## Distributed synchronous operation and isochronous mode via PROFINET IRT

SIMOTION & SINAMICS

Application example • September 2013

# Applikationen & Tools

Answers for industry.



## **Siemens Industry Online Support**

This article is taken from the Siemens Industry Online Support. The following link takes you directly to the download page of this document:

http://support.automation.siemens.com/WW/view/en/38486079

## CAUTION

The functions and solutions described in this article confine themselves to the realization of the automation task predominantly. Please take into account furthermore that corresponding protective measures have to be taken up in the context of Industrial Security when connecting your equipment to other parts of the plant, the enterprise network or the Internet. Further information can be found under the Item-ID 50203404.

http://support.automation.siemens.com/WW/view/en/50203404.

If you have any questions concerning this document please e-mail us to the following address:

profinet.team.motioncontrol.i-dt@siemens.com

You can also actively use our Technical Forum from the Siemens Industry Online Support regarding this subject. Add your questions, suggestions and problems and discuss them together in our strong forum community:

http://www.siemens.de/forum-applikationen

S	Task	1
	Solution	2
	Basics	3
SIMOTION & SINAMICS	Configuration	4
PROFINET IRT - Direct data exchange broadcast	Startup of the Application	5
- IRT I-Device	Operation of the Application	6
Application example	Further Notes, Tips and Tricks, etc.	7
	Related Literature	8
	Contact	9
	History	10

## Warranty and liability

#### Note

The Application Examples are not binding and do not claim to be complete regarding the circuits shown, equipping and any eventuality. The Application Examples do not represent customer-specific solutions. They are only intended to provide support for typical applications. You are responsible for ensuring that the described products are used correctly. These application examples do not relieve you of the responsibility to use safe practices in application, installation, operation and maintenance. When using these Application Examples, you recognize that we cannot be made liable for any damage/claims beyond the liability clause described. We reserve the right to make changes to these Application Examples at any time without prior notice. If there are any deviations between the recommendations provided in these application examples and other Siemens publications – e.g. Catalogs – the

We do not accept any liability for the information contained in this document.

contents of the other documents have priority.

Any claims against us – based on whatever legal reason – resulting from the use of the examples, information, programs, engineering and performance data etc., described in this Application Example shall be excluded. Such an exclusion shall not apply in the case of mandatory liability, e.g. under the German Product Liability Act ("Produkthaftungsgesetz"), in case of intent, gross negligence, or injury of life, body or health, guarantee for the quality of a product, fraudulent concealment of a deficiency or breach of a condition which goes to the root of the contract ("wesentliche Vertragspflichten"). The damages for a breach of a substantial contractual obligation are, however, limited to the foreseeable damage, typical for the type of contract, except in the event of intent or gross negligence or injury to life, body or health. The above provisions do not imply a change of the burden of proof to your detriment.

Any form of duplication or distribution of these Application Examples or excerpts hereof is prohibited without the expressed consent of Siemens Industry Sector.

## **Table of contents**

War	Warranty and liability4			
1	Task		7	
	1.1	Overview	7	
2	Solutio	n	8	
	21	Solution overview	8	
	2.1.1	Direct data exchange broadcast	8	
	2.1.2	IRT I-Device	8	
	2.2	Required Hardware and Software Components	10	
3	Basics.		11	
	3.1	PROFINET Communication		
	3.1.1	Device Name		
	3.1.2	Assign Device name via HW Config	11	
	3.1.3	Topology-based initialization	13	
	3.1.4	Device name assignment rules	14	
	3.1.5	IP addresses	15	
	3.1.6	Send clock for IRT communication	17	
	3.1.7	Isochronous mode	17	
4	Configu	Iration	19	
	4.1	HW Config of the master CPU		
	4.2	HW Config of the slave CPU	22	
	4.3	Configuration of PROFINET IRT	27	
	4.4	Commissioning of the drive	30	
	4.5	Axis and I/O configuration	31	
	4.5.1	on the master CPU	31	
	4.5.2	on the slave CPU		
	4.6	Activate isochronous mode on the drive		
	4.7		37	
	4.7.1	ST unit Fault		
	4.7.2	SI UNIT InterfaceSynchronization		
	4.7.3	ST unit MasterAxis on the master CPU		
	4.7.4	ST unit SlaveAxes on the slave CPU		
	4.8	Configuration of the direct data exchange broadcast	40	
	4.9	LW/ Configuration of the IPT I Device	43	
	4.9.1	HW Config of the higher-lever IO-Controller		
	4.3.2	Proxy Objects for distributed synchronous Operation	50	
5	Stortup	of the application	БЛ	
5	Startup			
	5.1	Preparation	54	
	5.1.1	Drive-CLiQ topology	54	
	5.1.2	IF addresses and device names	55	
	5.1.3	Stortup	55	
	0.2	Startup		
6	Operati	on of the application	56	
	6.1	Overview	56	
	6.2	Test of the distributed synchronous operation	56	
	6.2.1	by using the user defined SIMOTION IT website	56	
	6.2.2	by direct control of the global variables	57	

7	Further	Notes, Tips and Tricks, etc.	58
	7.1 7.2 7.3	Multiple use of an I-Device GSD file Deactivation of I-Devices by application Deactivation of synchronous operation relationships by application	58 58 59
8	Related	literature	
	8.1 8.2	Bibliography Internet link specifications	60 60
9	Contact		61
10	History		61

## 1 Task

## 1.1 Overview

## Introduction

Modular machine concepts have several controllers and drives. These components have to operate depending on each other. It means all controllers and drives have to exchange data.

## Overview of the automation task

The figure below provides an overview of the automation task.

## Figure 1-1



A virtual master in **machine A** calculates e.g. the command position for the slave axes of **machine B**. It means the master axis and following axes are on different controllers. This functionality is also called "distributed synchronous operation". Therefore an isochronous real-time communication between controller and drives is needed.

Note

More information about "distributed synchronous operation" are available in the SIMOTION document "Gear\_TechnologyFct.pdf". http://support.automation.siemens.com/WW/view/en/61055960 2.1 Solution overview

## 2 Solution

## 2.1 Solution overview

PROFINET IRT + isochronous mode (High Performance = RTC3, Real Time Class) is needed for an isochronous communication between controllers and drives.

This type of communication is required by SIMOTION CPUs for distributed synchronous operation. Following PROFINET IO functions can be used:

- Direct data exchange broadcast or
- IRT I-Device.

## 2.1.1 Direct data exchange broadcast

**Direct data exchange broadcast** allows isochronous communication of inputs and outputs between more than two SIMOTION CPUs.

For distributed synchronous operation the input and output addresses (distributed synchronous data) are automatically set by the engineering software SIMOTION SCOUT. It is not allowed to modify the addresses.

All participated SIMOTION CPUs must be in the same SIMOTION project!

## 2.1.2 IRT I-Device

**IRT-I-Device** transmits the input and output data also in synchronous mode. The difference is that in this case the SIMOTION I-Device can communicate only to <u>one</u> PROFINET IO-Controller.

For distributed synchronous operation the input and output addresses (distributed synchronous data) for the I-Device must be set by the user.

Instead of direct data exchange broadcast, where you have to configure both SIMOTION CPUs in the same project, you have the possibility to configure the IRT I-Device communication via GSD file and using two different SIMOTION projects. In addition you have the possibility to create modular machine concepts by activating or deactivating I-Devices during runtime without any bus failure.

# **CAUTION** The IRT I-Device of a SIMOTION CPU with FW V4.3 <u>cannot</u> be operated in isochronous mode when a SIMOTION CPU with FW < V4.2 is used as higher-level I/O controller!

 
 NOTE
 More information about modular machines you will find in the SIMOTION Document "Modular\_Machine\_Concepts.pdf".

 http://support.automation.siemens.com/WW/view/en/61056223

## Display



The following figure displays the most important components of the solution: Figure 2-1

## Table 2-1

No.	Connection
1.	PROFINET connection between master and slave CPU (IRT communication)
2.	PROFINET connection between slave CPU and the drive (IRT communication)
3.	Drive-CLiQ connection between SINAMICS control unit and SINAMICS motor module

## Delimitation

This application does not include a description of

- the SINAMICS drives and
- the SIMOTION CPU.

Knowledge of these topics is assumed.

## 2.2 Required Hardware and Software Components

## 2.2 Required Hardware and Software Components

The application was generated with the following components:

## Hardware components

Table 2-2

Component	No.	MLFB / order number	Note
Training unit SIMOTION D435	1	6ZB2470-0AE00	V4.3 SP1
SIMOTION D455-2	1	6AU1455-2AD00-0AA0	V4.3 SP1
CBE30 (PN option board for D4x5)	1	6FC5312-0FA00-0AA0	
CU320-2 PN	1	6SL3040-1MA01-0AA0	V4.5.0.6

**CAUTION** Motor Modules Booksize (SMM/DMM 6SL31\*) with order number smaller than 3 at the end are not released for use with SINAMICS V4.3 or higher.

## **CAUTION** SIMOTION D435 CPU with order number lower than 1 at the end is not released for use with PROFINET communication.

## Standard software components

Table 2-3

Component	Count	Order number	Comment
STEP7	1	6ES7810-4CC08-0YA5	V5.5 SP2 HF1
SIMOTION SCOUT	1	6AU1810-0BA42	V4.3 SP1 HF1

## Sample files and projects

The following list includes all files and projects that are used in this example.

- 38486079\_DistributedSyncOperation\_PN\_IRT\_V2\_2\_en.pdf this document.
- 38486079\_DistributedSyncOperation\_PN\_IRT\_V2\_2.zip
   > Projects > DistributedSyncOperation\_PN\_IRT\_CCQ\_V2\_2.zip
   SIMOTION Project with the PROFINET function
   direct data exchange broadcast
- 38486079\_DistributedSyncOperation\_PN\_IRT\_V2\_2.zip
   > Projects > DistributedSyncOperation\_PN\_IRT\_I-Device\_V2\_2.zip
   SIMOTION Project with the PROFINET function
   IRT I-Device

## 3 Basics

## 3.1 **PROFINET** Communication

In addition to the MAC address and IP address, PROFINET uses additionally a device name to identify the PROFINET devices. This device name must be unique within the PROFINET network.

## 3.1.1 Device Name

During the commissioning phase a device name is assigned to each PROFINET device by the engineering system (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool). The device name can be assigned by different ways:

- IO-Controller
  - Engineering Software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
  - By downloading the HW Config
  - By user program (system function \_setNameOfStation() for SIMOTION)
- IO-Device
  - Engineering Software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
  - From IO-Controller via topology-based initialization

The device name will be stored in the device (on MMC or CF card). When replacing this device (e.g. in case of malfunction), this device must be initiated using the device name of the replaced device. For this step more possibilities are available:

- By plugging the MMC or CF card (if available)
- Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
- Topology-based initialization by the IO-Controller itself. For this the PROFINET interface must be in factory settings.

It means the new device can assume the function of the replaced device without changing the configuration.

## 3.1.2 Assign Device name via HW Config

Open HW Config and select the PROFINET IO-System. Click in menu under "PLC > Ethernet" onto "Assign Device Name...". The dialog assign device name will appear. All configured device names are in dropdown box listed. All recognized PROFINET devices via Network interface are shown under available devices. IO-Controllers are not shown here, because they will get the device name by downloading the HW Config explicit.

