AXC F 2152 – CHANGE NOTES

Change notes for the AXC F 2152 controller

Application note
108427_en_24

1 General information

This document contains all changes made between firmware version 1.0.0 and the current firmware version of the AXC F 2152 controller (Order No. 2404267).

Current firmware version: 2021.6.0

Recommended:

To be able to use all new functions of a firmware version, always use all elements of the toolchain in the same version. The toolchain includes, for example, PLCnext Engineer, SDK and PLCnext CLI.

NOTE: Material damage due to a freezing of the outputs

With firmware versions 2019.6, 2019.3, or 2019.0 LTS, a high CPU load in conjunction with frequent PROFINET disconnections may cause the outputs of the Axioline local bus to freeze.

- Make sure to perform an update to firmware version **2019.0.4 LTS**, **2019.6.3** or **2019.9** or higher.

1.1 Maritime approvals

The following firmware versions are certified for use in maritime applications:

- 2021.0.3 LTS
- 2020.0.1 LTS
- 2020.0 LTS
- 2019.0.4 LTS
- 2019.0 LTS

Make sure you always use the latest documentation.
It can be downloaded at phoenixcontact.net/product/2404267.

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3 Changes in firmware version 2021.6.0

- To be able to use all new functions of the firmware, you need PLCnext Engineer version 2021.6.0 or newer.
  Select the latest template for firmware version 2021.6.0 in the PLCnext Engineer project.
- The versions “TLS v1.0/v1.1“ in the context of the web server are supported in this firmware version, but will be disabled in one of the future firmware versions. The deactivation may cause connection problems with old browsers. There are no effects on the TLS function block functionality.

3.1 New functions

WBM

- The WBM has been extended by a page to activate and deactivate “System Services“.
- It is now possible to edit the IP configuration via WBM. Therefore the former display page “Network Configuration“ has been renamed to “Network“ and was moved from the “Information“ to the “Configuration“ area. It depends on the user role whether the IP settings can be edited or only viewed.

SPNS

- Support of the left-alignable safety-related extension AXC F XT SPLC 1000 (order no. 1159811).

IEC 61131

- The data type WSTRING has been added for IEC 61131-3 applications programmed with PLCnext Engineer version 2021.3 (or newer). Correspondingly the data type StaticWString<> has been added in C++ as template class. This data type is supported by IEC Runtime, GDS, Data Logger, OPC UA Server and HMI.
- The new function block family UDP_SOCKET_2, UDP_SEND_2 and UDP_RECEIVE_2 supports sending of UDP broadcast datagrams.
  The new function block family TLS_SOCKET_2, TLS_SEND_2 and TLS_RECEIVE_2 supports programming a TCP/TLS server which can communicate with more than one TCP/TLS client at the same time. These function blocks can be used in combination with PLCnext Engineer versions newer than 2021.6.0.

GDS

The link ability between process data (Octet String) and variables of the user application was extended.

HMI

The PLC state “Force Mode“ is now displayed by the “DBG“ LED (debug LED) or a display flag. Besides debug states (e.g. triggered by breakpoints), the DBG LED (respectively its corresponding element on the touch screen display) now also shows when the variables are forced.

DataLogger

- The DataLogger has been extended: By specifying the name of an ESM task, the values of all configured variables will be sampled within this task. This concerns resource-global variables and component ports as well as variables instantiated within a program associated to any ESM task.
- The DataLogger supports the configuration for triggered data logging.

System

The binding of licences for certain extension functionalities is now also possible in connection with an inserted SD card with corresponding license. This works exclusively with the following SD cards:

- SD FLASH 8GB PLCNEXT MEMORY LIC (order no. 1151112)
- SD FLASH 32GB PLCNEXT MEMORY LIC (order no. 1151111)

PLCnext Store

PLCnext Store and app installation improvements:

- The installation of apps without reboot is supported.
- Apps can be downloaded with improved speed.

3.2 Changes

System

- Linux kernel was updated to version 5.4 LTS.
- “Paho“ libraries were updated to the following versions:
  - paho-mqtt-c: 1.3.8
  - paho-mqtt-cpp: 1.2.0
- The PLC project download performance was improved.
- When setting the IP address, subnet mask or gateway, the value “255.255.255.255“ is now rejected as invalid. Previously the firmware did not boot (a reset to default setting type 1 was required.)

3.3 Error corrections

The following errors have been rectified:

GDS/RSC

During the implementation of WSTRING, the behavior of the IGdsDataAccess service has been changed with regards to writing a value to a variable or port of data type STRING or StaticString<>. If in previous firmware versions the value was longer than the capacity of the variable/port, only as much bytes as provided by the variable have been copied. Additionally a warning message has been written to the Output.log file.
With firmware 2021.6 in this case the service method returns DataAccessError::StringLengthExceeds, no bytes are copied, and no warning message is emitted. The same handling has been implemented for data type WSTRING.

WBM

- A difference in the network configuration was not detected and displayed in the WBM if, for example, a change was made by a “DCP“ configuration via network.
- The representation of hex values in the WBM was partially inconsistent.
- After an update from firmware versions 2020.6.x and older to firmware versions 2021.0.x, it was possible that the adopted WBM certificate could not be changed afterwards. A reset to default setting type 1 was necessary to be able to change the certificate.
- When setting a new user password in WBM, an erroneous error message occurred if the new password was entered first in the field “Confirm Password“ and then in “New Password“.
- In the text field “Tip of the day“ inconsistent use of punctuation marks occurred.
- In the text field “Edit System Use Notification“ there was an inconsistent display of previously saved characters when editing again.

IEC 61131

- If an application was stopped by a breakpoint, the fieldbus process data could queue for one cycle when stepping on.
- The IEC 61131 runtime system could enter an undefined error state when downloading a PLC project that happened to use the same type names that were already used internally. This caused ambiguities. This applied, for example, to program/task/instance or function block names.
- In firmware versions 2021.0.x it could happen that after an update of older firmware versions the error message “Task 'Globals' already defined.“ could occur when restarting the existing boot project. As a result, the project could not start properly due to an incompatible ESM configuration.
- In connection with a PLC project which uses almost the entire number of possible retain variables, a PLC task watchdog could sporadically occur after a restart of the controller.
- The controller went into the FAIL state after frequent cold starts of the PLC project. Before each call of the OPC UA server, a warning from the root is displayed: “Enumerator: Too many open files“. After that a “CRITICAL“ log from the OPC UA server is displayed.

PROFINET

- An incompatibility of Engineer apps with the possibility to switch off PROFINET controller/device was fixed. Inconsistency errors occurred when trying to switch off the PROFINET device only.
- When shutting down the system, internal thread exceptions could sporadically occur when terminating the process. This could cause the system to stop responding.

Network

In case the “dhcp“ option was configured in the “interfaces“ configuration file, it could happen that the manual “DHCP Gateway“ setting was overwritten.

SDK/C++

It was not possible for the “StaticString“ class to completely empty the contained pre-initialized “CHAR“ array. With firmware 2021.6 the methods Clear() and IsEmpty() have been added.

System

- Starting with firmware versions 2020.9.x, numerous unhelpful logging outputs of the “rngd daemon“ could occur in the log file “/var/log/debug“. This led to very large logging files.
- During the system startup, the PLCManager loads the projects and checks whether a system watchdog has occurred before the controller is started. If C++ programs or components are part of the project, their constructors are executed during the loading process of the PLC project. If the project was reloaded after a system watchdog has occurred, this could lead to repeated crashes and restarts that result in an endless loop.

- After setting PROFINET device diagnosis (SF LED on) the SF LED remained on, even if the diagnostic event was already completed and no longer pending.
- When restarting the controller, some informative messages were erroneously written to the log as type “ERROR“.
- After activating the MRP function, it was not shown as activated when reading back the status. After restarting the controller it was deactivated again.

PROFICLOUD

- In case the PLC lost the connection to the internet, the link to Proficloud.io was not being re-established automatically. To return to online mode with proficloud.io, the PLC required a reboot or a restart of the ProficloudV3 services via WBM.
- If the connection to the Internet was lost, the WBM page of ProficloudV3 could not be accessed as long as the Internet connection remains lost.
- When writing log messages too quickly one after the other, it could happen that not all log messages were displayed in the cloud or some had the same timestamp.
- When a large number of data points could not be sent due to a network link failure, stopping of the TSD service was severely delayed.
- Sending significantly more than 50 configured data points could take an unexpectedly long time. With firmware 2021.6 the performance has been improved so that one PLC can send the values of up to 300 variables to the Proficloud.

OPC UA

- When an OPC UA client tried to call a function without required arguments, the PLC crashed.
- If an OPC UA client tried to browse an array of struct with children of kind array of primitive types where the index is out of range, the PLC could crash.
- Certain changes to security policies were applied only after a restart.

DataLogger

- During data logging in connection with the display of HMI data trend it could happen that memory was not released again.
- A “Download changes“ command of the PLC project did not work if a “Rocks DB“ session (HMI trending) of the DataLogger was active at the same time.

ESM

- Sporadically it could happen that a higher priority task together with a lower priority task on the same ESM core had a startup delay that should not have happened according to the priority.
- Sporadically, it could happen that when starting the PLC project, the task runtime was extended during the first cycle.

3.4 Known limitations and errors

The known limitations and errors can also be found in the PLCnext Info Center at:

https://www.plcnext.help/te/Known_issues.htm

Here you will find a constantly updated overview of all known issues.

- Retain variables
  - If a requested warm start is not possible to execute via PLCnext Engineer, an implicit cold start is automatically executed. The retain variables are set to their initialization value.
  - After a system watchdog, only a cold start can be performed when the controller is started. The retain variables are set to their respective initialization values.
    From firmware 2021.0 LTS and newer a dedicated state of the retain values can be restored from a backup.
  - If firmware version 2020.0 LTS or later is downgraded to 2019.9 or older and then upgraded again to firmware version 2020.0 LTS or later, a cold start is performed. The retain variables are set to their initialization value.
- EthernetIP
  If the firewall is activated via WBM, the operation of EthernetIP is no longer possible.
  This can be remedied by subsequently activating the ports:
  - Incoming connections: **port 44818**
  - Outgoing connection: **port 2222**
- PLCnext CLI version
  The PLCnext CLI version used must match the current SDK for this version. Downward compatibility cannot be guaranteed.
- Firmware downgrade
  After downgrading the firmware, it is recommended to reset to „Default setting type 1“. This is not necessary when updating the firmware.

