

# AXL F BK S3

## Axioline F bus coupler for Sercos



Data sheet  
105610\_en\_02

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## 1 Description

Valid from firmware version 1.10.

The bus coupler is intended for use within a third-generation Sercos network and represents the link to the Axioline F system.

Up to 63 Axioline F devices can be connected to an existing Sercos network with the help of the bus coupler.

### Features of Sercos

- 2 Ethernet-Ports
- Rotary coding switches for setting the Sercos address
- Transmission speed of 100 Mbps with a minimum Sercos cycle time of 31.25  $\mu$ s
- Sercos diagnostic LED
- Certified according to Sercos V1.12
- Supports Sercos V1.31
- FSP-IO (Function Specific Profile-IO) for modular I/O devices
- A maximum of 8 connections are supported (max. 4 consumer and max. 4 producer connections)
- Cross communication is possible up to reaching the maximum number of connections

- Synchronization

### Features of Axioline F

- Up to 63 additional Axioline F devices can be connected
- Typical cycle time of the Axioline F local bus is around 10  $\mu$ s
- Runtime in the bus coupler is negligible (goes to 0  $\mu$ s)
- Firmware can be updated
- Diagnostic and status indicators



This data sheet is only valid in association with the UM EN AXL F SYS INST user manual.  
You can find further information on Sercos in the UM DE SERCOS SYS user manual.



Make sure you always use the latest documentation.  
It can be downloaded from the product at [phoenixcontact.net/products](http://phoenixcontact.net/products).  
You will always find the current SDDML-files here.

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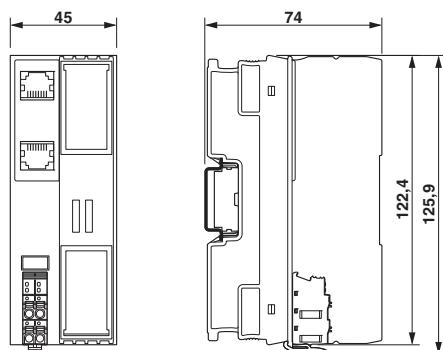
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### 3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Axioline F bus coupler for Sercos (including bus base module and connector)	AXL F BK S3	2701686	1
<b>Accessories</b>			
Axioline F bus base module for housing type BK (Replacement item)	AXL BS BK	2701422	5
Axioline F short power connector (for e.g., AXL F BK ...) (Replacement item)	AXL CN S/UL	2701421	5
RJ45 connector, shielded, with bend protection sleeve, 2 pieces, gray for straight cables, for assembly on site. For connections that are not crossed, it is recommended that you use the connector set with gray bend protection sleeve. (Connector/Adapter)	FL PLUG RJ45 GR/2	2744856	1
RJ45 connector, shielded, with bend protection sleeve, 2 pieces, green for crossed cables, for assembly on site. For connections that are crossed, it is recommended that the connector set with green bend protection sleeves is used. (Connector/Adapter)	FL PLUG RJ45 GN/2	2744571	1
CAT5-SF/UTP cable (J-02YS(ST)C HP 2 x 2 x 24 AWG), heavy-duty installation cable, 2 x 2 x 0.22 mm <sup>2</sup> , solid conductor, shielded, outer sheath: 7.8 mm diameter, inner sheath: 5.75 mm ± 0.15 mm diameter (Cable/conductor)	FL CAT5 HEAVY	2744814	1
CAT5-SF/UTP cable (J-LI02YS(ST)C H 2 x 2 x 26 AWG), light-duty, flexible installation cable 2 x 2 x 0.14 mm <sup>2</sup> , stranded, shielded, outer sheath: 5.75 mm ± 0.15 mm diameter (Cable/conductor)	FL CAT5 FLEX	2744830	1
Crimping pliers, for assembling the RJ45 plugs FL PLUG RJ45..., for assembly on site (Tools)	FL CRIMPTOOL	2744869	1
Zack marker strip for Axioline F (device labeling), in 2 x 20.3 mm pitch, unprinted, 25-section, for individual labeling with B-STIFT 0.8, X-PEN, or CMS-P1-PLOTTER (Marking)	ZB 20,3 AXL UNPRINTED	0829579	25
Zack marker strip, flat, in 10 mm pitch, unprinted, 10-section, for individual labeling with M-PEN 0.8, X-PEN, or CMS-P1-PLOTTER (Marking)	ZBF 10/5,8 AXL UNPRINTED	0829580	50
Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1. Mounting type: snapped into marker carrier, Lettering field: 35 x 18.7 mm (Marking)	EMT (35X18,7)R	0801831	1
Connecting cable, for connecting the controller to a PC for PC Worx and LOGIC+, USB A to micro USB B, 2 m in length. (Cable/conductor)	CAB-USB A/MICRO USB B/2,0M	2701626	1
<b>Documentation</b>			
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-
User manual, English, Sercos system manual for I/O devices	UM EN SERCOS SYS	-	-
Application note, English, Updating the firmware of an Axioline F bus coupler	AH EN TFTP FIRMWARE UPDATE AXL F BK	-	-

## 4 Technical data

### Dimensions (nominal sizes in mm)



Width	45 mm
Height	125.9 mm
Depth	74 mm
Note on dimensions	The depth is valid when a TH 35-7.5 DIN rail is used (according to EN 60715).

### General data

Color	traffic grey A RAL 7042
Weight	177 g (with connector and bus base module)
Ambient temperature (operation)	-25 °C ... 60 °C (Mounting position: wall mounting on horizontal DIN rail) -25 °C ... 55 °C (Mounting position: any)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Mounting position	Any (observe temperature derating)

### Connection data

Designation	Axioline F connector
Connection method	Push-in connection
Conductor cross section solid / stranded	0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> / 0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm



Please observe the information provided on conductor cross sections in the "Axioline F: system and installation" user manual.

### Interface Sercos

Number	2
Connection method	RJ45 socket, auto negotiation and auto crossing
Transmission speed	100 MBit/s (Full duplex)
Cycle Time	31.25 $\mu$ s
Transmission physics	Ethernet in RJ45 twisted pair
Transmission length	max. 100 m

### Interface Axioline F local bus

Connection method	Bus base module
Transmission speed	100 MBit/s

### Interface Service

Number	1
Connection method	Micro USB type B

### System limits

Number of supported devices	max. 63 (per station)
-----------------------------	-----------------------



**NOTE: Electronics may be damaged when overloaded**

Observe the logic current consumption of each device when configuring an Axioline F station. It is specified in every module-specific data sheet. The current consumption can differ depending on the individual module. The permissible number of devices that can be connected therefore depends on the specific station structure.