Figure 3-1



### Figure 3-2

Assign device name	×
Device name: S120xCU320x2xDPxCBE2 Device type: S120xCU320x2	xDPxCBE20
Available devices: (A)	(C)
IP address MAC address Device type Device name	Assign name
192.168.0.3 D0-0E-8C-92-55 SINAMICS S s120xcu320x2xdpxcb (B)	Node flashing test
	Duration (seconds): 3 💌
	Flashing on Elashing off
$\square$ Show only devices of the same type $\square$ Display only devices without names	
Update Export	
Close	Help

Select the configured device name (A) and select the corresponding device (B) and click on "Assign name" (C). The device name will be transferred to the device.

If the device identification is not clear you can activate the flashing of a specified LED. Select the device and click on "Flashing on" to activate the function. Depending on the device type following LED will start flashing:

#### Table 3-1

Device	LED
SIMOTION	SF-LED
SINAMICS S120	RDY-LED

## 3.1.3 Topology-based initialization

The device name can be assigned by the PROFINET IO-Controller itself. With the checkbox "Support device replacement without exchangeable medium" the PROFINET feature topology-based initialization is activated. This feature is activated by default.

Figure 3	3-3
----------	-----

operties - CBE30x	PNxIOxSlave (R0/S2.6)	
ieneral Addresses	PROFINET Sender Receiver H-Device Synchronization	
Short description:	CBE30xPNxIO	
Device name:	CBE30xPNxI0xSlave	
🔲 Use different me	thod to obtain device name	
Support device :	replacement without exchangeable medium	
	epideenienie wiendez exchangeable meatum	
- Interface		
Туре:	Ethernet	
Device number:	0	
Address:	192.168.0.2	
Networked:	Yes Properties	
Comment:		
		P
1		

This properties window will open by double clicking on the PN interface of the IO-Controller in HW Config.

Please observe that **the PN interface of IO-Device must be in factory settings** to support this function (in this state the interface has the IP address = 0.0.0.0 and an empty device name = ""). To reset the PROFINET interface to factory settings open HW Config and click on "PLC > Ethernet > Edit Ethernet Node > Reset" (see following figure).



Ethernet Node		
Ethernet node		
		Nodes accessible online
MAC <u>a</u> ddress:	00-0E-8C-92-55-F3	Browse
Set IP configuration		
<ul> <li>Use IP parameter</li> </ul>	ng	
		Gateway
IP address:	192.168.0.3	Do not use router
Subnet mask:	255.255.255.0	C <u>U</u> se router
-	,	Address: 192.168.0.3
Assign IP Config	juration	
Assign device name		
<u>D</u> evice name:	s120xcu320x2xdpxcbe20	Assign Name
Reset to factory setti	ings	
		<u>R</u> eset

Copyright © Siemens AG 2013 All rights reserved

## 3.1.4 Device name assignment rules

The device name has to follow the rules of DNS (Domain Name System). Following possibilities for DNS names are given:

- Letters (a..z),
- Numbers (0..9) and the signs
- Minus (-) and
- Dot (.) are allowed.

The dot divides the device name into labels. The device name can include more labels, for example:

<CPU name>.<Interface number >.<Name of IO-System>...

- <Interface number>, if the device has more than one PN interfaces available (e.g. "X150")
- <Name of IO-System>, optional and configured by HW Config (see Figure 3-5).
- Each label must start with a letter and doesn't end with minus or a dot.
- The maximum length of one label is 63 characters.

### Figure 3-5

Properties - PROFINE	T IO-System	×
General Update Time		
Short designation:	PROFINET IO-System	
Name:	PHOFINE HU-System	
	Use name in IO device / controller	
<u>1</u> 0 system no.:	100 🔽	
Subnet:	Ethernet(1)	
	Properties	
<u>C</u> omment:		
	<u>N</u>	
	_	
OK	Can	cel Help

Observe also following additional rules:

- The maximum total length is 127 characters (incl. minus and dot)
- The device name may only include lower case. On the device upper case are replaced through lower case.
- Do not use umlauts (ä, ö, ü)
- Do not use special characters ! " § \$ % & / () = ? \* '\_:; > < , # + | ~ \ } ] [ {</p>
- Do not use blanks
- The device name does not start with "port-xyz" (x, y, z = 0..9).
- Do not use the minus sign on SIMOTION controllers. Up from SIMOTION SCOUT Version 4.3 this limitation is raised.

### 3.1.5 IP addresses

PROFINET uses IP addresses for establishing the PROFINET IO communication and for NRT (Non Real Time Communication e. g. TCP, UDP, S7 communication).

The IP address is also needed to go online to the device. It is recommenced to assign an IP address to each PROFINET IO-Device during startup of a project commissions. To do this you have more possibilities:

- IO-Controller
  - Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
  - Download of HW Config, please observe the current active IP address of the device!
- IO-Device
  - Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)

In a PROFINET IO-System it is possible to receive the IP address from the IO-Controller. This feature is activated by default.

For this a correct working PROFINET connection between IO-Controller and IO-Device is required and the active device name must be the same as in the HW Config. Figure 3-6 shows the configuration of a SINAMICS S120. The device with device name "SINAMICS" will get the IP address 192.168.0.3 and the same subnet mask as the IO-Controller.

If the device doesn't receive the IP information from IO-Controller it is maybe not possible to go online with the engineering software (e. g. Starter or SCOUT). In this case assign a fixed IP to the device.

Figure	3-6
1 19010	00

Properties - SINAMICS		X
General Chanad Ass		<u> </u>
Ceneral Shared Acc	222	1
Short designation:	S120xCU320x2xPN	
	SINAMICS S120 CU320-2 PN V4.5 IO device with DriveES/SIMOTION interface (RT, IRT and acyclic communication, isochronous operation, PRDFIsafe),	×
Order no. / firmware:	6SL3 040-1MA01-0Axx (CU320-2 PN, S120) / V4.5	
Family:	SINAMICS	
Device name:	SINAMICS	- 1
- Mada / PN 10 austar		
- Node / FINHO system		
Device number:	1 PROFINET-IO-System (100)	
IP address:	192.168.0.3 <u>E</u> thernet	
Assign IP address	s via IO controller	
<u>C</u> omment:		
		~
ОК	Cancel He	lp

The received IP address from IO-Controller is just a temporary address (till next power OFF/ON of the device). The received address is higher prior as a fixed set IP address via engineering software.

After power ON the IP address must be received from IO-Controller first. If the address will not receive, the IP address set by the engineering system or the default IP address 0.0.0.0 (default setting of the PN interface) will be active. An IP address assigned by any engineering software is permanently saved.

If you <u>disable</u> the function "Assign IP address via IO-Controller" the fixed IP address will be used. The IO-Controller will not assign the configured IP address.

The IP address in the device must be unique. Please observe that the IP addresses used by PN interfaces (e.g. X150) and the IP addresses of the standard Ethernet interfaces (e.g. X127) must be in different IP subnets. For example: If you assign an IP address 169.254.11.23 to the PN interface X150 so the device will report an error if the standard Ethernet interface X127 is still assigned to 169.254.11.22 (default IP address of X127).

### Figure 3-7

thernet node	
	Nodes accessible online
AC <u>a</u> ddress:	00-1F-F8-00-9B-55 <u>B</u> rowse
et IP configuration	
Use IP paramete	15
	Gateway
IP address:	169.254.11.23 • Do not use router
Subnet mas <u>k</u> :	255.255.0.0
	Addr <u>e</u> ss:
Ubtain IP addres Identified by Cjient ID	Edit Ethernet Node (4502:529)
O Ubtain IP addres Identified by C Ojent ID Client ID Client ID: C	Edit Ethernet Node (4502:529)
Ubtan IP addres     Identified by     Cient ID     Client ID:     Assign IP Config  Issign device name	Edit Ethernet Node (4502:529)
Obtain IP addres     Identified by     Crient ID     Client ID     Client ID     Client ID     Assign IP Config  Assign device name Device name:	s from a DHCP server  Edit Ethernet Node (4502:529)  The function could not be executed.  OK  simotion-slave  Assign Name
Obtain IP addres     Identified by     Orient ID     Client ID     Client ID     Client ID     Assign IP Config  Assign device name Device name: Reset to factory setti	s from a DHCP server  Edit Ethernet Node (4502:529)  The function could not be executed.  OK  simotion-slave Assign Name  ngs
O Ubtain IP addres Identified by Cignt ID Client ID Client ID Assign IP Config Assign device name Device name: Reset to factory setti	s from a DHCP server  Edit Ethernet Node (4502:529)  Uration  The function could not be executed.  OK  simotion-slave Assign Name  ngs  Reset

## 3.1.6 Send clock for IRT communication

- The send clock for the IRT communication can be configured to a value ranging between 250 µsec and 4.0 msec.
  - Up from firmware V4.5 of SINAMICS S120 the minimum send clock time of the onboard PN interface is 250 µsec.
  - By using the CBE20 the minimum send clock time is 500 µsec.
  - Please refer also to the SIMOTION documentation "Communication.pdf" Chapter 4.2.2.3 "Overview of the possible bus cycle clocks".
- Up from SIMOTION V4.1 SP1 the send clock of the isochronous PROFIBUS interfaces must be equal to the servo cycle clock. This also applies to PROFIBUS Integrated (SINAMICS Intergrated). Maybe the servo cycle clock or PROFIBUS send clock must be a multiple of the PROFINET IO send clock.
- Isochronous applications (e.g. ServoTask) are synchronized to the send clock or a multiple of the send clock. The cycle reduction is configured in the SIMOTION SCOUT under "Set system cycle clocks...".

## 3.1.7 Isochronous mode

Isochronous mode means that the application (e.g. ServoTask of SIMOTION or OB6X of SIMATIC) is synchronized with the PROFINET IRT send clock. For this PROFINET IRT (High Performance = RTC3) is absolutely needed.

With a SIMOTION controller the synchronization of the application with the communication send clock will be handled as follow:

- As Sync-Master the synchronization will be handled automatically, but if the Sync-Master is configured as IRT I-Device the synchronization must be done manually like an Sync-Slave
- A Sync-Slave must always be synchronized with the send clock. This has to be done in the StartupTask with following system function:

```
i32RetValue := _enableDpInterfaceSynchronizationMode(
    dpInterfaceSyncMode := AUTOMATIC_INTERFACE_SYNCHRONIZATION
    );
```

If a SIMOTION controller is synchronized it can be checked by the LED SY (X150) respectively by the green LED on the CBE30 or CBE30-2.

- Green flashing = not synchronized
- Green continuous = synchronized

A check of the system variable stateOfDpInterfaceSynchronization = DP\_INTERFACES\_SYNCHRONIZED is also possible.

If a SINAMCIS device is synchronized you can check the LED PN (X150) respectively by the green LED on the CBE20.

