YASKAWA

System SLIO

IM | 053-1IP01 | Manual

HB300 | IM | 053-1IP01 | en | 25-10

Interface module EtherNet/IP - IM 053IP

YASKAWA Europe GmbH
Philipp-Reis-Str. 6
65795 Hattersheim
Germany
Tel.: +49 6196 569-300
Fax: +49 6196 569-398
Email: info@yaskawa.eu
Internet: www.yaskawa.eu.com

053-1IP01_000_IM 053IP,6,EN -

Table of contents

1 General. 5
1.1 About this manual. 5
1.2 Copyright © YASKAWA Europe GmbH. 6
1.3 Safety instructions. 7
2 Basics and mounting. 10
2.1 Safety notes for the user. 10
2.2 System conception. 11
2.2.1 Overview. 11
2.2.2 Components. 12
2.2.3 Accessories. 15
2.2.4 Hardware revision. 17
2.3 Dimensions. 17
2.4 Grounding concept. 20
2.4.1 Shielding. 20
2.5 Mounting bus coupler. 22
2.6 Wiring. 24
2.6.1 Wiring bus coupler. 25
2.6.2 Wiring 8x periphery modules. 27
2.6.3 Wiring 16x periphery modules. 28
2.6.4 Wiring power modules. 29
2.7 Demounting. 33
2.7.1 Demounting bus coupler. 33
2.7.2 Demounting 8x periphery modules. 34
2.7.3 Demounting 16x periphery modules. 37
2.8 Trouble shooting - LEDs. 40
2.9 Industrial security and installation guidelines. 41
2.9.1 Industrial security in information technology. 41
2.9.2 Installation guidelines. 43
2.10 General data for the System SLIO. 45
2.10.1 Use in difficult operating conditions. 47
3 Hardware description. 48
3.1 Designations. 48
3.2 Properties. 48
3.3 Structure. 49
3.3.1 Interfaces. 49
3.3.2 Address switch. 50
3.3.3 LEDs. 51
3.4 Technical data. 52

4 Deployment. 54
4.1 Basics EtherNet/IP. 54
4.2 Basics - IP address and subnet. 57
4.3 General notes. 58
4.4 Setting the IP address. 59
4.4.1 Setting the IP address via address switch. 59
4.4.2 Setting the IP address via web page. 60
4.4.3 Setting the IP address via standard object class. 61
4.5 Parameters. 62
4.6 Operating modes. 65
4.7 Web server. 67
4.8 Easy Maintenance. 72
4.9 Free Module Mapping (FMM). 72
4.9.1 Overview. 72
4.9.2 Examples. 74
4.10 Accessing the System SLIO. 78
4.10.1 Overview. 78
4.10.2 Accessing I/O area. 79
4.10.3 Accessing the parameter data. 82
4.11 Diagnostic data. 83
4.12 Firmware update. 88
4.13 Replacement EtherNet/IP 053-1IP00 by 053-1IP01. 88
4.14 Deployment of FORWARD_OPEN. 89
4.14.1 FORWARD_OPEN Commands. 90
4.14.2 Example. 93
4.14.3 Product specific error codes. 94
4.15 EtherNet/IP - Objects. 95
4.15.1 Standardized EtherNet/IP objects. 95
4.15.2 Product specific EtherNet/IP objects. 96
4.15.3 Assembly instances. 101
4.16 Examples. 104
4.16.1 Configuration at a Yaskawa MWIEC scanner. 104
4.16.2 Configuration at a Rockwell scanner. 110

1 General

1.1 About this manual

Objective and contents

This manual describes the IM 053IP of the System SLIO.

- It describes the structure, configuration and application.
- The manual is targeted at users with good basic knowledge in automation technology.
- The manual does not replace sufficient basic knowledge of automation technology or sufficient familiarity with the specific product.
- The manual consists of chapters. Each chapter describes a completed topic.
- For guidance, the manual provides:
  - An overall table of contents at the beginning of the manual
  - References with pages numbers

Validity of the documentation

Product	Order no.	as of version:	
IM 053IP	053-1IP01	HW: 01	FW: V01.212

Documentation

In the context of the use of the pertinent Yaskawa product, the manual is to be made accessible to the pertinent qualified personnel in:

- Project engineering
- Installation department
- Commissioning
- Operation

Icons and headings

Important passages in the text are highlighted by following icons and headings:

DANGER

- Immediate danger to life and limb of personnel and others.
- Non-compliance will cause death or serious injury.

CAUTION

- Hazardous situation to life and limb of personnel and others. Non-compliance may cause slight injuries.
- This symbol is also used as warning of damages to property.

NOTICE

- Designates a possibly harmful situation.
- Non-compliance can damage the product or something in its environment.

Supplementary information and useful tips.

1.2 Copyright © YASKAWA Europe GmbH

Download Center

By entering the product order number in the *'Download Center'* at www.yaskawa.eu.com, the pertinent manuals, data sheets, declarations of conformity, certificates and other helpful information for your product can be found.

General terms of use

Every effort was made by Yaskawa to ensure that the information contained in this document was complete and correct at the time of publication. Nevertheless, the information contained therein is only owed by Yaskawa as it is available at Yaskawa. Correctness is not assured by Yaskawa, the right to change the information contained herein is always reserved by Yaskawa. There is no obligation to inform the customer of any changes. The customer is requested to actively keep this documentation up to date. The use of the products covered by these instructions, together with the associated documentation, is always at the customer's own risk, in accordance with the applicable guidelines and standards. This documentation describes the hardware and software components and functions of the product. It is possible that units are described which the customer does not have. The exact scope of delivery is described in the respective purchase contract.

Document support

Contact your local representative of YASKAWA Europe GmbH if you have errors or questions regarding the content of this document. You can reach YASKAWA Europe GmbH via the following contact:

Email: Documentation.HER@yaskawa.eu

Technical support

Contact your local representative of YASKAWA Europe GmbH if you encounter problems or have questions regarding the product. If such a location is not available, you can reach the Yaskawa customer service via the following contact:

YASKAWA Europe GmbH,
European Headquarters, Philipp-Reis-Str. 6, 65795 Hattersheim, Germany
Tel.: +49 6196 569 500 (hotline)
Email: support@yaskawa.eu

1.3 Safety instructions

General safety instructions

DANGER

Danger to life due to non-compliance with safety instructions

Non-compliance with the safety instructions in the manual can result in serious injury or death. The manufacturer is not responsible for any injuries or damage to the equipment.

CAUTION

Before commissioning and operating the components described in this manual, it is essential to note the following:

- Modifications to the automation system must only be done in a voltage-free state!
- Connection and modification only by trained electricians
- National regulations and guidelines in the respective country of use must be observed and complied with (installation, protective measures, EMC, etc.)

Intended use

- It is the customer's responsibility to comply with all pertinent standards, codes, or regulations applicable to the use of the product, including those that apply when the Yaskawa product is used in combination with other products.
- The customer must confirm that the Yaskawa product is suitable for the customer's plant, machinery and equipment.
- If the Yaskawa product is used in a manner not specified by this manual, the protection provided by the Yaskawa product may be impaired and the use may result in material or immaterial damage.
- Contact Yaskawa to determine whether use is permitted in the following applications. If the use in the respective application is permissible, the Yaskawa product is to be used by considering additional risk assessments and specifications, and safety measures are to be provided to minimise the dangers in the event of a fault. Special caution is required and protective measures must be taken in the case of:
  - Outdoor use, use with possible chemical contamination or electrical interference, or use under conditions or in environments which are not described in product catalogs or manuals
  - Nuclear control systems, combustion systems, railway systems, aviation systems, automotive systems, medical devices, amusement machines and equipment that is specifically regulated by industry or government
  - Systems, machines and devices that can pose a risk to life or property
  - Systems that require a high degree of reliability, such as gas, water or electricity supply systems or systems that operate 24 hours a day
  - Other systems that require a similarly high level of security
- Never use the Yaskawa product in an application where failure of the product could cause serious danger to life, limb, health or property without first ensuring that the system is designed to provide the required level of safety with risk warnings and redundancy to avoid the realisation of such dangers and that the Yaskawa product is properly designed and installed.
- The connection examples and other application examples described in the product catalogs and manuals of Yaskawa are for reference purposes. Check the functionality and safety of the devices and systems actually to be used before using the Yaskawa product.
- To avoid accidental harm to third parties, read and understand all prohibitions on use and precautions, and operate the Yaskawa product correctly.

Field of application

- The Yaskawa product is not suited for use in life-support machines or systems.
- Please contact your Yaskawa representative or Yaskawa distributor if considering the use of the Yaskawa product for special purposes, such as machines or systems used in passenger cars, in medical, aircraft and aerospace applications, for power supply of networks, for electrical power distribution or for underwater applications.

DANGER

The device is not permitted for use

– in explosive environments (EX zone)

The system is designed and manufactured for proper use and use in accordance with the user manual and is designed for:

- Communication and process control
- general control and automation tasks
- for industrial use
- operation within the environmental conditions specified in the technical data
- installation in a cabinet

DANGER

If this Yaskawa product is used in applications where failure of the device can result in the loss of human life, a serious accident or physical injury, you must install appropriate safety devices.

– Death or serious injury can result if you do not install the safety devices properly.

Disclaimer

(1) The contractual and legal liability of Yaskawa and the legal representatives and vicarious agents of Yaskawa for compensation and reimbursement of expenses in relation to the content of this documentation is excluded or limited as follows:

a) For slightly negligent breaches of *Essential Contractual Duties* arising from the contractual obligation, for Yaskawa the amount of liability is limited to the foreseeable damage typical for the contract. *'Essential Contractual Duties'* are those duties that characterise the performance of the contract and on which the Yaskawa customer may reasonably rely.

(b) In each case, Yaskawa is not liable for (i) the slightly negligent breach of duties arising from the duties that are not *Essential Contractual Duties*, as well as (ii) force majeure, i.e. external events that have no operational connection and cannot be averted even by exercising the utmost care that can reasonably be expected.

(2) The aforementioned limitation of liability does not apply (i) in cases of mandatory statutory liability (in particular under the product liability law), (ii) if and to the extent that Yaskawa has assumed a guarantee or same as guaranteed procurement risk according to § 276 BGB, (iii) for culpably caused injuries to life, limb and/or health, also by representatives or vicarious agents, as well as (iv) in case of delay in the event of a fixed completion date.

(3) A reversal of the burden of proof is not associated with the provisions above.

Disposal

National rules and regulations apply to the disposal of the unit!

2 Basics and mounting

2.1 Safety notes for the user

DANGER

Protection against dangerous voltages

- When using System SLIO modules, the user must be protected from touching hazardous voltage.
- You must therefore create an insulation concept for your system that includes safe separation of the potential areas of extra-low voltage (ELV) and hazardous voltage.
- Here, observe the insulation voltages between the potential areas specified for the System SLIO modules and take suitable measures, such as using PELV/SELV power supplies for System SLIO modules.

Handling of electrostatic sensitive modules

The modules are equipped with highly integrated components in MOS technology. These components are highly sensitive to over-voltages that occur, e.g. with electrostatic discharge. The following symbol is used to identify these hazardous modules:

The symbol is located on modules, module racks or on packaging and thus indicates electrostatic sensitive modules. Electrostatic sensitive modules can be destroyed by energies and voltages that are far below the limits of human perception. If a person who is not electrically discharged handles electrostatic sensitive modules, voltages can occur and damage components and thus impair the functionality of the modules or render the modules unusable. Modules damaged in this way are in most cases not immediately recognized as faulty. The error can only appear after a long period of operation. Components damaged by static discharge can show temporary faults when exposed to temperature changes, vibrations or load changes. Only the consistent use of protective devices and responsible observance of the handling rules can effectively prevent malfunctions and failures on electrostatic sensitive modules.

Shipping of modules

Please always use the original packaging for shipping.

Measurement and modification of electrostatic sensitive modules

For measurements on electrostatic sensitive modules the following must be observed:

- Floating measuring instruments must be discharged before use.
- Measuring instruments used must be grounded.

When modifying electrostatic sensitive modules, ensure that a grounded soldering iron is used.

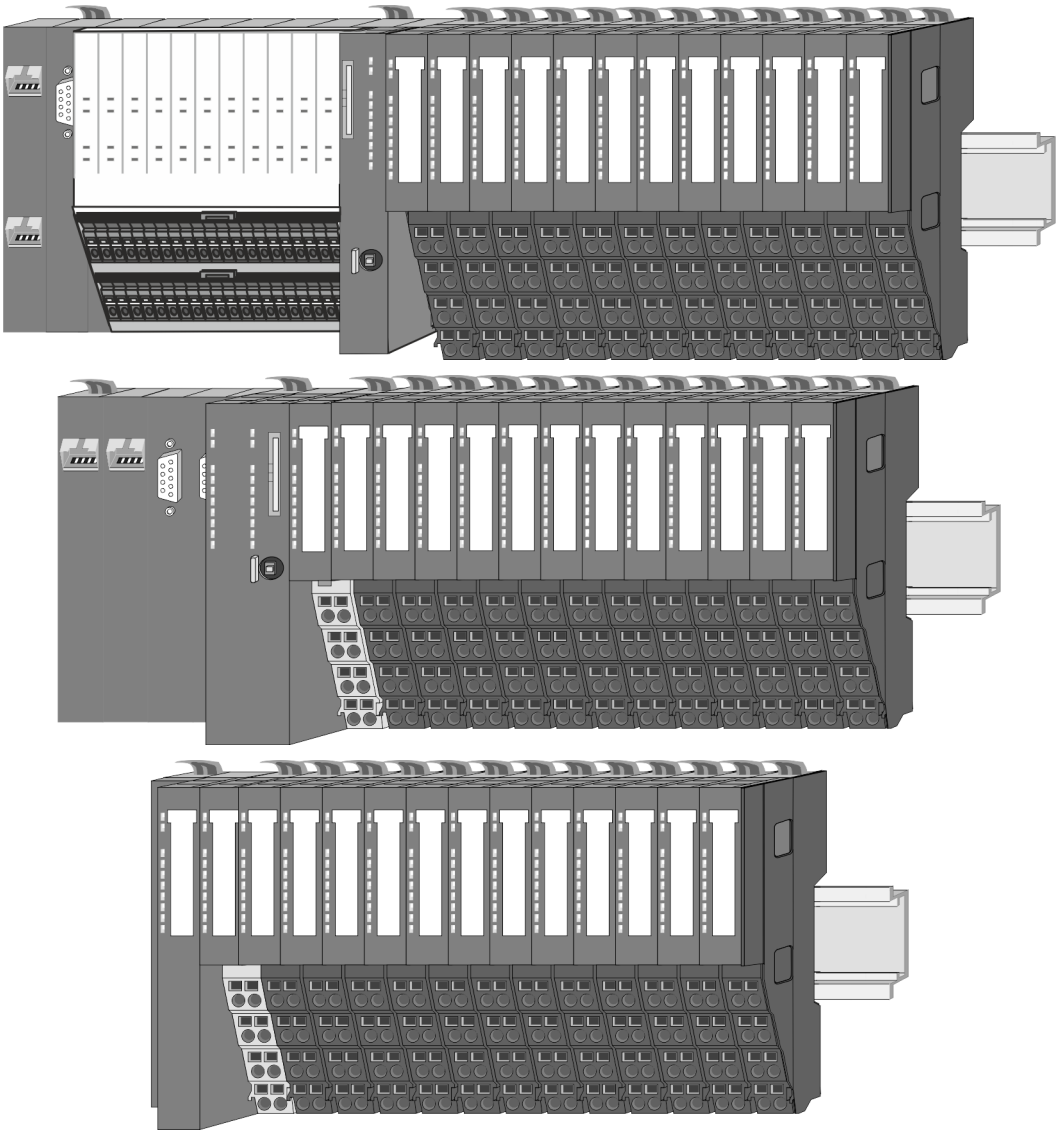
CAUTION

When working with and on electrostatic sensitive modules, make sure that personnel and equipment are adequately grounded.

2.2 System conception

2.2.1 Overview

The System SLIO is a modular automation system for assembly on a 35mm profile rail. By means of the periphery modules with 2, 4, 8 and 16 channels this system may properly be adapted matching to your automation tasks. The wiring complexity is low, because the supply of the DC 24V power section supply is integrated to the backplane bus and defective modules may be replaced with standing wiring. By deployment of the power modules in contrasting colors within the system, further isolated areas may be defined for the DC 24V power section supply, respectively the electronic power supply may be extended with 2A.



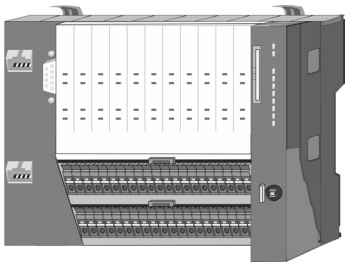
2.2.2 Components

- CPU (head module)
- Bus coupler (head module)
- Line extension
- 8x periphery modules
- 16x periphery modules
- Power modules
- Accessories

CAUTION

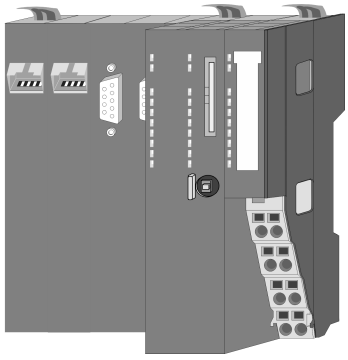
Only Yaskawa modules may be combined. A mixed operation with third-party modules is not allowed!

CPU 01xC



With the CPU 01xC electronic, input/output components and power supply are integrated to one casing. In addition, up to 64 periphery modules of the System SLIO can be connected to the backplane bus. As head module via the integrated power module for power supply CPU electronic and the I/O components are supplied as well as the electronic of the periphery modules, which are connected via backplane bus. To connect the power supply of the I/O components and for DC 24V power section supply of via backplane bus connected periphery modules, the CPU has removable connectors. By installing of up to 64 periphery modules at the backplane bus, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

CPU 01x



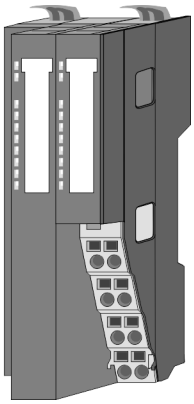
With this CPU 01x, CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24V power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the backplane bus, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

CAUTION

CPU part and power module may not be separated!

Here you may only exchange the electronic module!

Bus coupler



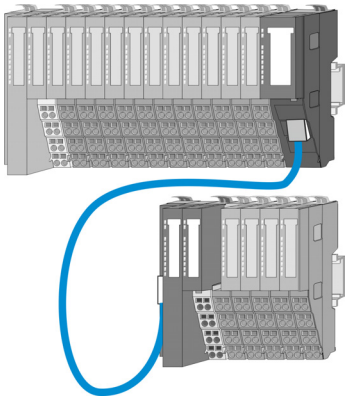
With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module, via the integrated power module for power supply, bus interface and the electronic of the connected periphery modules are supplied. The DC 24V power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the bus coupler, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

CAUTION

Bus interface and power module may not be separated!

Here you may only exchange the electronic module!

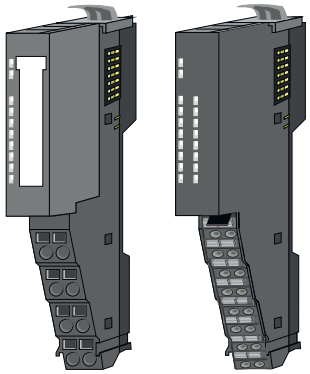
Line extension



In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension MainDevice at each end of a line and the subsequent line has to start with a line extension SubDevice. MainDevice and SubDevice are to be connected via a special connecting cable. In this way, you can divide a line on up to 5 lines. Depending on the line extension, the max. number of pluggable modules at the System SLIO bus is decreased accordingly. To use the line extension no special configuration is required.

Please note that some modules do not support line extensions due to the system. For more information, please refer to the compatibility list. This can be found in the 'Download Center' of www.yaskawa.eu.com under 'System SLIO Compatibility list'.

Periphery modules

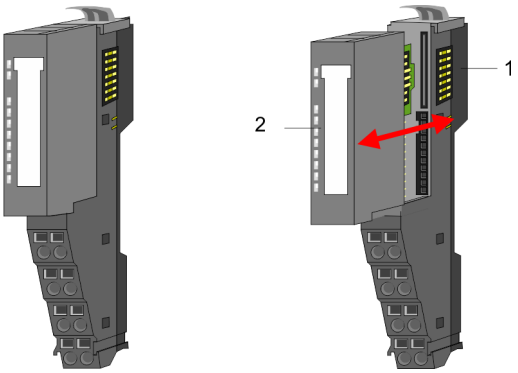


The periphery modules are available in the following 2 versions, whereby of each the electronic part can be replaced with standing wiring:

- 8x periphery module for a maximum of 8 channels.
- 16x periphery module for a maximum of 16 channels.

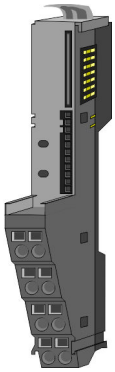
8x periphery modules

Each 8x periphery module consists of a *terminal* and an *electronic module*.



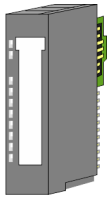
1 Terminal module
2 Electronic module

Terminal module



The *terminal* module serves to carry the electronic module, contains the backplane bus with power supply for the electronic, the DC 24V power section supply and the staircase-shaped terminal for wiring. Additionally the terminal module has a locking system for fixing at a profile rail. By means of this locking system your system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

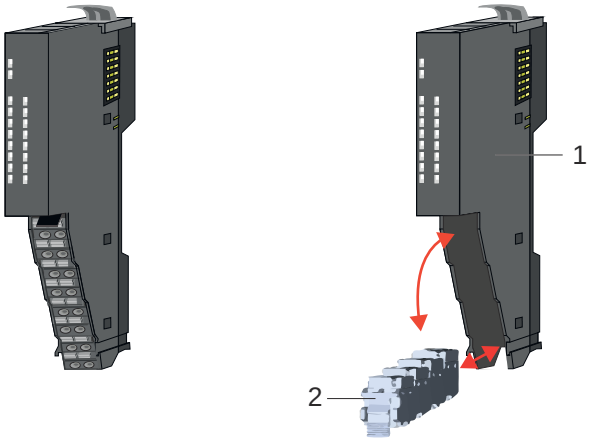
Electronic module



The functionality of a periphery module is defined by the *electronic module*, which is mounted to the terminal module by a sliding mechanism. With an error the defective electronic module may be exchanged for a functional module with standing installation. At the front side there are LEDs for status indication. For simple wiring each module shows corresponding connection information at the front and at the side.

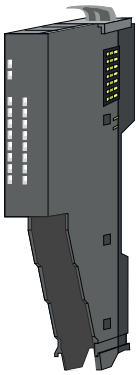
16x periphery modules

Each 16x periphery module consists of an *electronic unit* and a *terminal block*.



1 Electronic unit
2 Terminal block

Electronic unit

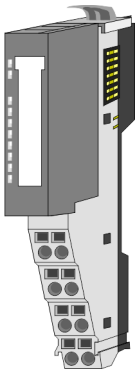


With the 16x periphery module the terminal block is connected to the *electronic unit* via a secure flap mechanism. In the case of an error you can exchange the defective electronic unit for a functional unit with standing wiring. At the front side there are LEDs for status indication. For easy wiring each electronic unit shows corresponding connection information at the side. The electronic unit provides the slot for the terminal block for the wiring and contains the backplane bus with power supply for the electronic and the connection to the DC 24V power section supply. Additionally the electronic unit has a locking system for fixing it at a profile rail. By means of this locking system your system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

Terminal block

The *terminal block* provides the electrical interface for the signalling and supplies lines of the module. When mounting the terminal block, it is attached to the bottom of the electronic unit and turned towards the electronic unit until it clicks into place. With the wiring a "push-in" spring-clip technique is used. This allows a quick and easy connection of your signal and supply lines. The clamping off takes place by means of a screwdriver.

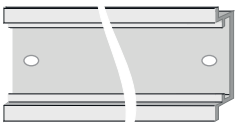
Power module



In the System SLIO the power supply is established by power modules. These are either integrated to the head module or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined respectively the electronic power supply may be extended with 2A. For better recognition the colour of the power modules are contrasting to the periphery modules.

2.2.3 Accessories

Profile rail



Order no.	Description
290-1AF00	35 mm profile rail length 2000mm
290-1AF30	35 mm profile rail length 530mm

NOTICE

To ensure EMC, the profile rail must be grounded!

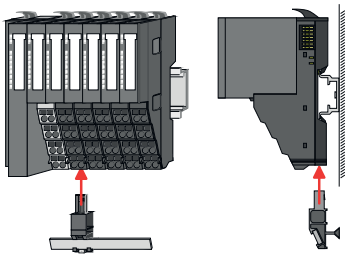
- Ensure that the profile rail is reliably and professionally grounded.
- By mounting them on the grounded profile rail, the modules are automatically connected to the grounding system.

'Grounding guidelines'...page 20

'Installation guidelines'...page 43

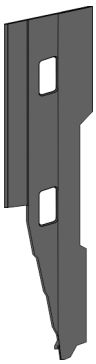
Shield bus carrier

Please note that a shield bus carrier cannot be mounted on a 16x periphery module!



The shield bus carrier (order no.: 000-0AB00) serves to carry the shield bus (10mm x 3mm) to connect cable shields. Shield bus carriers, shield bus and shield fixings are not in the scope of delivery. They are only available as accessories. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat profile rail for adaptation to a flat profile rail you may remove the spacer of the shield bus carrier.

Bus cover



With each head module, to protect the backplane bus connectors, there is a mounted bus cover in the scope of delivery. You have to remove the bus cover of the head module before mounting a System SLIO module. For the protection of the backplane bus connector you always have to mount the bus cover at the last module of your system again. The bus cover has the order no. 000-0AA00.

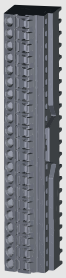
Coding pins

Please note that a coding pin cannot be installed on a 16x periphery module! Here you have to make sure that the associated terminal block is plugged again when the electronics unit is replaced.

There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) can be used. The coding pin consists of a coding jack and a coding plug. By combining electronic and terminal module with coding pin, the coding jack remains in the electronic module and the coding plug in the terminal module. This ensures that after replacing the electronic module just another electronic module can be plugged with the same encoding.

Spare parts

The following spare parts are available for the System SLIO:

Spare part	Order no.	Description	Packaging unit
	092-9BH00	Terminal block for System SLIO 16x periphery module.	5 pieces
	092-9BK00	Connector for System SLIO CPU 013C.	5 pieces

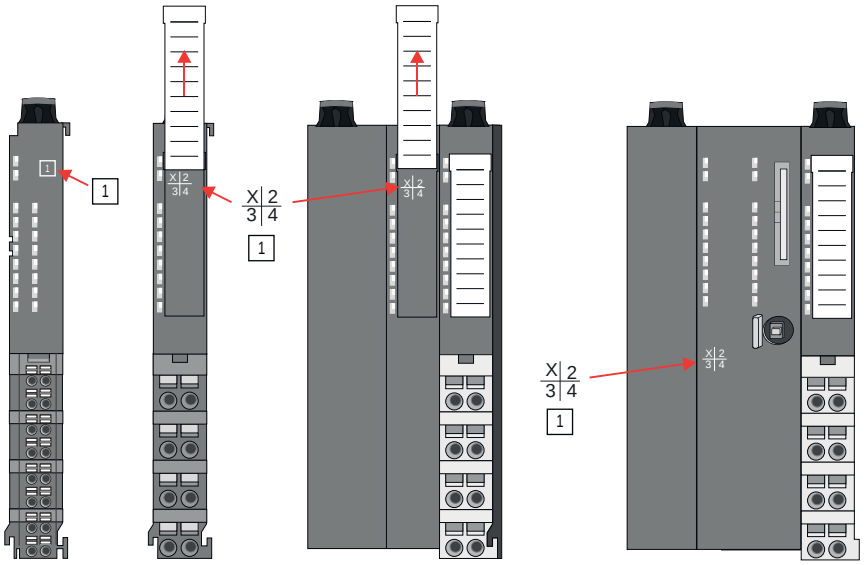
CAUTION

Please note that you may only use the spare parts with Yaskawa modules. Use with third-party modules is not allowed!

2.2.4 Hardware revision

Hardware revision on the front

- The hardware revision is printed on every System SLIO module.
- Since a System SLIO 8x periphery module consists of a terminal and electronic module, you will find a hardware revision printed on each of them.
- Authoritative for the hardware revision of a System SLIO module is the hardware revision of the electronic module. This is located under the labeling strip of the corresponding electronic module.
- Depending on the module type, there are the following 2 variants e.g. to indicate hardware revision 1:
  - With current labelling there is a 1 on the front.
  - With earlier labelling, the 1 is marked with *'X'* on a number grid.



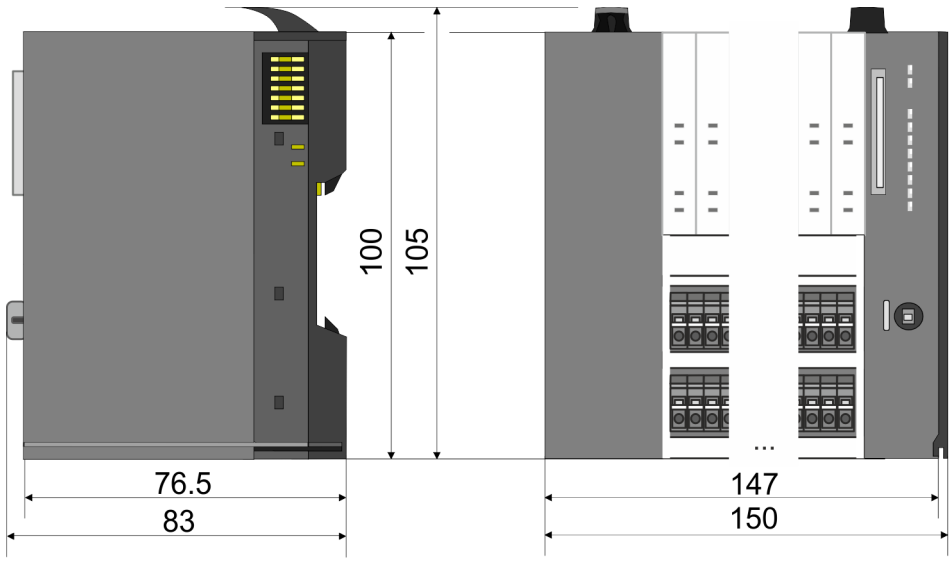
Hardware revision via web server

On the CPUs and some bus couplers, you can check the hardware revision *'HW Revision'* via the integrated web server.

