System SLIO

CP | 042-1IO00 | Manual

HB300 | CP | 042-1IO00 | en | 25-02

IO-Link Master - CP 042 IO-Link

Table of contents

1   General

1.1   About this manual

Objective and contents   This manual describes the CP 042 IO-Link 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:	
CP 042 IO-Link	042-1IO00	HW: 01	FW: V1.0.1.0

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.*

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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.

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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:

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(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.
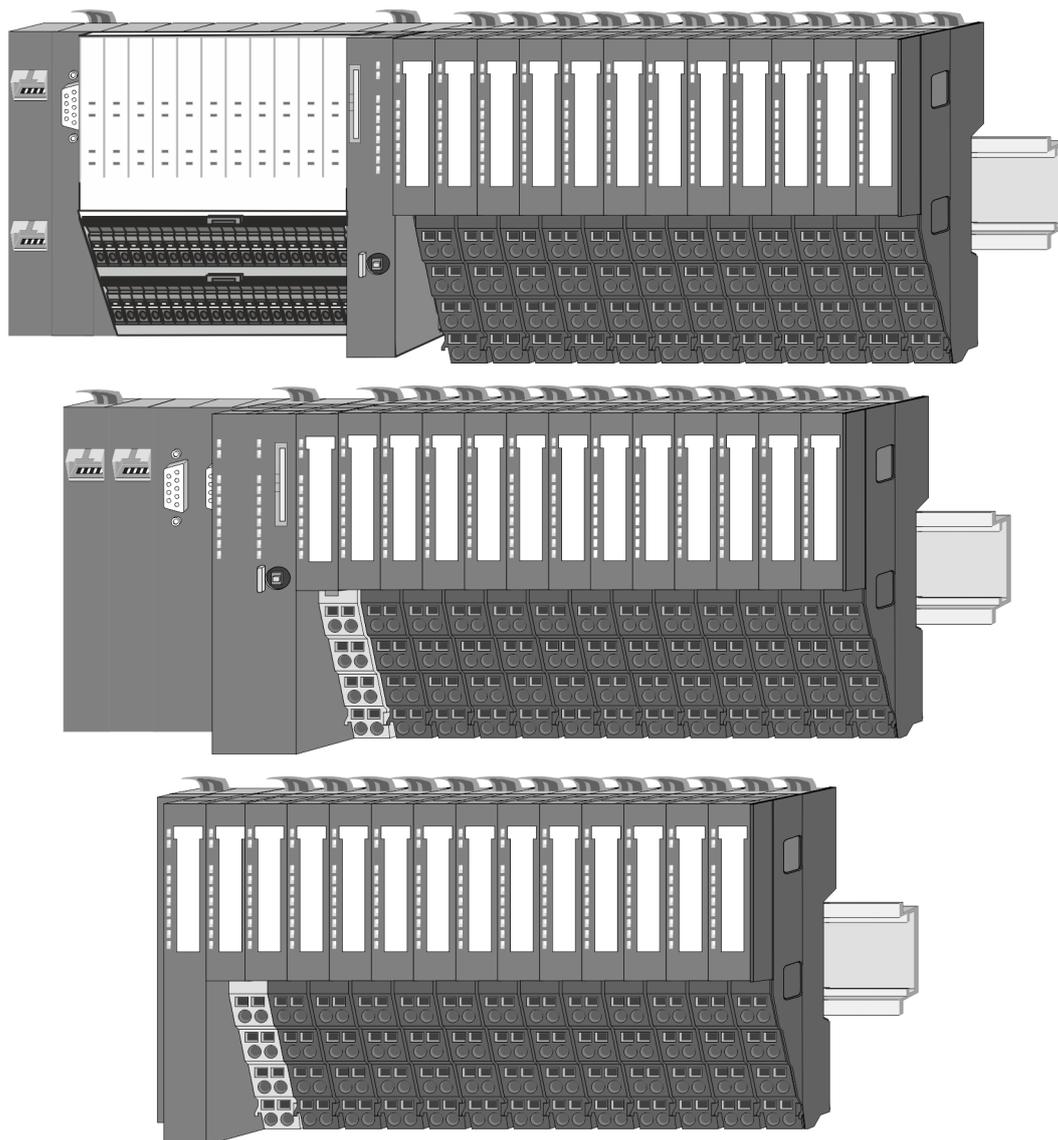
> ⚠️ **CAUTION**
>
> When working with and on electrostatic sensitive modules, make sure that personnel and equipment are adequately grounded.

2.2   System conception

2.2.1   Overview

The System SLIO is a modular automation system for assembly on a 35mm mounting 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.
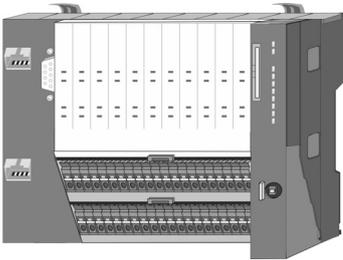
2.2.2   Components

- 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.
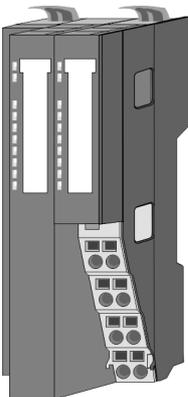
CPU 01x
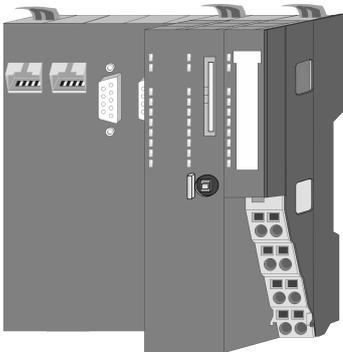
With this CPU 01x, CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24V power section supply for the linked periphery modules is established 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
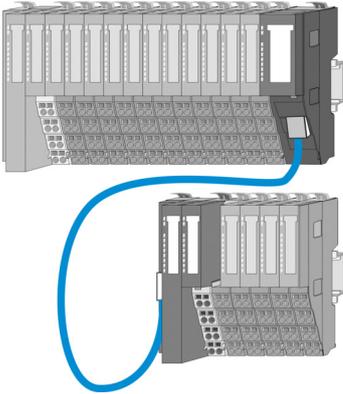
In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension MainDevice at each end of a line and the subsequent line has to start with a line extension SubDevice. 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'.*
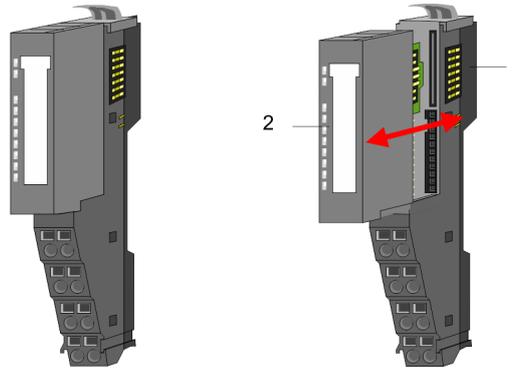
Periphery modules
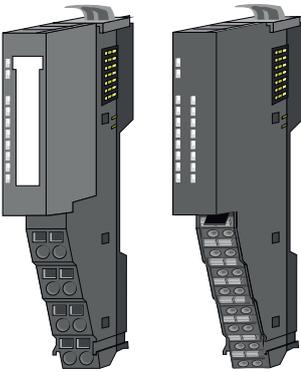
The periphery modules are available in the following 2 versions, whereby of each the electronic part can be replaced with standing wiring:

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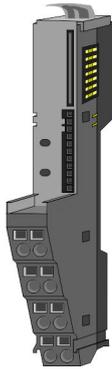- 16x periphery module for a maximum of 16 channels.

8x periphery modules

Each 8x periphery module consists of a *terminal* and an *electronic module*.
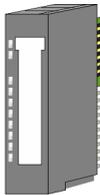
1   Terminal module
2   Electronic module

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 mounting 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.
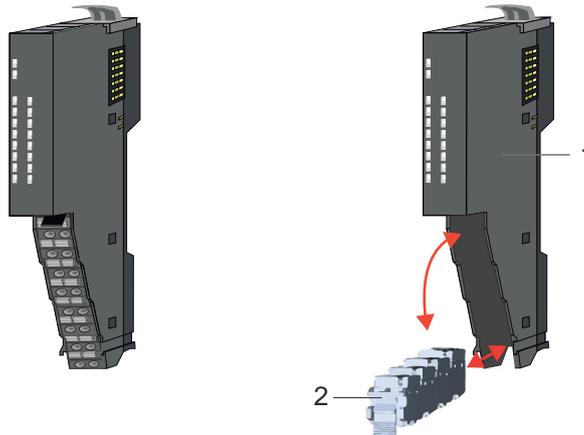
Electronic module

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.
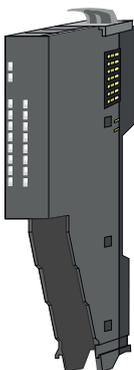
16x periphery modules

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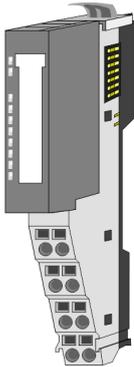
In the System SLIO the power supply is established by power modules. These are either integrated to the head module or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined respectively the electronic power supply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

## 2.2.3   Accessories

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 mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.

Clack
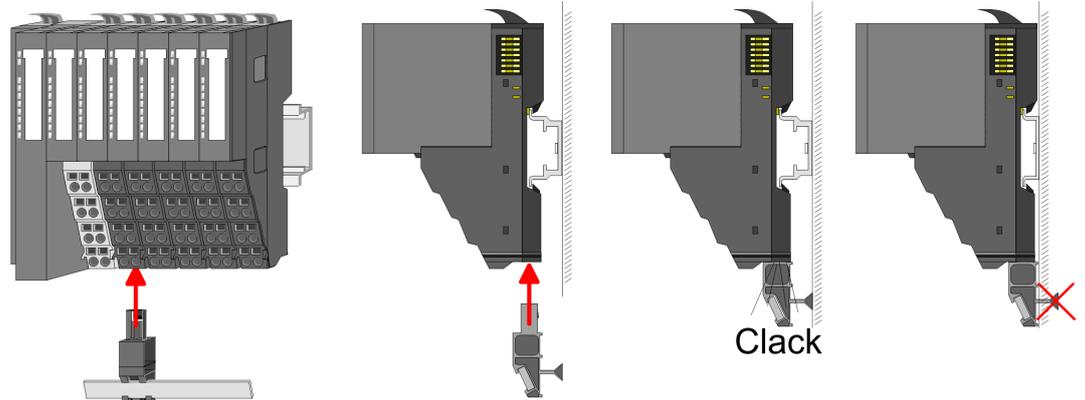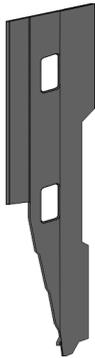
Bus cover

