

Readme File for the SIMATIC NET CDs "CP 1616 / CP 1604" and "DK-16xx PN IO"

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This file contains important information on the products of the SIMATIC NET CD "CP 1616 / CP 1604" and "DK-16xx PN IO".

The version of the PC software products of these SIMATIC NET CD is V2.6.0.1

All the information relating to the CP 1616 also applies to the "CP 1616 onboard" and CP 1604 unless a particular CP is named explicitly.

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1 Notes and restrictions for the CP 1616

1.1 Version history

Product version	Changes/additionally supported functions
V2.6.0.1	Bugs fixed, particularly for SIMATIC Industrial PCs
V2.6	New properties: PROFInergy as device Improved topology representation of lower-level systems in the Web server and in the topology editor Bugs fixed
V2.5.2.2	Bugs fixed Adaptation to new requirements for PNIO certification
V2.5.2	New properties: PROFInergy functions for reducing energy consumption of connected IO devices that support this function Additional entries for PROFINET in the diagnostics buffer; STEP 7 V 5.5 incl. SP V5.5.1.1 is required for this. Improved interrupt processing (maintenance alarms) Operation possible in Windows without administrator rights Bugs fixed
V2.5.1	Support of Windows 7 (32- and 64-bit) The function "module replacement without programming device" is supported. See note "Replacing a module with another of the same type" Partial access to submodules (see IO-Base user programming interface) Bugs fixed
V2.5	New properties: Expanded diagnostics options via Web server Important: this function can only be used with host software V2.5! The CP 1616 can operate shared devices. To allow this, STEP 7 V 5.5 incl. SP V5.5.0.2 is required. Bugs fixed
V2.4.1	New properties: The status of the peripheral inputs/outputs can be monitored with STEP 7 ("Read IO data"). STEP 7 V5.4.5 Service Pack 2 and HSP 1051 is required for this. Bugs fixed
V2.3.1	New properties: PROFINET IO IRT communication with high performance
V2.2.1	New properties: module replacement without programming device No PROFINET IO IRT communication possible with the high performance option (IRT top)!
V2.2.0	New properties: IRT with high flexibility, prioritized startup, media redundancy protocol (MRP) and download from host

	No PROFINET IO IRT communication possible with the high performance option (IRT top)!
V2.1.4	Bugs fixed (STEP 7, online diagnostics; IO routing)
V2.1.3	Bugs fixed
V2.1.2	Support for Windows XP (For more information, refer to CD path: \V2.1.3\CP16xx\Win\readme.txt)
V2.1	IO routing and bugs fixed; no IRT communication
V2.0.1	Bugs in V2.0 fixed
V2.0	PROFINET IRT, layer 2 access, SNMP diagnostics, Web diagnostics
V1.1	Improved performance through cache functions (CD path: /doc/MN_IO-Base_A04.pdf)
V1.0	Base version

1.2 General information

IMPORTANT NOTE

After installing the CP 1616 / CP 1604, first run a firmware update with the firmware supplied on this CD.

Important note

Operation of CP 1616 / CP 1604 as device

If you use the CP 1616 / CP 1604 with the firmware V2.6 as a device, you will need to select and configure the CP as V2.6 in STEP 7 in the hardware catalog. Note that the "DAP", the head station, must be plugged into slot 1 / subslot 1. This means that slot 0 is no longer used when operating as an IO device with V2.6. Up to version 2.5, the "DAP" had to be plugged into slot 0 / subslot 1. This means that a modification to your configuration and user software is necessary. You require STEP 7 V5.5.3 or higher.

IMPORTANT NOTE

No firmware with a version lower than V2.3.2 may be loaded on a module with order number 6GK1 161-6AA02.

If you want to load firmware version 2.5.1 or lower on a module with order number 6GK1 161-6AA01 or 6GK1 161-6AA02 and firmware version V2.5.2 or higher, follow the steps outlined below:

1. First load firmware V2.5.0.0.20 (on the CD in V2.5.2\CP16xx\previous_versions file: fw16xx-2.5.0.0.20.fwl) on the module .
2. Restart the PC
3. Load the required firmware on the module

Operating systems

The DK-16xx product has been released for Linux and Windows 7.

Purpose of this file

Please read the section on the SIMATIC NET CP 1616 product carefully. If other sections of other documents need to be read, this will be indicated at the relevant place in the readme.

Components of the product

- Firmware of the CP 1616 / CP 1604 (CD path: V2.6.0\CP16xx\firmware V2.6.0)
- Windows SW 32 Bit (CD path: V2.6.0\Win\disk_32)
- Windows SW 64 Bit (CD path: V2. 6.0\Win\disk_64)
- Linux SW for CP 1616 (CD path: V2.6.0\DK16xx\linux-sw)
- NCM PC V5.5.2.2 (CD path: \ncm_pc)

Documents available on the "SIMATIC NET CD, DK-16xx PN IO"

The "SIMATIC NET CD, DK-16xx PN IO" contains the following important documents:

- Operating Instructions CP 1616 / CP 1604 (CD path: \doc\BA_CP-1616-CP-1604_74.pdf)
- Operating Instructions (compact) CP 1616 (CD path: \doc\BAK_CP-1616_74.pdf)
- Operating Instructions (compact) CP 1604 (CD path: \doc\BAK_CP-1604_74.pdf)
- Commissioning PC Stations, instructions and quick start (CD path: \doc\PH_PC-Stations_76.pdf)
- SIMATIC, SIMATIC NET Technical Support, Contacts and Training (CD path: \doc\dc_support_99.pdf)

Important external documents

Other important external documents include:

- PROFINET standard IEC 61158 / IEC 61784
- "Industrielle Kommunikation mit PROFINET" by Manfred Popp (currently only available in German)

You can obtain this from the following address:

PROFIBUS & PROFINET International Support Center, Haid-und-Neu-Str. 7, 76131 Karlsruhe, Germany, Telephone +49 721 9658590, Fax +49 721 9658589

info@profibus.com, <http://www.profibus.com/>

Duplicate IP addresses/device names

In this case, the CP cannot establish any communications relation and no communications relation can be established with the affected CP.

This also applies if the IP addresses/device names of two IO devices are swapped over in the configuration. In this case, a dummy address/device name must first be assigned to the IO devices using "Assign Ethernet address".

The module must then be reset or restarted.

Replacing a module with another of the same type

If the module is replaced by a module of the same type, no reconfiguration is necessary. This assumes that the old module had been configured at least once and had a firmware version 2.2.1 and higher.

