YASKAWA

System SLIO

IM | 053-1DP00 | Manual

HB300 | IM | 053-1DP00 | en | 22-30

Interface module PROFIBUS-DP - IM 053DP

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1 General

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1.2 About this manual

Objective and contents

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

- It describes the structure, configuration and application.
- The manual is targeted at users who have a background in automation technology.
- 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 state:	
IM 053DP	053-1DP00	HW: 06	FW: 2.0.1

Icons Headings

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

DANGER!
Immediate or likely danger. Personal injury is possible.

CAUTION!
Damages to property is likely if these warnings are not heeded.

Supplementary information and useful tips.

1.3 Safety information

Applications conforming with specifications

The system is constructed and produced for:

- communication and process control
- general control and automation tasks
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

DANGER!

This device is not certified for applications in

– in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

CAUTION!

The following conditions must be met before using or commissioning the components described in this manual:

– Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!

– Installation and hardware modifications only by properly trained personnel.

– The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

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 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.

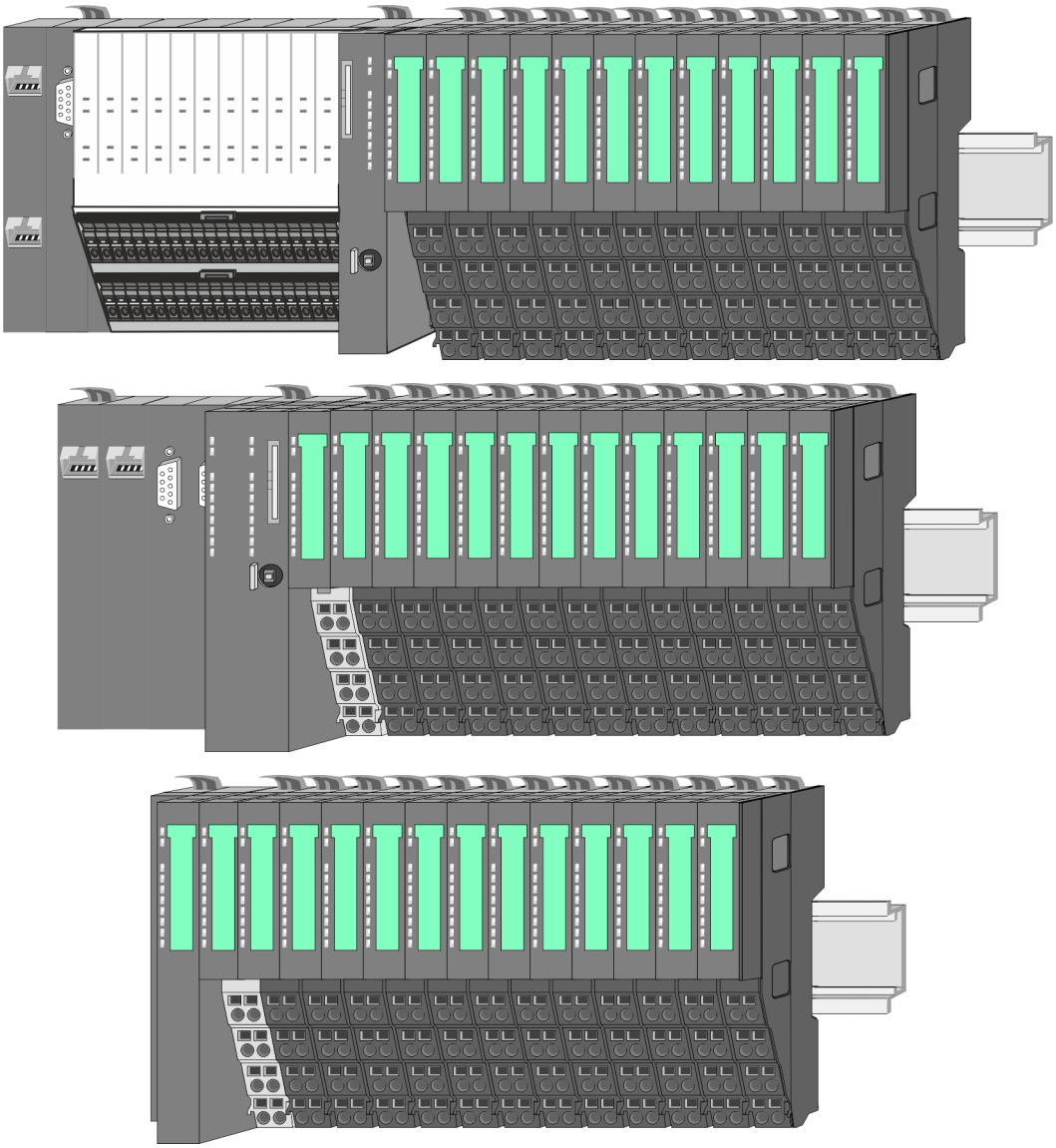
CAUTION!

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.

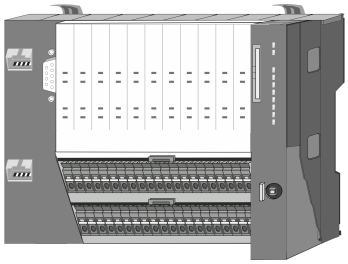


2.2.2 Components

- 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



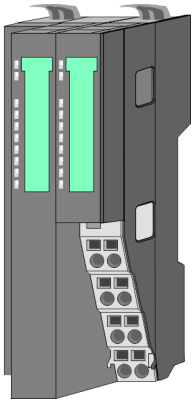
With the CPU 01xC electronic, input/output components and power supply are integrated to one casing. In addition, up to 64 periphery modules of the System SLIO can be connected to the backplane bus. As head module via the integrated power module for power supply CPU electronic and the I/O components 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!

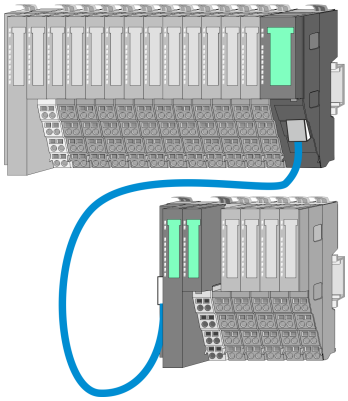
Bus coupler



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!

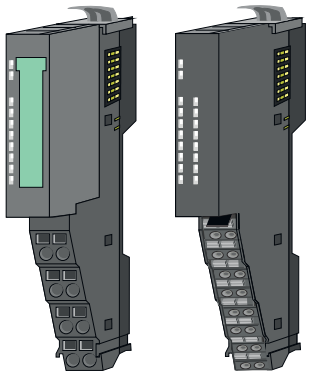
Line extension



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 master at each end of a line and the subsequent line has to start with a line extension slave. Master and slave are to be connected via a special connecting cable. In this way, you can divide a line on up to 5 lines. For each line extension the maximum number of pluggable modules at the System SLIO bus is decreased by 1. 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, see the 'System SLIO - Compatibility List' at www.yaskawa.eu.com

Periphery modules

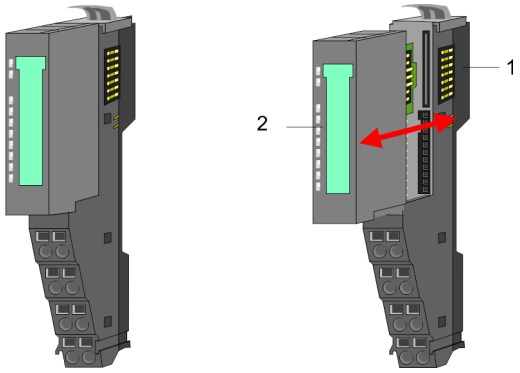


The periphery modules are available in the following 2 versions, whereby of each the electronic part can be replaced with standing wiring:

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

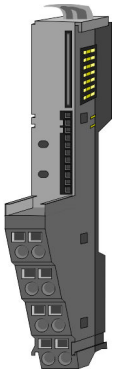
8x periphery modules

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



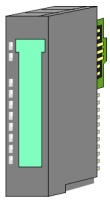
1 Terminal module
2 Electronic module

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.

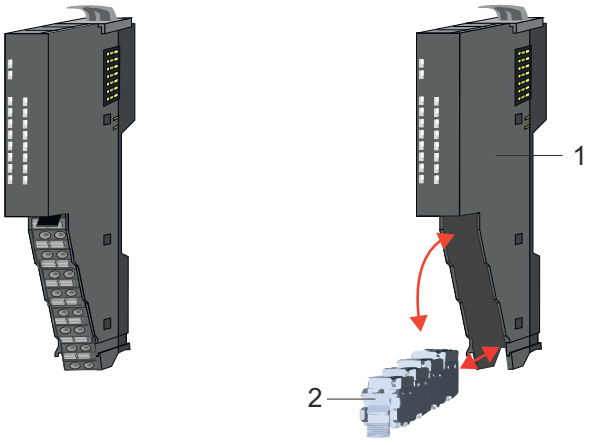
Electronic module



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.

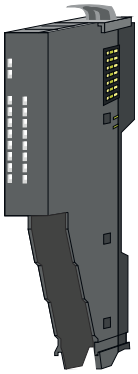
16x periphery modules

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



1 Electronic unit
2 Terminal block

Electronic unit

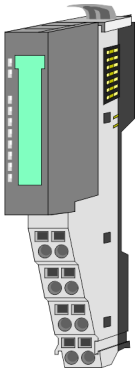


The functionality of a 16x periphery module is defined via the terminal block, which is connected to the *electronic unit* via a secure flap mechanism. In the case of an error you can exchange the defective electronic unit for a functional unit with standing wiring. At the front side there are LEDs for 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

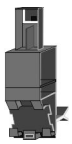


In the System SLIO the power supply is established by power modules. These are either integrated to the head module or may be installed between the periphery modules. Depending on the power module isolated areas of the DC 24V power section supply may be defined respectively the electronic power supply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

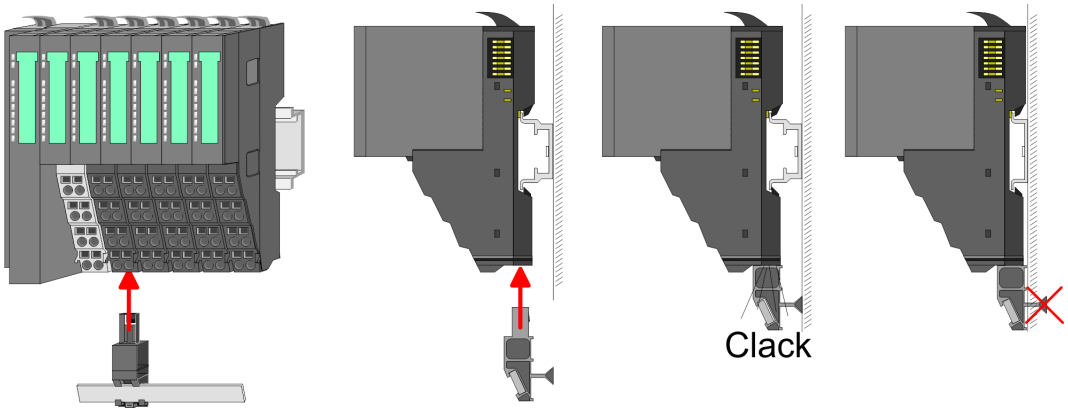
2.2.3 Accessories

Shield bus carrier

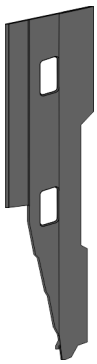
Please note that a shield bus carrier cannot be mounted on a 16x periphery module!



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.



Bus cover



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

Coding pins

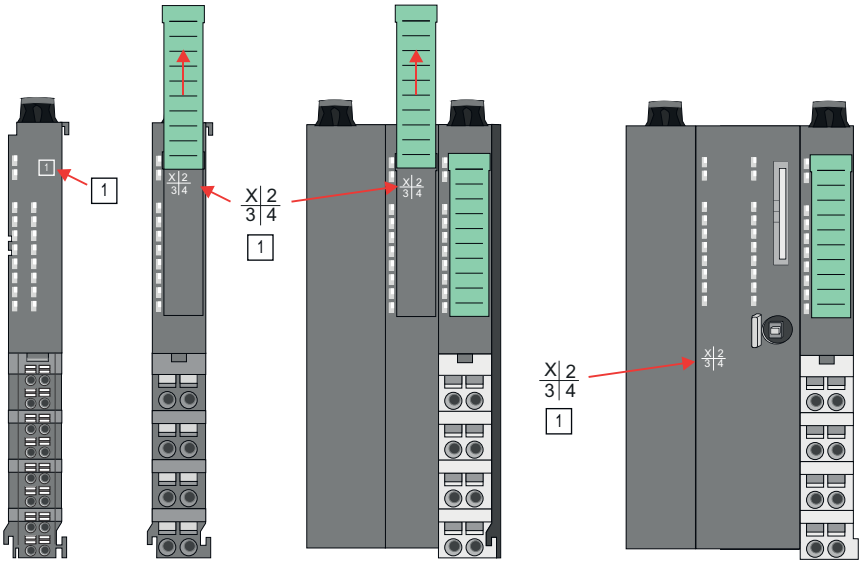
Please note that a coding pin cannot be installed on a 16x periphery module! Here you have to make sure that the associated terminal block is plugged again when the electronics unit is replaced.

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

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:
  - Current modules have a 1 on the front.
  - With earlier modules, the 1 is marked with *'X'* on a number grid.



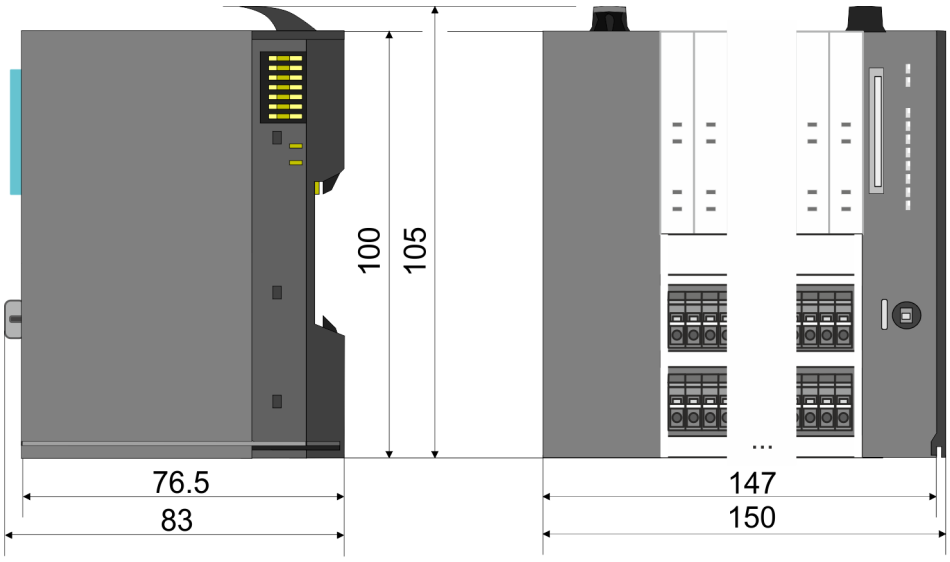
Hardware revision via web server

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

2.3 Dimensions

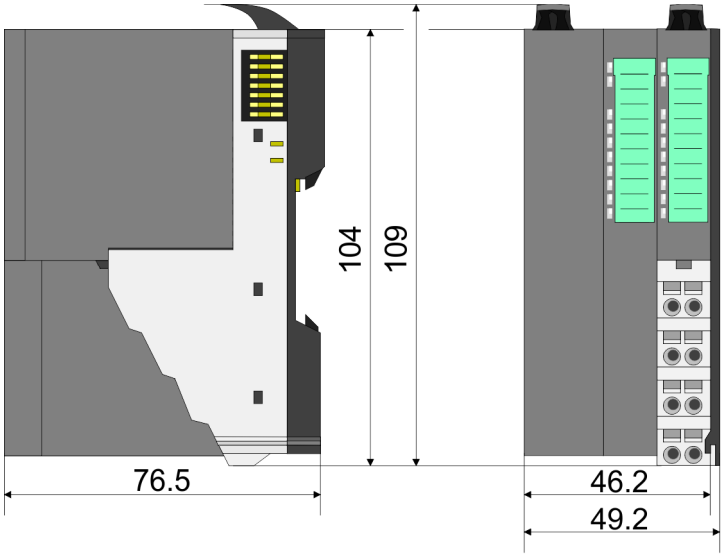
CPU 01xC

All dimensions are in mm.