### Sercos

Equipment type	Sercos slave
Device profile	FSP_IO
Update rate	31.25 $\mu$ s
Sercos protocols	Sercos
Specification	Sercos specification 1.31

### Supply of the bus coupler

Supply of communications power $U_L$	24 V DC
Maximum permissible voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current supply at $U_{Bus}$	2 A
Current consumption from $U_L$	typ. 105 mA (without I/Os and $U_L = 24$ V) max. 570 mA (with 2 A at $U_{Bus}$ for the I/Os and $U_L = 24$ V)
Power consumption at $U_L$	typ. 2.5 W (without I/Os) max. 13.7 W (with 2 A load at $U_{Bus}$ for the I/Os)



**NOTE: Electronics may be damaged when overloaded**

Provide external fuses for the 24 V  $U_L$  area. The power supply unit must be able to supply four times the nominal current of the external fuse to ensure that it blows in the event of an error.

### Error messages to the higher level control or computer system

None

### Mechanical tests

Vibration resistance in acc. with EN 60068-2-6/IEC 60068-2-6	5g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock according to EN 60068-2-27/IEC 60068-2-27	10g

**Conformance with EMC Directive 2004/108/EC**

**Noise immunity test in accordance with EN 61000-6-2**

Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2

Criterion B; 6 kV contact discharge, 8 kV air discharge

Electromagnetic fields EN 61000-4-3/IEC 61000-4-3

Criterion A; Field intensity: 10 V/m

Fast transients (burst) EN 61000-4-4/IEC 61000-4-4

Criterion B, 2 kV

Transient surge voltage (surge) EN 61000-4-5/IEC 61000-4-5

Criterion B; DC supply lines:  $\pm 0.5$  kV/ $\pm 0.5$  kV (symmetrical/asymmetrical); field-bus cable shield:  $\pm 1$  kV

Conducted interference EN 61000-4-6/IEC 61000-4-6

Criterion A; Test voltage 10 V

**Noise emission test according to EN 61000-6-3**

Radio interference properties EN 55022

Class B

**Approvals**

For the latest approvals, please visit [phoenixcontact.net/products](http://phoenixcontact.net/products).

**5 Internal circuit diagram**

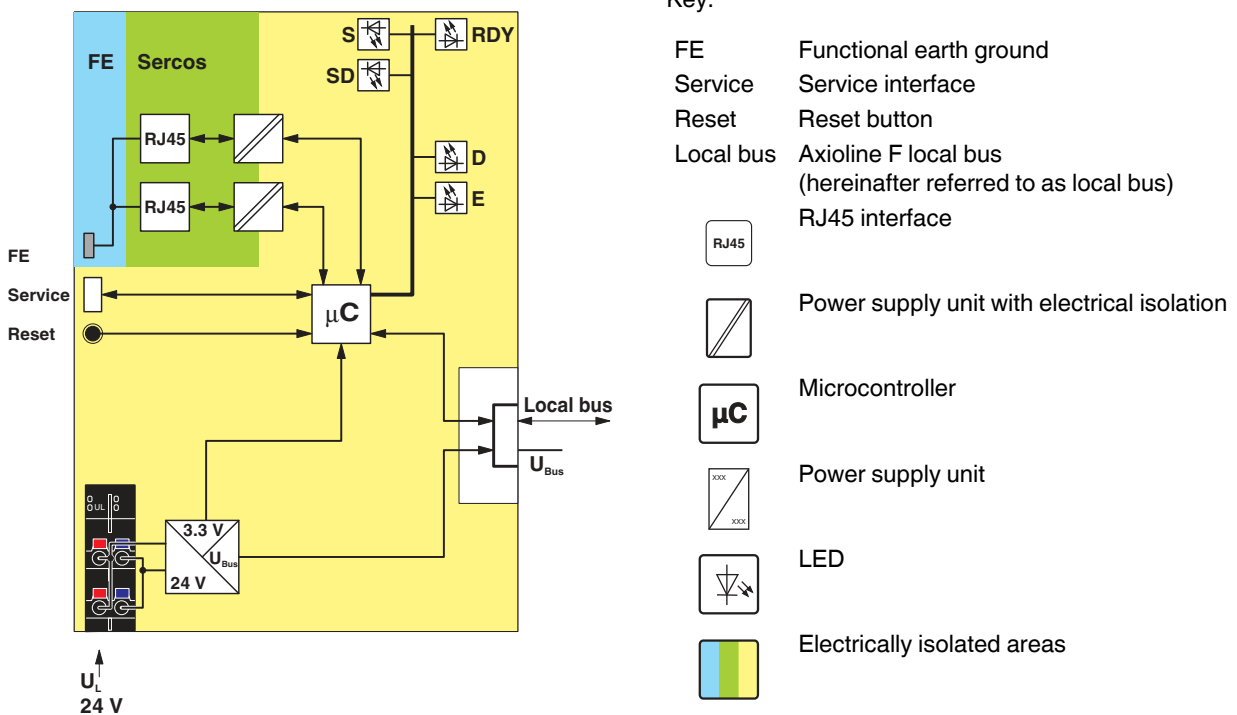


Figure 1 Internal wiring of the terminal points

## 6 Connection of Sercos and supply

### 6.1 Connecting Sercos

Connecting Sercos to the bus coupler via an 8-pos. RJ45 connector.

The Sercos connections are set to autocrossing (auto crossover).



Install Sercos in accordance with the specifications in the current "Planning and Installation Guide" (see [www.sercos.com](http://www.sercos.com)). Also observe the information in the "Sercos system manual for I/O devices" user manual.



**Shielding**  
The shielding ground of the connected twisted pair cables is electrically connected with the socket. When connecting network segments, avoid ground loops, potential transfers, and voltage equalization currents via the braided shield.



**Observe bending radii**  
The housing dimensions specified under "Dimensions" refer to the bus coupler with I/O connectors without Ethernet connection. When installing the bus coupler in a control box, observe the bending radii of the cables and the connectors used. If required, use angled RJ45 connectors to maintain these bending radii.

### 6.2 Connecting the supply voltage - terminal point assignment

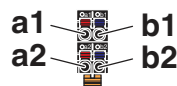


Figure 2 Terminal point assignment

Terminal point	Color	Assignment
<b>Supply voltage input</b>		
a1, a2	Red	24 V DC (U <sub>L</sub> ) Supply of the logic voltage (internally jumpered)
b1, b2	Blue	GND Reference potential of the supply voltage (internally jumpered)

## 7 Connection example

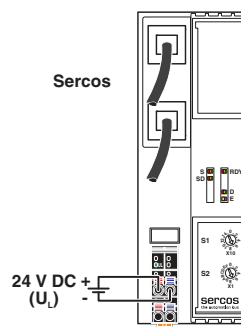


Figure 3 Connection of the cables

## 8 Configuration via rotary encoding switch

You can configure the address assignment and other functions using rotary encoding switches.

