

VIPA System SLIO

FM | 050-1BB40 | Manual

HB300 | FM | 050-1BB40 | en | 20-40

Frequency measurement 2x24Bit - FM 050



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1 General

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1.2 About this manual

Objective and contents This manual describes the VIPA FM 050-1BB40 of the System SLIO. It contains a description of the construction, project implementation and usage.

Product	Order number	as of state: HW
FM 050	050-1BB40	01

Target audience The manual is targeted at users who have a background in automation technology.

Structure of the manual The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document The following guides are available in the manual:

- An overall table of contents at the beginning of the manual
- References with page numbers

Availability The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

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 information for users

Handling of electrostatic sensitive modules

VIPA modules make use of highly integrated components in MOS-Technology. These components are extremely sensitive to over-voltages that can occur during electrostatic discharges. The following symbol is attached to modules that can be destroyed by electrostatic discharges.



The Symbol is located on the module, the module rack or on packing material and it indicates the presence of electrostatic sensitive equipment. It is possible that electrostatic sensitive equipment is destroyed by energies and voltages that are far less than the human threshold of perception. These voltages can occur where persons do not discharge themselves before handling electrostatic sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable. Modules that have been damaged by electrostatic discharges can fail after a temperature change, mechanical shock or changes in the electrical load. Only the consequent implementation of protection devices and meticulous attention to the applicable rules and regulations for handling the respective equipment can prevent failures of electrostatic sensitive modules.

Shipping of modules

Modules must be shipped in the original packing material.

Measurements and alterations on electrostatic sensitive modules

When you are conducting measurements on electrostatic sensitive modules you should take the following precautions:

- Floating instruments must be discharged before use.
- Instruments must be grounded.

Modifying electrostatic sensitive modules you should only use soldering irons with grounded tips.



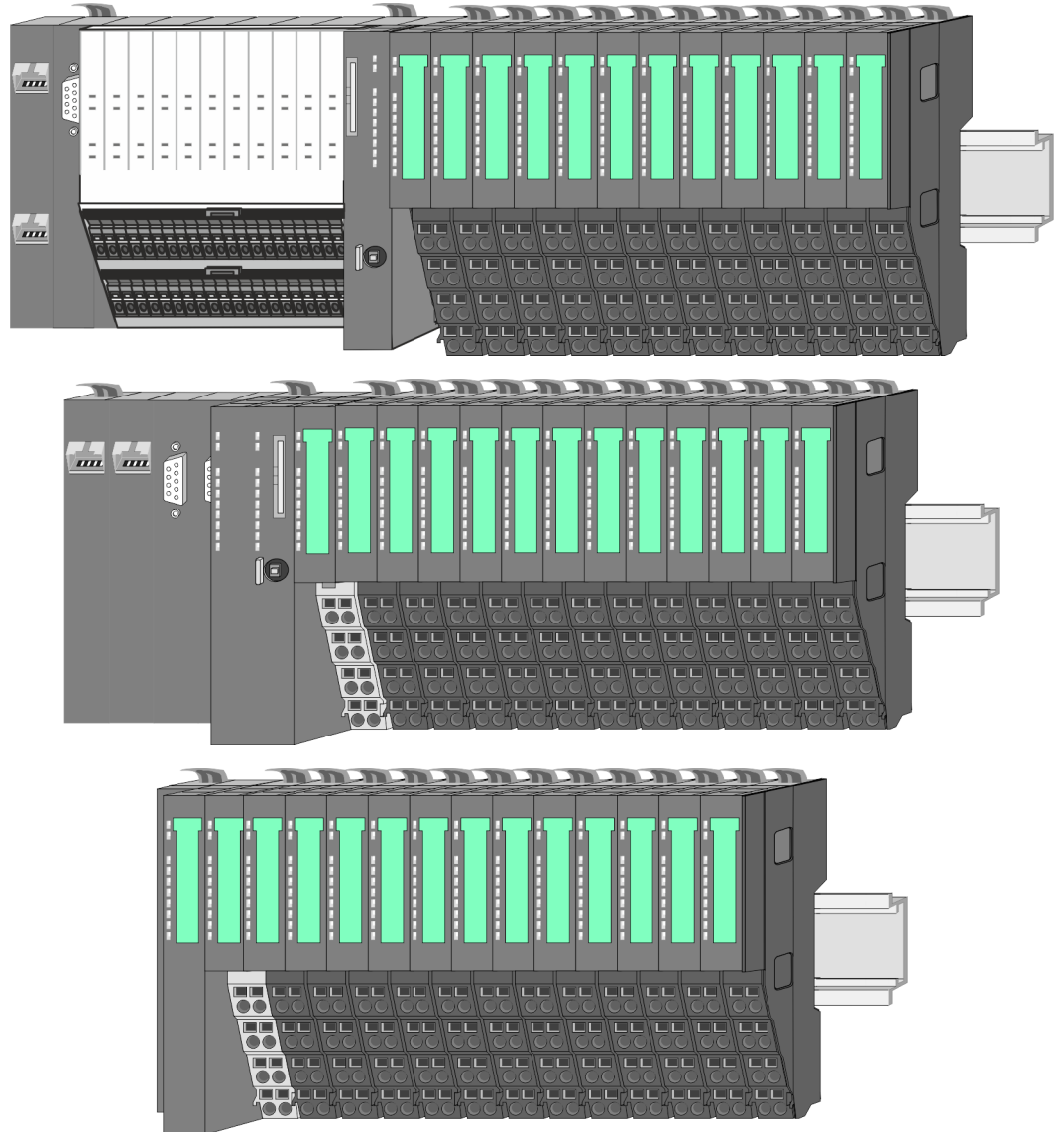
CAUTION!

Personnel and instruments should be grounded when working on electrostatic sensitive modules.

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

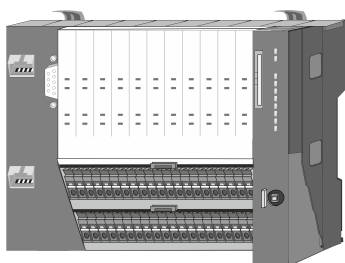
- CPU (head module)
- Bus coupler (head module)
- Line extension
- 8x periphery modules
- 16x periphery modules
- Accessories



CAUTION!

Only VIPA 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



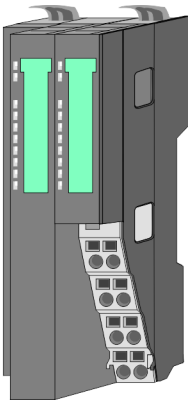
With this CPU 01x, CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24V power section supply for the linked periphery modules is established 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



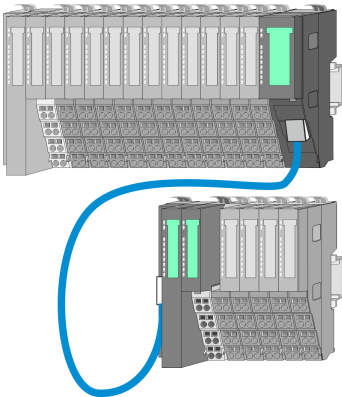
With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module, via the integrated power module for power supply, bus interface and the electronic of the connected periphery modules are supplied. The DC 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

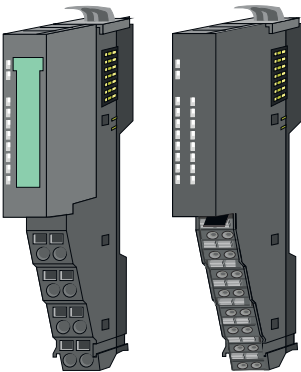


In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension master at each end of a line and the subsequent line has to start with a line extension slave. Master and 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.vipa.com

Periphery modules

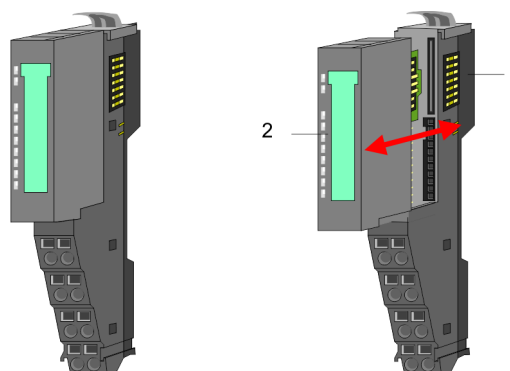


The periphery modules are available in the following 2 versions, whereby of each the electronic part can be replaced with standing wiring:

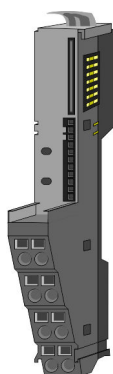
- 8x periphery module for a maximum of 8 channels.
- 16x periphery module for a maximum of 16 channels.

