DNC Service

ffDNC / FileHandlerService

Version 5.12

Manual

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Content

1   About this document

This document describes the configuration of ffDNC and installation and configuration of the FileHandlerService.

ⓘ For better readability, we generally use the generic masculine in the text. These formulations, however, are equally inclusive of all genders and intended to address all persons equally.

1.1 Target group

In this manual, we assume that you have knowledge in machine connection, the FORCAM PDM module and a general knowledge of FORCAM software. If you do not have any knowledge in this area, take the time to familiarize yourself with the basics.

ⓘ We recommend that you use our Academy: **https://forcam.com/academie/**
The FORCAM Academy provides the knowledge to effectively use the methods for digital transformation and the technologies for the Smart Factory.
Based on lean manufacturing and TPM methods, our institute team will guide you to initiate changes in the company and to use the technologies correctly.

2 Introduction

In extension to the Production Data Management (PDM) function of the FORCE MES FLEX (hereafter only referred to as MES FLEX), the Distributed Numerical Control Service (DNC Service) is intended for the transfer of files from the PDM module to the linked machine.
The connection to each machine has to be individually configured inside the Workbench. To ease up the configuration of similar machines, there is also a possibility to copy existing configurations to another machine, which results only in small changes of the machine specific information (e. g. IP-Address).
This manual will describe, how a machine can be configured for DNC and will also cover the diverse plug-ins that are available for the communication to the machines.

3 Configuration in Workbench

The configuration of a DNC machine can be found inside the PDM below the section **PDM Configurations** in the screen **DNC Machine Configuration**. Before starting the configuration of a concrete machine, the machine needs to be selected from the drop-down menu on the top.

On the left side, the tab **DNC Machine Configuration** will be shown and needs to be selected to do the basic configuration of the machine.
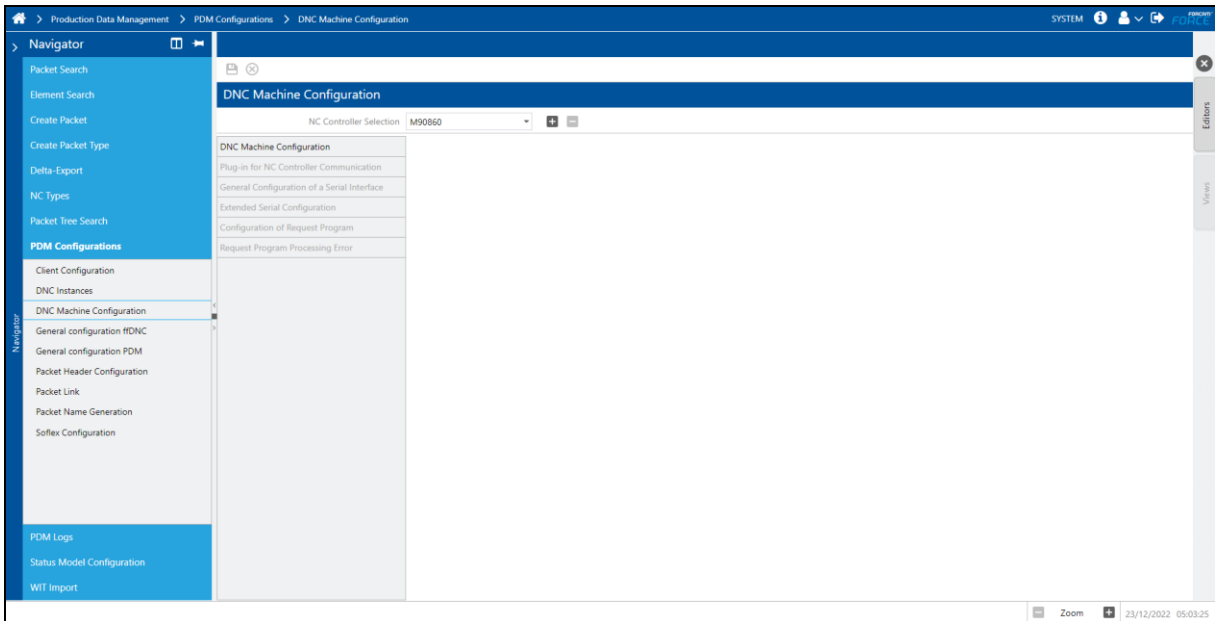
Figure 1: Overview DNC machine configuration in MES FLEX