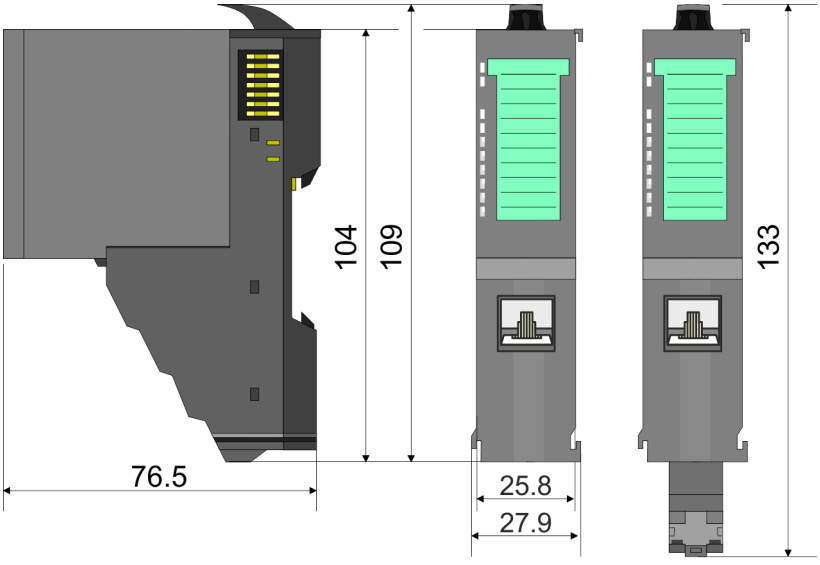


CPU 01x

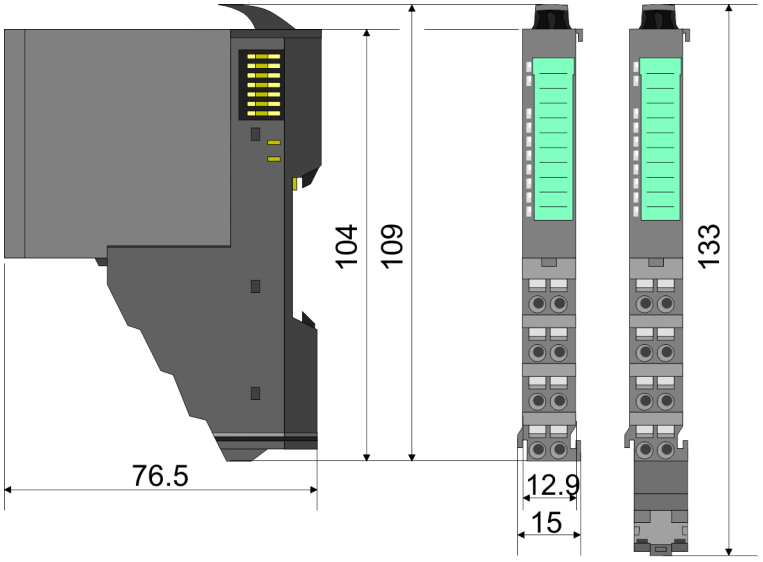
Bus coupler and line extension slave



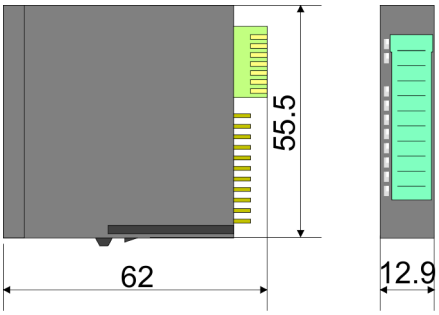
Line extension master



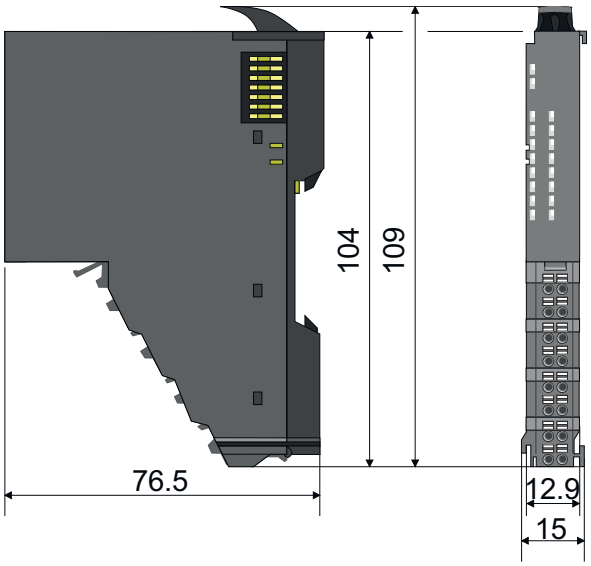
8x periphery module



Electronic module



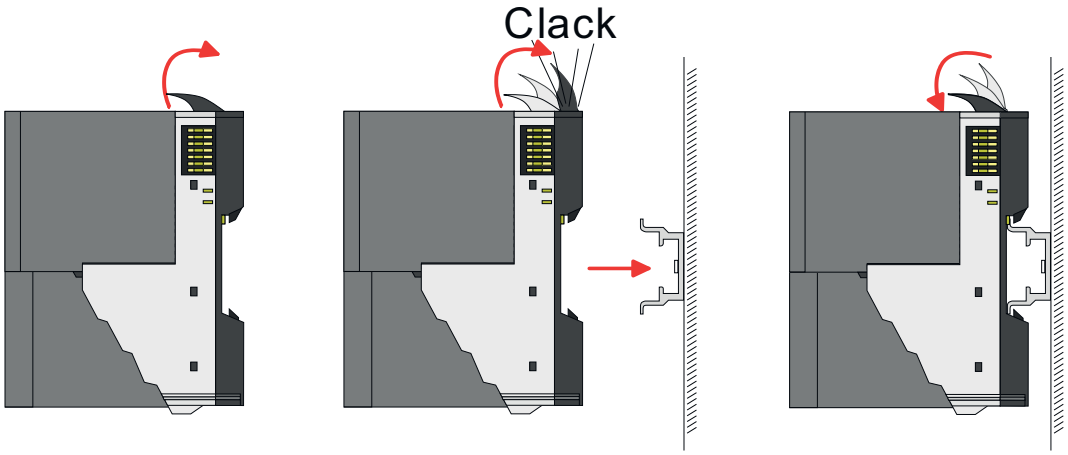
16x periphery module



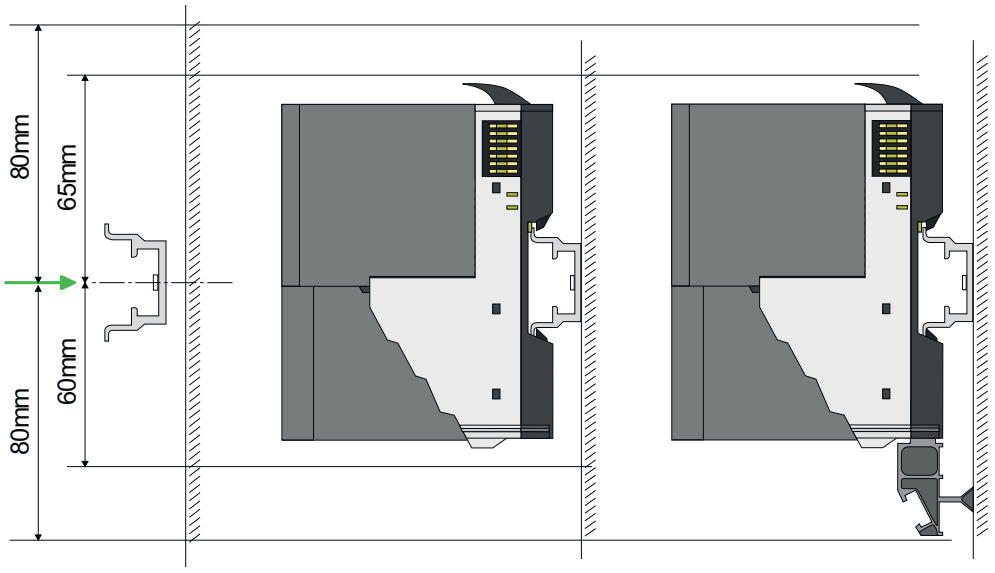
2.4 Mounting bus coupler

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

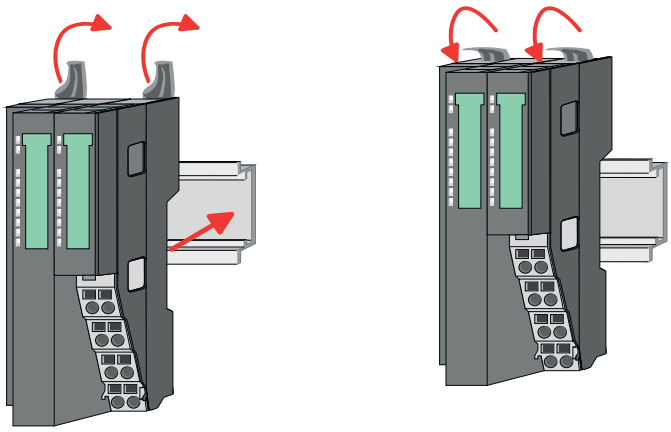
There are locking lever at the top side of the bus coupler. For mounting and demounting these locking lever are to be turned upwards until these engage. Place the bus coupler at the mounting rail. The bus coupler is fixed to the mounting rail by pushing downward the locking levers. The bus coupler is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



Proceeding



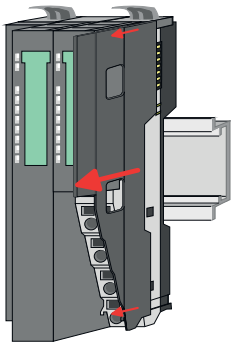
1. Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.



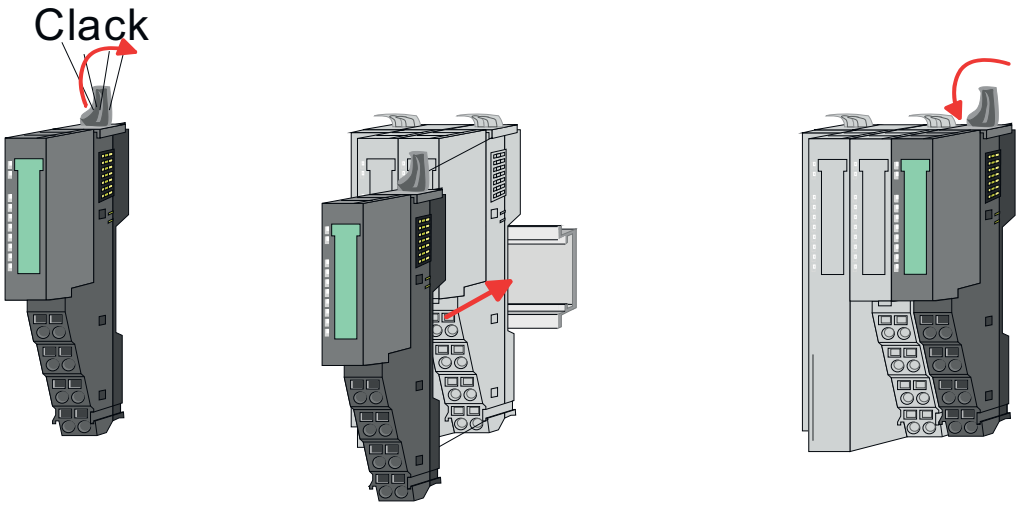
2. Turn the locking lever upwards, place the bus coupler at the mounting rail and turn the lever downward.

Mounting periphery modules

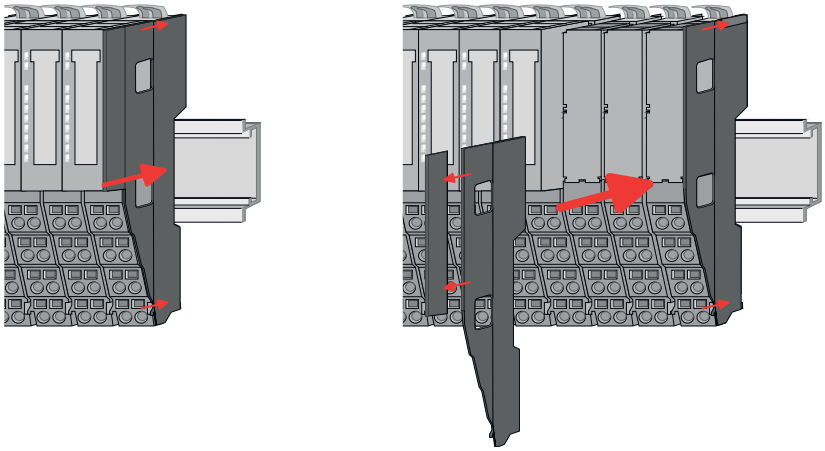
The procedure is identical for 8x and 16x periphery modules.



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



2. Mount the periphery modules you want.



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

2.5 Wiring

CAUTION!
Consider temperature for external cables!
Cables may experience temperature increase due to system heat dissipation. Thus the cabling specification must be chosen 5°C above ambient temperature!

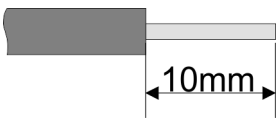
CAUTION!
Separate insulation areas!
The system is specified for SELV/PELV environment. Devices, which are attached to the system must meet theses specifications. Installation and cable routing other than SELV/PELV specification must be separated from the system's equipment!

2.5.1 Wiring bus coupler

Terminal module terminals

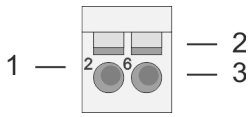
The System SLIO bus coupler have a power module integrated. Terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

Data

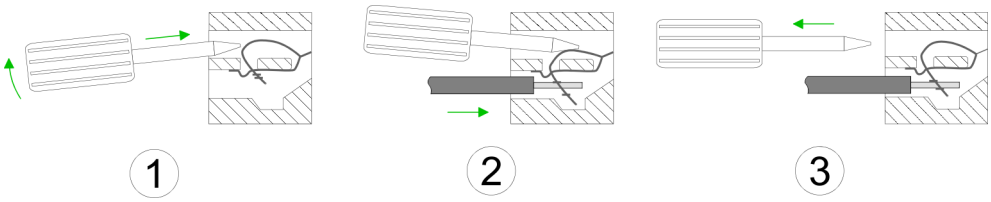


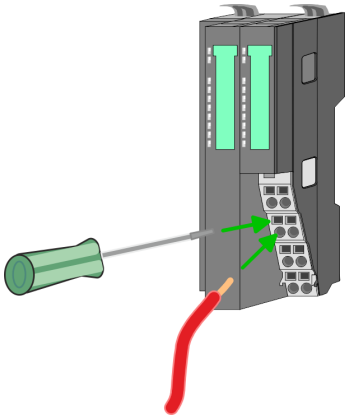
U_{max}	30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm^2 (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure



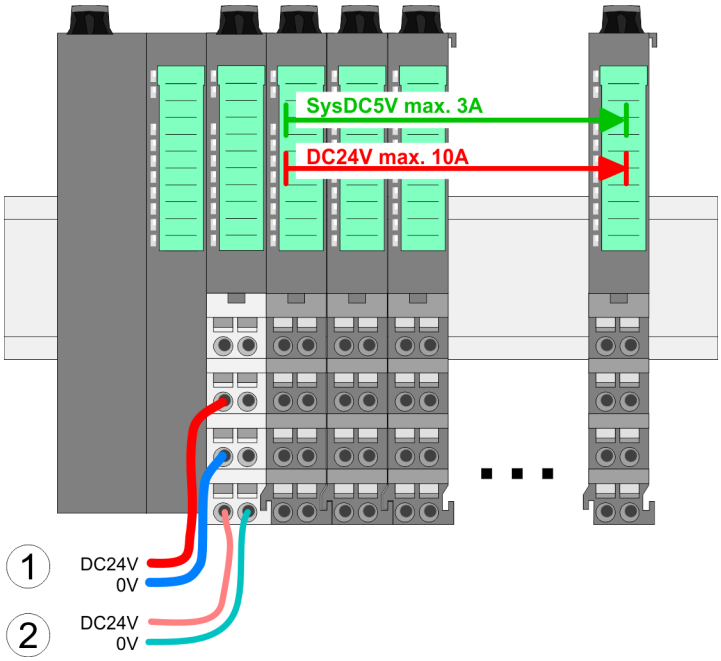
1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire





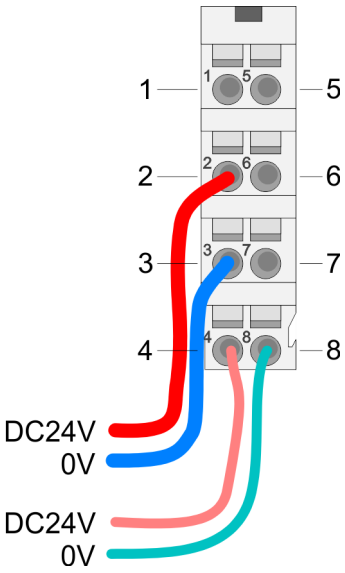
1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm²
3. By removing the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

Standard wiring



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

PM - Power module



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

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

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

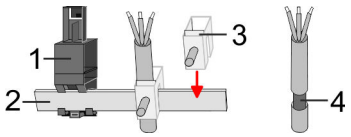
Fusing

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

State of the electronic power supply via LEDs

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

Shield attachment

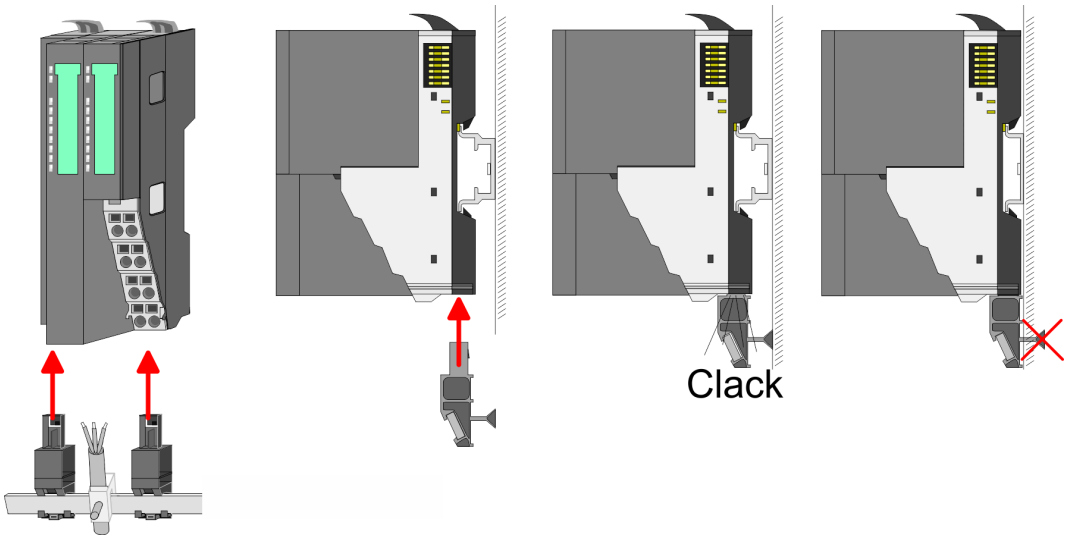


1 Shield bus carrier
2 Shield bus (10mm x 3mm)
3 Shield clamp
4 Cable shield

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.