After modifying the switch position, restart the bus coupler, as the modification to the switch position does not take effect during operation.

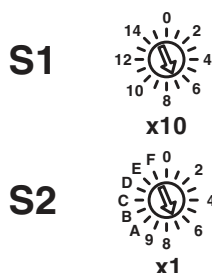


Figure 4 Rotary encoding switch

The code results from the sum of S1 x 10 plus S2 x 1. The image shows code 77 (7 x 10 + 7).

S1	S2	Code	Function
0	0	00	Remote address assignment
0 ... 15	0 ... 9	01 ... 159	Manual address assignment
12	C	12C	Resetting to the default settings
Other			Reserved

### 8.1 Remote address assignment

#### Switch position 00

The standard Sercos remote access is activated with this switch position, so that the bus coupler accepts an address assignment e.g., via the engineering system.

### 8.2 Manual address assignment

#### Switch position 01 ... 159

The devices are automatically assigned addresses as standard.

Set the Sercos address manually with this switch position. Remote address assignment, e.g., via an engineering tool, is deactivated.

### 8.3 Resetting to the default settings

#### Switch position 12C

All settings are reset to the delivery state.



The device is ready for operation after powering up, as soon as the RDY LED lights up green.  
A connection to the device however cannot be established in this switch position.  
As soon as the RDY LED lights up green, a new switch position can be selected on the rotary encoding switch and the device can be restarted.



Alternatively, the default setting can also be restored via the reset button (see "Reset button").

### 8.4 Reserved/invalid switch position

The device starts with the previous settings, e.g., with the settings that were valid before the device was restarted.



## 9 Local status and diagnostic indicators

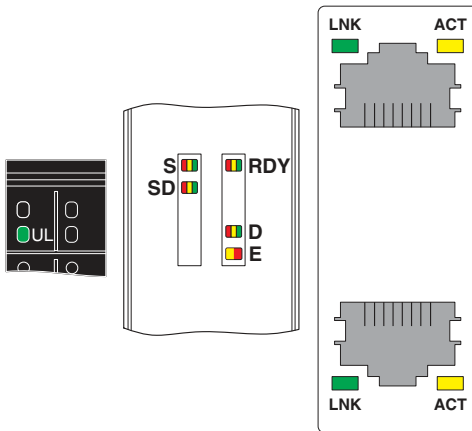


Figure 5 Local status and diagnostic indicators

Designation	Color	Meaning	State	Description
UL	Green	U <sub>Logic</sub>	ON	Communications power supply present.
			OFF	Communications power supply not present.
S	Red/orange/green	Sercos	OFF	NRT mode; no Sercos communication
			Orange ON	CP0
			Flashing orange/green	CP1: 250 ms green, 2750 ms orange
			Flashing orange/green	CP2: 250 ms green, 250 ms orange, 250 ms green, 2250 ms orange
			Flashing orange/green	CP3: 250 ms green, 250 ms orange, 250 ms green, 250 ms orange, 250 ms green, 1750 ms orange
			Green ON	CP4
			Green flashing	Loop back activated
			Flashing red/orange	User error; see chapter on "Diagnostics: bus and user errors"
			Flashing red/green	MST loss
			Red ON	Communication error
			Flashing orange (2 Hz)	Identification (bit 15 in device control); is used for address assignment and configuration errors.
			Flashing red (2 Hz)	Watchdog error

Designation	Color	Meaning	State	Description
SD	Red/orange/green	Sub Device	Green ON	Sub device is on the operation level (OL)
			Orange ON	Sub device is on the parameterization level (PL)
			Red ON	Error in the sub device (C1D)
			OFF	Sub device is not active.
RDY	Green/yellow/red	Ready	Green ON	Device is ready for operation.
			Flashing green/yellow	Communications power undervoltage or surge voltage Overtemperature
			Yellow ON	Firmware/bus coupler is booting
			Yellow flashing	Firmware update is being performed.
			Flashing yellow/red	Firmware update has failed.
			Flashing red	Faulty firmware
			Red ON	Rotary encoding switches are set to an invalid/reserved position.
			OFF	Device is not ready for operation.
D	Red/yellow/green	Diagnostics of local bus communication		
		Run	Green ON	The station is ready for operation, communication within the station is OK. All data is valid. There are no faults.
		Active	Green flashing	The station is ready for operation, communication within the station is OK. The data is <b>not</b> valid. Valid data from the controller/higher-level network not available. There is no fault in the module.
		Ready	Yellow ON	The station is ready for operation, no data exchange taking place.
			Yellow flashing	Access from Startup+ in I/O check mode
			Flashing yellow/red	Local bus error during active I/O check
			Flashing red	Local bus error on startup
				Possible causes:
				Configuration cannot be generated, information is missing from a device
				Chip version of a device is <V1.1
				The desired and actual configuration are different
		No local bus device connected		
		The maximum number of local bus devices is exceeded.		
		Red ON	The station is ready for operation but has lost connection to at least one device.	
			Possible causes:	
			Communication error	
Local bus device has been removed or configured device is missing.				
Reset at a local bus device				
Serious device error at a local bus device (local bus device can no longer be reached)				
Power down	OFF	Device in (power) reset.		

Designation	Color	Meaning	State	Description
E	Yellow/ red	Error	Yellow ON	I/O warning at a local bus device
			Red ON	I/O error at a local bus device
			OFF	No I/O messages present.
LNK 1/2	Green	Link port 1/2	ON	Connection via Ethernet to a module via port 1/2 established
			OFF	No connection established via port 1/2
ACT 1/2	Yellow	Activity port 1/ 2	Flashing	Transmission or reception of Ethernet telegrams at port 1/2
			OFF	No transmission or reception of Ethernet telegrams at port 1/2

## 10 Sercos

### 10.1 Realtime connections

The module supports a maximum of eight realtime data connections (S-0-1050.0.x to S-1050.7.x), with a maximum of four consumer and four producer connections.

