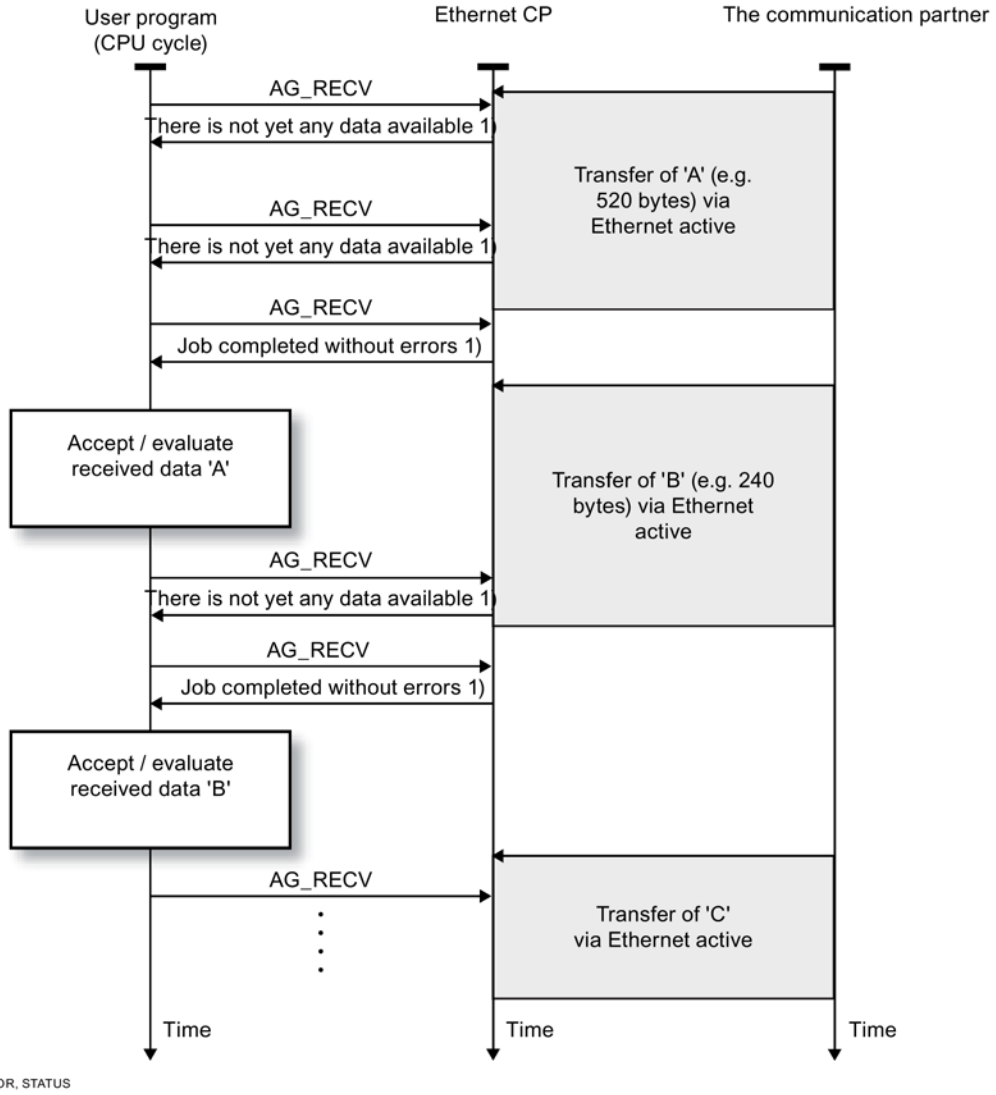
Case 1: Sequence with FC6 in S7-300 CPs

When FC6 is called, the user program prepares the buffer to receive data and instructs the CP to enter the received data there.

The protocol used here to transfer the data to the receive buffer requires the FC to be called again for each segment (240 bytes of user data).

Depending on the length of the user data, the FC must be called repeatedly until the complete transfer is indicated by parameter NDR=1.

The status code in the output parameters NDR, ERROR and STATUS is updated in each block call and can be evaluated.



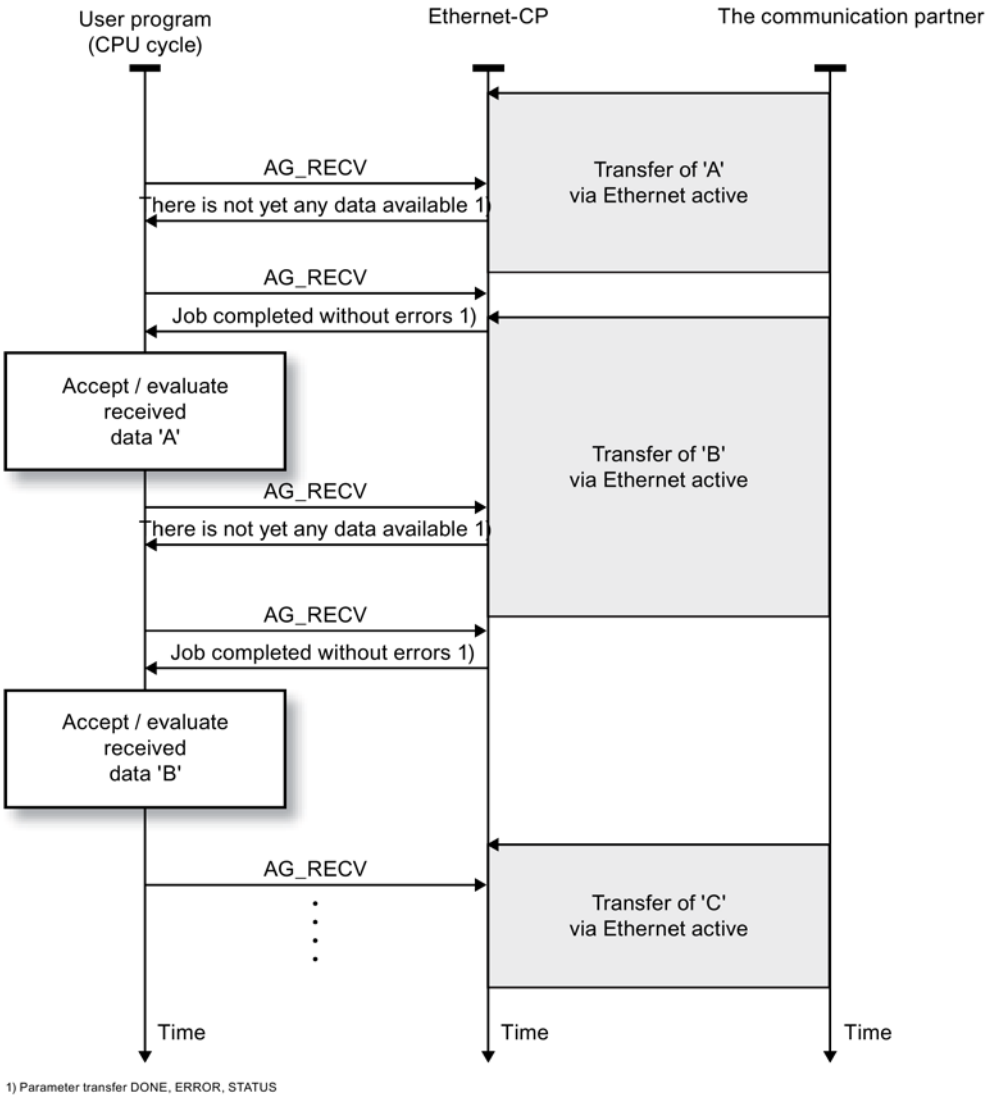
1) Parameter transfer NDR, ERROR, STATUS

Case 2a: Sequence with FC6 and FC60 in S7-400 CPs (with ISO transport, ISO-on-TCP, UDP connections)

When the FC is called, the user program prepares the buffer to receive data and instructs the CP to enter all available data there.

As soon as a data record has been entered fully and consistently in the receive buffer, this is indicated by the parameter NDR=1 in one of the next FC calls.

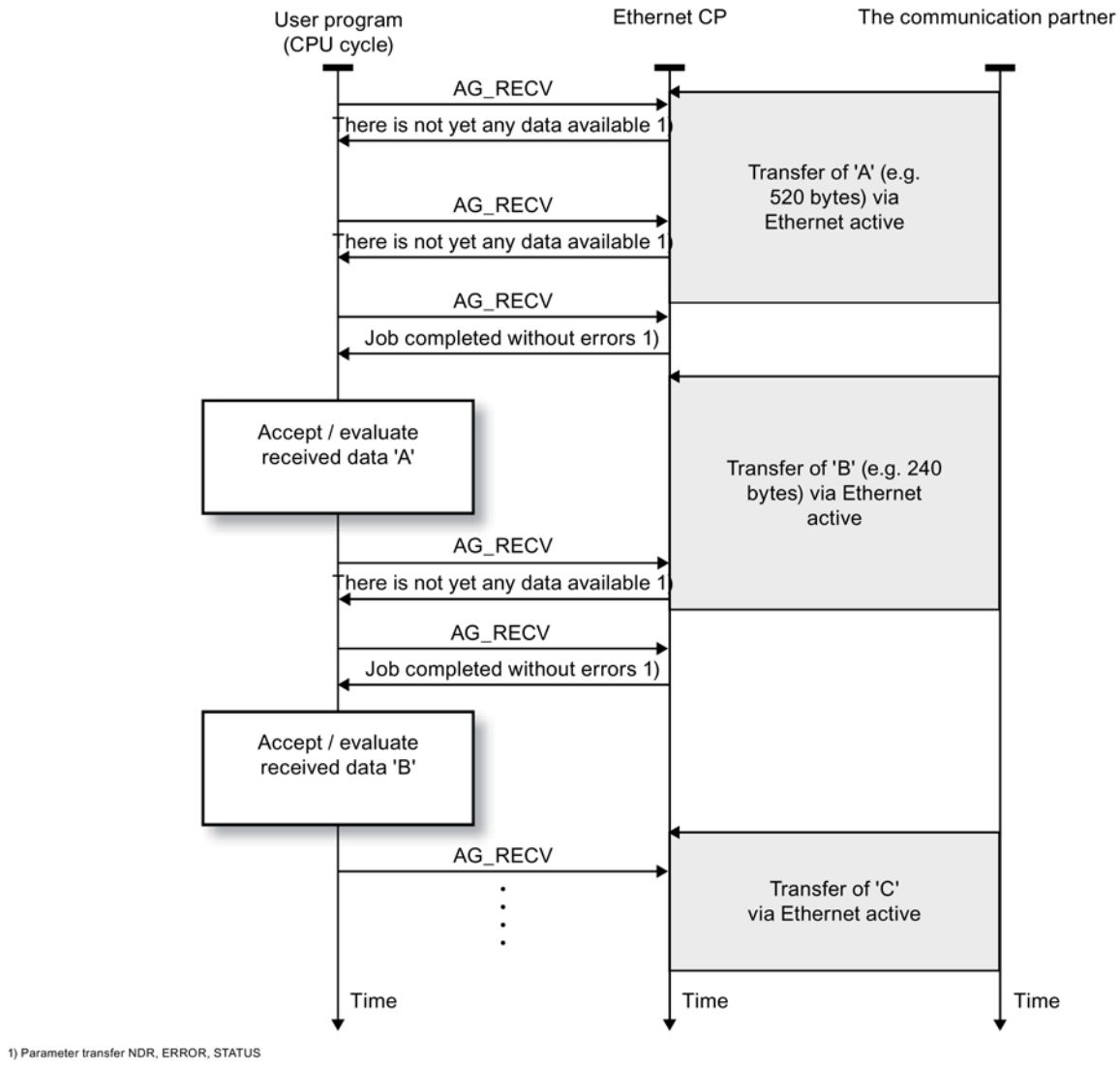
The status code in the output parameters NDR, ERROR and STATUS is updated in each block call and can be evaluated.



Case 2b: Sequence with FC6 / FC60 in S7-400 CPs (only for TCP connections)

On a TCP connection, the length specified in the ANY pointer of the RECV parameter is the deciding factor. An FC6 /FC60 job is completed with the condition code NDR=1, as soon as an amount of data corresponding to the specified length has been written to the receive buffer.

The sequence example shows a situation in which the length in the ANY pointer was set to 400 bytes for an FC60.



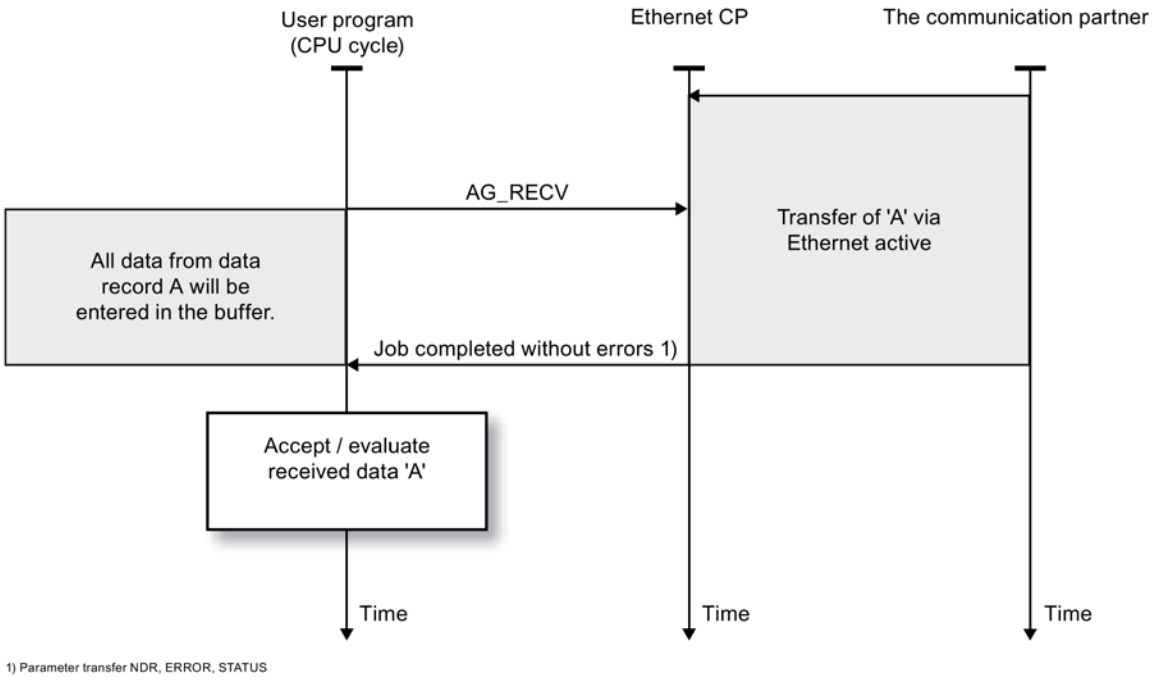
Case 3a: Sequence with FC63 in S7-400 CPs (with ISO transport, ISO-on-TCP, UDP connections)

When the FC is called, the user program prepares the buffer for the received data and instructs the CP to enter all data until the end of the transfer there; in other words, when the length specified in the ANY pointer is reached.

As soon as the data record has been entered fully and consistently in the receive buffer, this is indicated by the parameter NDR=1 in one of the next FC calls.

The maximum length for received data is 1452 bytes. The size of the receive buffer must always be set to this value.

The status code in the output parameters NDR, ERROR and STATUS is updated in each block call and can be evaluated.



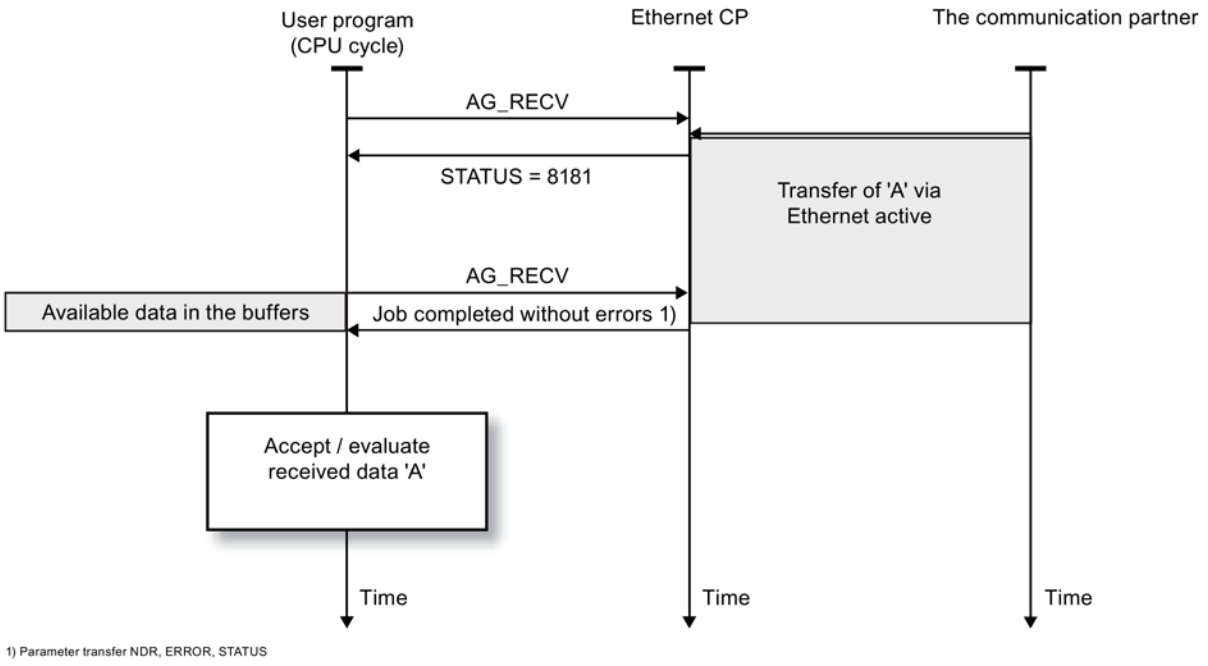
Case 3b: Sequence with FC63 in S7-400 CPs (only for TCP connections)

When the FC is called, the user program prepares the buffer to receive data and instructs the CP to enter the currently available data there. Until the data has been completely entered in the receive buffer, the message "Job active" (8181H) is sent.

With each new FC call, the currently available data is entered in the receive buffer. When the data record has been entered fully and consistently in the receive buffer, this is indicated by the parameter NDR=1 in one of the next FC calls.

The maximum length for received data is 1452 bytes. The size of the receive buffer must always be set to this value.

The status code in the output parameters NDR, ERROR and STATUS is updated in each block call and can be evaluated.



2.1.3.3 Explanation of the formal parameters - AG_RECV / AG_LRECV / AG_SRECV

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_RECV / AG_LRECV / AG_SRECV function:

Parameter	Declaration	Data type	Possible values	Description
ID	INPUT	INT	1, 2...64 (S7-400) 1, 2...16 (S7-300)	The connection number of the ISO transport connection is specified in the ID parameter.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
RECV	INPUT	ANY		Specifies the address and length The address of the data area points to one of the alternatives: • Memory bit area • Data block area Note on length: Performance is improved when transferring data records up to 212 bytes if you also restrict the length to 212 bytes at the RECV parameter. Note on FC63 AG_SRECV: With FC63 AG_SRECV, always set RECV to the maximum receive buffer length of 1452 bytes. Otherwise, the following error can occur in certain situations: NDR=0; ERROR=1; STATUS=8185$_H$

Parameter	Declaration	Data type	Possible values	Description
NDR	OUTPUT	BOOL	0: - 1: new data	The parameter indicates whether or not new data was accepted. For the meaning in conjunction with the ERROR and STATUS parameters, refer to AG_RECV, AG_LRECV and AG_SRECV condition codes (Page 39).
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the NDR and STATUS parameters, refer to AG_RECV, AG_LRECV and AG_SRECV condition codes (Page 39).
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the NDR and ERROR parameters, refer to AG_RECV, AG_LRECV and AG_SRECV condition codes (Page 39).
LEN	OUTPUT	INT	**On ISO Transport and ISOonTCP:** 1, 2...8192 **On UDP:** 1, 2...2048	Specifies the number of bytes accepted from the Ethernet CP and entered in the data area. Note the block type: • For S7-300 The current versions of FC AG_RECV allow up to 8192 bytes (2048 bytes for UDP) to be transferred. • For S7-400 With FC AG_RECV, the data area is restricted to a maximum of 240 bytes. With FC AG_SRECV, the data area is restricted to a maximum of 1452 bytes.

2.1.3.4 AG_RECV, AG_LRECV and AG_SRECV condition codes

Condition codes

The following table shows the codes formed by the NDR, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 2- 1 AG_RECV / AG_LRECV / AG_SRECV condition codes

NDR	ERROR	STATUS	Meaning
1	0	0000_H	New data accepted.
0	0	8180_H	There is no data available yet (not with AG_SRECV).

NDR	ERROR	STATUS	Meaning
0	0	8181_H	Job active.
0	1	8183_H	• The configuration is missing; • The ISO transport service has not yet started on the Ethernet CP; • The connection is not established.
0	1	8184_H	• Illegal type specified for the RECV parameter; • System error.
0	1	8185_H	Destination buffer (RECV) is too short.
0	1	8186_H	ID parameter invalid. ID != 1, 2....16 (S7-300). ID != 1, 2....64.(S7-400)
0	1	8304_H	The connection is not established. The receive job should only be attempted again after waiting for at least 100 ms.
0	1	$8F23_H$	Source area invalid, e.g.: Area does note exist in the DB.
0	1	$8F25_H$	Range error when writing a parameter.
0	1	$8F29_H$	Alignment error writing a parameter
0	1	$8F30_H$	Parameter is in the writeprotected first current data block.
0	1	$8F31_H$	Parameter is in the writeprotected second current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Destination area not loaded (DB).
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.
0	1	$8F45_H$	Address of the parameter to be written is disabled in the access track.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	• No module with this module start address exists or the CPU is in STOP mode; • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary.
0	1	8092_H	In the ANY reference, a type other than BYTE is specified. (S7-400 only)
0	1	$80A0_H$	Negative acknowledgment reading from the module.
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	Possible causes: • The destination area is invalid. • The destination area is too short. • The destination area for the received data was adequately dimensioned. Remedy: Run another receive call with maximum receive buffer size. This applies regardless of the connection type (unicast / multicast / broadcast) and the device family (S7-300 / S7-400).
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established.

NDR	ERROR	STATUS	Meaning
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	CPU resources (memory) occupied.
0	1	$80C4_H$	Communications error occurs temporarily and a repetition in the user program will often remedy the problem.
0	1	$80D2_H$	Module start address incorrect.

See also

/5/ (Page 282)

2.2 Program blocks for access coordination with FETCH/WRITE

2.2.1 Overview of program blocks and their use

Overview

The following program blocks are available for the FETCH/WRITE function to coordinate access:

Program block	can be used with:		Meaning
	S7-300	S7-400	
AG_LOCK (FC7)	x	x	Locks external data access with FETCH/WRITE.
AG_UNLOCK (FC8)	x	x	Releases external data access with FETCH/WRITE.

Caution when Configuring

If you use program blocks AG_LOCK and AG_UNLOCK, specify the following information for CPs in S7400 stations in the configuration:

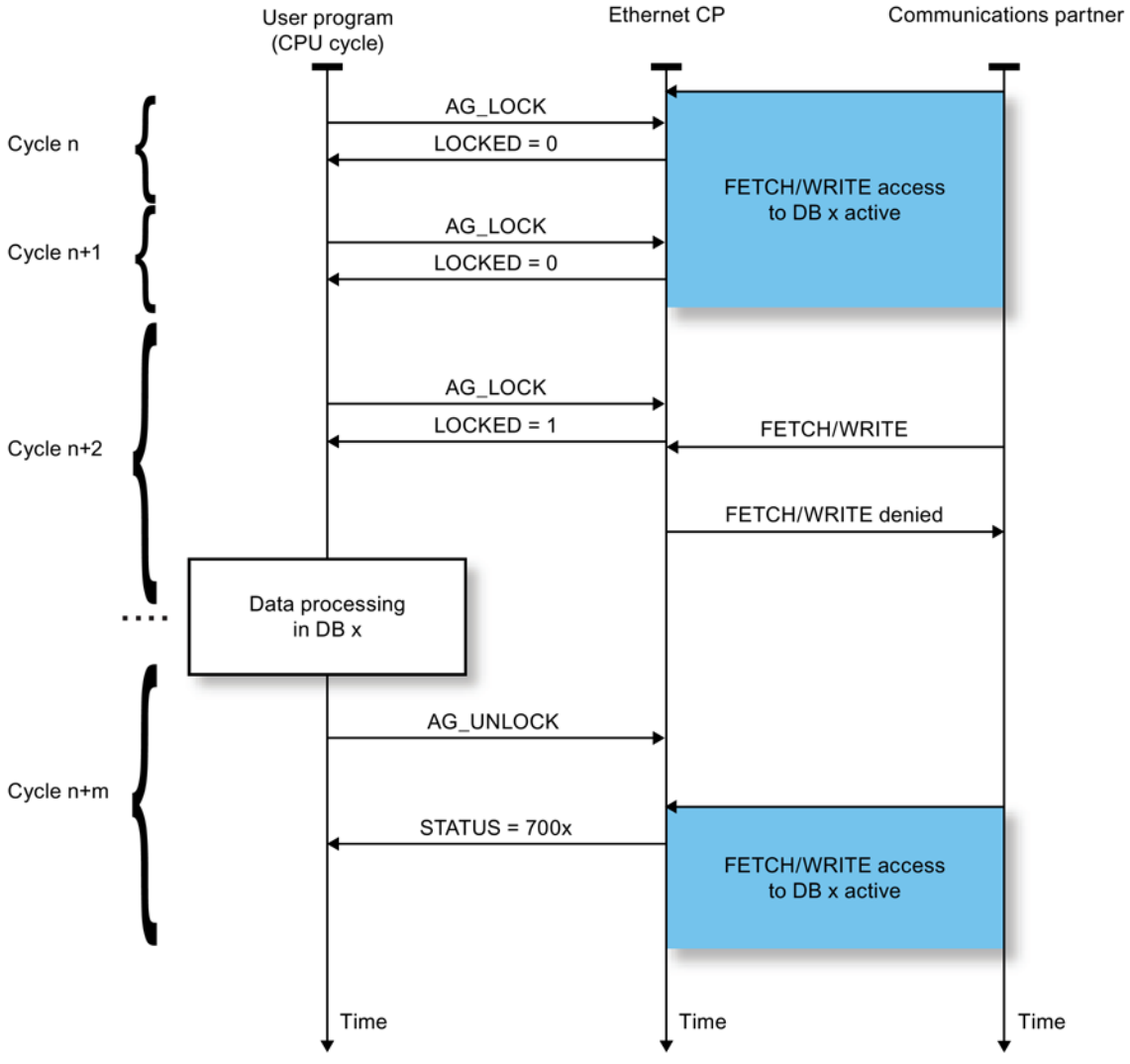
- Under "Properties > Addresses"
  The "Address setting for LOCK/UNLOCK" option must be selected if the selection is available.

How It works

With these program blocks, you can coordinate access to system memory areas so that no inconsistent data is created and transferred. The control is from the user program in the S7 CPU that can, if necessary, disable an external FETCH/WRITE access using an AG_LOCK call. After a certain time or after the local write/read access is completed, an AG_UNLOCK job can be used to enable external access again.

Another advantage is that this access lock only applies to the FETCH/WRITE connection specified in the call. If more than one FETCH/WRITE connection is configured, these can, for example, be used for certain specific system areas and a selective access coordination can be implemented.

The following diagram illustrates the usual chronological sequence of memory access coordination controlled in the user program with AG_LOCK and AG_UNLOCK.



The lock job must first be monitored in the user program using the code in the return parameter LOCKED. As long as LOCKED=0 is indicated, it must be assumed that there is still an external FETCH/WRITE access active.

If LOCKED=1 is indicated, this shows that the lock is active; data can now be modified by the user program.

The status code is updated at each block call.

2.2.2 AG_LOCK

2.2.2.1 Meaning and call - AG_LOCK

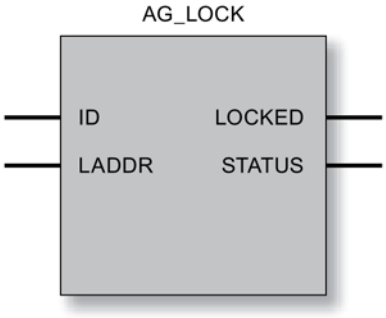
Meaning of the block

Using the AG_LOCK block the data exchange using FETCH or WRITE on the connection selected with the parameter ID is disabled. The LOCKED output indicates whether or not the lock was successful. If the lock was not successful, the job must be triggered again in a later CPU cycle.

The STATUS output indicates the status of the CP for this connection.

Call

Call interface in FBD representation



Example in STL representation

STL	Explanation
`call fc 7 (`	`//Block call`
`ID := DB 100.DBW 2,`	`//Connection ID acc. to configuration`
`LADDR := W#16#0100,`	`//=LADDR 256 dec. in HW Config`
`LOCKED := DB 100.DBX 0.6,`	`//Status code of access lock`
`STATUS := DB 100.DBW 4 );`	`//Status code`

2.2.2.2 Explanation of the formal parameters - AG_LOCK

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_LOCK function:

Parameter	Declaration	Data type	Range of values	Description
ID	INPUT	INT	1,2...16 for S7300 1,2...64 for S7400	The connection number of the connection is specified in the parameter ID.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
LOCKED	OUTPUT	BOOL	0: not (yet) locked 1: locked	Shows the status of the access lock requested on the specified FETCH/WRITE connection.
STATUS	OUTPUT	WORD		Status code For the meaning, refer to Condition codes of AG_LOCK (Page 44)

2.2.2.3 Condition codes of AG_LOCK

Condition codes

The following table shows the STATUS code that must be evaluated by the user program.

Table 2- 2 AG_LOCK condition codes

STATUS	Meaning
7000_H	CP is not processing a job
7001_H	FETCH active
7002_H	WRITE active
8183_H	FETCH/WRITE not configured for this connection (S7-400 only)
8186_H	ID number not in permitted range (e.g. 1...64 for S7-400 Industrial Ethernet CPs)
$80A4_H$	The communication bus connection between the CPU and CP is not established (with newer CPU versions)
$80B0_H$	The module does not recognize the data record.
$80B1_H$	The specified length (in the LEN parameter) is incorrect.
$80B2_H$	The communication bus connection between the CPU and CP is not established.
$80C0_H$	The data record cannot be read.
$80C1_H$	The specified data record is currently being processed.
$80C2_H$	There are too many jobs pending.
$80C3_H$	CPU resources (memory) occupied.
$80C4_H$	Communications error occurs temporarily and a repetition in the user program will often remedy the problem.
$80D2_H$	Module start address incorrect.

2.2.3 AG_UNLOCK

2.2.3.1 Meaning and call - AG_UNLOCK

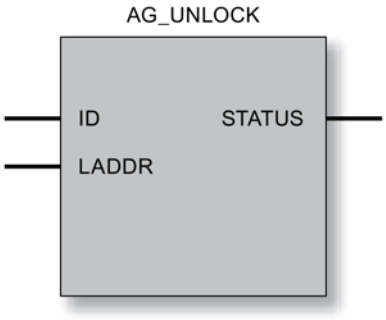
Meaning of the block

With the aid of the AG_UNLOCK block, you enable external access to user memory areas of the S7-CPU. With FETCH or WRITE, access via the connection selected with the ID parameter is then possible.

The AG_UNLOCK follows an access lock with AG_LOCK.

Call

Call interface in FBD representation



Example in STL representation

STL	Explanation
`call fc 8 (`	`//Block call`
`ID := DB 100.DBW 2,`	`//Connection ID acc. to configuration`
`LADDR := W#16#0100,`	`//=LADDR 256 dec. in HW Config`
`STATUS := DB 100.DBW 4 );`	`//Status code`

How it works

To release the connection again, the FC must clear the LOCK request bit again. The FC also shows the current status using error messages.

2.2.3.2 Explanation of the formal parameters - AG_UNLOCK

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_UNLOCK function:

Parameter	Declaration	Data type	Possible values	Description
ID	INPUT	INT	1,2...16 for S7300 1,2...64 for S7400	The connection number of the connection is specified in the parameter ID. (See Configuration)
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
STATUS	OUTPUT	WORD		Status code: For the meaning, refer to Condition codes of AG_UNLOCK (Page 46)

2.2.3.3 Condition codes of AG_UNLOCK

Condition codes

The following table shows the STATUS code that must be evaluated by the user program.

Table 2- 3 AG_UNLOCK condition codes

STATUS	Meaning
7000_H	CP is not processing a job
7001_H	FETCH active
7002_H	WRITE active
8183_H	FETCH/WRITE not configured for this connection (S7-400 only)
8186_H	ID number not in permitted range (e.g. 1...64 for S7-400 Industrial Ethernet CPs)
$80A4_H$	The communication bus connection between the CPU and CP is not established (with newer CPU versions)
$80B0_H$	The module does not recognize the data record.
$80B1_H$	The specified length (in the LEN parameter) is incorrect.
$80B2_H$	The communication bus connection between the CPU and CP is not established.
$80C0_H$	The data record cannot be read.
$80C1_H$	The specified data record is currently being processed.
$80C2_H$	There are too many jobs pending.
$80C3_H$	CPU resources (memory) occupied.
$80C4_H$	Communications error occurs temporarily and a repetition in the user program will often remedy the problem
$80D2_H$	Module start address incorrect.

2.3 Program blocks for connection and system diagnostics

2.3.1 AG_CNTRL

2.3.1.1 Meaning and call - AG_CNTRL

How It works

With the AG_CNTRL program block, you can diagnose connections. When necessary, you can initialize connection establishment again using AG_CNTRL.

Note

AG_CNTRL and AG_CNTEX

The AG_CNTEX program block provides expanded functionality compared with the AG_CNTRL program block.

All the functions of AG_CNTRL are included in AG_CNTEX and they can be used identically in the user program.

The following actions are possible by setting commands:

- Reading out connection information

  Based on status information, you can decide whether or not it would be useful to reset all or individual connections of the CP.

- Resetting configured connections

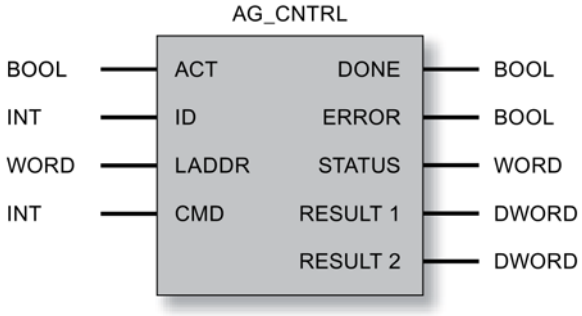
  You can reset individual connections or all connections of a CP.

- Aborting the active connection and establishing it again

The commands of the AG_CNTRL function (FC) are permitted only for SEND/RECV connections based on the ISO / RFC / TCP / UDP protocols.

Call interface

Call interface in FBD representation



Example in STL representation

```
STL                                 Explanation
call fc 10 (                        //AG_CNTRL block call
ACT := M1.0,                        //Job trigger
ID := MW8,                          //Connection ID acc. to configuration
LADDR := W#16#100,                  //Module address acc. to HW Config
CMD := MW6,                         //Command ID
DONE := M20.1,                      //Execution code
ERROR := M20.2,                     //Error code
STATUS := MW22,                     //Status code
RESULT1 := MD24,                    //Job result 1
RESULT2 := MD28 );                  //Job result 2
```

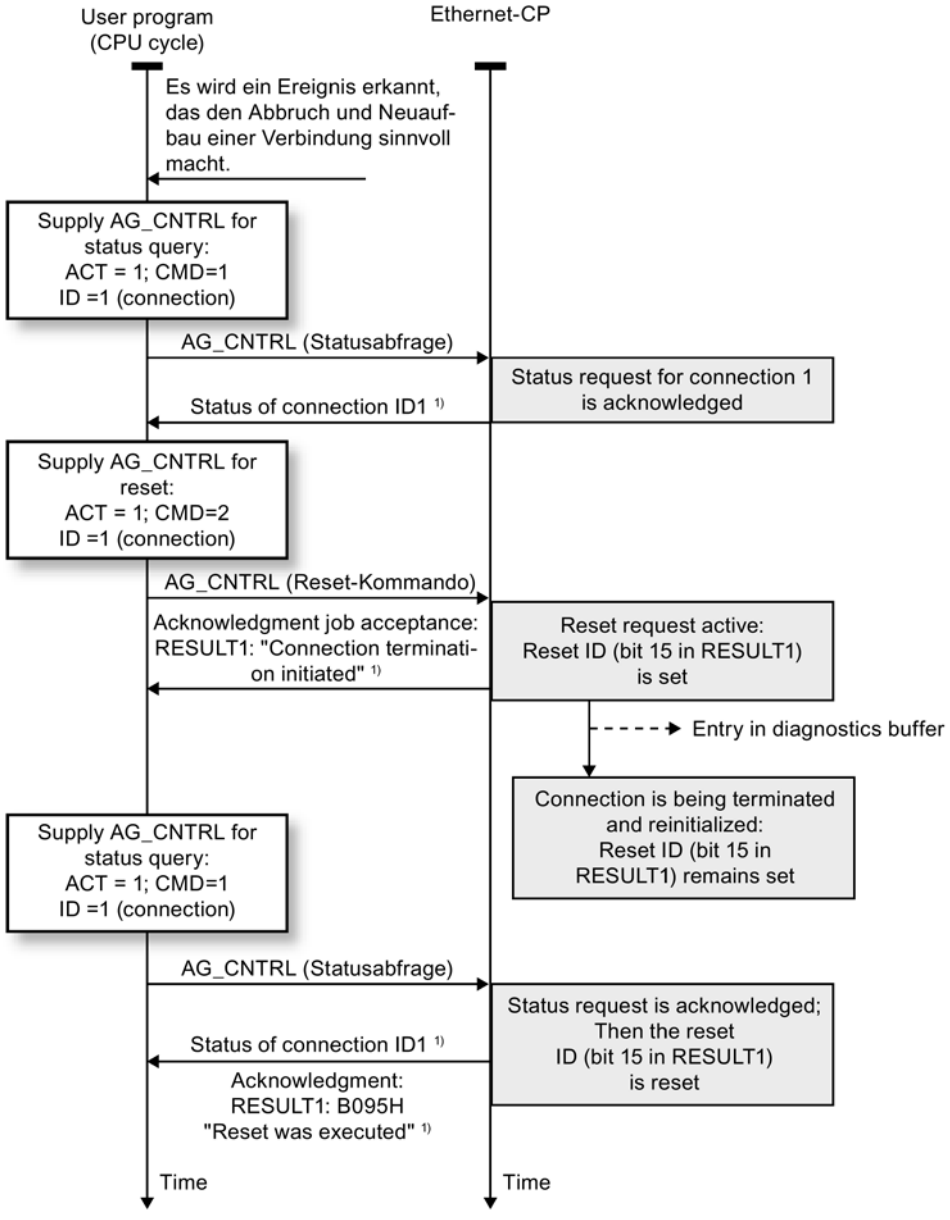
See also

FAQ under entry ID 33414377
(https://support.industry.siemens.com/cs/ww/en/view/33414377)

2.3.1.2 How AG_CNTRL works

Operating principle

The following diagram shows a typical sequence of AG_CNTRL jobs in the user program.



1) Parameter transfer DONE, ERROR, STATUS and RESULT1/2

The diagram shows how the connection status is initially queried and then, in a second job, how the connection termination is triggered with the reset command.

The reset ID (bit 15 in RESULT1) is set on the CP. If there is a status query later, it is therefore clearly recognizable whether the connection has been reset due to a reset job. The reset ID is cleared on the CP only after this status query (or as a result of an explicit CN_CLEAR_RESET command)

Note

The block must be called with ACT = 1; if it is called with ACT=0, there is no function call and the block is exited again immediately.

Since the job result of FC10 is obtained synchronous to the call, it can be called again in the same cycle.

2.3.1.3 Explanation of the formal parameters - AG_CNTRL

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_CNTRL function:

Parameter	Declaration	Data type	Possible values	Description
ACT	INPUT	BOOL	0, 1	The FC must be called with ACT=1. If it is called with ACT=0, there is no function call and the block is exited again immediately.
ID	INPUT	INT	• 1, 2, .., n, or • 0	The connection number of the connection is specified in the parameter ID. The connection number can be found in the configuration. n is the maximum number of connections and is dependent on the product (S7-300 or S7-400). If the call addresses all connections (_ALL function with CMD 3 or 4), 0 must be specified as the ID.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
CMD	INPUT	INT		Command to FC AG_CNTRL.
DONE	OUTPUT	BOOL	0: Job still being processed or not yet triggered 1: Job done	This parameter indicates whether or not the job was completed without errors. For the meaning in conjunction with the parameters ERROR and STATUS, refer to AG_CNTRL codes (Page 51) Note: If DONE=1, RESULT can be evaluated
ERROR	OUTPUT	BOOL	0: No error 1: Error situation	Error code For the meaning in conjunction with the parameters DONE and STATUS, refer to AG_CNTRL codes (Page 51)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters DONE and ERROR, refer to AG_CNTRL codes (Page 51)

Parameter	Declaration	Data type	Possible values	Description
RESULT1	OUTPUT	DWORD		Information returned according to the command sent to FC AG_CNTRL.
RESULT2	OUTPUT	DWORD		Only to be evaluated for S7-400: Part 2 of information returned according to the command sent to FC AG_CNTRL.

2.3.1.4 AG_CNTRL codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

The command results in the RESULT1/2 parameters must also be evaluated according to "Commands and job results - AG_CNTRL (Page 52) ".

Table 2- 4 AG_CNTRL codes

DONE	ERROR	STATUS	Meaning
1	0	0000_H	A job (CMD) was transferred successfully to the CP (for example RESET) or a status was read successfully from the CP. The RESULT1/2 parameters can be evaluated.
0	0	0000_H	There has been no block call yet or the block was called with ACT=0.
0	0	8181_H	Job active The block call must be repeated with the same parameters until DONE or ERROR is signaled.
0	1	8183_H	No configuration or the service has not yet started on the Ethernet CP.
0	1	8186_H	The ID parameter is invalid. The permitted ID depends on the selected command.
0	1	8187_H	The CMD parameter is invalid.
0	1	8188_H	Sequence error in the ACT control (Note: this code does not occur in the product version of the CP / firmware).
0	1	8189_H	The CP version / firmware used does not support FC10. The code is set when you call a CP 3431-EX20 with firmware as of V1.3.9; with other CP types, the code 80B0H is set instead. Note: FC10 in version V1.0 is supported by the CPs as of CP 343-1EX21/GX21; this code does not occur with these modules.
0	1	8090_H	• No module with this module start address exists. or • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400). or • The function is not supported by this module.
0	1	8091_H	The module start address is not at a doubleword boundary.
0	1	$80B0_H$	The module does not recognize the data record.

DONE	ERROR	STATUS	Meaning
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established. The corresponding CPU in the H system is in STOP mode.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	CPU resources (memory) occupied.
0	1	$80C4_H$	Communication error The error occurs temporarily; it is usually best to repeat the job in the user program.
0	1	$80D2_H$	The module start address is incorrect.

2.3.1.5 Commands and job results - AG_CNTRL

Commands and evaluating the job results

The following table shows you the possible commands and the results that can be evaluated in the RESULT1/2 parameters.

Note

Command evaluation with older CP types or firmware versions

The commands described below are supported by the current CP types or firmware versions. You should also check the more detailed information under the following entry ID:

33414377 (https://support.industry.siemens.com/cs/ww/en/view/33414377)

Table 2- 5 Commands to FC AG_CNTRL

CMD	Meaning		
0	NOP – no operation The block executes without a job being sent to the CP.		
	RESULT (for CMD = 0)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	$0000\ 0001_H$	Executed without error
	RESULT2	$0000\ 0000_H$	Default

CMD	Meaning			
1	CN_STATUS – connection status This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 000*$_H$	Bits 0-3: Codes for the send direction (excluded values: 0x2)	
			Bit 0	Connection type • 0: no send and receive connection • 1: Connection reserved for send and receive jobs
			Bit 1	Status of current job • 0: No send job being executed • 1: Send job being executed
			Bits 2+3	Previous job: • 00: No information available on previous send job • 01: previous send job completed successfully • 10: previous send job not completed successfully

CMD	Meaning			
1	CN_STATUS – connection status **(CMD=1 continued)** This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 00*0$_H$	Bits 4−7: Codes for the receive direction (excluded values: 0x2)	
			Bit 4	Connection type • 0: no send and receive connection • 1: Connection reserved for send and receive jobs
			Bit 5	Status of current job • 0: No receive job being executed • 1: Receive job being executed
			Bits 6+7	Previous job: • 00: No information available on previous receive job • 01: previous receive job completed successfully • 10: previous receive job not completed successfully

CMD	Meaning			
1	CN_STATUS – connection status **(CMD=1 continued)** This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 0*00$_H$	Bits 8-11: Codes for FETCH/WRITE (excluded values: 0x3, 0x7, 0x8, 0xB, 0xF)	
			Bit 8	Connection type: • 0: No FETCH connection • 1: Connection reserved for FETCH jobs
			Bit 9	Connection type: • 0: No WRITE connection • 1: Connection reserved for WRITE jobs
			Bit 10	Job status (FETCH/WRITE): • 0: Job status OK • 1: Job status NOT OK This ID is set in the following situations: – The job was acknowledged negatively by the CPU – The job could not be forwarded to the CPU because the connection was in the "LOCKED" status. – The job was rejected because the FETCH/WRITE header did not have the correct structure.
			Bit 11	Status of FETCH/WRITE job • 0: No job active • 1: Job from LAN active

<table>
<tr><td>CMD</td><td colspan="4">Meaning</td></tr>
<tr><td>1</td><td colspan="4">CN_STATUS – connection status (CMD=1 continued)
This command returns the status of the connection selected with the ID.
The CP is selected in the LADDR parameter.
If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).</td></tr>
<tr><td></td><td colspan="3">RESULT (for CMD = 1)</td><td>Value / meaning</td></tr>
<tr><td></td><td>Parameter</td><td>Hex value/range</td><td>Bit</td><td></td></tr>
<tr><td></td><td>RESULT1</td><td>0000 *000$_H$</td><td colspan="2">Bits 12-15: General CP information
(excluded values: 0x3, 0xB)</td></tr>
<tr><td></td><td></td><td></td><td>Bit 12 + 13</td><td>Information on connection status:
(only available for SEND/RECV connections based on the ISO/RFC/TCP protocols, with UDP, the corresponding internal information is output)
• 00: Connection is terminated
• 01: Connection establishment active
• 10: Connection termination active
• 11: Connection is established</td></tr>
<tr><td></td><td></td><td></td><td>Bit 14</td><td>CP information:
• 0: CP in STOP
• 1: CP in RUN</td></tr>
<tr><td></td><td></td><td></td><td>Bit 15</td><td>Reset ID
• 0: FC10 has not yet reset a connection or the reset ID was cleared.
• 1: The control block has executed a connection reset.</td></tr>
<tr><td></td><td>RESULT1</td><td>**** 0000$_H$</td><td></td><td>Bits 16-31: Reserved
0 – reserved for later expansions</td></tr>
<tr><td></td><td>RESULT2</td><td>0000 0000$_H$</td><td></td><td>- reserved for later expansions</td></tr>
</table>

<table>
<tr><td>CMD</td><td colspan="3">Meaning</td></tr>
<tr><td>2</td><td colspan="3">CN_RESET – connection reset
This command resets the connection selected with ID.
The CP is selected in the LADDR parameter.
Resetting the connection means that a connection is aborted and established again (active or passive depending on the configuration). Data that has been received but not yet entered in the user program when the connection aborts is deleted.
An entry is also generated in the diagnostics buffer in which the job result can be found.</td></tr>
<tr><td></td><td colspan="2">RESULT (for CMD = 2)</td><td>Meaning</td></tr>
<tr><td></td><td>Parameter</td><td>Hex value/range</td><td></td></tr>
<tr><td></td><td>RESULT1</td><td>0000 0001$_H$</td><td>The reset job was transferred to the CP successfully.
The connection abort and subsequent connection establishment were triggered.</td></tr>
</table>

CMD	Meaning		
		0000 0002$_H$	The reset job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
3	CN_STATUS_ALL – all connections status This command returns the connection status of all connections (established/terminated) in the RESULT1/2 parameters (at total of 8 bytes of group information). The ID parameter must be set to "0" (checked for 0). The CP is selected in the LADDR parameter. When necessary, you can obtain detailed information about a terminated or unconfigured connection using a further connection status call with CMD=1.		
	RESULT (for CMD = 3)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	**** ****$_H$	32 bits: Connection 1 - 32 • 0 – connection terminated / not configured • 1 – connection established
	RESULT2	**** ****$_H$	32 bits: Connection 33 - 64 • 0 – connection terminated / not configured • 1 – connection established

CMD	Meaning		
4	CN_RESET_ALL – all connections reset: This command resets all connections. The ID parameter must be set to "0" (checked for 0). The CP is selected in the LADDR parameter. Resetting the connections means that connections are aborted and established again (active or passive depending on the configuration). Data that has been received but not yet entered in the user program when the connection aborts is deleted. An entry is also generated in the diagnostics buffer in which the job result can be found.		
	RESULT (for CMD = 4)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The reset job was transferred to the CP successfully. The connection abort and subsequent connection establishment of all connections were triggered.
	RESULT1	0000 0002$_H$	The reset job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
5	CN_CLEAR_RESET – Clear the reset ID This command resets the reset ID (bit 15 in RESULT1) for the connection selected with ID. The CP is selected in the LADDR parameter. This job executes automatically when the connection status is read (CMD=1); the separate job described here is therefore only required in special situations.		
	RESULT (for CMD = 5)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The clear job was transferred to the CP successfully.
	RESULT1	0000 0002$_H$	The Clear job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
6	CN_DISCON − connection disconnect This command resets the connection selected with ID and LADDR. Resetting the connection is achieved by aborting the connection. Any data in the stack is lost without any message being displayed. The connection is not established again automatically afterwards. The connection can be established again with the CN_STARTCON control job. A diagnostics buffer entry is created in which you will find the job result.		
	RESULT (for CMD = 6)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The job was transferred to the CP successfully. The connection abort was initiated.
	RESULT1	0000 0002$_H$	The job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
7	CN_STARTCON − start connection This command establishes a connection selected with ID and LADDR and aborted earlier with the control job CN_DISCON. A diagnostics buffer entry is created in which you will find the job result.		
	RESULT (for CMD = 7)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The connection establishment job was transferred to the CP successfully. The connection establishment was initiated.
	RESULT1	0000 0002$_H$	The connection establishment job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

See also

You will find further information in the FAQ under the following entry ID: 33414377 (https://support.industry.siemens.com/cs/ww/en/view/33414377)

2.3.2 AG_CNTEX

2.3.2.1 Meaning and call - AG_CNTEX

Significance and how it works

With the AG_CNTEX program block, it is possible run diagnostics on connections and to address devices using the ping command via the network. When necessary, you can initialize connection establishment again using AG_CNTEX.

Note

AG_CNTRL and AG_CNTEX

The AG_CNTEX program block provides expanded functionality compared with the AG_CNTRL program block.

All the functions of AG_CNTRL are included in AG_CNTEX and they can be used identically in the user program.

The following actions are possible by setting commands:

- Reading out connection information

  Based on status information, you can decide whether or not it would be useful to reset all or individual connections of the CP.
- Resetting configured connections

  You can reset individual connections or all connections of a CP.
- Aborting the active connection and establishing it again
- Reading out connection types configured on the CP (expanded functionality compared with AG_CNTRL)
- Send PING command (expansion compared with AG_CNTRL)

  You can check whether a specific node is reachable in the network.