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

○ⱼ	*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.
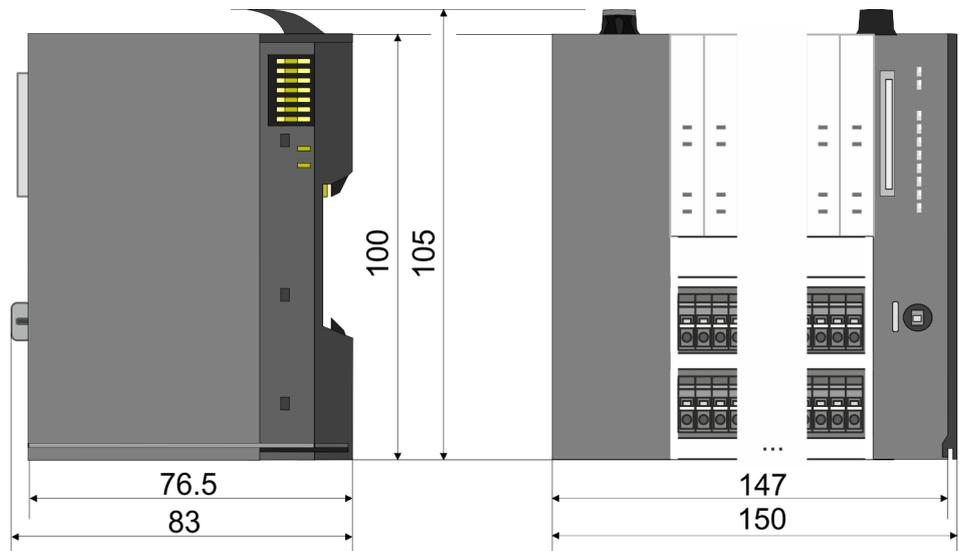 - With earlier labelling, the 1 is marked with *'X'* on a number grid.
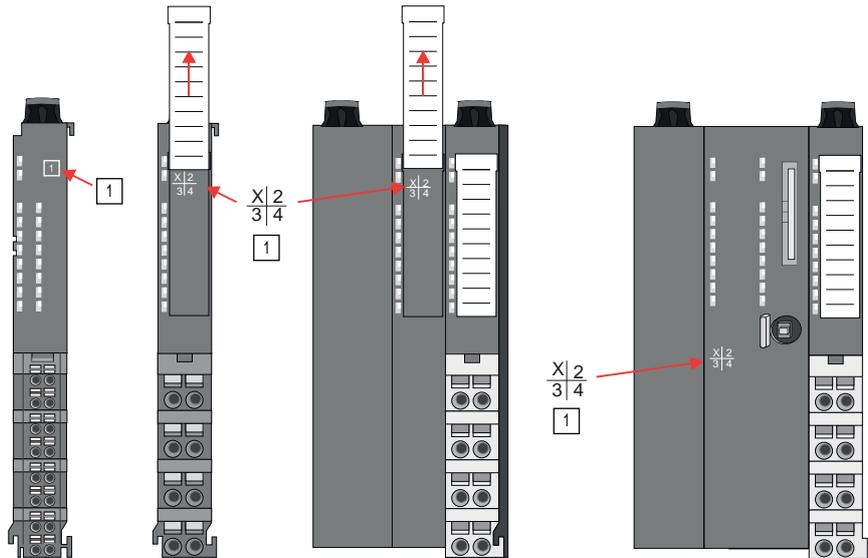
Hardware revision via web server

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

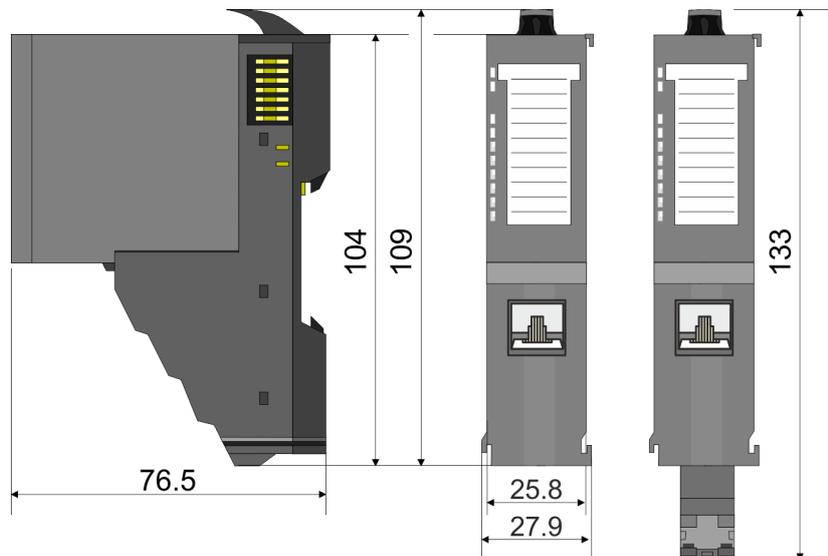## 2.3 Dimensions

CPU 01xC

All dimensions are in mm.

CPU 01x

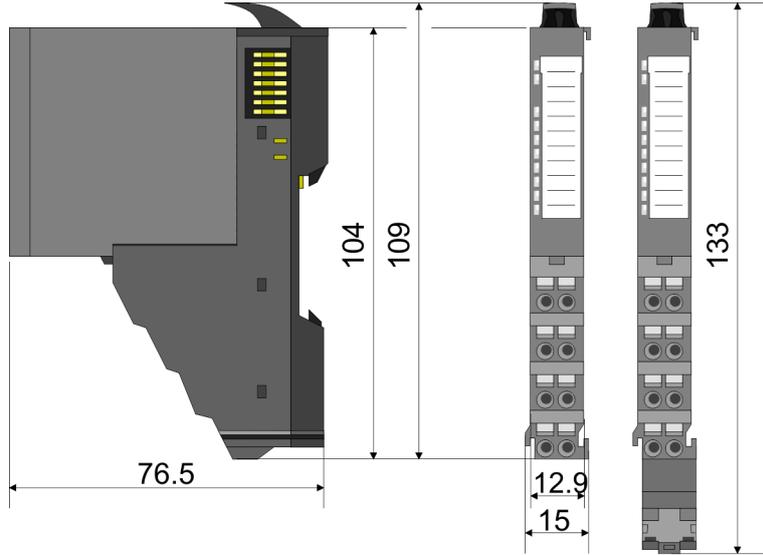104
109
76.5
83
129.2
132.2

Bus coupler and line extension SubDevice

104
109
76.5
46.2
49.2

Line extension MainDevice

104
109
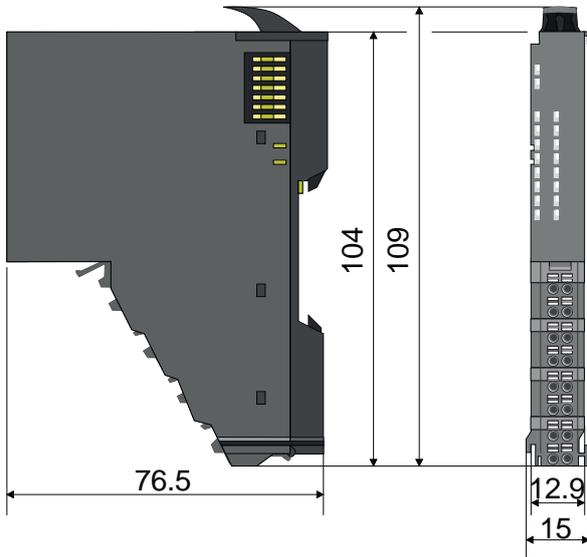76.5
133
25.8
27.9

8x periphery module

Electronic module
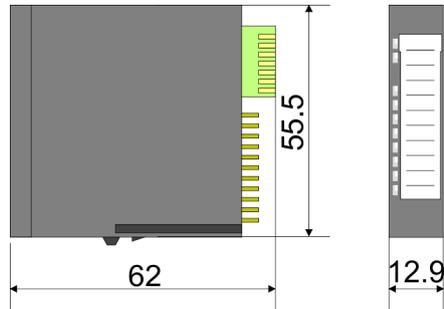
16x periphery module

2.4 Mounting 8x periphery modules

> ⚠️ **CAUTION**
>
> **Requirements for UL compliance use**
>
> − Use for power supply exclusively SELV/PELV power supplies.
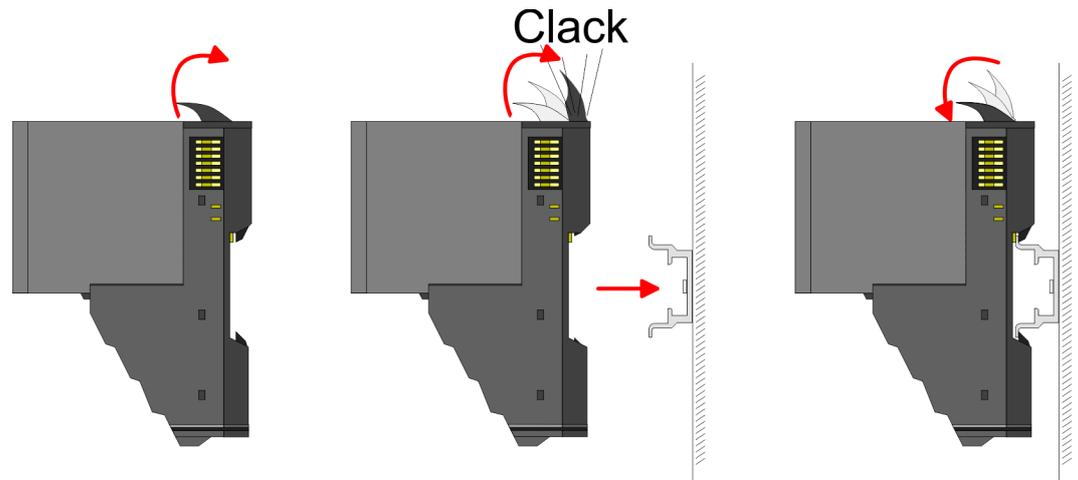> − The System SLIO must be installed and operated in a housing according to IEC 61010-1 9.3.2 c).

> ⚠️ **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 is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. 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.

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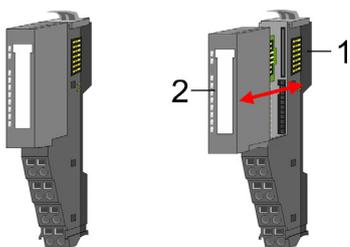
Each periphery module consists of a *terminal* and an *electronic module*.

1 Terminal module
2 Electronic module

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. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.

2. Pull ←

1. Press

Clack
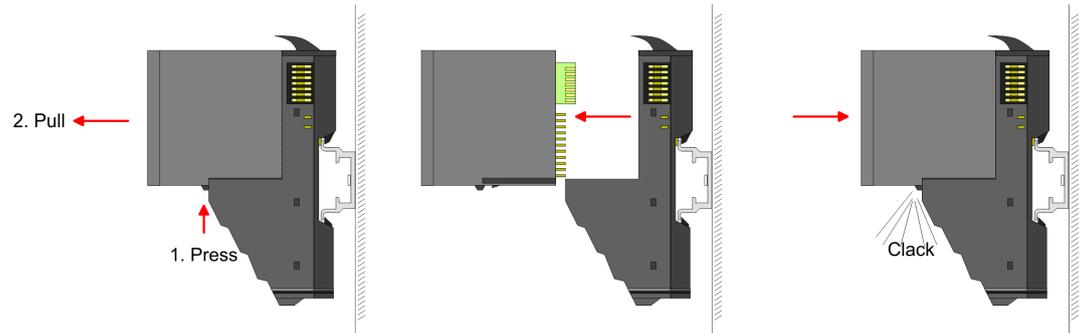
Coding

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 electronics module just another electronic module can be plugged with the same encoding.