- WBM error message
  If the PLCnext system firmware has not started up properly, the WBM displays the error message "Bad Gateway 502".
- Task name
  If "Event", "EventTask", "ServiceTask" or "Globals" is used as the name of a task, an error condition of the controller occurs when the project is downloaded. It occurs because these names are already used internally as class name.
- DHCP
  DHCP can only be switched on for Ethernet adapters that are not assigned as PROFINET controllers or PROFINET devices. To make the settings effective in the network, the device must be restarted.
- Variables
  The content of the variables „ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT" and „ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL" is permanently set to 0.
- Error during program download
  During a PLCnext Engineer program download (both total and changes), the web server returns an error 503 (busy) for requests to the HMI pages.
- DataLogger
  If two or more DataLogger sessions are configured to write to the same database, only the data of one session will be transferred to the database on the SD card at the end. The user does not receive a message that not all data can be saved.
- Retain data
  Using the maximum quantity structures of the retain data can increase the task duration of the using task. This can trigger a task watchdog for time-critical applications.
- STRING variables
  Access to long STRING variables outside the application is limited to 511 bytes. This concerns reading and writing via the RSC services „IDataAccessService" and „ISubscriptionService". These services are used by OPC UA, PLCnext Engineer HMI and the online functions of PLCnext Engineer, among others.

  From firmware version 2021.6: The same applies for WSTRING variables. Please note that WSTRING variables are converted to UTF8 when accessed via RSC services.
- "Download Changes"
  Sporadically a PLCnext Engineer project may reject „Download changes" without giving a reason.
- Restart after app installation
  Sporadically it can happen that a restart of the firmware requested by an app installation does not work properly. If the firmware does not start up correctly, the controller can be restarted by one of the following 3 possible actions:
  - Restart of the firmware via SSH (/etc/init.d/plcnext restart)
  - Reboot of the controller via SSH
  - Power reset of the controller
- Local time zone setting
  Setting local time zones is not fully supported.
- "Link" and "Active" LEDs
  The "Link" and "Active" LEDs on the network interfaces "X1" and "X2" are not active when a "10BaseT" connection is used.
- PROFINET cycle time
  The use of a PROFINET cycle time of 1 ms leads to a deviation of the jitter behavior required by the controller certification.
  Operation in this state is possible, but not recommended.
- Language standard C++ 17
  With the SDK version 2021.6 the language standard C++ 17 has been set in the compiler options ("-std=c++17"). The firmware itself is also compiled with this option set. Besides some general C++ issues related to this C++17 standard, the following issue is related to PLCnext:
  C++ 17 introduces the data type "std::byte" which is unfortunately not compatible with "Arp::byte". Therefore, if the namespaces "std" and "Arp" are both active the compilation results in an error. In this case existing C++ sources have to be adjusted so that they explicitly use "Arp::byte" (e.g. by adding "using byte = Arp::byte;").
- Communication errors
  Sporadic communication errors may occur between PLCnext Engineer and the controller. A reboot of the controller solves the problem.
- Unexpected behavior using the Select() method
  The Select() method of the classes Arp::System::Commons::Ipc::IpcSocket, Arp::System::Commons::Net::Socket
  and Arp::System::Commons::Net::TlsSocket returns true, when the socket is shut down. Compared to BSD sockets, this behavior is unexpected. As this is a legacy method it is now remarked as deprecated. In future, additionally a new method Poll() will be implemented.

– System crash caused by user components
  If a user component causes a crash before the system watchdog is activated, the firmware terminates and the controller is available via SSH only.
  Note: The system watchdog is activated just before the IControllerComponent::Start() method is invoked.

3.5 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

– https://nvd.nist.gov/vuln
– https://cert.vde.com

Information on the Phoenix Contact “PSIRT“ can be found at: https://www.phoenixcontact.com/psirt

SSL

– CVE-2020-1971
– CVE-2021-3449
– CVE-2021-3450
– When updating the OpenSSL version from 1.1.1i to 1.1.1k in firmware version 2021.0.5, the “scrypt“ function for generating hash values was no longer supported.

RAUC

– CVE-2020-25860

HTTP

– A DoS attack on port 80 using HTTP frames could lead to a real-time impact on the PLC runtime.
– CVE-2021-23017

WBM

– A XSS attack was reflected in a JSON response. This might leave content consumers vulnerable to attacks if they do not appropriately handle the data (response).
– A string entered in “Edit System Use Notification“ could be executed on the login page of the controller.
– Cross-site scripting (XSS) exploitation could occur when setting the certificate for the Identity Store.

System

– The “execute bit“ of the PLCnext log files (and database files) was mistakenly set.
– When starting the operating system (or the “rngd“-service), the CPU usage consistently spiked to 100% for several seconds.
– CVE-2021-3156
– CVE-2020-8492

4 Changes in firmware version 2021.0.5 LTS

To be able to use all new functions of the firmware, you need PLCnext Engineer version 2021.0.2 LTS or newer.

Select the latest template for firmware version 2021.0.0 LTS in the PLCnext Engineer project.

4.1 Changes

System

"Paho" libraries were updated to the following versions:

– paho-mqtt-c: 1.3.8
– paho-mqtt-cpp: 1.2.0

4.2 Error corrections

The following errors have been rectified:

System

An unusually high amount of logging entries in the log file /var/volatile/log/auth.log could cause the system to crash after some time.

GDS

Firmware version 2021.0 LTS rejected a GDS connection between a port variable of a C++ component and a port variable of a program instance. As a consequence the program did not start.

PLCnext Store

– During offline installation of licenses a reboot is recommended. If this reboot has been performed by switching off the power, the license files on the controller could be lost.
– If a controller has been updated from a firmware version older than 2020.3 to a firmware version 2020.3 or newer, the folder /opt/plcnext/config in the overlay partition sporadically got wrong access rights. As a consequence it was not possible to install licenses. In the past, a reset to "Default setting type 1" had to be performed as workaround. Firmware version 2021.0.5 LTS corrects the access rights.

ESM

With firmware version 2021.0 LTS the execution of tasks sporadically did not obey the task priorities, when a code worksheet was displayed in the online mode of PLCnext Engineer.

DataLogger

During the writing of large databases and simultaneous unexpected system restart due to a voltage interruption or a system watchdog, an invalid state of the database could occur. As a result, the system could not restart properly afterwards.

4.3 Known limitations and errors

– The app "MQTT_Client_Library" version 2 (Build 20210205), which is available in the PLCnext Store, is not compatible with firmware version 2021.0.5 and will cause a system watchdog which reboots the controller. Please contact the contributor of the app (PLCnext Store) for any questions and potential fixes.
– In addition, the known errors and limitations from firmware version 2021.0.2 LTS also exist in this firmware version.
See section 6.3 "Known limitations and errors" on page 9.

4.4 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

– https://nvd.nist.gov/vuln
– https://cert.vde.com

Information on the Phoenix Contact "PSIRT" can be found at: https://www.phoenixcontact.com/psirt

SSL

– CVE-2021-3449
– CVE-2021-3450

RAUC

– CVE-2020-25860

5 Changes in firmware version 2021.0.3 LTS

All changes described in section 6 “Changes in firmware version 2021.0.2 LTS” on page 9 are also valid for this firmware version.

5.1 Error corrections

The following errors have been rectified:

System

The bug fixing of firmware version 2021.0.2 LTS concerning the logging of information into files located at „tmpFS“ has been reworked. As of firmware version 2021.0.3 LTS the following applies:

Logging information into files located at „tmpFS“ occupied too much RAM. Consequently the System Watchdog re-started the controller. Now the following files are regularly checked:

- /var/log/debug
- /var/log/error
- /var/log/messages
- /var/log/syslog
- /var/log/auth.log
- /var/log/kern.log
- /var/log/user.log
- /var/log/cron.log
- /var/log/btmp
- /var/log/wtmp

If one of the files is too large, it will be moved to the backup. The backups are located in the same folder and „.1“ is appended to the backup file name. This will overwrite existing backups.

6 Changes in firmware version 2021.0.2 LTS

To be able to use all new functions of the firmware, you need PLCnext Engineer version 2021.0.2 LTS or newer.

Select the latest template for firmware version 2021.0.0 LTS in the PLCnext Engineer project.

6.1 New functions

PROFINET

- PROFINET controller certification according to PROFINET specification version 2.4.1 and Net Load Class II.
- PROFINET device certification according to PROFINET specification version 2.4.1 and Net Load Class II.

6.2 Error corrections

The following errors have been rectified:

PROFINET

- After a restart of the device by voltage reset it could happen that the PROFINET controller could not establish a connection to all PROFINET devices.
  This occurred when connecting with large numbers of PROFINET devices.
- Minor problems were solved, which occurred when a superseded PROFINET controller requested to check the MRP configuration of the PROFINET device.
- Minor problems in the representation of device specific information via LLDP were solved.
- Sporadic link problems were solved that occurred with a PROFINET device which only offers 100 Mbit full-duplex/half-duplex.
- In combination with AXC F XT ETH 1 TX:
  If autonegotiation of remote devices is deactivated, the default speed option of the interface is 100 Mbit half-duplex.
  In that case an existing PROFINET connection has not been aborted.

System

- Logging information into files located at „tempFS“ occupied too much RAM. Consequently the System Watchdog restarted the controller.
  Now the following files are regularly checked:
  - /var/log/debug
  - /var/log/error
  - /var/log/messages
  - /var/log/syslog
  - /var/log/auth.log
  - /var/log/kern.log
  - /var/log/user.log

  If one of the files is too large it will be moved to the backup. This will overwrite existing backups.
- With firmware version 2021.0 LTS a reset to „Default setting type 1“ was not possible when executed by pressing the reset button of the controller.

SDK/C++

The SDK related to firmware version 2021.0 LTS redefines the „std::make_unique“ function, thus creating a conflict when compiling existing code.
Use the SDK related to firmware version 2021.0.2 LTS instead.

Network

- In case the „dhcp“ option was configured in the „interfaces“ configuration file, it could happen that the manual „DHCP Gateway“ setting was overwritten.
- The Ethernet connection froze after a few minutes when the controller is connected to another port that is configured to 100 Mbit full-duplex without autonegotiation.

6.3 Known limitations and errors

- Firmware update
  The firmware update removes the following files so that the contents are lost:
  - /opt/plcnext/projects/Default/Plc/Eclr/Default.eclr.config
  - /opt/plcnext/projects/Default/Plc/Gds/Default.gds.config
  - /opt/plcnext/projects/Default/Plc/Meta/Default.meta.config
  - /opt/plcnext/projects/Default/Plc/Plm/Plm.config
  - /opt/plcnext/projects/Default/Plc/Esm/Default.esm.config
  - /opt/plcnext/projects/Default/Plc/Esm/ServiceTask.esm.config
  - /opt/plcnext/projects/Default/Plc/Esm/Globals.esm.config

  These files are not edited by PLCnext Engineer nor are they intended to be modified by the user.
- In addition, the known errors and limitations from firmware version 2021.0 LTS also exist in this firmware version.
  See section 7.3 “Known limitations and errors” on page 14.

6.4 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

– https://nvd.nist.gov/vuln

– https://cert.vde.com

Information on the Phoenix Contact “PSIRT“ can be found at: https://www.phoenixcontact.com/psirt

SSL

– CVE-2020-1971

SNMP

– The SNMP “Get” call of “OID .1.3.6.1.2.1.2.2.1.6.0” for network interface used as PROFINET controller or device caused the firmware to crash.

7 Changes in firmware version 2021.0 LTS

To be able to use all new functions of the firmware, you need PLCnext Engineer version 2021.0 LTS.

Select the latest template for firmware version 2021.0 LTS in the PLCnext Engineer project.

7.1 New functions

Articles

With this firmware version the following articles are supported for the first time:

– AXC F XT EXP (Order No. 1139999)

IEC 61131

– Backup and restore of GDS retain variables is supported.
– The priority of the Linux thread representing an ESM task of type „IDLE“ has been increased. It is now just below the lowest ESM priority (15). This results in less jitter and faster execution of the associated program instances due to less interruptions.
As a consequence the IDLE task can now interrupt the „Globals“ task which updates system variables and IEC 61131-3 resource global variables that are connected with I/O. To prevent this Phoenix Contact recommends to select appropriate „update tasks“ in the PLCnext Engineer project.

WBM

– Security related product information is available via links in the „Help“ menu in the header of the WBM and in the „Tip of the day“ section on the start page.
– IO-Link diagnostic information is available in the Axioline tree view on the „Local Bus“ page.
– The „System Use Notification“ can be edited on the „User Authentication“ page in the „Security“ area.
– The „System Use Notification“ is displayed when logging in to WBM or PLCnext Engineer.
– The HTTPS certificate can be configured on the „Web Services“ page to avoid browser security warnings.

PROFINET

The PROFINET controller and device can be enabled and disabled separately via configuration file.

Proficloud

„Proficloud V3 TSD service“ is supported and replaces the „Proficloud TSD service“. Hereby the change from „www.proficloud.net“ to „www.proficloud.io“ is necessary.

OPC UA

The following topics apply to projects created with PLCnext Engineer 2021.0 LTS for a controller of firmware 2021.0 LTS:

– The new security policies „AES 128 SHA256 RSA OAEP“ and „AES 256 SHA256 RSA PSS“ are supported. These policies can be selected in the OPC UA configuration.
– When the UA server checks the certificate of the connecting client, the „ApplicationURI“ from the client's „ApplicationDescription“ has to match to the „SubjectAlternateURI“ in the client's certificate. This check is performed by default for new projects as well as when an older controller is replaced by a controller of firmware 2021.0 LTS in the PLCnext Engineer project. If necessary the check can be suppressed by deactivating the „Check application URI against client certificate“ checkbox in the OPC UA configuration in PLCnext Engineer.
– When the UA server is configured to use a „self-signed“ certificate, the trust store „OpcUA-configurable“ is used. The client certificate is checked against the Trust List and the Certificate Revocation List is applied. This applies to new projects as well as when an older controller is replaced by a controller of firmware 2021.0 LTS in the PLCnext Engineer project. Previous versions used the trust store „Empty“ as default and no client authentication was applied. If necessary the former default can be applied by deactivating the „Use the truststore for client authentication“ checkbox in the OPC UA configuration in PLCnext Engineer.
– The „SubscriptionKind“ can now be selected in the OPC UA configuration in PLCnext Engineer. The options „Direct Read“, „High Performance“ and „Real Time“ are available. „Direct Read“ is set as default for new projects as when an older controller is replaced by a controller of firmware 2021.0 LTS in the PLCnext Engineer project.
The previous default „Real Time“ can be selected if required.

PLCnext Store

Multiple controller types are supported in the app extension („app_info.json“).
During the installation of the app, the extension checks if the version of the app is suitable for the controller used.

HMI

– Trending data services in interaction with the PLCnext Engineer HMI trending functionality are supported.
– Multiple project languages in interaction with PLCnext Engineer HMI language settings are supported.

Docker

For Docker support a possible co-existence of „iptables“ and „nftables“ is useful. Therefore the default firewall configuration has been adjusted.
The names of the following tables and chains have been changed:

Old name	New name
FILTER	**plcnext_filter**
input	**plcnext_input**
output	**plcnext_output**
basic_filter	**plcnext_basic_filter**
user_input	**plcnext_user_input**
user_output	**plcnext_user_output**

For compatibility with existing firewall configurations, the new settings also contain the old names as „deprecated-Name“.

IO-Link

The IO-Link system integration refers to all types of IO-Link master modules from Phoenix Contact which can be driven by the PLCnext controllers via PROFINET or Axioline:
  – AXL F IOL8 2H (Order No. 1027843)
  – AXL SE IOL4 (Order No. 1088132)
  – AXL F IOL8 2H (Order No. 1027843)
  – AXL SE IOL4 (Order No. 1088132)
  – AXL E PN IOL8 DI4 M12 6M (Order No. 2701519)
  – AXL E PN IOL8 DI4 M12 6P (Order No. 2701513)
  – IOL MA8 PN DI8 (Order No. 1072838)

Note: A support by PLCnext Engineer is planned for version 2021.3.

7.2 Error corrections

The following errors have been rectified:

WBM

– When displaying the network settings, an empty page could be displayed if a parameter could not be read. Now the page is displayed completely and affected parameters are shown as „N/A“.
– When adding a new user in the user administration, the entered password was not deleted if the process was cancelled with „Cancel“.
– When using the Internet Explorer for LDAP configuration, a new LDAP server entry could not be created successfully.
– Spelling mistakes in various messages of the WBM have been corrected.
– If an INTERBUS peripheral error occurred that was resolved and acknowledged by the application, the „Local Bus (Interbus)“ page was not reset and the error was still displayed.
– After downloading a PLC project, the name of the project was not immediately displayed in the WBM. The page had to be refreshed in the browser by the user.
– Conflicting error messages occurred when entering invalid characters on the „Certificate Authentication“ page.

IEC 61131

– The system could sporadically crash during the „Write and Start Project Changes“ process if the PLCnext Engineer HMI component was reading variables at the same time. This fix has the following effects on the „Write and Start Project Changes“ process:
  – GDS: Services respond with status „CurrentlyUnavailable“
  – OPC UA: It is not possible to update values and browse variables
  – PLCnext Engineer HMI: Use replacement value „0“
– Exceptions in connection with managed C# code used in the PLC project were not handled correctly. This could cause the IEC 61131 runtime to stop responding.
  Now the exception is shown/listed including the call stack.
– An unexpected PLC task watchdog could occur in a low-priority task with a very long cycle time in connection with cold, warm and hot restart.
– When reading the eCLR error catalog with PLCnext Engineer, the firmware of the standard controller (SIGSEGV) could sporadically crash. This subsequently raised a software watchdog.

- After starting the PLC project, the system variables for the system time were only maintained with a delay. As a result, the value „0“ was displayed for several cycles.
- PROFINET plug alarms could not be reported via the function block „RECV_ALARM“.
- The cyclical call of the function block „AR_STATISTIC“ led to a very high system load up to the sporadic reduction of the PROFINET communication.
- When executing the function blocks „RDREC“ and „WRREC“ in fast succession, it could happen that the corresponding PROFINET AR was removed and the function blocks could not process any further services. Corresponding error messages were issued.

PROFINET

- Under various project conditions, PROFINET performance could deteriorate or unexpected connection failures could occur.
  Extensive PROFINET performance optimizations have been made to eliminate this behavior.
- When reading the PROFINET device of the controller via PLCnext Engineer, it could happen that the matching module „I/O 512“ could not be determined.
- The system variable „PNIO_CONFIG_STATUS“ did not match the documented behavior. The corrected behavior now shows the value 3 after a successful connection setup. Bit 0 (Ready) and Bit 1 (Active) are set.
- No more DCP or DCERPC frames were sent after changing the local date or time of the controller. As a result, PROFINET could not function properly.
- The PROFINET controller performance was improved.

RSC

The RSC service „Write DeviceSettings“ with the parameter „Rtc.Date“ had not considered leap years and had rejected corresponding settings with „OutOfRange“.

System

- When restarting the PLCnext firmware after a software reset, an exception could occur very sporadically. This meant that the firmware could not be started properly.
- Sporadically it could happen that a remoting based communication (such as that of PLCnext Engineer) could not be established if connection requests were already sent to the controller during the boot phase.
- During the reboot of the controller a system watchdog could occur very sporadically. Especially when triggering the reboot via SSH terminal the current retain data of the PLC project could be lost.
- An SD card that was removed during operation triggered a stop of the PLC project, although the support of an external SD card was deactivated in the WBM configuration.
- The status LED on the device was blinking with the wrong frequency in case of a removed external SD card. It has been corrected according to the description.
- Reading „Status.Memory.Usage.Percent“ via RSC interface was only possible with the user role „Admin“.
- If an app with temporary data was installed but not started and then the controller was restarted, the folder previously created for the app was deleted. As a result, the app could not access the folder after starting.
- The cold start event task was no longer executed during a cold start of the PLC project if a change was previously made that caused a cold start (e.g. change of project name).
- The basic CPU usage of the system was improved.
- The default text of the „System Use Notification“ was improved. The “System Use Notification“ is displayed when logging in to the controller (e.g. WBM or PLCnext Engineer).
- The file name of the firmware update container was changed.
  Now the complete firmware version is considered.

OPC UA

- With certain method calls the status „Bad“ of the OPC UA server could occur during download changes of the PLC project.
- Due to an unfavorable startup sequence of the OPC UA component it could happen that certain alarms could not be detected in time.
- Browsing from a node to a child node and back did not work.
- When a value which shall be written to a STRING variable exceeds the maximum length of this variable, then writing is rejected with the error code „Bad_OutOfRange“.
  In previous versions the UA server truncated the value to the maximum length of the variable.

7.3 Known limitations and errors

- Retain variables
  - If a requested warm start is not possible to execute via PLCnext Engineer, an implicit cold start is automatically executed. The retain variables are set to their initialization value.
  - After a system watchdog, only a cold start can be performed when the controller is started. The retain variables are set to their respective initialization values.
    From firmware 2021.0 LTS a dedicated state of the retain values can be restored from a backup.
- Retain handling
  With extended retain handling in the context of this firmware, the retain variables are reinitialized by a cold start when downgrading to firmware 2020.3 or older. A previous saving of the retain variables by the user is not supported with firmware 2020.6 and older.
- Retain variable behavior in case of firmware downgrade
  If firmware 2020.0 LTS or later is downgraded to 2019.9 or older and then upgraded again to firmware version 2020.0 LTS or later, a cold start is performed. The retain variables are set to their initialization value.
- PLCnext CLI version
  The PLCnext CLI version used must match the current SDK for this version. Downward compatibility cannot be guaranteed.
- EthernetIP
  If the firewall is activated via WBM, the operation of EthernetIP is no longer possible.
  This can be remedied by subsequently activating the ports:
  - Incoming connections: **port 44818**
  - Outgoing connection: **port 2222**
- Firmware downgrade
  After downgrading the firmware, it is recommended to reset to „Default setting type 1“. This is not necessary when updating the firmware.
- PROFINET PRL support
  Firmware version 2021.0.0 LTS is the last version which supports PROFINET PRL (Phoenix Redundancy Layer).
  Future versions will no longer support this feature.
- Firmware startup
  If the PLCnext system firmware has not started up properly, the WBM displays the error message „Bad Gateway 502“.
- Task name
  If „Event“, „EventTask“ or „Globals“ is used as the name of a task, an error condition of the controller occurs when the project is downloaded.
  This is because „Event“, „EventTask“ and „Globals“ are already used internally as class name.
- DHCP
  DHCP can only be switched on for Ethernet adapters that are not assigned as PROFINET controllers or PROFINET devices. To make the settings effective in the network, the device must be restarted.
- Variables
  The content of the variables „ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT“ and „ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL“ is permanently set to 0.
- HMI pages during program downloads
  During a PLCnext Engineer program download (both total and changes), the web server returns an error 503 (busy) for requests to the HMI pages.
- Multiple DataLogger Sessions
  If two or more DataLogger sessions are configured to write to the same database, only the data of one session will be transferred to the database on the SD card at the end. The user does not receive a message that not all data can be saved.
- Retain data
  Using the maximum quantity structures of the retain data can increase the task duration of the using task. This can trigger a task watchdog for time-critical applications.
- Crash during startup phase
  The system watchdog is not yet active during the startup phase if you start C++ extensions very early. If the user code causes a crash during this phase, this can lead to an endless boot loop.
  You can solve the problem by removing the SD card before rebooting.
- STRING variables
  Access to long STRING variables outside the application is limited to 511 bytes. This concerns reading and writing via the RSC services „IDataAccessService“ and „ISubScriptionService“. These services are used by OPC UA, PLCnext Engineer HMI and the online functions of PLCnext Engineer, among others.
- „Download Changes“
  Sporadically a PLCnext Engineer project may reject „Download changes“ without giving a reason.
- Uninstalling Solution Apps
  When a Solution App is uninstalled by the PLCnext Store, it can happen that the controller then no longer reacts to any actions by the PLCnext Store, al-

though it reports the status „online“. A system watchdog was also sporadically observed. This behavior has not been observed when using the offline deactivation in the WBM for uninstalling a solution app.

– LAN gateway settings
  AXC F 2152 in combination with AXC F XT ETH 1TX extension module: If there are several „Default Gateway“ settings, only the setting of the first network interface is applied. The settings of other LAN adapters are ignored. Only one „standard gateway“ is supported internally.
– Local time zone setting
  Setting local time zones is not fully supported.
– „DBG“ LED
  The „DBG“ LED should signal if a variable has been set via forcing in debug mode in the PLC project.
  This behavior is currently not supported. Despite forcing the variable, the „DBG“ LED remains off.
– „Link“ and „Active“ LEDs
  The „Link“ and „Active“ LEDs on the network interfaces „X1“ and „X2“ are not active when a „10BaseT“ connection is used.
– PROFINET cycle time
  The use of a PROFINET cycle time of 1 ms leads to a deviation of the jitter behavior required by the controller certification.
  Operation in this state is possible, but not recommended.

7.4 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

– https://nvd.nist.gov/vuln
– https://cert.vde.com

Information on the Phoenix Contact “PSIRT“ can be found at: https://www.phoenixcontact.com/psirt

WBM

– CVE-2020-12517

System

– CVE-2020-12518

Shell

– CVE-2020-12519

LLDP

– CVE-2020-12521

8 Changes in firmware version 2020.6.1

To be able to use all new functions of the firmware, you need PLCnext Engineer version 2020.6.

Select the latest template for firmware version 2020.6.1 in the PLCnext Engineer project.

8.1 New functions

WBM

The connection to existing LDAP(S) servers can be configured in WBM.

GDS

Enhanced Retain Handling:

When changes to retain variables are transferred to the controller via „Download All“, no implicit cold start is performed. As many retain values as possible are retained. This behavior of the retain variables corresponds to the „Download Changes“ behavior, where all variables are retained even if the project is changed at runtime.

To avoid data inconsistencies with retain variables, the retain variables are always initialized by an implicit cold start after a project change (project name). In the previous firmware versions a warm start was only carried out if the retain variables were exactly the same.

IEC 61131

- Improvement of jitter and latency for programs with IEC 61131 or C# context..
- New system variable „USER_PARTITION“ to display the load of the user partition with the following elements:
  - MEM_TOTAL
  - MEM_FREE
  - MEM_USED
  - MEM_USAGE

PROFINET

Support of Fast Startup (FSU) by the PROFINET controller (up to 16 FSU devices).

OPC UA

- User comments on the confirmation and acknowledgement of alarms via OPC UA are supported. The comments are also entered in the „Notification Logger“.
- Basic support for loading new user-specific information models into the OPC UA server.

DataLogger

New RSC-API „IDataLoggerService2“ for application of the DataLogger. The triggered logic analysis in PLCnext Engineer is based on this API.

Network

Support of a DHCP basic functionality for IP address allocation.

SDK/C++

The GCC compiler has been updated from version 8.3 to version 9.3. All newly created applications are now compiled on this basis.

PROFICLOUD

PROFICLOUD V3 basic support (firmware update from the cloud).

8.2 Error corrections

The following errors have been rectified:

WBM

- The call of WBM pages could sporadically lead to a PROFINET connection termination.
- When configuring new firewall rules in WBM, not all available network interfaces were displayed.
- There was no character limitation when entering user or password. After 64 or 128 bytes the input string was cut off without error message.
- A notification field of a message was displaced in the „Notifications“ menu when switching languages.
- Certain UTF-8 special characters could not be entered in the „Username“ input field in the „User Authentication“ menu.
  An empty error message was displayed.
- In the „Certificate Authentication“ menu, the key type „RSA TPM 2048“ was displayed in the „Add Identity Store“ entry by mistake.

IEC 61131

- A „Fatal Exception“ could occur if the project was to be restarted after debugging the project while following a certain procedure.
- If a PLCnext Extension component (ACF or PLM) or a PLCnext Engineer Shared Native Library was to be linked against a non-existent „shared object library“, a crash could occur.
- From this version on, the block „RTC_S“ returns the local time, provided a time zone with root rights has been set before.
  In previous versions, the UTC time was always returned.

DataLogger

- The project could not be loaded if an exception was thrown due to too many configured variables in a DataLogger session.
  In this case the notification „Arp.Services.DataLogger.Error“ is now displayed. The project is loaded without starting the incorrectly configured DataLogger session.
- The firmware could not be accessed if the parameter „maxFileSize“ was too large during a DataLogger session that writes to a volatile sink.

PROFINET

- When loading projects that were created with PLCnext Engineer 2020.3, a notification „Arp.Io.PnC.ConfigurationWarning“ with the severity „Warning“ can be triggered. The PayLoadString is „Parsed FSParameterUUID '{}' has invalid format. Parameter will be ignored. Please check engineering and/or device description“.
  This problem has been fixed in PLCnext Engineer 2020.6 or later.
- The PROFINET connection setup could take a relatively long time if many nodes were used.
- The PROFINET controller could only process 10 RPC requests at a time. So far „nca_server_too_busy“ was reported back to the PROFINET devices. Some devices did not repeat their RPC request.
  The PROFINET controller can now accept up to 45 RPC requests simultaneously.
- The controller sporadically had incorrect IP settings after a DCP factory reset was requested by the higher-level PROFINET controller.
- After switching off MRP, an AXC F 2152 was no longer accessible as a device.

GDS

- In case of fatal error (e.g. SIGSEGV) in a C++ program, a system watchdog could be triggered cyclically. Under certain circumstances this could also be caused by a faulty GDS configuration.
- When using the Write functions of the „IDataAccessService“ RSC service, the variable could not be overwritten correctly if the data type of the overwrite value did not match the data type of the variable to be overwritten.

RSC

When using certain RSC services simultaneously, an exception in „CommonRemoting“ or a „Protocol violation“ ERROR could occur.

ESM

In rare cases the detected watchdog of an ESM task was not handled correctly. Thereupon the firmware was terminated.

System

- During system startup, a system watchdog could be triggered if, for example, a higher-level PROFINET controller changed the IP settings via DCP protocol.
- With the C++ function „Directory::Clear(path)“ from the namespace „Arp.System.Commons.Io“ a directory could not be cleared as long as it was viewed with WinSCP.
- Names of NTP servers could not be set if they contained more than 2 dots.
- Under certain operating conditions cyclic error messages were entered in conjunction with LLDP. These messages are not errors and were therefore reclassified as debug information.
- When setting the IP address via DCP, an error message was erroneously entered in the „Output.log“, although the setting was successful.

INTERBUS

With the AXC F 2152 in conjunction with the AXC F IL ADAPT extension module, the error „SYSFAIL“ could occur when working with breakpoints. If, after working with breakpoints in a project, the program continued running without entering a breakpoint again, the „SYSFAIL“ signal was not reset. Although the fieldbus continued to run, process data exchange was no longer possible.

Docker

An issue related to calling the Docker „exec“ command to install or configure a Docker Container was fixed. So far only the Docker „run“ command could be used.

8.3 Known limitations and errors

- Retain variables
  - If a requested warm start is not possible to execute via PLCnext Engineer, an implicit cold start is automatically executed. The retain variables are set to their initialization value.
  - After a system watchdog, only a cold start can be performed when the controller is started. The retain variables are set to their respective initialization values.
- PLCnext CLI version
  The PLCnext CLI version used must match the current SDK for this version. Downward compatibility cannot be guaranteed.
- EthernetIP
  If the firewall is activated via WBM, the operation of EthernetIP is no longer possible.
  This can be remedied by subsequently activating the ports:
  - Incoming connections: **port 44818**
  - Outgoing connection: **port 2222**
- DHCP
  DHCP can only be switched on for Ethernet adapters that are not assigned as PROFINET controllers or PROFINET devices. To make the settings effective in the network, the device must be restarted. In general, when DHCP is switched on, the current IP settings are not yet displayed in the WBM and on the display, but the static settings last set are displayed.
- Retain handling
  With extended retain handling in the context of this firmware, the retain variables are reinitialized by a cold start when downgrading to firmware 2020.3 or older. A previous saving of the retain variables by the user is currently not supported.
- Variables
  The content of the variables „ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT“ and „ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL“ is permanently set to 0.
- HMI pages during program downloads
  During a PLCnext Engineer program download (both total and changes), the WebServer returns an error 503 (busy) for requests to the HMI pages.
- Multiple DataLogger Sessions
  If two or more DataLogger sessions are configured to write to the same database, only the data of one session will be transferred to the database on the SD card at the end. The user does not receive a message that not all data can be saved.
- Internal network interface
  Sporadically, frequent calls of PROFINET Read or Write REC may cause communication to the corresponding AR to be disturbed and a connection termination may occur.
- Retain data
  Using the maximum quantity structures of the retain data can increase the task duration of the using task. This can trigger a task watchdog for time-critical applications.
- STRING variables
  Access to long STRING variables outside the application is limited to 511 bytes. This concerns reading and writing via the RSC services „IDataAccessService“ and „ISubScriptionService“. These services are used by OPC UA, PLCnext Engineer HMI and the online functions of PLCnext Engineer, among others.
- SDK
  The SDK only works with PLCnext CLI 2020.0 or later, not with older versions (both PLCnext CLI 2019.x and PC WORX Target for Simulink 2019.x).
- If the controller is rebooted using the Linux command „sudo reboot“ or the RSC service „IDeviceControlService::RestartDevice()“ (also used by the „Reboot“ button in the PLCnext Engineer cockpit), a system watchdog may occur in rare cases. This means that only a cold start is possible when the controller is subsequently booted, i.e. all retain variables are reinitialized.
  This behavior does not occur when the operating voltage is switched off and then booted.
- Crash during startup phase
  The system watchdog is not yet active during the startup phase if you start C++ extensions very early. If the user code causes a crash during this phase, this can lead to an endless boot loop.
  You can solve the problem by removing the SD card before rebooting.
- PROFINET name
  If firmware 2020.6 is downgraded to an older version, the PROFINET name is lost.
- Debugging of IEC 61131 code
  When debugging IEC 61131 code with activated breakpoints, display errors may occur in the call sequence function and variable contents.
- „Download Changes“
  Sporadically a PLCnext Engineer project may reject „Download changes“ without giving a reason.
- RTC setting
  After setting a local time zone, unexpected results may

occur when reading out times from different contexts (RTC-S FB, OPC UA, SPNS LOG).

– Restriction for Device Info service
  The „DI - Device Info - Status.Memory.Usage.Percent“ service no longer returns a value with the following roles:
  – „Engineer“
  – „Commissioner“
  – „Service“
  – „DataViewer“
  – „DataChanger“
  – „Viewer“
  – „UserManager“
– Controller in error state
  When using „Event“ as name of a program, an error condition of the controller occurs when downloading the project. „Event“ is already used internally as class name.
– Firmware downgrade
  After downgrading the firmware, it is recommended to reset to „Default setting type 1“. This is not necessary when updating the firmware.
– Retain variable behavior with firmware downgrade
  If firmware 2020.0 or later is downgraded to 2019.9 or older and then upgraded again to firmware version 2020.0 or later, a cold start is performed.
  The retain variables are set to their initialization value.
– Bus behavior after power failure
  If an Axioline bus contains a power terminal and a Smart Elements module with empty slots, the bus will not restart after a power failure.
– AXC F 2152 with extension module
  AXC F XT ETH 1TX
  If both network adapters are configured with the same „Subnet Mask“, the PROFINET controller functionality will not work as desired. A proper connection setup is not possible.
– Uninstalling Solution Apps
  When a Solution App is uninstalled by the PLCnext Store, it can happen that the controller then no longer reacts to any actions by the PLCnext Store, although it reports the status „online“. A system watchdog was also sporadically observed. This behavior has not been observed when using the offline deactivation in the WBM for uninstalling a solution app.
– Task watchdog
  A task watchdog may sporadically occur with a low-priority PLC task with a cycle time in the range of seconds if the running PLC project was stopped and immediately restarted with a cold/warm/hot start.
– After resetting the controller there is no TrustStore with the name „proficloudv3“. The TrustStore is necessary for the update via ProficloudV3.
  Workaround: Re-create the TrustStore in the WBM of the controller.
– Gateway settings LAN2
  AXC F 2152 in combination with AXC F XT ETH 1TX extension module: If there are several „Default Gateway“ settings, only the setting of LAN1 is used. The settings of other LAN adapters are ignored.

8.4 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

– https://nvd.nist.gov/vuln
– https://cert.vde.com

Information on the Phoenix Contact “PSIRT“ can be found at: https://www.phoenixcontact.com/psirt

OpenSSL

– CVE-2020-1967

Python

– CVE-2020-8492

System

– Activation of security-relevant compiler flags (e.g. to prevent unauthorized introduction of executable code).
– Correction of a problem that RSC-Services of fieldbus components could be used without authentication.

OpenSSL

– The outdated OpenSSL version 1.0.2 is no longer supported. Instead, the current OpenSSL version 1.1.1 is used.

9 Changes in firmware version 2020.3.1

To be able to use all new functions of the firmware, you need PLCnext Engineer version 2020.3.

Select the latest template for firmware version 2020.3.1 in the PLCnext Engineer project.

9.1 New functions

System

You can now set the parameters for the NTP time server protocol in PLCnext Engineer.

DCP flashing

DCP flashing for PROFINET controllers/devices of the PLCnext Control family has been implemented.

PROFINET diagnostics

The PROFINET controller provides diagnostic information as function block “ARStatistik“.

New functions in WBM

- Display and download of the notification log
  The notifications are displayed in the WBM on a separate page.
- Extended Ethernet display
  The WBM provides an extended display of information about the Ethernet configuration of all available LAN interfaces.

Docker

“Docker“ is supported for all articles of the PLCnext family. Additionally the “Balena Engine“ is supported. (“nftables“ configuration, “cgroups“ are mounted at boot time).

OPC UA server

- Configurable “subscription type“
  The component can now be configured using the configuration file “PCWE.opcua.config“, e.g. using the PLCnext Engineer software.
- Support of “DateTime“
  The data type “DateTime“ is supported via OPC UA in any nesting, e.g. Structs, ArraysOf ..., Simple Var, FBs etc.

Linux

The packages for “rsync“ for file synchronization are supported.

9.2 Error corrections

The following errors have been rectified:

- System files
  System files modified with “root“ access could prevent proper reboot after a firmware update.
- Axioline
  In conjunction with the AXC F XT IB module, the contents of the diagnostic parameter registers in the system variables were swapped.
- WBM
  - Some WBM diagnostic pages were not displayed correctly with Internet Explorer.
  - On the WBM page for network configuration, the name “Baud rate“ was incorrect. This was changed to "Data rate".
  - A WBM session of a logged on user was never terminated if a page with cyclically updated data was open.
  - An eHMI user could never log out completely.
- IEC 61131
  An error could occur when restoring the retain data after a reboot.
  This behavior only occurred in the PLCnext Engineer project if program instances were moved to another ESM task.
- DataLogger
  After a firmware update, logging into the DataLogger database did not work anymore if the database design had changed.
- RSC
  Synchronous execution of RSC services without security context was not supported and could lead to an unexpected error message.

9.3 Known limitations and errors

- Retain variables
  - If a warm start is requested via PLCnext Engineer and this is not possible internally, an implicit cold start is automatically executed. The retain variables are set to their initialization value.
  - After a system watchdog, only a cold start can be performed when the controller is started. The retain variables are set to their initialization values.
- Special characters
  When using UTF8 special characters (Unicode) for the user name and password, the length restriction (user name = 64 bytes, password = 128 bytes) can take effect, although the maximum character length was not used. This reason is that the number of bytes and not the number of characters is limited in the RSC service.
- OpenSSL
  For security reasons, applications should no longer be linked against the outdated OpenSSL version 1.0.2.
- PLCnCLI version
  The PLCnCLI version used must match the current SDK for this version. Backward compatibility cannot be guaranteed.
- GNU compiler
  With the GNU compiler types GCC (8.3.0, 9.2.1) used, a quadratic increase in compilation time and memory consumption on the desktop PC is observed when very large structures are used.
  Note this behavior if you use a large number of ports in PLCnext applications (e.g. connection of a very large number of Simulink signals).
- EthernetIP
  If the firewall is activated via WBM, the operation of EthernetIP is no longer possible.
  This can be remedied by subsequently activating the ports:
  - Incoming connections: **port 44818**
  - Outgoing connection: **port 2222**
- System variables
  The system variables
  ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT and
  ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL
  are no longer supported.
  Now, the value of the variables is always 0.
- Error during program download
  During a program download (both complete and modifications) in PLCnext Engineer, the WebServer returns error 503 (busy) for requests to the HMI pages.
- DataLogger
  If two or more DataLogger sessions are configured to write to the same database, only the data from one session is transferred to the database on the SD card. You will **not** receive a message that not all data can be saved.
- Debugging
  After debugging a PLCnext Engineer project with breakpoints, the project may stop after restarting.
- PROFINET connection setup
  The PROFINET connection setup can take a long time in combination with a very large PROFINET structure.
- PROFINET Read/Write
  Frequent calls of PROFINET Read or Write REC may disturb the communication to the corresponding AR. A connection termination may occur.
- Increased task duration caused by retain data
  If the maximum retain data volume is used, the duration of the task may increase. A task watchdog could be triggered in time-critical applications.
- STRING variables
  Access to long STRING variables outside the application is limited to 511 bytes. This concerns reading and writing via the RSC services “IDataAccessService“ and “ISubScriptionService“.
  These services are used by OPC UA,
  PLCnext Engineer-HMI and the online functions of PLCnext Engineer, among others.
- SDK and PLCnCLI
  The SDK only works with PLCnCLI 2020.0 or later, not with older versions (both PLCnCLI 2019.x and PC Worx Target for Simulink 2019.x).
- Reboot via Linux shell
  After rebooting the controller via the Linux shell, a system watchdog may occur in rare cases. When the controller is subsequently booted, only a cold start is possible. This initializes all retain variables.
  This behavior only occurs when rebooting via the Linux shell. No system watchdog was observed when the controller lost power.

- OpenSSL update
  Updating the OpenSSL version 1.0.2 to version 1.1.1 can lead to problems with existing C++ applications that are based on this and run in the same process (e.g. function extensions). Phoenix Contact recommends

paying attention to possible updates in the PLCnext Store.
In the event of incompatibility, the firmware may not start up.

- Switching off MRP
  After switching off MRP, a restart of the AXC F 2152 is required in order for it to work properly.
- Bus behavior after power failure
  If an Axioline bus contains a power terminal and a Smart Elements module with empty slots, the bus will not restart after a power failure.
- Crash during startup phase
  The system watchdog is not yet active during the start-up phase if you start C++ extensions very early. If the user code causes a crash during this phase, this can lead to an endless boot loop.
  You can solve the problem with a “factory reset“.
- PROFINET name
  If firmware 2020.3 is downgraded to an older version, the PROFINET name is lost.
- Debugging IEC 61131 code
  When debugging IEC 61131 code with activated breakpoints, display errors may occur in the call sequence function and variable contents.
- “Download Changes“
  Occasionally “Download Changes“ may be rejected in a PLCnext Engineer project without stating a reason.

9.4 Security updates

The following security updates have been made in this release. For more information about the specified CVE numbers, see:

- https://nvd.nist.gov/vuln
- https://cert.vde.com

Information on the Phoenix Contact “PSIRT“ can be found at: https://www.phoenixcontact.com/psirt

git

- CVE-2019-19604
- CVE-2019-1387
- CVE-2019-1348

vim

- CVE-2019-20079

sqlite3

- CVE-2019-19646
- CVE-2019-19645
- CVE-2019-16168
- CVE-2019-8457

10 Changes in firmware version 2020.0.1 LTS

In interaction with this firmware the following points are not necessary:

– Update of PLCnext Engineer
– Update of SDK files for high-level language applications

10.1 Error corrections

The following problems have been fixed:

– A problem that led to cyclical connection terminations of the PROFINET application relationships (AR). This behavior occurred depending on the cycle times of the ESM tasks.
– A problem that caused an incorrect recovery of the retain data after a reboot of the controller. This behavior only occurred if program instances in the PLC project were moved to another ESM task.
– A problem that caused the controller to stop booting after resetting the controller to factory default type 2 (factory default). In this state the BOOT LED flashes red (2 Hz). The LED D is permanently yellow.
– A problem that was possible in conjunction with OPC UA. Scalar data types could be written with the wrong data type. This could lead to incorrect data in the IEC project when overwriting with larger data types. The error code “StatusCodes.BadTypeMismatch” would be expected here.

11 Changes in firmware version 2020.0 LTS

If you changed system files via a “root” access, the controller might not start up correctly after a firmware update.

- In this case, reset the controller to default setting type 1.

11.1 New functions

Offline installation of apps from the PLCnext Store

You can install apps downloaded from the PLCnext Store via the WBM of the controller without Internet connection and activate the corresponding licenses.

DataLogger improvements

– When configuring the DataLogger, you can specify the percentage of data to be deleted when the database reaches its maximum size (attribute “deleteRatio”).
– You can configure the data format of time and date (attribute “tsfmt”).

For more detailed information on configuring the DataLogger, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

Axioline Smart Elements

The controller supports Axioline Smart Elements.

Implementation of the “SysV IPC” Linux extension

With this extension, you can use the three IPC techniques (semaphore, message queue, and shared memory) of “SysV”.

OpenSSL update to version 1.1.1

The OpenSSL library has been updated to version 1.1.1.

Recommended:

- Use version 1.1.1 of the OpenSSL library.

The older version 1.0.2 of the OpenSSL library is still part of the firmware for reasons of downward compatibility.

Docker software support

Options for support of the Docker software have been enabled in the Linux kernel.

11.2 Error corrections

– Task execution

  Sporadically a task was not executed correctly in the given cycle.

  This error has been rectified.

– eHMI visualization after “Download Changes”

  After downloading program changes to the controller, the eHMI visualization could only be used after reloading the page in the browser.

  This error has been rectified.

– Data exchange with PROFICLOUD

  If variable values from an ESM1 task and from an ESM2 task were to be transferred to PROFICLOUD at the same time, the data exchange with PROFICLOUD was interrupted.

  This error has been rectified.

– Accessing an undefined element in the array

  When accessing an undefined element within a multidimensional array (“Array of Array” or “Array of Struct”) with OPC UA, the controller broke down.

  This error has been rectified.

– Length limitation of strings

  If strings with a length of more than 2993 bytes were created, access with OPC UA or RSC services of the GDS could cause the controller to break down.

  This error has been rectified. As part of the error correction, the length of a string was limited to a maximum of 511 bytes.

11.3 Known limitations and errors

– Mixed operation of different OpenSSL versions

  If the use of existing C++ applications (Function Extensions) results in mixed operation of the OpenSSL versions 1.0.2 and 1.1.1, the controller does not boot.

  Recommended: If you are using an app of the type "Function Extension" from the PLCnext Store, check whether an update is already available in the PLCnext Store.

– Automatic cold start

  If you initiate a warm start in PLCnext Engineer and this is not possible internally, a cold start is performed automatically, i.e., the retain variables are reinitialized.

– Cold start after system watchdog

  After a system watchdog, a cold start is performed.

– System watchdog after reboot via shell

  If you restart the controller via the shell, the system watchdog is triggered sporadically.

– Limitation of password and username

  The length of the password is limited to 64 bytes and the length of the user name is limited to 128 bytes. Note that the entered characters are UTF-8 encoded, i.e. one character can occupy up to four bytes (e.g. umlauts).

– PLCnCLI version and SDK version

  The PLCnCLI version must match the current SDK version (2020.0.0). Downward compatibility cannot be ensured.

– One database for several DataLogger sessions

  If you configure two or more DataLogger sessions to write to the same database, only the data from one session is transferred to the database on the SD card. There is no message that not all of the data can be stored.

– STOP of the controller after debugging

  After setting breakpoints in debug mode, the controller can switch to the STOP state when the project is restarted.

– PROFINET connection setup

  In the case of very large PROFINET quantity structures, the PROFINET connection setup can take several minutes.

– PROFINET connection interruptions

  Frequent calls of the “Read Record” and “Write Record” function blocks can occasionally interrupt the PROFINET connection.

– EtherNet/IP™

  If you enable the controller firewall in the WBM, EtherNet/IP™ is no longer available.

  To be able to use EtherNet/IP™ with enabled firewall, you have to activate the ports for incoming and outgoing connections subsequently (port 44818 and port 2222).

– C++ projects

  C++ projects that were created using “WorkerThread” in SDK version 2019.0 LTS have to be compiled again using an SDK version ≥ 2019.3.

  Otherwise, the “WorkerThread” is not loaded after restart of the application.

– Copying configuration files

  If you use the Linux command “scp” **without** the option “-p” to copy configuration files from a Linux PC to the directory /opt/plcnext/projects on the controller, the file permissions are partly set incorrectly.

  Remedy:

  After copying the configuration files, use the Linux command “chmod” to set the file permissions in such a way that the firmware can delete the configuration files in case of “Download Changes” (group: “plcnext”, owner: “plcnext_firmware”).

– Large amount of retain data

  In projects with a large amount of retain data, the PLC task watchdog infrequently triggers.

– Error message on HMI display

  While a program or program changes are being downloaded to the controller, the “503 (busy)“ error message is displayed on a connected HMI display.

12 Changes in firmware version 2019.9

If you changed system files via a “root” access, the controller might not start up correctly after a firmware update.

- In this case, reset the controller to default setting type 1.

12.1 New functions

New function in the WBM

A diagnosis for the local bus is available in the WBM.

PROFINET System Redundancy Layer (SRL)

In operation as PROFINET controller or PROFINET device the controller now supports PROFINET SRL.

Forcing GDS variables

You can now force GDS variables and thus the I/Os connected via PROFINET or Axioline F.

PROFINET controller: Behaviour of the BF-C LED

If you do not configure a PROFINET device or interrupt the connection using the "AR_MGT" function block, the BF-C LED remains switched off.

12.2 Error corrections

– Freezing of the outputs

  A high CPU load and frequent PROFINET disconnections could cause the outputs to freeze.
  This error has been rectified.

– Delay of a variable value during the start of the controller

  If 24 V voltage was applied to a digital input of the Axioline F local bus and the signal was transmitted with a global variable or a port link into the application, there could be a delay of several cycles. The error occurred during the start of the controller.
  This error has been rectified.

– Changing the IP address via DCP

  Changing the IP address via DCP could affect the real-time of the project and trigger the PLC task watchdog.
  This error has been rectified.

– CPU load after PROFINET connection setup

  After many PROFINET connections had been established, the controller could reach 100 % CPU load and the firmware could no longer react.
  This error has been rectified.

– Resetting the IP address via DCP

  If there was a connection to at least one configured PROFINET participant, the PLC task watchdog could be triggered when the IP address was reset via DCP.
  This error has been rectified.

– Setting breakpoints in debug mode

  If a breakpoint was set in debug mode, the PLC task watchdog could be triggered.
  This error has been rectified.

– Error of the Notification Logger

  If an error occurred during a restart of the controller, the Notification Logger was not automatically configured and notifications were not displayed in PLCnext Engineer.
  This error has been rectified.

12.3 Known limitations and errors

When using SafetyBridge Technology, note the following:

To ensure reliable operation in conjunction with SafetyBridge Technology, make the following settings in PLCnext Engineer.

„/ Profinet“ editor group, „Interface List“ editor:

– Reduction ratio: 8 (or higher)
– Monitor factor: 6 (or higher)

– System variables

  The system variables ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT and ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL are no longer supported.
  Now, the value of the variables is always 0.

– Copying configuration files

  If you use the Linux command “scp” **without** the option “-p” to copy configuration files from a Linux PC to the directory /opt/plcnext/projects on the controller, the file permissions are partly set incorrectly.
  Remedy:
  After copying the configuration files, use the Linux command “chmod” to set the file permissions in such a way that the firmware can delete the configuration files in case of “Download Changes” (group: “plcnext”, owner: “plcnext_firmware”).

– Deinstalling a licensed app from the PLCnext Store

  The deinstallation of a licensed app via the PLCnext Store is not possible if you manually deleted the license from the controller beforehand.

– Large amount of retain data

  In projects with a large amount of retain data, the PLC task watchdog infrequently triggers.

– Error message on HMI display

  While a program or program changes are being downloaded to the controller, the "503 (busy)" error message is displayed on a connected HMI display.

– C++ projects

  C++ projects that were created using “WorkerThread” in SDK version 2019.0 LTS have to be compiled again using an SDK version ≥ 2019.3.

  Otherwise, the “WorkerThread” is not loaded after restart of the application.

– EtherNet/IP™

  If you enable the controller firewall in the WBM, EtherNet/IP™ is no longer available.

  To be able to use EtherNet/IP™ with enabled firewall, you have to activate the ports for incoming and outgoing connections subsequently (port 44818 and port 2222).

13 Changes in firmware version 2019.0.4 LTS

When using SafetyBridge Technology, note the following:

To ensure reliable operation in conjunction with SafetyBridge Technology, make the following settings in PLCnext Engineer.

„/ Profinet“ editor group, „Interface List“ editor:

– Reduction ratio: 8 (or higher)
– Monitor factor: 6 (or higher)

Firmware version 2019.0.4 LTS offers the same features as firmware version 2019.0 LTS, but the error described below has been rectified.

13.1 Error corrections

– Freezing of the outputs
  A high CPU load and frequent PROFINET disconnections could cause the outputs to freeze.
  This error has been rectified.

14 Changes in firmware version 2019.6.3

When using SafetyBridge Technology, note the following:

To ensure reliable operation in conjunction with SafetyBridge Technology, make the following settings in PLCnext Engineer.

„/ Profinet“ editor group, „Interface List“ editor:

– Reduction ratio: 8 (or higher)
– Monitor factor: 6 (or higher)

Firmware version 2019.6.3 offers the same features as firmware version 2019.6, but the error described below has been rectified.

14.1 Error corrections

– Freezing of the outputs
  A high CPU load and frequent PROFINET disconnections could cause the outputs to freeze.
  This error has been rectified.

15 Changes in firmware version 2019.6

If you changed system files via a “root” access, the controller might not start up correctly after a firmware update.

- In this case, reset the controller to default setting type 1.

15.1 New functions

PROFINET stack

The PROFINET controller/device stack was updated from version 6.2 to version 6.3:

– MRP Client function

– SRL S2 function

MRP (Media Redundancy Protocol)

You can use the controller as a Media Redundancy Client (MRC) in an MRP ring. The MRC is activated and configured via the higher-level controller and PDEV objects. Only the default domain 0xFFFFFFFF is supported.

DataLogger

The DataLogger transfers real-time date from the GDS (Global Data Space) to an SQL based database for recording and storage.
The scope of functions of the DataLogger was extended:

– New recording modes:
  – Storage in case of changes
  – Continuous

– Historical data can be called within a defined period of time.

For more detailed information on the DataLogger, please refer to the “PLCnext Technology” user manual.

Updating Axioline F I/O data

The behavior for updates of Axioline F I/O data was changed:

If you do not select a trigger task, the firmware automatically calculates an interval for updating the Axioline F I/O data from the interval times of all available cyclic tasks. Event or idle tasks are not taken into account for the calculation. If no cyclic task is available, the data of the Axioline F modules is updated every 500 µs.

As an alternative to a cyclic task, you can select an idle task for updating Axioline F I/O data.

Interval times for cyclic tasks

The interval time of a cyclic task now has to be at least 1 ms. For projects that were created using an earlier firmware version and contain cyclic tasks with interval times < 1 ms, the PLC task watchdog might trigger.

TON_R_LTIME, TP_R_LTIME and TOF_R_LTIME function blocks

The time accuracy of the TON_R_LTIME, TP_R_LTIME and TOF_R_LTIME function blocks was improved. Now, also times < 1 ms can be recorded.
To be able to use the improved time accuracy of the function blocks in existing projects, you have to compile the project again and transfer it to the controller.

New functions in the WBM

– On the “Profinet” page, the PROFINET topology is displayed in tree view.

– You can activate the support of an external SD card via the WBM.
  If you deactivate the support of an SD card, and the SD card is then inserted into the controller, the SD card is not recognized during the initialization phase of the controller. Therefore, the data from the internal parameterization memory is **not** automatically copied to the SD card.

– The name of the PLCnext Engineer project running on the controller is displayed.

– On the “License Management“ page, you can view the licenses of the apps from the PLCnext Store that are installed on the controller.

OPC UA Historical Access (HA)

The integrated OPC UA server (eUA) supports access to historical data (OPC UA Historical Access Specification).

PROFINET controller/device function

- Now, you can select if an application relation (AR) is to be established while the boot project is being loaded.
- The DNS names of the PROFINET controller and the PROFINET devices can now be set via the "IConfigurationService" RSC service.
  Via the RSC interface, the functions Read(), Write(), GetControllerName() und GetDeviceNames() are now available.

For more detailed information on RSC (Remote Service Calls), please refer to the "PLCnext Technology" user manual.

15.2 Error corrections

- HTTPS connection
  After 20 minutes, the connection of an HTTPS client to the HTTPS server used to be disconnected automatically.
  This error has been rectified.
- Static_String array in C++ programs
  In an array of the type Static_String (C++), the array size was miscalculated.
  This error has been rectified.
- Disconnection from the HMI web server
  After the DISABLE system variable of the HMI_CONTROL data structure was set to TRUE, and this way, the connection to the HMI web server was set, the PLCnext Engineer HMI web server and the client were able to connect nevertheless.
  This error has been rectified.
- Controller breakdown in the PROFINET network
  If in a larger PROFINET network, the IP address of a PROFINET device was changed, the controller used to break down.
  This error has been rectified.
- PROFINET diagnostic state in the WBM
  If the application relation (AR) of a PROFINET device was disabled, a wrong diagnostic state was displayed on the "Profinet" page in the WBM.
  This error has been rectified.
- AXC F 2152 as a PROFINET device
  The AXC F 2152 could not be operated as a PROFINET device under PROFINET controllers from third-party manufacturers.
  This error has been rectified.
- SINT type process data elements
  Linking SINT type process data elements led to a runtime error in the application program (LED FAIL).
  This error has been rectified.
- Reading out OPC UA subscriptions
  Reading out OPC UA subscriptions via the "UA Expert" tool was not possible.
  This error has been rectified.
- OPC UA: "IecTime" data type variables
  "IecTime" data type variables were not displayed correctly.
  This error has been rectified.
- OPC UA: Index based monitoring
  Independent of the index set, all data of an array was output during index based monitoring.
  This error has been rectified.
- OPC UA: Index calculation
  Access to an array of the data type StaticString resulted in errors in index calculation.
  This error has been rectified.
- Traces in the format YYYYMMDD
  For traces in the format YYYYMMDD, sometimes the leading 0 was missing for the day.
  This error has been rectified.
- Setting breakpoints
  Setting breakpoints in extensive ST code worksheets resulted in controller freezing.
  This error has been rectified.
- Event task "Cold Start"
  In the following cases, the event task "Cold Start" was not executed:
  - After resetting the controller to default setting type 1 or 2
  - After SFTP transmission of the project and subsequent reboot of the controller

  This error has been rectified.
- Installed apps from the PLCnext store
  Resetting the controller to default setting type 1 or 2 resulted in licensing conflicts for apps from the PLCnext store that were installed on the controller.
  This error has been rectified.

15.3 Known limitations and errors

– System variables

  The system variables ESM_DATA.ESM_INFOS[*].ESM_TICK_COUNT and ESM_DATA.ESM_INFOS[*].ESM_TICK_INTERVAL are no longer supported.
  Now, the value of the variables is always 0.

– C++ projects

  C++ projects that were created using “WorkerThread” in SDK version 2019.0 LTS have to be compiled again using an SDK version ≥ 2019.3.
  Otherwise, the “WorkerThread” is not loaded after restart of the application.

– EtherNet/IP™

  If you enable the controller firewall in the WBM, EtherNet/IP™ is no longer available.
  To be able to use EtherNet/IP™ with enabled firewall, you have to activate the ports for incoming and outgoing connections subsequently (port 44818 and port 2222).

– HMI applications

  You cannot access an HMI application while a PLCnext Engineer project is downloaded to the controller.
  In this case, an error message is displayed in the web browser.

– Copying configuration files

  If you use the Linux command “scp” **without** the option “-p” to copy configuration files from a Linux PC to the directory /opt/plcnext/projects on the controller, the file permissions are partly set incorrectly.
  Remedy:
  After copying the configuration files, use the Linux command “chmod” to set the file permissions in such a way that the firmware can delete the configuration files in case of “Download Changes” (group: “plcnext”, owner: “plcnext_firmware”).

– Deinstalling a licensed app from the PLCnext Store

  The deinstallation of a licensed app via the PLCnext Store is not possible if you manually deleted the license from the controller beforehand.

– Availability of network services

  In case of frequent and fast linkUp and linkDown in large PROFINET quantity structures, the controller can infrequently reach 100% CPU load. In this case, network services are no longer available.

– Restart of a project

  For projects with extremely long task cycle times (e.g., 15000 ms), the restart of the project after a project download can take several minutes.

– Setting network settings via DCP

  Setting network settings via DCP can affect the real-time of the project. For watchdog times < 10 ms, this can infrequently result in a triggering of the PLC task watchdog.

– SafetyBridge Technology

  Reliable operation in conjunction with SafetyBridge Technology is not ensured.
  If you want to use SafetyBridge Technology, use the controller with firmware version 2019.3.

16 Changes in firmware version 2019.3

16.1 New functions

PRL (Phoenix Redundancy Layer)

The PROFINET device functionality has been extended to include the PRL function (Phoenix Redundancy Layer).

EtherNet/IP™ device function

You can use the controller as an EtherNet/IP™ device.

Dynamic bus configuration

The controller supports the dynamic bus configuration of the Axioline F local bus.

Left-alignable INTERBUS master

The controller now supports left-alignment of the INTERBUS AXC F XT IB master (Order No. 2403018).

PLCnext Store: New app types

The controller supports the execution of the app types “function extension”, “runtime”, “library”, and “solution app”.

16.2 Known limitations and errors

– Static_String array in C++ programs

  The array sizes are incorrectly calculated in Static_String-type arrays (C++), meaning that access to the second element contained in the array and to those following is incorrect.
  String arrays in IEC 61131 programs are not affected by this.

– AXC F 2152 as a PROFINET device

  The AXC F 2152 cannot be operated as a PROFINET device under PROFINET controllers from third-party manufacturers.

– Monitor time of PROFINET data

  The PROFINET data monitor time must be at least 24 ms. The monitor time is the product of „Reduction ratio“ and „Monitor factor“ (in PLCnext Engineer: „Profinet“ editor group, „Interface list“ editor).

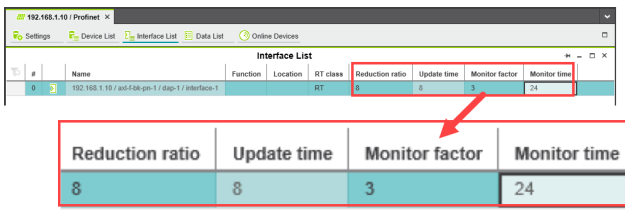

Figure 1 Monitor time

– Metrics that can be transferred to the PROFICLOUD

  You can transfer up to 194 variable values as metrics into the PROFICLOUD.

– Very high CPU utilization

  The online connection to PLCnext Engineer may be interrupted when the controller CPU utilization is very high.
  The connection interruption is indicated in PLCnext Engineer without any indication of the cause.

– Setting breakpoints is not supported

  Setting breakpoints in debug mode results in the controller becoming unreachable.

17 Changes in firmware version 2019.0 LTS

Please note:

Updating to firmware version 2019.0 LTS will reset the controller to factory default setting type 1. Any application-specific data and projects on the controller will be deleted.

17.1 New functions

Download changes

The controller now supports the “Download Changes” function. With the “Download Changes” function, program changes can be transferred to the controller during operation without interruption.

This is subject to the following conditions:

– You have not made any changes to the bus configuration.
– You have not changed the process data assignment.
– You have not changed the properties of the existing tasks (e.g., task type, interval, watchdog).
– You have not deleted any tasks or added any new tasks.

Left-alignment of Axioline F extension modules

The controller now supports left-alignment of the Axioline F AXC F XT ETH 1TX extension module (left-alignable Ethernet interface, Order No. 2403115).

New functions in the WBM

New functions are now available in the web-based management (WBM), e.g., PROFINET diagnostics and firewall configuration.

Declaring retentive data

You can now also declare variables from C++ programs as retentive data in PLCnext Engineer.

Updating Axioline F I/O data

You can now specify the refresh interval for Axioline F I/O data. This is done by selecting which task triggers the Axioline F I/O data update in the PLCnext Engineer project.

To do this, proceed as follows:

- Double-click on the “Axioline F (x)” node in the “PLANT” area.

The “/ Axioline F” controller editor group opens.

- Select the “Trigger task” view in the “Settings” editor.
- In the drop-down list, select the task that is to trigger the Axioline F I/O data update.

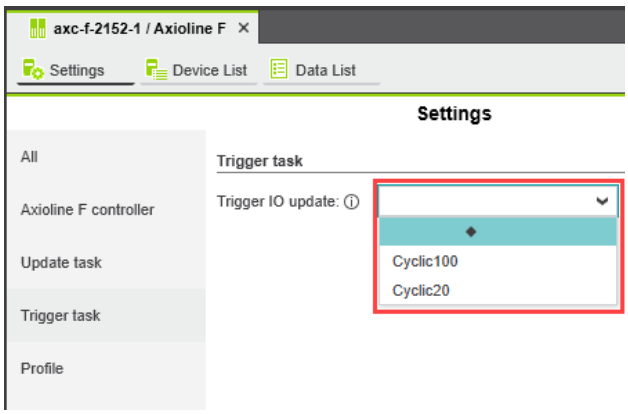

Figure 2 Select Trigger task

If you do not select a task, the update will occur by default every 50 ms.

17.2 Known limitations and errors

– AXC F 2152 as a PROFINET device

  The AXC F 2152 cannot be operated as a PROFINET device under PROFINET controllers from third-party manufacturers.

– Downloading PC Worx Engineer projects to the controller

  You can only download PLCnext Engineer projects to the controller with firmware version 2019.0 LTS that were created and compiled in PLCnext Engineer version 2019.0 LTS. Projects that you created in PC Worx Engineer must be re-created in PLCnext Engineer.

  If you download a PC Worx Engineer project to the controller with firmware version 2019.0 LTS, the project will not run on the controller. However, no error message is displayed in PLCnext Engineer.

Please note:

The PC Worx Engineer software has been renamed to PLCnext Engineer:

– Name up to Version 7.2.3:
  PC Worx Engineer

– Name starting from Version 2019.0 LTS:
  PLCnext Engineer

– Monitor time of PROFINET data

  The PROFINET data monitor time must be at least 24 ms. The monitor time is the product of „Reduction ratio“ and „Monitor factor“ (in PLCnext Engineer: „Profinet“ editor group, „Interface list“ editor).

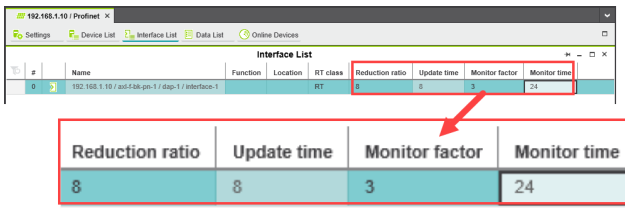

Figure 3 Monitor time

– Metrics that can be transferred to the PROFICLOUD

  You can transfer up to 194 variable values as metrics into the PROFICLOUD.

– Exceeding CPU system limits

  Exceeding the CPU system limits for the controller may result in an interruption of the online connection to PLCnext Engineer.
  The connection interruption is indicated in PLCnext Engineer without any indication of the cause.

– Setting breakpoints is not supported

  Setting breakpoints in debug mode results in the controller becoming unreachable.

18 Changes in firmware version 1.2.0

18.1 New functions

Design of a PLCnext Inline station

As an alternative to an Axioline F station, you can now set up a PLCnext Inline station using the controller. To do so, you need the AXC F IL ADAPT Inline adapter terminal (Order No. 1020304). You can directly install the Inline modules in series on the adapter terminal.

License verification

When an SD card is used, the controller now verifies if the SD card contains a Phoenix Contact license. You can only use the controller together with an appropriate Phoenix Contact SD card.

18.2 Notes on firmware downgrades and resetting the controller

For performing firmware downgrades, please note the following:

Downgrade to a firmware version ≤ 1.0.2

After downgrading to a firmware version ≤ 1.0.2, you can only use the controller **with** an SD card. Using it without an SD card is possible starting from firmware version 1.1.0.

- Ensure that the SD card has been inserted before switching the controller on, in order that the controller can use it.
- Only use an SD card provided by Phoenix Contact.

Downgrade to firmware version 1.0.0

After downgrading to firmware version 1.0.0, you can only use the reset button of the controller while an application is running.
Resetting the controller to default setting type 2 is not possible.

For resetting the controller to default setting type 2, please note the following:

When restoring to default setting type 2, the firmware of the controller is also reset to the delivery state. Controllers with a firmware version ≤ 1.0.2 can only be used **with** an SD card. Using them without an SD card is possible starting from firmware version 1.1.0.

- Ensure that the SD card has been inserted before switching the controller on, in order that the controller can use it.
- Only use an SD card provided by Phoenix Contact.

18.3 Known limitations and errors

– Time-outs during the communication with PCP devices

  If more than eight PCP devices are connected at the same time, time-outs can occur during the communication between the controller and the PCP devices.

– Maximum permissible number of Axioline F local bus devices

  Currently, a maximum of 30 Axioline F local bus devices is supported.

– Interrupting the PROFINET communication

  When transmitting files via SFTP to the controller, the PROFINET communication is interrupted.

– Function of the reset button

  When the controller is reset to default setting type 2, all LEDs light up after approx. 30 s.
  To actually restore the controller to default setting type 2, you need to press and hold the reset button for another 2 s after all LEDs have lit up.

19 Changes in firmware version 1.1.0

Please note:
After the update to firmware version 1.1.0, the controller has to be restarted.

19.1 New functions

Use of SD card now optional

The SD card is now optional and is no longer mandatory for operating the controller.

– Operation without SD card:
  All data is saved on the internal parameterization memory. If you make changes to files and directories on the internal parameterization memory, the Linux operating system generates an overlay filesystem from the changed files and directories.
– Operation with SD card:
  If you use an SD card, all application-specific data (e.g. network configuration, project bus configuration, etc.) is saved to the SD card.
  Two cases of SD card use can be distinguished:
  1) There is no overlay filesystem on the SD card:
     If there is an overlay filesystem on the internal parameterization memory, it is copied to the SD card.
  2) There already is an overlay filesystem on the SD card:
     If there is an overlay filesystem on the internal parameterization memory, it is **not** copied to the SD card.
     The controller accesses the overlay filesystem on the SD card. The overlay filesystem on the internal parameterization memory is deleted.

Please note:
The SD card is recognized during initialization of the controller. If you insert the SD card during operation, the SD card will not be detected.
- Make sure that the SD card has been inserted before you switch on the controller.

Memory expanded

– The program memory of the controller has been expanded from 4 MB to 8 MB.
– The data memory of the controller has been expanded from 8 MB to 16 MB.

20 Changes in firmware version 1.0.2

Please note:

After an update from firmware version 1.0.0 to firmware version 1.0.2, high-level language programs created with the Phoenix Contact SDK version 1.0.0 will no longer be executable. In this case, proceed as follows:

- Download the latest version of the Phoenix Contact SDK from phoenixcontact.net/products and install it.
- Compile existing high-level language programs with the latest version of the Phoenix Contact SDK.

When updating from firmware version 1.0.1 to firmware version 1.0.2, this procedure is not necessary.

20.1 Error corrections

– PROFINET configuration

The controller was stopped when transmitting a PC Worx Engineer project with a faulty PROFINET configuration to the controller.
This error has been rectified.

20.2 Known limitations and errors

– Controller breakdown

In some rare cases the controller may break down. In case of a controller breakdown, power is disconnected to the I/O modules contained in the bus configuration.

21 Changes in firmware version 1.0.1

Please note:

After an update from firmware version 1.0.0 to firmware version 1.0.1, high-level language programs created with the Phoenix Contact SDK version 1.0.0 will no longer be executable. In this case, proceed as follows:

- Download the latest version of the Phoenix Contact SDK from phoenixcontact.net/products and install it.
- Compile existing high-level language programs with the latest version of the Phoenix Contact SDK.

21.1 Error corrections

– Task processing time

  The programmed maximum task processing time was exceeded by occasional task processing time outliers. The ESM watchdog was triggered.
  This error has been rectified.

– User authentication

  A user authentication security vulnerability was patched.

– Requested memory

  An error occurred when memory was requested from a C++ program. The requested memory was not released again.
  This error has been rectified.

– Data Access Service

  An error in the Data Access Service (online view in the “Data List” editor in PC Worx Engineer) has been rectified.

– Subscription service

  During data query via OPC UA, an error occasionally occurred in the subscription service.
  This error has been rectified.