The commands of the AG_CNTEX program block are permitted only for SEND/RECV connections based on the ISO / RFC / TCP / UDP protocols.

Note

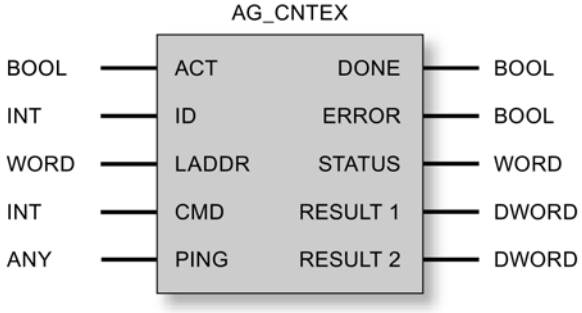
Availability in the block library

If the program block AG_CNTEX is not yet available in the SIMATIC_NET_CP block library, install the current SIMATIC NET block library. You will find this under the following entry ID on the Internet:

Link: (https://support.industry.siemens.com/cs/ww/en/view/109481127)

Call interface

Call interface in FBD representation



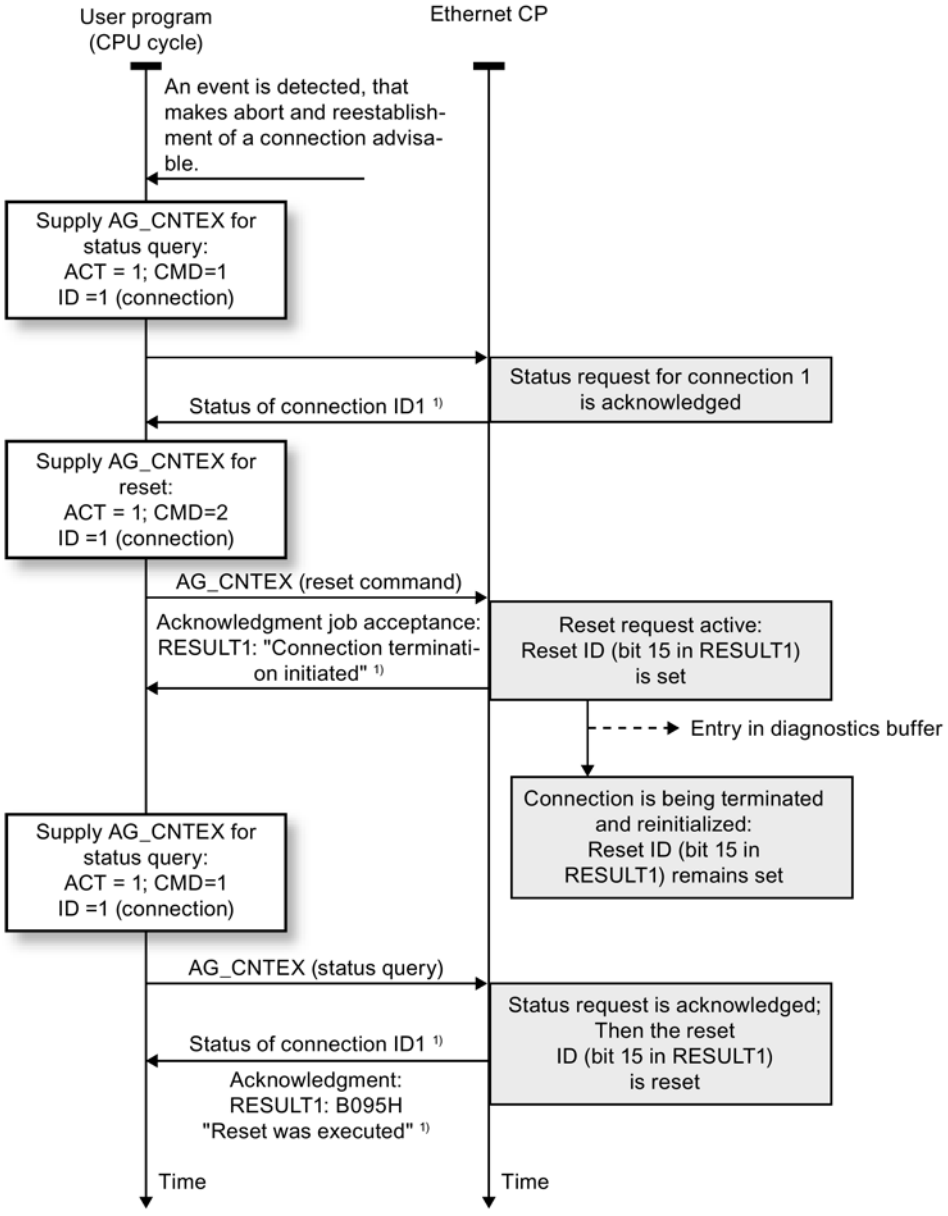
Example in STL representation

```
STL                                 Explanation
call fb 10, DB10 (                  //AG_CNTEX block call
ACT := DB11.DBX0.0,                 //Job trigger
ID := DB11.DBW2,                    //Connection ID acc. to configuration
LADDR := DB11.DBW4,                 //module address acc. to hardware configuration
CMD := DB11.DBW6,                   //Command ID
PING := P#DB11.DBX8.0,              // Data area with ping data
DONE := DB11.DBX16.0,               //Execution code
ERROR := DB11.DBX16.1,              //Error code
STATUS := DB11.DBW18,               //Status code
RESULT1 := DB11.DBD20,              //Job result 1
RESULT2 := DB11.DBD24);             //Job result 2
```

2.3.2.2 How AG_CNTEX works

Operating principle

The following diagram shows a typical sequence of AG_CNTEX jobs in the user program. Below you will find examples of the sequence of ping commands.



1) Parameter transfer DONE, ERROR, STATUS and RESULT1/2

The diagram shows how the connection status is initially queried and then, in a second job, how the connection termination is triggered with the reset command.

The reset ID (bit 15 in RESULT1) is set on the CP. If there is a status query later, it is therefore clearly recognizable whether the connection has been reset due to a reset job. The

reset ID is cleared on the CP only after this status query or as a result of an explicit CN_CLEAR_RESET command

Note

When the block is called, ACT = 1 must be set. If it is called with ACT=0, there is no function call and the block is exited again immediately.

Since the job result of AG_CNTEX is obtained synchronous to the call, AG_CNTEX can be called again in the same cycle.

2.3.2.3 How the ping function works

Mode of operation / call sequence

Below there is a description of how to use the commands CMD=8 and CMD=9 to send a ping command.

With the CMD=8 ping command, you instruct the CP to send 4 successive ping requests over the network to the IP address specified in the job. The ping echo is expected by the CP within the period of time you set in the ping job field.

The CP registers the response times and enters these in the RESULT 1/2 parameters.

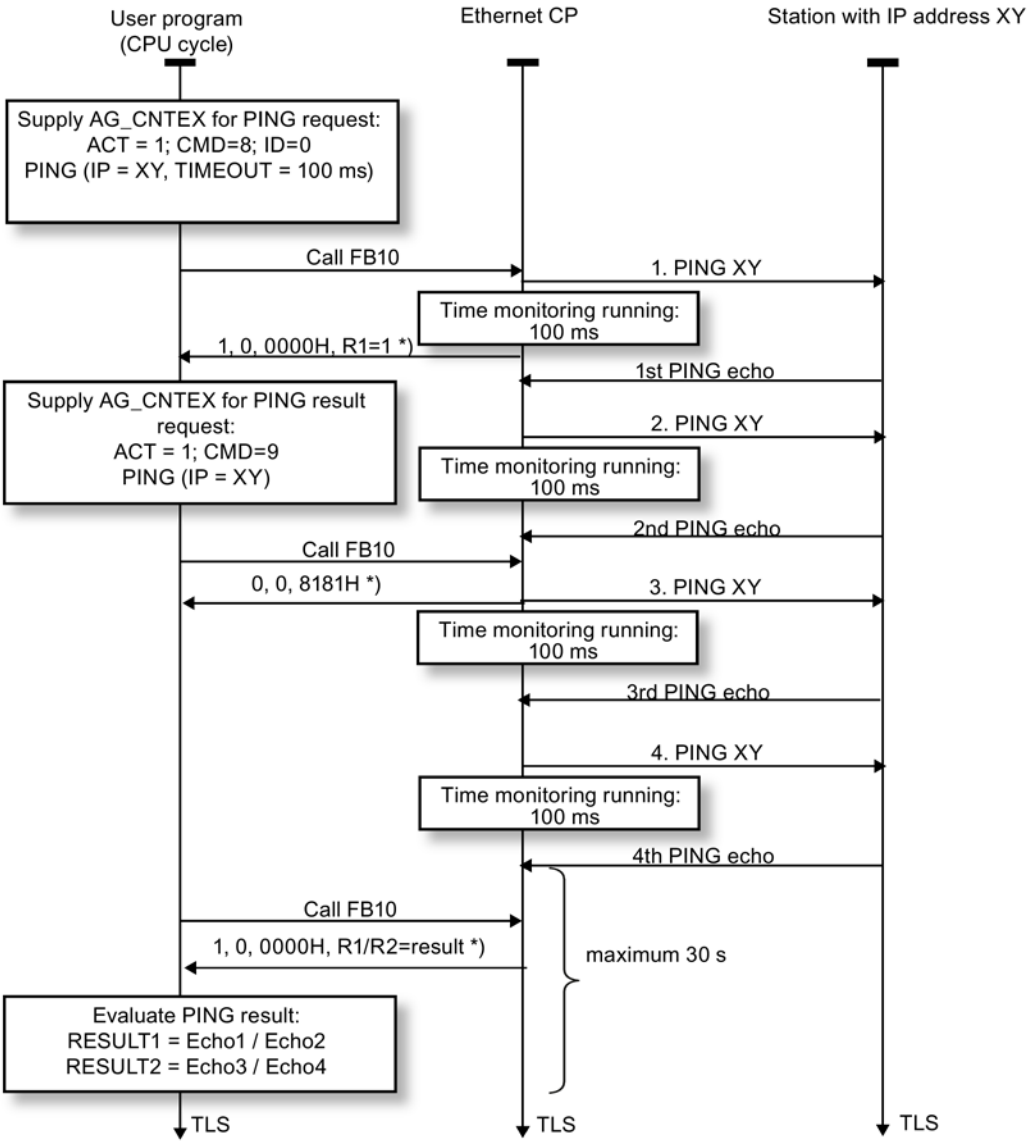
The RESULT 1/2 parameters can be queried with ping command CMD=9. As soon as the 4 ping requests have been replied to, or their set monitoring time has been exceeded, execution is confirmed in the DONE=1 parameter. The ping result can then be queried within a maximum of 30 seconds; afterwards, the RESULT entries become invalid.

Note

Ping is only possible over a configured connection

The ping command is only possible if at least one connection for the SEND/RECEIVE interface (TCP, ISO-on-TCP, ISO-Transport, UDP) is configured.

The following schematic shows a typical sequence of a ping request with the corresponding ping result request.



*) Parameter transfer DONE, ERROR, STATUS and RESULT1/2

Several ping requests at the same time

You can send up to 4 ping requests at the same time to different IP addresses. To do this, you must use the same instance DB for the ping requests. Further ping requests are possible only after completion of at least one of the current PING requests.

If too many ping requests are sent at the same time, an error message to this effect is output (STATUS parameter = $828A_H$).

When are ping requests completed?

Ping requests count as being completed as soon as one of the following conditions is met:

- The ping result was read out:
- The ping result was not read out but 30 seconds have elapsed since the ping result was available.

Replies of the SIMATIC NET CPs to ICMP frames

To reduce the activity of the CPs to ping requests of AG_CNTEX, SIMATIC NET CPs for S7-300/S7-400 reply to ICMP frames a maximum of ten times within 100 milliseconds.

2.3.2.4 Explanation of the formal parameters - AG_CNTEX

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_CNTEX function:

Parameter	Declaration	Data type	Range of values	Description
ACT	INPUT	BOOL	0, 1	The FB must be called with ACT=1. If it is called with ACT=0, there is no function call and the block is exited again immediately.
ID	INPUT	INT	• 1, 2, .., n, or • 0	The connection number of the connection is specified in the parameter ID. The connection number can be found in the configuration. n is the maximum number of connections and is dependent on the product (S7-300 or S7-400). For a call that addresses all connections, 0 must be specified as the ID. This affects: • the functions CN_STATUS_ALL (CMD3) and CN_RESET_ALL (CMD4) • Ping command with CMD 8 or CMD 9
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
CMD	INPUT	INT		Command to FB AG_CNTEX
PING	INPUT	ANY		References a block of data (for example DB) that contains the data structure for the ping command. The block of data contains the IP address and optional information about the time monitoring and the number of bytes to be transferred in the ping request. Data structure, see below

Parameter	Declaration	Data type	Range of values	Description
DONE	OUTPUT	BOOL	0: Job still being processed or not yet triggered 1: Job done	This parameter indicates whether or not the job was completed without errors. For the meaning in conjunction with the parameters ERROR and STATUS, refer to AG_CNTEX codes (Page 64) Note: If DONE=1, RESULT can be evaluated
ERROR	OUTPUT	BOOL	0: No error 1: Error situation	Error code For the meaning in conjunction with the parameters DONE and STATUS, refer to AG_CNTEX codes (Page 64)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters DONE and ERROR, refer to AG_CNTEX codes (Page 64)
RESULT1	OUTPUT	DWORD		Information returned to AG_CNTEX according to the command.
RESULT2	OUTPUT	DWORD		Part 2 of the information returned to AG_CNTEX according to the command.

PING block of data

The PING parameter references a block of data with the following data structure:

Parameter	Data type	Range of values	Note
IP address	ARRAY [1..4] of Byte		
TIMEOUT	INT	1..60000 ms	Can be specified as an option; default value = 1000 ms
Size	INT	1..1000 bytes	Can be specified as an option; default value = 32 bytes

2.3.2.5 AG_CNTEX codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

The command results in the RESULT1/2 parameters must also be evaluated according to Commands and job results - AG_CNTEX (Page 66).

Table 2- 6 AG_CNTEX codes

DONE	ERROR	STATUS	Meaning
1	0	0000_H	A job (CMD) was transferred successfully to the CP (for example RESET) or a status was read successfully from the CP. The RESULT1/2 parameters can be evaluated.
0	0	0000_H	There has been no block call yet or the program block was called with ACT=0.
0	0	8181_H	Job active The block call must be repeated with the same parameters until DONE or ERROR is signaled.
0	1	8183_H	No configuration or the service has not yet started on the Ethernet CP.
0	1	8184_H	System error or wrong parameter type. The cause can be: • Data type of the ANY pointer not correct for the PING parameter. • The ANY pointer references an odd bit address.
0	1	8186_H	The ID parameter is invalid. The permitted ID depends on the selected command.
0	1	8187_H	The CMD parameter is invalid.
0	1	8090_H	Possible meanings: • No module with this module start address exists; • The program block being used does not match the system family being used (remember to use different program blocks for S7300 and S7400); • The function is not supported by this module.
0	1	8091_H	The module start address is not at a doubleword boundary.
0	1	8092_H	The module start address is incorrect.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established. The corresponding CPU in the H system is in STOP mode.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	CPU resources (memory) occupied.
0	1	$80C4_H$	Communication error The error occurs temporarily; it is usually best to repeat the job in the user program.
0	1	8286_H	The value for the "Timeout" in the PING data block is outside the valid range of values.
0	1	8287_H	The IP address specified in the ping DB is reserved and therefore not permitted.
0	1	8288_H	The display occurs only with the PING result request command. Possible meanings: • The IP address was not reached by the ping command (for example because the CP was changed to STOP mode after the ping request command was sent); • The ping result has already been read out; • The ping result was not read out within the maximum time of 30 seconds.

DONE	ERROR	STATUS	Meaning
0	1	8289_H	The data volume for the ping request has exceeded the permitted range (maximum 1000 bytes; see data structure for the PING command)
0	1	$828A_H$	There are already 4 ping requests being processed. New requests are only possible again after processing the existing requests.
0	1	$828B_H$	There is already a PING request being processed for the specified IP address. Use the PING result request to complete the current processing.

2.3.2.6 Commands and job results - AG_CNTEX

Commands and evaluating the job results

The following table shows you the possible commands and the results that can be evaluated in the RESULT1/2 parameters.

Note

Command evaluation with older CP types or firmware versions

The commands described below are supported by the current CP types or firmware versions. You should also check the more detailed information under the following entry ID:

33414377 (https://support.industry.siemens.com/cs/ww/en/view/33414377)

Table 2- 7 Commands to FC AG_CNTRL

CMD	Meaning		
0	NOP – no operation The block executes without a job being sent to the CP.		
	RESULT (for CMD = 0)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	$0000\ 0001_H$	Executed without error
	RESULT2	$0000\ 0000_H$	Default

CMD	Meaning			
1	CN_STATUS – connection status This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 000*$_H$	Bits 0-3: Codes for the send direction (excluded values: 0x2)	
			Bit 0	Connection type • 0: no send and receive connection • 1: Connection reserved for send and receive jobs
			Bit 1	Status of current job • 0: No send job being executed • 1: Send job being executed
			Bits 2+3	Previous job: • 00: No information available on previous send job • 01: previous send job completed successfully • 10: previous send job not completed successfully

CMD	Meaning			
1	CN_STATUS – connection status **(continued for CMD=1)** This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 00*0$_H$	Bits 4−7: Codes for the receive direction (excluded values: 0x2)	
			Bit 4	Connection type • 0: No send and receive connection • 1: Connection reserved for send and receive jobs
			Bit 5	Status of current job • 0: No receive job being executed • 1: Receive job being executed
			Bits 6+7	Previous job: • 00: No information available on previous receive job • 01: previous receive job completed successfully • 10: previous receive job not completed successfully

CMD	Meaning			
1	CN_STATUS – connection status **(continued for CMD=1)** This command returns the status of the connection selected with the ID. The CP is selected in the LADDR parameter. If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).			
	RESULT (for CMD = 1)			**Value / meaning**
	Parameter	**Hex value/range**	**Bit**	
	RESULT1	0000 0*00$_H$	Bits 8-11: Codes for FETCH/WRITE (excluded values: 0x3, 0x7, 0x8, 0xB, 0xF)	
			Bit 8	Connection type: • 0: No FETCH connection • 1: Connection reserved for FETCH jobs
			Bit 9	Connection type: • 0: No WRITE connection • 1: Connection reserved for WRITE jobs
			Bit 10	Job status (FETCH/WRITE): • 0: Job status OK • 1: Job status NOT OK This ID is set in the following situations: – The job was acknowledged negatively by the CPU – The job could not be forwarded to the CPU because the connection was in the "LOCKED" status. – The job was rejected because the FETCH/WRITE header did not have the correct structure.
			Bit 11	Status of FETCH/WRITE job • 0: No job active • 1: Job from LAN active

<table>
<tr><th>CMD</th><th colspan="4">Meaning</th></tr>
<tr><td>1</td><td colspan="4">CN_STATUS – connection status (continued for CMD=1)
This command returns the status of the connection selected with the ID.
The CP is selected in the LADDR parameter.
If bit 15 (reset ID) is set, this is automatically reset (this action corresponds to the CN_CLEAR_RESET job - see CMD = 5).</td></tr>
<tr><td></td><td colspan="3">RESULT (for CMD = 1)</td><td>Value / meaning</td></tr>
<tr><td></td><td>Parameter</td><td>Hex value/range</td><td>Bit</td><td></td></tr>
<tr><td></td><td>RESULT1</td><td>0000 *000$_H$</td><td colspan="2">Bits 12-15: General CP information
(excluded values: 0x3, 0xB)</td></tr>
<tr><td></td><td></td><td></td><td>Bit 12 + 13</td><td>Information on connection status:
(only available for SEND/RECV connections based on the ISO/RFC/TCP protocols, with UDP, the corresponding internal information is output)
• 00: Connection is terminated
• 01: Connection establishment active
• 10: Connection termination active
• 11: Connection is established</td></tr>
<tr><td></td><td></td><td></td><td>Bit 14</td><td>CP information:
• 0: CP in STOP
• 1: CP in RUN</td></tr>
<tr><td></td><td></td><td></td><td>Bit 15</td><td>Reset ID
• 0: AG_CNTEX has not yet reset a connection or the reset ID was cleared.
• 1: AG_CNTEX caused a connection reset.</td></tr>
<tr><td></td><td>RESULT1</td><td>**** 0000$_H$</td><td></td><td>Bits 16-31: Reserved
0 – reserved for later expansions</td></tr>
<tr><td></td><td>RESULT2</td><td>0000 0000$_H$</td><td></td><td>- reserved for later expansions</td></tr>
</table>

<table>
<tr><th>CMD</th><th colspan="3">Meaning</th></tr>
<tr><td>2</td><td colspan="3">CN_RESET – connection reset
This command resets the connection selected with ID.
The CP is selected in the LADDR parameter.
Resetting the connection means that a connection is aborted and established again (active or passive depending on the configuration). Data that has been received but not yet entered in the user program when the connection aborts is deleted.
An entry is also generated in the diagnostics buffer in which the job result can be found.</td></tr>
<tr><td></td><td colspan="2">RESULT (for CMD = 2)</td><td>Meaning</td></tr>
<tr><td></td><td>Parameter</td><td>Hex value/range</td><td></td></tr>
<tr><td></td><td>RESULT1</td><td>0000 0001$_H$</td><td>The reset job was transferred to the CP successfully.
The connection abort and subsequent connection establishment were triggered.</td></tr>
</table>

CMD	Meaning		
		0000 0002$_H$	The reset job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
3	CN_STATUS_ALL – all connections status This command returns the connection status of all connections (established/terminated) in the RESULT1/2 parameters (at total of 8 bytes of group information). The ID parameter must be set to "0" (checked for 0). The CP is selected in the LADDR parameter. When necessary, you can obtain detailed information about a terminated or unconfigured connection using a further connection status call with CMD=1.		
	RESULT (for CMD = 3)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	**** ****$_H$ 32 bits with the following validity: • For S7-400: Bits 0-31 for connections 1 - 32 • For S7-300: Bits 0-15 for connections 1 - 16	For the relevant connection: • 0 – connection terminated / not configured • 1 – connection established
	RESULT2	**** ****$_H$ 32 bits with the following validity: • For S7-400: Bits 0-31 for connections 33 - 64	For the relevant connection: • 0 – connection terminated / not configured • 1 – connection established

CMD	Meaning		
4	CN_RESET_ALL – all connections reset This command resets all connections. The ID parameter must be set to "0" (checked for 0). The CP is selected in the LADDR parameter. Resetting the connections means that connections are aborted and established again (active or passive depending on the configuration). Data that has been received but not yet entered in the user program when the connection aborts is deleted. An entry is also generated in the diagnostics buffer in which the job result can be found.		
	RESULT (for CMD = 4)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The reset job was transferred to the CP successfully. The connection abort and subsequent connection establishment of all connections were triggered.
	RESULT1	0000 0002$_H$	The reset job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
5	CN_CLEAR_RESET - Clear the reset ID This command resets the reset ID (bit 15 in RESULT1) for the connection selected with ID. The CP is selected in the LADDR parameter. This job executes automatically when the connection status is read (CMD=1); the separate job described here is therefore only required in special situations.		
	RESULT (for CMD = 5)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The clear job was transferred to the CP successfully.
	RESULT1	0000 0002$_H$	The Clear job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
6	CN_DISCON − connection disconnect This command resets the connection selected with ID and LADDR. Resetting the connection is achieved by aborting the connection. Any data in the stack is lost without any message being displayed. The connection is not established again automatically afterwards. The connection can be established again with the CN_STARTCON control job. A diagnostics buffer entry is created in which you will find the job result.		
	RESULT (for CMD = 6)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The job was transferred to the CP successfully. The connection abort was initiated.
	RESULT1	0000 0002$_H$	The job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
7	CN_STARTCON − start connection This command establishes a connection selected with ID and LADDR and aborted earlier with the control job CN_DISCON. A diagnostics buffer entry is created in which you will find the job result.		
	RESULT (for CMD = 7)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The connection establishment job was transferred to the CP successfully. The connection establishment was initiated.
	RESULT1	0000 0002$_H$	The connection establishment job could not be transferred to the CP because the service has not started on the CP (for example, CP in STOP).
	RESULT2	0000 0000$_H$	Default

CMD	Meaning		
8	PING_REQUEST - Send a ping request This command sends a ping command to the CP. The CP then initiates 4 ping echo requests to the specified IP address.		
	RESULT (for CMD = 8)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 0001$_H$	The ping request was sent to the CP successfully.
	RESULT2	0000 0002$_H$	The ping request could not be sent to the CP because the corresponding service was not available on the CP. A possible cause might, for example, be: CP in STOP mode

CMD	Meaning		
9	PING_RESULT - Query ping result This command sends a ping result request to the CP. The CP transfers the results of the 4 executed ping echo requests in the RESULT parameter. The call is successful when the 4 ping echo requests have been completed on the part of the CP.		
	RESULT (for CMD = 9)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	**** ****$_H$	1. Word: Reply time in ms for the 1st ping echo request. 2. Word: Reply time in ms for the 2nd ping echo request. Example: 0005 FFFF$_H$ Echo 1 -> received after 5 ms Echo 2 -> no echo in the set monitoring time
	RESULT2	**** ****$_H$	1. Word: Reply time in ms for the 3rd ping echo request. 2. Word: Reply time in ms for the 4th ping echo request. Example: 0002 3456$_H$ Echo 3 -> received after 2 ms Echo 4 -> received after 13398 ms
	Range of values for data words in RESULT1 / RESULT 2:		
		0000$_H$	not used
		0001$_H$ ... EA60$_H$	Reply time in ms 0001$_H$ = 1 ms EA60$_H$ = 60000 ms
		EA61$_H$ ... FFFE$_H$	not used
		FFFF$_H$	Timeout: No echo within the specified monitoring time.

CMD	Meaning		
10	CONN_TYPE - Connection type This command requests the CP to specify the current connection type for the specified connection ID.		
	RESULT (for CMD = 10)		**Meaning**
	Parameter	**Hex value/range**	
	RESULT1	0000 000*$_H$	The request returns the following values for the possible connection types: 0: no connection set up 1: UDP connection 2: SMTP connection 3: TCP connection 4: Free UDP connection 5: FTP connection 6: ISO transport connection 7: ISOonTCP connection
	RESULT2	0000 0000$_H$	Default

See also

You will find further information in the FAQ under the following entry ID: 33414377 (https://support.industry.siemens.com/cs/ww/en/view/33414377)

2.4 Program blocks for FTP services

2.4.1 Overview of FTP

FB and FCs for FTP services (FTP client)

The following list shows the program blocks available for the FTP client services.

Note

Note that the FTP client services of older SIMATIC S7-300 CPUs, for example the CPU 312 or CPU 315-1AF01, cannot be used because they do not support SFC24.

The following applies to S7-300s when using FC40 - FC44: The CP requires the supplied FC5 (AG_SEND) to start the FTP FCs; do not rename the FC5 for this application.

Program block	can be used with:		Meaning
	S7-300	S7-400	
FTP_CMD (FB40)	•	•	Handling of complete FTP job sequences
FTP_CONNECT (FC40)	•	•	Establishing an FTP connection from client to server.
FTP_STORE (FC41)	•	•	Transferring a DB from client to server.
FTP_RETRIEVE (FC42)	•	•	Transferring a file from client to server.
FTP_DELETE (FC43)	•	•	Deleting a file on the server.
FTP_QUIT (FC44)	•	•	Terminating a connection established with the ID.

Using the program blocks

With the latest CP module types, you should preferably use FB40. As alternatives you can use FC40...FC44 if necessary and if they are available in the STEP 7 library.

Requirement - configured FTP connection

To manage an FTP request sequence between the S7 station as FTP client and an FTP server, you will need to configure an FTP connection. To do this, first configure an unspecified TCP connection with the additional "Use FTP protocol" attribute.

See also

Migration of FC 40-44 to FTP_CMD (Page 85)

2.4.2 FTP_CMD - universal program block for FTP services

Validity

FB40 can be used as of the following module types:

- As of CP 343-1 Advanced - GX30*) / GX31)
- As of CP 443-1 Advanced - GX20*) / GX30

  *) The commands 33 (CONNECT_PASSIVE), 17 (CONNECT_TLS_PRIVATE) and 49 (CONNECT_TLS_PRIVATE_PASSIVE) cannot be used.

  **) The commands 33 (CONNECT_PASSIVE) and 49 (CONNECT_TLS_PRIVATE_PASSIVE) cannot be used

The commands 33 "CONNECT_PASSIVE" and 49 "CONNECT_TLS_PRIVATE_PASSIVE" are only supported by the CP 443-1 Advanced as of firmware version V3.2 and as of block version 2.2.

2.4.2.1 Meaning and call - FTP_CMD

Meaning

Using FB40, you can establish FTP connections and transfer files from and to an FTP server.

FB40 replaces the FTP functions FC40 to FC44 used previously. The differences in these functions are mapped to a command parameter in FB40.

The advantages of FB40 are as follows:

- Simplification in the user program by using a command variable instead of different function calls
- The AG_SEND (FC5) function is not required here.
- The following commands with the parameter “CMD” provide additional functions:
  - APPEND

    The command allows data to be appended to an existing file.
  - RETR_PART

    The command allows selected data areas to be read from a file.
  - CONNECT_PASSIVE

    Command for establishing an FTP connection

    The client establishes the data connection, the server is in passive mode.
  - CONNECT_TLS_PRIVATE

    Command for establishing an SSL secured FTP connection

    The server actively establishes the FTP data connection.
  - CONNECT_TLS_PRIVATE_PASSIVE

    Command for establishing an SSL secured FTP connection

    The client establishes the data connection, the server is in passive mode.

Call interface

Call interface in FBD representation

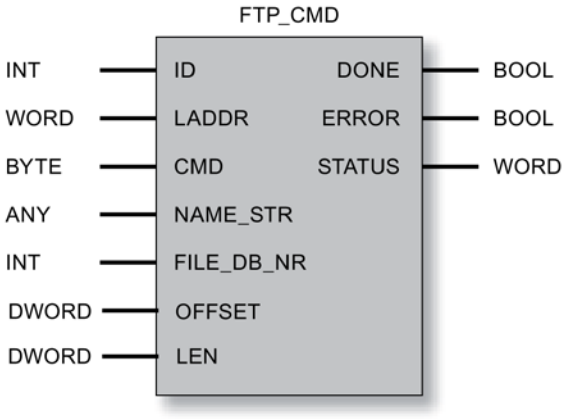


Table 2- 8 Example of a call in STL representation

STL	Explanation
`CALL FB 40, DB 40 (`	`// Block call`
`ID := 4,`	`// FTP connection ID acc. to configuration`
`LADDR := W#16#3FFD,`	`// Module address acc. to configuration`
`CMD := B#16#3,`	`// The FTP command to be executed`
`NAME_STR := P#DB44.DBX 170.0 BYTE 220,`	`// Target data area address and length`
`FILE_DB_NR := 42,`	`// Number of the data block`
`OFFSET := DW#16#0,`	`// (not relevant in example)`
`LEN := DW#16#0,`	`// (not relevant in example)`
`DONE := M 420.1,`	`// Status parameter`
`ERROR := M 420.2,`	`// Error information`
`STATUS := MW 422);`	`// Status information`

System functions called

The following system functions are called by the program block FTP_CMD:

SFC 1, SFC 20, SFC 24, SFC 58, SFC 59

Note

Note that the FTP client services of old SIMATIC S7-300 CPUs, for example the CPU 312 or CPU 315-1AF01, cannot be used because they do not support SFC24.

2.4.2.2 Input parameter - FTP_CMD

Explanation of the input parameters

Each FTP block call must be supplied with the following input parameters:

Table 2- 9 Formal parameters of FB40 (FTP_CMD) - input parameters

Parameter	Declaration	Type	Range of values	Meaning / remarks
ID	INPUT	INT	For S7-300: 1 ... 16 For S7-400: 1 ... 64	The FTP jobs are handled on FTP connections. The parameter identifies the connection being used.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
CMD	INPUT	BYTE	See table below - FTP commands in the "CMD" parameter	FTP commands executed when FB40 is called. You will find further information following the table. If a command is not supported by the CP firmware, an error message with STATUS = $8F6B_H$ is output. Examples of FTP commands: • RETRIEVE: B#16#3 • CONNECT_TLS_PRIVATE: B#16#11
NAME_STR	INPUT	ANY	Only "BYTE" is permitted as VARTYPE.	The address references a data block area. Here, you specify the address and length of the data area in which the target data is entered. • When CMD = 1, 33, 17, 49: With this command, the "NAME_STR" parameter specifies the FTP server to be addressed over the FTP connection with the following attributes: - IP address of the FTP server - User name - Password for the login These values must be specified as consecutive strings in the destination range of the ANY pointer. • When CMD = 2, 3, 4, 6, 7: With this command, the "NAME_STR" parameter specifies the file name on the FTP server, in other words, the data source or data destination. The file name is specified as a string in the destination range of the ANY pointer. • When CMD = 5: Parameter not relevant You will find example of content further below.

Parameter	Declaration	Type	Range of values	Meaning / remarks
FILE_DB_NR	INPUT	INT		The data block specified here contains the file DB to be read / written. The parameter is relevant only when CMD = 2, 3, 6 and 7.
OFFSET	INPUT	DWORD		Only when CMD = 7: Offset in bytes starting at which the file will be read.
LEN	INPUT	DWORD		Only when CMD = 7: Sublength in bytes that is read starting at the value specified in "OFFSET". Special features: • If "DW#16#FFFFFFFF" is specified, the available rest of the file will be read. Result OK (DONE = 1, STATUS = 0) if no other error occurred. • When OFFSET > length of the original file: The length of the destination file is displayed in this case in the ACT_LENGTH parameter in the file DB: 0 bytes on the CPU. Result OK (DONE = 1, STATUS = 0) if no other error occurred. • When OFFSET + LEN > length of the original file (and LEN ≠ 0xFFFFFFFF): The length of the destination file is displayed in this case in the ACT_LENGTH parameter in the file DB: Available bytes starting at "OFFSET". Result OK (DONE = 1, STATUS = 0) if no other error occurred.

FTP commands in the "CMD" parameter

The following table explains the meaning of the commands of the "CMD" parameter and which input parameters need to be supplied. The ID and LADDR parameters must always be set to identify the connection.

Table 2- 10 FTP commands in the "CMD" parameter

Command	Relevant input parameters (in addition to ID and LADDR)	Meaning / handling
0 (NOOP)	-	The called FC does not execute any action. The status codes are set as follows when these parameters are supplied: DONE=1; ERROR=0; STATUS=0
1 (CONNECT)	NAME_STR	With this command, the FTP client establishes an FTP connection to an FTP server (active FTP). The connection is available under the connection ID specified here for all further FTP commands. Data is then exchanged with the FTP server specified for this user. Sequence (shortened): 1. The client sends a query to the control port 21 of the server. The client also sends the number of the data port to the server and opens it. 2. The server acknowledges the query to the client. 3. The server establishes the data connection to the client from its port 20.
33 (CONNECT_PASSIVE)	NAME_STR	With this command, the FTP client establishes an FTP connection to an FTP server (passive FTP). The connection is available under the connection ID specified here for all further FTP commands. Data is then exchanged with the FTP server specified for this user. The use of this command is recommended if the client is located in a protected (internal) subnet. Sequence (shortened): 1. The client sends a query to the control port 21 of the server. The client sends the “PASV” command to the server that does not then establish a data connection. 2. The server acknowledges the query and sends the client its port number for the data connection. 3. The client establishes the data connection to the server with the port number specified by the server.
2 (STORE)	NAME_STR FILE_DB_NR	This function call transfers a data block (file DB) from the FTP client (S7-CPU) to the FTP server. Caution: If the file (file DB) already exists on the FTP server, it will be overwritten.
3 (RETRIEVE)	NAME_STR FILE_DB_NR	This function call transfers a file from the FTP server to the FTP client (S7-CPU). Caution: If the data block (file DB) on the FTP client already contains a file, it will be overwritten.
4 (DELETE)	NAME_STR	With this function call, you delete a file on the FTP server.
5 (QUIT)	-	With this function call, you establish the FTP connections selected with the ID.

Command	Relevant input parameters (in addition to ID and LADDR)	Meaning / handling
6 (APPEND)	NAME_STR FILE_DB_NR	Similar to "STORE", the "APPEND" command saves a file on the FTP server. With "APPEND", the file on the FTP server is, however, not overwritten. The new content is appended to the existing file. If the file (file DB) does not exist on the FTP server, it will be created.
7 (RETR_PART)	NAME_STR FILE_DB_NR OFFSET LEN	Using the "RETR_PART" command (retrieve part) , you can request a section of a file from the FTP server. If very large files are involved, this allows you to restrict the read to the part you currently require. To do this, you need to know the structure of the file. Enter the required part of the file using the two parameters "OFFSET" and "LEN" in FB40.
17 (CONNECT_TLS_PRIVATE)	NAME_STR	With the "CONNECT_TLS_PRIVATE" command, the FTP client sets up an active SSL-secured FTP connection (FTPS) to the FTP server (active FTP). The data of the control connection and the data connection is transferred encrypted. The connection is available under the connection ID specified here for all further FTP commands. Data is then exchanged with the FTP server specified for this user. Requirements: The FTPS server certificate must be imported into the CP configuration (Security). Sequence (shortened): 1. The client sends a query to the control port 21 of the server. The client also sends the number of the data port to the server and opens it. 2. The server acknowledges the query to the client. 3. The server establishes the data connection to the client from its port 20.
49 (CONNECT_TLS_PRIVATE_PASSIVE)	NAME_STR	With the "CONNECT_TLS_PRIVATE" command, the FTP client sets up an SSL-secured FTP connection (FTPS) to the FTP server (passive FTP). The data of the control connection and the data connection is transferred encrypted. The connection is available under the connection ID specified here for all further FTP commands. Data is then exchanged with the FTP server specified for this user. Requirements: The FTPS server certificate must be imported into the CP configuration (Security). Sequence (shortened): 1. The client sends a query to the control port 21 of the server. The client sends the “PASV” command to the server that does not then establish a data connection. 2. The server acknowledges the query and sends the client its port number for the data connection. 3. The client establishes the data connection to the server with the port number specified by the server.

Examples of the content of the "NAME_STR" parameter

The parameter record has the following content:

Table 2- 11 Content of the parameter record for CMD = 1, 17, 33, 49

Relative address 2)	Name	Type 1)	Example	Meaning
0.0	ip_address	STRING[100]	’142.11.25.135’	IP address of the FTP server
102.0	username	STRING[32]	'user'	User name for the login on the FTP server
136.0	password	STRING[32]	'password'	Password for the login on the FTP server
1) The maximum possible string length is specified 2) The specified values relate to the string lengths specified in "Type".				

Table 2- 12 Content of the parameter record for CMD = 2, 3, 4, 6, 7

Relative address 2)	Name	Type 1)	Example	Meaning
170.0	filename	STRING[220] or STRING[212]	'plant1/tank2/press.dat'	Name of the destination or source file Note: When CMD=7 (RETR_PART), the maximum length of the file name is limited to 212 characters.
1) The maximum possible string length is specified 2) The specified values relate to the string lengths specified in "Type".				

2.4.2.3 Output parameters and status information - FTP_CMD

Introduction

For status evaluation, the following parameters must be evaluated in the user program:

Table 2- 13 Formal parameters of FB40 (FTP_CMD) - output parameters

Parameter	Declaration	Type	Range of values	Meaning / remarks
DONE	OUTPUT	BOOL	0: - 1: Job done	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: - 1: Error/fault	Error code This parameter signals that the job could not be executed error-free.
STATUS	OUTPUT	WORD	See following table	Status code This parameter supplies detailed information about the execution of the job.

The DONE, ERROR and STATUS parameters are updated at every block call.

Example

During job execution, the FB40 returns the following codes:

- DONE=0
- ERROR=0
- STATUS=8181_H

Meaning: Job still running.

Evaluating status codes

Note

For entries coded with 8FxxH in STATUS, refer to the information in the STEP 7 Standard and System Functions reference manual. The chapter describing error evaluation with the RET_VAL output parameter contains detailed information.

Table 2- 14 FB 40: Meaning of the STATUS parameter in conjunction with DONE and ERROR

DONE	ERROR	STATUS	Meaning
0	0	0000_H	No job being executed.
1	0	0000_H	Job completed without error.

DONE	ERROR	STATUS	Meaning
0	0	8181_H	Job active. If 8181_H is indicated permanently: The CP is not released for FB40. An illegal command was for the firmware version was called: CMD 6 / CMD 7 / CMD 17 / CMD 33 / CMD 49
0	1	8090_H	• No module with this module start address exists. • The block being used does not match the system family being used (remember to use different blocks for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary
0	1	8092_H	Type information in the ANY pointer is not byte
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established (with newer CPU versions). This can, for example, be caused by the following: • No connection configuration • Maximum number of CPs operating at the same time was exceeded
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	Destination area invalid; for example, destination area > 240 bytes.
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established (with older CPU versions). (with newer CPU versions, see $80A4_H$)
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Module start address incorrect.
0	1	8180_H	There is no data available yet.
0	1	8183_H	The configuration does not match the job parameters.
0	1	8184_H	Illegal data type specified for the NAME_STR parameter.
0	1	8185_H	Destination buffer (LEN) is too small.
0	1	8186_H	ID parameter invalid. ID = 1, 2....64
0	1	8302_H	No receive resources available on the destination station.
0	1	8304_H	FTP connection not established. Wrong or non-existent connection ID.
0	1	$8F22_H$	Source area invalid, for example: Area does not exist in the DB
0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short).
0	1	$8F24_H$	Range error when reading a parameter
0	1	$8F28_H$	Alignment error reading a parameter
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error
0	1	$8F3A_H$	Area not loaded (DB)

DONE	ERROR	STATUS	Meaning
0	1	8F50$_H$	File DB DB 0 or DB does not exist
0	1	8F51$_H$	Specified file DB data area larger than existing data area
0	1	8F52$_H$	File DB in write-protected memory
0	1	8F53$_H$	File DB max. length < current length
0	1	8F54$_H$	File DB does not contain any valid data.
0	1	8F55$_H$	Header status bit: Locked
0	1	8F56$_H$	The NEW bit in the file DB header was not reset
0	1	8F57$_H$	The FTP client does not have write access to the file DB but rather the FTP server (header status bit: WriteAccess).
0	1	8F60$_H$	Bad user data, for example bad IP address of the FTP server
0	1	8F61$_H$	FTP server not obtainable
0	1	8F62$_H$	Possible meanings: • Job not supported or rejected by FTP server • The FTP server does not support SSL-secured connections.
0	1	8F63$_H$	File transfer aborted by the FTP server
0	1	8F64$_H$	Error on the FTP control connection; data could not be sent or received; the FTP control connection must be established again after such an error.
0	1	8F65$_H$	Error on the FTP data connection; data could not be sent or received. The job must be called again. This error can, for example, be caused by RETRIEVE (CMD=3) when the addressed file is already open on the FTP server.
0	1	8F66$_H$	Error reading/writing data from/to the CPU (for example DB does not exist or too short)
0	1	8F67$_H$	Error in the FTP client on the CP; for example attempting to open more than the maximum number of FTP connections.
0	1	8F68$_H$	The job was rejected by the FTP client. This error can, for example, be caused by RETRIEVE (CMD=3) when the value for the parameter MAX_LENGTH was selected too low in the file DB header.
0	1	8F69$_H$	The FTP connection in an incorrect status, for example: • The connection is called without a previous connection termination (with the same connection ID) • There is a connection termination for a connection that has already been terminated; • A STORE command was sent on a connection that is not established.
0	1	8F6A$_H$	The connection could not be established due to a temporary resource bottleneck. Remedy: Repeat the block call.

DONE	ERROR	STATUS	Meaning
0	1	$8F6B_H$	Possible causes: • Wrong value for the CMD parameter • An FB40 command is not supported. Possible cause: Wrong firmware on the CP Remedy: Firmware update (with older CPs, use the functions FC 40...FC 44 instead of FB 40.)
0	1	$8F6C_H$	A value > 7FFF FFF_H was set in the OFFSET parameter.
0	1	$8F6D_H$	The FTP client does not support SSL-secured connections.
0	1	$8F6E_H$	The signature of the certificate is invalid.
0	1	$8F6F_H$	Possible causes: • The certificate contains an invalid value for "notBefore". • The certificate is invalid: The "notBefore" entry contains a time after the current time.
0	1	$8F70_H$	Possible causes: • The certificate contains an invalid value for "notAfter". • The certificate has expired: The "notAfter" entry contains a time before the current time.
0	1	$8F71_H$	The CA certificate of a non-trustworthy device certificate could not be found.
0	1	$8F72_H$	The original CA certificate is invalid. This is either not a CA certificate or its expansions are not consistent with the intended purpose.
0	1	$8F73_H$	The original CA certificate is marked as not trustworthy for the specified purpose.
0	1	$8F74_H$	Other errors occurred during the verification of a certificate.
0	1	$8F7F_H$	Internal error, for example illegal ANY reference

2.4.2.4 Migration of FC 40-44 to FTP_CMD

Comparison of the function block FB40 with older functions FC40...44

All CPs with FTP functionality support the functions FC40...44. This means that existing user programs can be used unchanged.

If you want to convert from the FTP functions FC40...44 to FB40, you will need to modify your user program.

The following table shows the FB40 commands used to replace the functions FC40...44.

- Correlation is indicated by "X".
- Where there is no correlation, this is indicated by "-".

	Commands of the "CMD" parameter of FTP_CMD					
Older FTP functions FC40...44	**CMD = 1**	**CMD = 2**	**CMD = 3**	**CMD = 4**	**CMD = 5**	**CMD = 6 / 7 / 17 / / 33 / 49**
FC40	X [1]					
FC41		X [2]				
FC42			X [3]			
FC43				X [4]		
FC44					X	
						-

[1] ...[4] The parameters of FC40...43 and CMD 1...4 (FB40) are not identical (see table below).

The corresponding parameters that specify a particular function in the functions FC40...FC43 or in the commands of FB40 are listed in the following table.

Parameters of the FC			Parameters in FTP_CMD (with CMD 1...4)	
FC40:	LOGIN	→	CMD = 1:	NAME_STR
FC41:	FILE_NAME	→	CMD = 2:	NAME_STR
FC42:	FILE_NAME	→	CMD = 3:	NAME_STR
FC43:	FILE_NAME	→	CMD = 4:	NAME_STR
FC40...43:	BUFFER_DB_NR	→	Omitted (replaced by instance DB)	

2.4.3 FTP_CONNECT

2.4.3.1 Meaning and call - FTP_CONNECT

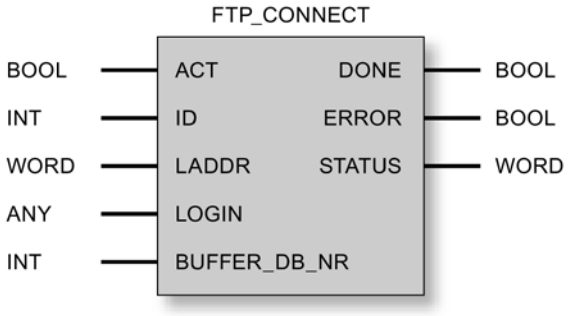
Meaning

With this function call, the FTP client establishes an FTP connection to an FTP server.

The IP address of the FTP server, the user identification (username) and (if necessary) the password for user identification must be transferred to the FTP server.

All further access by the FTP client is then based on this user identification if you use the same FTP connection ID. Data is then exchanged with the FTP server specified for this user.

Call interface



Example of a call in STL representation

STL	Explanation
call fc40 (	//Call FTP_CONNECT
ACT := M 420.0,	//Job triggered by memory bit
ID := 4,	//FTP connection ID acc. to configuration
LADDR := W#16#3FFD,	//Module address acc. to configuration
LOGIN := P#DB40.DBX 0.0 BYTE 170,	//Information for LOGIN in DB40
BUFFER_DB_NR := 9,	//Buffer area for FTP service
DONE := M 420.1,	
ERROR := M 420.2,	
STATUS := MW 422);	

2.4.3.2 Explanation of the formal parameters - FTP_CONNECT

Explanation of the general call parameters

The general parameters have the same significance in every FTP function call; they are therefore described in one section.

Explanation of the formal parameters specific to the call

Table 2- 15 Formal parameters for FTP_CONNECT

Parameter	Declaration	Data type	Description
LOGIN	INPUT	ANY (only the following are permitted as VARTYPE: BYTE)	This parameter specifies the FTP server to be accessed on the FTP connection. (for further details, refer to the following table) Here, you specify the address and length of the data area in which the target data are entered. The address references a data block area. The ANY pointer data type is used to address this area. For more detailed information on this data type, refer to the STEP 7 online help under the appendix topic "Format of the parameter type ANY".
BUFFER_DB_NR	INPUT	INT	Here, you enter a data block required as a buffer area by the FTP client for FTP transfer. You can use the same data block as the buffer area for all FTP jobs. Note: The length of the reserved DB must be **at least 255 bytes**!

LOGIN parameter

This parameter record has the following content for FTP_CONNECT:

Relative address [2]	Name	Type [1]	Example	Meaning
0.0	ip_address	STRING[100]	'142.11.25.135'	IP address of the FTP server.
102.0	username	STRING[32]	'user'	User name for the login on the FTP server.
136.0	password	STRING[32]	'password'	Password for the login on the FTP server.
170.0	filename	STRING[220]	'plant1/tank2/press.dat'	Name of the destination or source file [3]

1) in each case, the maximum possible string length is specified

2) The specified values relate to the string lengths specified in "Type".

3) These rows are irrelevant for this call.

2.4.4 FTP_STORE

2.4.4.1 Meaning and call - FTP_STORE

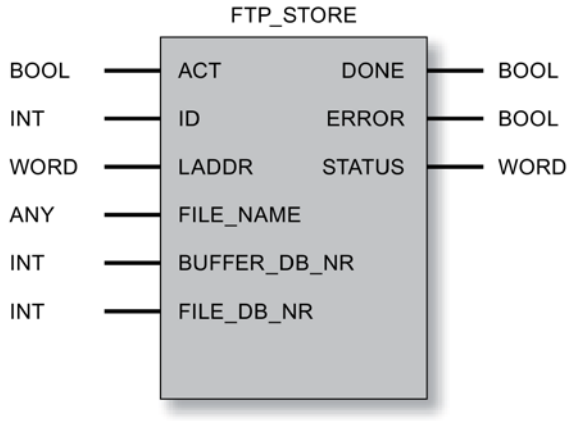
Meaning

This function call transfers a data block (file DB) from the FTP client (S7-CPU) to the FTP server.

You need to specify the data block that contains the file. You will also have to select the path/file name under which the file will be created on the FTP server.

If the file (file DB) already exists on the FTP server, it will be overwritten.

Call interface



Example of a call in STL representation

STL	Explanation
`call fc41 (`	`//Call FTP_STORE`
`ACT := M 420.0,`	`//Job triggered by memory bit`
`ID := 4,`	`//FTP connection ID acc. to configuration`
`LADDR := W#16#3FFD,`	`//Module address acc. to configuration`
`FILE_NAME := P#DB40.DBX 170.0 BYTE 220,`	`//Information for target file in DB40`
`BUFFER_DB_NR := 9,`	`//Buffer area for FTP service`
`FILE_DB_NR := 42,`	`DB no. in source file`
`DONE := M 420.1,`	
`ERROR := M 420.2,`	
`STATUS := MW 422);`	

2.4.4.2 Explanation of the formal parameters - FTP_STORE

Explanation of the general call parameters

The general parameters have the same significance in every FTP function call; they are therefore described in one section.

Explanation of the formal parameters specific to the call

Table 2- 16 Formal parameters for FTP_STORE

Parameter	Declaration	Data type	Description
FILE_NAME	INPUT	ANY (only the following are permitted as VARTYPE: BYTE)	This parameter specifies the data destination. (for further details, refer to the following table) Here, you specify the address and length of the data area in which the target data are entered. The address references a data block area. The ANY pointer data type is used to address this area. For more detailed information on this data type, refer to the STEP 7 online help under the appendix topic "Format of the parameter type ANY".
BUFFER_DB_NR	INPUT	INT	Here, you enter a data block required as a buffer area by the FTP client for FTP transfer. You can use the same data block as the buffer area for all FTP jobs. Note: The length of the reserved DB must be at least 255 bytes!
FILE_DB_NR	INPUT	INT	The data block specified here contains the file DB to be read.

FILE_NAME parameter

This parameter record has the following content for FTP_STORE:

Relative address [2]	Name	Type [1]	Example	Meaning
0.0	ip_address	STRING[100]	'142.11.25.135'	IP address of the FTP server. [3]
102.0[1]	username	STRING[32]	'user'	User name for the login on the FTP server. [3]
136.0	password	STRING[32]	'password'	Password for the login on the FTP server. [3]
170.0	filename	STRING[220]	'plant1/tank2/press.dat'	Name of the destination or source file

[1] in each case, the maximum possible string length is specified

[2] The specified values relate to the string lengths specified in "Type".

[3] These rows are irrelevant for this call.

2.4.5 FTP_RETRIEVE

2.4.5.1 Meaning and call - FTP_RETRIEVE

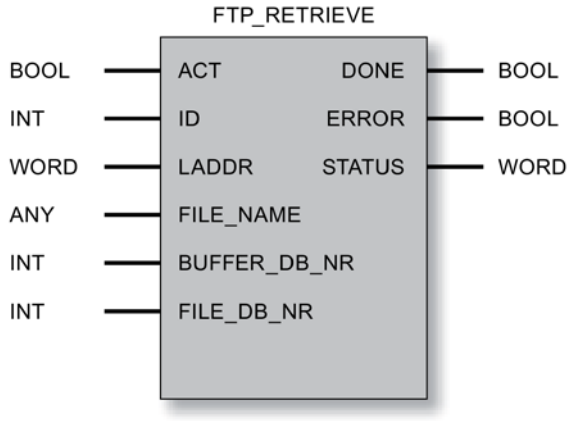
Meaning

This function call transfers a file from the FTP server to the FTP client (S7-CPU).

You need to specify the data block in which the file will be entered. You will also have to select the path/file name under which the file is located on the FTP server.

If the data block (file DB) on the FTP client already contains a file, it will be overwritten.

Call interface



Example of a call in STL representation

STL	Explanation
`call fc42 (`	`//Call FTP_RETRIEVE`
`ACT := M 420.0,`	`//Job triggered by memory bit`
`ID := 4,`	`//FTP connection ID acc. to configuration`
`LADDR := W#16#3FFD,`	`//Module address acc. to configuration`
`FILE_NAME := P#DB40.DBX 170.0 BYTE 220,`	`//Information for source file in DB40`
`BUFFER_DB_NR := 9,`	`//Buffer area for FTP service`
`FILE_DB_NR := 42,`	`DB no. in target file`
`DONE := M 420.1,`	
`ERROR := M 420.2,`	
`STATUS := MW 422);`	

2.4.5.2 Explanation of the formal parameters - FTP_RETRIEVE

Explanation of the general call parameters

The general parameters have the same significance in every FTP function call; they are therefore described in one section.

Explanation of the formal parameters specific to the call

Table 2- 17 Formal parameters for FTP_RETRIEVE

Parameter	Declaration	Data type	Description
FILE_NAME	INPUT	ANY (only the following are permitted as VARTYPE: BYTE)	This parameter specifies the data source. (for further details, refer to the following table) Here, you specify the address and length of the data area in which the target data are entered. The address references a data block area. The ANY pointer data type is used to address this area. For more detailed information on this data type, refer to the STEP 7 online help under the appendix topic "Format of the parameter type ANY".
BUFFER_DB_NR	INPUT	INT	Here, you enter a data block required as a buffer area by the FTP client for FTP transfer. You can use the same data block as the buffer area for all FTP jobs. Note: The length of the reserved DB must be **at least 255 bytes**!
FILE_DB_NR	INPUT	INT	The data block specified here contains the file DB to be written (data destination).

FILE_NAME parameter

This parameter record has the following content for FTP_RETRIEVE:

Relative address [2]	Name	Type [1]	Example	Meaning
0.0	ip_address	STRING[100]	'142.11.25.135'	IP address of the FTP server. [3]
102.0	username	STRING[32]	'user'	User name for the login on the FTP server. [3]
136.0	password	STRING[32]	'password'	Password for the login on the FTP server. [3]
170.0	filename	STRING[220]	'plant1/tank2/press.dat'	Name of the destination or source file

[1] in each case, the maximum possible string length is specified

[2] The specified values relate to the string lengths specified in "Type".

[3] These rows are irrelevant for this call.

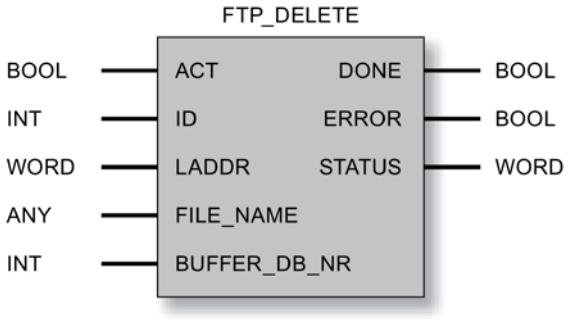
2.4.6 FTP_DELETE

2.4.6.1 Meaning and call - FTP_DELETE

Meaning

With this function call, you delete a file on the FTP server.

Call interface



Example of a call in STL representation

STL	Explanation
`call fc43 (`	`//Call FTP_DELETE`
`ACT := M 420.0,`	`//Job triggered by memory bit`
`ID := 4,`	`//FTP connection ID acc. to configuration`
`LADDR := W#16#3FFD,`	`//Module address acc. to configuration`
`FILE_NAME := P#DB40.DBX 170.0 BYTE 220,`	`//Information for target file in DB40`
`BUFFER_DB_NR := 9,`	`//Buffer area for FTP service`
`DONE := M 420.1,`	
`ERROR := M 420.2,`	
`STATUS := MW 422);`	

2.4.6.2 Explanation of the formal parameter - FTP_DELETE

Explanation of the general call parameters

The general parameters have the same significance in every FTP function call; they are therefore described in one section.

Explanation of the formal parameters specific to the call

Table 2- 18 Formal parameters for FTP_DELETE

Parameter	Declaration	Data type	Description
FILE_NAME	INPUT	ANY (only the following are permitted as VARTYPE: BYTE)	This parameter specifies the data destination. (for further details, refer to the following table) Here, you specify the address and length of the data area in which the target data are entered. The address references a data block area. The ANY pointer data type is used to address this area. For more detailed information on this data type, refer to the STEP 7 online help under the appendix topic "Format of the parameter type ANY".
BUFFER_DB_NR	INPUT	INT	Here, you enter a data block required as a buffer area by the FTP client for FTP transfer. You can use the same data block as the buffer area for all FTP jobs. Note: The length of the reserved DB must be **at least 255 bytes**!

LOGIN parameter

This parameter record has the following content for FTP_DELETE:

Relative address [2]	Name	Type [1]	Example	Meaning
0.0	ip_address	STRING[100]	'142.11.25.135'	IP address of the FTP server. [3]
102.0	username	STRING[32]	'user'	User name for the login on the FTP server. [3]
136.0	password	STRING[32]	'password'	Password for the login on the FTP server. [3]
170.0	filename	STRING[220]	'plant1/tank2/press.dat'	Name of the destination or source file

[1] in each case, the maximum possible string length is specified

[2] The specified values relate to the string lengths specified in "Type".

[3] These rows are irrelevant for this call.

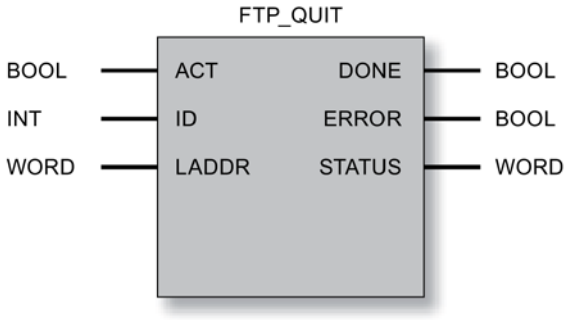
2.4.7 FTP_QUIT

2.4.7.1 Meaning and call - FTP_QUIT

Meaning

With this function call, you establish the FTP connections selected with the ID.

Call interface



Example of a call in STL representation

STL	Explanation
`call fc44 (`	`//Call FTP_QUIT`
`ACT := M 420.0,`	`//Job triggered by memory bit`
`ID := 4,`	`//FTP connection ID acc. to configuration`
`LADDR := W#16#3FFD,`	`//Module address acc. to configuration`
`DONE := M 420.1,`	
`ERROR := M 420.2,`	
`STATUS := MW 422);`	

Note

The output of FC44 must be assigned a memory word as value. If you enter DBx.DWy, an error message is displayed (applies only to S7-300).

2.4.7.2 Explanation of the formal parameters - FTP_QUIT

Explanation of the general call parameters

The general parameters have the same significance in every FTP function call; they are therefore described in one section.

2.4.8 Parameters for CP and connection assignment (input parameters)

Parameters for CP and connection assignment (input parameters)

Apart from the input parameters specific to the jobs started with each FTP block call, the following general input parameters must also have values supplied to them:

Parameter	Declaration	Type [1]	Possible values	Meaning
ACT	INPUT	BOOL	0.1	The parameter contains the initialization bit for triggering the job. • If ACT = 1, the job is executed. During job execution, the FC returns the following codes: – DONE=0 – ERROR=0 – STATUS=8181$_H$ • If ACT = 0, the called FC does not execute any actions; the status codes are then as follows for these parameters settings: – DONE=0 – ERROR=1 – STATUS=8F70$_H$ Note / recommendation: You should execute the FTP calls conditionally in your application, for example by evaluating the codes. It is not a good idea to control the call using the ACT bit. The ACT bit must be set to 1 until the execution is signaled by the DONE bit.
ID	INPUT	INT	1,2...64	The FTP jobs are handled on FTP connections. The parameter identifies the connection being used.
LADDR	INPUT	WORD		Module start address When you call an FC, you transfer the module start address of the ADVANCED-CP in the LADDR parameter. You will find the module start address of the ADVANCED-CP in the configuration of the properties of the ADVANCED-CP in "Addresses > Inputs".

NOTICE

Make sure that only one FTP client program block is called per user ID as long as ACT = 1 is set.

For example, FTP_STORE and FTP_RETRIEVE must not be running on the same FTP connection at the same time. This requirement corresponds to normal FTP functionality.

Otherwise you cannot rely on the correctness of the output parameters (DONE bit, ERROR bit and STATUS word).

2.4.9 Status information (output parameters)

Status information (output parameters)

For status evaluation, the following parameters must be evaluated in the user program:

Parameter	Declaration	Type [1)]	Possible values	Meaning
DONE	OUTPUT	BOOL	0: - 1: Job done	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: - 1: Error situation	Error code This parameter signals that the job could not be executed error-free.
STATUS	OUTPUT	WORD	See following table	Status code This parameter supplies detailed information about the execution of the job.

Note

For FC FTP_QUIT, use only the data type memory word for the STATUS parameter (applies only to the CP 343-1 IT).

Example

During job execution, the FC returns the following codes:

- DONE=0
- ERROR=0
- STATUS=8181_H

Evaluating status codes

Remember that the status codes DONE, ERROR, STATUS are updated at each block call.

Note

For entries coded with 8FxxH in STATUS, refer to the information in the STEP 7 Standard and System Functions reference manual. The chapter describing error evaluation with the RET_VAL output parameter contains detailed information

DONE	ERROR	STATUS	Meaning
1	0	0000_H	Job completed without error.
0	0	0000_H	No job being executed.
0	0	8181_H	Job active.

DONE	ERROR	STATUS	Meaning
0	1	8090_H	• No module with this module start address exists. • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary.
0	1	8092_H	Type information in the ANY pointer is not byte.
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established. (with newer CPU versions). This can, for example, be caused by the following: • No connection configuration; • Maximum number of CPs operating at the same time was exceeded.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	• Destination area invalid. for example, destination area > 240 bytes.
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established (with older CPU versions; otherwise $80A4_H$; for further information, refer to this code)
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Module start address incorrect.
0	1	8183_H	The configuration does not match the job parameters.
0	1	8184_H	Bad data type specified for the FILE_NAME / LOGIN parameter.
0	1	8186_H	ID parameter invalid. ID != 1,2....64.
0	1	$8F22_H$	Source area invalid, for example: Area does not exist in the DB
0	1	$8F24_H$	Area error reading a parameter.
0	1	$8F28_H$	Alignment error reading a parameter.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Area not loaded (DB).
0	1	$8F50_H$	File DB DB 0 or DB does not exist
0	1	$8F51_H$	Specified file DB data area larger than existing data area
0	1	$8F52_H$	File DB in write-protected memory
0	1	$8F53_H$	File DB max. length < current length
0	1	$8F54_H$	File DB does not contain any valid data
0	1	$8F55_H$	Header status bit: Locked
0	1	$8F56_H$	The NEW bit in the file DB header was not reset
0	1	$8F57_H$	The FTP client does not have write access to the file DB but rather the FTP server (header status bit: WriteAccess)
0	1	$8F5A_H$	Buffer DB DB 0 or DB does not exist
0	1	$8F5B_H$	Buffer DB data area too short

DONE	ERROR	STATUS	Meaning
0	1	$8F5C_H$	Buffer DB in write-protected memory
0	1	$8F60_H$	Bad user data, for example bad IP address of the FTP server
0	1	$8F61_H$	FTP server not obtainable
0	1	$8F62_H$	Job not supported or rejected by FTP server
0	1	$8F63_H$	File transfer aborted by the FTP server
0	1	$8F64_H$	Error on the FTP control connection; data could not be sent or received; the FTP control connection must be established again after such an error.
0	1	$8F65_H$	Error on the FTP data connection; data could not be sent or received; the job (FTP_STORE or FTP_RETRIEVE) must be called again. This error can, for example, be caused by FTP_RETRIEVE when the addressed file is already open on the FTP server.
0	1	$8F66_H$	Error reading/writing data from/to the CPU (for example DB does not exist or too short)
0	1	$8F67_H$	Error in the FTP client on the CP; for example attempting to open more than 10 FTP connections.
0	1	$8F68_H$	The job was rejected by the FTP client This error can, for example, be caused by FTP_RETRIEVE when the value for the parameter MAX_LENGTH was selected too low in the file DB header.
0	1	$8F69_H$	FTP connection in the incorrect status for this call, for example a double connect call or when attempting to retrieve without previously connecting (using the same connection ID)
0	1	$8F6A_H$	The connection could not be established due to a temporary resource bottleneck. Remedy: Repeat the block call.
0	1	$8F6C_H$	The connection could not be established; the FTP client only supports only SSL-secured connections. Remedy: Use program block FTP_CMD.
0	1	$8F70_H$	Calling an FTP client block with ACT = 0
0	1	$8F7F_H$	Internal error, for example illegal ANY reference

2.4.10 Data block file DB

2.4.10.1 Structure of the data blocks (file DBs) for FTP services - FTP client mode

Procedure

To transfer data with FTP, create data blocks (file DBs) on the CPU of your S7 station. These data blocks must have certain structure to allow them to be handled as transferable files by the FTP services. They consist of the following sections:

- Section 1: File DB header (has a fixed length of 20 bytes)
- Section 2: User data (has a variable length and structure)

File DB header for FTP client mode

Note: The file DB header described here is largely identical to the file DB header for server mode. The differences relate to the following parameters:

- WRITE_ACCESS
- FTP_REPLY_CODE

Parameter	Type	Value / meaning	Supply
EXIST	BOOL	The EXIST bit indicates whether the user data area contains valid data. The retrieve FTP command executes the job only when EXIST=1. • 0: The file DB does not contain valid user data ("file does not exist"). • 1: The file DB contains valid user data ("file exists").	The dele FTP command sets EXIST=0; The stor FTP command sets EXIST=1;
LOCKED	BOOL	The LOCKED bit is used to restrict access to the file DB. • 0: The file DB can be accessed. • 1: The file DB is locked.	The stor and retr FTP commands set LOCKED=1 when they are executed. The following function is also possible when writing from the user program: The user program on the S7 CPU can set or reset LOCKED during write access to achieve data consistency. Recommended sequence in the user program: 1. Check LOCKED bit; if = 0 2. Set WRITEACCESS bit = 0 3. Check LOCKED bit; if = 0 4. Set LOCKED bit = 1 5. Write data 6. Set LOCKED bit = 0

Parameter	Type	Value / meaning	Supply
NEW	BOOL	The NEW bit indicates whether data has been modified since the last read access. • 0: The content of the file DB is unchanged since the last write access. The user program of the S7 CPU has registered the last modification. • 1: The user program of the S7 CPU has not yet registered the last write access.	After execution, the stor FTP command sets NEW=1 After reading the data, the user program in the S7-CPU must set NEW=0 to allow a new retr command.
WRITE_ACCESS	BOOL	0: The user program (FTP client blocks) has write access rights for the file DBs on the S7 CPU. 1: The user program (FTP client blocks) has no write access rights for the file DBs on the S7 CPU.	During the configuration of the DB, the bit is set to an initialization value. Recommendation: Whenever possible, the bit should remain unchanged! In special situations, adaptation during operation is possible.
ACT_LENGTH	DINT	Current length of the user data area. The content of this field is only valid when EXIST = 1.	The current length is updated following write access.
MAX_LENGTH	DINT	Maximum length of the user data area (length of the entire DB less 20 bytes header).	The maximum length should be specified during configuration of the DB. The value can also be modified by the user program during operation.
FTP_REPLY_CODE	INT	Unsigned integer (16-bit) containing the last reply code from FTP as a binary value. The content of this field is only valid when EXIST = 1.	This is updated by the FTP client when the FTP command is executed.
DATE_TIME	DATE_AND_TIME	Date and time of the last modification to the file. The content of this field is only valid when EXIST = 1.	The current date is updated following a write access. If the function for forwarding the time of day is used, the entry corresponds to the time that was passed on. If the function for forwarding the time of day is not used, a relative time is entered. This time relates to the startup of the IT-CP (the initialization value is 1.1.1994 0.0 (midnight)).

2.4.10.2 Structure of the data blocks (file DBs) for FTP services - FTP server mode

Procedure

To transfer data with FTP, create data blocks (file DBs) on the CPU of your S7 station. These data blocks must have certain structure to allow them to be handled as transferable files by the FTP services. They consist of the following sections:

- Section 1: File DB header (has a fixed length (20 bytes) and structure)
- Section 2: User data (has a variable length and structure)

File DB header for FTP server mode

Note: The file DB header described here is largely identical to the file DB header for client mode. The differences relate to the following parameters:

- WRITE_ACCESS
- FTP_REPLY_CODE

Parameter	Type	Value / meaning	Supply
EXIST	BOOL	The EXIST bit indicates whether the user data area contains valid data. The retrieve FTP command executes the job only when EXIST=1. • 0: The file DB does not contain valid user data ("file does not exist"). • 1: The file DB contains valid user data ("file exists").	The dele FTP command sets EXIST=0; The store FTP command sets EXIST=1;

Parameter	Type	Value / meaning	Supply
LOCKED	BOOL	The LOCKED bit is used to restrict access to the file DB. • 0: The file DB can be accessed. • 1: The file DB is locked.	The stor and retr FTP commands set LOCKED=1 when they are executed. The following function is also possible when writing from the user program: The user program on the S7 CPU can set or reset LOCKED during write access to achieve data consistency. Recommended sequence in the user program: 1. Check LOCKED bit; if = 0 2. Set WRITEACCESS bit = 0 3. Check LOCKED bit; if = 0 4. Set LOCKED bit = 1 5. Write data 6. Set LOCKED bit = 0
NEW	BOOL	The NEW bit indicates whether data has been modified since the last read access. • 0: The content of the file DB is unchanged since the last write access. The user program of the S7 CPU has registered the last modification. • 1: The user program of the S7 CPU has not yet registered the last write access.	After execution, the stor FTP command sets NEW=1 After reading the data, the user program on the S7-CPU must set NEW=0 to allow store to be used again or to be able to delete the file with the dele FTP command.
WRITE_ACCESS	BOOL	0: The FTP client on the PG/PC has no write access rights for the file DBs on the S7 CPU. 1: The FTP client on the PG/PC has write access rights for the file DBs on the S7 CPU.	During the configuration of the DB, the bit is set to an initialization value. Recommendation: Whenever possible, the bit should remain unchanged! In special situations, adaptation during operation is possible.
ACT_LENGTH	DINT	Current length of the user data area. The content of this field is only valid when EXIST = 1.	The current length is updated following write access.

Parameter	Type	Value / meaning	Supply
MAX_LENGTH	DINT	Maximum length of the user data area (length of the entire DB less 20 bytes header).	The maximum length should be specified during configuration of the DB. The value can also be modified by the user program during operation.
FTP_REPLY_CODE	INT	This parameter is irrelevant in FTP server mode.	Is set to "0" by the FTP server.
DATE_TIME	DATE_AND_TIME	Date and time of the last modification to the file. The content of this field is only valid when EXIST = 1.	The current date is updated following a write access. If the function for forwarding the time of day is used, the entry corresponds to the time that was passed on. If the function for forwarding the time of day is not used, a relative time is entered. This time relates to the startup of the IT-CP (the initialization value is 1.1.1994 0.0 (mid-night)).

2.5 Program blocks for programmed connections and IP configuration

In certain areas of application, it is an advantage to set up the communications connections or to create the IP configuration program-controlled in a special application instead of via the configuration interface of STEP 7.

Typical users who will find this useful are, for example, mass producers of machines who want to offer their customers a simple user interface but need to adapt the communication services to the operator input. The end user should not need knowledge of STEP 7.

For such applications, function block FB55 is available for setting up connections on the SEND/RECEIVE interface and for IP configuration. FB55 allows the flexible transfer of data blocks with configuration data to an Ethernet CP.

Note

Remember that the functions described here depend on the characteristics (supported connection types) of the CP type you are using. You will find information on this in the manuals.

Further information

You will find further information on the following topics in /1/ (Page 281):

- Properties of the configurable connection types;
- Information on configuring IP access protection;
- Information on amounts of data and configuration limits.

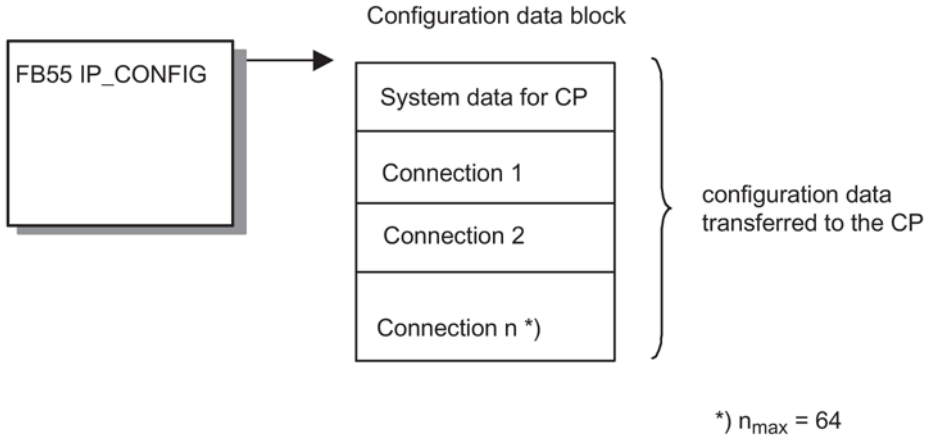
2.5.1 Operating principle

Interplay between programming and configuration

You configure connections on the SEND/RECEIVE interface and the IP configuration of a CP either with STEP 7 or you configure them during runtime of the S7 station via the user program. Mixing these variants on a CP is not possible!

Principle of programmed configuration

Configuration data for communication connections and the IP configuration can be transferred to the CPU using the function block called in the user program.



The configuration DB can be loaded on the CP at any time. The previously applicable connections and configuration data (IP address, subnet mask, default router, NTP time server and other parameters) are overwritten.

Based on the configuration data, the Ethernet CP recognizes that the communication connections must be set up by the user program.

Note

The functions can only be executed if "Not locked" was configured for the module access protection. Refer to the "Options" tab in the properties dialog of the CP (not available for every CP).

The "Set IP address in user program" option must also be enabled (see properties dialog of the CP or the Ethernet interface of the CP, "IP Configuration" tab).

Based on the configuration data, the Ethernet CP recognizes that the communication connections must be set up by the user program.

Note

As soon as the user program transfers the connection data via FB55 IP_CONFIG, the CPU switches the CP briefly to STOP. The CP receives the system data (including the IP address) and the new connection data and processes them during startup (RUN).

Quantity framework

A maximum of 64 connections can be specified in program block CP_CONFIG. The most important factor, however, is the maximum number of connections supported by the CP type you are using.

Special features / restrictions

- Consistency check only with STEP 7

  The connection configuration in STEP 7 involves consistency checks that are not possible or only possible with restrictions when using the programmed configuration!

- Connection configuration required on the partner

  When configuring specified connections in STEP 7, you implicitly create the connection for the partner; with a programmed configuration, this is not possible! In this case, you must configure suitable connections for the partner.

- Configuring IP access protection

  Using IP access protection gives you the opportunity of restricting communication over the CP of the local S7 station to partners with specific IP addresses. This parameter assignment also applies to programmed communications connections. You either disable IP access protection in STEP 7 (= default) or authorize the communications partner.

- DHCP / DNS is supported

  With a programmed configuration, IP addressing is also possible using DHCP (and DNS for the mail service).

  The use of a DHCP server is defined in this case in FB55 (not in the configuration).

- No connection information when uploading

  When you upload the S7 station data in STEP 7, this does not contain the data of the programmed configuration.

- Configuring connections for CPs with several interfaces

  If you are using CPs with several interfaces (for example with a gigabit interface), check the device manual to see whether or not the connection configuration is supported for both interfaces.

- PROFINET IO is not possible at the same time

  On a device you intend to operate as a PROFINET IO controller or IO device, it is not possible to set up the connection using FB55 as described here.

- No use of IP_CONFIG when operating the CP with fault-tolerant S7 connections

  If you configure fault-tolerant S7 connections via the CP, you cannot use the IP_CONFIG program block for IP configuration of the CP.

2.5.2 Procedure

Initial situation

The steps described here assume the following:

- You have created the local S7 station and the required partner stations in your STEP7 projects.
- You have clarified the other station types with which connections must be established. You create substitute objects for these station types in your STEP 7 projects.

Configuring CP properties

Set the CP properties in "IP Configuration": Select the "Set IP address in user program" option.

Programming connection setup

The basic procedure for setting up connections via the user program is as follows:

1. Create the subfields for system and connection data in the configuration DB.
2. Set the connection properties in the configuration DB.
3. Program the FB55 interface in the user program.
4. Use the FCs of the SEND/RECEIVE interface for open communications services in the user program.

2.5.3 Configuration data block (CONF_DB)

Meaning

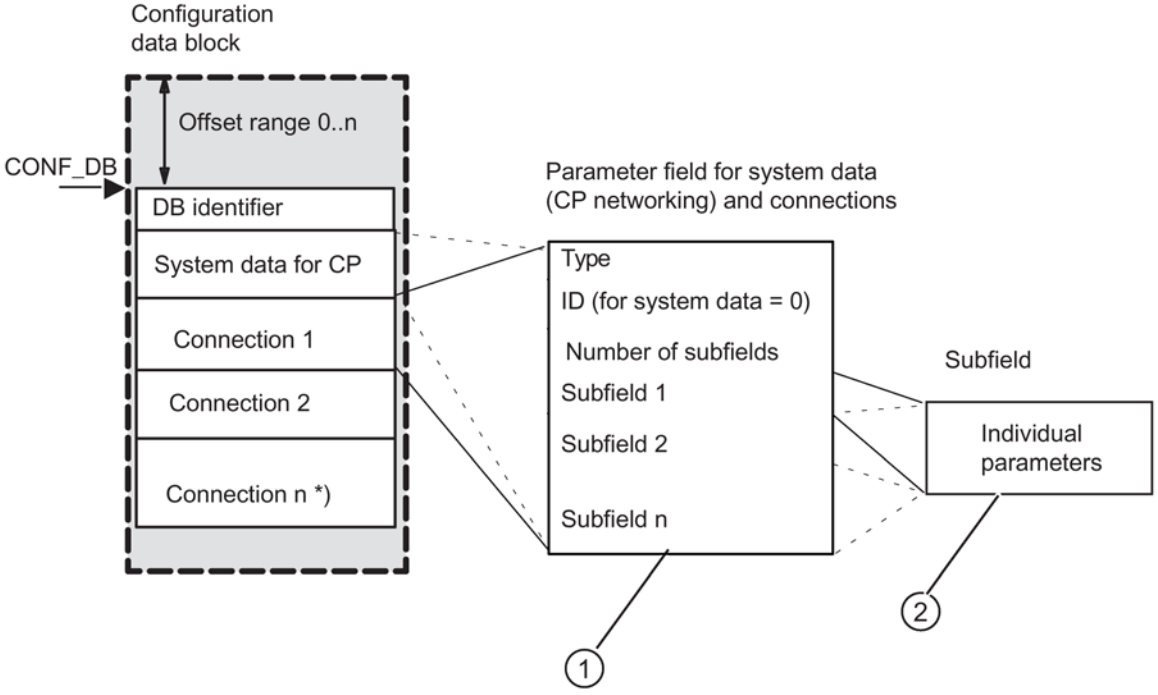
The configuration data block (CONF_DB) contains all the connection data and configuration data (IP address, subnet mask, default router, NTP time server and other parameters) for an Ethernet CP. The configuration data block is transferred to the CP with function block FB55.

Block and Data Structure

The graphic below shows the following:

- Structure resulting from parameter fields and subfields
  - The connections and specific system data are is described by an identically structured parameter field.
  - Individual parameters are characterized by subfields.
- Offset range

  The CONF_DB can start at any point within a data block as specified by an offset range. The address (or offset) must simply be an even number.



① Parameter fields are described below in Parameter field for system data (IP configuration) (Page 112)
② Subfield types are described below in Parameter fields for connection types (Page 113)

See also

Subfield types (Page 119)

2.5.4 Configuration data block - example

Below, you will find a sample of a configuration data block with the parameter field for system data and a parameter field for a TCP connection.

CONF_DB

STL

```
DATA_BLOCK DB271
TITLE=IP_CONFIG for 1 active nTCP connection,
AUTHOR : SIMATIC //CP-Daten : IP=200.12.1.144, Router=200.12.1.80
FAMILY : AS300 //Connection data: Destination IP-Addr=200.12.1.99,
NAME : ipconf //Local port = 4001, remote port = 5001, estab=active
VERSION : 1.0 //07-June-2005
STRUCT
 DB_TYP : INT := 1;
// ------------------------------------------------------- System Data ------
sys_pb : INT:=0;                                  // Subfield type: System data for CP
sys_id : INT:= 0;                                 // System parameter ID, always 0
sys_sb_cnt: INT:= 3;                              // Number of subfields in the system parameter
ip_addr: SUB_IP_V4;                               field
ip_netmask: SUB_NETMASK;                          // IP address of the CP
ip_router: SUB_DEF_ROUTER;                        // Subnet mask of the CP
                                                  // Default router
// ------------------------------------------------------- tcp VB 01 --------
tcp_pb_01 : int := 1;                             // Subfield type: TCP connection
tcp_id_01 : int := 1;                             // 1. TCP_VB
tcp_sb_cnt_01 : int := 6;                         // 6 elements per TCP connection
tcp_vb_ip_01 : SUB_IP_V4;                         // IP address of the partner
tcp_loc_01 : SUB_LOC_PORT;                        //
tcp_rem_01 : SUB_REM_PORT;                        //
tcp_vb_01_name : CON_NAME_L;                      //
tcp_vb_01_kbus : SUB_KBUS_ADDR;                   // only relevant for S7-400
rq_01 : ACT_CN_REQ;                               //
//-----------------------------------
END_STRUCT ;
BEGIN

tcp_loc_01.port := 4001;                          // Definition of the ports, when the value of
tcp_rem_01.port := 5001;                          // of the predefinition is different !
END_DATA_BLOCK
```

The type definitions used in the sample DB follow.

Type definitions for the "system data" subfield

STL

```
// Data structure IP Config
TYPE "SUB_IP_V4"
STRUCT
id : int := 1; // ID for IP, V4-Addr.
len: int := 8; // Sub Block Length
b_3 : BYTE := b#16#C8; // IP_High 200.
b_2 : BYTE := b#16#0C; // IP_ 12.
b_1 : BYTE := b#16#01; // IP_ 1.
b_0 : BYTE := b#16#90; // IP_Low 144
END_STRUCT;
END_TYPE
TYPE "SUB_NETMASK"
STRUCT
id : int := 2; // ID for Sub Net Mask
len: int := 8; // Sub Block Length
b_3 : BYTE := b#16#FF; // SNM_High
b_2 : BYTE := b#16#FF; // SNM_
b_1 : BYTE := b#16#FF; // SNM_
b_0 : BYTE := b#16#00; // SNM_Low
END_STRUCT;
END_TYPE
TYPE "SUB_DEF_ROUTER"
STRUCT
id : int := 8; // ID_4_Router
len: int := 8; // Sub Block Length
r_3 : BYTE := b#16#C8; // R_High
r_2 : BYTE := b#16#0C; // R_
r_1 : BYTE := b#16#01; // R_
r_0 : BYTE := b#16#50; // R_Low
END_STRUCT;
END_TYPE
```

Type definitions for the subfield "TCP connection"

STL

```
TYPE "SUB_LOC_PORT"
STRUCT
id : int := 9; // ID_4_LOC_PORT
len: int := 6; // Sub Block Length
port: int := 2001; // Loc. Port
END_STRUCT;
END_TYPE
TYPE "SUB_REM_PORT"
STRUCT
id : int :=10; // ID_4_REM_PORT
len: int := 6; // Sub Block Length
port: int := 2002; // Rem. Port
END_STRUCT;
END_TYPE
TYPE "CON_NAME_L" // 24 characters
STRUCT
id : int := 18; // ID for CON Name
len: int := 28; // 4+len(n[0..x]
c : ARRAY [1..24] of CHAR := 'V','B','_','N','a','m','e','_','2','4','C','h','a','r',
'a','c','t','e','r','s','_','0','0','1';
END_STRUCT;
END_TYPE
TYPE "SUB_KBUS_ADDR"
STRUCT
id : int := 21; // ID for KBUS-Address
len: int := 5; //
addr: BYTE := B#16#04; // =R0/S4
END_STRUCT
END_TYPE
TYPE "ACT_CN_REQ"
STRUCT
id : int := 22; // ID for CON REQ Mode
len: int := 5; // Sub Block Length
w : BYTE := b#16#1; // = Active
END_STRUCT;
```

Note:
The structures listed here must also be entered in the symbol table.

Example of SUB_IP_V4 entry:

Symbol	Address	Data type
SUB_IP_V4	UDT 100	UDT 100

See also

Subfield types (Page 119)

2.5.5 Parameter field for system data (IP configuration)

Meaning

Below, you will find the parameter field for system data relevant to the IP configuration of the CP and the subfields that need to be specified in it.

Some applications do not require all the subfield types - refer to the table for details.

Layout

On CPs with several interfaces, the structure of the parameter field described below applies only to the PROFINET interface.

• **Type = 0**
• **ID = 0**
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Usable subfields

Subfield		Parameter	
ID	Type	Special features / notes	Application ***)
1	SUB_IP_V4	Local IP address	++
2	SUBNET_MASK	-	++
8	SUB_DEF_ROUTER	-	+
4	SUB_DNS_SERV_ADDR *)	This subfield can occur from 0 to 4 times. The first entry is the primary DNS server.	+
14	SUB_DHCP_ENABLE	0: No DHCP 1: DHCP	+

Subfield		Parameter	
ID	Type	Special features / notes	Application ***)
15	SUB_CLIENT_ID	- Note: Only useful when SUB_DHCP_ENABLE = 1	+
30**)	SUB_DEVICE_NAME	Device name complying with PROFINET IO convention Enter a device name to make the device individually recognizable for analysis and diagnostics in the network.	+
*)The subfield type is used only for E-mail connections. **) ID is supported only be certain CP types. ***) ++ = mandatory; + = optional			

See also

Subfield types (Page 119)

2.5.6 Parameter fields for connection types

General

Below, you will see which values need to be entered in the parameter fields and which subfields are used for the various connection types.

Some applications do not require all the subfield types - refer once again to the table for details.

Connection ID

The ID parameter that precedes each connection parameter field beside the type ID is particularly important.

On programmed connections, you can assign this ID freely within the permitted range of values. You must then use this ID on the call interface of the FCs for the SEND/RECV interface to identify the connection.

Range of values for the connection ID:

- S7-400: 1,2...64
- S7-300: 1,2...16

2.5.6.1 Parameter field for TCP connection

Layout

Enter the parameters in the parameter field for TCP connections as follows:

• **Type = 1 ->** ①
• **ID = connection ID ->** ②
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Legend:

① Identifier for the connection type

② Freely selectable connection reference; must be specified in AG_SEND / AG_RECV.
Range of values for the connection ID:
for S7-400: 1, 2...64
for S7-300: 1,2...16

Usable subfields

Subfield		**Parameter**	
ID	**Type**	**Special features / notes**	**Application ***)**
1	SUB_IP_V4	IP address of the partner	++ *)
9	SUB_LOC_PORT	-	++
10	SUB_REM_PORT	-	++ **)
18	SUB_CONNECT_NAME	-	+
19	SUB_LOC_MODE	-	+
21	SUB_KBUS_ADR	This value is always set to 2 for CPs for the S7300 and does not need to be specified.	++ (for S7-400)
22	SUB_CON_ESTABL	-	++
*) optional for a passive connection. ***) ++ = mandatory; + = optional			

See also

Subfield types (Page 119)

2.5.6.2 Parameter field for UDP connection

Layout

Enter the parameters in the parameter field for UDP connections as follows:

• **Type = 2 ->** ①
• **ID = connection ID ->** ②
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Legend:

① Identifier for the connection type

② Freely selectable connection reference; must be specified in AG_SEND / AG_RECV.
Range of values for the connection ID:
for S7-400: 1, 2...64
for S7-300: 1,2...16

Usable subfields

Subfield		**Parameter**	
ID	**Type**	**Special features / notes**	**Application ***)**
1	SUB_IP_V4	IP address of the partner	++
9	SUB_LOC_PORT	-	++
10	SUB_REM_PORT	-	++
18	SUB_CONNECT_NAME	-	+
19	SUB_LOC_MODE	-	+
21	SUB_KBUS_ADR	This value is always set to 2 for CPs for the S7300 and does not need to be specified.	++ (for S7-400)
23	SUB_ADDR_IN_DATABLOCK	If the "Free UDP connection" is selected for this parameter, the parameters SUB_IP_V4 and SUB_REM_PORT are omitted.	+
***) ++ = mandatory; + = optional			

See also

Subfield types (Page 119)

2.5.6.3 Parameter field for an ISOonTCP connection

Layout

Enter the parameters in the parameter field for ISO-on-TCP connections as follows:

• **Type = 3 -> ①**
• **ID = connection ID -> ②**
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Legend:

① Identifier for the connection type

② Freely selectable connection reference; must be specified in AG_SEND / AG_RECV.
Range of values for the connection ID:
for S7-400: 1, 2...64
for S7-300: 1,2...16

Usable subfields

Subfield		**Parameter**	
ID	**Type**	**Special features / notes**	**Application ***)**
1	SUB_IP_V4	IP address of the partner	++ *)
11	SUB_LOC_TSAP	-	++
12	SUB_REM_TSAP	-	++ *)
18	SUB_CONNECT_NAME	-	+
19	SUB_LOC_MODE	-	+
21	SUB_KBUS_ADR	This value is always set to 2 for CPs for the S7300 and does not need to be specified.	++ (for S7-400)
22	SUB_CON_ESTABL	-	++
*) optional on the passive connection (if the IP address is specified, the TSAP must also be specified) ***) ++ = mandatory; + = optional			

See also

Subfield types (Page 119)

2.5.6.4 Parameter field for an Email connection

Meaning

To send Emails, one Email connection must be set up per Advanced CP. The Email connection specifies the mail server via which all the mails sent by the Advanced CP are delivered.

Layout

Enter the parameters in the parameter field for E-mail connections as follows:

• **Type = 4 ->** ①
• **ID = connection ID ->** ②
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Legend:

① Identifier for the connection type

② Freely selectable connection reference; must be specified in AG_SEND / AG_RECV.
Range of values for the connection ID:
for S7-400: 1, 2...64
for S7-300: 1,2...16

Usable subfields

Subfield		Parameter	
ID	**Type**	**Special features / notes**	**Application ***)**
1	SUB_IP_V4	IP address of the mail server, over which the Emails are sent. You can specify an absolute or alias IP address. The use of an alias assumes that the Advanced CP knows the address of the domain name server (DNS). This entry must be made when configuring the Advanced CP in STEP 7. For more detailed information refer to the online help.	++ / + *)
3	SUB_DNS_NAME	DNS name of the Email server	++ / + *)
13	SUB_EMAIL_SENDER	Email address of the sender	++
18	SUB_CONNECT_NAME	-	+

Subfield		Parameter	
ID	**Type**	**Special features / notes**	**Application ***)**
21	SUB_KBUS_ADR	This value is always set to 0 for CPs for the S7300 and does not need to be specified.	++ (for S7-400)
22	SUB_CON_ESTABL	-	++
) The parameters SUB_IP_V4 and SUB_DNS_NAME are mutually exclusive; one or the other parameter must be specified. *) ++ = mandatory; + = optional			

Note

Mail server ports are "wellknown ports" and do not need to be specified.

See also

Subfield types (Page 119)

2.5.6.5 Parameter field for FTP connection

Meaning

To run an FTP job sequence between the S7 station acting as the FTP client and an FTP server, the Advanced CP must establish a connection to the S7 CPU. This connection is known as an FTP connection.

FTP connections are TCP connections, with the parameter SUB_LOC_MODE set to the "FTP" mode.

Layout

Enter the parameters in the parameter field for FTP connections as follows:

• **Type = 1 ->** ①
• **ID = connection ID ->** ②
• Number of subfields = n
• Subfield 1
• Subfield 2
• Subfield n ...

Legend:

① Identifier for the connection type

② Freely selectable connection reference; must be specified in AG_SEND / AG_RECV.
Range of values for the connection ID:
for S7-400: 1, 2...64
for S7-300: 1,2...16

Usable subfields

Subfield		Parameter	
ID	Type	Special features / notes	Application ***)
18	SUB_CONNECT_NAME	-	+
19	SUB_LOC_MODE	here: 0x01 = FTP protocol	++
21	SUB_KBUS_ADR	This value is always set to 0 for CPs for the S7300 and does not need to be specified.	++ (for S7-400)
***) ++ = mandatory; + = optional			

See also

Subfield types (Page 119)

2.5.7 Subfield types

Different parameters are required depending on the parameter field. Each parameter is described by a subfield. Which subfields are required is explained in the descriptions of the system data and the connection types in the previous sections.

Each subfield consists of the specific parameter section and the header (4 Byte).

Example

The following excerpt from a CONF_DB illustrates the structure of a subfield based on the example of the SUBNET_MASK subfield type.

Address	Name	Type	Initial value	Comment
+14.0	Sub_field_2	STRUCT		// Subfield 2 type SUBNET_MASK
+0.0	Sub_field_ID	INT	2	// Subfield ID
+2.0	Sub_field_len	INT	8	// Total length of the subfield in bytes
+4.0	Parameter	STRUCT		Parameter range of SUBNET_MASK
+0.0	Value_1	BYTE	B#16#FF	
+1.0	Value_2	BYTE	B#16#FF	
+2.0	Value_3	BYTE	B#16#FF	
+3.0	Value_4	BYTE	B#16#0	
=4.0		END_STRUCT		
=8.0		END_STRUCT		

In total, the following subfield types are available:

Subfield ID [1)]	Subfield type	Subfield length (in bytes)	Meaning of the Parameter
1	SUB_IP_V4	4 + 4	IP address according to IPv4
2	SUBNET_MASK	4 + 4	Subnet mask
3	SUB_DNS_NAME	Length of DNS name + 4	DNS name
4	SUB_DNS_SERV_ADDR	4 + 4	DNS server address
8	SUB_DEF_ROUTER	4 + 4	IP address of default router
9	SUB_LOC_PORT	2 + 4	Local port
10	SUB_REM_PORT	2 + 4	Remote port, also for Email connections
11	SUB_LOC_TSAP	TSAP length + 4	Local TSAP *
12	SUB_REM_TSAP	TSAP length + 4	Remote TSAP *
13	SUB_EMAIL_SENDER	Length of the sender E-mail address + 4	Email address of the sender
14	SUB_DHCP_ENABLE	2 + 4	Obtain an IP address from a DHCP server • Range of values: 0 = no DHCP 1 = DHCP (optional)
15	SUB_CLIENT_ID	Length of the client ID + 4	(optional)
18	SUB_CONNECT_NAME	Length of the name + 4	Name of the connection Possible characters are: a...z, A...Z, 0...9, -, _
19	SUB_LOC_MODE	1 + 4	Local mode of the connection • Range of values: 0x00 = SEND/RECV 0x01 = FTP protocol (TCP connection only) 0x10 = S5 addressing mode for FETCH/WRITE *) 0x20 = SPEED SEND/RECV (permitted only for CP 443-1 Advanced) 0x80 = FETCH *) 0x40 = WRITE *) If you do not set the parameter, the default setting is SEND/RECV. Note: FETCH / WRITE require the passive connection establishment setting (see SUB_CON_ESTABL.

Subfield ID [1]	Subfield type	Subfield length (in bytes)	Meaning of the Parameter
20	SUB_REM_MODE	1 + 4	Setting the mode on the communication partner. (not currently supported)
21	SUB_KBUS_ADR	5	• For S7-400 KBUS address of the CPU • For S7-300 To be entered as a fixed value for the slot address: 2
22	SUB_CON_ESTABL	1 + 4	Type of connection establishment. With this option, you specify whether connection establishment from this S7 station is active or passive. • Range of values: 0 = passive 1 = active
23	SUB_ADDR_IN_DATA-BLOCK	1 + 4	Select free UDP connection. The remote node is entered in the job header of the job buffer by the user program when it calls AG_SEND. This allows any node on Ethernet/LAN/WAN to be reached. • Range of values: 1 = free UDP connection 0 = other The parameter is practical only for a UDP connection.
24	SUB_NTP_SERVER	4 + 4	The subfield defines an NTP server from which the CP can obtain its time via the NTP protocol. For the situation when one or more NTP servers are defined, up to 4 subfields of ID 24 can be defined. The subfields of ID 24 may only be installed in the system parameter field type 0 / ID 0.

Subfield ID [1)]	Subfield type	Subfield length (in bytes)	Meaning of the Parameter
30	SUB_DEVICE_NAME	Length of the name + 4	Device name complying with PROFINET IO convention The device name must comply with DNS conventions, in other words; • Restriction to a total of 127 characters (letters, numbers, hyphen or period) • Parts of the name within the device name; in other words, a string between two periods, must not exceed a maximum of 63 characters. • No special characters such as umlauts (ä, ö etc.), brackets, underscore, slash, blank etc. The dash (hyphen) is the only permitted special character. • The device name must not begin or end with the "-" or "." character, nor may either of these be the last character. • The device name must not begin with numbers. • The device name must not have the format n.n.n.n (n = 0...999). • The device name must not begin with the character string "port-xyz-" (x, y, z = 0...9).
1) Note: ID numbers not listed are not currently used.			

***** For subfield 11 and 12: If the subblock length is an uneven number of bytes, a padding byte that has no further use is inserted after the subblock so that there is an even byte address for the next subblock. The padding byte is not displayed in the subblock length, but must be taken into account in the total length of the data block.

See also

Configuration data block - example (Page 108)

2.5.8 IP_CONFIG - meaning and call

Meaning of the block

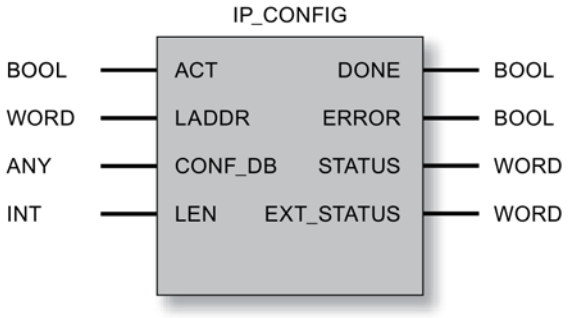
FB55 transfers the IP configuration specified in a data block (configuration DB) and the connection data to the CP. The configuration DB contains all the connection data to allow the connections for the SEND/RECEIVE interface of an Ethernet CP to be set up.

You can use this variant of programmed communication connections as an alternative to connection configuration with STEP 7.

Depending on the size of the configuration DB, the data may be transferred to the CP in several segments. This means that the FB must continue to be called until the FB signals complete transfer by setting the DONE bit to 1.

Call

Call interface in FBD representation



Example in STL representation

STL	Explanation
`call fb 55 (`	`//IP_CONFIG block call`
`ACT := M 10.0,`	`//Job initiated by memory bit`
`LADDR := W#16#0100,`	`//=LADDR 256 dec. in hardware configuration`
`CONF_DB:= P#db99.dbx10.0 byte 240,`	`//Data block with connection data`
`LEN := MW 14,`	`//Length info for the connection data`
`DONE := M 10.1,`	`//Execution code`
`ERROR := M 10.2,`	`//Error code`
`STATUS := MW 16,`	`//Status code`
`EXT_STATUS := MW 18);`	`//Cause of error in connection data`

Note

No use of FB55 when operating the CP with fault-tolerant S7 connections

If you configure fault-tolerant S7 connections via the CP, you cannot use FB55 for IP configuration of the CP.

Note

Avoid possible double addressing

If you use FB55, make sure that the assignment of IP addresses is unique. If an address is detected twice, it is possible that the CP will not become active in the network.

2.5.9 How IP_CONFIG works

Handling in the user program

When using FB55, the following use cases must be distinguished:

- Standard application

  call FB55 in the startup OB (OB100). When OB1 starts, the CP then already has its IP configuration and possibly also its connection configuration.

- Use in fault-tolerant systems (H systems)

  The procedure recommended below allows CPs in the redundant system to be configured with FB55 if there is a redundancy failover in the H system.

Note

CPU in RUN mode

In an H system, you can only configure a CP with FB55 if the assigned CPU is in RUN.

Initially, only one rack starts up in the H system. This means that the CPU can only reach its own peripherals (CP). As a result, you can only set parameters for the CPs in this rack with FB55 in the startup OB (OB100).

To be able to set parameters for the CPs in the redundant rack as well, the following procedure is recommended:

1. In OB100, program the FB55 calls for all CPs that are to received a configuration from FB55.
2. As the individual FB55 blocks execute, save the information as to whether or not configuration of the individual CPs was possible.
3. When the H system changes to the redundant state, OB72 (CPU redundancy error) is called automatically. Make sure that status information is saved while OB72 executes to indicate which configuration FBs (FB55) still need to be called.
4. Based on the previously saved status information, call the FB55 blocks in OB1 that you require for the IP configuration in the redundant system.

