

## Smart Function Kit SFK field bus



The information in this manual is for product description purposes only. Any information on how to use the product is only an example and a recommendation. Catalog information is not binding. The information in this manual does not release the user from exercising their own judgment and conducting their own tests. Our products are subject to natural wear and aging.

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# 1 Introduction

The field bus interface allows for the *Smart Function Kit* to be used as a subsystem in an automation plant.

The following field bus protocols are available for the *Smart Function Kit*:

- SercosIII
- EtherCAT (SoE)
- Profinet
- Ethernet/IP

**Notice**

To ensure error-free operation as a subsystem of a master control, data exchange must be carried out according to the instructions described here.

The field bus protocol can be selected via the *Selection list* in the *System configuration* area. The exact procedure for this is explained in the following chapter.

# 2 Hardware

## 2.1 Hardware topology

The following figures show the physical integration of the *Smart Function Kit* (consisting of IndraDrive HCS01 and PR21) into a higher-level automation system. In doing so, care must be taken to ensure correct cabling and use of the appropriate device ports to ensure error-free communication between the devices involved.

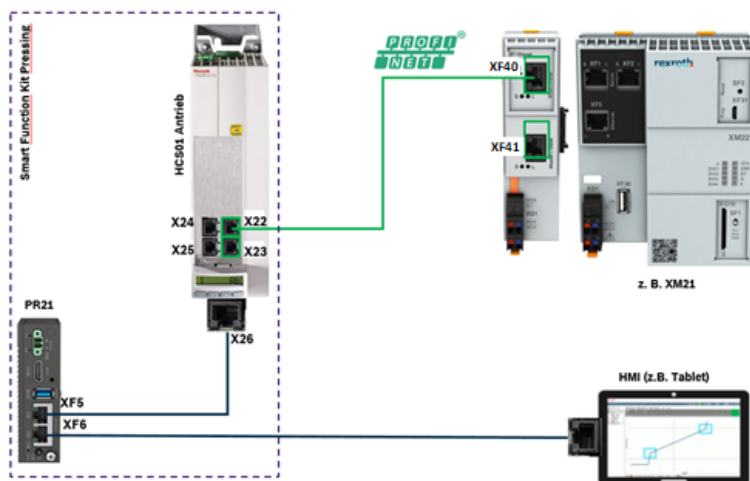
In the figures, a **Rexroth XM21** control system is used as field bus master. This control version already has an integrated **SercosIII-Master** field bus connection. For the deployment as a Profinet master, the **XFE01.1-FB-03** expansion module is used.



### Notice

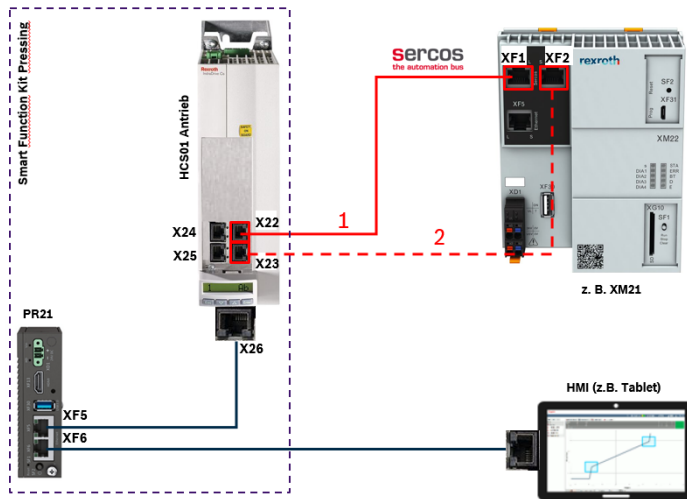
Third-party hardware can be used for the field bus master. In this case please refer to the additional documentation on the homepage.

#### 1. Structure of a Profinet field bus



#### 1 Physical structure of a Profinet field bus

#### 2. Structure and/or cabling of a SercosIII field bus.



## 2 Physical structure of a SercosIII field bus

This field bus can be designed either as a line or ring topology. To increase the fault tolerance against EMC interference and cable defects, the SercosIII master expects a ring topology (cable 1 + 2). This ensures redundancy of the data.

## 2.2 Settings

### General requirements

Communication with the *Smart Function Kit* web interface requires a faultless network connection between the HMI (e.g. tablet) and PR21/XF6.

The following requirements apply to the HMI (e.g. notebook, tablet) for connection to the *Smart Function Kit*:

- Web browser with HTML5 and Java Script support (e.g. Firefox **version 52** or higher, Chrome **version 74** or higher)
- Screen diagonal 10 inches (format 16:9) or higher
- Screen resolution 120px 720px or higher

### IP addresses configuration

The correct configuration of the IP addresses and subnet marks for the individual ports of the devices is a prerequisite for error-free communication.

The standard settings are listed below:

#### ✓ IndraDrive HCS01 – X22/X23 (MT):

- IP address: 172.31.254.1
- Subnet mask: 255.255.255.0

#### ✓ IndraDrive HCS01 – X26 (ET):

- IP address: 192.168.1.1
- Subnet mask: 255.255.255.0

#### ✓ Industrial PC PR21 – XF5 (cannot be changed):

- IP address: 192.168.1.100
- Subnet mask: 255.255.255.0

#### ✓ Industrial PC PR21 – XF6 (can be changed via the web interface):

- IP address: 192.168.0.1

- Subnet mask: 255.255.255.0



#### Notice

The IP addresses can be changed or adapted individually for some ports. The corresponding configuration procedure is explained below.

