FTP data exchange between an FTP server and a SIMATIC S7-1200 / S7-1500

FTP

https://support.industry.siemens.com/cs/ww/en/view/81367009

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1 Introduction

1.1 Overview

Scenario

In order to work outside of the controller environment with data collected within the controller environment, it is necessary to exchange process data between controllers and servers or PCs. This is possible with standardized protocols.

A simple protocol that works according to the client/server principle and which meets the demands of this task is the **F**ile **T**ransfer **P**rotocol (FTP).

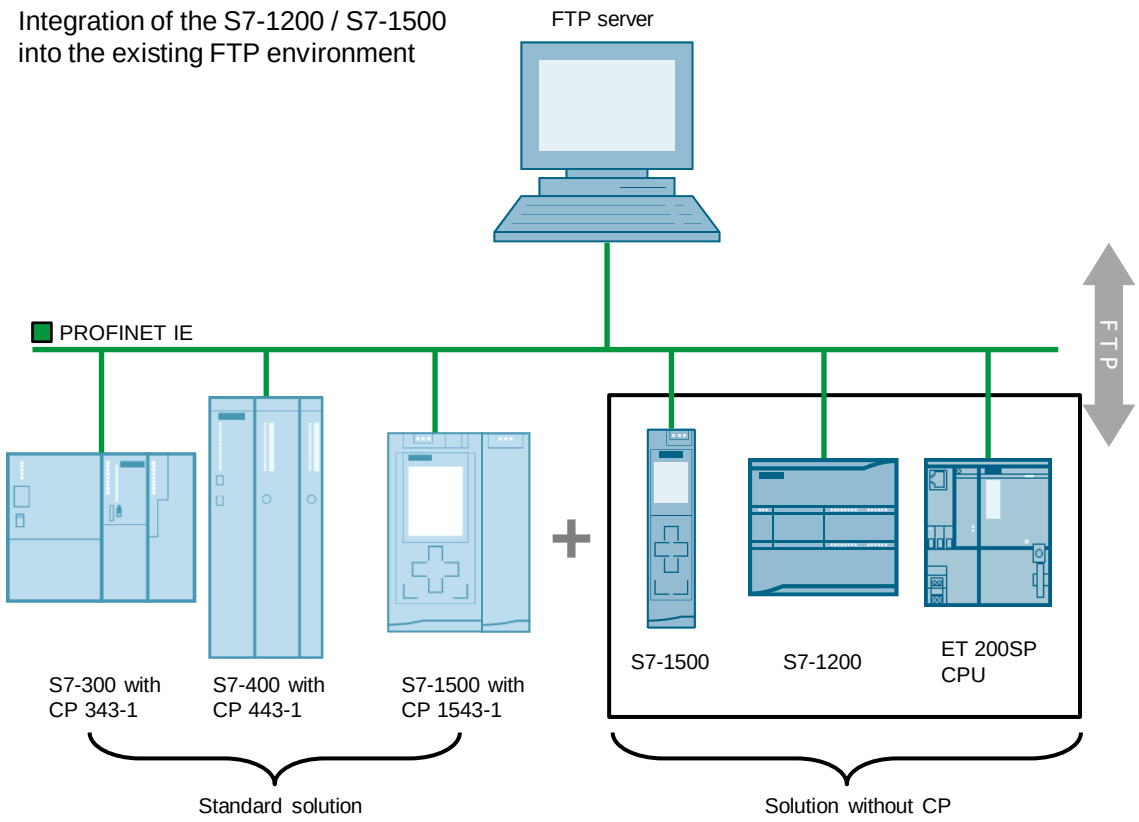
FTP allows you to store data on server systems. FTP supports almost all server systems and operating systems.

The controllers from the SIMATIC S7-300, S7-400 and S7-1500 product families support FTP communication with the help of specialized communications processors (CPs).

For an S7-1200, S7-1500 or ET200SP CPU to use FTP communication with certain FTP servers **without a special CP**, a block based on Open User Communication (TCON, TSEND, TRCV, TDISCON and TCONSETTINGS) must be used.

Overview of the application example

The Figure below provides an overview of the application example:



Description

Until now, users working with an S7-300, S7-400 or S7-1500 could only exchange process data with an FTP server over FTP if they had a CP.

The "LFTP" library has been made available to you so that you can integrate a controller as an FTP client into an FTP environment without the use of a communications processor.
This library consists of the following blocks:

- Function block (FB) "LFTP_Client"
- Data type "LFTP_typeConnParam"
- Data type "LFTP_typeFtpParam"

This application example provides you with step-by-step instructions on how to use and deploy the library blocks.

Note The "LFTP" library is part of the "Libraries for Communication". You can find the "Libraries for Communication", including a detailed block description, in Siemens Industry Online Support (see \6\ in chapter 4.3).

Note This application example also provides you with a preconfigured TIA Portal project. The "LFTP" library has already been added to this TIA Portal project and assigned parameters.

FTP in the SIMATIC S7 environment

The table below lists the various ways of using FTP in the SIMATIC S7 environment.

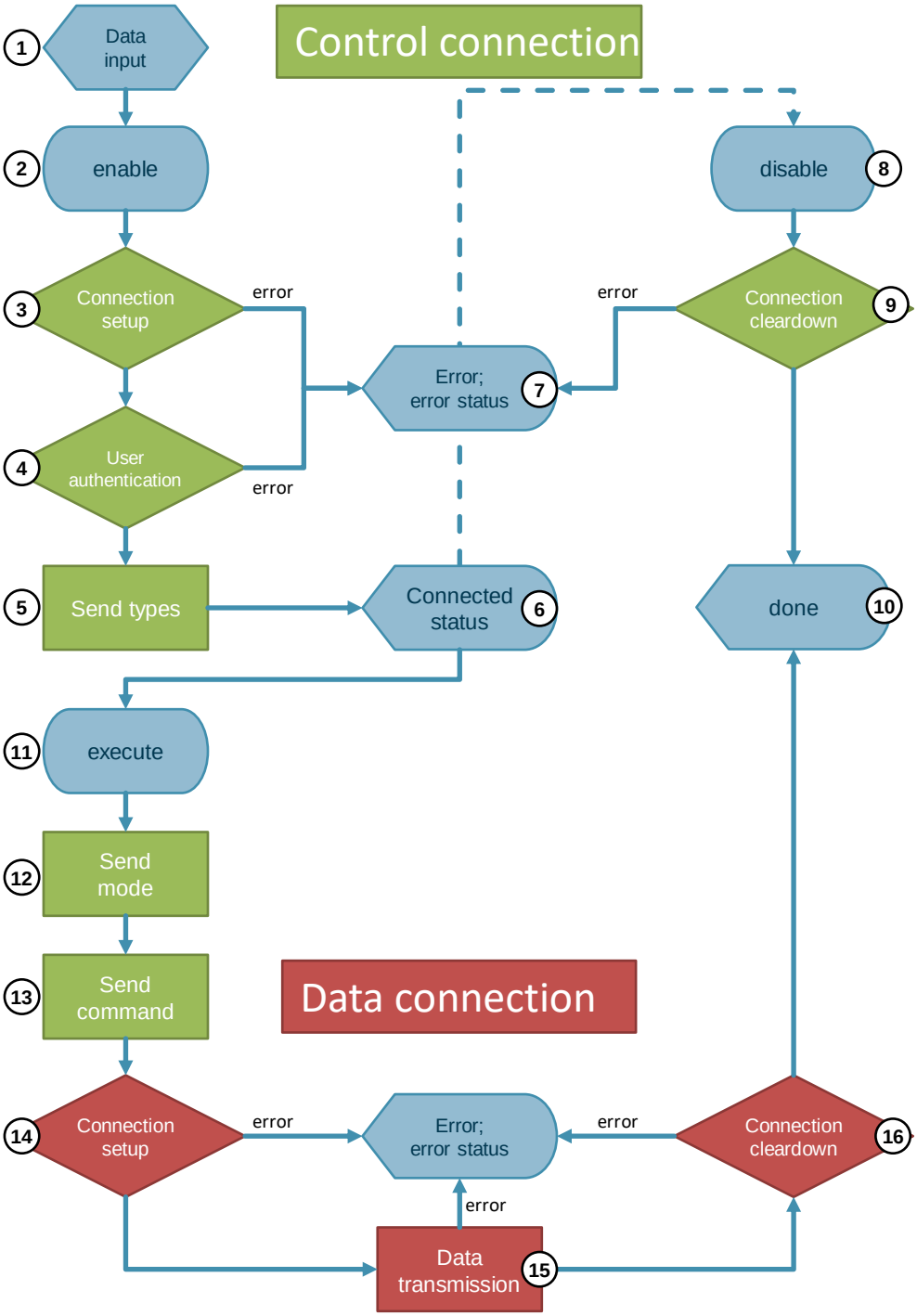
Table 1-1

FTP feature	S7-300 or S7-400 (CP 343-1/443-1)	S7-1500 (CP 1543-1)	S7-1200 and S7-1500 (FB "LFTP_Client")
With special CP	☑ (CP 343-1 / 443-1)	☑ (CP 1543-1)	☒
FTP server	☑	☑	☒
Number of parallel client connections	10/20	32	4
FTP active	☑	☑	☑
FTP passive	☒	☑	☑
FTPS	☒	☑	☒
Full S7 FTP command set	☑	☑	☒

1.2 Principle of operation

Function block "LFTP_Client"

The following Figure shows the principle of operation, structure and states of the function block "LFTP_Client".



Description of the number labels

The Table below describes the numbered labels from Figure 1-2.

Table 1-2

No.	Action	Description
1.	Store connection data in DB	The user specifies the following connection data: • IP address or QDN of the server • Hardware ID of the interface used • Username • Password • File name • FTP mode • FTP command • FTP data
2.	Set enable command	The user initiates the control connection.
3.	Control connection is established.	The control connection (port 21) to the FTP server is established. The connection ID is generated by the TCONSettings block.
4.	User authentication	The FTP client logs on with the specified user credentials (username, password).
5.	Send types to server	The type of the transmitted file is sent to the FTP server.
6.	Connected status	The control connection is ready. FTP commands can be carried out as long as the control connection is open (no. 13).
7.	Error set; output error status	An error occurred during processing. The error-specific status is output (see chapter 2.5).
8.	Reset enable signal	The user closes the control connection.
9.	Control connection termination	The control connection (port 21) to the FTP server is terminated.
10.	Done is set	The initiated job is executed.
11.	Set execute signal	The user initiates an FTP command.
12.	Send mode to server	The mode selected by the user (active, passive) is sent to the FTP server.
13.	Send FTP command to server	The FTP command selected by the user is sent to the FTP server. The following commands are available: • STORE (save data) • APPEND (append data) • RETRIEVE (retrieve data) • DELETE (delete a file)
14.	Establish data connection	The data connection (FTP active: port 20) to the FTP server is established.
15.	Data transmission to/from server	Data are either stored on the FTP server or in the assigned range in the controller (FTP client).
16.	Terminate data connection	The data connection (FTP active: port 20) to the FTP server is terminated.