8x periphery modules

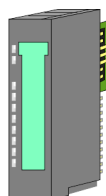
Each 8x periphery module consists of a *terminal* and an *electronic module*.



- 1 Terminal module
- 2 Electronic module

Terminal module

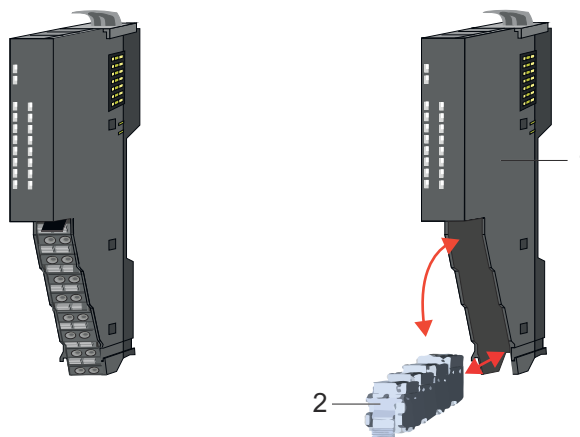
The *terminal* module serves to carry the electronic module, contains the backplane bus with power supply for the electronic, the DC 24V power section supply and the staircase-shaped terminal for wiring. Additionally the terminal module has a locking system for fixing at a mounting rail. By means of 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.

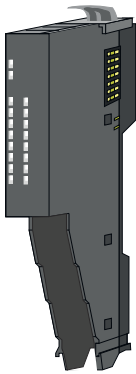
16x periphery modules

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



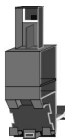
The *terminal block* provides the electrical interface for the signalling and supplies lines of the module. When mounting the terminal block, it is attached to the bottom of the electronic unit and turned towards the electronic unit until it clicks into place. With the wiring a "push-in" spring-clip 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.

2.2.3 Accessories

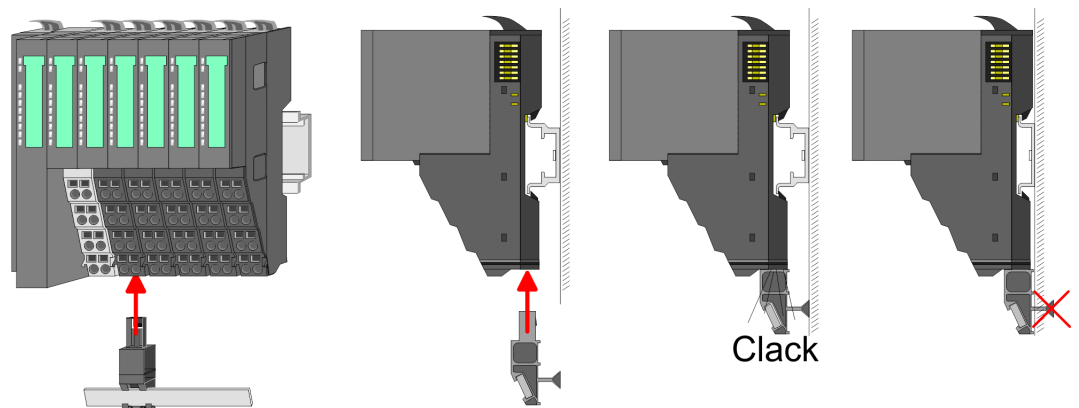
Shield bus carrier

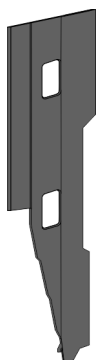


Please note that a shield bus carrier cannot be mounted on a 16x periphery module!



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

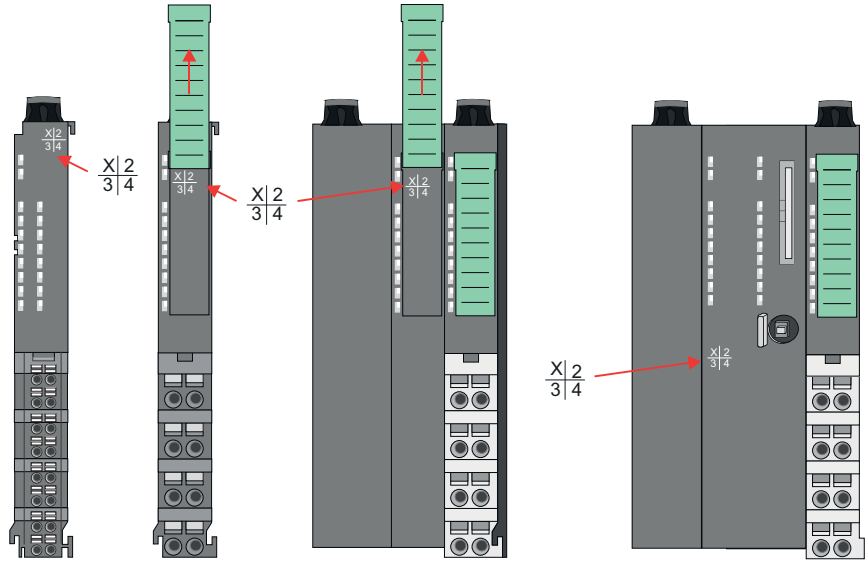
Please note that a coding pin cannot be installed on a 16x periphery module! Here you have to make sure that the associated terminal block is plugged again when the electronics unit is replaced.

There is the possibility to fix the assignment of electronic and terminal module. Here VIPA 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 version 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 on each of them.
- Authoritative for the hardware revision of a System SLIO module is the hardware revision of the electronic module. This is always located under the labeling strip of the corresponding electronic module.
- On modules without labeling strip, such as CPUs and 16x periphery modules, the hardware revision is printed on the front.

Dimensions



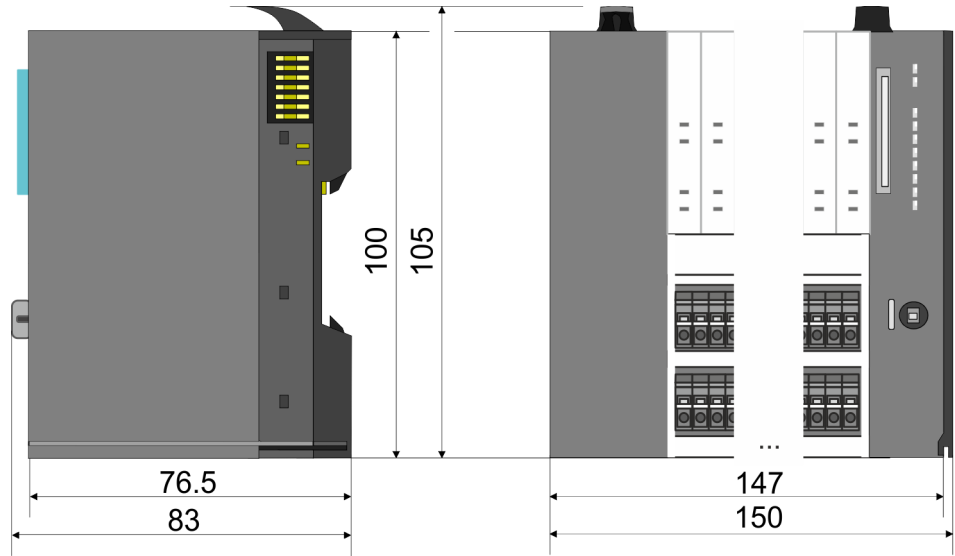
The example here shows the hardware revision 1. 1 is marked with 'X'.

Hardware revision via web server

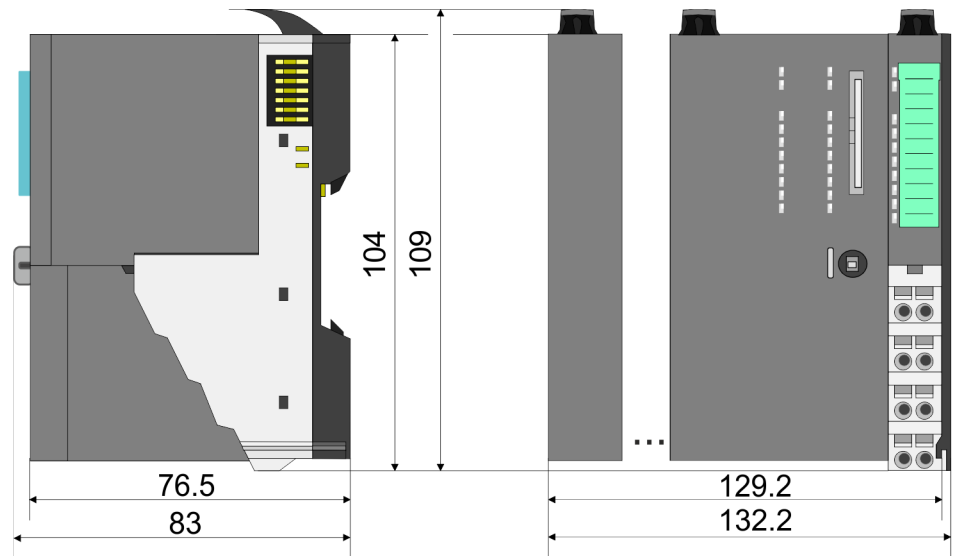
On the CPUs and some bus couplers, you can check the hardware revision 'HW Revision' via the integrated web server.