Coding

Clack
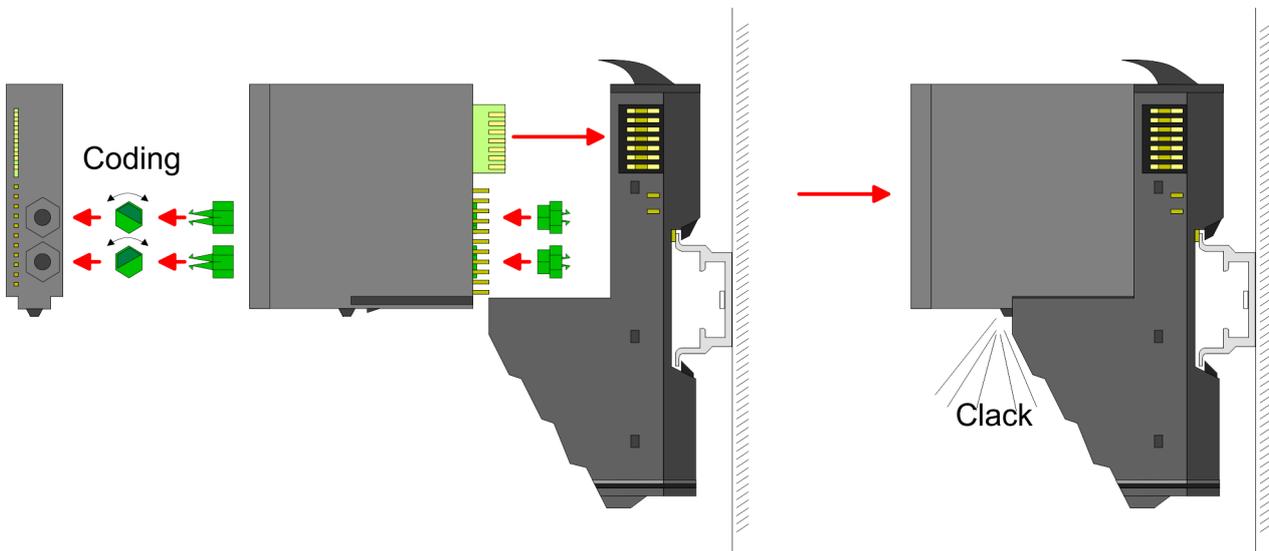
Each electronic module has on its back 2 coding sockets for coding jacks. Due to the characteristics, with the coding jack 6 different positions can be plugged, each. Thus there are 36 possible combinations for coding with the use of both coding sockets.

1. ▷ Plug, according to your coding, 2 coding jacks in the coding sockets of your electronic module until they lock

2. ▷ Now plug the according coding plugs into the coding jacks.

3. ▷ To fix the coding put both the electronic and terminal module together until they lock

> ⚠ **CAUTION**
>
> Please consider that when replacing an already coded electronic module, this is always be replaced by an electronic module with the same coding.
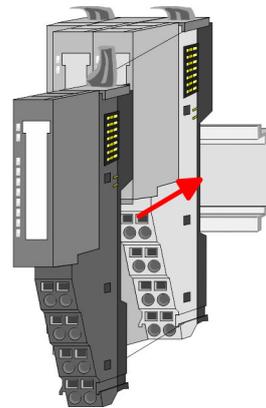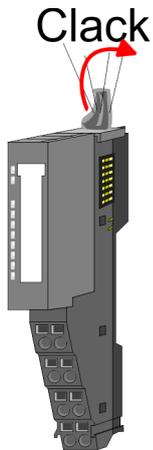>
> Even with an existing coding on the terminal module, you can plug an electronic module without coding. The user is responsible for the correct usage of the coding pins. Yaskawa assumes no liability for incorrectly attached electronic modules or for damages which arise due to incorrect coding!

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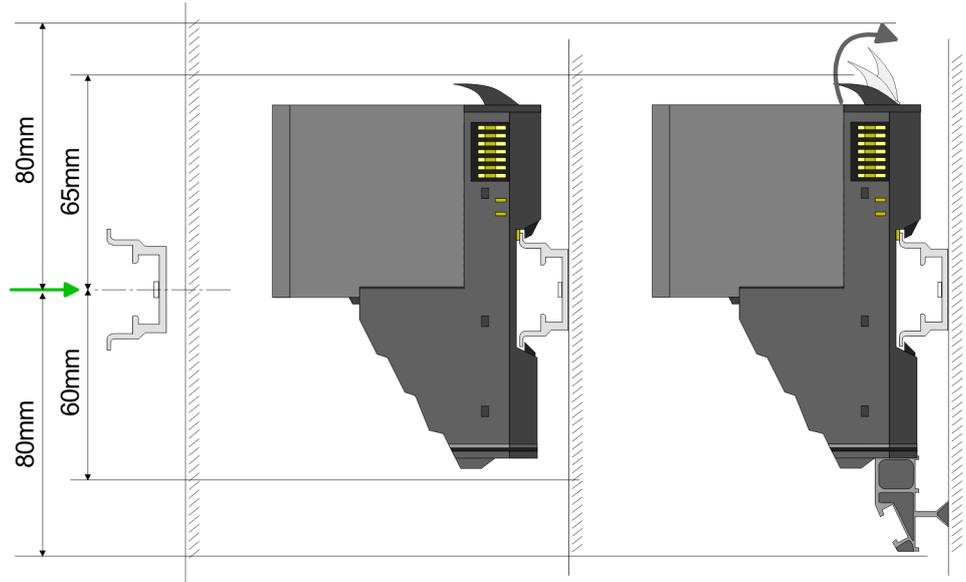
1. ▸ Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.

2. ▸ Mount your head module such as CPU or field bus coupler.

3. ▸ Before mounting the periphery modules you have to remove the bus cover at the right side of the head module by pulling it forward. Keep the cover for later mounting.

4. ▸ For mounting turn the locking lever of the module upwards until it engages.

5. ▸ For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.

6. ▸ Turn the locking lever of the periphery module downward, again.

7. ▷ 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.

2.5 Mounting 16x periphery modules

> ⚠ **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).
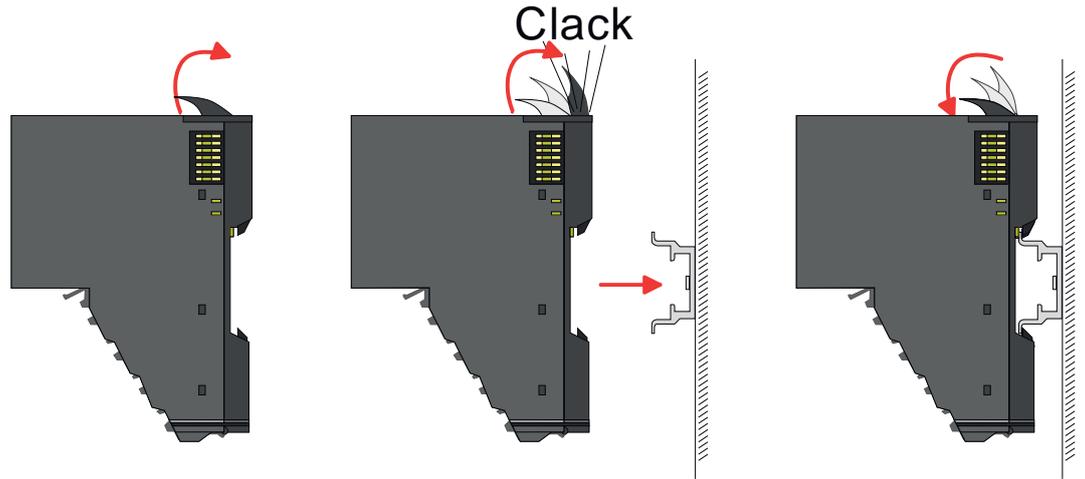
> ⚠ **CAUTION**
>
> **Danger of injury from electrical shock and damage to the unit!**
>
> Put the System SLIO in a safe, powered down state before starting installation, disassembly or wiring of the System SLIO modules!

There is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. 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.

Clack

Electronic unit and terminal block

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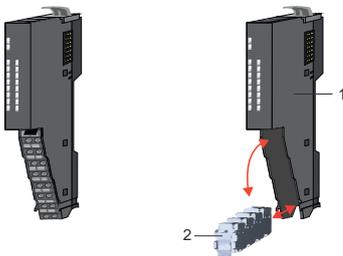
1   Electronic unit
2   Terminal block

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.

Clack
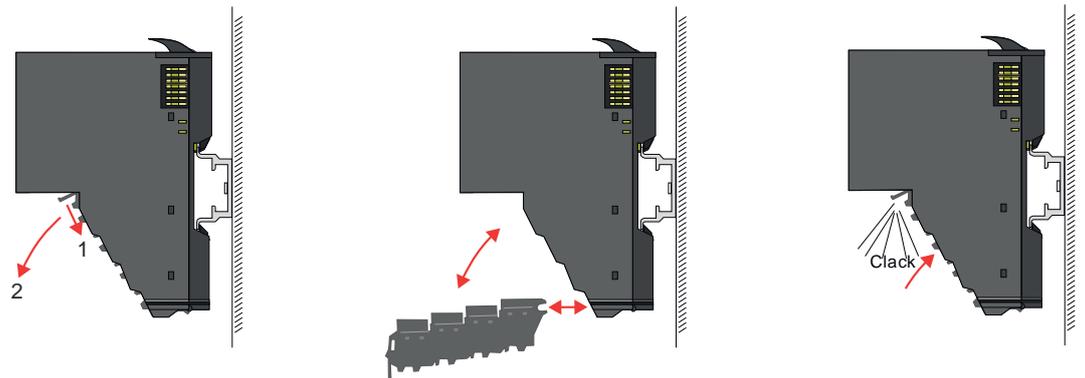
Mounting periphery module
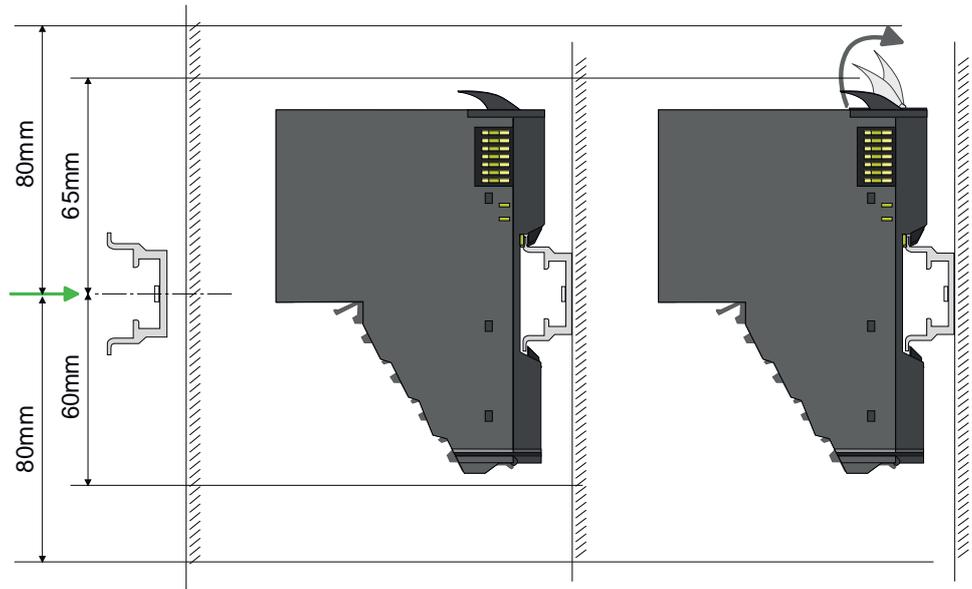
1. ▶ Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 80mm below exist.

