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User Manual Document

HTTP-Direct / FTPServer and FLASH file system

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1 User Information

1.1 Introduction

This document is intended to present the features associated with the new firmware modules HTTP-Direct, FTP-Server and FLASH file system, as well as to provide preliminary information about the Flash storage media hardware module.

This document is valid for Classic and xx7 PLC users.

1.2 TCPIP Setup

In order to have the HTTP-Direct and FTP-Server running, it is necessary to give an Internet address.

For "Classic" firmware, this is done by giving an IP address, e.g. 179.168.10.12 and a mask, e.g. 255.255.255.0, in the hardware setting window of a PG5 project / defined CPU. This configuration shall be downloaded to the PCD using either the serial line or the USB interface.

For xx7 firmware, this is done by configuring a CP 443-1 (6GK7 443-1EX02-0XE0), connecting it to an Ethernet network and defining a TCPIP address and mask, e.g. 179.168.10.12 and 255.255.255.0. This configuration shall be downloaded on the PCD using either the serial line or the USB.

Remark: In the actual version, the IP address, its associated mask and default router (in any is defined) are not set as long as a hardware configuration containing this information has not been downloaded to the PLC. Without these configuration files, any accesses to FTP-Server or direct access to WEB-Server will not work. This is valid for Classic PLC's and xx7 PLC's.

2 FLASH access and specific FLASH behavior

2.1 PCD7.R5xx Devices

The PCD7.R550M01 (1 MB) / PCD7.R550M04 (4MB) / PCD7.R551 (3 MB) and PCD7.R561 (1 MB) devices are dedicated (full or partly) to file system and can be seen as dedicated drives accessible from different tools running on the PLC (Classic or xx7). The device is blue.

FLASH accesses (read and/or write) can be performed from either:

- The PLC user program (read/write/format/compress access) (Classic or xx7)
- The FTP-Server (read/write access)
- The WEB-Server (read access/format/compress access)

By default, the FLASH devices are sold formatted. As soon as inserted in the M1 or M2 slot of the extension, it is usable by any of the mentioned tools.

These devices are organized into pages (256 / 512 bytes), blocks (512 B .. 8 KB) and sectors (64KB). A page is a unit of write, a block is a unit of file and a sector is a unit of erase.

The PCD7.R550M04 FLASH itself is 4MB large. Out of this, 64 KB is reserved and some blocks are used to store file system internal data. This means that a little bit less than the complete FLASH size can be used by the user.

When a file is created, at least one block (e.g. 2 KB) is allocated to that file. Even if the file is smaller than this, the place taken on the device is 2 KB. When the 2 KB are filled by file data, a new block is taken and the size taken on the device is now 4 KB. The physical space taken by a file is $2 \text{ KB} * ((\text{mod } 2\text{KB of filesize}) + 1)$.

When a file is deleted, the blocks taken by the file are marked as freed. However, on this type of devices, it is not yet possible to write new data on it. First, all bits of the block shall be raised to 1. This operation is complex and is either triggered automatically or by user program function call. During this operation, the device is busy and no accesses (read / write / list) can be performed. During the "compression", the sector is first copied into a reserved sector, the current compressed sector is erased and only the still used blocks are copied back from the reserved sector. At the end of the operation, the reserved sector is also erased. This sequence of operations is executed for all sectors of the FLASH. For a 4 MB device, 63 sectors are considered.

Taking into account that a sector is erased in about 2 seconds (given by the FLASH provider) a compression algorithm performed over all sectors of the FLASH will last for a maximum of about 400 seconds (more than 6 minutes). During all this time, the device is marked as busy. However, some sectors may not need to be compressed, because no blocks have been released in that sector, which highly decrease the compression time.

The PCD7.R550M04 is hot pluggable. This means that it can be inserted at any time during the PLC operations. Immediately after its insertion, the file system is built and eventually, a compression algorithm is automatically executed if compression criteria are met. This implies that at insertion time, the device may be visible to users, but it is well possible that the device is marked as busy.

Even if the PCD7.R550M04 is electrically hot un-pluggable, the removal of a device shall be carefully done. This device has no LED providing information if the device is currently accessed or not.