2.3 Dimensions

CPU 01xC

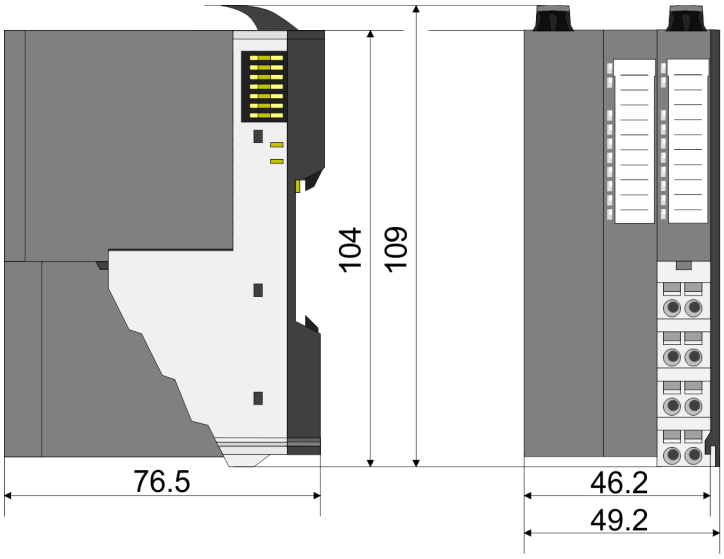
All dimensions are in mm.



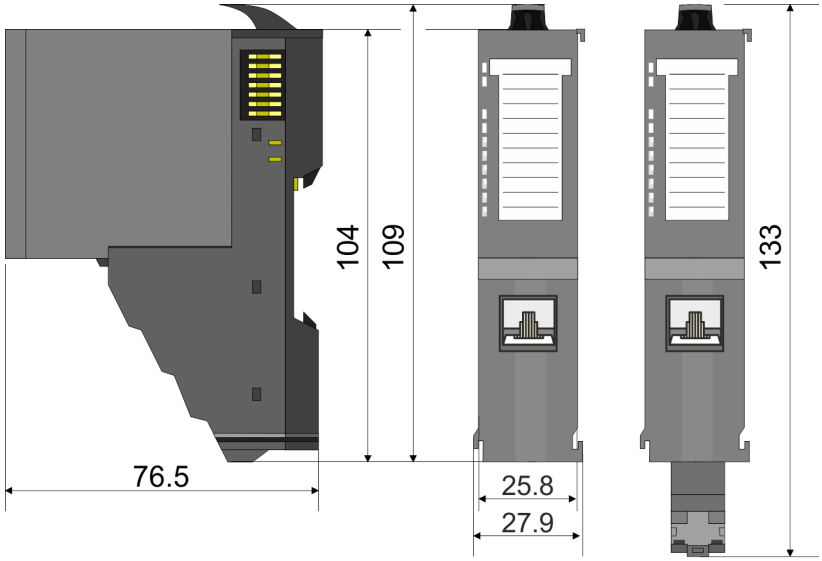
Dimensions

CPU 01x

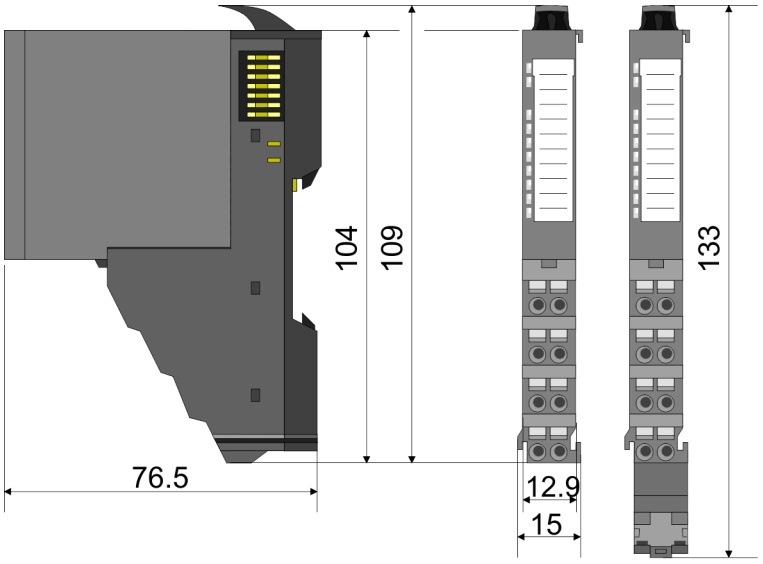
Bus coupler and line extension SubDevice



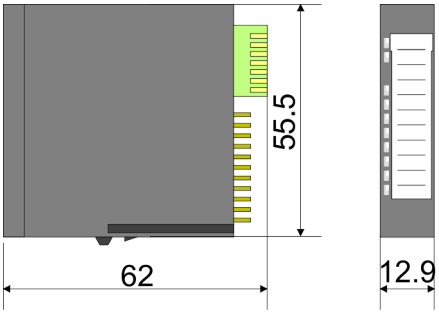
Line extension MainDevice



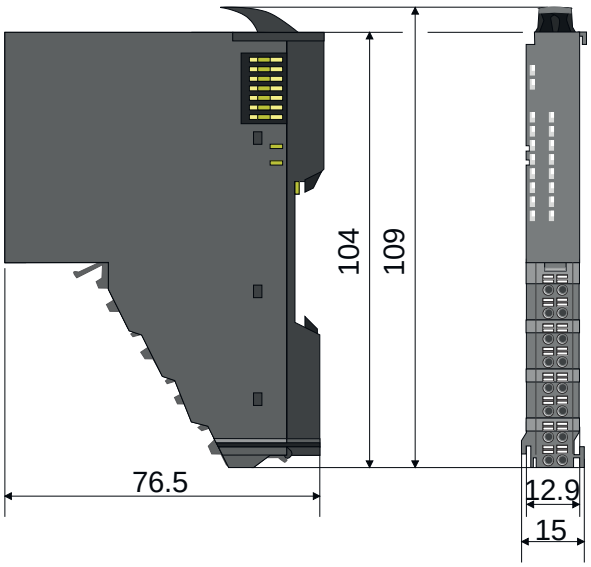
8x periphery module



Electronic module



16x periphery module



2.4 Grounding concept

Grounding guidelines

For reliable grounding, ensure that all common ground connections and the functional earth (FE) of your System SLIO and all connected devices are connected to a central point and grounded there.

NOTICE

To ensure EMC, the profile rail must be grounded!

- Ensure that the profile rail is reliably and professionally grounded.
- By mounting them on the grounded profile rail, the modules are automatically connected to the grounding system.

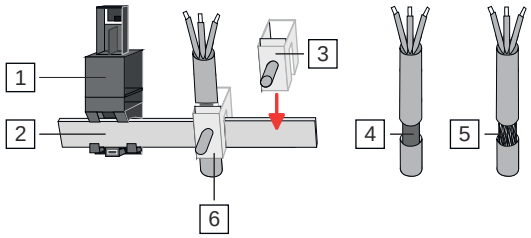
'Installation guidelines'...page 43

- To avoid potential differences, use grounding cables that are as short as possible and have a large cross-section.
- When selecting grounding points, observe the applicable safety regulations.
- When assembling your components, ensure that the inactive metal parts are properly grounded over a large area.
  - Connect all inactive metal parts over a large area and with low impedance.
  - Avoid using aluminium parts if possible. Aluminium is easily oxidizing and is therefore less suitable for grounding.

2.4.1 Shielding

Overview

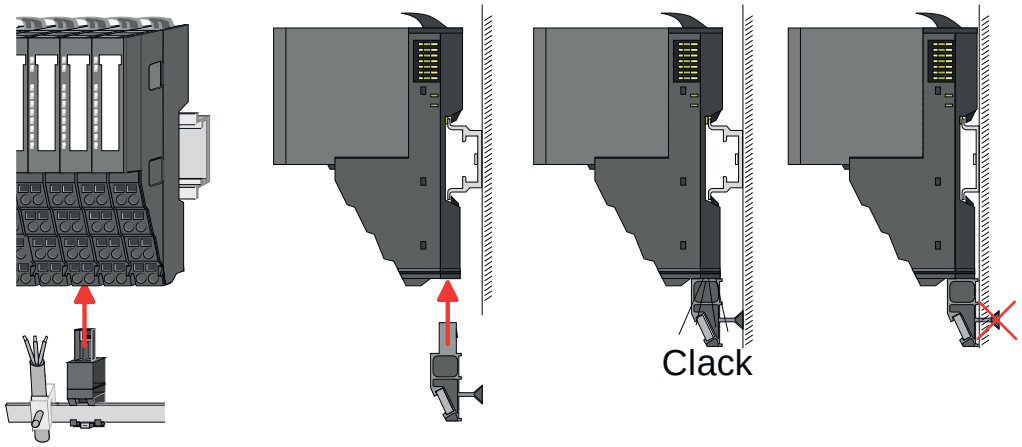
Shielding is required for interference-free signal transmission. This weakens electrical, magnetic or electromagnetic interference fields. To attach the shield the mounting of shield bus carriers are necessary. The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields. *'Installation guidelines'...page 43*



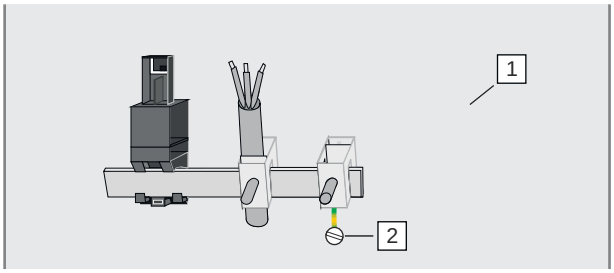
1 Shield bus carrier
2 Shield bus (10mm x 3mm)
3 Shield clamp
4 Cable shield with metal foil
5 Cable shield with wire mesh (close-meshed)
6 Cable shield mounted with shield clamp

Shield attachment

1. System SLIO head and 8x periphery modules have a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat profile rail for adaptation to a flat profile rail you may remove the spacer of the shield bus carrier.
2. Put your shield bus into the shield bus carrier.



3. Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.
4. The shield bus must always be grounded. Keep all cable connections as short as possible. To ground the shield bus, connect a FE conductor to the shield bus via a shield clamp and screw it to the base plate as close as possible and with low impedance.



1 Base plate
2 FE conductor screwed to base plate

2.5 Mounting bus coupler

CAUTION

Requirements for UL compliance use

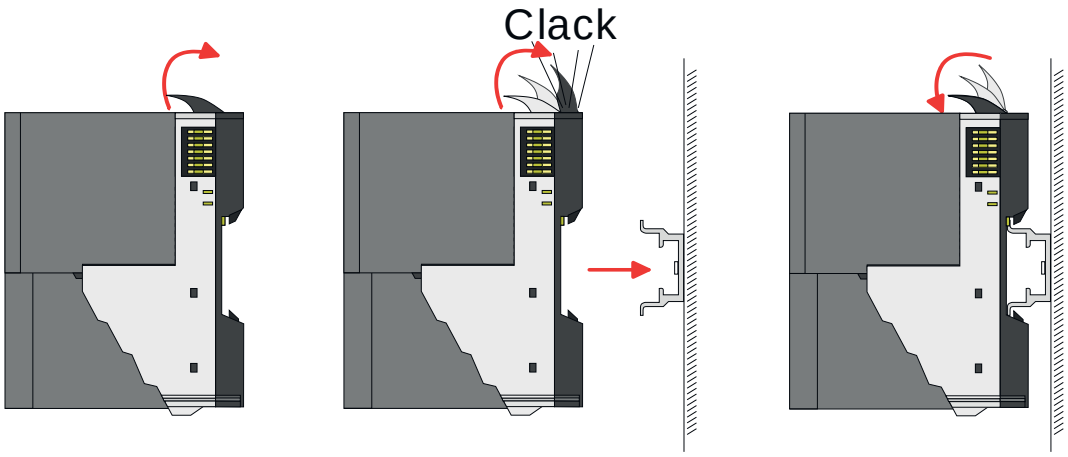
- Use for power supply exclusively SELV/PELV power supplies.
- The System SLIO must be installed and operated in a housing according to IEC 61010-1 9.3.2 c).

CAUTION

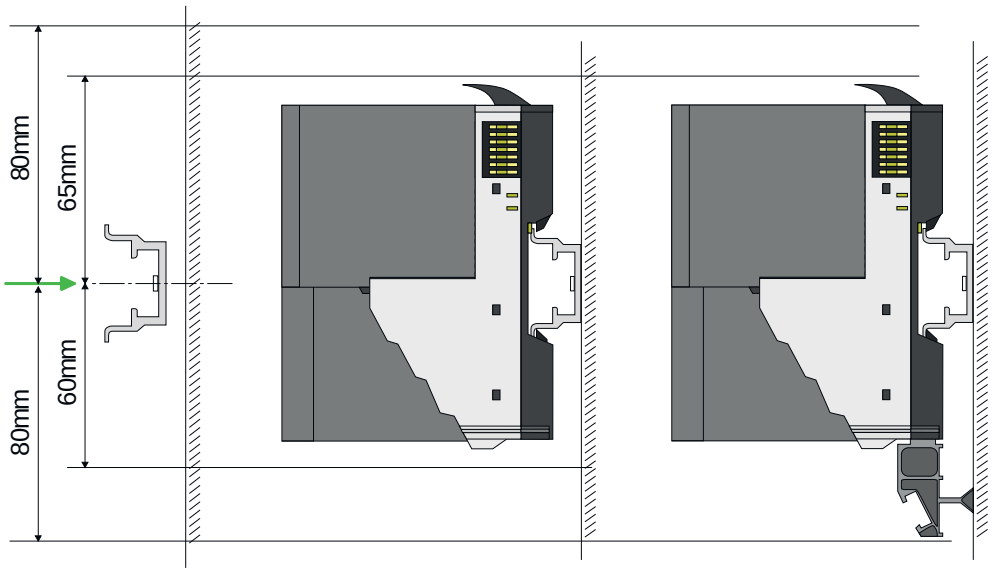
Danger of injury from electrical shock and damage to the unit!

Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!

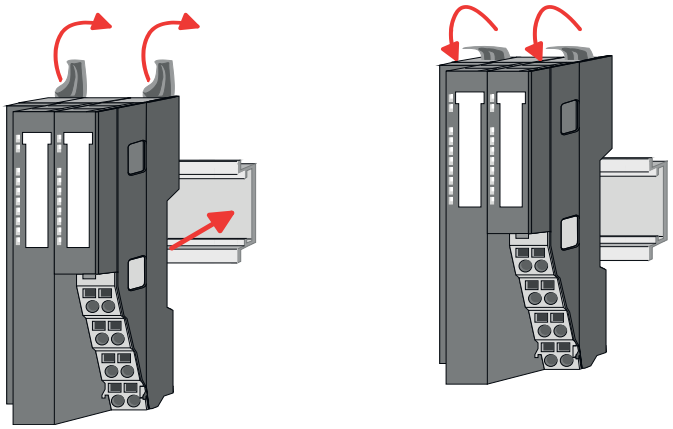
There are locking lever at the top side of the bus coupler. For mounting and demounting these locking lever are to be turned upwards until these engage. Place the bus coupler at the profile rail. The bus coupler is fixed to the profile rail by pushing downward the locking levers. The bus coupler is directly mounted at a profile rail. Up to 64 modules may be mounted. The electronic and power section supply are connected via the backplane bus. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



Proceeding



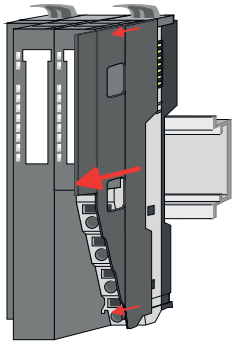
1. Mount the profile rail. Please consider that a clearance from the middle of the profile rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.



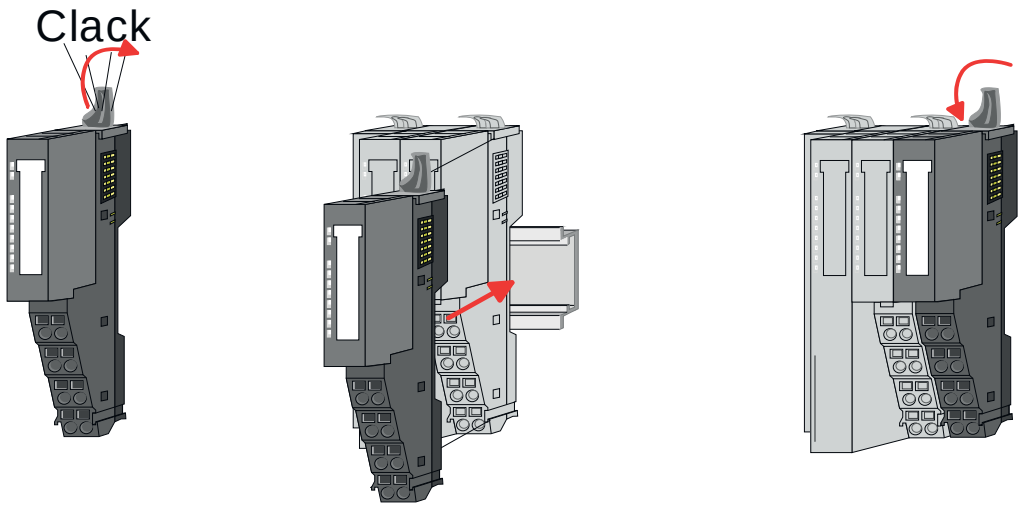
2. Turn the locking lever upwards, place the bus coupler at the profile rail and turn the lever downward.

Mounting periphery modules

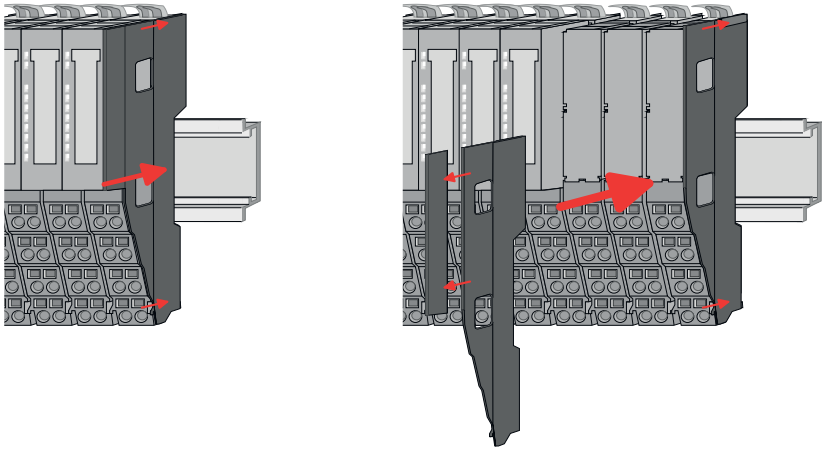
The procedure is identical for 8x and 16x periphery modules.



1. Before mounting the periphery modules you have to remove the bus cover at the right side of the bus coupler by pulling it forward. Keep the cover for later mounting.



2. Mount the periphery modules you want.



3. After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now. If the last module is a clamp module, for adaptation the upper part of the bus cover is to be removed.

2.6 Wiring

CAUTION

Consider temperature for external cables!

Cables may experience temperature increase due to system heat dissipation. Thus the cabling specification must be chosen 25°C above ambient temperature!

CAUTION

Separate insulation areas!

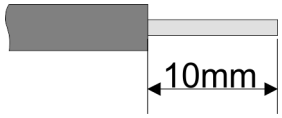
The system is specified for SELV/PELV environment. Devices, which are attached to the system must meet theses specifications. Installation and cable routing other than SELV/PELV specification must be separated from the system's equipment!

2.6.1 Wiring bus coupler

Terminal module terminals

The System SLIO bus coupler have a power module integrated. Terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

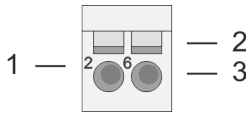
Data



Please use copper wire only!

U_{max}	30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm² (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure

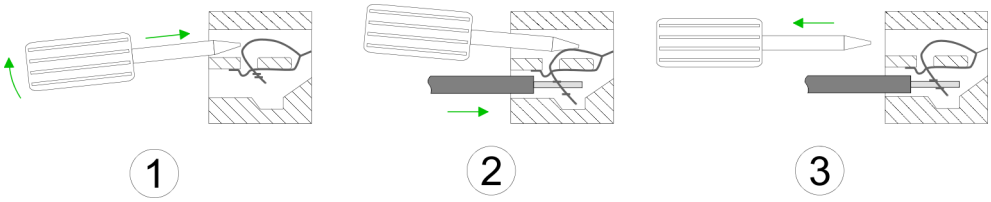


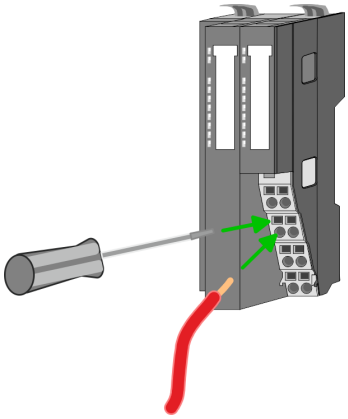
1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire

CAUTION

Danger of injury from electrical shock and damage to the unit!

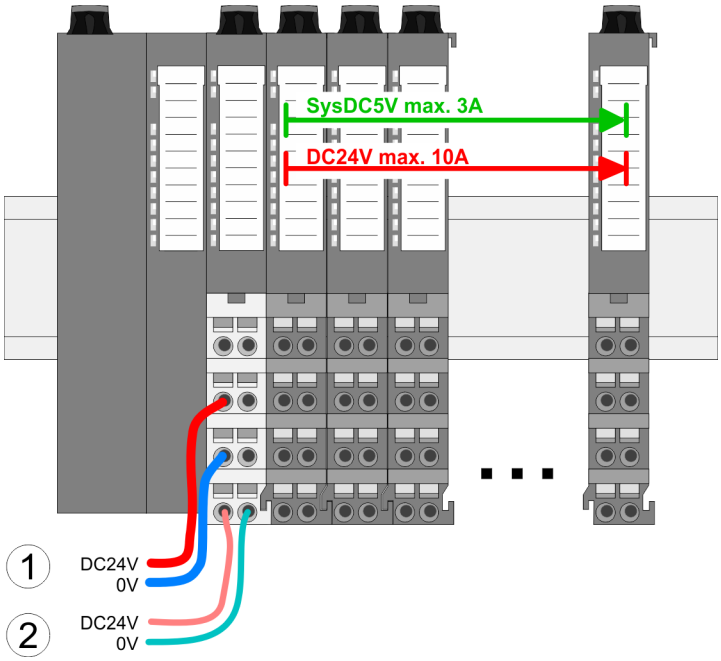
Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!





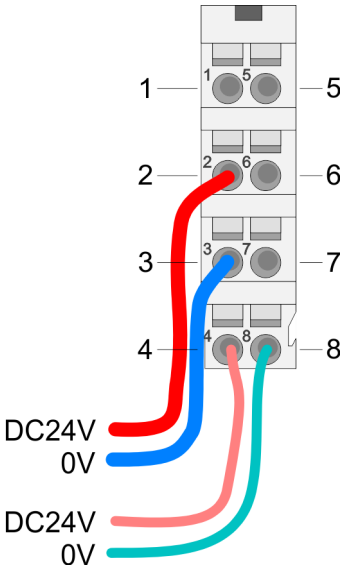
1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm²
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

Standard wiring



(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area

PM - Power module



For wires with a core cross-section of 0.08mm² up to 1.5mm².

Pos.	Function	Type	Description
1	---	---	not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic power supply
5	---	---	not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND for electronic power supply

I: Input

CAUTION

Since the power section supply is not internally protected, it is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected by a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z and should be UL approved!

The electronic power section supply is internally protected against higher voltage by fuse. The fuse is within the power module. If the fuse releases, its electronic module must be exchanged!

Fusing

- The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z!
- It is recommended to externally protect the electronic power supply for bus coupler and I/O area with a 2A fuse (fast) respectively by a line circuit breaker 2A characteristics Z.
- The electronic power supply for the I/O area of the power module 007-1AB10 should also be externally protected with a 1A fuse (fast) respectively by a line circuit breaker 1A characteristics Z.

State of the electronic power supply via LEDs

After PowerON of the System SLIO the LEDs RUN respectively MF get on so far as the sum current does not exceed 3A. With a sum current greater than 3A the LEDs may not be activated. Here the power module with the order number 007-1AB10 is to be placed between the peripheral modules.

Shield attachment

'Shielding'...page 20

2.6.2 Wiring 8x periphery modules

Terminal module terminals

CAUTION

Do not connect hazardous voltages!

If this is not explicitly stated in the corresponding module description, hazardous voltages are not allowed to be connected to the corresponding terminal module!

CAUTION

Danger of injury from electrical shock and damage to the unit!

Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!

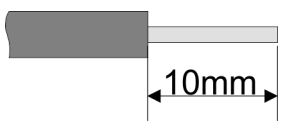
CAUTION

Consider temperature for external cables!

Cables may experience temperature increase due to system heat dissipation. Thus the cabling specification must be chosen 25°C above ambient temperature!

- With wiring the terminal modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

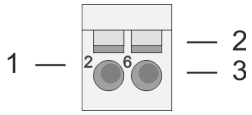
Data



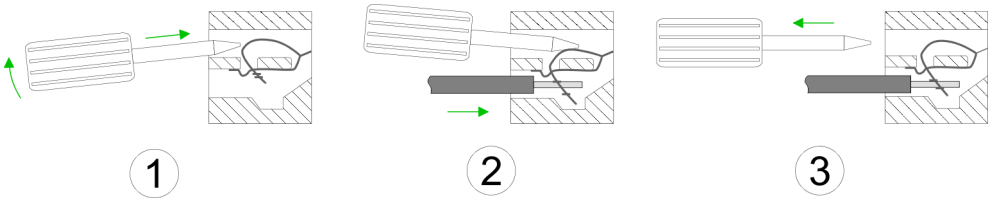
Please use copper wire only!

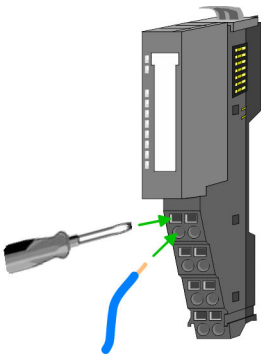
U_{max}	240V AC / 30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm² (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure



1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire





1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm²
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

Shield attachment *'Shielding'...page 20*

2.6.3 Wiring 16x periphery modules

Terminal block connectors

CAUTION

Do not connect hazardous voltages!

If this is not explicitly stated in the corresponding module description, hazardous voltages are not allowed to be connected to the corresponding terminal block!

CAUTION

Danger of injury from electrical shock and damage to the unit!

Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!

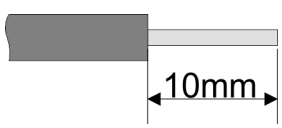
CAUTION

Consider temperature for external cables!

Cables may experience temperature increase due to system heat dissipation. Thus the cabling specification must be chosen 25°C above ambient temperature!

- The 16x periphery module has a removable terminal block for wiring.
- With the wiring of the terminal block a "push-in" spring-clip technique is used. This allows a quick and easy connection of your signal and supply lines.
- The clamping off takes place by means of a screwdriver.

Data



Please use copper wire only!

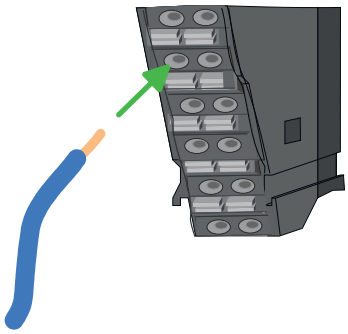
U_{max}	30V DC
I_{max}	10A
Cross section solid wire	0.25 ... 0.75mm²
Cross section with ferrule	0.14 ... 0.75mm²
AWG	24 ... 16
Stripping length	10mm

Wiring procedure

1 Release area
2 Connection hole for wire

Insert wire

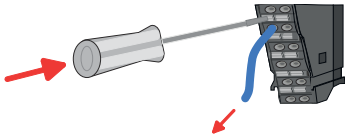
The wiring happens without a tool.



1. Determine according to the casing labelling the connection position.
2. Insert through the round connection hole of the according contact your prepared wire until it stops, so that it is fixed.
   ➡ By pushing the contact spring opens, thus ensuring the necessary contact pressure.

Remove wire

The wire is to be removed by means of a screwdriver with 2.5mm blade width.



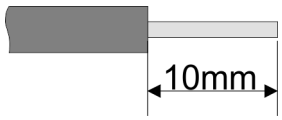
1. Press with your screwdriver vertically at the release button.
   ➡ The contact spring releases the wire.
2. Pull the wire from the round hole.

2.6.4 Wiring power modules

Terminal module terminals

Power modules are either integrated to the head module or may be installed between the periphery modules. With power modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

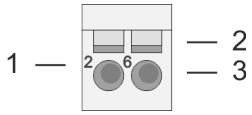
Data



Please use copper wire only!

U_{max}	30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm² (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure



1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire

CAUTION

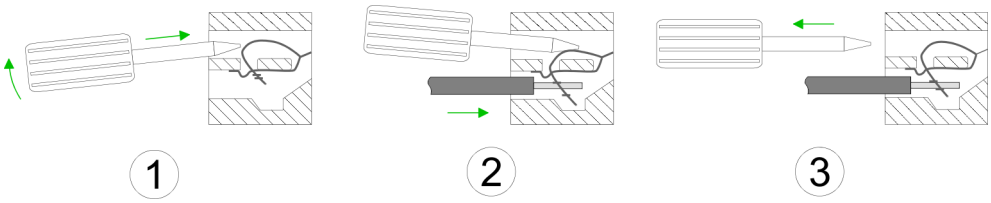
Danger of injury from electrical shock and damage to the unit!