1. Each System SLIO module has 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.



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

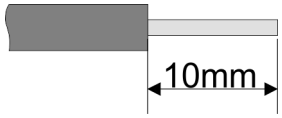
2.5.2 Wiring 8x periphery modules

Terminal module terminals

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

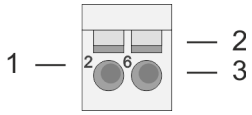
- With wiring the terminal modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

Data

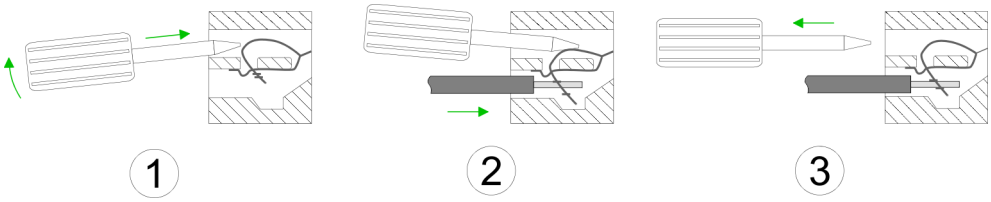


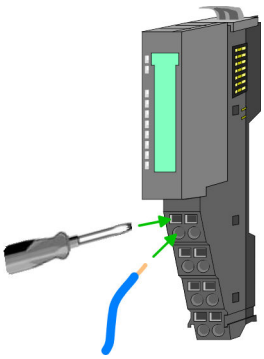
U_{max}	240V AC / 30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm² (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure



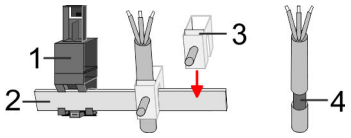
1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire





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

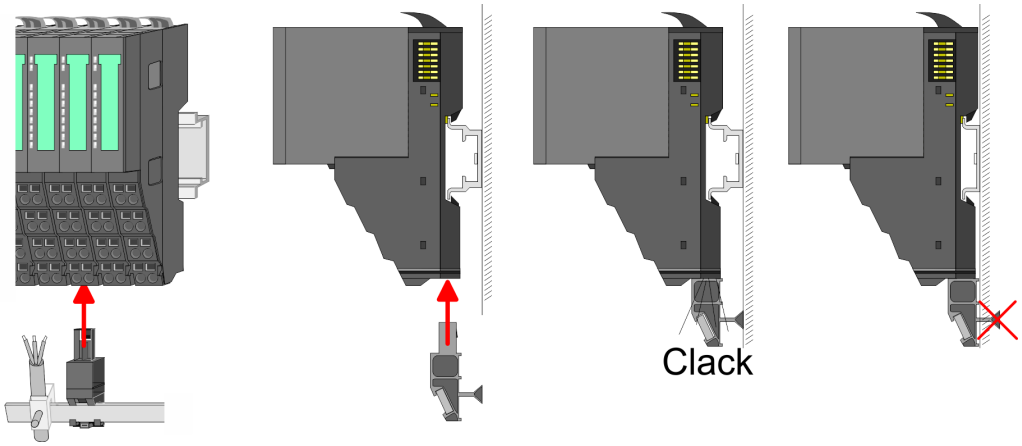
Shield attachment



1 Shield bus carrier
2 Shield bus (10mm x 3mm)
3 Shield clamp
4 Cable shield

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.

1. Each System SLIO 8x periphery module has 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.



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

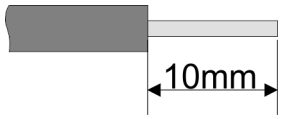
2.5.3 Wiring 16x periphery modules

Terminal block connectors

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

- 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.
- Please use copper wire only!

Data

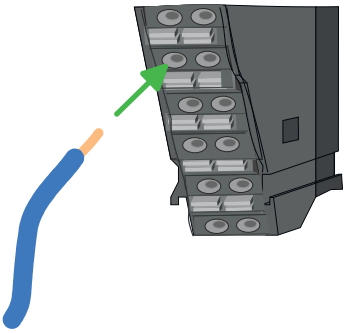


U_{max}	30V DC
I_{max}	10A
Cross section solid wire	0.25 ... 0.75mm²
Cross section with ferrule	0.14 ... 0.75mm²
Wire type	CU
AWG	24 ... 16
Stripping length	10mm

Wiring procedure

1 Release area
2 Connection hole for wire

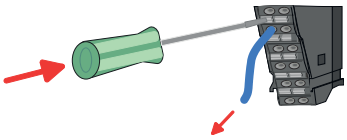
Insert wire



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.

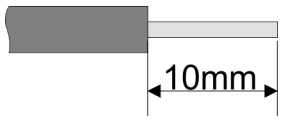
1. Press with your screwdriver vertically at the release button.
   ⇨ The contact spring releases the wire.
2. Pull the wire from the round hole.

2.5.4 Wiring power modules

Terminal module terminals

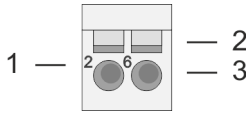
Power modules are either integrated to the head module or may be installed between the periphery modules. With power modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw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

Data

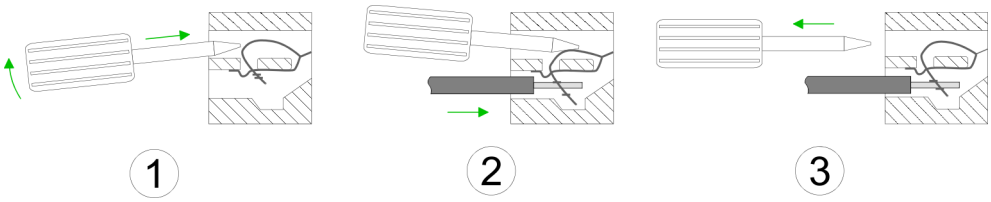


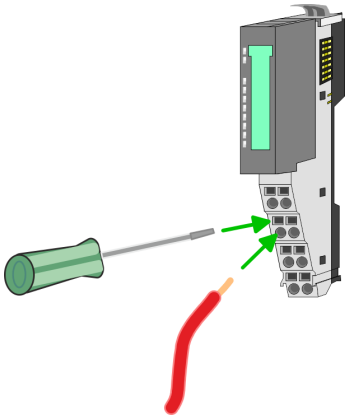
U_{max}	30V DC
I_{max}	10A
Cross section	0.08 ... 1.5mm² (AWG 28 ... 16)
Stripping length	10mm

Wiring procedure



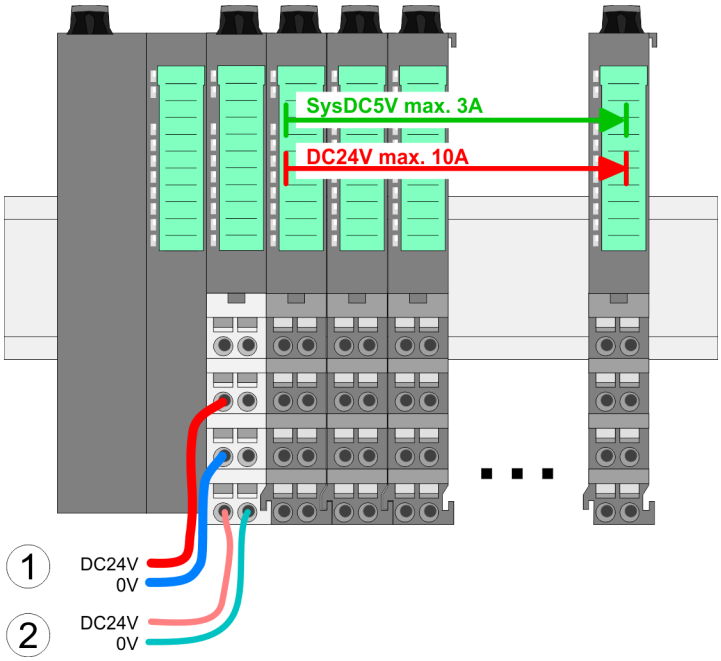
1 Pin number at the connector
2 Opening for screwdriver
3 Connection hole for wire





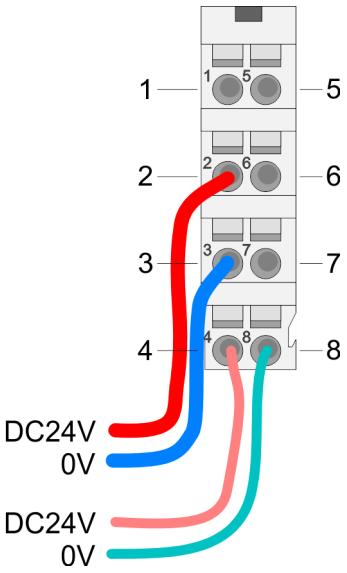
1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm².
3. By removing the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

Standard wiring



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

PM - Power module



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

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

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

Fusing

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

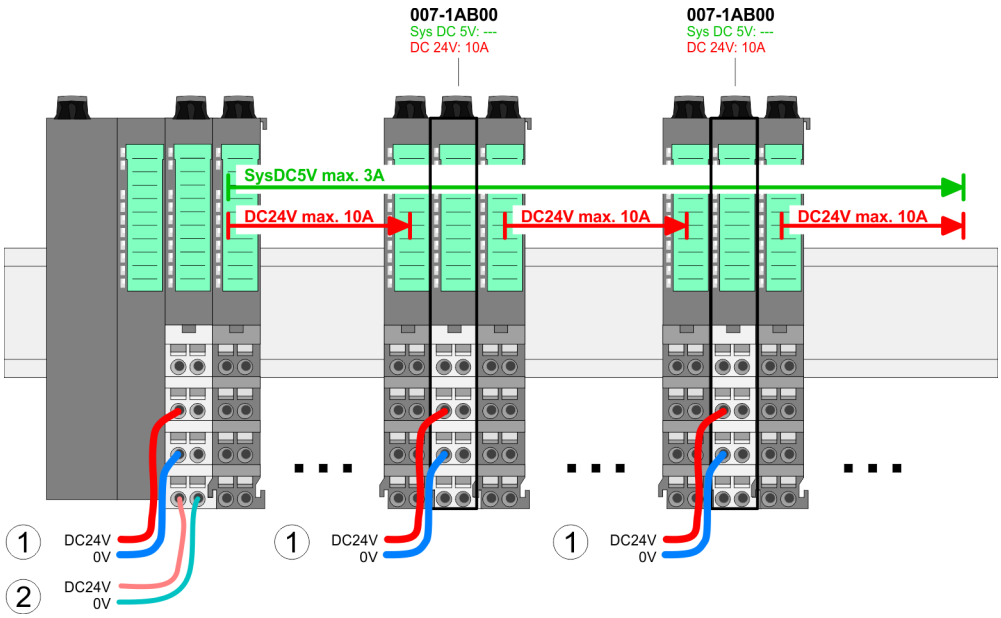
State of the electronic power supply via LEDs

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

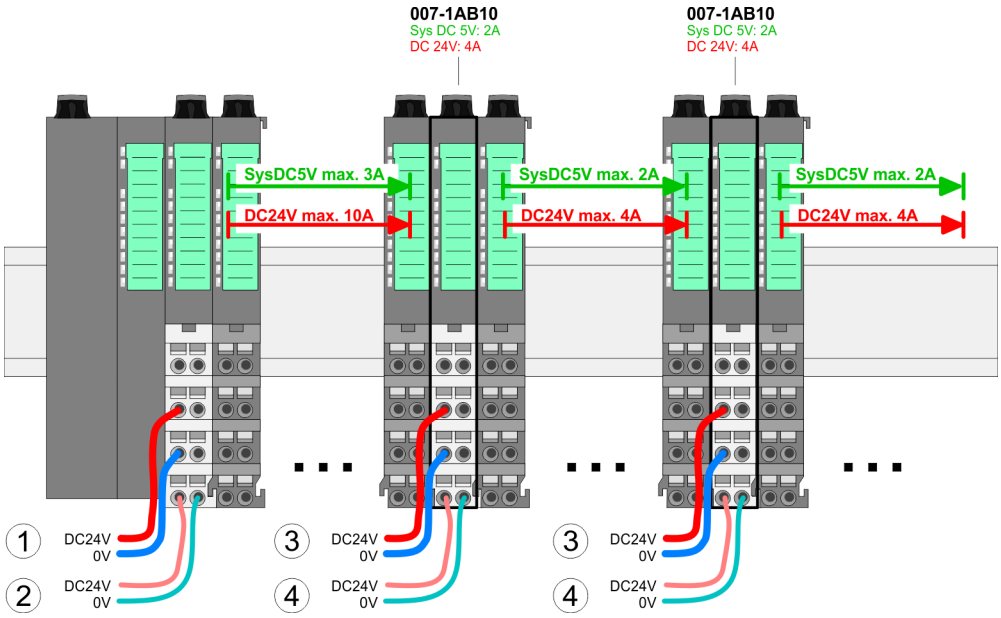
Deployment of the power modules

- 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

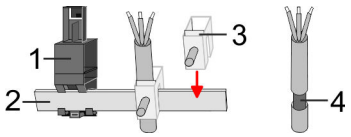


Power module 007-1AB10



(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

Shield attachment

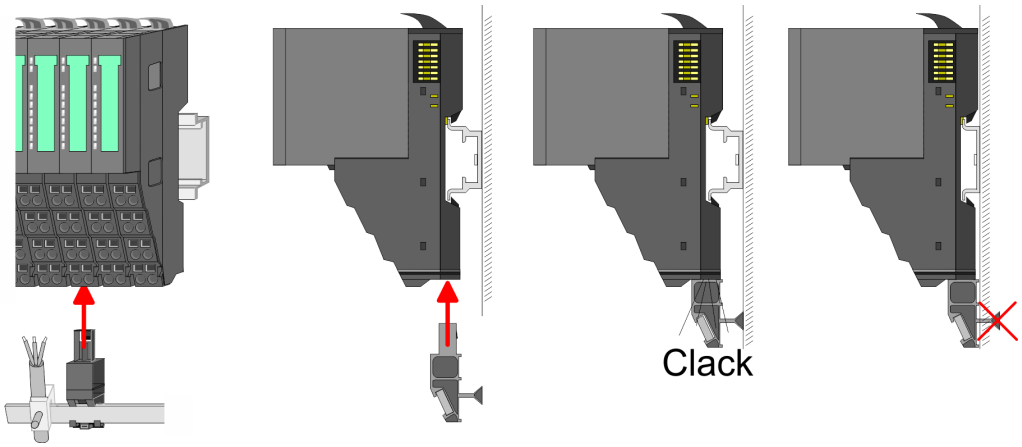


1 Shield bus carrier
2 Shield bus (10mm x 3mm)
3 Shield clamp
4 Cable shield

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.

1. Each System SLIO 8x periphery module has 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.



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

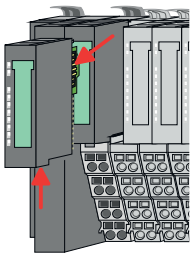
2.6 Demounting

2.6.1 Demounting bus coupler

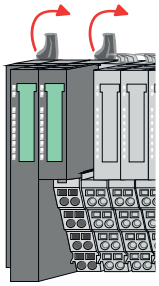
Proceeding

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

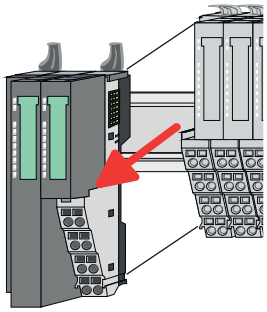
1. Power-off your system.
2. Remove if exists the wiring of the bus coupler.
3. *For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.*



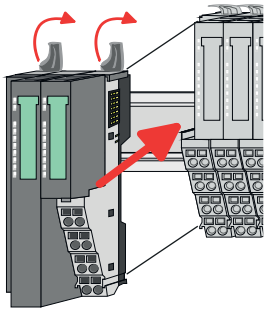
Press the unlocking lever at the lower side of the just mounted right module near the bus coupler and pull it forward.



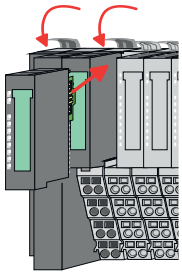
4. Turn all the locking lever of the bus coupler to be exchanged upwards.



5. Pull the bus coupler forward.
6. For mounting turn all the locking lever of the bus coupler to be exchanged upwards.



7. To mount the bus coupler put it to the left periphery module and push it, guided by the stripes, to the mounting rail.
8. Turn all the locking lever downward, again.



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

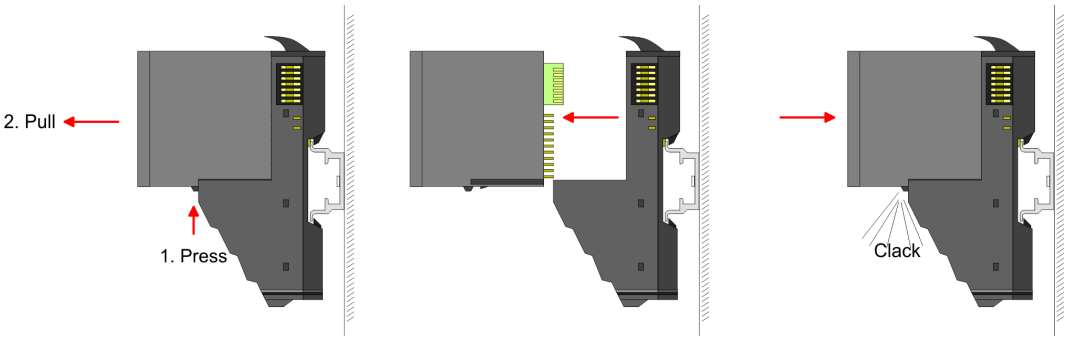
    ⇨ Now you can bring your system back into operation.