2. ▶ Mount your head module such as CPU or field bus coupler.

3. ▶ Before mounting the periphery modules you have to remove the bus cover at the right side of the head module by pulling it forward. Keep the cover for later mounting.

4. ▶ For mounting turn the locking lever of the module upwards until it engages.

5. ▶ For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.

6. ▶ Turn the locking lever of the periphery module downward, again.

7. ▶ 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 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
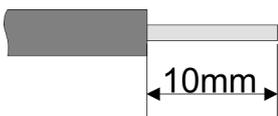
Please use copper wire only!

U_{max}	240V AC / 30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm^2 (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure
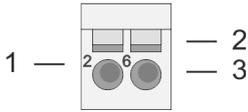
1   Pin number at the connector
2   Opening for screwdriver
3   Connection hole for wire
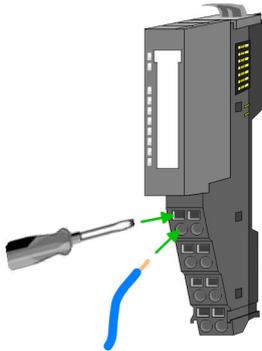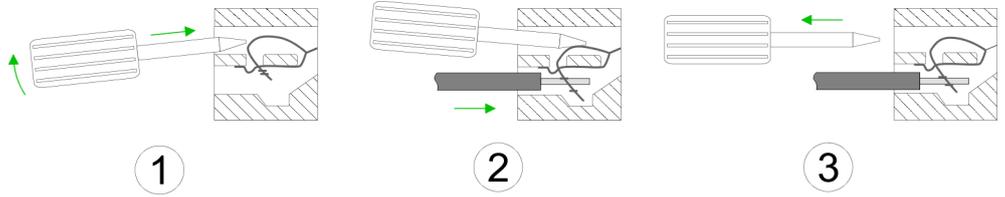
1. ▸ Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.

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 32*

2.7   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
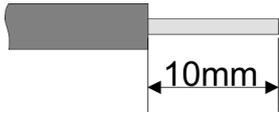
Please use copper wire only!

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
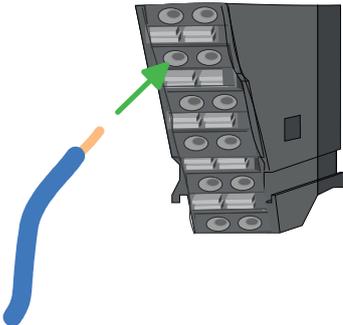
The wiring happens without a tool.

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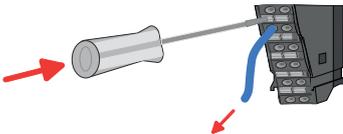
The wire is to be removed by means of a screwdriver with 2.5mm blade width.

1. ▸ Press with your screwdriver vertically at the release button.

    ➡ The contact spring releases the wire.

2. ▸ Pull the wire from the round hole.

2.8   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
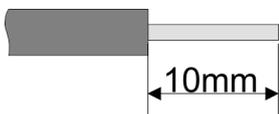
Please use copper wire only!

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 0.08mm^2 up to 1.5mm^2

3. ▸ By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

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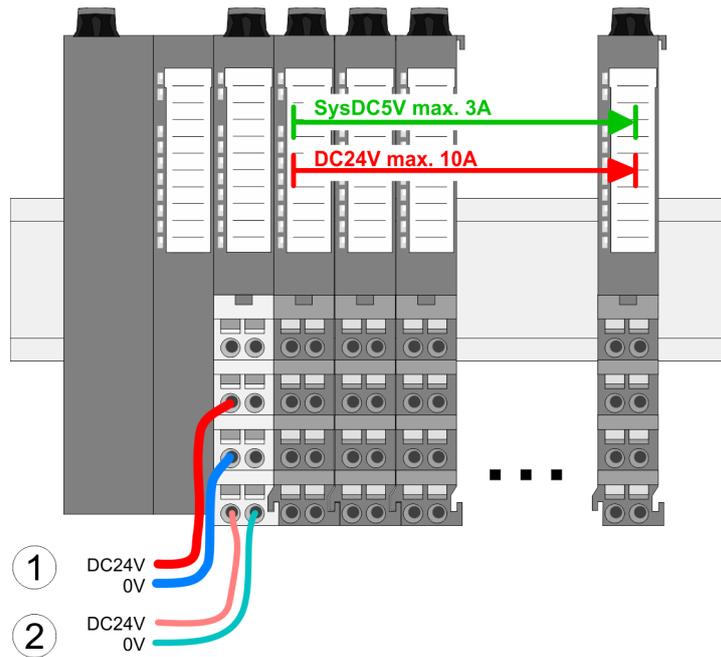
(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area

PM - Power module

For wires with a core cross-section of 0.08mm^2 up to 1.5mm^2.

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
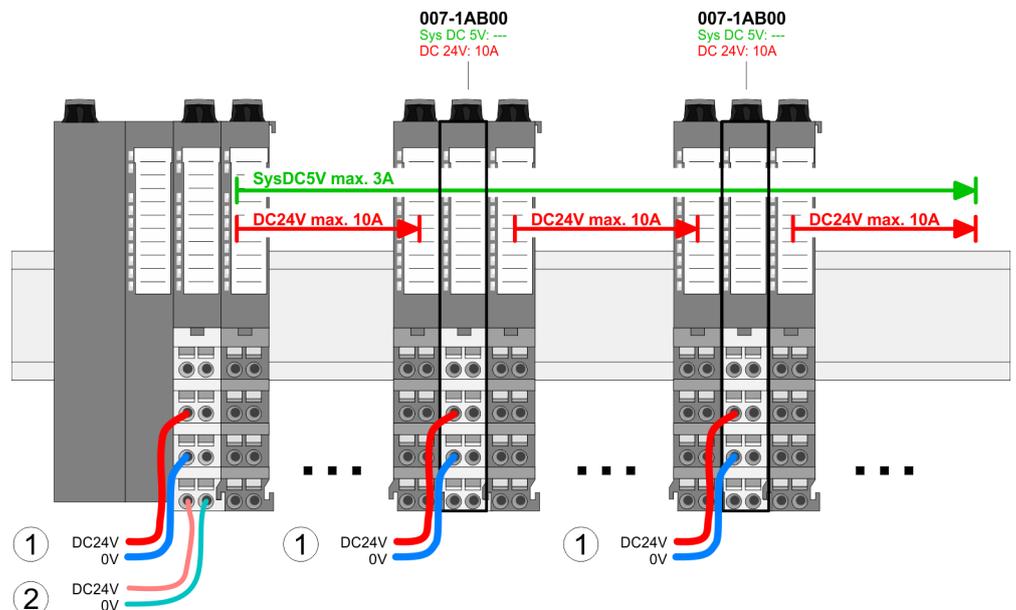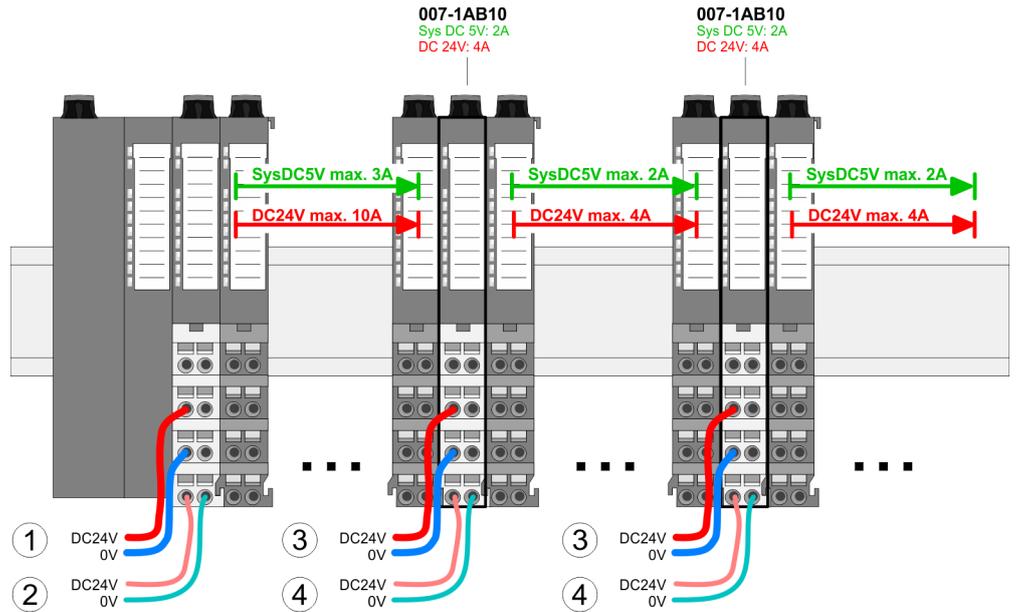
Power module 007-1AB10
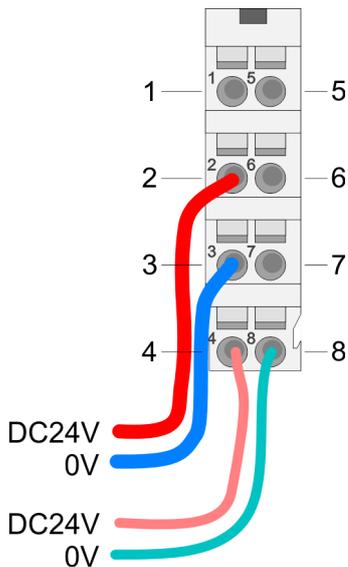

(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area
(3) DC 24V for power section supply I/O area (max. 4A)
(4) DC 24V for electronic power supply I/O area

2.9   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*
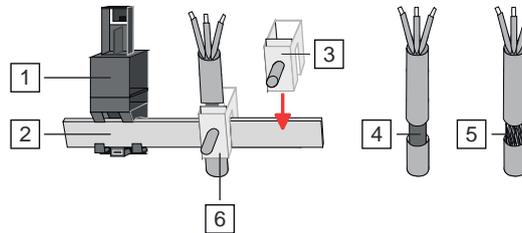
1   Shield bus carrier
2   Shield bus (10mm x 3mm)
3   Shield clamp
4   Cable shield with metal foil
5   Cable shield with wire mesh (close-meshed)
6   Cable shield mounted with shield clamp

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 mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.