2.3 Dimensions

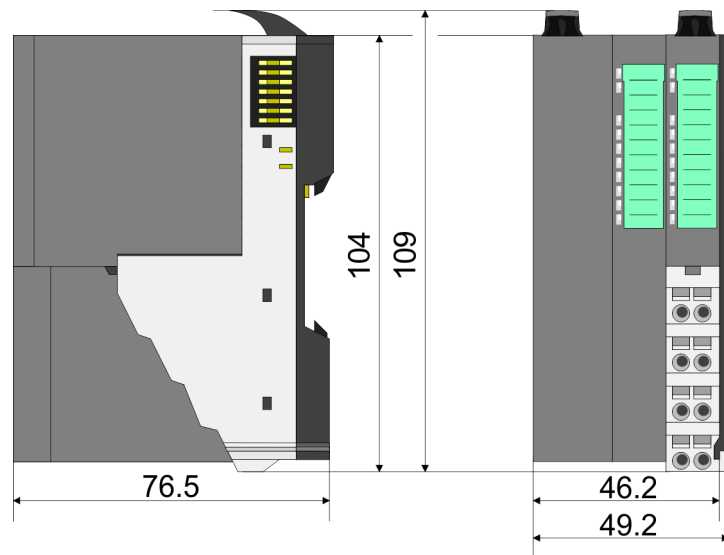
Dimensions CPU 01xC



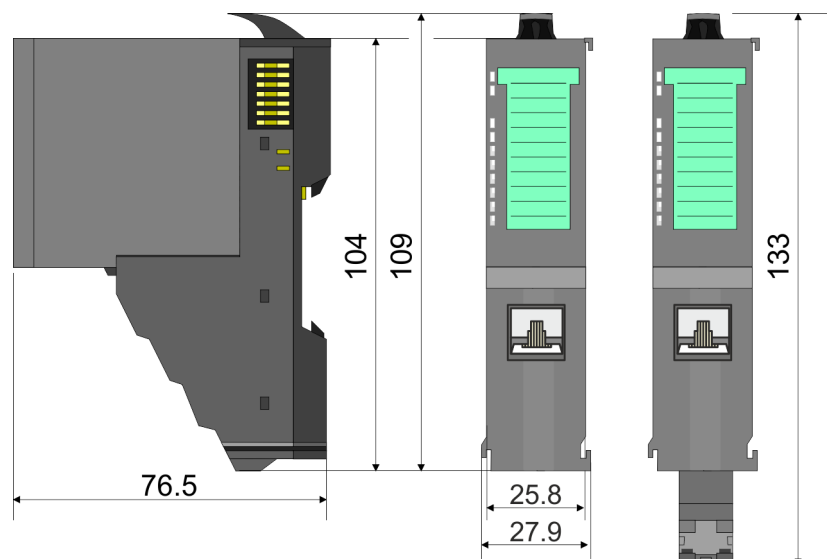
Dimensions CPU 01x



Dimensions bus coupler and line extension slave

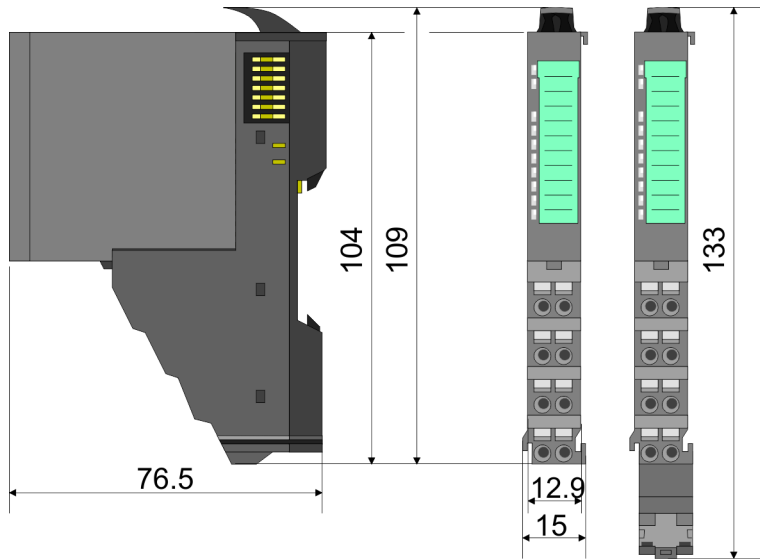


Dimensions line extension master

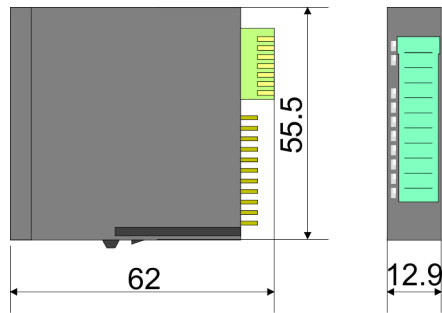


Dimensions

Dimensions 8x periphery module

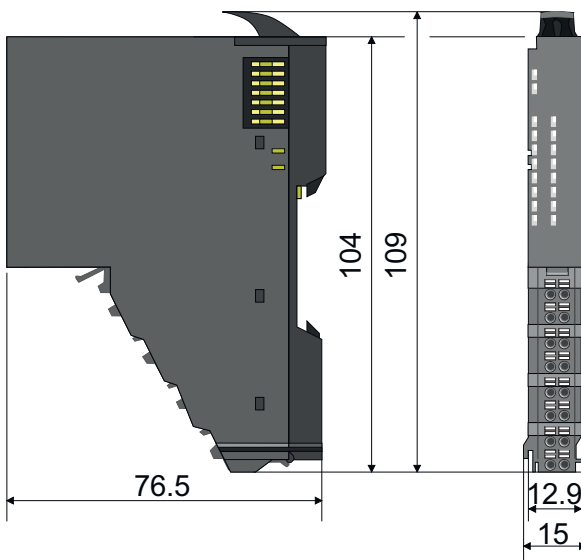


Dimensions electronic module



Dimensions in mm

Dimensions 16x periphery module



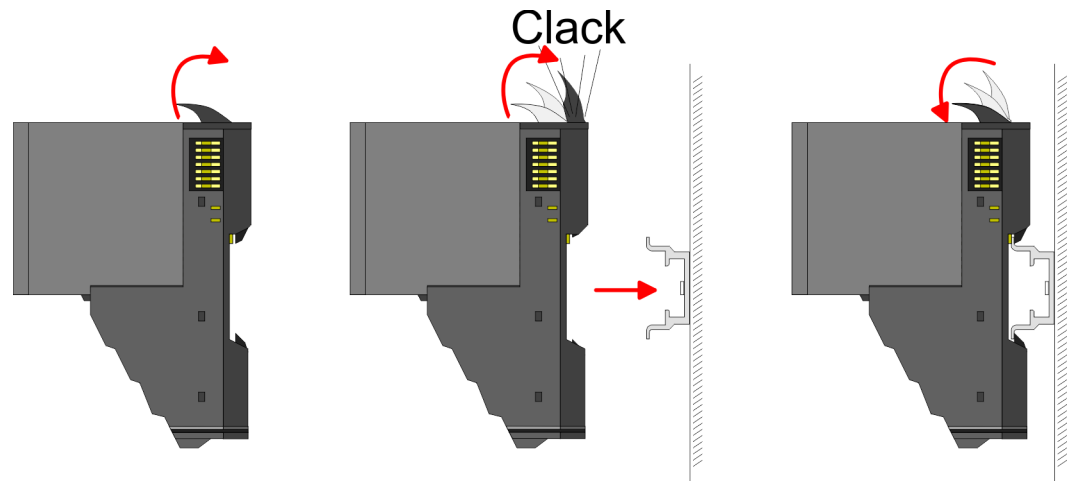
2.4 Mounting 8x peripheral modules



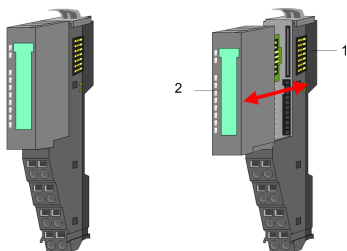
Requirements for UL compliance use

- 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 is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