When an application starts, the stored configuration is loaded automatically on the new module with the first PROFINET IO function call. The new module automatically receives the firmware version of the original module.

If the configuration needs to be modified, this can be done afterwards.

This function is also called "module replacement without programming device".

Storage location of the data backup for "module replacement without programming device":

To make this function possible, the firmware currently on the CP and the configuration on the host system need to be saved.

In the course of this, the following files are created automatically:

16xx_cp1_fw_Backup.fwl

16xx_cp1_s7prj_backup.xdb

16xx_cp1_ser_nr_backup.

These files are located in the following directory:

Windows 7: C:\Users\Public\Documents\SIEMENS\SIMATIC.NET\CP1616\Backup

Linux: /etc/16xx_config/backup

Settings of the Ethernet ports

The default setting of the Ethernet ports of the module is "**Automatic settings**", unless you use the "**Prioritized startup**" option for the connected IO devices. In this case, you will need to select "TP/ITP at 100 Mbps full duplex" from the "Transmission medium/duplex" drop-down list in HW Config (right-click on the port of the CP 1616/CP 1604, port menu **Object Properties** -> **Options** tab -> **Connection** group box -> **Transmission medium/duplex** -> **TP/ITP at 100 Mbps full duplex**). The communications partner must also be configured with fixed settings. The "prioritized startup" option is particularly useful when IO device are added and removed in ongoing operation (tool changes).

Downloading the configuration

As of version 2.2 of the firmware, the "Download configuration from host" function is available (SERV_CP-download). With this function, you can download the configuration in the form of an XDB file from the host system to the CP. We recommend this method and not a direct download to the CP with STEP 7/NCM PC.

Downloading new firmware to the CP

If new firmware is downloaded, the PC needs to be restarted or the driver deactivated and reactivated.

PROFINET IRT

It is not possible to operate the CP 1616 with IRT communication when using Windows operating systems.

If you accidentally load a STEP 7 project with IRT communication, the CP 1616 may change to an exception status that can only be cleared by cycling power and resetting to the factory settings.

TCP port 23 is only opened for diagnostics

Make sure that TCP port 23 is opened for diagnostics on the module. Prevent TCP port 23 from having access to the Internet. Take suitable measures to achieve this, e.g. a firewall.

1.3 Restrictions

CP 16xx device: No firmware update during PROFINET energy pause

Firmware updates, device name modifications and changing the IP address are not permitted during the PROFINET energy pause.

Interrupts for media redundancy

To allow diagnostic interrupts for media redundancy to be reported, the redundancy master must be assigned to an IO device.

Firmware-software compatibility

The following table shows the released combinations of versions of the host software on the "DK-16xx PN IO" CD with the firmware versions on the CP:

Version of the host software	Version of the firmware
------------------------------	-------------------------

V2.0	V2.0
V2.1	V2.1
V2.2	V2.2
V2.3	V2.3, V2.4
V2.4	V2.4
V2.5	V2.5
V2.5	V2.5, V2.6
V2.6	V2.6

Data status with shared modules in IO routing

The data status of modules written by two IO controllers is only GOOD when all status values of the module are GOOD. This happens only when the IO controller user program of the IO router has written its data once.

IO routing

When using the CP 1616 as an IO router, less IO devices are possible with a given cycle time than in the normal mode as a PROFINET IO controller. The number depends on the particular configuration.

Firmware download

During a firmware download, neither the IO-Base user programming interface nor the layer 2 interface may be open.

Number of modules in a PC

A maximum of 1 (one) CP 1616 or CP 1604 can be operated.

Changing the device name of the CP

A device name must be assigned to the CP for use as an IO device (using NCM PC/STEP 7, Assign Ethernet address...). It is not possible to change the device name of a CP once the CP has been configured as an IO controller.

In this case, attempting to assign a device name is rejected with the message "The function could not be executed".

Remedy:  Reset to factory settings

This is possible in the STEP 7 Manager in "Edit Ethernet Node".

Removing a module in online mode

If a module is removed from an IO device that is in online mode, the error code PNIO_ERR_NO_CONNECTION is returned when reading from or writing to this module.

"pIOremState" is set to BAD and this must be evaluated by the IO controller user program.

Switch mode with PC turned off (not with CP 1616 onboard)

The switch function of the CP is also available when the PC is turned off as long as it was turned on briefly at least once and the external power supply is connected.

IRT switch mode

The IRT switch function of the integrated switch can only be assured when an IRT user program is registered on the CP.

When operating as an IRT-IO device, the IRT-IO device must also be in cyclic mode with the corresponding IRT-IO controller.

Resetting the module

If you want to reset the CP module, follow the steps below:

1. Disconnect the external power supply on the CP (does not apply to the CP 1616 onboard).
2. Run a cold restart on the PC. (Shut the PC down for several seconds.)

Isochronous modules in IO devices

Use isochronous modules for PROFINET IO IRT communication with high performance with IO devices if you have an I/O synchronized with the cycle. In this case, the "Operate IO device/application in isochronous mode" check box can be enabled.

IRT StartOp callbacks with RTAI

To obtain the IRT StartOp callbacks under the real-time extension RTAI of the Linux operating system, the IRT user program must be started with "root" and "su" rights.

BIOS setting of "Intel® SpeedStep™" in IRT mode

If the "Intel® SpeedStep™tech" parameter is included in the BIOS of your PC, it must be set to "disabled" for IRT mode. You will find this, for example, in the Phoenix BIOS in "Advanced BIOS Features".

Released configuration limits for CP 16xx IO controller communication

The released configuration limits for a CP 16xx IO controller are as follows:

IO devices	128, of those maximum 64 IRT-IO devices with the "high performance" option or the "high flexibility" option (additional IRT-IO
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	controllers in direct data exchange count as RT-IO devices)
Modules	<ul style="list-style-type: none"> • 2048, of those maximum 256 for IRT • Up to 8192 bytes of data values; the IO data for the IRT-IO controller direct data exchange are included here.
Maximum module size	254 bytes
Transmit clock	RT and IRT mode with the "high flexibility" option 250 µs, 500 µs, 1 ms IRT mode the "High performance" option Starting at 250 µs in 125 µs steps up to 4 ms
Data records	Maximum length of the data records (reading and writing): 4096 bytes

Released configuration limits for CP 16xx IO device communication

The released configuration limits for a CP 16xx IO device are as follows:

Modules (V1.0 RT)	max. 8 (range: slot 1 to 8)
Modules (V2.0 RT/IRT)	max. 16 (range: slot 1 to 16)
Modules (V2.1 RT)	max. 16 (range: slot 1 to 16)
Modules (V2.2 RT, IRT with high flexibility)	max. 64 (range: slot 1 to 64)
Modules (V2.3, V2.4, V2.5, V2.6 RT, IRT with high flexibility)	max. 64 (range: slot 1 to 64)
Modules (V2.3, V2.4, V2.5, V2.6 IRT with high performance)	max. 16 (range: slot 1 to 16)
Data records	Maximum length of the data records (reading and writing) <ul style="list-style-type: none"> • 4096 bytes (as of DK 16 XX V2.5.2) • 3984 bytes (DK versions lower than V2.5.2) Note: The maximum possible data length of a data record is decided by the entry "MaxSupportedRecordSize" in the GSDML file. (If this does not exist, the default value 4068 applies) According to the following formula: Maximum possible data length = MaxSupportedRecordSize - 84.