2. ▸ Put your shield bus into the shield bus carrier.

Clack
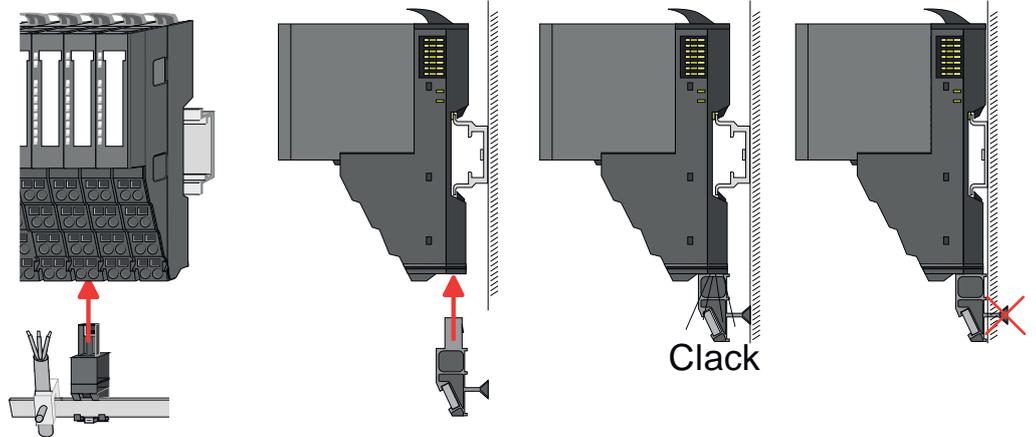
3. ▸ Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

4. ▸ The shield bus must always be earthed. Keep all cable connections as short as possible. To earth the shield bus, connect a PE conductor to the shield bus via a shield clamp and screw it to the base plate as close as possible and with low impedance.
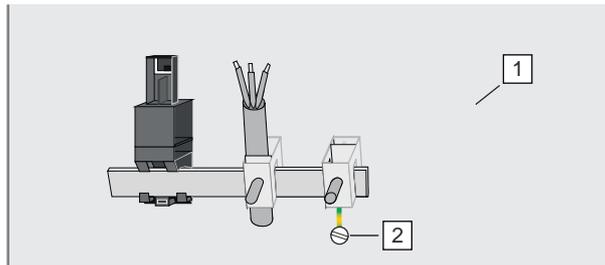
1 Base plate
2 PE conductor screwed to base plate

2.10   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. Pull ←   1. Press   Clack
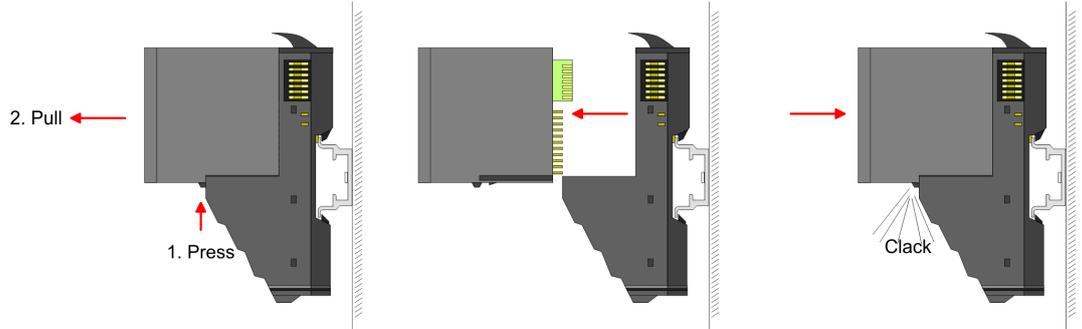
2. ▸ For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.

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.*

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 <u>right</u> 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.
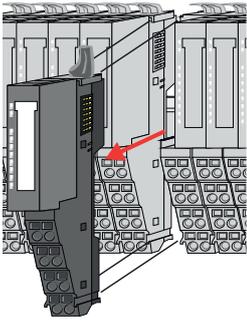
5. ▸ Pull the module.

6. ▸ For mounting turn the locking lever of the module to be mounted upwards.
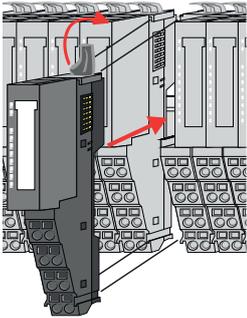
7. ▸ To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.

8. ▸ Turn the locking lever downward, again.
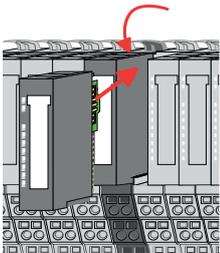
9. ▸ Plug again the electronic module, which you have removed before.

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. ▸

> ℹ *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 <u>right</u> 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.
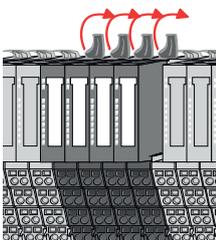
4. ▸ Turn all the locking lever of the module group to be exchanged upwards.
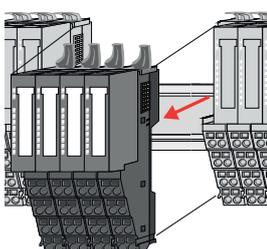
5. ▸ Pull the module group forward.

6. ▸ For mounting turn all the locking lever of the module group to be mounted upwards.
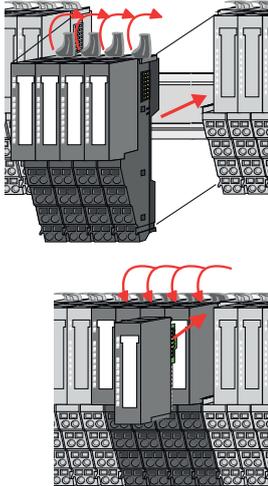
7. ▸ To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.

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.

2.11 Demounting 16x periphery modules

Proceeding

Exchange of an electronic unit

> ⚠ **CAUTION**
>
> Put the System SLIO in a safe, powered down state before starting disassembly!
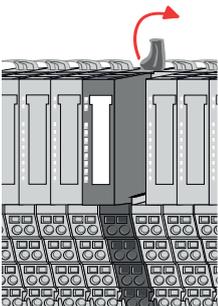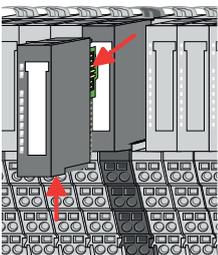
1. ▸ Power-off your system.

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.
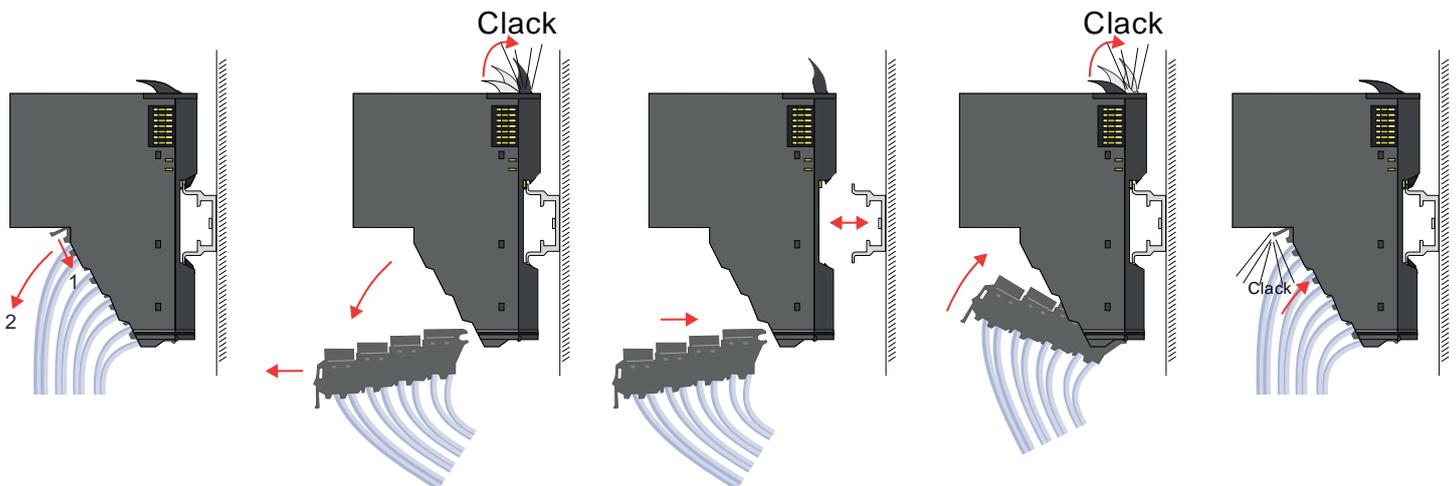
Exchange of a 16x periphery module

1. ▸ Power-off your system.

2. ▸ Remove if exists the wiring of the module respectively the wired terminal block.
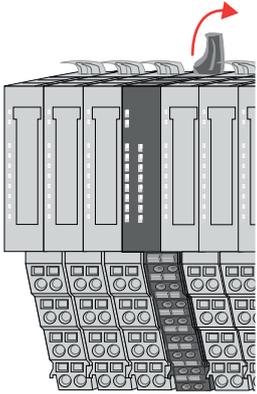
3. ▶

> ℹ️ *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.
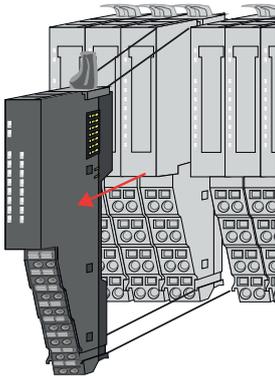
4. ▶ Pull the module.

5. ▶ For mounting turn the locking lever of the module to be mounted upwards.
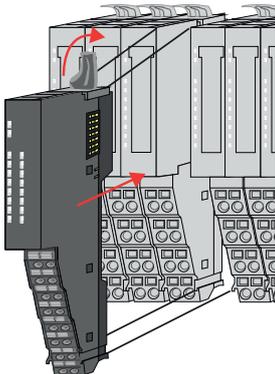
6. ▶ To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
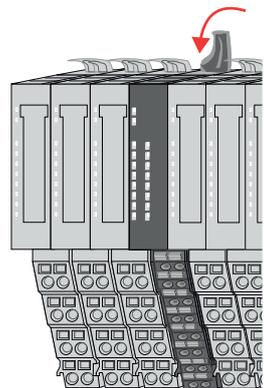
7. ▶ Turn the locking lever downward, again.

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.