The IP addresses of the ports X22/23 (MT) can be adjusted and changed at the IndraDrive HCS01. For communication via ProfiNet, the desired IP address of the IndraDrive HCS01 **must always be** assigned via the TIA portal. Before assignment via the TIA portal, the IP address of IndraDrive HCS01 must not be identical with the desired IP address. After assignment, the addresses are automatically synchronized to the desired IP address.

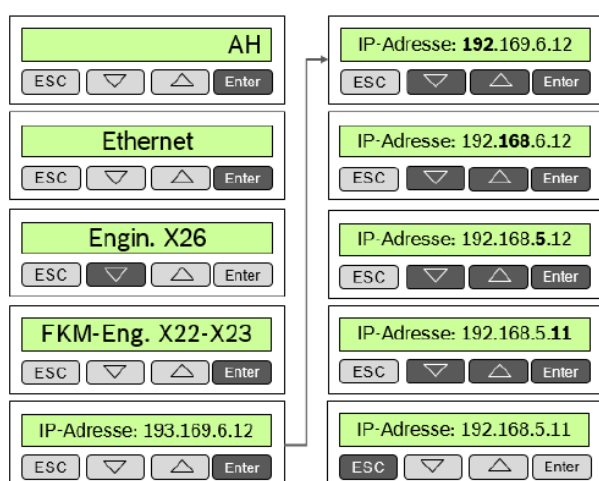
### ATTENTION



#### Changing the IP address of port X26

If the IP address of port X26 is changed, the system becomes inoperable.

→ Do not change the IP address of port X26.



### 3 Adaptation of the IP address via the operating panel of the drive

The figure shows the procedure using the example of ports X22/23 (MT) via the control unit of the drive.

On the PR21 industrial PC, only the IP address for port XF6 can be changed, which is used to establish the connection between the HMI (e.g. tablet) and the web interface.

In order to adapt or change the IP address/subnet mask, please follow the steps below:

## Network

Configure network settings

XF5 IP-address (drive)

192.168.0.198

XF5 subnet mask (drive)

255.255.255.0

XF6 IP-address (HMI)

172.18.0.2

XF6 subnet mask (HMI)

255.255.0.0

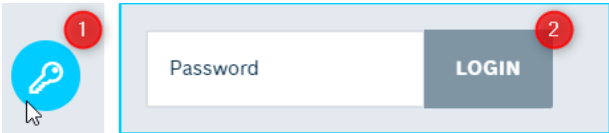
SAVE

### 4 Network settings of PR21 - adjusting XF6

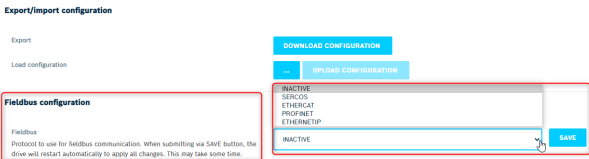
- Open the **Configuration**.
- In the *System* tab, change the IP address and the subnet mask for port XF6 under *Network* .

### Field bus activation

In order for the *Smart Function Kit* to communicate with or to enable control via a field bus, the corresponding field bus protocol must first be selected in the web interface. To do this, the following steps are required:

| Screens/comments                                                                    | Action steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | <p>→ Open the web browser in the HMI.</p> <p>→ In case of connection problems: Empty the cache and clear the browser history, cookies and other data.</p> <div style="border: 1px solid green; padding: 10px; margin: 10px 0;"> <p>✓ <b>Notice</b><br/>Web browsers usually have a private mode in which no data such as cookies are stored. If this is activated, there is no need to empty the cache or delete the history.</p> </div> <p>→ Enter the IP address in the address bar.</p> <p><i>Default IP address: 192.168.0.1</i></p> <p>✓ The web interface of the <i>Smart Function Kit</i> is opened.</p> |
|  | <p>→ Enter the password <i>admin</i> (if not previously changed) and log in.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Screens/comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Action steps                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Specification of a station name is possible with Profinet and Ethernet/IP. By default, the name is set to to “SPK”.</p> <p>Other station names must comply with the following criteria:</p> <ul style="list-style-type: none"> <li>• No longer than 240 characters (letters, numbers, hyphen or dot)</li> <li>• The length of the letter sequence between two dots should not exceed 63 characters</li> <li>• Do not use special characters (umlauts, quotation marks, underline, slash, space, etc.), except hyphens</li> <li>• Neither the first, nor the last character should be a hyphen</li> <li>• The designation should not have the following format: n.n.n.n (n = 0...999)</li> <li>• The designation should not start as follows: port-xyz- (x,y,z = 0...9)</li> </ul> | <p>→ Scroll down under <i>Configuration</i> -&gt; <i>System</i>.</p> <p>→ Select the corresponding type under <i>Field bus configuration</i>.</p> <p>→ If required, change the station name from “SPK” to the desired name.</p> <p>→ Click <i>Save</i>.</p> |

## 1 Field bus activation

## 3 Field bus configuration

To establish the communication, the master control must be configured correctly. Depending on the field bus protocol, the configuration can look different.

As examples, the configurations for the **SercosIII** and **Profinet field bus** based on an **XM21 control** from Bosch Rexroth are described below. *IndraWorks Engineering* is used as the development environment.

### 3.1 Create variable list

For communication between the *Smart Function Kit* and the higher-level control, specific data is transmitted via the field bus in the form of **WORDS**. These are recorded by the field bus master as inputs or outputs.