First of all, a DNC Instance needs to be assigned to the machine configuration. This is necessary, as the DNC service can run multiple times within one installation, so that e. g. the load can be split or there could be one DNC service per line or per plant.
Each machine can only be connected with one instance that will do the connection and file transfer.
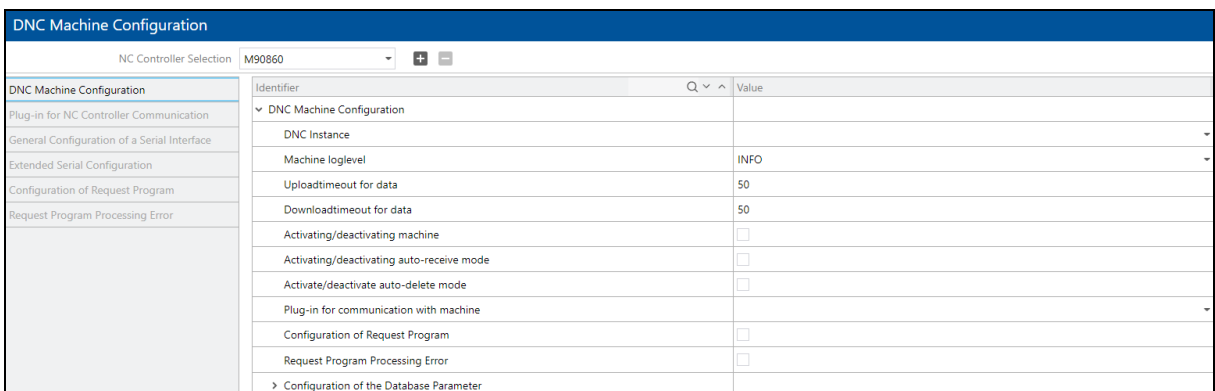
Figure 2: Dialog for DNC machine configuration

After selecting the instance, some basic information can be set, such as **Machine loglevel**, if the machine is active and so on. Beside the instance, the **Plug-in for communication with machine** is one of the central configuration steps, as this determines, how the connection to the machine will be established.

Within MES FLEX, there are various possibilities to do this connection, which are shown in Table 1. The details of all these different plug-ins will be described in the following chapters.

Plug-ins
ComPortServer for redirection to TCP-Communication to a local serial port
Execute Process (Force DNC)
FANUC
FANUC (Force DNC)
FORCAM Mazak Service (MazakForcamDNC.dll)
FTP (Force DNC)
File handler for communication on data basis
File system copy (Force DNC)
FileHandlerService
Force DNC Client
Heidenhain (Force DNC)
Legacy Plug-in
MOXA (Force DNC)
Mazak Communication Server
Plug-in for communicaiton with a MOXA-Box
Plug-in for communicaiton with a WuT-Box
Plug-in for communicaiton with an FTP-Server
RPC Sinumerik
Serial COM Port (Force DNC)

Table 1: Plug-ins for communication with machine: list of available plug-ins

3.1.1 ComPortServer

With the plug-in *ComPortServer* the connection to legacy machines, using an RS232 connection can be established. This plug-in is mostly used, if there is a computer next to the machine, that already has an existing RS232 connection with the machine.

⚠ RS232 allows only one participant to be connected. Therefore this can only be used, if no other program is using the connection already!

To use this local connection via the RS232 connection, an additional program, the so called *ComPortServer*, needs to be installed on the computer next to the machine. The DNC Service will then connect to the *ComPortServer* via TCP. The *ComPortServer* will do a translation from TCP to RS232. To establish the connection to the *ComPortServer*, the following information need to be set:

- **IP-Address of the Server**:
  This is the IP-Address of the computer where the *ComPortServer* is running on.