### 10.2 Sercos profile, classes and function groups

The following Sercos profile, classes and function groups are implemented in the module:

#### Sercos device model (GDP: Generic Device Profile)

- Basis device model (GDP\_Basic)
  - Diagnostics (FG\_Diagnosis)
  - Administration (FG\_Administration)
  - Device identification (FG\_Identification)
- Identification (GDP\_Id)
- Function/Hardware/Firmware/Firmware loader version (GDP\_Rev)
- Password (GDP\_PWD)
- State machine (GDP\_StM)
  - State machine (FG\_StateMachine)
- Diagnosis trace (GDP\_DiagT)
- Diagnosis trace advanced (GDP\_DiagTAdv)
- Energy status (GDP\_EnS)
  - Energy (FG\_Energy)
- Energy control basic (GDP\_EnCBasic)
  - Energy (FG\_Energy)

#### Sercos communication model (SCP: Sercos Communication Profiles)

- Variable configuration (SCP\_VarCfg, SCP\_VarCfg\_0x02, SCP\_VarCfg\_0x03)
  - Identification of SCP classes (FG SCP Identification)
  - Control of communication phases (FG Control)
  - Telegram structure (FG Telegram Setup)
  - Parameters for producer-consumer connection (FG Connection)
  - Bus diagnostics (FG Bus-Diagnostics)
  - Parameters for the non-realtime channel (FG NRT)
  - Timing behavior of the communication (FG Timing)
- Synchronous and isochronous producer and consumer data (SCP\_Sync, SCP\_Sync\_0x02)
- Diagnostics (SCP\_Diag)
  - Control of communication phases (FG Control)
  - Bus diagnostics (FG Bus-Diagnostics)
- Non-realtime channel (SCP\_NRTPC)
  - Parameters for the non-realtime channel (FG NRT)
- Consumer connection monitoring; Watchdog (SCP\_WDCon)
  - Parameters for the producer-consumer connection (FG Connection)
- Support for SCP\_SIP and SCP\_TFTP
- Cyclic communication (SCP\_Cyc)

#### Sercos function model (FSP: Function Specific Profile I/O)

- I/O function profile (FSP\_IO)

### 10.3 Electronic rating plate

The electronic rating plate comprises the IDNs S-0-1300.x.y. See the table in the “Sercos parameter” section.

### 10.4 Mapping of I/O modules in Sercos

The local bus devices are assigned to the I/O function groups and structure instances according to the Sercos I/O profile.

A structure instance (slot) can consist of an I/O function group or several I/O function groups (for example devices with inputs and outputs).

The first local bus device occupies slot 1 (structure instance 1), the second occupies slot 2 (structure instance 2), etc.

When assigning the inputs and outputs to the container input data (S-0-1500.0.9) or to the container output data (S-0-1500.0.5), the input and output process data is always mapped in byte limits in the container according to the Sercos I/O profile.

The number of bytes of the containers is always even.

The following function groups are defined:

Function group (FG_IO)	Name
S-0-1501	I/O function group unknown
S-0-1502	I/O function group digital output
S-0-1503	I/O function group digital input
S-0-1504	I/O function group analog output
S-0-1505	I/O function group analog input
S-0-1506	I/O function group counter
S-0-1507	I/O function group complex protocol
S-0-1508	I/O function group sub bus master
S-0-1509	I/O function group sub bus slave
S-0-1512	I/O function group PLC module
S-0-1513	I/O function group motor starter
S-0-1514	I/O function group PWM (pulse width modulation)
S-0-1515	I/O function group positioning
S-0-1516	I/O function group passive

The bus coupler supports the following IDNs as configurable data:

In a producer connection	In a consumer connection
S-0-1500.0.2	S-0-1500.0.1
S-0-1500.0.9	S-0-1500.0.5
FG_IO.x.9	FG_IO.x.5
FG_IO.x.13	FG_IO.x.11
S-0-0390	
This information is stored in the IDN.	
S-0-0187	S-0-0188

### 10.5 Synchronization mechanisms of the bus coupler

The bus coupler offers three synchronization mechanisms. These are standardized according to the Sercos specification and are configured by the Sercos master.

The modules, which support a synchronization method, are stored in IDN S-0-1050.x.13.

#### Asynchronous mode

The local bus, which is at a lower level to the bus coupler, runs asynchronously to the higher-level Sercos bus.

#### Clock-synchronous mode

The local bus, which is at a lower level to the bus coupler, runs synchronously to the higher-level Sercos bus.

The input and output data is read in or output at a time determined by the master.

In doing so, the runtimes of the Axioline F modules are taken into consideration.

#### Cyclic mode

The local bus, which is at a lower level to the bus coupler, runs synchronously to the higher-level Sercos bus.

The output data is output as quickly as possible and the input data is read in as late as possible.

In doing so, the runtimes of the Axioline F modules are taken into consideration.

## 10.6 Diagnostics: bus and user errors

Sercos diagnostic code (IDN S-0-0390.0.0) [hex]	Message	Meaning	Corrective
<b>Local bus error</b>			
C10F.B001	Local bus device is missing	Device not present	Install the device or check the contacts and replace a defective device, if necessary.
C10F.B002	Incorrect local bus device present	Wrong device	An incorrect device was detected at the specified location. Check the contacts, replace a defective device, if necessary or adapt the configuration.
C10E.B012	Local bus device peripheral or application error	Error in a local bus device	See corresponding data sheet.
<b>Device error</b>			<b>Read out via IDN 1500.0.32 to ascertain which device and possibly which channel is affected and check the contact, parameterization and function.</b>
C10F.B012	Application not ready	Application on device not ready	Check the specified channel of the device, the devices connected to the module, the parameters of the specified device as well as the connected sensors and actuators. Delay the start after power on or replace the device. See corresponding data sheet.
C10F.B013	Local bus device power on reset	Local bus devices causes a restart	The specified device executed a reset due to a fault or insufficient voltage supply. Check the power supply. Find the cause by checking the power supply to the devices and check whether they conform to the nominal value of the permissible AC component. Check the power supply unit of the bus coupler for overload (see corresponding data sheet).
<b>Transmission error</b>			<b>Check the system and replace devices, if necessary.</b>
C109.B022	Communication error	Multiple transmission error	Bus errors occurred. The system has transmission errors. Check the segment, shielding of the bus cables, grounding/equipotential bonding, connectors, communications power (for power drops), FO assembly, as well as the remote bus devices and whether the devices are aligned correctly.
C10F.B023	Data communication error	I/O communication error	Check the system, shielding of the bus cables, connectors, grounding/equipotential bonding, voltage supply of the periphery and the voltage supply of the inputs/outputs. Replace devices if necessary.
C10F.B024	Management communication error	Strong interference in local bus communication	Check the system, shielding of the bus cables, connectors, grounding/equipotential bonding, voltage supply of the periphery and the voltage supply of the inputs/outputs. Replace devices if necessary.
<b>Configuration errors</b>			
C10F.B030	Configuration error	Configuration errors	The configuration is invalid. Replace device or modify configuration.

Sercos diagnostic code (IDN S-0-0390.0.0) [hex]	Message	Meaning	Corrective
<b>General errors</b>			
C10F.B041	Hardware error	Hardware fault	Replace the device.
C10F.B042	Firmware error	Firmware error	Replace the device.
C10F.B043	Local bus is running asynchronously (in relation to the Sercos bus cycle)	Local bus is running asynchronously (in relation to the Sercos bus cycle)	Check the time parameters and adapt them, if necessary.
<b>Manufacturer-specific errors</b>			
400F.0A73	Not supported local bus slave at slot: x	Axioline F module at slot x is not supported; x = slot of the first non-supported module	At least one old, non-supported module is located in the Axioline F station. Replace the module for a module with a current hardware/firmware version.

