



Migration Guide
PROFINET IO Device
Migration from V3.x to V3.13

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DOC120404MG09EN | Revision 9 | English | 2018-08 | Released | Public

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1 Introduction

1.1 About this document

This document describes the steps required to migrate an existing PROFINET IO Device application from stack/firmware Version V3.4 (or newer) to current available version V3.13.

1.2 List of revisions

Rev	Date	Name	Chapter	Revision
9	2018-08-09	BM	1.3 7	Reference to PROFINET IO Device API manual updated to revision 18 Section <i>Migration to V3.13.0.x</i> added

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 RT/IRT Device, V3.13.0.x, Revision 18, English, 2018.

Table 2: References to documents

2 Migration from V3.4 to V3.x

The PROFINET IO Device Firmware/Stack V3.5 (and newer) supports *Shared Device* as a new feature. This means that firmware/Stack V3.5 supports 2 IO ARs at the same time. Therefore an application must be able to deal with requests of multiple application relations (AR) at the same time. For packet communication the field `hDeviceHandle` is used by the firmware/stack to indicate the associated Application Relation.

Multiple ARs require some handling of ownership. Only one AR is allowed to write data to an output, otherwise inconsistent data might be sent to a submodule. This ownership handling is done inside the PROFINET IO Device stack and completely hidden from the user.

Special care needs to be taken by application when handling `PNSIF_CHECK_IND` packets. This packet indicates a difference between local submodule configuration and expected submodule configuration of IO Controller. Firmware/Stack V3.4 only generated this packet during connection establishment. Only one application relation was supported by firmware/stack V3.4. There was only a small timeslot when this indication was created. As a result of the feature *shared device* these indications are now **additionally** generated by stack/firmware V3.5 in different situations.

- One AR exists, another AR is established. A submodule not locally plugged is requested by the second AR. Now a check indication is sent to the user application although there is an AR already established. This is context of an additional AR establishment.
- One AR exists, another AR is established. The first AR expects output submodule in slot 1 subslot 1. The second AR expects a different output submodule in slot 1 subslot 1. At first the second IO Controller will be informed that the submodule cannot be used and no check indication is generated. If the first AR breaks down now, the firmware/stack will generate a check indication to the user application and inform the user about the difference between expected and real configuration. This check indication is generated completely out of the context of AR establishment.

The cyclic data exchange with multiple application relations is handled by the firmware/stack V3.5 internally in the following ways (according to the PROFINET specification):

- For outputs, only the data of the submodules owner AR is copied into the dual-port memory input area/consumer image
- For inputs, the data is copied from the dual-port memory output area/provider image only to the submodule owner's AR. The feature "Shared Input" is not supported!

The parameter record access is also controlled by the ownership:

- Parameter writes (`PNS_IF_WRITE_RECORD_REQ`) are only allowed from the submodules owner AR. Requests from other ARs will be filtered by firmware/stack automatically.
- Parameter reads (`PNS_IF_READ_RECORD_REQ`) are allowed from all ARs.

2.1 IRT

The PROFINET IO Device firmware/stack V3.5 uses a new IRT technology called *Relative Forwarder* whereas the firmware/stack V3.4 implemented an *Absolute Forwarder*. Therefore, if the application uses IRT, the GSDML file must be adapted (see section *GSDML device description* on page 6).

Important: If an existing IRT capable device is upgraded from a firmware/stack V3.4 based firmware to a firmware/stack V3.5 based firmware, the PROFINET IO Controllers configuration must be updated using the new GSDML file.

It is NOT possible to simply replace a device based on stack/firmware V3.4 with one of stack/firmware v3.5 when IRT is used. In this situation the new GSDML file needs to be imported in the engineering and the project in engineering needs to be newly calculated and downloaded to the IO-Controller using the new GSDML file.