2.6.2 Demounting 8x periphery modules

Proceeding

Exchange of an electronic module

1. Power-off your system.



2. For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.

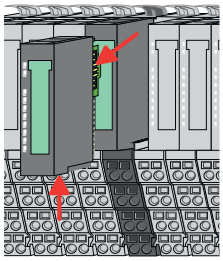
3. For installation plug the new electronic module guided by the strips at the lower side until this engages to the terminal module.

⇨ Now you can bring your system back into operation.

Easy Maintenance

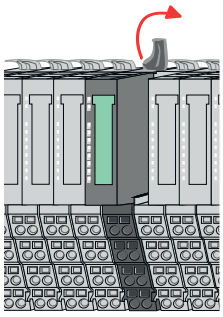
'Easy Maintenance' means the support for adding and removing electronic modules during operation without having to restart the system. If this is supported by your head module, you will find more detailed information on this in the "Deployment" chapter.

Exchange of a periphery module

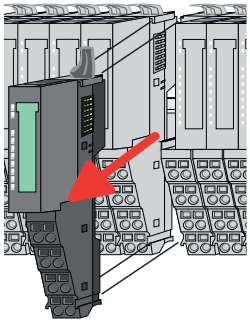


1. Power-off your system.
2. Remove if exists the wiring of the module.
3. *For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.*

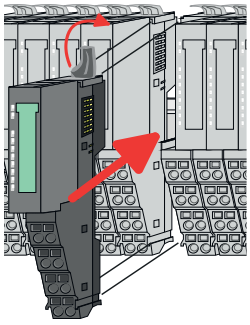
   Press the unlocking lever at the lower side of the just mounted right module and pull it forward.



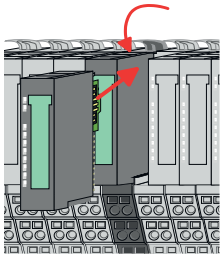
4. Turn the locking lever of the module to be exchanged upwards.



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



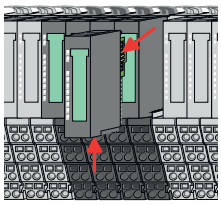
7. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
8. Turn the locking lever downward, again.



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

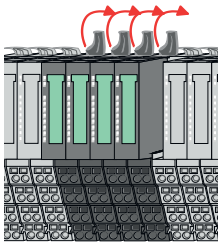
    ⇨ Now you can bring your system back into operation.

Exchange of a module group

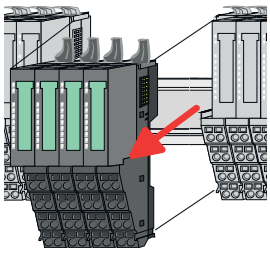


1. Power-off your system.
2. Remove if exists the wiring of the module group.
3. *For demounting and exchange of a (head) module or a group of modules, due to mounting reasons you always have to remove the electronic module right beside. After mounting it may be plugged again.*

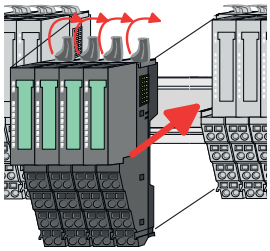
   Press the unlocking lever at the lower side of the just mounted right module near the module group and pull it forward.



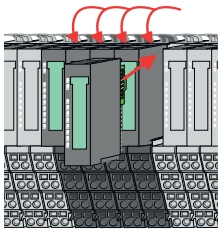
4. Turn all the locking lever of the module group to be exchanged upwards.



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



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

2.6.3 Demounting 16x periphery modules

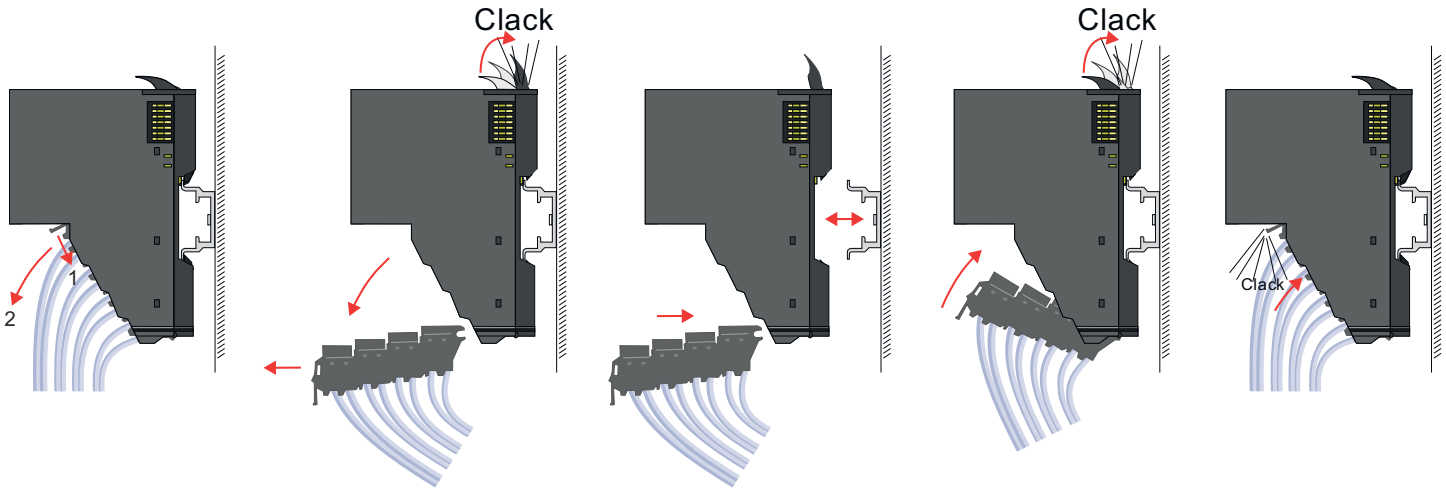
Proceeding

Exchange of an electronic unit

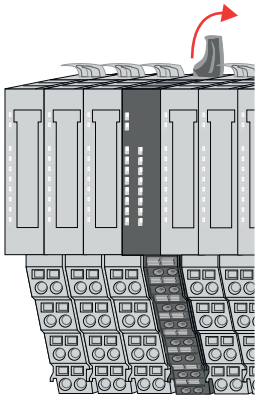
1. Power-off your system.
2. To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock.

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

   ⇨ Now you can bring your system back into operation.

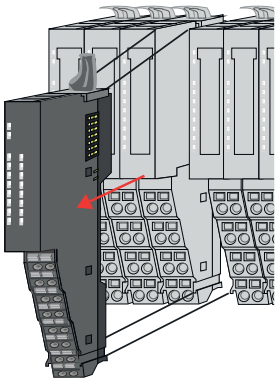


Exchange of a 16x periphery module

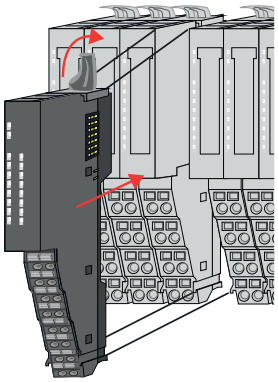


1. Power-off your system.
2. Remove if exists the wiring of the module respectively the wired terminal block.
3. *In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.*

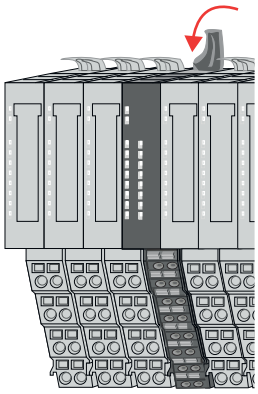
   Turn the locking lever of the module to be exchanged upwards.



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

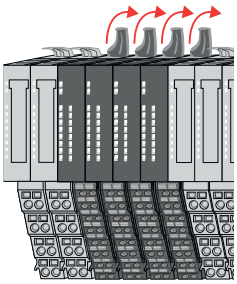


6. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.



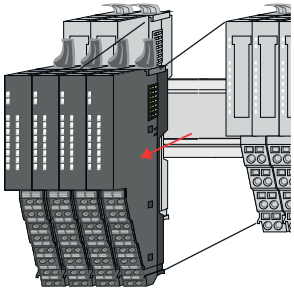
7. Turn the locking lever downward, again.
8. Wire your module respectively plug the wired terminal block again.
   ⇨ Now you can bring your system back into operation.

Exchange of a module group

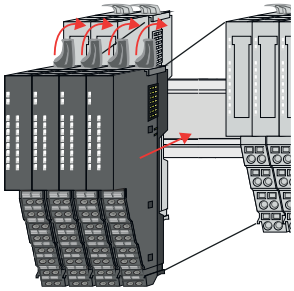


1. Power-off your system.
2. Remove if exists the wiring of the module group respectively the wired terminal blocks.
3. *In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.*

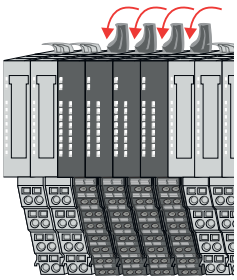
   Turn all the locking lever of the module group to be exchanged upwards.



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



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

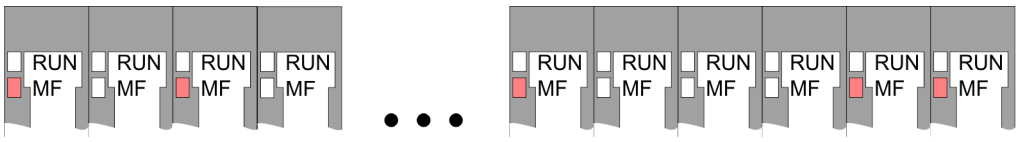
2.7 Trouble shooting - LEDs

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

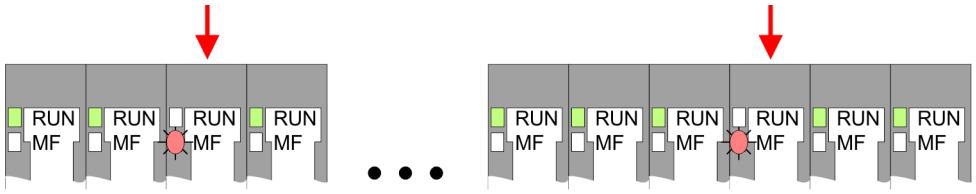


Behaviour: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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. ↬ *Chap. 2.5.4 'Wiring power modules' page 26*

Error in configuration

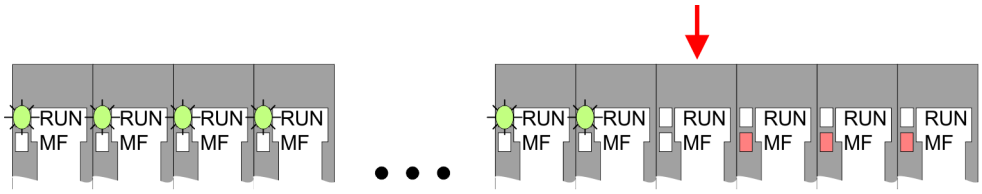


Behaviour: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

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

Remedy: Match configuration and hardware structure.

Module failure



Behaviour: 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.

2.8 Industrial security and installation guidelines

2.8.1 Industrial security in information technology

Latest version

This chapter can also be found as a guide *'IIndustrial IT Security'* at *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*

2.8.1.1 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.

2.8.1.2 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.

2.8.2 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. Lead the isolation further on to your PLC and don't lay it on there again!

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

2.9 General data for the System SLIO

Conformity and approval		
Conformity		
CE	2014/35/EU	Low-voltage directive
	2014/30/EU	EMC directive
Approval		
UL	-	Refer to Technical data
Others		
RoHS	2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment

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		
Climatic		
Storage / transport	EN 60068-2-14	-25…+70°C
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 ... 2.0GHz, 3V/m, 80% AM (1kHz) 2GHz ... 2.7GHz, 1V/m, 80% AM (1kHz)
		EN 61000-4-6	HF conducted 150kHz … 80MHz, 10V, 80% AM (1kHz)
		EN 61000-4-4	Burst, degree of severity 3
		EN 61000-4-5	Surge, degree of severity 3[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.

2.9.1 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

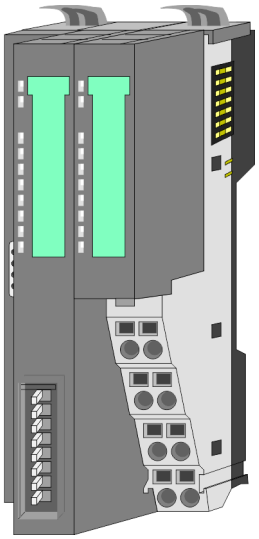
3.1 Properties

Features

- Field bus: PROFIBUS (DP-V0, DP-V1)
- PROFIBUS DP slave for max. 64 periphery modules
- Max. 244byte input and 244byte output data
- Supports every PROFIBUS transfer rates
- Integrated DC 24V power supply for power and electronic section supply of the periphery modules

Use as DP-V1 slave

- 1 MSAC_C1 connection (Read, Write) with 244byte data
  (4byte DP-V1 header + 240byte user data)
- 3 MSAC_C2 connections (Initiate, Read, Write, DataTransport, Abort) with each 244byte data
  (4byte DP-V1 header + 240byte user data)

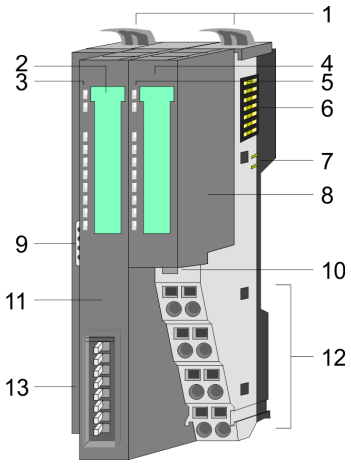


Ordering data

Type	Order number	Description
IM 053DP	053-1DP00	PROFIBUS DP slave for System SLIO

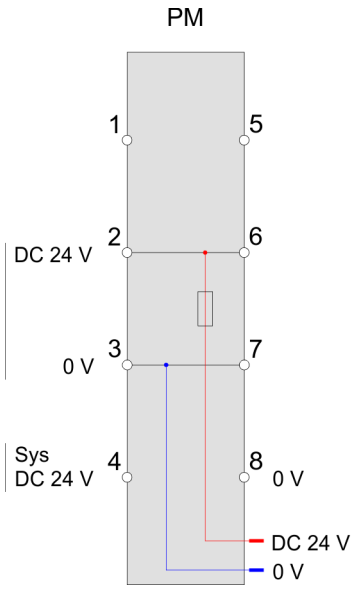
3.2 Structure

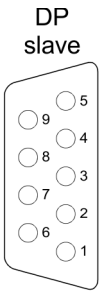
053-1DP00



1 Locking lever terminal module
2 Labeling strip bus interface
3 LED status indication bus interface
4 Labeling strip power module
5 LED status indication power module
6 Backplane bus
7 DC 24V power section supply
8 Power module
9 PROFIBUS jack bus interface
10 Unlocking lever power module
11 Bus interface
12 Terminal power module
13 Address selector

3.2.1 Interfaces



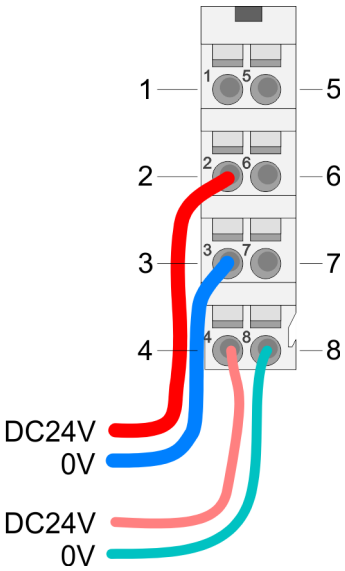


① shield
② n. c.
③ RxD/TxD-P (line B)
④ RTS
⑤ M5V
⑥ P5V
⑦ n. c.
⑧ RxD/TxD-N (line A)
⑨ n.c.

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

Here you may only exchange the electronic module!