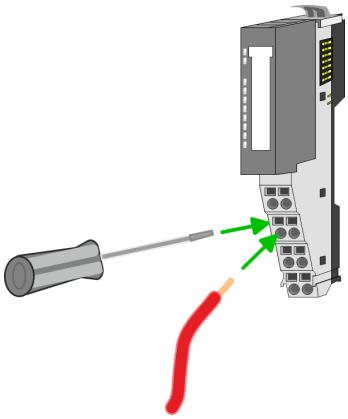
Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!

CAUTION

Consider temperature for external cables!

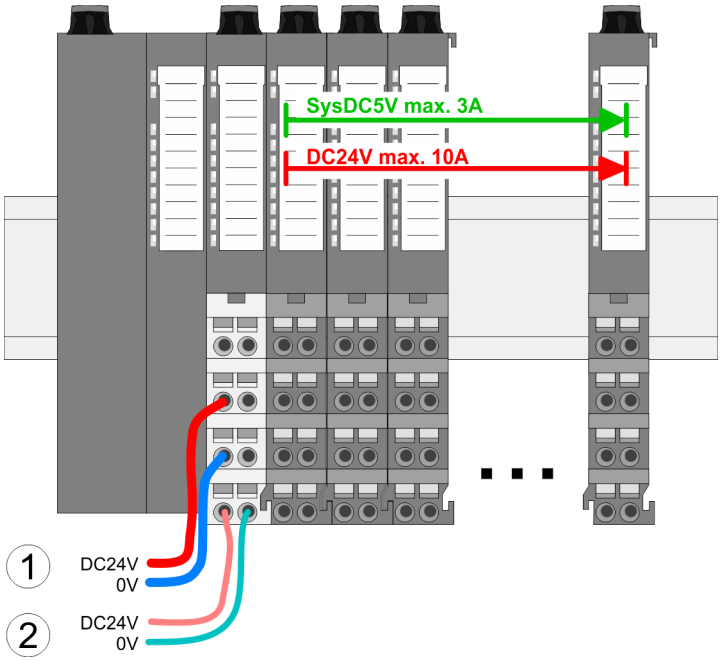
Cables may experience temperature increase due to system heat dissipation. Thus the cabling specification must be chosen 25°C above ambient temperature!





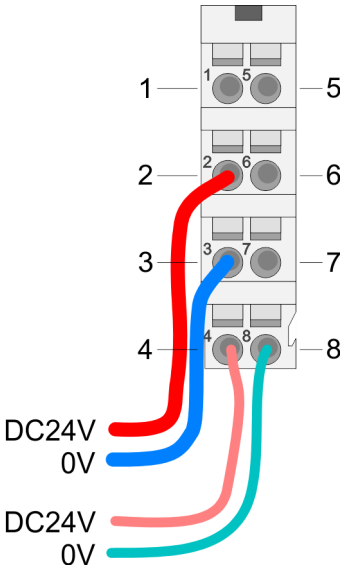
1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm²
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

Standard wiring



(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area

PM - Power module



For wires with a core cross-section of 0.08mm² up to 1.5mm².

Pos.	Function	Type	Description
1	---	---	not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic power supply
5	---	---	not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND for electronic power supply

I: Input

CAUTION

Since the power section supply is not internally protected, it is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected by a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z and should be UL approved!

The electronic power section supply is internally protected against higher voltage by fuse. The fuse is within the power module. If the fuse releases, its electronic module must be exchanged!

Fusing

- The power section supply is to be externally protected with a fuse, which corresponds to the maximum current. This means max. 10A is to be protected with a 10A fuse (fast) respectively by a line circuit breaker 10A characteristics Z and should be UL approved.
  - For modules with positive logic (PNP), place the fuse on the positive connector.
  - For modules with negative logic (NPN), place the fuse on the negative connector.
  - For mixed logic, one fuse must be placed on the negative and one on the positive connector.
- It is recommended to externally protect the electronic power supply for head modules and I/O area with a 2A fuse (fast) respectively by a line circuit breaker 2A characteristics Z and should be UL approved.
- The electronic power supply for the I/O area of the power module 007-1AB10 should also be externally protected with a 1A fuse (fast) respectively by a line circuit breaker 1A characteristics Z and should be UL approved.

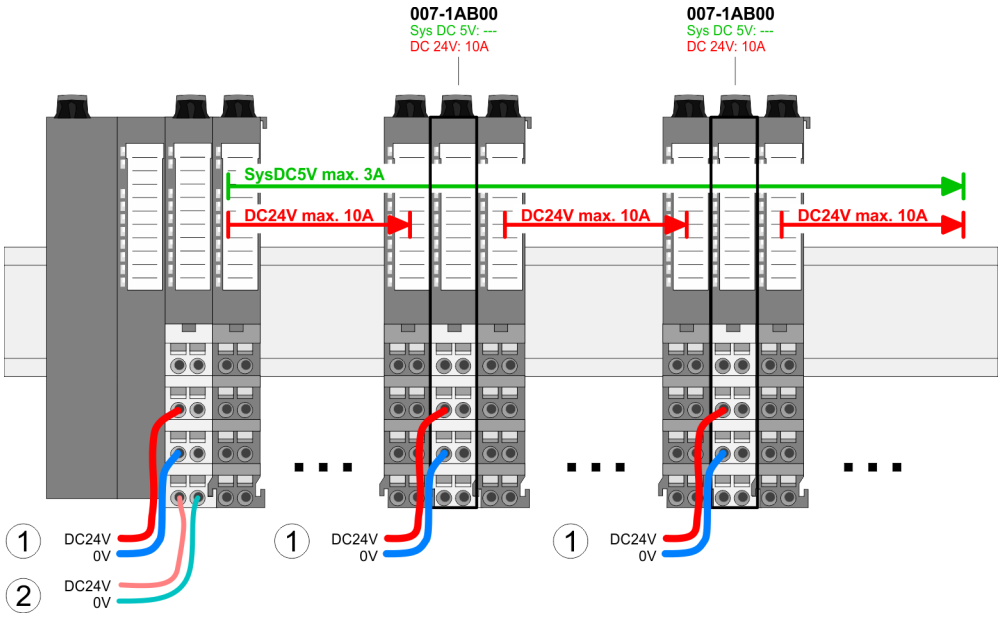
State of the electronic power supply via LEDs

After PowerON of the System SLIO the LEDs RUN respectively MF get on so far as the sum current does not exceed 3A. With a sum current greater than 3A the LEDs may not be activated. Here the power module with the order number 007-1AB10 is to be placed between the peripheral modules.

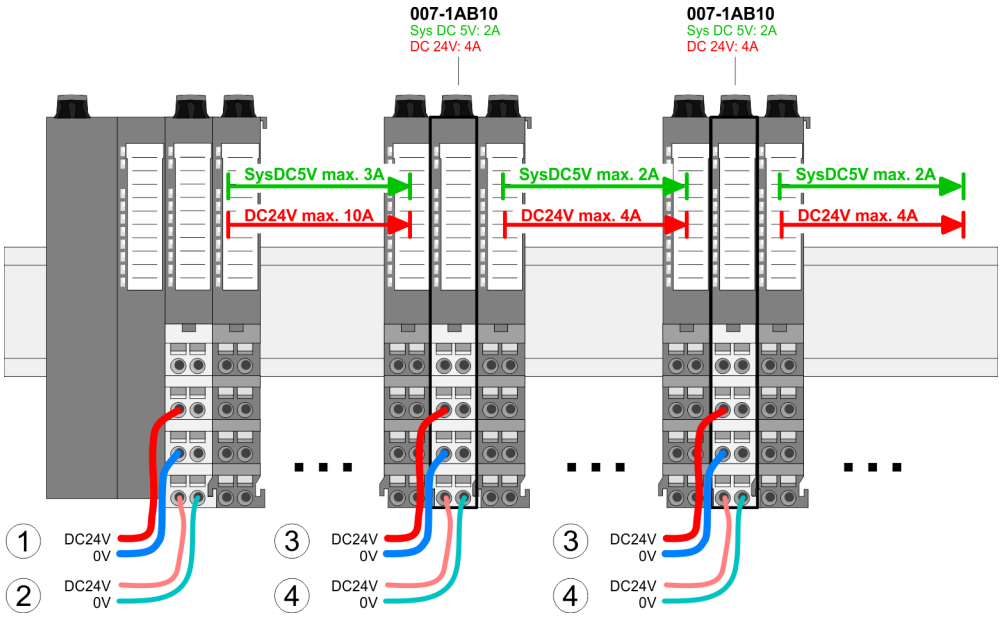
Deployment of the power modules

- If the 10A for the power section supply is no longer sufficient, you may use the power module with the order number 007-1AB00. So you have also the possibility to define isolated groups.
- The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with max. 4A.
- By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards a power module is to be placed again. To secure the power supply, the power modules may be mixed used.

Power module 007-1AB00



Power module 007-1AB10



(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area
(3) DC 24V for power section supply I/O area (max. 4A)
(4) DC 24V for electronic power supply I/O area

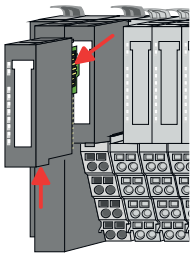
2.7 Demounting

2.7.1 Demounting bus coupler

Proceeding

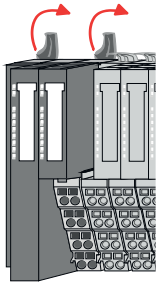
CAUTION

Put the System SLIO in a safe, powered down state before starting disassembly!



1. Power-off your system.
2. Remove if exists the wiring of the bus coupler.
3. Press the unlocking lever at the lower side of the just mounted right module near the bus coupler and pull it forward.

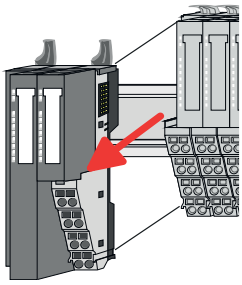
For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.



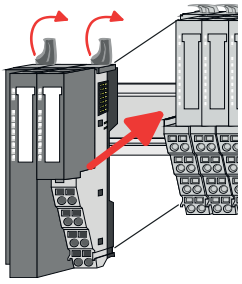
4. Turn all the locking lever of the bus coupler to be exchanged upwards.

CAUTION

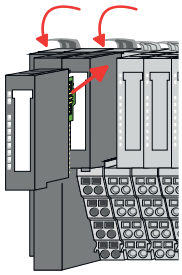
Bus interface and power module may not be separated! Here you may only exchange the electronic module!



5. Pull the bus coupler forward.



6. For mounting turn all the locking lever of the bus coupler to be exchanged upwards.
7. To mount the bus coupler put it to the left periphery module and push it, guided by the stripes, to the profile rail.



8. Turn all the locking lever downward, again.
9. Plug again the electronic module, which you have removed before.
10. Wire your bus coupler.

➡ Now you can bring your system back into operation.

2.7.2 Demounting 8x periphery modules

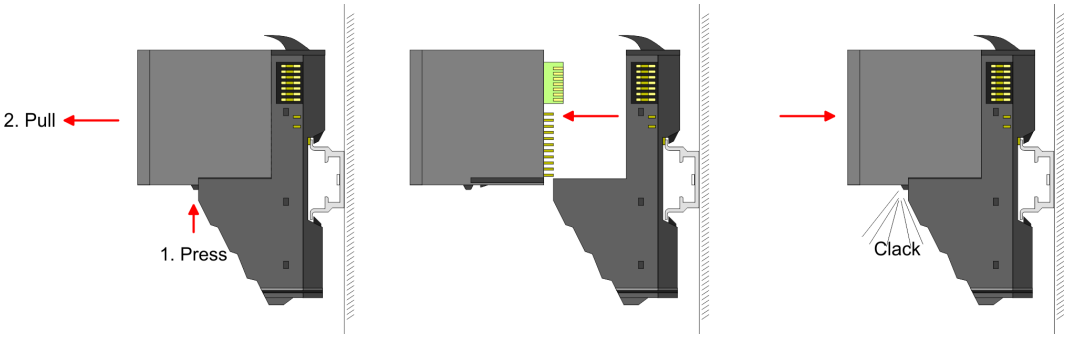
Proceeding

Exchange of an electronic module

CAUTION

Put the System SLIO in a safe, powered down state before starting disassembly!

1. Power-off your system.



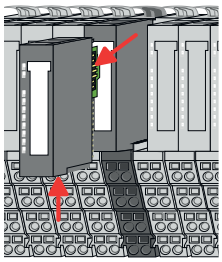
2. For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.
3. For installation plug the new electronic module guided by the strips at the lower side until this engages to the terminal module.

➡ Now you can bring your system back into operation.

Easy Maintenance

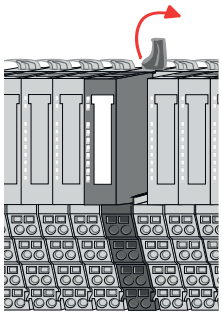
'Easy Maintenance' means the support for adding and removing electronic modules during operation without having to restart the system. If this is supported by your head module, you will find more detailed information on this in the "Deployment" chapter. *'Easy Maintenance'...page 72*

Exchange of a periphery module

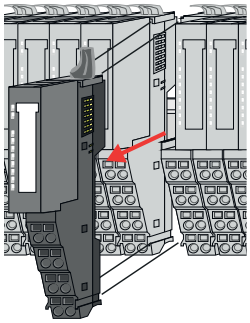


1. Power-off your system.
2. Remove if exists the wiring of the module.
3. *For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.*

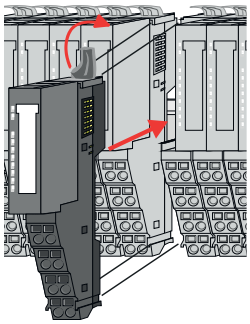
   Press the unlocking lever at the lower side of the just mounted right module and pull it forward.



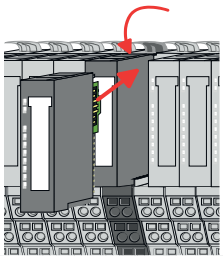
4. Turn the locking lever of the module to be exchanged upwards.



5. Pull the module.
6. For mounting turn the locking lever of the module to be mounted upwards.



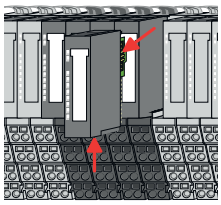
7. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the profile rail.
8. Turn the locking lever downward, again.



9. Plug again the electronic module, which you have removed before.
10. Wire your module.

➡ Now you can bring your system back into operation.

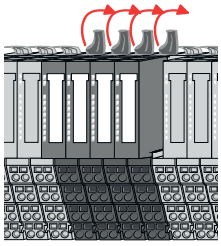
Exchange of a module group



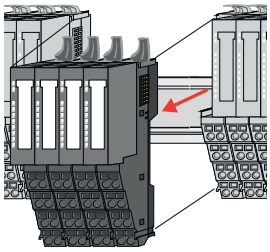
1. Power-off your system.
2. Remove if exists the wiring of the module group.
3.

For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.

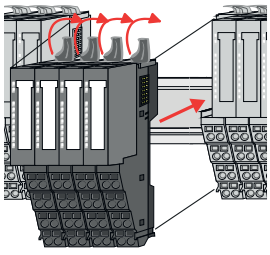
Press the unlocking lever at the lower side of the just mounted right module near the module group and pull it forward.



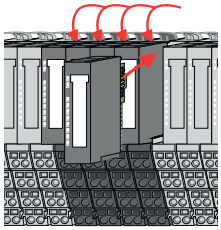
4. Turn all the locking lever of the module group to be exchanged upwards.



5. Pull the module group forward.
6. For mounting turn all the locking lever of the module group to be mounted upwards.



7. To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the profile rail.
8. Turn all the locking lever downward, again.



9. Plug again the electronic module, which you have removed before.
10. Wire your module group.

➡ Now you can bring your system back into operation.

2.7.3 Demounting 16x periphery modules

Proceeding

Exchange of an electronic unit

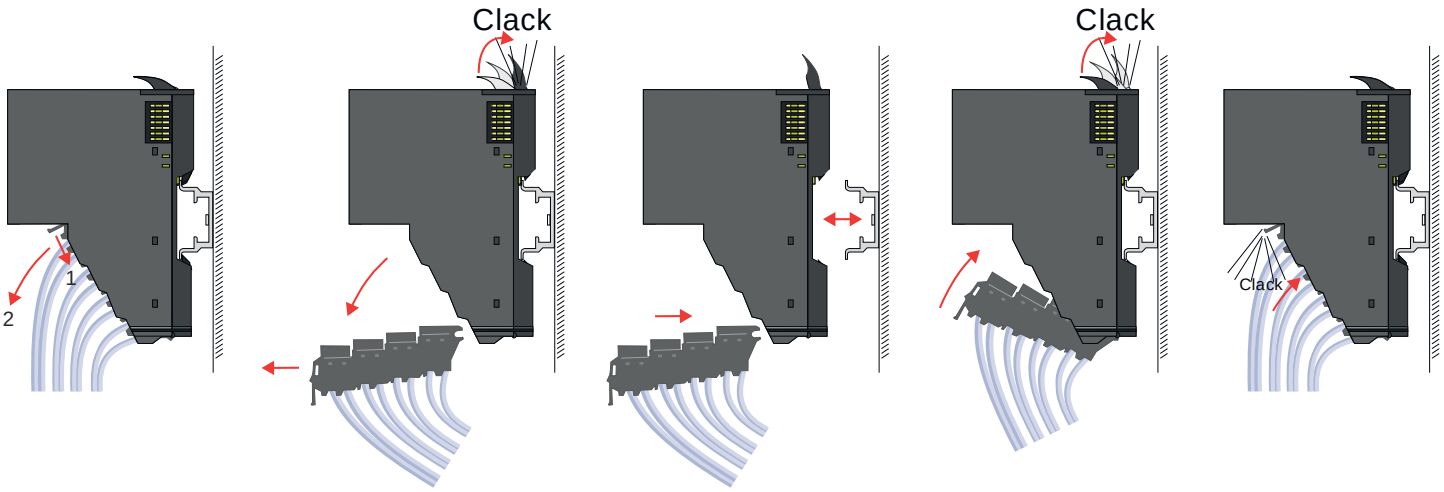
CAUTION

Put the System SLIO in a safe, powered down state before starting disassembly!

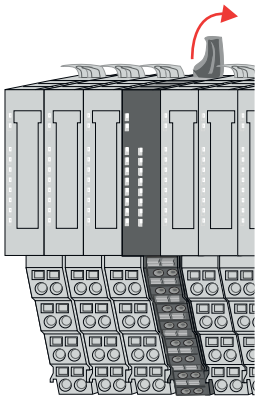
1. Power-off your system.
2. To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock.

   To mount the terminal block, place it horizontally on the lower side of the electronic unit and push it towards the electronic unit until it clicks into place.

   ➡ Now you can bring your system back into operation.

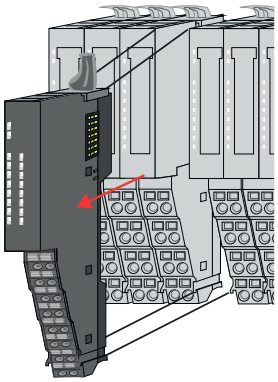


Exchange of a 16x periphery module

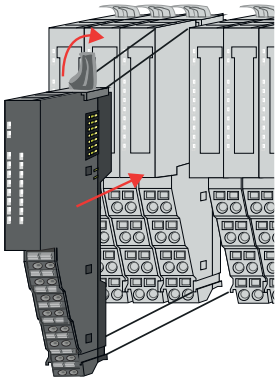


1. Power-off your system.
2. Remove if exists the wiring of the module respectively the wired terminal block.
3. *In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.*

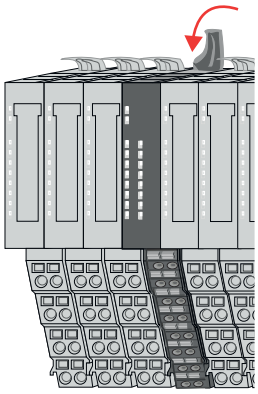
   Turn the locking lever of the module to be exchanged upwards.



4. Pull the module.
5. For mounting turn the locking lever of the module to be mounted upwards.



6. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the profile rail.

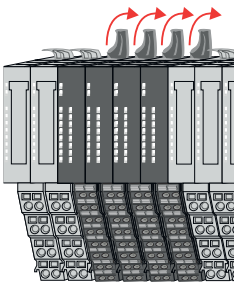


7. Turn the locking lever downward, again.
8. Wire your module respectively plug the wired terminal block again.

➡ Now you can bring your system back into operation.

Exchange of a module group

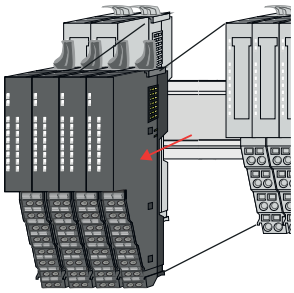
1. Power-off your system.
2. Remove if exists the wiring of the module group respectively the wired terminal blocks.



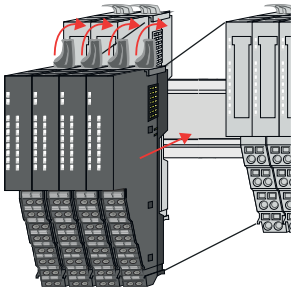
3.

In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.

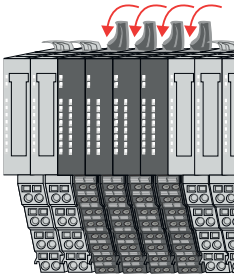
Turn all the locking lever of the module group to be exchanged upwards.



4. Pull the module group forward.
5. For mounting turn all the locking lever of the module group to be mounted upwards.



6. To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the profile rail.



7. Turn all the locking lever downward, again.
8. Wire your module group respectively plug the wired terminal blocks again.

➡ Now you can bring your system back into operation.

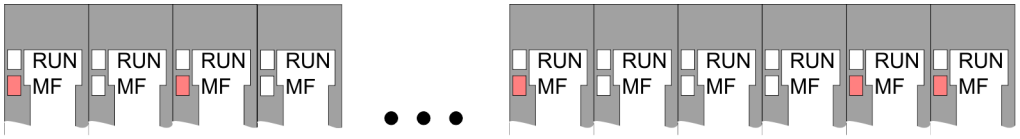
2.8 Trouble shooting - LEDs

General

Each module has the LEDs RUN and MF on its front side. Errors or incorrect modules may be located by means of these LEDs.

In the following illustrations flashing LEDs are marked by ☼.

Sum current of the electronic power supply exceeded

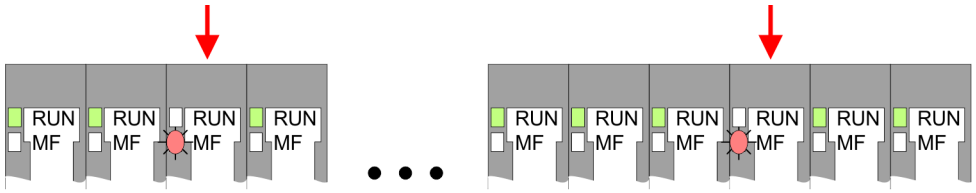


Behavior: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

Reason: The maximum current for the electronic power supply is exceeded.

Remedy: As soon as the sum current of the electronic power supply is exceeded, always place the power module 007-1AB10. *'Wiring power modules'...page 29*

Error in configuration

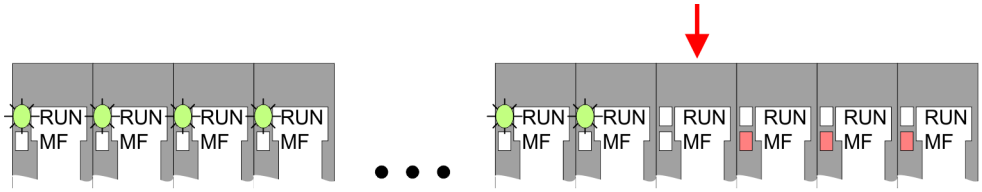


Behavior: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

Reason: At this position a module is placed, which does not correspond to the configured module.

Remedy: Match configuration and hardware structure.

Module failure



Behavior: After PowerON all of the RUN LEDs up to the defective module are flashing. With all following modules the MF LED is on and the RUN LED is off.

Reason: The module on the right of the flashing modules is defective.

Remedy: Replace the defective module.

2.9 Industrial security and installation guidelines

2.9.1 Industrial security in information technology

Latest version

This chapter can also be found as a guide *'Industrial IT Security'* in the *'Download Center'* of www.yaskawa.eu.com

Hazards

The topic of data security and access protection has become increasingly important in the industrial environment. The increased networking of entire industrial systems to the network levels within the company together with the functions of remote maintenance have all served to increase vulnerability. Hazards can arise from:

- Internal manipulation such as technical errors, operating and program errors and deliberate program or data manipulation.
- External manipulation such as software viruses, worms and trojans.
- Human carelessness such as password phishing.

Precautions

The most important precautions to prevent manipulation and loss of data security in the industrial environment are:

- Encrypting the data traffic by means of certificates.
- Filtering and inspection of the traffic by means of VPN - "Virtual Private Networks".
- Identification of the user by "Authentication" via save channels.
- Segmenting in protected automation cells, so that only devices in the same group can exchange data.
- Deactivation of unnecessary hardware and software.

Further Information

You can find more information about the measures on the following websites:

- Federal Office for Information Technology ➦ *www.bsi.bund.de*
- Cybersecurity & Infrastructure Security Agency ➦ *us-cert.cisa.gov*
- VDI / VDE Society for Measurement and Automation Technology ➦ *www.vdi.de*

2.9.1.1 Protection of hardware and applications

Precautions

- Do not integrate any components or systems into public networks.
  - Use VPN "Virtual Private Networks" for use in public networks. This allows you to control and filter the data traffic accordingly.
- Always keep your system up-to-date.
  - Always use the latest firmware version for all devices.
  - Update your user software regularly.
- Protect your systems with a firewall.
  - The firewall protects your infrastructure internally and externally.
  - This allows you to segment your network and isolate entire areas.
- Secure access to your plants via user accounts.
  - If possible, use a central user management system.
  - Create a user account for each user for whom authorization is essential.
  - Always keep user accounts up-to-date and deactivate unused user accounts.
- Secure access to your plants via secure passwords.
  - Change the password of a standard login after the first start.
  - Use strong passwords consisting of upper/lower case, numbers and special characters. The use of a password generator or manager is recommended.
  - Change the passwords according to the rules and guidelines that apply to your application.
- Deactivate inactive communication ports respectively protocols.
  - Only the communication ports that are used for communication should be activated.
  - Only the communication protocols that are used for communication should be activated.
- Consider possible defence strategies when planning and securing the system.
  - The isolation of components alone is not sufficient for comprehensive protection. An overall concept is to be drawn up here, which also provides defensive measures in the event of a cyber attack.
  - Periodically carry out threat assessments. Among others, a comparison is made here between the protective measures taken and those required.
- Limit the use of external storage media.
  - Via external storage media such as USB memory sticks or SD memory cards, malware can get directly into a system while bypassing a firewall.
  - External storage media or their slots must be protected against unauthorized physical access, e.g. by using a lockable control cabinet.
  - Make sure that only authorized persons have access.
  - When disposing of storage media, make sure that they are safely destroyed.
- Use secure access paths such as HTTPS or VPN for remote access to your plant.
- Enable security-related event logging in accordance with the applicable security policy and legal requirements for data protection.

2.9.1.2 Protection of PC-based software

Precautions

Since PC-based software is used for programming, configuration and monitoring, it can also be used to manipulate entire systems or individual components. Particular caution is required here!

- Use user accounts on your PC systems.
  - If possible, use a central user management system.
  - Create a user account for each user for whom authorization is essential.
  - Always keep user accounts up-to-date and deactivate unused user accounts.
- Protect your PC systems with secure passwords.
  - Change the password of a standard login after the first start.
  - Use strong passwords consisting of upper/lower case, numbers and special characters. The use of a password generator or manager is recommended.
  - Change the passwords according to the rules and guidelines that apply to your application.
- Enable security-related event logging in accordance with the applicable security policy and legal requirements for data protection.
- Protect your PC systems by security software.
  - Install virus scanners on your PC systems to identify viruses, trojans and other malware.
  - Install software that can detect phishing attacks and actively prevent them.
- Always keep your software up-to-date.
  - Update your operating system regularly.
  - Update your software regularly.
- Make regular backups and store the media at a safe place.
- Regularly restart your PC systems. Only boot from storage media that are protected against manipulation.
- Use encryption systems on your storage media.
- Perform security assessments regularly to reduce the risk of manipulation.
- Use only data and software from approved sources.
- Uninstall software which is not used.
- Disable unused services.
- Activate a password-protected screen lock on your PC systems.
- Always lock your PC systems as soon as you leave your PC workstation.
- Do not click any links that come from unknown sources. If necessary ask, e.g. on e-mails.
- Use secure access paths such as HTTPS or VPN for remote access to your PC system.

2.9.2 Installation guidelines

General

The installation guidelines contain information about the interference free deployment of a PLC system. There is the description of the ways, interference may occur in your PLC, how you can make sure the electromagnetic compatibility (EMC), and how you manage the isolation.

What does EMC mean?

Electromagnetic compatibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interfered respectively without interfering the environment.

The components are developed for the deployment in industrial environments and meets high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

- Electromagnetic fields (RF coupling)
- Magnetic fields with power frequency
- Bus system
- Power supply
- Protected ground conductor

Depending on the spreading medium (lead bound or lead free) and the distance to the interference cause, interferences to your control occur by means of different coupling mechanisms.

There are:

- galvanic coupling
- capacitive coupling
- inductive coupling
- radiant coupling

Basic rules for EMC

In the most times it is enough to take care of some elementary rules to guarantee the EMC. Please regard the following basic rules when installing your PLC.