   Note:
   In principle, you can make those FB55 calls that were unsuccessful during startup in OB100 in OB72. Since, however, this is an FB that requires more than one call, this would extend the execution time of the OB. This is why the procedure in OB1 described above is recommended.

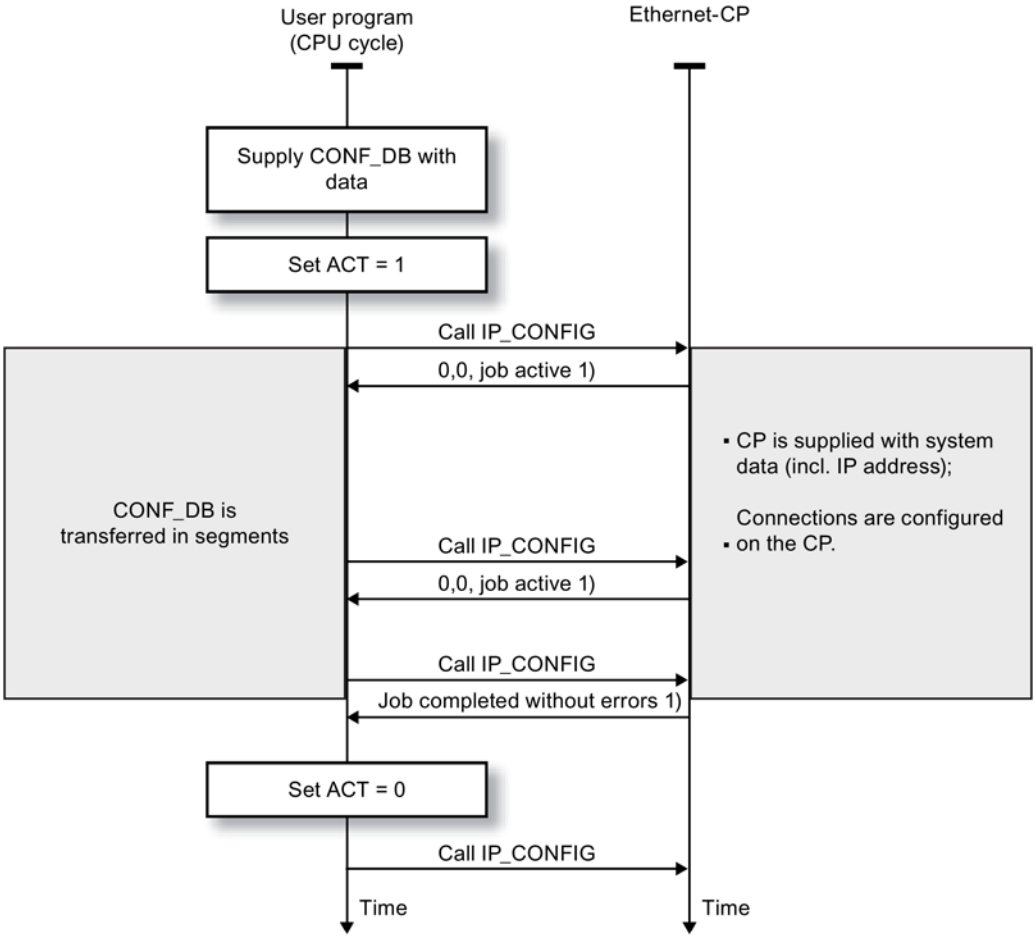
Operating principle

The following diagram illustrates the normal sequence of IP configuration and connection configuration triggered by IP_CONFIG in the user program.

The job executes as soon as the parameter ACT is transferred with value 1.

Due to the segmented transfer of the CONF_DB, you will need to repeat the job with ACT = 1 until completion of the job is indicated in the parameters DONE, ERROR, and STATUS.

If you want to transfer a connection configuration again later, the parameter ACT must first be transferred with value 0 in at least one further call.



1) Parameter transfer DONE, ERROR, STATUS

Note

The data transferred with the configuration DB are stored in volatile memory on the CP and must be downloaded to the CP again following a power down!

2.5.10 Explanation of the formal parameters - IP_CONFIG

Explanation of the formal parameters

The following table explains the formal parameters for the call interface of the IP_CONFIG function block :

Parameter	Declaration	Data type	Possible values	Description
ACT	INPUT	BOOL	0.1	When the FB is called with ACT = 1, the DBxx is sent to the CP. If the FB is called with ACT = 0, only the status codes DONE, ERROR and STATUS are updated.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed in the configuration table. Specify this address here.
CONF_DB	INPUT	ANY		The parameter points to the start address of the configuration data area in a data block (data type: byte).
LEN	INPUT	INT		Length information in bytes for the configuration data area.
DONE	OUTPUT	BOOL	0: - 1: Job completed with data transfer.	The parameter indicates whether the configuration data area was completely transferred. Remember that it may be necessary to call the FB several times depending on the size of the configuration data area (in several cycles) until the DONE parameter is set to 1 to signal completion of the transfer. For the meaning in conjunction with the parameters ERROR and STATUS, refer to IP_CONFIG status codes (Page 127)
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the parameters DONE and STATUS, refer to IP_CONFIG status codes (Page 127)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters DONE and ERROR, refer to IP_CONFIG status codes (Page 127)
EXT_ STATUS	OUTPUT	WORD		If an error occurs in the execution of a job, the parameter indicates which parameter was detected as the cause of the error in the configuration DB. High byte: Index of the parameter field Low byte: Index of the subfield within the parameter field

2.5.11 Reserved port numbers - IP_CONFIG

Reserved Port Numbers

The following local port numbers are reserved; do not use these in the connection project engineering.

Table 2- 19 Reserved Port Numbers

Protocol	Port number	Service
TCP	20, 21	FTP
TCP	25	SMTP
TCP	80	HTTP
TCP	102	RFC1006
TCP	135	RPC-DCOM
HTTPS	443	Security With CPs with the Security function
TCP	502	ASA application protocol
UDP	161	SNMP_REQUEST
UDP	34964	PN IO
UDP	65532	NTP
UDP	65533	NTP
UDP	65534	NTP
UDP	65535	NTP

2.5.12 IP_CONFIG status codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Table 2- 20 Condition codes for FB55 IP_CONFIG

DONE	ERROR	STATUS	Meaning
General codes relating to job execution			
1	0	0000_H	Job completed without errors
0	0	8181_H	Job active
Errors detected on the interface between CPU and CP.			
0	1	$80A4_H$	• Communication error on the K-bus or • Data error: Configuration by the user program is not set.

DONE	ERROR	STATUS	Meaning
0	1	$80B1_H$	The number of data bytes to be sent exceeds the upper limit for this service. (upper limit = 16 Kbytes)
0	1	$80C4_H$	Communication error The error can occur temporarily; it is usually best to repeat the job in the user program.
0	1	$80D2_H$	Configuration error The module you are using does not support this service.
Errors detected in the evaluation of the FB in the CPU or on the interface between CPU and CP.			
0	1	8183_H	The CP rejects the requested data record number.
0	1	8184_H	System error or bad parameter type. (data type of the ANY pointer CONF_DB not OK) (Currently only the byte data type is accepted)
0	1	8185_H	The value of the LEN parameter is larger than the CONF_DB less the reserved header (4 bytes) or the length information is incorrect.
0	1	8186_H	Illegal parameter detected The ANY pointer CONF_DB does not point to a data block.
0	1	8187_H	Illegal status of the FB Data in the header of CONF_DB was possibly overwritten.
Further errors detected on the interface between the CPU and CP.			
0	1	$8A01_H$	The status code in the data record is invalid (value is >= 3).
0	1	$8A02_H$	There is no job running on the CP; the FB, however, expected an acknowledgment for a completed job.
0	1	$8A03_H$	There is no job running on the CP and the CP is not ready; the FB triggered the first job to read a data record.
0	1	$8A04_H$	There is no job running on the CP and the CP is not ready; the FB nevertheless expected an acknowledgment for a completed job.
0	1	$8A05_H$	There is a job running, but there was no acknowledgment; the FB nevertheless triggered the first job for a read data record job.
0	1	$8A06_H$	A job is complete but the FB nevertheless triggered the first job for a read data record job.
Errors detected when evaluating the FB on the CP.			
0	1	$8B01_H$	Communication error The DB could not be transferred.
0	1	$8B02_H$	Parameter error Double parameter field
0	1	$8B03_H$	Parameter error The subfield in the parameter field is not permitted.
0	1	$8B04_H$	Parameter error The length specified in the FB does not match the length of the parameter fields / subfields.
0	1	$8B05_H$	Parameter error The length of the parameter field is invalid.
0	1	$8B06_H$	Parameter error The length of the subfield is invalid.
0	1	$8B07_H$	Parameter error The ID of the parameter field is invalid

DONE	ERROR	STATUS	Meaning
0	1	8B08$_H$	Parameter error The ID of the subfield is invalid
0	1	8B09$_H$	System error The connection does not exist
0	1	8B0A$_H$	Data error The content of the subfield is not correct.
0	1	8B0B$_H$	Structure error A subfield exists twice.
0	1	8B0C$_H$	Data error The parameter does not contain all the necessary parameters.
0	1	8B0D$_H$	Data error The CONF_DB does not contain a parameter field for system data.
0	1	8B0E$_H$	Data error / structure error The CONF_DB type is invalid.
0	1	8B0F$_H$	System error The CP does not have enough resources to process CONF_DB completely.
0	1	8B10$_H$	Data error Configuration by the user program is not set.
0	1	8B11$_H$	Data error The specified type of the parameter field is invalid.
0	1	8B12$_H$	Data error Too many connections were specified (either in total or too many for a specific type; for example, only one Email connection is possible).
0	1	8B13$_H$	CPinternal error
0	1	8B14$_H$	The active protection level does not permit the change that will result from the action.
Further errors detected on the program interfaces within the CPU (SFC errors).			
0	1	8F22$_H$	Area length error reading a parameter (e.g. DB too short).
0	1	8F23$_H$	Area length error writing a parameter (e.g. DB too short).
0	1	8F24$_H$	Area error reading a parameter.
0	1	8F25$_H$	Area error writing a parameter.
0	1	8F28$_H$	Alignment error reading a parameter.
0	1	8F29$_H$	Alignment error writing a parameter.
0	1	8F30$_H$	The parameter is in the writeprotected first current data block.
0	1	8F31$_H$	The parameter is in the writeprotected second current data block.
0	1	8F32$_H$	The parameter contains a DB number that is too high.
0	1	8F33$_H$	DB number error
0	1	8F3A$_H$	The target area was not loaded (DB).
0	1	8F42$_H$	Timeout reading a parameter from the I/O area.
0	1	8F43$_H$	Timeout writing a parameter to the I/O area.
0	1	8F44$_H$	Access to a parameter to be read during block execution is prevented.
0	1	8F45$_H$	Access to a parameter to be written during block execution is prevented.
0	1	8F7F$_H$	Internal error For example, an illegal ANY reference was detected.

2.6 Program blocks for ERPC-CP

2.6.1 LOGICAL_TRIGGER for the logical trigger

Meaning of the function block

The FB56 function block LOGICAL_TRIGGER is available if you want to use a logical trigger for ERPC communication.

To start a logical trigger, call the LOGICAL_TRIGGER program block in the user program of the CPU in OB1.

Further blocks are required for the LOGICAL_TRIGGER call:

- An automatically generated instance DB
- A data block "CONF_DB"

  This configuration DB contains the configuration data of the logical trigger. You create and configure the configuration DB available in the STEP 7 project.

  If you want to call more than one logical trigger, you will also need to make more than one configuration DB available.

You can change the numbers of FB56 and the instance DB.

Validity

The LOGICAL_TRIGGER program block can be used with the following module types:

- CP 343-1 ERPC

Call

Call interface in FBD representation

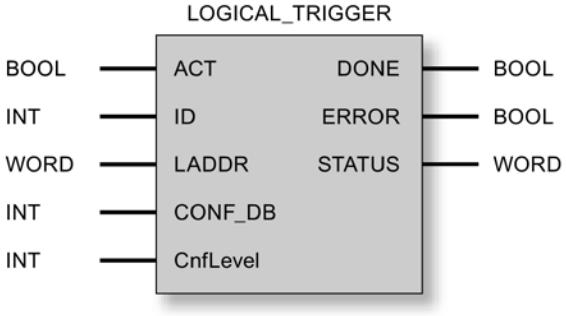


Table 2- 21 Example in STL representation

```
call fb 56, DatabaseInstanceDB (          //FB56 call with data area
ACT := TRUE,                              //Trigger job when value = 1
ID := 1                                   //Trigger ID (possible values: 1...16)
LADDR := W#16#100,                        //Module start address
CONF_DB:= 1,                              //Configuration data block (here: DB 1)
CnfLevel:= 1,                             //Acknowledgment mode (here: 1)
DONE := M 1.1,                            //Execution code
ERROR := M 1.2,                           //Error code
STATUS := MW 2);                          //Status code
```

2.6.2 How LOGICAL_TRIGGER works

Operating principle

The following table shows the steps involved in a trigger call by the user program of the CPU.

Step	Meaning
1	FB56 LOGICAL_TRIGGER is called at the intended point in the user program of the CPU with the corresponding instance DB and the selected configuration data block CONF_DB. • If FB56 LOGICAL_TRIGGER is called with ACT = 1, the current trigger data is read and sent to the CP firmware. • If FB56 LOGICAL_TRIGGER is called with ACT = 0, the status codes DONE, ERROR and STATUS are updated.
2	FB56 LOGICAL_TRIGGER reads the current trigger data.
3	FB56 LOGICAL_TRIGGER creates the PDU that will be sent to the CP firmware with the current data.
4	The CP firmware creates the data frame and transfers it to the ERPC application.
5	The ERPC application sends the data frame to the ERP subscriber (ERP system or MES).

2.6.3 Explanation of the formal parameters for LOGICAL_TRIGGER

Explanation of the formal parameters

The following table explains all the formal parameters for the FB56 LOGICAL_TRIGGER function block:

Parameter	Declaration	Data type	Possible values	Description
ACT	INPUT	BOOL	0	If the FB is called with ACT = 0, the status codes DONE, ERROR and STATUS are updated.
			1	If the FB is called with ACT = 1, the current trigger data is read in and sent to the CP.
ID	INPUT	INT		Trigger ID This value identifies the logical trigger configured in the ILS Workbench.
LADDR	INPUT	WORD		Module start address When you configure the CP with STEP 7, the module start address is displayed. Specify this address here.
CONF_DB	INPUT	INT		This data block contains the configuration data of the configured logical trigger.
CnfLevel	INPUT	INT	0: Transport acknowledgment 1: End-to-end acknowledgment	Acknowledgment mode You can find the relevant acknowledgment based on the STATUS value in the codes of FB56. • 0 = transport acknowledgment (STATUS = 0000_H) The job is reported as successful, as soon as the data is transferred to the ERPC application. This does not necessarily mean that the data frame was sent to the ERP subscriber (ERP system or MES) and does not preclude the ERPC application detecting an error later. • 1 = end-to-end acknowledgment (STATUS = 0001_H) The job is only acknowledged after the ERPC application has checked the data. The "TriggerResponse" variable of the configuration DB (DB_CONF) is used to report whether or not the ERP subscriber could be reached an whether the ERPC application is in store-and-forward mode. Compared with the transport acknowledgment, the end-to-end acknowledgment means a longer job execution time.

Parameter	Declaration	Data type	Possible values	Description
DONE	OUTPUT	BOOL	0: Job active 1: Job completed	The parameter indicates whether or not the job for transferring the configuration data area was handled free of errors. When the job is accepted, DONE is set to 0 by the CP. As long as DONE = 0, no further job can be triggered. For the meaning in the context of the ERROR and STATUS parameters, refer to the table "FB56 LOGICAL_TRIGGER codes".
ERROR	OUTPUT	BOOL	0: - 1: Error situation	Error code For the meaning in the context of the DONE and STATUS parameters, refer to the table "FB56 LOGICAL_TRIGGER codes".
STATUS	OUTPUT	WORD	Refer to the table "FB56 LOGICAL_TRIGGER codes".	Status code For the meaning in the context of the DONE and ERROR parameters, refer to the table "FB56 LOGICAL_TRIGGER codes".

2.6.4 LOGICAL_TRIGGER codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Table 2- 22 FB56 LOGICAL_TRIGGER codes

DONE	ERROR	STATUS	Meaning
Codes relating to job execution			
1	0	0000_H	Job completed without error. The logical trigger was completed successfully.
1	0	0001_H	Job completed without error. The database is unreachable (store-and-forward mode).
0	0	8181_H	Job active.
0	1	7000_H	FB56 was called with ACT = 0. The job will, however, not be executed. Call the block at least once with ACT = 1
Codes relating to configuration and the sequence of the logical trigger			
0	1	$80D2_H$	The CP in use does not support ERPC communication (wrong CP type).
0	1	8183_H	The CP in use does not support ERPC communication (wrong CP type).
0	1	8187_H	Invalid FB56 status (unknown LOGICAL_TRIGGER_STATE). Call the block again.
0	1	$8A01_H$	The number of configured logical triggers equals 0.
0	1	$8A02_H$	The is no configuration in the configuration DB for this logical trigger. Check the ILS Workbench configuration.
0	1	$8A03_H$	The structure of the configuration DB is incorrect. The "header identifier" does not have the correct value. Correct the value of the "ident" variable in the configuration DB (see manual of the ERPC-CP).

DONE	ERROR	STATUS	Meaning
0	1	$8A04_H$	The structure of the configuration DB is incorrect. Download the ILS Workbench configuration to the CP again, create and configure the configuration DB(s) again (see "ERPC-CP" manual).
0	1	$8A05_H$	The configured configuration DB does not exist on the CPU.
0	1	$8A06_H$	The next call called a trigger that is still running with a different ID. Check the "ID" in the called FB56 function blocks.
0	1	$8A08_H$	The configuration data in the configuration DB does not exist or is incomplete. If the error occurs only during startup of the S7 station, the cause may be that the configuration data of the logical trigger was not completely transferred to the configuration DB. If the error continues to occur, check the configuration of the ERPC symbols.
0	1	$8A09_H$	An unknown error was reported in the configuration DB.
0	1	$8A0A_H$	The logical trigger cannot be started because a new trigger configuration is currently being loaded.
0	1	$8A0B_H$	Error identifying the time stamp of the current data record (CPU data)
0	1	$8A0C_H$	The configuration DB was created with the "Unlinked" property. Correct the object properties of the block.
0	1	$8A0D_H$	Error in the the input parameter CONF_DB of FB56. The parameter has the value "0" or higher than the maximum DB number for the CPU.
0	1	$8A0E_H$	The transferred trigger ID is not in the permitted range of 1...16. Correct the value in the FB56 call in the user program.
0	1	$8A0F_H$	The set acknowledgment mode (CnfLevel) is invalid. Correct the value in the FB56 call in the user program.
0	1	$8Bxx_H$	Error copying the current variable values to the PDU of the logical trigger. The last two places (xx) are the variable number. Check the configuration of the symbol involved in the symbol table of the CPU and in the list of ERPC symbols in the properties dialog of the CP.
0	1	$8C01_H$	The internal status code of FB56 is invalid. Download the ILS Workbench configuration to the CP again, create and configure the configuration DB(s) again (see "ERPC-CP" manual).
0	1	$8C02_H$	The return value of the end-to-end acknowledgment is invalid. Download the ILS Workbench configuration to the CP again, create and configure the configuration DB(s) again (see "ERPC-CP" manual).
0	1	$8C03_H$	The logical trigger contains more than 255 variables.
0	1	$8C06_H$	Error reading the data record.
0	1	$8D03_H$	The firmware is signaling a timeout during a database action.
0	1	$8D04_H$	The database application is signaling a general error in the acknowledgment of the current action.
0	1	$8E01_H$	The configured configuration DB on the CPU is not large enough. Change the size of the configuration DB.
0	1	$8E06_H$	No connection has yet been established to the logical trigger.
0	1	$8EXX_H$	Status codes with values in the range $8E02_H$ ... $8EFF_H$ are copies of an internal trigger response. If such values occur, they are relevant for service purposes.

2.6.5 The configuration data block

Preparing the configuration data block "CONF_DB"

If you use the "logical trigger" ERPC function, you will need to create a data block (DB) in STEP 7 for the configuration data of the logical trigger and specify it in the call parameters of FB56. FB56 accesses DB CONF_DB. CONF_DB has no further significance for the user program.

Programming the configuration data block

To identify the newly created DB, you will need to open the DB and specify the "header identifier" and the DB size in the first two free lines.

Open the DB in STEP 7 and configure the first two free lines with the variables "ident" and "data" as follows:

Address	Name	Type	Initial value	Comment (*optional*)
*)		STRUCT *)		
*)	ident	DWORD	DW#16#45525043	*header identifier*
*)	data	array[1..2048]		*DB size (see warning below)*
*)		Byte		
*)		END_STRUCT *)		
*) Values are entered by the program				

Note

DB size

2 048 bytes are recommended as the DB size. If it becomes apparent during commissioning that this value is not enough, increase it. If a value is too low, this is reported by FB56 LOGICAL_TRIGGER with an error and the STATUS "8A05$_H$".

2.7 Configuration limits / resources required for the program blocks (Ethernet)

Required resources

Note

Note the version information of the blocks. The currently supplied block versions may differ from those shown here. Blocks with other versions have different resource requirements.

You will find information on the current block versions under entry ID:

Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

Table 2- 23 Information for FCs / FBs with S7400

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
AG_SEND	1.2	FC5	732	576	540	20
AG_RECV	1.2	FC6	656	522	486	20
AG_LOCK	1.0	FC7	272	200	164	6
AG_UNLOCK	1.0	FC8	256	186	150	6
AG_CNTRL	1.0	FC10	2048	1610	1574	178
AG_CNTEX	1.0	FB10	7002	6036	6000	78
AG_LSEND	3.1	FC50	1044	846	810	52
AG_LRECV	3.1	FC60	1190	992	956	58
AG_SSEND	1.2	FC53	1928	1618	1582	154
AG_SRECV	1.2	FC63	1882	1584	1548	158
IP_CONFIG	1.3	FB55	1864	1576	1540	76
FTP_CMD	2.0	FB40	2400	2084	2048	154
FTP_CONNECT	1.0	FC40	1482	1236	1200	86
FTP_STORE	1.0	FC41	1794	1514	1478	102
FTP_RETRIEVE	1.0	FC42	1934	1642	1606	106
FTP_DELETE	1.0	FC43	1478	1232	1196	86
FTP_QUIT	1.0	FC44	968	796	760	46

Table 2- 24 Information for FCs / FBs with S7-300

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
AG_SEND	4.2	FC5	1976	1664	1628	50
AG_RECV	4.7	FC6	1440	1206	1170	40
AG_LOCK	4.0	FC7	748	636	600	34
AG_UNLOCK	4.0	FC8	712	604	568	32
AG_CNTRL	1.4	FC10	1418	1152	1116	82
AG_CNTEX	1.0	FB10	4594	4006	3970	78
IP_CONFIG	1.3	FB55	2406	1984	1948	62
FTP_CMD	1.0	FB40	2590	2240	2204	70
FTP_CONNECT	1.1	FC40	928	774	738	68
FTP_STORE	1.1	FC41	1232	1046	1010	74
FTP_RETRIEVE	1.1	FC42	1306	1114	1078	84
FTP_DELETE	1.1	FC43	922	770	734	68
FTP_QUIT	1.1	FC44	452	370	334	28
LOGICAL_TRIGGER	1.0	FB56	4294	3648	3612	98

Program blocks for PROFINET IO (S7-300) 3

3.1 Overview of program blocks and their use

Program blocks for transferring user data

The program blocks listed below are available for transferring data cyclically on the PROFINET IO interface. The significance of the program blocks differs depending on how you use the CP (as a PROFINET IO controller or PROFINET IO device) in an S7 station.

Program block	can be used with:		Meaning
	S7-300	S7-400	
PNIO_SEND (FC11)	x	-	Depending on the mode of the CP: • For a PROFINET IO controller Sending output data to the PROFINET IO devices. • On a PROFINET IO device Forwarding process input data to the PROFINET IO controller.
PNIO_RECV (FC12)	x	-	Depending on the mode of the CP: • On a PROFINET IO controller Receiving process input data from the PROFINET IO devices. • On a PROFINET IO device Receiving process output data from the PROFINET IO controller.

For CPs operating as PROFINET IO controller and IO device at the same time, the FCs as of version 2.0 are available.

Program blocks for transferring data records and interrupt information

The FBs listed below are available for transferring data (data records, alarm information) acyclically on the PROFINET IO interface. The two blocks can only be used in PROFINET IO controller mode.

Program block	can be used with:		Meaning
	S7-300	S7-400	
PNIO_RW_REC (FB52)	x	-	• Read data record (from a PROFINET IO device) • Write data record (to a PROFINET IO device)
PNIO_ALARM (FB54)	x	-	Receive alarm information from the PROFINET IO devices

Program blocks for PROFIenergy

The following FBs are available for the PROFIenergy functions.

Program block	can be used with:		Meaning
	S7-300	S7-400	
PE_START_END_CP (FB85)	x	-	Start / end of an energy-saving pause (on the PROFINET IO controller)
PE_CMD_CP (FB86)	x	-	Start / end of an energy-saving pause and reading out of energy data from the device (on the PROFINET IO controller)
PE_I_DEV_CP (FB87)	x	-	Execution of the PROFIenergy commands from the controller (on the PROFINET IO device) Requires supplementary functions FC 0... FC 8 (standard library).
DS3_WRITE_CP (FB53)	x	-	Transfer of PROFIenergy data to an ET 200S (in the PROFINET IO controller) No PROFIenergy block

3.2 PROFINET IO - data transfer and interrupt evaluation

3.2.1 PNIO_SEND

3.2.1.1 Meaning and call - PNIO_SEND

How It works

The PNIO_SEND program block is used to transfer data in the PROFINET IO controller or PROFINET IO device modes of the CP.

- Operating as a PROFINET IO controller

  The block transfers process data (outputs) of a specified output area to the CP for forwarding to PROFINET IO devices. As the status code, the block returns the IO Consumer Status (IOCS) of the outputs from the PROFINET IO devices.

- Operating as a PROFINET IO device

  The block reads the preprocessed process inputs of the CPU on the PROFINET IO device and transfers them to the PROFINET IO controller (configured I addresses); the block also returns the IO Consumer Status (IOCS) of the PROFINET IO controller as a status code.

The preprocessed process data is available in a DB or bit memory area.

Expansions

- As of block version V2.0

  PNIO_SEND supports the parallel operation of PROFINET IO controller and IO device on one CP. With the additional MODE parameter, you set the mode for which the FC will be called.

- As of block version V3.0

  Using the MODE parameter, you have the following options for the transfer of the IO consumer status:

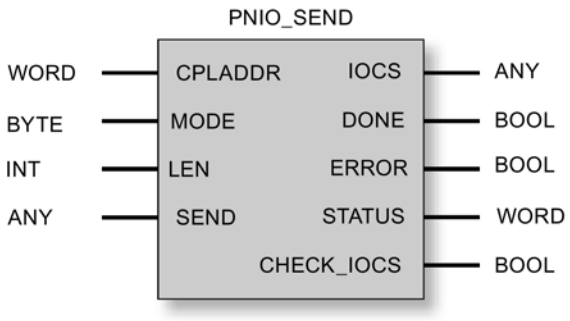
  – Restriction to the group status information in the CHECK_IOCS parameter optimized for faster transfer;

    or

  – Additional, detailed status information in the IO Consumer Status parameter

Call interface (as of block version 2.0)

Call interface in FBD representation



Example in STL representation

STL	**Explanation**
`call fc 11 (`	`//Call PNIO_SEND`
`CPLADDR:=W#16#0100,`	`//Module address from hardware configuration`
`MODE :=B#16#80,`	`//Controller mode or device mode;`
	`//IOCS status bits are not transferred.`
`LEN :=20,`	`//Length of the data area`
`IOCS :=P#DB10.DBX20.0 BYTE 3,`	`//One bit status per send data byte in DB10`
`DONE :=M 70.0,`	`//Address for return parameter DONE`
`ERROR :=M 70.1,`	`//Address for return parameter ERROR`
`STATUS :=MW 72,`	`//Address for return parameter STATUS`
`CHECK_IOCS :=M 70.2,`	`//Address for return parameter CHECK_IOCS`
`SEND :=P#DB10.DBX0.0 BYTE 20 );`	`//Data area to transfer from DB10`
	`//(20 bytes)`

3.2.1.2 Explanation of the formal parameters - PNIO_SEND

Explanation of the formal parameters

The following table explains all the formal parameters for FC11:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD	-	Module start address
MODE (parameters version 2.0 or later)	INPUT	BYTE	The following can be specified for XY_H: • $X0_H$: – IO controller mode – IO device mode (without parallel operation) – Not compatible with FC in version 1.0 • $X1_H$: IO device mode (both modes at same time) • $0Y_H$ Status bits are transferred in IOCS. • $8Y_H$ Restriction to group message in CHECK_IOCS; no status bits in IOCS.	Specification of the CP operating mode with: Y = selection of IO controller IO device mode; X = selection whether only group message is transferred in CHECK_IOCS or also status bits in IOCS. Notes on compatibility;: • The version 1.0 FC can continue to be used as long as the CP is not being operated as an IO controller and IO device at the same time. • When MODE=0, the FC as of version 2.0 behaves like the FC version 1.0. • When MODE=0 and MODE = 1, the FC as of version 3.0 behaves like the FC version 2.0.

Parameter	Declaration	Data type	Possible values	Description
SEND	IN_OUT	ANY (as VARTYPE only BYTE is permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area	Specifies the address and length IO controller mode: The length should match the total length of the distributed IO configured, whereby address gaps are also transmitted. The length can also be shorter than the total length of the distributed IO, for example when the block is called more than once in one OB. It must, however, have the total length in at least one call. IO device mode: The data structure results from the order of the slots of the input modules configured for this PROFINET IO device on the PROFINET IO controller line and their length without address gaps. Notes: • The block begins to transfer the data at address 0 regardless of how you configured the addresses (regardless of the lowest configured address). • Specifying an I/O area is not permitted since you must first check the IOCS for GOOD before data can be accepted in the I/O.

Parameter	Declaration	Data type	Possible values	Description
LEN	INPUT	INT	Value > 0 The maximum total length of the data areas to be transferred can be found in the devicespecific Part B of this manual in the "Performance data" chapter. This may differ for controller or device mode.	Length of the data area to be transferred in bytes. The transfer of the data always begins with address 0 regardless of the configuration. Please note that the IO address "0" with a length of 1 is included. IO controller mode: • The highest configured address of the devices must be specified here. The individual areas are not grouped together. If the block is called more than once, LEN can also be shorter than the highest address. The highest address should be specified in at least one call (compare "SEND" parameter). • The data is transferred in the order of the logical addresses (as with PROFIBUS DP). IO device mode: • The data is transferred in the order of the slots as the configured input modules on the PROFINET IO controller chain for this PROFINET IO device. Note: Make sure that the length programmed here and the configuration of the PROFINET IO controller are consistent. The entire data area length including any gaps is transferred for the device.
DONE	OUTPUT	BOOL	0: - 1: new data accepted	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: -1: Error	Error code
STATUS	OUTPUT	WORD	-	Status code

Parameter	Declaration	Data type	Possible values	Description
CHECK_ IOCS	OUTPUT	BOOL	0: All IOCS set to GOOD 1: At least one IOCS set to BAD	Group message that indicates whether or not it is necessary to evaluate the IOCS status area. CHECK_IOCS is always returned regardless of the MODE parameter.
IOCS	OUTPUT	ANY (as VARTYPE only BYTE is permit-ted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area Length: For the maximum value, refer to the devicespecific Part B of this manual in the section "Perfor-mance data". This may differ for controller or device mode.	IO Consumer Status A status bit is transferred per byte of user data. Requirement: Transfer is requested in the MODE parameter (MODE=0 or MODE=1). The parameter is relevant only in this mode. The length information depends on the length in the LEN parameter (one bit per byte) = (Length LEN + 7/ 8) Controller mode: Address gaps are also transferred according to the SEND parameter. Address gaps are transferred with the status GOOD. Device mode: Address gaps are not transferred. The block begins the transfer of the status for address 0. Note: The minimum length of the ANY pointer is (length LEN + 7/8)

Note

Wait for confirmation of execution

Execute the following actions only after the block has signaled either DONE = 1 or ERROR = 1:

- Evaluate output parameters;
- Change the MODE parameter.

Note

You must assume that the returned IOCS status does not arrive timesynchronized with the data (SEND parameter) but delayed by one user program cycle. This means: User data and IOCS are not consistent.

3.2.1.3 Condition codes of PNIO_SEND

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Note

For entries coded with 8Fxx$_H$ in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 3- 1 Condition codes PNIO_SEND

DONE	ERROR	STATUS	Meaning
0	0	8180$_H$	• Data transfer active; or • The CP is in STOP mode.
0	0	8181$_H$	Module does not support block version 2.0. Remedy: Use block version 1.0.
1	0	0000$_H$	New data transferred without error.
0	1	8183$_H$	• PROFINET IO configuration missing; or • CPLADDR parameter is bad; or • The CP is in STOP mode; or • The interconnection of MODE does not match the module configuration or there is an incorrect interconnection of the MODE parameter. Extra in device mode: • The connection between PROFINET IO controller and PROFINET IO device is down, or • PROFINET IO controller not reachable or • Total lengths (configuration and LEN parameter) are not consistent.
0	1	8184$_H$	System error or bad parameter type.
0	1	8185$_H$	Parameter LEN is greater than source area SEND or target buffer (IOCS) is too small.
0	1	8F22$_H$	Area length error reading a parameter (e.g. DB too short).
0	1	8F23$_H$	Area length error writing a parameter (e.g. DB too short).
0	1	8F24$_H$	Range error when reading a parameter.

DONE	ERROR	STATUS	Meaning
0	1	$8F25_H$	Range error when writing a parameter.
0	1	$8F28_H$	Alignment error when reading a parameter.
0	1	$8F29_H$	Alignment error when writing a parameter.
0	1	$8F30_H$	Parameter is in the write-protected 1st current data block.
0	1	$8F31_H$	Parameter is in the write-protected 2nd current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F3A_H$	Destination area is not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area.
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.
0	1	$8F44_H$	Access to a parameter to be read during block execution is prevented.
0	1	$8F45_H$	Access to a parameter to be written during block execution is prevented.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	Module with this address does not exist.
0	1	$80A0_H$	Negative acknowledgment writing to the module.
0	1	$80A1_H$	Negative acknowledgment writing to the module.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	• The specified data record length is incorrect. or • The CP changes to STOP.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).

3.2.2 PNIO_RECV

3.2.2.1 Meaning and call - PNIO_RECV

How It works

The PNIO_RECV program block is used to receive data in the PROFINET IO controller or PROFINET IO device modes of the CP.

- Operating as a PROFINET IO controller

  The block received the process data from PROFINET IO devices (inputs of the controller) and the IO provider status (IOPS) from the PROFINET IO devices in the specified input areas.

- Operating as a PROFINET IO device

  The block receives the data transferred by the PROFINET IO controller (configured O addresses) and the IO Provider Status (IOPS) of the PROFINET IO controller and writes it to the data areas on the CPU of the PROFINET IO device reserved for the process outputs.

Expansions

- As of block version V2.0

  PNIO_RECV supports the parallel operation of PROFINET IO controller and IO device on one CP. With the additional MODE parameter, you set the mode for which the FC will be called.

- As of block version V3.0

  Using the MODE parameter, you have the following options for the transfer of the IO provider status:

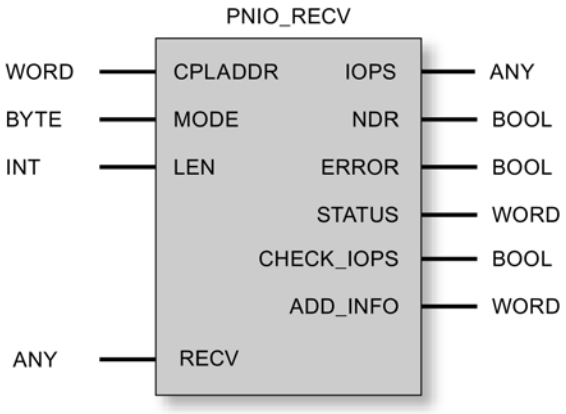
  – Restriction to the group status information in the CHECK_IOPS parameter optimized for faster transfer;

    or

  – Additional, detailed status information in the IO Provider Status parameter

Call interface (as of block version 2.0)

Call interface in FBD representation



Example in STL representation

STL	Explanation
call fc 12 (	//Call PNIO_RECV
CPLADDR :=W#16#0100,	//Module address from hardware configuration
MODE :=B#16#80,	//Controller mode or device mode;
	//IOCS status bits are not transferred.
LEN :=7,	//Length of the data area
IOPS :=P#DB11.DBX7.0 BYTE 1,	//One bit status per received data byte in DB11
NDR :=M 74.0,	//Address for return parameter NDR
ERROR :=M 74.1,	//Address for return parameter ERROR
STATUS :=MW76,	//Address for return parameter STATUS
CHECK_IOPS :=M74.2,	//Address for return parameter CHECK_IOPS
ADD_INFO :=MW 26,	//Diagnostic information
RECV :=P#DB11.DBX0.0 BYTE 7);	//Received data in DB11 (7 bytes)

See also

Data consistency (Page 158)
Substitute values (Page 159)

3.2.2.2 Explanation of the formal parameters - PNIO_RECV

Explanation of the formal parameters

The following table explains all the formal parameters for FC12:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD	-	Module start address
MODE (parameters version 2.0 or later)	INPUT	BYTE	Values with the following meaning can be specified in the MODE = XY_H parameter: • $X0_H$: – IO controller mode – IO device mode (without parallel operation) – Not compatible with FC in version 1.0 • $X1_H$: IO device mode (both modes at same time) • $0Y_H$ Status bits are transferred in IOPS. • $8Y_H$ Restriction to group message in CHECK_IOPS; no status bits in IOPS.	Specification of the CP operating mode with: Y = selection of IO controller IO device mode; X = selection whether only group message is transferred in CHECK_IOPS or also status bits in IOPS. Notes on compatibility;: • The version 1.0 FC can continue to be used as long as the CP is not being operated as an IO controller and IO device at the same time. • When MODE=0, the FC as of version 2.0 behaves like the FC version 1.0. • When MODE=0 and MODE = 1, the FC as of version 3.0 behaves like the FC version 2.0.

Parameter	Declaration	Data type	Possible values	Description
RECV	IN_OUT	ANY (as VARTYPE only BYTE is permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area	Specifies the address and length IO controller mode: The length should match the total length of the distributed IO configured, whereby address gaps are also transmitted. The length can also be shorter than the total length of the distributed IO, for example when the block is called more than once in one OB. It must, however, have the total length in at least one call. IO device mode: The data structure results from the order of the slots of the output modules configured for this PROFINET IO device on the PROFINET IO controller line and their length without address gaps. Notes: • The block begins to transfer the data at address 0 regardless of how you configured the addresses (regardless of the lowest configured address). • Specifying an I/O area is not permitted since you must first change the IOPS for GOOD before data can be accepted in the I/O.

Parameter	Declaration	Data type	Possible values	Description
LEN	INPUT	INT	Value > 0 You will find the maximum total length of the data to be transferred in the performance data in the CP documentation. The maximum total length can be different for controller and device mode.	Length of the data area to be transferred in bytes. The transfer of the data always begins with address 0 regardless of the configuration. Please note that the IO address "0" with a length of 1 is included. IO controller mode: • The highest configured address of the devices must be specified here. The individual areas are not grouped together. If the block is called more than once, LEN can also be shorter than the highest address. The highest address should be specified in at least one call (compare "RECV" parameter). • The data is transferred in the order of the logical addresses (as with PROFIBUS DP). IO device mode: • The data is transferred in the order of the slots corresponding to the configuration of the input modules on the PROFINET IO controller line for this PROFINET IO device. • Note: Make sure that the length programmed here and the configuration of the PROFINET IO controller are consistent. The entire data area length including any gaps is transferred for the device.
NDR	OUTPUT	BOOL	0: - 1: Data accepted	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code
STATUS	OUTPUT	WORD	-	Status code
CHECK_ IOPS	OUTPUT	BOOL	0: All IOPS set to GOOD 1: At least one IOPS set to BAD	Group message that indicates whether or not it is necessary to evaluate the IOPS status area. CHECK_IOPS is always returned regardless of the MODE parameter.

Parameter	Declaration	Data type	Possible values	Description
IOPS	OUTPUT	ANY (as VARTYPE only BYTE is permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area Length: For the maximum value, refer to the devicespecific Part B of this manual in the section "Performance data". This may differ for controller or device mode.	IO Provider Status A status bit is transferred per byte of user data. Requirement: Transfer is requested in the MODE parameter (MODE=0 or MODE=1). The parameter is relevant only in this mode. The length information depends on the length in the RECV parameter (one bit per byte) = (Length LEN + 7/ 8) Controller mode: Address gaps are also transferred according to the RECV parameter. Address gaps are transferred with the status GOOD. Device mode: Address gaps are not transferred. The block begins the transfer of the status for address 0. Note: • The minimum length of the ANY pointer is (length LEN + 7/8)
ADD_INFO	OUTPUT	WORD	Additional Diagnostic Information In controller mode: • 0: No alarm • >0: Number of pending alarms In device mode, the parameter is always = 0.	Parameter expansion Note: The ADD_INFO parameter is also updated when there are no INPUT addresses configured on the PROFINET IO controller. In this case, the PNIO_RECV block is called with a length LEN > 0 (for example LEN = 1 byte). It then transfers an address gap of 1 byte. The parameter expansion can be used for CPs as of the following firmware version: • CP 343−1 (EX30) as of firmware V2.0 • CP 343−1 Lean (CX10) as of firmware V2.0 • CP 343−1 Advanced (GX30) as of firmware V1.0 In older firmware versions, the parameter is reserved.

Note

Wait for confirmation of execution

Execute the following actions only after the block has signaled either DONE = 1 or ERROR = 1:

- Evaluate output parameters;
- Change the MODE parameter.

3.2.2.3 Condition codes of PNIO_RECV

Condition codes

The following table shows the codes formed by the NDR, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 3- 2 Condition codes PNIO_RECV

NDR	ERROR	STATUS	Meaning
0	0	8180_H	• Data acceptance active; or • The CP is in STOP mode.
0	0	8181_H	Module does not support block version 2.0. Remedy: Use block version 1.0.
1	0	0000_H	New data accepted without error.

NDR	ERROR	STATUS	Meaning
0	1	8183_H	• PROFINET IO configuration missing; or • CPLADDR parameter is bad; or • The CP is in STOP mode. or • The interconnection of MODE does not match the module configuration or there is an incorrect interconnection of the MODE parameter. Extra in device mode: • The connection between PROFINET IO controller and PROFINET IO device is down, or • PROFINET IO controller not reachable or • Total lengths (configuration and LEN parameter) are not consistent
0	1	8184_H	System error or bad parameter type.
0	1	8185_H	Destination buffer (RECV of IOCS) is too small.
0	1	$8F22_H$	Area length error reading a parameter (e.g. DB too short).
0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short).
0	1	$8F24_H$	Range error when reading a parameter.
0	1	$8F25_H$	Range error when writing a parameter.
0	1	$8F28_H$	Alignment error when reading a parameter.
0	1	$8F29_H$	Alignment error when writing a parameter.
0	1	$8F30_H$	Parameter is in the write-protected 1st current data block.
0	1	$8F31_H$	Parameter is in the write-protected 2nd current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F3A_H$	Destination area is not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area.
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.
0	1	$8F44_H$	Access to a parameter to be read during block execution is prevented.
0	1	$8F45_H$	Access to a parameter to be written during block execution is prevented.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	Module with this address does not exist.
0	1	$80A0_H$	Negative acknowledgment writing to the module.
0	1	$80A1_H$	Negative acknowledgment writing to the module.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	• The specified data record length is incorrect. or • The CP changes to STOP.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.

NDR	ERROR	STATUS	Meaning
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).

3.2.3 General characteristics of the FCs for PROFINET IO

IO Consumer Status (IOCS) and IO Provider Status (IOPS)

For both communication partners - CPU/CP on the one hand and IO device on the other - there is the status information GOOD or BAD for the data. This status information is transferred parallel to the data. The status of the partner that sends the data is called IOPS (IO Provider Status), the status of the receiving partner is called IOCS (IO Consumer Status).

The IOPS and IOCS status are not necessarily identical. It is, for example, possible that the S7-300 CPU is in STOP mode (output disable or no PROFINET IO blocks active). In this case, the CP as PROFINET IO controller transfers the BAD status to the IO devices.

You receive a group message informing you whether an evaluation of the status information is necessary. With the MODE parameter, you also decide whether you want detailed status information returned on the call interface. The jobs are handled faster if you restrict the information to the group message.

Relationship between block call and IO data

- Operation as PROFINET IO controller
  As a PROFINET IO controller, the CP does not monitor the cyclic calls of the PNIO_SEND/RECV blocks. If the blocks are not called, the last transferred IO data and IOCS/IOPS data are taken as valid.
- Operation as PROFINET IO device
  FC11 and FC12 each have their own watchdog. Depending on the CPU cycle time, the connection to the PROFINET IO controller is terminated if one of the two blocks is no longer called following the initialization phase.

Optimizing data transfer (only when operating as PROFINET IO controller)

It is possible to call the blocks with a length (LEN parameter) that is shorter than the configured total length of the IO data on the PNIO chain.

You can use this so that timecritical data is transferred in every CPU cycle whereas non critical data is not transferred in every cycle.

Example:
You could, for example, transfer only the first data area (timecritical data) in every cycle and the total length of the configured IO data in every second cycle. To do this, place the time-critical data in the lower area (starting at IO address 0) during configuration.

3.2.4 Data consistency

The entire input or output data area of the PROFINET IO controller is always transferred in its entirety and is therefore consistent.

- Operating as PROFINET IO controller
  Regardless of this, using the length information in the block call, you can also read or output an input or output area smaller than the configured area consistently.

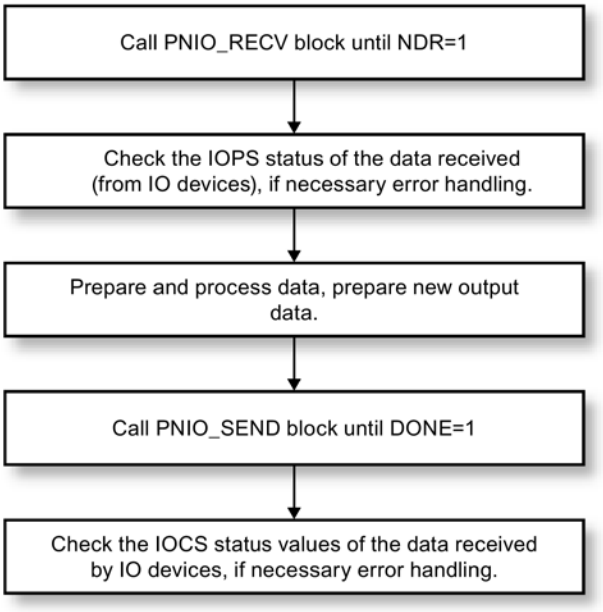
Note: You should, however, bear in mind that in terms of the "IO user data" within a PROFINET IO system, data consistency can only be guaranteed within the individual IO slots. This applies regardless of the fact that consistent data transfer between CPU and IO controller is guaranteed for the blocks described here.

Block call

To guarantee data consistency, you may, however, only access the IO data when the block has completed free of errors (output parameter NDR = TRUE). You must also check that the IOCS or IOPS status for the data is GOOD.

Example

In a normal situation (depending on the total length of the IO data), the block will run over several user program cycles until the condition code DONE/NDR = 1 is signaled.



Note: The user program cycle and the cycle of the IO data exchange between the PROFINET IO controller and PROFINET IO devices are independent of each other.

3.2.5 Substitute values

Operational situations

The setting of substitute values is supported for the two following operational situations:

- Substitute values during startup (mode change on the CPU from STOP to RUN)
- Substitute values if problems are detected (remove/insert or station failure/return)

Substitute values during startup

You can initialize the outputs with substitute values by setting a memory bit ("startup" memory bit) in the startup OB. In cyclic mode (OB1), evaluate this "startup" memory bit to call PNIO_SEND with the initialization values when appropriate.

Substitute values if a problem occurs (only when operating as PROFINET IO controller)

If there is a fault (device/submodule failed), you can find out which submodules have failed by querying the status information IOCS / IOPS status. You then have the option of setting substitute values.

3.2.6 PNIO_RW_REC

3.2.6.1 Meaning and call - PNIO_RW_REC

Significance and how it works

FB52 is used both for the "read data record" and the "write data record" function in PROFINET IO controller mode. FB52 can only execute one of the functions at any one time. The "read data record" or "write data record" function is controlled by the WRITE_REC parameter.

CPs support only I&M0 and I&M1.

Example: The CP can be informed of the location ID and plant designation using the "write data record" function (if this parameter was not already set in the properties dialog of the CP in STEP 7). This is done using the maintenance data record "IM1" with index $AFF1_H$.

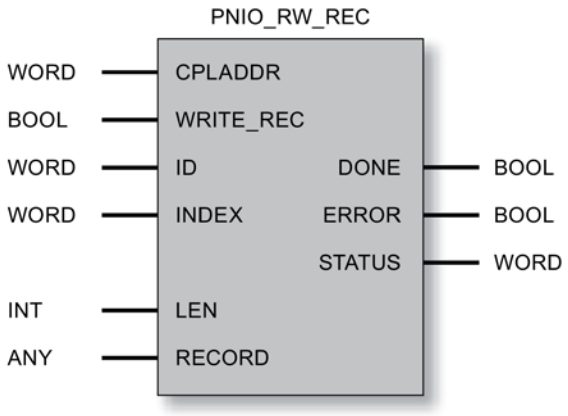
Data record I&M0 with index $AFF0_H$ (order number, serial number, version) can only be read out (write protected).

You will find details of the supported data records and their structure at the following Internet address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/19289930)

Call interface

Call interface in FBD representation:



Example in STL representation:

STL	Explanation
`CALL FB 52, DB 52 (`	`//Call PNIO_RW_REC`
`CPLADDR := W#16#0110,`	`//Module address from hardware configuration`
`WRITE_REC := M 1.1,`	`//Job type`
`ID := W#16#86A,`	`//Logical address of the module to be addressed`
`INDEX := W#16#8000,`	`//Data record number`
`DONE := M 1.3,`	`//Address for return parameter DONE`
`ERROR := M 1.1,`	`//Address for return parameter ERROR`
`STATUS := MW 12,`	`//Address for return parameter STATUS`
`LEN := MW 16,`	`//Length of the data record in bytes`
`RECORD := P#DB3.DBX0.0 BYTE 80 );`	`//Target or source of the data record`
	`//(here max. 80 bytes)`

3.2.6.2 Explanation of the formal parameters - PNIO_RW_REC

Explanation of the formal parameters

The following table explains all the formal parameters for FB52:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD	-	Module start address
WRITE_REC	INPUT	BOOL	0: Read data record 1: Write data record	Job type; The parameter must not be changed while the block is executing.
ID	INPUT	WORD		Logical address of the PROFINET IO component (module or submodule). For an output module, bit 15 is set (example of output address 5: ID:=DW#16#8005). For a mixed module, the lower of the two addresses must be specified.