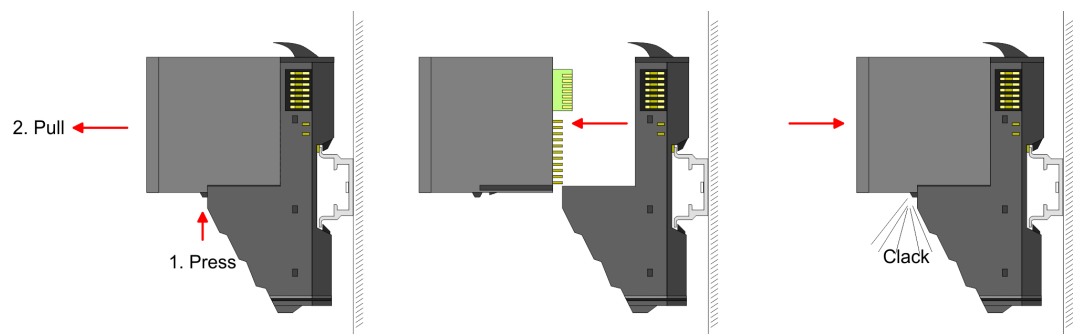
Terminal and electronic module



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

- 1 Terminal module
- 2 Electronic module

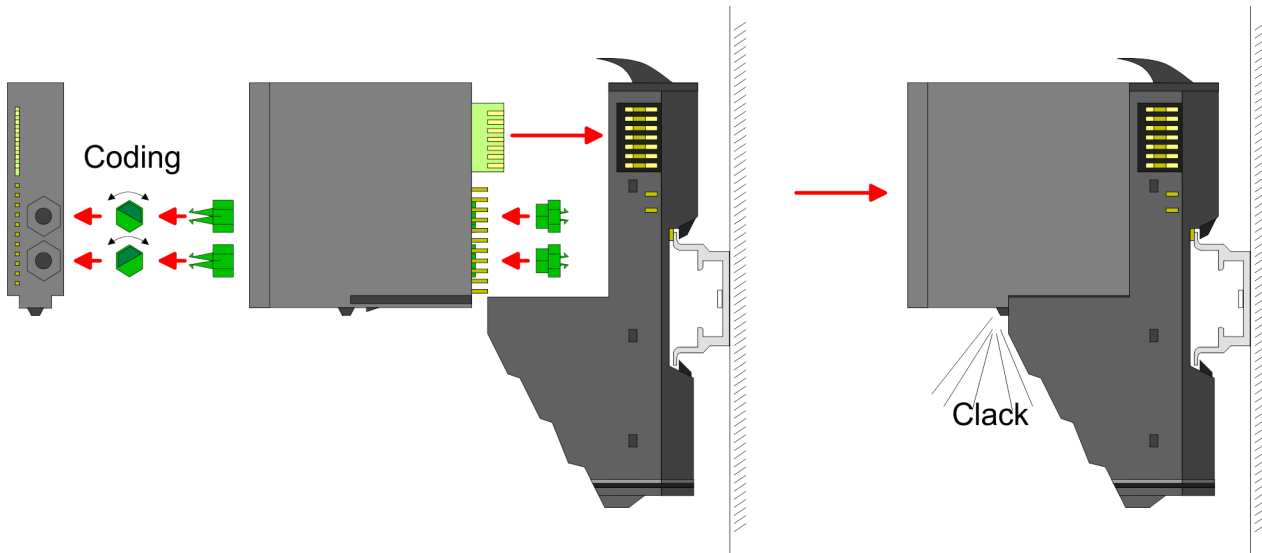
For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



Coding



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



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

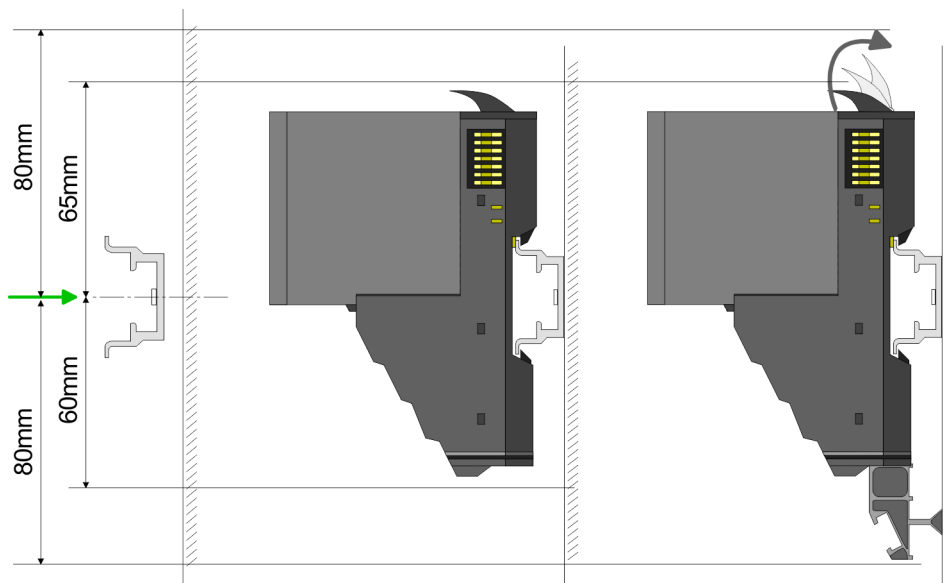
1. Plug, according to your coding, 2 coding jacks in the coding sockets of your electronic module until they lock
2. Now plug the according coding plugs into the coding jacks.
3. To fix the coding put both the electronic and terminal module together until they lock

**CAUTION!**

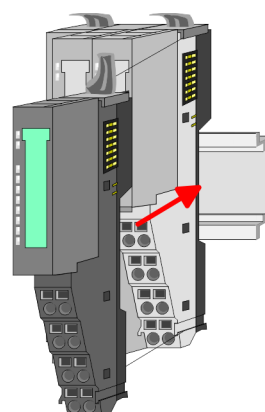
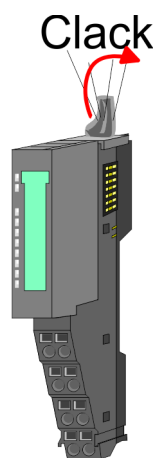
Please consider that when replacing an already coded electronic module, this is always be replaced by an electronic module with the same coding.

Even with an existing coding on the terminal module, you can plug an electronic module without coding. The user is responsible for the correct usage of the coding pins. YASKAWA assumes no liability for incorrectly attached electronic modules or for damages which arise due to incorrect coding!

Mounting periphery modules

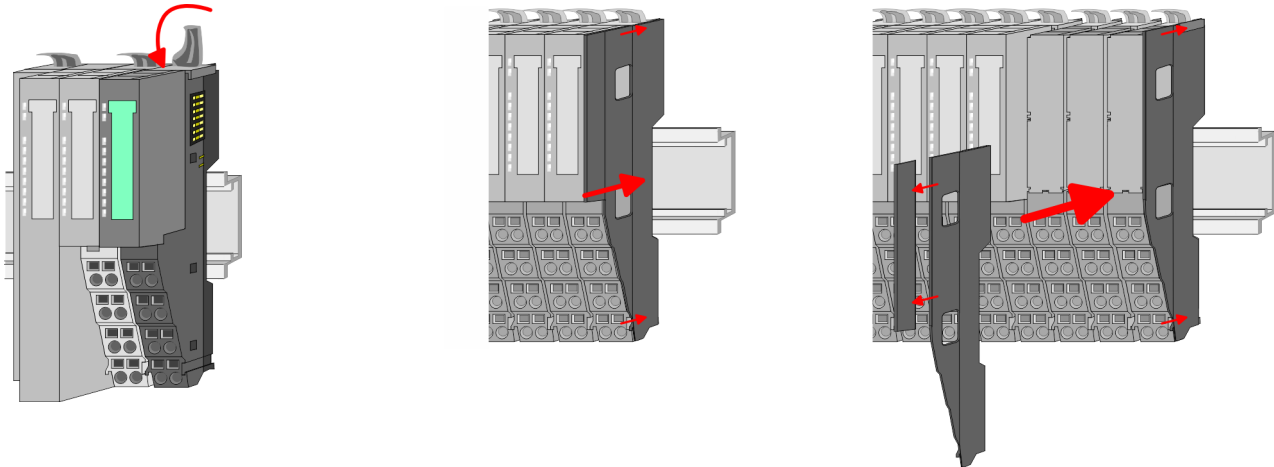


1. ➤ Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.
2. ➤ Mount your head module such as CPU or field bus coupler.
3. ➤ Before mounting the periphery modules you have to remove the bus cover at the right side of the head module by pulling it forward. Keep the cover for later mounting.