Requirements

Note the following requirements when using the "LFTP" library:

- S7-1200 with firmware V4.5 or later
- S7-1500 with firmware V2.9 or later

Restrictions

The following restrictions apply for this application example:

- The application example was tested with the FileZilla FTP server. You will need the FTP software version 1.3 or higher for this.
- A maximum of four users can connect from a controller to an FTP server.
- The FTPS function is not part of this application example.
- Open User Communication allows for a maximum of 8192 bytes per command to be sent or received with the S7-1200 and 65536 bytes per command with the S7-1500.
- If access is not optimized, the lower and lower bounds for arrays are -32768 and 32767, respectively.
- If access is optimized, the lower and lower bounds for arrays are -2,147,483,648 and 2,147,483,647, respectively.
- With an S7-1200 or an S7-1500, the maximum size of received data depends on the maximum size of the CPU's receiving memory.

Note

The following applies to S7-1500 CPUs:

For a block with the "Optimized block access" property, an element of data type Bool requires 1 byte of storage space. This also applies for arrays of Bool.

1.3 Components used

General hardware

You will need a PC for the FTP server and TIA Portal installation.

Hardware of the sample project

This application example provides you with a prefabricated sample project. This sample project was developed with the hardware component listed below.

Table 1-3

Component	Quantity	Item number	Note
SIMATIC S7-1500 CPU 1513-1 PN	1	6ES7 513-1AL01-0AB0	Alternatively, you can use any other SIMATIC S7-1500 or ET 200SP CPU with firmware V2.9 or later.

Software components

The Table below shows the necessary software components.

Table 1-4

Component	Quantity	Item number	Note
STEP 7 PROFESSIONAL V17	1	6ES7 822-1AA07-0YA5	A package with a prior version is also possible.
FileZilla Server V1.3.0	1	Freeware (GPL)	You can find the download link for **FileZilla Server** under \4\ in chapter 4.2.

Project and documentation

This application example consists of the following components:

Table 1-5

Component	File name	Note
Project	81367009_LFTP_PROJ_V61.zip	This zipped file contains the STEP 7 project of the example project for the S7-1500.
Documentation	81367009_LFTP_DOC_V611_en.pdf	This document.

2 Engineering

2.1 Preparing the environment

IP addresses

Make sure that your CPU (FTP client) and the PC (FTP server) are located in the same subnet and that every IP address is unique within the subnet.

The following IP addresses were used in the TIA Portal project of this application example:

Table 2-1

Component	IP address	Subnet mask
S7-1500 (FTP client)	192.168.0.3	255.255.255.0
PC (FTP server)	192.168.0.1	255.255.255.0

Wiring

Connect the PC to your controller.

TIA Portal project

Open your TIA Portal project or create a new project with your hardware components. When you add the CPU, follow the instructions from the Security Wizard and adjust the safety functions to suit your needs.

Library

Download the "Communication Library". You can find the library in Siemens Industry Online Support (see \6\ in chapter 4.3).

2.2 Configuring the FTP server

Note

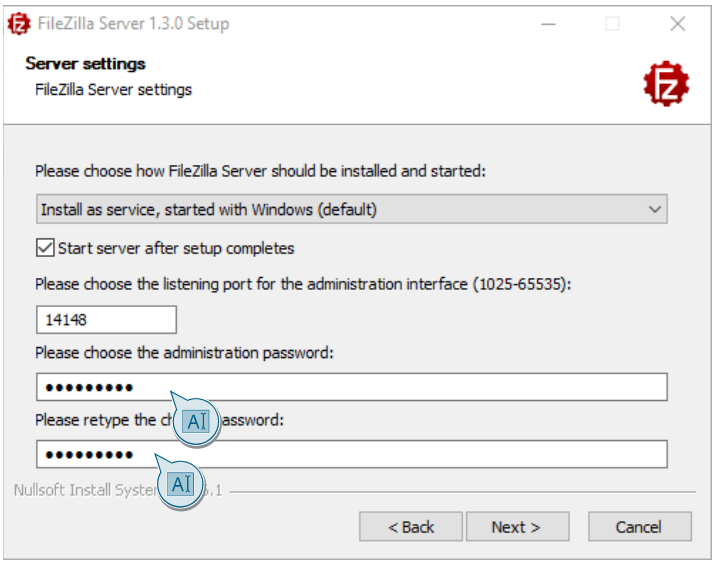
This application example shows the FTP server configuration using FileZilla. If you are using a different FTP server, then change the configuration steps according to the input screens for your specific FTP server.

If you are using a different FTP server software program, then consult its manual for commissioning instructions.

Installation

1. Download latest version of FileZilla Server from https://filezilla-project.org/.

2. Install the FTP server software on your server. Now follow the instructions in the installation program to do this. During the installation, you can optionally create a password for the FTP server.



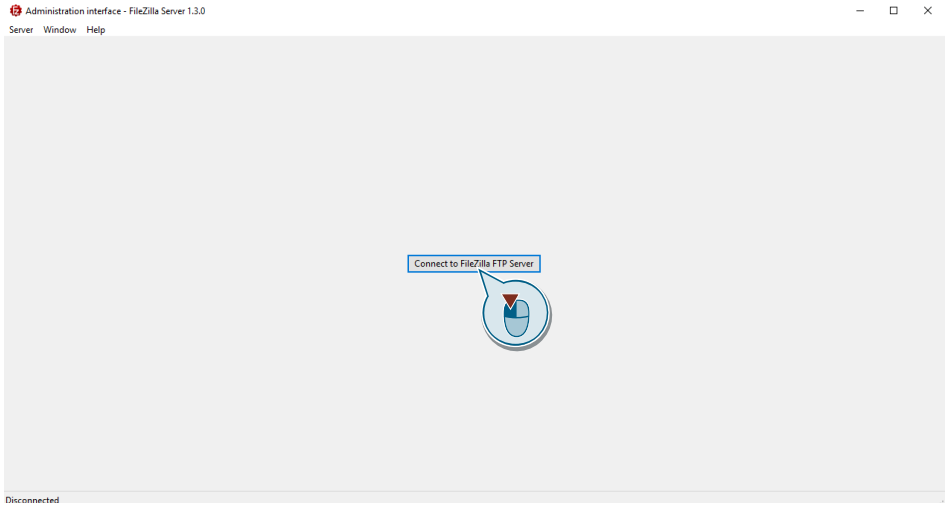
Note

Make sure that the FTP server is always up-to-date.

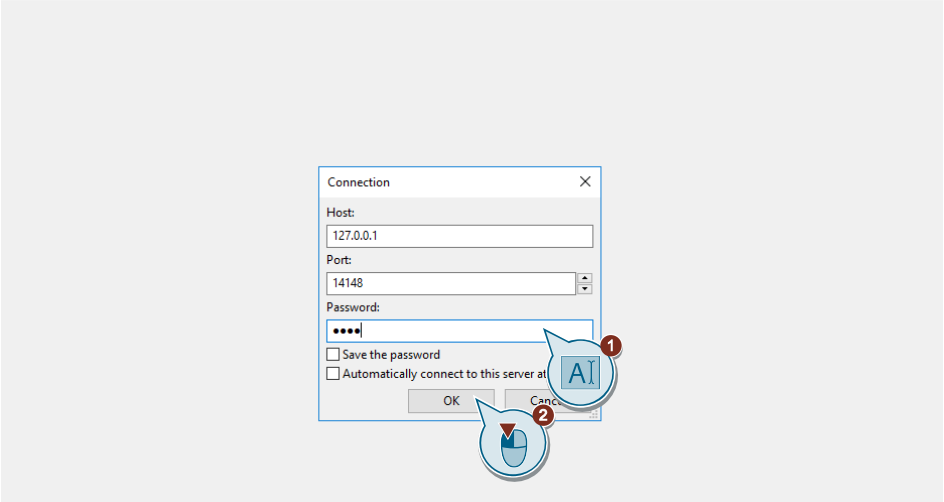
Configuration

Proceed as follows to configure FileZilla Server:

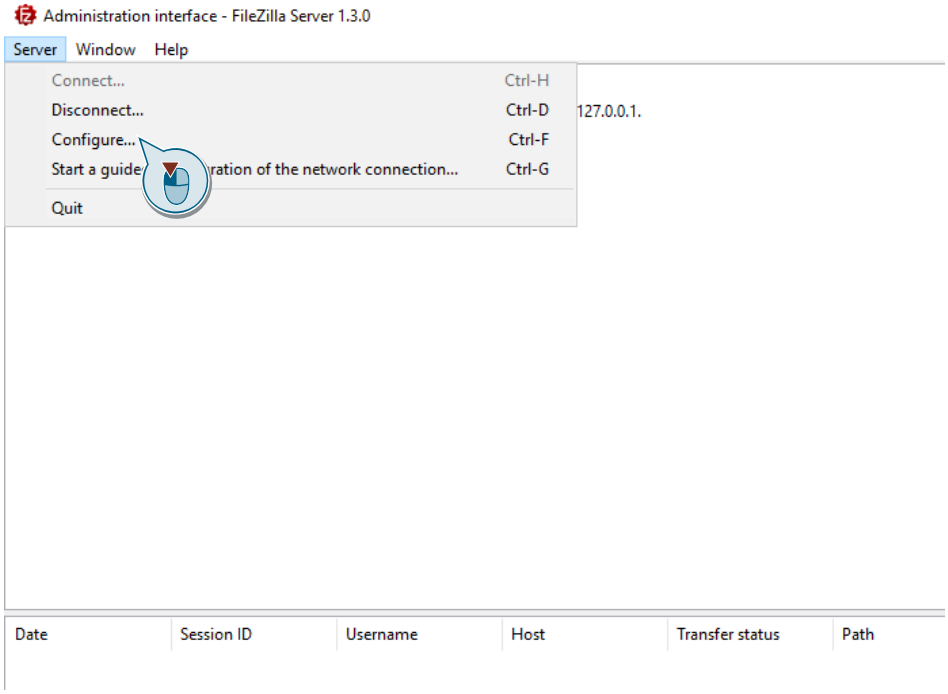
1. Launch the FileZilla Administration interface on your FTP server and click "Connect to FileZilla FTP Server".