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminium parts. Aluminium is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal respectively data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be shielded.
  - Analog lines must be shielded. When transmitting signals with small amplitudes the one sided laying of the isolation may be favourable.
  - Cables for frequency inverters, servo and stepper motors must be shielded.
  - Lay the line isolation extensively on an isolation/protected ground conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected ground conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metallised plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Consider to wire all inductivities with erase links.
  - Please consider luminescent lamps can influence signal lines.
- Create a homogeneous reference potential and ground all electrical operating supplies when possible.
  - Please take care for the targeted employment of the grounding actions. The grounding of the PLC serves for protection and functionality activity.
  - Connect installation parts and cabinets with your PLC in star topology with the isolation/protected ground conductor system. So you avoid ground loops.
  - If there are potential differences between installation parts and cabinets, lay sufficiently dimensioned potential compensation lines.

Isolation of conductors

Electrical, magnetically and electromagnetic interference fields are weakened by means of an isolation, one talks of absorption. Via the isolation rail, that is connected conductive with the rack, interference currents are shunt via cable isolation to the ground. Here you have to make sure, that the connection to the protected ground conductor is impedance-low, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area. Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible.
  - analog signals (some mV respectively µA) are transferred.
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metallised plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected ground conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet.

CAUTION

Please regard at installation!

At potential differences between the grounding points, there may be a compensation current via the isolation connected at both sides.

Remedy: Potential compensation line

2.10 General data for the System SLIO

Conformity and approval		
Conformity		
CE	2014/35/EU	Low Voltage Directive
	2014/30/EU	EMC Directive
RoHS (EU)	2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment
UKCA	2016 No. 1101	Electrical Equipment (Safety) Regulations
	2016 No. 1091	Electromagnetic Compatibility Regulations
RoHS (UK)	2012 No. 3032	Use of Certain Hazardous Substances
Approval		
Certifications	-	Refer to technical data

Protection of persons and device protection		
Type of protection	-	IP20
Electrical isolation		
to the field bus	-	electrically isolated
to the process level	-	electrically isolated
Insulation resistance	-	-
Insulation voltage to reference ground		
Inputs / outputs	-	AC / DC 50V, test voltage AC 500V
Protective measures	-	against short circuit

Environmental conditions to EN 61131-2		
Operation		
Horizontal installation hanging	EN 61131-2	0…+60°C
Horizontal installation lying	EN 61131-2	0…+55°C
Vertical installation	EN 61131-2	0…+50°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 10…95%)
Pollution	EN 61131-2	Degree of pollution 2
Installation altitude max.	-	2000m
Mechanical		
Oscillation	EN 60068-2-6	1g, 9Hz ... 150Hz
Shock	EN 60068-2-27	15g, 11ms

Mounting conditions		
Mounting place	-	In the control cabinet
Mounting position	-	Horizontal and vertical

EMC	Standard		Comment
Emitted interference	EN 61000-6-4		Class A (Industrial area)
Noise immunity zone B	EN 61000-6-2		Industrial area
		EN 61000-4-2	ESD 8kV at air discharge (degree of severity 3), 4kV at contact discharge (degree of severity 2)
		EN 61000-4-3	HF field immunity (casing) 80MHz … 1000MHz, 10V/m, 80% AM (1kHz) 1.4GHz ... 6GHz, 3V/m, 80% AM (1kHz)
		EN 61000-4-6	HF conducted 150kHz … 80MHz, 10V, 80% AM (1kHz)
		EN 61000-4-4	Burst
		EN 61000-4-5	Surge[1]

1) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

2.10.1 Use in difficult operating conditions

Without additional protective measures, the products must not be used in locations with difficult operating conditions; e.g. due to:

- *dust generation*
- *chemically active substances (corrosive vapors or gases)*
- *strong electric or magnetic fields*

3 Hardware description

3.1 Designations

Scanner

The scanner is the central control unit under EtherNet/IP. It assumes the role of the higher-level device that coordinates the communication process and sends commands to the connected adapters.

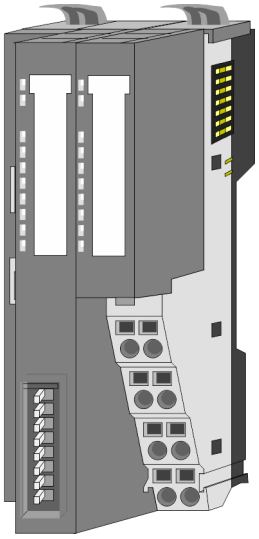
Adapter

The adapter is a lower-level device under EtherNet/IP. This receives the instructions from the scanner and reacts accordingly. 053-1IP01 is an adapter.

3.2 Properties

Features

- Ethernet coupler with EtherNet/IP for max. 64 peripheral modules
- I/O access of up to 8 scanners
- Online configuration via integrated Web server
- X1/X2: RJ45 interface 100BaseTX as switch for connection to the EtherNet/IP network in line, star, ring and tree topology.
- Supports Free Module Mapping (FMM) 72
- Supports Easy Maintenance 72
- Automatic polarity and speed recognition (auto negotiation)
- Automatic recognition of parallel or crossed cable (auto crossover)
- Network LEDs for link/activity
- Status LEDs for Ready and Error

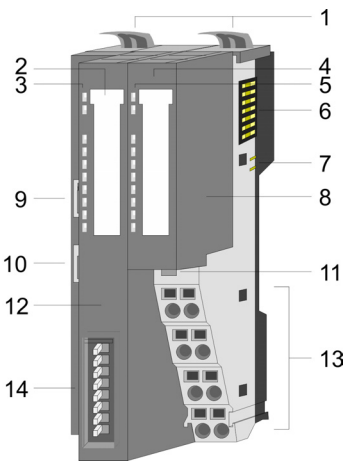


Order data

Type	Order number	Description
IM 053IP	053-1IP01	EtherNet/IP coupler for System SLIO

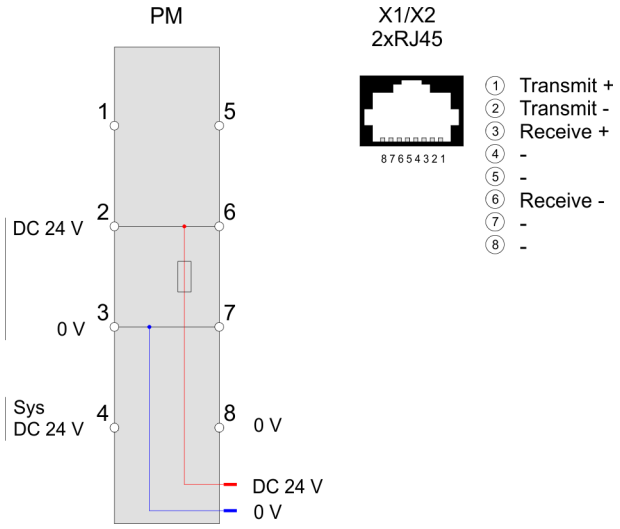
3.3 Structure

053-1IP01

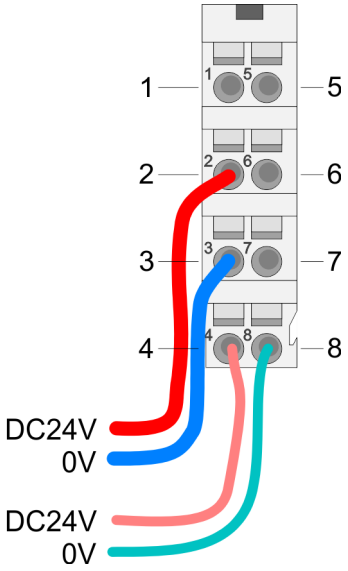


1 Locking lever terminal module
2 Labelling strip bus interface
3 LED status indication bus interface
4 Labelling strip power module
5 LED status indication power module
6 Backplane bus
7 DC 24V power section supply
8 Power module
9 X1: EtherNet/IP interface (switch)
10 X2: EtherNet/IP interface (switch)
11 Unlocking lever power module
12 Bus interface
13 Terminal
14 Address switch

3.3.1 Interfaces



PM - Power module



For wires with a core cross-section of 0.08mm² up to 1.5mm².

Pos.	Function	Type	Description
1	---	---	not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic power supply
5	---	---	not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND for electronic power supply

I: Input

CAUTION

Bus interface and power module of the bus coupler may not be separated!

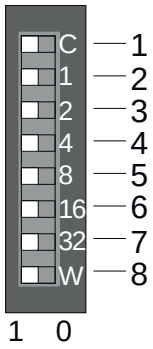
Here you may only exchange the electronic module!

X1/X2: EtherNet/IP interface

8pin RJ45 jack:

- The RJ45 jack serves as interface for connection to an EtherNet/IP network.
- The interface is designed as switch. This allows the direct connection of up to 2 scanners or the direct integration into a line or ring topology.
- To operate an EtherNet/IP network, at least 1 scanner is required.

3.3.2 Address switch



Pos.	Designation	Description
1	C	■ 0 = DHCP off ■ 1 = DHCP on, if switch *'2'* ... *'32'* = 0
	■ With *'C'* = *'0'*: 4th octet (x) of the IP address 192.168.1.x resp. ■ With *'C'* = *'1'*: Offset of the configured IP address a.b.c.d+x	
2	1	$2^0 = 1$
3	2	$2^1 = 2$
4	4	$2^2 = 4$
5	8	$2^3 = 8$
6	16	$2^4 = 16$
7	32	$2^5 = 32$
8	Parameter *'Extend hardware IP addressing to DIP W'* is enabled. 62	
	W	$2^6 = 64$
	Parameter *'Extend hardware IP addressing to DIP W'* is disabled (default).	
	W	■ 0 = Web server is disabled ■ 1 = Web server is enabled

IP address on delivery

On delivery, all switches of the address switch are set to *'0'*. Here the EtherNet/IP coupler has the following IP address data:

- Subnet mask: 255.255.255.0
- IP address: 192.168.1.2

To adjust the IP address data, you have the following options:

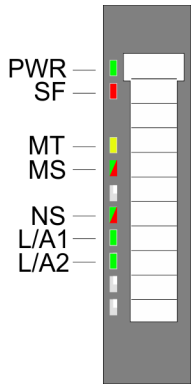
- *'Setting the IP address via address switch'...page 59*
- *'Setting the IP address via web page'...page 60*
- *'Setting the IP address via standard object class'...page 61*

Please note!

'General notes'...page 58

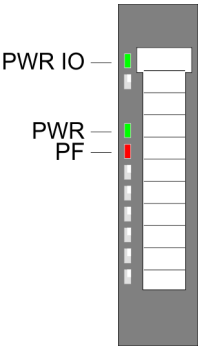
3.3.3 LEDs

Bus interface



LED	Color	Description
PWR	green	The EtherNet/IP coupler is power supplied.
SF	red	Operating mode *Error* mode. Possible cause: ■ Faulty module configuration. Check or delete the stored module configuration. ■ Error on the Ethernet or on the System SLIO bus. Please perform a power cycle! ■ Pending process/diagnostic interrupt, readable via *'Diagnostics and interrupt class 0x65'...page 97*.
	red 1Hz	Operating mode *Error* mode. ■ Unrecoverable error. Please contact our support.
MT	yellow	Operating mode *Commissioning* mode. ■ Maintenance
	yellow 1Hz	Firmware update is in progress. ■ SF and MT LEDs blink alternately.
	yellow 2Hz	DHCP request ongoing.
MS	green	Operating mode *Operational* mode.
	green 1Hz	Operating mode *Idle* mode.
	red	Unrecoverable module error. If after a power cycle the error still exists persists, please contact our support!
	red 1Hz	Recoverable module error (e.g. error in the configuration).
	green/red	Start-up self-test (1 x blinking: green, red).
NS	green	Network status: EtherNet/IP communication: RUN
	green 1Hz	There is no connection to a scanner.
	red 1Hz	Recoverable EtherNet/IP error.
	green/red	Start-up self-test (1 x blinking: green, red).
L/A1/2	green	Network activity (Port A / Port B)
'Operating modes'...page 65		

LEDs power module



PWR IO green	PWR green	PF red	Description
■	X	□	Power section supply OK.
■	■	□	Electronic section supply OK.
X	X	■	Fuse electronic section supply defective.
not relevant: X			

3.4 Technical data

Order no.	053-1IP01
Type	IM 053IP - EtherNet/IP adapter
Module ID	-
Technical data power supply	
Power supply (rated value)	DC 24 V
Power supply (permitted range)	DC 20.4...28.8 V
Reverse polarity protection	✓
Current consumption (no-load operation)	95 mA
Current consumption (rated value)	0.95 A
Inrush current	3.9 A
I^2t	0.14 A^2s
Max. current drain at backplane bus	3 A
Max. current drain load supply	10 A
Power loss	3 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Supply voltage display	green LED
Service Indicator	yellow LED
Group error display	red SF LED
Channel error display	none
Hardware configuration	
Racks, max.	1
Modules per rack, max.	64
Number of digital modules, max.	64
Number of analog modules, max.	64
Communication	
Fieldbus	EtherNet/IP
Type of interface	Ethernet 100 MBit
Connector	2 x RJ45
Topology	Line, Star
Electrically isolated	✓
Number of participants, max.	-

Order no.	053-1IP01
Node addresses	IP V4 address
Transmission speed, min.	100 Mbit/s
Transmission speed, max.	100 Mbit/s
Address range inputs, max.	1 KB
Address range outputs, max.	1 KB
Number of TxPDOs, max.	-
Number of RxPDOs, max.	-
Supported profile	-
Supported transfer cycle	-
Cyclic data size per node	-
Max. Number of nodes	-
Supported communication method	-
Supported command "Cyclic"	-
Supported command "Event driven"	-
Supported command "Message"	-
Datasizes	
Input bytes	-
Output bytes	-
Parameter bytes	-
Diagnostic bytes	-
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	48.5 mm x 109 mm x 76.5 mm
Net weight	160 g
Weight including accessories	160 g
Gross weight	175 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes
UKCA certification	yes
ChinaRoHS certification	yes

4 Deployment

4.1 Basics EtherNet/IP

General

EtherNet/IP (Ethernet Industrial Protocol) is an open standard for industrial networks, which is real-time capable. EtherNet/IP is developed by ODVA (**O**pen **D**eviceNet **V**endor **A**ssociation) and is standardized in IEC 61158. Especially in the U.S. market EtherNet/IP is a standard in communication.

EtherNet/IP

EtherNet/IP bases on TCP/IP. As user protocol CIP (Common Industrial Protocol) is used. CIP bases on a object model , which consists of classes, attributes, methods, states and instances. In contrast to the classical source-destination model, EtherNet/IP uses a modern producer/consumer model that requires data packets with identifier fields for the identification of the data. This approach caters for multiple priority levels, more efficient transfers of I/O data and multiple consumers for the data. A device that has data to send produces the data on the network together with an identifier. All devices requiring data listen for messages. When devices recognize a suitable identifier, they act and consume the respective data.

Via EtherNet/IP 2 types of messages are transported:

Implicit communication - Messages for time-critical and control-oriented data, which are exchanged in a single or multiple cyclic connections. This connection is especially used for I/O data. For this the UDP protocol is used.

Explicit communication - Here multipurpose point-to-point communication paths between two devices can be established. These are used in the configuration of the physical coupler and for diagnostics. This data are transferred with the TCP/IP protocol.

EtherNet/IP in the ISO/OSI layer model

The so called ISO/OSI layer model is generally accepted for the standardization of computer communication. The layer model is based upon seven layers with guidelines for the deployment of hard- and software.

Layer	Function	Protocols	
Layer 7	Application Layer (application)	CIP	
Layer 6	Presentation Layer (presentation)		
Layer 5	Session Layer (session)		
Layer 4	Transport Layer (transport)	TCP	UDP
Layer 3	Network Layer (network)	IP	
Layer 2	Data Link Layer (security)	Ethernet MAC	
Layer 1	Physical Layer (bit transfer)	Ethernet	

Transfer medium

EtherNet/IP uses as transfer medium Ethernet cable. EtherNet/IP can be operated via an already existing company network. To operate an EtherNet/IP network at least 1 scanner is required. The number of EtherNet/IP interface modules (adapters) is only limited by the number of available IP addresses and the performance of the scanner.

Topology

The EtherNet/IP coupler supports the following topologies:

- Line
  - With the linear structure all the communication devices are connected via a linear bus topology.
  - The line structure is realized by switches. A switch is already integrated in the EtherNet/IP coupler.
  - If a communication member fails, the communication across the failed member is not possible.
- Star
  - If you connect communication devices to a switch with more than 2 EtherNet/IP interfaces, you automatically create a star network topology.
  - If an individual EtherNet/IP coupler fails, this does not automatically lead to failure of the entire network, in contrast to other structures.
  - It is only if a switch fails that part of the communication network will fail as well.
- Ring
  - We support DLR (Device Level Ring).
  - In order to increase the availability of a network the both open ends of a linear structure may be connected to a scanner.
  - If a scanner supports the connection to a ring structure, it ensures that the data is transmitted over an intact network connection during network interruption.
- Tree
  - If you interconnect several star structures, you obtain a tree network topology.

Addressing

All stations of the network must be uniquely identified by means of an IP address. Every EtherNet/IP device has addressing facilities.

Terms

Connection	- A connection is required for communication. You can transmit combined data in an *assembly* over a connection.
Assembly	- You can combine input/output data along with configuration data in assembly objects and transfer them over a single connection. Assembly objects are structured into *classes*, *instances* and *attributes*.
Object class	- The objects of a system component are grouped in an object class.
Object instance	- The object instance corresponds to an object within an object class.
Object attributes	- An attribute is the property of an object or an object class.
O	- **O**riginator: Origin station, which is responsible for the connection to the target station.
T	- **T**arget: Target station to which a connection is established.
O→T	- Data direction origin station to target station.
T→O	- Data direction target station to origin station

Application types

Of the Application types *Listen Only*, *Input Only*, *Exclusive Owner* and *Redundant Owner* are supported *Listen Only* and *Exclusive Owner*.

- Listen Only
  - If a connection has an application type of *Listen Only*, it shall be dependent on just sending application connection for its existence.
  - For a scheduled *Listen Only* connection, the FORWARD_OPEN path shall contain a schedule segment.
  - The O→T connection shall use the heartbeat format. A target may accept multiple *listen only* connections which specify the same T→O path.
  - Devices that wish to listen to multicast data without providing configuration may use this application type.
  - If the last connection on which a *Listen Only* connection depends is closed or times out, the target device shall stop sending the T→O data, which will result in the *listen only* connection being timed out by the originator device.
- Exclusive Owner
  - If a connection has an application type of *Exclusive Owner*, it shall not be dependent on any other connection for its existence.
  - For scheduled *Exclusive Owner* connections, the FORWARD_OPEN path shall contain a schedule segment. O→T application data that controls outputs may be present.
  - A target may only accept one *exclusive owner* connection which specifies the same O→T path. In addition, the target may accept *listen only* and *input only* connections that use the same multicast T→O data.
  - The term *connection owner* shall refer to the connection originator whose O→T packets are being consumed by the target object.
  - When an *Exclusive Owner* connection timeout occurs in a target device, the target device shall stop sending the associated T→O data.
  - The T→O data must not be sent even if one or more *input only* connections exist. This requirement exists to signal the originator of the *exclusive owner* connection that the O→T data is no longer being received by the target device.

One possible way to prevent an Exclusive Owner connection timeout in a target device from stopping the T→O production is for the target device to also support production of the T→O data as point to point for the Exclusive Owner connection.

Cyclic time

During the initialisation phase, the EtherNet/IP coupler scans the connected modules on the backplane bus and uses this to determine the fastest possible cycle time for the backplane bus. This cycle time is 1ms by default. If the scan on the backplane bus exceeds a certain period of time due to large I/O areas or when using a line extension, the cycle time of 2ms is used. If the cycle time exceeds the value specified by the higher-level scanner, accesses by the scanner are rejected with the standard message *RPI_VALUE_NOT_ACCEPTABLE (0x0112)*.

EDS file

From Yaskawa there is an EDS (Electronic Data Sheet) file for the EtherNet/IP coupler available. Here the scanner finds all information for establishing a connection with the EtherNet/IP coupler. This file can be found in the *'Download Center'* of www.yaskawa.eu.com at *'EDS 053-1IP01'*. Install the EDS file in your configuration tool. Details on the installation of the EDS file are available from the manual supplied with your configuration tool.

4.2 Basics - IP address and subnet

IP address structure

Exclusively IPv4 is supported. At IPv4 the IP address is a 32bit address that must be unique within the network and consists of 4 numbers that are separated by a dot. Every IP address is a combination of a *Net-ID* and a *Host-ID* and has the following structure: **xxx.xxx.xxx.xxx**

Range: 000.000.000.000 to 255.255.255.255

Net-ID, Host-ID

The **Net**work-ID identifies a network res. a network controller that administrates the network. The Host-ID marks the network connections of a participant (host) to this network.

Subnet mask

The Host-ID can be further divided into a *Subnet-ID* and a new *Host-ID* by using a bit for bit AND assignment with the Subnet mask.

The area of the original Host-ID that is overwritten by 1 of the Subnet mask becomes the Subnet-ID, the rest is the new Host-ID.

Subnet mask	binary all "1"		binary all "0"
IPv4 address	Net-ID	Host-ID	
Subnet mask and IPv4 address	Net-ID	Subnet-ID	new Host-ID

Subnet

A TCP-based communication via point-to-point, hub or switch connection is only possible between stations with identical Network-ID and Subnet-ID! Different area must be connected with a router. The subnet mask allows you to sort the resources following your needs. This means e.g. that every department gets an own subnet and thus does not interfere another department.

Address classes

For IPv4 addresses there are five address formats (class A to class E) that are all of a length of 4byte = 32bit.

Class A	0	Network-ID (1+7bit)	Host-ID (24bit)
Class B	10	Network-ID (2+14bit)	Host-ID (16bit)
Class C	110	Network-ID (3+21bit)	Host-ID (8bit)
Class D	1110	Multicast group	
Class E	11110	Reserved	

The classes A, B and C are used for individual addresses, class D for multicast addresses and class E is reserved for special purposes. The address formats of the 3 classes A, B, C are only differing in the length of Network-ID and Host-ID.

Private IP networks

These addresses can be used as net-ID by several organizations without causing conflicts, for these IP addresses are neither assigned in the Internet nor are routed in the Internet. To build up private IP-Networks within the Internet, RFC1597/1918 reserves the following address areas (Host-ID is underlined):

Class	from IP	to IP	Standard subnet mask
A	10.0.0.0	10.255.255.255	255.0.0.0
B	172.16.0.0	172.31.255.255	255.255.0.0
C	192.168.0.0	192.168.255.255	255.255.255.0

Reserved Host-IDs

Some Host-IDs are reserved for special purposes.

Host-ID = "0"	Identifier of this network, reserved!
Host-ID = maximum (binary complete "1")	Broadcast address of this network

Never choose an IP address with Host-ID=0 or Host-ID=maximum! (e.g. for class B with subnet mask = 255.255.0.0, the "172.16.0.0" is reserved and the "172.16.255.255" is occupied as local broadcast address for this network.)

4.3 General notes

In the following you will find notes which have to be observed when using the address switch and assigning IP address data.

Address switch

- *The IP configuration via the address switch is dominant. A configured IP address is only used if switch 'C' and all address setting switches are set to '0'.*
- *Changes to the address switch are only accepted after a power cycle or an automatic reset. Changes during the normal operation are not recognized!*

IP address

- *With the EtherNet/IP coupler you should always use a static IP address.*
- *Entering an IP address on the web page at the 'IP' tab is only possible if 'BASP'...page 65 command output disable is active, i.e. no scanner is connected or all connected scanners are in idle mode.*
- *The specified IP address data are checked for conformity. In case of an error, the system error message 'POST method could not be executed!' is shown on the web page.*
- *With a network mask > 24 bit and a corresponding offset setting, range violations in other IP groups may not be recognized.*
- *If the range is exceeded when commissioning the EtherNet/IP coupler, the EtherNet/IP coupler will not start. Here, the SF LED lights up.*

Use with DHCP

- *If the EtherNet/IP coupler is configured via a DHCP server, the DHCP server must supply a valid gateway address, otherwise the IP address is not accepted!*
- *When using a DHCP server, make sure that the IP address assignment (lease) in the DHCP server is not changed. Otherwise the EtherNet/IP coupler can not be found by the EtherNet/IP scanner after a restart.*

4.4 Setting the IP address

IP address on delivery

On delivery, all switches of the address switch are set to *'0'*. Here the EtherNet/IP coupler has the following IP address data:

- Subnet mask: 255.255.255.0
- IP address: 192.168.1.2

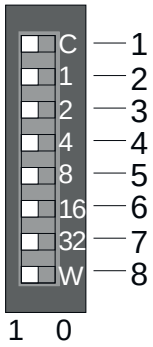
To adjust the IP address data, you have the following options:

- *'Setting the IP address via address switch'...page 59*
- *'Setting the IP address via web page'...page 60*
- *'Setting the IP address via standard object class'...page 61*

Please note!

'General notes'...page 58

4.4.1 Setting the IP address via address switch



Pos.	Designation	Description
1	C	■ 0 = DHCP off ■ 1 = DHCP on, if switch *'2'* ... *'32'* = 0
		■ With *'C'* = *'0'*: 4th octet (x) of the IP address 192.168.1.x resp. ■ With *'C'* = *'1'*: Offset of the configured IP address a.b.c.d+x
2	1	$2^0 = 1$
3	2	$2^1 = 2$
4	4	$2^2 = 4$
5	8	$2^3 = 8$
6	16	$2^4 = 16$
7	32	$2^5 = 32$
8	Parameter *'Extend hardware IP addressing to DIP W'* is enabled. *62*	
	W	$2^6 = 64$
	Parameter *'Extend hardware IP addressing to DIP W'* is disabled (default).	
	W	■ 0 = Web server is disabled ■ 1 = Web server is enabled

Extend addressing for the 4th octet:

- By enabling the *'Extend hardware IP addressing to DIP W'* parameter, you can extend the addressing for the 4th octet to the switch *'W'* by the value $2^6 = 64$.

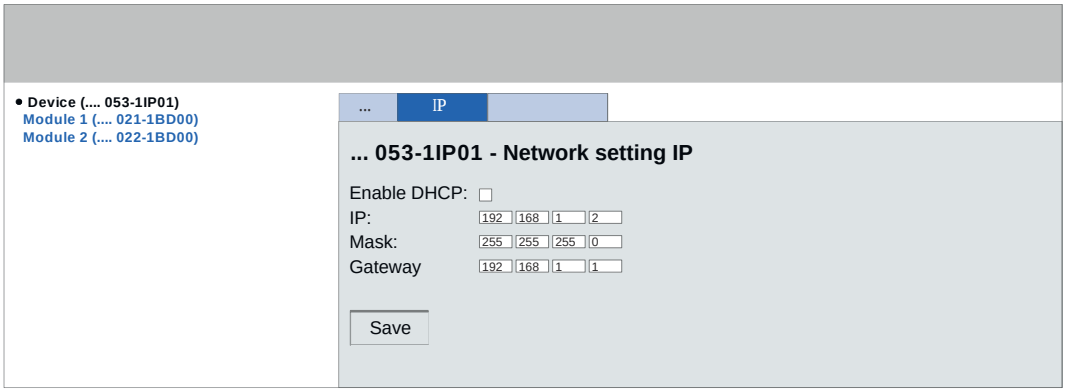
Switch positions

IP address	Switch *'C'*	Switch *'2'...'32'*	Description
DHCP	*'1'*	*'0'* (each)	The IP address is obtained via DHCP.
Configured IP address	*'0'*	*'0'* (each)	If an IP address is configured, the configured IP address is used.
192.168.1.2	*'0'*	*'0'* (each)	If no IP address is configured, the fixed address 192.168.1.2 is used.
192.168.1.x	*'0'*	*'1'* (one at least)	The address 192.168.1.x is used, with the value x for the 4th octet, set via switch *'2'...'32'*.
'DIP base IP address' a.b.c.d+x	*'1'*	*'1'* (one at least)	The configured *'DIP base IP address'* a.b.c.d+x is used, with the value x for the offset, set via switch *'2'...'32'*.

4.4.2 Setting the IP address via web page

Setting the IP address

1. Navigate to *'IP'* tab.



2. Enter the relevant IP address data here. Press [Save] to accept the entries.

> *Please note that input is only possible here if 'BASP'...page 65 command output disable is active, i.e. no scanner is connected or all connected scanners are in idle mode.*

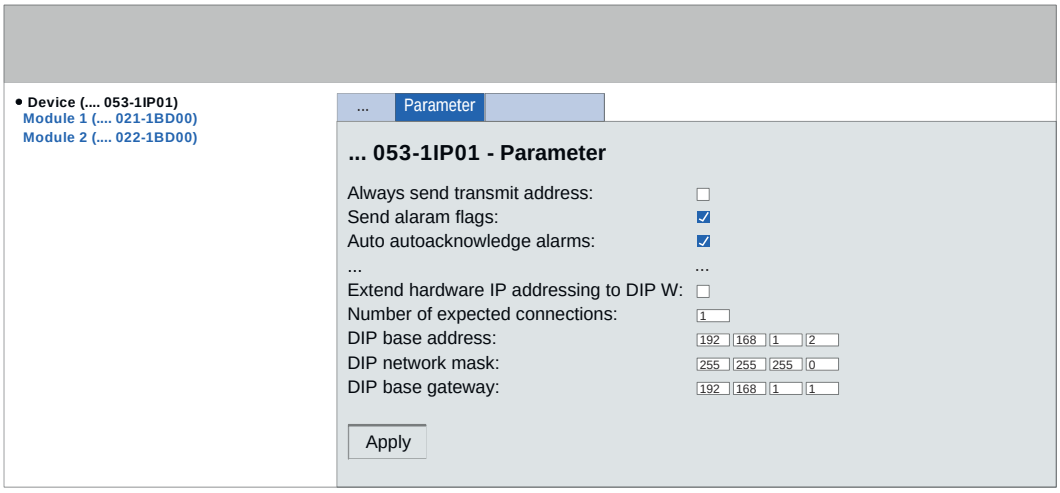
3. Navigate to the *'Configuration'* tab. Save the current configuration remanently in the EtherNet/IP coupler with [Save].
4. On the address switch, set switch *'C'* and all address setting switches to *'0'* and perform a power cycle.

   ➡ The EtherNet/IP coupler is started and is online with the configured IP address.