- Green flashing = not synchronized
- Green continuous = synchronized

4.1 HW Config of the master CPU

## 4 Configuration

## 4.1 HW Config of the master CPU

Table 4-1

No.	Instruction		
1.	Start SIMOTION SCOUT and create a new project.		
2.	Add a new SIMOTION device and open the HW Config. In the sample project a SIMOTION D455-2 DP/PN V4.3 is used as master CPU (without CBE30-2)	Insert SIM0TION device           Device	
		D435-2 DP/PN         6AUT 435-2AD/UAAU           D445         6AUT 445-0AA0-0AA0           D445-1         6AUT 445-0AA0-0AA0           D445-1         6AUT 445-0AA00-0AA0           D445-2 DP/PN         6AUT 445-0AA00-0AA0           D455-2 DP/PN         6AUT 445-0AA00-0AA0           D455-2 DP/PN         6AUT 455-2AD00-0AA0           D455-2 DP/PN         6AUT 455-2AD00-0AA0           D455-2 DP/PN         6AUT 455-0A00-0AA0           SINAMICS         SINAMICS S120 Integrated           SINAMICS version         V4.5.0           Insert CBE 30-2         Image: Cancel           OK         Cancel	
3.	Set the IP address of the SIMOTION PN interface. In the sample project following addresses are used: IP address: 192.168. 0 .1 Subnet mask: 255.255.255.0 If necessary create a new subnet.	Properties - Ethernet interface       PNxI0 (R0/S2.6)         General       Parameters         If a subnet is selected, the next available addresses are suggested.         JP address:       192.168.0.1         Subnet mask:       255.255.255.0         Use different method to obtain IP address       Gateway         Subnet:	

## 4 Configuration

## 4.1 HW Config of the master CPU

4.	A dialog will open to select a SIMOTION interface, where the engineering system (PG/PC) is connected. In the sample project no interface will be selected first.	Interface Selection - D455 Interface selection for PG/PC connection: No interconnection
5.	By double click on the CPU (Slot 2) the properties dialog will open. There you can change the name of the CPU. This name is not the PROFINET IO device name (see instruction 6). In the sample project the name of the master CPU is "D455_Master".	Properties - D455 - (R0/S2)       Image: Control Control Unit: Firmware V4.3 - PN V2.2 with SINAMICS         General Ethernet Extended Isochronous Tasks       F-Proxy         Short Description:       D455         D455-2 DP/PN Control Unit: Firmware V4.3 - PN V2.2 with SINAMICS       Image: SI20 V4.5         Order No./ firmware:       6AU1 455-2AD00-0AA0 / V4.3         Name:       D455_Master         Image: D455_Master       Image: Control Unit: Con
6.	By double click on the PROFINET IO interface of the SIMOTION CPU the properties dialog will open. There you have to modify the device name. Device name: "SIMOTION-Master.X150" The Setting "Support device replacement without exchangeable medium" activates the topology-based initialization.	Properties - PNxI0 (R0/S2.6)       Image: Synchronization       Media Redundancy         General       Addresses       PROFINET       Sender       Receiver         Short description:       PNxI0         Device name:       SIMOTION-Master.X150         Use different method to obtain device name         Image: Simotic explacement without exchangeable medium         Interface         Type:       Ethernet         Device number:       0         Address:       192.168.0.1         Networked:       Yes         Properties       Image: Simotic explanation         Domment:       Image: Simotic explanation

7.	A double click on the SINAMICS_Integrated will open the properties dialog.	DP slave properties X General Configuration Isochronous Operation
	If required change in the tab	Violaile Order no.: Family: SINAMICS DP slave type: SINAMICS Integrated
	Sinamics_Integrated.	Designation:         SINAMICS_Integrated_M           Addresses         Node / master system
	In the sample project the designation for the master CPU is "SINAMICS_Integrated_M".	Diagnostics address:     16372       Address for "Slot" 2:     16371
		Image: Syncecapable     Image: EREEZE-capable       Comment:
		OK Cancel Help
8.	Change to the tab "Isochronous Operation".	DP slave properties
	Modify the DP cycle to match the cycle time of the servo cycle clock.	Sygchronize drive to equidistant DP cycle Network settings in ms Equidistant bus cycle activated Equidistant DP cycle: 1.000 Data_Exchange_Time comp. Tdx: 0.000
	In the sample project the servo cycle clock = 1 msec.	Master application cycle Tmapc [ms]:         1.000         =         Factor         Grid / base time [ms]           DP cycle Tdp [ms]:         1.000         =         8         ×         1.000
		Time To [ms] Time To [ms] 0.250 = Factor Grid / base time [ms] Factor Grid / base time [ms]
		(serpoint acceptance)
9.	Save and compile HW Config.	

## 4.1 HW Config of the master CPU

4.2 HW Config of the slave CPU

## 4.2 HW Config of the slave CPU

## Table 4-2

No.	Instruction		
1.	Change to the SIMOTION SCOUT.		
2.	Add an additional SIMOTION device into the project and open HW Config. In the sample project the training unit with a SIMOTION D435 V4.3 + CBE30 as PN interface is used.	Insert SIMOTION device       ▼         Device       SIMOTION         Device characteristic:       SIMOTION D         Characteristic:       Order no.         D410 PP       GAU1 410-0A800-0AA0         D410 2DP       GAU1 410-0A800-0AA0         D413 2DP/PN       GAU1 410-2A00-0AA0         D4252 DP/PN       GAU1 425-0A00-0AA0         D4252 DP/PN       GAU1 435-2A00-0AA0         D4352 DP/PN       GAU1 435-2A00-0AA1         D4352 DP/PN       GAU1 435-2A00-0AA1         D4352 DP/PN       GAU1 435-2A00-0AA1         D4352 DP/PN       GAU1 435-2A00-0AA1         D4352 DP/PN       GAU1 445-0A00-0AA1         D4352 DP/PN       GAU1 445-0A00-0AA1         D4451       GAU1 445-0A00-0AA1         D4452 DP/PN       GAU1 445-0A00-0AA1         D4451       GAU1 445-0A00-0AA1         D4452 DP/PN       GAU1 45-0A00-0AA1         D4552 DP/PN       GAU1 45-0A00-0AA1         D4552 DP/PN       GAU1 45-0A00-0AA1         D4552 DP/PN       GAU1 45-0A00-0AA1	
3.	Select the already configured subnet. Set the IP address of the SIMOTION PN interface. In the sample project following address will be used: IP address: 192.168. 0 .2 Subnet mask: 255.255.255.0	OK       Cancel       Help         Properties - Ethernet interface       CBE30xPNxI0 (R0/S2.6)       X         General       Parameters       If a subnet is selected, the next available addresses are suggested.         IP address:       192.168.0.2       © Do not use router         Subnet mask:       255.255.25.0       © Do not use router         Use different method to obtain IP address       General         Subnet:       Mew         Properties       Dejete         OK       Cancel	
4.	A message box reminds that you have to check the PG/PC settings in NetPro.	Create new device (3470:6697)  Please check the PG/PC assignment in NetPro for device D435.  K	

5. By double click on the CPU	Properties - D435 - (R0/S2)
(Slot 2) the properties dialog v	General Ethernet Extended Isochronous Tasks F-Proxy
open. There you can change t	he Short Description: D435
not the PROFINET IO device	D435 Control Unit; Firmware V4.3 - PN V2.2 with SINAMICS S120 V2.6.2
name (see instruction 6).	
In the sample project the nam	Dider No.7 nimware: 6401 435-04400-0441 / V4.3
of the salve CPU is	Tame Programme
"D435_Slave".	
	Comment:
	2
	-
	OK. Cancel Help
6 By double click on the	Properties_CDE20uDNul0_(D0JC2_C)
PROFINET IO interface of the	
SIMOTION CPU the propertie	S
dialog will open. There you ha	Ve Short description: CBE30xPNxIO
to modify the device name.	Vevice name: SIMOTION-Slave.CBE30
	Use different method to obtain device name
Device name:	Support device replacement without exchangeable medium
"SINOTION-Slave.CBE30	_ Interface
The Setting Support device	Type: Ethernet
replacement without	Device number: 0
exchangeable medium"	Address: 192.168.0.2
activates the topology-based	Networked: Yes <u>Properties</u>
Initialization.	Comment:
	OK Cancel Help
7. A double click on the	DP slave properties
SINAMICS_Integrated will ope	Configuration Isochronous Operation
the properties dialog.	
	Order no.:
If required change in the tab	Family: SINAMICS DP slave type: SINAMICS Integrated
"General" the designation of th	Designation: SINAMICS_Integrated_S
In the sample project the	Node / master system Diagnostics address: 16376 Address: 3
designation is changed to	Address for "Sibt" 2
"SINAMICS_Integrated_S" for	
the slave CPU	SYNC/FREEZE capabilities
	SYNC+capable EREEZE+capable Response monitoring
	Comment:
	OK Cancel Help

## 4 Configuration

## 4.2 HW Config of the slave CPU



4.2 HW Config of the slave CPU

10.	Set the IP address of the SINAMICS PN interface (X150).	Properties - Ethernet interface     \$120xCU320x2xPN       General     Parameters
	In the sample project following address will be used: IP address: 192.168. 0 .3 Subnet mask: 255.255.255.0	IP address: 192.168.0.3   Subnet mask: 255.255.255.0   Image: Subnet: Image: Image
11.	By double click on the PROFINET interface of the SIMOTION CPU the properties dialog will open. There you have to modify the device name. With the setting "Assign IP address via IO-Controller" the IO-Controller will transfer the configured IP address to the IO-Device with the device name "SINAMCIS.X150". In the sample project the IO-Device "SINAMICS.X150" has the IP address 192.168.0.3.	Properties - S120xCU320x2xPN         General       Shared         Access         Shot designation:       S120xCU320x2xPN         SiNAMICS S120 CU320.2 PN V4.5 ID device with DriveES/SIMOTION interface         IPT, IRT and acyclic communication, isochronous operation, PROFIsafe).         Order no. / firmware:       6SL3 040-1MA01-0Axx (CU320-2 PN, S120) / V4.5         Family.       SINAMICS         Device name:       SINAMICS.X150         Node / PN-I0 system       PROFINET-IO-System (100)         IP address:       IS2168 0.3       Ethernet         IP address:       IS2168 0.3       Ethernet
		OK Cancel Help
12.	Save and compile HW Config.	<b>₽</b> 01
13.	If required modify with the SIMATI not required MPI Network. SIMATIC Manager - [PN_IRT D:\PN_IRT] By Elle Edit Insett PLC View Options Window Hi	C Manager the name of the SIMOTION CPUs and delete the
	Image: Structure of the st	Image: Size in the i

## 4 Configuration

4.2 HW Config of the slave CPU



4.3 Configuration of PROFINET IRT

## 4.3 Configuration of PROFINET IRT

For using PROFINET IRT (High Performance = RTC3)

- the PROFINET topology and
- the Sync-Domain (Sync-Master and Sync-Slave)

have to be configured.

-3
0

No.		Instruction
1.	Open HW Config, click with the right mouse button on the PN interface (e.g. X150) and select "PROFINET IO Topology…".	Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ELC View Options Window Help       Image: Station Edit Inset: ElC View Options Vi
		Image: Construct of Construction         Construct of Construction           Image: Construct of Construction         Construction         Construction           Image: Construct of Construction         Construction         Construction         Construction           Image: Construct of Construction         Construction         Construction         C
2.	Change to the graphic view to get a comfortable possibility to edit the PROFINET topology. If the engineering system is connected to the PN network the current topology can be compared with the configured topology (tab "Offline/online comparison"). If the current and the configured topology is different, the device will flash a red LED at "PN" respectively "OPT" on SIMOTION device.	SIMOTION D455       Include the comparison         SIMOTION D455       Include the comparison         SIMOTION Master:XISOD4       Include the comparison         SIMOTION D455       Include the comparison         Option       Detech

## 4 Configuration

## 4.3 Configuration of PROFINET IRT

3.	The used cable length	Interconnection Properties
	respectively the signal delay	Port Interconnection
	time must be adjusted	Port: SIMOTION D455 Master \ SIMOTION-Master.X150(D455_Master) \ Port 2 (X1
	(especially for fiber optic or slip	Partner port: SIMOTION D435 Slave \ SIMOTION-Slave.CBE30(D435_Slave) \ Port 1 (X140
	nings).	Medium: Port: Copper Partner port: Copper
	For copper cables use the	Cable name:: Copper
	default setting	- Cable Data
	(Cable length < 100 m).	
		(• <u>Cable length</u> ; < 100 m (signal delay unle. 0.000 µs)
		C Signal delay time [µs]: 0.600
		Comment
		QK Cancel Help
4	Click with the right mayon by the	
4.	On the PN interface (e.g. X150)	Big Station Edit Inset PLC View Options Window Help
	and select "PROFINET IO	
	Domain Management".	(0) SIMOTION D455-2     PROFIBUS Integrated(1): DP master system (1)
		x126 DP/MP/
		X130 DP Integrated
		X150 T SIMOTION-Master X150
		LIFL LIFL
		X150 P2 R Port 2 Paste Crt+V
		X150 P 7         Poil 2         Paste         Drift/V           X150 P 3         Poil 3         Replace Diject         Y           X1400         Add Master System         Y         Y
		X150 P2R         Port 2         Paste         Orl HV           X150 P2R         Port 3         Replace Object         Replace Object           X1400
		X150 P2 R         Port 2         Paste         OriHV           X150 P3         Port 3         Replace Diject         Replace Diject           X1400         Add Master System         Disconnect Master System         Disconnect Master System           X127         Powt 7         Master System Inschronous Mode         Inschronous Mode         Inschronous Mode           X142         I//O         Inschronous Mode         Inschronous Mode         Inschronous Mode
		X150 P2 A     Post 2     Paste     Ori HV       X150 P3     Post 3     Replace Diject     Nater System       X127     Polva 7     Object     Object       X127     Polva 7     Object     Object       X127     Polva 7     Master System     Object       X127     Polva 1     Master System     Object       X142     I/O     Insert Polytem Isochronous Mode     Insert Polytem
		X150 P28     Port 2       X150 P28     Port 2       X150 P3     Port 3       X150 P3     Port 3       X127     PNv6E       Discorrect Master System       X127 P1       Port 7       X142       I/O       PROFINET ID Domain Management       PROFINET ID Isochronous mode       PROFINET ID Isochronous mode       IO
		X150 P2 // Port 2     Paste     Orl+V       X150 P3     Port 2     Paste     Orl+V       X150 P3     Port 3     Paste     Orl+V       X127     Port 3     Paste     Orl+V       X127     Port 7     Port 7     Paster System     Orl+V       X142     I/O     Inset System Isotronous Node     Orl+V       Inset P30FINET IO Domain Management     PROFINET IO System     Orl+V       PROFINET IO Isochronous mode     Specity Module     Orl+V       Stot     Module     Delete     Del
		X150 P2 // Port 2     Parte     Orl+V       X150 P3 // Port 3     Perploce Diject     Add Moster System       X120 P3 // Port 3     Perploce Diject     Add Moster System       X127 P1     Powrit     Disconnext Master System     Oil       X142     I//D     Intel PAROFINET to Domain Management     PROFINET to Domain Management       PROFINET to Domain Management     PROFINET to Disconneus mode     Intel Parte       Stat     Module     Colete     Del       VI28     Defe     Del     Add
		X150 P2 // Port 2     Paste     Dri+V       X150 P2 // Port 3     Peolog Diget     Add Mater System       X120 P1     Port 3     Peolog Diget       X127 P1     Port 1     Add Mater System       X122 P1     Port 1     Mater System       Y122 P1     Port 1     Peol 1       X122 P1     Port 1     Peol 1       X122 P1     Port 1     Peol 1       X122 P1     Port 1     Peol 2       Y122 P1     Port 1     Peol 2       Y122 P1     Port 1     Peol 3       X125 P2     Provide 1     Peol 1       X125 P2     Peol 1     Peol 1       X125 P1     Port 1     Peol 2       Y122 P1     Port 2     Peol 2       Y122 P1     Port 2
		X150 P2 // X150 P2 // X150 P3         Port 2 Port 2         Paste         Orl HV           X150 P3         Port 3         Replace Diject Add Mater System         Disconnect Master System           X127 P1         Port 7         Mater System Insoftwork Master System         Disconnect Master System           X127 P1         Port 7         Mater System Insoftwork Master System         Disconnect Master System           X127 P1         Port 7         Master System Insoftwork Master System         Disconnect Master System           X127 P1         Port 7         Master System Insoftwork Master System         Disconnect Master System         Disconnect Master System           X128         Image: PROFINET 10 Southwork Master Into Nanogement         PROFINET 10 Southwork Master         PROFINET 10 Southwork Master           Stat         Module         C         Delete         Del         Q add         Comment           X138         DPAMP         Filter Assigned Madules         Filter As
		X150 P2 R         Port 2         Paste         Ori HV           X150 P2 R         Port 3         Replace Dijet         Add Mater System           X120 P3         Port 3         Replace Dijet         Add Mater System           X127         Port 7         Port 7         Mater System isochronos Mode Inset Rogen         0)           X142         I/O         Inset System isochronos Mode Inset Rogen         0)           PROFINE 110 Domain Management         PROFINE 110 System         0)           PROFINE 110 Isochronous mode         PROFINE 110 Isochronous mode         Image: PROFINE 110 Isochronous mode           X128         DPART         Filer Assigned Modules         Image: PROFINE 10 Isochronous mode         Image: PROFINE 10 Isochronous mode           X128         DPART         Filer Assigned Modules         Image: Profine 10
		X150 P2 B     Post 2       X150 P2 B     Post 2       X150 P3     Post 2       X150 P3     Post 3       X127     Post 3       X127     Post 3       X127     Post 4       X127     Post 1       X127     Post 1       X142     I/D       PROFINET ID Domain Management       PROFINET ID Isochronous mode       PROFI
		X150 P2 // X150 P2 // X150 P3         Post 2         Paste         OritV           X150 P3         Post 3         Replace Dijet         Add Master System           X127         Pow 7         Add Master System         Disconnect Master System         Disconnect Master System           X122         Pow 7         Pow 7         Master System Isochronous Mode Invert PROFINET ID System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X142         I/D         Proteines         Disconnect Master System         Disconnect Master System           X128         DP         Fabric Master System         Fabric Master System         Disconnect Master System           X128         DP         Fabric Master System         Disconnect Master System         Disconnect Master System<
		X150 P2 // X150 P2 // X150 P3         Post 2         Paste         Dri+V           Y50 P3 // X150 P3         Post 2         Period         Peri

4.3 Configuration of PROFINET IRT

5.	Define the PROFINET IRT send clock time and the Sync-Domain as shown. Each Sync-Domain requires an IO-Controller or SCALANCE X200 IRT switch defined as Sync-Master. All other devices	Domain management - Ethernet(1)     X       Sync Domain     Sync Domain       Sync domain:     sync.domain.default       Sync domain:     sync.domain.default       Sync domain:     sync.domain.default       Send clock time     1.000       In Details     Details       Nodes     Station / ID system       SiMOTION D435 Slave / PROFINET-ID-System (100)     132:168: 0.0 / 24
	are configured as Sync-Slave. The send clock time can be between 250 µsec and 4.0 msec depending on the used PROFINET devices.	Add     Eemove       Station / Device Name     Synchronization Role     RT Class     IRT Option     M       SIMOTION D455 Master / SIMOTION-Master X150     Sync master     RT, IRT     high performance
	Select in section "Nodes" the corresponding device and define the role as Sync-Master by double click on it.	
	CPU will be the Sync-Master.	OK Cancel Help
6.	Select under "Nodes" the slave CPU and define all other devices of this Sync-Domain as Sync-Slave (High Performance = RTC3). It means all PROFINET devices in the same IRT line, between the Sync-Master and the last IRT device must be configured as Sync-Slave. A SIMOTION controller can also be a <b>Sync-Master (redundant)</b> (see sample project). In this case the Sync-Master (redundant) takes the role for synchronizing all IRT devices. This function is designed for commissioning of machine parts. Please observe that is not possible to switch to often between Sync-Master and Sync-Master (redundant). If required a reset of the PN interface is needed (power OFF/ON)!	Domain management - Ethernet(1)       X         Sync Domain       Sync Domain         Sync Domain       gync domain         Station / Device Name       gync domain         Sync Domain       <
7.	Save and compile Hardware config.	
8.	Download first both Hardware con CPUs.	figurations and then download the SIMOTION projects into the

## 4.4 Commissioning of the drive

## 4.4 Commissioning of the drive

In SIMOTION SCOUT the commissioning of the drive has to be made. These steps are shown only particular.

Figure 4-1
Figure 4-1
Automatic Configuration     Automatic Configuration
Hummg operation:     Waiting for START       Hummg operation:     Waiting for START       Home Start     Control Unit       Home Start     Configure       Configure     Cancel
Atoms       Symbol browser         Address setup output       Compile/check output         Press F1 to open Help display.       TCP/IP > LevelOne USB-0201 USB2 / Ti

## SERVO\_02

- Connector: X1
- Drive Object (DO) type: Servo
- Motor <u>with</u> Drive-CLiQ (1FK7022-5AK71-1LG0)
- Without motor holding brake
- SIEMENS standard telegram 105, PZD-10/10

## SERVO\_03

- Connector: X2
- Drive Object (DO) type: Servo
- Motor without Drive-CLiQ (1FK7022-5AK71-1AG0)
- Without Motor holding brake
- SIEMENS standard telegram 105, PZD-10/10
- **Note** A signal for (p0864) has to be configured. In the sample project the constant "1" is used for "Infeed operation" (p0864).

In real application the constant "1" should not be used for "Infeed operation" (p0864).