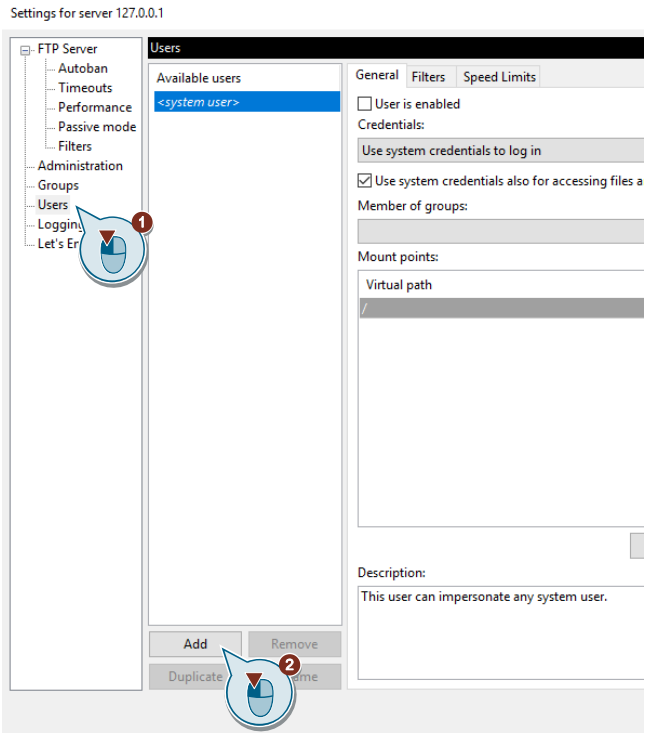
2. Leave the IP address of the host and the port as the default setting.
   Enter the same password you assigned when installing the FTP server. If you did not assign a password during the installation process, then leave the password field blank.
   Confirm with "OK".



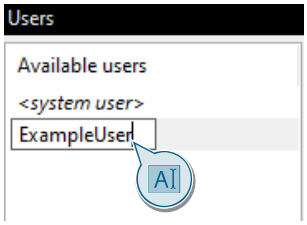
3. Click on "Server > Configure…"



4. Click on "Users". Click "Add" to add a new user.

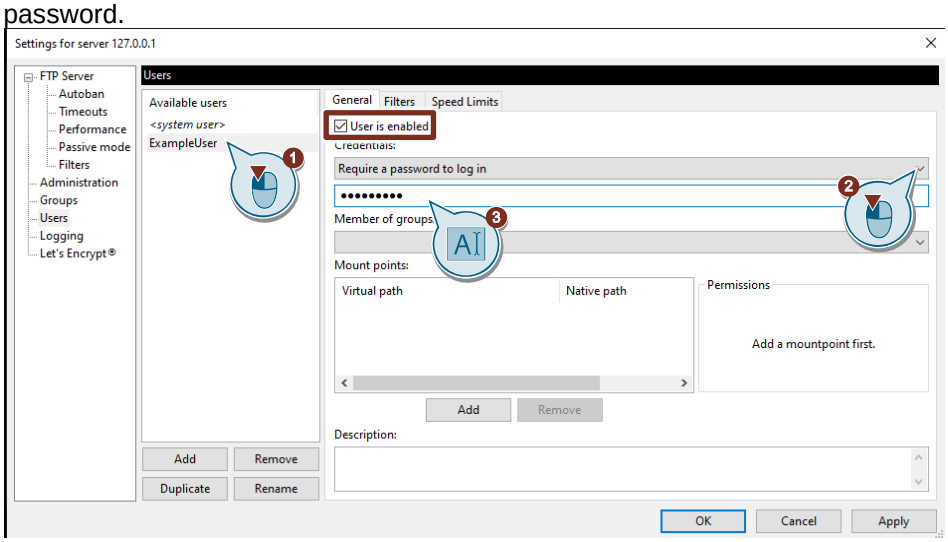


5. Assign a username, e.g. "ExampleUser".

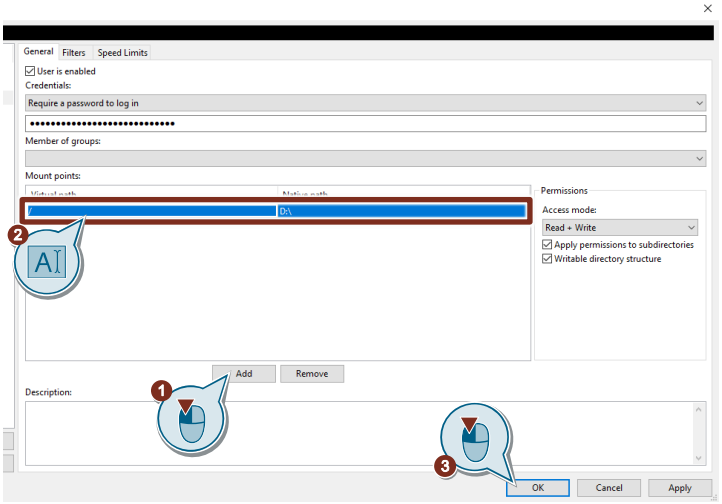


6. In the list of available users, select the user you just created. See whether the checkbox for "User is enabled" is checked.

   Select "Require a password to log in" from the dropdown menu, then assign a user password.



7. To define a native destination path, click "Add".
   In the "Virtual path" column, enter the absolute path "/".
   In the "Native path" column, enter the native destination path, e.g. "D:\".
   Click "OK" to save your changes.



2.3 Using the "LFTP" library

In this chapter, you will integrate the "LFTP" library and a global data block into your TIA Portal project.

Note This application example provides you with a prefabricated sample TIA Portal project. The "LFTP" library has already been added to this TIA Portal project and assigned parameters.

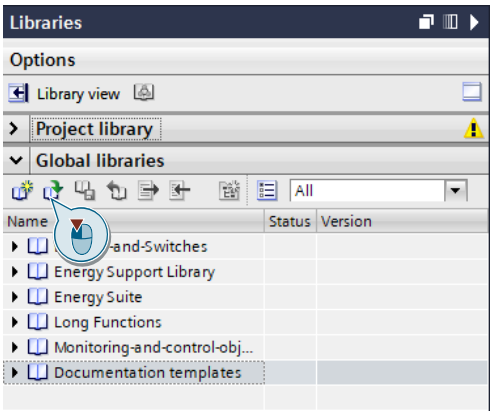
2.3.1 Integrate library blocks

Open "Library for communication"

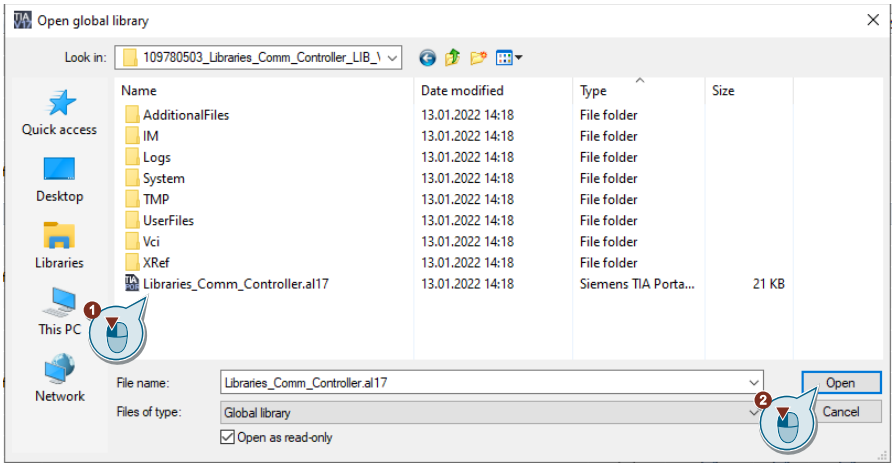
The "LFTP" library is part of the "Communication Library". Proceed as follows to open the "Communication Library":

1. In your TIA Portal project, click the "Libraries" tab and open the "Global libraries" palette.

2. Click the "Open global library" button. The "Open global library" dialog will open.

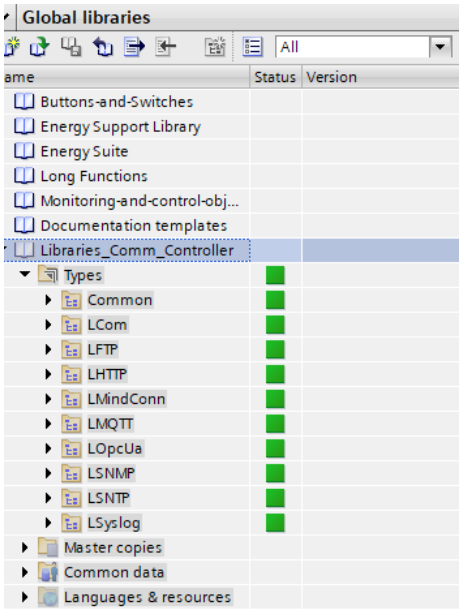


3. Navigate to the directory with the global library and select the global library "Libraries_Comm_Controller.al17".
   Confirm your selection by clicking the "Open" button.



Result

The "Libraries_Comm_Controller" library appears under the "Global libraries" palette.