Setting the base address for the DIP switch setting

The base address for the DIP switch setting is changed via the parameter *'DIP base IP address'* according to the following procedure:

1. Navigate to *'Parameter'* tab.



2. At *'DIP Base ...'* enter the corresponding IP address data. Press [Apply] to accept the entries.
3. Navigate to the *'Configuration'* tab. Save the current configuration remanently in the EtherNet/IP coupler with [Save].
4. On the address switch, set switch *'C'* to *'1'* and an offset x for the 4th octet and perform a power cycle.

   ➡ The EtherNet/IP coupler is started and is online with the configured IP address a.b.c.d+x und offset x.

4.4.3 Setting the IP address via standard object class

Setting the IP address via standard object class

The EtherNet/IP coupler supports the setting of the IP address by means of the standard object class TCP/IP (0xF5).

More information about the standardized EtherNet/IP object classes may be found in the according EtherNet/IP respectively CIP standard of the ODVA (Open DeviceNet Vendor Association).

Setting the base address for the DIP switch setting

The base address for DIP switch settings can be set with *'Coupler class 0x67'...page 99*.

4.5 Parameters

Parameter settings

If there is an active connection between the EtherNet/IP coupler and the scanner, the current state of the parameters is shown during read access. If the EtherNet/IP coupler is not connected, you can see here the parameters stored internally as set points. You have the following options for setting the parameters of the EtherNet/IP coupler:

- Read/write access via the integrated web page in the "Parameters" tab. *'Web server'...page 67*
- Read/write access via *'Coupler class 0x67'...page 99*.
- Write access via FORWARD_OPEN - SetParameters (0x0A). *'SetParameters (0x0A)'...page 92*

Please note that it is not possible to activate the 'Enable free module mapping' parameter via Forward Open.

EtherNet/IP coupler parameters

Field name	Data type	Description	Default
Config	ARRAY of BYTE	Bit 0: Always send transmit address	0
		Bit 1: Enable default values at scanner loss	0
		Bit 2: reserved	0
		Bit 3: Send alarm flags	1
		Bit 4: Auto acknowledge alarms	1
		Bit 5: Enable web server	0
		Bit 6: Enable free module mapping	0
		Bit 7: reserved	0
		Bit 8: Enable default values at link loss Port A	0
		Bit 9: Enable default values at link loss Port B	0
		Bit 10: Extend HW IP addressing to DIP "W"	0
		Bit 15 ... 11:reserved	0 ... 0
ExpectedCons	UINT	Number of expected connections	1
DIP Base - IP	DWORD	DIP base - IP address	192.168.1.0
DIP Base - Mask	DWORD	DIP base - network mask	255.255.255.0
DIP Base - Gateway	DWORD	DIP base - gateway	192.168.1.1
DIP Base - DNS	DWORD	DIP base - domain name server	192.168.1.1

Please note!

'General notes'...page 58

- *'Always send transmit address'*
  - If this parameter is activated, the EtherNet/IP coupler responds in FORWARD_OPEN always with the T→O *IP address*.
  - You should enable this parameter with the deployment of a scanner, which was specified for an older standard.
  - Default: disabled
- *'Send alarm flags'*
  - When enabled, the input process image is preceded by the alarm status byte:
    Bit 0: Hardware interrupt
    Bit 1: Diagnostic interrupt
    Bit 2: Command output disable *'BASP'...page 65*
    Bit 3: Commissioning
    Bit 7 ... 4: reserved
  - Default: enabled
- *'Auto acknowledge alarms'*
  - When enabled, hardware and diagnostic interrupts are automatically acknowledged.
  - Default: enabled
- *'Enable web server'*
  - Enables the embedded web server to access the web page.
  - Default: disabled
- *'Enable free module mapping'*
  - Enables FMM **F**ree **M**odule **M**apping *72*
  - Default: disabled
- *'User stored default values'*
  - This parameter is only taken into account if the *Enable default values ...* parameter is activated!
  - If this parameter is enabled, in the event of an error, the substitute values specified via *'I/O data class 0x64'...page 96* are output.
  - If this parameter is disabled, the output values are kept in case of an error.
  - Default: disabled
- *'Enable default values at scanner loss'*
  - If *'Enable default values at scanner loss'* is activated, in the event of a scanner loss by time-out ...
    ... with enabled *User stored default values* the substitute values specified via *'I/O data class 0x64'...page 96* are output.
    ... with disabled *User stored default values* the output values are kept.
    See also parameter *User stored default values*.
  - If *'Enable default values at scanner loss'* is disabled, in the event of a scanner loss via time-out, *'BASP'...page 65* is activated.
  - Default: disabled
- *'Enable default values at link loss Port A'*
  - If *'Enable default values at link loss Port A'* is activated, when the network plug is pulled at switch port A ...
    ... with enabled *User stored default values* the substitute values specified via *'I/O data class 0x64'...page 96* are output.
    ... with disabled *User stored default values* the output values are kept.
    See also parameter *User stored default values*.
  - If *'Enable default values at scanner loss'* is disabled, in the event of a scanner loss via time-out, command output disable *'BASP'...page 65* is activated.
  - Default: disabled

- *'Enable default values at link loss Port B'*
  - If *'Enable default values at link loss Port B'* is activated, when the network plug is pulled at switch port B ...

    ... with enabled *User stored default values* the substitute values specified via *'I/O data class 0x64'...page 96* are output.

    ... with disabled *User stored default values* the output values are kept.

    See also parameter *User stored default values*.
  - If *'Enable default values at link loss Port B'* is disabled, in the event of a scanner loss via time-out, command output disable *'BASP'...page 65* is activated.
  - Default: disabled

CAUTION

- Please consider that controlling of output values represents a potentially dangerous condition.
- As long as *Commissioning* state is activated, set variables retain their value.
- *Commissioning* state should only be used for test purposes respectively for troubleshooting.

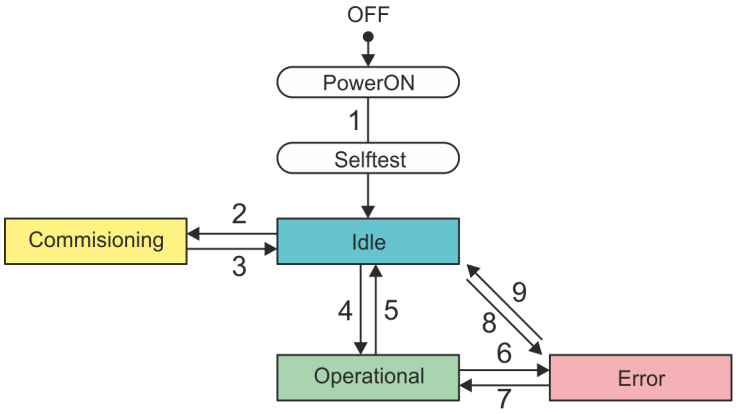
- *'Number of expected connections'*
  - Minimum number of activated connections (scanner, adapter).
  - The adapter switches to *'BASP'...page 65* if the number of expected configured connections is not reached. If 2 is set, *'BASP'...page 65* is not reset until two scanners are connected. The smallest permissible value is 1.
  - Default: 1
- *'Extend hardware IP addressing to DIP W'*
  - By enabling the *'Extend hardware IP addressing to DIP W'* parameter, you can extend the addressing for the 4. octet to the switch *'W'* by the value $2^6 = 64$.
  - Default: disabled
- *'DIP base ...'*
  - *'DIP base - IP address'*: Base address a.b.c.d for the DIP switch setting.
  - *'DIP base - network mask'*: Here you can specify the IP range of the base address.
  - *'DIP base - gateway'*: If available, you can enter a gateway here.
  - *'DIP base - DNS'*: If available, you can enter a domain name server here.
  - As soon as you set switch *'C'* on the address switch and at least one switch for the offset x to *'1'*, after the power cycle the configured *'DIP base IP address'* a.b.c.d+x with the value x for offset is used.

4.6 Operating modes

Overview

The EtherNet/IP coupler can take the following operating modes, which are described below:

- *Commissioning* mode
- *Idle* mode
- *Operational* mode
- *Error* mode



1 OFF → *Idle*: After switching on the power supply and successful self-test.
2 *Idle* → *Commissioning*: By clicking [Activate] on the web page in the *'Configuration'* tab.
3 *Commissioning* → *Idle*: By clicking [Deactivate] on the web page in the *'Configuration'* tab.
4 *Idle* → *Operational*: As soon as a communication connection to at least one scanner exists respectively at least one scanner is in "RUN mode".
5 *Operational* → *Idle*: With removing the last communication connection by the scanner, i.e. as soon as there is no communication connection to a scanner or all the scanners are in *Idle* mode.
6 *Operational* → *Error*: If e.g. the Ethernet cable is removed during operation (Link loss).
7 *Error* → *Operational*: If e.g. a previously pulled Ethernet cable is plugged again while there is a communication connection to a scanner.
8 *Idle* → *Error*: Due to a configuration error e.g. in the FORWARD_OPEN *config assembly*.
9 *Error* → *Idle*: If e.g. a previously pulled Ethernet cable is plugged again while there is no communication connection to a scanner.

Run/Idle header functionality is supported. Here you have the possibility to establish and remove a communication connection by means of the scanner software.

BASP

- BASP (**B**efehls-**A**usgabe-**Sp**erre) means command output disable.
- BASP is enabled.
  - All module outputs are switched off.
  - Parameters can be changed.
- BASP is disabled.
  - Module outputs can be controlled.

Idle mode

- In *Idle* mode the green MS LED blinks.
- *'BASP'...page 65* is enabled.
- After switching on the power supply and successful self-test, an automatic change to the *Idle* mode takes place.
- The EtherNet/IP coupler is idle and waiting for scanner connections.
- Parametrization via the web page in the *'Parameter'* tab of the selected module is possible.
- Only in *Idle* mode a firmware update can be performed. The update is done via the web page in the *'Firmware'* tab.

Commissioning mode

- In *Commissioning* mode the yellow MT LED is on
- *'BASP'...page 65* is disabled.
- You can access the *Commissioning* mode by clicking [Activate] on the web page in *'Tab: 'Configuration''...page 70*.
- The attempt to connect to a scanner is prevented and error 0x0041 is reported.
- Set outputs via the web page in the *'Data'* tab of the selected module is possible.

CAUTION

- Please consider that controlling of output values represents a potentially dangerous condition.
- As long as *Commissioning* state is activated, set variables retain their value.
- *Commissioning* state should only be used for test purposes respectively for troubleshooting.

Operational mode

- In *Operational* mode, the green MS LED is on.
- *'BASP'...page 65* is disabled.
- As soon as at least one scanner establishes a communication connection to the EtherNet/IP coupler, it switches to the *Operational* mode.
- The coupler copies the output data received from the scanners to its outputs and forwards the input values to the scanners.

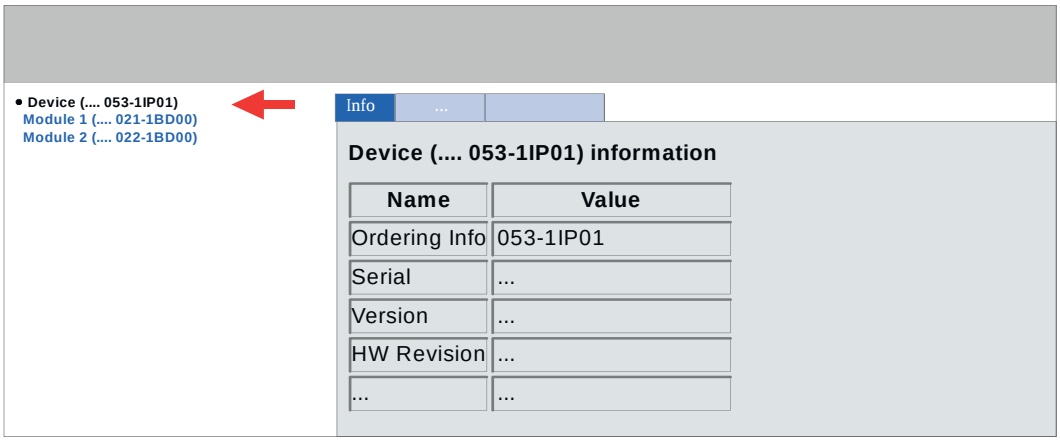
Error mode

- In *Error* mode the red SF LED is on. If the error can not be fixed, the red SF LED blinks.
- *'BASP'...page 65* is enabled.
- Examples of switching to the *Error* mode:
  - Faulty module configuration. Check or delete the stored module configuration.
  - Configuration error in the FORWARD_OPEN *Config Assembly*.

4.7 Web server

Activate web server

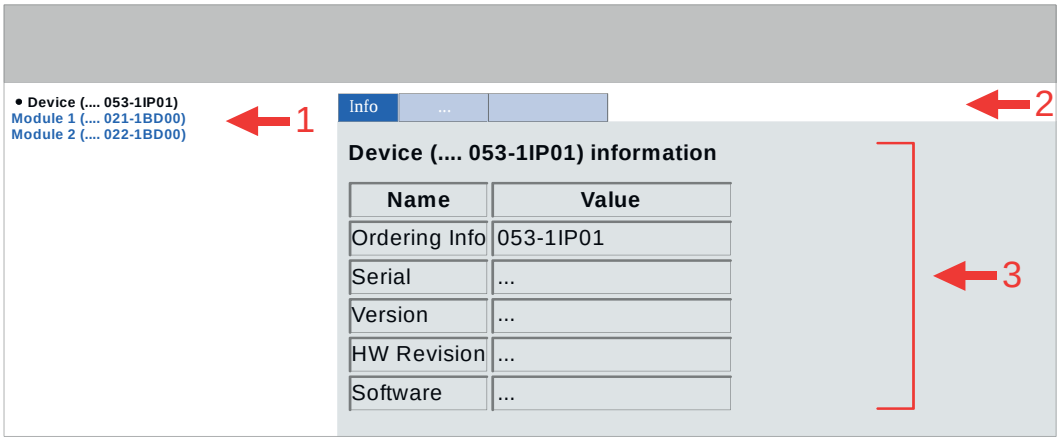
1. On delivery, the web server is deactivated. Activate it by setting the *'W'* switch to *'1'*. *'Address switch'...page 50*
2. Perform a power cycle.
   ➡ The web server is activated and the website can be reached via the set IP address (default: 192.168.1.2).
3. Connect via Ethernet and go to the EtherNet/IP coupler web page.
   ➡ The web page is opened and the information page of the EtherNet/IP coupler is shown.



Structure of the web page

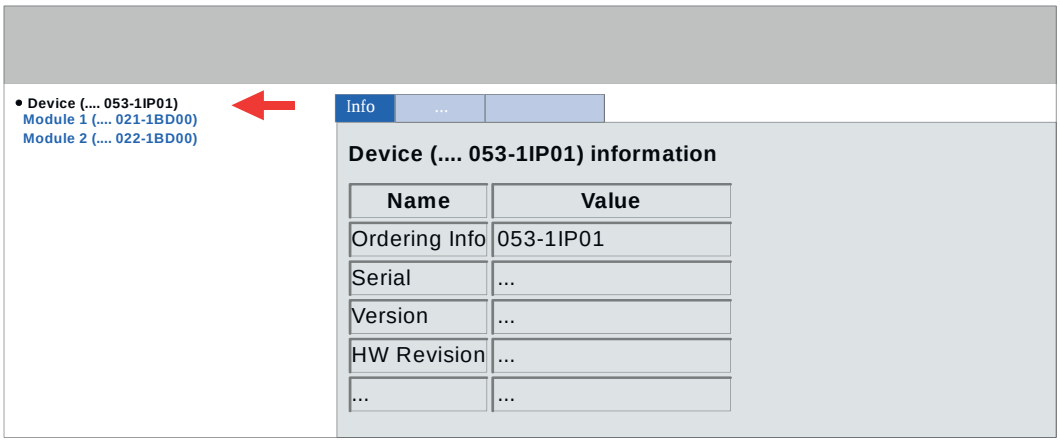
The web page is built dynamically and depends on the number of modules, which are connected to the EtherNet/IP coupler. For fast diagnostic missing or incorrectly configured modules are shown after updating the web page in the module list in red.

- *Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the EtherNet/IP coupler and so are not listed and considered during slot allocation.*
- *Further within EtherNet/IP the slots are designated as 'EtherNet/IP-Slot'. The counting always begins with 1.*



1 Module list: EtherNet / IP couplers and System SLIO modules in installed order
2 Functions for the module, which is selected in the *module list*
3 Information respectively input field for the according function

Web page with selected EtherNet/IP coupler



Tab: *'Info'*

Here are order no., Serial no. and the version of the firmware and hardware of the EtherNet/IP coupler are listed.

Tab: *'Data'*

The size of the process output and process input image is shown here. The size specifications can be used when using dynamic assemblies. *101*

> *If the 'Send alarm flags' parameter is activated, 1 byte must be added.*

Tab: *'Parameter'*

The parameters currently active in the module are shown here. These can be parameters stored via web configuration or parameters that were transmitted by the scanner via e.g. FORWARD_OPEN telegram.

'Parameters'...page 62

'Deployment of FORWARD_OPEN'...page 89

Tab: *'Diagnosis'*

Server events that occur during processing are shown in the *'Diagnosis'* tab. The diagnosis is not stored remanently and is lost after a reset or a restart. *'Diagnostics data'...page 83*

Tab: *'Security'*

You can secure all functions of the web page for write access to the EtherNet/IP coupler with a password query.

Tab: *'IP'*

Here you can enter IP address data for the EtherNet/IP coupler. Only if the bus is in *'BASP'...page 65*, an input is possible, i.e. no scanner is connected or every connected scanner is in *Idle* mode. Otherwise the input fields are de-activated but the settings are shown. You get valid IP address parameters from your system administrator. Directly after entering the IP address will be accepted; the web page can now only be reached via the new IP address. *'Setting the IP address'...page 59*

Tab: *'Firmware'*

CAUTION

- When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the IM 053-1IP01, for example if the voltage supply is interrupted during transfer or if the firmware file is defective. In this case, please contact the Yaskawa support!
- Please regard that the version of the update firmware has to be different from the existing firmware otherwise no update is executed.

Please note that a firmware update is only possible if no active connection to the Scanner is established.

1. You can find current firmware versions in the *'Download Center'* of www.yaskawa.eu.com at *'Firmware [Product]'*.
2. Select the Px000325.pkg file for download and load it into your working directory.
3. On the web page click at *'Firmware'*.
4. Navigate to your work directory and load the file Px000325.pkg to the IM 053-1IP01.
   ➡ After the package has been completely transferred to the IM 053-1IP01, the firmware update starts automatically. Here the SF and MT LEDs blink alternately.

   During this process, the IM 053-1IP01 must never be disconnected from the power supply!
5. When the firmware update of the IM 053-1IP01 is finished, all the red LEDs are switched on and the coupler is restarted.
   ➡ After the start-up, the coupler is online with the new firmware.

Open Source license information

'Open Source Software License Information' is optionally shown if open source software is used in the firmware. By clicking [Download] you can view the corresponding license information and download it to your PC.

Tab: *'Configuration'*

In this dialog you can enable or disable the *Commissioning* mode, import the current module configuration of your EtherNet/IP coupler or import a module configuration. With [Delete] you can delete the configuration of all modules in the EtherNet/IP coupler.

- *'Activate Commissioning mode'*

  Press[Activate] to enter the *Commissioning* mode. *'Operating modes'...page 65*
  - When enabled, the connection with a scanner is prevented and error 0x0041 is reported.
  - *'BASP'...page 65* is disabled i.e. module outputs can be controlled.
  - You can control module outputs and read the inputs via the web page in the *'Data'* tab of the selected module.

  Press [Deactivate] to exit the *Commissioning* mode.
  - *'BASP'...page 65* is enabled, i.e. all module outputs are switched off.
  - The inputs are still read and shown on the web page in the *'Data'* tab.

CAUTION

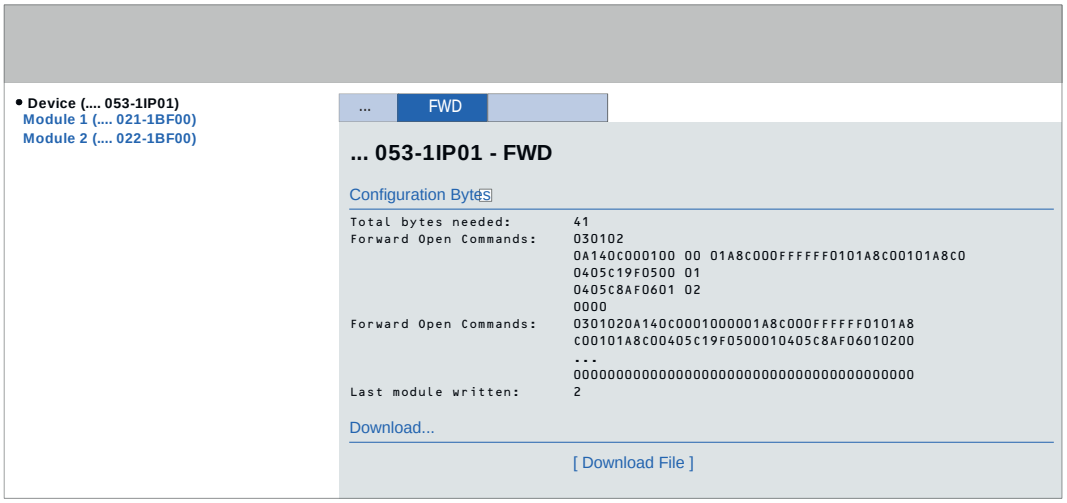
- Please consider that controlling of output values represents a potentially dangerous condition.
- As long as *Commissioning* state is activated, set variables retain their value.
- *Commissioning* state should only be used for test purposes respectively for troubleshooting.

- *'Export station configuration'*
  - With [Apply] a window opens and shows the configuration as XML. Select *'File → Safe as'* and safe the current configuration as XML file.
- *'Import station and modules configuration'*
  - Select with [Search...] the according XML file and load this with [Load]. When loading, EtherNet/IP coupler and module parameters are loaded.
- *'Import modules configuration'*
  - Select with [Search...] the according XML file and load this with [Load]. While loading, only the module parameters are loaded. The parameters of the EtherNet/IP coupler further exist.
- *'Save configuration of all modules'*
  - With [Apply] the current configuration is retentive stored in the EtherNet/IP coupler. If the current module ID deviates from the just configured module ID after a connection establishment, the EtherNet/IP coupler does not go into RUN and shows the error on its web page.
- *'Delete configuration of all modules'*
  - With [Delete] the configuration in the EtherNet/IP coupler may be deleted.

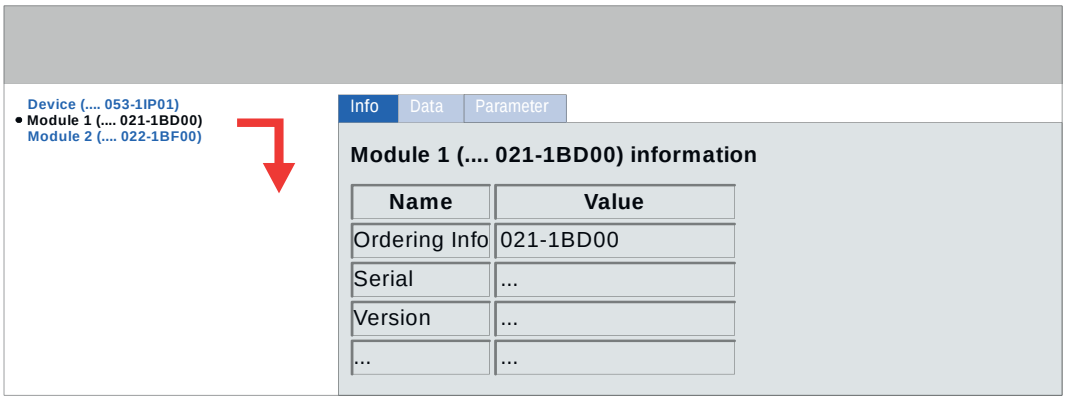
Tab: *'FWD'*

Here you will find a generator that creates a FORWARD_OPEN *Config Assembly* from the current configuration and parametrization of the coupler and the connected modules. The FORWARD_OPEN *Config Assembly* is shown here as a byte sequence and can be downloaded as a file.

'Deployment of FORWARD_OPEN'...page 89



Web page with selected module



Tab: *'Info'*

Here product name, order number, serial number, firmware version and hardware revision number of the according module are listed.

Tab: *'Data'*

At *Data* the states of the inputs respectively outputs are listed. In the *Commissioning* mode you can control outputs here. *'Tab: 'Configuration''...page 70*

Tab: *'Parameter'*

- If available the parameter data of the corresponding module may be shown and possibly be changed. For this, the EtherNet/IP coupler must be in *Idle* mode. *'Operating modes'...page 65*
- With [Apply], the parameters are not written retentively to the module and are active. When the coupler is restarted, the parameters are cleared again.
- To store the parameters permanently you have to save the configuration with *'Configuration → Save current Device Parameters → Module Parameters into remanent memory'* afterwards. *'Tab: 'Configuration''...page 70*
- For external backup, you can export your configuration as an XML file via *'Export station configuration'*. *'Tab: 'Configuration''...page 70*
- In the *'FWD'* tab the parameters are shown as byte sequence.

Tab: *'Diagnosis'*

Here you will receive the corresponding diagnostic messages for the selected module.

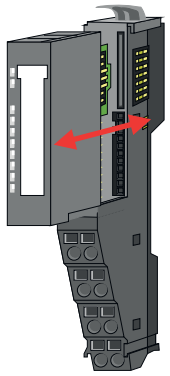
Tab: Firmware (option)

Open Source license information

The tab 'Firmware' with 'Open Source Software License Information' is optionally shown if open source software is used in the firmware of the selected module. By clicking [Download] you can view the corresponding license information and download it to your PC.

4.8 Easy Maintenance

Behavior



Easy Maintenance means the support for adding and removing electronic modules during operation without having to restart the system. This allows you to replace a defective electronic module without switching off the system. The behavior is as follows when the bus cable is plugged in, the IM 053-1IP01 is connected to a scanner and is in *operational mode*:

- As soon as an electronic module is removed, the IM 053-1IP01 recognizes this, automatically switches to maintenance mode, activates *'BASP'...page 65* and reports a diagnostics interrupt. Otherwise the process communication continues.
- By re-plugging a compatible electronic module, the maintenance mode is left again.

Please always replace only one electronic module in your configuration.

4.9 Free Module Mapping (FMM)

4.9.1 Overview

FMM

- With FMM you can use the IM 053IP with different hardware variants without adapting your user program. You only have to adapt the FMM configuration in the IM 053IP when configuring the hardware variants.
- The FFM configuration is adjusted with the object *'FFM class 0x68'...page 100*.
- After activating FMM, for example via the web page and with correct configuration, the system behaves as follows:
  - During start-up, no target/actual difference of the hardware is diagnosed.
  - Output data of missing modules are ignored and not output.
  - Input data of missing modules are set to 0.

Configuration target configuration

The *target configuration* serves as template for the configuration of hardware variants. The target configuration represents a superset of all available hardware variants.

1. Configure your system with a hardware configuration as target configuration and create your user program.
2. Enable FMM. By default, FMM is disabled. To enable it, you have the following options:
   - Enable the parameter *Enable free module mapping* via the web page. *68*
   - Enable the parameter *Enable free module mapping* via FORWARD_OPEN. *90*
   - Enable the parameter *Enable free module mapping* via *'Coupler class 0x67'...page 99*

   ➡ Via an FMM configuration, you can configure a hardware variant based on the target configuration.

FMM configuration for hardware variant

To configure a hardware variant, a FMM configuration is to be done.

1. Convert your system to the intended actual configuration. Here you have the following possibilities:
   - Modules of the target configuration can be placed on the slots of the actual configuration in any order.
   - Modules of the target configuration may be missing in the actual configuration.
   - Individual slots of the target configuration can be disabled, on which modules are located in the actual configuration.
2. Adapt the FMM configuration to the intended hardware variant (actual configuration). A corresponding FMM value is to be specified via object *'FFM class 0x68'...page 100* for each slot.
3. Save the FMM configuration in a block via the service 0x02 *Set Attributes All*.

   ➡ The configuration is retentively stored in the IM 053IP, but not sent to the IM 053IP, when the connection is established by the scanner.
4. A changed configuration only becomes active if it is detected by the scanner. Disconnect the active connection to the scanner in *Idle* mode or request via *'Coupler class 0x67'...page 99* and Attribute ID: 0x6C *ForceConnectionAbort* the abort of all connections.
5. Reconnect to the scanner.

   ➡ The scanner recognizes the new actual configuration. Your system is now ready for operation. An additional adaptation of your PLC program is not required.

4.9.2 Examples

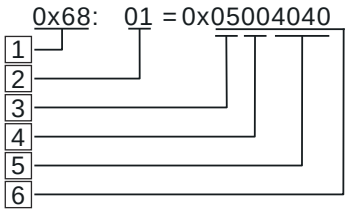
4.9.2.1 Target configuration

Determination of I/O_{target}

The *target configuration* serves as template for the configuration of hardware variants. It represents a superset of all available hardware variants. For the FMM configuration, you must describe the corresponding Attribute ID with an FMM value for each occupied slot of the target configuration. This *FMM* value consists of *Mapping* & 00 & I/O_{target}. The determination of I/O_{target} is shown with the following sample application.

1: Target configuration

Configuration	$Slot_{target}$	Module	Input	Output	I/O_{target}
	1	DI	1byte	-	0100h
	2	DO	-	1byte	0001h
	3	DIO	1byte	1byte	0101h
	4	AI	8byte	-	0800h
	5	AO	-	8byte	0008h
	6	CP	60byte	60byte	3C3Ch
	7	-	-	-	0000h
	...	-	-	-	0000h



1 Object *'FFM class 0x68'...page 100*
2 Attribute ID respectively $Slot_{target}$
3 Mapping respectively $Slot_{actual}$
4 00h (fix)
5 I/O_{target}
6 FMM value

Mapping - *Mapping* corresponds to the hex value of $Slot_{actual}$ i.e. the slot of the actual configuration on which the module of the target configuration is located.

If a module from the target configuration is missing, for *Mapping* the value FFh for "virtual module" is to be used.