2.2 GSDML device description

As stated above, if the application supports IRT, the GSDML file must be updated to Version 2.31 because older GSDML versions do not support the *Relative Forwarder* technology. Besides that the new Stack supports multiple ARs (*Shared Device*). Both features require, that the following parameters should be used for the interface submodule.

```
<InterfaceSubmoduleItem
  DCP_HelloSupported="true"
  ID="DIM 20 Interfacesubmodule"
  NetworkComponentDiagnosisSupported="true"
  SubmoduleIdentNumber="0x00002061"
  SubslotNumber="32768"
  SupportedMibs="MIB2"
  SupportedProtocols="SNMP;LLDP"
  SupportedRT_Classes="RT_CLASS_1;RT_CLASS_3"
  TextId="PN-IO">

  <RT_Class3Properties
    ForwardingMode="Relative"
    MaxBridgeDelay="5500"
    MaxNumberIR_FrameData="256"
    StartupMode="Legacy" />

  <SynchronisationMode
    MaxLocalJitter="50"
    SupportedRole="SyncSlave"
    SupportedSyncProtocols="PTCP"
    T_PLL_MAX="1000" />

  <ApplicationRelations
    NumberOfAR="2"
    StartupMode="Advanced;Legacy">

    <TimingProperties
      ReductionRatio="1 2 4 8 16 32 64 128 256 512"
      SendClock="32 64 128" />

    <RT_Class3TimingProperties
      ReductionRatio="1 2 4 8 16"
      SendClock="8 16 32 64 128" />
  </ApplicationRelations>

  <MediaRedundancy SupportedRole="Client" />
</InterfaceSubmoduleItem>
```

As a further consequence of this new IRT technology, Hilscher has assigned new module and submodule ident numbers to the device access point. If the stack is configured using the netX Configuration Tool, the following numbers shall be used by the application to match Hilscher default values for cifX:

Description	Value for V3.4	Value for V3.5.35, V3.7-V3.11
DAP ModuleIdentNumber	0x00001001 or 0x00001101	0x00002081
DAP SubmoduleIdentNumber	0x00001000 or 0x00001100	0x00002080
Interface SubmoduleIdentNumber	0x00001001 or 0x00001101	0x00002081
Port 1 SubmoduleIdentNumber	0x00001002 or 0x00001102	0x00002082
Port 2 SubmoduleIdentNumber	0x00001003 or 0x00001103	0x00002083

Table 3: Module/Submodule Ident Number Comparison Firmware/Stack V3.4 and V3.5, V3.7-V3.11

Usage of other moduleidentnumbers or submoduleidentnumbers is possible as well.

2.3 Interface dependent changes

2.3.1 Dual-port memory

As a consequence of the Shared Device feature, the COMMUNICATING-Bit is handled as follows:

- The COMMUNICATING-Bit is set when the first AR enters valid Data-Exchange
- The COMMUNICATING-Bit is cleared when the last AR is shut down

2.3.2 Linkable Object Module

The internal structure of stack V3.5 has changed in many ways so that several changes are required when using the *Linkable Object Module* (LOM). The required changes are not shown in this document. Please refer to the NXLOM example provided together with the PROFINET IO Device protocol stack to see how to startup and configure PROFINET IO Device Protocol stack.

2.4 Packet handling

No incompatible changes are done by firmware/stack V3.5.

2.4.1 Services having structural changes compared to V3.4

The following services have been changed or extended:

Changed Service	Description
PNS_IF_SET_CONFIGURATION_REQ / PNS_IF_SET_CONFIGURATION_CNF	Set Configuration Service (support of IOCS configuration)
PNS_IF_SET_IOXS_CONFIG_REQ / PNS_IF_SET_IOXS_CONFIG_CNF	Set IOxS Config Service (support of IOCS configuration)
PNS_IF_SET_OEM_PARAMETERS_REQ / PNS_IF_SET_OEM_PARAMETERS_CNF	Set OEM Parameters Service
PNS_IF_LINK_STATE_CHANGE_IND / PNS_IF_LINK_STATE_CHANGE_RES	Link state change indication replaced with generic rcX packet RCX_LINK_STATUS_CHANGE_IND / RCX_LINK_STATUS_CHANGE_RES
PNS_IF_GET_DEVICE_HANDLE_REQ / PNS_IF_GET_DEVICE_HANDLE_CNF	This service does no longer exist in stack V3.5.
PNS_IF_RESET_FACTORY_SETTINGS_REQ / PNS_IF_RESET_FACTORY_SETTINGS_CNF	This service has been extended to support requirements for PROFINET specification V2.3 starting with Protocol stack version V3.7.0.3 . The structure now contains a new field in packet data section.

Table 4: Changes Packets/Services

2.4.2 Services that can be issued in parallel

As already stated, the protocol firmware/stack V3.5 (and higher) now supports multiple ARs at the same time. Each AR is assigned a specific device handle (`hDeviceHandle`) which may be used to relate indications and requests with a specific AR. One import consequence of this new feature is that the application must be able to deal with multiple indications of the same type at the same time. This comes into account if the application stores a packet for a time before returning it back to the stack. The following services are affected by this behavior:

Affected Service	Description
PNS_IF_PARAM_END_IND / PNS_IF_PARAM_END_RES	Parameter End Service
PNS_IF_SET_APPL_READY_REQ / PNS_IF_SET_APPL_READY_CNF	Application Ready Service
PNS_IF_AR_CHECK_IND / PNS_IF_AR_CHECK_RES	AR Check Service
PNS_IF_AR_INDATA_IND / PNS_IF_AR_INDATA_RES	AR InData Service
PNS_IF_AR_ABORT_IND / PNS_IF_AR_ABORT_RES	AR Abort Service
PNS_IF_APDU_STATUS_IND / PNS_IF_APDU_STATUS_RES	APDU Status Service
PNS_IF_ALARM_IND / PNS_IF_ALARM_RES	Alarm Service
PNS_IF_READ_IM_IND / PNS_IF_READ_IM_RES	Read Identification & Maintenance Service
PNS_IF_WRITE_IM_IND / PNS_IF_WRITE_IM_RES	Write Identification & Maintenance Service
PNS_IF_READ_RECORD_IND / PNS_IF_READ_RECORD_RES	Read Record Service
PNS_IF_WRITE_RECORD_IND / PNS_IF_WRITE_RECORD_RES	Write Record Service
PNS_IF_PARAM_BEGIN_IND / PNS_IF_PARAM_BEGIN_RES	Parameter Begin Service
PNS_IF_CONNECT_REQ_DONE_IND / PNS_IF_CONNECT_REQ_DONE_RES	Connect Request Done Service
PNS_IF_RELEASE_RECV_IND / PNS_IF_RELEASE_RECV_RES	Release Received Service

Table 5: Packets/Services affected by `hDeviceHandle`

3 Migration to 3.7.0.x

The following services have been changed starting with stack / firmware V3.7.0.0.

Affected Service	Description
PNS_IF_GET_XMAC_DIAGNOSIS_REQ / PNS_IF_GET_XMAC_DIAGNOSIS_CNF	The field <code>ulFramesReceivedOk</code> no longer reports back the number of frames successfully received but instead the number of octets successfully received. The field <code>ulFramesTransmittedOk</code> no longer reports back the number of frames successfully transmitted but instead the number of octets successfully transmitted.

4 Migration to 3.8.0.x

The following services have been changed starting with stack / firmware V3.8.0.0.

Affected Service	Description
PNS_IF_RESET_FACTORY_SETTINGS_REQ / PNS_IF_RESET_FACTORY_SETTINGS_CNF	This service has been extended to support requirements for PROFINET specification V2.3. The structure now contains a new field in packet data section.

Table 6: Packets/Services affected by V3.8.0.x

5 Migration to 3.11.0.x

The following services have been changed starting with stack / firmware V3.11.0.0.

Affected Service	Description
PNS_IF_PLUG_MODULE_REQ / PNS_IF_PLUG_MODULE_CNF	The already obsolete parameter <code>hDeviceHandle</code> has been renamed to <code>ulReserved</code> .
PNS_IF_PLUG_SUBMODULE_REQ / PNS_IF_PLUG_SUBMODULE_CNF	The already obsolete parameter <code>hDeviceHandle</code> has been renamed to <code>ulReserved</code> .
PNS_IF_PULL_MODULE_REQ / PNS_IF_PULL_MODULE_CNF	The already obsolete parameter <code>hDeviceHandle</code> has been renamed to <code>ulReserved</code> .
PNS_IF_PULL_SUBMODULE_REQ / PNS_IF_PULL_SUBMODULE_CNF	The already obsolete parameter <code>hDeviceHandle</code> has been renamed to <code>ulReserved</code> .
PNS_IF_SET_OEM_PARAMETERS_REQ / PNS_IF_SET_OEM_PARAMETERS_CNF	A new parameter type has been defined.
PNS_IF_GET_PARAM_REQ / PNS_IF_GET_PARAM_CNF	New parameter types have been defined.

Table 7: Packets/Services affected by V3.11.0.x

6 Migration to V3.12.0.x

6.1 Changes in packet handling introduced with 3.12.0.x

The following services have been changed starting with stack / firmware V3.12.0.x.