- **Port of the server:**
  The HTTP-Port the *ComPortServer* is listening on (needs to be open in the firewall!).
  Default is port 11002

- **COM-Port to be used**:
  Determines the local COM-Port on the computer where the *ComPortServer* is running.

DNC Machine Configuration		
NC Controller Selection	M90860 ▾ ➕ ➖	
DNC Machine Configuration	Identifier 🔍 ⌄ ⌃	Value
Plug-in for NC Controller Communication	⌄ *ComPortServer for redirection of TCP-Communication to a local serial port.*	
General Configuration of a Serial Interface	*IP-Address of the Server*	127.0.0.1
Extended Serial Configuration	*Port of the server*	11.002
Configuration of Request Program	*COM-Port to be used*	COM1
Request Program Processing Error		

Figure 3: Dialog for configuration of plug-ins for NC controller communication

The connection to the *ComPortServer* only initiates the connection. To be able to exchange data with the machine, the **General Configuration of a Serial Interface** and the **Extended Serial Configuration** need to be configured. For further information see chapter 3.1.13.

3.1.2 FileHandlerServer

With this plug-in it is possible to transfer files to controllers with the SMB (CIFS) protocol.
A separate installation of the application FileHandlerServer.exe is required.

FileHandlerServer accesses a local folder:

Figure 4: Access to FileHandlerServer via local folder

FileHandlerServer accesses a network folder:

Figure 5: Access to FileHandlerServer via network folder

3.1.3 FANUC

This plug-in is used to connect to *FANUC* controllers.

Figure 6: Configuration of FANUC plug-in

The parameters of the plug-in are described in the following table:

Parameter	Description
Server name (host name)	Host name (or IP-Address) of the FANUC controller
Port	TCP port of the FANUC controller Default is 8193. You don't need to change it.
Connection timeout in seconds	On initial connection the plug-in waits for a maximum time. Default is 5 s. With a slow or bad network connection you can increase this value.
Fanuc status group	The plug-in supports program numbers and program/file names. Default is 6 for program numbers. Set it to 8 when the controller supports program/file names.
Path number	Path of the controller to use The first path begins with 0.
Download delay in seconds between files	When you download multiple files from the controller you can limit the load.
Activate simulation mode	The plug-in can simulate a controller in a very simple form. Default: deactivated Set it to yes if you do not have access to a real controller or a simulator.
Clear program range?	Use clear memory function. Clear memory: Programs within the file range start and end will be deleted. A dummy NC program with a specified name and content will be transferred to the controller. All this information is configured with the following parameters.
Program range start	Start range program number

Parameter	Description
Program range end	End range program number
Dummy NC program name for clear memory	Example: 1212
Dummy NC program content	A NC program which needs a correct syntax. Example: o1212 M30
File name dependend path number	List of mappings Regex for file name -> path number

Table 2: FANUC plug-in: Parameters

3.1.4 Plug-in for communication with a MOXA-Box

This plug-in is used to directly connect to a MOXA-Box.

Figure 7: Configuration of MOXA-Box plug-in

The parameters of the plug-in are described in the following table:

Parameter	Description
IP-Address of the MOXA-Box	Host name (or IP-Address) of the MOXA-Box
Port-Index of the MOXA-Box	Port of the serial (RS232) port Port Index 1..9: Auto detect protcol. Try IPserial then SSDK_v1.2 Port Index 11..19: Use IPSerial Port Index 21..29: Use SSDK_v1.2 The MOXA-Box itself uses port index modulo 10.
Timeout for opening connection	On initial connection the plug-in waits for a maximum time. Default is 5000 ms = 5s. With a slow or bad network connection you can increase this value.

Table 3: MOXA-Box plug-in: Parameters

3.1.5 File Handler for communication on data basis

With this plug-in it is possible to transfer files to controllers with the SMB (CIFS) v1 protocol. Because of the limitation to version 1 of the SMB protocol it is only usable with very old controllers. You have to enable SMB v1 on your Windows server.