Demounting 16x periphery modules
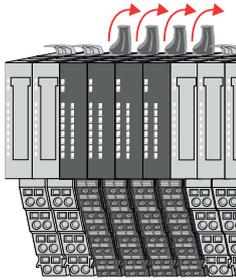
3. ▸

> ℹ️ *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.
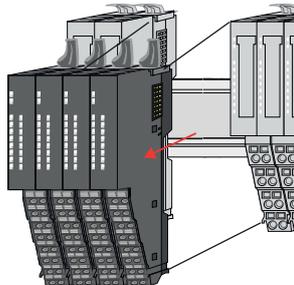
4. ▸ Pull the module group forward.

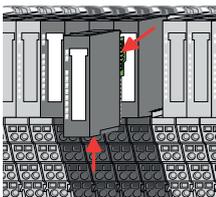**5.** ▸ For mounting turn all the locking lever of the module group to be mounted upwards.
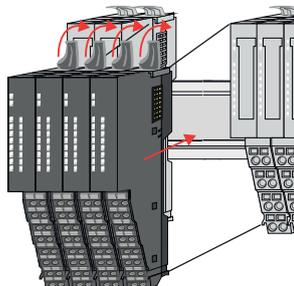
6. ▸ To mount the module group put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
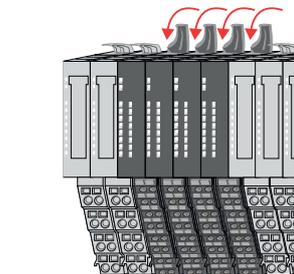
7. ▸ Turn all the locking lever downward, again.

8. ▸ Wire your module group respectively plug the wired terminal blocks again.

➡ Now you can bring your system back into operation.

2.12 Easy Maintenance

Overview
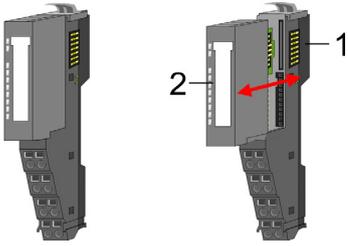
1 Terminal module
2 Electronic module

Easy Maintenance means the support for adding and removing an electronic module during operation without having to restart the system. Here the following behavior is shown by the example of a CPU:

- Electronic module is removed
    - The CPU detects a module failure on the backplane bus.
    - Diagnostic message *'System SLIO bus failure'* (0x39D0) is triggered.
    - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
    - The SF LED of the CPU lights up.
    - The I/O data of all modules become invalid.
- Identical electronic module is plugged
    - The CPU detects the module return on the backplane bus.
    - The SF-LED of the CPU gets off.
    - All RUN LEDs on the modules get on and the MF LEDs get off.
    - Diagnostic message *'System SLIO bus recovery'* (0x38D0) is triggered.
    - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
    - The I/O data of all modules become valid again.
- Wrong electronic module is plugged
    - The CPU detects the wrong module.
    - Diagnostic message *'System SLIO bus recovery, but expected configuration does not match actual configuration'* (0x38D1) is triggered.
    - The SF LED of the CPU remains on.
    - The MF LED of the wrong module flashes.
    - OB 86 is called. If this is not available, the CPU switches to STOP otherwise it remains in RUN.
    - With the exception of the wrong module, the I/O data of all modules become valid again.

> ⚠ **CAUTION**
>
> Please note that only electronic modules may be exchanged during operation! Replacing an 8x or 16x periphery module during operation can damage the module and the system!

> ⓘ *Please note that the CPU switches to STOP, if there is no OB 86 configured when adding or removing System SLIO modules!*

2.13   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
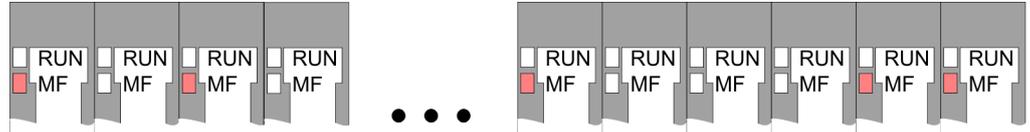
Behavior: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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 28*

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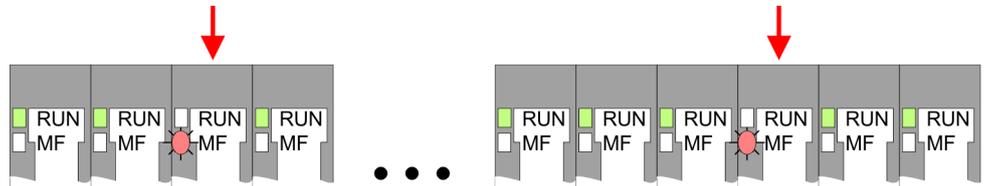
Behavior: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

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

Remedy: Match configuration and hardware structure.

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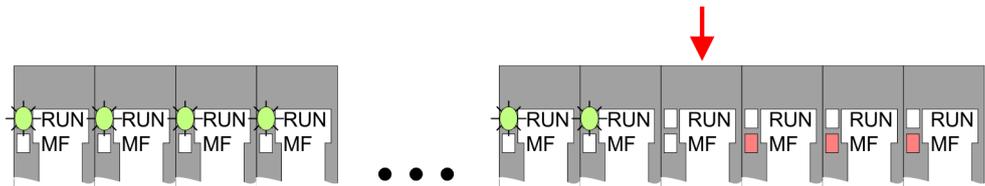
Behavior: After PowerON all of the RUN LEDs up to the defective module are flashing. With all following modules the MF LED is on and the RUN LED is off.

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

Remedy: Replace the defective module.

2.14 Industrial security and installation guidelines

2.14.1 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*

2.14.1.1 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.

2.14.1.2   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.

2.14.2   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 earth 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.
  - Install a central connection between the ground and the protected earth conductor system.
  - 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 earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth 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 earth 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 earth 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 earth 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

2.15   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 earth		
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.

2.15.1 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 Properties

Feature

- IO-Link master with 4 ports.
- The IO-Link ports are galvanically isolated from the backplane bus.
- Permanent memory for parameters.
- The ports can be used in the IO-Link mode or as standard I/O (SIO).
- Status LEDs for IO-Link, SIO mode and error indication.
- The length of the process data for input and output is 64bytes each.
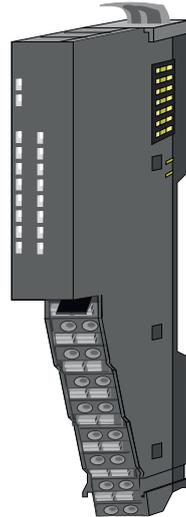
Ordering data

Type	Order number	Description
CP 042 IO-Link	042-1IO00	IO-Link master 4 channel

3.2 Structure

042-1IO00
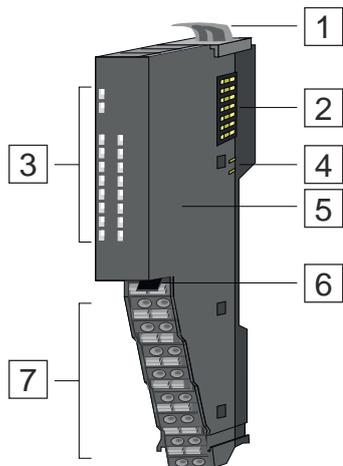
1 Locking lever module
2 Backplane bus
3 LED status indication
4 DC 24V power section supply
5 Electronic unit
6 Locking lever terminal block
7 Terminal block

> ℹ️ *For mounting and wiring, follow the description of the 16x periphery module. 'Mounting 16x periphery modules'...page 23*

Status indication

RUN —
MF —

C1 —   — C2
Q1 —   — Q2
F1 —   — F2
C3 —   — C4
Q3 —   — Q4
F3 —   — F4
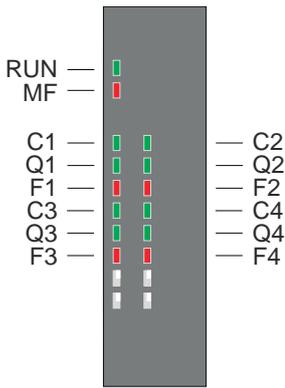
IO-Link master

LED	Color	Description
RUN	🟩 green	Bus communication
MF	🟥 red	Module status
Cn	🟩 green	Status port *n* in *IO-Link mode*
Qn	🟩 green	Status port *n* in *SIO mode*
Fn	🟥 red	Error at port *n*

RUN 🟩 green	MF 🟥 red	C*n* 🟩 green	Q*n* 🟩 green	F*n* 🟥 red	Description
🟩	X	X	X	X	▪ IO-Link master is power supplied.
🟩	🟥	X	X	X	▪ Error on the backplane bus (e.g. module failure, bus faulted).
🟩	X	🟩	⬜	X	▪ Port *n* of the IO-Link master is in *IO-Link mode*. ▪ No IO-Link device is connected to port *n*.
🟩	X	🟩	🟩	X	▪ Port *n* of the IO-Link master is in *IO-Link mode*. ▪ An IO-Link device is connected via port *n*.
🟩	X	⬜	⬜	X	▪ Port *n* of the IO-Link master is disabled. ▪ Port *n* of the IO-Link master is in *SIO mode*. – C/Q at port *n* has "0" signal.
🟩	X	⬜	🟩	X	▪ Port *n* of the IO-Link master is in *SIO mode*. ▪ C/Q at port *n* has "1" signal.
X	🟥	X	X	🟥	Configuration respectively parametrization error
X	X	🟩◣	X	X	All C-LEDs flash according to the following pattern: ON / OFF — 1000ms, 100ms, 100ms, 300ms ▪ Localisation for identifying the IO-Link master is enabled. See manual IO-Link Manager.
X	X	🟩◣	X	🟥◣	LEDs C1, F3 and C2, F4 are blinking alternately with 1 Hz. ▪ A firmware update is done on the IO-Link master.
X	X	🟩◣	X	⬜	LEDs C1 and C2 are blinking alternately with 1 Hz. ▪ An error occurred during the firmware update. ▪ Check that the firmware file matches your IO-Link master and run the update again. If the error persists, please contact the Yaskawa hotline!
🟩	⬜	🟩	🟩	🟥	An error occurred on port *n*.
not relevant: X					

Structure

Pin assignment

For wires with a core cross-section of 0.14mm^2 up to 0.75mm^2. With a core cross-section < 0.25mm^2, ferrules must be used. *'Data'...page 28*
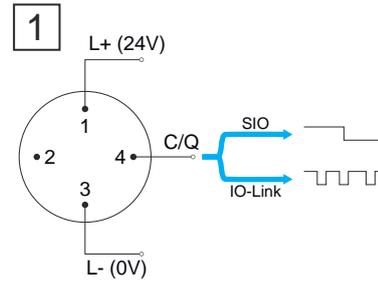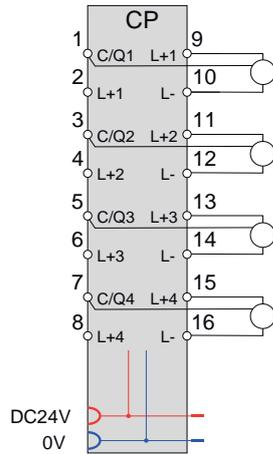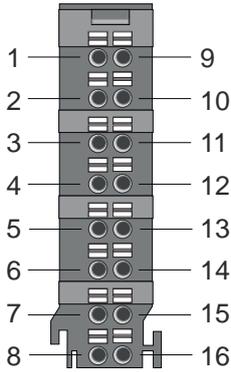
☐1 Port class A M12 connector

Pos.	Function	Type	Description
1	C/Q 1	I/O	▪ IO-Link mode: Coded switching signal port 1 ▪ SIO mode: Digital input/output channel 1
2	L+ 1	O	DC 24V port 1
3	C/Q 2	I/O	▪ IO-Link mode: Coded switching signal port 2 ▪ SIO mode: Digital input/output channel 2
4	L+ 2	O	DC 24V port 2
5	C/Q 3	I/O	▪ IO-Link mode: Coded switching signal port 3 ▪ SIO mode: Digital input/output channel 3
6	L+ 3	O	DC 24V port 3
7	C/Q 4	I/O	▪ IO-Link mode: Coded switching signal port 4 ▪ SIO mode: Digital input/output channel 4
8	L+ 4	O	DC 24V port 4
9	L+ 1	O	DC 24V port 1
10	L-	O	Ground port 1[1]
11	L+ 2	O	DC 24V port 2
12	L-	O	Ground port 2[1]
13	L+ 3	O	DC 24V port 3
14	L-	O	Ground port 3[1]
15	L+ 4	O	DC 24V port 4
16	L-	O	Ground port 4[1]
I: Input, O: Output			

1) The grounds of the ports are connected to each other.