#### 4.5 Axis and I/O configuration

**CAUTION** If the configuration includes a Single Line Module for 1AC 230V (training unit SIMOTION D435) then you have to modify the parameters for both Servo module as followed:

p0210: 345V p1244[0]: 401V p1248[0]: 240V

See also the Entry ID 27038754: "Change/Replace Motor Module in SINAMICS S120 Demo Case" <u>http://support.automation.siemens.com/WW/view/en/27038754</u>

## 4.5 Axis and I/O configuration

## 4.5.1 ... on the master CPU

#### Axis "MasterAxis"

- Position axis
- Rotary
- Virtual
- Modulo axis: 0..360° (Axis > "Mechanics")

### I/O variables (ADDRESS LIST)

For data exchange between master and slave CPU user data have to be transmitted (e. g. control or status data). Therefore you have to define in SIMOTION SCOUT for both CPUs I/O variables in "ADDRESS LIST". On the master CPU following I/O variables are required:

Та	ble	4-4
	~	• •

Variable	Address	Туре	Bit	Note
ib16ReceiveData	<b>P</b> IW0	WORD	0	ightarrow Axis "SlaveAxisRed" is synchronized
			1	TRUE → Axis "SlaveAxisBlue" is synchronized
			215	reserved
qb16SendData	PQWO	WORD	0	TRUE starts (FALSE stops) the synchronous operation of axis "SlaveAxisRed"
			1	TRUE starts (FALSE stops) the synchronous operation of axis "SlaveAxisBlue"
			215	reserved

Note

The I/O variables are assigned to the process image of the "BackgroundTask", but by referring the variable with the syntax P (not %) the access will be **directly**. In the sample project the I/O variables are copied into a user process image.

Fixed Process image of the "BackgroundTask" (64 Bytes):

- Input range: %IB0..%IB63
- Output range: %QB0..%QB63

## 4.5 Axis and I/O configuration

## 4.5.2 ... on the slave CPU

## Axis "SlaveAxisRed"

- Synchronous operation
- Rotary
- Electrical axis
- Mode: Standard (position control)
- Drive: SERVO\_02
- Encoder: Absolute encoder, cyclic absolute (Encoder pulses per revolution 512, Data width 21)
- Modulo axis: 0..360° (axis > "Mechanics")

## Axis "SlaveAxisBlue"

- Synchronous operation
- Rotary
- Electrical axis
- Mode: Standard (position control)
- Drive: SERVO\_03
- Encoder type: incremental encoder: Sin/Cos incremental (Encoder pulses per revolution 2048). The encoder is connected via drive-CLiQ using SMC20.
- Modulo axis: 0..360° (axis > "Mechanics")

## I/O variables (ADDRESS LIST)

Table 1-5

On the slave CPU following IO variables have to be defined.

Variable	Address	Туре	Bit	Note			
ib16ReceiveData	<b>P</b> IW0	WORD	0	TRUE starts (FALSE stops) the synchronous operation of axis "SlaveAxisRed"			
			1	TRUE stops (FALSE stops) the synchronous operation of axis "SlaveAxisBlue"			
			215	reserved			
qb16SendData	₽QW0	WORD	0	TRUE $\rightarrow$ Axis "SlaveAxisRed" is synchronized			
			1	TRUE $\rightarrow$ Axis "SlaveAxisBlue" is synchronized			
			215	reserved			

(see the note at chapter "I/O variables (ADDRESS LIST)" of the master CPU)

## Synchronization with HW Config

During the configuring of the axis the engineering system creates automatically the communication between axis and the drive, because the setting "Standard/Automatic" is active (see chapter 4.4).

Following dialog appears after clicking on "Communication > Message frame configuration". If necessary the telegram configuration must be aligned with the HW Config.



SIMOTION SCOUT - PN_IRT - [SINAMICS.X150 - Message frame configuration]												
Depart For Project Edit Paste Target system View Option	ns Window	Help										_ 8 ×
	<u>?</u>   -∞	X X I	<b>m</b>	🐘 🕂 🔺 😫 😫	<u>61 🔤 🔛</u>		<u>.</u>			2		
	د السب د الت ا							-111				
No filter>												
×		Idrive PZD mes-	ane fr	ames IF2 PZD message frames								0
												f
Insert single drive unit	Communication interface: PROFINET - Control Unit onboard (isochronous)											
⊡ III D435_Slave	The PRO	Flsafe communic	ation i	s performed via this interface								
- a EXECUTION SYSTEM	The PRO	FIdrive message	frames	of the drive objects are transferred	in the following order:							
	The inp	ut data corres	ponds	to the send and the output d	ata of the receive	dire	ction of	the drive o	bject.			
	Master	view:										
EXTERNAL ENCODERS			1				Inpu	ıt data	Outp	ut data	_	
😥 🚞 PATH OBJECTS	Object	Drive object	-No.	Message frame type	Settings		Length	Address	Length	Address	Technology object	
		Control_Unit	1	SIEMENS telegram 390, PZD-2/2	Standard/automatic	~	2	256259	2	256259		
		SERVO 03	2	SIEMENS telegram 105, PZD-10/10 SIEMENS telegram 105, PZD-10/10	Standard/automatic	2	10	352 371	10	352 371	SlaveAxisBlue	
SINAMICS.X150	Without	PZDs (no cycli	ic data	exchange)		_						
-> Overview												
E-≫ Communication												
Message frame configuration												
B Inter (A unit components Adapt message frame with HW Contra Set up addresses												
B Input/output components     Adept message trane with HW Coning Set up addresses												
🖃 🧰 Documentation												
SINAMICS_Integrated_S     SINAMICS_Integrated_S												
E IBBABIES												
🗄 🦲 SINAMICS LIBRARIES												
🕀 🚞 MONITOR	3:1									\$5	Close	lelp
Project Command library	6 CINIALU		_			_		_				
	Lie SINAMI	C3:X130										
×						_						
Symbol browser Address list Address :	setup output	Compile/ch	eck ou	tput								
Press F1 to open Help display.				TCP/IP ->	LevelOne USB-0201	USB	2 / T(	Offline mo	de		NUI	1 //

On electrical axis as default "Dynamic Servo control" (DSC) is activated. In this case automatically the PROFdrive telegram "SIEMENS Telegram 105" will be configured. This telegram type needs isochronous mode, see following chapter.

4.6 Activate isochronous mode on the drive

## 4.6 Activate isochronous mode on the drive

With PROFIdrive telegrams including control word 2 (STW2) and status word 2 (ZSW2) the application must (can) be synchronized to the communication send clock (e. g. Standard Telegram 2, 3, ... or SIEMENS Telegram 105, 106, ...).

1 able 4-6
------------

No.	Instruction							
1.	Open HW Config of the slave CPU "D435-Slave" to activate the isochronous mode.							
2.	Open the properties dialog of the PN interface by double click.	Big HW Config - [SIM0TION D435 Slave (Configuration) PN_IRT]         □ □ ×           Big Station Edit Inset PLC View Options Window Help         □ Ø ×           □ Ø *         ■ <t< th=""></t<>						
		Image: Simple constraint of the system (1)         PROFIBUS Integrated (1): DP master system (1)           2         0 435; Slave         Slave           X128         DP?         Slave           X139         DP22MPI         Petrovice (1): DP master system (1)           Petrovice (1): DP integrated         X130 P1         Petrovice (1): DP master system (1)           X130 P1         Petrovice (1): DP integrated         Simon (1): None (CB30)           X1400 P2         Petrovice (1): Petrovice (1						
		Slot Order number Laddress Daddr Diagn C Access						
		XIG0         SIMMUCSX120         MS025         Rul           NS02FTR         Fort         170000         170000           NS02FTR         Fort         1700000         170000           NS02FTR         Fort         1700000         1700000           NS02FTR         Fort         1700000         1700000           NS02FTR         Fort         17000000         17000000           NS02FTR         Fort         170000000         15364*           11         Control_Unit         15364*         17000000           12         SIEMENS message hame 300         206259         16363*           2         SERVO_02         16363*         1700000           13         SERVO_03         16362*         17000000000           3         SERVO_03         16362*         17000000000000000000000000000000000000						

3. If you use a SIMOTION Version <= V4.1 you have to enable the feature "Operate IO device / application isochronously" in the tab "Application".	SIMOTION device <= V4.1
With a SIMOTION device > V4.1 the activation of the isochronous mode is in the tab "IO Cycle". Here the IO-Device (SINAMICS drive) will be synchronized to the "Servo". It means the drive will now work in isochronous mode to the ServoTask of the	OK     Cancel     Help   SIMOTION device > V4.1        Properties - SINAMICS X150     X         General     Addresses     Synchronization         OC     Shared Device     Media Redundancy         Update Time     Fixed factor     Send clock (ms)         Update Time     Fixed factor     Eactor         Mode:     Fixed factor     I.000         Videbdog Time
SIMOTION CPU. By clicking on "Isochronous Mode Modules / Submodules…" the submodules can be selected for isochronous mode. As default all modules are assigned. This setting should not be changed.	Watchdog time         Number of accepted update cycles with missing ID data:         Watchdog time [ms]:         Isochronous Mode         Assign ID device in isochronous mode:         Servo         Data cycle [us]:         TVTo mode:         Twin.TMex[rs]:         Time Ti (fead in process values) [us]:         Tothin.TMex[rs]:         Tothin.TMex[rs]:         Tothin.TMex[rs]:         Tothin.TMex[rs]:         Tothin.TMex[rs]:         Tothin.TMex[rs]:         Tothin.Tothex[rs]:         Tothex[rs]:         Tothex[rs]:         Tothex[rs]:         Tothex[rs]: <td< td=""></td<>

## 4.6 Activate isochronous mode on the drive

## 4 Configuration

## 4.6 Activate isochronous mode on the drive

4.	Activate for all PROFIdrive modules the isochronous mode operation.	Isochronous Modules / Submodules       ×         Module       Isochronous mode operation         □       Slot / Name         □       (10) SINAMICS ×150         □       (11) Module access point         □       (12) SIEMENS message frame 330         □       (22) SIEMENS message frame 105         □       (22) SIEMENS message frame 105         □       (3) SERV0_03         □       (3.2) SIEMENS message frame 105         □       (3.2) SIEMENS message frame 105
5.	Save and compile HW Config.	ធ្វើរុ

4.7 Description of the sample program

## 4.7 Description of the sample program

## 4.7.1 ST unit Fault

To prevent the SIMOTION controller from changing into the STOP mode in case of execution, peripheral or technological fault, a program must be executed in the

- ExecutionFaultTask,
- PeripheralFaultTask and
- TechnologyFaultTask.

#### Figure 4-3



In the sample project exists a ST unit Fault with the programs

- pTechnologyFaultTask,
- pPeripheralFaultTask and
- pExecutionFaultTask.

In case of a peripheral fault a global variable gboError will be set in the pPeripheralFaultTask. This flag will be used to acknowledge the technological faults after unplugging and plugging PROFINET cables.

This acknowledgement will be handled by the "BackgroundTask" of the slave CPU "D435\_Slave" (at the end of ST unit SlaveAxes). On the master CPU "D455\_Master" only a virtual axis exists, therefore no acknowledgement is needed.

## 4.7 Description of the sample program

## 4.7.2 ST unit InterfaceSynchronization

The PROFINET interface of the slave CPU "D435\_Slave" (Sync-Slave) must be synchronized in the user program.

For this, the program pStartupTask calls the system function \_\_enableDpInterfaceSynchronizationMode(). The program is located in the ST unit InterfaceSynchronization and has to be assigned to the "StartupTask".