Figure 8: Configuration of File Handler for communication on data basis

3.1.6 Plug-in for communication with an FTP-server

The FTP plug-in can be used to exchange files with an FTP-server, that might be hosted directly on the machine or some exchange directory.

Figure 9: Configuration of plug-in for communication with an FTP-server

The parameters of the plug-in are described in the following table:

Parameter	Description
Network address of the server	The connection parameters for the FTP-server that needs to be connected. Hostname and port
Port of the FTP-server	TCP port of the FTP server. Often this is 21.
Local COM port	Local TCP Port on server side. Normally you can leave this blank.
Username for login	Username for the FTP connection
Password for the user	Password for the FTP connection
Download path for elements	Folder on the FTP-server
Upload Path for elements	Folder on the FTP-server
Parameter for clear memory: regex for include files	For clear memory function: Remove the files which match this regex.
Parameter for clear memory: regex for exclude files	For clear memory function: Do not remove the files which match this regex.

Table 4: Plug-in for communication with an FTP-server: Parameters

3.1.7 Heidenhain (Force DNC)

With this type of the plug-in can transfer files with a Heidenhain controller.

Identifier	Q ∨ ∧	Value
∨ Heidenhain (Force DNC)		
Force DNC Service Host Name		127.0.0.1
Force DNC Service Port For TCP/IP		14,086
Name of connection (Heidenhain DNC Connections)		TNC640
Folder on controller for sending files		TNC:\nc_prog
Folder on controller for receiving files		TNC:\nc_prog
Parameter for Clear Memory: Regex for Include Files		
Parameter for clear memory: Regex for exclude files		
Comment		HeidenhainDncLib: TNC640 ; Supercom: TNC640:10.48.114.114

Figure 10: Configuration of Heidenhain (Force DNC) plug-in

The parameters of the plug-in are described in the following table:

Parameter	Description
Force DNC service host name	Host name (or IP-Address) of the server where the Force DNC Service is running on.
Force DNC service port for TCP/IP	Port where the Force DNC Service is listening on, on the host machine
Name of the connection (Heidenhain DNC connections)	If HeidenhainDncLib is used (Default): Connection name which was created with CreateConnections App If Supercom Lib is used: Name of the controller: IP address
Folder on controller for sending files	Example: TNC:\nc_prog
Folder on controller for receiving files	Example: TNC:\nc_prog
Parameter for clear memory: regex for include files	For Clear Memory function: Remove the files which match this regex.
Parameter for clear memory: regex for exclude files	For Clear Memory function: Do not remove the files which match this regex.
Comment	Place your comments here.

Table 5: Heidenhain (Force DNC): Parameters

3.1.8 FTP (Force DNC)

The FTP plug-in can be used to exchange files with an FTP server, that might be hosted directly on the machine or some exchange directory. To use this plug-in, the additional Force DNC Service needs to be installed, as this service is needed to use the FTP function.

Figure 11: Configuration of FTP (Force DNC) plug-in

The parameters of the plug-in are described in the following table:

Parameter	Description
Force DNC service host name	Host name (or IP-Address) of the server where the Force DNC Service is running on.
Force DNC service port for TCP/IP	Port where the Force DNC Service is listening on, on the host machine.
FTP-Server with format: Hostname:Port	The connection parameters for the FTP server that needs to be connected. Hostname and port
User name	User name for the FTP connection
Password	Password for the FTP connection
Folder for sending	Folder on the FTP server
Folder for receiving	Folder on the FTP server
Clear memory include	For Clear Memory function: Remove the files which match this regex.
Clear memory exclude	For Clear Memory function: Do not remove the files which match this regex.
Comment	Place your comments here.

Table 6: FTP (Force DNC): Parameters

3.1.9 File system copy (Force DNC)

With this plug-in it is possible to transfer files to controllers with the SMB (CIFS) protocol.