Maximum amount of data per IO device

When configuring an IO device, the maximum amount of process data is decided by the maximum frame size (net 1434 bytes) and the number of submodules inserted in the IO device (configured in HW Config).

- The following applies to homogeneous submodules:
The maximum data length in bytes (attribute "MaxInputLength" and "MaxOutputLength" in the GSDML file) is 1434 bytes of data minus the number of submodules inserted.
- The following applies to mixed modules (DI/DO): 1434 bytes of data minus twice the number of inserted submodules.

Example of the calculation mentioned above

- Example of an IO device with 16 inserted DI submodules:
1434 bytes minus 16 submodules = maximum 1418 bytes of user data in total via 16 submodules.
- Example of an IO device with 32 inserted DI/DO submodules:
1434 bytes minus 2 x 32 submodules = maximum 1370 bytes of user data in total via 32 submodules.

0x1FFFFFFF-DMA mask necessary

Your PC system must allow a 0x1FFFFFFF DMA mask to be used, otherwise no PROFINET IO-IRT communication with the "high performance" option and no layer 2 access is possible.

For more detailed information, refer to the hardware description of your PC system.

No 0x1FFFFFFF DMA mask with Ultra Sparc under Linux

With Ultra Sparc, there is no PN IO IRT with the "high performance" option or layer 2 access possible under Linux because the required 0x1FFFFFFF DMA mask is absent.

SNMP-MIB-I counter for the NRT multicast packets not released

The counter for non unicast packets (NRT) in the receive direction (ifInNUcastPkts) and the counter in the send direction (ifOutNUcastPkts) have not been released because some packets from the IRT phase are also counted.

Non-isochronous access to the cyclic IRT data is not approved

Access to cyclic IRT data with the "High performance" option outside the callback event PNIO_CP_CBE_STARTOP_IND is non-isochronous. This type of access is not released.

Restarting the CP 1604 module

If the optional "power supply for CP 1604" module is not connected to the CP 1604, the PC must be turned off to reset and restart the CP 1604 module.

Rebooting the operating system alone is not adequate.

Flood ping

If the ping load at the ports of the module is particularly high, for example due to triggering a flood ping, this will lead to loss of the connection between IO controller and IO device. After eliminating the problem, the connection is reestablished (DEVICE_RETURN).

Operating a CP 1616 with IE/PB Link PN IO or IWLAN/PB Link PN IO

If the LAN cable with which a CP 1616 is connected to an IE/PB Link PN IO or IWLAN/PB Link PN IO module is interrupted during a download or when restarting, in some situations, the parameters for the links may not be correctly set.

Remedy:

Reinsert the cable and either stop and restart the CP 1616-IO controller (STOP/START) or repeat the download.

IO controller (RT communication) and IO device (RT communication) on the same CP

Simultaneous operation of an IO controller and IO device both for RT communication on the same CP is possible. However the following constraint applies: IO devices from the catalog entry in "HW Config" V2.0, V2.1, V2.2 or V2.3 may not be used.

Loading older firmware versions

If you want to load a firmware version V2.1.4 or earlier, the CP memory must first be cleared/reset. Refer to the section on "Firmware-software compatibility" in this document.

Updating older firmware versions

Before you install more recent host software on a PC with a module with firmware version V2.4 or lower, you will first need to run a firmware update of the module to install the same version.

Media redundancy

If there are interruptions on the bus that lead to a reconfiguration, devices that are not located in the interrupted section can also be briefly interrupted (200 ms).

Configuring the Media Redundancy Protocol

Before reconfiguring the MRP role of the CP in a ring configuration (Media Redundancy Protocol activated), the ring must be opened at one point.

Short-circuiting the LAN ports

Accidentally short-circuiting 2 LAN ports of the CP (both connectors of one network cable are plugged into the ports of the CP) causes malfunctions in the network and on the CP. Under some circumstances, this needs to be reset before it will function correctly again.

Display of pulled IO module on the Web server or in STEP 7

If you use STEP 7 V5.5.1 or an older version, the address of a pulled output module is not displayed correctly. Instead, of output address 8, 32776 (32768 + 8). You should therefore deduct 32768 from the displayed address to obtain the correct address.

Loading firmware using STEP 7

After loading firmware using STEP 7, the PC must be shut down and restarted.

CP 1616 web pages and untrusted Internet sites affect MRP settings

Simultaneous operation of a web browser with the CP 1616 web pages and untrusted Internet sites is not permitted. Simultaneous operation could have a negative effect on the MRP setting due to "cross-site scripting". This restriction does not apply if the CP 1616 is part of a configured PROFINET IO network.

With the "Konqueror" browser, the "Skip Intro" check box does not work

Follow the steps below so that the "Skip Intro" check box works:

1. In Konqueror, go to the menu item "Settings" > "Configure Konqueror".
2. In the dialog box that opens, select "Web Browsing" > "Cookies" in the navigation tree.
3. In the "Policy" tab, deselect the "Only accept cookies from originating server" check box.

1.4 Note

Diagnostics over the SNMP OPC server

Use the profile files supplied in NCM PC or on the CP 16xx-CD in ".\snmp\profile" for SNMP diagnostics of the CP 1616 or CP 1604 via the SNMP OPC server.

SUSE plugger automatically signals installation of a new network adapter (CP 16xx)

If a CP 16xx is installed in a PC with SUSE Linux higher than 9.0, the SUSE plugger automatically signals the installation of a new network adapter and prompts you to configure it. Ignore this because the network configuration and project engineering (IP address etc.) is done in the PROFINET IO project engineering of STEP 7/NCM PC.