## 4.7.3 ST unit MasterAxis on the master CPU

## Global variables for operating the sample application

Table 4-7

Variable	Туре	Note
gsMaster.sMasterAxis.boMove	BOOL	Start and stop the master axis
gsMaster.sMasterAxis. r64CommandVelocity	LREAL	Setpoint speed for the master axis
gsSlave.sAxisRed.boEnableGearing	BOOL	De-/Synchronization of the slave axis (red) to the master axis
gsSlave.sAxisRed.boSynchronized	BOOL	Status of the slave axis (red)
gsSlave.sAxisBlue.boEnableGearing	BOOL	De-/Synchronization of the slave axis (blue) to the master axis
gsSlave.sAxisBlue.boSynchronized	BOOL	Status of the slave axis (blue)

## Function block FBMoveAxis to control the master axis

This function block supports a position controlled movement of an axis. The input enable is used to start (TRUE) and stop (FALSE) the movement. The setpoint speed is specified at the input commandVelocity. The setpoint speed can be modified during operation. Further dynamic parameters are hard-coded in the function block.

This function block will be called in the program pBackgroundTask. This program must be executed in the "BackgroundTask".

#### Table 4-8

Globale variables		I/O variables
gsSlave.sAxisRed.boEnableGearing	$\rightarrow$	qboEnableGearingAxisRed
gsSlave.sAxisRed.boSynchronized	÷	iboAxisSynchronizedRed
gsSlave.sAxisBlue.boEnableGearing	$\rightarrow$	qboEnableGearingAxisBlue
gsSlave.sAxisBlue.boSynchronized	←	iboAxisSynchronizedBlue

**Note** The Sync-Master must not be synchronized by the user application. Only if the Sync-Master is an IRT I-Device it has to be synchronized in the user program!

4.7 Description of the sample program

## 4.7.4 ST unit SlaveAxes on the slave CPU

### Function block FBSyncAxis to control the slave axis (gearing axis)

This function block allows to de-/synchronize a gearing axis. The input enable is used to start (TRUE) and stop (FALSE) the synchronous operation. The de-/synchronization starts immediately, depending on the dynamic parameters which are hard-coded in the function block.

This function will be called in program pBackgroundTask. This program must be executed in the "BackgroundTask".

#### Table 4-9

I/O-Variablen	Funktion	
iboEnableGearingAxisRed	De-/synchronization of the slave axis (red)	
iboEnableGearingAxisBlue	De-/synchronization of the slave axis (blue)	
qboAxisSynchronizedRed	Status of the slave axis (red)	
qboAxisSynchronizedBlue	Status of the slave axis (blue)	

As already mentioned at the end of this unit in the program <code>pBackgourndTask</code> the automatically acknowledgement of a technological fault is implemented.

#### Acknowledgement of technological faults after sign-of-life failure

After sign-of-life failure the Alarm 20005 will appear. This alarm will be acknowledged if the cyclic communication between drive object (DO) of the SINAMICS and the technology object (TO) of the SIMOTION is established again.

\_toAxis.actorMonitoring.cyclicInterface = ACTIVE

#### Acknowledgement of technological faults after disconnection to the master CPU

If the PROFINET cable between the master and slave CPU is removed during distributed synchronous operation, all synchronous objects get the technological alarm 50201. This alarm is acknowledged if the cyclic communication between drive object (DO) of the SINAMICS and the technology object (TO) of the SIMOTION is established again.

\_toAxis.actorMonitoring.cyclicInterface = ACTIVE

**Note** For the command value calculation (interpolation) of the distributed synchronous operation maybe the number of level overflows in the IPO-Task or the IPO cycle time has to be increased depending on the CPU type.

4.8 Configuration of the direct data exchange broadcast

## 4.8 Configuration of the direct data exchange broadcast

In following cases the direct data exchange broadcast (German: Controller-Controller-Querverkehr) will be used for communication between more than one SIMOTION CPUs:

### • **Distributed synchronous operation** Data transmission between master and slave axes (located on different CPUs)

User data

Data transmission between more than one SIMOTION CPUs via I/O variables

In total an amount of 3072 input bytes and 3072 output bytes per SIMOTION CPU can be transmitted via direct data exchange broadcast.

#### **Distributed synchronous operation**

The communication data for distributed synchronous operation are automatically created by the SIMOTION SCOUT when defining a master and slave axis. The HW Config doesn't need to be changed for this.

In the sample project both gearing axis "SlaveAxisRed" and "SlaveAxisBlue" are synchronized to the setpoint value of the virtual axis "MasterAxis" of CPU "D455\_Master" (distributed synchronous operation, see following figure).

SWSIMOTION SCOUT - PN_IRT_1 - [D435_Slave.SlaveAxisBlue_ 29 Project Edit Paste Target system View Dotions Window Help	SYNCHRONOUS	OPERATION - I	nterconnections]	
	X. B.	900   ale   ale   ale		
Ko filter>				
P BA PN IBT 1	Interconnection	is		
a Insert SIMOTION device	Following axis:	Sia	veðvisBlue - Botaru avis (standard/pres	(au)
	T bildwing data.	1010	remediae motory and forandaras pres	surcy
EXECUTION SYSTEM	Interce	onnections to the ma	ster value interface:	
ADDRESS LIST		T0 name	Coupling type	Device
	MasterAxis	;	Setpoint	D455_Master
🔤 İnsert axis	SlaveAxis	Red		D435_Slave
E - 🔒 SlaveAxisBlue				
Conguration     Expert list				
> Mechanics				
> Default				
> Actual value				
Closed-loop control	Interce	nnections with came	r -	
> Homing				
> Profiles			T0 name	
> Control panel				
SlaveAxisBlue_SYNCHRONOUS_OPERATION				
	l'a			I ⊫I
> Interconnections				
				Jose Help
Project Command library	🗱 SlaveAxisBl	ue_SYNCHRONOUS	i	
×				أآتم
Symbol browser				
Press F1 to open Help display	> LevelOne LISB-0	1201 LISB2 / T( 0	fline mode	NUM SCBL //

24 bytes are required for each synchronous operation. This will be allocated in HW Config via direct data exchange broadcast (see following figures).

#### Figure 4-4

4.8 Configuration of the direct data exchange broadcast

## **CAUTION** The 24 bytes input and output data created by the SIMOTION SCOUT may <u>not</u> be changed.

## User data

User data transferred via direct data exchange broadcast must be configured in HW Config.

## Table 4-10

No.		Instruction
1.	Double click the PROFINET interface of the SIMOTION controller to open its properties.	Properties - SIMOTION-Slave.CBE30 (R0/S2.6)       Image: CBE30 (R0/S2.6)         General       Addresses       PROFINET         Sender       Receiver       I-Device         Djagnostic Address:       16361
	All send data for the direct data exchange broadcast is listed under the tab "Sender".	Line     Address     Length     Comment       1     64     24     SIMOTION: generated autom       2     260     24     SIMOTION: generated autom
	Here is also the data for both synchronous operations (24 bytes each). This configuration may not be manipulated.	
	Create additional user data by clicking on "New".	New     Edit     Delete       OK     Cancel     Help
2.	In the sample project the user data is created as a WORD starting from the address 0.	Sender Properties - Line [3]
	Max. 254 bytes can be created per data block. Further max. 3 KBytes can be configured for each sender.	English     English       Ei     Unit       BYTE       Ei     Update time [ms]       1.000
	Under "Comment" a comment for each data block can be entered.	Comment: slave axes are synchronized
		<u> <u> </u>     -     <u> </u> <u> </u> <u> </u>     -     </u>

## 4 Configuration

## 4.8 Configuration of the direct data exchange broadcast

3.	After defining all send data the receive data can be configured. Open for this the HW Config of the receiving CPU. Here is also the input data for both synchronous operations (24 bytes each). <b>This configuration may not</b> <b>be manipulated.</b> Create additional user data by clicking on "New".	Properties - SIMOTION-Master.X150 (R0/S2.6)       X         I-Device       Synchronization       Media         General       Addresses       PROFINET       Sender         Receiver:
		New         Edit         Delete         Diagnostic Addresses           OK         Cancel         Help
4.	Press "Assign Sender…" to select the previously defined send data of another CPU. In the sample project the user data is created as a WORD starting from the address 0. Under "Comment" a comment for each data block can be entered.	Receiver       Value         Image: Sender       Image: Sender         Image: Sender       <
5.	All previously defined transmission Assign Sender Station SIMOTION D435 Slave SIMOTION-S	on ranges are displayed here.

## **Note** First configure all send data of the controllers. After that the receive data can be created by using the previously defined send data of the other controllers.

**Note** A SIMOTION CPU supports max. 3 KBytes of data for each direction via direct data exchange broadcast, including the 24 bytes for each synchronous operation.

Alternatively to direct data exchange broadcast the IRT I-Device can be used to transfer data in isochronous mode <u>between 2 SIMOTION CPUs</u>:

- Distributed synchronous operation Data transmission between master and slave axes (located on different CPUs)
- User data

Additional data transmission between SIMOTION CPUs via I/O variables

In total an amount of 1440 input bytes and 1440 output bytes per SIMOTION CPU can be transmitted via I-Device communication. Please observe that an I-Device can be assigned only to one PROFINET IO-Controller.

The benefit by using the IRT I-Device instead of direct data exchange broadcast is the possibility to use two different SIMOTION projects (configuration via GSD file). In this case more engineers are able to work independent with different SIMOTION projects.

**CAUTION** Please observe that it is not possible to add on the SIMOTION PN interface, which is already configured as IRT I-Device, any additional IRT IO-Device. In this case only RT IO-Devices are possible. The CPU doesn't support IRT I-Device and IRT IO-Controller at the same time!

Due to this issue the master CPU in the sample project must be configured as IRT I-Device, because on the slave CPU additional IRT IO-Devices are connected.

With SIMOTION D4x5-2 up from firmware V4.3 two PROFINET interfaces (X150 and CBE30-2) are supported. In this case the SIMOTION CPU can be used one PN interface (CBE30-2) as IRT I-Device and on the other interface (X150) as IRT IO-Controller for additional IRT I-Devices. More information are available in the entry "Use of two PROFINET interfaces with SIMOTION"

(see http://support.automation.siemens.com/WW/view/en/59396321)

## **Distributed synchronous operation**

If distributed synchronous operation is configured via IRT I-Device and not configured by direct data exchange broadcast, the 24 bytes input and output data per synchronous operation are <u>not configured automatically</u>. By using IRT I-Device the configuration has to be done manually like for the user data.

#### User data

The user data must be configured manually in HW Config for the IRT I-Device communication.