If modules of the target configuration are to be ignored, the value 00h is to be used for *Mapping*. In this way, gaps can be projected.

00h - This value is fixed.

I/O_{target} - Number of input and output bytes of the target configuration. This value is identical for the configuration of hardware variants.

High byte: Number of input bytes

Low byte: Number of output bytes

$Slot_{target}$ - The FMM configuration always refers to the slot of the target configuration.

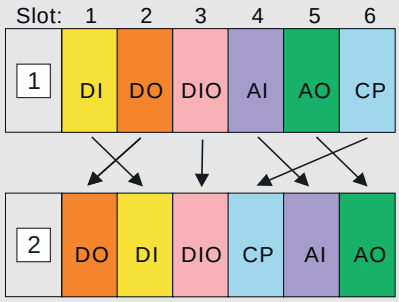
Attribute ID - The Attribute ID for the FMM configuration results from the $Slot_{target}$. This value is identical for the configuration of hardware variants.

For modules with variable IO size, the number of bytes to which the module was configured in the hardware configuration must be specified for I/O_{target}.

4.9.2.2 Examples of hardware variants

Based on the target configuration, the following examples show how to determine the FMM values for the hardware variants.

Variant 1: Same type and number of modules but reversed slots



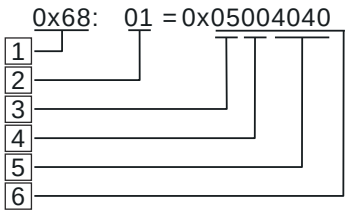
1: Target configuration

2: Actual configuration

$Slot_{target}$	Attribute ID	$Slot_{actual}$	Mapping	I/O_{target}	FMM
1	01	2	**02**h	0100h	0x**02**000100
2	02	1	**01**h	0001h	0x**01**000001
3	03	3	**03**h	0101h	0x**03**000101
4	04	5	**05**h	0800h	0x**05**000800
5	05	6	**06**h	0008h	0x**06**000008
6	06	4	**04**h	3C3Ch	0x**04**003C3C
7	-	-	-	-	0x00000000 or 0x07000000
...					...

Determination of *Mapping* values:

- Attribute ID 01: The module of $Slot_{target}$ = 1 is in the actual configuration at $Slot_{actual}$ = 2 → Mapping = 02h
- Attribute ID 02: The module of $Slot_{target}$ = 2 is in the actual configuration at $Slot_{actual}$ = 1 → Mapping = 01h
- Attribute ID 03: The module of $Slot_{target}$ = 3 is in the actual configuration at $Slot_{actual}$ = 3 → Mapping = 03h
- Attribute ID 04: The module of $Slot_{target}$ = 4 is in the actual configuration at $Slot_{actual}$ = 5 → Mapping = 05h
- Attribute ID 05: The module of $Slot_{target}$ = 5 is in the actual configuration at $Slot_{actual}$ = 6 → Mapping = 06h
- Attribute ID 06: The module of $Slot_{target}$ = 6 is in the actual configuration at $Slot_{actual}$ = 4 → Mapping = 04h



1 Object *'FFM class 0x68'...page 100*
2 Attribute ID respectively $Slot_{target}$
3 Mapping respectively $Slot_{actual}$
4 00h (fix)
5 I/O_{target}
6 FMM value

$Slot_{target}$ - The FMM configuration always refers to the slot of the target configuration.

Attribute ID - The Attribute ID for the FMM configuration results from the $Slot_{target}$. This value is identical for the configuration of hardware variants.

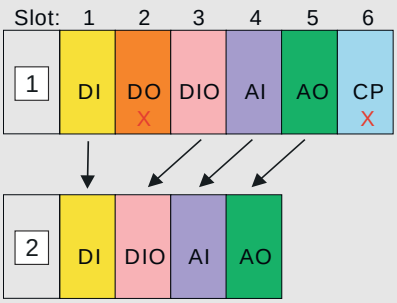
$Slot_{actual}$ - Slot of the actual configuration on which the module of the target configuration is located.

Mapping - For variant 1 *Mapping* corresponds to the hex value of $Slot_{actual}$ i.e. the slot of the actual configuration on which the module of the target configuration is located. *Mapping* must be adapted when configuring the hardware variant.

I/O_{target} - Number of input and output bytes of the target configuration. This value is identical for the configuration of hardware variants.

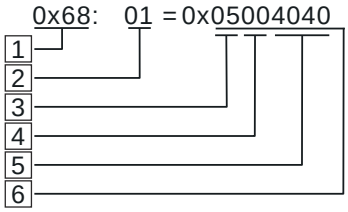
FMM - The value for *FMM* consists of *Mapping* & 00 & I/O_{target}. This value must be specified at *'FFM class 0x68'...page 100* for the corresponding slot.

Variant 2: Reversed slots and modules are missing

Configuration	$Slot_{target}$	Attribute ID	$Slot_{actual}$	Mapping	I/O_{target}	FMM
 1: Target configuration 2: Actual configuration	1	01	1	**01**h	0100h	0x**01**000100
	2	02	-	**FF**h	0001h	0x**FF**000001
	3	03	2	**02**h	0101h	0x**02**000101
	4	04	3	**03**h	0800h	0x**03**000800
	5	05	4	**04**h	0008h	0x**04**000008
	6	06	-	**FF**h	3C3Ch	0x**FF**003C3C

Determination of *Mapping* values:

- Attribute ID 01: The module of $Slot_{target}$ = 1 is in the actual configuration at $Slot_{actual}$ = 1 → Mapping = 01h
- Attribute ID 02: The module of $Slot_{target}$ = 2 is not available in the actual configuration → Mapping = FFh
- Attribute ID 03: The module of $Slot_{target}$ = 3 is in the actual configuration at $Slot_{actual}$ = 2 → Mapping = 02h
- Attribute ID 04: The module of $Slot_{target}$ = 4 is in the actual configuration at $Slot_{actual}$ = 3 → Mapping = 03h
- Attribute ID 05: The module of $Slot_{target}$ = 5 is in the actual configuration at $Slot_{actual}$ = 4 → Mapping = 04h
- Attribute ID 06: The module of $Slot_{target}$ = 6 is not available in the actual configuration → Mapping = FFh



1 Object *'FFM class 0x68'...page 100*
2 Attribute ID respectively $Slot_{target}$
3 Mapping respectively $Slot_{actual}$
4 00h (fix)
5 I/O_{target}
6 FMM value

$Slot_{target}$ - The FMM configuration always refers to the slot of the target configuration.

Attribute ID - The Attribute ID for the FMM configuration results from the $Slot_{target}$. This value is identical for the configuration of hardware variants.

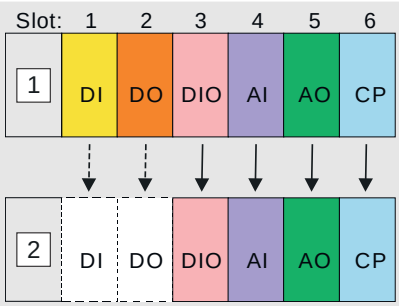
$Slot_{actual}$ - Slot of the actual configuration on which the module of the target configuration is located.

Mapping - For variant 2 *Mapping* corresponds to the hex value of $Slot_{actual}$ i.e. the slot of the actual configuration on which the module of the target configuration is located. If a module from the target configuration is missing, for *Mapping* the value FFh for "virtual module" is to be used.

I/O_{target} - Number of input and output bytes of the target configuration. This value is identical for the configuration of hardware variants.

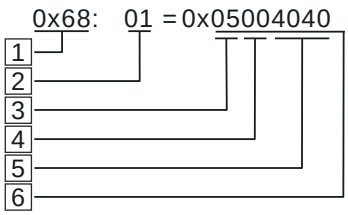
FMM - The value for *FMM* consists of *Mapping* & 00 & I/O_{target}. This value must be specified at *'FFM class 0x68'...page 100* for the corresponding slot.

Variant 3: Modules are ignored

Configuration	$Slot_{target}$	Attribute ID	$Slot_{actual}$	Mapping	I/O_{target}	FMM
 1: Target configuration 2: Actual configuration	1	01	empty	**00**h	0100h	0x**00**000100
	2	02	empty	**00**h	0001h	0x**00**000001
	3	03	3	**03**h	0101h	0x**03**000101
	4	04	4	**04**h	0800h	0x**04**000800
	5	05	5	**05**h	0008h	0x**05**000008
	6	06	6	**06**h	3C3Ch	0x**06**003C3C

Determination of *Mapping* values:

- Attribute ID 01: The module of $Slot_{target}$ = 1 is ignored in the actual configuration (gap) → Mapping = 00h
- Attribute ID 02: The module of $Slot_{target}$ = 2 is ignored in the actual configuration (gap) → Mapping = 00h
- Attribute ID 03: The module of $Slot_{target}$ = 3 is in the actual configuration at $Slot_{actual}$ = 3 → Mapping = 03h
- Attribute ID 04: The module of $Slot_{target}$ = 4 is in the actual configuration at $Slot_{actual}$ = 4 → Mapping = 04h
- Attribute ID 05: The module of $Slot_{target}$ = 5 is in the actual configuration at $Slot_{actual}$ = 5 → Mapping = 05h
- Attribute ID 06: The module of $Slot_{target}$ = 6 is in the actual configuration at $Slot_{actual}$ = 6 → Mapping = 06h



1 Object *'FFM class 0x68'...page 100*
2 Attribute ID respectively $Slot_{target}$
3 Mapping respectively $Slot_{actual}$
4 00h (fix)
5 I/O_{target}
6 FMM value

$Slot_{target}$ - The FMM configuration always refers to the slot of the target configuration.

Attribute ID - The Attribute ID for the FMM configuration results from the $Slot_{target}$. This value is identical for the configuration of hardware variants.

$Slot_{actual}$ - Slot of the actual configuration on which the module of the target configuration is located.

Mapping - For variant 3 *Mapping* corresponds to the hex value of $Slot_{actual}$ i.e. the slot of the actual configuration on which the module of the target configuration is located. If modules of the target configuration are to be ignored, the value 00h is to be used for *Mapping*.

I/O_{target} - Number of input and output bytes of the target configuration. This value is identical for the configuration of hardware variants.

FMM - The value for *FMM* consists of *Mapping* & 00 & I/O_{target}. This value must be specified at *'FFM class 0x68'...page 100* for the corresponding slot.

The presence of gaps in the System SLIO is not allowed! But you can place modules and define them via the configuration as empty slot for the target hardware configuration.

4.10 Accessing the System SLIO

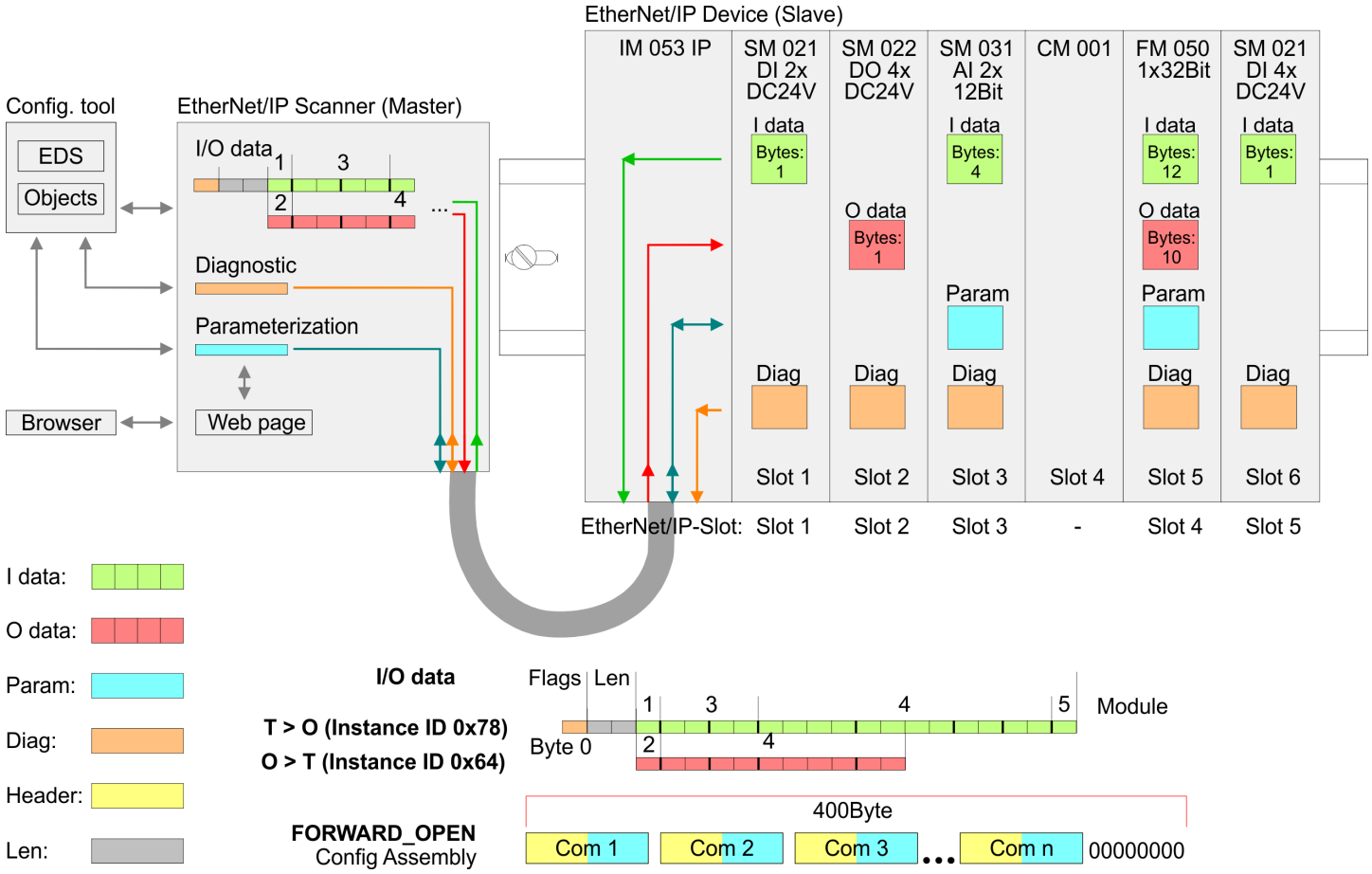
4.10.1 Overview

- The EtherNet/IP coupler can control maximally 64 System SLIO modules.
- A System SLIO module can contain 1 ... 60byte I/O data.
- For the transport of this data stream, the data must be divided into EtherNet/IP packages and encapsulated.
  - Each package starts with the interrupt flags (1byte). With a pending hardware interrupt respectively diagnostics interrupt the according flag is set. *'Diagnostic data'...page 83*
  - Behind the interrupt flags there is the length ModLen located in the data stream followed by the I/O data of the modules in plugged sequence. Information concerning the allocation of the I/O area of a module may be found in the description of the corresponding System SLIO module.

From Yaskawa there is an EDS (Electronic Data Sheet) file for the EtherNet/IP coupler available. This file can be found in the *'Download Center'* of www.yaskawa.eu.com at *'EDS 053-1IP01'*. Install the EDS file in your configuration tool. Details on the installation of the EDS file are available from the manual supplied with your configuration tool.

In the following you will find the description of accessing I/O area and parameter data of the System SLIO via EtherNet/IP. Here *'I stream'* is according to assembly class with Instance-ID 0x78 and *'O stream'* is according to assembly class with instance-ID 0x64. *'EtherNet/IP - Objects'...page 95*

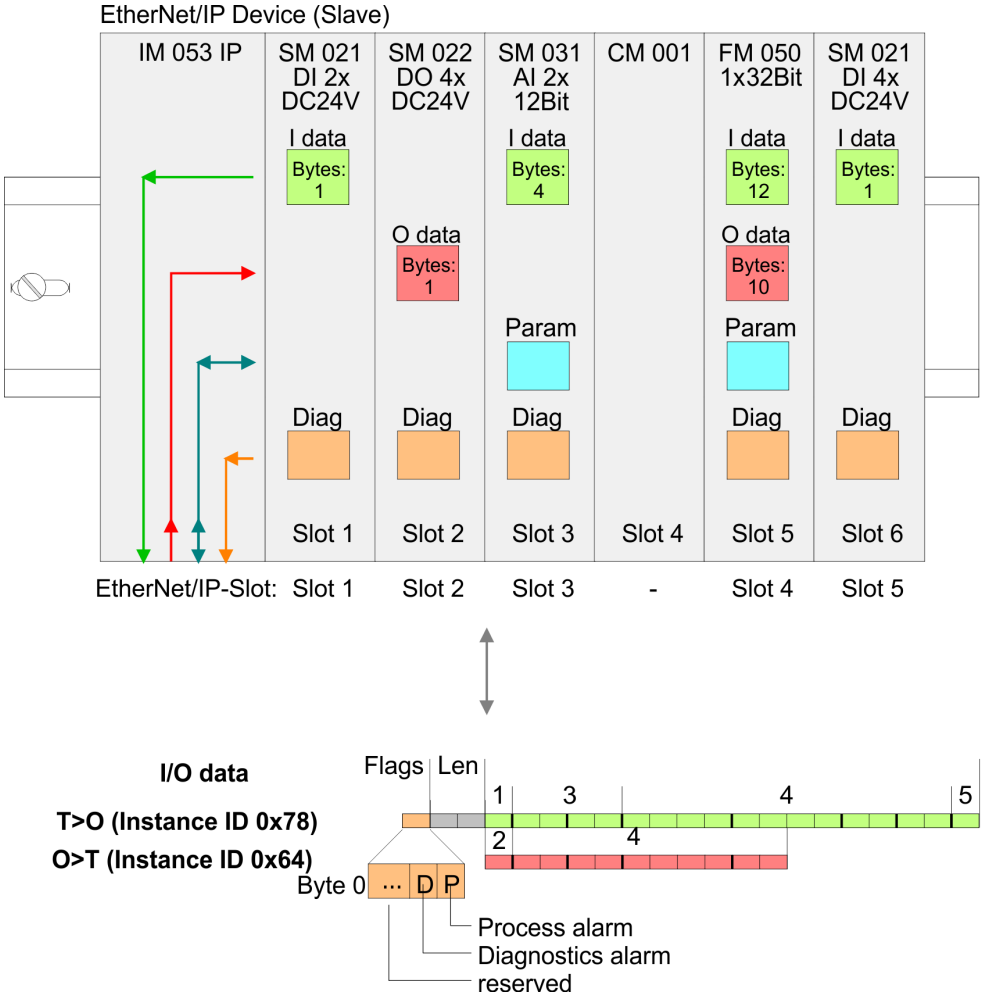
You can start the communication with a *Class1 connection*. This should be a point-to-point connection in both directions. Here the frame size depends on the configured *assembly class*.



- *Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the EtherNet/IP coupler and so are not listed and considered during slot allocation.*
- *Further within EtherNet/IP the slots are designated as 'EtherNet/IP-Slot'. The counting always begins with 1.*

4.10.2 Accessing I/O area

- The EtherNet/IP coupler determines automatically the modules on the System SLIO bus and generates from this the number of input and output bytes.
  - Information concerning the I/O allocation of a module may be found in the corresponding manual.
- The position (offset) of the input respectively output bytes within the input respectively output data results from the order of the modules (EtherNet/IP slot 1 ... 64).
- By means of the base address, which is to be preset in the EtherNet/IP scanner for the bus coupler and the offset you may access the input or output data of a module.
- During operation the EtherNet/IP coupler cyclically reads the input data of the peripheral modules and serves for the last state of these data for the EtherNet/IP scanner. Output data, which the EtherNet/IP coupler has received from the EtherNet/IP scanner, were directly transferred to the modules, as soon as they were received.



Structure of the Input data

Instance ID: 0x78 ... 0x7B - Input values; fixed size

Byte	Structure	Field name	Data type	Field value
0[1]	Header	AlarmFlags	USINT	Interrupt and diagnostics flags An interrupt is pending when the corresponding bit is set. ■ Bit 0: Process alarm ■ Bit 1: Diagnostic alarm ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
1		ModLen	UINT	Length of the module data
3	Module packages	ModData	ARRAY of USINT	Module data (see manual System SLIO module)

1) If the *'Send alarm flags'* parameter is deactivated, this line is hidden.

Instance ID: 0x7C ... 0x7F - Input values; dynamic size

Byte	Structure	Field name	Data type	Field value
0[1]	Header	AlarmFlags	USINT	Interrupt and diagnostics flags An interrupt is pending when the corresponding bit is set. ■ Bit 0: Process alarm ■ Bit 1: Diagnostic alarm ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
1	Module packages	ModData	ARRAY of USINT	Module data (see manual System SLIO module)

1) If the *'Send alarm flags'* parameter is deactivated, this line is hidden.

Instance ID: 0x80 - Input values; only DI modules

Byte	Structure	Field name	Data type	Field value
0[1]	Header	AlarmFlags	USINT	Interrupt and diagnostics flags An interrupt is pending when the corresponding bit is set. ■ Bit 0: Process alarm ■ Bit 1: Diagnostic alarm ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
1		ModLen	UINT	Length of the module data
3	Module packages	ModData	ARRAY of USINT	Module data (see manual System SLIO module)

1) If the *'Send alarm flags'* parameter is deactivated, this line is hidden.

Instance ID: 0x81 - Input values; only AI modules

Byte	Structure	Field name	Data type	Field value
0[1]	Header	AlarmFlags	USINT	Interrupt and diagnostics flags An interrupt is pending when the corresponding bit is set. ■ Bit 0: Process alarm ■ Bit 1: Diagnostic alarm ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
1		ModLen	UINT	Length of the module data
3	Module packages	ModData	ARRAY of USINT	Module data (see manual System SLIO module)

1) If the *'Send alarm flags'* parameter is deactivated, this line is hidden.

Instance ID: 0x82 - Input values; only special modules

Byte	Structure	Field name	Data type	Field value
0[1]	Header	AlarmFlags	USINT	Interrupt and diagnostics flags An interrupt is pending when the corresponding bit is set. ■ Bit 0: Process alarm ■ Bit 1: Diagnostic alarm ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
1		ModLen	UINT	Length of the module data
3	Module packages	ModData	ARRAY of USINT	Module data (see manual System SLIO module)

1) If the *'Send alarm flags'* parameter is deactivated, this line is hidden.

Behavior of the outputs

- Interrupting a connection
  - If the connection is aborted or the Ethernet connection is disconnected with disabled parameter *Enable default values*, BASP is activated.
  - If the connection is aborted or the Ethernet connection is disconnected with enabled parameter *Enable default values*, the last written output value is retained.
- PowerOn
  - With PowerOn BASP is active.
  - When the IM 053-1IP01 is power supplied, PWR LED gets on.

BASP - BASP (**B**efehls-**A**usgabe-**Sp**erre) means command output disable.

If BASP is active, all module outputs are switched off and the inputs are not read.

4.10.3 Accessing the parameter data

For the parametrization of the System SLIO modules you have the following possibilities:

- Parametrization via web page
  'Web server'...page 67
- Parametrization via FORWARD_OPEN (object 0x66 - attribute ID 0x64)
  'Deployment of FORWARD_OPEN'...page 89
  'Module class 0x66'...page 98

Parametrization via the web page

When the coupler is switched on (PowerOn), parameterizable modules can be operated with their default parameters. If you want to change parameters the EtherNet/IP coupler respectively the corresponding modules may be parameterized via the integrated web page. Here by means of the corresponding *EtherNet/IP-Slot* parameter may be viewed and changed.

Parametrization via *'FORDWARD_OPEN'*

With this method the EtherNet/IP scanner passes in the FORDWARD_OPEN call a *config assembly* to the EtherNet/IP coupler. The *config assembly* is a collection of commands and has a fixed size of 400byte.

Here the corresponding System SLIO module can be parameterized with the command *SetModParam* by specifying the *EtherNet/IP-Slot* at *'Pos'* and the module parameters at *'Param'*. *'Deployment of FORWARD_OPEN'...page 89*.

A description of the parameters of the modules can be found in the manual for the corresponding module System SLIO module.

4.11 Diagnostic data

Diagnostics behavior

- As soon as a System SLIO module reports an interrupt via the backplane bus, this is automatically recognized by the EtherNet/IP coupler.
- The EtherNet/IP coupler informs the EtherNet/IP scanner by setting the corresponding interrupt bit in the I/O data stream. In the EtherNet/IP scanner you can react to the interrupt accordingly.
- You can specifically access diagnostic data via the web page *'Web server'...page 67* or by EtherNet/IP objects. *'Product specific EtherNet/IP objects'...page 96*

The following error types are distinguished in the diagnostics:

- Error on the System SLIO backplane bus
  - The command output disable *'BASP'...page 65* is set.
  - The outputs are set to *'0'*.
- Internal system error
  - The command output disable *'BASP'...page 65* is set.
  - The outputs are set to *'0'*.
- Connection error
  - With the parameter *'Enable default values at link loss Port x'* enabled, the last active outputs remain active.
  - When the parameter *'Enable default values at link loss Port x'* is disabled, the command output disable *'BASP'...page 65* is set and the outputs are set to *'0'*.
- Scanner timeout
  - With the parameter *'Enable default values at scanner loss'* enabled, the last active outputs remain active.
  - When the parameter *'Enable default values at scanner loss'* is disabled, the command output disable *'BASP'...page 65* is set and the outputs are set to *'0'*.

Diagnostics data

Event ID	Description	Parameter A	Parameter B
0x00001001	General error on the backplane bus. Check the contacting of your modules on the backplane bus.		
0x00001002	Scan error on backplane bus, check the contacting of your modules on the backplane bus.		
0x00001003	Initialisation error on backplane bus, check the contacting of your modules on the backplane bus.		
0x00002001	Internal error[1]		
0x00002002	Internal error[1]		
0x00002003	An IP address was assigned via DHCP.		
0x00002004	Internal error[1]		
0x00002005	Internal error[1]		
0x00002006	Internal error[1]		
0x00002007	The DHCP lease has expired.		
0x00002008	Internal error[1]		
0x00004001	Internal error[1]		
0x00004002	Internal error[1]		
0x00004003	Firmware update was finished without error.		
0x00004004	An error occurred during the firmware update.		
0x00004005	The coupler was restarted (warm start).		
0x00004006	Internal error[1]		

Event ID	Description	Parameter A	Parameter B
0x00004007	The firmware signature is incorrect.		
0x00004008	Internal error[1]		
0x00004009	Internal error[1]	Internal code	
0x0000400A	Internal error[1]	Internal code	
0x0000400B	Internal error[1]		
...			
0x10000001	A coupler restart was performed.	Reason for restart: 0x01: Internal code (watchdog) 0x02: Restart was requested 0x03: Internal code (Mx) 0x04: Internal code (firmware)	
0x10000002	System SLIO module reports an error.	Slot	
0x10000003	The plugged System SLIO module does not correspond to the configuration.	Slot	
0x10000004	Error in the configuration.		
0x10000005	DHCP error		
0x10000006	Error on the System SLIO backplane bus.	Slot	Internal code (SlioLib)
0x10000007	Error when writing the configuration[1].	Internal code	
0x10000008	Error when reading the configuration[1].	Internal code	
0x10000009	System SLIO module was removed.	Slot	
0x1000000A	System SLIO module was plugged.	Slot	
0x1000000B	The specified IP address is incorrect.	Internal code (BSD)	
0x1000000C	Error during command execution.		
0x1000000D	Parameter could not be written.		
0x1000000E	Error in FORWARD_OPEN.	*'Product specific error codes'...page 86*	Position in byte order
0x1000000F	Error when deleting the configuration.		
0x10000010	Attribute was read.		
0x10000011	Attribute was written.		
0x10000012	Error during firmware update. Check the firmware package used. If the error persists, please contact our support.	Internal code	
0x10000013	System SLIO error in the configuration.	*'Product specific error codes'...page 86*	
...			

Event ID	Description	Parameter A	Parameter B
0x10000080	Status message	0x01: IP address was set. 0x02: Configuration was reset. 0x03: Web server was not started. 0x05: Configuration was deleted.	
		0x04: State maintenance mode.	Status: 0x01: on 0x02: off
		0x05: Configuration was deleted.	
		0x06: Status commissioning mode.	Status: 0x01: on 0x02: off
		0x07: Coupler was reset.	Reset type: 0 = Restart (warm start): 1 = Factory reset (delivery state) 2 = Reset the configuration (without IP address)
		0x08: The connection was terminated by the coupler.	Internal code
		0x09: Configuration was stored.	
		0x0A: The coupler was restarted.	
		0x0B: TCP connection was terminated.	Reason: 0x00: no error (default) 0x01: Establishing a connection 0x02: Interrupting a connection 0x03: Connection timeout 0x04: Connection idle 0x05: Lease has expired. 0x06: Connection abort port A 0x07: Connection abort port B 0x08: Socket error 0x09: Lack of storage space 0x0A: Range overflow IP address
...			
0x100000FF	Internal error[1]	Internal code	Internal code (option)

1) Check the contacting of your modules on the backplane bus. Restart your system. If the error persists even after repeated restarts, reset the coupler to the factory settings. If the error persists, please contact our support.

Product specific error codes

Error	Description
0x0000	Command has been executed without error.
0x0001	Configuration in FORWARD_OPEN could not be read.
0x0002	Unknown command in *config assembly*.
0x0003	Length in *config assembly* is not correct.
0x0004	Data missing for the command.
0x0005	*SetIOStartEnd* twice in *config assembly*.
0x0006	*SetModCnt* twice in *config assembly*.
0x0007	*SetModCnt* overflows max available number of modules.
0x0008	*SetModType* overflows max available number of modules.
0x0009	*SetModType* for same module twice in *config assembly*.
0x000A	*NoFwdOpenCfg* twice in *config assembly*.
0x000B	*IgnoreWebCfg* twice in *config assembly*.
0x000C	*UseExistingCfg* twice in *config assembly*.
0x000D	*SetModCnt* underflows min. available modules.
0x000E	*SetModCnt* doesn't match EtherNet/IP coupler module count.
0x000F	System SLIO bus could not return the module ID.
0x0010	*SetModType* found wrong-plugged module.
0x0011	*DeleteWebCfg* twice in *config assembly*.
0x0012	This function is not supported.
0x0013	*SlioModGetParameterLength* is wrong in *SetModParam*.
0x0014	The length of *SetModParam* differs to the expected length of the module.
0x0015	*SlioModSetParameters* faulty in *SetModParam*.
0x0016	*SetModParam* is greater than the max. possible number of modules.
0x0017	*SetIOStartEnd* could not find assembly information.
0x0018	*SetIOStartEnd*: The assembly has the wrong type.
0x0019	*SetIOStartEnd* is behind the available data length of the module.
0x001A	Initialization: *ClientStart* was faulty.
0x001B	Initialization: Assembly with input data could not be added.
0x001C	Initialization: Assembly with output data could not be added.
0x001D	Initialization: *Config assembly* could not be added.
0x001E	Initialization: Identity object could not be initialized.
0x001F	Initialization: Identity object could not be set.
0x0020	*SetIOStart*: Input assembly out of range.
0x0021	*SetIOStart*: Output assembly out of range.
0x0022	*SetModTypeRange*: There were more modules configured as exist.
0x0023	*SetModTypeRange*: A wrong plugged module was found.
0x0024	Initialization: Initialization could not be executed.