The figure shows an overview of the field bus data:

| ET-Master<br>(Input 20 Words) | ET-Master<br>(Output 9 Words) |
|-------------------------------|-------------------------------|
| responseHandle (Word)         | requestHandle (Word)          |
| responseStatus (Word)         | requestAction (Word)          |
| responseValue1 (DWord)        | requestValue1 (DWord)         |
| responseValue2 (DWord)        | requestValue2 (DWord)         |
| responseValue3 (DWord)        | requestValue3 (DWord)         |
| notificationID (Word)         | virtual IO output (Word)      |
| notificationValue (DWord)     |                               |
| notificationStatus (Word)     |                               |
| notificationPosition (DWord)  |                               |
| notificationVelocity (DWord)  |                               |
| notificationForce (DWord)     |                               |
| digital IOMapping (Word)      |                               |
| virtual IO input (Word)       |                               |

#### 5 Structure of the cyclic configuration

To enable the field bus master to access the corresponding field bus data via functions, it is useful to assign these data to global variables.

A practical implementation consists of creating one global array of the **WORD** data type each for the input and output data.

The corresponding assignment of the input and output data of the field bus to the corresponding array elements (mapping) is explained below for the respective field bus protocols.

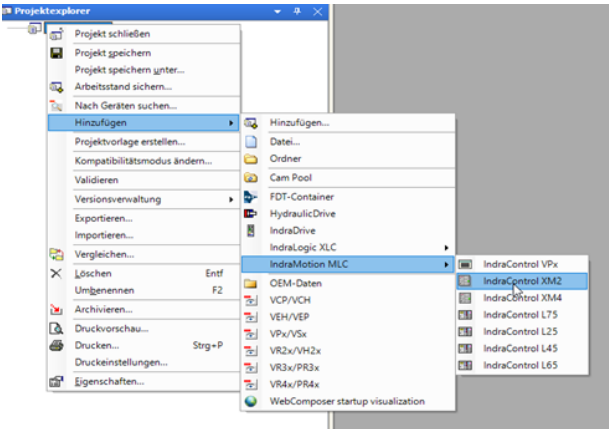
The following listing shows a printout from the global variable list *SFK\_GlobalVariables* of the example projects provided on the homepage.

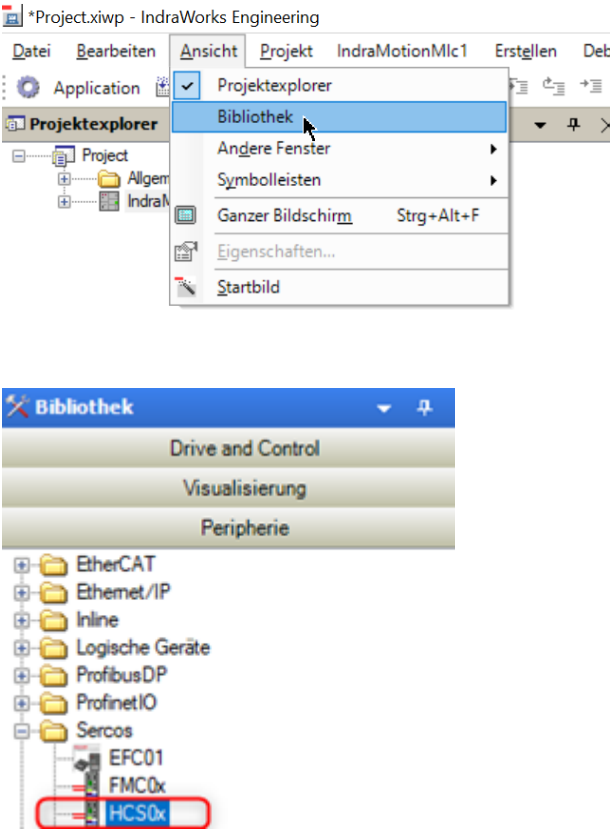
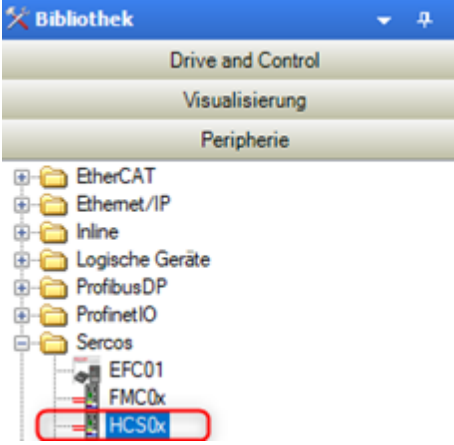
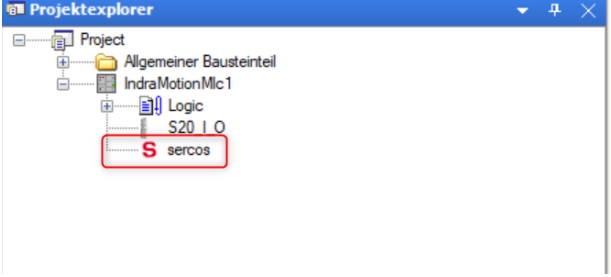
#### Listing: Excerpt from global variables list "SFK\_GlobalVariables"

```
VAR_GLOBAL
    ///Cyclic mapping variables
    InputDataContainer: ARRAY[0..19] OF WORD;
    OutputDataContainer: ARRAY[0..8] OF WORD;

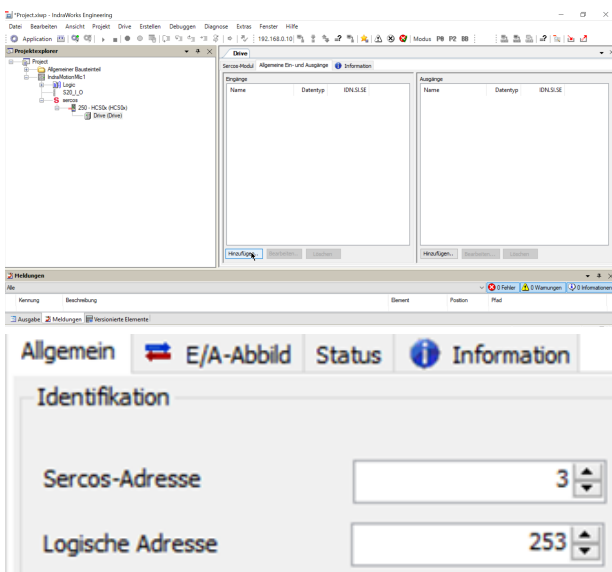
END_VAR
```