Two cases shall be carefully studied when a FLASH device is removed:

- Some write operations are currently going on. These operations can be performed either by the user program or by FTP. Before removing the device, put the PLC in STOP if the user

program is writing on a FLASH device and make sure that no FTP connection is currently on-going.

- The compression algorithm is currently going on. This operation is either triggered by the user program (directly triggered or indirectly through erasing of files) or indirectly by FTP after erasing files. These actions are difficult to detect by external users.

For these reasons, and even if the removal of a FLASH device is not strictly forbidden, it is highly NOT recommended to remove a FLASH device while the system is running.

Space care shall also be taken when the PLC is powered OFF. If the user program is executing some calls to the FLASH file system (write or compress function calls) or if a FTP-Client is currently accessing the FLASH while the PLC is powered OFF, the data recovery at power ON or at insertion time may not be achieved. At that moment, a dedicated algorithm will be triggered to recover as many data as possible, but it may happen that the latest written data / files may be lost.

From a user point of view, the inserted FLASH devices will have the following names:

- M1_FLASH when a PCD7.R550M04 is inserted in M1 slot of the PCD3 extension
- M2_FLASH when a PCD7.R550M04 is inserted in M2 slot of the PCD3 extension

Given an absolute path to access a file will look like:

- M2_FLASH:/CONFIG/MyTCPIPConfig.txt

The file names and directory names are case insensitive.

2.2 PCD3.R5xx Devices

Using a PCD3.R5xx I/O module or a PCD3.F1xx I/O module, it is possible to have the same functionalities as described previously. The PCD3.R5xx and PCD3.F1xx shall be equipped with one of the defined PCD7.R5xx device. When a file system is available on these I/O devices, the device names are defined as follows:

- SL0FLASH when a PCD3.R5xx/F1xx is inserted in the first I/O slot (slot #0) of a PCD3
- SL1FLASH when a PCD3.R5xx/F1xx is inserted in the second I/O slot (slot #1) of a PCD3
- SL2FLASH when a PCD3.R5xx/F1xx is inserted in the third I/O slot (slot #2) of a PCD3
- SL3FLASH when a PCD3.R5xx/F1xx is inserted in the forth I/O slot (slot #3) of a PCD3

Given an absolute path to access a file will look like:

- SL0FLASH:/CONFIG/MyTCPIPConfig.txt

The file names and directory names are case insensitive.

2.3 PCD3.R600 Devices

The PCD3.R600 devices can be inserted in one of the 4 I/O slot. It is an IO interface board including a SD/MMC card (128 MB up to 1GB). From a user point of view (User program, FTP and HTTP-direct), this device will behave identically as the PCD3.R5xx/F1xx devices. The same device names are visible.

Refer to the PCD3.R600 user documentation for detailed operations.

3 HTTP-Direct access

3.1 Default access

The HTTP-Direct functionality allows connecting any browser to the PCD using Ethernet connection without the need of any connecting tools (e.g. WEB-Connect).

By default, 3 pages are available to the user:

- The start.htm page
- The passwd.htm page
- The status.htm page

Using the Internet Explorer, the following command can be issued

<http://<defined IP Address>>, e.g. [http:// 179.168.10.12](http://179.168.10.12) (refer to § 1.2 above)

This will give access to the “start.htm” page loaded by default in the PCD. From that page, it is possible to access the password form or the PCD status form.

3.2 Priority Port

Two HTTP direct ports are created by default (port 80 and port 81), for which the request load is distributed 50:50. This allows having one port for low priority requests to the web server and reserving the other port for high priority access.

3.3 Adding new pages

Other HTML pages and associated files can be loaded on the PCD. 2 possibilities exist to download web pages into a PCD:

- FTP-Server: The FTP server allows copying all files from a PC directory into a local PCD storage area, e.g. plugged in FLASH device.
- Packed pages into DBX / DB's: It is possible to encapsulate all files into some dedicated PLC Data blocks (Classic and xx7).

3.4 Available PCD storage location for WEB pages

As packed pages, the downloaded files will be seen in the `WEB:/WEBPAGES` directory.