Parameter	Declaration	Data type	Possible values	Description
INDEX	INPUT	WORD	See vendor information for the data record numbers supported by the module.	Data record number that the user wants to read or write.
DONE	OUTPUT	BOOL	0: - 1: Data record transferred successfully	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code
STATUS	OUTPUT	WORD	-	Status code
LEN	IN_OUT	INT	The maximum length is 480 bytes.	• Read data record: OUTPUT parameter only; after a successful read, the length of the read data record is indicated; otherwise 0. • Write data record: INPUT parameter only; length of the data record to be written is entered here by the user. The length must match the definition of the data record.
RECORD	IN_OUT	ANY (as VARTYPE, BYTE, WORD and DWORD are permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area The length of the ANY pointer must be greater than or equal to the definition of the data record.	• Read data record: OUTPUT parameter only; after a successful read, the data of the data record is stored here. If the ANY pointer is too short, as much data as possible is transferred. • Write data record: INPUT parameter only; the data to be written from the data record is stored here by the user. The ANY pointer must be at least as long as specified in the LEN parameter.

3.2.6.3 Condition codes of PNIO_RW_REC

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 3- 3 PNIO_RW_REC condition codes

DONE	ERROR	STATUS	Meaning
0	0	8180_H	Data transfer active
1	0	0000_H	Data record transferred successfully
0	1	8183_H	• No PROFINET IO controller configuration, • wrong CPLADDR or • CP in STOP mode
0	1	8184_H	System error or illegal parameter type
0	1	8185_H	Destination buffer (RECORD) is too short
0	1	$8F22_H$	Area length error reading a parameter (e.g. DB too short)
0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short)
0	1	$8F24_H$	Area error reading a parameter
0	1	$8F25_H$	Area error writing a parameter
0	1	$8F28_H$	Orientation error when reading a parameter
0	1	$8F29_H$	Alignment error writing a parameter
0	1	$8F30_H$	Parameter is in the write-protected 1st active data block.
0	1	$8F31_H$	Parameter is in the write-protected 2nd active data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F3A_H$	Destination area not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area
0	1	$8F43_H$	Timeout writing a parameter to the I/O area
0	1	$8F44_H$	Access to a parameter to be read during block execution is prevented.
0	1	$8F45_H$	Access to a parameter to be written when executing the block is disabled.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference
0	1	8090_H	Module with this address does not exist.
0	1	$80A0_H$	Negative acknowledgment reading from the module
0	1	$80A1_H$	Negative acknowledgment writing to the module
0	1	$80A3_H$	General PROFINET IO context management error
0	1	$80A9_H$	PROFINET IO device or module reports an illegal type.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	• The specified data record length is incorrect; or • The CP changes to STOP.
0	1	$80B2_H$	The logical address or the configured slot is not in use.
0	1	$80B4_H$	PROFINET IO device or module reports access to an illegal area.
0	1	$80B6_H$	PROFINET IO device or module denies access.
0	1	$80B8_H$	The module reports an illegal parameter.
0	1	$80B9_H$	The block type and / or version is not permitted.
0	1	$80C0_H$	The data record cannot be read.

DONE	ERROR	STATUS	Meaning
0	1	$80C1_H$	Write access to the data record is not currently permitted. The data record is either currently being processed or its content was set in the configuration.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources (memory) occupied
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).

3.2.7 PNIO_ALARM

3.2.7.1 Meaning and call - PNIO_ALARM

How It works

FB54 is used for alarm evaluation by a CP 3431 operating as PROFINET IO controller and should be called in its user program when the ADD_INFO parameter in FC12 is not equal to 0. After complete and errorfree transfer of all OUTPUT parameters of FB54, the received alarms are acknowledged automatically.

The alarms are forwarded to the user program in the chronological order in which they were signaled. Older alarms that have not yet been signaled to the user program and that become invalid due to more recent alarms are not deleted by the newer alarms.

Note

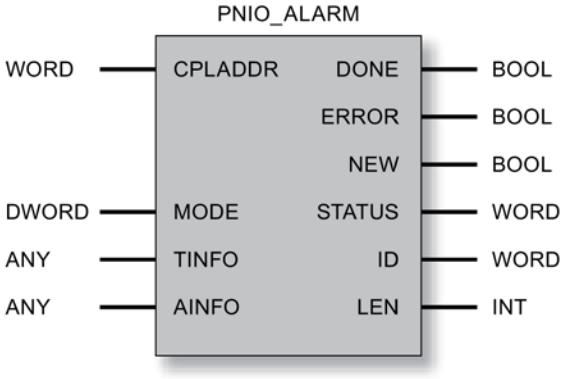
As long as the block has not yet been called, the alarms are acknowledged automatically in the CP.

If FB54 has been called (at least) once in the user program, it must continue to be called to acknowledge pending alarms. This is the situation when FC12 signals a value not equal to "0" in the ADD_INFO parameter.

If FB54 is no longer called after it has been called once or more in the user program, alarms are not acknowledged and there is no guarantee that the IO image will be updated correctly. The can occur, for example, following a station return alarm. The need to call FB54 can only be reset by restarting the CP (power cycle).

Call interface

Call interface in FBD representation



Example in STL representation:

STL	Explanation
`CALL FB 54, DB 54 (`	`//Call PNIO_ALARM`
`CPLADDR:= W#16#0110,`	`//Module address from hardware configuration`
`DONE := M 1.1,`	`//Address for return parameter DONE`
`ERROR := M 1.2,`	`//Address for return parameter ERROR`
`NEW := M 1.3,`	`//TRUE: A new alarm was received`
`STATUS := MW 12,`	`//Error code`
`ID := MW14,`	`//Logical start address of the reporting component`
`LEN := MW 16,`	`//Length of the received alarm information (AINFO)`
`MODE := MD 18,`	`//RESERVED (value always = 0)`
`TINFO := P#DB4.DBX0.0 BYTE 32,`	`//task information`
`AINFO := P#DB4.DBX32.0 BYTE 532 );`	`//alarm information`

3.2.7.2 Explanation of the formal parameters - PNIO_ALARM

Explanation of the formal parameters

The following table explains all the formal parameters for FB54:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD	-	Start address of the module that caused the error
DONE	OUTPUT	BOOL	0: - 1: Alarm information transferred successfully	This parameter indicates whether or not the job was completed without errors. If DONE = 1, the NEW parameter must also be checked.
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code

Parameter	Declaration	Data type	Possible values	Description
NEW	OUTPUT	BOOL	0: Data transfer active or no new alarm 1: New alarm received and acknowledged	If DONE = 1 and NEW = 1, a new received alarm is signaled.
STATUS	OUTPUT	WORD	-	Status code
ID	OUTPUT	WORD		Logical start address of the PNIO component that triggers the alarm (module or submodule). For an output module, bit 15 is set (example of output address 5: ID:=DW#16#8005). For a mixed module, the lower of the two addresses is specified.
LEN	OUTPUT	INT		Length of the received alarm information (AINFO)
MODE	IN_OUT	DWORD	0	Reserved
TINFO	IN_OUT	ANY (as VARTYPE, BYTE, WORD and DWORD are permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area The length of the ANY pointer must be >= 32 bytes.	(task information) Destination area for the alarm management information. The error OB start information (OB header = byte 0...19 of TINFO) is reproduced as far as possible by the CP firmware. See also [1]
AINFO	IN_OUT	ANY (as VARTYPE, BYTE, WORD and DWORD are permitted)	The address of the data area points to one of the alternatives: • Memory bit area • Data block area The length of the ANY pointer must be greater than or equal to the maximum additional alarm information that can be expected, maximum 1432 bytes (see LEN parameter)	(alarm information) Destination area for header information and additional alarm information. If the ANY pointer AINFO is too low, the information will be truncated. See also [1]

[1] Reference Manual "STEP 7 - System and Standard Functions for S7-300 and S7-400", receiving an alarm with SFB54 "RALRM" /5/ (Page 282)

3.2.7.3 Condition codes of PNIO_ALARM

Condition codes

The following table shows the condition codes formed by the DONE, NEW, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

DONE	NEW	ERROR	STATUS	Meaning
0	0	0	8180_H	Data transfer active
1	1	0	0000_H	Alarm data successfully transferred and alarm acknowledged
1	0	0	0000_H	No alarm data exist
0	0	1	8183_H	• No PROFINET IO controller configuration, • wrong CPLADDR or • CP in STOP mode
0	0	1	8184_H	System error or illegal parameter type
0	0	1	8185_H	Destination buffer (TINFO or AINFO) is too short
0	0	1	$8F22_H$	Area length error reading a parameter (e.g. DB too short)
0	0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short)
0	0	1	$8F24_H$	Area error reading a parameter
0	0	1	$8F25_H$	Area error writing a parameter
0	0	1	$8F28_H$	Orientation error when reading a parameter
0	0	1	$8F29_H$	Alignment error writing a parameter
0	0	1	$8F30_H$	Parameter is in the write-protected first active data block
0	0	1	$8F31_H$	Parameter is in the write-protected second active data block
0	0	1	$8F32_H$	The DB number in the parameter is too high
0	0	1	$8F3A_H$	Destination area not loaded (DB)
0	0	1	$8F42_H$	Timeout reading a parameter from the I/O area
0	0	1	$8F43_H$	Timeout writing a parameter to the I/O area
0	0	1	$8F44_H$	Access to a parameter to be read during block execution is prevented.
0	0	1	$8F45_H$	Address of the parameter to be written is disabled in the accessed rack
0	0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference
0	0	1	8090_H	Module with this address does not exist
0	0	1	$80A0_H$	Negative acknowledgment reading from the module
0	0	1	$80A1_H$	Negative acknowledgment writing to the module
0	0	1	$80B0_H$	Module does not recognize the data record

DONE	NEW	ERROR	STATUS	Meaning
0	0	1	80B1$_H$	• The specified data record length is incorrect or • The CP changes to STOP
0	0	1	80C0$_H$	The data record cannot be read
0	0	1	80C1$_H$	The specified data record is being processed
0	0	1	80C2$_H$	Too many jobs pending
0	0	1	80C3$_H$	Resources (memory) occupied
0	0	1	80C4$_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).

3.3 PROFIenergy

PROFIenergy

The PROFIenergy functions in PROFINET are used for energy management of plants. These include the planned or spontaneous shutdown of individual field devices, units or plant sections to save energy. The shutdown takes place during times without production or during breaks in production. Energy and diagnostics data can be read from devices included in the energy concept and that support these functions.

PROFIenergy controller

The commands for shutting down are output by the higher-level controller, in PROFINET IO, the IO controller.

With the SIMATIC S7-300, an S7-300 CPU with PROFIenergy functionality can be the PROFIenergy controller.

PROFIenergy devices

The commands of the PROFIenergy controller are processed by the IO devices with PROFIenergy functionality to shut down connected devices in the field.

In the context of the PROFIenergy program blocks, an IO device with PROFIenergy functionality is known as a PROFIenergy device. With the SIMATIC S7-300, an S7-300 CPU with PROFIenergy functionality can be the PROFIenergy device.

I-devices

In SIMATIC S7, an intelligent device (I-device) itself can have subordinate PROFIenergy devices. In this case, the I-device also has the function of a PROFIenergy controller.

Energy saving modes and PE_MODE_ID

Many devices support only the operating states "ready to operate" (power ON) and "pause" (power OFF). Scaled energy-saving states with different energy-saving modes can be specified for devices that support this or for groups of units in the controller of the PROFIenergy device. With PROFIenergy, these various states of energy consumption can be assigned to the devices that will be shut down in the field.

The various states of energy consumption are known as "energy-saving modes". For each individual energy-saving mode, a defined "PE_MODE_ID" is specified.

Programming of the features of the energy saving modes

The details of the energy-saving modes (addressed field device, pause duration etc) are programmed in the user program of the CPU of the PROFIenergy device.

3.3.1 PROFIenergy program blocks for the CP 300

Implementation of the PROFIenergy functions in S7-300

With a SIMATIC S7-300, the PROFIenergy functions are provided by program blocks for the IO controller and the IO device.

Note that an S7-300 CPU and a CP 300 use different PROFIenergy program blocks.

PROFIenergy specification

The functions of the PROFIenergy program blocks for the CP 300 are based on the following specification of the PROFIBUS Users Organization (PNO):

Common Application Profile PROFIenergy, Technical Specification for PROFINET, Version 1.0, January 2010, Order No. 3.802

PROFIenergy program blocks for the CP 300

The PROFIenergy program blocks are called by the user program of the CPU. The following PROFIenergy program blocks are available for the PROFIenergy functions of the CP 300:

- CP 300 as IO controller:
  - PE_START_END_CP

    Program block for initiating and ending pauses for power supply and setting defined energy-saving modes for the PROFIenergy device.
  - PE_CMD_CP

    Program block for initiating and ending pauses for power supply and setting defined energy-saving modes and for querying measured energy values from the PROFIenergy device.

The two program blocks can be used as alternatives. Compared with PE_START_END_CP, PE_CMD_CP has an expanded range of functions for the integration of measured energy values.

For each PROFIenergy device, the program block must be called separately.

– DS3_WRITE_CP

  Does not belong to the PROFIenergy function blocks, but expands the PROFIenergy functions for an ET 200S.

  With DS3_WRITE_CP, the settings for the switching behavior of up to 8 slots (in this case: power modules) of the ET 200S are specified.

- CP 300 as IO device:

  – PE_I_DEV_CP

    Receives all PROFIenergy commands and allows the user program to execute the PROFIenergy functions.

    Makes the response frames of the IO device available to the IO controller.

    PE_I_DEV_CP is called cyclically by the user program of the IO device.

  – Supplementary program blocks (FC 0...FC 8) for PE_I_DEV_CP:

    These FCs make the response data available for PE_I_DEV_CP. The FCs must be called in the user program and linked with PE_I_DEV_CP.

  If the PROFIenergy device is an I-device and itself has subordinate PROFIenergy devices, PE_START_END_CP or PE_CMD_CP is called in the CPU of the I-device for the subordinate PROFIenergy devices.

System and program blocks for transferring data records

The PROFIenergy commands and status information between IO controller and IO device are exchanged by reading and writing data records. This is implemented using the program blocks RDREC and RWREC.

The PROFIenergy data records are described below along with the response data of the individual program blocks.

Note

Block calls

PE_START_END_CP, PE_CMD_CP, PE_I_DEV_CP and DS3_WRITE_CP must not be called at the same time. The next program block can only be called after one of these program blocks as signaled "no error" (VALID = 1) or "error" (ERROR = 1).

The program block PNIO_RW_REC must also not be called at the same time as PE_START_END_CP, PE_CMD_CP, PE_I_DEV_CP or DS3_WRITE_CP.

3.3.2 PE_START_END_CP

3.3.2.1 Meaning and call - PE_START_END_CP

Significance and how It works

PE_START_END_CP can be used as an alternative to PE_CMD_CP.

PE_START_END_CP is used on the IO controller. It triggers an energy saving pause or ends a pause on the assigned PROFIenergy device.

The program block can be used ideally on IO controllers with IO devices that have only field devices connected to them and no energy data needs to be or can be read out from them.

The energy-saving modes are configured in the user program of the IO device. The energy-saving mode actually adopted is reported back by the IO device after execution of PE_START_END_CP and output at the PE_MODE_ID parameter.

The Pause_Time parameter specifies the length of the energy-saving pause for the IO device. On the IO device, the PE_I_DEV_CP program block checks whether or not the specified duration of the pause is adequately long and can be implemented.

Sequence

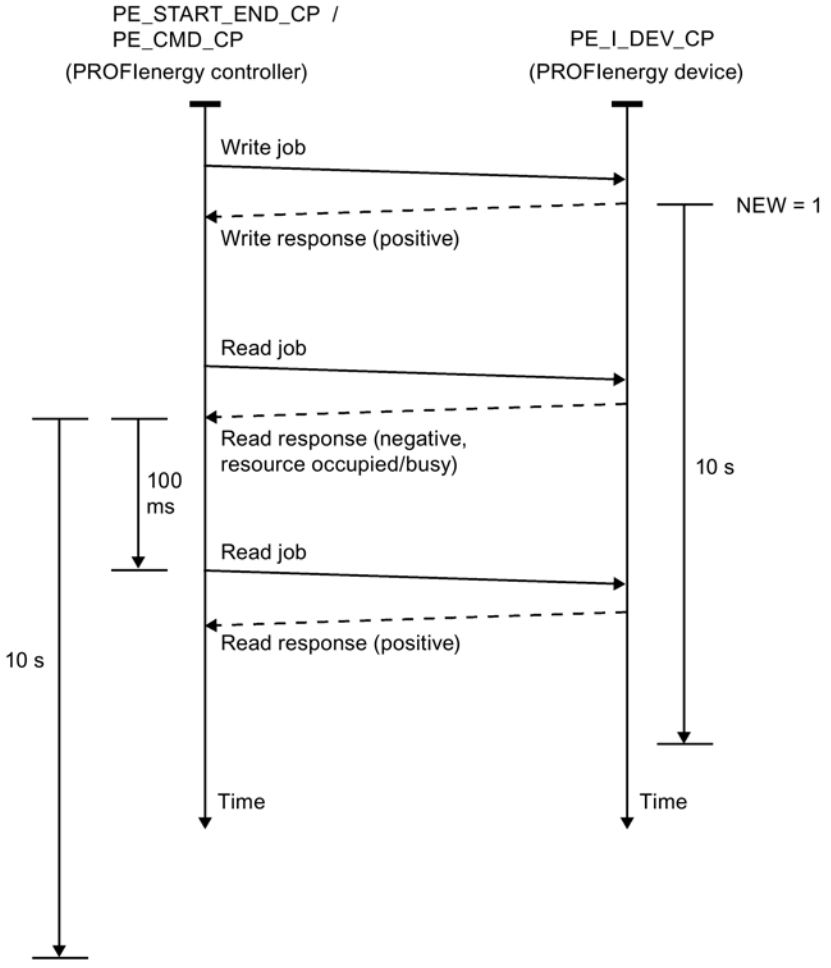


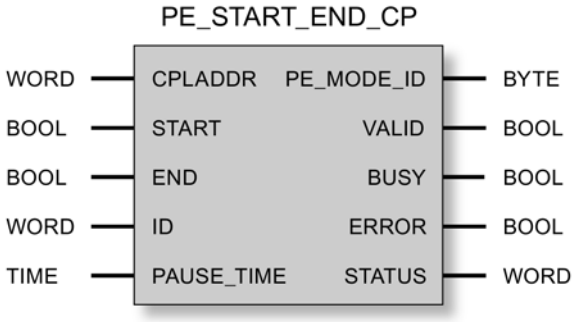
Image 3-1 Flow chart of the write/read jobs of PE_START_END_CP and PE_CMD_CP

Using WRREC, PE_START_END_CP sends a PROFIenergy command as a write job to the IO device. Following this, PE_START_END_CP waits for the acknowledgment from the IO device. To achieve this, the acknowledgement data record is read every 100 milliseconds using the program block RDREC.

As long as no acknowledgement has arrived from the IO device, the read job is repeated for 10 seconds at intervals of 100 ms.

The response data of the IO device is read with RDREC.

Call interface in FBD representation



Call interface in STL representation

```
STL                              Explanation
call fb 85 (                     //Call program block PE_START_END_CP;
CPLADDR :=W#16#0100,             //Module address from the hardware configuration;
START :=M100.0,                  //Address for "Start of pause" signal;
END :=M100.1,                    //Address for "End of pause" signal;
ID :=W#16#110,                   //Address of the destination device;
PAUSE_TIME :=T#10S               //Specification of the pause time as IEC time;
VALID :=M100.2                   //Address for VALID return parameter;
BUSY :=M110.0,                   //Address for BUSY return parameter;
ERROR :=M110.1,                  //Address for ERROR return parameter;
STATUS :=MW128,                  //Address for STATUS return parameter;
PE_MODE_ID :=MB111 );            //Address for the ID of the energy-saving mode
```

3.3.2.2 Explanation of the formal parameters of PE_START_END_CP

Explanation of the formal parameters of PE_START_END_CP

Parameter	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD	I, Q, M, D, L, const.	Module start address of the CP
START	INPUT	BOOL	• 1 = command active • 0 = command not active	A rising edge enables the "Start_Pause" command

Parameter	Declaration	Data type	Range of values	Description
END	INPUT	BOOL	• 1 = command active • 0 = command not active	A rising edge enables the "End_Pause" command
ID	INPUT	WORD		Logical address of the destination PROFIenergy device
PAUSE_ TIME	INPUT	TIME	T#-24D_20H_31M_23S_648MS to T#24D_20H_31M_23S_647MS	IEC time in steps of 1 ms, integer with sign
PE_MODE_ ID	OUTPUT	BYTE	• 00_h: Power OFF (pause) • 01_h...FE_h: Configurable • FF_h: Ready for operation	ID of the energy-saving mode adopted by the IO device after execution of the command.
VALID	OUTPUT	BOOL	0: - 1: Execution completed successfully	This parameter indicates whether or not the job was completed without errors.
BUSY	OUTPUT	BOOL	0: Execution completed, aborted or not yet started 1: Execution active	Condition code of the processing status of the program block
ERROR	OUTPUT	BOOL	0: - 1: Errors	Error code For the meaning in conjunction with the STATUS parameter, refer to Condition codes of PE_START_END_CP (Page 172).
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the ERROR parameter, refer to Condition codes of PE_START_END_CP (Page 172).

3.3.2.3 Condition codes of PE_START_END_CP

Condition codes of PE_START_END_CP

PE_START_END_CP is based on the program block PNIO_RW_REC and returns all condition codes of PNIO_RW_REC, see condition codes of the block PNIO_RW_REC.

The following additional PROFIenergy-specific condition codes are output. The error codes of STATUS are valid only in conjunction with ERROR = 1.

Table 3- 4 Specific condition codes of PE_START_END_CP

STATUS	Meaning
Block-specific errors	
8080_h	Rising edge at START and END at the same time
8081_h	Length conflict between CMD_PARAM and CMD_PARAM_LEN
PROFIenergy-specific errors	
$FE01_h$	Invalid Service_Request_ID

STATUS	Meaning
FE02h	Invalid Request_Reference
FE03h	Invalid CMD_MODIFIER
FE04h	Invalid information about the data structure of a command (Data_Structure_Identifier_RQ) in the frame for writing the PROFIenergy data record
FE05h	Invalid information about the data structure of a command (Data_Structure_Identifier_RS) in the frame for reading the PROFIenergy data record
FE06h	Energy saving mode (PE_Mode_ID) not supported
FE07h	Response longer than max transfer length
FE08h	Invalid number of commands
FE09h	Invalid block type (see frame header)
FE0Ah	Invalid block length (see frame header)
FE0Bh	Invalid block version (see frame header)
FE50h	Not a suitable energy saving mode (PE_Mode_ID)
FE51h	Value for PAUSE_TIME not supported
FE52h	PE_Mode_ID not supported

Details on the parameters of the PROFIenergy-specific errors can be found in the section Response data (Page 179).

See also

Condition codes of PNIO_RW_REC (Page 161)

3.3.3 PE_CMD_CP

3.3.3.1 Meaning and call - PE_CMD_CP

Significance and how it works

PE_CMD_CP can be used as an alternative to PE_START_END_CP.

PE_CMD_CP is used on the IO controller and initiates an energy-saving pause or ends a pause on the assigned PROFIenergy device. PE_CMD_CP can also read out further information and energy measured values from an IO device.

The program block can be used ideally on IO controllers with IO devices that have field devices connected to them and energy data needs to be read out from them.

You will find a flowchart of the write/read jobs of PE_CMD_CP in section Meaning and call - PE_START_END_CP (Page 170).

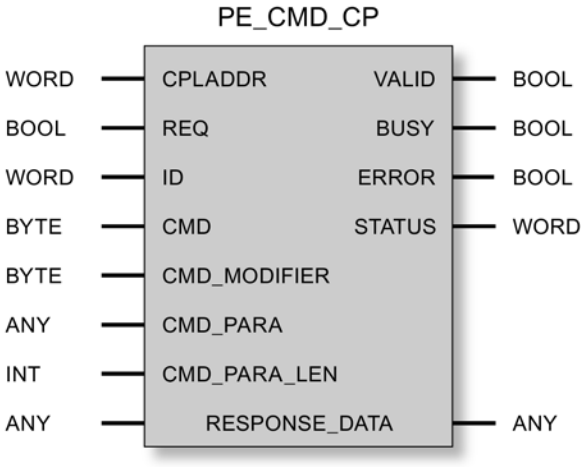
The individual commands that can be transferred to the IO device with the program block are assigned defined "Service_Request_IDs". The Service_Request_IDs 01...05 and 16 are assigned in the CMD parameter.

The CMD_MODIFIER parameter specifies the two commands 04 (Query_Modes) and 16 (Query_Measurement) in greater detail.

The CMD_PARA parameter assigns the values for certain parameters to some commands using an Any pointer. The CMD_PARA_LEN parameter specifies the length of this parameter.

The RESPONSE_DATA parameter points to the data area of the response data of the IO device.

Call interface in FBD representation



Call interface in STL representation

STL	Explanation
`call fb 86 (`	`//Call program block PE_CMD_CP;`
`CPLADDR :=W#16#0100,`	`//Module address from the hardware configuration;`
`REQ :=M220.0,`	`//Address for edge signal for block execution;`
`ID :=W#16#110,`	`//Address of the destination device;`
`CMD :=MB222,`	`//Service_Request_ID of the PROFIenergy command;`
`CMD_MODIFIER :=MB224,`	`//Modifier of the PROFIenergy command;`
`CMD_PARA :=MD240,`	`//Pointer to parameter of the modifier;`
`CMD_PARA_LEN :=MW226,`	`//Length of the parameter of CMD_PARA;`
`VALID :=M220.2`	`//Address for VALID return parameter;`
`BUSY :=M220.1,`	`//Address for BUSY return parameter;`
`ERROR :=M220.3,`	`//Address for ERROR return parameter;`
`STATUS :=MW228,`	`//Address for STATUS return parameter;`
`RESPONSE_DATA :=P#DB400.DBX0.0 BYTE 244 );`	`//Address for the response data of the IO device`

See also

Explanation of the formal parameters of PE_CMD_CP (Page 175)

3.3.3.2 Explanation of the formal parameters of PE_CMD_CP

Explanation of the formal parameters of PE_CMD_CP

Parameters	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD	I, Q, M, D, L, const.	Module start address of the CP
REQ	INPUT	BOOL		Starts the transfer of the PROFIenergy commands on a rising edge.
ID	INPUT	WORD		Logical address of the destination PROFIenergy device
CMD	INPUT	BYTE	• 01: Start_Pause • 02: End_Pause • 03: Query_Modes • 04: PEM_Status • 05: PE_Identity • 16: Query_Measurement	Service_Request_ID of the PROFIenergy command. You will find the meaning of the commands below this table.
CMD_ MODIFIER	INPUT	BYTE	For "Start_Pause": 00 For "End_Pause": 00 For "Query_Modes": • 01: List_Energy_Saving _Modes • 02: Get_Mode For "PEM_Status": 00 For "PE_Identity": 00 For "Query_Measurement": • 01: Get_Measurement_List • 02: Get_Measurement_Values	Modifier of the PROFIenergy command, meaning: • "Query_Modes" command – Modifier 01: Reads all supported energy-saving modes (PE_Mode_ID). – Modifier 02 reads the parameters of the selected PE_Mode_ID. • "Query_Measurement" command – Modifier 01: Reads the configured Measurement_IDs. – Modifier 02: Reads the measured values of the selected Measurement_IDs. You will find information on the parameters in Response data (Page 179) in the section for the particular command. Modifier 00 means "no options".

Parameters	Declaration	Data type	Range of values	Description
CMD_PARA	INPUT	ANY		Any pointer to parameters for commands • For command 01 Start_Pause: "Pause_Time" • For command 02 End_Pause: Irrelevant • For command 03 Query_Modes: – For modifier 01: Irrelevant – For modifier 02 Get_Mode: "PE_Mode_ID" • For command 04 PEM_Status: Irrelevant • For command 05 PE_Identity: Irrelevant • For command 16 Query_Measurement: – For modifier 01: Irrelevant – For modifier 02 Get_Measurement_Values: ANY pointer to the data structure with the parameters "Count" and "Measurement_IDs" You will find information on the parameters in Response data (Page 179) in the section for the particular command. The entire data area of the data record to be written (Service_Data_Request) is entered. Maximum length: 234 bytes
CMD_PARA_LEN	INPUT	INT		Actual length of the parameters in CMD_PARA. Max. length: 234 bytes
RESPONSE_DATA	INOUT	ANY		Pointer to the address of the response data of the IO device (complete frame including block header) **Note:** If the area selected is not large enough, only the configured number of bytes is saved.
VALID	OUTPUT	BOOL	0: - 1: Execution completed successfully	The status parameter of the program block indicates whether or not the job was completed without errors.
BUSY	OUTPUT	BOOL	0: Execution not yet started, completed or aborted 1: Execution active	Condition code of the processing status of the program block
ERROR	OUTPUT	BOOL	0: - 1: Errors	Error code For the meaning in conjunction with the STATUS parameter, refer to Condition codes of PE_CMD_CP (Page 178).
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the ERROR parameter, refer to Condition codes of PE_CMD_CP (Page 178).

Service_Request_IDs and meaning of the PROFIenergy commands

The PROFIenergy commands with Service_Request_ID 01...05 and 16 have the following significance:

- **01 = Start_Pause**

  Command for starting an energy-saving pause.

  The IO device selects the configured energy-saving mode. The energy-saving mode is reported back to the controller in the response data.

- **02 = End_Pause**

  Command for ending an energy saving pause

- **03 = Query_Modes**

  Queries the configured energy-saving modes with all corresponding time and energy information on the IO device.

  The queried information is detailed using the CMD_MODIFIER parameter:

  – **List_Energy_Saving_Modes**

    Reads all supported PROFIenergy modes of the IO device.

  – **Get_Mode**

    Reads the data of the selected PROFIenergy mode.

- **04 = PEM_Status**

  Query of the energy-saving mode actually adopted by the field device or the unit group.

- **05 = PE_Identity**

  Queries the PROFIenergy services supported by the IO device.

- **16 = Query_Measurement**

  Queries the energy data of the IO device.

  The queried information is detailed using the CMD_MODIFIER parameter:

  – **Get_Measurement_List**

    Reads all the configured Measurement_IDs on the device.

  – **Get_Measurement_Values**

    Reads the measured energy values of the selected Measurement_IDs.

Commands for various device classes

The devices that can be included in PROFIenergy concepts can be divided into three classes that are addressed by the IO controller with different commands:

- IO modules, actuators, motor starters

  Supported commands:

  – Start_Pause, End_Pause

  – Query_Modes, PEM_Status, PE_Identify

- Measuring devices for electrical variables

  Supported commands:

  – Query_Measurement

- Frequency converters

  Supported commands:

  – Start_Pause, End_Pause

  – Query_Modes, PEM_Status, PE_Identify

  – Query_Measurement

    Data of electrical variables data acquired by frequency converters can also be queried.

3.3.3.3 Condition codes of PE_CMD_CP

Condition codes of PE_CMD_CP

PE_CMD_CP is based on the program block PNIO_RW_REC and returns all condition codes of PNIO_RW_REC, see condition codes of the block PNIO_RW_REC.

The following additional PROFIenergy-specific condition codes are output. The error codes of STATUS are valid only in conjunction with ERROR = 1.

Table 3- 5 Specific condition codes of PE_CMD_CP

STATUS	Meaning
Block-specific errors	
8081_h	Length conflict between CMD_PARAM and CMD_PARAM_LEN
PROFIenergy-specific errors	
$FE01_h$	Invalid Service_Request_ID
$FE02_h$	Invalid Request_Reference
$FE03_h$	Invalid CMD_MODIFIER
$FE04_h$	Invalid information on the data structure of a command (Data_Structure_Identifier_RQ) in the frame for the PROFIenergy data record to be written
$FE05_h$	Invalid information on the data structure of a command (Data_Structure_Identifier_RS) in the frame for the PROFIenergy data record to be read
$FE06_h$	Energy saving mode (PE_Mode_ID) not supported

STATUS	Meaning
FE07h	Response longer than max transfer length
FE08h	Invalid number of commands
FE09h	Invalid block type (see frame header)
FE0Ah	Invalid block length (see frame header)
FE0Bh	Invalid block version (see frame header)
FE50h	Not a suitable energy saving mode (PE_Mode_ID)
FE51h	Value for PAUSE_TIME not supported
FE52h	PE_Mode_ID not supported

Details on the parameters of the PROFIenergy-specific errors can be found in the section Response data (Page 179).

See also

Condition codes of PNIO_RW_REC (Page 161)

3.3.4 Response data

Structure of the response data

The following tables show the structure of the data record ($80A0_h$) of the response data of PE_START_END_CP and PE_CMD_CP.

The following table shows an overview of the structure of the data record of the returned response data according to the PROFIenergy specification. The composition of the "Service Data Response" area is described below for the individual PROFIenergy commands.

Table 3- 6 Structure of the response data

Block definitions	Attributes	Value	Data type	Description
Block header	BlockType	0801_h	Unsigned16	
	BlockLength		Unsigned16	Frame length (without the "BlockType" and "BlockLength" fields)
	BlockVersionHigh	01_h	Unsigned8	
	BlockVersionLow	00_h	Unsigned8	

Block definitions	Attributes	Value	Data type	Description
Response header	Service_Request_ID	01_h...FF_h	Unsigned8	01_h: Start_Pause 02_h: End_Pause 03_h: Query_Modes 04_h: PEM_Status 05_h: PE_Identify 06_h...09_h: - Reserved - 10_h: Query_Measurement 11_h...CF: - Reserved - $D0_h$...FF_h: Vendor-specific
	Request_Reference	01_h...FF_h	Unsigned8	Identification number of the query (mirrored in the response of the IO device)
Service header response	Status	01_h...FF_h	Unsigned8	00_h: - Reserved - 01_h: Done 02_h: Done with error(s) 03_h: Data incomplete 04_h...CF_h: - Reserved - $D0_h$...FF_h: Depends on the Service_Request_ID
	Data_Structure_Identifier_RS	01_h...FF_h	Unsigned8	00_h: - Reserved - 01_h...FF_h: Data structure dependent on the Service_Request_ID FF_h: error
Service data response				Response data of the IO device Depending on the particular PROFIenergy command (described below)

Meaning of "Service data request" and "Service data response"

The following sections explain the parameter values for the queries of the IO controller to the IO device (Service Data Request) for each PROFIenergy command and the structure of the response data of the IO device (Service Data Response).

- **Service data request**

  Parameter values for IO controller queries

- **Service data response**

  Structure of the response data of the IO device

PROFIenergy command "Start_Pause"

- **Service data request**
  - CMD = 01
  - CMD_MODIFIER = 00
  - CMD_PARA_LEN = 04
  - CMD_PARA = Any pointer to the value for "Pause_Time" (data type "TIME")

    IEC time in steps of 1 ms, integer with sign

    Value: T#-24D_20H_31M_23S_648MS to T#24D_20H_31M_23S_647MS
- **Service data response**

Parameters	Value	Data type
PE_Mode_ID *	01_h...FF_h	Unsigned8
- Reserved -	00_h	Unsigned8

* Identification number of the energy-saving mode

PROFIenergy command "End_Pause"

- **Service data request**
  - CMD = 02
  - CMD_MODIFIER = 00
  - CMD_PARA_LEN = 00
  - CMD_PARA = irrelevant
- **Service data response**

Parameters	Value	Data type
Time_to_operate *		Unsigned32

* Expected time for switching over the PROFIenergy device to "ready to operate"

PROFIenergy command "Query_Modes" – List_Energy_Saving_Modes

- **Service data request**
  - CMD = 03
  - CMD_MODIFIER = 01
  - CMD_PARA_LEN = 00
  - CMD_PARA = irrelevant
- **Service data response**

Parameters	Value	Data type
Number_of_PE_Mode_IDs *	01_h	Unsigned8
PE_Mode_IDs		Unsigned8 array of Number_of_PE_Mode_IDs (unique ID for mode)

* Number of energy-saving modes

PROFIenergy command "Query_Modes" – Get_Mode

- **Service data request**
  - CMD = 03
  - CMD_MODIFIER = 02
  - CMD_PARA_LEN = 01
  - CMD_PARA = Any pointer to value for PE_MODE_ID (unsigned8)
- **Service data response**

Parameters	Value	Data type
PE_Mode_ID	01_h...FF_h	Unsigned8
PE_Mode_Attributes *	00_h...01_h	Unsigned8
Time_min_Pause		Unsigned32
Time_to_Pause		Unsigned32
Time_to_operate		Unsigned32
Time_min_length_of_stay		Unsigned32
Time_max_length_of_stay		Unsigned32
Mode_Power_Consumption		Float32
Energy_Consumption_to_pause		Float32
Energy_Consumption_to_operate		Float32

* Coding of bit 0:
  0 = Only static time and energy measured values available.
  1 = Dynamic time and energy measured values available.

Bits 1...7: Reserved

PROFIenergy command "PEM_Status"

- **Service data request**
  - CMD = 04
  - CMD_MODIFIER = 00
  - CMD_PARA_LEN = 00
  - CMD_PARA = irrelevant
- **Service data response**

Parameters	Value	Data type
PE_Mode_ID_Source *	00_h 01_h...FE_h FF_h	Unsigned8
PE_Mode_ID_Destination *	00_h 01_h...FE_h FF_h	Unsigned8
Time_to_operate		Unsigned32
Remaining_time_to_destination		Unsigned32
Mode_Power_Consumption		Float32
Energy_Consumption_to_Destination		Float32
Energy_Consumption_to_operate		Float32

* Possible values for "PE_Mode_ID_Source" and "PE_Mode_ID_Destination":
00_h: PE_Power_off
01_h...FE_h: Freely configurable
FF_h: PE_Ready_to_operate

PROFIenergy command "PE_Identify"

- **Service data request**
  - CMD = 05
  - CMD_MODIFIER = 00
  - CMD_PARA_LEN = 00
  - CMD_PARA = irrelevant
- **Service data response**

Parameters	Value	Data type
Count *	6	Unsigned8
Start_Pause **	01_h	Unsigned8
End_Pause	02_h	Unsigned8
Query_Modes	03_h	Unsigned8
PEM_Status	04_h	Unsigned8
PE_Identify	05_h	Unsigned8
Query_Measurement ***	10_h	Unsigned8

* Number of supported PROFIenergy commands

** Service_Request_ID of the first supported PROFIenergy command

*** Service_Request_ID of the last supported PROFIenergy command

PROFIenergy command "Query_Measurement" – Get_Measurement_List

- **Service data request**
  - CMD = 16
  - CMD_MODIFIER = 01
  - CMD_PARA_LEN = 00
  - CMD_PARA = irrelevant
- **Service data response**

Parameters	Value	Data type
Count *		Unsigned8
- Reserved -		Unsigned8
Measurement_ID **		Unsigned16
Accuracy_Domain [1]		Unsigned8
Accuracy_Class [2]		Unsigned8
Range [3]		Float32
…		
Measurement_ID ***		Unsigned16
Accuracy_Domain [1]		Unsigned8
Accuracy_Class [2]		Unsigned8
Range [3]		Float32

* Number of Measurement_IDs

** First supported Measurement_ID

*** Last supported Measurement_ID

[1] Accuracy domain (range 1...4):
0 = Reserved
1 = Percentage of the measuring range
2 = Percentage of the current measured values
3 = Accuracy according to IEC 61557-12
4 = Accuracy according to EN 50470-3 section 8

[2] Accuracy class (range 1...15):
0 = Reserved
1 (0.01%) ... 15 (>20%)

[3] Measuring range if Accuracy_Domain = 1; otherwise undefined

PROFIenergy command "Query_Measurement" – Get_Measurement_Values

- **Service data request**
  - CMD = 16
  - CMD_MODIFIER = 02
  - CMD_PARA_LEN = length of the data structure in bytes
  - CMD_PARA = Any pointer to data structure with the following structure:

Parameters	Value	Data type
Count *		Unsigned8
- Reserved -		Unsigned8
Measurement_ID **		Unsigned16
…		
Measurement_ID ***		Unsigned16

* Number of Measurement_IDs

** First queried measured value

*** Last queried measured value

- **Service data response**

Parameters	Value	Data type
Count *		Unsigned8
- Reserved -		Unsigned8
Length_of_Structure	0002_h...$FFFF_h$	Unsigned16
Measurement_Data_Structure_ID	1 = simple value	Unsigned8
Measurement_ID **	00_h...FF_h	Unsigned16
Status_of_Measurement_Value	1 = valid 2 = not available 3 = not available at times	Unsigned8
Transmission_Data_Type		Float32
End_of_demand		Unsigned32 or Unsigned16
Length_of_Structure		Unsigned16
Measurement_Data_Structure_ID		Unsigned8
Measurement_ID ***		Unsigned16
Status_of_Measurement_Value		Unsigned8
Transmission_Data_Type		Float32
End_of_demand		Unsigned32 or Unsigned16

* Number of Measurement_IDs

** First queried measured value

*** Last queried measured value

3.3.5 PE_I_DEV_CP

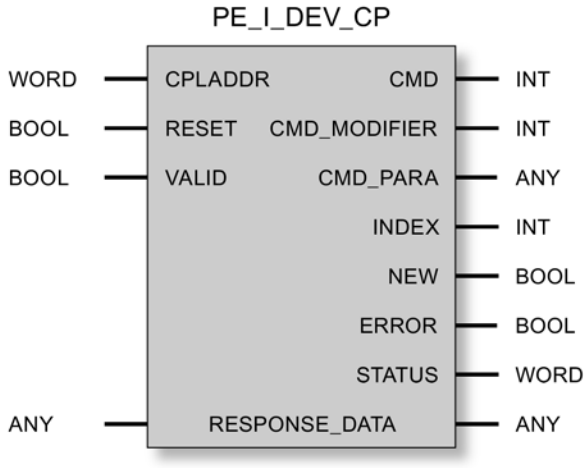
3.3.5.1 Meaning and call - PE_I_DEV_CP

Significance and how It works

The program block PE_I_DEV_CP is used on the PROFIenergy device where it handles the PROFIenergy commands of the IO controller. The PROFIenergy data records ($80A0_h$) sent by the IO controller are forwarded by the CP firmware to PE_I_DEV_CP. The PROFIenergy data of the IO device is made available to the IO controller as the response by PE_I_DEV_CP using the PROFIenergy data record ($80A0_h$).

The response data of PE_I_DEV_CP is generated by the supplementary functions FC 0 to FC 8, see section Supplementary program blocks for PE_I_DEV_CP (Page 189).

Call interface in FBD representation



Call interface in STL representation

STL	Explanation
`call fb 87 (`	`//Call program block PE_I_DEV_CP;`
`CPLADDR :=W#16#0100,`	`//Module address from the hardware configuration;`
`RESET :=M1.0,`	`//Signal for resetting the block;`
`VALID :=M1.3,`	`//Signal for data transfer to the controller;`
`CMD :=MW222,`	`//Service_Request_ID of the PROFIenergy command;`
`CMD_MODIFIER :=MW224,`	`//Modifier of the PROFIenergy command;`
`CMD_PARA :=MD230,`	`//Pointer to parameters of the modifier;`
`INDEX :=MW228,`	`//Number of the PROFIenergy data record;`
`NEW :=M1.1,`	`//Processing status of the block;`
`ERROR :=M1.2,`	`//Address for the ERROR return parameter;`
`STATUS :=MW2,`	`//Address for the STATUS return parameter;`
`RESPONSE_DATA`	`//Address for the response data of the IO device`
`  :=P#DB400.DBX0.0 BYTE 244 );`	

3.3.5.2 Explanation of the formal parameters of PE_I_DEV_CP

Explanation of the formal parameters of PE_I_DEV_CP

Parameters	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD	I, Q, M, D, L, const.	Module start address of the CP
RESET	INPUT	BOOL		Resets processing of the program block. NEW is set to 0.
VALID	INPUT	BOOL		If the response data was written to the relevant memory area of the IO device, VALID = 1 must be set by the user program. Following this, the program block makes the data available to the IO controller. NEW is set to 0.
CMD	OUTPUT	INT	• 01: Start_Pause • 02: End_Pause • 03: Query_Modes • 04: PEM_Status • 05: PE_Identity • 16: Query_Measurement	Service ID of the PROFIenergy command
CMD_ MODIFIER	OUTPUT	INT	• Modifier for Start_Pause: 00 • Modifier for End_Pause: 00 • Query_Modes, Modifier: – 01 (List_Energy_ Saving_Modes) – 02 (Get_Mode) • Modifier for PEM_Status: 00 • Modifier for PE_Identity: 00 • Query_Measurement, Modifier: – 01 (Get_Measurement _List) – 02 (Get_Measurement _Values)	Modifier of the PROFIenergy commands Meaning of the modifiers for commands: • "Query_Modes" command, Modifier: – 01 (List_Energy_Saving_Modes): Reads all supported PROFIenergy modes – 02 (Get_Mode): Reads the data of the selected PROFIenergy mode • "Query_Measurement" command, Modifier: – 01 (Get_Measurement_List): Reads all configured Measurement_IDs. – 02 (Get_Measurement_Values): Reads the measured values of the selected Measurement_IDs.

Parameters	Declaration	Data type	Range of values	Description
CMD_PARA	OUTPUT	ANY		Any pointer to parameters for the following command modifiers (compare CMD_MODIFIER parameter): • For "Get_Mode": PE_Mode_ID (ID of the energy-saving mode) length = 1 • For "Get_Measurement_Values": measured values of the Measurement_IDs length = max. 236 bytes (complete frame of the controller command without header)
INDEX	OUTPUT	INT		Number of the PROFIenergy data record ($80A0_h$)
NEW	OUTPUT	BOOL	0: Execution not yet started, completed or aborted 1: Execution active	Condition codes of the processing status of the program block
ERROR	OUTPUT	BOOL	0: - 1: Errors	Error code For the meaning in conjunction with the STATUS parameter, refer to Condition codes of PE_I_DEV_CP (Page 188).
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the ERROR parameter, refer to Condition codes of PE_I_DEV_CP (Page 188).
RESPONSE_DATA	INOUT	ANY	See "Response data" of the program block	Pointer to the data area of the response of the IO device (complete response frame including header). The data area must match the data area of the supplementary program blocks FC 0 - FC 8 (parameter "DATA_ERRORRSP"). Recommended size: At least 244 bytes. If the data area is too small, only the data of the configured bytes are transferred.

3.3.5.3 Condition codes of PE_I_DEV_CP

Condition codes of PE_I_DEV_CP

PE_I_DEV_CP is based on the program block PNIO_RW_REC and returns all condition codes of PNIO_RW_REC, see condition codes of the block PNIO_RW_REC.

See also

Condition codes of PNIO_RW_REC (Page 161)

3.3.6 Supplementary program blocks for PE_I_DEV_CP

3.3.6.1 Overview of the FCs

Function

The supplementary program blocks FC 0 to FC 8 support the preparation of the response data made available to the controller by PE_I_DEV_CP:

- For the response data of each PROFIenergy command, there is a separate program block (FC 1 - FC 8).
- FC 0 generates a common negative response for all PROFIenergy commands.

The FCs are called in the user program. In STEP 7 V5.5, they are available in the standard library in the "PROFIenergy" folder.

The FCs have several common parameters as well as individual parameters. Some of the common parameters of the FCs are interconnected with parameters of PE_I_DEV_CP. With some of the individual input parameters of the FCs, the response data is entered as plain language for the user or stored in the memory area of the IO device.

Overview of the FCs

The following supplementary program blocks are made available:

Table 3- 7 Overview of the supplementary FCs

Number	Name
FC 0	PE_ERROR_RSP
FC 1	PE_START_RSP
FC 2	PE_END_RSP
FC 3	PE_LIST_MODES_RSP
FC 4	PE_GET_MODE_RSP
FC 5	PE_PEM_STATUS_RSP
FC 6	PE_IDENTIFY_RSP
FC 7	PE_MEASUREMENT_LIST_RSP
FC 8	PE_MEASUREMENT_VALUE_RSP

See also

Individual parameters of the FCs (Page 191)

3.3.6.2 Interconnection of the FCs with PE_I_DEV_CP

Interconnection of the FCs with the program block PE_I_DEV_CP

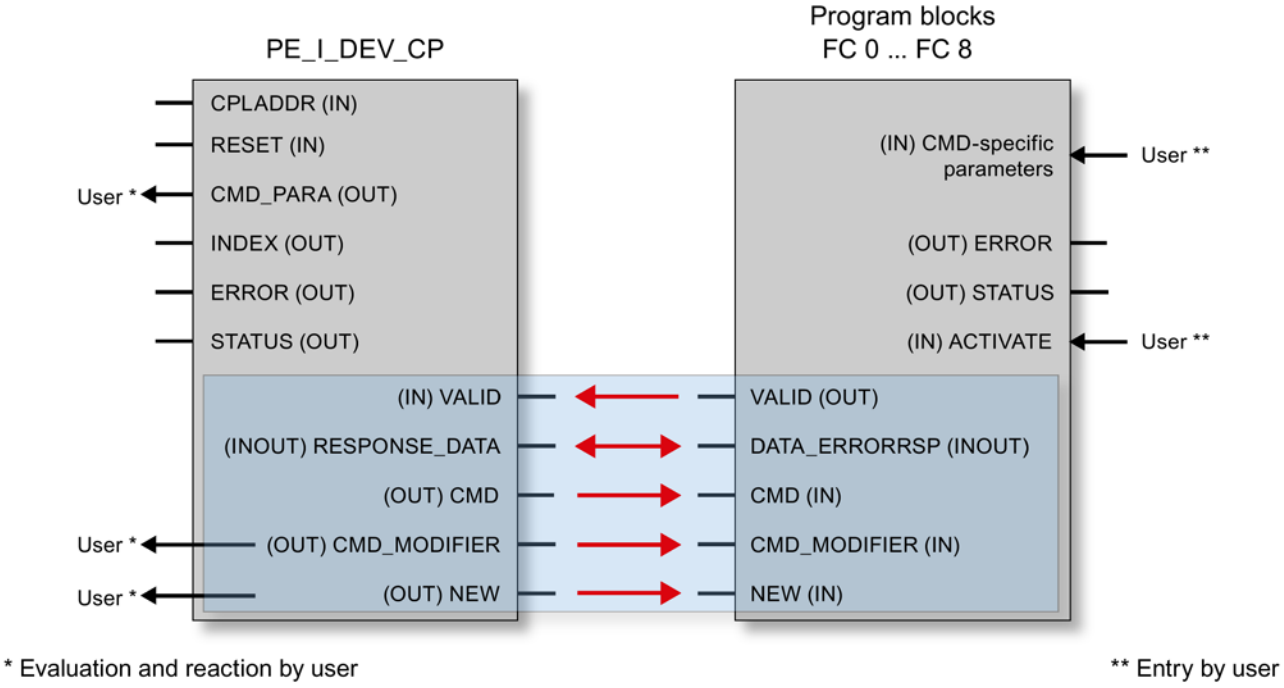


Image 3-2 Interconnection of the FCs with PE_I_DEV_CP

Note

Interconnection of the program blocks is an absolute necessity

PE_I_DEV_CP must be interconnected with FC 0...FC 8 at the parameters shown on a light blue background that are assigned to the corresponding parameters of the FCs indicated by red arrows.