3.3 Technical data

Order no.	042-1IO00
Type	CP 042 - IO-Link Master
Module ID	0A81BC80
Current consumption/power loss	
Current consumption from backplane bus	32 mA
Current consumption from load voltage L+ (without load)	17.7 mA
Power loss	1.2 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	-
Group error display	red LED
Channel error display	red LED
Datasizes	
Input bytes	64
Output bytes	64
Parameter bytes	0
Diagnostic bytes	20
Power delivery	
Rated load voltage	DC 24 V
Rated load voltage (permitted range)	DC 20.4...28.8 V
Encoder supply	
Number of outputs (L+n)	4
Rated output current	500 mA per port
Overload protection	yes
Reverse polarity protection	yes
Port settings	
Port mode	Deactivated (default)
	IO-Link mode (autostart)
	IO-Link mode (manual)
	SIO mode DI (digital input)
	SIO mode DO (digital output)
IO-Link mode	
Number of ports	4

Technical data

Order no.	042-1IO00
Specification	IO-Link V1.1.3
Overload protection	C/Q pins
Reverse polarity protection	C/Q pins
Data transfer rates	4.8 kBaud (COM1)
	38.4 kBaud (COM2)
	230.4 kBaud (COM3)
Connection	3-wire
Cable length, unshielded	max. 20m
SIO mode (C/Q) digital input	
Number of inputs	4
Rated input current (C/Q) at signal "1"	5,5 mA per port
Connector	2, 3 wires
Fulfilled standard	IEC 61131-2
	IEC 61131-9 SDCI
SIO mode (C/Q) digital output	
Number of outputs	4
Rated output current (C/Q) at signal "1"	200 mA per port (DC general use)
Overload protection	C/Q pins
Reverse polarity protection	C/Q pins
Connector	2, 3 wires
Fulfilled standard	IEC 61131-2
	IEC 61131-9 SDCI
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	52 g
Weight including accessories	67 g
Gross weight	67 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 IO-Link

General

> ⃝
> ⓘ   *Open Source license information*
>
> –   *Open source software is used within the firmware.*
>
> –   *You can retrieve the corresponding 'Open Source licence information' via the head module used.*
>
> –   *For more details, refer to the 'Open Source Licence Information' in the manual for your head module.*

IO-Link is an open standard for industrial point-to-point communication down to the sensor/actuator level. Here you have access to process and diagnostic data and device information. IO-Link is specified in IEC 61131-9.

IO-Link consists of the following components:

- ▪ IO-Link master
- ▪ IO-Link device
- ▪ Unshielded 3-wire standard cable
- ▪ Engineering tool for configuration and parametrization of IO-Link

IO-Link master

The IO-Link serves as an interface between the automation system and the IO-Link devices. The communication takes place via IO-Link ports.

Port operating modes

You can operate the IO-Link ports in the following operating modes:

- ▪ *IO-Link mode*
  - – The port communicates via IO-Link.
- ▪ *SIO mode* - DI
  - – The port behaves like a digital input.
- ▪ *SIO mode* - DO
  - – The port behaves like a digital output.
- ▪ Disabled
  - – The port is disabled.

IO-Link device

An IO-Link device is an element from the sensor/actuator level that can supply or process diagnostic data in addition to process data. You can connect an I/O-Link device to each port of the I/O-Link master. The communication between the IO-Link master and an IO-Link device takes place as point-to-point communication.

IO-Link Manager

IO-Link Manager is software from Yaskawa for configuring your IO-Link master and the connected IO-Link devices. You can find the software IO-Link Manager in the *'Download Center'* of www.yaskawa.eu.com at SW300I0EA.

Device description IODD file

For integration into your configuration tool, you will receive an IODD file (**IO D**evice **D**escription) from the manufacturer of the corresponding IO-Link device. The IODD file contains individual device properties for the corresponding IO-Link device, which is available after integration in the configuration tool and thus simplifies configuration and parametrization.

Transfer medium

IO-Link uses unshielded 3-wires with a maximum length of 20m to connect the IO-Link devices. In addition to the IO-Link communication, a power supply for the connected IO-Link device is also realised via these 3-wires

Signal transmission

IO-Link uses 24V levels for signal transmission. In the event of an error, a telegram is repeated 2 times. The IO-Link master then reports a communication abort.

Transfer rate

An IO-Link master supports the following transfer rates defined according to IO-Link specification V1.1:

- COM 1 = 4.8 kbaud
- COM 2 = 38.4 kbaud
- COM 3 = 230.4 kbaud

An IO-Link device supports one of the transfer rates to which the IO-Link master adapts automatically. You can connect IO-Link devices with different transfer rates to the various ports of the IO-Link master.

Data types

The following data types are used in IO-Link:

- Process data
  - Process data is cyclic data whose size (max. 32 bytes) is defined by the IO-Link device.
- PQI data
  - PQI data (Port Qualifier Information) are cyclic data which contains status information about the IO-Link port or device. You can enable PQI accordingly via the parametization.
- Device data
  Device data are acyclic data such as parameters and diagnostic messages, which can be exchanged with the IO-Link device on request from the IO-Link master.
- Events
  - Events are acyclic requests that the IO-Link device sends to the IO-Link master, such as error messages and warnings. The IO-Link master can forward this to the higher-level system accordingly.

Cyclic time

During the initialization, the IO-Link master determines the cycle time for the process data exchange for each connected IO-Link device. In IO-Link Manager you can manually adjust the cycle time for the process data exchange to the cycle time of the higher-level system if necessary.

4.2 Commissioning

Head modules

Max. 6 IO-Link masters are supported on the backplane bus by the following System SLIO CPUs respectively interface modules:

- CPUs 01x as of Firmware V3.0.14
- IM - 053-1PN01 - interface module PROFINET as of firmware V1.1.1.0
- IM - 053-1EC01 - interface module EtherCAT as of firmware V2.1.1.0
- IM - 053-1IP01 - Interface module EtherNet/IP as of firmware V1.210
- IM - 053-1MT01 - Interface module Modbus/TCP as of firmware V1.2.0

Proceeding

1. ▸ Mount your System SLIO with the IO-Link master and wire this. For mounting and wiring of the IO-Link master, follow the description of the 16x periphery module. *'Basics and mounting'...page 10*

2. ▸ Connect the corresponding IO-Link device to the ports. *'Pin assignment'...page 50*

3. ▸

> ⓘ **Power supply**
>
> *The module is to be power supplied with the both DC 24V voltages power section supply I/O area and electronic power supply. When commissioning these may simultaneously or electronic power supply must be switched on first. When commissioning these may simultaneously or power section supply I/O area must be switched on first.* *'Standard wiring'...page 30*

Switch on the power supply for your system and establish an online connection to your IO-Link master via the head module.

4. ▸ Configure your system in your head station and integrate the address area of the IO-Link master into your user program. More may be found in the corresponding manual of your Head station respectively *'In-/Output area'...page 56*.

5. ▸ Configure the IO-Link master. To do this, use the *IO-Link Manager*. For more information, see the corresponding manual.

   - ▪ Configure the IO-Link master.
   - ▪ Configure the IO-Link devices.
   - ▪ Apply the port mapping.
   - ▪ Transfer the configuration online to the IO-Link master.

> ⚠ **CAUTION**
>
> **Port mapping necessary**
>
> Please note that the port mapping of the process data must always be applied in *IO-Link Manager* and is not done automatically! You can access the port mapping in the editor area via *'Master Control → Advanced Master Control → Process Data'*.

6. ▸ If necessary, adapt the port mapping in your user program.
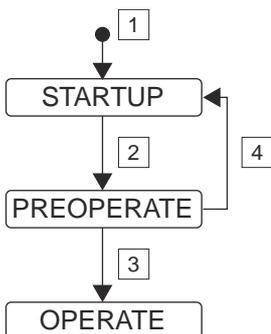
The IO-Link master is now ready for communication.

- ▪ If an IO-Link device is connected and the corresponding port is in *IO-Link mode*, it starts in the *STARTUP* state ☐1.
- ▪ The IO-Link master attempts to establish a connection to the IO-Link device. First, the appropriate transmission rate and the cycle time for the process data exchange are determined for the corresponding port. The IO-Link device then transfers the basic parameters for device identification.
- ▪ If the determined basic parameters match the configured ones, the IO-Link device changes to the *PREOPERATE* state ☐2.
- ▪ In the *PREOPERATE* state, the IO-Link device is supplied with the corresponding parameter data and changes to the *OPERATE* state ☐3. In the *OPERATE* state, the IO-Link device is in cyclic data exchange with the IO-Link master.
- ▪ If no connection could be established or if the basic parameters for device identification deviate from the configured basic parameters, you will receive an error message and the IO-Link device remains in the *STARTUP* state ☐4.

4.3   In-/Output area

4.3.1   Input area 64byte

Input area   With CPU, PROFINET and EtherNet/IP, the input area, consisting of the status and input data of the ports, is shown in the corresponding address area.

SX   Subindex for access via EtherCAT with index 6000h + EtherCAT-Slot.

For details, refer to the manual for your bus coupler.