PM - Power module



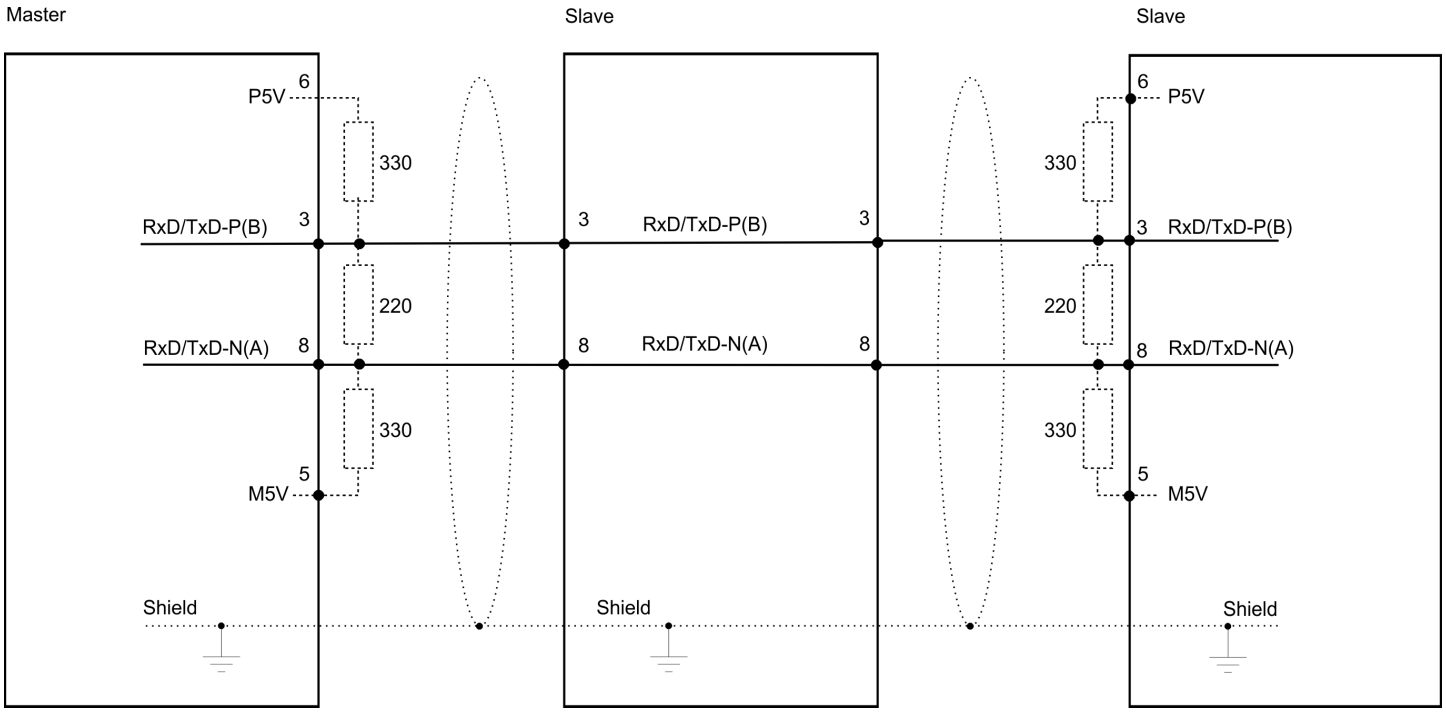
For wires with a core cross-section of 0.08mm² up to 1.5mm².

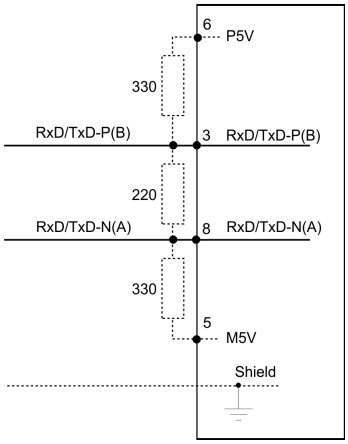
Pos.	Function	Type	Description
1	---	---	not connected
2	DC 24V	I	DC 24V for power section supply
3	0V	I	GND for power section supply
4	Sys DC 24V	I	DC 24V for electronic section supply
5	---	---	not connected
6	DC 24V	I	DC 24V for power section supply
7	0V	I	GND for power section supply
8	Sys 0V	I	GND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

I: Input

Interface for PROFIBUS communication

- Logical conditions as voltage difference between 2 twisted lines
- Serial bus connection in two-wire technique
- Data transfer up 500m
- Data transfer rate up to 12Mbit/s

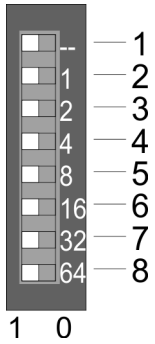




The PROFIBUS line is to be terminated with its ripple resistor. Please consider to terminate the last participants on the bus at both ends by activating the terminating resistor.

3.2.2 Address selector

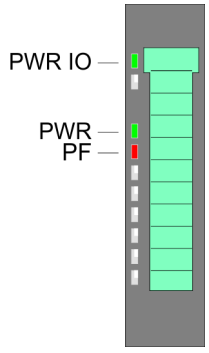
Valid address may range from 1 to 125. Addresses must be unique on the bus. The slave address must have been preset before the bus coupler is turned on.



Pos.	Value	Example	
		State	Address
1	not used	---	1+2+32=35
2	1	1	Address: 35
3	2	1	
4	4	0	
5	8	0	
6	16	0	
7	32	1	
8	64	0	

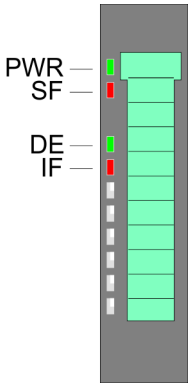
3.2.3 LEDs

LEDs power module



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

LEDs bus interface



For the fast diagnosis of the current module status 4 LEDs are on the front side.

PWR green	SF red	DE green	IF red	Description
	X	X	X	Bus interface is power supplied.
		2Hz		SLIO bus error.
				Error in the parameterization.
	2Hz	2Hz		Configuration error (structure is not corresponding to the configuration).
	2Hz	X	2Hz	A firmware update is in progress. Here SF and IF flash alternately.
				State Data Exchange.
		2Hz		Bus interface is waiting for parameters.
		2Hz	2Hz	Internal error occurred. Perform a power cycle.

not relevant: X

3.3 Technical data

Order no.	053-1DP00
Type	IM 053DP
Module ID	-
Technical data power supply	
Power supply (rated value)	DC 24 V
Power supply (permitted range)	DC 20.4...28.8 V
Reverse polarity protection	✓
Current consumption (no-load operation)	90 mA
Current consumption (rated value)	0.95 A
Inrush current	3.9 A
I^2t	0.14 A^2s
Max. current drain at backplane bus	3 A
Max. current drain load supply	10 A
Power loss	3 W
Status information, alarms, diagnostics	
Status display	yes
Interrupts	yes, parameterizable
Process alarm	yes, parameterizable
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes, parameterizable
Diagnostics information read-out	possible
Supply voltage display	green LED
Service Indicator	-
Group error display	red LED
Channel error display	none
Hardware configuration	
Racks, max.	1
Modules per rack, max.	64
Number of digital modules, max.	64
Number of analog modules, max.	64
Communication	
Fieldbus	PROFIBUS-DP to EN 50170
Type of interface	RS485 isolated
Connector	Sub-D, 9-pin, female
Topology	Linear bus with bus termination at both ends
Electrically isolated	✓

Order no.	053-1DP00
Number of participants, max.	125
Node addresses	1 - 125
Transmission speed, min.	9.6 kbit/s
Transmission speed, max.	12 Mbit/s
Address range inputs, max.	244 Byte
Address range outputs, max.	244 Byte
Number of TxPDOs, max.	-
Number of RxPDOs, max.	-
Datasizes	
Input bytes	-
Output bytes	-
Parameter bytes	-
Diagnostic bytes	-
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	48.5 mm x 109 mm x 76.5 mm
Net weight	160 g
Weight including accessories	160 g
Gross weight	177.5 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL certification	yes
KC certification	yes

4 Deployment

4.1 Basics

General

- PROFIBUS is an international standard applicable to an open field bus for building, manufacturing and process automation.
- PROFIBUS defines the technical and functional characteristics of a serial field bus system that can be used to create a low (sensor-/actuator level) or medium (process level) performance network of programmable logic controllers.
- Together with other field bus systems, PROFIBUS has been standardized in **IEC 61158** since 1999. IEC 61158 bears the title "Digital data communication for measurement and control - Field bus for use in industrial control systems".
- PROFIBUS comprises an assortment of compatible versions. The following details refer to PROFIBUS DP.

PROFIBUS DP-V0

- PROFIBUS DP-V0 (*Decentralized Peripherals*) provides the basic functionality of DP, including cycle data exchange as well as diagnostics functions.
- PROFIBUS DP is a special protocol intended mainly for automation tasks in a manufacturing environment.
- DP is very fast, offers Plug'n'Play facilities and provides a cost-effective alternative to parallel cabling between PLC and remote I/O.
- PROFIBUS DP was designed for high-speed cyclical data communication between bus master and slave systems.

PROFIBUS DP-V1

- The original version, designed DP-V0, has been expanded to include version DP-V1, offering acyclic data exchange between master and slave.
- DP-V1 contains enhancements geared towards process automation, in particular acyclic data communication for parameter assignment, operation, visualization and alarm handling of intelligent field devices, parallel to cycle user data communication. This permits online access to station using engineering tools.
- DP-V1 defines interrupts. Examples for different types of interrupts are status interrupt, update interrupt and a manufacturer-specific interrupt.
- Please note in operating the DP V1 functionality that your DP master supports DP-V1 as well. For this you find details in the documentation to your DP master.

Master and slaves

PROFIBUS distinguishes between active stations (master) and passive stations (slave).

- Master devices
  - Master devices control the data traffic at the bus.
  - It is also possible to operate with multiple masters on a PROFIBUS. This is referred to as multi-master operation.
  - The protocol on the bus establishes a logical token ring between intelligent devices connected to the bus. Only the master that has the token, can communicate with its slaves.
  - A master is able to issue unsolicited messages if it is in possession of the access key (token).
  - The PROFIBUS protocol also refers to masters as active participants.
- Slave devices
  - A PROFIBUS slave acquires data from peripheral equipment, sensors, actuators and transducers.
  - The Yaskawa PROFIBUS couplers are modular slave devices that transfer data between the periphery and the high-level master. In accordance with the PROFIBUS standards these devices have no bus access rights. They are only allowed to acknowledge messages or return messages to a master when this has issued a request.
  - Slaves are also referred to as passive participants.

Master class 1 MSAC_C1

The master of the class 1 is a central control that exchanges cyclically information with the decentral stations (slaves) in a defined message cycle. Typical MSAC_C1 devices are controls (PLC) or PCs. MSAC_C1 devices gain active bus access, which allows them to read the measuring values (inputs) of the field devices and to write the set points (outputs) of the actuators at a fixed time.

Master class 2 MSAC_C2

MSAC_C2 are employed for service and diagnostic. Here connected devices may be configured, measuring values and parameters are evaluated and device states can be requested. MSAC_C2 devices don't need to be connected to the bus system permanently. These also have active bus access. Typical MSAC_C2 devices are engineering, project engineering or operator devices.

RS485 interface as data transfer medium

- PROFIBUS employs screened twisted pair cable on the basis of the RS485 interface.
- There is a 9pin jack at the DP slave. This jack is used to connect the PROFIBUS DP slave to the PROFIBUS network.
- The data transfer rate of the system is limited to a max. of 12Mbit/s.
- The RS485 interface operates by means of differential voltages. For this reason it is less sensitive to external interference than a pure voltage or current based interface.
- The network may be configured as linear or as tree structure.
- Due to the bus structure of RS485 it is possible to connect or disconnect any station without interruption to the system. Extensions to the system do not affect stations that have already been commissioned. New and failed stations are detected automatically.

Addressing

Every device on the PROFIBUS is identified by an address. This address must be an unique number in the bus system for System SLIO between 1 and 125.

GSD file

You get an GSD file from Yaskawa for the PROFIBUS coupler. For System SLIO this file can be found in the *'Download Center'* of *www.yaskawa.eu.com* at *'GSD 053-1DP00'*. Install the GSD files in your configuration tool. More information about installing the GSD and/or type file may be found in the manual of the according engineering tool. Structure and content of the GSD file are dictated by the PROFIBUS User Organization (PNO) and may be retrieved there. After the installation of the GSD file you will find this entry e.g. the DP-V1 slave in the hardware catalog from Siemens at:

PROFIBUS DP > Additional field devices > I/O > VIPA_SLIO > VIPA 053-1DP00 (DPV1)

The assignment of the GSD-file to your slave is shown in the following table:

SLIO order number	GSD file
053-1DP00 (DP-V0)	VI200C19.gse
053-1DP00 (DP-V1)	VI210C19.gse

Communication

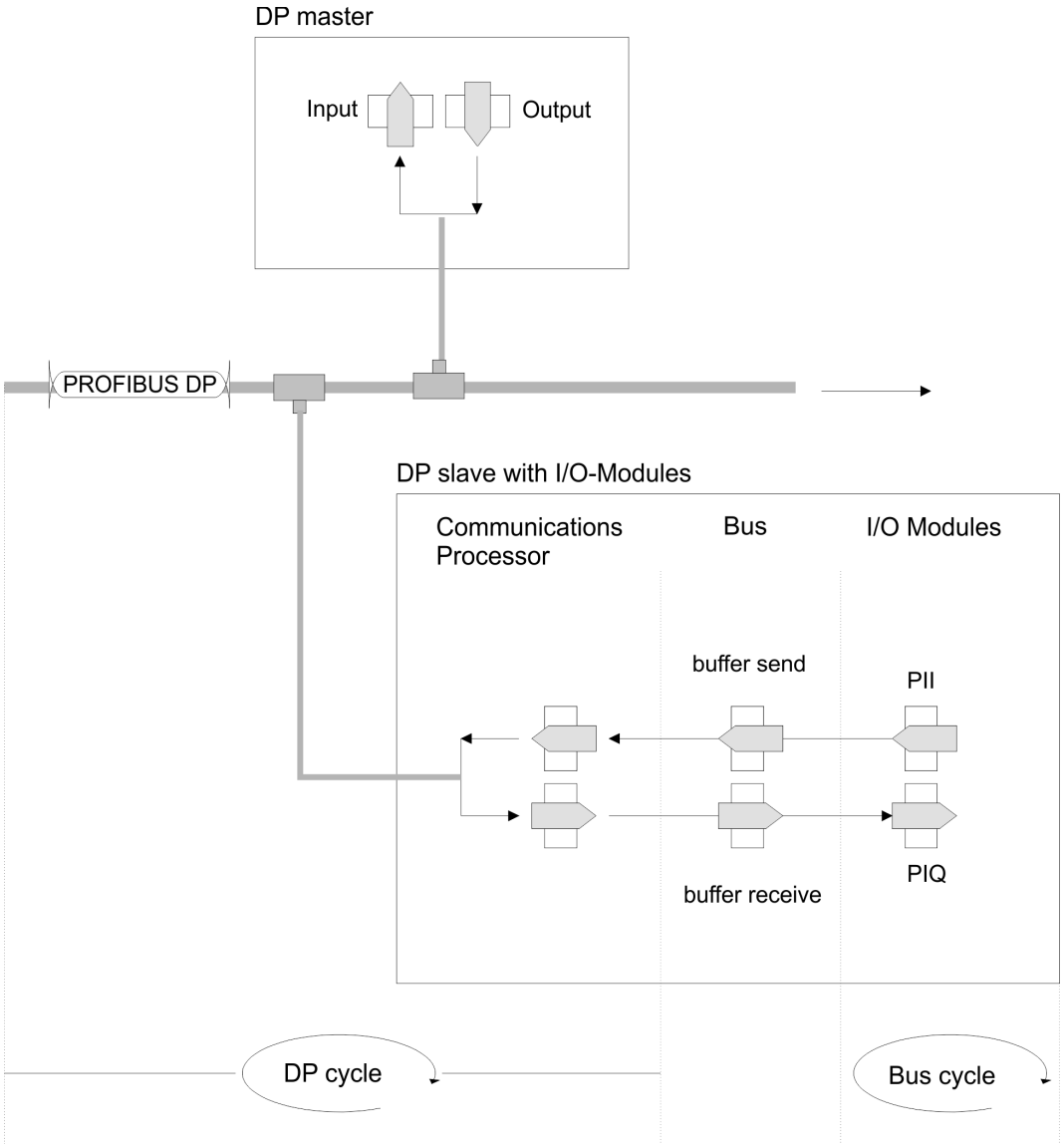
The bus transfer protocol provides two alternatives for the access to the bus:

- Master with master
  - Master communication is also referred to as token-passing procedure. The token-passing procedure guarantees the accessibility of the bus.
  - The permission to access the bus is transferred between individual devices in the form of a "token". The token is a special message that is transferred via the bus.
  - When a master is in possession of the token it has the permission to access the bus and it can communicate with any active or passive device.
  - The token retention time is defined when the system is configured.
  - Once the token retention time has expired, the token is passed to the following master which now has permission to access the bus and may therefore communicate with any other device.
- Master slave procedure
  - Data communication between a master and the slaves assigned to it is conducted automatically in a predefined and repetitive cycle by the master.
  - You assign a slave to a specific master when you define the project. You can also define which DP slaves are included and which are excluded from the cyclic exchange of data.
  - Data communication between master and slave can be divided into a parameterization, a configuration and a data transfer phase. Before a DP slave is included in the data transfer phase the master checks whether the defined configuration corresponds with the actual configuration. This check is performed during the definition and configuration phase. The verification includes the device type, format and length information as well as the number of inputs and outputs. In this way a reliable protection from configuration errors is achieved.
  - The master handles the transfer of application related data independently and automatically. You can, however, also send new configuration settings to a bus coupler.
  - When the status of the master is DE "Data Exchange" it transmits a new series of output data to the slave and the reply from the slave contains the latest input data.

4.1.1 Cyclic data communication (DP-V0)

Functionality

DP-V0 provides the basic functionality of DP, including cycle data exchange as well as station diagnostic, module diagnostic and channel-specific diagnostic. Data is transferred cyclically between the DP master and the DP slave by means of transmit and receive buffers.



PII process image of the inputs
PIQ process image of the outputs

Bus cycle

A bus cycle saves all the input data from the modules in the PII and all the output data from the PIQ in the output modules. When the data has been saved the PII is transferred into the ”buffer send” and the contents of the ”buffer receive” is transferred into PIQ.