4. ➤ For mounting turn the locking lever of the module upwards until it engages.
5. ➤ For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.
6. ➤ Turn the locking lever of the periphery module downward, again.

Mounting 16x periphery modules



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

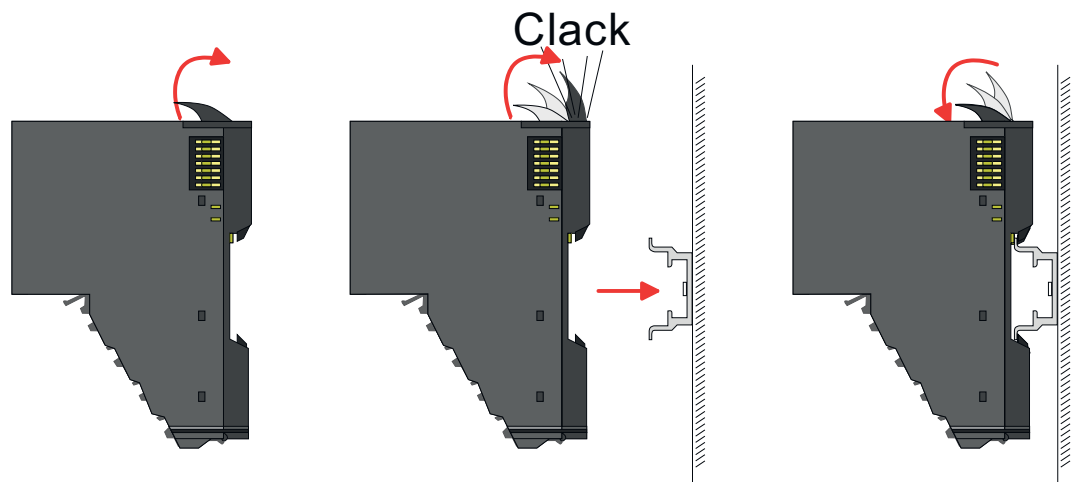
2.5 Mounting 16x periphery modules



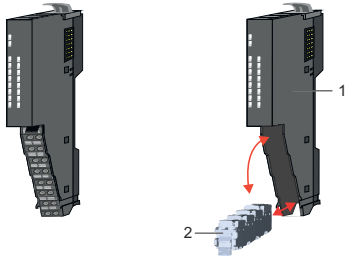
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There is a locking lever at the top side of the module. For mounting and demounting this locking lever is to be turned upwards until this engages. For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module. The module is fixed to the mounting rail by pushing downward the locking lever. The modules may either separately be mounted to the mounting rail or as block. Here is to be considered that each locking lever is opened. The modules are each installed on a mounting rail. The electronic and power section supply are connected via the backplane bus. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.



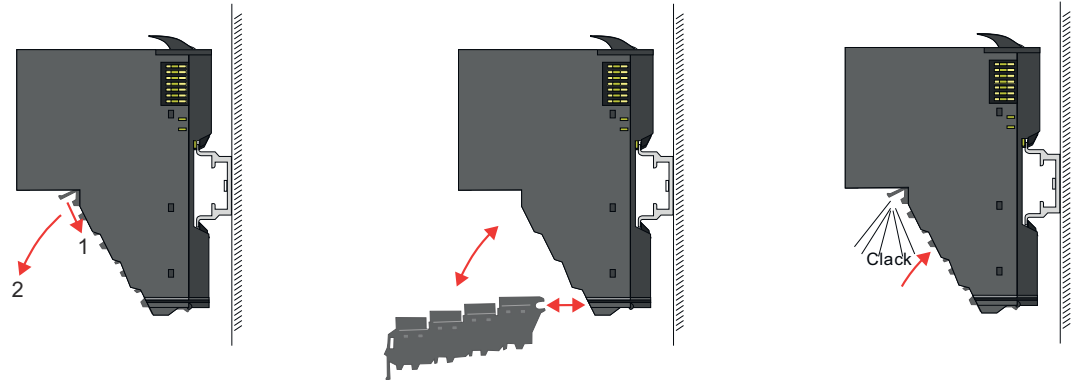
Electronic unit and terminal block



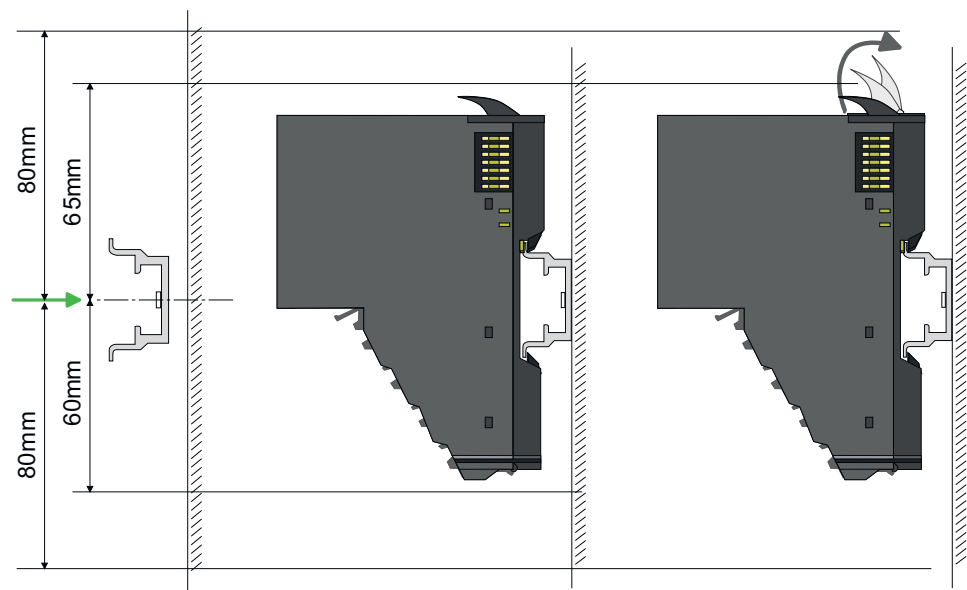
Each 16x periphery module consists of an *electronic unit* and a *terminal block*.

- 1 Electronic unit
- 2 Terminal block

To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock. To mount the terminal block, place it horizontally on the lower side of the electronic unit and push it towards the electronic unit until it clicks into place.

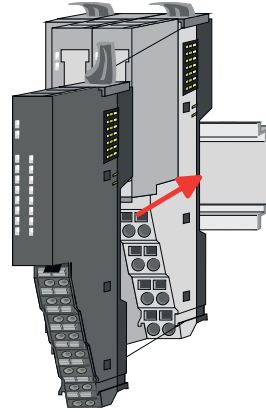
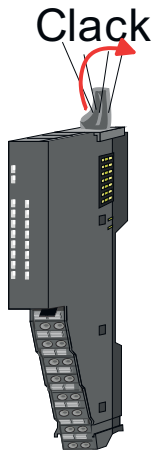


Mounting periphery module

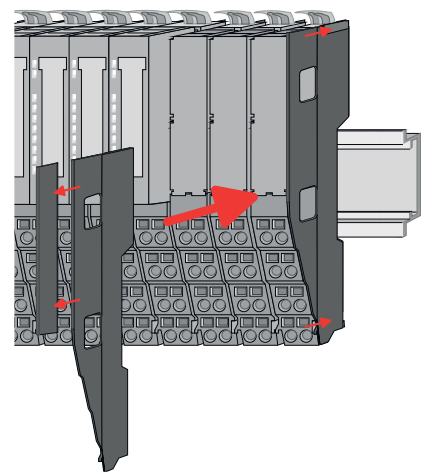
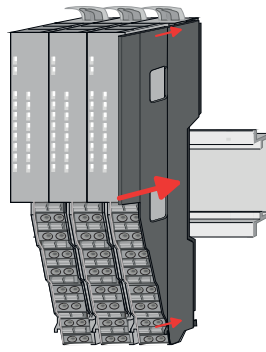
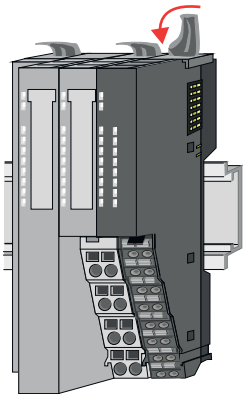


1. ➤ Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 80mm below exist.
2. ➤ Mount your head module such as CPU or field bus coupler.
3. ➤ Before mounting the periphery modules you have to remove the bus cover at the right side of the head module by pulling it forward. Keep the cover for later mounting.