Addr.	Name	Bytes	Function	SX
+0	STATUS	1	Status information of the IO-Link master.	01h
+1		1	Mapped port input data.	02h
...	INPUT_DATA	...	■ The mapping of the IO-Link devices is to be set via the *IO-Link Manager*.	...
+63		1	■ By activating *'EnablePqi'*, the input data of devices in *IO-Link mode* are extended by the PQI byte at the end.	3Fh

STATUS

Bit	Name	Function
0	STS_ALARM	For internal use.
1	STS_PARAM_ERROR	Set on parametrization error.
2	STS_CONFIG_ERROR	Set on configuration error.
3-5	reserved	Reserved
6	STS_READY	■ Set when the IO-Link firmware has been successfully initialized and is in RUN. ■ Not set when the IO-Link master is in *Bootloader Mode*. The IO-Link master is in *Bootloader Mode* during a firmware update. If the IO-Link master is still in *Bootloader Mode* after the firmware update, an error has occurred. Check that the firmware file matches your IO-Link master and run the update again. *'Firmware update'...page 62* If the error persists, please contact the Yaskawa hotline!
7	STS_TOGGLE	Toggle bit ■ The toggle bit changes state every 100ms (default). ■ This can be used to detect a failure on the field side. ■ You can set the time interval in the *IO-Link Manager* at IO-Link master parameters via Toggle Bit Interval.

4.3.2   Output area 64byte

Output area   With CPU, PROFINET and EtherNet/IP, the output area, consisting of the output data of the ports, is shown in the corresponding address area.

SX   Subindex for access via EtherCAT with index 6000h + EtherCAT-Slot.

For details, refer to the manual for your bus coupler.

Addr.	Name	Bytes	Function	SX
+0		1	Mapped port output data.	01h
...	OUTPUT_DATA	...	■ The mapping of the IO-Link devices is to be set via the *IO-Link Manager*.	...
+63		1		3Fh

4.4 Product specific parameters

The product-specific parameters for the IO-Link master can only be set or retrieved via the *IO-Link Manager* configuration tool. For access, the *IO-Link Manager* uses product-specific SMI services for reading and writing the parameters. The IO-Link master has the following product-specific parameters:

Product specific parameters

Name	Definition	Data type	Values	Default
EnablePqi	PQI - Port Qualifier Information ■ 0: Port input data are not extended by the PQI byte. ■ 1: Port input data are extended by the PQI byte.	UINT_8	0 and 1	0
CYC_TGL	Toggle Bit Interval ■ Toggle-Bit interval in ms.	UINT_32	1 bis 10000	100
P_IN_OFF	Offset of the port input data in the process image.	UINT_8	1 to 63	1
P_IN_LEN	Length of the port input data (without PQI).	UINT_8	0 to 32	0
P_OUT_OFF	Offset of the port output data in the process image.	UINT_8	0 to 63	0
P_OUT_LEN	Length of the port output data.	UINT_8	0 to 32	0

EnablePqi

■ By activating *'EnablePqi'*, the input data of devices in *IO-Link mode* are extended by the PQI byte at the end.

■ The PQI byte contains information about the port status and IO-Link device status.

Byte	Bit 7 ... 0
PQI	■ Bit 4 ... 0: reserved ■ Bit 5: DevCom – 1: IO-Link device was recognized and is in the OPERATE respectively PREOPERATE state. – 0: No IO-Link device was detected. ■ Bit 6: DevError – 1: A warning respectively an error has occurred on the IO-Link device. – 0: There is no error. ■ Bit 7: PQ – 1: The port data are valid. – 0: The port data are not valid.

Product specific parameters

Mapping of the I/O data

Here you can adapt the mapping of the process data accordingly. Whenever the configuration is changed, consistency checks are done according to the following rules:

- The process data of each port must be within the input respectively output process image of the IO-Link master.
- If *'EnablePqi'* is activated, the additional PQI byte must be taken into account accordingly for the input data of IO-Link devices in *IO-Link mode*.
- The process data of the individual ports must not overlap in the input or output process image of the IO-Link master.
- The process input data of the individual ports must not overlap with the status byte of the IO-Link master.

Name	Definition	Data type	Values	Default
P_IN_OFF	Offset of the port input data in the process image.	UINT_8	1 to 63	1
P_IN_LEN	Length of the port input data (without PQI).	UINT_8	0 to 32	0
P_OUT_OFF	Offset of the port output data in the process image.	UINT_8	0 to 63	0
P_OUT_LEN	Length of the port output data.	UINT_8	0 to 32	0

Example of valid port mapping

Output process image				Input process image			
	Port	Offset	Length		Port	Offset	Length
	Port 1	0x00	0x02		Port 1	0x01	0x02
	Port 2	0x04	0x02		Port 2	n/a	n/a
	Port 3	0x06	0x02		Port 3	0x3C	0x02
	Port 4	0x3C	0x04		Port 4	0x04	0x04

Example of incorrect port mapping

Output process image			
	Port	Offset	Length
	Port 1	0x00	0x04
	Port 2	0x3D	0x04
	Port 3	n/a	n/a
	Port 4	0x02	0x04

Input process image			
	Port	Offset	Length
	Port 1	0x01	0x02
	Port 2	n/a	n/a
	Port 3	0x3C	0x02
	Port 4	0x04	0x04

- The output mapping of port 2 is partly outside the output process image of the IO-Link master.
- The ranges of port 1 and port 4 overlap.

- If PQI is enabled, the port 4 input mapping is outside of the input process image.
- If PQI is enabled, port 2 and port 3 overlap.
- Port 1 overlaps with the status byte.

4.5 Diagnostics

In case of an error, the error LED of the corresponding port is on and the error is registered in the diagnostic data as a channel error and the corresponding bit is set in the *STATUS* byte. The following errors are registered in the diagnostic data:

- Error in parametrization
- Error in configuration

DS   Record set for access via CPU and PROFINET. Access is via DS 01h. Additionally the first 4 bytes may be accessed by record set DS 00h.

SX   Subindex for access via EtherCAT with index 5005h.

For details, refer to the manual for your bus coupler.

Diagnostic data

Name	Bytes	Function	Default	DS	SX
ERR_A	1	Diagnostic	00h	01h	02h
MODTYP	1	Module information	1Ch		03h
ERR_C	1	reserved	00h		04h
ERR_D	1	Diagnostic	00h		05h
CHTYP	1	Channel type	60h		06h
NUMBIT	1	Number diagnostics bits per channel	08h		07h
NUMCH	1	Number channels of the module	04h		08h
CHERR	1	Channel error	00h		09h
CH0ERR	1	Channel error port 1	00h		0Ah
CH1ERR	1	Channel error port 2	00h		0Bh
CH2ERR	1	Channel error port 3	00h		0Ch
CH3ERR	1	Channel error port 4	00h		0Dh
CH4ERR… CH7ERR	4	reserved	00h		0Eh ... 11h
DIAG_US	4	µs ticker	00h		13h

ERR_A Diagnostic

Byte	Bit 7 ... 0
0	▪ Bit 0: set at module failure ▪ Bit 1: set at internal error ▪ Bit 2: set at external error ▪ Bit 3: set at channel error ▪ Bit 4: set at external auxiliary supply missing ▪ Bit 5: reserved ▪ Bit 6: set at error in configuration ▪ Bit 7: set at error in parametrization

MODTYP Module information

Byte	Bit 7 ... 0
0	▪ Bit 3 ... 0: Module class – 1100b: CP ▪ Bit 4: set at channel information present ▪ Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	▪ Bit 6 ... 0: Channel type – 60h: CP ▪ Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostic bits of the module per channel (here 08h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of a module (here 04h)

CHERR Channel error

Byte	Bit 7 ... 0
0	■ Bit 0: set at channel error port 1 ■ Bit 1: set at channel error port 2 ■ Bit 2: set at channel error port 3 ■ Bit 3: set at channel error port 4 ■ Bit 7 ... 4: reserved

CHxERR Channel-specific

Byte	Bit 7 ... 0
0	Channel-specific error Port 1 ... Port 4 ■ Bit 0: set at error in parametrization ■ Bit 1: set at error in configuration ■ Bit 7 ... 2: reserved

DIAG_US µs ticker

Byte	Bit 7 ... 0
0...3	Value of the µs ticker at the moment of the diagnostic

µs ticker

In the System SLIO module there is a timer (µs ticker). With PowerON the timer starts counting with 0. After $2^{32}-1\mu s$ the timer starts with 0 again.

ERR_C/D, CH4ERR ... CH7ERR reserved

Byte	Bit 7 ... 0
0	reserved

4.6 Firmware update

> ⚠️ **CAUTION**
> – When installing a new firmware you have to be extremely careful. In certain circumstances, your CP 042 IO-Link may become unusable if, for example, the power supply is interrupted during transmission or the firmware file is faulty. In this case, please call the Yaskawa hotline!

> ℹ️ – *The update deletes the port configurations saved in the IO-Link master and resets the parameters to their default values.*

- You can only apply a firmware update via the *IO-Link Manager*.
- You can find current firmware versions in the *'Download Center'* of www.yaskawa.eu.com.

For example, the following file is required for the firmware update of the 042-1IO00 for hardware revision 01:

- Bx000808.bin

Proceeding

1. ▸ Go to the *'Download Center'* of www.yaskawa.eu.com.
2. ▸ Download the corresponding zip file for your IO-Link master to your PC at *'Firmware'*, by stating the order number.
3. ▸ Extract the zip file into your working directory.
4. ▸ Switch on the power supply for your system.
5. ▸ Open the *IO-Link Manager and establish an online connection to your IO-Link master via the head module.*.
6. ▸ Select the corresponding IO-Link master in *'Topology'*.
7. ▸ Navigate to the firmware update dialog via *'Master Control → Advanced Master Control → General'*.

> ℹ️ *To identify the IO-Link master, you can localize it on the System SLIO bus. To do this, enter a period of time in seconds at "Locate Master ..." and click on [ACTIVATE]. This starts the localisation with device-specific blinking behavior at the corresponding IO-Link master for the set period of time.*

8. ▸ At *'System Management'* navigate with ☐ your firmware file in the working directory.
9. ▸ Start the firmware update with [Update].
   ➡ During the firmware update, the LEDs C1, F3 and C2, F4 are blinking alternately. After the update, the IO-Link master is restarted without configuration with default parameters.

> ℹ️ *If only the LEDs C1 and C2 are blinking alternately, an error has occurred, the IO-Link master is still in Bootloader Mode and indicates this at 'TOPOLOGY'. Check that the firmware file matches your IO-Link master and run the update again. If the error persists, please contact the Yaskawa hotline!*

4.7   Reset to factory settings

Proceeding

1. ▸ Switch on the power supply for your system.

2. ▸ Open the *IO-Link Manager and establish an online connection to your IO-Link master via the head module.*.

3. ▸ Select the corresponding IO-Link master in *'Topology'*.

4. ▸ Navigate to the reset dialog via *'Master Control → Advanced Master Control → General'*.

> *To identify the IO-Link master, you can localize it on the System SLIO bus. To do this, enter a period of time in seconds at "Locate Master ..." and click on [ACTIVATE]. This starts the localisation with device-specific blinking behavior at the corresponding IO-Link master for the set period of time.*

5. ▸ With the [FACTORY RESET] button at *'System Management'*, you can trigger the reset to Factory setting.

➥ Reset to Factory setting is done and the IO-Link master is restarted without configuration with default parameters.