## 4.9.1 HW Config of the IRT I-Device

Table 4-11

No.	Instruction			
1.	Open HW Config of master CPU "D455_Master"			
2.	By double click on the PROFINET interface the properties dialog will open.	Properties - SIMOTION-Master.X150 (R0/S2.6)         X           Control         Addresses         PROFINET         Sender         Receiver           I-Device         Synchronization         Media Redundancy		
	<ul> <li>Select in the tab "I-Device" the option</li> <li>"I-device mode",</li> <li>"Parameter assignment for the PN interface and its ports on the higher-level IO-Controller" and</li> <li>"Operate the complete I-device in isochronous mode"</li> <li>Click on "New" and create all input- and output modules as shown on the right side.</li> <li>For each synchronous operation 24 bytes for input and output data are required.</li> <li>In the sample project the data for the blue axis are assigned at byte address 260 to 283, for red axis at byte address 284 to 307.</li> <li>In addition 2 bytes of user data are created in the sample project for each direction.</li> </ul>	Image: set of the set of the PN interface and its ports on the higher-level ID-controller         Image: set informative set of the PN interface and its ports on the higher-level ID-controller         Image: set informative set of the PN interface and its ports on the higher-level ID-controller         Image: set informative set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-controller         Image: set of the PN interface and its ports on the higher-level ID-Controller         Image: set of the properties (13:5632)         Image: set of the properties of the controller         Image: set of the properties of the properties of the properties         Image: set of the properties of the properties         Image: set on the properties of the properties         Image: set of the properties of the properties         Image: set on the properties of the properties         Image: set of the properties of the properties         Image: set on the properties of the properties         Image: set on the properties of the propertise         Image:		
3.	Change to the tab "Synchronization" and if required change the synchronization role to "Not synchronized". In this case the SIMOTION CPU operates on this PN interface as RT IO-Controller. Confirm the dialog by clicking on "OK".	Properties - SIM0TION-Master.X150 (R0/S2.6)       X         General       Addresses       PROFINET       Sender       Receiver         I-Device       Synchronization       Media Redundancy         Parameter       Value       Value       Value         Configuration       Not synchronized       Synchronized         Name of sync domain       Synchronized       Synchronized         RT class       RT_IRT       IRT option         DK       Cancel       Help		

No.		Instruction
4.	Save and compile after finishing the configuration of the I-Device.	<b>₽</b> 1
5.	Now the GSD file for the I-Device must be created. Select for this in the menu "Options > Create GSD file for I-Device".	WW Config - [SIMOTION D455 Master (Configuration) - PN_IRT_2]         Why Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Edit Insert PLC View Options Window Help         Image: Station Plant
6.	Click on "Create" to generate the file.	Image: Create GSD File for I-Device       I-device:         D455_Master/SIMOTION-Master X150
	The generated file must be imported in the engineering system, which is used for the higher-level IO-Controller configuration. The imported GSD File will be shown in the hardware catalogue in following directory "PROFINET IO > Preconfigured Stations > D455".	Identifier for generic I-device:       SIMOTION-Master X150         Catalog comment:       Image: Simotion Simotic Simotion Simotic Simotic Simotic Simotic Simotion Simotic Simo

- **Note** If the I-Device configuration is changed afterwards, it has to be created and installed again. In the HW Config of the higher-lever IO-Controller the I-Device proxy has to be updated. After that the addressing of the inputs and outputs must be checked again.
- **Note** If the configuration of the higher-level IO-Controller is done by another engineering system, the GSD file of the I-Device must be exported and installed in the other engineering system.

## 4.9.2 HW Config of the higher-lever IO-Controller

Table 4-12

No.	Instruction		
1.	Open HW Config of the slave CPU "D435_Slave". Add the I-Device via Drag&Drop to the PROFINET IO-System. You will find the imported I-Device in following directory "PROFINET IO > Preconfigured Stations > D455".		
瞬 Station Edit Insert PLC View Options Window Help □ 26 월 명 명, 25 월 8 월 8 월 8 월 8 월 8 월 8 월 8 월 8 월 8 월			
	Image: Standard Standard       Image: Standard Standard         Image: Standard Standard       Image: Standard Standard         Image: Standard Standard       Image: Standard         Image: Standard S		
	Image: Structure of the st		
	Etheme(1): PROFINE T-IO-System (100)     Device Number I IP address Device Name Order number Firmware Diag In S C     SIMOTION Drive-based     GAUT 455-2AD00-0AA0     SIEVENS     SIMONICS X150     SL3 040-1MA01-0Axx V4.5     SIA66* Shari     ON-Master X150-20120829-093202.vml  Press F1 to get Help.		
2.	By double click on the I-Device proxy the Properties dialog will open.          By How Config - (SIMOTION D435 Slave (Configuration) ~ PN_IRT_2)         If yeaking Edit Inset FLC View Options Window Help         If will Be I will be		
	Image: Program (1)       PROFIBUS Integrated(1): DP master system (1)         Image: Program (1)       Protection (1)         Image: Protection (1)       Protection (1)         Image: Prot (1)       Prot (1)		
	Stat         Module         Dider number         I address         Diagnost         Comment           0		
	21000         2400         2601283         genering data for slave axis blue           21001         241         2602283         genering data for slave axis blue           21002         240         282315         genering data for slave axis blue           21003         241         292315         genering data for slave axis ned           21004         201         01         slave axis axis genering data for slave axis ned           21004         201         01         slave axis axis generinchard           21005         21         01         slave axis axis generinced		
	Press F1 to get Help.		

No.	Instruction		
3.	Please observe that the device name of the I-Device is the same as the device name of the corresponding CPU. If the I-Device Proxy and the corresponding CPU are in the same project, so the engineering system will add automatically "-1" at the end of the device name. This is caused by the rule, that a device name must be unique in a PROFINET IO-System. But if the device is an I-Device proxy the name must be the same as on the corresponding CPU.	Properties - SIM0TION-Master.X150-1         General         Short description:       SIM0TION-Master.X150         Order No. / firmware:       6AU1 455-2AD00-0AA0 / V4.3         Family:       D455         Device name:       SIM0TION-Master.X150         GSD file:       GSDML-V2.3-#Siemens-PreConf_SIM0TION-Master.X150-20120829-093202.xml         @Prange Refease Number       Prange Refease Number         Node in PROFINET 10 System       Device number:         ?       PROFINET-ID-System (100)         IP address:       Ejternet         Assign IP address via IC controller       ?         OK       Cancel	
	After changing the device name following message must be confirmed with "Yes", because it is the same hardware. In the sample project the device name of the CPU is "SIMOTION-Master.X150".	Object Properties (13:5144)         Image: A strength of the strengt of the strength of the strength of the strength of the strengt o	

## 4 Configuration



No.	Instruction			
6.	Edit the PROFINET Domain Management by clicking with right mouse button on the PROFINET IO interface and select "PROFINET IO Domain Management …". Define the Sync-Master and Sync-Slave to activate <b>PROFINET IRT</b> . In the sample projekt the IRT I-Device (CPU "D455_Master") is the Sync-Master. Set all other devices to Sync-Slave. The send clock time is set to 1 msec. Depending on the used devices a send clock time between 250µsec up to 4 msec is possible.			
	Domain management - Ethernet(1)			
	Sync Domain MRP Domain			
	Sync Domain			
	Sync domain: syncdomain-default 🖳 New Delete Edit			
	Send clock time 1.000 Details			
	Nodes			
	Station / ID system			
	SIMOTION D435 Slave / PROFINET-IO-System (100)         192.168. 0. 0 / 24           SIMOTION D455 Master / PROFINET-IO-System (100)         192.168. 0. 0 / 24			
	Add <u>R</u> emove			
	Station / Device Name Synchronization Role RT Class IRT Option Media			
	SIMOTION D435 Slave / SIMOTION-Slave CB20 Sync slave RT, IRT high performance ···· SIMOTION D435 Slave / (1) SINAMICS X150 Sync slave IRT high performance ····			
	x			
	Degice Properties			
	r Modules			
	Display			
1				

No.		Instruction
7.	Double click on the PN interface of the I-Device to open the properties dialog. Change to the tab "Application" (FW <= V4.1) or "IO-Cycle" (FW > V4.1) and activate the <b>Isochronous mode</b> . With this setting the I-Device will work synchronous to the PROFINET IO send clock and to the ServoTask of the SIMOTION CPU. For this all sub modules have to operate in isochronous mode (see "Isochronous Mode Modules / Submodules"). Confirm the dialog with "OK".	Properties - Interface (K150)         General Addresses Synchronizatio         Update Time         Mode:       Fored factor         Send clock (ms)         Update time (ms)       1000 = = * × 11000         Watchdog Time       * 1000         Number of accepted update cycles with missing I0 data:       3         Watchdog time (ms):       8000         Isochronous Mode       9         Application cycle (µs):       1000.000         TivTo mode:       125.000         Time To (explete insochronous mode:       125.000         Time To (output process values) [µs):       Time To (sochronous Mode         TothinTMax(rs):       (250.0001000.000)         Isochronous Mode Modules / Submodules:::       125.000         OK       Cancel         Help       This picture is only valid for firmware > V4.1.

# **NOTE** Please note, that the IRT I-Device of a SIMOTION CPU with **FW V4.3** <u>cannot</u> be operated in isochronous when a SIMOTION CPU with **FW < V4.2** is used as higher-level I/O controller.

## 4.9.3 Proxy Objects for distributed synchronous Operation

With IRT I-Device the synchronous operation data are not automatically configured. Therefore following proxy objects exist.

## **Proxy object types**

There are two different types of proxy objects:

- External synchronous operation (ExternalFollowingObjectType) A proxy object for external synchronous operation can be created under the following technology object types, i.e. interconnected with them:
  - External encoder
  - Synchronized axis
  - Positioning axis
  - Path axis
- External master value (ExternalMasterType) A proxy object for an external master value can only be created under a synchronous object, i.e. interconnected with it.

## Creating of a proxy object

The proxy objects are created in SIMOTION SCOUT, see following instructions.

#### Table 4-13







5.1 Preparation

## 5 Startup of the application

In the archive **DistributedSyncOperation\_PN\_IRT\_CCQ\_V2\_1.zip** is a SIMOTION sample project, which includes the configuration of

- a distributed synchronous operation via
- direct data exchange broadcast. (German: Controller-Controller-Querverkehr)

In the archive **DistributedSyncOperation\_PN\_IRT\_I-Device\_V2\_1.zip** is a SIMOTION sample project, which includes the configuration of

- a distributed synchronous operation via
- IRT I-Device.

These archives can be unpacked with the SIMOTION SCOUT or SIMATIC Manager.

In both projects a distributed synchronous operation will be shown between a virtual master axis and two real slave axes. The drive is a SINAMICS S120 CU320-2 PN, which is connected via PROFINET IRT to a SIMOTION CPU.

Furthermore it shows how to transfer user data (control and status data) in isochronous mode between SIMOTION controllers via direct data exchange broadcast or IRT I-Device.

## 5.1 Preparation

## 5.1.1 Drive-CLiQ topology

Figure 5-1



## 5.1.2 IP addresses and device names

Table 5-1

Device	Device name	IP address
D455_Master (X150)	SIMOTION-Master.X150	192.168.0.1
D435_Slave (CBE30)	SIMOTION-Slave.CBE30	192.168.0.2
CU320-2 PN (X150)	SINAMICS.X150	192.168.0.3
PG/PC		192.168.0.99

The subnet mask is for all devices 255.255.255.0.

**Note** Upper characters of the configured device name are replaced by lower characters during the node initialization (e.g. HW Config download).

**Note** In case of a SIMOTION CPU the name of the PROFINET interface will be used as device name. Via double click on the PN interface X150 or CBE30 or CBE30-2 in HW Config the device name can be changed.

In case of a SINAMICS device the device name can be found by double click on the device in HW Config (not the PN interface). The device name is also shown in SIMOTION SCOUT or STARTER.

## 5.1.3 Windows settings of the PG/PC interface

The IP address of the PC Ethernet network adapter must be adapted under "Control Panel > Network connections".

Click with the right mouse button on the network adapter and select "Properties".

Select "Internet Protocol (TCP/IP)" and click on "Properties" to get the IP settings of this Ethernet network adapter. Set IP and subnet mask shown in Table 5-1 for the PG/PC.