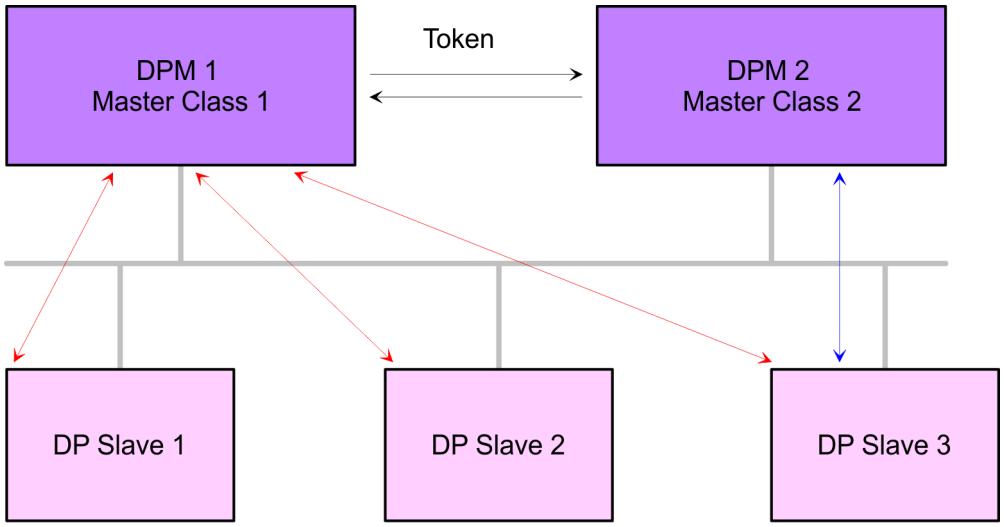
DP cycle

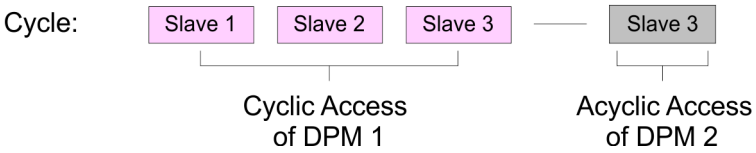
During a PROFIBUS cycle the master addresses all its slaves according to the sequence defined in the data exchange. The data exchange reads and writes data from/into the memory areas assigned to the PROFIBUS. The contents of the PROFIBUS input area is entered into the ”buffer receive” and the data in the ”buffer send” is transferred into the PROFIBUS output area. The exchange of data between DP master and DP slave is completed cyclically and it is independent from the bus cycle.

4.1.2 Acyclic data communication (DP-V1)

Functionality

The key feature of version DP-V1 is the extended function for acyclic data communication. This forms the requirement for parameterization and calibration of the field devices over the bus during runtime and for the introduction of confirmed interrupt messages. This forms the requirement for parameterization and calibration of the field devices over the bus during runtime and for the introduction of confirmed interrupt messages.





The DPM 1 (Master Class 1) has the token and is able to send messages to or retrieve them from slave 1, then slave 2, etc. in a fixed sequence until it reaches the last slave of the current list (MS0 channel). It then passes on the token to the DPM 2 (Master Class 2). This master can then use the remaining available time ("gap") of the programmed cycle to set up an acyclic connection to any slave (e.g. slave 3) to exchange records (MS2 channel). At the end of the current cycle time it returns the token to the DPM1. The acyclic exchange of records can last for several scan cycles on their "gaps". At the end, the DPM 2 uses the gap to clear the connection. Similarly as well as the DPM 2, the DPM 1 can also execute acyclic data exchange with slaves (MS1 channel).

Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the PROFIBUS coupler and so are not listed respectively considered during slot allocation.

Further within PROFIBUS the slots are designated as PROFIBUS-Slot. The counting always begins with 1. periphery module.

Addressing with PROFIBUS-Slot and Index

- When addressing data, PROFIBUS assumes that the physical structure of the slaves is modular or it can be structured internally in logical functional units, so-called modules. This model is also used in the basic DP functions for cyclic data communication where each module has a constant number of input-/output bytes that are transmitted in a fixed position in the user data telegram.
- The addressing procedure is based on identifiers, which characterize a module type as input, output or a combination of both. All identifiers combined produce the configuration of the slave, which is also checked by the DPM when the system starts up. The acyclic data communication is also based on this model.

- All record sets enabled for read/write access are also regarded as assigned to the modules and can be addressed using PROFIBUS-Slot and index. The PROFIBUS-Slot addresses the module and the index addresses the record sets of a module.
- The PROFIBUS-Slot = 0 addresses data of the PROFIBUS coupler, PROFIBUS-Slot > 0 addresses the data of the function module(s).
- Each record set can be up to 240bytes.
- Compact devices are used as a unit of virtual modules. These can also be addressed with PROFIBUS-Slot and index.
- Through the length specification in the read/write request, it is also possible to read/write parts of a record set.

For the addressing at the deployment of the Siemens SIMATIC Manager the following conventions are valid:

- *DP slave coupler:*
  - *Setting of the diagnostic address as ID*
- *Modules of the DP slave coupler:*
  - *Setting of the module address as ID. For an output module you have to set additionally bit 15 of the module address (e.g. address 0004h becomes 8004h).*
  - *With a combination module you have to set the lower one of the two addresses.*

Services acyclic data communication

For the deployment of the DP-V1 services you have to take care that your master system supports DP-V1 communication. More detailed information about this may be found in the description of your master system. There are the following handling blocks available for CPUs, programmable with Siemens STEP7, like SPEED7 CPUs from Yaskawa:

- SFB 52: Read record set from a DP slave
- SFB 53: Write record set to a DP slave
- SFB 54: Receive interrupt from a DP slave

In the following the services for the acyclic data transfer that are using that function blocks are shown.

More detailed information about the services and the DP-V0/V1 communication may be found in the PROFIBUS norm IEC 61158.

DPM 1 (Master class 1) Services for acyclic data communication between DPM 1 and slaves	
Read	The master reads a record set from the slave.
Write	The master writes a record set to the slave.
Interrupt	An interrupt is transmitted from the slave to the master, which explicitly acknowledges receipt. The slave can only send a new interrupt message after it has received this acknowledgment; this prevents any interrupt being overwritten.
Interrupt_Acknowledge	The master acknowledges receipt of an interrupt to the slave.

Status	A status message is transmitted from the slave to the master. There is no acknowledgment.
Data transmission is connection-oriented over a MS1 connection. This is set up by the DPM 1 and is closely linked to the connection for cyclic data communication. It can be used by the master that has parameterized and configured the respective slave.	

DPM 2 (Master class 2) Services for acyclic data communication between DPM 2 and slaves	
Initiate / Abort	Setup respectively termination of a connection for acyclic data communication between DPM 2 and slave.
Read	The master reads a record set from the slave.
Write	The master writes a record set to the slave.
Data_Transport	The master can write application-specific data (specified in profiles) a cyclically to the slave and if required, read data from the slave in the same cycle.
Data transmission is connection-oriented over a MS2 connection. This is set up before the start of the acyclic data communication by the DPM 2 using the Initiate service. The connection is then available for Read, Write and Data_Transport services. The connection is terminated correspondingly. A slave can maintain several active MS2 connections simultaneously. A limitation is given by the resources available in the slave.	

4.2 Accessing the System SLIO

4.2.1 General

Overview

In the following you will find the description of accessing the following System SLIO areas via PROFIBUS:

- I/O area
- Parameter data
- Diagnostics data

Information concerning the allocation of these areas may be found in the description of the corresponding System SLIO module.

Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the PROFIBUS coupler and so are not listed respectively considered during slot allocation.

Further within PROFIBUS the slots are designated as PROFIBUS-Slot. The counting always begins with 1. periphery module.

GSD file

You get an GSD file from Yaskawa for the PROFIBUS coupler. For System SLIO this file can be found in the *'Download Center'* of www.yaskawa.eu.com at *'GSD 053-1DP00'*. Install the GSD files in your configuration tool. More information about installing the GSD and/or type file may be found in the manual of the according engineering tool. Structure and content of the GSD file are dictated by the PROFIBUS User Organization (PNO) and may be retrieved there. After the installation of the GSD file you will find this entry e.g. the DP-V1 slave in the hardware catalog from Siemens at:

PROFIBUS DP > Additional field devices > I/O > VIPA_SLIO > VIPA 053-1DP00 (DPV1)

The assignment of the GSD-file to your slave is shown in the following table:

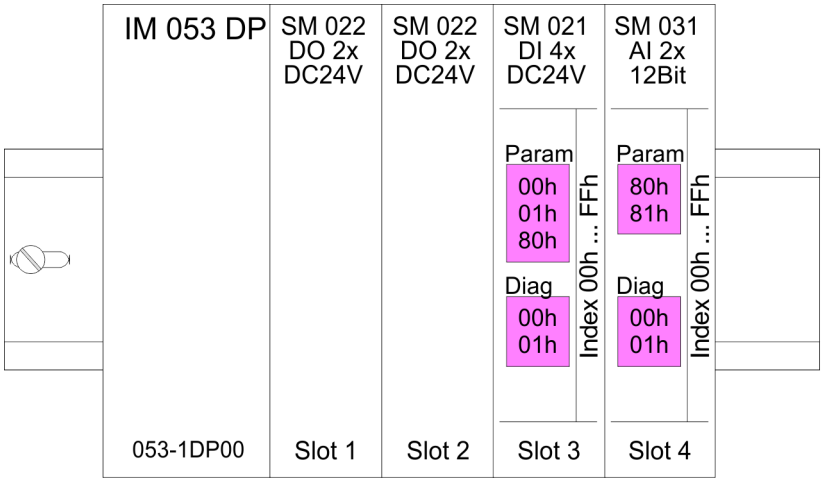
SLIO order number	GSD file
053-1DP00 (DP-V0)	VI200C19.gse
053-1DP00 (DP-V1)	VI210C19.gse

Handling blocks

To set respectively change parameters during runtime there are according handling blocks for record set read/write necessary. For the deployment of the DP-V1 services you have to take care that your master system supports DP-V1 communication. There are the following handling blocks available for CPUs, programmable with Siemens STEP7, like SPEED7 CPUs from Yaskawa:

- SFB 52: Read record set from a DP slave
- SFB 53: Write record set to a DP slave
- SFB 54: Receive interrupt from a DP slave

Addressing: The *PROFIBUS-Slot* addresses the module and the *index* addresses the record sets (DS) of a module.



4.2.2 Accessing the I/O area

- At PROFIBUS the input respectively output area is automatically embedded to the corresponding address area of the master system.
- Up to 244byte I/O data may be each transferred via PROFIBUS.
- Please consider when using modules with a big address area e.g. analog modules the max. configuration with 64 System SLIO modules may not be reached.

4.2.3 Accessing parameter data

There is the possibility to set parameter data of the corresponding modules by means of the GSD file via hardware configuration. With the startup of the PROFIBUS couplers these once were sent from the PROFIBUS DP master to the modules.

Read parameter data

Request for reading parameter data (DP-V1 Read.Request)

0x5E	PROFIBUS-Slot	Index (DS)	Length (max. 240)
8bit	8bit	8bit	8bit

Response with parameter data (DP-V1 Read.Response)

0x5E	PROFIBUS-Slot	Index (DS)	Length (max. 240)	Data
8bit	8bit	8bit	8bit	

Write parameter data

Request for writing parameter data (DP-V1 Write.Request)

0x5F	PROFIBUS-Slot	Index (DS)	Length (max. 240)	Data
8bit	8bit	8bit	8bit	

Response with length (DP-V1 Write.Response)

0x5E	PROFIBUS-Slot	Index (DS)	Length
8bit	8bit	8bit	8bit

The parameters are activated as soon as they where transferred.

The parameter record sets 00h respectively 01h are read respectively written with record set 7Eh respectively 7Fh. Write access with index 00h/01h causes an error!

4.2.4 Accessing diagnostics data

Hardware and diagnostic interrupt data of System SLIO modules with interrupt capability were automatically sent by an diagnostics telegram if the interrupt is activated by parameterization. There is also the possibility to request diagnostics data, if your master system supports DP-V1 services.

Request for reading diagnostics data (DP-V1 Read.Request)

0x5E	PROFIBUS-Slot	Index (DS)	Length (max. 240)
8bit	8bit	8bit	8bit

Response with diagnostics data (DP-V1 Read.Response)

0x5E	PROFIBUS-Slot	Index (DS)	Length (max. 240)	Data
8bit	8bit	8bit	8bit	

Structure diagnostics data (record set 1)

Name	Byte	Function
ERR_A	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 missing external power supply ■ Bit 6 ... 5: reserved ■ set at error in parameterization
MODTYP	1	■ Bit 3 ... 0: Module class – 1111b: Digital module – 0101b: Analog module – 1000b: FM – 0111b: ETS, CP ■ Bit 4: Channel information present ■ Bit 7 ... 5: reserved
ERR_C	2	see module description

Name	Byte	Function
ERR_D	3	see module description
CHTYP	4	■ Bit 6 ... 0: Channel type – 70h: Digital input – 71h: Analog input – 72h: Digital output – 73h: Analog output – 74h: Analog input/-output ■ Bit 7: reserved
NUMBIT	5	Number diagnostics bits per channel
NUMCH	6	Number channels of the module
CHERR	7	see module description
CH0ERR	8	Diagnostics event on the channel/channel group 0 Assignment see module description
CH1ERR	9	Diagnostics event on the channel/channel group 1 Assignment see module description
...	...	...
CH7ERR	15	Diagnostics event on the channel/channel group 7 Assignment see module description
DIAG_US	16...19	Value of the System SLIO µs ticker at the moment of the diagnostics
Byte 0 ... 3 of record set 1 correspond to record set 0.		

4.3 Project engineering

General

The configuration happens as hardware configuration in your PROFIBUS DP master engineering tool such as the Siemens SIMATIC Manager. Here you assign the according PROFIBUS DP slave module to the DP master. A direct assignment takes place via the PROFIBUS address that you set at the DP slave address selector and in the DP slave properties. By installing the corresponding GSD file the IM 053DP is listed at the hardware catalog as "... 053-1DP00 (DP-V0 or DP-V1)". You'll find this at:

PROFIBUS DP > Additional Field devices > I/O > VIPA_SLIO

GSD file

You get an GSD file from Yaskawa for the PROFIBUS coupler. For System SLIO this file can be found in the *'Download Center'* of *www.yaskawa.eu.com* at *'GSD 053-1DP00'*. Install the GSD files in your configuration tool. More information about installing the GSD and/or type file may be found in the manual of the according engineering tool. Structure and content of the GSD file are dictated by the PROFIBUS User Organization (PNO) and may be retrieved there. After the installation of the GSD file you will find this entry e.g. the DP-V1 slave in the hardware catalog from Siemens at:

PROFIBUS DP > Additional field devices > I/O > VIPA_SLIO > VIPA 053-1DP00 (DPV1)

The assignment of the GSD-file to your slave is shown in the following table:

SLIO order number	GSD file
053-1DP00 (DP-V0)	VI200C19.gse
053-1DP00 (DP-V1)	VI210C19.gse

Proceeding

1. Mount your PROFIBUS system.
2. Start your project engineering tool with a new project.
3. Configure a master system and create a new PROFIBUS subnet.
4. For the project engineering of the IM 053DP take the "... 053-1DP00 (DPV0)" or "... 053-1DP00 (DPV1)" for each functionality from the hardware catalog and drag it to the DP master subnet.
5. Enter a PROFIBUS address between 1 and 125 into the properties of the DP slave and set the same address at the address switch.
6. Parameterize the DP slave (see parameters).
7. Transfer your project to the PLC.

Parameter data 053-1DP00 (DP-V0)

Byte	Bit 7 ... Bit 0	Default
0	■ Bit 2 ... 0: 0 (fix) ■ Bit 3: WD-Timebase – 0 = 10ms – 1 = 1ms ■ Bit 4: 0 (fix) ■ Bit 5: Publisher-Mode – 0 = not supported – 1 = supported ■ Bit 7, 6: 0 (fix)	00h
1	00h (fix)	00h

Byte	Bit 7 ... Bit 0	Default
2	08h (fix)	08h
3	0Ah (fix)	0Ah
4	81h (fix)	81h
5	00h (fix)	00h
6	00h (fix)	00h
7	00h (fix)	00h
8	■ Bit 0: Identifier-related diagnostics – 0 = enable – 1 = disable ■ Bit 1: Module status – 0 = enable – 1 = disable ■ Bit 2: Channel-related diagnostics – 0 = enable – 1 = disable ■ Bit 3: SLIO version in diagnostics – 0 = enable – 1 = disable ■ Bit 4: 0 (fix) ■ Bit 5: 0 = V0: Diagnostics interrupt – 0 = not supported – 1 = supported ■ Bit 6: 0 = V0: Hardware interrupt – 0 = not supported – 1 = supported ■ Bit 7: 0 (fix)	78h
9	■ Bit 1...0: 0 (fix) ■ Bit 2: Auto restart ■ Bit 6 ... 3: 0 (fix) ■ Bit 7: Data format – 0 = Motorola – 1 = Intel (only at analog modules)	00h
10 ... 12	00h (fix)	00h

Auto restart - When activated, the system is automatically restarted in the event of a fault on the backplane bus. After automatic restart, you receive a diagnostic alarm that signals a system failure.

When deactivated, the system must be restarted by means of a power cycle in the event of a fault on the backplane bus.

Data format Motorola/ Intel - This parameter is exclusively evaluated with deployment of analog modules and refers to how a value is stored in the CPU address range.

In the *Motorola format* (default) the bytes were stored in descending significance, i.e. the 1. byte contains the high byte and 2. byte the low byte.

In the *Intel format* the value is switched and it is worked with ascending significance, i.e. the 1. byte contains the low byte and 2. byte the high byte.