### 10.7 Diagnose: periphery and channel error

Periphery and channel error can only occur once for each I/O module or channel.

In accordance with the Sercos specification, errors and messages are mapped in diagnostic IDNs S-0-0390, S-0-0095, S-1500.0.32, and S-1500.0.33.

The messages are also entered in IDNs S-0-1303.0.10, S-0-1303.0.11, and S-0-1303.0.12.

You can also read out module-specific diagnostics via IDN P-1-0024.x.0.

Access PDI object 0018<sub>hex</sub> (DiagState) with IDN P-1-0024.x.0 via the mapping method. See “Mapping method” section and module-specific data sheet.

### 10.8 Sercos address

You can configure the Sercos address assignment manually or remotely, see section “Configuration via rotary coding switch”.

The Sercos address is saved retentively.



For an automatic address assignment description, please refer to the documentation of your Sercos master.

### 10.9 Password (IDN/S-0-0267)

In the default setting some module parameters are write-protected with a password.

The default password is PW170875.

The following IDNs are password protected:

IDN	Description
P-0-2000.0.1	Update procedure command

## 11 Sercos parameter

The following table lists all Sercos parameters (S parameters) with important features that have been implemented into the bus coupler.

IDN	Name	Default values	Unit
S-0-0014	Interface status	-	-
S-0-0017	IDN list of all operation data	-	-
S-0-0021	IDN list of invalid operation data for CP2	-	-
S-0-0022	IDN list of invalid operation data for CP3	-	-
S-0-0025	IDN list of all procedure commands	-	-
S-0-0095	Diagnostic message	-	-
S-0-0099	Reset class 1 diagnostic (process command)	-	-
S-0-0127	CP3 transition check (process command)	-	-
S-0-0128	CP4 transition check (process command)	-	-
S-0-0187	IDN list of configurable data as producer	-	-
S-0-0188	IDN list of configurable data as consumer	-	-
S-0-0267	Password	PW170875	-
S-0-0279	IDN-list of password protected data	-	-
S-0-0390	Diagnostic number	-	-
S-0-0420	Activate parameterization level procedure command (PL)	-	-
S-0-0422	Exit parametrization level procedure command	-	-
S-0-0423	IDN-list of invalid data for parametrization level	-	-
S-0-0425	Sub-device state machine control	-	-
S-0-1000	SCP type & version	-	0201 <sub>hex</sub> , 0202 <sub>hex</sub> , 0203 <sub>hex</sub> , 0301 <sub>hex</sub> , 0302 <sub>hex</sub> , 0501 <sub>hex</sub> , 0801 <sub>hex</sub> , 1801 <sub>hex</sub> , 0E01 <sub>hex</sub> , 1601 <sub>hex</sub> , 1A01 <sub>hex</sub> , 1901 <sub>hex</sub>
S-0-1002	Communication cycle time ( $t_{Scyc}$ )	-	μs
S-0-1003	Allowed MST losses in CP3/CP4	10	-
S-0-1005	Minimum feedback processing time ( $t_5$ )	250 000	μs
S-0-1006	AT0 transmission starting time ( $t_1$ )	-	μs
S-0-1007	Feedback acquisition capture point ( $t_4$ )	-	μs
S-0-1008	Command value valid time ( $t_3$ )	-	μs
S-0-1009	Device control (C-Dev) offset in MDT	-	-
S-0-1010	Length of MDTs	-	-
S-0-1011	Device status (S-Dev) offset in AT	-	-
S-0-1012	Length of ATs	-	-
S-0-1013	SVC offset in MDT	-	-
S-0-1014	SVC offset in AT	-	-
S-0-1015	Ring delay	-	μs
S-0-1016	Slave delay	-	μs
S-0-1017	NRT transmission time	650 000 950 000	μs
S-0-1019	MAC address	00.A0.45.xx.xx.xx	-
S-0-1020	IP address	192.168.0.10	-
S-0-1020.0.1	Current IP address	192.168.0.10	-
S-0-1021	Subnet mask	255.255.255.0	-
S-0-1021.0.1	Current subnet mask	255.255.255.0	-
S-0-1022	Gateway address	192.168.0.1	-
S-0-1022.0.1	Current gateway address	192.168.0.1	-



IDN	Name	Default values	Unit
S-0-1023	SYNC jitter	1000	μs
S-0-1024	SYNC delay measuring procedure command (process command)	-	-
S-0-1026	Version of communication hardware	-	-
S-0-1027.0.1	Requested MTU	-	-
S-0-1027.0.2	Effective MTU	-	-
S-0-1028	Error counter MST-P/S	-	-
S-0-1031	Test pin assignment port 1 and port 2	-	-
S-0-1035	Error counter port1 and port2	-	-
S-0-1036	Inter frame gap	-	-
S-0-1037	Slave jitter	-	-
S-0-1040	Sercos address	1	-
S-0-1041	AT command value valid time (t9)	-	μs
S-0-1044	Device control	-	-
S-0-1045	Device status	-	-
S-0-1047	Maximum consumer activation time (t11)	-	μs
S-0-1048	Activate network settings	-	-
S-0-1050.x.1	Connection setup	-	-
S-0-1050.x.2	Connection number	-	-
S-0-1050.x.3	Telegram assignment	-	-
S-0-1050.x.4	Max. length of connection	-	-
S-0-1050.x.5	Current length of connection	-	-
S-0-1050.x.6	Configuration list	-	-
S-0-1050.x.8	Connection control	-	-
S-0-1050.x.9	Connection state	-	-
S-0-1050.x.10	Producer cycle time	-	μs
S-0-1050.x.11	Allowed data losses	-	-
S-0-1050.x.12	Error counter data losses	-	-
S-0-1050.x.13	Configuration list for sync	-	-
S-0-1051	Image of connection setups	-	-
S-0-1300.0.1	Component name	sercos bus coupler	-
S-0-1300.0.2	Vendor name	Phoenix Contact	-
S-0-1300.0.3	Vendor code	200	-
S-0-1300.0.4	Device name	AXL F BK S3	-
S-0-1300.0.5	Device ID	2701686	-
S-0-1300.0.6	Connected to subdevice	-	-
S-0-1300.0.7	Function revision	-	-
S-0-1300.0.8	Hardware revision	-	-
S-0-1300.0.9	Software revision	-	-
S-0-1300.0.10	Firmware loader revision	-	-
S-0-1300.0.11	Order number	2701686	-
S-0-1300.0.12	Serial number	xxxx...	-
S-0-1300.0.20	Operational hours	-	h
S-0-1300.0.134	FIBO version info	-	-
S-0-1300.x.1	Component name	xxxx...	-
S-0-1300.x.2	Vendor name	xxxx...	-
S-0-1300.x.3	Vendor code	xxx	-
S-0-1300.x.4	Device name	xxxx...	-
S-0-1300.x.5	Device ID	xxxx...	-
S-0-1300.x.7	Function revision	-	-
S-0-1300.x.8	Hardware revision	-	-