Register "PNIO_CP_CBE_NEWCYCLE_IND" callback event before "PNIO_CP_CBE_STARTOP_IND" callback event or "PNIO_CP_set_opdone()" call

The "PNIO_CP_CBE_NEWCYCLE_IND" callback event must be registered by the user application before the "PNIO_CP_CBE_STARTOP_IND" callback event or before "PNIO_CP_set_opdone()" is called.

OPFAULTs despite correctly timed PNIO_set_opdone()

Please note that after calling PNIO_set_opdone(), the time for the DMA transfer to the local process image must be taken into account. If this means that the end of the cycle is exceeded, an OPFAULT occurs.

Additional network load due to broadcast pings

The 16xx CPs respond to a ping (ICMP echo) request sent to all stations as a broadcast. This results in extra network load.

Update times for cyclic data exchange with RT

The following table indicates the possible update times depending on the number of connected modules and IO devices:

Time (in ms)	Number of IO devices (4 modules per IO device)	Number of IO devices (max. 64 modules per IO device)
1	22	9
2	44	18
4	88	36
8	128	72
16	128	128

* Taking into account the restriction regarding the maximum number of possible modules in the section "Released configuration limits for CP16xx IO controller communication".

Aborting loading of firmware

Note that aborting the loading of firmware can lead to an inconsistent status on the module!

An "inconsistent status on the module" can be recognized by the following symptoms:

- The module is NOT accessible (visible) to STEP 7, SIMATIC Manager **PLC -> Edit Ethernet Node** ... Online Accessible Nodes.
- When you restart the computer, all LEDs on the RJ-45 jacks go on briefly and then off again; except for the ports in which a cable is plugged in and a link exists.
- The SF-LED flashes at 2-second intervals.

Remedying the problem:

Turn the PC off and on again.

Download the current firmware file to the module, for example fw16xx-v.v.v.b.b.fwl ("v" represents the current version, "b" the build numbers) via the ISO access point. To download using the ISO protocol, you require the first MAC address of the module. You can see this on the module. Confirm the message "Error in connection establishment to identify hardware version" with "yes" (in other words, ignore it).

Operating IRT communication with high performance with older hardware versions

If you use a CP 1616 hardware version 7 or older, the amount of user data per IO device is restricted to 200 bytes.

Downloading a configuration with more data blocks connection establishment.

Remedy: Remove the configuration by resetting memory and download a corrected configuration to the CP.

Overview of the performance data

You will find reaction and transfer times on the following Siemens Web pages (performance statements) for PROFINET IO communication:

<http://www.siemens.com/automation/pd>

1.5 Notes on configuration and project engineering with NCM PC or STEP 7

Operating the CP 1616 as an IO device

If you want to operate the CP as an IO device and it was previously configured as an IO controller, you will first need to reset to factory settings.

This is possible in the STEP 7 Manager in "Edit Ethernet Node".

Point to note when using media redundancy

If you enable media redundancy when configuring the CP 1616, in other words, select either "Manager" or "Client" as the role, you will have to run a memory reset on **all CPs involved before** downloading.

Special feature of IO routing

After configuring transfer relations, the underlying IO system must be compiled in HW Config.

Uniform PROFINET RT class for all synchronized devices

Assign the same RT class to all synchronized devices in a PROFINET project (STEP 7/NCM PC -> Domain Management -> Device Properties -> Synchronization tab -> Parameters RT Class); either "High performance" or "High flexibility".

Avoiding bit-oriented assignment with transfer modules

It is also possible to assign more than one transfer module to input modules bit-oriented when configuring. This function should, however, not be used because input modules can always be read in their entirety by two IO controllers at the same time.

Notes on permitted configurations when using IO routing

If two IO controllers want to access a specific output module or bit of an output module, the following table shows which combinations are permitted:

	Access to data	IO controller 2	
Access to data		WRITE	READ
IO controller 1	WRITE	No	Yes
	READ	Yes	Yes

Example:

If IO controller 1 writes to an area of an output module, IO controller 2 cannot write to this area at the same time, therefore: No.

Firmware update with loaded Linux driver (host-xxx.tar.gz)

If the Linux driver was loaded prior to or during a firmware update, the Linux driver must be loaded again with the "make reload" command on completion of the firmware download.

IP protocol and "S7ONLINE" access point when loading firmware

Make sure that the IP protocol is selected in the 2nd step "Select the interface..." when loading the firmware. Here, enter the IP address of the target module. In the 3rd step, "Check the configuration", the access point "S7ONLINE" must reference a **TCP/IP interface**.

Full description of the topic configuration and project engineering for the CP in a PC station

The configuration and project engineering for the CP in a PC station with SIMATIC NCM PC or STEP 7 is described in detail in the "Commissioning PC Stations" manual on the "DK-16xx PN IO" CD (nm_ncm-pc_76.pdf).

Time stamp in S7 online diagnostics and on the Web server

The time stamp is always relative to the start or reset of the module and the start time is always 01.01.1984 00:00. Example: Current display in S7 online diagnostics: 1.2.1985 means that the module was started or reset one year and one month ago. If you use the "SERV_CP_set_time" function, the correct time and the correct date can be displayed.

Which IO controller can communicate with which IO device in different PC stations?

The following tables show the combination of an IO controller and an IO device. The product or firmware version is named that is listed on the accompanying product CD. The name listed in STEP 7/NCM PC is also named. The rows of the tables represent tested combinations of an IO controller and an IO device in different PC stations.

Combinations with PROFINET IO RT communication

IO controller		IO device
Product/firmware version listed on product CD	Catalog entry in HW Config	Possible IO device combinations
V1.0	V1.0	<ul style="list-style-type: none"> Product/firmware version - V1.0 HW Config - V1.0
		<ul style="list-style-type: none"> Product/firmware version - V2.0 HW Config - V1.0
		<ul style="list-style-type: none"> Product/firmware version - V2.1 HW Config - Migration/V2.1
		<ul style="list-style-type: none"> Product/firmware version - V2.2

		<ul style="list-style-type: none"> • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
V2.0	V1.0	<ul style="list-style-type: none"> • Product/firmware version - V1.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - Migration/V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
V2.0	V2.0	<ul style="list-style-type: none"> • Product/firmware version - V1.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V2.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - Migration/V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
		Third party IO device, PN IO standard V2.0
V2.1	V2.1 (PN IO V1.0)	<ul style="list-style-type: none"> • Product/firmware version - V1.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - Migration/V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
V2.1	V2.1 (PN IO V2.0)	<ul style="list-style-type: none"> • Product/firmware version - V1.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V2.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - Migration/V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.2

		<ul style="list-style-type: none"> • HW Config - V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
		Third party IO device, PN IO standard V2.0
V2.2	V2.2	<ul style="list-style-type: none"> • Product/firmware version - V1.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V1.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V2.0
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - Migration/V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.1 • HW Config - V2.1
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - Migration/V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - Migration/V2.3
		Third party IO device, PN IO standard V1.0
V2.3	V2.3	<ul style="list-style-type: none"> • Product/firmware version - V1.0 to V2.3 • HW Config - V1.0 to V2.3
V2.4	V2.4	<ul style="list-style-type: none"> • Product/firmware version - V1.0 to V2.4 • HW Config - V1.0 to V2.4
V2.5	V2.5	<ul style="list-style-type: none"> • Product/firmware version - V1.0 to V2.5 • HW Config - V1.0 to V2.5
V2.6	V2.6	<ul style="list-style-type: none"> • Product/firmware version - V1.0 to V2.6 • HW Config - V1.0 to V2.6

Combinations with PROFINET IO IRT communication with high flexibility (IRT flex)

IO controller		IO device
Product/firmware version listed on product CD	Catalog entry in HW Config	Possible IO device combinations
V2.2	V2.2	<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - V2.2
V2.3	V2.3	<ul style="list-style-type: none"> • Product/firmware version - V2.2 • HW Config - V2.2
		<ul style="list-style-type: none"> • Product/firmware version - V2.3 • HW Config - V2.3
V2.4	V2.4	<ul style="list-style-type: none"> • Product/firmware version - V2.3 , V2.4 • HW Config - V2.3,V2.4
V2.5	V2.5	<ul style="list-style-type: none"> • Product/firmware version - V2.3 to V2.5 • HW Config - V2.3 to V2.5
V2.6	V2.6	<ul style="list-style-type: none"> • Product/firmware version - V2.3 to V2.6 • HW Config - V2.3 to V2.6

Combinations with PROFINET IO IRT communication with high performance (IRT top)

IO controller		IO device
Product/firmware version listed on product CD	Catalog entry in HW Config	Possible IO device combinations
V2.0	V2.0	<ul style="list-style-type: none"> • Product/firmware version - V2.0 • HW Config - V2.0
		Third party IO device, PN IO standard V2.0

V2.3	V2.3	<ul style="list-style-type: none"> Product/firmware version - V2.3 HW Config - V2.3
V2.4	V2.4	<ul style="list-style-type: none"> Product/firmware version - V2.3, V2.4 HW Config - V2.3, V2.4
V2.5	V2.5	<ul style="list-style-type: none"> Product/firmware version - V2.3 to V2.5 HW Config - V2.3 to V2.5
V2.6	V2.6	<ul style="list-style-type: none"> Product/firmware version - V2.3 to V2.6 HW Config - V2.3 to V2.6

IO controller (IRT communication) and IO device (RT communication) on the same CP

Simultaneous operation of an IO controller and IO device both with IRT communication on the same CP is not possible. If an IO controller was configured for IRT communication, a maximum of one IO device (V1.0 or migration) can be configured and operated for RT communication at the same time on the same CP.

IO controller and IO device combinations on the same CP when using IO routing

The following table shows combinations of an IO controller and an IO device on the same CP and that exchange information using IO routing.

The product or firmware version is named that is listed on the accompanying product CD. The name listed in STEP 7/NCM PC is also named.

All rows of the table represent tested combinations.

IO controller		IO device
Product/firmware version listed on product CD	Catalog entry in HW Config	Possible IO device combinations
V2.1	V2.1 (PN IO V1.0)	<ul style="list-style-type: none"> Product/firmware version - V2.1 HW Config - V2.1
		<ul style="list-style-type: none"> Product/firmware version - V2.2 HW Config - V2.2
V2.1	V2.1 (PN IO V2.0)	<ul style="list-style-type: none"> Product/firmware version - V2.1 HW Config - Migration/V2.1
		<ul style="list-style-type: none"> Product/firmware version - V2.2 HW Config - Migration/V2.2
V2.2	V2.2	<ul style="list-style-type: none"> Product/firmware version - V2.1 HW Config - Migration/V2.1
		<ul style="list-style-type: none"> Product/firmware version - V2.2 HW Config - Migration/V2.2
V2.3	V2.3	<ul style="list-style-type: none"> Product/firmware version - V2.1 HW Config - Migration/V2.1
		<ul style="list-style-type: none"> Product/firmware version - V2.2 HW Config - Migration/V2.2
		<ul style="list-style-type: none"> Product/firmware version - V2.3 HW Config - Migration/V2.3
V2.4	V2.4	<ul style="list-style-type: none"> Product/firmware version - V2.2 to V2.4 HW Config - Migration/V2.2 to V2.4
V2.5	V2.5	<ul style="list-style-type: none"> Product/firmware version - V2.5 HW Config - Migration/V2.5
V2.6	V2.6	<ul style="list-style-type: none"> Product/firmware version - V2.6 HW Config - Migration/V2.6

Downloading a PROFINET IO configuration to a CP 16xx stops the SNMP agent

Downloading a PROFINET IO configuration to a CP 16xx stops the SNMP agent. This means that no SNMP diagnostics is possible during the download.

GSDML specification

The PROFINET IO GSDML files are described in the document "PROFINET Specification, Order No: 2.352, GSDML Specification for PROFINET IO".

You can obtain this document from:

PROFIBUS International
Haid-und-Neu-Str. 7

D-76131 Karlsruhe, Germany
Phone: ++49-721-96 58 590
Fax: ++49-721-96 58 589
pi@profibus.com
www.profibus.com

Creating a user-defined GSDML file

When creating a user-defined GSDML file, note that some parameter settings are restricted. The XML schema files require syntactically and structurally valid XML files. Use the CP 16xx GSDML file supplied with STEP 7/NCM PC as a template. Assign a unique name and, where possible, change only the number of modules and sizes within the permitted configuration limits (see above).

Some attributes and/or elements must not be modified in the GSDML file.

- In the "IsochroneMode" element: T_DC_Base, T_DC_Min, T_DC_Max, T_IO_Base, T_IO_InputMin and T_IO_OutputMin
- In the "IOData" element: IOPS_Length and IOCS_Length
- The elements "VirtualSubmoduleList" and "SystemDefinedSubmoduleList".

Note on IRT configuration (High performance option)

You have more time available for your IO controller/IO device IRT user program in IRT mode with the "High performance" option (in the STARTOP callback) when the IRT time is lower and the cycle time higher. The IRT time depends on the network topology: a linear structure increases the IRT time whereas a tree structure reduces the IRT time. The execution time of the IRT user program is also dependent on the performance of the PC system.

IO system with direct data exchange configuration

When configuring IO controller-IO controller direct data exchange on a CP 1616/CP 1604 V2.5, an IO system must always exist (exists in the factory default setting). This must not be deleted.

Data length direct data exchange

When using IO controller - IO controller direct data exchange, the following restrictions apply to the data configured in the "Sender" or "Receiver" tab:

$[(length+1) \text{ in row } 1] + [(length+1) \text{ in row } 2] + \dots + [(length+1) \text{ in row } n] \leq 1440 \text{ bytes}$

Problems downloading the configuration

If the error message "System data cannot be loaded" appears when downloading to the module with STEP 7/HW Config, you will need to reset the firmware of the module ("cp16xctest", \host-linx\testapps program); call: ".\cp16xctest reset".

Reading output modules when using IO routing

If you assign entire output modules to a second IO controller, when reading output modules smaller than 8 bits, remember that only the physically existing bits may be evaluated (for example 4DO module: bits 0-3).

IE/PB Link PN IO

Note that when operating an IE/PB Link PN IO, this must first have a device name and IP address assigned to it before you can load a configuration on the CP 1616/CP 1604.

Operating CP 1616 / CP 1604 as a "Device"

To make operation as a PROFINET device possible, a head station (DAP) must be plugged in in the device user program. This depends on the version of the device configured in STEP 7:

V1.0 to V2.2

The DAP module needs to be plugged into slot 0.

The DAP submodule with the submodule identification number = 0x00000001 must also be plugged into subslot 1 of slot 0.

V2.3 to V2.5

The DAP module needs to be plugged into slot 0.

The DAP submodule with the submodule identification number = 0x00010001 must also be plugged into subslot 1 of slot 0.

As of V2.6

The DAP module needs to be plugged into slot 1.

The DAP submodule with the submodule identification number = 0x00010001 must also be plugged into subslot 1 of slot 1. Slot 0 is no longer used.

See also the table in the section "GSD file and sample programs".

Incorrect indication of the MLFB (order number) with CP 16xx

A CP 16xx with MLFB "02" and firmware lower than V2.5.2 logs on with the Web server and in the TIA Portal with MLFB "00".

2 Notes and Restrictions Relating to the "DK-16xx PN IO" product

2.1 Version history

See chapter 1.1

2.2 Components of the product

- LINUX SW for CP 1616 (CD path: V2.6.0\DK16xx\linux-sw)
- CP 1616 and CP 1604 sample programs included in the Linux driver in "host_lin\examples".
- Windows SW 32 Bit (CD path: V2.6.0\Win\disk_32)
- Windows SW 64 Bit (CD path: V2.6.0\Win\disk_64)
- Operating Instructions CP 1616 / CP 1604 (CD path: V2.6.0\DK16xx\doc)
- Commissioning PC Stations, instructions and quick start (CD path: V2.6.0\DK16xx\doc\PH_PC-Stations__76.pdf)
- SIMATIC, SIMATIC NET Technical Support, Contacts and Training (CD path: V2.6.0\DK16xx\doc\pi-support_76.pdf)
- IO-Base user programming interface (CD path: V2.6.0\DK16xx\doc\PGH_IO-Base_76.pdf)
- DK-16xx PN IO porting manual and layer-2 interface (CD path: V2.6.0\DK16xx\doc\PGH_DK-16xx_76.pdf)

2.3 Computer requirements

Refer to the operating instructions of the relevant CP.

2.4 Restrictions

PC is sometimes blocked when shutting down

Shutting down the PC is sometimes blocked

Remedy: Copy the "...\host_lin\driver\cp16xxloader " file to the "\etc\init.d" directory and create a symbolic link to this file in the "\etc\init.d\rc5.d" directory.

(You can create the link with the command:

```
ln -s \etc\init.d\cp16xxloader K07cp16xxloader)
```

PNIO_data_write_cache()

PNIO_data_write_cache_flush()

Windows: These functions must not be used if the CP 1616 is configured as a IO router.

2.5 Installing the Linux driver

See SIMATIC NET, Commissioning PC Stations, Instructions and Quick Start (CD path: \doc\PH_PC-Stations_76.pdf).

2.6 Sample programs

Further information

See SIMATIC NET, Commissioning PC Stations, Instructions and Quick Start (CD path: \doc\PH_PC-Stations_76.pdf).

Folder for the sample programs

The PROFINET IO sample programs are in the /host-linx/examples folder.

IO controller sample programs

The following sample programs are available for use of the CP 1616 or CP 1604 as IO controller:

Sample program name	Description
pnioeasy1	<ul style="list-style-type: none"> • Logon/logoff • Read/write digital IO data

pnioeasy1_load_proj	<ul style="list-style-type: none"> • Loading the configuration to the module from the host
pnioeasy2	<ul style="list-style-type: none"> • Logon/logoff • Read/write digital IO data • Output interrupt information • Start/stop IO device
pnioeasy2_load_firmware	<ul style="list-style-type: none"> • Loading the firmware to the module from the host
pnioeasy3	<ul style="list-style-type: none"> • Logon/logoff • Read data record • Read/write digital IO data • Output interrupt information • Start/stop IO device
pnioeasy4	<ul style="list-style-type: none"> • Logon/logoff • Read/write analog IO data • Output interrupt information, start/stop IO device
pnioeasy_irt1	<ul style="list-style-type: none"> • Logon/logoff • Read/write IRT IO data (with the "High performance" option)

IO device sample programs

The following sample programs are available for use of the CP 1616 or CP 1604 as IO device:

Sample program name	Description
dev_easy1	<ul style="list-style-type: none"> • Register IO device • Initialize • Register APIs • Insert/remove modules • Start IO device • Deregister IO device
dev_easy2	In addition to the functions of dev_easy1: <ul style="list-style-type: none"> • Read/write IO data • Read/write data records
dev_easy3	In addition to the functions of dev_easy1: <ul style="list-style-type: none"> • Send/reset diagnostic interrupts • Send hardware interrupts
dev_easy_irt1	<ul style="list-style-type: none"> • Logon/logoff • Read/write IRT IO data
dev_easy_im	<ul style="list-style-type: none"> • Logon/logoff • Read/write I&M data
dev_easy_cert	<ul style="list-style-type: none"> • Sample program for the certification of a PROFINET IO device with the CP 1616 • Sample program for the certification of CP 1604 as a PROFIenergy device • Turning the host PC on and off using PROFIenergy
time_daemon	<ul style="list-style-type: none"> • Sets the time on the CP 1616

Layer 2 sample program

The sample program "l2eth_ping" is available for layer 2 mode.