#### Sercos field bus configuration

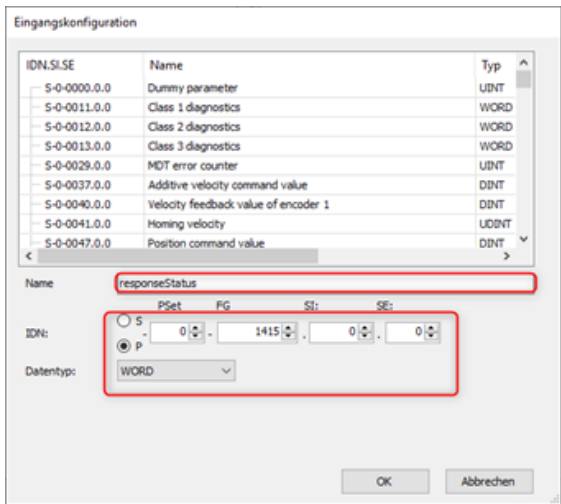
| Screens/comments                                                                  | Action steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>First step:</b> Add the <i>Smart Function Kit</i> drive to the field bus master as a Sercos device:</p> <ul style="list-style-type: none"> <li>→ Start IndraWorks and add a new project (empty project).</li> <li>→ Press the right mouse button.</li> <li>→ In the menu navigate to <i>Add</i>.</li> <li>→ Click <i>IndraMotion MLC</i>.</li> <li>→ Select <i>IndraControl XM2</i>.</li> </ul>                                                                                                                                                                                                                                 |
|                                                                                   | <p>✓ A dialog window is opened for configuration of the MLC controller (XM2).</p> <p>The following steps of the configuration are performed chronologically.</p> <ol style="list-style-type: none"> <li>1. General properties</li> <li>2. Hardware/communication</li> <li>3. Extended settings</li> <li>4. Function packages</li> <li>5. Interfaces</li> </ol> <p>→ In every window enter the required inputs and click <i>Next &gt;&gt;</i>.</p> <p>→ In the last Interfaces window click <i>Finish</i> when all inputs have been made.</p> <p>✓ Configuration is completed and the controller is displayed in the project node.</p> |

| Screens/comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Action steps                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>*Project.xiwp - IndraWorks Engineering</p> <p>→ In the <i>View</i> tab activate the <i>Library</i>.</p> <p>→ In the <i>Library</i> click the <i>Peripherals</i> tab.</p> <p>→ Under <i>Sercos</i> select the device <i>HCS01</i>.</p> <p>→ Alternatively, you can drag the device under the <i>Sercos node</i> in the project explorer.</p>  <p>*Project.xiwp - IndraWorks Engineering</p> <p>→ In the <i>View</i> tab activate the <i>Library</i>.</p> <p>→ In the <i>Library</i> click the <i>Peripherals</i> tab.</p> <p>→ Under <i>Sercos</i> select the device <i>HCS01</i>.</p> <p>→ Alternatively, you can drag the device under the <i>Sercos node</i> in the project explorer.</p>  | <p>Adding a Sercos device (IndraDrive HCS01)</p> <p>→ In the <i>View</i> tab activate the <i>Library</i>.</p> <p>→ In the <i>Library</i> click the <i>Peripherals</i> tab.</p> <p>→ Under <i>Sercos</i> select the device <i>HCS01</i>.</p> <p>→ Alternatively, you can drag the device under the <i>Sercos node</i> in the project explorer.</p> |

Screens/comments



| Inputs                                                   |          |              | Outputs                                            |          |              |
|----------------------------------------------------------|----------|--------------|----------------------------------------------------|----------|--------------|
| Name                                                     | Datatype | IDN.SI.SE    | Name                                               | Datatype | IDN.SI.SE    |
| <input checked="" type="checkbox"/> responseHandle       | WORD     | P-0-1414.0.0 | <input checked="" type="checkbox"/> requestHandle  | WORD     | P-0-1394.0.0 |
| <input checked="" type="checkbox"/> responseStatus       | WORD     | P-0-1415.0.0 | <input checked="" type="checkbox"/> requestAction  | WORD     | P-0-1395.0.0 |
| <input checked="" type="checkbox"/> responseValue1       | DWORD    | P-0-1290.0.0 | <input checked="" type="checkbox"/> requestValue1  | DWORD    | P-0-1287.0.0 |
| <input checked="" type="checkbox"/> responseValue2       | DWORD    | P-0-1291.0.0 | <input checked="" type="checkbox"/> requestValue2  | DWORD    | P-0-1288.0.0 |
| <input checked="" type="checkbox"/> responseValue3       | DWORD    | P-0-1292.0.0 | <input checked="" type="checkbox"/> requestValue3  | DWORD    | P-0-1289.0.0 |
| <input checked="" type="checkbox"/> notificationID       | WORD     | P-0-1416.0.0 | <input checked="" type="checkbox"/> virtual_io_out | WORD     | P-0-1396.0.0 |
| <input checked="" type="checkbox"/> notificationValue    | DWORD    | P-0-1293.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> notificationStatus   | WORD     | P-0-1417.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> notificationPosition | DWORD    | S-0-0051.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> notificationVelocity | DWORD    | S-0-0040.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> notificationForce    | DWORD    | P-0-1294.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> I/O's Haaping        | WORD     | P-0-1418.0.0 |                                                    |          |              |
| <input checked="" type="checkbox"/> virtual_io_in        | WORD     | P-0-1419.0.0 |                                                    |          |              |