Error	Description
0x0025	Initialization: Could not add diagnosis assembly.
0x0026	Initialization: Could not add extended diagnosis assembly.
0x0027	Initialization: Could not add diagnosis and input assembly.
0x0028	Initialization: Could not add extended diagnosis and input assembly.
0x0029	Initialization: Bus scan failed.
0x002A	Initialization: Clear module errors failed.
0x002B	Initialization: Process image preparation failed.
0x002C	Initialization: Delete *Webconfig* failed.
0x002D	*SetModParam* under flows min module address of 1.
0x002E	Initialization: Could not add dynamic input assembly.
0x002F	Initialization: Could not add dynamic output assembly.
0x0030	*SetIOStart*: Input assembly overlapping range.
0x0031	*SetIOStart*: Output assembly overlapping range.
0x0032	*SetIOStart*: Input assembly out of range.
0x0033	*SetIOStart*: Output assembly out of range.
0x0034	Parameters: The specified IP addresses do not match.
0x0035	Module configuration doesn't exist, was deleted.
0x0036	Module configuration could not be written.
0x0037	Number of connections is to small, must be minimum 1.
0x0038	Set module parameter twice.
0x0039	Set parameter IM 053-1IP01 twice.
0x0040	reserved
0x0041	Attempted connection setup in *Commissioning* mode.
0x0042	FMM could not be activated.
0x0043	DHCP error
0x0044	General network error
0x0045	Current module configuration differs from expected.
0xFFFF	Internal error

4.12 Firmware update

CAUTION

- When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the IM 053-1IP01, for example if the voltage supply is interrupted during transfer or if the firmware file is defective. In this case, please contact the Yaskawa support!
- Please regard that the version of the update firmware has to be different from the existing firmware otherwise no update is executed.

Please note that a firmware update is only possible if no active connection to the Scanner is established.

You can only update the firmware via the *'Firmware'* tab on the web page.

'Tab: 'Firmware''...page 69

4.13 Replacement EtherNet/IP 053-1IP00 by 053-1IP01

The EtherNet/IP coupler 053-1IP01 is not compatible with the 053-1IP00.

- A direct device replacement without adjustments is not possible.
- Replacing the 053-1IP00 by 053-1IP01 an adjustment of access to the I/O area (input/output assembly) is required.

Settings

Description	053-1IP00	053-1IP01
Device profile	0x2B	0x0C
Output assembly		
Fixed size	0x0A - 0x13	0x64 - 0x67
Dynamic size	0x32 - 0x3B	0x68 - 0x6B
Input assembly		
Fixed size	0x14 - 0x1D	0x78 - 0x7B
Dynamic size	0x3C - 0x45	0x7C - 0x7F

The 053-1IP01 has the following additional properties:

- X1/X2: RJ45 interface 100BaseTX as switch for connection to EtherNet/IP network in line, star, ring and tree topology.
- Supports *Free Module Mapping* (FMM) 72
- Supports Easy Maintenance 72

4.14 Deployment of FORWARD_OPEN

FORWARD_OPEN Instance ID 0x8C (140) 400byte

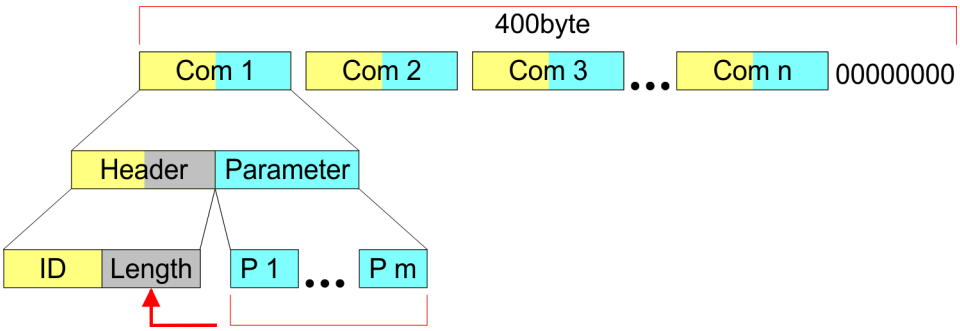
With a FORWARD_OPEN *Config assembly* (short: FORWARD_OPEN) you can configure and parametrize the EtherNet/IP coupler and modules on the backplane bus:

- FORWARD_OPEN consists of commands as a byte sequence and must be created accordingly in the configuration tool for the scanner under the assembly instance ID 0x8C (140). Here, the instance ID 0xFE (input only) must be set on the *Originator* part.
- Partial configurations are possible, default parameters are used for non-configured modules in FORWARD_OPEN.
- With a configured *'Module ID'* in FORWARD_OPEN, the corresponding module must be in the configured position. Otherwise, you will get an error message.

On the web page of the EtherNet/IP coupler you can access the 'FORWARD_OPEN generator' via the 'FWD' tab. This generates a FORWARD_OPEN file from the current configuration and parametrization of the coupler and the connected modules, which is shown as a byte sequence and you can download this as a file.

Structure

FORWARD_OPEN can be set up with any number of commands and has the following structure:



- Length FORWARD_OPEN
  - 400byte (fixed)
  - Unused areas are to be zeroed.
- Data FORWARD_OPEN
  - Sequence of commands *'Com x'*
    Com 1
    ...
    Com n
  - *'FORWARD_OPEN Commands'...page 90*
- Termination FORWARD_OPEN
  - END_OF_CFG 0x00
- Structure command *'Com x'*
  - Command header
  - Command parameters (option)
- Structure *Command header*
  - Command ID
  - Length (number of bytes of command parameters)
- Structure *Command parameter*
  - The structure depends on the command-specific data.

4.14.1 FORWARD_OPEN Commands

Below there is a list of all the commands, which can be used in a FORWARD_OPEN *config assembly*. Please note that the *config assembly* can be limited any time by means of the command *EndOfCfg*. After you insert the command *EndOfCfg* all subsequent commands are ignored.

Elementary data types

Name	Description	Width	Range	
		(bit)	Minimum	Maximum Load
BOOL	Boolean	1	0: FALSE	1: TRUE
SINT	Short Integer	8	-128	127
INT	Integer	16	-32768	32767
DINT	Double Integer	32	-2^{31}	$2^{31}-1$
LINT	Long Integer	64	-2^{63}	$2^{63}-1$
USINT	Unsigned Short Integer	8	0	255
UINT	Unsigned Integer	16	0	65535
UDINT	Unsigned Double Integer	32	0	$2^{32}-1$
ULINT	Unsigned Long Integer	64	0	$2^{64}-1$
BYTE	Byte	8	-	-
WORD	Word	16	-	-
DWORD	Double word	32	-	-
LWORD	Long word	64	-	-
STRING	Character string (1 byte per character)		-	-
SHORT_STRING	Character string (1 byte per character + 1 byte length specification)		-	-

EndOfCfg (0x00)

The command *EndOfCfg* (0x00) specifies that the configuration finishes at the inserted position. The subsequent commands after this command are ignored.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x00	EndOfCfg
	Length	USINT	0x00	No parameters

The config assembly is always to be finished with END_OF_CFG!

DeleteWebCfg (0x02)

The command *DeleteWebCfg* (0x02) specifies that the EtherNet/IP coupler has to delete an existing web configuration and may only be configured by a FORWARD_OPEN *config assembly*.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x02	DeleteWebCfg
	Length	USINT	0x00	No parameters

SetModCnt (0x03)

The command *SetModCnt* (0x03) specifies the number of modules by the parameter *ModCnt*.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x03	SetModCnt
	Length	USINT	0x01	Length of the command data
Command parameter	ModCnt	USINT	1 ... 64	Number of modules

SetModType (0x04)

The command *SetModType* (0x04) defines the module ID *ModID* for the module at position *Pos*.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x04	SetModType
	Length	USINT	0x05	Length of the command data
Command parameters	ModID	UDINT	4 bytes in little-endian format (least significant byte first) *'Module ID'* (see technical data System SLIO)	
	Pos	USINT	1 ... 64	Module position

If, for example, the digital output module 022-1BF00 - DO 8xDC 24V 0.5A with *'Module ID'* 0106 AFC8 is to be defined, the following command results:
Command: 0405 C8AF0601 03

SetModTypeRange (0x05)

The command *SetModTypeRange* (0x05) specifies the module ID *ModID* of the modules starting with position *PosStart* to position *PosEnd*.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x05	SetModTypeRange
	Length	USINT	0x06	Length of the command data
Command parameters	ModID	UDINT	4 bytes in little-endian format (least significant byte first) *'Module ID'* (see technical data System SLIO)	
	PosStart	USINT	1 ... 63	Start position
	PosEnd	USINT	2 ... 64	End position

SetModParam (0x06)

The command *SetModParam* (0x06) specifies the module parameter Para of the module at position *Pos*. A description of the parameters may be found in the manual of the according System SLIO module.

To get the current parameters as basis record set for parametrization, you can use a 'class3 connection'!

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x06	SetModParam
	Length	USINT	0x01 + n	Length of the command data
Command parameters	Pos	USINT	1 ... 64	Module position
	Param	ARRAY of USINT	n = number	Module parameter

SetIOSegment (0x07)

The command *SetIOSegment* (0x07) defines the I/O area of the System SLIO bus image, which is to be cyclically transferred in the selected assembly *AsmId*. Since an I/O connection may only transfer max. 496byte I/O data (excluding interrupt header and length), with *SetIOStartEnd* a second connection may be opened to transfer the specified area. This command can be used e.g. with *UseExistingCfg*.

This command is only valid for the I/O area with fixed size or with dynamic size assemblies (0x64 ... 0x6B; 0x78 ... 0x7F).

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x07	SetIOSegment
	Length	USINT	0x05	Length of the command data
Command parameters	AsmId	USINT	Number of the assembly	
	Start	UINT	Start of the I/O data area of the according assembly	
	End	UINT	End of the I/O data area of the according assembly	

SetParameters (0x0A)

Via the command *SetParameters* (0x0A) you can parametrize the EtherNet/IP coupler (Slot 0) accordingly.

Please note that it is not possible to activate the 'Enable free module mapping' parameter via Forward Open.

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x0A	SetParameters
	Length	USINT	0x14	Length of the command data
Command parameters	Config	*'Parameters'...page 62*		

SetModTypeAndParam (0x0B)

The command *SetModTypeAndParam* (0x0B) defines both, the type of module and the module parameters for the module at position *Pos*. The length of the module parameter is derived from the length *Length* of the command specific data, minus the size of the entry position *Pos*. For a *Length* of 24byte, the pure module parameters are 23byte (24byte length - 1byte position = 23byte parameters).

Structure	Field name	Data type	Value	Designation
Command header	ID	USINT	0x0B	SetModTypeAndParam
	Length	USINT	0x01 + X	Length of the command data
Command parameters	ModID	UDINT	4 bytes in little-endian format (least significant byte first) *'Module ID'* (see technical data System SLIO)	
	Pos	USINT	1 ... 64	Module position
	Param	ARRAY of USINT	Number = *Length* - 1	Module parameters (Number = Length - 1)

4.14.2 Example

4.14.2.1 Example - partial configuration

Task:

- Any existing web configuration is to be deleted.
- There are max. 5 modules.
- The digital input module 021-1BB00 - DI 2xDC 24V with the *'Module ID'* 0001 9F82 is to be located in position 3.

This results in the following commands:

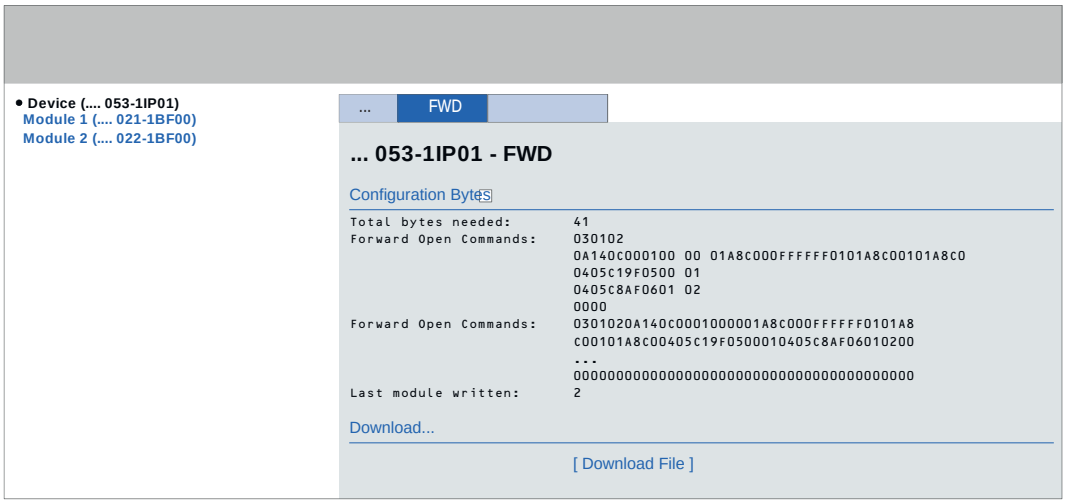
- Com 1: DeleteWebCfg (0x02): 02 00
- Com 2: SetModCnt (0x03): 03 01 05
  - Command header: 03 01
  - Command parameters: ModCnt: 05
- Com 3: SetModType (0x04): 04 05 829F0100 03
  - Command header: 04 05
  - Command parameters:
    ModID: Specification in little-endian format: 829F0100
    Pos: 03
- Com 4: EndOfCfg (0x00)

FORWARD_OPEN *Config Assembly*

- 400byte: 02000301050405829F01000300 ... 00

4.14.2.2 Example - FORWARD_OPEN Generator

On the web page of the EtherNet/IP coupler you can access the *'FORWARD_OPEN generator'* via the *'FWD'* tab. This generates a FORWARD_OPEN file from the current configuration and parametrization of the coupler and the connected modules, which is shown as a bit sequence and you can download this as a file. *'Web server'...page 67*



Example

Range	Entry	Description
Total bytes needed:	40	Number of bytes required
Forward open commands:	030102	Number of modules: 2
	0A140C000100 02	EtherNet/IP coupler parameters
	0405C19F0500 01	Module at the 1. slot with the *'Module ID'* 0005 9FC1. It is specified in little-endian format.
	0506C8AF0601 02 00	Module at the 2. slot with the *'Module ID'* 0106 AFC8. It is specified in little-endian format. 00 marks the end.
Forward open commands:	0301020A140C0001000201A8C000FFFFFF0101A8C00101A8C00405C19F0500010506C8AF06010200 00000000000000000000000000000000000000000000 ... 00000000000000000000000000000000	FORWARD_OPEN bit string

4.14.3 Product specific error codes

Overview

- If an error message occurs when the IM 053-1IP01 is connected, this error message can consists a result from several error entries.
- For the error message 0x0320 (Vendor specific), evaluate the following information (product specific error).

Error		Description
1. Error message	0x0320	see CIP (Vol. 1: Common Industrial Protocol Specification - 3-5.5)
2. Error message	0xXXXX	*'Product specific error codes'...page 86*

4.15 EtherNet/IP - Objects

Classes, Objects, Instances and Attributes

'Objects' are specified by their properties. The properties are called attributes. Similar objects are summarized in *'object classes'*. An *'object'*, which was built during run-time of an class is an *'instance'*.

The EtherNet/IP coupler supports the following objects:

- Standardized EtherNet/IP objects
- Product specific EtherNet/IP objects

4.15.1 Standardized EtherNet/IP objects

The following standardized object classes are supported by the EtherNet/IP coupler:

Object classes	Description
Identity (0x01)	Provides identification and general information about the device. With Identity, you can use the *Reset Service Type* function and *0* to a software reset.
Message Router (0x02)	Distributed explicit requests to the associated handler
Connection Manager (0x06)	Responsible for different areas of the connection
Device Level Ring - DLR (0x47)	Configuration and status information about DLR
QoS Object (0x48)	Interface to configure QoS
Port (0xF4)	Abstraction of a physical network connection
TCP/IP (0xF5)	Configuration of the TCP/IP interface (e.g. IP address, Netmask, Gateway)
Ethernet Link (0xF6)	Shows information about the network interface (Error counter, …)
Custom Objects	Self-defined objects

More information about the standardized EtherNet/IP object classes may be found in the according EtherNet/IP respectively CIP standard of the ODVA (Open DeviceNet Vendor Association).

4.15.2 Product specific EtherNet/IP objects

The following product specific object classes are supported by the EtherNet/IP coupler:

Object class	Description
'I/O data class 0x64'...page 96	Access to the I/O data of the System SLIO module.
'Diagnostics and interrupt class 0x65'...page 97	Access to the diagnostics and interrupt messages of the EtherNet/IP coupler.
'Module class 0x66'...page 98	Access to the parameter, diagnostics and status data of the System SLIO modules
'Coupler class 0x67'...page 99	Access to the configuration and status data of the EtherNet/IP coupler.
'FFM class 0x68'...page 100	Access to the FFM configuration. *'Free Module Mapping (FMM)'...page 72*

I/O data class 0x64

With this class the I/O data, which were configured via FORWARD_OPEN before, may be accessed.

- The *instances* represent the INPUT respectively OUTPUT assemblies. Enter here 0 for the *instance*.
- Is the ID assigned to the first INPUT assembly e.g. number 20, so the instance 20 is directly assigned with this assembly.
- The attribute IDs of the object class can be found in the following table:

Attribute ID	Access	Name	Data type	Description
0x64	Set	I/O Set	ARRAY of BYTE	Output values (outputs)
0x65	Get	I/O Get	ARRAY of BYTE	Input values (inputs)
0x66	Get/Set	I/O Get / Set	ARRAY of BYTE	Default values

Diagnostics and interrupt class 0x65

With this class the diagnostics and interrupt messages of the EtherNet/IP coupler can be accessed. If you have not selected automatic acknowledgement, you can acknowledge the interrupt via *'Module class 0x66'...page 98* for the corresponding *EtherNet/IP slot*.

The attribute IDs of the object class can be found in the following table:

Attribute ID	Access	Name	Data type	Description
0x64	Get	Status	USINT	Access to the status byte of the I/O data. An interrupt is pending, if the according bit is set: ■ Bit 0: Process interrupt ■ Bit 1: Diagnostics interrupt ■ Bit 2: *'BASP'...page 65* ■ Bit 3: Maintenance ■ Bit 7 ... 4: reserved
0x65	Get/Set	Process Config	BYTE	Auto acknowledge for hardware and diagnostics interrupt ■ 0: Disabled ■ 1: Enabled
0x66	-	-	-	reserved
0x67	Set	Reset Data	-	Deletes each available hardware and diagnostic data (API SlioModClearAllErrors)
0x68	Get	Next Process Interrupt	see following table	Reads the next available hardware interrupt. Contains the raw data of the interrupt type IO_EVENT_PROCESS_ALARM
0x69	Get	Next Diagnostic Data	see following table	Reads the next available diagnostics interrupt. Contains the raw data of the interrupt type IO_EVENT_DIAGNOSTIC_ALARM

Structure of the interrupt and diagnostic data

Field name	Data type	Field value
Pos	USINT	*EtherNet/IP-Slot* (1 ... 64)
Typ	USINT	Interrupt type
Length	UINT	Length of the interrupt respectively diagnostics data
TimeStamp	INT	Time stamp
Data	ARRAY of BYTE	*'Diagnostic data'...page 83*

Module class 0x66

- *Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the EtherNet/IP coupler and so are not listed and considered during slot allocation.*
- *Further within EtherNet/IP the slots are designated as 'EtherNet/IP-Slot'. The counting always begins with 1.*

This class gives you access to the parameter, status and diagnostics data of your System SLIO modules. Use the *Instance* to define which *EtherNet/IP slot* you want to access.

The attribute IDs of the object class can be found in the following table:

Attribute ID	Access	Name	Data type	Description
0x64	Get/Set	Config	ARRAY of BYTE	Module parameters The structure and description of the parameter data can be found in the corresponding manual.
0x65	Set	ClearCounter	-	Reset error counter (MDL, NDL)
0x66	Get	GetMDL	WORD	Counter: General error on the backplane bus MDL (Master Data Line).
0x67	Get	GetNDL	WORD	Counter: General error on the backplane bus NDL (Node Data Line).
0x68	Get	VerFPGA	WORD	FPGA version
0x69	Get	VerFW	UDINT	Firmware version
0x6A	Get	Serial	ARRAY of BYTE	Serial number
0x6B	Get	Hardware Interrupt	refer to the table below	Data hardware interrupt
0x6C	Get	Diagnostic Data	refer to the table below	Data diagnostics interrupt
0x6D	Set	Hardware Interrupt Reset	-	Reset hardware interrupts
0x6E	Set	Diagnostic Reset	-	Reset diagnostic interrupts
0x6F	Get	Input Byte Length	UINT	Length of the input data
0x70	Get	Output Byte Length	UINT	Length of the output data
0x71	Get	Parameters Byte Length	UINT	Length of the parameter data
0x72	Get	Module ID	UINT	ID of the module
0x73	Get	HW Version	UINT	Hardware version of the module

Structure of the interrupt and diagnostics data

Field name	Data type	Field value
Pos	USINT	*EtherNet/IP-Slot* (1 ... 64)
Length	UINT	Length of the interrupt and diagnostics data
Data	ARRAY of BYTE	Interrupt and diagnostics data in raw format. The structure and description of the data can be found in the corresponding manual.

Coupler class 0x67

This class offers access to the parameter and status data of the EtherNet/IP coupler.

- The *Instance* is always 0.
- The attribute IDs of the object class can be found in the following table:

Attribute ID	Access	Name	Data type	Description
0x64	Get/Set	*'Parameters'...page 62*		
0x65	Set	ClearCounter	-	Clear master counter
0x66	Get	GetMC	BYTE	Read master counter
0x67	Get	ProdVer	STRING	Product version
0x68	Get	PkgVer	STRING	Firmware version (Pkg)
0x69	Get	MxVer	STRING	Name and version of the Mx file
0x6A	Get	ModuleIDs	ARRAY of BYTE	Read module IDs of the plugged System SLIO modules
0x6B	Set	WriteSettings	-	Write user configuration to flash. Configuration ■ Bit 1: Web configuration ■ Bit 2: Network configuration ■ Bit 3: Module configuration
0x6C	Set	ForceConnectionAbort	DWORD	■ Forced abort of all connections.
0x6D	Set	ResetParameter	-	Reset all parameters.

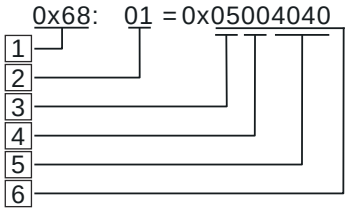
FFM class 0x68

This class gives you read and write access to the FMM configuration. With FMM you can use the IM 053IP with different hardware variants without adapting your user program. You only have to adapt the FMM configuration in the IM 053IP when configuring the hardware variants. *'Free Module Mapping (FMM)'...page 72*

The FMM configuration is made with the object FMM class 0x68. The object consists of 64 attributes, on each of which an FMM value with 4 bytes can be written.

Attribute ID	Access	Data type	Description
0x01	Get/Set	DWORD	FMM configuration for slot 1.
...	...	...	...
0x40	Get/Set	DWORD	FMM configuration for slot 64.

Here, the *Attribute ID* represents the slot $Slot_{target}$ of the target configuration. This value is identical when configuring hardware variants. For the FMM configuration, you must describe the corresponding Attribute ID with an FMM value for each occupied slot of the target configuration. It has the following structure:



1. Object FMM class 0x68
2. Attribute ID respectively $Slot_{target}$
3. Mapping respectively $Slot_{actual}$
4. 00h (fix)
5. I/O_{target}
6. FMM value

FMM value for slot x

Byte	Range	Description
Byte 0	0 ... 60	I/O_{target} Number of output bytes of the target configuration.
Byte 1	0 ... 60	I/O_{target} Number of input bytes of the target configuration.
Byte 2	00h (fix)	00h
Byte 3	0 ... 64 or 255	Mapping respectively $Slot_{actual}$ of the actual configuration. ■ 0: Module of the target configuration is ignored (gap). ■ 1 ... 64: Slot of the actual configuration on which the module of the target configuration is located. ■ 255: Virtual module - module does not exist in the actual configuration. – The input area always has the value 0, regardless of its size. – The writing to the output area has no effect.

For modules with variable IO size, the number of bytes to which the module was configured in the hardware configuration must be specified for I/O_{target}.

The presence of gaps in the System SLIO is not allowed! But you can place modules and define them via the configuration as empty slot for the target hardware configuration.

4.15.3 Assembly instances

Instances

In the following the product specific instances are listed for R/W access and for read access to the diagnostics data.

Instance ID 0x64 (100) ... 0x67 (103) - Output values; fixed size (496byte) - O→T

Offset	Type	Content
0	ARRAY of BYTE	Output values; fixed size (outputs) - output assembly

- Since an connection (output assembly) can only transfer a maximum of 496byte I/O data (less interrupt header and length), with *SetIOStartEnd* a second connection can be opened over which the defined start area is transferred. *'Deployment of FORWARD_OPEN'*

Instance ID 0x68 (104) ... 0x6B (107) - Output values; dynamic size - O→T

Offset	Type	Content
0	ARRAY of BYTE	Output values; dynamic size (Outputs) - output assembly

- The value of the size is dynamic and corresponds to the size of the process image of the outputs in byte. *'Web server'...page 67*

Instance ID 0x6C (108) - Output values (only DO modules) - O→T

Offset	Type	Content
0	ARRAY of BYTE	Output values - output assembly ■ All digital output modules 022-xxxxx without the ETS modules 022-xxx70.

Instance ID 0x6D (109) - Output values (only AO modules) - O→T

Offset	Type	Content
0	ARRAY of BYTE	Output values - output assembly ■ All analog output modules 032-xxxxx

Instance ID 0x6E (110) - Output values (only special modules) - O→T

Offset	Type	Content
0	ARRAY of BYTE	Output values - output assembly ■ All output areas of the modules that are not assigned to other instance IDs such as ETS modules, CPs, counter modules, etc.

Instance ID 0x78 (120) ... 0x7B (123) - Input values; fixed size (496byte) - T→O

Offset	Type	Content
0	BYTE	Header
1	UINT	Data length
3	ARRAY of BYTE	Input values; fixed size (inputs) - input assembly (T→O)

- If you do not request setpoints, to use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.
- Since an connection (input assembly) can only transfer a maximum of 496byte I/O data (less interrupt header and length), with *SetIOStartEnd* a second connection can be opened over which the defined start area is transferred.
- *'Structure of the Input data '...page 80*

Instance ID 0x7C (124) ... 0x7F (127) - Input values; dynamic size - T→O

Offset	Type	Content
0	BYTE	Header
1	ARRAY of BYTE	Input values; dynamic size (inputs) - input assembly (T→O

- If you do not request setpoints, to use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.
- *'Structure of the Input data '...page 80*

For small systems with short cycle times, you should use instances with dynamic values.

Instance ID 0x80 (128) - Input values (only DI modules) - T→O

Offset	Type	Content
0	BYTE	Header
1	UINT	Data length
3	ARRAY of BYTE	Input values - input assembly ■ All digital input modules 021-xxxxx without the ETS modules 021-xxx70

- To use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.
- *'Structure of the Input data '...page 80*

Instance ID 0x81 (129) - Input values (only AI modules) - T→O

Offset	Type	Content
0	BYTE	Header
1	UINT	Data length
3	ARRAY of BYTE	Input values - input assembly ■ All analog input modules 031-xxxxx

- To use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.
- *'Structure of the Input data '...page 80*

Instance ID 0x82 (130) - Input values (only special modules) - T→O

Offset	Type	Content
0	BYTE	Header
1	UINT	Data length
3	ARRAY of BYTE	Input values - input assembly ■ All input areas of the modules that are not assigned to other instance IDs such as ETS modules, CPs, counter modules, etc.

- To use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.
- *'Structure of the Input data '...page 80*

Instance ID 0x83 (131) - Diagnostics (20bytes) - T → O

Offset	Type	Content
0	WORD	System diagnostics: ■ Bit 0: Watchdog reset ■ Bit 1: Module error ■ Bit 2: Module reversed ■ Bit 3: Configuration invalid ■ Bit 4: DHCP error ■ Bit 5: Internal error ■ Bit 6: Writing of configuration is not possible ■ Bit 15 … 7: reserved
2	BYTE	Module diagnostics: ■ Bit 0: Hardware interrupt (collective interrupt) ■ Bit 1: Diagnostics interrupt (collective interrupt) ■ Bit 2: Missing Module ■ Bit 3: Wrong Module ■ Bit 7 ... 4: reserved
3	BYTE	Reserved

- To use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.

Instance ID 0x84 (132) - Diagnostics & Input values (500byte) - T→O

Offset	Type	Content
0	DWORD	Instance ID 0x83 (131) - diagnostics
4	ARRAY of BYTE	Instance ID 0x64 (100) - Input values (input assembly 1)

- To use this instance ID, you must set the instance ID 0xFE (Input Only) on the *Originator* part.