Notes on the sample program for layer 2 (l2eth_ping)

The "l2eth_ping" test program sends a ping to the IP and MAC address transferred as the parameter. Remember that the test program does not use any IP functions and that the IP address used in the ICMP ECHO request frame as source address is only a pseudo IP address. The destination computer cannot therefore resolve the reply address with the standard procedure (ARP frames).

Before the destination computer can reply correctly to the ping request, its ARP table must be edited manually; in other words, the combination MAC <--> pseudo IP CP 16xx of the source computer must be added (arp -s).

GSD file and sample programs

The sample programs for CP 1616 IO devices are not optimized for the GSD files supplied with STEP 7 and must be modified. The following Table lists the module ident numbers of the head module (DAP) for the specified configurations.

This head module is plugged into slot 0.

As of V2.6 of the device, the head module is plugged into slot 1, slot 0 is no longer used. The submodule for the head station

is plugged into subslot 1 of slot 0 (up to and including V2.5) or slot 1 (as of V2.6). 0x00000001 (up to and including V2.2) or 0x00010001 (as of V2.3) is entered as the submodule identification number.

Version	CP 1616	CP 1616 Migration	CP 1616 onboard	CP 1616 onboard Migration	CP 1604	CP 1604 Migration
V1.0	0x01	-	-	-	0x02	-
V2.0	0x03	-	-	-	0x04	-
V2.1	0x07	0x05	-	-	0x08	0x06
V2.2	0x0B	0x09	0x02	0x01	0x0C	0x0A
V2.3	0x0F	0x0D	0x04	0x03	0x10	0x0E
V2.4	0x13	0x11	0x06	0x05	0x14	0x12
V2.5	0x17	0x15	0x08	0x07	0x18	0x16
V2.6	0x1B	0x19	0x0A	0x09	0x1C	0x1A

"ANNOT_ORDERID" must match the value "OrderNumber value" in the GSDML file.

2.7 Notes on porting the CP 1616 software

Software required for operation

The software required to operate the CP 1616 consists of 2 components:

- The firmware that runs directly on the CP 1616.
- The host software that runs on the PC.

Source code of the host software

In contrast to the firmware that is always used in its original form as shipped, the host software may need to be ported to the target operating system by the user.

To allow this, the source code of the host software is included on the "SIMATIC NET CD, DK-16xx PN IO" for Linux and Windows.

Further development directly in the firmware

Software modifications resulting from further development and product maintenance are made, whenever technically possible, in the firmware.

This means that it is not absolutely necessary to make changes in the host software ported by user.

It may, however, sometimes be necessary to include expansions in the ported host software to be able to use new product functions.

2.8 Restriction and additional information for the IO-Base user programming interface >for IO controllers>

Note on generating a maintenance alarm on the device interface

Maintenance alarms are generated like diagnostics interrupts. However, the channel properties (packed bit structure for channel diagnostics data records, see section 7.7.1 PGH_IO-Base) must be expanded.

- For maintenance required alarms, PNIO_CHAN_PROP_MAINT_REQUIRED_BIT must be added to the bit structure:
ChannelProp |= PNIO_CHAN_PROP_MAINT_REQUIRED_BIT;
- For maintenance demanded alarms, PNIO_CHAN_PROP_MAINT_DEMANDED_BIT must be added to the bit structure:
ChannelProp |= PNIO_CHAN_PROP_MAINT_DEMANDED_BIT;

See also example "dev_easy_rt3 -> maintenance alarms"

New function SERV_CP_set_time

The time and date can be set on the CP 1616 with this function. For more information, refer to the file "servusrx.h". Only the parameter "unix_utc_time" is relevant. For more information, refer to the example "time_daemon".

Writing to individual submodules of an ET 200S

It is only possible to write to individual submodules of an ET 200S station after all submodules of this station (with status=Good) have been written to.

This applies both during startup and when a station returns following station failure.

This restriction is due to the firmware version of the ET 200S and does not apply as of version V2.0.0.

PNIO_controller_open() call while the firmware is loading

If PNIO_controller_open() is called while firmware is being downloaded to the CP 16xx communications processor, depending on the progress of the download, the call will be denied with the error message PNIO_ERR_INVALID_CONFIG, PNIO_ERR_CONFIG_IN_UPDATE, PNIO_ERR_NO_CONFIG or PNIO_ERR_NO_FW_COMMUNICATION.

PNIO_controller_open() function

The PNIO_controller_open() function can take up to 1 minute if the module is replaced by another of the same type. The time is necessary to load stored configuration data on the new module.

Ignoring the PNIO_CP_CBE_OPFAULT_IND callback during startup

The PNIO_CP_CBE_OPFAULT_IND callback event (violation of isochronous real-time mode) can, in some circumstances, occur in the startup phase of a connection (approx. 30 s) although there is no violation of the isochronous real-time mode. This can be ignored.

Error code PNIO_ERR_SEQUENCE with the PNIO_set_mode() function

Calling the PNIO_set_mode() a second time with the same parameters returns PNIO_OK if the required status has already been reached. While the job is being processed, the second PNIO_set_mode() call returns PNIO_ERR_SEQUENCE.

Points to note when receiving an alarm type "Return of Submodule"

When receiving an alarm type "Return of Submodule" on the interface for IO controllers:

If the parameter "UserAlarmDataLen" contains the value 0, the content of the parameter "UserStruIdent" is invalid.

PROFINET IO controller and IO device at the same time (deregister device)

If the CP is operated at the same time as IO controller and IO device in the same user program, before deregistering one of these devices, the writing and reading of IO data of the other device must also be stopped.

PNIO_data_read() without user data

The PNIO_data_read() function can also be called with the parameters "pDataLen=0" and "pBuffer=0" to simply read the remote status of the communications partner.

Diagnostics interrupts

You will find more information on decoding diagnostics interrupts in the accompanying document "Von_PROFIBUS_DP_nach_PROFINET_IO_en-US.pdf".

2.9 Restriction and additional information for the IO-Base user programming interface >for IO devices>

Note on step 12 in Section 6.3.1 The PNIO_CBF_AR_INFO_IND() callback function can also be called after the PNIO_CBF_PRM_END_IND() function.

Return values for PNIO_initiate_data_write and PNIO_initiate_data_read

The PNIO_initiate_data_write and PNIO_initiate_data_read functions can return the error codes PNIO_WARN_NO_SUBMODULES and PNIO_WARN_IRT_INCONSISTENT if they are called in the PNIO_CBF_PRM_END_IND() function.