Action steps

**Second step:** Comparing the field bus addresses in IndraWorks with the device addresses and adapting them if necessary

- In the project explorer navigate to *Sercos*. → *HCS0x*.
- Select *Drive*.
- In the General inputs and outputs tab, create the parameters.

→ Change the cyclic inputs and outputs so that they are similar to the example opposite (left).

- Click *Add*.
- ✓ An input form is opened.
- Enter the name of the input or output.
- Select the data type and enter the corresponding parameters.

## Screens/comments

Drive

Sercos-Modul Allgemeine Ein- und Ausgänge E/A-Abbild Information

Find Filter Alle anzeigen

| Variable               | Mapping | Kanal | Adresse | Typ | Standardwert | Einheit | Beschreibung |
|------------------------|---------|-------|---------|-----|--------------|---------|--------------|
| * requestHandle        |         |       |         |     |              |         |              |
| * requestAction        |         |       |         |     |              |         |              |
| * requestValue1        |         |       |         |     |              |         |              |
| * requestValue2        |         |       |         |     |              |         |              |
| * requestValue3        |         |       |         |     |              |         |              |
| * virtualJo_out        |         |       |         |     |              |         |              |
| * responseHandle       |         |       |         |     |              |         |              |
| * responseStatus       |         |       |         |     |              |         |              |
| * responseValue1       |         |       |         |     |              |         |              |
| * responseValue2       |         |       |         |     |              |         |              |
| * responseValue3       |         |       |         |     |              |         |              |
| * notificationID       |         |       |         |     |              |         |              |
| * notificationValue    |         |       |         |     |              |         |              |
| * notificationStatus   |         |       |         |     |              |         |              |
| * notificationPosition |         |       |         |     |              |         |              |

Mapping zurücksetzen Variablen aktualisieren: Aktiviert 1 (Buszyklus-Task)

Sercos-Modul Allgemeine Ein- und Ausgänge E/A-Abbild Information

Find Filter Alle anzeigen

| Variable                                               | Ma...         | Kanal | Adresse | Typ  |
|--------------------------------------------------------|---------------|-------|---------|------|
| requestHandle                                          |               |       |         |      |
| Application.SPK_GlobalVariables.OutputDataContainer[0] | requestHandle |       | %QHW0   | WORD |
| requestAction                                          |               |       |         |      |
| Application.SPK_GlobalVariables.OutputDataContainer[1] | requestAction |       | %QHW2   | WORD |

## Action steps

✓ After creating the cyclic inputs and outputs in the General inputs and outputs tab, they are displayed in the I/O image.

→ Via the "I/O image", assign the inputs and outputs of the field bus to the internal variables using the + symbol.

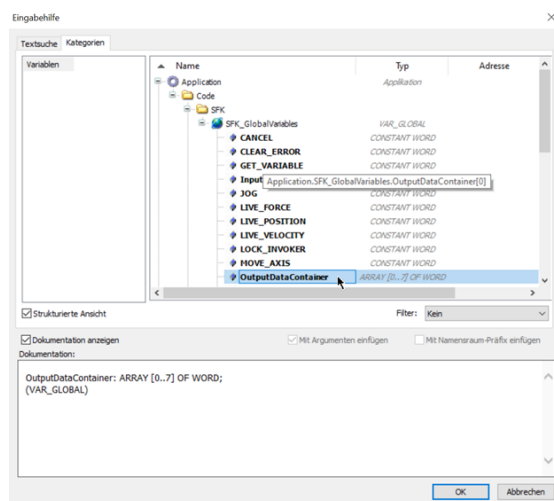
✓ The field bus master will then access the field bus data via functions.

**Notice**

After configuration, a restart of the field bus may be required.

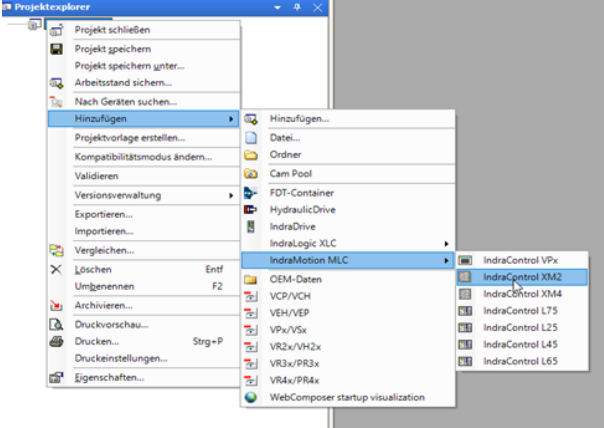
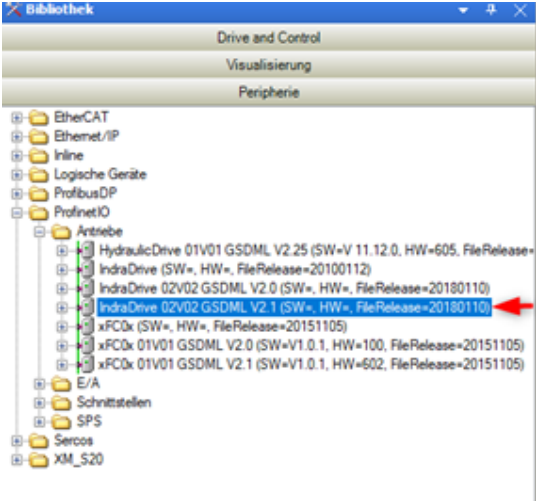
This restart is carried out with the following changes of the control modes:

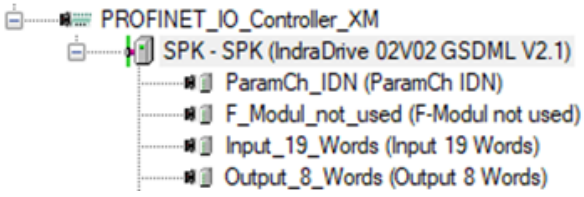
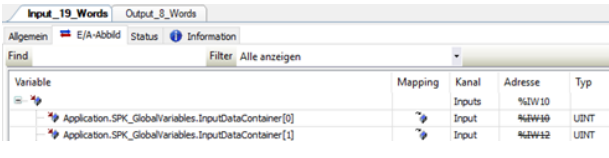
- Operating mode (BB)
- Download mode (P0)
- Parameterization mode (P2)
- Operating mode (BB)



→ Select the correct array element from the input or output container.

**2 Sercos field bus configuration****Profinet field bus configuration**

| Screens/comments                                                                    | Action steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>Requirement:</b></p> <ul style="list-style-type: none"> <li>• New project (empty project) has been created in IndraWorks.</li> <li>• Field bus master (here Bosch Rexroth XM21) has been added.</li> </ul> <p><b>First step:</b> Add the <i>Profinet IO controller XM</i> device.</p> <p>→ In the project tree navigate to the <i>RT_Ethernet...</i> tab.</p> <p>→ Press the right mouse button.</p> <p>→ In the menu navigate to <i>Set device</i>.</p> <p>→ Select the <i>Profinet-IO-Controller XM</i> device.</p> |
|                                                                                     | <p><b>Second step:</b> Add the IndraDrive HCS01 to the Profinet IO controller as a field bus slave.</p> <p><b>First procedure:</b></p> <p>→ In the project tree navigate to the <i>Profinet- IO-Controller XM</i> device.</p> <p>→ Press the right mouse button.</p> <p>→ In the menu navigate to <i>Add → Device → Drives</i>.</p> <p>→ Select the <i>IndraDrive 02V02 GSDML V2.1</i> device as field bus slave.</p>                                                                                                       |
|  | <p><b>Second procedure:</b></p> <p>→ In the <i>Library</i> select the <i>Peripherals</i> tab.</p> <p>→ In the peripherals tree navigate to <i>ProfinetIO → Drives</i>.</p> <p>→ Drag the <i>IndraDrive 02V02 GSDML V2.1</i> device into the project tree.</p>                                                                                                                                                                                                                                                               |
|                                                                                     | <p>→ In the corresponding <i>General</i> tab, enter <i>SPK</i> as the station name.</p> <div style="border: 1px solid green; padding: 10px; margin-top: 10px;"> <p>✓ <b>Notice</b></p> <p>During activation of the field bus within the SFK software, another station name can be specified. No distinction is made here between lower and upper case.</p> </div>                                                                                                                                                           |

| Screens/comments                                                                    | Action steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>✓ In the project tree, the <i>IndraDrive HCS01</i> (Profinet slave) is displayed under the <i>Profinet IO controller</i>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                     | <p>✓ If Profinet is used, the IndraDrive obtains its IP address automatically from the field bus master (for this reason it is necessary to enter the correct station name).</p> <p>The following standard IP addresses are assigned by the field bus master:</p> <ul style="list-style-type: none"> <li>PROFINET_IO_Cotroller_XM (Master): 192.168.2.1 / 255.255.255.0</li> <li>SPK (IndraDrive 02V02) (slave): 192.168.2.2 / 255.255.255.0</li> </ul> <p>To enable access to the field bus data (inputs and outputs), the corresponding blocks of the field bus slave must be configured or added as follows:</p> <ol style="list-style-type: none"> <li>ParamCH_IDN</li> <li>Input_20_Words</li> <li>Output_9_Words</li> </ol> |
|  | <p><b>Third step:</b></p> <p>→ Via the “I/O image”, finally assign the inputs and outputs of the field bus to the internal variables.</p> <p>✓ The field bus master will then access the field bus data via functions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

### 3 Profinet field bus configuration



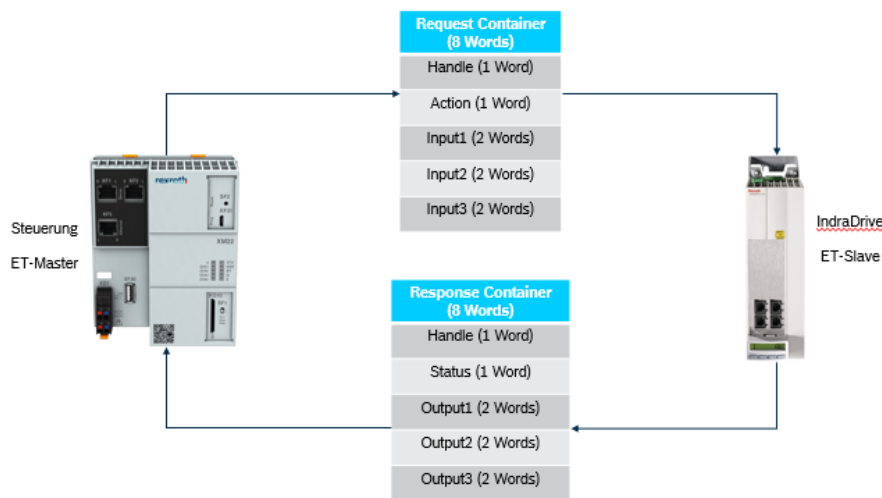
# 4 Communication

Control via the field bus is carried out via

- Requests,
- Responses
- Notifications.