The order of file search within the WEB-Server is first the `WEB:/WEBPAGES` directory, followed in order by `M2_FLASH:/WEBPAGES`, `M1_FLASH:/WEBPAGES`, `SLxFLASH:/WEBPAGES` and finally in `WEB:/DEFPAGES`.

When the FTP-Server is used, it is forbidden to write files into the `WEB:/WEBPAGES` directory, as this drive is quite small (about 30 KB only). If FTP-Server is used for downloaded files, the `xxxFLASH:/WEBPAGES` directories shall be used to hold downloaded files.

3.5 IMaster.jar file

When used with HTTP-Direct, this file shall be present on the PLC.

For xx7 PLC's, it is impossible to encapsulate this file into a DB, as their size is limited to 64K. The FTP solution remains valid to download this file.

3.6 Configuration File

A dedicated configuration file can be created and downloaded in the PCD to specially configure the WEB-Server of the PLC.

This configuration file shall be named "WEBSocketConfig.txt" (case insensitive) and it shall be located either in

- M2_FLASH:/Config (FLASH device in M2 slot of the extension)
- WEB:/WEBPAGES (Built-in file system)
- M1_FLASH:/Config (FLASH device in M1 slot of the extension)
- M2_FLASH:/Config (FLASH device in M2 slot of the extension)
- SL0FLASH:/Config (FLASH device in slot #0 of IO Bus)
- SL1FLASH:/Config (FLASH device in slot #1 of IO Bus)
- SL2FLASH:/Config (FLASH device in slot #2 of IO Bus)
- SL3FLASH:/Config (FLASH device in slot #3 of IO Bus)

It is searched at boot time only in one of these directories (in the order given above) and if found, it is parsed. For the `xxxFLASH` file system, the file is downloaded using the FTP-Server (and the currently used parameters), whereas in the `WEB` file system, it is loaded using DB / DBx as part of the PLC user program (valid for xx7 AND Classic PLC). Downloaded parameters will be taken into account at next power OFF / ON sequence.

The configuration file overwrites the default preferences of the WEB-Server:

```
Direct = on
Timeout = 3000
Listener = 16
Port = 80
PrioPort = 90
KeepAlive = 8
KeepAliveTimeout = 10000
KeepAliveStrict = off
KeepAliveRequests = 2000
NoTimeWait = off
```

Figure 1 WEBSocketConfig.txt file example

The sign "=" in the configuration file can be suppressed, e.g. `Direct on`

Keyword	Arguments	Description
Direct	on / off	By defining the Direct directive you can deactivate Http Direct on the PCD (default:on).
Timeout	10 - 10000	The reception and send time out in ms. When reading or writing is not successful after this time, the connection is reset (default:1000).
Listener	4 - 24	The number of maximum waiting connections

		without processing them (default:12). Example: 12 web browser opened simultaneously to the PCD. All will wait for a response but a 13 th will be disconnected without waiting.
Port	1 - 65536	The tcp port the web server is listening on (default:80).
KeepAlive	0 - 16	The number of permanent connections (default:8). The client browser always uses the same connection when it supports the Http Keep Alive feature. Zero indicates that no permanent connections are made and strict mode is off.
KeepAliveTimeout	1000 - 60000	Last access time out in ms. If this time elapses without access, the connection is not kept alive anymore (default:2000).
KeepAliveStrict	on / off	In strict mode the number of permanent connections is absolute. No additional connection will be accepted. In normal mode the last connection is always toggling and every waiting request will be processed, sharing the resources available (default:on).
KeepAliveRequests	0-10000	The numbers of requests which can be executed on the same keep alive session. After this the connection is closed and reopened. Zero indicates that the session is kept alive until a time out (default:0).
NoTimeWait	on / off	This option disables the wait state of the TCP protocol. By default the wait state is enabled (default:off). If a client is used which does one shot requests (closes all socket <u>immediately</u>) – use this option to prevent web server to run out of sockets.
PrioPort	1-65536	Additionally to the default port configuration a priority socket port is activated on start-up. The request load is distributed 50:50 to each port. This option allows to configure on which port the priority port is listening (default:81).