Wiring 8x periphery modules



4. ➤ For mounting turn the locking lever of the module upwards until it engages.
5. ➤ For mounting place the module to the module installed before and push the module to the mounting rail guided by the strips at the upper and lower side of the module.
6. ➤ Turn the locking lever of the periphery module downward, again.



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

2.6 Wiring 8x periphery modules

Terminal module terminals



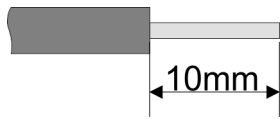
CAUTION!

Do not connect hazardous voltages!

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

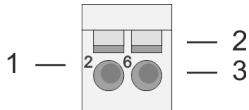
With wiring the terminal modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw terminal connections this type of connection is vibration proof.

Data

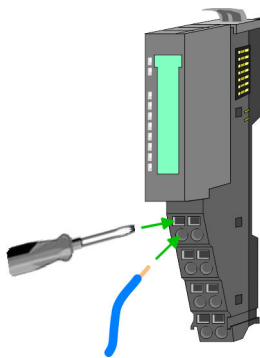
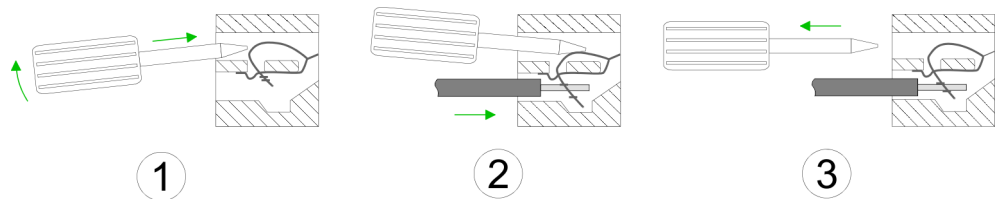


U_{max} 240V AC / 30V DC
 I_{max} 10A
 Cross section 0.08 ... 1.5mm² (AWG 28 ... 16)
 Stripping length 10mm

Wiring procedure

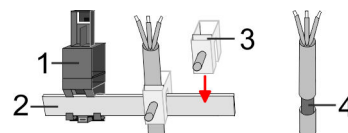


- 1 Pin number at the connector
- 2 Opening for screwdriver
- 3 Connection hole for wire



1. Insert a suited screwdriver at an angle 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

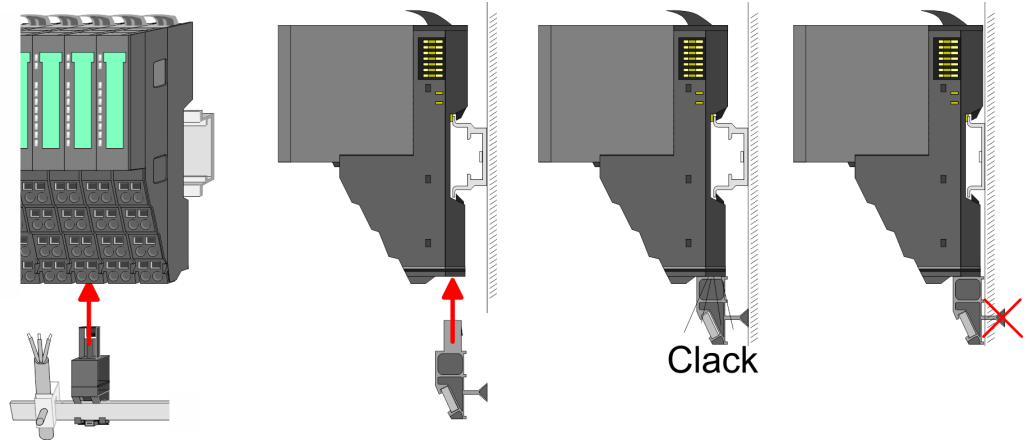


- 1 Shield bus carrier
- 2 Shield bus (10mm x 3mm)
- 3 Shield clamp
- 4 Cable shield

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.

Wiring 16x periphery modules



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

2.7 Wiring 16x periphery modules

Terminal block connectors



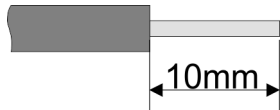
CAUTION!

Do not connect hazardous voltages!

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

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

Data

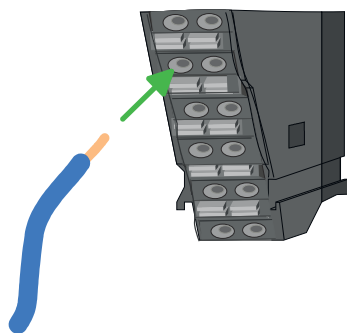


U_{max}	30V DC
I_{max}	10A
Cross section solid wire	0,25 ... 0,75mm ²
Cross section with ferrule	0,14 ... 0,75mm ²
AWG	24 ... 16
Stripping length	10mm

Wiring procedure

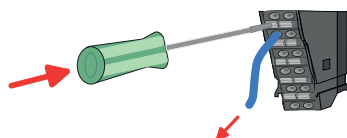


- 1 Release area
- 2 Connection hole for wire

Insert wire

The wiring happens without a tool.

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

Remove wire

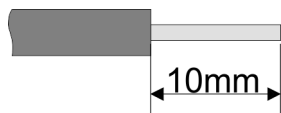
The wire is to be removed by means of a screwdriver with 2.5mm blade width.

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

2.8 Wiring power modules

Terminal module terminals

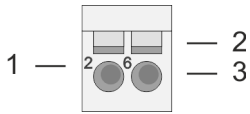
Power modules are either integrated to the head module or may be installed between the periphery modules. With power modules, terminals with spring clamp technology are used for wiring. The spring clamp technology allows quick and easy connection of your signal and supply lines. In contrast to screw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

Data

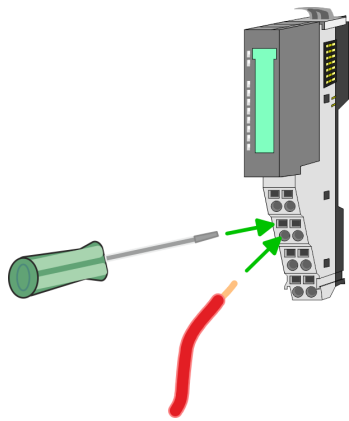
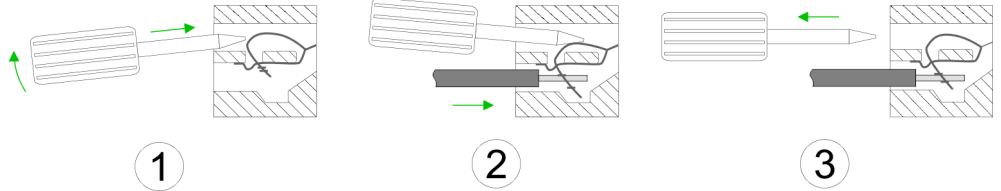
U_{\max}	30V DC
I_{\max}	10A
Cross section	0.08 ... 1.5mm ² (AWG 28 ... 16)
Stripping length	10mm

Wiring power modules

Wiring procedure

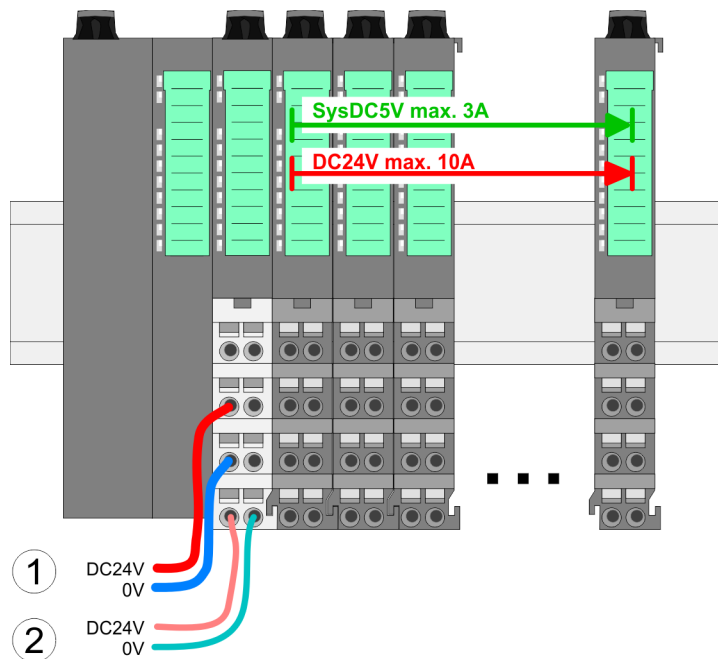


- 1 Pin number at the connector
- 2 Opening for screwdriver
- 3 Connection hole for wire