3.3.6.3 Common parameters of the FCs

Common parameters of the supplementary program blocks FC 0 - FC 8

Parameters	Declaration	Data type	Range of values	Description
Input parameters				
ACTIVATE	INPUT	BOOL		Instructs the block to copy the input parameters to the "DATA_ERRORRSP" data area are on a rising edge. Is then reset by the block. Must be set by the user within 10 seconds after a positive edge was detected at PE_I_DEV_NEW.
PE_I_DEV_NEW	INPUT	BOOL		Must be interconnected with the NEW output parameter of PE_I_DEV_CP. The block is processed only when 1 is set.
CMD	INPUT	INT		Must be interconnected with the CMD output parameter of PE_I_DEV_CP.
CMD_MODIFIER	INPUT	INT		Must be interconnected with the CMD_MODIFIER output parameter of PE_I_DEV_CP.
Output parameters				
DATA_ERRORRSP	OUTPUT	ANY		Pointer to the data area in which the response data will be stored (complete response frame including header). Must be interconnected with the RESPONSE_DATA output parameter of PE_I_DEV_CP. Recommended size: At least 244 bytes.
VALID	OUTPUT	BOOL	0: - 1: No error	Is set by the block. Must be interconnected with the VALID input parameter of PE_I_DEV_CP.
ERROR	OUTPUT	BOOL	0: No error 1: Errors	Error code
STATUS	OUTPUT	WORD	0: No error	Status code 80B1$_h$: Error in ANY information (for example wrong area)

3.3.6.4 Individual parameters of the FCs

Individual parameters of FC 0 to FC 8

Below you will find a description of the individual parameters of the FCs.

PE_ERROR_RSP

Generates a negative response if the required PROFIenergy command is generally or temporarily not supported. The negative response is not dependent on the requesting command.

Table 3- 8 Individual parameters of FC 0 PE_ERROR_RSP

Parameters	Declaration	Data type	Range of values	Description
ERROR_CODE	INPUT	BYTE		Error number

PE_START_RSP

Initiates an energy saving pause. Generates the response to the "Start_Pause" command. Returns the energy-saving mode adopted by the device.

Table 3- 9 Individual parameters of FC 1 PE_START_RSP

Parameters	Declaration	Data type	Range of values	Description
PE_Mode_ID	INPUT	BYTE		ID of the energy-saving mode that the device or the unit group adopts.

Return message with the PE_Mode_ID of the energy-saving mode that the field devices or the unit group have adopted.

PE_END_RSP

Generates the response to the "End_Pause". command

Table 3- 10 Individual parameters of FC 2 PE_END_RSP

Parameters	Declaration	Data type	Range of values	Description
Time_to_Operate	INPUT	DWORD		Time required to change from the current energy-saving mode after "ready to operate".

PE_LIST_MODES_RSP

Generates the response to the "Query_Modes" > modifier "List_Modes" command (list of the supported energy-saving modes).

The IDs of the energy-saving modes must be specified in the user program.

Table 3- 11 Individual parameters of FC 3 PE_LIST_MODES_RSP

Parameters	Declaration	Data type	Range of values	Description
Number_of_PE_Mode_IDs	INPUT	BYTE		Number of supported energy-saving modes
PE_Mode_ID	INPUT	ANY	• 00_h • 01_h...FE_h • FF_h	Pointer to the area in which the energy-saving modes are stored. As the user, you will need to store the IDs of the energy-saving modes here. An energy-saving mode ID is configured in the Unsigned8 format. Permitted range: 1 to 254 bytes.

If the devices or a group need to react differently to different lengths of pause you can set up different energy-saving modes (PE_Mode) to achieve this. You assign a different PE_Mode_ID to the various energy-saving modes.

Possible values for "PE_Mode_ID":

- 00_h: PE_Power_off
- 01_h...FE_h: Freely configurable or vendor-specific
- FF_h: PE_Ready_to_operate

PE_GET_MODE_RSP

Generates the response to the "Query_Modes" > Modifier "Get_Mode". command

Table 3- 12 Individual parameters of FC 4 PE_GET_MODE_RSP

Parameters	Declaration	Data type	Range of values	Description
PE_Mode_ID	INPUT	BYTE		Currently used energy-saving mode ID
Time_Min_Pause *	INPUT	Unsigned32		Minimum pause duration for this PE energy-saving mode. It is the sum of the three parameters: • Time_to_Pause • Time_to_operate • Time_min_length_of_stay
Time_to_Pause *	INPUT	Unsigned32		Time from the START edge until the requested energy-saving mode is reached
Time_to_operate *	INPUT	Unsigned32		Max. time after turn on before PE_ready_to_operate Time_to_operate can be used directly for the relevant calculations. The value can either be a static MAX value or can be calculated dynamically by the PE device.
Time_min_length_of_stay *	INPUT	Unsigned32		Minimum time that the PE device must remain in this PE_Mode.

Parameters	Declaration	Data type	Range of values	Description
Time_max_length_of_stay *	INPUT	Unsigned32		Maximum time that the PE device can remain in this PE_Mode.
Mode_Power _Consumption **	INPUT	Float32		Energy consumption in current PE_Mode [kW]
Energy_Consumption _to_pause **	INPUT	Float32		Energy consumption of PE_ready_to_operate until the current PE_Mode [kWh]
Energy_Consumption _to_operate **	INPUT	Float32		Energy consumption from current PE_Mode until PE_ready_to_operate [kWh]

* The PROFIenergy profile does not specify an invalid time format.
If the time is unlimited, the maximum value $FFFFFFFF_h$ can be specified.
If the time is zero, 00_h can be used.

** If an energy consumption value is not defined, 0.0 (Float32) can be specified.

PE_PEM_STATUS_RSP

Generates the response to the "PEM_STATUS". command

Table 3- 13 Individual parameters of FC 5 PE_PEM_STATUS_RSP

Parameters	Declaration	Data type	Range of values	Description
PE_Mode_ID_Source	INPUT	BYTE	• 00_h • 01_h...FE_h • FF_h	ID of the energy-saving mode actually adopted
PE_Mode_ID_Destination	INPUT	BYTE	• 00_h • 01_h...FE_h • FF_h	ID of the energy-saving mode set by the controller
Time_to_operate *	INPUT	Unsigned32		Max. time after turn on before PE_ready_to_operate Time_to_operate can be used directly for the relevant calculations. The value can either be a static MAX value or can be calculated dynamically by the PE device.
Remaining_time_to _destination *	INPUT	Unsigned32		Optional: Time remaining until the requested PE_Mode. Dynamic value or static MAX value
Mode_Power _Consumption **	INPUT	Float32		Energy consumption in current PE_Mode [kW]

Parameters	Declaration	Data type	Range of values	Description
Energy_Consumption _to_Destination **	INPUT	Float32		Energy consumption until the requested PE_Mode [kWh]
Energy_Consumption _to_operate **	INPUT	Float32		Energy consumption from current PE_Mode until PE_ready_to_operate [kWh]

* The PROFIenergy profile does not specify an invalid time format.
If the time is unlimited, the maximum value $FFFFFFFF_h$ can be specified.
If the time is zero, 00_h can be used.

** If an energy consumption value is not defined, 0.0 (Float32) can be specified.

Possible values for "PE_Mode_ID_Source" and "PE_Mode_ID_Destination":

- 00_h: PE_Power_off
- 01_h...FE_h: Freely configurable or vendor-specific
- FF_h: PE_Ready_to_operate

PE_IDENTIFY_RSP

Generates the response to the "PE_Identify". command

As the user you need to specify which PROFIenergy commands are supported.

Table 3- 14 Individual parameters of FC 6 PE_IDENTIFY_RSP

Parameters	Declaration	Data type	Range of values	Description
Count	INPUT	BYTE	0...6	Meaning of supported PROFIenergy commands
Start_Pause	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported
End_Pause	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported
Query_Modes	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported
PEM_Status	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported
PEM_Identify	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported
Query_Measurement	INPUT	BOOL	0...1	• 1: Command is supported • 0: Command is not supported

PE_MEASUREMENT_LIST_RSP

Generates the response to the "Query_Measurement" > Modifier "Get_Measurement_List". command

Table 3- 15 Individual parameters of FC 7 PE_MEASUREMENT_LIST_RSP

Parameters	Declaration	Data type	Range of values	Description
Count	INPUT	BYTE		Number of supported measured value IDs (Measurement_ID)
Measurement_List	INPUT	ANY		Pointer to the data area with the supported measured value IDs. As the user, you store the measured value IDs in this data area. Per frame, a maximum of 29 measured value IDs can be transferred. For information on the structure of the array, refer to section Response data (Page 179) > "Query_Measurement" – Get_Measurement_List.

PE_MEASUREMENT_VALUE_RSP

Generates the response to the "Query_Measurement" > Modifier "Get_Measurement_Values". command

Table 3- 16 Individual parameters of FC 8 PE_MEASUREMENT_VALUE_RSP

Parameters	Declaration	Data type	Range of values	Description
Count	INPUT	BYTE		Number of supported Measurement_Values
Measurement_Values	INPUT	ANY		Pointer to the data area of the measured values (Measurement_Values). As the user, you store the measured values in this data area. Per frame, a maximum of 116 measured values can be transferred. For information on the structure of the array, refer to section Response data (Page 179) > "Query_Measurement" – Get_Measurement_List.

3.3.7 DS3_WRITE_CP / PE_DS3_Write_ET200S_CP

The following description of the program block DS3_WRITE_CP also applies to PE_DS3_Write_ET200S_CP for STEP 7 Professional that has the same functionality.

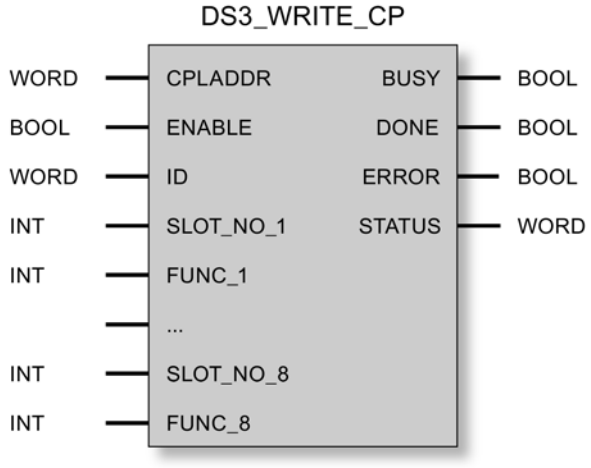
3.3.7.1 Meaning and call - DS3_WRITE_CP

Significance and how It works

DS3_WRITE_CP is used in the CPU of the CP 300 as a PROFIenergy controller to transfer the settings for the switching behavior of power modules of an ET 200S. The switching behavior for up to 8 slots (in this case: power modules) can be transferred.

DS3_WRITE_CP is not a PROFIenergy program block.

Call interface in FBD representation



Call interface in STL representation

STL	Explanation
CALL FB 53, DB 53 (	//Call program block DS3_WRITE_CP;
CPLADDR := W#16#0110,	//Module address from hardware configuration;
ENABLE := M 1.1,	//Address for edge signal for block execution;
ID := W#16#86A,	//Address of the header slot of the IO device;
SLOT_NO_1 := W#16#1000,	//Logical address of power module 1;
FUNC_1 := M 2.1,	//Address of the value of the switching behavior of power module 1;
...	//...
...	//...
BUSY := M 1.2,	//Address for the BUSY return parameter;
DONE := M 1.3,	//Address for the DONE return parameter;
ERROR := M 1.4,	//Address for the ERROR return parameter;
STATUS := MW 12);	//Address for the STATUS return parameter

3.3.7.2 Explanation of the formal parameters of DS3_WRITE_CP

Explanation of the formal parameters of DS3_WRITE_CP

Parameters	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD	I, Q, M, D, L, const.	Module start address of the CP
ENABLE	INPUT	BOOL		Starts the processing of the program block on a rising edge.
ID	INPUT	WORD		Logical address of the header slot of the IO device
SLOT_NO_1	INPUT	INT		Slot number of the first power module
FUNC_1	INPUT	INT		Specifies the switching behavior for the power module in terms of starting or ending energy-saving pauses • 0 (FALSE) – PAUSE_START: No influence (power module remains turned on) – PAUSE_STOP: Turns the power module on again. • 1 (TRUE) – PAUSE_START: Turns the power module off. – PAUSE_STOP: Turns the power module on again.
...	INPUT	INT		
...	INPUT	INT		
SLOT_NO_8	INPUT	INT		Slot number of the eighth power module
FUNC_8	INPUT	INT		See "FUNC_1"
BUSY	OUTPUT	BOOL	0: Execution not yet started, completed or aborted 1: Execution active	Condition code of the processing status of the program block
DONE	OUTPUT	BOOL	0: - 1: Data record transferred successfully	This parameter indicates whether or not the job was completed without errors.
ERROR	OUTPUT	BOOL	0: - 1: Errors	Error code
STATUS	OUTPUT	WORD		Status code

For the meaning of DONE, ERROR and STATUS, see Condition codes of DS3_WRITE_CP (Page 199).

3.3.7.3 Condition codes of DS3_WRITE_CP

Condition codes of DS3_WRITE_CP

DS3_WRITE_CP is based on the program block PNIO_RW_REC and returns all condition codes of PNIO_RW_REC, see condition codes of the block PNIO_RW_REC.

See also

Condition codes of PNIO_RW_REC (Page 161)

3.4 Configuration limits / resources required for the program blocks (PROFINET)

Required resources

Note

Note the version information of the blocks. The currently supplied block versions may differ from those shown here. Blocks with other versions have different resource requirements.

You will find information on the current block versions under entry ID:

Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

Table 3- 17 Information for FCs / FBs with S7400

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
PN_InOut	1.3	FB88	2678	2234	2198	48
PN_InOut_Fast	1.0	FB90	2906	2266	2230	48

Table 3- 18 Information for FCs / FBs with S7-300

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
PN_InOut	1.5	FB88	2470	2066	2030	54
PNIO_SEND	3.0	FC11	1420	1182	1146	46
PNIO_RECV	3.0	FC12	1270	1052	1016	46
PNIO_RW_REC	1.1	FB52	1636	1378	1342	62
PNIO_ALARM	1.1	FB54	1168	960	924	62
PE_START_END_CP	1.0	FB85	3286	2808	2772	92
PE_CMD_CP	1.0	FB86	3750	3264	3228	358
PE_I_DEV_CP	1.0	FB87	3192	2902	2866	114
DS3_WRITE_CP	1.0	FB53	1716	1408	1372	84

Program blocks for PROFINET CBA

4

4.1 PN_InOut / PN_InOut_Fast - meaning and call

Significance and how It works

The task of function block FB88 / FB90 is to transfer data from the interface DB to the CP and from the CP to the interface DB. The interface DB itself is the interface to the user program.

FB88 / FB90 is called cyclically. It is also possible to call FB88 /FB90 more than once in a cycle.

At its interface, FB88 /FB90 only needs to be supplied with the module address of the CP.

To ensure data consistency, you can only modify the data to be transferred or start to read the received data when the job is completed (DONE=1 or ERROR=1).

As soon as DONE=1 or ERROR=1 is set, the transfer is complete or has been terminated with an error message. Data can now be evaluated or set again. Data will only be transferred with the next call.

In your user program, make sure that on completion of data transfer FB88 /FB90 is called again only after all the input data has been read and all output data has been written to the interface DB.

Calling the FB88 / FB90 blocks time-driven is permitted in principle. Refer to the notes on this mode later in this chapter.

Differences between FB88 and FB90

The activities of the function blocks FB90 and FB88 on the interface to the user program are largely identical. You can use FB90 with certain CP/CPU types with an S7-400; refer to the information in the manual of the CP.

If FB90 is approved for the CP type being used, we recommend that you use it. As a result, you can achieve shorter reaction times than with FB88. You should, however, remember the constraints regarding its use.

The following points apply:

- The interface parameters are identical;
- For FB90, there are several additional codes in the STATUS parameter;

- With some errors, there are different codes in the STATUS parameter of FB88 and FB90;
- There are differences in the configuration limits of the interface DB (see relevant manual).

Note

For more detailed information on handling the interface DB, refer to the SIMATIC iMap documentation.

Note

When you reload user program blocks, data consistency is only guaranteed if the CPU is first changed to STOP.

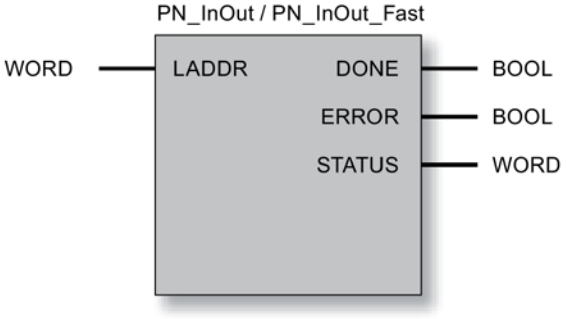
How supplied - block library

FB88 and FB90 are supplied with SIMATIC iMap. There are different block types for S7-300 and S7-400.

After SIMATIC iMap has been installed, the program blocks are available in the STEP 7 library "PROFINET System Library/CP300/Blocks" or "PROFINET System Library/CP400/Blocks".

Call interface

Call interface in FBD representation



Example of a call in STL representation

STL	Explanation
`Call FB 88 , DB88 (`	`//Block call with instance DB88`
`LADDR := W#16#0120,`	
`DONE := M 99.1,`	
`ERROR := M 99.0,`	
`STATUS := MW 104);`	

4.2 Explanation of the formal parameters - PN_InOut / PN_InOut_Fast

Explanation of the formal parameters

The following table explains all the formal parameters for FB88 / FB90:

Parameter	Declaration	Data type	Description
LADDR	INPUT	WORD	Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here. Since only one CP in the rack supports operation with PROFINET CBA, this parameter must not be changed.
DONE	OUTPUT	BOOL	Reports the (positive) completion of a job.
ERROR	OUTPUT	BOOL	This indicates that the job could not be executed errorfree.
STATUS	OUTPUT	WORD	This parameter supplies detailed information about the execution of the job. Status codes can be returned during execution of the job (DONE=0 and ERROR=0).

4.3 Condition codes of the PN_InOut and PN_InOut_Fast blocks

Evaluating status codes

Remember that the status codes DONE, ERROR, STATUS are updated at each block call.

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Table 4- 1 Codes for PN_InOut (FB88) and PN_InOut_Fast (FB90)

DONE	ERROR	STATUS	Meaning
1	0	0000_H	Job completed without error.
0	0	0000_H	No job being processed; the block can be called.
0	0	8181_H	• Job active. or • (only with FB90): Connection establishment to addressed module active (see also information under 8090_H).
0	1	8183_H	(S7-300 only) The service has not yet started; data acceptance is not yet possible.
0	1	8184_H	• Bad instance DB, generally triggered by illegal writing of the instance DB by the user program. or • (only with FB90) Bad send or receive job.

DONE	ERROR	STATUS	Meaning
0	1	8085_H	(only with FB90) Bad interface DB.
0	1	8090_H	(S7-400 only) Parameter assignment error An incorrect module address was specified; the address points to an empty slot. Note (only with FB90): In the following cases, the value 8181H is shown in STATUS (job active); In actual fact, there is no communication: • The address points to a slot that contains a different module type. • The addressed module is configured for PROFINET CBA operation.
0	1	$80A1_H$	(only with FB90) Possible communications errors: • Stationinternal connection to addressed module being terminated; • The configuration limits for connections of the CPU has been exceeded; • The interface is being reinitialized.
0	1	$80B0_H$	(S7-300 only) Block error: The data record number is wrong. This status can also occur after the following actions: • Cold or warm restart after power DOWN/UP • Cold or warm restart on the CPU
0	1	$80B1_H$	(S7-300 only) Block error: Data record length or offset wrong.
0	1	$80B3_H$	(S7-300 only) Parameter error: Wrong CP address.
0	1	$80C1_H$	(S7-300 only) Temporary error: The specified data record is currently being processed.
0	1	$80C2_H$	(S7-300 only) Temporary error: There is a job bottleneck; the data record cannot be read yet.
0	1	$80C3_H$	(S7-300 only) Temporary error: Resources occupied (memory).
0	1	$80C4_H$	(S7-300 only) Communication error: Occurs temporarily and a repetition in the user program will often remedy the problem.
0	1	$80D0_H$	(S7-300 only) Configuration error: The maximum number of blocks of input and output data has been exceeded; the interface DB is too large.
0	1	$80D1_H$	(S7-300 only) Configuration error Possible causes: • The interface of the configured component does not match the one used in the program (outputs). • The wrong module was inserted; The PROFINET service is not supported.

DONE	ERROR	STATUS	Meaning
0	1	$80D2_H$	(S7-300 only) Configuration error Possible causes: • The interface of the configured component does not match the one used in the program (inputs). • The wrong module was inserted; The PROFINET service is not supported. • Parameter error: Wrong CP address
0	1	8322_H	(only with FB90) Bad interface DB.
0	1	8332_H	(only with FB90) The number of the interface DB is too high.
0	1	$833A_H$	(only with FB90) Access to the interface DB is not possible (possibly because the interface DB was deleted).
0	1	8623_H	(only with FB90) Bad interface DB.
0	1	$863A_H$	(only with FB90) Access to the interface DB is not possible (possibly because the interface DB was deleted).

To find out which SFCs are used that are relevant for error evaluation, display the properties dialog of the FB described here in the "Calls" tab.

Note

For entries with the coding 8FxxH (for S7-300) or 8xxxH (for S7-400) under STATUS, note the information in the Reference Manual STEP 7 Standard and System Functions. The chapter describing error evaluation with the RET_VAL output parameter contains detailed information

Status codes during CP startup

With a complete restart or restart of the PROFINET CP (after activating a switch on the module), the output parameters of the block are reset as follows:

- DONE = 0
- ERROR = 0
- STATUS = 8181_H

4.4 Timedriven PN_InOut / PN_InOut_Fast call - recommendation on application

Timedriven call - recommendation on application

If your application requires timedriven transfer of the CBA data instead of cyclic or event-driven processing, we recommend the following procedure to call the FB88 / FB90 blocks.

If you use a timedriven call, remember that the block must be called repeatedly after it has been started until the DONE flag is set. To allow the CBA data to be copied between the CPU and CP without any longer interruptions, the followon calls should be as fast as possible and independent of the timing.

Note the following recommendations for programming:

- The timing is provided by a timer OB; the timer OB should only cause the first call for the PROFINET CBA blocks FB88 or FB90 not by calling the block directly but, for example, by setting a start flag.

  The cycle for calling the time OB should not exceed 30 s.
- The call of the PROFINET CBA blocks FB88 and FB90 should then always be made in OB1; OB1 starts the call as soon as the start flag is set by the timer OB.
- After the first block call, this is repeated in OB1 until the DONE bit is set (or until an error occurs); the start flag must then be reset.

Result:
The CBA user data can be copied between the CPU and CP without any significant interruption thanks to separating the timer OB from the actual block calls in OB1. You can select the interval between the first calls depending on the requirements of your application.

Program blocks for PROFIBUS

5

5.1 Program blocks for open communications services (SEND/RECEIVE interface)

5.1.1 Overview of uses

Overview

The following program blocks are available for the SEND/RECEIVE interface for transferring data on configured FDL connections:

Program block	Can be used with 1)		Meaning
	S7-300	S7-400	
AG_SEND (FC5)	x	x	for sending data
AG_RECV (FC6)	x	x	for receiving data
AG_LSEND (FC50)		x	for sending data
AG_LRECV (FC60)		x	for receiving data

1) Notes on the FCs for S7-300 and S7-400

To ensure the compatibility of PROFIBUS and Ind. Ethernet on the interface in the user program, you can use the FCs AG_LSEND and AG_LRECV on PROFIBUS as alternatives to AG_SEND and AG_RECV. There is no difference in the interface or the way they function. On PROFIBUS, however, you can only transfer data up to a maximum of 240 bytes even with these FCs although they are intended for longer data records on Industrial Ethernet.

This is only possible if the block type and block version are permitted for the CP type you are using.

With the S7-CPs for S7-300 only the FCs AG_SEND and AG_RECV are used; on Industrial Ethernet even for transferring longer data records

The manuals contain information on the compatibility of the S7-CPs and the corresponding blocks (FCs / FBs). You will find an overview of the versions of the FCs/FBs in the documentation and block history.

Application

The following diagram illustrates the use of the FCs AG_SEND / AG_LSEND and AG_RECV / AG_LRECV for bi-directional data transfer on one configured FDL connection.
With certain connection types, a job header should be included in the user data area.

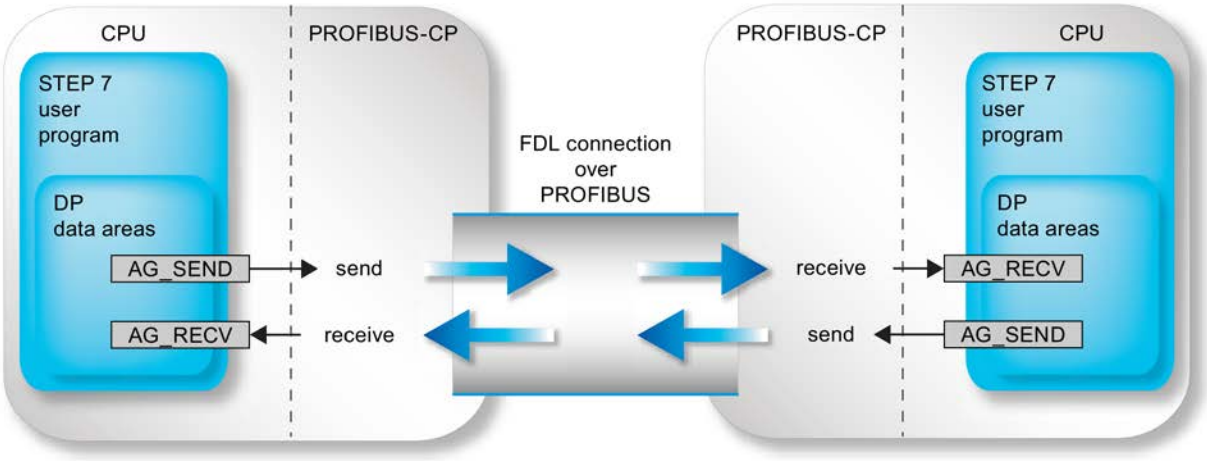


Image 5-1 Using AG_SEND and AG_RECV on both communications partners

Application without job header

With a specified FDL connection, the address and job parameters are specified by the configuration of the connection. The user program only provides the user data in the FDL data area when sending with AG_SEND / AG_LSEND or receives the data with AG_RECV / AG_LRECV.

Up to 240 bytes of user data can be transferred. This applies to PROFIBUS for both the AG_SEND or AG_LSEND functions.

Working with the job header

The following connection types require a job header in the FDL (user) data area:

- Unspecified FDL connection with free layer 2 access
- FDL connection with broadcast
- FDL connection with multicast

The following schematic illustrates the structure of the job buffer and the meaning and location of the parameters in the job header.

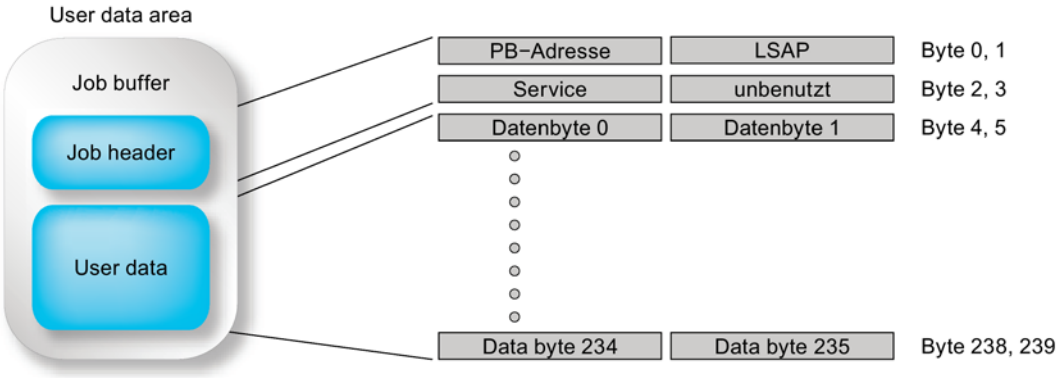


Image 5-2 Sending and receiving via an FDL connection with programmed broadcast addressing

|The user data area can be up to 240 bytes. Up to 236 bytes of user data can be transferred. 4 bytes are reserved for the job header.

Please note that the data length specified in the block call (LEN parameter) must include the header and the user data!

5.1.2 AG_SEND / AG_LSEND

5.1.2.1 Meaning and call - AG_SEND / AG_LSEND

Meaning of the block

The AG_SEND / AG_LSEND program block transfers data to the PROFIBUS CP for transmission on a configured FDL connection.

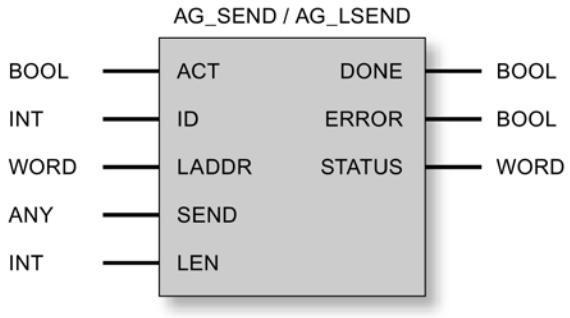
The selected data area can be a process image area, a memory bit area or a data block area.

Error free execution of the function is indicated when the entire FDL data area could be sent on PROFIBUS.

Note:
Unless otherwise stated, all the following information applies equally to the FCs AG_SEND and AG_LSEND.

Call

Call interface in FBD representation



Example in STL representation

STL	Explanation
`call fc 5 (`	`//Function call`
`ACT := M 20.0,`	`//Job triggered by memory bit`
`ID := MW 22,`	`//Connection ID acc. to configuration`
`LADDR := W#16#0100,`	`//=LADDR 256 dec. in HW Config`
`SEND := P#db99.dbx10.0 byte 240,`	`//Buffer with send data`
`LEN := MW 24,`	`//Length for send data`
`DONE := M 20.1,`	`//Execution code`
`ERROR := M 20.2,`	`//Error code`
`STATUS := MW 26 );`	`//Status code`

Calls with job header

The following table shows the connection types and job types for which parameters must be supplied in the job header.

The job header is located in the FDL (user) data area. It occupies the first 4 bytes and must be added to the length specified in the LEN parameter. The maximum user data length is therefore reduced for jobs with a job header to 236 bytes.

Table 5- 1 Supplying the job header in the user data area

Parameter	FDL connection type		
	Unspecified: free layer 2 [2)]	Broadcast	Multicast
PB address	Address of the destination station Range of values: 0..126 depending on node / 127 for broadcast/multicast	For AG_SEND no relevance; but area must be reserved.	For AG_SEND no relevance; but area must be reserved.

Parameter	FDL connection type		
LSAP	LSAP of the destination station Range of values: 0..62 depending on node / 63 for broadcast	No significance but area must be reserved.	No significance but area must be reserved.
Service [1]	SDA (Send Data with Acknowledge): Value: 00_H SDN (Send Data with No Acknowledge): Value: 01_H	No significance but area must be reserved.	No significance but area must be reserved.

[1] for broadcast and multicast, only the SDN service is possible.

[2] The information on broadcast and multicast in this column is relevant only when an unspecified FDL connection is used for broadcast or multicast. On a configured FDL connection (recommended application) with broadcast or multicast as the connection partner, the address parameters are assigned automatically according to the configuration.

5.1.2.2 How AG_SEND / AG_LSEND work

Operating principle

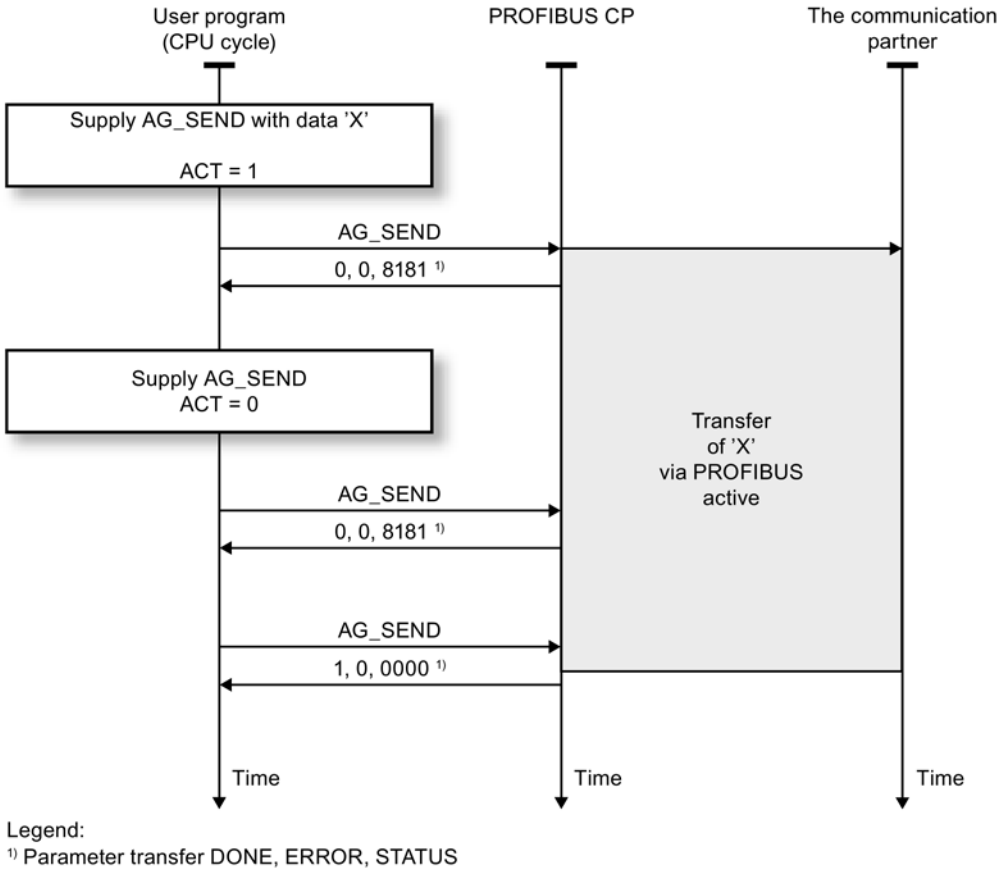
The following diagram illustrates the normal sequence of data transmission triggered in the user program using AG_SEND.

The send job in executed as soon as the parameter ACT = 1 is passed.

Following this, the parameter ACT = 0 must be passed in at least one further call.

The status code in the output parameters DONE, ERROR and STATUS is updated in each block call and can be evaluated. To update the status code without starting a new send job, start a new block call with the parameter ACT = 0.

Refer to the sample program at the end of this section.



5.1.2.3 Explanation of the formal parameters - AG_SEND / AG_LSEND

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_SEND /AG_LSEND functions:

Parameter	Declaration	Data type	Possible values	Description
ACT	INPUT	BOOL	0,1	If an FC is called with ACT=1, LEN bytes are sent from the ISO transport data area specified with the SEND parameter. If an FC is called with ACT = 0, the status codes DONE, ERROR and STATUS are updated.
ID	INPUT	INT	1,2...64 (S7-400) 1,2...16 (S7-300)	The connection number of the FDL connection is specified in the parameter ID.
LADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.

Parameter	Declaration	Data type	Possible values	Description
SEND	INPUT	ANY (only the following are permitted as VARTYPE: WORD and DWORD are permitted)		Specifies the address and length The address of the data area points to one of the alternatives: • PI area • Memory bit area • Data block area With a call with job header, the FDL data area contains the job header and the user data.
LEN	INPUT	INT	1,2,...240 (or up to "length specified for SEND parameter")	Number of bytes to be sent from the FDL data area with this job. The possible values range from 1 to length specified for the SEND parameter. In a call, with job header, the length information is made up of the job header (4 bytes) + user data (1 to 236 bytes). Therefore LEN >= 4 !
DONE	OUTPUT	BOOL	0: - 1: new data	The status parameter indicates whether or not the job was completed without errors. For the meaning in conjunction with the ERROR and STATUS parameters, refer to AG_SEND and AG_LSEND condition codes (Page 213).
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the parameters DONE and STATUS, refer to AG_SEND and AG_LSEND condition codes (Page 213)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters DONE and ERROR, refer to AG_SEND and AG_LSEND condition codes (Page 213)

5.1.2.4 AG_SEND and AG_LSEND condition codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 5- 2 AG_SEND condition codes

DONE	ERROR	STATUS	Meaning
1	0	0000_H	Job completed without error.
0	0	0000_H	No job being executed.
0	0	8181_H	Job active.
0	1	7000_H	The condition code is possible only with S7-400: The FC was called with ACT=0; the job has not yet been processed.
0	1	8183_H	No configuration or the FDL service has not yet started on the PROFIBUS CP.
0	1	8184_H	Possible causes: • Illegal data type specified for the SEND parameter. • FDL connection without job buffer: System error. • FDL connection with job buffer: Parameter LEN<4 or illegal parameter in job header (with free layer 2 access).
0	1	8185_H	LEN parameter longer than SEND source area.
0	1	8186_H	ID parameter invalid. ID != 1, 2...16.
0	1	8301_H	SAP not activated on destination station.
0	1	8302_H	No receive resources on the destination station; the receiving station cannot process received data quickly enough or has not prepared any receive resources.
0	1	8303_H	The PROFIBUS service (SDA Send Data with Acknowledge) is not supported on this SAP by the destination station. This condition code can also occur temporarily when connections or gateways are downloaded "in RUN".
0	1	8304_H	The FDL connection is not established.
0	1	8311_H	The destination station is not obtainable at the specified PROFIBUS address or the service is not possible for the specified PROFIBUS address.
0	1	8312_H	PROFIBUS error on the CP: for example, bus short-circuit, own station not in ring.
0	1	8315_H	Possible causes: • Internal parameter error on an FDL connection with job header: Parameter LEN<4 or illegal parameter in job header (with free layer 2 access). • Bus disruption Possible additional meaning: • This error code can also occur with bus problems (for example physical disturbances due to bad cable connections or different settings for the transmission speed on the nodes).
0	1	$8F22_H$	Source area invalid, e.g.: Area does not exist in the DB LEN parameter < 0
0	1	$8F24_H$	Area error reading a parameter.
0	1	$8F28_H$	Alignment error reading a parameter.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Area not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area.
0	1	$8F44_H$	Address of the parameter to be read is disabled in the access track.

DONE	ERROR	STATUS	Meaning
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference e.g. parameter LEN=0
0	1	8090_H	• No module with this module start address exists. • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary.
0	1	8092_H	In the ANY reference, a type other than BYTE is specified. (S7-400 only)
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established. (with newer CPU versions). This can, for example, be caused by the following: • No connection configuration; • The maximum number of CPs that can be operated at one time has been exceeded (for further information, refer to the CP manual).
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	The destination area is invalid. The amount of data to be sent exceeds the upper limit permitted for this service (e.g. destination area > 240 bytes).
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established (with older CPU versions; otherwise $80A4_H$; for further information, refer to this code)
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Module start address incorrect.

5.1.3 AG_RECV / AG_LRECV

5.1.3.1 Meaning and call - AG_RECV / AG_LRECV

Meaning of the block

The AG_RECV program block receives the data transferred on a configured FDL connection from the PROFIBUS CP.

The data area specified for the receive data can be a process image area, a bit address area or a data block area.

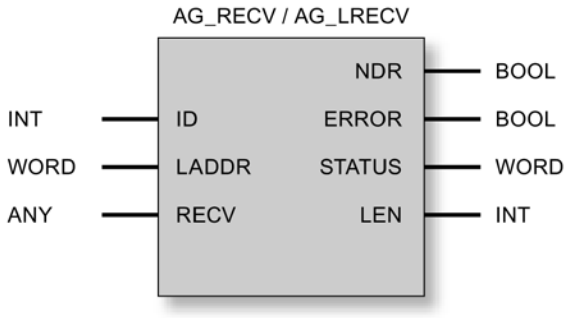
Errorfree execution is indicated when the data could be received from the PROFIBUS CP.

Note:

All the following information applies equally to both FCs AG_RECV and AG_LRECV unless stated otherwise.

Call interface

Call interface in FBD representation



Example in STL representation

```
STL                                 Explanation
call fc 6 (                         //Function call
ID := MW 30,                        //Connection ID acc. to configuration
LADDR := W#16#0100,                 //=LADDR 256 dec.in HW Config
RECV := P#M 10.0 BYTE 100,          //Buffer for received data
NDR := DB 100.DBX 0.6,              //Receive code
ERROR := DB 100.DBX 0.7,            //Execution code
STATUS := DB 100.DBW 2,             //Error code
LEN := DB 100.DBW 4 );              //Status code
```

Calls with job header

Table 5- 3 Return parameters in the job header in the FDL (user) data area

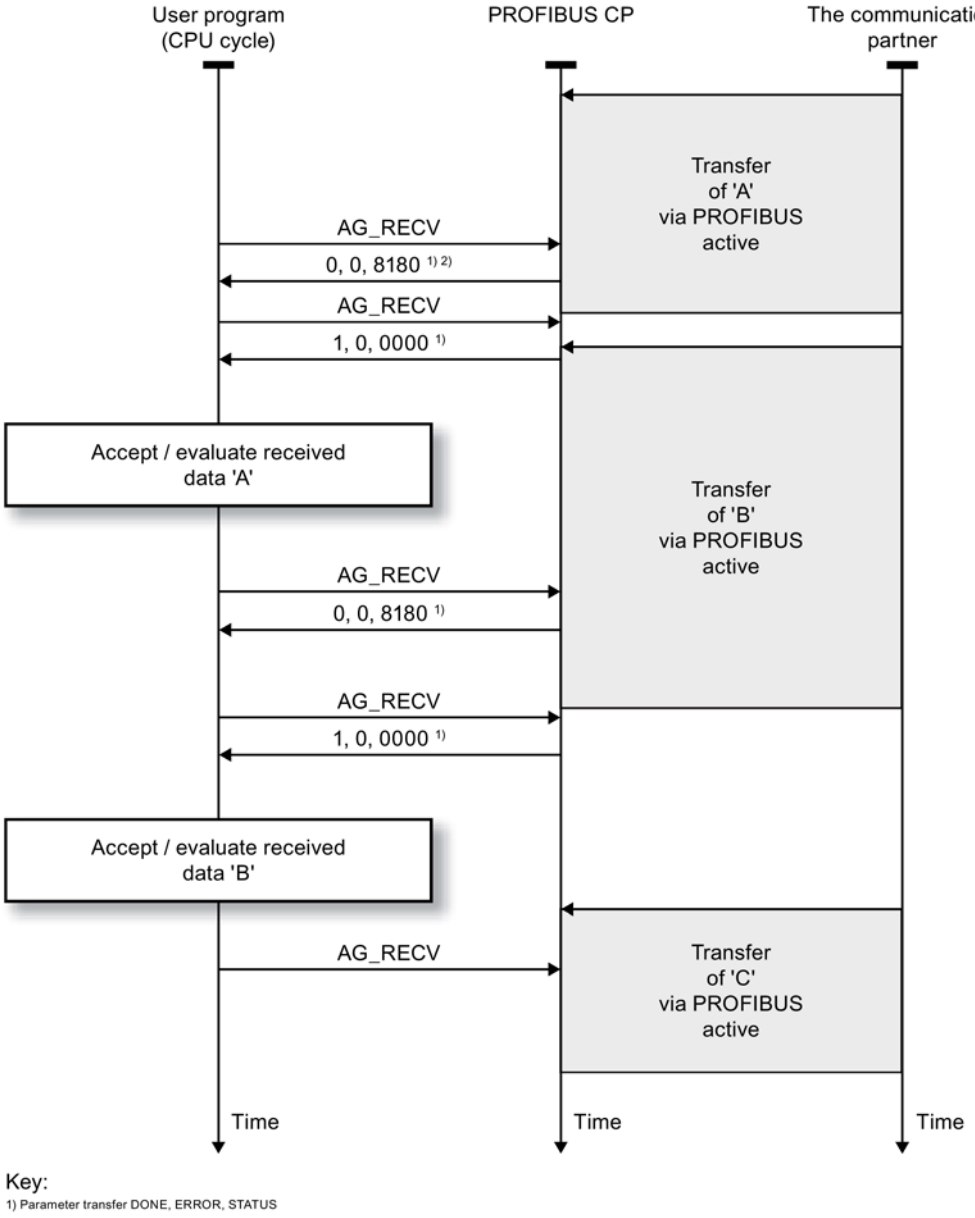
Parameter	FDL connection type		
	Unspecified: free layer 2)	Broadcast	Multicast
PB address	Address of the sender Range of values: 0 to 126 depending on node		
LSAP	LSAP of the sender Range of values: 0 to 63 depending on node		
Service	SDN indication (Send Data with No Acknowledge - Indication): Value: 01_H or SDA indication (Send Data with Acknowledge - Indication): Value: 00_H	SDN indication (Send Data with No Acknowledge - Indication): Value: $7F_H$	SDN indication (Send Data with No Acknowledge - Indication): Value: $7F_H$

5.1.3.2 How AG_RECV / AG_LRECV work

Operating principle

The following diagram illustrates the normal sequence of data acceptance triggered by an AG_RECV in the user program.

Each AG_RECV job in the user program is acknowledged by the Ethernet CP with an entry in the output parameters NDR, ERROR and STATUS.



5.1.3.3 Explanation of the formal parameters - AG_RECV / AG_LRECV

Explanation of the formal parameters

The following table explains all the formal parameters for the AG_RECV / AG_LRECV function:

Parameter	Declaration	Data type	Possible values	Description
ID	INPUT	INT	1,2...16 (S7-300) 1,2...32 (S7-400)	The connection number of the FDL connection is specified in the parameter ID.
LADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.
RECV	INPUT	ANY (only the following are permitted as VARTYPE: WORD and DWORD are permitted)		Specifies the address and length The address of the FDL data area points to one of the alternatives: • PI area • Memory bit area • Data block area With a call with job header, the FDL data area contains the job header and the user data.
LEN	OUTPUT	INT	1,2,...240	Specifies the number of bytes to be received in the FDL data area from the PROFIBUS CP. In a call, with job header, the length information is made up of the job header (4 bytes) + user data (1 to 236 bytes). Therefore LEN >= 4 !
NDR	OUTPUT	BOOL	0: - 1: new data	This parameter indicates whether new data were received. For the meaning in conjunction with the parameters ERROR and STATUS, refer to AG_RECV and AG_LRECV condition codes (Page 219).
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the parameters NDR and STATUS, refer to AG_RECV and AG_LRECV condition codes (Page 219).
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters NDR and ERROR, refer to AG_RECV and AG_LRECV condition codes (Page 219).

5.1.3.4 AG_RECV and AG_LRECV condition codes

Condition codes

The following table shows the codes formed by the NDR, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 5- 4 AG_RECV / AG_LRECV condition codes

NDR	ERROR	STATUS	Meaning
1	0	0000_H	New data accepted.
0	0	8180_H	• There is no data available yet. The configuration is missing or the FDL service has not started on the PROFIBUS CP (occurs here instead of the code 0,1,8183_H).
0	0	8181_H	Job active.
0	1	8183_H	No configuration or the FDL service has not yet started on the PROFIBUS CP.
0	1	8184_H	• Illegal data type specified for the RECV parameter. • System error.
0	1	8185_H	Destination buffer (RECV) is too short.
0	1	8186_H	ID parameter invalid. ID != 1, 2...16.
0	1	8303_H	The PROFIBUS service (SDA - Send Data with Acknowledge) is not supported on this SAP. This condition code can also occur temporarily when connections or gateways are downloaded "in RUN".
0	1	8304_H	The FDL connection is not established.
0	1	$8F23_H$	Source area invalid, e.g.: Area does note exist in the DB.
0	1	$8F25_H$	Area error writing a parameter.
0	1	$8F29_H$	Alignment error writing a parameter
0	1	$8F30_H$	Parameter is in the writeprotected 1st current data block.
0	1	$8F31_H$	Parameter is in the writeprotected 2nd current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Destination area not loaded (DB).
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.

NDR	ERROR	STATUS	Meaning
0	1	$8F45_H$	Address of the parameter to be written is disabled in the access track.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	• No module with this module start address exists. • The FC being used does not match the system family being used (remember to use different FCs for S7300 and S7400).
0	1	8091_H	Module start address not at a doubleword boundary.
0	1	8092_H	In the ANY reference, a type other than BYTE is specified. (S7-400 only)
0	1	$80A0_H$	Negative acknowledgment reading from the module.
0	1	$80A4_H$	The communication bus connection between the CPU and CP is not established. (with newer CPU versions). This can, for example, be caused by the following: • No connection configuration; • The maximum number of CPs that can be operated at one time has been exceeded (for further information, refer to the CP manual).
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	Possible causes: • The destination area is invalid. • The destination area is too short. The destination area for the received data was adequately dimensioned. Remedy: Run another receive call with maximum receive buffer size. This applies regardless of the connection type (unicast / multicast / broadcast) and the device family (S7-300 / S7-400).
0	1	$80B2_H$	The communication bus connection between the CPU and CP is not established.
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	80C3H	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Module start address incorrect.

5.2 Program blocks for DP (distributed I/O) with S7-300

5.2.1 Overview of uses

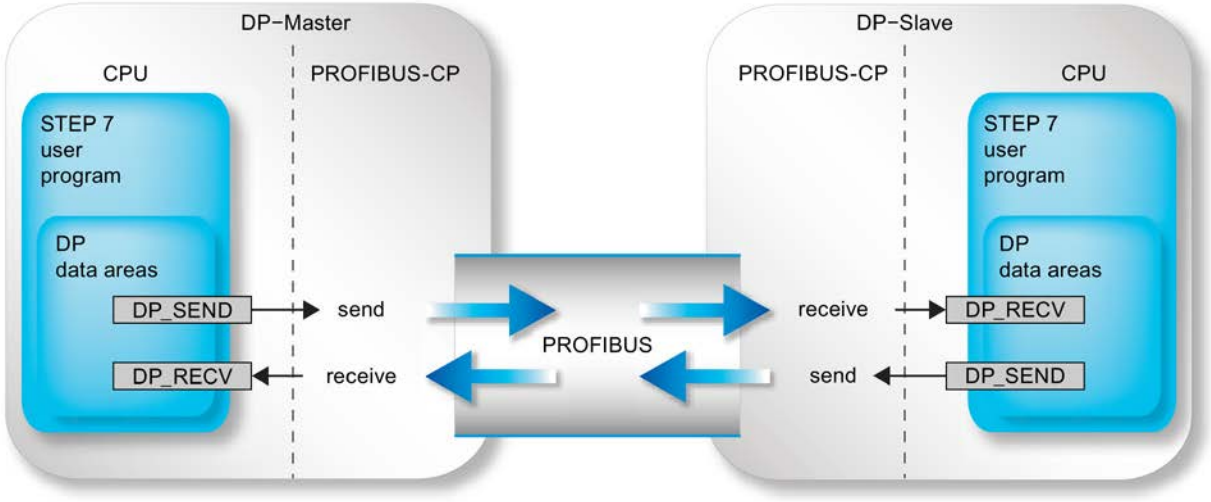
Overview

The following program blocks are available for the DP master and DP slave modes with an S7300:

Program block	can be used with:		Meaning
	DP master	DP slave	
DP_SEND (FC1)	X	X	for sending data
DP_RECV (FC2)	X	X	for receiving data
DP_DIAG (FC3)	X	-	for diagnostic functions initiated by the DP master
DP_CTRL (FC4)	X	-	for control functions

Application

The following diagram illustrates the use of the DP_SEND and DP_RECV program blocks on the DP master and DP slave.



5.2.2 DP_SEND

5.2.2.1 Meaning and call - DP_SEND

Meaning

The DP_SEND program block transfers data to the PROFIBUS CP. Depending on the mode of the PROFIBUS CP, DP_SEND has the following significance:

- When used in the DP master

  The block transfers the data of a specified DP output area to the PROFIBUS CP for output to the distributed I/O system.

- When used in the DP slave

  The block transfers the input data of the DP slave to the PROFIBUS CP for transfer to the DP master

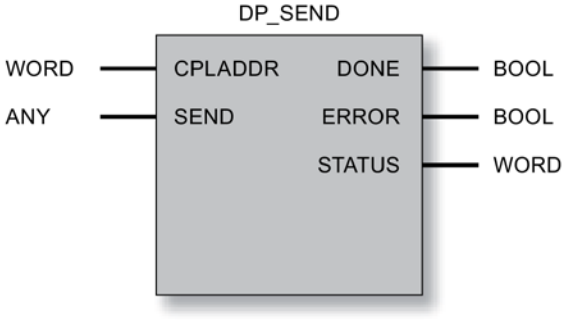
The selected data area can be a process image area, a memory bit area or a data block area.

Correct execution is signaled when the entire DP data area could be accepted by the PROFIBUS CP.

To start the DP master exactly one DP-SEND or DP-RECV call must precede the call sequence. The following applies to this first call:

If DP-SEND is used for initialization, the transferred data area is not accepted and "0" is sent to the slaves. The user data to be transferred is accepted only with the second block call.

Call interface



Example of a call in STL representation

STL	Explanation
`call fc 1 (`	`//DP_SEND function call`
`CPLADDR:= W#16#0120,`	
`SEND := P#db17.dbx0.0 byte 103,`	
`DONE := M 99.1,`	
`ERROR := M 99.0,`	
`STATUS := MW 104 );`	

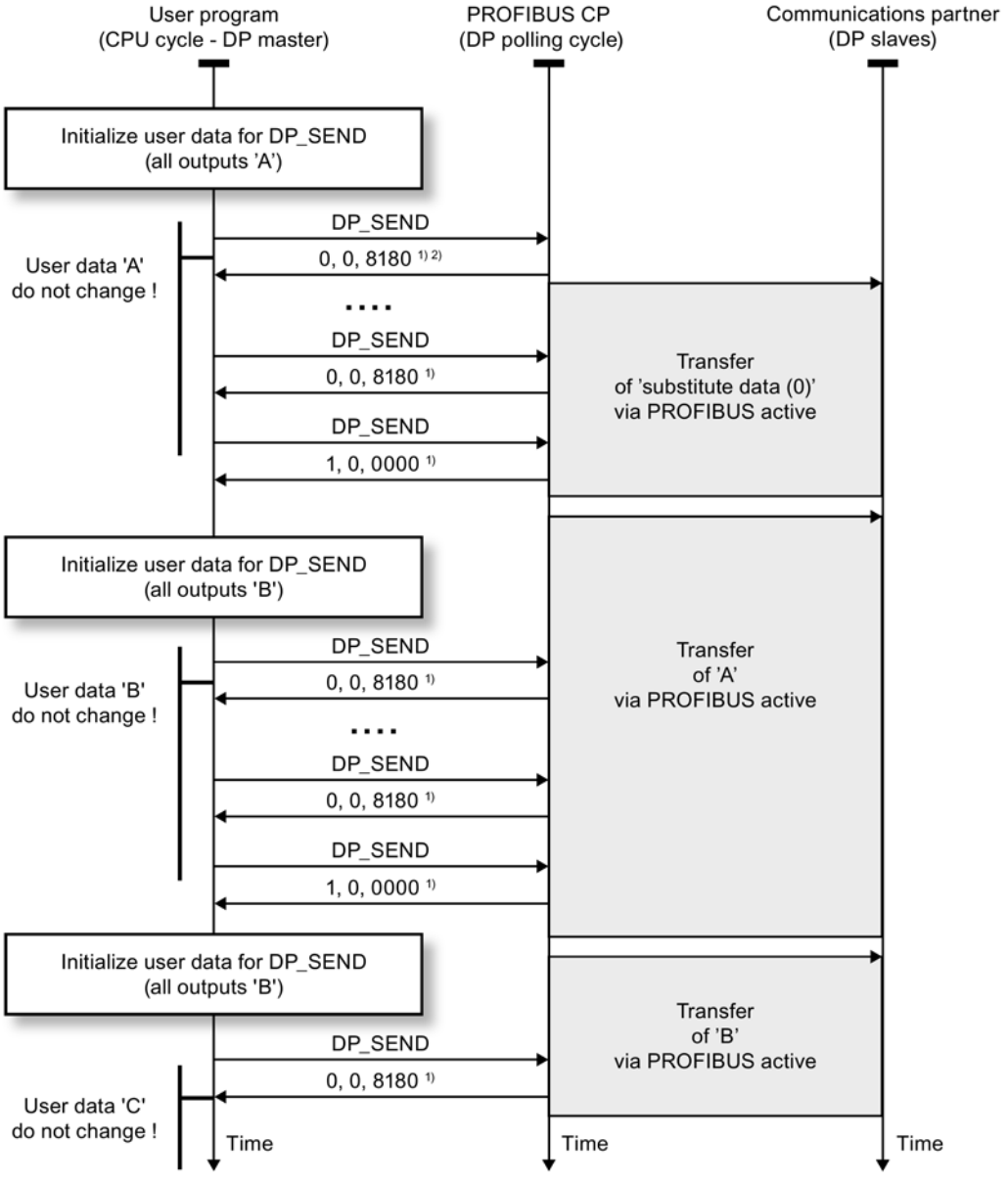
5.2.2.2 How DP_SEND works

Operating principle

The following flow diagram illustrates the normal sequence of data transfer triggered with DP_SEND in the user program.

In the diagram, it is assumed that the DP master has already been initialized by a previous DP_SEND or DP-RECV call.

Each DP_SEND job in the user program is acknowledged by the PROFIBUS CP setting values in the DONE, ERROR and STATUS output parameters.



Legend:
1) Parameter transfer DONE, ERROR, STATUS
2) With older CP types condition code 8183H is possible

Guarantee of data transfer

The diagram also shows that with the confirmation DONE=1, ERROR=0 and STATUS=0000, data transfer to the communications partner is functioning correctly.

The latest send data transferred to the PROFIBUS CP is always passed on to the communications partner. For this reason, new user data must only be entered in the send buffer following a positive acknowledgment (DONE=1, ERROR=0, STATUS=0000).

5.2.2.3 Explanation of the formal parameters - DP_SEND

Explanation of the formal parameters

The following table explains all the formal parameters for the DP_SEND function:

Parameter	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.
SEND	INPUT	ANY (only the following are permitted as VARTYPE: With FC1 as of V3: BYTE With FC1 up to V2.x: BYTE, WORD and DWORD)		Specifies the address and length The address of the DP data area points to one of the alternatives: • PI area • Memory bit area • Data block area The length must be set for • DP master: 1...2160 • DP slave: 1...240
DONE	OUTPUT	BOOL	0: - 1: new data	The status parameter indicates whether or not the job was completed without errors. For the meaning in conjunction with the ERROR and STATUS parameters, refer to DP_SEND condition codes (Page 225).
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the DONE and STATUS parameters, refer to DP_SEND condition codes (Page 225)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the DONE and ERROR parameters, refer to DP_SEND condition codes (Page 225)

5.2.2.4 DP_SEND condition codes

Condition codes

The following table shows the condition codes formed based on DONE, ERROR and STATUS that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 5- 5 DP_SEND condition codes

DONE	ERROR	STATUS	Meaning
0	0	8180_H	• Startup: The DP service was started but data acceptance is not yet possible. • Normal operation Data transfer active. • DP has not started due to: – CP STOP or – "No parameter assignment" (occurs here instead of the code 0,1,8183_H)
1	0	0000_H	New data transferred without error.
0	1	8183_H	No configuration or the DP service has not yet started on the PROFIBUS CP.
0	1	8184_H	System error or bad parameter type.
0	1	$8F22_H$	Area length error reading a parameter (e.g. DB too short).
0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short).
0	1	$8F24_H$	Area error reading a parameter.
0	1	$8F25_H$	Area error writing a parameter.
0	1	$8F28_H$	Alignment error reading a parameter.
0	1	$8F29_H$	Alignment error writing a parameter.
0	1	$8F30_H$	Parameter is in the writeprotected 1st current data block.
0	1	$8F31_H$	Parameter is in the writeprotected 2nd current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Destination area not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area.
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.
0	1	$8F44_H$	Address of the parameter to be read is disabled in the access track.
0	1	$8F45_H$	Address of the parameter to be written is disabled in the access track.

DONE	ERROR	STATUS	Meaning
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	No module with this address exists.
0	1	8091_H	Logical base address not at a double word boundary.
0	1	$80A1_H$	Negative acknowledgment writing to the module.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	The number of data bytes to be sent exceeds the upper limit for this service (applies to DP master and DP slave mode).
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Logical base address incorrect.

5.2.3 DP_RECV

5.2.3.1 Meaning and call - DP_RECV

Meaning

The DP_RECV program block receives data over PROFIBUS. DP_RECV has the following significance depending on the mode of the PROFIBUS CP:

- When used in the DP master
  DP_RECV receives the process data from the distributed I/O along with status information and enters this in a specified DP input area.
- When used on the DP slave
  DP_RECV accepts the output data transferred by the DP master in the DP data area specified in the block.

The data area specified for the receive data can be a process image area, a bit address area or a data block area.

Errorfree execution of the function is signaled when the entire DP data input area could be transferred by the PROFIBUS CP.

Note that FC DP_RECV must be called successfully at least once on the DP slave in the user program if output data was configured for this DP slave. Please read the information in the manual.

To start the DP master exactly one DP-SEND or DP-RECV call must precede the call sequence. The following applies to this first call:

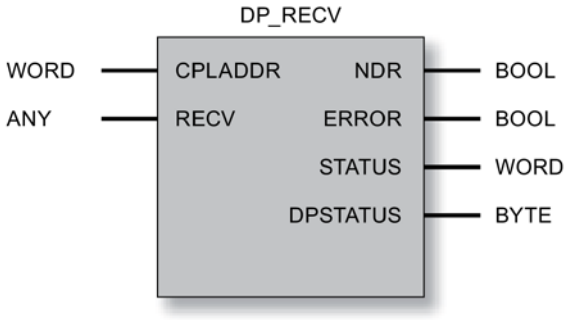
- If DP-RECV is used for initialization, the received data is not adopted. The user data to be received is accepted only with the second block call.

Additional task: Entering the status byte

The DP_RECV function has the following additional task:

- Updating the DP status byte DPSTATUS. This means that DP_RECV handles tasks for DP diagnostics
  If no receive data is configured, DP_RECV must be called with a length of 1 to update the DPSTATUS status byte (applies only to DP masters).
  Please read the information in the manual as well.
- Enabling the station list (see DP_DIAG (Page 233)).

Call interface



Example in STL representation

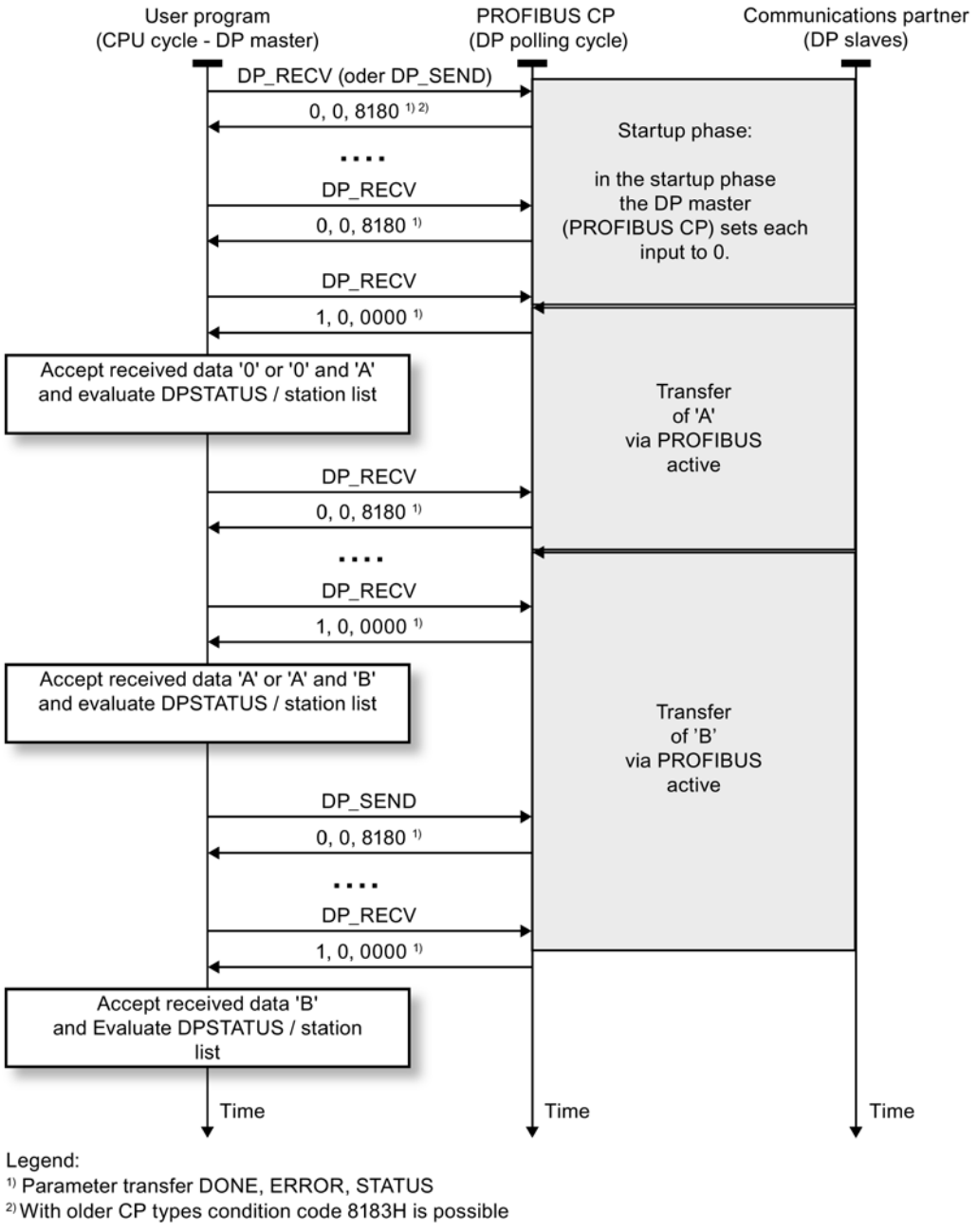
STL	Explanation
`call fc 2 (`	`//DP_RECV function call`
`CPLADDR:= W#16#0120,`	
`RECV := P#db17.dbx240.0 byte 103,`	
`NDR := M 99.1,`	
`ERROR := M 99.0,`	
`STATUS := MW 104,`	
`DPSTATUS:= MB 0 );`	

5.2.3.2 How DP_RECV works

Operating principle

The following flow diagram illustrates the normal sequence of data transfer triggered with DP_RECV in the user program.

Each DP_RECV job in the user program is acknowledged by the PROFIBUS CP setting values in the NDR, ERROR and STATUS output parameters.



Guarantee of data acceptance

The diagram also shows that the confirmation NDR=1, ERROR=0 and STATUS=0000 indicates reliable data reception. Requirement: The DP master and the DP slaves are in the data transfer phase.

Note the following:

- In DP master mode:
  If a DB slave is not in the data transfer phase, the corresponding received data is set to 0.
  If the DP master is neither in the RUN nor CLEAR state (bits 4 and 5 in DPSTATUS), all

the received data is set to 0.
If data has been received from the DP slave several times since the last DP_RECV function call, only the last received data is fetched with the next DP_RECV.

- In DP slave mode:
  If the DP slave is not in the data transfer phase (bit 1 in DPSTATUS) or the DP master is in the CLEAR state (bit 2 in DPSTATUS), the received data is set to 0.
  If data has been received from the DP master several times since the last DP_RECV function call, only the last received data is fetched with the next DP_RECV.

5.2.3.3 Explanation of the formal parameters - DP_RECV

Explanation of the formal parameters

The following table explains all the formal parameters for the function DP_RECV:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.
RECV	INPUT	ANY (only the following are permitted as VARTYPE: With FC1 as of V3: BYTE With FC1 up to V2.x: BYTE, WORD and DWORD)		Specifies the address and length The address of the DP data area points to one of the alternatives: • PI area • Memory bit area • Data block area The length must be set for: • DP master: 1...2160 • DP slave: 1...240 • DP master; only read status byte: 1 (see also CP manual)
NDR	OUTPUT	BOOL	0: - 1: New data accepted	The status parameter indicates whether or not new data was accepted. For the meaning in conjunction with the ERROR and STATUS parameters, refer to DP_RECV condition codes (Page 230).
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the NDR and STATUS parameters, refer to DP_RECV condition codes (Page 230).

Parameter	Declaration	Data type	Possible values	Description
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters NDR and ERROR, refer to DP_RECV condition codes (Page 230).
DPSTATUS	OUTPUT	Byte	For coding, see below under DPSTATUS	DP status code

5.2.3.4 DP_RECV condition codes

Condition codes

The following table shows the codes formed by the NDR, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

NDR	ERROR	STATUS	Meaning
0	0	8180_H	• Startup: The DP service was started but data acceptance is not yet possible. • Normal operation Data transfer active. • DP has not started due to: – CP STOP or – "No parameter assignment" (occurs here instead of the code $0,1,8183_H$).
1	0	0000_H	New data accepted without error.
0	1	8183_H	No configuration or the DP service has not yet started on the PROFIBUS CP.
0	1	8184_H	System error or bad parameter type.
0	1	$8F22_H$	Area length error reading a parameter (e.g. DB too short).
0	1	$8F23_H$	Area length error writing a parameter (e.g. DB too short).
0	1	$8F24_H$	Area error reading a parameter.
0	1	$8F25_H$	Area error writing a parameter.
0	1	$8F28_H$	Alignment error reading a parameter.
0	1	$8F29_H$	Alignment error writing a parameter.

NDR	ERROR	STATUS	Meaning
0	1	$8F30_H$	Parameter is in the writeprotected 1st current data block.
0	1	$8F31_H$	Parameter is in the writeprotected 2nd current data block.
0	1	$8F32_H$	Parameter contains a DB number that is too high.
0	1	$8F33_H$	DB number error.
0	1	$8F3A_H$	Destination area not loaded (DB).
0	1	$8F42_H$	Timeout reading a parameter from the I/O area.
0	1	$8F43_H$	Timeout writing a parameter to the I/O area.
0	1	$8F44_H$	Address of the parameter to be read is disabled in the access track.
0	1	$8F45_H$	Address of the parameter to be read is disabled in the access track.
0	1	$8F7F_H$	Internal error, e.g. illegal ANY reference.
0	1	8090_H	No module with this address exists.
0	1	8091_H	Logical base address not at a double word boundary.
0	1	$80A0_H$	Negative acknowledgment writing to the module.
0	1	$80B0_H$	The module does not recognize the data record.
0	1	$80B1_H$	The number of data bytes to be sent exceeds the upper limit for this service (applies to DP master and DP slave mode).
0	1	$80C0_H$	The data record cannot be read.
0	1	$80C1_H$	The specified data record is currently being processed.
0	1	$80C2_H$	There are too many jobs pending.
0	1	$80C3_H$	Resources occupied (memory).
0	1	$80C4_H$	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	Logical base address incorrect.

5.2.3.5 DPSTATUS - DP_RECV

DPSTATUS

The coding of the DPSTATUS output parameter is different for the DP master mode and DP slave mode.

DP master mode

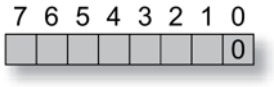


Table 5- 6 Meaning of the bits in DPSTATUS in DP master mode

Bit	Meaning
7	not used
6	This bit is not set. Please read the information in the manual as well.

Bit	Meaning
5,4	Values for DPSTATUS of the DP master: 00 RUN 01 CLEAR 10 STOP (this is now the OFFLINE mode) 11 OFFLINE Please read the information in the manual as well.
3	Value 1: Cyclic synchronization is active
2	Value 0: No new diagnostic data exists Value 1: Evaluation of diagnostic list useful; at least one station has new diagnostic data
1	Value 0: All DP slaves are in the data transfer phase Value 1: Evaluating the station list is useful
0	DP mode Value 0: DP master mode The other bits only have the specified meaning when this bit is not set.

DP slave mode

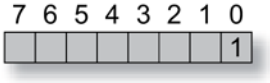


Table 5- 7 Meaning of the bits in DPSTATUS in DP slave mode

Bit	Meaning
7-5	not used
4	This bit is not set. Please read the information in the manual as well.
3	This bit is not set. Please read the information in the manual as well.
2	Value 1: DP master 1 is in the CLEAR mode. The DP slave receives the value 0 in the DP data intended for the outputs. This has no effect on the send data.
1	Value 1: The configuration/parameter assignment is not yet completed.
0	Value 1: DP slave mode. **The other bits only have the specified meaning when this bit is set.**

Note

Please note, that DPSTATUS must not be evaluated until the return parameter NDR=1 is set.

5.2.4 DP_DIAG

5.2.4.1 Meaning and call - DP_DIAG

Meaning of the block

The DP_DIAG program block is used to request diagnostic information. The following types of job are possible:

- Request DP station list
- Request DP diagnostics list;
- Request DP single status;
- Read input/output data of a DP slave acyclically
- Read older DP single diagnostic information
- Read DP status.
- Read DP mode for PLC/CP stop
- Read current status of the DP slave.

Diagnostics data can also be requested for a specific slave by specifying a station address.

To transfer the diagnostic data to the CPU, you should reserve a memory area in the CPU and specify this area in the call. This memory area can be a data block area or a bit memory area. The maximum length of the available memory area must also be specified in the job.

Note

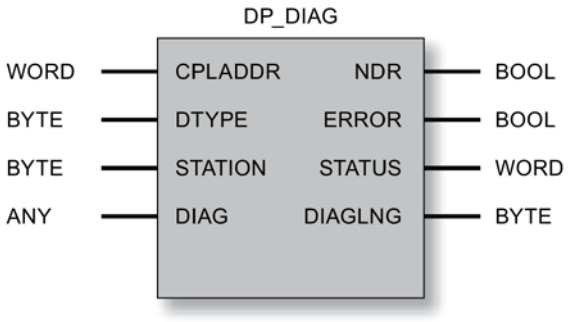
FC DP_DIAG is only of practical use in the DP master mode.

Exclusion

As long as this block is running, it must not be supplied with new job data.

Exception: Requesting the DP station list or DP diagnostics list.

Call interface



Example in STL representation

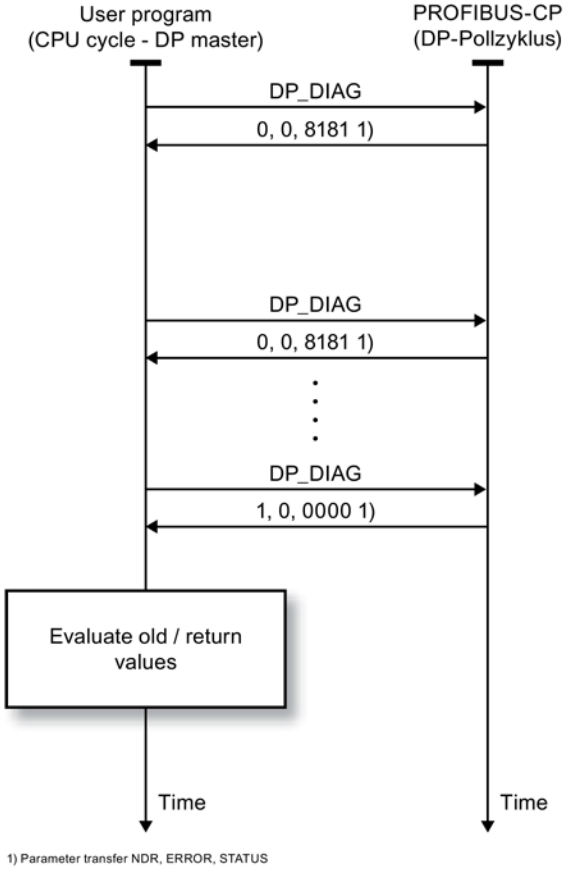
```
STL                                                    Explanation
call fc 3 (                                            //DP_DIAG function call
CPLADDR:= W#16#0120,
DTYPE := B#16#00,
STATION:= B#16#03,
DIAG := P#db18.dbx0.0 byte 16,
NDR := M 70.0,
ERROR := M 70.1,
STATUS := MW 72,
DIAGLNG:= MB 20 );
```

5.2.4.2 How DP_DIAG works

Sequence / handling on the call interface

The DP_DIAG function call is processed during cyclic execution of the user program as follows:

The job is triggered with the first call. Diagnostic data is only returned in the acknowledgment of one of the subsequent calls.



Note

Please note the following special feature of the job types read_DP_station_list and read_DP_diagnostic_list:

- The diagnostic job supplies the diagnostic data available at the time of the last DPRECV call. Reading a list prevents the data from being read out again (return value 0x8182).
- The lists are released again after a new diagnostic event followed by a DPRECV call.

After calling DP_DIAG, you obtain information indicating one of the situations below:

- **NDR=0, ERROR=0, STATUS=8181**
  As long as the code combination NDR=0, ERROR=0 and STATUS=8181 is set, the job parameters must not be modified.
- **NDR=1**
  The parameter value NDR=1 indicates that valid diagnostic data is available. Additional information is possible in the STATUS parameter.
- **NDR=0, ERROR=1**
  An error has occurred. The diagnostic data is invalid. The error message is located in STATUS.

5.2.4.3 Explanation of the formal parameters - DP_DIAG

Explanation of the formal parameters

The following table explains all the formal parameters for the function DP_DIAG:

Parameter	Declaration	Data type	Possible values	Description
CPLADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.
DTYPE	INPUT	BYTE	0: Station list 1: Diagnostic list 2: Current diagnostic info 3: Older diagnostics info 4: Read status 5: Read status for CPU STOP 6: Read status for CP STOP 7: Read input data (acyclically) 8: Read output data (acyclically) 10: Read current status of the DP slave	Diagnostics type
STATION	INPUT	BYTE		Station address of the DP slave
DIAG	INPUT	ANY (only the following are permitted as VARTYPE: BYTE, WORD and DWORD)	The length must be set from 1 to 240	Specifies the address and length Address of the data area. References the following alternatives: • PI area • Memory bit area • Data block area
NDR	OUTPUT	BOOL	0: - 1: new data	This parameter indicates whether or not new data were accepted. For the meaning in conjunction with the parameters ERROR and STATUS, refer to DP_DIAG codes (Page 239)
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the parameters NDR and STATUS, refer to DP_DIAG codes (Page 239).

Parameter	Declaration	Data type	Possible values	Description
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the parameters NDR and ERROR, refer to DP_DIAG codes (Page 239).
DIAGLNG	OUTPUT	BYTE		This contains the actual length (in bytes) of the data made available by the PROFIBUS CP, regardless of the buffer size specified in the DIAG parameter. The following applies to job types with DTYPE 4, 5 and 6 Here, DIAGLNG always has the value "1". The value returned in the DIAG parameter is not relevant for the evaluation in these cases. In these cases, the relevant value is contained in the STATUS parameter.

5.2.4.4 Job types - DP_DIAG

Job types

The following overview of the specifications for DTYPE, STATION and DIAGLNG shows the permitted or useful entries.

Table 5- 8 Job types for DP_DIAG

DTYPE	Corresponds to job	Parameter STATION	DIAGLNG	Acknowledgement code (contained in the STATUS parameter; shown in Table "DP_DIAG codes")
0	Read DP station list	---	- ignored -	With the DP station list, you obtain information in the user program on the status and availability of DP slaves. The information in the DP station list relates to all DP slaves assigned to the DP master by the configuration.
1	Read DP diagnostics list	---	- ignored -	The DP diagnostics list informs the user program about the DP slaves with new diagnostics data.
2	Read current DP single diagnostic data	1...126	>=6	The current DP single diagnostics informs the user program of the current diagnostics data of a DP slave.
3	Read older DP single diagnostic information	1...126	>=6	The older DP single diagnostics informs the CPU program of the older diagnostics data of a DP slave. This data is stored on the PROFIBUS CP and read according to the "last in - first out" principle in the ring buffer. The structure of the ring buffer is explained below. If changes occur quickly in the DP slave diagnostic data, this function allows the diagnostic data of a DP slave to be acquired and evaluated in the CPU program of the DP master.

DTYPE	Corresponds to job	Parameter STATION	DIAGLNG	Acknowledgement code (contained in the STATUS parameter; shown in Table "DP_DIAG codes")
4	Read the operating status requested with DP-CTRL job (CTYPE=4)		=1	With this job, the DP operating status can be read that was set previously with the DP-CTRL job (CTYPE=4). Note: The operating status that is read out does not necessarily match the current operating status. The following statuses are possible: • RUN • CLEAR • STOP (is mapped to the OFFLINE status) *) • OFFLINE
5	Read DP status for CPU STOP		=1	With this job you can find out the DP status to which the PROFIBUS CP changes if the CPU changes to STOP: • RUN • CLEAR • STOP (is mapped to the OFFLINE status) *) • OFFLINE As default, the PROFIBUS CP changes to the DP status CLEAR if the CPU changes to STOP.
6	Read DP status for CP STOP		=1	With this job you can find out the DP status to which the PROFIBUS CP changes if the CP changes to STOP: • STOP (is mapped to the OFFLINE status) *) • OFFLINE As default, the PROFIBUS CP changes to the DP status OFFLINE if the CP changes to STOP.
7	Read input data	1...126	>=1	With this job, the DP master (class 2) reads the input data of the DP slave. This function is also known as shared input.
8	Read output data	1...126	>=1	With this job, the DP master (class 2) reads the output data of a DP slave. This function is also known as shared output.
10	Read current status of the DP slave	1...126	>=0	With this job, you can read out the current status of the DP slave. The following statuses are possible : • The DP master exchanges data with the DP slave cyclically. • The DP master reads the input data of the DP slave cyclically. • The DP master reads the output data of the DP slaves cyclically. • The DP master is not currently processing this DP slave cyclically.

*) The STOP status is no longer supported on the latest modules (as of module type DA02).

5.2.4.5 Ring buffer for diagnostics data - DP_DIAG

Ring Buffer for Diagnostic Data

The following diagram illustrates how diagnostic data is read using the "read older DP single diagnostic data" function. The first access reads the **most recent of the older diagnostic data**.

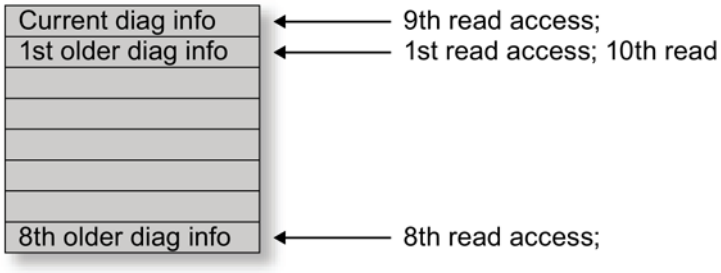


Image 5-3 Ring Buffer for Diagnostic Data

When the current diagnostic data is read out, the read pointer is reset to the first older diagnostic data.

5.2.4.6 DP_DIAG codes

Condition codes

The following table shows the codes formed by the NDR, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 5- 9 DP_DIAG codes

NDR	ERROR	STATUS	Possible with DTYPE	Meaning
0	0	8181_H	2-10	Job active. DP master not started due to • CP STOP or • "no parameter assignment" (occurs here instead of the code $0,1,8183_H$).
0	0	8182_H	0	Triggering job pointless. DP master not started due to • CP STOP or • "no parameter assignment" (occurs here instead of the code $0,1,8183_H$).
0	0	8182_H	1	No new diagnostic data exist. DP master not started due to • CP STOP or • "no parameter assignment" (occurs here instead of the code $0,1,8183_H$).
1	0	0000_H	0, 1 and 4-9	Job completed without error. Note: With DTYPE 2, 3 and 10, error-free execution is indicated by a status code other than "0". Below you will see the detailed status codes for error-free execution for the range: 82XXH If an error occurs in execution, you receive status codes in the following ranges: 80XXH, 83XXH, 8FXXH
1	0	8222_H	7, 8	Job completed without error. The length of the DP slave data that was read is not the same as the data length expected by the DP master based on the module list of the DP slave in the CP database.
1	0	8227_H	7, 8	Job completed without error. Message: No data exists.
1	0	8231_H	4, 5, 6	Job completed without error. Message: The DP status is already "RUN"
1	0	8232_H	4, 5, 6	Job completed without error. Message: The DP status is already "CLEAR"
1	0	8233_H	4, 5, 6	Job completed without error. Message: The DP status is already STOP The STOP status is now the OFFLINE status (here code 8234_H). Please read the information in the manual as well.
1	0	8234_H	4, 5, 6	Job completed without error. Message: The DP status is already "OFFLINE"

NDR	ERROR	STATUS	Possible with DTYPE	Meaning
1	0	$823A_H$	2, 3, 7, 8	Job completed without error. Message: 241 or 242 bytes of data were read. 240 bytes of data are available.
1	0	8241_H	2, 3, 10	Job completed without error. Message: The specified DP slave was not configured.
1	0	8243_H	2, 3, 10	Job completed without error. Message: The module list of the DP slave in the CP database only contains empty modules.
1	0	8245_H	2, 3, 10	Job completed without error. Message: The DP slave is in the "read input data cyclically" mode.
1	0	8246_H	2, 3, 10	Job completed without error. Message: The DP slave is in the "read output data cyclically" mode.
1	0	8248_H	2, 3, 10	Job completed without error. Note: This is the default code for the named diagnostics types if there is no special situation to signal.
1	0	8249_H	2, 3, 10	Job completed without error. Message: The DP slave is deactivated due to a DP mode change (e.g. CP mode selector set to STOP).
1	0	$824A_H$	2, 3, 10	Job completed without error. Message: The DP slave is deactivated due to a DP_CTRL job in the user program.
0	1	8090_H	0-10	Logical base address of the module is invalid
0	1	$80B0_H$	0-10	The module does not recognize the data record or is changing from RUN --> STOP.
0	1	$80B1_H$	0-10	Specified data record length incorrect
0	1	$80C0_H$	0-10	Data record cannot be read
0	1	$80C1_H$	0-10	The specified data record is being processed
0	1	$80C2_H$	0-10	Too many jobs pending
0	1	$80C3_H$	0-10	Resources (memory) occupied
0	1	$80C4_H$	0-10	Communication error
0	1	$80D2_H$	0-10	Logical base address wrong
0	1	8183_H	0-10	DP master not configured.
0	1	8184_H	0-10	System error or bad parameter type.
0	1	8311_H	>=2	DTYPE parameter outside range of values.
0	1	8313_H	2, 3, 7, 8, 10	STATION parameter outside range of values.
0	1	8321_H	>=2	The DP slave is not providing any valid data.
0	1	8326_H	7, 8	The DP slave has more than 242 bytes of data available. The PROFIBUS CP supports a maximum of 242 bytes.
0	1	8335_H	7, 8	The PROFIBUS CP is in PROFIBUS status: "Station not in ring".
0	1	8341_H	2, 3, 7, 8, 10	The specified slave was not configured
0	1	8342_H	7, 8	The DP slave with the PROFIBUS address specified in the STATION parameter is not obtainable.
0	1	8349_H	7, 8	The DP master is in the OFFLINE mode.

NDR	ERROR	STATUS	Possible with DTYPE	Meaning
0	1	$8F22_H$	0-10	Area length error reading a parameter (e.g. DB too short)
0	1	$8F23_H$	0-10	Area length error writing a parameter (e.g. DB too short)
0	1	$8F24_H$	0-10	Range error when reading a parameter
0	1	$8F25_H$	0-10	Area error writing a parameter
0	1	$8F28_H$	0-10	Orientation error when reading a parameter
0	1	$8F29_H$	0-10	Alignment error writing a parameter
0	1	$8F30_H$	0-10	Parameter is in the writeprotected 1st current data block
0	1	$8F31_H$	0-10	Parameter is in the writeprotected 2nd current data block
0	1	$8F32_H$	0-10	The DB number in the parameter is too high
0	1	$8F33_H$	0-10	DB number error
0	1	$8F3A_H$	0-10	Area not loaded (DB)
0	1	$8F42_H$	0-10	Timeout reading a parameter from the I/O area
0	1	$8F43_H$	0-10	Timeout writing a parameter to the I/O area
0	1	$8F44_H$	0-10	Address of the parameter to be read locked in the access track
0	1	$8F45_H$	0-10	Address of the parameter to be written is disabled in the access track
0	1	$8F7F_H$	0-10	Internal error, e.g. illegal ANY reference

5.2.5 DP_CTRL

5.2.5.1 Meaning and call - DP_CTRL

Meaning of the block

The DP_CTRL program block transfers control jobs to the PROFIBUS CP. You specify a job field (CONTROL parameter) to specify the control job in greater detail.

The following types of job are possible:

- Global control acyclic/cyclic;
- Delete older diagnostic data;
- Set current DP mode;
- Set DP mode for PLC/CP STOP;
- Read input/output data cyclically;
- Set the operating mode of the DP slave.

There are restrictions relating to the job types listed here (please refer to the information in the manual for the module).

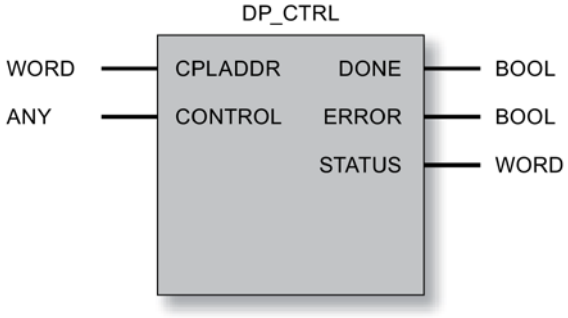
Note

FC DP_CTRL is only of practical use in the DP master mode.

Connector

As long as this block is running, it must not be supplied with new job data.

Call interface



Example in STL representation

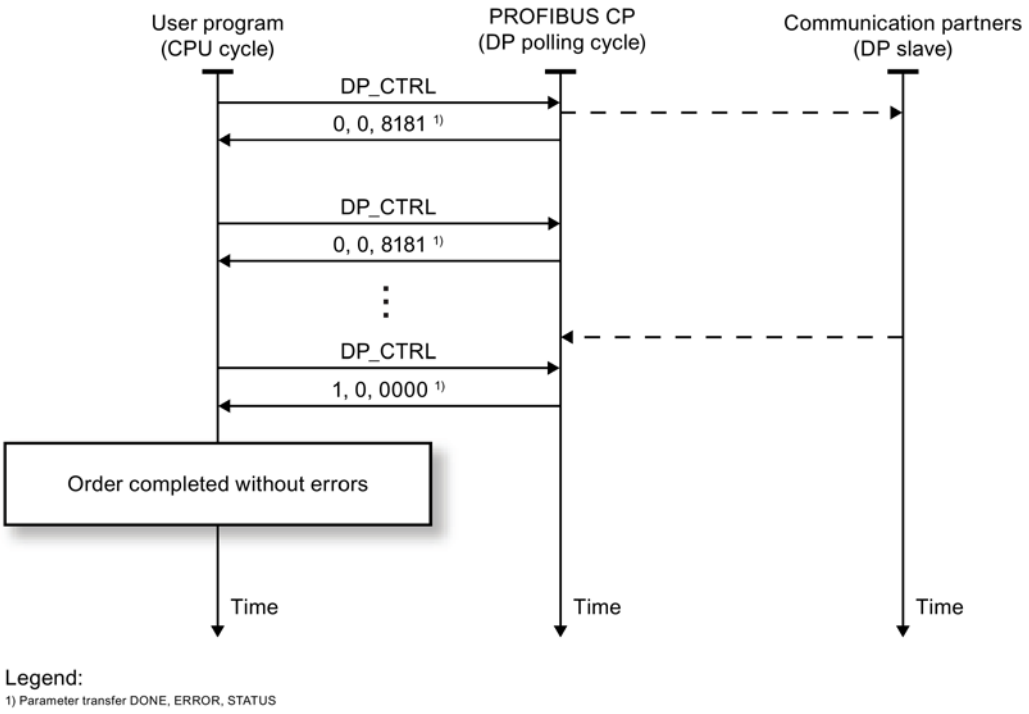
STL	Explanation
`call fc 4 (`	`//DP_CTRL block call`
`CPLADDR:= W#16#0120,`	
`CONTROL:= P#db14.dbx0.0 byte 30,`	`// The buffer for the control job`
	`// occupies the first 30 bytes in DB 14.`
`DONE := M 70.0,`	
`ERROR := M 70.1,`	
`STATUS := MW 72 );`	

5.2.5.2 How DP_CTRL works

Sequence / handling on the call interface

The DP_CTRL function call is processed within the cyclic execution of the user program as shown below:

The job is triggered with the first call. Diagnostic data is only returned in the acknowledgment of one of the subsequent calls.



After calling DP_CTRL, you obtain one of the following condition code patterns as the reaction:

- DONE=0, ERROR=0, STATUS=8181
  As long as the code combination DONE=0, ERROR=0 and STATUS=8181 is set, the job parameters must not be modified.
- DONE=1
  The parameter value DONE=1 indicates that the job was executed. Additional information is possible in the STATUS parameter.
- DONE=0, ERROR=1
  An error has occurred. The error message is located in STATUS.

5.2.5.3 Explanation of the formal parameters - DP_CTRL

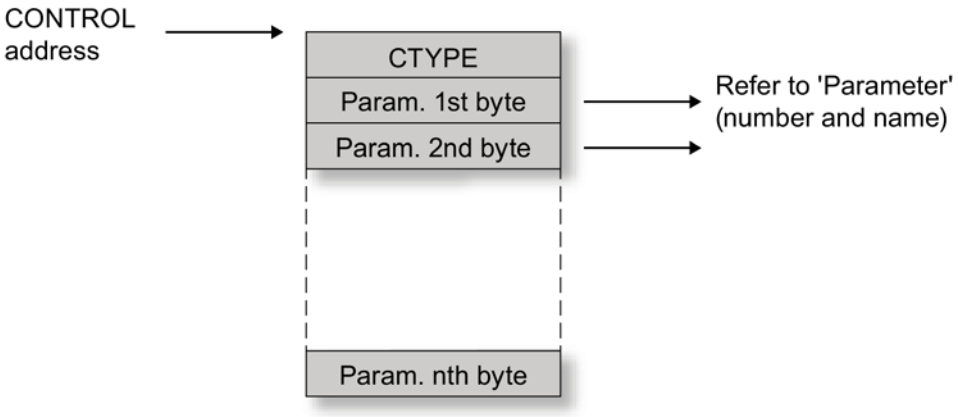
Explanation of the formal parameters

The following table explains all the formal parameters for the DP_CTRL function:

Parameter	Declaration	Data type	Range of values	Description
CPLADDR	INPUT	WORD		Module start address When you configure the CP, the module start address is displayed in the configuration table. Specify this address here.
CONTROL	INPUT	ANY (only the following are permitted as VARTYPE: BYTE, WORD and DWORD)	The length must be set from 1 to 240	Specifies the address and length of the CONTROL job field Address of the data area. References the following alternatives: • PI area • Memory bit area • Data block area The length must be at least as long as the number of parameters.
DONE	OUTPUT	BOOL	0: - 1: Job executed without error.	Indicates whether the job was sent and completed without errors. For the meaning in conjunction with the parameters ERROR and STATUS, refer to DP_CTRL condition codes (Page 250)
ERROR	OUTPUT	BOOL	0: - 1: Error	Error code For the meaning in conjunction with the DONE and STATUS parameters, refer to DP_CTRL condition codes (Page 250)
STATUS	OUTPUT	WORD		Status code For the meaning in conjunction with the DONE and ERROR parameters, refer to DP_CTRL condition codes (Page 250)

Structure of the CONTROL job field

The control job has the following structure:



Example of the job field

With a job field as shown below, a cyclic global control job SYNC and Unfreeze is sent for group 4 and group 5 without the autoclear option.

DB 14

Byte 0	01H	CTYPE
Byte 1	24H	Command Mode
Byte 2	18H	Group Select
Byte 3	00H	Autoclear

The length in the ANY pointer must be at least 4 (in the example, 30 has been selected).

5.2.5.4 Job types - DP_CTRL

Job types

Permitted or feasible specifications for the job are shown in the following overview based on the specification for CTYPE and the information in the job field.

CTYPE	Corresponds to job	Parameter in job field		Description
		Name	Number	
0	Trigger global control	1. byte: command mode 2nd byte: group select (See section following this table.)	2	A single global control job is sent to the DP slaves selected with group select. The command mode parameter specifies the following global control jobs: • SYNC • UNSYNC • FREEZE • UNFREEZE • CLEAR - is not supported (please read the information in the manual as well) It is possible to specify more than one job in the command mode parameter.
1 *)	Trigger cyclic global control	1. byte: command mode 2nd byte: group select 3rd byte: autoclear (See section following this table.)	3	The sending of cyclic global control jobs to the DP slaves selected with group select is triggered on the PROFIBUS CP. The autoclear parameter is only evaluated with the SYNC global control job. If at least one DP slave in the selected group is not in the data transfer phase and autoclear=1 is set, the CLEAR mode is activated. In other words, the output data of the DP slaves is set to "0". The following global jobs can be activated in the command mode parameter: • SYNC • FREEZE • CLEAR (CLEAR-Bit = 1) - is not supported (please read the information in the manual as well) or deactivated: • UNSYNC • UNFREEZE • UNCLEAR (CLEAR bit = 0) It is possible to specify more than one job in the command mode parameter. An active cyclic global control job can only be terminated by a further global control job (cyclic or acyclic). To terminate the job set in the command mode, the job must be canceled. For example, the SYNC job is canceled by an UNSYNC job.

CTYPE	Corresponds to job	Parameter in job field		Description
		Name	Number	
3	Delete older DP single diagnostic data	1. byte: Slave address 1 to 126 127 = all slaves	1	The older diagnostic data stored on the PROFIBUS CP is deleted for one or all DP slaves.
4	Set current DP mode	1. byte: RUN = 00_H CLEAR = 01_H OFFLINE = 03_H RUN with AUTOCLEAR = 04_H RUN without AUTOCLEAR = 04_H	1	The DP mode can be set with this job as follows: • RUN • CLEAR • OFFLINE The AUTOCLEAR parameter means that the DP master class 1 changes to the CLEAR status automatically when the following condition is met: at least one of the DP slaves with which the DP master class 1 wants to exchange data is not in the data transfer phase. The RUN without AUTOCLEAR parameter resets AUTOCLEAR. Notes: The STOP = 02_H mode is no longer supported on the later modules (as of module type DA02). STOP = 02_H is mapped to the OFFLINE mode.
5	Set DP mode for CPU STOP	1. byte: RUN = 00_H CLEAR = 01_H OFFLINE = 03_H	1	This job specifies which DP mode the PROFIBUS CP changes to if the CPU changes to STOP: • RUN • CLEAR • OFFLINE As default, the PROFIBUS CP changes to the DP status CLEAR if the CPU changes to STOP. This mode remains set during a CP mode change from RUN --> STOP --> RUN. Notes: The STOP = 02_H mode is no longer supported on the later modules (as of module type DA02). STOP = 02_H is mapped to the OFFLINE mode.
6	Set DP mode for CP STOP	1. byte: OFFLINE=03_H	1	This job specifies which DP mode the PROFIBUS CP changes to if the CP changes to STOP: • OFFLINE As default, the PROFIBUS CP changes to the DP status OFFLINE if the CP changes to STOP. This mode remains set during a CP mode change from RUN --> STOP --> RUN. Notes: The STOP = 02_H mode is no longer supported on the later modules (as of module type DA02). STOP = 02_H is mapped to the OFFLINE mode.

CTYPE	Corresponds to job	Parameter in job field		Description
		Name	Number	
7 *)	Read input data cyclically (DP master class 2)	1. byte: slave address 1 to 125	1	This job is not supported. Please read the information in the manual as well.
8 *)	Read output data cyclically (DP master class 2)	1. byte: slave address 1 to 125	1	This job is not supported. Please read the information in the manual as well.
9	Terminate cyclic processing of the DP slave by the DP master (class 1, class 2)	1. byte: slave address 1 to 125	1	This job terminates the cyclic reading of the input data or output data of the addressed DP slave or the data transfer (DP master class 1). The DP slave is then no longer processed by the PROFIBUS CP acting as DP master (class 2) **This deactivates the DP slave.**
10	Start cyclic processing as DP master (class 1)	1. byte: slave address 1 to 125	1	The PROFIBUS CP acting as the DP master (class 1) then assigns parameters to the addressed DP slave and starts cyclic data transfer (writing outputs/reading inputs). **This activates the DP slave.**

*) This CTYPE is no longer supported on the latest modules (as of module type DA02).

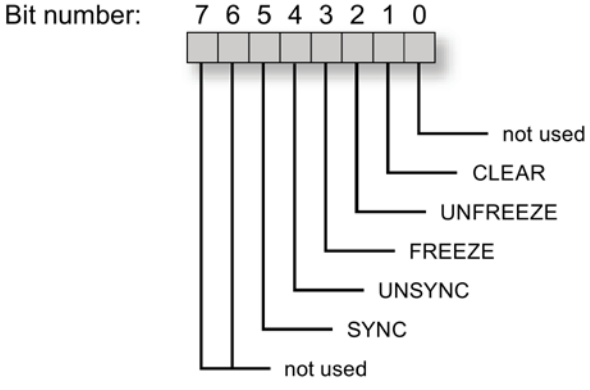
5.2.5.5 Command mode and group select - DP_CTRL

Structure of command mode

In the command mode parameter, you specify the modes for input and output data for the cyclic and acyclic global control jobs.

The meaning is as follows:

1 = activated
0 = not activated

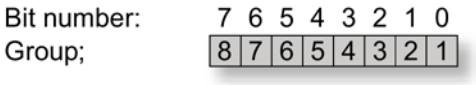


Structure of group select

In the group select parameter, you specify the group to be addressed by the control job specified in the command mode parameter. The group select parameter occupies the second byte in the control job. Each bit defines a possible DP slave group.

The meaning is as follows:

1 = assigned
0 = not assigned



5.2.5.6 DP_CTRL condition codes

Condition codes

The following table shows the return codes formed by the DONE, ERROR and STATUS parameters that must be evaluated by the user program.

Note

For entries coded with 8FxxH in STATUS, refer to the information about the output parameter RET_VAL in the descriptions of the referenced system program blocks.

Which system program blocks are used and are relevant for error evaluation, can be queried in STEP 7.

Table 5- 10 DP_CTRL condition codes

DONE	ERROR	STATUS	Possible with CTYPE	Meaning
0	0	8181_H	0..10	Job active. DP master not started due to: • CP STOP or • "no parameter assignment" Note: The code described here occurs instead of one of the codes described later: 0, 1, 8183_H 0, 1, 8333_H 0, 1, 8334_H
1	0	0000_H	0..10	**Job completed without error.**
1	0	8214_H	0, 1	**Job completed without error.** Message: Cyclic global control job is sent as acyclic global control job
1	0	8215_H	0, 1	**Job completed without error.** The slaves addressed in the selected group are all deactivated.