IDN	Name	Default values	Unit
S-0-1300.x.9	Software revision	-	-
S-0-1300.x.11	Order number	xxxx...	-
S-0-1300.x.12	Serial number	xxxx...	-
S-0-1301	List of GDP classes & version	0101 <sub>hex</sub>	-
S-0-1302.0.1	FSP type & version	00010001 <sub>hex</sub>	-
S-0-1302.0.2	Function groups	S-0-1500.0.0	-
S-0-1302.0.3	Application type	Modular IO station	-
S-0-1303.0.01	Diagnosis trace configuration	-	-
S-0-1303.0.02	Diagnosis trace control	-	-
S-0-1303.0.03	Diagnosis trace state	-	-
S-0-1303.0.10	Diagnosis trace buffer no1	-	-
S-0-1303.0.11	Diagnosis trace buffer no2	-	-
S-0-1303.0.12	Diagnosis trace buffer no3	-	-
S-0-1305.0.1	Sercos current time	-	-
S-0-1305.0.2	Sercos current fine time	-	-
S-0-1320	List of available energy modes	-	-
S-0-1321.0.6	Power consumption	-	-
S-0-1322	Procedure command change energy mode	-	-
S-0-1322.0.1	List of supported command types	-	-
S-0-1322.0.2	Command type selection for procedure command change energy mode	-	-
S-0-1322.0.3	Target energy mode for procedure command change energy mode	-	-
S-0-1323.0.1	Current energy mode	-	-
S-0-1500.0.1	IO control	-	-
S-0-1500.0.2	IO status	-	-
S-0-1500.0.3	List of module type codes	-	-
S-0-1500.0.5	Container output data	-	-
S-0-1500.0.9	Container input data	-	-
S-0-1500.0.19	Parameter channel receive	-	-
S-0-1500.0.20	Parameter channel transmit	-	-
S-0-1500.0.23	Local bus cycle time	-	µs
S-0-1500.0.32	IO diagnostic message	-	-
S-0-1500.0.33	Current IO diagnostic message	-	-
S-0-1500.0.128	Local bus error continue mode	-	-
S-0-1501	I/O function group unknown	-	-
S-0-1502	I/O function group digital output	-	-
S-0-1503	I/O function group digital input	-	-
S-0-1504	I/O function group analog output	-	-
S-0-1505	I/O function group analog input	-	-
S-0-1506	I/O function group counter	-	-
S-0-1507	I/O function group complex protocol	-	-
S-0-1508	I/O function group sub bus master	-	-
S-0-1509	I/O function group sub bus slave	-	-
S-0-1512	I/O function group PLC module	-	-
S-0-1513	I/O function group motor starter	-	-
S-0-1514	I/O function group PWM (pulse width modulation)	-	-
S-0-1515	I/O function group positioning	-	-
S-0-1516	I/O function group passive	-	-
P-1-x.y.z	Sercos SVC/PDI 1:1 mapping (x = PDI-Index, y = module slot, z = Subindex)	-	-
P-0-2000.0.1	Update command (process command)	-	-



You can find further information on Sercos in the UM DE SERCOS SYS user manual.

### **S-0-1050.x.1 (Connection setup)**

The following connection types (bit 0 and 1 of IDN S-0-1050.x.1) are supported:

- Producer cycle, synchronous operation (clock synchronous,  $00_{\text{bin}}$ )
- Asynchronous operation without watchdog (non-cyclic type 2,  $10_{\text{bin}}$ )

### **S-0-1500.0.128 (Local bus error continue mode)**

This IDN defines the behavior after a bus error.

- = 0: The data transfer is only started once the error has been removed and the S-0-0099 command has been executed.
- = 1: The data transfer is started automatically once the error has been removed.

## 12 Access to PDI objects

You can access PDI objects from the modules of a station via Sercos. You have two options here:

- Mapping method
  - Simple method
  - For PDI objects with the index 0001<sub>hex</sub> ... 1000<sub>hex</sub>
- Tunnel method
  - More complex method
  - For all PDI objects



For an overview of the PDI objects of a module, please refer to the module-specific data sheet.  
 You can find further information on Sercos in the UM DE SERCOS SYS user manual.

## 13 Mapping method

You can use the mapping method for PDI objects with the index 0001<sub>hex</sub> ... 1000<sub>hex</sub> (1<sub>dec</sub> ... 4096<sub>dec</sub>).

In the bus coupler, these PDI objects are mapped to the manufacturer-specific parameters P-1-x.y.z.

This means that you have read and/or write access to the PDI objects via the manufacturer-specific parameters P-1-x.y.z.

### P-1-x.y.z Sercos SVC/PDI 1:1 mapping

- x PDI index (decimal)  
P-1-0001.y.z ... P-1-4096.y.z
  - y Module slot  
Bus coupler: y = 0  
1st module after the bus coupler: y = 1  
:  
63rd module after the bus coupler: y = 63
  - z Subindex
- Example: P-1-0010.15.0

### 13.1 Description of parameter P-1-x.y.z

#### Function

You can use this parameter to access PDI objects with index 0001<sub>hex</sub> ... 1000<sub>hex</sub>.

#### Attributes

Length	Maximum number of elements is device-specific Current length variable
Format	Object-specific
Function	Parameter
Changeability	Yes
Executability	Communication phases CP2, CP3, CP4

After the IDN has been sent, the result is shown in the IDN.

### 13.2 Example: read PDI object

Read the order number of the first module after the bus coupler.

x	PDI index	000A <sub>hex</sub> = 0010 <sub>dec</sub>
y	Module slot; 1st module	1
z	PDI subindex	0

The parameter to be sent is P-1-0010.1.0.

The contents of the object are reported as the result in the IDN.

Byte	Contents (hex)	Meaning
0	32	Order No. 2688161
1	36	
2	38	
3	38	
4	31	
5	36	
6	31	
7	00	Zero-terminated

## 14 Tunnel method

### 14.1 Tunnel method

You can use the tunnel method for all PDI objects.

You tunnel the PDI object through the function groups of the FSP\_I/O, i.e. through IDNs S-0-1501 to S-0-1516.

**S-0-15xx.y.20 Parameter channel transmit**  
 Transferring data to the parameter channel via the service channel. The response is in S-0-15xx.y.19.