Instance ID 0x8C (140) - Config (400byte)

Offset	Type	Content
0	ARRAY of BYTE	Configuration ForwardOpen *89*

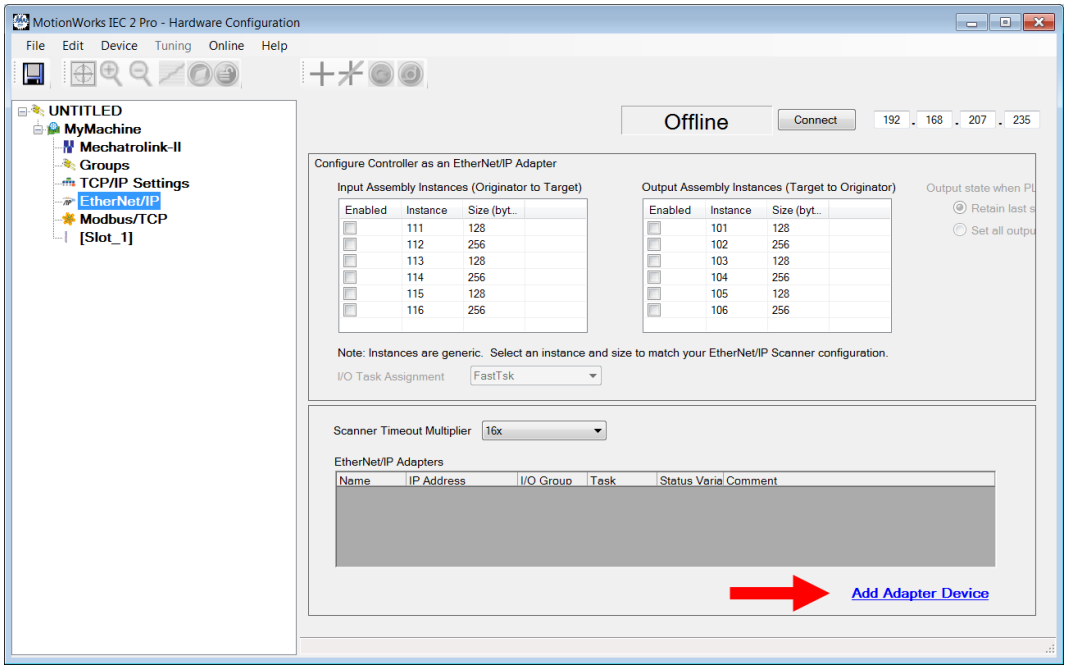
- *To use this instance ID, you must set the instance ID 0xFE (Input Only) on the Originator part.*
- *Instance ID 0xFE (254) - Input Only - O→T*

4.16 Examples

4.16.1 Configuration at a Yaskawa MWIEC scanner

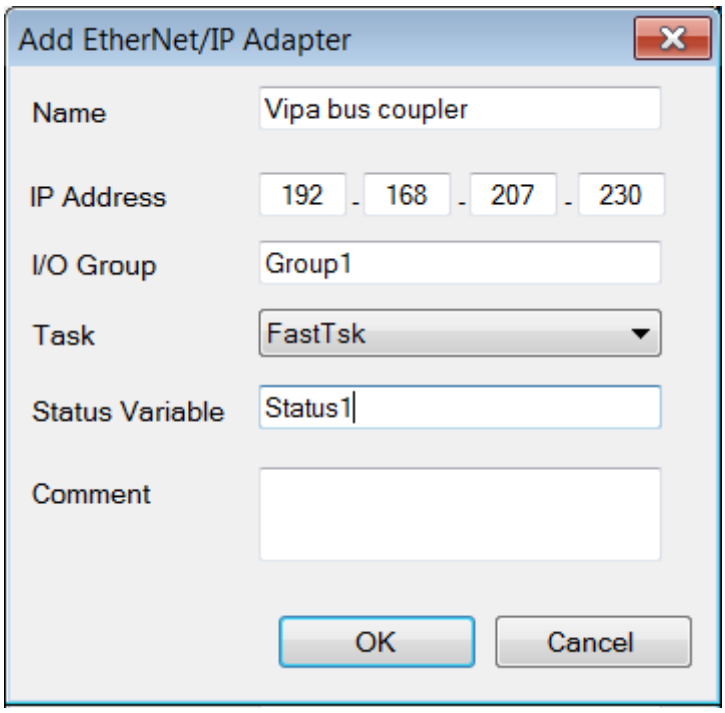
Proceeding

1. Open MotionWorks from Yaskawa with your project.

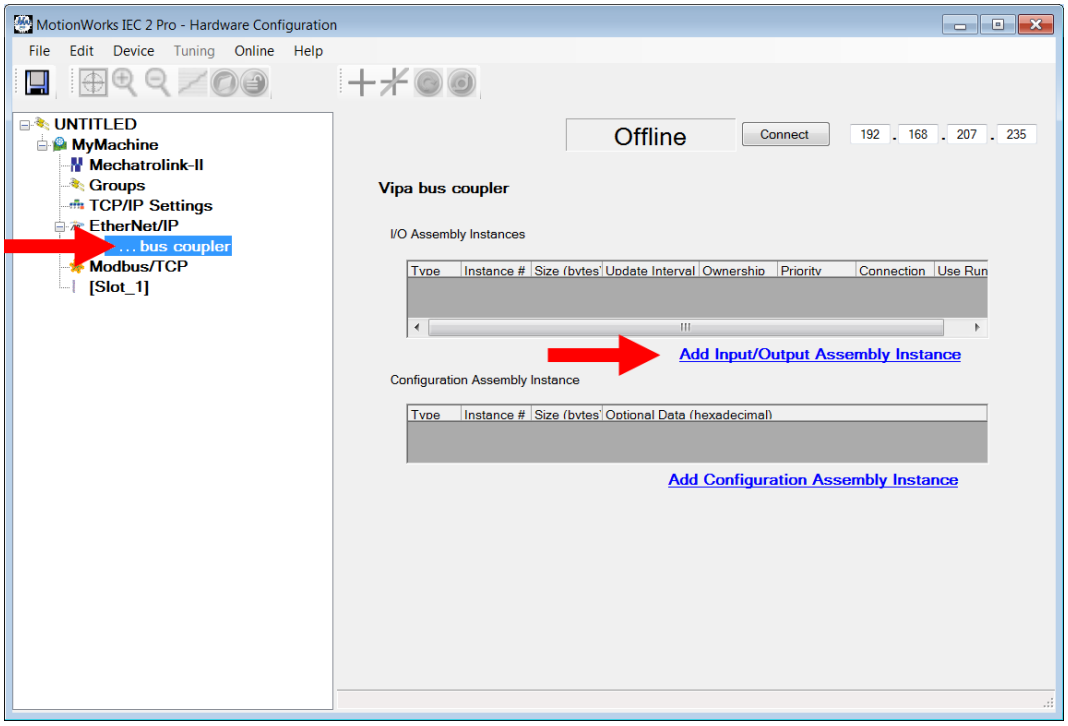


2. Select *'EtherNet/IP'* and click at [Add Adapter Device].
   ➡ The dialog *'Add EtherNet/IP Adapter'* opens.

3. Please enter *Name*, *IP Address*, *I/O Group* and *Status Variable* and click at [OK]. When the configuration is saved, the status variable will be created in the global variable table under I/O group.



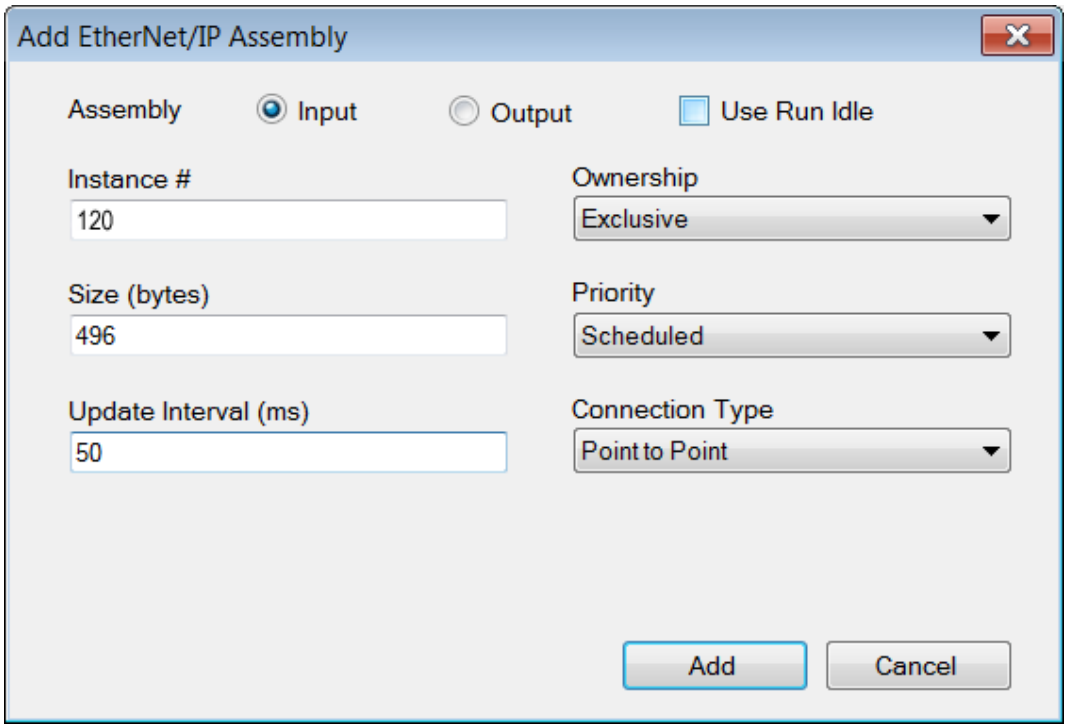
➡ The dialog window is closed and the EtherNet/IP adapter is listed in the *'Hardware Configuration'* below *'EtherNet/IP'*.



4. Select *'... bus coupler'* and click at [Add Input/Outpu Assembly].

➡ The dialog *'Add EtherNet/IP Assembly'* opens.

5. Set the following values and click at [Add]:
   - Assembly: Input
   - Instance: 120
   - Size (byte): 496
   - Update Interval (ms): 50
   - Connection Type: Point to Point

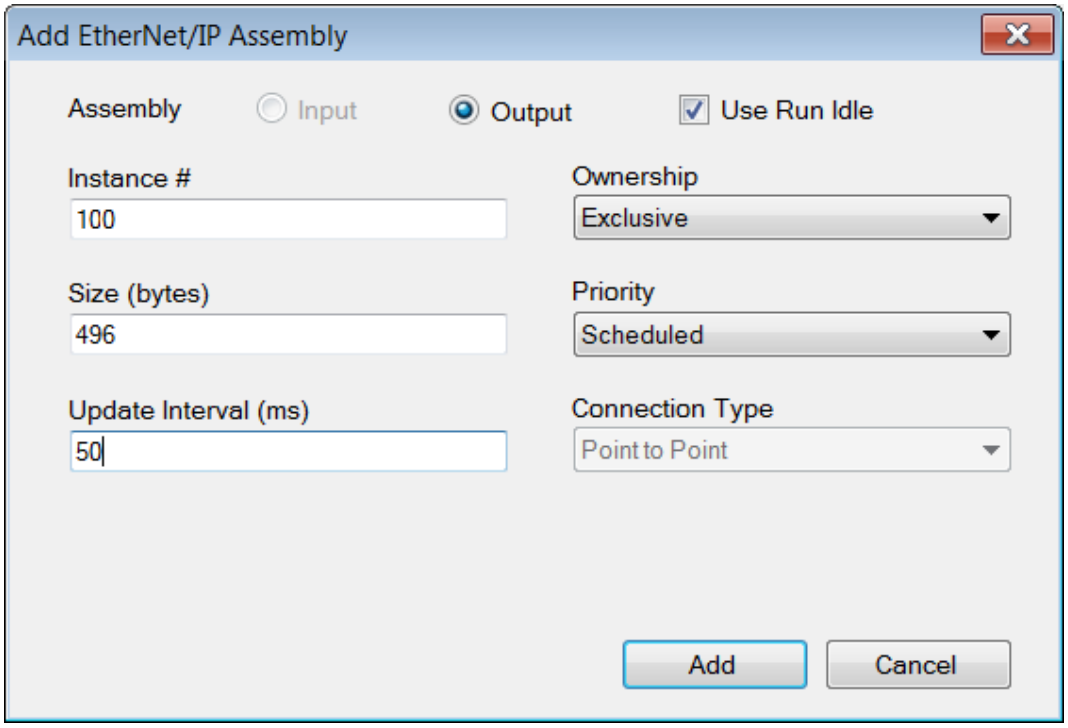


➥ The dialog is closed and the new instance is shown in the table.

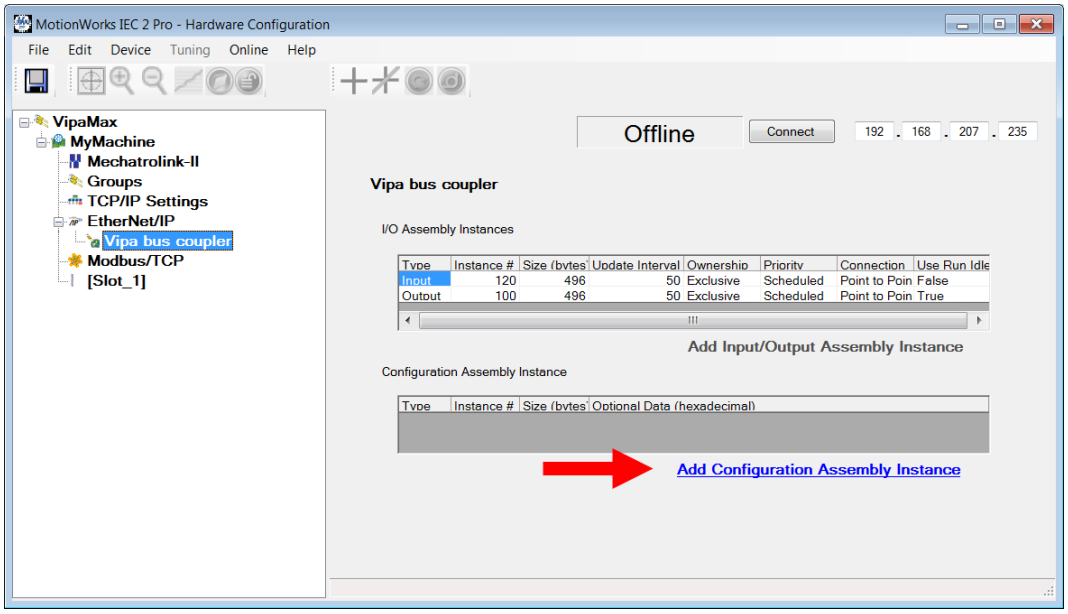
6. Click at [Add Input/Output Assembly Instance] again.

➥ The dialog *'Add EtherNet/IP Assembly'* opens.

7. Set the following values and click at [Add]:
   - Assembly: Output
   - Instance: 100
   - Size (byte): 496
   - Update Interval (ms): 50

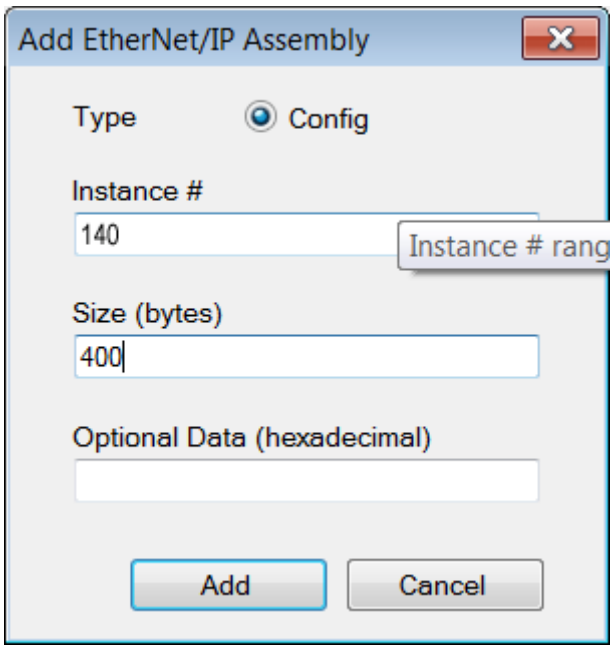


➥ The dialog is closed and the new instance is shown in the table.

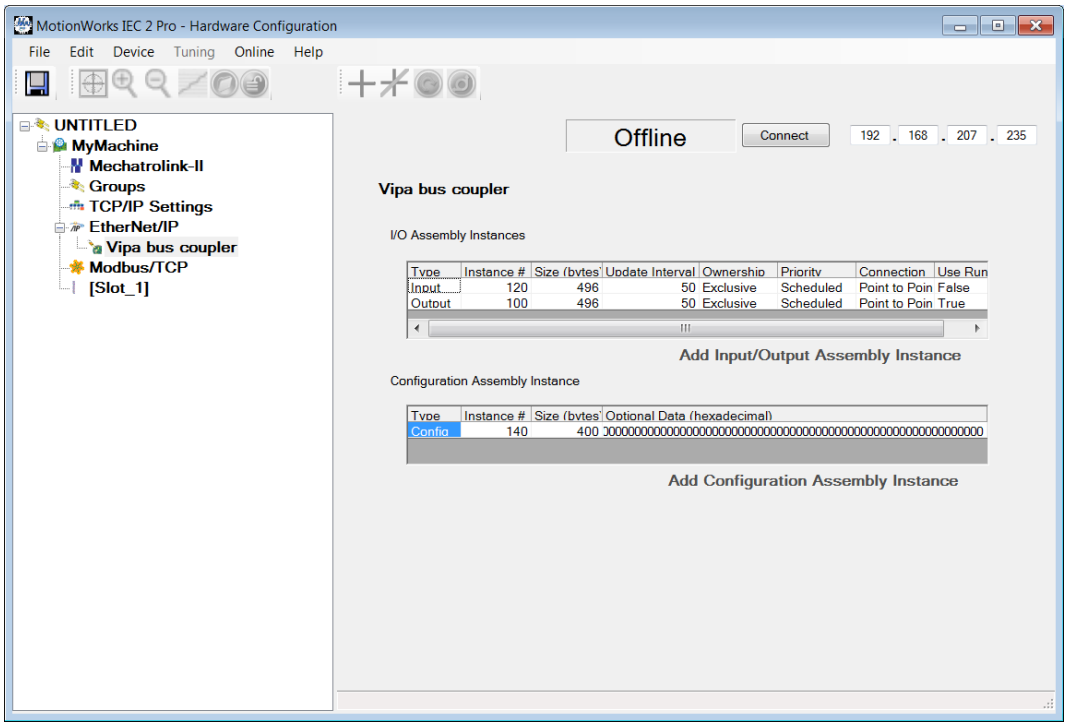


8. Click at [Add Configuration Assembly Instance].
   ➥ The dialog *'Add EtherNet/IP Assembly'* opens.

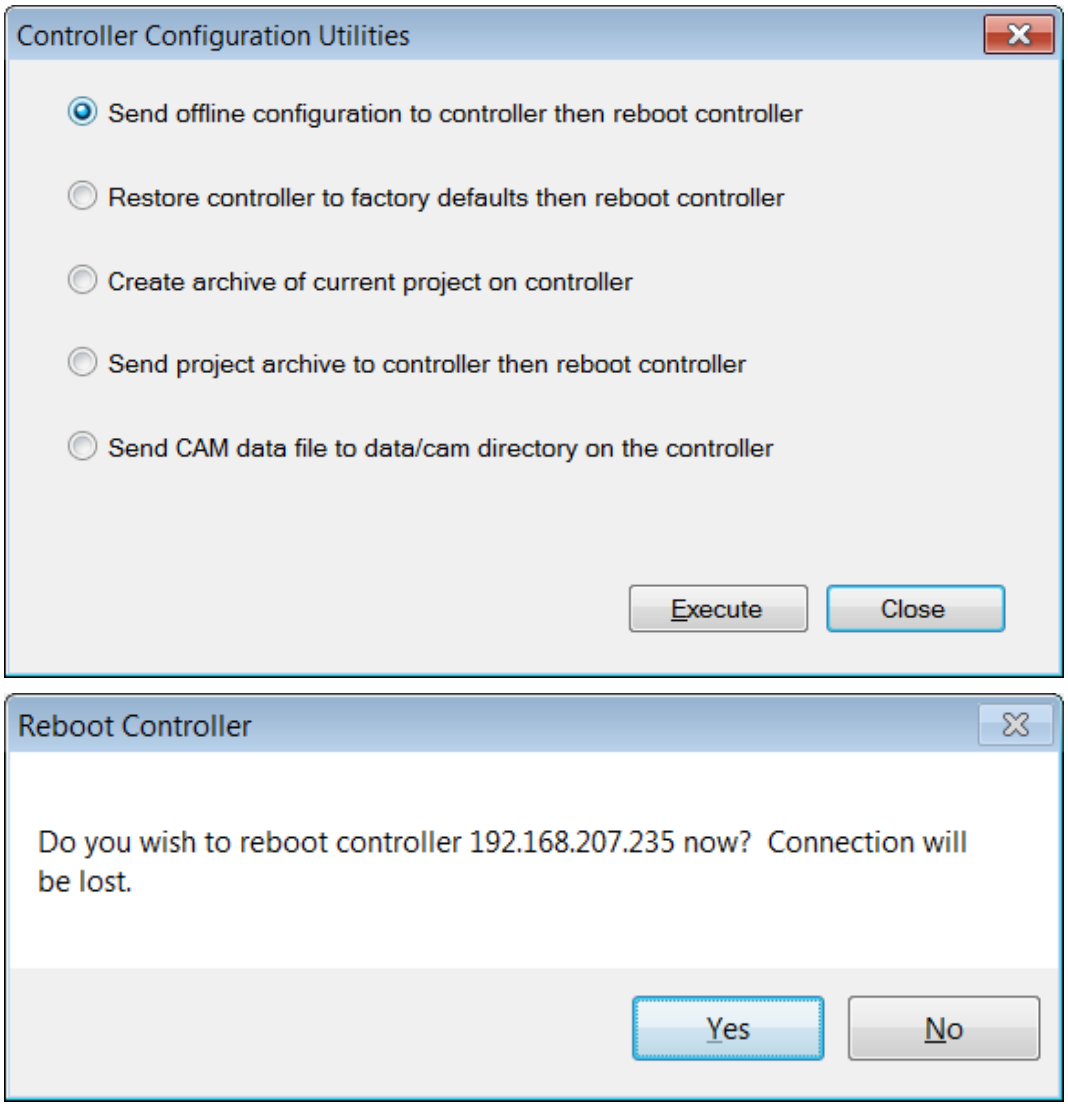
9. Set the following values and click at [Add]:
   - Instance: 140
   - Size (byte): 400



➡ The dialog is closed and the new instance is shown in the table. Optionally this is padded with zeros.



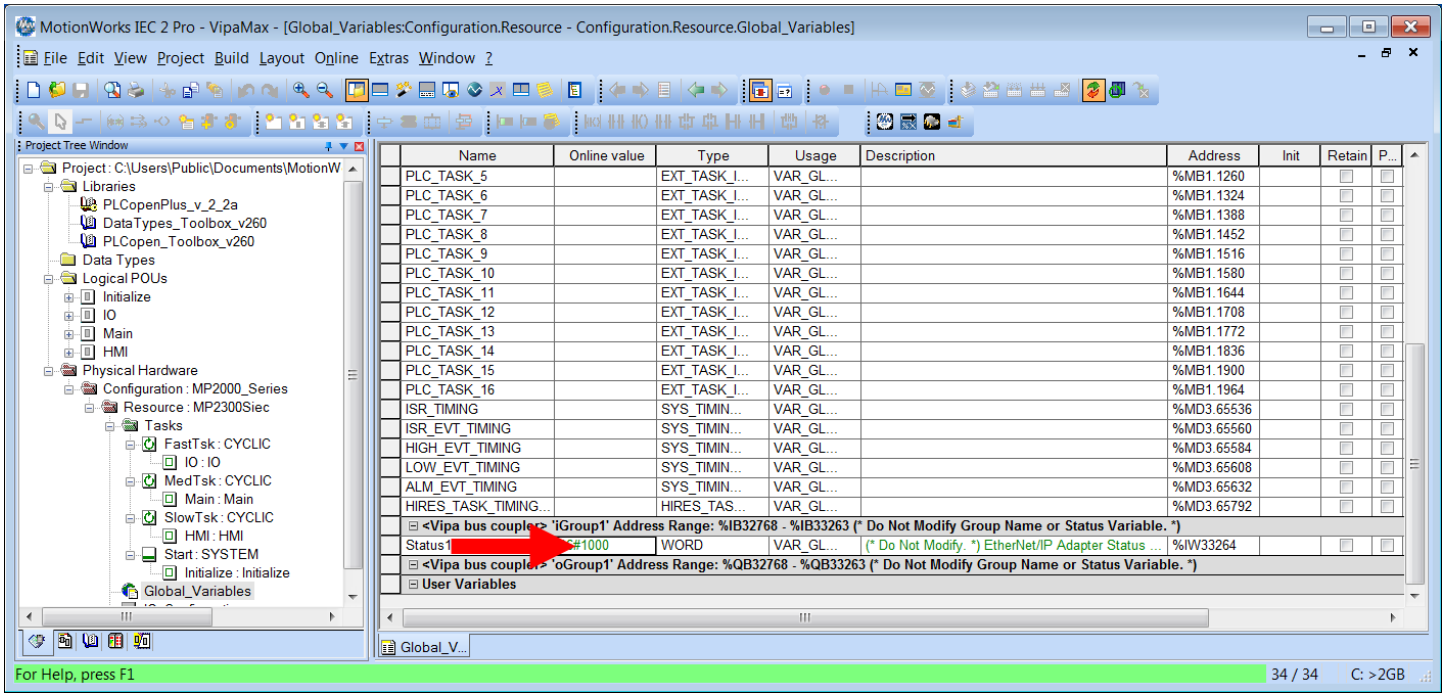
10. Save with the configuration.
11. Open *'Online → Controller Configuration Utilities...'*, select *'Send offline configuration to controller then reboot controller'* and click on [Execute].



12. Confirm the prompt for reboot with [Yes].
13. Open the web page of the EtherNet/IP coupler.
14. Navigate to the register *'Parameter'*.

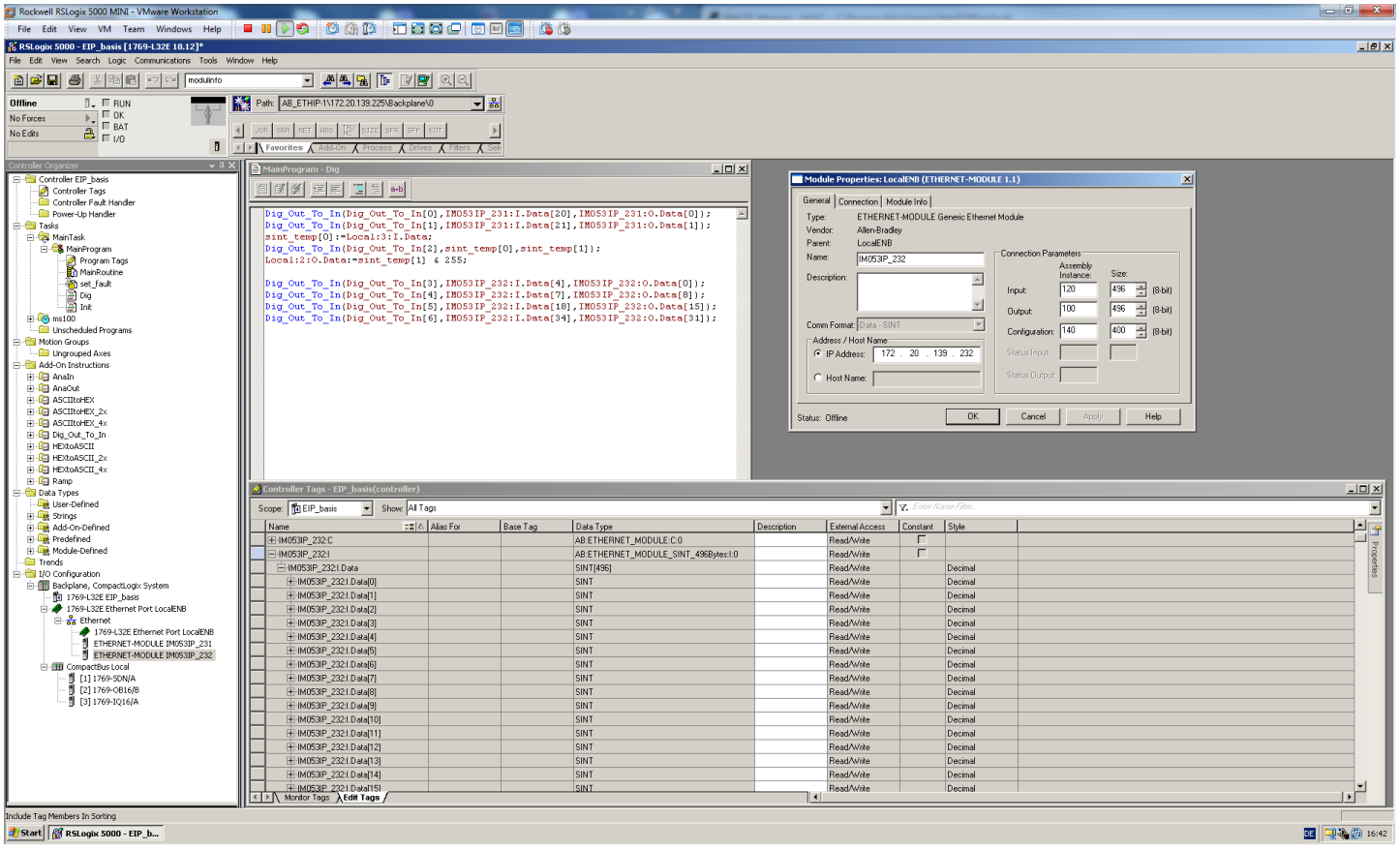
15. Activate the parameters *'Display stored config'* and *'Number of expected connections'* = "1" and click on [Apply].

➡ When the controller powers up, you can find the variable *'Status1'* in the global variable table. The value 0x1000 indicates that the controller is connected to the bus coupler.



4.16.2 Configuration at a Rockwell scanner

Configuration



Here the following settings are necessary: