



Migration Guide
PROFINET IO Controller
Migration from V2 to V3

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1 Introduction

1.1 About this document

This document describes the steps required to migrate an existing PROFINET IO Controller application from stack/firmware Version V2 to V3.

1.2 List of revisions

Rev	Date	Name	Chapter	Revision
1	2016-12-09	BM	all	Created

Table 1: List of revisions

1.3 References to documents

This document refers to the following documents:

- [1] Hilscher Gesellschaft für Systemautomation mbH: Protocol API, PROFINET IO Controller, V3, Revision 5, English, 2016.

Table 2: References to documents

1.4 Legal notes

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2 General

2.1 Features and limitations

New features

The PROFINET Controller V3 implements several new features which are not available in the PROFINET Controller V2:

- **IRT operating mode:** The PROFINET Controller V3 support PROFINET IRT High Performance communication mode and synchronized application process data. In order to use this feature the application must perform an IRT frame planning and configure the IRT related PROFINET parameters.
- **Optimized process data performance:** The performance of the process data handling has been optimized. Depending on the sendclock and operation mode up to 128 devices can be addressed. In IRT operation mode cycle times down to 250 µs can be configured.
- **Automatic name assignment:** The PROFINET Controller supports automatic name assignment to unnamed (uncommissioned) PROFINET devices according network topology
- **Automatic alarm acknowledgement:** The application can configure the PROFINET Controller to automatically handle PROFINET alarms.
- **MRP Client and Manager:** The PROFINET Controller can be configured for operating as MRP client or manager for Media Redundancy. In that case another network station must be configured for MRP manager functionality.
- **PROFINET Specification 2.3:** The PROFINET Controller V3 supports the requirements for PROFINET IO specification v2.3 (e.g. advanced startup, MultipleInterfaceMode, netload requirements).

Existing features

The following features from PROFINET Controller V2 are implemented for PROFINET Controller V3 as well:

- **Fast Startup:** The PROFINET Controller supports fast establishment of application relations.

Limitations to features of V2

The following features from PROFINET Controller V2 are not implemented for PROFINET Controller V3:

- **Swapping of IO data:** The PROFINET Controller V3 does not support swapping byte order of cyclic IO data. This is a side effect of optimized process data performance. See section Process data for details.
- **Automatic IOPS handling:** The PROFINET Controller V3 does not support automatic IOPS or automatic IOCS handling. It is now a mandatory task of application to handle IOPS and IOCS. Any certified IO Controller application using PROFINET Controller V2 will already be made in the way that it handles IOPS. See section Process data for details.

2.2 Process data

The process data handling has been subject to a major rework in PROFINET Controller V3. This rework was done under the requirements of performance optimization, support of synchronized applications and netX XC limitations. The main changes are summarized as follows:

- **Process data image structure:** The structure of the process data has been changed compared to PROFINET Controller V2. While for PROFINET Controller V2 the process data of a single submodule could be placed arbitrarily within the whole image and the data states could be optionally enabled this is not possible for PROFINET Controller V3. Here the process data of one IOCR can be placed arbitrarily (respecting a 4-byte alignment) within the image. Thus the process data of submodules belonging to one IOCR will be grouped together.

Furthermore the data states are included in the IOCR process data as well. This on the one side provides the application with full control over provider and consumer data states and on the other side requires the application to properly set the data states. When computing the maximum process data length the alignment requirements and the data states must be taken into account. The data states are always placed right after the corresponding process data itself. Automatic handling by PROFINET Controller V3 firmware is not supported.

- **Process data timing:** For PROFINET Controller V3 the process data timing is strongly coupled to the bus cycle. In contrast to PROFINET Controller V2, the DPM handshakes are not handled immediately but are coupled to the network timings. This is required to allow for a synchronized controller application. As a consequence it is not possible to update an DPM process data area more than once per bus cycle.

Detailed information about the organization and handling of process data with PROFINET Controller V3 can be found in the PROFINET Controller V3 API manual.

2.3 Alarm handling

The PROFINET Controller V3 supports all kind of PROFINET alarms. When an alarm is received the application will be notified about the alarm using the Receive Alarm service or Receive Diagnosis service. After processing the alarm the application must use the Acknowledge Alarm service to confirm the alarm. The PROFINET Controller V3 supports automatic alarm acknowledgment. For each alarm type it can be configured if the PROFINET Controller shall acknowledge the alarm automatically or if the alarm is to be handled by the application. For automatically handled alarms no notification will be generated.

3 Packet handling

3.1 Packet services

The Profinet Controller V3 protocol implements a new packet api. This packet api is incompatible with the Profinet Controller V2 packet api. As a general rule, the new api does not support configuring multiple items in one packet. A separate packet for each item has to be used.

Unchanged services

- **Register Service:** This service is implemented as generic rcX service.
- **Deregister Service:** This service is implemented as generic rcX service.
- **Obtain Device Connection Information:** This service is implemented as generic rcX service.
- **Common Status Service:** This service is implemented as generic rcX service.

Replaced configuration packet services

The following list shows which PROFINET Controller V3 services replace a PROFINET Controller V2 service. The replacement services have a different structure than the PROFINET Controller V2 services.

- PNM (IO Controller) Dataset: This service is replaced by the Configure IO Controller service
- Extended PNM (IO Controller) Dataset: This service is replaced by a combination of Configure IO Controller service and Configure IO Controller parameter service.
- PNM_IOD (IO-Device) Datasets: This service is replaced by the Configure IO Device service.
- Extended PNM_IOD (IO-Device) Datasets: This service is replaced by a combination of Configure IO Device service and Configure record service.
- PNM_IOD_IOCRR (Communication Relation) Datasets: This service is replaced by the Configure IOCRR service.
- PNM_IO_AP (Application Process) Datasets: This service is replaced by the Configure submodule service.
- PNM_IOD_Module (Module) Datasets: This service is replaced by the Configure submodule service.
- PNM_IOD_Submodule (Submodule) Datasets: This service is replaced by the Configure submodule service.
- PNM_IOD_SubmDescr (Submodule Description) Datasets: This service is replaced by the Configure submodule service.
- PNM_IOD_SubmDescr_Ext (Extended Submodule Description) Datasets: This service is replaced by the Configure submodule service.
- PNM_IOD_IntfSubm (Interface Submodule) Datasets: This service is replaced by a combination of Configure submodule service and Configure record service.
- PNM_IOD_PortSubm (Port Submodule) Datasets: This service is replaced by a combination of Configure submodule service and Configure record service.
- PNM_IOD_RecData (Record Data) Datasets: This service is replaced by the Configure record service.
- PNM Download Finish: This service is replaced by the Download finished service.

Replaced acyclic packet services

The following list shows which PROFINET Controller V3 services replace a PROFINET Controller V2 service. The replacement services have a different structure than the PROFINET Controller V2 services.

- Device Diagnosis Service: This service is not implemented. In order to obtain device diagnoses, the Read submodule record service should be used to read the diagnosis record objects.
- ModuleDiffBlock Service: This service is not implemented. In order to obtain the module diff block, the Read submodule record service should be used to read the module diff block record objects.
- DCP Signal: This service is replaced by the DCP Set Signal Service.
- DCP SET Name: This service is replaced by the DCP Set Name service.
- DCP SET IP: This service is replaced by the DCP Set IP service.
- DCP RESET FACTORYSETTINGS: This service is replaced by the DCP Reset Factory Settings service.
- DCP GET: This service is replaced by the DCP Get service.
- Alarm Acknowledge Service: This service is replaced by the Acknowledge Alarm service.
- Release IO-Device Service: This service is not implemented. An AR can be activated/deactivate at runtime using the Set AR Status service instead.
- Alarm Service: This service is replaced by the Receive Alarm service.
- Diagnosis Service: This service is replaced by the Receive Diagnosis service.

Backwards compatible services

The PROFINET Controller V3 implements some backwards compatible services. These services are implemented identical to PROFINET Controller V2. Nevertheless it is strongly recommended to use the new services provided by the PROFINET Controller V3.

- Read Service: Use the PNM_AP_DEVICEHANDLE_T for packet field ulHandle. This service should be replaced in the application using the Read submodule record service.
- Write Service: Use the PNM_AP_DEVICEHANDLE_T for packet field ulHandle. This service should be replaced in the application using the Write submodule record service.
- Read Implicit Service: This service should be replaced in the application using the Read implicit record service.
- DCP IDENT ALL: This service should be replaced using the generic rcX Bus Scan service.
- DCP IDENT ENTRY Service: This service will be used if the DCP IDENT ALL services is used by the application.
- DCP IDENT ALL Finished Service: This service will be used if the DCP IDENT ALL services is used by the application.

New configuration packet services

The PROFINET Controller V3 packet api defines some new services. Details about these services can be found in the Protocol Api manual. The following services have been added:

- Configure AR Parameters service: This service can be used to configure the AR Vendor Block Request used by the PROFINET Controller when connecting to a PROFINET Device.
- Configure topology service: This service can be used to configure the network topology into the PROFINET Controller. This is required to allow for seamless device replacement. The PROFINET Controller will use this information to automatically assign station names to unnamed configured devices.

New acyclic packet services

The PROFINET Controller V3 packet api defines some new services. Details about these services can be found in the Protocol Api manual. The following services have been added:

- Get Logbook Service: The PROFINET Controller V3 maintains internal logbooks for each configured profinet device and for the controller itself. The logbook contains time based information about events occurred at the device or within the controller.
- Get AR Vendor Block Response Service: This service can be used by the application to retrieve the ar vendor information delivered by the profinet device in its connect response.
- Set AR Status Service: This service can be used to activate/deactivate a particular application relation at runtime.
- Load Remanent Service / Store Remanent Service: This service needs to be used in order to build a final product (e.g. PLC) based on PROFINET Controller V3 that can be certified. Using this service data to be stored persistent is indicated from firmware to application at runtime. On startup application needs to give this data to firmware.
- Configure OEM Parameter service: The PROFINET Controller V3 allows to modify some values (e.g. software version number) with this service.

Removed packet services

The following list summarizes all PROFINET Controller V2 packet services not implemented by the PROFINET Controller V3.

- PNM_IOD_IO_Signals (SubmDescr Signal Configuration) Dataset: The PROFINET Controller V3 does not support changing the byte order of the process data. The process data will be presented in big endian byte order always.
- PNM Set VersionInfo Service: This service is not supported. It is replaced with Configure OEM Parameter service.

4 Incompatible changes

- Configuration database: The configuration database has been adapted to meet the requirements of IRT configuration. The new configuration database uses a different format and is therefore incompatible to the previous format. The previous database was stored in a `nwid.nxd` and `config.nxd` file while the new format uses a single `config.nxd` file. The PROFINET Controller V3 can not be configured using a PROFINET Controller V2 configuration database and vice versa.
- Configuration messages: The PROFINET Controller V3 uses a different internal structure to organize the configuration. This structure is incompatible to the PROFINET Controller V2 configuration messages. Therefore the PROFINET Controller V2 configuration messages are not supported. They shall be replaced as described in Packet handling
- Little Endian Process Data: The PROFINET Controller V3 does not support little endian process data. This feature was rarely used and has been removed for better process data performance.

5 Appendix

5.1 List of tables

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5.2 Contacts

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