**S-0-15xx.y.19 Parameter channel receive**  
 Read the response via the service channel after transmitting IDN S-0-15xx.y.20.

y Module slot  
 1st module after the bus coupler: y = 1  
 :  
 63rd module after the bus coupler: y = 63



The parameters are described in the "Sercos system manual for I/O devices" user manual.

If a module is assigned to several function groups, the PDI objects can be read via each assigned function group.

### 14.2 Structure of IDN S-0-15xx.y.20

Byte	Meaning
0	Service command code (high byte)
1	Service command code (low byte)
2	Parameter count (high byte)
3	Parameter count (low byte)
4	Reserved
5	Reserved (slot)
6	Subslot
7	Reserved
8	PDI object index (high byte)
9	PDI object index (low byte)
10	PDI object subindex
11	Amount of data to be written in bytes
14 ... xxxx	Data to be written

### Command code

0041<sub>hex</sub> Read PDI object  
 0042<sub>hex</sub> Write PDI object

### Parameter count

Number of following parameters in words

### Reserved (slot)

It is not necessary to specify the slot number because it is taken from the IDN (y). If you enter a value that does not equal 00<sub>hex</sub> in byte 5, this value is overwritten internally by the slot number specified by y.

### Subslot

Specify a subslot if you wish to access a submodule (e.g., IO-Link). Not used at present (= 0).

### PDI object index

See module-specific data sheet.

### PDI object subindex

See module-specific data sheet.

See user manual, Sercos system manual for I/O devices.

### Amount of data to be written in bytes

For command 0041<sub>hex</sub>: 00<sub>hex</sub>  
 For command 0042<sub>hex</sub>: Amount of data to be written in bytes

### Data to be written

For command 0041<sub>hex</sub>: Not available  
 For command 0042<sub>hex</sub>: Data to be written

14.3 Structure of IDN S-0-15xx.y.19

Byte	Meaning
0	Service command code (high byte)
1	Service command code (low byte)
2	Parameter count (high byte)
3	Parameter count (low byte)
4	Reserved (copy)
5	Slot
6	Subslot (copy)
7	Reserved
8	PDI object index (high byte) (copy)
9	PDI object index (low byte) (copy)
10	PDI object subindex (copy)
11	Amount of data read in bytes
12	Error class
13	Error code
14 ... xxxx	Read data or additional code

Read data or additional code

**Positive response**

For command 0041<sub>hex</sub>: Read data  
 For command 0042<sub>hex</sub>: Not available

**Negative response**

Byte 14, 15 Additional error code

Should an error occur, the error message details the error class, error code, and additional code. Potential errors are listed in the following table.

**Command code**

8041<sub>hex</sub> Response to "Read PDI object"  
 8042<sub>hex</sub> Response to "Write PDI object"

**Parameter count**

Number of following parameters in words

**... (copy)**

Copy of request from IDN S-0-15xx.y.20

**Amount of data read in bytes**

For command 0041<sub>hex</sub>: Amount of data read in bytes  
 For command 0042<sub>hex</sub>: 00<sub>hex</sub>  
 For an error: 00<sub>hex</sub>

**Error class, error code**

= 0000<sub>hex</sub>: No error; positive response  
 ≠ 0000<sub>hex</sub>: An error has occurred; negative response

## Error messages

Error class (hex)	Error code (hex)	Additional code (hex)	Meaning
00	00	0000	No error
05	02	0031	Permissible length exceeded. Object cannot be read completely.
06	02	00A2	Hardware fault
	03	0000	Write and fetch not supported
06	05	0000	Inconsistent object attributes
		0011	Subindex is not supported
		0012	Code is not a request
		0013	A reserved bit has been used
		0014	Subslot not supported
		0015	Read/write service type is not supported
		0016	Index of request fetch service does not equal 0000 <sub>hex</sub>
		0017	Length for read or fetch service does not equal zero
		0018	Length does not correspond to the object length which has been read from the EEPROM
	0019	Read only object cannot be overwritten	
	07	0000	Object does not exist
08	01	0000	Error writing the object
		00A2	Error reading the object
0F	00	0000	Error cannot be assigned
	04	0000	Inconsistent parameters
	05	0000	Invalid parameters
	06	0000	Access not supported
	11	0000	Invalid device
	12	0000	Timeout
	21	0000	Invalid slot number
	22	0000	Slot is not active
	23	0000	Invalid data length
24	0000	Invalid parameter counter	

### 14.4 Example: read PDI object

Read the order number of the first module after the bus coupler.

#### Read request

In this example, the first module is a digital output module. Therefore, IDN S-0-1502.1.20 is used.

Byte	Contents (hex)	Meaning	
0	00	Code	Read PDI object
1	41		
2	00	Parameter count	4 words follow
3	04		
4	00	Reserved	
5	00		
6	00	Subslot	No subslot
7	00	Reserved	
8	00	PDI object index	000A: order number
9	0A		
10	00	Subindex	No subindex
11	00	Amount of data to be written in bytes	Read, therefore = 00



Ensure that a write request always contains an even number of bytes. Top up with an additional byte if necessary. If you transmit an uneven number of bytes, you will receive a negative response with a corresponding error message.

#### Response

The result is stored in IDN S-0-1502.1.19.



The response always contains an even byte count. A byte with 00<sub>hex</sub> is added if necessary in order to top up to an even byte number.

#### - Positive response

Byte	Contents (hex)	Meaning	
0	80	Code	Response to "Read PDI object"
1	41		
2	00	Parameter count	9 words follow
3	09		
4	00	Reserved	Copy
5	01	Slot	Slot (y from IDN)
6	00	Subslot	Copy
7	00	Reserved	Copy
8	00	PDI object index	Copy
9	0A		
10	00	PDI object subindex	Copy
11	08	Amount of data read in bytes	8 bytes of read data
12	00	Result	No error
13	00		
14	32 36	Read data	Order number (8 bytes, including zero termination) E.g., 2688161
...	38 38		
21	31 36		
	31 00		

#### - Negative response

Byte	Contents (hex)	Meaning	
0	80	Code	Response to "Read PDI object"
1	41		
2	00	Parameter count	6 words follow
3	06		
4	00	Reserved	Copy
5	01	Slot	Slot (y from IDN)
6	00	Subslot	Copy
7	00	Reserved	Copy
8	00	PDI object index	Copy
9	0A		
10	00	PDI object subindex	Copy
11	00	Amount of data read in bytes	No data read
12	xx	Error class	Error message
13	xx	Error code	
14	xx	Additional error code	
15	xx		



## 15 Reset button

The reset button is located beneath the top marking label on the bus coupler.