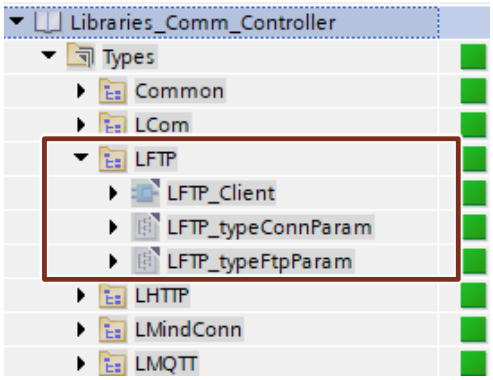
Copy the "LFTP" library

The "LFTP" library is composed of the following blocks:

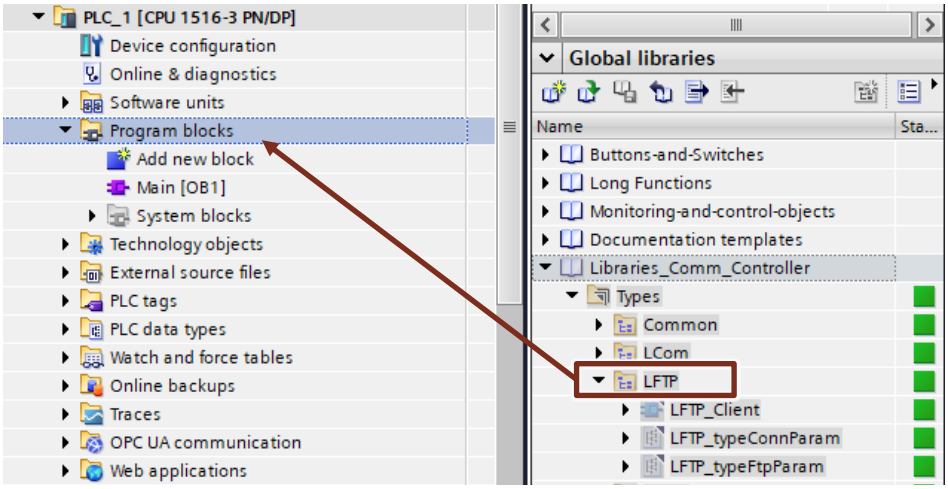
- Function block "LFTP_Client"
- Data type "LFTP_typeConnParam"
- Data type "LFTP_typeFtpParam"
- Data type "typeDiagnostics"

To copy the "LFTP" library into your user program, follow these steps:

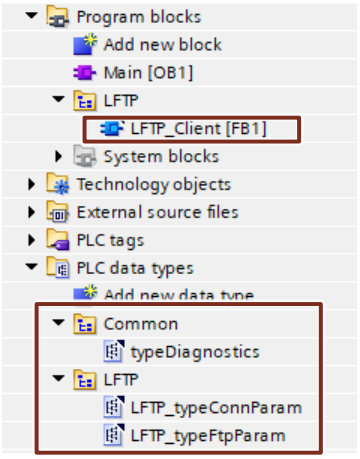
1. In the "Libraries_Comm_Controller" library, open the folder "Types > LFTP".



2. Drag and drop the "LFTP" folder into the "Program blocks" folder of your device, e.g. the S7-1500 CPU.



3. The data types required by the function block will be automatically added to the "PLC data types" folder of your CPU.



2.3.2 Create global data block

In this chapter you will create a global data block with the following parameters:

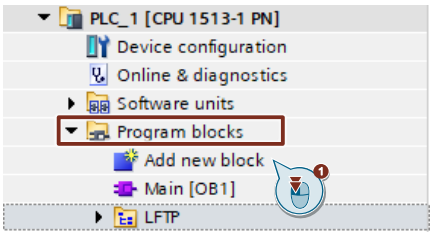
- Connection parameters
- Parameters for monitoring and control of the communication with the FTP server
- Parameters for storing data transmitted via FTP

Create data block

Proceed as follows to create a new global data block:

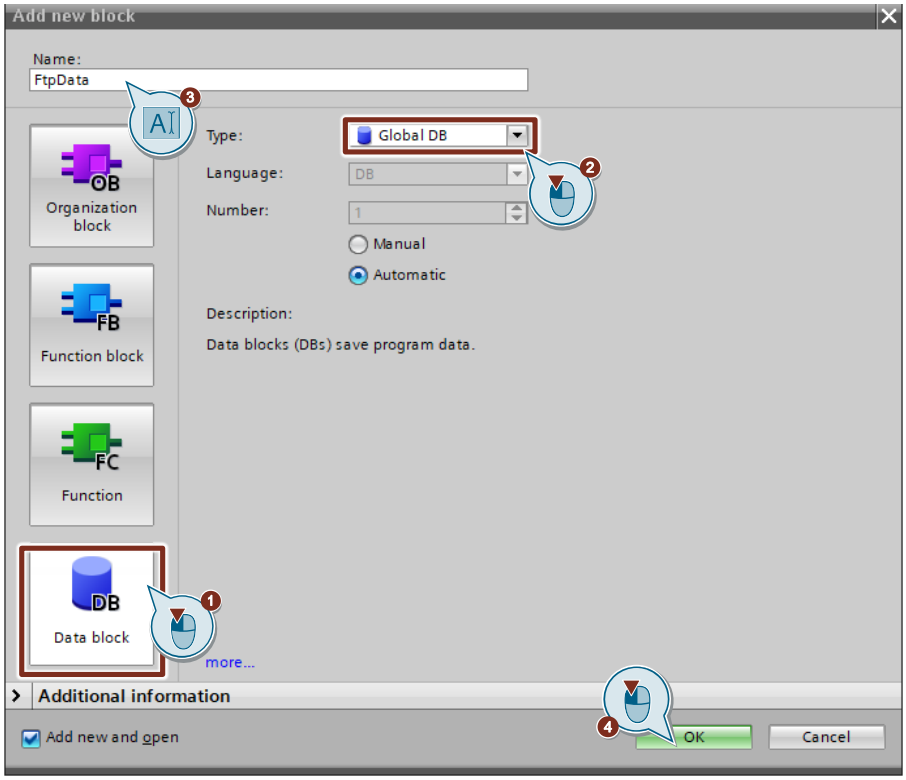
1. In the project tree, navigate to the device folder of the S7 CPU.

2. Open the "Program blocks" folder and double-click the "Add new block" command.



The dialog "Add new block" opens.

3. Create a new Global DB and assign a block name, e.g. "FtpData". Acknowledge the dialog with "OK".



The "Add new block" dialog closes.

Result

The new data block appears in the program folder of the CPU.

Connection parameters

Open the data block.

Define the following connection tags and control tags in the data block. Double-click "<Add new>" in an empty row to do this.

Name	Datentyp
Static	
enable	Bool
execute	Bool
connParam	"LFTP_typeConnParam"

FTP parameters

To create the FTP parameters, insert the tag <ftpParam> with the data type "LFTP_typeFtpParam".
Double-click "<Add new>" in an empty row to do this.

ftpParam	"LFTP_typeFtpParam"

FTP data buffer

To save the FTP data bytewise, add the <data> tag of data type "Array [0..9999] of Byte" and a parameter for the length to the data block.
Double-click "<Add new>" in an empty row to do this.

dataLen	UDInt
data	Array[0..9999] of Byte

Note Modify the size of the <data> byte array to suit your needs.

Note

Data transmission of user-defined structures:

The "LFTP_Client" function block expects an Array of Bytes at the <data> input. Therefore, the FTP data must be available in a byte array.

The system function "Serialize" lets you copy your defined user data (PLC data types) into the <data> memory range in the data block "FtpData". For a detailed description of the "Serialize" system function, please refer to the TIA Portal Help.

LFTP_Client FB diagnostics

Add the following tags in order to create the output and diagnostic data:
Double-click "<Add new>" in an empty row to do this.

valid	Bool
done	Bool
busy	Bool
error	Bool
status	Word
diagnostics	"typeDiagnostics"

Result

The data block with all the necessary tags has been declared.

Name	Data type
Static	
enable	Bool
execute	Bool
connParam	"LFTP_typeConnParam"
hwID	HW_ANY
serverAddress	String
username	String
password	String
ftpParam	"LFTP_typeFtpParam"
ftpActiveMode	Bool
portActiveMode	UInt
ftpCmd	Int
filename	String
dataLen	UDInt
data	Array[0..9999] of Byte
valid	Bool
done	Bool
busy	Bool
error	Bool
status	Word
diagnostics	"typeDiagnostics"
status	Word
subfunctionStatus	DWord
stateNumber	DInt

2.3.3 Call "LFTP_Client" in the user program and connect it

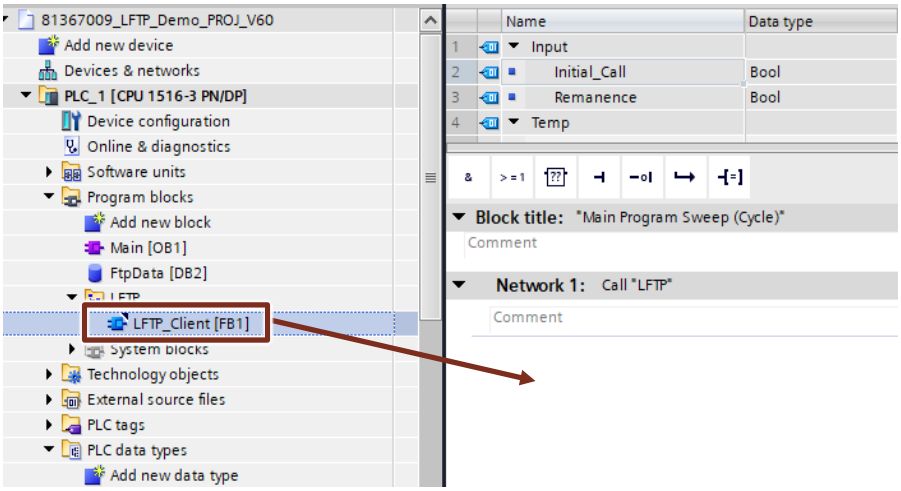
Call the "LFTP_Client" block

Proceed as follows to call the "LFTP_Client" block in the user program:

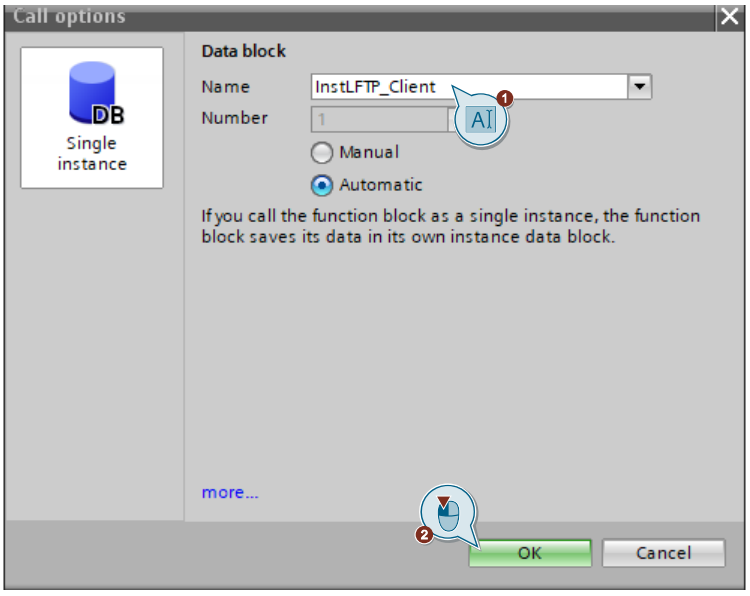
1. In the "Project tree" for your CPU, open the folder "Program blocks".