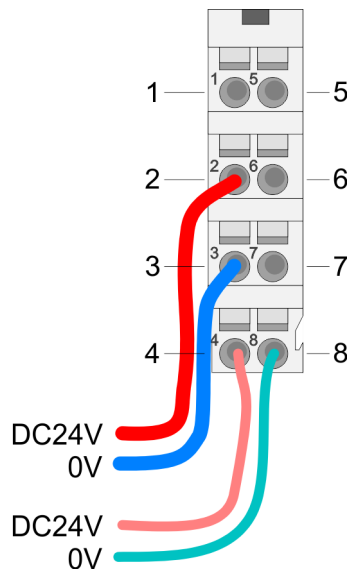
- 1. Insert a suited screwdriver at an angle into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.
- 2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm²
- 3. By removing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

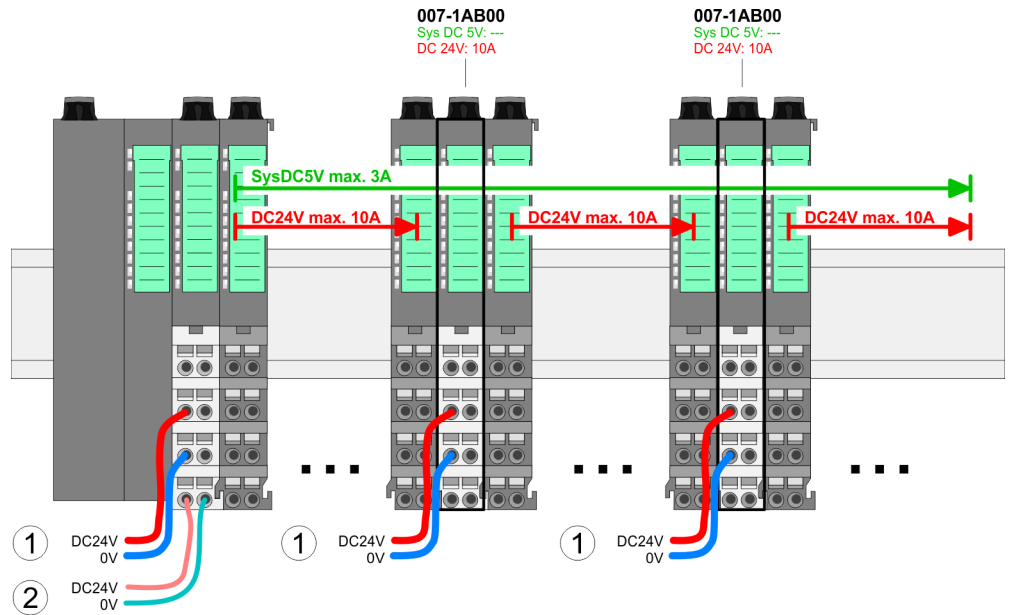
State of the electronic power supply via LEDs

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.

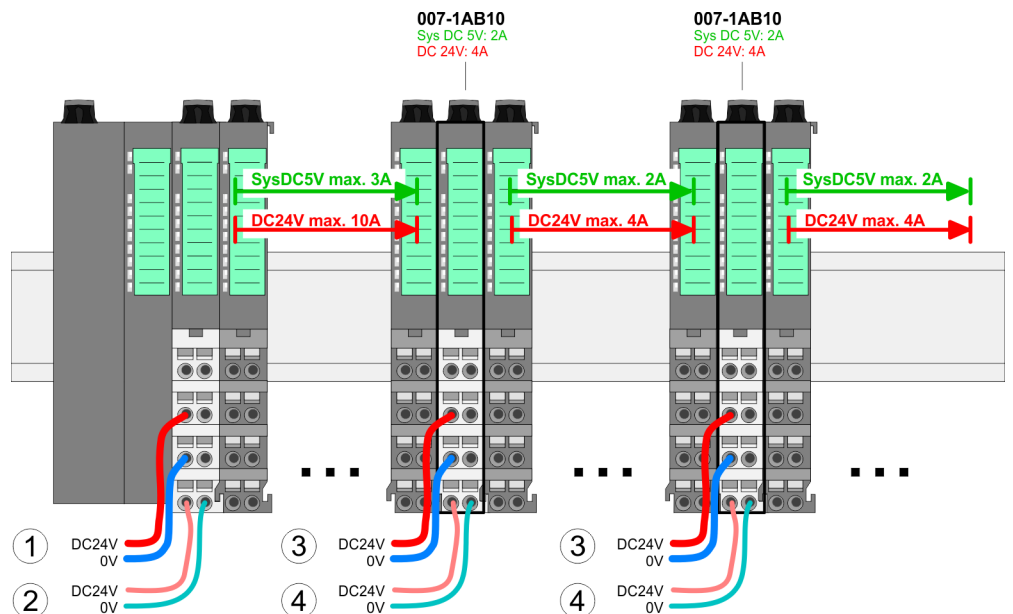
Deployment of the power modules

- 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

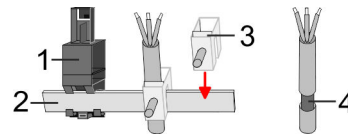


Power module 007-1AB10



- (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

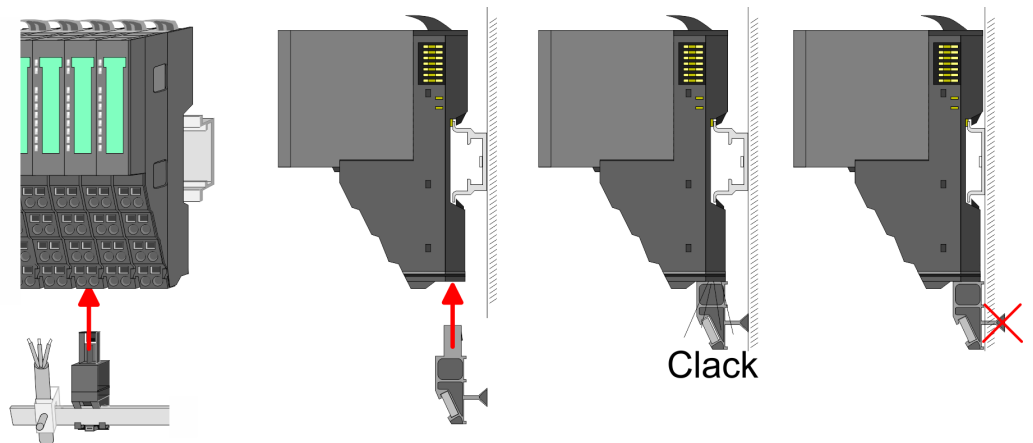
Shield attachment



- 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 peripheral 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.



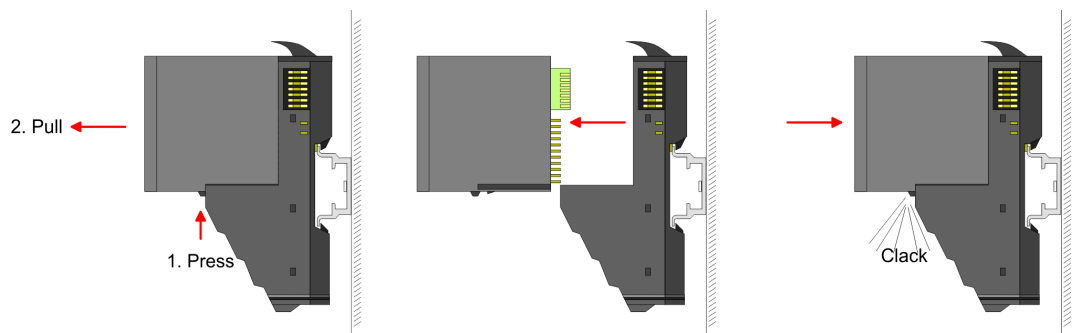
3. ➤ Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

2.9 Demounting 8x peripheral modules

Proceeding

Exchange of an electronic module

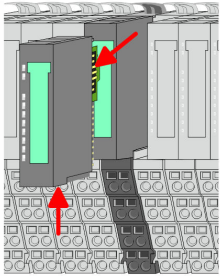
1. ➤ Power-off your system.