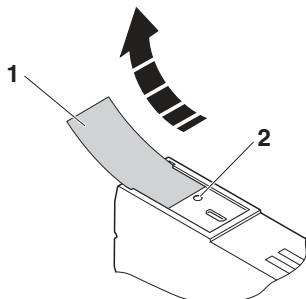


Figure 6 Reset button

- 1 Labeling field
- 2 Reset button

The reset button has two functions:

- Restarting the bus coupler
- Resetting of the default settings

### 15.1 Restarting the bus coupler

The bus coupler is restarted when the button is pressed during operation.

The outputs of the station are set to the parameterized substitute values.

The process image of the inputs is not re-read.

### 15.2 Restoring the default settings

The bus coupler is supplied with the following default settings:

Default values (default settings)		
S-0-1019	00-A0-45-xx-xx-xx	MAC address
S-0-1020	192.168.0.10	IP address
S-0-1021	255.255.255.0	Subnet mask
S-0-1022	192.168.0.1	Gateway address
S-0-1040	1	Sercos address
S-0-0267	PW170875	Password
S-0-1302.0.3	Modular IO station	Application type

Holding down the button during the initialization phase restores the default settings.

If you wish to restore the default settings, proceed as follows:

- Disconnect the power to the module.
- Press and hold the reset button.
- Switch on the power.

The LEDs indicate the initialization phase:

LED	State	Meaning
RDY	OFF	Starting firmware
RDY	Flashing	Initializing firmware
RDY	Green	Initialization complete

- When the RDY LED lights up green, release the button.

The default settings are restored.

## 16 Service interface

The service interface is located beneath the top marking field on the bus coupler.

The service interface is used for later applications.

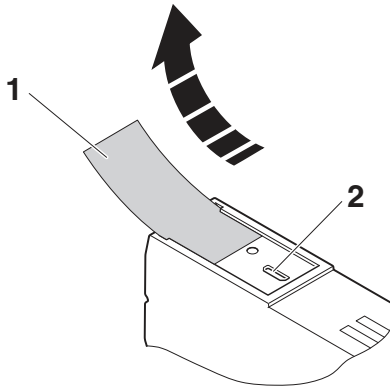


Figure 7 Service interface

- 1 Labeling field
- 2 Service interface

## 17 Startup

### 17.1 Starting the firmware

The firmware is started after you have supplied power to the bus coupler.

The bus coupler is ready for operation when the RDY LED lights up permanently green.

### 17.2 Basic configuration

The bus coupler executes the basic communication after switching on the bus coupler or after resetting with the reset button and the first entry into the CP2 communication phase.

These means:

- The corresponding I/O function groups and the structure elements are generated for all devices detected on the local bus.
- Channel number and width correspond to the detected data widths of the devices.
- The input/ output process data of all I/O function groups are configured via IO\_FG.x.2 for mapping in S-0-1500.0.5 (container output data) or S-0-1500.0.9 (container input data).
- The content and lengths of the input/output process data on the local bus are mapped to Sercos according to the Sercos profile.
- Local bus devices are not parameterized. The devices can be parameterized in CP2 or CP3.

By switching over the communication phases to CP3 and subsequently CP4, the Sercos master now has the possibility to accept this configuration for realtime operation unchanged or to make changes and to activate them before switching to CP3 via process command S-0-1500.0.12 (Rearrangement of IO resource).

### 17.3 Sending BootP requests

On startup, the bus coupler sends three BootP requests.

If it receives a BootP response, the new IP parameters (IP address, subnetwork mask) are saved.

If the bus coupler does not receive a response, it starts with the previous configuration.

A BootP server must be available to respond to a BootP request.

## 17.4 Modifying IP parameters

The following IDNs for IP parameters are implemented on the bus coupler:

IP parameters		Current IP parameters		Default setting
S-0-1020	IP address	S-0-1020.0.1	Current IP address	192.168.0.10
S-0-1021	Subnet mask	S-0-1021.0.1	Current subnet mask	255.255.255.0
S-0-1022	Gateway address	S-0-1022.0.1	Current gateway address	192.168.0.1

The default settings of the relevant IDNs are identical.

The bus coupler functions with the IP parameters stored in IDNs S-0-1020.0.1, S-0-1021.0.1, and S-0-1022.0.1

If you wish to modify one or more IP parameters, proceed as follows:

- Adjust the IP parameters in IDNs S-0-1020, S-0-1021, and S-0-1022.
- Execute procedure command S-0-1048 (Activate network settings).

In doing so, at the same time, all modified IP parameters are applied as current IP parameters and the bus coupler now functions with the modified settings.

## 18 Firmware update



**NOTE: Potential damage to the device**  
 If the bus coupler is disconnected from the supply voltage during the firmware update, the bus coupler may be destroyed.

- Never disconnect the bus coupler from the supply voltage during the firmware update.



If you are using Windows 7 or Windows 8: Make sure that the "TFTP Client" check box is activated in the control panel under "Activate or deactivate Windows functions".

### 18.1 Firmware update according to Sercos specification

The firmware update is carried out in accordance with the procedure described in the Sercos specification. This means that a TFTP server is implemented on the bus coupler, which can receive files from any TFTP client. The file for the update is saved by the bus coupler in the file system, verified, and, if found to be valid, transferred to the program code area of the memory during the boot phase following a reset (power down). This process can take a few minutes.

#### Update requirements

- In the following, the term "PC" will be used as a general term for a PC and notebook, or similar.
- To make sure that no settings are lost during updating, take suitable measures to back up the device settings.
- In order to establish a connection to the bus coupler, it may be necessary to deactivate the firewall of your PC.
- Current firmware update file is available from the download area of the bus coupler at [phoenixcontact.net/products](http://phoenixcontact.net/products).

#### Transfer file for firmware update to the bus coupler (using Windows XP)

- Save the current firmware update file to your PC.
- Rename the file c2701686.fw.
- Connect the bus coupler to the the LAN card of your PC via an Ethernet cable.
- Switch on the power supply to the bus coupler.
- Make sure that the IP address of your PC is in the same ip address space as the bus coupler, which you wish to update.
- Run the command console of your PC.

- Enter the following command line:

```
tftp -i <ip address> PUT <file name>
ip address  IP address of the bus coupler
file name   Name of the update file
Example:    tftp -i 192.168.0.2 PUT c2701686.fw
```



The update file is transmitted as quickly as possible to the NRT to CP2 modes.  
 The transmission is complete as soon as the next command line appears in the command console of your PC.

- Once the firmware file has been successfully transferred, restart the bus coupler by resetting the voltage or execute IDN/P-0-2000.0.1.

#### Firmware update

After the bus coupler restart, the firmware update is performed automatically.

The firmware update is automatically completed with a bus coupler restart.

The status LEDs signal the current status of the firmware update.

#### LED states during firmware update

RDY LED	Meaning
Flashing yellow/red	Incorrect update file downloaded to bus coupler.
Yellow flashing	Firmware update is being performed.
Green ON	Device is ready for operation.