2. Double-click the block "Main [OB1]" to open the associated program editor.

3. Drag & drop the block "LFTP_Client" from the project tree to any OB1 network.

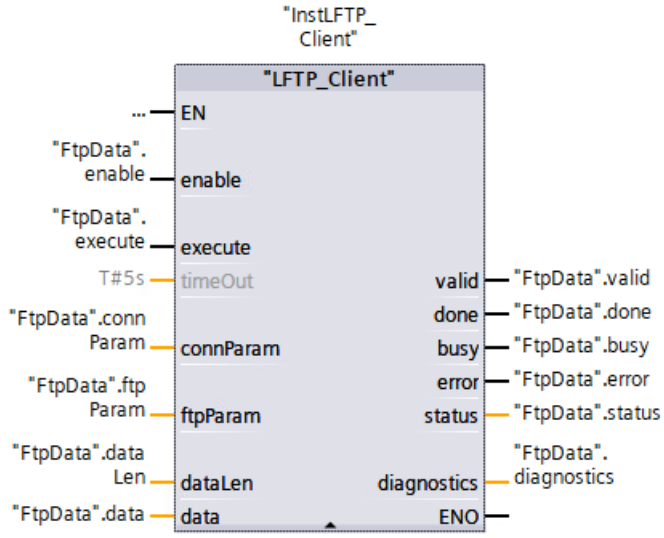


4. Create the corresponding instance DB.



Connect the block

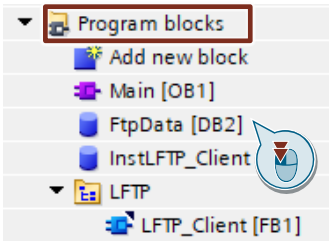
Connect the inputs and outputs of the FB "LFTP_Client" with the tags that you created in the global DB "FtpData" (see chapter 2.3.2).



2.3.4 Parameterize tags

Assign parameters to the tags in the global data block as follows:

1. Open the "Program blocks" folder and double-click on the global data block "FtpData".



The "FtpData" data block opens.

2. In the data block, declare the following tags:

Table 2-2

Tag	Data type	Meaning
connParam.hwID	HW_ANY	Set to the ID of the communication interface. You can find the hardware ID in the CPU's system constants.
connParam.serverAddress	String	IP address or QDN of the FTP server
connParam.username	String	Username of the FTP user (see chapter 2.2)
connParam.password	String	Password of the FTP user (see chapter 2.2)

For each of these tags, enter the required value in the "Start value" column. The following screenshot shows the tag declarations in the TIA Portal project of this application example:

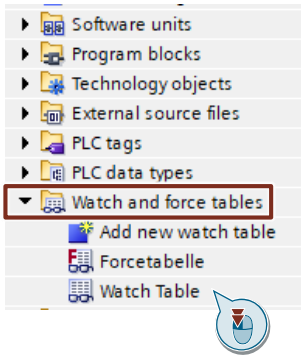
Name	Data type	Start value
Static		
enable	Bool	false
execute	Bool	false
connParam	"LFTP_typeConnParam"	
hwID	HW_ANY	64
serverAddress	String	'192.168.0.2'
username	String	'ExampleUser'
password	String	'xxx'

2.3.5 Create tag table

Create a watch table to better control the "LFTP" library.
To do this, proceed as follows:

1. Navigate in the "Project tree" to the device folder of the S7 CPU.

2. Open the "Watch and force tables" folder. A watch table is present by default. To open it, double-click the "Watch table" item or create a new one with "Add new watch table".



3. Define the following tags in the watch table. To do this, double-click "<Add new>" in an empty row for each one.

1	// control bits	
2	"FtpData".enable	Bool
3	"FtpData".execute	Bool
4	// Connection Parameter	
5	"FtpData".connParam.hwID	DEC
6	"FtpData".connParam.serverAddress	String
7	"FtpData".connParam.username	String
8	"FtpData".connParam.password	String
9	// ftpParam	
10	"FtpData".ftpParam.ftpActiveMode	Bool
11	"FtpData".ftpParam.ftpCmd	DEC+/-
12	"FtpData".ftpParam.portActiveMode	DEC
13	"FtpData".ftpParam.filename	String
14	// ftp output	
15	"FtpData".valid	Bool
16	"FtpData".done	Bool
17	"FtpData".busy	Bool
18	"FtpData".error	Bool
19	"FtpData".status	Hex
20	// ftpdiagnostic	
21	"FtpData".diagnostics.status	Hex
22	"FtpData".diagnostics.subfunctionStatus	Hex
23	"FtpData".diagnostics.stateNumber	DEC+/-
24	// ftpdata	
25	"FtpData".dataLen	DEC
26	"FtpData".data[0]	Character
27	"FtpData".data[1]	Character
28	"FtpData".data[2]	Character
29	"FtpData".data[3]	Character
30	"FtpData".data[4]	Character
31	"FtpData".data[5]	Character
32	"FtpData".data[6]	Character
33	"FtpData".data[7]	Character
34	"FtpData".data[8]	Character

4. Save, compile and download the project to your controller. If errors occur, fix them.

2.4 Operation

2.4.1 General remarks

Requirements

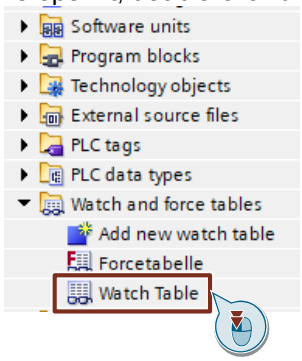
The following requirements must be met before establishing an FTP link between the controller (FTP client) and a PC (FTP server):

- The FTP server has been configured according to chapter 2.2.
- The FTP server is started.
- An FTP user has been created with a password and has full access to the files in its root directory.
- The "LFTP_Client" block has been integrated into the user program, interconnected and parameterized.
- FTP access from the controller (FTP client) to the PC (FTP server) is not blocked by a firewall or the like.

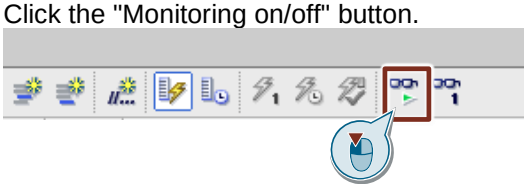
Watch table

You will control the FTP function using the watch table.

1. To open it, double-click the "Watch Table" item.



2. Click the "Monitoring on/off" button.



Result

You can now monitor and control the tags.

Name	...	Display format	Monitor value
// control bits			
"FtpData".enable		Bool	FALSE
"FtpData".execute		Bool	FALSE
// Connection Parameter			
"FtpData".connParam.hwID		DEC	64
"FtpData".connParam.serverAddress		String	'192.168.0.2'
"FtpData".connParam.username		String	'ExampleUser'
"FtpData".connParam.password		String	'xxx'
// ftpParam			
"FtpData".ftpParam.ftpActiveMode		Bool	FALSE
"FtpData".ftpParam.ftpCmd		DEC+/-	3
"FtpData".ftpParam.portActiveMode		DEC	2001
"FtpData".ftpParam.filename		String	'test.txt'
// ftp output			
"FtpData".valid		Bool	FALSE
"FtpData".done		Bool	FALSE
"FtpData".busy		Bool	FALSE
"FtpData".error		Bool	FALSE
"FtpData".status		Hex	16#7000
// ftpdiagnostic			
"FtpData".diagnostics.status		Hex	16#0000
"FtpData".diagnostics.subfunctionStatus		Hex	16#0000_0000
"FtpData".diagnostics.stateNumber		DEC+/-	0
// ftpdata			
"FtpData".dataLen		DEC	0
"FtpData".data[0]		Character	'$00'
"FtpData".data[1]		Character	'$00'
"FtpData".data[2]		Character	'$00'
"FtpData".data[3]		Character	'$00'
"FtpData".data[4]		Character	'$00'
"FtpData".data[5]		Character	'$00'
"FtpData".data[6]		Character	'$00'
"FtpData".data[7]		Character	'$00'

Note Create the number of bytes in the array <FtpData.data> as desired.

Modify tags

To control bit tags, select the "Monitor Value" column for the tags and press the following keyboard combination:

- "<Ctrl> + F2" for the value TRUE
- "<Ctrl> + F3" for the value FALSE

For all other data types, enter the desired value in the "Modify value" column for the tags in question. Press the keyboard combination "<Shift> + F9" to modify the tags immediately.

Overview of the control tags

You can control the "LFTP_Client" function block with the following inputs:

- <FtpData.enable>
- <FtpData.execute>
- <FtpData.ftpParam.ftpCmd>
- <FtpData.ftpParam.ftpActiveMode>
- <FtpData.ftpParam.portActiveMode>

<FtpData.enable>

The input <FtpData.enable> controls the connection setup and connection termination of the control connection to the FTP server. Once the controller has established a control connection to the FTP server, the tag <FtpData.status> shows the value 16#7004.

The <FtpData.enable> tag must be TRUE as long as data are being exchanged.

If the <FtpData.enable> tag is set to FALSE, the connection termination process for the control connection begins and the user connected to the FTP server is logged out.

<FtpData.ftpParam.ftpCmd>

The <FtpData.ftpParam.ftpCmd> input defines the FTP command for data transmission. The following commands are available:

- 2=STORE
- 3=RETRIEVE
- 4=DELETE
- 6=APPEND

<FtpData.ftpParam.ftpActiveMode>

Use the input <FtpData.ftpParam.ftpActiveMode> to define the transmission mode (TRUE=active, FALSE=passive). Determine the transmission mode before you establish the control connection.

<FtpData.ftpParam.portActiveMode>

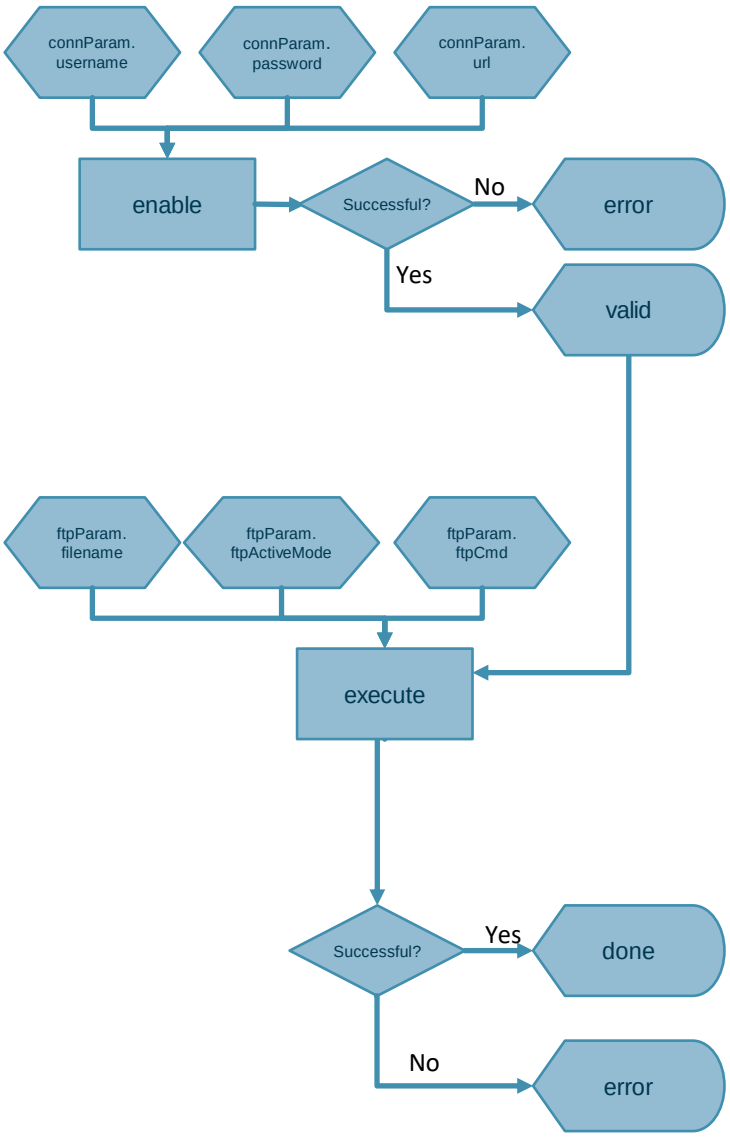
The <FtpData.ftpParam.portActiveMode> input defines the port for the active FTP mode. Use a value greater than 2000 as the port number.

<FtpData.execute>

Execute FTP commands with a rising edge at the <FtpData.execute> input. Requirements for this are:

- There is an active control connection (<FtpData.ftpParam.status>=16#7004).
- The transmission mode has been selected.
- A valid FTP command has been defined.
- A valid file name / file path has been entered.

The following Figure illustrates the dependencies between the inputs and outputs of the "LFTP_Client" block.



2.4.2 Establish control connection

To establish a control connection to the FTP server, modify the <FtpData.enable> tag to TRUE.

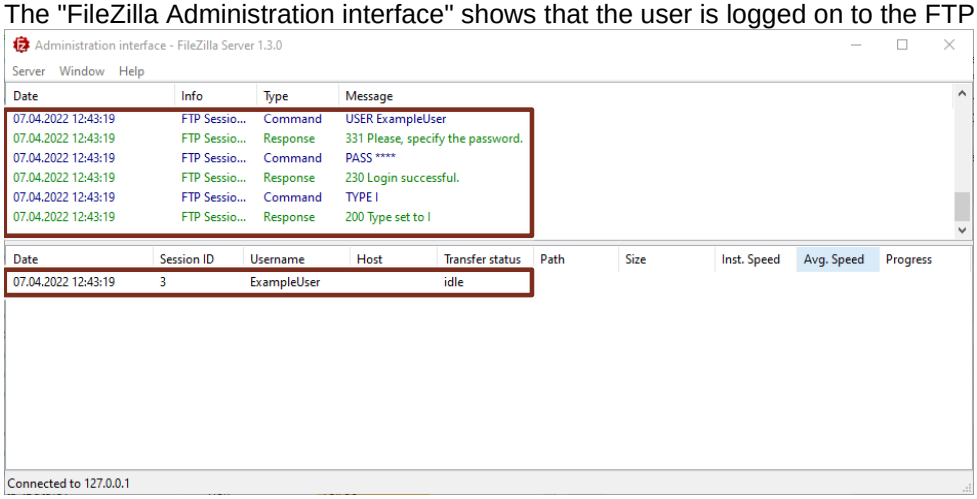
// control bits			
	"FtpData".enable	Bool	TRUE
	"FtpData".execute	Bool	FALSE

Result

The block establishes the connection to the FTP server. Once the block outputs the value TRUE at the <FtpData.valid> output and <FtpData.status> outputs the value "16#7004", then the client is connected with the server.

// ftp output			
	"FtpData".valid	Bool	TRUE
	"FtpData".done	Bool	FALSE
	"FtpData".busy	Bool	TRUE
	"FtpData".error	Bool	FALSE
	"FtpData".status	Hex	16#7004

The "FileZilla Administration interface" shows that the user is logged on to the FTP server.



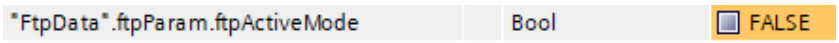
2.4.3 Issue FTP commands

General procedure

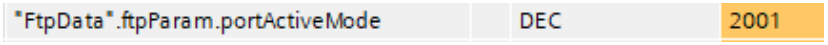
Establish a data connection to the FTP server in order to issue FTP commands.
Note that data exchange is only possible once the control connection has been established (<FtpData.status> is 16#7004").

Proceed as follows to issue any one of the commands:

1. If you require an active FTP connection, modify the tag <FtpData.ftpParam.ftpModeActive> to TRUE.
   For a passive FTP connection, set <FtpData.ftpModeActive> to FALSE.



2. If necessary, change the port number for the active mode. Select a value higher than 2000.



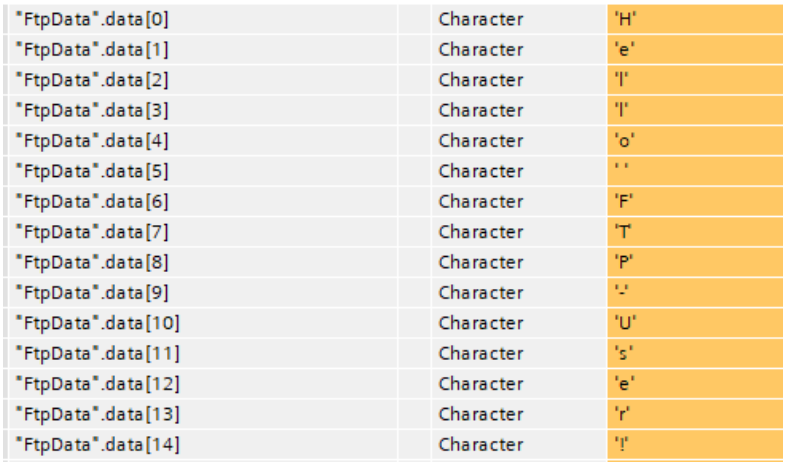
3. Set <FtpData.ftpParam.ftpCmd> to the same value as the FTP command that you wish to execute (example FTP command in the screenshot is "STORE"). The following commands are available:

Table 2-3

FTP command	Value	Description
STORE	2	Store data on the FTP server
RETRIEVE	3	Request data from the FTP server
DELETE	4	Delete data from the FTP server
APPEND	6	Append data to the FTP server

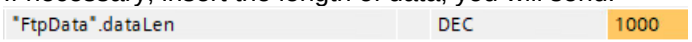
4. Specify the file name in the <FtpData.ftpParam.filename> tag (example in the screenshot is "Testfile.txt").

5. If necessary, populate the data store <FtpData.data> with the data you wish to send.



6. Set <FtpData.execute> to TRUE in order to issue the FTP command.

7. If necessary, insert the length of data, you will send.



Result
Based on the value of the <FtpData.ftpParam.ftpCmd> tag, the CPU will execute the FTP command as an FTP client.

STORE command

To save data on the FTP server, you will need the STORE command.

To do this, proceed as follows:

1. Establish a control connection to the FTP server (see chapter 2.4.2).

2. Set <FtpData.ftpParam.ftpCmd> to the value "2" (FTP command "STORE").

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	2
"FtpData".ftpParam.portActiveMode	DEC	2001

3. Specify the file in the <FtpData.ftpParam.filename> tag (here: "Testfile.txt").

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	2
"FtpData".ftpParam.portActiveMode	DEC	2001
"FtpData".ftpParam.filename	String	'Testfile.txt'

4. Populate the data store <FtpData.data> with the data you wish to send.

"FtpData".data[0]	Character	'H'
"FtpData".data[1]	Character	'e'
"FtpData".data[2]	Character	'l'
"FtpData".data[3]	Character	'l'
"FtpData".data[4]	Character	'o'
"FtpData".data[5]	Character	' '
"FtpData".data[6]	Character	'F'
"FtpData".data[7]	Character	'T'
"FtpData".data[8]	Character	'P'
"FtpData".data[9]	Character	'-'
"FtpData".data[10]	Character	'U'
"FtpData".data[11]	Character	's'
"FtpData".data[12]	Character	'e'
"FtpData".data[13]	Character	'r'
"FtpData".data[14]	Character	'!'

5. Insert at <FtpData.dataLen> the lenght of sending data.

"FtpData".dataLen	DEC	1000

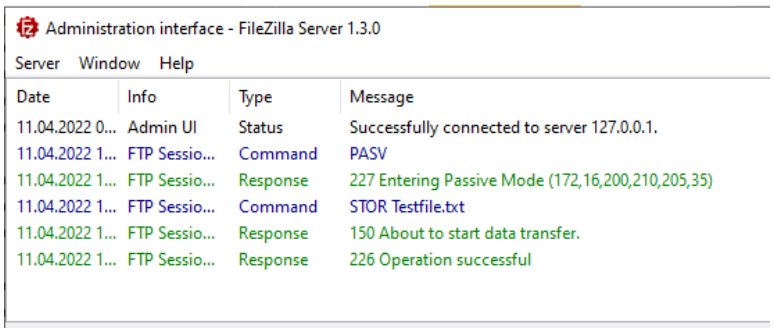
6. Trigger <FtpData.execute> with a rising edge to issue the FTP command.

"FtpData".execute	Bool	TRUE

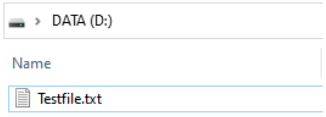
Result

The CPU in its role as FTP client saves a file (here: "Testfile.txt") on the FTP server with the contents of the data array <FtpData.data> in the native destination path. This is the same directory that you defined when setting up the FTP server (here: "D:\").

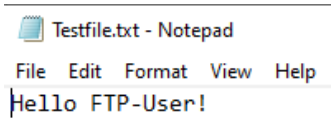
You can follow the process in the "FileZilla Administration interface".



In the destination path of the FTP server (here: "D:\") you will see the file (here: "Testfile.txt").



The contents of the file are the same as the contents of the <FtpData.data> data array.



Note

The byte array <FtpData.data> is defined with a size of 10000 bytes. The STORE command writes the contents of the entire byte array to the file.
Array fields that contain no values will appear in the file as spaces.

APPEND command

An APPEND command is required in order to add data to a file on the FTP server.

To do this, proceed as follows:

1. Establish a control connection to the FTP server (see chapter 2.4.2).

2. Set <FtpData.ftpParam.ftpCmd> to the value "6" (FTP "APPEND" command).

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	6
"FtpData".ftpParam.portActiveMode	DEC	2001

3. Specify the file in the <FtpData.ftpParam.filename> tag (here: "Testfile.txt").

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	6
"FtpData".ftpParam.portActiveMode	DEC	2001
"FtpData".ftpParam.filename	String	'Testfile.txt'

4. Populate the data store <FtpData.data> with the data you wish to append.

"FtpData".data[0]	Character	'H'
"FtpData".data[1]	Character	'a'
"FtpData".data[2]	Character	'v'
"FtpData".data[3]	Character	'e'
"FtpData".data[4]	Character	' '
"FtpData".data[5]	Character	'a'
"FtpData".data[6]	Character	' '
"FtpData".data[7]	Character	'n'
"FtpData".data[8]	Character	'i'
"FtpData".data[9]	Character	'c'
"FtpData".data[10]	Character	'e'
"FtpData".data[11]	Character	' '
"FtpData".data[12]	Character	'd'
"FtpData".data[13]	Character	'a'
"FtpData".data[14]	Character	'y'

5. Insert at <FtpData.dataLen> the lenght of data you want to append.

"FtpData".dataLen	DEC	1000

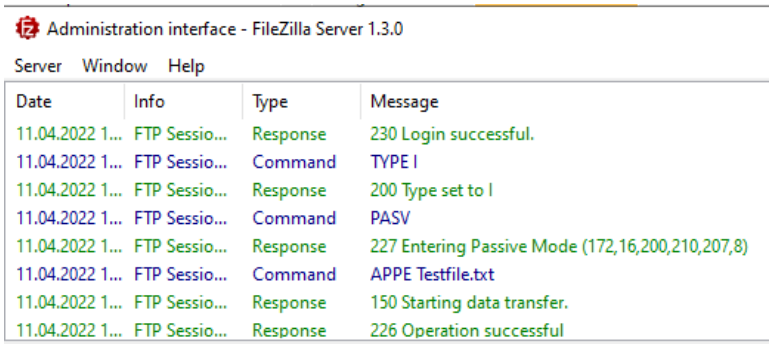
6. Trigger <FtpData.execute> with a rising edge to issue the FTP command.

"FtpData".execute	Bool	TRUE

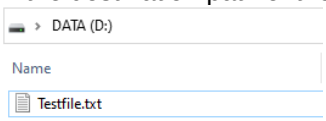
Result

The CPU in its role as FTP client appends a file (here: "Testfile.txt") on the FTP server with the contents of the data array <FtpData.data> in the native destination path. This is the same directory that you defined when setting up the FTP server (here: "D:\").

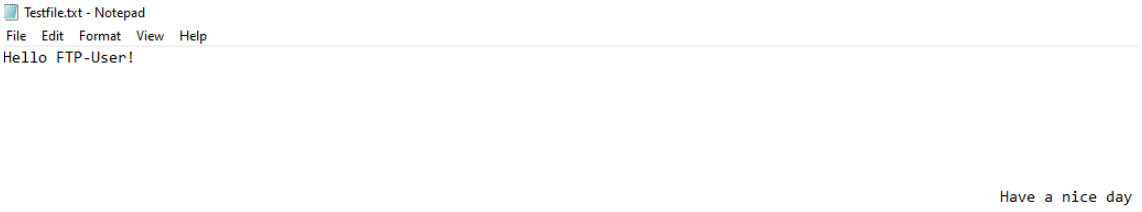
You can follow the process in the "FileZilla Administration interface".



In the destination path of the FTP server (here: "D:\") you will see the file (here: "Testfile.txt").



The contents of the data array <FtpData.data> have been added to the file.



RETRIEVE command

The RETRIEVE command lets you pull a file from the FTP server.

Note

The file that you retrieve must be present in the native destination directory on the FTP server (here: "Testfile.txt" in the native destination directory "D:\" (see also chapter 2.2).

To do this, proceed as follows:

1. Establish a control connection to the FTP server (see chapter 2.4.2).

2. Set <FtpData.ftpParam.ftpCmd> to the value "3" (FTP "RETRIEVE" command).

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	3
"FtpData".ftpParam.portActiveMode	DEC	2001

3. Specify the file in the <FtpData.ftpParam.filename> tag (here: "Testfile.txt"). It is important that the file on the FTP server be located in the native destination path.

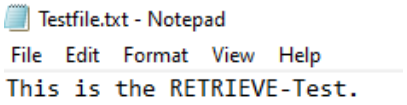
"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	3
"FtpData".ftpParam.portActiveMode	DEC	2001
"FtpData".ftpParam.filename	String	'Testfile.txt'

4. Trigger <FtpData.execute> with a rising edge to issue the FTP command.

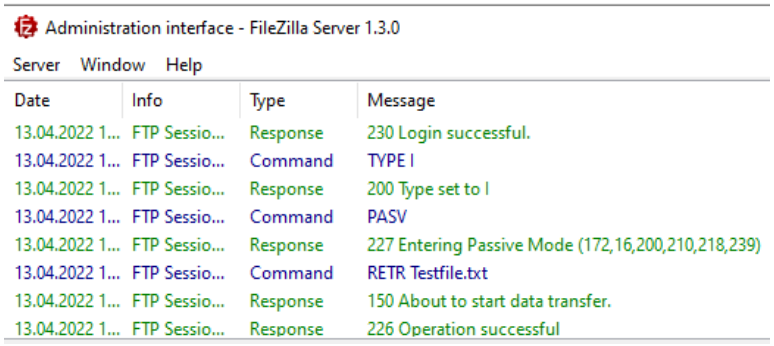
"FtpData".execute	Bool	TRUE

Result

The CPU, in its role as FTP client, retrieves the file (here: "Testfile.txt") from the FTP server and copies the contents to the data array <FtpData.data>. The lenght of the received data you see in the parameter <FtpData.dataLen>.



You can follow the process in the "FileZilla Administration interface".



The contents of the file are copied to the data array <FtpData.data>.

"FtpData".data[0]	Character	'T'
"FtpData".data[1]	Character	'h'
"FtpData".data[2]	Character	'i'
"FtpData".data[3]	Character	's'
"FtpData".data[4]	Character	' '
"FtpData".data[5]	Character	'i'
"FtpData".data[6]	Character	's'
"FtpData".data[7]	Character	' '
"FtpData".data[8]	Character	't'
"FtpData".data[9]	Character	'h'
"FtpData".data[10]	Character	'e'
"FtpData".data[11]	Character	' '
"FtpData".data[12]	Character	'R'
"FtpData".data[13]	Character	'E'
"FtpData".data[14]	Character	'T'
"FtpData".data[15]	Character	'R'
"FtpData".data[16]	Character	'I'
"FtpData".data[17]	Character	'E'
"FtpData".data[18]	Character	'V'
"FtpData".data[19]	Character	'E'
"FtpData".data[20]	Character	'-'
"FtpData".data[21]	Character	'T'
"FtpData".data[22]	Character	'e'
"FtpData".data[23]	Character	's'
"FtpData".data[24]	Character	't'
"FtpData".data[25]	Character	'.'

DELETE command

The DELETE command lets you delete a file from the FTP server.

To do this, proceed as follows:

1. Establish a control connection to the FTP server (see chapter 2.4.2).

2. Set <FtpData.ftpParam.ftpCmd> to the value "4" (FTP "DELETE" command).

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	4
"FtpData".ftpParam.portActiveMode	DEC	2001

3. Indicate the file you wish to delete in the tag <FtpData.ftpParam.filename> (here: "Testfile.txt"). It is important that the file on the FTP server be located in the native destination path.

"FtpData".ftpParam.ftpActiveMode	Bool	FALSE
"FtpData".ftpParam.ftpCmd	DEC+/-	4
"FtpData".ftpParam.portActiveMode	DEC	2001
"FtpData".ftpParam.filename	String	'Testfile.txt'

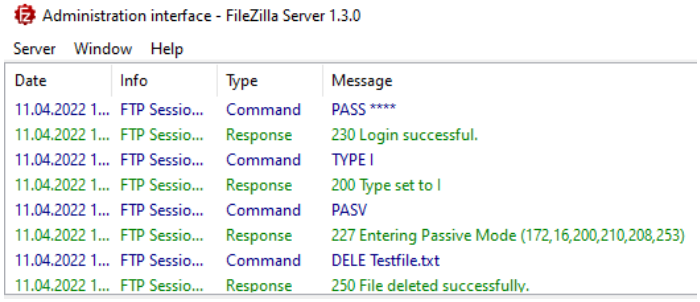
4. Trigger <FtpData.execute> with a rising edge to issue the FTP command.

"FtpData".execute	Bool	TRUE

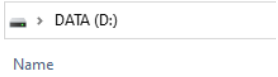
Result

The CPU, in its role as FTP client, deletes the file (here: "Testfile.txt") from the FTP server.

You can follow the process in the "FileZilla Administration interface".



The file (here: "Testfile.txt") is no longer available in the destination path of the FTP server (here: "D:\").