For each **request**, the **response** corresponding to the request is sent. **Notifications** are divided into cyclic and acyclic information.

The following figure schematically shows the functional principle of the communication.



## 6 Schematic structure of field bus communication

This “Request Container” is continuously evaluated by the Smart Function Kit. If it is recognized that the “Handle” field has changed, it is checked for a valid query involving the fields “Action” and “Input 1 - 3”.

## 4.1 Requests

The response to a request is given after the entire command/request has been processed.

The following table contains all available commands that can be sent via the field bus.

| ID | Command            | Value 1                     | Value 2                      | Value 3                       |
|----|--------------------|-----------------------------|------------------------------|-------------------------------|
| 1  | Start program      | (Serial number, digits 1-7) | (Serial number, digits 8-14) | (Serial number, digits 15-21) |
| 2  | Set program active | Field bus ID                | x                            | x                             |
| 3  | Positioning        | Target position             | Travel speed                 | Acceleration                  |
| 4  | Jog                | Distance                    | Travel speed                 | Acceleration                  |
| 5  | Delete error       | x                           | x                            | x                             |

| ID | Command                | Value 1     | Value 2                    | Value 3 |
|----|------------------------|-------------|----------------------------|---------|
| 6  | Stop movement          | x           | x                          | x       |
| 7  | Restart drive          | x           | x                          | x       |
| 8  | Reserved               | -           | -                          | -       |
| 9  | Tare                   | Offset      | x                          | x       |
| 10 | Start of reference run | x           | x                          | x       |
| 11 | Set system variable    | Type        | Number                     | Value   |
| 12 | Block participant      | Participant | Block (1) /<br>Unblock (0) | x       |
| 13 | Set reference          | x           | x                          | x       |
| 14 | Read system variable   | Type        | Variable number            | x       |

#### 4 Requests

##### 1 Start program:

With this command, the currently active program is started. The program is run once completely and after completion the corresponding response is provided. The program sequence is considered to be finished when the quality assessment has been completed.

There is also the option of linking a self-assigned serial number with up to 21 digits with the data set of a program sequence. For this purpose, the serial number must be divided to up to 3 REAL values, depending on the total length (see table "Requests").

##### Example:

Serial number: '123451234567541'

Value 1 = 4567.541 | Value 2 = 2345.123 | Value 3 = 0.001

##### 2 Set program active:

The command activates the program specified in value 1. The field bus ID corresponds to the field bus ID assigned during program creation. If the program is switched, the corresponding response is provided.

##### 3 Positioning:

The command enables the movement to a defined target position. The desired travel speed profile can be realized via the parameters *travel speed* and *acceleration*. When the target position is reached, the corresponding response is provided.

#### 4 Jog:

With the *Jog* command, a distance relative to the current position can be covered. The desired travel speed profile can be realized via the parameters *travel speed* and *acceleration*. When the target position is reached, the corresponding response is provided.

#### 5 Delete error:

The command acknowledges all errors present on the *Smart Press Kit*. Once the command has been processed by the system, the corresponding response is provided.

#### 6 Stop movement:

The command terminates any currently pending command. If a movement is active, it is aborted and the drive is stopped. When the drive is stopped, the corresponding response is provided.

#### 7 Restart drive:

The command restarts the drive controller.

#### 9 Tare:

Executes the *Tare* command and sets the actual force value to the specified offset. When the command has been completed, the corresponding response is provided.

#### 10 Start reference run:

The command starts the reference run.



#### Notice

Please always observe the notes in the [Reference run](#) chapter!

#### 11 Set system variable:

This command sets the values of system variables. All available variables are listed in the table below. The system does not enter parameterization mode when changing these values.

◇ For further information, see the chapter [Hardware configuration](#).

|        |        |
|--------|--------|
| 0: VFR | 10: VF |
| 1: MFR | 11: MF |

#### 5 Coding the variable types

Example: Writing the system variable VF500

Arg. 1: 10

Arg. 2: 500

## Arg. 3: Value

| Variable | Description                                  | Type | Number | Value                                |
|----------|----------------------------------------------|------|--------|--------------------------------------|
| VFR004   | Set force limitation for positioning command | 0    | 4      | Force value [N] 0=inactive (default) |
| MFR002   | Actual data filter                           | 1    | 2      | 0 = Off   1 = On                     |
| MFR005   | Cyclic variables documentation               | 1    | 5      | 0 = Off   1 = On                     |

**6 System variable****12 Block participant:**

The command blocks or unblocks access for a participant. If the access of a participant is blocked, they cannot access the functions of the *Smart Function Kit*. Blocking of a participant is undone after every restart. Possible participants are:

- Web HMI (1)
- Field bus (2)
- Physical inputs and outputs (3)

Selection of the participant to be blocked is performed via the first input parameter. The corresponding number must be set for the parameter. The second input parameter is used for deciding whether a participant is to be blocked or unblocked. The following values apply:

0 = Unblock participant

1 = Block participant

**13 Set reference:**

The command *Set reference* sets a reference point at the position where the drive is located. The standard value for that position is zero. However, this value can be globally changed for the system via the extended hardware configuration.