These return values can be ignored.

PNIO_set_dev_state

The PNIO_set_dev_state() function is no longer necessary. If it is nevertheless called, it always returns OK.

PROFINET IO controller and IO device at the same time (deregister device)

If the CP is operated at the same time as IO controller and IO device in the same user program, before deregistering one of these devices, the writing and reading of IO data of the other device must also be stopped.

PNIO_api_add(), Section 7.2.1 "API" parameter

The PNIO_api_add() call with "API" set to 0 is mandatory for the head station.

For the modules, the API parameter must match the API specified in the project engineering with the GSDML file. Otherwise no connection to the IO controller is possible.

More precise description of the interrupt response in sections

7.3.1 PNIO_mod_plug() (inserting a module)

7.3.5 PNIO_sub_plug() (inserting a submodule)

7.3.6 PNIO_sub_plug_ext() (extended insertion of a submodule)

"Insert alarms" are only sent to the IO controller when the start of the cyclic data exchange is signaled at the IO device end with the PNIO_CBF_AR_INDATA_IND() callback function.

If a module is inserted, no interrupt is triggered.

Whenever a submodule is inserted in a module, an "insert interrupt" is sent to the IO controller.

Data type of the PNIO_diag_channel_add() function

No PNIO_UINT16 values are permitted for the ChannelErrType parameter of this function.

More precise description of the interrupt response in sections

7.3.2 PNIO_mod_pull() (removing a module)

7.3.4 PNIO_sub_pull() (removing a submodule)

"Remove interrupts" are only sent to the IO controller when the start of the cyclic data exchange is signaled at the IO device end with the PNIO_CBF_AR_INDATA_IND() callback function.

Whenever a submodule is removed, a "remove interrupt" is generated.

If a module is removed, that does not have a submodule, no interrupt is generated.

Meaning of "InstanceID" with PNIO_device_open()

The "InstanceID" parameter when calling PNIO_device_open() is a reserved ID. The value must be 1.

What is the minimum that needs to be done so that an IO device is included in cyclic operation?

1. Calling PNIO_device_open()
2. For each configured profile, PNIO_api_add() must be executed successfully with the relevant API.
Remember that PNIO_api_add() with API=0 is mandatory for the head station.

PNIO_device_open returns PNIO_ERR_SEQUENCE

During the startup of a system, the PNIO_device_open function sometimes returns the error code PNIO_ERR_SEQUENCE. In such situations, repeat the function call.

Removing "Manufacturer-specified diagnostic data", Section 6.8.1

The title "Removing channel diagnostic data" will be replaced by the title: "Removing manufacturer-specified diagnostic data". The text "Channel diagnostic data is removed in four steps" is replaced by the following text "Manufacturer specified diagnostic data is removed in four steps".

Diagnostic data records supported by the IO device

The following table lists the data record numbers of diagnostic data records supported by the IO device; in other words, these diagnostic data records can be read by the IO controller:

Data record number (record index)	Content and meaning
0x800A	Channel diagnostics for a submodule slot
0x800B	Channel diagnostics and vendor-specific diagnostic information for a submodule slot
0x800C	Channel diagnostics and vendor-specific diagnostic information for a submodule slot
0xC00A	Channel diagnostics for a slot
0xC00B	Channel diagnostics and vendor-specific diagnostic information for a slot
0xC00C	Channel diagnostics and vendor-specific diagnostic information for a submodule slot
0xE002	Deviation of the expected configuration from the actual configuration of the IO device assigned to an IO controller
0xE00A	Channel diagnostics for an AR
0xE00B	Channel diagnostics and vendor-specific diagnostic information for an AR
0xE00C	Channel diagnostics and vendor-specific diagnostic information for an AR
0xF00A	Channel diagnostics for an API
0xF00B	Channel diagnostics and vendor-specific diagnostic information for an API
0xF00C	Channel diagnostics and vendor-specific diagnostic information for an API

PNIO_device_close() function

The PNIO_device_close() function may only be called when all jobs have been acknowledged by the IO device with asynchronous callbacks. If this is not adhered to, PNIO_ERR_SEQUENCE is returned and the PNIO_device_close() job will need to be executed again.

2.10 Restriction for the layer 2 interface

l2eth_send() function

The l2eth_send() function can be called several times consecutively. Make sure, however, that at least one packet reserved with "l2eth_allocate_packet()" is always available. Currently, a maximum of 39 packets can be reserved at the same time.

Behavior of the Layer 2 Interface

The Layer 2 interface is designed for optimum performance and guaranteed reaction time.

When being operated at the same time as PROFINET IO, the reaction time of layer 2 can be impaired briefly when IO devices drop out and restart again.

2.11 Notes and addenda to the manual "DK-16xx PN IO Porting Instructions and Layer 2 Interface"

Section 6.1, Expanding the IO-Base Library

RTAI support has been added to the platform-dependent parts of the IO-Base library.

Section 6.2.2, Functions Dependent on the Operating System

Functions for real-time support (RTAI) - The file "fct_common.cpp" has been expanded for IRT enhancements. The following functions have been added and must be ported:

Function	Description
ICommon::CP_register_cbf()	The "ICommon::CP_register_cbf()" function is used by the IO-Base library to start three real-time threads for signaling the following events: <ul style="list-style-type: none"> • PNIO_CP_CBE_NEWCYCLE_IND • PNIO_CP_CBE_STARTOP_IND • PNIO_CP_CBE_OPFAULT_IND The IO-Base library then calls the corresponding callbacks of the user application. These are called within the context of the threads and therefore run with their priorities. Each of these threads waits for a real-time semaphore that is assigned to the event of the particular thread. These semaphores are signaled by the driver as soon as the communications processor signals one of the events listed above with an interrupt.
void ICommon::deinit_und_unregister()	The "void ICommon::deinit_und_unregister()" function is used to exit all real-time threads.
start_irt_thread()	The "start_irt_thread()" function starts a real-time thread.
stop_irt_thread()	The "stop_irt_thread()" function exits a real-time thread.
procCallbackIrt()	The "procCallbackIrt()" function contains the functionality of the real-time threads.

Note: When porting, make sure that these threads have adequately high priority so that the events can be signaled to the user application quickly enough. Otherwise, the user application is not capable of working in isochronous real-time with the IRT cycle.

DMA mode

When porting the Linux driver, note the following about the protocols:

- When using IRT mode with the "high performance" option or layer 2, DMA mode is used. The physical start address of the memory for DMA that is transferred to the module must be divisible by 8.
- In purely RT mode or IRT mode with the "high flexibility" option, no DMA is required.