Figure 12: Configuration of File system copy (Force DNC) plug-in

Parameter	Description
Force DNC service host name	Host name (or IP-Address) of the server where the Force DNC Service is running on
Force DNC service port for TCP/IP	Port where the Force DNC Service is listening on, on the host machine
Network same on controller (optional)	The connection parameters for the SMB/CIFS server that needs to be connected. Example: \\controller\ncfiles
User name	User name for the FTP connection
Password	Password for the FTP connection
Folder for sending	Folder on the FTP server
Folder for receiving	Folder on the FTP server
Clear memory include	For Clear Memory function: Remove the files which match this regex.
Clear memory exclude	For Clear Memory function: Do not remove the files which match this regex.
Comment	Place your comments here.

Table 7: File system copy (Force DNC): Parameters

3.1.10 MOXA (Force DNC)

Identifier	Value
∨ MOXA (Force DNC)	
Force DNC Service Host Name	127.0.0.1
Force DNC Service Port For TCP/IP	14,086
IP-Address of the MOXA-Box	
Port-Index of the MOXA-Box	
Timeout for Opening Connection	5,000
lbl$ffworkbench$cfgName$DNCMachineSerialComOptions	
Comment	

Figure 13: Configuration of MOXA (Force DNC)

3.1.11 Serial COM Port (Force DNC)

Identifier	Value
∨ Serial COM Port (Force DNC)	
Force DNC Service Host Name	127.0.0.1
Force DNC Service Port For TCP/IP	14,086
lbl$ffworkbench$cfgName$DNCMachineSerialComComPort	com1
lbl$ffworkbench$cfgName$DNCMachineSerialComOptions	
Comment	

Figure 14: Configuration of Serial COM Port (Force DNC)

3.1.12 Execute Process (Force DNC)

The plug-in *Execute Process* is used, to connect the old DNC function known from FORCAM Factory Framework. This might be helpful in case machines need to be connected where no alternate plug-in exists in MES FLEX as this might be a very rare connection type.
To connect machines via this plug-in, expert knowledge of FORCAM software is required.

Identifier	Value
∨ lbl$ffworkbench$cfgName$ExecProcess	
Force DNC Service Host Name	127.0.0.1
Force DNC Service Port For TCP/IP	14,086
Command for send file	cmd.exe /c copy /Y "{sourcefile}" "{sendpath}{destfile}"
Command for Receive File	cmd.exe /c copy /Y "{receivepath}{sourcefile}" "{destfile}"
Command for Delete File	cmd.exe /c del /Q "{sourcefile}"
Command for Receive File List	cmd.exe /c dir "{receivepath}{sourcefile} /B"
Folder for Send	d:\temp\
Folder for Receive	d:\temp\
Comment	

Figure 15: Configuration of Execute Process (Force DNC)

3.1.13 Serial interface configuration

3.1.13.1 General serial interface configuration

Basic parameters for serial communication and timing parameters are set here.

Identifier	Value
⌄ General configuration of a serial interface	
Baud rate of the serial interface	9,600
Number of data bits	7
Number of stop bits	2.0
Parity	Even
Handshake-Method	RTS/CTS
Timeout when sending of data is aborted	10,000
Timeout when receiving of data is aborted	60,000

Figure 16: Basic parameters for serial communication

All these parameters must match with those on the controller.

Parameter	Description
Baud rate of the serial interface	Baud rate Usual values are: 2400, 4800, 9600, 19200
Number of data bits	Data bits The usual values are: 7, 8
Number of stop bits	Stop bits The usual values are: 1, 2
Parity	Parity Usual values are: None, Even, Odd
Handshake-Method	Handshake The usual values are: RTS/CTS: preferred XON/XOFF: needs parameters in extended serial configuration None: Do not used this, data could be lost.

Table 8: Parameters of general interface configuration

Timeout parameters:

Parameter	Description
Timeout when sending of data is aborted	ms
Timeout when receiving of data is aborted	ms

Table 9: Timeout parameters

3.1.13.2 Extended serial configuration

Figure 17: Parameters for extended serial configuration

Parameters for upload. Data is sent from the controller to the plug-in.

Parameter	Description
Timeout between two read cycles (only request program)	Value in ms
Activating/deactivating the use of the XON-symbol	Activation of the special treatment for XON/XOFF
Timeout when using XON-symbol	Value in ms
XON-symbol	ASCII code of the XON symbol Normally this is #17
End symbol for upload	When this symbol is received the upload will be stopped.
Activate/deactivate attach of end symbol	If activated, the end symbol is appended to the file.
Start symbol for upload	When this symbol is received the upload will be started.
Newline-sign	ASCII code for new line in the program file Default: #10 The usual values are:

Parameter	Description
	#10 #10#13 #13#10
Save the control characters	Control characters, ASCII Code is smaller than 32, are saved into the program file.

Table 10: Extended serial configuration: Parameters for upload

Parameters for download. Data is sent from the plug-in to the controller.

Parameter	Description
Start symbol for download	The download starts from this symbol. Usual values are: empty %
End symbol for download	This symbol ends the download.
String for new line	ASCII code for new line in the program file Default: #10 Usual values are: #10 #10#13 #13#10
Prefix for download	These characters are transmitted before the file content is transferred. When using XON/XOFF, #17 might be necessary.
Trailer for download	After the file content has been transferred, these characters are transferred.
Download type for transfer	Possible values are: Package, Char, Line
Download delay of elements	

Table 11: Extended serial configuration: Parameters for download

Example settings for XON/XOFF

For Upload from the controller:

In some cases the controller needs a XON to start the transmission.
Activating XON.
Set XON-Symbol to #17. (#17 is ASCII Code 17 Dec)

For Download to the controller:

In some cases the controller sends a XON to start the transmission.
Set Prefix for download #17. (#17 is ASCII Code 17 Dec)
The plug-in waits for a XON before starting the download.

Figure 18: Example settings for XON/XOFF

4 ForceDncService installation via Command Line

To install ForceDncService:
1. Start from console
   ForceDncService.exe --debug --servicename ForceDncService
2. Install as service
   ForceDncService.exe --install --servicename ForceDncService
3. Remove service
   ForceDncService.exe --remove --servicename ForceDncService

ForceDncService.ini Configuration

[ForceDncService]
PORT=14086
LISTENER_ADDRESS = 0.0.0.0

; configuration of another instance of the service
; use command line option: --servicename ForceDncService_2
[ForceDncService_2]
PORT=14087
LISTENER_ADDRESS = 0.0.0.0

5   Technical details

5.1 Architecture
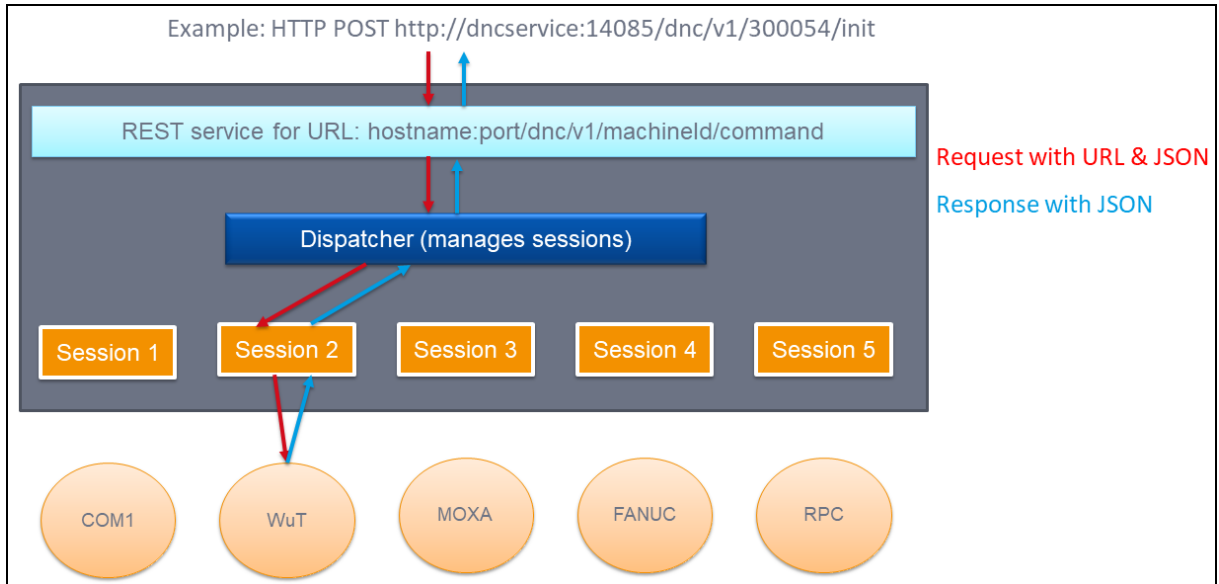
5.2 REST API

Supported functions:

- init
- loglevel
- unload
- connect
- disconnect
- checkconnection
- sendfile
  To send or write a file to the controller.
  The file content is inside the JSON encoded with Base64.
  To avoid data errors, also a hash code is calculated.
  Variables: fileContentBase64 and md5hash
- deletefile
- receivefile
- clearmemory
- lockfile
- unlockfile
- receivefilelist
- stoptransfer
- transferstatus
- deleteOrderProgram

5.3 URL parsing

Parameter	Value/Description
Format of the URL	http://hostname:port/dnc/v1/machineId/command
hostname:port	Address and port of the DNC service
dnc/v1	Used for identifying DNC
machineId	Unique machine ID (hibernate ID)
command	Command for the session with optional data in JSON
List of commands[1]	− init − unload − loglevel − connect − disconnect − checkconnection − sendfile − deletefile − receivefile − receivefilelist − transferstatus − stoptransfer − clearmemory (FANUC only)

Table 12: URL parsing

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[1] The list is currently incomplete and will be extended in the upcoming releases.

5.4 All supported types

Type	Filedriver type	Serial type	Description	JAVA configuration class	Required hardware/software

filesystem	filesystem		Transfer files with a native copy command	`ForceDncClientConfiguration with init in JSON:`
				`{ "type" : "filesystem",`
				`  "filedrivertype" : "filesystem",`
				`  "sendpath" : "d:/DNC-Testdata/machine2",`
				`  "receivepath" : "d:/DNC-Testdata/machine2"`
				`}`
					OS with SMB

filesystem	ftp		Transfer files to FTP server	`ForceDncClientConfiguration with init in JSON:`
				`{ "type" : "filesystem",`
				`  "filedrivertype" : "ftp",`
				`  "address" : "ftpserver:21",`
				`  "user" : "dnc",`
				`  "password" : "secret",`
				`  "sendpath" : "/ncfiles",`
				`  "receivepath" : "/ncfiles"`
				`}`
					OS with FTP Server

filesystem	fanuc		FANUC FOCAS	`FanucForceConfiguration`	FANUC controller
filesystem	rpc		Siemens RPC	`RPCConfiguration`	Siemens controller/ScMa.exe
filesystem	execprocess		Call external process (cmd.exe, python, etc.)	`ExecProcessConfiguration`	-
filesystem	heidenhain		HeidenhainDNC	`HeidenhainForceDncConfiguration`	Heidenhain Simulator Virtual Box
serialport		com	Native COM port (COM1, COM2, …)	`SerialComConfiguration`	Physical COM port USB COM port

Type	Filedriver type	Serial type	Description	JAVA configuration class	Required hardware/software
			Mapped COM Ports: MOXA Real COM WuT COM Port Redirector		MOXA NPort WuT COM server
serialport		moxa	MOXA	`SerialForceMoxaForceConfiguration`	MOXA NPort
serialport		wut	WuT COM Server	`SerialWuTConfiguration`	WuT COM Server

ksdnc			Version 4 Legacy DNC	`ForceDncClientConfiguration with init in JSON:`
				`{ "type" : "ksdnc",`
				`  "dncdll" : "nctrs60",`
				`  "dncport" : "com4",`
				`  "dncparm" : "38400,N,8,1,R",`
				`  "tracelevel" : "10"`
				`}`
					-