## 5.2 Startup

Table 5-2

No.	Instruction
1	Set the IP addresses of each device to download the Configuration into the devices (see also chapter 3 "Basics")
2	Download the corresponding SIMOTION project (direct data exchange broadcast or IRT I-Device) into all required devices.
3	Set the device name of the SINAMICS S120 "SINAMICS.X150", or reset the PN interface to factory settings (topology-based initialization).
4	Switch both CPU to RUN state.
5	Load the user defined SIMOTION IT Web site into the master CPU "D455-Master". The Web sites are located in folder "38486079_DistributedSyncOperation_PN_IRT_V2_1.zip > HTML > MBS". The data content of this folder must be transferred to the folder "Files" of the SIMOTION master CPU "D455_Master".

6.1 Overview

#### **Operation of the application** 6

#### 6.1 **Overview**

The controlling of the slave axes can be done by the global variables of the master CPU "D455\_Master". The value of these variables will be transferred via I/O variables to the slave CPU "D435\_Slave".

#### Test of the distributed synchronous operation 6.2

#### 6.2.1 ... by using the user defined SIMOTION IT website

With the website "DistributedSyncOperation.mbs" all axes can be controlled via changing the velocity and start or stop the synchronous operation. Each axis can be controlled separately.

9					
👹 SIMOTION D455_Ma	ster - Mozilla Firefo:	×			
<u>Datei B</u> earbeiten <u>A</u> nsie	cht <u>C</u> hronik <u>L</u> esez	eichen E <u>x</u> tras <u>H</u> ilfe			
SIMOTION D455_Maste	at .	+			
🗲 💽 192.168.0.1/IN	DEX.MCS			☆ ⊽ 🖱 🚼 ד Goo	gle 🔎 🏫
	SIEMENS	5		Watch	Overview Copy Link
The second secon	Connected d	levice name: D45	5_Master		Thu Aug 30 16:03:15 2012
SIMOTION D455-2	User's Area				Refresh
► Home	BASIC Distribut	tedSyncOperation			
►Device Info	Axis		Synchronized	Command velocity	Current velocity
► Diagnostics	Master S	TART STOP		360 [°/sec] Set	360.0 °/sec
►Messages&Logs	Slave red 🔄	TART STOP			
►Machine Overview	Slave blue S	TART	۲		
► Manage Config					
► Settings					
►Files					
►User's Area					

Figure 6-1

## 6.2 Test of the distributed synchronous operation

## 6.2.2 ... by direct control of the global variables

The symbol browser allows to control the variables of the ST unit MasterAxis. The global variables have following functionality.

<sup>−</sup> igure 6-2								
SIMOTION SCOUT - PN_IRT_2 - [S	T - [D455_Master.	MasterAxis]]						- D ×
Project Edit Paste Target system	/iew Options Wind	tow Help						_ 8 ×
Defr 6 196	∞ a <b>№</b> •	$ X_{\rm I} X_{\rm E} $	<mark></mark>	*	<b>1</b>			
<no filter=""></no>	-	)% -						6E
Who fillero       100 %         PN_IRT_2       38         Insett SIMOTION device       39         Insett SIMOTION device       40         Insett SIMOTION device       50         Insett SIMOTION SYSTEM       41         Insett SIMOTION SYSTEM       43         Insett SIMOTION SYSTEM       44         Insett SIMOTION SYSTEM       44         Insett SIMOTION SYSTEM       50         Insett SIMOTION SYSTEM       54         Insett SIMOTION SYSTEM       54         Insett SIMOTION SYSTEM       52         Insett SIMOTION SYSTEM       54         Insett SIMOTION SYSTEM       54         Insett SIMOTION SYSTEM       55         Insett SIMOTION SYSTEM       54         Insett SIMOTION SYSTEM       55         Insett SIMOTION SYSTEM       55         Insett SIMOTION SYSTEM       56         Insett SIMOTION SYSTEM       56         Insett SIMOTION SYSTEM       56         Insett SIMOT				× */sec				
		100	Contration			-		
H Name	Data type	Display format	Initial value	status value		Control value	r I	
1 Constituent	All	AI	AI 👱			All 👱		
2 - sMasterAxis	'sMasterAxisType'				F		1	
3 r64CommandVelocity	LREAL	DEC-16	360.0000000	360.0000000	Г		1	
4 boMove	BOOL		FALSE	TRUE	Ē	TRUE		
5 mgsSlave	'sSlaveType'				Ē		1	
6 Ha sAxisRed	'sSlaveAxisType'				Ē		1	
7   boEnableGearing	BOOL		FALSE	TRUE	Г	TRUE	1	
8 boSynchronized	BOOL		FALSE	TRUE	Ē		1	
9 4 sAxisBlue	'sSlaveAxisType'				Ē		1	
10 boEnableGearing	BOOL		FALSE	FALSE	Г			
11 boSynchronized	BOOL		FALSE	FALSE	Ē			
	1							
				. 16				
Alarms Symbol browser	Address list 🔛 Addi	ress setup output	E Compile/c	neck output	∄ Target sj	ystem output	Ubject compa	rison out 4 🕨
Line 1, column 1		TCP/IP -> LevelC	)ne USB-0201 L	ISB2 / T( <mark> On </mark>	ine mod	e		NUM //

#### Table 6-1

No.	Instruction
1.	Go online
2.	Both controllers must be in the RUN state.
3.	Define the command velocity, e.g. gsMaster.sMasterAxis.r64CommandVelocity = 360 °/sec
4.	Enable and start virtual master axis
	gsMaster.sMasterAxis.boMove = TRUE
5.	Enable and synchronize slave axis red <i>SlaveAxisRed</i> .gsSlave.sAxisRed.boEnableGearing = TRUE
6.	The variable boSynchronized is set as feedback signal.
7.	Enable and synchronize slave axis blue SlaveAxisBlue.gsSlave.sAxisBlue.boEnableGearing = TRUE
8.	The variable boSynchronized is set as feedback signal.

7.1 Multiple use of an I-Device GSD file

## 7 Further Notes, Tips and Tricks, etc.

## 7.1 Multiple use of an I-Device GSD file

Using an I-Device GSD file, several I-Device substitutes, with the same GSD file, can be connected to the higher-level I/O controller.

This means that when using a GSD file several times, each associated I-Device substitute on the I-Device side uses the same I/O addresses in order to communicate with the higher-level I/O controller. It goes without saying that at the higher-level I/O controller, the I/O addresses at the I-Device substitutes are different.

The multiple use of an I-Device GSD file is used to implement modular machine concepts and offers the following advantages:

- 1. On the one hand, the individual machine modules (I-Devices) internally operate with the same I/O addresses.
- 2. On the other hand, a machine module (I-Device) can be deactivated and activated by application as required (e.g. for partial commissioning purposes).

In order to do this, each machine module requires its own controller (e.g. SIMOTION controller) and the complete machine a higher-level controller (e.g. SIMATIC CPU, SIMOTION CPU).

**NOTE** Further information about modular machines you will find in the SIMOTION document "Modular\_Machine\_Concepts.pdf".

http://support.automation.siemens.com/WW/view/en/61056223

## 7.2 Deactivation of I-Devices by application

Table 7-1

No.	Instruction						
1.	Open the HW configuration of the higher-level I/O controller and select the I-Device substitute afterwards.						
2.	For the d assigned system fu	For the deactivation of an I-Device by application, its diagnostic address has to be assigned to the input parameter logicalAddressOfStation of the SIMOTION system function _deactivateDpSlave.					
	Slot 🚺 Module Order number I address		Q address	Diagnostic address:			
	2	🚡 SINOTION-Slave. CBE 30	6AU1 435-0AA00-0AA1			308"	
	X1400	Interface					
	X1400 F1	Fort 1					
	X1400 F2	Fort 2					
	X1400 F3	Faxt 3					
	X1400 F4	Favt 4					
	2.1000	240			308331		
	2.1001	24/		308331			
	2.1002	20			332333		
	2.1003	2		332333			

7.3 Deactivation of synchronous operation relationships by application

# 7.3 Deactivation of synchronous operation relationships by application

Beside the deactivation of whole machine modules (I-Devices) also individual synchronous operation relationships can be deactivated by application when direct data exchange broadcast is used.

Therefore there is the possibility to deactivate and activate unused SIMOTION CPUs participating on the direct data exchange broadcast, without getting any bus failure.



No.	Instruction					
1.	Open the HW configuration of the relative master CPU and afterwards the properties of the used PROFINET interface.					
	Image: Proceeding of the system     Proceeding of the system					
	X150         SIM0 T10N-Master X150           X150 P2P         Foil 2           X150 P3         Foil 2           X1400         X1400           X127         PNME           X127         PNME           X127         Poil 1           X122         I/0					
2.	From the view of the master CPU all slave CPUs are displayed in the tab					
	Properties - SIMOTION-Master.X150 (R0/S2.6)     Image: Simotion Control and the South an					
	Line     Address     Diagnostic Addr     Sender     Len     Comment       1     0     16363     SIMOTION D435 Slav     2     slave axes       2     260     16369     SIMOTION D435 Slav     24     SIMOTION:       3     284     16369     SIMOTION D435 Slav     24     SIMOTION:					
	New     Edit     Delete     Djagnostic Addresses       OK     Cancel     Help					
3.	For deactivating the desired synchronous operation relationship by application, the diagnostic address of the appropriate slave CPU has to be used.					
	It has to be assigned to the input parameter logicalAddressOfDpStation of the SIMOTION system function _deactivateDpSlave.					

# **NOTE** Further information about the SIMOTION system function \_deactivateDpSlave you will find in the SIMOTION online help as well as in the SIMOTION document "RefList\_Device.pdf".

http://support.automation.siemens.com/WW/view/en/61230890

8.1 Bibliography

## 8 Related literature

## 8.1 Bibliography

This list is not complete and only represents a selection of relevant literature.

### Table 8-1

	Subject	Title
/1/	SIMOTION	Gear_TechnologyFct.pdf
		http://support.automation.siemens.com/WW/view/en/61055960
/2/	SIMOTION	Modular_Machine_Concepts.pdf
		http://support.automation.siemens.com/WW/view/en/61056223
/3/	SIMOTION	Communication.pdf
		http://support.automation.siemens.com/WW/view/en/61055999

## 8.2 Internet link specifications

This list is not complete and only represents a selection of relevant information.

Tab	le	8-2
1 ab		~ -

	Subject	Title
\1\	Direct link to internet document	http://support.automation.siemens.com/WW/view/en/38486079
\2\	Siemens Industry Online Support	http://support.automation.siemens.com

## 9 Contact

Siemens AG

Industry Sector I DT MC PMA APC Frauenauracher Straße 80 D - 91056 Erlangen mailto: profinet.team.motioncontrol.i-dt@siemens.com

## 10 History

Table	10-1
-------	------

Version	Date	Modifications
V1.1	05/2007	Publication
V1.2	08/2007	Correction, References
V2.0	11/2010	New release with new hardware and firmware
V2.1	01/2013	New revision / implementation of IRT I-Device
V2.2	09/2013	New revision / implementation of chapter "Further Notes, Tips and Tricks, etc."