Parameter data 053-1DP00 (DP-V1)

Byte	Bit 7 ... Bit 0	Default
0	■ Bit 2 ... 0: 0 (fix) ■ Bit 3: WD-Timebase – 0 = 10ms – 1 = 1ms ■ Bit 4: 0 (fix) ■ Bit 5: Publisher-Mode – 0 = not supported – 1 = supported ■ Bit 6: Fail-Safe-Mode – 0 = disabled – 1 = enabled ■ Bit 7: DP-V1 mode – 0 = disable – 1 = enable	80h
1	■ Bit 0: Startup when expected/actual config. differ (must always be 0 else a parameterization error occurs) ■ Bit 3 ... 1: 0 (fix) ■ Bit 4: V1: Vendor specific interrupt – 0 = disabled – 1 = enabled ■ Bit 5: V1: Diagnostics interrupt – 0 = disabled – 1 = enabled ■ Bit 6: V1: Hardware interrupt – 0 = disabled – 1 = enabled ■ Bit 7: 0 (fix)	70h
2	08h (fix)	08h
3	0Ah (fix)	0Ah
4	81h (fix)	81h
5	00h (fix)	00h
6	00h (fix)	00h
7	00h (fix)	00h
8	■ Bit 0: Identifier-related diagnostics – 0 = enable – 1 = disable ■ Bit 1: Module status – 0 = enable – 1 = disable ■ Bit 2: Channel-related diagnostics – 0 = enable – 1 = disable ■ Bit 3: SLIO version in diagnostics – 0 = enable – 1 = disable ■ Bit 7 ... 4: 0 (fix)	08h

Byte	Bit 7 ... Bit 0	Default
9	■ Bit 1...0: 0 (fix) ■ Bit 2: Auto restart ■ Bit 6 ... 3: 0 (fix) ■ Bit 7: Data format – 0 = Motorola – 1 = Intel (only at analog modules)	00h
10 ... 12	00h (fix)	00h

Auto restart - When activated, the system is automatically restarted in the event of a fault on the backplane bus. After automatic restart, you receive a diagnostic alarm that signals a system failure.

When deactivated, the system must be restarted by means of a power cycle in the event of a fault on the backplane bus.

Data format Motorola/ Intel - This parameter is exclusively evaluated with deployment of analog modules and refers to how a value is stored in the CPU address range.

In the *Motorola format* (default) the bytes were stored in descending significance, i.e. the 1. byte contains the high byte and 2. byte the low byte.

In the *Intel format* the value is switched and it is worked with ascending significance, i.e. the 1. byte contains the low byte and 2. byte the high byte.

4.4 DP-V1 services

Overview

For the deployment of the DP-V1 services you have to take care that your master system supports DP-V1 communication. More detailed information about this may be found in the description of your master system. There are the following handling blocks available for CPUs, programmable with Siemens STEP7, like SPEED7 CPUs from Yaskawa:

- SFB 52: Read record set from a DP slave
- SFB 53: Write record set to a DP slave
- SFB 54: Receive interrupt from a DP slave

Per default, one class-1 master and max 3 class-2 master connection with 244byte data (4byte DP-V1 header plus 240byte user data) are supported. The class-1 master connection is established together with the cyclic connection and is activated via the parameterization. The class-2 master connection can be used by a C2 master that then communicates with the slave only a cyclical and provides an own connection establishment.

Data of the DP-V1 slave

To access the record sets of the DP-V1 coupler, as *ID* the *diagnostics address* is to be used, which you have specified in the properties of the hardware configuration. Using the following record set no. as *Index* you get access for reading (R) respectively writing (W) to the listed DP slave elements respectively modules of the coupler:

Index/Record set	Access	Description
50h	R	Device name as ASCII code
51h	R	Hardware version (short version) as ASCII code e.g. V02
52h	R	Software version as ASCII code
53h	R	Serial number of the device in ASCII Unsigned32

Index/Record set	Access	Description
54h	R	FPGA version Unsigned16
56h	R	Module version (long version) as ASCII code e.g. 02V20.001
58h	R	Device configuration (list of module types)1. Word: Number n of modules2. ... n. Word: Module type
59h	R	FPGA version (list of FPGA versions) 1. Word: FPGA version head module 2. ... n. Word: FPGA version function modules
5Bh	R	Serial number as ASCII code
FFh	R	I&M functions
	W	I&M functions

Device configuration

- Via the index 58h, the module configuration of the DP slave may be monitored. With the 1. word you will get the number of modules. With the next words you will find the module type in the installed sequence.

  The *module type* corresponds to the first 2 digits of the module ID. The module ID may be found in the technical data of the periphery modules.

Data of the function modules

To access the function modules with the Siemens SIMATIC Manager the *module address*, which can be set by properties, is used as ID.

Using the following record set no. as Index you get access for reading (R) res. writing (W) to the listed DP slave elements:

Index/Record set	Access	Description
00h	R	Diagnostics - record set 0
01h	R	Diagnostics - record set 1
50h	R	Device name as ASCII code
51h	R	Hardware version as ASCII code
52h	R	Software version as ASCII code - is only shown with analog modules
53h	R	Serial number of the device in ASCII Unsigned32
54h	R	FPGA version Unsigned16
5Bh	R	Serial number as ASCII code
7Dh	R/W	Every parameters record set 0 ... n
7Eh	R/W	Parameter record set 00h
7Fh	R/W	Parameter record set 01h
80h	R	Parameter record set 80h
	W	Parameter record set 80h
81h	R	Parameter record set 81h

Index/Record set	Access	Description
	W	Parameter record set 81h
...		
AFh	R	Parameter record set AFh
	W	Parameter record set AFh
FFh	R	I&M functions (only IM0)
	W	I&M functions

4.5 DP-V1 - I&M data

Overview

- Identification and maintenance data (I&M) are stored information in a module which support you at:
  - Check of the system configuration
  - Discover of hardware changes
  - Remove errors in a system
- Identification data (I data) are information of the module e.g. order number, serial number, which can be found printed at the module.
- I data are manufacturer information and can only be read.
- Maintenance data (M data) are information like location and date of installation.
- M data were produced and stored during project engineering. By means of I&M data the modules can online be identified.

Only one DP master may access at one time the I&M data of a PROFIBUS coupler.

Structure

The data structure of the I&M data corresponds to the specifications of PROFIBUS guideline - order number 3.502, version 1.1 from May 2003.

I&M data	Access	Preset	Description
Identification data 0: IM_INDEX: 65000			
MANUFACTURER_ID	read (2byte)	022Bh (555)	Here the name of the manufacturer is stored. (555)
ORDER_ID	read (20byte)	depends on the module	Here the order number of the module is stored. ... 053-1DP00
SERIAL_NUMBER	read (16byte)	depends on the module	Here the serial number of the module is stored for clear identification.
HARDWARE_REVISION	read (2byte)	depends on the module	Here the hardware revision of the module is stored, which is incremented on changes at the firmware or hardware.
SOFTWARE_REVISION	read (4byte)	Firmware version Vxyz	Provides information about the firmware version of the module. An increase of the firmware version also increases the hardware revision of the module.

I&M data	Access	Preset	Description
REVISION_COUNTER	read (2byte)	0000h	reserved
PROFILE_ID	read (2byte)	F600h	Generic Device
PROFILE_SPECIFIC_TYPE	read (2byte)	0003h 0004h 0005h	I/O modules Communication modules Interface modules
IM_VERSION	read (2byte)	0101h	Provides information about the Version of the I&M data. (0101h = Version 1.1)
IM_SUPPORTED	read (2byte)	001Fh	Provides information about the I&M data. (IM_INDEX: 650000 ...65004)
Maintenance data 1: IM_INDEX: 65001			
TAG_FUNCTION	read/write (32byte)	-	Enter here a system-wide unique identifier for the module.
TAG_LOCATION	read/write (22byte)	-	Enter here the location of installation of the module.
Maintenance data 2: IM_INDEX: 65002			
INSTALLATION_DATE	read/write (16byte)	-	Enter here for the module the date of installation and possibly the time.
RESERVED	read/write (38byte)	-	reserved
Maintenance data 3: IM_INDEX: 65003			
DESCRIPTOR	read/write (54byte)	-	Enter here a comment for the module.
Maintenance data 4: IM_INDEX: 65004			
SIGNATURE	read/write (54byte)	-	Enter here a comment for the module.

4.6 PROFIBUS installation guidelines

PROFIBUS in general

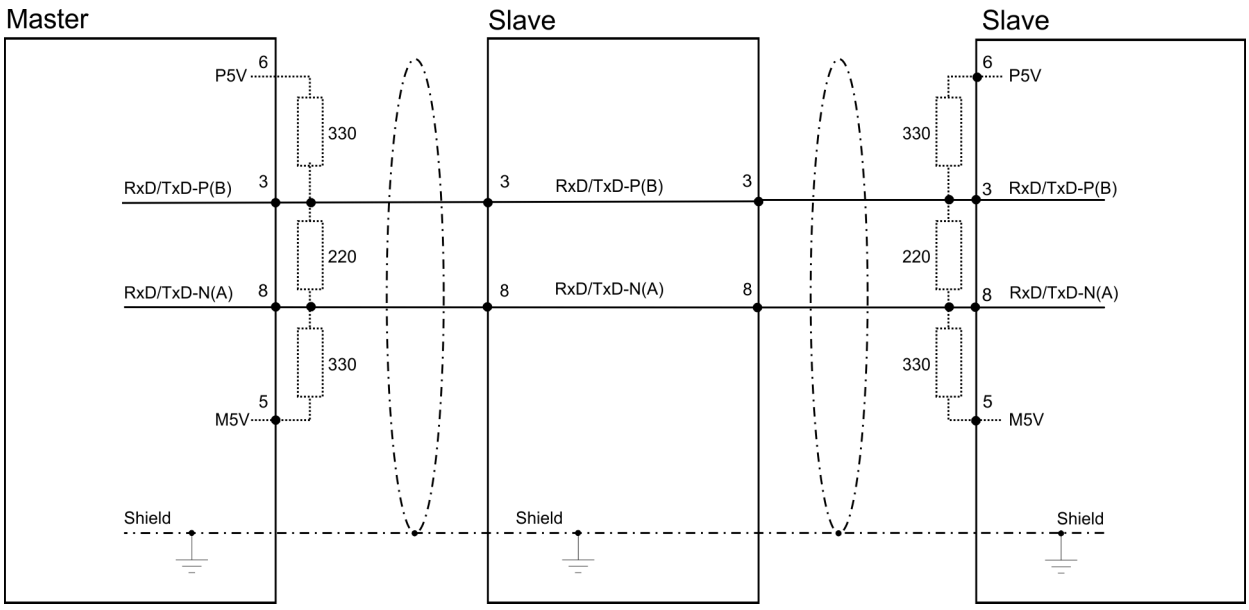
- A PROFIBUS DP network may only be built up in linear structure.
- PROFIBUS DP consists of minimum one segment with at least one master and one slave.
- A master has always been deployed together with a CPU.
- PROFIBUS supports max. 126 participants.
- Per segment a max. of 32 participants is permitted.
- The max. segment length depends on the transfer rate:
  9.6 ... 187.5bit/s → 1000m
  500kbit/s → 400m
  1.5Mbit/s → 200m
  3 ... 12Mbit/s → 100m
- Max. 10 segments may be built up. The segments are connected via repeaters. Every repeater counts for one participant.
- The bus respectively a segment is to be terminated at both ends.
- All participants are communicating with the same transfer rate. The slaves adjust themselves automatically on the transfer rate.

Transfer medium

- As transfer medium PROFIBUS uses an isolated twisted-pair cable based upon the RS485 interface.
- The RS485 interface is working with voltage differences. Though it is less irritable from influences than a voltage or a current interface. You are able to configure the network as well linear as in a tree structure.
- Max. 32 participants per segment are permitted. Within a segment the members are linear connected. The segments are connected via repeaters. The maximum segment length depends on the transfer rate.
- PROFIBUS DP uses a transfer rate between 9.6kbit/s and 12Mbit/s, the slaves are following automatically. All participants are communicating with the same transfer rate.
- The bus structure under RS485 allows an easy connection res. disconnection of stations as well as starting the system step by step. Later expansions don't have any influence on stations that are already integrated. The system realizes automatically if one partner had a fail down or is new in the network.

Bus connection

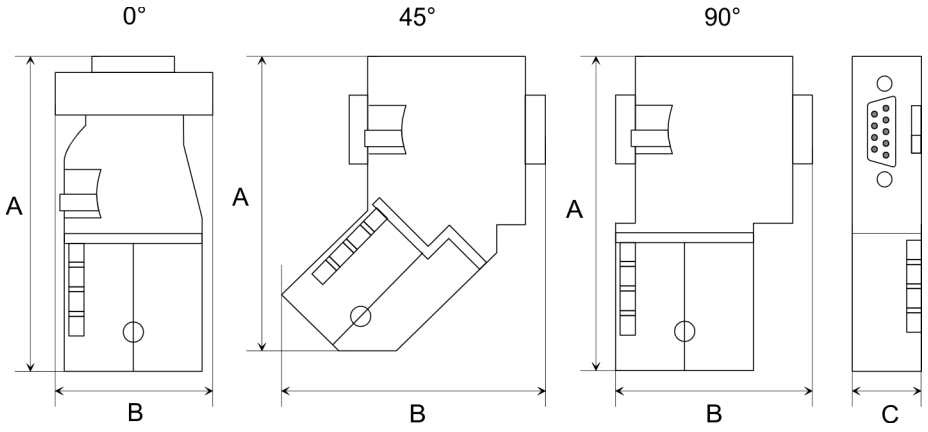
The following picture illustrates the terminating resistors of the respective start and end station.



The PROFIBUS line has to be terminated with its ripple resistor. Please make sure to terminate the last participants on the bus at both ends by activating the terminating resistor.

EasyConn bus connector

In PROFIBUS all participants are wired parallel. For that purpose, the bus cable must be feed-through. Via the order number 972-0DP10 you may order the bus connector "Easy-Conn" from Yaskawa. This is a bus connector with switchable terminating resistor and integrated bus diagnostic.



Dimensions in mm	0°	45°	90°
A	64	61	66
B	34	53	40
C	15.8	15.8	15.8

To connect this EasyConn plug, please use the standard PROFIBUS cable type A (EN50170). Starting with release 5 you also can use highly flexible bus cable:

Lapp cable order no: 2170222, 2170822, 2170322.

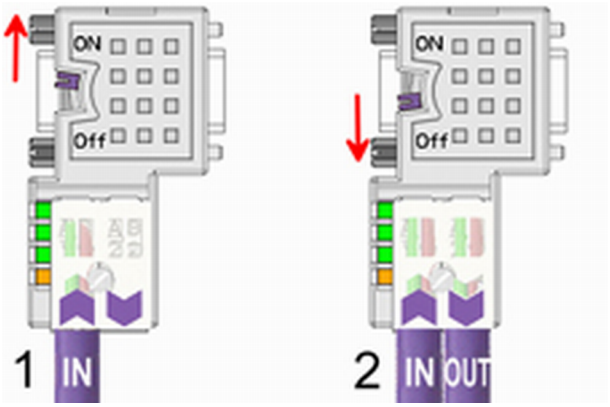
With the order no. 905-6AA00 Yaskawa offers the "EasyStrip" de-isolating tool that makes the connection of the EasyConn much easier.

Dimensions in mm

Termination with "Easy-Conn"

The "EasyConn" bus connector is provided with a switch that is used to activate a terminating resistor.

Wiring



[1] 1./last bus participant
[2] further participants

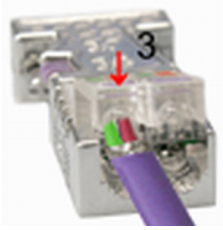
CAUTION!
The terminating resistor is only effective, if the connector is installed at a bus participant and the bus participant is connected to a power supply.

The tightening torque of the screws to fix the connector to a device must not exceed 0.02Nm!

A complete description of installation and deployment of the terminating resistors is delivered with the connector.

Assembly

1. Loosen the screw.
2. Lift contact-cover.
3. Insert both wires into the ducts provided (watch for the correct line colour as below!)
4. Please take care not to cause a short circuit between screen and data lines!



5. Close the contact cover.
6. Tighten screw (max. tightening torque 0.08Nm).

The green line must be connected to A, the red line to B!

4.7 Diagnostic functions

Structure of the 053-1DP00 diagnostic data

PROFIBUS DP provides an extensive set of diagnostic functions for quick error localization. Diagnostic messages are transferred via the bus and collected by the master. There the diagnostic data may be accessed e.g. by your configuration tool. The diagnostic messages that are created by the PROFIBUS slave have, depending on the parameterization, a length of 122byte. As soon as the PROFIBUS slave sends a diagnostic to the master, the max. of 122byte diagnostic data are prepended by 6byte standard diagnostic data:

Byte 0 ... 5	Standard diagnostic data Is only prepended at transfer to the master via PROFIBUS.	
x ... x+8	Identifier-related diagnostic	may be enabled or disabled via parameterization
x ... x+19	Module status	
max. 21× (x ... x+2)	Channel-related diagnostic	
x ... x+20	Interrupt	

Standard diagnostic data

At the transfer of a diagnostic to the master the slave standard diagnostic data are prepended to the diagnostic bytes. More detailed information to the structure of the slave standard diagnostic data can be found in the standard papers of the PROFIBUS User Organization.

Standard diagnostic data

Byte	Bit 7 ... Bit 0
0	■ Bit 0: 0 (fix) ■ Bit 1: Slave is not yet ready for exchange data ■ Bit 2: Configuration data do not correspond to current configuration ■ Bit 3: Slave has external diagnostic data ■ Bit 4: Requested function is not supported by the slave ■ Bit 5: 0 (fix) ■ Bit 6: Wrong parametrization ■ Bit 7: 0 (fix)
1	■ Bit 0: New parameters have to be assigned to the slave ■ Bit 1: Static diagnostics ■ Bit 2: 1 (fix) ■ Bit 3: Response monitoring has been enabled ■ Bit 4: "FREEZE" control command received ■ Bit 5: "SYNC" control command received ■ Bit 6: reserved ■ Bit 7: 0 (fix)
2	■ Bit 6 ... 0: reserved ■ Bit 7: Diagnostic data overflow
3	■ Master address after parametrization – FFh: Slave has not been parametrized
4	ID number high byte
5	ID number low byte

Identifier-related diagnostic

Via the Identifier-related diagnostic you gain information at which PROFIBUS-Slot (module) an error has occurred. More information about the error is available via the *Module state* and the *channel-related diagnostic*. The Identifier-related diagnostic can be activated via the parametrization.