3.7 Compatibility

To obtain the best results with HTTP-Direct projects consider using:

- MS Internet Explorer 6.0
- MS Java Virtual Machine or Sun Java Virtual Machine 5 (S-Web Editor projects)

Please have a look at the compatibility grid if you would like to use other products:

	*Permanent connections	S-Web Projects (Applet)	Html
MS Internet Explorer 6.0			
MS Java Virtual Machine 6.0			
Netscape Browser 7.2			
Sun Java Virtual Machine 1.4	X		
Sun Java Virtual Machine 5			
x not supported			

*When permanent connections (Http Keep Alive) are not supported the refreshing of values in a web project is not regularly.

3.8 Special configuration aspects for xx7 platforms

On xx7 platforms, it is possible to configure the password(s) to access the pages using the IO_Builder program.

It is possible to download project pages in DB's using the WEB-Builder program and the SIMATIC® Manager.

4 FTP-Server

4.1 Introduction

The PCD built in FTP-Server is defined to be connected with only one user, namely username = root and password=rootpasswd. This information shall be entered for any FTP-Client requesting an access.

The PCD built in FTP-Server can be used to download from a FTP-Client (on a PC) the HTML pages.

- From the Explorer, use the address <ftp://<defined IP Address>, e.g ftp://179.168.10.12>
- Right click to enter username and password
- A folder containing the actual PCD drives is presented and the user can navigate as requested in all presented directories.

4.2 Drive Names

The drives are present:

- PLC: (xx7 specific drive): Do NOT touch (read/write) anything on that drive.
- WEB: This drives owns the WEB pages (hard-coded pages and DB's downloaded pages). Please do not modify NOR delete any files / directory present on that drive.
- xFLASH: (x = M1_, M2_, SL0, SL1, SL2, SL3 representing the position of the FLASH card on the PCD). For WEB configuration, this (these) drive(s) shall own a directory called `WEBPAGES` where the user is allowed to download any required files (html, tcr, jar files) as generated by the WEB-Editor. For FTP or other configuration file, this (these) drive(s) shall own a directory called `CONFIG`, where the user is allowed to download any required configuration file.

4.3 Configuration File

At startup, and only at startup, the FTP-Server can be configured with modified parameters. The following list of parameters can be updated:

- FTP Start Status: By default, the FTPServer is started and can be accessed as soon as the TCPIP address is configured on the system. Setting this parameter to OFF, it is possible to disable the FTPServer functionalities. Default is ON.
- FTP Default Port: Normally, this port has the value 21 (default FTP Server port).
- FTP Instance number: The FTP-Server can run parallel sessions of FTP connections. The default is 3 simultaneous sessions.
- FTP Connection timeout: The FTP-Server can close a connection after a defined amount of time if no new commands have been received. By default, no timeout is defined.
- FTP Default User: A default user is always provided "hard coded" in the FTP-Server. It can be specified if this user is kept or removed. By default, this user is kept.
- FTP User: A number of users can be specified in the configuration file, together with some access parameters. By default, only the default user is configured (See § 4.1 above).

The syntax of the configuration file is as follows:

- Any lines starting with # is ignore and treated as comment;
- Empty lines as skipped;

- The parameter names are case sensitive;
- The usernames, password and parameter values (e.g. on/off) are case insensitive;
- The parameter name shall appear at the beginning of the line (except spaces or tabs);

The parameters names are defined together with the expected syntax as follows:

- `FTPStart=<on/off>`: Defines if the FTP-Server functions shall be started or not. By default, FTP-Server is started.
- `FTPPort=<decimal value>`: Defines default FTP port where FTP client can issue connection requests. Used value shall be carefully selected in order not to interfere with already defined ports, e.g. port 80 is used for WEB-Server. Default is 21.
- `FTPMaxInstNbr=<decimal value>`: Defines how many server instances can run in parallel. Negative values, 0 and values bigger than 5 will not be taken into account. Default is 3.
- `FTPConnectionTimeout=<decimal value>`: Defines if an open connection is automatically closed after a specified number of seconds if no commands have been received. Value smaller than 30 shall be avoided, as well as values bigger than 1 day (86400). Default is that connection remains open until FTP-Client closes its connection with the server.
- `FTPRemoveDefaultUser=<decimal value>`: Defines if the default user "ROOT" shall be kept within the internal FTP-Server user table. 1 means that it will be removed. Any other value means it is kept. By default, the entry is kept.
- `UserName=<username>, <password>, <GroupID>, <AccessGroup> [,<AccessType>]`: Defines a new user to access the FTP-Server / file system. `<username>` is a string defined from the "=" character up to the "," character, including space and any special characters. `<password>` is a string defined from the "," character up to the next "," character, including space and any special characters. `<GroupID>` is a value specifying the user group, e.g. a file created by this user will belong to that `<GroupID>`. `<AccessGroup>` is a value specifying the file system access group(s). A file / directory will be accessible if its `<GroupID>` belongs to the given `<AccessGroup>`. `<AccessType>` is the kind of access given to the user, either `RD_ONLY` (it is not possible to delete / nor write into a file nor create a file in any provided file system) or `RD_WR`. `<AccessType>` is an optional parameter and is set to `RD_WR` by default.

The valid `GroupID` is defined as follows:

- `0x00,` // does NOT belong to any group. This value is kept for compatibility reason, but it shall be avoided when specified in a configuration file.
- `0x02:` // User belongs to CONFIG Group
- `0x04:` // User belongs to DOWNLOAD Group
- `0x08:` // User belongs to WEB Group
- `0x10:` // User belongs to USER1 Group (free group)
- `0x20:` // User belongs to USER2 Group (free group)
- `0x40:` // User belongs to USER3 Group (free group)
- `0x80:` // User belongs to USER4 Group (free group)

A valid `AccessGroup` value is an ORED value of any of the given group here above.

4.4 Configuration file example

The following lines provide an example of configuration file which can be downloaded to the PLC.

```
# *****
# FTP Configuration file
#
# Default values
#   FTPStart=on
#   FTPPort=21
#   FTPMaxInstNbr=3
#   FTPConnectionTimeout=0           0=No timeout, != 0 timeout of specified seconds
#   FTPRemoveDefaultUser=0         Default user and password is kept
#   UserName=root,rootpasswd,0,0xFF,rd_wr
#
# *****
#
# Uncomment next line do forbid FTP connections
# FTPStart=off
#
# *****
#
# Overwritten values
FTPPort=6034           # Check if this value is NOT used by any other connections ?
FTPMaxInstNbr=2       # Two instances max
FTPConnectionTimeout=3600 # 1 hour timeout if no command received
FTPRemoveDefaultUser=1 # default user is removed
UserName=francis,hello,0x04,0xFE # User = francis
                                # password = hello
                                # Belong to download Group.
                                # Have access to all files / directories
                                # By default read/write access
UserName=root,12hrs37,0x00,0xFF # User = root
                                # password = 12hrs37
                                # Belong to no group
                                # Have access to all files / directories
                                # By default read/write access
UserName=limited,,0x80,0x80,rd_only # User = limited
                                    # no password is defined
                                    # Belong USER3 group
                                    # Have access to files / directories belonging to USER3
                                    group
                                    # defined with read only access
```

4.5 Configuration File Location

The configuration file shall be named "FTPConfig.txt" (case insensitive) and it shall be located either in

- M2_FLASH:/Config (FLASH device in M2 slot of the extension)
- WEB:/WEBPAGES (Built-in file system)
- M1_FLASH:/Config (FLASH device in M1 slot of the extension)
- SL0FLASH:/Config (FLASH device in slot #0 of IO Bus)
- SL1FLASH:/Config (FLASH device in slot #1 of IO Bus)
- SL2FLASH:/Config (FLASH device in slot #2 of IO Bus)
- SL3FLASH:/Config (FLASH device in slot #3 of IO Bus)

It is searched at boot time only in one of these directories (in the order given above) and if found, it is parsed. For the M2_FLASH file system, the file is downloaded using the FTP-Server (and the currently used parameters), whereas in the WEB file system, it is loaded using DB / DBx as part of the PLC user program (valid for xx7 AND Classic PLC). Downloaded parameters will be taken into account at next power OFF / ON sequence.

5 System Functions to access file system from user program

It is possible to use system functions to access the file system(s) from the user program. Please refer to the following documents:

[SFB FileSystem xx7.pdf](#) [for xx7 (SIMATIC® Manager) users].

[SFC FileSystem Classic.pdf](#) [for SAIA PG5® users].

6 File System Compression and reformat using WEB pages

It is possible to start a file system compression or a FLASH (re-)format using specific tags. It is also possible to see the current FLASH state (busy compressing, busy formatting, all OK, device error, etc).

This can be achieved using dedicated tags, as described in the next table. The x has the following possible values:

- 0: related to M1_FLASH: device
- 1: related to M2_FLASH: device
- 2: related to SL0FLASH: device
- 3: related to SL1FLASH: device
- 4: related to SL2FLASH: device
- 5: related to SL3FLASH: device

Tag name	R/W	Description
NT-FileSys,DeviceStatus[x]	Read only	Provides the following device status: "DeviceName:" Device NOT mounted "DeviceName:" Device mounted with error(s) "DeviceName:" Device mounted OK
NT-FileSys,DeviceActionStatus[x]	Read only	Provides the following device status: "DeviceName:" Action not started "DeviceName:" Compressing... "DeviceName:" Formatting... "DeviceName:" Action finished OK "DeviceName:" Action finished with error(s) "DeviceName:" Action NOT executed, e.g. parameter error "DeviceName:" Action Undefined "DeviceName:" Device is currently busy
NT-FileSys,DeviceBlockSize[x]	Read only	Provides the following device status: "DeviceName:" <current device block size>
NT-FileSys,DeviceBlockNbr[x]	Read only	Provides the following device status: "DeviceName:" <current number of blocks on the device>
NT-FileSys,DeviceSize[x]	Read only	Provides the following device status: "DeviceName:" <device size>
NT-FileSys,DeviceReqBlockSize[x]	Read/Write	Provides the following device status: "DeviceName:" <new/current block size> New block size can be given as argument 512 .. 8 KB for PCD7.R5xx devices (in steps of *2) 4 KB .. 512 KB for PCD3.R600 devices (in steps of *2)
NT-FileSys,DeviceReqBlockNbr[x]	Read only	Provides the following device status: "DeviceName:" "new/current block number" The new values is calculated according to new provided block size.
NT-FileSys,StartDeviceCompression[x]	Read/Write	Provides the following device status: "DeviceName:" 0: no compression active "DeviceName:" 1: compression active When setting this value to '1', a compression is started on the selected device. The DeviceActionStatus will return the status of the compression.

Tag name	R/W	Description
NT-FileSys,StartDeviceFormatting[x]	Read/Write	<p>Provides the following device status: "DeviceName:" 0: no formatting active "DeviceName:" 1: formatting active "DeviceName:" 2: formatting active</p> <p>When setting this value to '1', a reformatting is started if the current device status is unknown or mounted with error, or if a new block size has been provided in the DeviceReqBlockSize parameter.</p> <p>When setting this value to '2', a reformatting is started in any case. The values of the DeviceReqBlockSize is taken as block size (new or identical to current block size).</p> <p>Other values are ignored.</p> <p>The DeviceActionStatus will return the status of the compression.</p>
NT-FileSys, EnableAutoCompression[x]	Read/Write	<p>Reading this tag allows to know the current status of the automatic compression.</p> <p>"0": automatic compression is disabled "1": automatic compression is enabled</p> <p>It is possible to configure the automatic compression, either through an user program system function call or by writing a "0" or a "1" with the tag.</p>
NT-FileSys,DeviceUsedBlockNbr[x]	Read only	<p>Returns the size really used on the device, in the form: "DeviceName:" <used size></p> <p>Used blocks includes internally used blocks, file (data) used blocks and blocks released (e.g. when a file is deleted) but not yet recovered by a call to the compression algorithm.</p>
NT-FileSys,DeviceFreeBlockNbr[x]	Read only	<p>Returns the free size of the device, in the form: "DeviceName:" <free size></p>
NT-FileSys,DeviceFreeBlockNbr[x]	Read only	<p>Returns the total size of freed blocks of the device, in the form: "DeviceName:" <freed size></p>

The defined tags can be entered in as defined WEB pages, e.g. in a WEB-Editor teq view.