

SIEMENS

SIMATIC

S7-1500/ET 200MP

Amendments to documentation S7-1500/ET 200MP

Product Information

Introduction

Scope of validity of the product information

This product information supplements the documentation for S7-1500/ET 200MP and takes precedence over our system manuals, function manuals and manuals.

You can find additional information on the S7-1500 fail-safe CPUs in the Product Information for F-CPU's on the Internet (<https://support.industry.siemens.com/cs/de/en/view/109478599>).

The section "Notes on S7-1500 Motion Control" applies for the following function manuals as of edition 12/2017:

- S7-1500 Motion Control V4.0 in TIA Portal V15
- S7-1500T Motion Control V4.0 in TIA Portal V15
- S7-1500T Kinematics Functions V4.0 in TIA Portal V15

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (<https://www.siemens.com/industrialsecurity>).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (<https://www.siemens.com/industrialsecurity>).

Amendments to documentation S7-1500/ET 200MP

S7-1500/ET 200MP - Requirements for power supplies in the event of voltage interruption

Note

To ensure adherence to IEC 61131-2 and NAMUR Recommendation NE 21, only use power packs/power supply units (230 V AC → 24 V DC) with a mains buffering time of at least 20 ms. Observe the relevant requirement in your product standards (e.g. 30 ms for "burners" pursuant to EN 298) as regards possible voltage interruptions. The latest up-to-date information on PS components is available on the Internet (<https://mall.industry.siemens.com>).

These requirements, of course, also apply to power packs/power supply units not constructed using ET 200SP or S7-300-/400-/1500 technology.

S7-1500 - Access protection for F-CPU and blocking online access to a password-protected CPU

Access protection for F-CPU

If you want to achieve the same access protection for an F-CPU as for a standard CPU "No access (complete protection)", you need to have assigned the two passwords above in STEP 7 in the "Protection & Security" area of the F-CPU properties:

- Full access incl. fail-safe (no protection)
and
- Full access (no protection)

Blocking online access to a password-protected CPU

You can block online access to a password-protected CPU. The effect of the access block is independent of password protection. This means that if you access a CPU via a PG/PC and enter the correct password, you are still denied access to the CPU.

You have two options for blocking online access:

- Via the display on the CPU (Settings > Protection > Level of protection)
- In STEP 7 using the instruction ENDIS_PW: Limit and enable password legitimation

Special note for standard and F-CPU

If you want to block individual access levels for a standard or F-CPU (e.g. read access, HMI access, no access (complete protection)) via the display or the ENDIS_PW instruction, you need to have assigned passwords for these access levels (in the "Protection & Security" area in the CPU properties).

S7-1500 CPUs

CPU Manuals, Edition 12/2017 and Edition 09/2016

Technical specifications section The listed technical specifications correspond to the respective edition of the device manual (Edition 12/2017 or Edition 09/2016). You can find the data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/td>). Enter the article number or the short designation of the desired module on the website.

CPU Manuals, Edition 12/2017 and Edition 09/2016

You can read the status (e.g. "On" or "Off") of LEDs of a CPU or a module using the "LED" instruction. Note, however, that it is not possible to read the LED status of the LINK RX/TX LEDs on all S7-1500 CPUs.

You can find additional information on the "LED" instruction in the STEP 7 online help.

CPU Manuals, Edition 11/2019, Edition 12/2017 and Edition 09/2016

Unlike as described in the manuals, the MAINT-LED does not light up during PROFIenergy pause.

Note

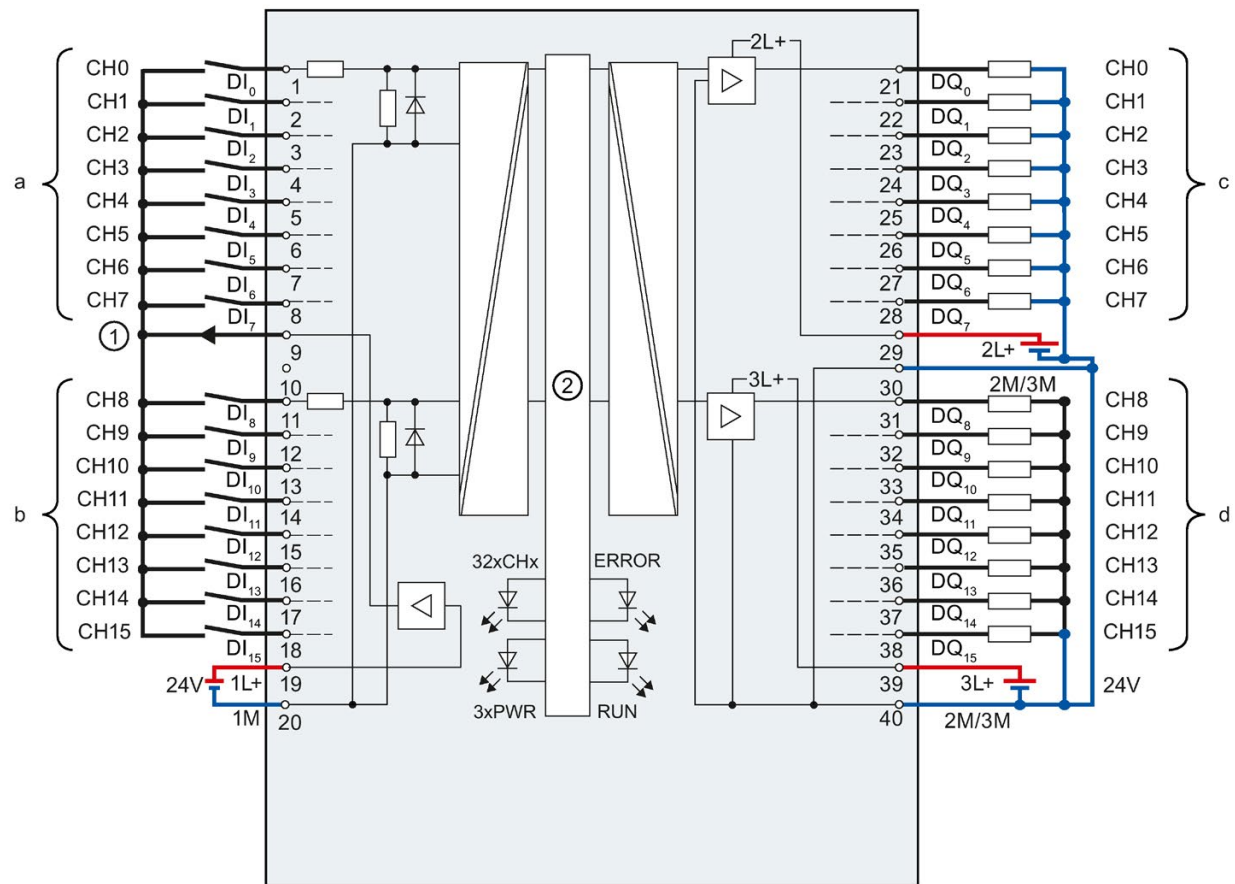
Isochronous mode

If you use high-speed OBs with cycle times of 125 µs, the creation by the system of several hundred DBs may have an effect on the jitter of an OB6x. To avoid possible impacts on the execution and processing times of high-speed OBs, use the CREATE_DB sparingly or not at all.

S7-1500 CPU 1511C-1 PN and CPU 1512C-1 PN

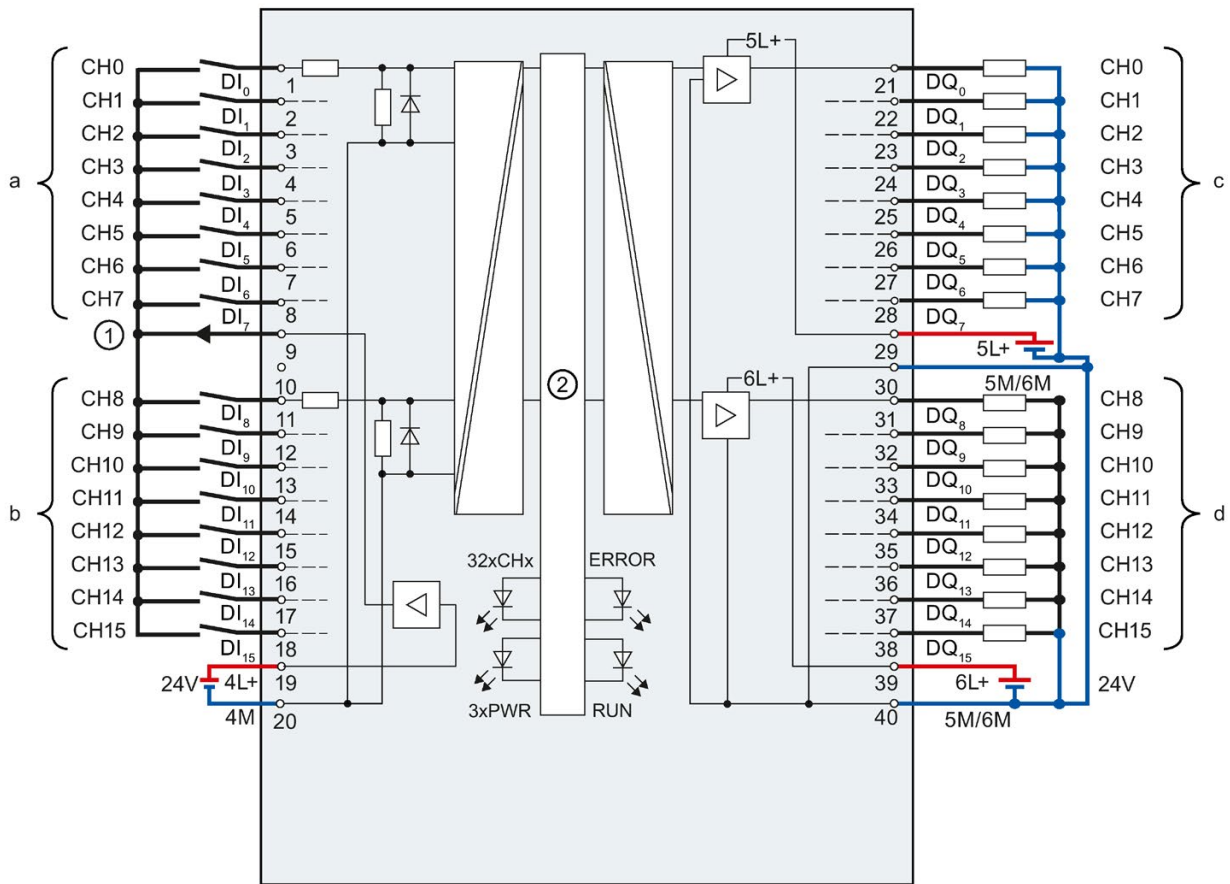
CPU 1511C-1 PN and CPU 1512C-1 PN manuals, Edition 12/2017

The loads of the digital onboard I/O X11 and X12 connected at the outputs have a connection to ground 2M/3M and 5M/6M.



- ① Encoder supply for the digital inputs
- ② CPU interface module
- xL+ Connection for 24 V DC supply voltage
- xM Connection for ground
- CHx Channel or channel status LED (green)
- RUN Status display LED (green)
- ERROR Error display LED (red)
- PWR POWER supply voltage LED (green)

Figure 1 Block diagram and pin assignment X11 of CPU 1511C-1 PN and CPU 1512C-1 PN



- ① Encoder supply for the digital inputs
- ② CPU interface module
- xL+ Connection for 24 V DC supply voltage
- xM Connection for ground
- CHx Channel or channel status LED (green)
- RUN Status display LED (green)
- ERROR Error display LED (red)
- PWR POWER supply voltage LED (green)

Figure 2 Block diagram and pin assignment X12 of CPU 1512C-1 PN

S7-1500 CPU 1518-4 PN/DP MFP - Defective C/C++ Runtime Container

Manual CPU 1518-4 PN/DP MFP, Edition 12/2017, Section 2.3.1 Quick start instructions for commissioning C/C++ Runtime

Note

Corrupt C/C++ Runtime container

The 3 C/C++ Runtime containers are located in the "/CppEnv1.MFP" directory on the SIMATIC memory card.

If the C/C++ Runtime containers are damaged or lost when the CPU is switched off, a diagnostic entry is created in the diagnostic buffer of the CPU the next time the CPU is started up. C/C++ Runtime is not available and the ERROR LED flashes.

If automatic repair of the containers by the automation system is not possible, the containers can no longer be used by the Linux file system. The automation system starts C++ Runtime in root mode.

A new logon with the standard user and password is possible. However, you cannot make any permanent changes to the automation system, e.g:

- Change the password
- Save data
- Change system settings

Solution:

- Copy a previously created backup copy of the C/C++ Runtime container to the SIMATIC memory card.
or
 - Delete the affected C/C++ Runtime container from the SIMATIC memory card. The automation system then recreates the container during the next startup.
-

S7-1500 CPU 1518-4 PN/DP MFP

Manual CPU 1518(F)-4 PN/DP MFP, Edition 12/2017, Section 2.3. Firmware functions

In addition to the information in the manual, note that the IPv6 protocol is activated by default for the CPU 1518(F)-4 PN/DP MFP. Ensure that your system is protected against unauthorized access by implementing appropriate protective measures, e.g. the use of firewalls. If you do not use the IPv6 protocol for communication, we recommend that you deactivate IPv6.

Procedure for deactivating Ipv6:

Add the following entry to the shell script file "autostart.sh":

```
echo 1 > /proc/sys/net/ipv6/conf/all/disable_ipv6
```

Note

Assign "autostart.sh" "execution" rights (chmod +x autostart.sh).

S7-1500 CPU 1518-4 PN/DP MFP

Manual CPU 1518(F)-4 PN/DP MFP, Edition 12/2017, Section 2.3. Firmware functions

Note the following updated information for the firmware function C/C++ applications:

Function	Description
C/C++ applications	<p>CPU 1518-4 PN/DP MFP can execute both STEP 7 blocks as well as blocks and applications programmed with C/C++ (CPU function library) in the user program.</p> <p>The multifunctional platform enables you to execute C/C++ code (CPU function library for the real-time environment) synchronously in the CPU cycle.</p> <p>In addition, the multifunctional platform can run C/C++ applications (C/C++ Runtime application) parallel to the CPU cycle.</p> <p>You create the CPU function library for the realtime and Linux C/C++ Runtime applications with the "ODK 1500S Open Development Kit" (ODK).</p> <p>Using the ODK provides you with the mechanisms of higher programming languages (e.g. object-oriented) within a modern programming environment.</p> <p>You can use Target 1500S for Simulink and ODK 1500S to create CPU function libraries for your complex open and closed-loop control algorithms for the realtime environment in C/C++.</p>

ET 200MP with IM 155-5 PN ST - Channel diagnostics, MSI/MSO

Manual IM 155-5 PN ST interface module, edition 11/2017

Channel diagnostics

In contrast to the order specified in the manual, the User Structure Identifiers (USI) are structured as follows:

- USI data block
- Reserved bytes
- Manufacturer-specific diagnostics

ET 200MP with IM 155-5 DP ST – Operation on a WIN AC RTX

When operating the ET 200MP (PROFIBUS) on a WIN AC RTX, configuration is only possible via GSD file (selection in the hardware catalog under "Additional field devices"). Configuration on the basis of a support package is not supported in the TIA Portal for this device arrangement.

ET 200MP with IM 155-5 DP ST - operation on Y-Link, interrupts, technical specifications

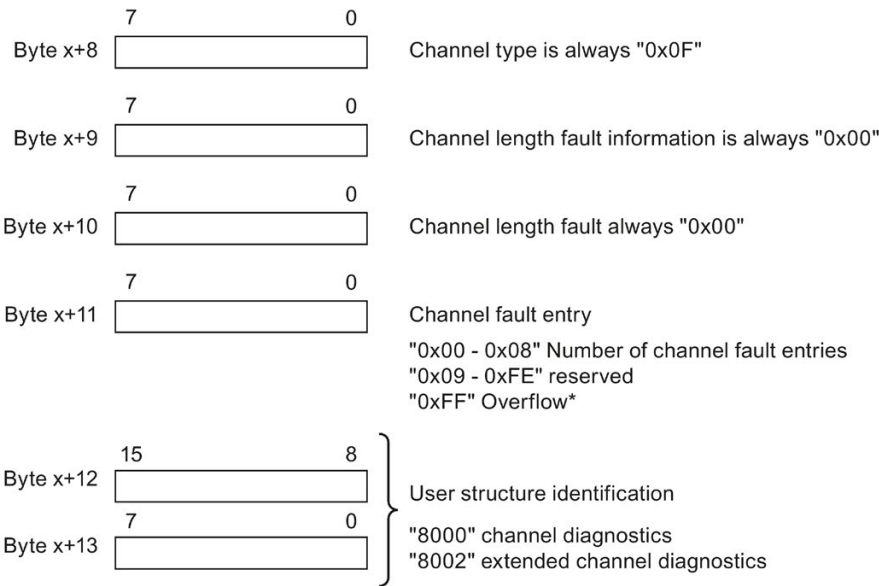
Manual Interface module IM 155-5 DP ST, edition 08/2013

Operation on Y-Link

As of firmware version V2.0.0, the IM 155-5 DP ST interface module can be operated as DP slave after the Y-Link.

Interrupts

The bytes x+8 to x+19 of the diagnostic interrupt are assigned as follows:



* The number of existing channel faults is greater than 8.

Figure 3 Structure starting at byte x+8

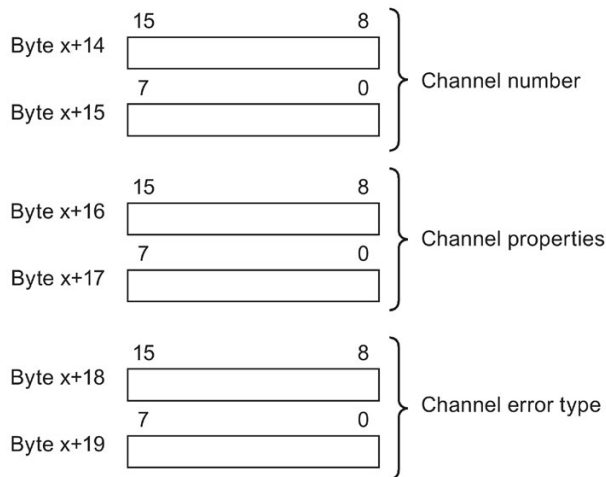


Figure 4 Structure starting at byte x+14

Technical specifications

For the IM 155-5 DP ST, the address space of each module can be assigned a maximum of 64 bytes of inputs and a maximum of 64 bytes of outputs.

S7-1500/ET 200MP - Substitute value behavior in shared device mode

Observe the following special characteristics for substitute value behavior in shared device mode with the modules/configurations in the following table:

Note

Substitute value behavior in shared device mode

If the system is in shared device mode and one of the IO controllers involved goes into STOP or fails due to a communication failure, for example, all submodules of the output module perform the configured substitute value reaction (e.g. shutdown).

This means that even when only one IO controller fails, that the other IO controllers associated with the shared device no longer control the assigned submodule of the output module.

Module/module name	Configuration	Article no.:
DQ 32x24VDC/0.5A BA	4 x 8-channel without value status	6ES7522-1BL10-0AA0
DQ 16x24VDC/0.5A BA	2 x 8-channel without value status	6ES7522-1BH10-0AA0

S7-1500/ET 200MP - Modules with isochronous mode

The following configurations rule out isochronous mode of the module:

- Module-internal shared input (MSI)
- Module-internal shared output (MSO)
- Submodules for shared device

Digital input module with isochronous mode

When operating the following digital input modules, make sure that the digital input modules have at least one of the following firmware versions (FW) or higher. Otherwise, you may experience a high jitter in the application.

- DI 16x24VDC HF (6ES7521-1BH00-0AB0):
For modules with functional status FS 03: FW V2.1.4
For modules with functional status FS 04: FW V2.2.0
- DI 32x24VDC HF (6ES7521-1BL00-0AB0):
For modules with functional status FS 03: FW V2.1.4

S7-1500/ET 200MP - Calibration of analog modules

Requirements: The module is integrated in the hardware catalog of STEP 7 (TIA Portal) (no GSD file).

The "Calibration" function (calibration in RUN) is only possible with the following configurations.

Module/module name	Configuration	Article no.:
AI 8xU/I/RTD/TC ST QI	1 x 8-channel with value status	6ES7531-7KF00-0AB0
AI 8xU/I/RTD/TC ST	1 x 8-channel without value status	
AI 8xU/I HS QI	1 x 8-channel with value status	6ES7531-7NF10-0AB0
AI 8xU/I HS	1 x 8-channel without value status	
AQ 8xU/I HS QI	1 x 8-channel with value status	6ES7532-5HF00-0AB0
AQ 8xU/I HS	1 x 8-channel without value status	
AQ 4xU/I ST QI	1 x 4-channel with value status	6ES7532-5HD00-0AB0
AQ 4xU/I ST	1 x 4-channel without value status	
AQ 4xU/I HF QI	1 x 4-channel with value status	6ES7532-5ND00-0AB0
AQ 4xU/I HF	1 x 4-channel without value status	
AI 4xU/I/RTD/TC/ AQ 2xU/I ST QI	1 x 6-channel with value status	6ES7534-7QE00-0AB0
AI 4xU/I/RTD/TC/ AQ 2xU/I ST	1 x 6-channel without value status	
AI 4xU/I/RTD/TC ST QI	1 x 4-channel with value status	6ES7531-7QD00-0AB0
AI 4xU/I/RTD/TC ST	1 x 4-channel without value status	
AQ 2xU/I ST QI	1 x 2-channel with value status	6ES7532-5NB00-0AB0
AQ 2xU/I ST	1 x 2-channel without value status	

S7-1500/ET 200MP - Technical specifications

Manual AI 8xU/I HS (6ES7531-7NF10-0AB0), Edition 12/2016

Manual AI 4xU/I/RTD/TC ST (6ES7531-7QD00-0AB0), Edition 09/2016

Manual AI 4xU/I/RTD/TC / AQ 2xU/I ST (6ES7534-7QE00-0AB0), Edition 09/2016

Contrary to the information given in the manuals, the following statements apply:

24 V encoder supply	
Short-circuit protection	Yes
Output current, max.	20 mA; max. 47 mA per channel for a duration < 10 s

The "encoder supply" depends on the module and is described in the technical specifications of the respective device manual. You can find the data sheet including daily updated technical specifications on the Internet (<https://support.industry.siemens.com/cs/ww/en/ps/td>). Enter the article number or the short designation of the desired module on the website.

S7-1500/ET 200MP - modules with switching cycle counter

The following modules have a switching cycle counter:

- Digital output module DQ 8x230VAC/5A ST Relay (6ES7522-5HF00-0AB0) with firmware version V2.1.0
- Digital output module DQ 16x230VAC/2A ST Relay (6ES7522-5HH00-0AB0) with firmware version V1.1.0

These modules are already integrated in the hardware catalog STEP 7 (TIA Portal) V16 and in the GSD file for PROFINET IO.

The modules with the "Switching cycle counter" function will, however, only be available at a later date.

OPC UA client-server connection via NAT router

Communication Function Manual, Edition 11/2019

If client and server are connected via NAT routers, this attempt to make a connection fails with the error message "BadCommunicationError" or "BadNotConnected".

Background: The IPv4 packets are manipulated by the router in NAT systems. As a result, either the source IP ("Source NAT") or the destination IP ("Destination NAT") of a packet is replaced by an IP address configured in the router (depending on the destination port). This process is transparent for client and server, i.e. these devices are not informed about this process.

The problem: The NAT router also has no way to replace the endpoint description returned by the server (this is the EndpointUrl), since this address information is located in the user data of "GetEndpointsResponse".

You can find a detailed description of the procedure in the following FAQ (<https://support.industry.siemens.com/cs/ww/en/view/109766709>).

CPU Firmware Version V2.6

No OPC UA client-server connection via NAT router possible.

Remedy as of CPU firmware version V2.8

Use the "ServerUri" attribute of the connection information ("SessionConnectInfo" parameter of the "OPC_UA_Connect" instruction).

Enter the complete ServerEndpointUrl with the IP address of the NAT router as "ServerUri". This ServerEndpointUrl is then used to establish the connection instead of the EndpointUrl returned in GetEndpointsResponse. If you leave the attribute empty, the behavior will be the same as in CPU firmware version V2.6.

When you use the connection parameter assignment for the OPC UA connection setup (create client interface), then you must open the client interface DB (*_Configuration[DBx]) after the parameter assignment and change the string in the "ServerUri" parameter. The entry is retained after compiling the OPC UA configuration.

Example of establishing a connection (address from ServerUri replaces address from GetEndpointsResponse)

Procedure: In the "ServerUri" parameter, enter the complete server address (ServerEndpointUrl), consisting of IP address, port and optional path. The IP address is the client-side IP address of the NAT router:

- 1) Open configuration DB

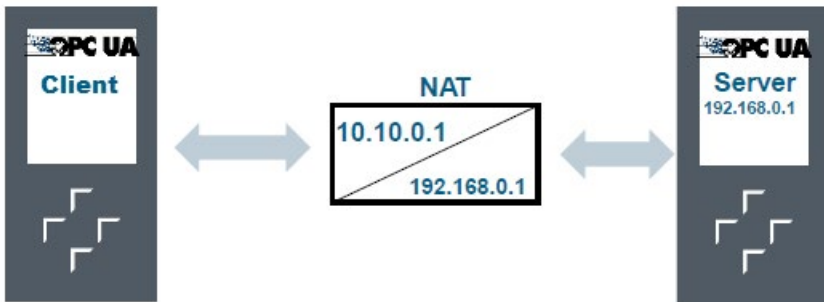


- 2) Change "ServerUri" parameter

myClientInterface_Configuration		
Name	Data type	Start value
Static		
Connection	Struct	
ConnectInfo	OPC_UA_SessionCo...	
SessionName	WString[64]	WSTRING#'OPC UA Connection_1'
ApplicationName	WString[64]	WSTRING#'myAppName'
SecurityMsgMode	UDInt	1
SecurityPolicy	UDInt	1
ServerUri	String[254]	'opc.tcp://10.10.0.1:4840/UA/DemoServer'

The connection is then established with the following steps:

- **GetEndpointsRequest:** The S7-1500 OPC UA client addresses the server via the destination address of the NAT router in the client subnet (10.10.0.1).
The NAT router converts the destination address into the IP address of the server (192.168.0.1) in the subnet of the server.
- **GetEndpointsResponse:** The server returns its EndpointUrl in "GetEndpointsResponse":
"opc.tcp://192.168.0.1:4840/UA/DemoServer".
This address cannot be reached directly by the client because it is located behind a NAT router.
- **OpenSecureChannel:**
The client does not take the EndpointUrl from the GetEndpointsResponse to open the secure channel. Instead, it takes the EndpointUrl from the "ServerUri" parameter:
"opc.tcp://10.10.0.1:4840/UA/DemoServer".
This IP address can be reached by the client; the data is routed from the NAT router to the IP address of the server.



Notes on S7-1500 Motion Control

Technology alarms 900-902

Contrary to the documented behavior, the received leading value is detected as invalid with technology alarms 900 and 901 as alarm response. Technology alarm 902 has no alarm response.

The technology alarms 900 and 901 are displayed in the diagnostics buffer.

No.	Response	Error bit	Warning bit	Restart	Diagnosis buffer	Alarm text
900	Set invalid leading value	X2	-	-	X	Invalid leading values.
901	Set invalid leading value	X2	-	-	X	Data transmission error.
902	No response	-	X2	-	-	Accuracy of leading value is limited.

You can acknowledge a technology alarm 900 with an "MC_Reset" job with "Restart" = FALSE. A restart is not required.

The technology alarm 900 is displayed with the following alarm text:

Alarm text	Solution
Invalid leading values.	<p>Set a higher tolerance time (<TO>.Parameter.ToleranceTimeExternalLeadingValueInvalid).</p> <p>Check the connection of the interconnected components. Make sure that there is no communication interference.</p> <p>Make sure that the CPUs involved are in RUN operating state.</p>

The technology alarm 901 is displayed with the following alarm text:

Alarm text	Solution
Data transmission error	
Invalid version	Check the communication.
Invalid modulo start value	
Invalid modulo length	
Sign-of-life error	
Invalid position	Check the leading value of the leading axis on the other CPU.
Invalid velocity	
Invalid acceleration	

Upgrading projects in TIA Portal version V16

Due to changes in the project storage format in TIA Portal version V16, a conversion of existing projects is necessary. Depending on the size of the project, a conversion can take a long time. The total duration of the conversion can take between several minutes to over an hour.

Behavior of the modulo cycle counter when homing with "MC_Home"

In contrast to the documented behavior, the modulo cycle counter responds during direct relative homing with "Mode" = 1, 12 and with absolute value encoder calibration (relative) with "Mode" = 6 as with direct absolute homing with "Mode" = 0. The counter values of the modulo cycles change during homing and the absolute encoder calibration with the listed modes as follows:

Action	Description
Absolute value calibration with "Mode" = 6	The modulo value is the shortest distance between the current and new position. Depending on the distance, the modulo cycle counter can remain the same, increase by 1 or decrease by 1.
Direct homing relative with "Mode" = 1, 12	The modulo value is the shortest distance between the current and new position. Depending on the distance, the modulo cycle counter can remain the same, increase by 1 or decrease by 1.

Use of the "DX_TEL_SyncOp" data type for cross-PLC synchronous operation

Output and input tags with the "DX_TEL_SyncOp" data type are created for the cross-PLC synchronous operation at the start address of the transfer area. If the data type "DX_TEL_SyncOp" cannot be assigned, it was deleted with the last compilation.

Unused data types are deleted during the compilation. To restore the "DX_TEL_SyncOp" data type, add a V5.0 technology object. After using the data type in the PLC tag, the technology object can be deleted again.

Manually configuring delay times on the leading axis and the virtual following axis

If you increase the delay time of the leading axis in the leading value settings, this results in a reduction of the extrapolation time at the leading axis proxy or to an increase of the interpolation time of the distributed leading value at the leading axis proxy. This reduces the error resulting from extrapolation in the acceleration and delay phases of the leading value.

If the delay time at the leading axis proxy is increased, this results in an increase of the extrapolation time or to a reduction of the interpolation time.

Calculation of the following error

The following error is the difference between the setpoint and actual position based on the connection of the axis at the drive. In contrast to the documented behavior, the transmission times of the setpoints from the controller to the drive and the position values from the drive to the controller are not part of the following error. The value of the following error is thus not the same as the difference between the setpoint available in the controller minus the existing actual position.

Performance of the user transformation with dynamic adaptation (S7-1500T)

With the Technology Version V5.0, longer runtimes of the MC-Interpolator [OB92] arise with the user transformation. With longer runtimes of the MC-Interpolator [OB92] the runtimes of the organization blocks with lower priority are extended.

The maximum bandwidth of the CPU is limited for records with kinematics trace (S7-1500T)

For violations of the maximum bandwidth, not all signals of a record can be recorded and evaluated with kinematics trace.

Consider the system limits of the CPU (maximum 16 signals)

For different objects, the following signals are required:

Object	Signals used
TCP and kinematics (depending on kinematics)	4-8
TCP (depending on kinematics)	2-4
OCS 1 (depending on kinematics)	2-6
OCS 2 (depending on kinematics)	2-6
OCS 3 (depending on kinematics)	2-6

Deactivate active signals under "Technology object > Kinematics trace > Configuration > Records".

Blending between path motions and synchronous "point-to-point" motions (sPTP motions) (S7-1500T)

When using blending from a path motion to an sPTP motion, there might not be any blending or the blending segment could be significantly shortened.

When using blending of path motions and sPTP motions, set the path dynamics as high as possible.

- Jerk
- Acceleration

Changing the override for synchronous "Point-to-point" motions (sPTP motion) (S7-1500T)

When changing the override, the path of the motion of the tool center point (TCP) can change an sPTP motion.

If the motion contour of the TCP is to be retained, proceed with kinematics with minimal change to the override.

Use of blending with kinematics motions (S7-1500T)

Dynamic overruns on the kinematics axes might occur during blending.

Use of the "MC_TrackConveyorBelt" Motion Control instruction with the technology version V5.0 (S7-1500T)

Use of the "MC_TrackConveyorBelt" Motion Control instruction is not possible with the technology version V5.0.

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