DONE	ERROR	STATUS	Possible with CTYPE	Meaning
1	0	8219_H	0, 1	**Job completed without error.** An attempt was made to send an already active cyclic global control again. The global control continues unchanged.
1	0	8228_H	0, 1	**Job completed without error.** Message: The DP slaves addressed in the selected groups do not have any input modules.
1	0	8229_H	0, 1	**Job completed without error.** Message: The DP slaves addressed in the selected groups do not have any output modules.
1	0	8231_H	4, 5, 6	**Job completed without error.** Message: The DP status is already "RUN"
1	0	8232_H	4, 5, 6	**Job completed without error.** Message: The DP status is already "CLEAR"
1	0	8233_H	4, 5, 6	**Job completed without error.** Message: The DP status is already "STOP"
1	0	8234_H	4, 5, 6	**Job completed without error.** Message: The DP status is already "OFFLINE"
1	0	8235_H	4	**Job completed without error.** Message: The DP status is already "RUN" with activated AUTOCLEAR
1	0	8236_H	4	**Job completed without error.** Message: The DP status is already "RUN" with deactivated AUTOCLEAR
1	0	8241_H	7-10	**Job completed without error.** Message: The specified DP slave was not configured.
1	0	8243_H	7-10	**Job completed without error.** Message: The DP slave is already deactivated since the module list of the DP slave in the CP database only contains empty modules.
1	0	8245_H	7-10	**Job completed without error.** Message: The DP slave is already in the "read input data cyclically" mode
1	0	8246_H	7-10	**Job completed without error.** Message: The DP slave is already in the "read output data cyclically" mode
1	0	8248_H	7-10	**Job completed without error.** Message: The module list of the DP slave in the CP database contains input, output, or input/output modules.
1	0	8249_H	7-10	**Job completed without error.** Message: This slave is deactivated due to a change in the DP mode.
1	0	$824A_H$	7-10	**Job completed without error.** Message: The DP slave is already deactivated due to a DP_CTRL job in the CPU program
0	1	8090_H	0..10	No module with this address exists.
0	1	8091_H	0..10	Logical address not at a double word boundary.
0	1	$80B0_H$	0..10	The module does not recognize the data record.
0	1	$80B1_H$	0..10	The specified data record length is incorrect.
0	1	$80C0_H$	0..10	The data record cannot be read.
0	1	$80C1_H$	0..10	The specified data record is currently being processed.
0	1	$80C2_H$	0..10	There are too many jobs pending.
0	1	$80C3_H$		Resources occupied (memory).

DONE	ERROR	STATUS	Possible with CTYPE	Meaning
0	1	8183_H	0..10	The DP master is not configured... Note: If the DP master is in "STOP" status, the status 8181_H can also be output.
0	1	8184_H		System error or illegal parameter type...
0	1	8311_H	0..10	CTYPE parameter outside the range of values
0	1	8312_H	0..10	The length of the area in the CONTROL parameter is too short.
0	1	8313_H	3, 7, 8, 9, 10	The slave address parameter is outside the range of values.
0	1	8315_H	0, 1	All DP slaves of the group specified in the global control are deactivated (always occurs with an empty group).
0	1	8317_H	8	The length of the configured output data is greater than the configured receive area of the DP slave. Activating the slave mode "Read output data" is not possible.
0	1	8318_H	0, 1, 4, 5, 6	The parameter 1st byte of the job data field is outside the range of values. With GLOBAL CONTROL, CLEAR was used with SYNC or a GLOBAL CONTROL with CLEAR set was sent to group 0.
0	1	$831A_H$	0, 1	At least one DP slave cannot handle FREEZE.
0	1	$831B_H$	0, 1	At least one DP slave cannot handle SYNC.
0	1	8333_H	0, 1	This job is not permitted in the DP "STOP" mode. Note: If no DP master is configured, the status 8181_H can also be output.
0	1	8334_H	0, 1	This job is not permitted in the DP "OFFLINE" mode. Note: If no DP master is configured, the status 8181_H can also be output.
0	1	8335_H	0, 1	The PROFIBUS CP is in PROFIBUS status: "Station not in ring".
0	1	8339_H	0, 1	At least one DP slave in the selected group is not in the data transfer phase.
0	1	$833C_H$	1	Cyclic global control must not be used in the "PLC <-> CP free running" mode. This error does not occur on the CP 3425 because this mode is not possible with this CP (PBUS data records are always used for data transfer).
0	1	8341_H	7-10	The specified DP slave was not configured.
0	1	8183_H	0..10	DP master not configured.
0	1	8184_H	-	System error or bad parameter type.
0	1	$8F22_H$	0..10	Area length error reading a parameter (e.g. DB too short).
0	1	$8F23_H$	0..10	Area length error writing a parameter.
0	1	$8F24_H$	0..10	Area error reading a parameter.
0	1	$8F25_H$	0..10	Area error writing a parameter.
0	1	$8F28_H$	0..10	Alignment error reading a parameter.
0	1	$8F29_H$	0..10	Alignment error writing a parameter.
0	1	$8F30_H$	0..10	The parameter is in the writeprotected first current data block.
0	1	$8F31_H$	0..10	The parameter is in the writeprotected second current data block.
0	1	$8F32_H$	0..10	Parameter contains a DB number that is too high.
0	1	$8F33_H$	0..10	DB number error.
0	1	$8F3A_H$	0..10	Area not loaded (DB).

DONE	ERROR	STATUS	Possible with CTYPE	Meaning
0	1	$8F42_H$	0..10	Timeout reading a parameter from the I/O area.
0	1	$8F43_H$	0..10	Timeout writing the parameter to the I/O area.
0	1	$8F44_H$	0..10	Access to a parameter to be read during block execution is prevented.
0	1	$8F45_H$	0..10	Access to a parameter to be written during block execution is prevented.
0	1	$8F7F_H$	0..10	Internal error, e.g. illegal ANY reference.
0	1	$80C4_H$	0..10	Communication error (occurs temporarily, it is usually best to repeat the job in the user program).
0	1	$80D2_H$	0..10	Logical base address incorrect.

5.3 Configuration limits / resources required for the program blocks (PROFIBUS)

Required resources

Note

Note the version information of the blocks. The currently supplied block versions may differ from those shown here. Blocks with other versions have different resource requirements.

You will find information on the current block versions under entry ID:

Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

Table 5- 11 Information for FCs / FBs with S7400

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
AG_SEND	1.2	FC5	732	576	540	20
AG_RECV	1.2	FC6	656	522	486	20
AG_LSEND	3.1	FC50	1044	846	810	52
AG_LRECV	3.1	FC60	1190	992	956	58

Table 5- 12 Information for FCs / FBs with S7-300

NAME	Version	FC/FB no.	Load memory requirements [bytes]	Work memory requirements [bytes]	MC7 [bytes]	Local data [bytes]
DP_SEND	3.0	FC1	1066	886	850	42
DP_RECV	3.0	FC2	1144	950	914	46
DP_DIAG	3.0	FC3	1956	1638	1602	58
DP_CTRL	3.0	FC4	1532	1292	1256	52
AG_SEND	4.2	FC5	1976	1664	1628	50
AG_RECV	4.7	FC6	1440	1206	1170	40

Program blocks for PROFIBUS FMS

6

6.1 Overview of uses

Overview

The following function blocks are available for an S7 station involved in FMS communication.

The list shows the block numbers as they are when supplied. You can change these block numbers.

Function block		Can be used in the function of the PROFIBUS CP as:		Meaning / function
Type	Block number	FMS client	FMS server	
IDENTIFY	FB2	X	X	For querying device properties
READ	FB3	X	-	For reading data
REPORT	FB4	-	X	For transferring data unconfirmed
STATUS	FB5	X	X	For a status query
WRITE	FB6	X	-	For writing data

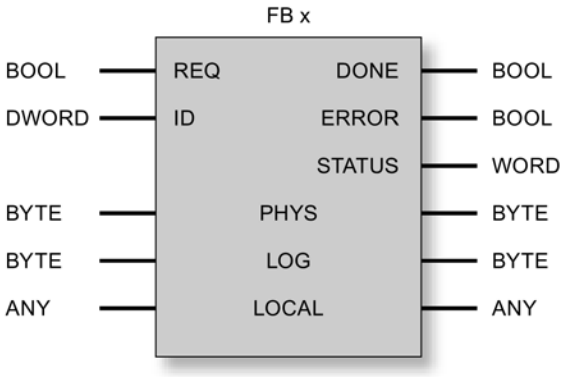
Difference between S7300 and S7400

Different FBs are supplied for the S7300 and S7400. Make sure you access the appropriate block library (SIMATIC_NET_CP) depending on whether you are creating a user program for an S7300 or an S7400.

6.2 FMS block parameters

FB call interfaces

The following sections describe the call interface for each FB as shown below:



Depending on the FB type, the FB has different parameters of the type INPUT, OUTPUT or INOUT.

The following tables explain the meaning, data type, range of values and memory area of **all** block parameters.

INPUT parameters

INPUT parameters	Meaning	Data type	Value range/memory area	Used in FB				
REQ	Edge signal for executing the block	BOOL	0=FALSE; 1=TRUE 0->1: "Start"/ I,Q,M,D,L	2	3	4	5	6
ID	This identifier identifies the FMS connection. S7300: The ID specifies both the LAN connection and the P bus address. S7400: The ID specifies both the LAN connection and the K bus connection. Make sure you use the ID from connection configuration or match it to this ID.	DWORD (with FB 1: WORD)	0001 0001 .. FFFF FFFF / I,Q,M,D,L	2	3	4	5	6

INPUT parameters	Meaning	Data type	Value range/memory area	Used in FB				
VAR_1	The parameter addresses the remote communications variable to be read or written. Depending on the configuration on the FMS server, a name or index can be specified.	ANY	String: Max. length = 254 bytes e.g. '<102>' (index access) "SLAVE2" (named access) DB	2	3	4	-	6
SD_1	Address of a local data area from which the variables will be transferred.	ANY	This type corresponds to a reference to a DB, I/O process image or bit memory area. Example: SD_1 := P#DB17.DBX0.0 BYTE 16 In this example, the first 16 bytes of DB17 are transferred. I,Q,M,D,L,C,T,DBx	-	-	4	-	6
RD_1	Address of a local data area to which the variables will be transferred.	ANY	This type corresponds to a reference to a DB, I/O process image or bit memory area. Example: SD_1 := P#DB17.DBX0.0 BYTE 16 In this example, the first 16 bytes of DB17 are transferred. I,Q,M,D,L,DBx Note on array of bytes for S7-300: If there is an odd number of bytes to be read, the length of the receive area must be configured up to the next higher even number of bytes. Example: For an array[1..13] of bytes, reserve a receive buffer size of 14 bytes.	-	3	-	-	-

OUTPUT parameters

OUTPUT parameters	Meaning	Data type	Range of values/ memory area	Used in FB
DONE	Indicates that the job is completed.	BOOL	0=FALSE 1=TRUE: Job completed; I,Q,M,D,L	- - 4 - 6
NDR	Indicates reception of data.	BOOL	0=FALSE 1=TRUE: New data were accepted; I,Q,M,D,L	2 3 - 5 -
ERROR	Indicates whether or not an error occurred.	BOOL	0=FALSE 1=TRUE: Error occurred; I,Q,M,D,L	2 3 4 5 6
STATUS	Provides detailed information about warnings or errors after the job has been completed.	WORD	You will find detailed decoding information in the sections following. I,Q,M,D,L	2 3 4 5 6

INPUT/OUTPUT parameters

INOUT parameters	Meaning	Data type	Range of values/ memory area	Used in FB
PHYS	Indicates the physical status of the partner device (VFD).	BYTE	0...3 I,Q,M,D,L	- - - 5 -
LOG	Indicates the logical status of the partner (VFD).	BYTE	0...3 I,Q,M,D,L	- - - 5 -
LOCAL	"local detail" parameter of the partner	ANY	This detail can be up to 16 bytes long. I,Q,M,D,L	- - - 5 -
VENDOR	Name of the device vendor.	STRING	Length<255 D	2 - - - -
MODEL	Name of the device model.	STRING	Length<255 D	2 - - - -
REVISION	Version (revision) of the device.	STRING	Length<255 D	2 - - - -

Memory area

The abbreviated forms for the memory areas in the table correspond to the following:

Short form	Type
I	Input
Q	Output
M	Bit memory

Short form	Type
L	Temporary local data
D	Data block area
C	Counter
T	Timer
DBX	Data block

FB output parameters during the CP startup (S7400)

When the FB is called (REQ:0->1, EN_R=1) while the PROFIBUS CP is starting up (for example due to a power cycle or activating a switch) the following output parameters are possible:

- DONE = 0
- NDR = 0
- ERROR = 1
- STATUS = 0001 (connection has not been established yet) or
  STATUS = 0607 (Get-OV still running)

6.3 IDENTIFY

6.3.1 Meaning and call - IDENTIFY

Meaning of the block

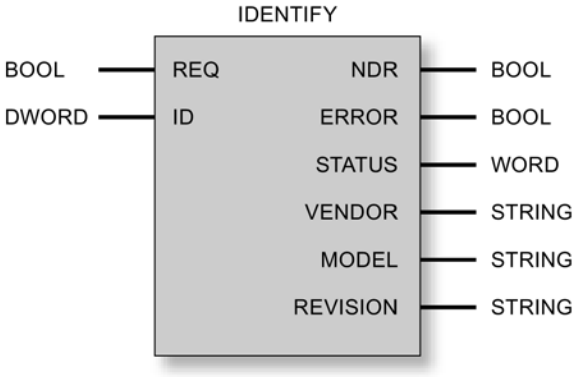
With the IDENTIFY function block, you can fetch the following information about the partner device (with S7 stations about the CPU):

- Name of the device vendor.
- Name of the device model.
- Version (revision) of the device.

Depending on the information you receive, you could, for example:

- Set the local program function to match the performance and response of the partner
- Set communication parameters

Call interface



Example in STL representation

```
STL                                          Explanation
call FB 2, DB 22 (                           //IDENTIFY block call with instance DB
REQ := M 1.0,                                //Edge signal for executing the FB
ID := DW#16#10001,                           //Matched with configuration of the
                                             //FMS connection
NDR := M 1.1,                                //Indicates when "new data accepted"
ERROR := M 1.2,                              //Indicates error in execution
STATUS := MW 20,                             //Detailed error decoding
VENDOR := "SLAVE2".VENDOR_ABBILD,            //Data area for vendor name
MODEL := "SLAVE2".MODEL_ABBILD,              //Data area for model
REVISION := "SLAVE2".REV_ABBILD );           //Data area for revision
```

Additional information

"SLAVE2"
is the symbolic name of a data block. This name is defined in the corresponding symbols table.
VENDOR_IMAGE, MODEL_IMAGE and REVISION_IMAGE
are variables of the data type STRING. These are defined in the "SLAVE2" data block.

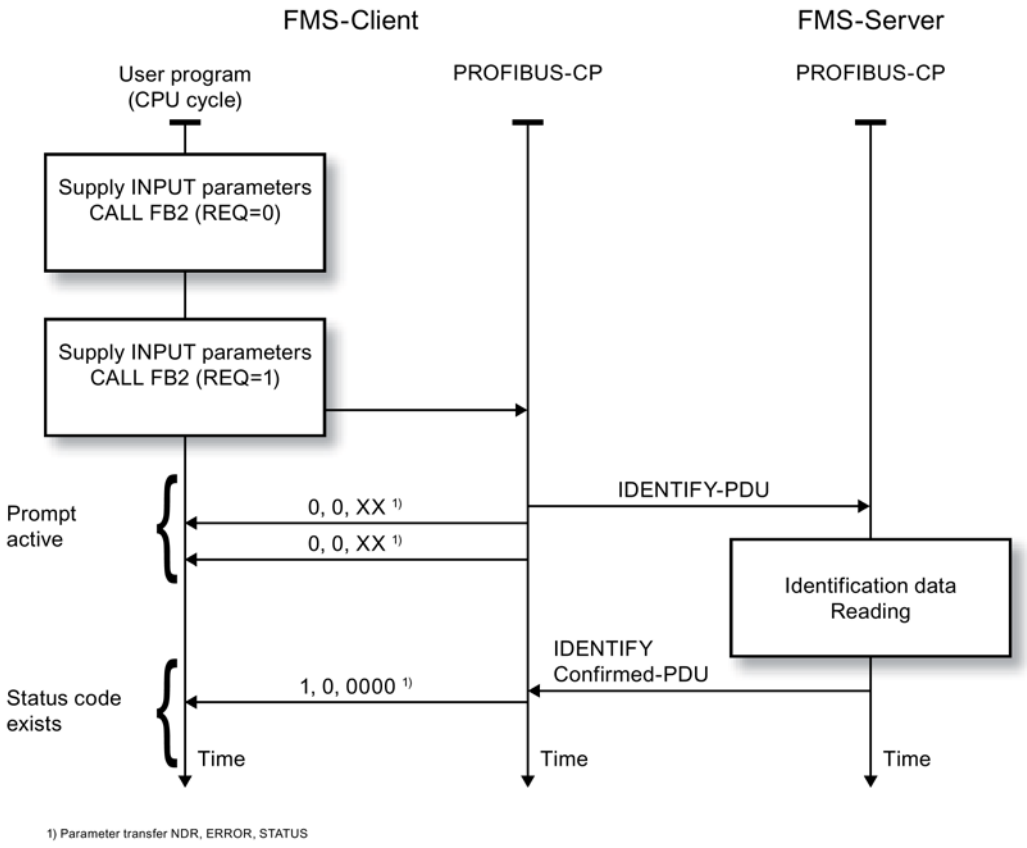
6.3.2 How IDENTIFY works

Operating principle

The following flow chart illustrates the normal sequence of an IDENTIFY job.

The job is activated by a (positive-going) edge change at the parameter REQ.

Each IDENTIFY job of the user program is acknowledged by the PROFIBUS CP with a value in the output parameters NDR, ERROR and STATUS.



6.4 READ

6.4.1 Meaning and call - READ

Meaning

The READ function block reads data from a data area of the communication partner specified by a name or index depending on the assignment of parameters for the job. The data that is read is saved locally in a data block, an area in the process image of the inputs/outputs or in a bit memory area.

Requirement: Configuration of communications variables

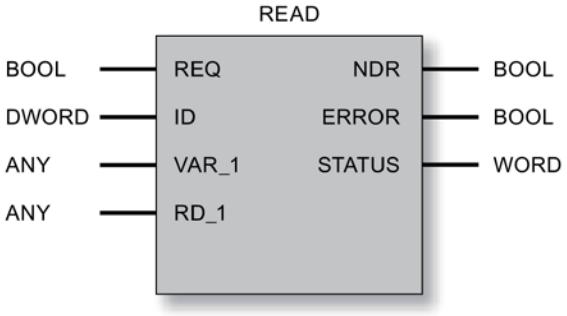
The structure of the variables on the communications partner (FMS server) is fixed. When the FMS connection is established, the structure description is read out from the communications partner. This is then available on the PROFIBUS CP to convert the data to the FMS representation.

The structure description is only read when the connection is established if the communications variable was selected during configuration of the FMS connection.

Access rights

Remember that access rights can be set for the data transfer. Data transmission is then only possible if the FMS client has been assigned suitable rights.

FB call interface



Example in STL representation

STL	Explanation
`call FB 3, DB 29 (`	`//READ block call with instance DB`
`REQ := M 1.0,`	`//Signal edge change to execute the FB`
`ID := DW#16#10001,`	`//Compared with configuration of`
	`//FMS connection`
`VAR_1 := "SLAVE2".INDEX,`	`//Addresses K variable that will be read`
`RD_1 := "PROZESS".Motor1,`	`//Addresses data area as destination`
`NDR := M 1.1,`	`//Confirmation of execution`
`ERROR := M 1.2,`	`//Indicates incorrect execution`
`STATUS := MW 20 );`	`//Detailed error decoding`

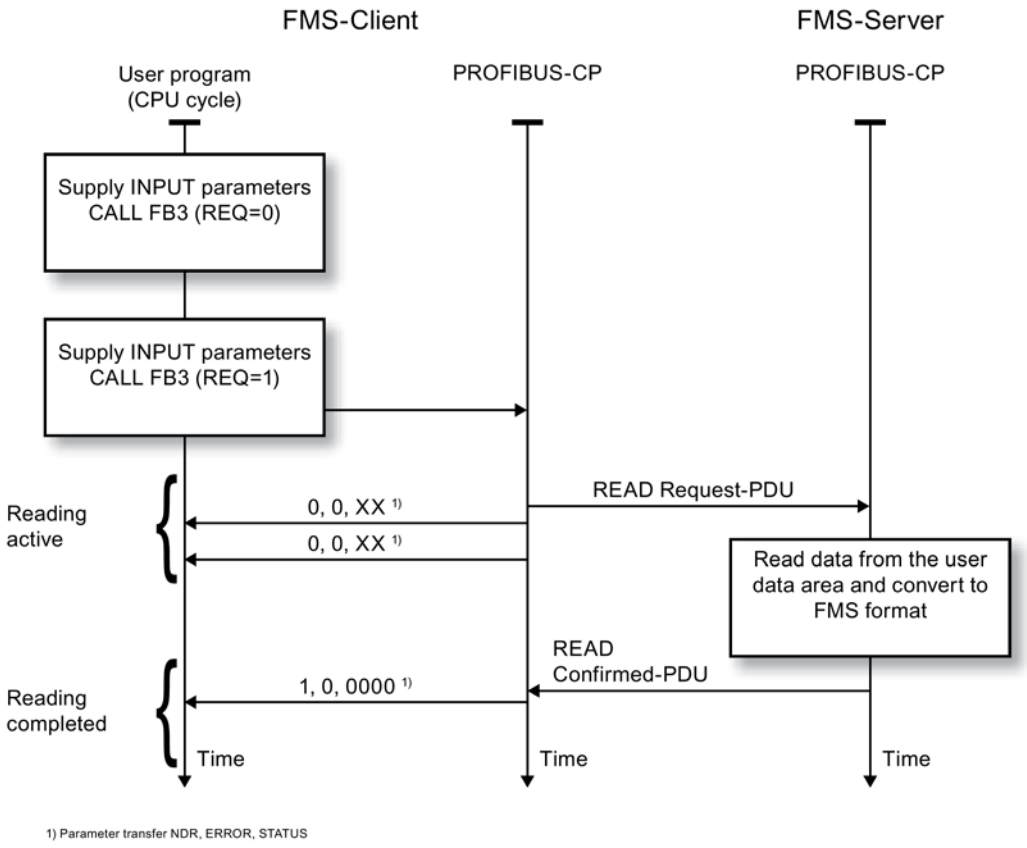
6.4.2 How READ works

Operating principle

The following sequence chart shows the normal sequence of data reception triggered with READ in the user program.

The job is activated by a (positive-going) edge change at the parameter REQ.

Every READ job in the user program is acknowledged by the PROFIBUS CP with values in the output parameters NDR, ERROR and STATUS.



Guarantee of data transfer

The diagram shows that the reading out of the data is confirmed with the code NDR=1, ERROR=0 and STATUS=0000.

Positive confirmation of the read job does not necessarily mean that the read job was registered by the partner application.

6.5 REPORT

6.5.1 Meaning and call - REPORT

Meaning of the block

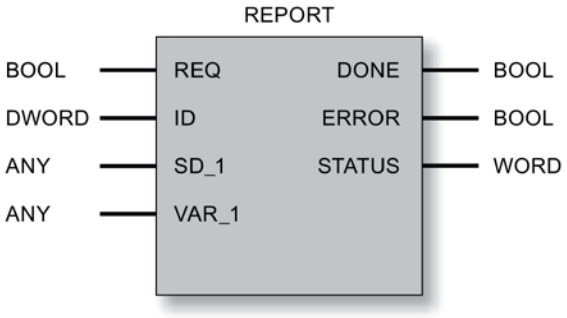
The REPORT function block allows unconfirmed transmission of variables by an FMS server. This job type is used particularly for transmission on broadcast/multicast FMS connections.

The structure of the variables to be reported must be configured locally on the FMS server.

S7 station as communications partner

To allow the reported variables to be accepted by the communications partner, the variables must be entered during configuration of the communications partner (FMS client).

Call interface



Example in STL representation

STL	Explanation
`call FB 4, DB 28 (`	`//REPORT block call with instance DB`
`REQ := M 1.0,`	`//Signal edge change to execute the FB`
`ID := DW#16#10001,`	`//Compared with configuration of FMS connection`
`VAR_1 := "SLAVE2".INDEX,`	`//Names the C variable to be reported`
`SD_1 := "PROZESS".Motor1,`	`//Addresses the source data area`
`DONE := M 1.1,`	`//Confirmation of execution`
`ERROR := M 1.2,`	`//Indicates incorrect execution`
`STATUS := MW 20 );`	`//Detailed error decoding`

Note

The parameter SD_1 is used to address the data area from which the variable values are read and reported. According to the FMS conventions, you also need to specify the variable index on the FC interface. The consistency of this information is not, however, checked when the call is executed.

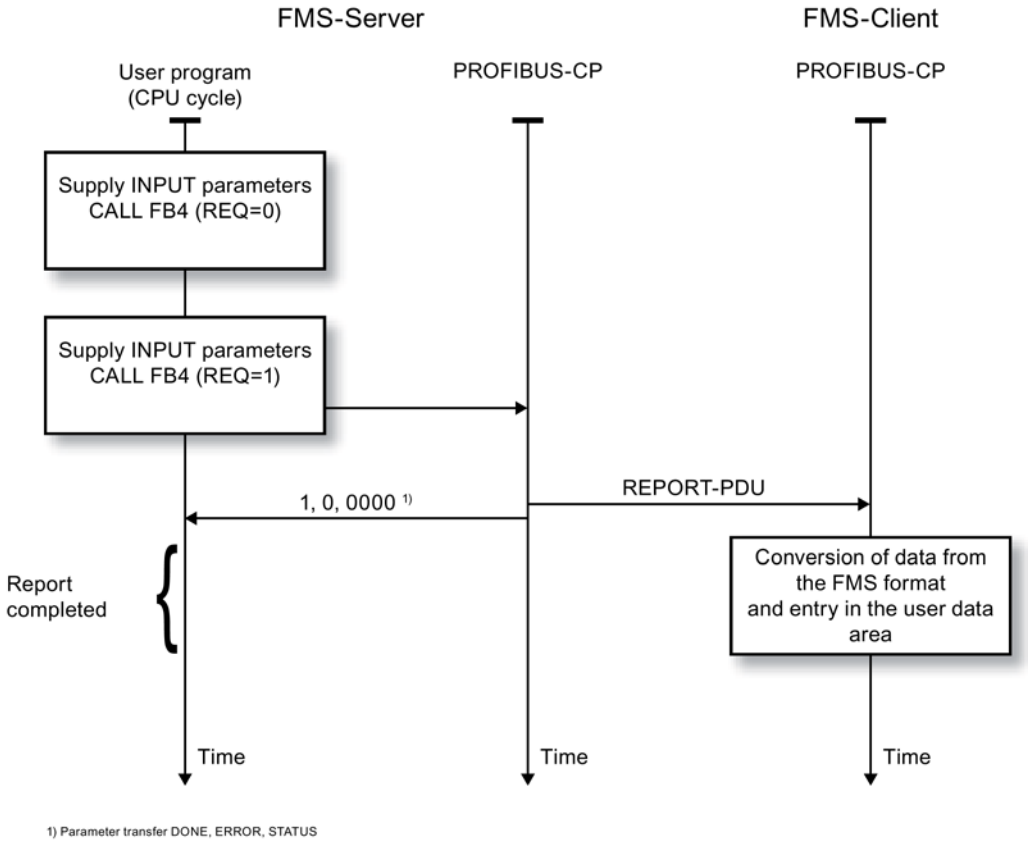
6.5.2 How REPORT works

Operating principle

The following flow chart shows the normal sequence of a data transfer transferred by REPORT in the user program.

The job is activated by a (positive-going) edge change at the parameter REQ.

Every REPORT job in the user program is acknowledged by the PROFIBUS CP with values in the output parameters DONE, ERROR and STATUS.



6.6 STATUS

6.6.1 Meaning and call - STATUS

Meaning of the block

The STATUS function block allows status information to be requested from the communications partner on the specified FMS connection.

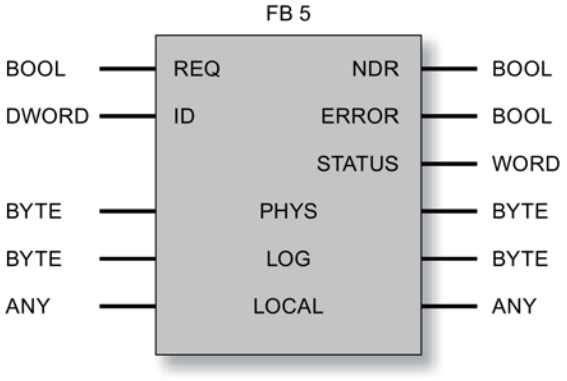
The following information is available:

- The logical status of the VFD;
  for example information whether communication is possible.
- The physical status of the VFD
  information about the status of the device
- Device-specific information
  normally provides vendorspecific information

The following table provides information about the codes that a device can supply as a result of the status request:

Device	Message version	Log	Phys	Local detail
S7 with PROFIBUS CP	1	00_H: Ready for communication CP in RUN, CPU in RUN	10_H: Ready for communication, CPU in RUN	No entry
	2	02_H: Limited services, CP in RUN, CPU in STOP	13_H: Maintenance required, CPU in STOP	No entry
Third-party device	The following are possible:	00_H: Ready for communication 02_H: Number of services limited	10_H: Operational 11_H Partly operational 12_H Not operational 13_H Maintenance required	- vendor specific -

Call interface



Example in STL representation

```
STL                                  Explanation
call FB 5, DB 21 (                   //STATUS block call with instance DB
REQ := M 1.0,                        //Signal edge change to execute the FB
ID := DW#16#10001,                   //Compared with configuration of FMS connection
NDR := M 1.1,                        //Indicates when new data is accepted
ERROR := M 1.2,                      //Indicates incorrect execution
STATUS := MW 20,                     //Detailed error decoding
PHYS := MB 22,                       //Data area for physical status
LOG := MB 23,                        //Data area for logical status
LOCAL := P#DB18.DBX0.0 WORD8 );      //Data area for "local detail"
```

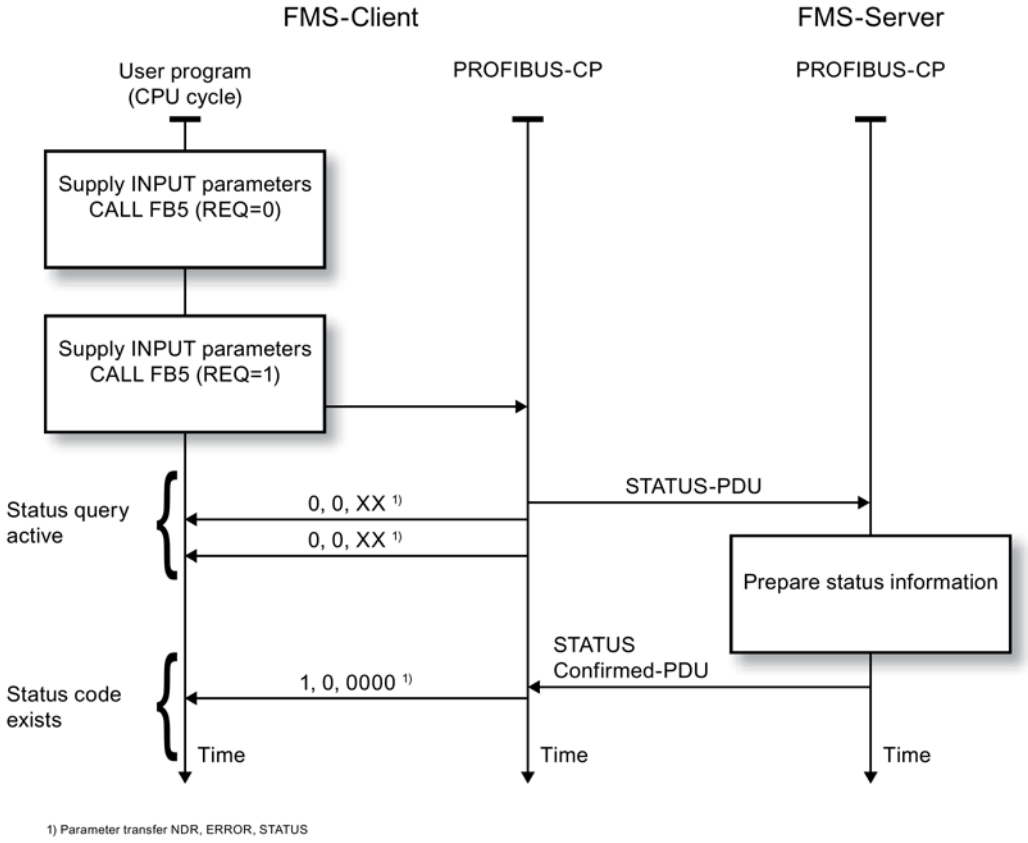
6.6.2 How STATUS works

Operating principle

The following flow chart shows the normal sequence of a STATUS job.

The job is activated by a (positive-going) edge change at the parameter REQ.

Every STATUS job in the user program is confirmed by the PROFIBUS CP with values in the output parameters NDR, ERROR and STATUS.



6.7 WRITE

6.7.1 Meaning and call - WRITE

Meaning

The WRITE FB transfers data from a specified local data area to a data area on the communication partner. The local data area can be a data block, an area in the process input or output image or a bit memory area. (See also parameter SD_1, FMS block parameter (Page 256))

The data area of the communication partner is specified using a variable name or a variable index.

Requirement: Configuration of communications variables

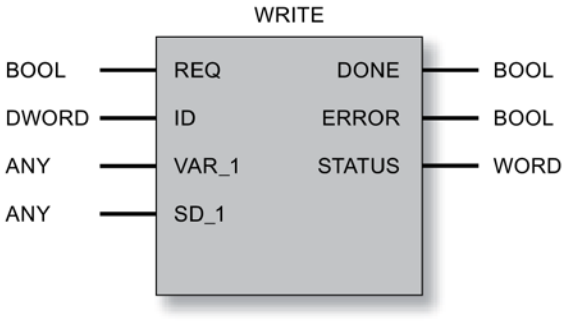
The structure of the variables on the communications partner (FMS server) is fixed. When the FMS connection is established, the structure description is read out from the communications partner. This is then available on the PROFIBUS CP to convert the data to the FMS representation.

The structure description is only read when the connection is established if the communications variable was selected during configuration of the FMS connection.

Access rights

Remember that access rights can be set for the data transfer. Data transmission is then only possible if the FMS client has been assigned suitable rights.

Call interface



Example in STL representation

```
STL                                     Explanation
call FB 6, DB 28 (                      //WRITE block call with instance DB
REQ := M 1.0,                           //Signal edge change to execute the FB
ID := DW#16#10001,                      //Compared with configuration of FMS connection
VAR_1 := "SLAVE2".INDEX,                //Names the C variable to be written
SD_1 := "PROZESS".Motor1,               //Addresses the source data area
DONE := M 1.1,                          //Confirmation of execution
ERROR := M 1.2,                         //Indicates incorrect execution
STATUS := MW 20 );                      //Detailed error decoding
```

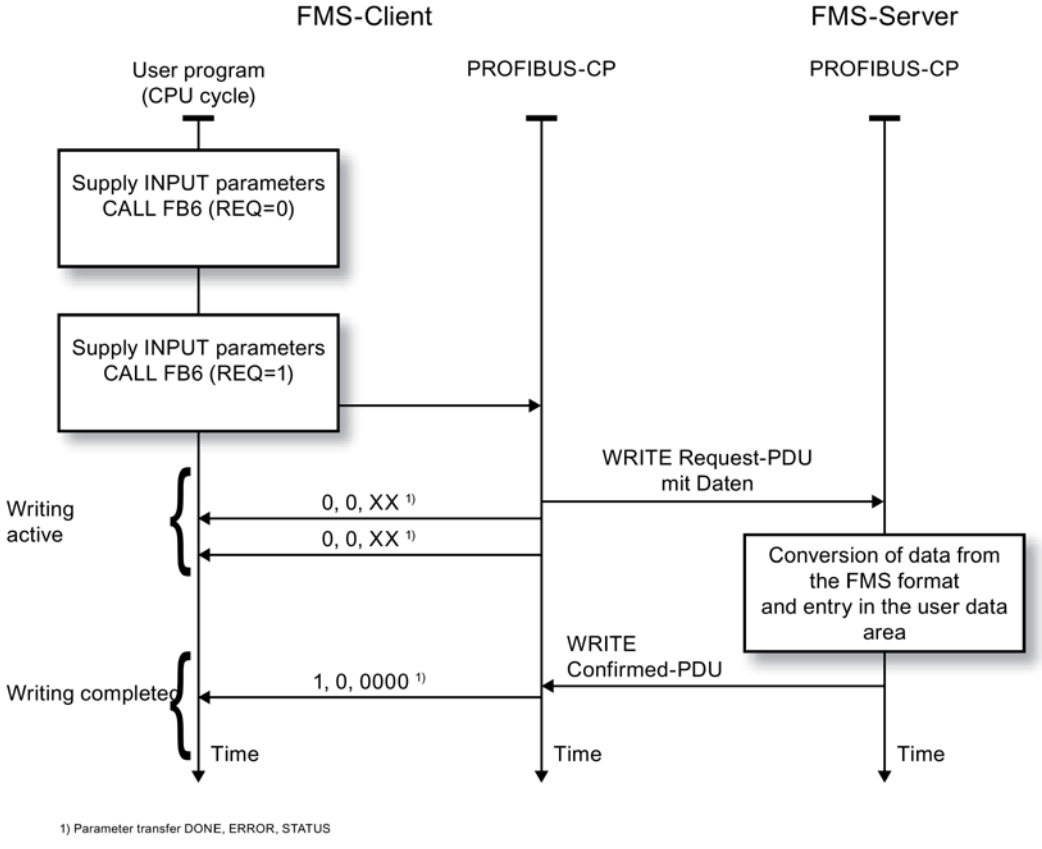
6.7.2 How WRITE works

Operating principle

The following flow chart shows the normal sequence of a data transfer triggered with WRITE in the user program.

The job is activated by a (positive-going) edge change at the parameter REQ.

Every WRITE job in the user program is confirmed by the PROFIBUS CP with values in the output parameters DONE, ERROR and STATUS.



Guarantee of data transfer

The diagram also shows that with the confirmation DONE=1, ERROR=0 and STATUS=0000, data transfer to the communications partner and entry in the remote data area is functioning correctly.

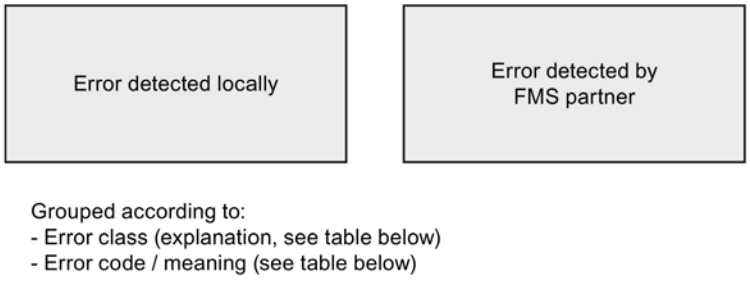
A positive confirmation of the job does not necessarily mean that the data has already been received and processed by the partner application.

6.8 Condition codes and error messages - FMS blocks

Structure of the tables

The following tables explain the condition codes and error codes that must be handled in your user program. The meanings of the parameters DONE/NDR, ERROR and STATUS are explained in FMS block parameters (Page 256)

To provide a better overview, the error codes are listed as follows:



Error-free job execution

If the job was executed free of errors, the parameters on the FB interface have the following values:

DONE/NDR	ERROR	STATUS	Meaning
1	0	0x0000	Job completed without errors
0	0	0x000B	Job active

Error classes

The possible error codes are grouped into the following error classes:

Table 6- 1 "Block" error class

Error class	Meaning
Block	Indicates errors or problems involving the following: • FB parameter assignment • Block execution in the CPU and CP
Application	Indicates errors or problems on the interface between the user program and FB.
Definition	Indicates errors that usually involve inconsistencies between the user program and FMS configuration.
Components	Indicates resource problems on the PROFIBUS CP.
Service	Indicates errors or problems in conjunction with the requested FMS service.
Access	Indicates denied access to objects due to the following: • Absence of access rights • Hardware problems • Other inconsistencies
OD (object directory)	Indicates problems accessing the object dictionary of the VFD.
VFD status	Unspecified error on the VFD
otherwise	Other errors

6.8.1 Error detected locally

Table 6- 2 "Application" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0001	Communications problem: For example, communications bus connection not established.
0	1	0x0002	The function cannot be executed: Either negative acknowledgment from CP or error in the sequence, for example communications bus error.
0	1	0x0003	The connection is not configured (invalid ID specified). If the connection is configured, the error message indicates that the permitted parallel job processing limit has been exceeded. Example: SAC=0 is configured and a REPORT job is sent.
0	1	0x0004	The receive data area is too short or the data types do not match.
0	1	0x0005	A reset request has been received from the CP (BRCV).

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0006	The corresponding job execution on the CP is in the DISABLED state or a reset request has been received from the CP; the transfer is therefore incomplete.
0	1	0x0007	Corresponding job execution on the CP is in the wrong state. For REPORT: The error is specified in greater detail in the diagnostic buffer.
0	1	0x0008	Job execution on the CP signals an error accessing the user memory.
0	1	0x000A	Access to local user memory not possible (for example, the DB was deleted).
0	1	0x000C	When the underlying BSEND or BRCV SFBs were called, an instance DB that does not belong to SFB12/SFB13 was specified or no instance DB was used, but rather a global DB.
0	1	0x0014	Not enough work or load memory available.

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0200	Unspecified application reference error.
0	1	0x0201	The configured connection cannot be established at present; for example LAN connection not established.

Table 6- 3 "Definition" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0300	Unspecified definition error.
0	1	0x0301	Object with requested index/name is not defined.
0	1	0x0302	Object attributes are inconsistent.
0	1	0x0303	Name exists already.

Table 6- 4 "Resources" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0400	Unspecified resource error.
0	1	0x0401	No memory available.

Table 6- 5 "Service" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0500	Unspecified service error.
0	1	0x0501	Conflict due to object status.
0	1	0x0502	Configured PDU size exceeded.
0	1	0x0503	Conflict due to object restrictions.

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0504	Inconsistent parameters.
0	1	0x0505	Illegal parameters.

Table 6- 6 "Access" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0600	Unspecified access error.
0	1	0x0601	Invalid object or no OD loaded;
0	1	0x0602	Hardware fault
0	1	0x0603	Object access was denied.
0	1	0x0604	Invalid address.
0	1	0x0605	Inconsistent object attributes.
0	1	0x0606	Object access not supported.
0	1	0x0607	Object does not exist in OD or GetOD still active.
0	1	0x0608	Type conflict or variable content outside permitted range of values
0	1	0x0609	Access using names not supported.

Table 6- 7 "Object dictionary" (OD) error class / VFD Status/Reject error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0700	Unspecified OD error.
0	1	0x0701	Permitted name length exceeded.
0	1	0x0702	Overflow of the object dictionary.
0	1	0x0703	Object dictionary is write protected.
0	1	0x0704	Overflow of the extension length.
0	1	0x0705	Overflow of the object description length.
0	1	0x0706	Processing problem.

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0100	Unspecified VFD status error.
0	1	0x0108	RCC/SAC/RAC error
0	1	0x0106	Service not supported.
0	1	0x0105	PDU length error
0	1	0x0102	Bad FMS-PDU

Table 6- 8 "Other" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x0800	Unspecified error.

6.8.2 Errors detected by FMS partner

Table 6- 9 Application error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8200	Unspecified application reference error.
0	1	0x8201	Application (e.g. user program) cannot be reached.

Table 6- 10 Definition error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8300	Unspecified definition error.
0	1	0x8301	Object with requested index/name is not defined.
0	1	0x8302	Object attributes are inconsistent.
0	1	0x8303	Name exists already.

Table 6- 11 Resources error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8400	Unspecified resource error.
0	1	0x8401	No memory available.

Table 6- 12 Service error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8500	Unspecified service error.
0	1	0x8501	Conflict due to object status.
0	1	0x8502	Configured PDU size exceeded.
0	1	0x8503	Conflict due to object restrictions.
0	1	0x8504	Inconsistent parameters.
0	1	0x8505	Illegal parameters.

Table 6- 13 Access error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8600	Unspecified access error.
0	1	0x8601	Invalid object.
0	1	0x8602	Hardware error.
0	1	0x8603	Object access was denied.
0	1	0x8604	Invalid address.
0	1	0x8605	Inconsistent object attributes.
0	1	0x8606	Object access is not supported.
0	1	0x8607	Object does not exist.
0	1	0x8608	Type conflict or variable content outside permitted range of values
0	1	0x8609	Access using names is not supported.

Table 6- 14 OD (object dictionary) error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8700	Unspecified OD error.
0	1	0x8701	Permitted name length exceeded.
0	1	0x8702	Overflow of the object dictionary.
0	1	0x8703	Object dictionary is write protected.
0	1	0x8704	Overflow of the extension length.
0	1	0x8705	Overflow of the object description length.
0	1	0x8706	Processing problem.

Table 6- 15 VFD status error class / "Other" error class

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8100	Unspecified VFD status error.

DONE/NDR	ERROR	STATUS	Meaning
0	1	0x8000	Unspecified error detected by partner.

6.9 Quantity framework / resource requirements of FBs (PROFIBUS FMS)

Note

Note the version information of the blocks. The currently supplied block versions may differ from those shown here. Blocks with other versions have different resource requirements.

You will find information on the current block versions under entry ID:

Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

Table 6- 16 Information for FBs with S7-400

NAME	Version	FB No.	Load memory require-ments [bytes]	Work memory require-ments [bytes]	MC7 [bytes]	Local data [bytes]	Instance DB [bytes]	Instance DB MC7 [bytes]
IDENT	1.4	2	1658	1364	1328	136	464	196
READ	1.5	3	2474	2086	2050	130	606	338
REPORT	1.5	4	2184	1818	1782	156	588	332
STATUS	1.3	5	1656	1390	1354	112	438	190
WRITE	1.5	6	2486	2094	2058	142	632	358

Table 6- 17 Information for FBs with S7-300

NAME	Version	FB No.	Block [bytes]	Work memory require-ments [bytes]	MC7 [bytes]	Local data [bytes]	Instance DB [bytes]	Instance DB MC7 [bytes]
IDENT	1.6	2	1462	1254	1218	86	306	158
READ	1.5	3	1998	1700	1664	64	218	70
REPORT	1.6	4	2036	1732	1696	76	230	72
STATUS	1.6	5	1430	1244	1208	60	182	46
WRITE	1.6	6	2028	1724	1688	76	230	72

Document history

A

This chapter provides an overview of the previous issues of this manual and the functional expansions of the program blocks.

This was new in release 07

This manual release contained corrections and new information.

Changes / additions:

- Names of the PROFIenergy program blocks for the S7-300 in STEP 7 Professional
- Configuration limits / resources required for the program blocks for Ethernet and PROFIBUS FMS
- Reaction of the SIMATIC NET CPs to ICMP frames

This was new in release 06

This manual release contained corrections.

Corrections:

- PROFIenergy program blocks

This was new in release 05

This manual release contained corrections and new information.

Changes / additions:

- PROFIenergy

  New program blocks for PROFIenergy functions

This was new in release 04

This manual release contained corrections and new information.

Changes / additions:

- New program block AG_CNTEX
- Adaptation to the new STEP 7 Professional configuration software

  In the new configuration software, program blocks are always specified by their symbolic names. This manual follows this convention by using the names of the program blocks in most situations. The assignment of the names and block numbers as used in STEP 7 V5.5 is nevertheless retained.
- Expanded program block FTP_CMD

  You can set up SSL-secured FTP connections.

This was new in release 03

This manual release contained corrections and new information.

Changes / additions:

- Reference to FAQ entry on block handling.
- Special features when using the FB for programmed connections and IP configuration in fault-tolerant systems (H systems)
- DP_SEND / DP_RECV explanation of status code 8180_H expanded.
- DP_CTRL: The missing description of job type CTYPE = 4 was added.

  Information on CTYPE 1, 7 and 8 was added because these are no longer supported as of module type DA02.
- DP_CTRL: Explanation of the following status codes was expanded: 8181_H, 8183_H, 8333_H, 8334_H

This was new in release 02

This manual release contained corrections and new information.

The following was added to the previous release:

Changes / additions:

- In the section on Industrial Ethernet

  A new function block FB56 is available for ERPC communication with ERPC-CPs.
- In the section on FBs / FCs for FTP services

  The description of the data block file DB is now both in the online help and in this manual.
- In the section on FBs for programmed connections and IP configuration

  The section now includes a full description of the required configuration data block.

  The option of configuring a device name for certain CP types has also been added here.
- In the section on FBs / FCs for PROFINET IO

  Here, the option of transferring detailed status information with the FCs PNIO_SEND and PNIO_RECV has been added. This allows you to achieve a faster reaction on the interface.

This was new in release 01

This manual grouped together the block descriptions that were previously in the manuals for S7 CPs structured according to network types. These manuals will no longer include the block descriptions.

Compared with the previously valid versions of the manuals for S7 CPs, version 1 includes the following innovations in the block descriptions:

- In the section on Industrial Ethernet

  A new function block FB 40 is available for the FTP client mode of advanced CPs. Using this FB, complete FTP job sequences can be created efficiently in the user program.

- In the section on PROFINET IO

  Parameter modification in the blocks for PROFINET IO

  – FC11 PNIO_SEND (block version 2.0)

  – FC12 PNIO_RECV (block version 2.0)

  These two functions must be used for CPs that use PROFINET IO controller and device mode at the same time.

References

B

Finding the SIMATIC NET documentation

- **Catalogs**

  You will find the order numbers for the Siemens products of relevance here in the following catalogs:

  – SIMATIC NET Industrial Communication / Industrial Identification, catalog IK PI

  – SIMATIC Products for Totally Integrated Automation and Micro Automation, catalog ST 70

  You can request the catalogs and additional information from your Siemens representative.

  You can go to the Industry Mall on the Internet at the following address:

  Link: (https://mall.industry.siemens.com)

- **Documentation on the Internet**

  You will find SIMATIC NET manuals on the Internet pages of Siemens Automation Customer Support:

  Link: (https://support.industry.siemens.com/cs/ww/en/ps/15247)

  Go to the required product group and make the following settings:

  "Entry list" tab, Entry type "Manuals / Operating Instructions"

- **Documentation from the STEP 7 installation**

  Manuals that are included in the online documentation of the STEP 7 installation on your PG/PC can be found in the start menu ("Start" > "All Programs" > "Siemens Automation" > "Documentation").

B.1 On configuring, commissioning and using the CP

/1/

SIMATIC NET
S7 CPs for Industrial Ethernet
Configuring and Commissioning
Manual Part A - General Applications
Configuration Manual
Siemens AG
Link to Part A: (https://support.industry.siemens.com/cs/ww/en/view/30374198)

B.2 On programming

/2/

SIMATIC NET
Program blocks for SIMATIC NET S7 CPs
Programming Manual
Siemens AG
Link: (https://support.industry.siemens.com/cs/ww/en/view/30564821)

/3/

SIMATIC NET
Program blocks for SIMATIC NET S7 CPs
Version history, reference document
Siemens AG
Entry ID: Link: (https://support.industry.siemens.com/cs/ww/en/view/9836605)

/4/

SIMATIC
Programming with STEP 7
Siemens AG
(Part of the STEP 7 documentation package STEP 7 Basic Knowledge)
(Part of the online documentation in STEP 7)
Link: (https://support.industry.siemens.com/cs/ww/en/view/45531107)

/5/

SIMATIC
System and Standard Functions for S7-300/400 - Volume 1/2
Reference manual
Siemens AG
(Part of the STEP 7 documentation package STEP 7 Basic Knowledge)
(Part of the online documentation in STEP 7)
On the Internet under the following entry ID:
Link: (https://support.industry.siemens.com/cs/ww/en/view/1214574)

Index

S

T

U