Identifier-related diagnostic

Byte	Bit 7 ... Bit 0
x	■ Bit 5 ... 0: – 001001 (fix) Length of the Identifier-related diagnostic ■ Bit 7 ... 6: – 01 (fix) Code for Identifier-related diagnostic
x+1	The bits of the modules per PROFIBUS-Slot are set if: ■ the module is removed ■ a not configured module is installed ■ a module cannot be accessed ■ a module reports a diagnostic interrupt ■ Bit 0: Entry for module on PROFIBUS-Slot 1 ■ Bit 1: Entry for module on PROFIBUS-Slot 2 ■ Bit 2: Entry for module on PROFIBUS-Slot 3 ■ Bit 3: Entry for module on PROFIBUS-Slot 4 ■ Bit 4: Entry for module on PROFIBUS-Slot 5 ■ Bit 5: Entry for module on PROFIBUS-Slot 6 ■ Bit 6: Entry for module on PROFIBUS-Slot 7 ■ Bit 7: Entry for module on PROFIBUS-Slot 8
x+2	■ Bit 0: Entry for module on PROFIBUS-Slot 9 ■ Bit 1: Entry for module on PROFIBUS-Slot 10 ■ Bit 2: Entry for module on PROFIBUS-Slot 11 ■ Bit 3: Entry for module on PROFIBUS-Slot 12 ■ Bit 4: Entry for module on PROFIBUS-Slot 13 ■ Bit 5: Entry for module on PROFIBUS-Slot 14 ■ Bit 6: Entry for module on PROFIBUS-Slot 15 ■ Bit 7: Entry for module on PROFIBUS-Slot 16
x+3	■ Bit 0: Entry for module on PROFIBUS-Slot 17 ■ Bit 1: Entry for module on PROFIBUS-Slot 18 ■ Bit 2: Entry for module on PROFIBUS-Slot 19 ■ Bit 3: Entry for module on PROFIBUS-Slot 20 ■ Bit 4: Entry for module on PROFIBUS-Slot 21 ■ Bit 5: Entry for module on PROFIBUS-Slot 22 ■ Bit 6: Entry for module on PROFIBUS-Slot 23 ■ Bit 7: Entry for module on PROFIBUS-Slot 24
x+4	■ Bit 0: Entry for module on PROFIBUS-Slot 25 ■ Bit 1: Entry for module on PROFIBUS-Slot 26 ■ Bit 2: Entry for module on PROFIBUS-Slot 27 ■ Bit 3: Entry for module on PROFIBUS-Slot 28 ■ Bit 4: Entry for module on PROFIBUS-Slot 29 ■ Bit 5: Entry for module on PROFIBUS-Slot 30 ■ Bit 6: Entry for module on PROFIBUS-Slot 31 ■ Bit 7: Entry for module on PROFIBUS-Slot 32

Byte	Bit 7 ... Bit 0
x+5	■ Bit 0: Entry for module on PROFIBUS-Slot 33 ■ Bit 1: Entry for module on PROFIBUS-Slot 34 ■ Bit 2: Entry for module on PROFIBUS-Slot 35 ■ Bit 3: Entry for module on PROFIBUS-Slot 36 ■ Bit 4: Entry for module on PROFIBUS-Slot 37 ■ Bit 5: Entry for module on PROFIBUS-Slot 38 ■ Bit 6: Entry for module on PROFIBUS-Slot 39 ■ Bit 7: Entry for module on PROFIBUS-Slot 40
x+6	■ Bit 0: Entry for module on PROFIBUS-Slot 41 ■ Bit 1: Entry for module on PROFIBUS-Slot 42 ■ Bit 2: Entry for module on PROFIBUS-Slot 43 ■ Bit 3: Entry for module on PROFIBUS-Slot 44 ■ Bit 4: Entry for module on PROFIBUS-Slot 45 ■ Bit 5: Entry for module on PROFIBUS-Slot 46 ■ Bit 6: Entry for module on PROFIBUS-Slot 47 ■ Bit 7: Entry for module on PROFIBUS-Slot 48
x+7	■ Bit 0: Entry for module on PROFIBUS-Slot 49 ■ Bit 1: Entry for module on PROFIBUS-Slot 50 ■ Bit 2: Entry for module on PROFIBUS-Slot 51 ■ Bit 3: Entry for module on PROFIBUS-Slot 52 ■ Bit 4: Entry for module on PROFIBUS-Slot 53 ■ Bit 5: Entry for module on PROFIBUS-Slot 54 ■ Bit 6: Entry for module on PROFIBUS-Slot 55 ■ Bit 7: Entry for module on PROFIBUS-Slot 56
x+8	■ Bit 0: Entry for module on PROFIBUS-Slot 57 ■ Bit 1: Entry for module on PROFIBUS-Slot 58 ■ Bit 2: Entry for module on PROFIBUS-Slot 59 ■ Bit 3: Entry for module on PROFIBUS-Slot 60 ■ Bit 4: Entry for module on PROFIBUS-Slot 61 ■ Bit 5: Entry for module on PROFIBUS-Slot 62 ■ Bit 6: Entry for module on PROFIBUS-Slot 63 ■ Bit 7: Entry for module on PROFIBUS-Slot 64

Module status

The module status gives you detailed information about the error that occurred at a module. The module status can be activated via the parametrization.

Module status

Byte	Bit 7 ... Bit 0
x	14h (fix) length of the module status
x+1	82h (fix) Status type module status
x+2	00h (fix)
x+3	00h (fix)

Byte	Bit 7 ... Bit 0
x+4	For PROFIBUS-Slot 1 ... 64 the following errors are specified ■ 00: Module has valid data ■ 01: Module error - invalid data (module defective) ■ 10: Incorrect module - invalid data ■ 11: No module - invalid data ■ Bit 1, 0: Module status PROFIBUS-Slot 1 ■ Bit 3, 2: Module status PROFIBUS-Slot 2 ■ Bit 5, 4: Module status PROFIBUS-Slot 3 ■ Bit 7, 6: Module status PROFIBUS-Slot 4
x+5	■ Bit 1, 0: Module status PROFIBUS-Slot 5 ■ Bit 3, 2: Module status PROFIBUS-Slot 6 ■ Bit 5, 4: Module status PROFIBUS-Slot 7 ■ Bit 7, 6: Module status PROFIBUS-Slot 8
x+6	■ Bit 1, 0: Module status PROFIBUS-Slot 9 ■ Bit 3, 2: Module status PROFIBUS-Slot 10 ■ Bit 5, 4: Module status PROFIBUS-Slot 11 ■ Bit 7, 6: Module status PROFIBUS-Slot 12
x+7	■ Bit 1, 0: Module status PROFIBUS-Slot 13 ■ Bit 3, 2: Module status PROFIBUS-Slot 14 ■ Bit 5, 4: Module status PROFIBUS-Slot 15 ■ Bit 7, 6: Module status PROFIBUS-Slot 16
x+8	■ Bit 1, 0: Module status PROFIBUS-Slot 17 ■ Bit 3, 2: Module status PROFIBUS-Slot 18 ■ Bit 5, 4: Module status PROFIBUS-Slot 19 ■ Bit 7, 6: Module status PROFIBUS-Slot 20
x+9	■ Bit 1, 0: Module status PROFIBUS-Slot 21 ■ Bit 3, 2: Module status PROFIBUS-Slot 22 ■ Bit 5, 4: Module status PROFIBUS-Slot 23 ■ Bit 7, 6: Module status PROFIBUS-Slot 24
x+10	■ Bit 1, 0: Module status PROFIBUS-Slot 25 ■ Bit 3, 2: Module status PROFIBUS-Slot 26 ■ Bit 5, 4: Module status PROFIBUS-Slot 27 ■ Bit 7, 6: Module status PROFIBUS-Slot 28
x+11	■ Bit 1, 0: Module status PROFIBUS-Slot 29 ■ Bit 3, 2: Module status PROFIBUS-Slot 30 ■ Bit 5, 4: Module status PROFIBUS-Slot 31 ■ Bit 7, 6: Module status PROFIBUS-Slot 32
x+12	■ Bit 1, 0: Module status PROFIBUS-Slot 33 ■ Bit 3, 2: Module status PROFIBUS-Slot 34 ■ Bit 5, 4: Module status PROFIBUS-Slot 35 ■ Bit 7, 6: Module status PROFIBUS-Slot 36
x+13	■ Bit 1, 0: Module status PROFIBUS-Slot 37 ■ Bit 3, 2: Module status PROFIBUS-Slot 38 ■ Bit 5, 4: Module status PROFIBUS-Slot 39 ■ Bit 7, 6: Module status PROFIBUS-Slot 40

Byte	Bit 7 ... Bit 0
x+14	■ Bit 1, 0: Module status PROFIBUS-Slot 41 ■ Bit 3, 2: Module status PROFIBUS-Slot 42 ■ Bit 5, 4: Module status PROFIBUS-Slot 43 ■ Bit 7, 6: Module status PROFIBUS-Slot 44
x+15	■ Bit 1, 0: Module status PROFIBUS-Slot 45 ■ Bit 3, 2: Module status PROFIBUS-Slot 46 ■ Bit 5, 4: Module status PROFIBUS-Slot 47 ■ Bit 7, 6: Module status PROFIBUS-Slot 48
x+16	■ Bit 1, 0: Module status PROFIBUS-Slot 49 ■ Bit 3, 2: Module status PROFIBUS-Slot 50 ■ Bit 5, 4: Module status PROFIBUS-Slot 51 ■ Bit 7, 6: Module status PROFIBUS-Slot 52
x+17	■ Bit 1, 0: Module status PROFIBUS-Slot 53 ■ Bit 3, 2: Module status PROFIBUS-Slot 54 ■ Bit 5, 4: Module status PROFIBUS-Slot 55 ■ Bit 7, 6: Module status PROFIBUS-Slot 56
x+18	■ Bit 1, 0: Module status PROFIBUS-Slot 57 ■ Bit 3, 2: Module status PROFIBUS-Slot 58 ■ Bit 5, 4: Module status PROFIBUS-Slot 59 ■ Bit 7, 6: Module status PROFIBUS-Slot 60
x+19	■ Bit 1, 0: Module status PROFIBUS-Slot 61 ■ Bit 3, 2: Module status PROFIBUS-Slot 62 ■ Bit 5, 4: Module status PROFIBUS-Slot 63 ■ Bit 7, 6: Module status PROFIBUS-Slot 64

Channel-related diagnostic

With the channel-related diagnostic you gain detailed information about the channel error within a module. For the usage of the channel-related diagnostic you have to release the diagnostic interrupt for every module via the parametrization. The channel-related diagnostic can be activated via the parametrization.

Channel-related diagnostic for one channel

Byte	Bit 7 ... Bit 0
x	■ Bit 5 ... 0: ID number of the module that delivers the channel-specific diagnostic (000000 ... 111111) – PROFIBUS-Slot 1 has ID number 0 – ... – PROFIBUS-Slot 64 has ID number 63 ■ Bit 7, 6: 10 (fix) Code for channel-specific diagnostic
x+1	■ Bit 5 ... 0: Number of the channel or the channel group that delivers the diagnostic (00000 .... 11111) ■ Bit 7, 6: Module type – 01: Input module – 10: Output module – 11: In-/Output module
x+2	■ Bit 4 ... 0: *Error messages to PROFIBUS standard* – 00001: Short circuit – 00010: Under voltage (supply voltage) – 00011: Over voltage (supply voltage) – 00100: Output module is overloaded – 00101: Temperature rise output module – 00110: Wire break sensors or actors – 00111: Upper limit violation – 01000: Lower limit violation – 01001: Error (Load voltage at the output, sensor supply, hardware error in the module) ■ Bit 4 ... 0: *Error messages - manufacturer-specific* – 10000: Parameter assignment error – 10001: Module specific error – 10010: Fuse defect – 10100: Ground fault – 10101: Reference channel error – 10110: Hardware interrupt lost – 11001: Safety-related shutdown – 11010: External error – 11010: Indefinable error - not specified ■ Bit 7 ... 5: Channel type – 001: bit – 010: 2bit – 011: 4bit – 100: byte – 101: word – 110: 2words

The maximum number of channel-related diagnostic is limited by the total length of 122byte for diagnostic. By de-activating of other diagnostic ranges you may release these areas for further channel-related diagnostic. For each channel always 3byte are used.

Interrupts

The interrupt section of the slave diagnostic shows information about interrupt type and cause. The interrupt section consists of max. 24byte. For every slave diagnostic max. 1 interrupt can be sent. The interrupt section is always the last part of the diagnostic telegram if it was activated in the parametrization.

Depending on the interrupt type, the interrupt section has the following structure:

Byte	Element	Description
x ... x+3	Interrupt status	Contains information about the interrupt type
x+4 ... x+20	Diagnostic interrupt	The 20byte correspond to the record set 1 of the CPU diagnostic
x+4 ... x+7	Hardware interrupt	The 4byte are module specific and are described with the according module.

Interrupt status

If there is a diagnostic event for channel/group 0 of a module, there may be a module error as well as a channel error. The entry is made in this case even if you have not enabled the diagnostic for channel/channel group 0 of a module.

Interrupt status byte x ... x+3

Byte	Bit 7 ... Bit 0
x	■ Bit 5 ... 0: 010100: Length of the interrupt incl. byte x ■ Bit 7 ... 6: 00 (fix) Code for module-related diagnostic
x+1	■ Bit 6 ... 0: Interrupt type – 0000001: Diagnostics interrupt – 0000010: Hardware interrupt ■ Bit 7: Code for interrupt
x+2	■ Bit 7 ... 0: PROFIBUS-Slot of the module that is producing interrupt 1 ... 64
x+3	■ Bit 1, 0: Interrupt type – 00: Hardware interrupt – 01: Diagnostics interrupt$_{incoming}$ – 10: Diagnostics interrupt$_{outgoing}$ – 11: reserved ■ Bit 2: 0 (fix) ■ Bit 7 ... 3: Interrupt sequence number 0 … 31

Interrupt status at diagnostics interrupt Byte x+4 to x+20

Byte	Bit 7 ... Bit 0
x+4	■ Bit 0: Module malfunction, i.e. a problem has been detected ■ Bit 1: Internal error in the module ■ Bit 2: External error - module no longer addressable ■ Bit 3: Channel error in the module ■ Bit 4: External power supply missing ■ Bit 5, 6: reserved ■ Bit 7: Parameter assignment error
x+5	■ Bit 3 ... 0: Module class – 1111: Digital module – 0101: Analog module – 1000: FM – 0111: ETS, CP ■ Bit 4: Channel information available ■ Bit 7 ... 5: 0 (fix)
x+6	see module description
x+7	■ Bit 5 ... 0: reserved ■ Bit 6: Hardware interrupt lost ■ Bit 7: reserved
x+8	■ Channel type – 70h: Module with digital inputs – 71h: Module with analog inputs – 72h: Module with digital outputs – 73h: Module with analog outputs – 74h: Module with analog in-/outputs – 76h: Counter
x+9	Number diagnostic bits per channel
x+10	Number of channels per module
x+11	Position (channel) with diagnostic event
x+12	Diagnostic event on the channel/channel group 0 Assignment see module description
x+13	Diagnostic event on the channel/channel group 1 Assignment see module description
...	...
x+19	Diagnostic event on the channel/channel group 7 Assignment see module description
x+20	µs ticker (4byte) µs value at the moment of the Diagnostics interrupt

Interrupt status at hardware interrupt Byte x+4 to x+7

More detailed information to the diagnostic data may be found in the concerning module description.

Diagnostics with Siemens STEP®7

In Siemens SIMATIC S7 there are functions integrated for processing diagnostic data. Here depending on cause the following OBs are called:

- OB 40: Hardware interrupt
- OB 57: Vendor specific interrupt
- OB 82: Diagnostics interrupt
- OB 86: Slave failure

With the corresponding OB you may react to the cause. For example you can analyse the relevant record sets by means of handling blocks, which your System SLIO provides. If the OB does not exist the CPU goes to STOP.

With the following handling blocks the record sets may be accessed:

- SFC 13: Read diagnostic data of a DP salve
- SFB 52: Read record set
- SFB 53: Write record set
- SFB 54: Read interrupt data from a DP-V1 slave

Here among others via *ID* the diagnostics address of your PROFIBUS coupler and via *INDEX* the record set number is to be entered.

More information about the usage of the handling blocks may be found in the operating of your CPU.

4.8 Firmware update

Overview

A firmware update for the DP slave is currently only possible by means of PROFIBUS via a master system and the Siemens hardware configurator. Here, your firmware from the hardware configurator is routed online to the CPU, which forwards the firmware with the connected DP master via PROFIBUS to the corresponding DP slave.

Please note that a firmware update is only possible from hardware release 06 an up.

Proceeding

CAUTION!
When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the DP slave, for example if the power supply is interrupted during transfer or if the firmware file is faulty. In this case, please call our service!

1. The latest firmware can be found in the service area of www.yaskawa.eu.com. Unzip the file and copy the *header.upd* file to your working directory.
2. Open the Siemens hardware configurator with the configured DP slave.
3. Click on the DP slave and select *'PLC ➔ Update firmware'*. This menu option is only available when the highlighted DP slave supports the function "Update firmware ".
   ⇨ The dialog *'Update firmware'* opens.
4. Choose your work directory via the button [Search] and select the *header.upd* file.
   ⇨ You will see information for which modules and from which firmware version on the chosen file is convenient.
5. Activate the check box *'Activate firmware after loading'* and click on [Execute].
   ⇨ The selected file is checked for validity and transferred as firmware to the selected DP slave if the check is positive.

During operation, a firmware update takes place on the DP slave after approx. 3s. Here the SF and MT LEDs flash alternately. Please note that in this case a restart is made by the DP slave, whereby the DP master could remain in STOP or your application program could be affected.