Affected Service	Description
PNS_IF_SET_OEM_PARAMETERS_REQ / PNS_IF_SET_OEM_PARAMETERS_CNF	New parameter types have been defined.
PNS_IF_READ_IM_IND / PNS_IF_READ_IM_RES	Support for I&M5 was added.

Several new APIs have been added.

- PNS_IF_GET_ASSET_IND / PNS_IF_GET_ASSET_RES
- PNS_IF_SEND_ALARM_REQ / PNS_IF_SEND_ALARM_CNF
- PNS_IF_ADD_PE_ENTITY_REQ / PNS_IF_ADD_PE_ENTITY_CNF
- PNS_IF_REMOVE_PE_ENTITY_REQ / PNS_IF_REMOVE_PE_ENTITY_CNF
- PNS_IF_UPDATE_PE_ENTITY_REQ / PNS_IF_UPDATE_PE_ENTITY_CNF

6.2 PROFlenergy

The PROFINET IO Device Protocol Stack V3.12.0.x supports the PROFlenergy ASE in order to allow application to implement the PROFlenergy Profile V1.2.

Applications that have implemented older versions of the PROFlenergy Profile must be upgraded to implement PROFlenergy Profile V1.2 and use the new PROFlenergy services provided by stack. Older PROFlenergy Profile versions are not supported any more.

The PROFlenergy ASE requires that PROFlenergy related Read Record and Write Record services are only forwarded to the application if the addressed submodule is associated with an PROFlenergy entity. Therefore, to receive the related service indication packet, the application must register all submodules supporting PROFlenergy with the protocol stack using the Add PE Entity service.

7 Migration to V3.13.0.x

7.1 General changes introduced with 3.13.0.x

The following changes have been introduced with stack / firmware V3.13.0.x:

- Phy configuration timeout is changed from 500ms to 5 seconds.
 - After poweron a loadable firmware will now wait 5 seconds to receive remanent data and SetConfiguration service from host application before activating the default phy behavior (Autonegotiation).
 - Older firmware used a timeout of only 500ms
- netJACK50 firmware is no longer provided
- stack usage with rcX V2.0 is no longer officially supported and will be completely removed with V3.14.0.x
- the complete API header received a major rework and cleanup of unused services
- support of multiple IO Supervisor ARs and removal of exclusive IO Supervisor AR resources
 - if stack / firmware is configured to support more than 1 AR now all supported ARs can be IO Supervisor AR (as required by Profinet specification)
 - older stack / firmware used a single dedicated AR resource for IO Supervisor which was available all the time (even if all configured IO ARs were active)
- SNMP sysDescr coding was changed to match recommendation from Profinet specification (to avoid warning messages in certification tools)
- I&M5 behavior was changes in the ways that NXLFW is no longer I&M5 capable by default
 - Product firmware like cifX, comX, netJACK are still I&M5 capable by default

7.2 Changes in packet handling introduced with 3.13.0.x

The following services have been changed starting with stack / firmware V3.13.0.0.

Affected Service	Description
PNS_IF_ADD_CHANNEL_DIAG_REQ / PNS_IF_ADD_EXTENDED_DIAG_REQ	Value "0" is no longer accepted as ChannelErrorType in field <code>usChannelErrType</code> . This value is reserved according to the PROFINET specification and shall not be used.
PNS_IF_GET_XMAC_DIAGNOSIS_REQ / PNS_IF_GET_XMAC_DIAGNOSIS_CNF	This service no longer returns data that can be interpreted by the user.
RCX_DELETE_CONFIG_REQ / RCX_DELETE_CONFIG_CNF	This service now sets all remanent data in the protocol stack to default values. This is in addition to already known behavior to delete last stored SetConfig copy in the protocol stack.
RCX_GET_DPM_IO_INFO_REQ / RCX_GET_DPM_IO_INFO_CNF	In case of active IOxS interface to the application, this service now returns the length of pure I/O data only. Older stack versions returned the combined length of I/O data plus IOxS which is not intended for this service.
PNS_IF_GET_ASSET_IND / PNS_IF_GET_ASSET_RES	This service can now issue with <code>usEntryNumber > 200</code> .
PNS_IF_SET_OEM_PARAMETERS_REQ / PNS_IF_SET_OEM_PARAMETERS_CNF	New parameter types have been defined.

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8.2 Legal notes

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