2.5 Troubleshooting

The "LFTP_Client" assumes the following status values:

Table 2-4

Code	Meaning
16#0000	FTP command successfully executed
16#7000	Idling, no active connections
16#7001	First call of the block
16#7002	Control connection is being established.
16#7003	Control connection is being terminated.
16#7004	Control connection established, no job active
16#7005	FTP command is being executed.
16#8202	Invalid URL
16#8400	Error received from FTP server. Some possible causes could be that the login credentials are wrong or that the file name does not exist. The FTP-specific error code is output at "diagnostics.subfunctionStatus". The meaning of the FTP-specific error code can be found in the FTP specification.
16#8600	Undefined sequencer status
16#8601	Error in subordinate command "TCON" The error code of the instruction is output to "diagnostics.subfunctionStatus". For the meaning of the respective error code, refer to the TIA Portal information system.
16#8602	Error in subordinate command "TSEND" The error code of the instruction is output to "diagnostics.subfunctionStatus". For the meaning of the respective error code, refer to the TIA Portal information system.
16#8603	Error in subordinate command "TRCV" The error code of the instruction is output to "diagnostics.subfunctionStatus". For the meaning of the respective error code, refer to the TIA Portal information system.
16#8604	Error in subordinate command "TCONSETTINGS" The error code of the instruction is output to "diagnostics.subfunctionStatus". For the meaning of the respective error code, refer to the TIA Portal information system.
16#8605	Error in subordinate command "BLK_MOVE" The error code of the instruction is output to "diagnostics.subfunctionStatus". For the meaning of the respective error code, refer to the TIA Portal information system.
16#8D11	Control connection not connected; data connection cannot be opened.
16#8D26	Data connection cannot be opened.
16#8D28	FTP server timeout
16#8DF1	Timeout of the watchdog timer (5s)
16#8DF2	Unknown reply code
16#8DF3	Unknown command
16#8DF4	Port number lower than 2000.
16#8F62	Action aborted; data connection will be terminated.
16#8F69	Connection attempt on existing connection

3 Useful information

3.1 Fundamentals

General information on FTP

FTP was developed to exchange data between a client and a server. It is also designed for directory management via remote access. In the world of automation engineering, FTP is a useful protocol for easily exchanging data.

There are two modes in FTP communication:

- Active FTP
- Passive FTP

Along the same lines, encrypted data exchange is also provided for using:

- FTPS
- SFTP

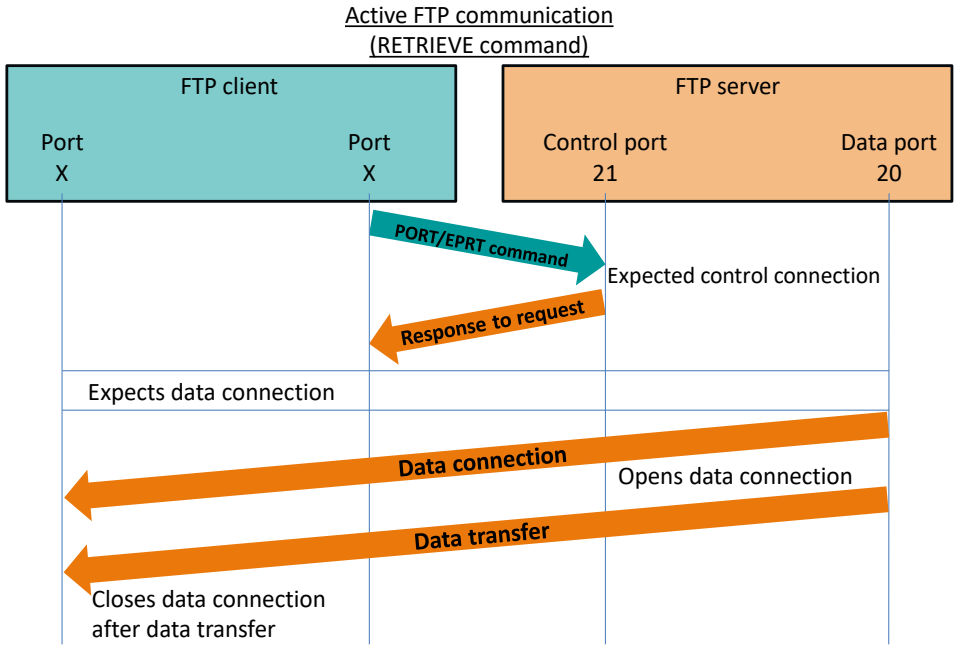
Active FTP

In this mode, the FTP client opens a random port (>1023), then sends the port and its own IP address to the FTP server with a special command (PORT or EPRT). The command is sent to port 21 of the FTP server by default. Port 21 must be open or forwarded in the server firewall, otherwise communication will not occur. Should data transfer be requested, the FTP server now initiates a data connection to the IP address that it received and the FTP server port 20.

Active mode is used if the FTP server is located behind a firewall, as the data connection is outbound from the FTP server and therefore it will not be blocked by the firewall. The FTP server is thus acting in an active capacity.

The following Figure illustrates active FTP communication using the example of the RETRIEVE command.

Figure 3-1



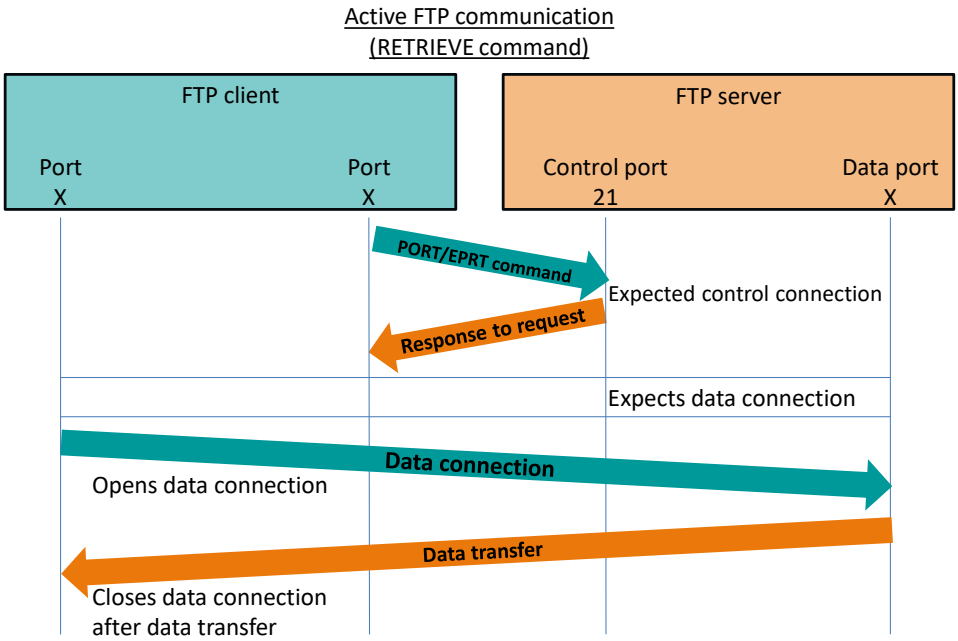
Passive FTP

In this mode, the FTP client sends PASV or EPASV commands to port 21 of the FTP server. Then the FTP server opens a random port and sends this port number together with its IP address to the FTP client. For data transfer in this case, the FTP client initiates a TCP connection to the IP address and port that were sent by the FTP server.

Passive mode is used if the FTP client is located behind a firewall. Stateful Packet Inspection typically ensures that outbound data packets are always allowed in the firewall. The FTP server is thus acting in a passive capacity.

The following Figure illustrates passive FTP communication using the example of the RETRIEVE command:

Figure 3-2



FTPS

FTPS, also known as FTP over SSL/TLS, is employed to send data over FTP in encrypted form. With FTPS, a distinction is made between two types of encryption:

- Explicit FTPS (FTPES)
- Implicit FTPS

With explicit FTPS, also known as FTPES, the client must explicitly request the server for a secure connection. If a client in this mode does not make such a request to the server, the server can decide whether it will continue to allow this unsecured connection or deny/limit it.

With implicit FTPS, the client is expected to declare itself immediately to the server with a "TLS/SSL ClientHello" message. If the client does not register itself in this way, the server terminates the connection.

Note

You will use explicit FTPS with a CP x43-1 Advanced V3 and a CP 1x43-1. Implicit FTPS is not supported by the CPs.

SFTP

The SSH File Transfer Protocol, aka Secure File Transfer Protocol (SFTP) is an alternative to FTP. Data are transmitted via Secure Shell (SSH).

SFTP is also the abbreviation for Simple File Transfer Protocol, a simpler version of FTP. It should not be confused with SSH File Transfer Protocol!

Note SFTP is not supported by any of the CPs.

3.2 Alternative solutions

As an alternative to the solution described here, FTP functionality can also be integrated into the S7 universe with different hardware.

The Table below shows the alternative solutions along with a link to the respective application example.

Table 3-1

Solution	Link
FTP/FTPS communication with S7-1500 and CP 1543-1	https://support.industry.siemens.com/cs/ww/en/view/103550797
FTP communication with S7-300/400 and CPx43-1 Advanced	https://support.industry.siemens.com/cs/ww/en/view/21605954

4 Appendix

4.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

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

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

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

support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers
– ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

siemens.com/SupportRequest

SITRAIN – Digital Industry Academy

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

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

siemens.com/sitrain

Service offer

Our range of services includes the following:

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

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

support.industry.siemens.com/cs/sc

Industry Online Support app

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

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

4.2 Industry Mall

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

4.3 Links and literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the article page of the application example https://support.industry.siemens.com/cs/ww/en/view/81367009
\3\	SIMATIC STEP 7 Basic/Professional V17 und SIMATIC WinCC V17 https://support.industry.siemens.com/cs/ww/en/view/109798671
\4\	FileZilla Server https://filezilla-project.org/download.php?type=server
\5\	Programming style guide https://support.industry.siemens.com/cs/ww/en/view/109478084
\6\	Libraries for Communication for SIMATIC Controllers https://support.industry.siemens.com/cs/ww/en/view/109780503

4.4 Change documentation

Table 4-2

Version	Date	Change
V1.0	10/2013	First edition
V2.0	05/2015	Added FTP client functionality for S7-1500 and migration to TIA Portal V13 SP1, update of the OUC library
V3.0	07/2017	Migration to TIA Portal V14 SP1 Complete revision of the "Ftp1X00Cmd" block according to the programming style guide
V3.1	11/2017	Bug fixes and performance improvements
V3.2	02/2018	Added to the Troubleshooting chapter
V3.3	03/2018	Migration to TIA Portal V15, troubleshooting
V3.4	04/2018	Added SFTP/FTPS, troubleshooting to the Useful information chapter
V3.5	02/2019	Troubleshooting
V4.0	07/2019	Update for TIA Portal V15.1
V5.0	02/2021	Update for TIA Portal V16 Update 3
V6.0	06/2022	Bug fixes for TCP/IP connections and update to TIA Portal V17
V6.1	06/2022	Change requirements: only for S7-1500
V6.1.1	12/2022	Library LFTP: - Compatibility with S7-1200, - Timeout error resolved. Documentation: - Change requirements: S7-1200/1500 - Version numbers fixed