**14 Read system variable:**

This command is used to read system variables. The variable type must be supplied as the first argument.

The second argument specifies the variable number.

◇ For more information, see the Coding the variable types table

|        |        |
|--------|--------|
| 0: VFR | 10: VF |
| 1: MFR | 11: MF |

**7 Coding the variable types****Example:**

Read system variable

VF500 Arg. 1: 10

Arg. 2: 500

✓ As response value, the Smart Function Kit supplies the value of the variable VF500 in ResponseValue [1].

Accordingly, the following values for the last press curve can be read via the field bus:

|       |               |
|-------|---------------|
| VF600 | Max. position |
| VF601 | Max. force    |
| VF602 | Cycle time    |

### 8 Press curve values

The values are only valid after a pressing process and must be read before a new pressing process begins. The period required for reading the values is not deterministic, since this is performed via the NRT channel.



#### Notice

A response value of -1 signals that the value is invalid. This may occur, e.g. for cycle time due to abortion of the program.

## 4.2 Status information

With the status information, the states of the *Smart Function Kit* can be queried. This enables targeted control of the *Smart Function Kit* via the field bus master. The following tables show the corresponding commands (ID) and assignments within the status word.

| ID  | Description           | Functional description                              |
|-----|-----------------------|-----------------------------------------------------|
| 301 | Active program number | The program number active in the drive is read out. |
| 401 | Current position      | Cyclically transmitted position is read out         |
| 402 | Current speed         | Cyclically transmitted travel speed is read out     |
| 403 | Current force         | Cyclically transmitted force is read out            |

### 9 Status information 1

| Bit   | Description | Value 1 |
|-------|-------------|---------|
| 0 - 2 | Reserve     |         |

| Bit     | Description            | Value 1                                                                                                                                 |
|---------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 3       | Program active         | 1 – pressing active, program is being processed<br>Data is recorded (force - travel curve) 0 - No program active<br>No data is recorded |
| 4       | Last pressing OK       | 1 – Last pressing provides result Good 0 - No result                                                                                    |
| 5       | Last pressing NOK      | 1 – Last pressing provides result Bad 0 - No result                                                                                     |
| 6       | Sensor tared           | 1 – Force sensor is tared (offset active)<br>0 – Force sensor is not tared (no offset active)                                           |
| 7       | Press ready            | 1 – Press is ready and can be moved 0 - Press not ready, check status                                                                   |
| 8       | Error                  | 1 – Error active<br>0 – No error active                                                                                                 |
| 9       | Warning                | 1 – Warning active<br>0 – No warning active                                                                                             |
| 10      | Reserve                |                                                                                                                                         |
| 11      | Request possible       | 1 – A request can be sent to the system. 0 – No request can be sent to the system                                                       |
| 12      | Response available     | 1 – Valid response available 0 - Response pending                                                                                       |
| 13      | Notification available | 1 – Valid notification available 0 - Notification pending                                                                               |
| 14 - 15 | Reserve                |                                                                                                                                         |

#### 10 Status information 2

## 4.3 Virtual inputs and outputs

The *Smart Function Kit* also provides virtual inputs and outputs to enable communication between the master controller and a program sequence. This enables various application options, such as dynamic stops and/or delays during the program sequence or waiting for external signals from measuring systems or grippers.

For this purpose, 16 bits are available for each direction, which can be written and/or read at any time. To be able to use them, the corresponding program variables must be assigned in the settings of the *Smart Function Kit*. They can then be used when creating the program.

# 5 Programming example

## 5.1 Positioning example

To move to a specific target position with the *Smart Function Kit*, the *Positioning* command can be sent via the *Request* channel. When the target position is reached, the result is displayed in the *Response* container.

| Handle ID | Command | Value 1       | Value 2       | Value 3          |
|-----------|---------|---------------|---------------|------------------|
| 151       | 3       | 50            | 150           | 150              |
| Word 1    | Word 2  | Word 3 Word 4 | Word 5 Word 6 | Word 7<br>Word 8 |

### 11 Request scheme for container request

The Handle ID is a freely selectable integer number that is used to identify a request and the associated response. The ID can be used to check whether the current response matches the request. Two consecutive commands must necessarily have a different Handle ID, otherwise no unique assignment can be made.

When the target position is reached, the *Smart Function Kit* responds with the following response scheme:

| Handle ID | Status | Value 1       | Value 2       | Value 3       |
|-----------|--------|---------------|---------------|---------------|
| 151       | 0      | 0             | 0             | 0             |
| Wort 1    | Wort 2 | Wort 3 Wort 4 | Wort 5 Wort 6 | Wort 7 Wort 8 |

### 12 Response scheme for container response

Status = 0 → no error

Status <> 0 → Error. The status value corresponds to the error number of the occurred error, see [Error catalog](#).

## 5.2 Integration/use of example projects

The supplied example implementations can be used for **Indra Works Engineering** or the **TIA Portal** development environment.

The examples serve as an abstraction layer with the aim of making it easier for the user to familiarize themselves with the **request** and **response** scheme. Using function modules based on the PlcOpen Notation simplifies the interface and makes use more intuitive.

- ◇ Detailed description/integration and functionality in the respective documentation of the example projects
- ◇ The example projects can be directly downloaded from the user interface. To do this, navigate to the help menu and select the corresponding example project.

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