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.

Demounting 8x periphery modules

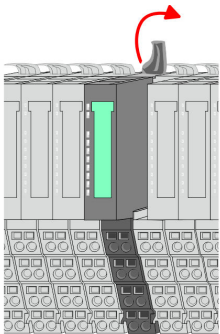
Exchange of a periphery module



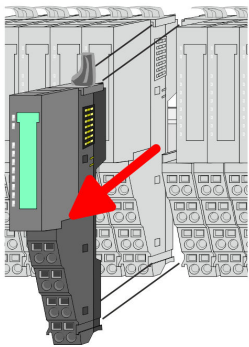
1. ➤ Power-off your system.
2. ➤ Remove if exists the wiring of the module.
3. ➤

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

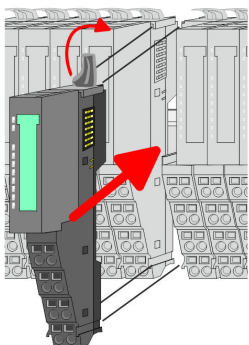
Press the unlocking lever at the lower side of the just mounted right module and pull it forward.



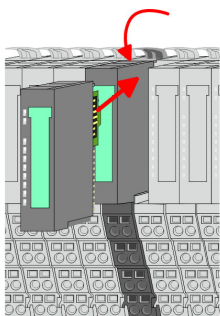
4. ➤ Turn the locking lever of the module to be exchanged upwards.



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

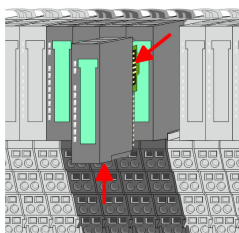


7. ➤ To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
8. ➤ Turn the locking lever downward, again.



9. ➤ Plug again the electronic module, which you have removed before.
10. ➤ Wire your module.
⇒ Now you can bring your system back into operation.

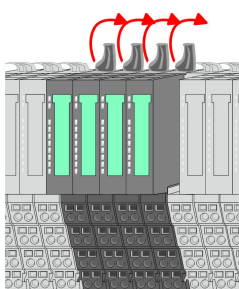
Exchange of a module group



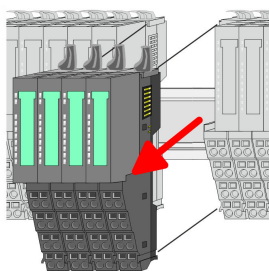
1. ➤ Power-off your system.
2. ➤ Remove if exists the wiring of the module group.
3. ➤

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

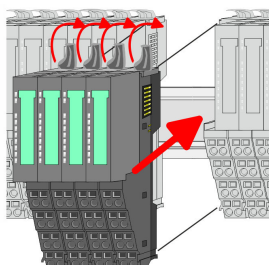
Press the unlocking lever at the lower side of the just mounted right module near the module group and pull it forward.



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

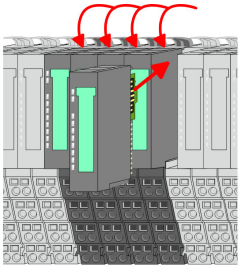


5. ➤ Pull the module group forward.
6. ➤ For mounting turn all the locking lever of the module group to be mounted upwards.



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.

Demounting 16x periphery modules



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.

2.10 Demounting 16x periphery modules

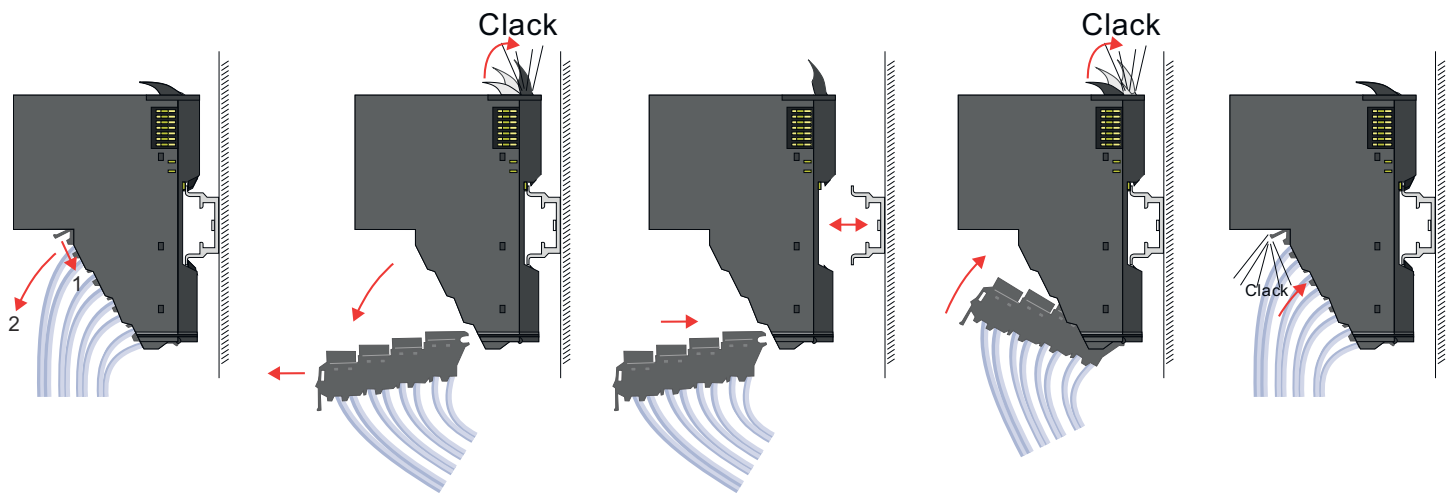
Proceeding

Exchange of an electronic unit

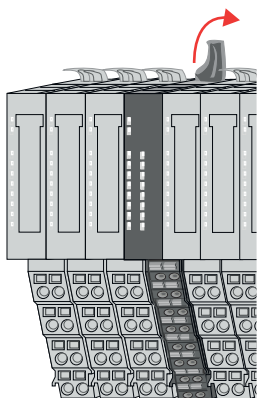
1. Power-off your system.
2. To replace an electronic unit, you can push down and pull off the terminal block after releasing the lock.

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.



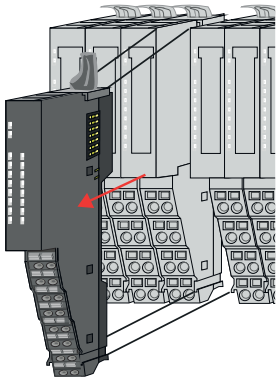
Exchange of a 16x periphery module



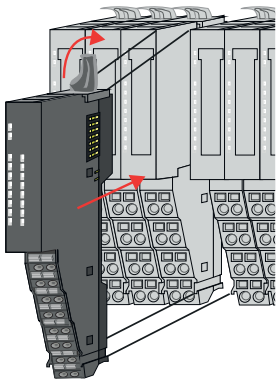
1. Power-off your system.
2. Remove if exists the wiring of the module respectively the wired terminal block.
- 3.

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

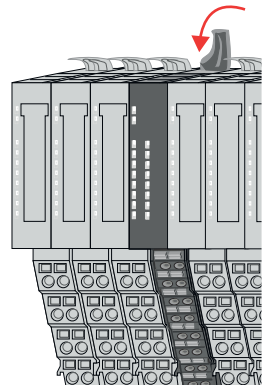
Turn the locking lever of the module to be exchanged upwards.



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

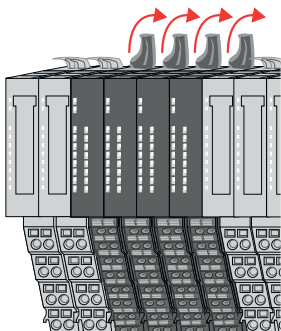


6. ➤ To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.



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

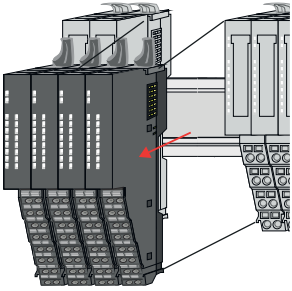


1. ➤ Power-off your system.
2. ➤ Remove if exists the wiring of the module group respectively the wired terminal blocks.
3. ➤

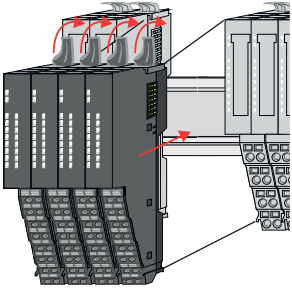
i *In contrast to 8x periphery modules, you can directly demount and mount 16x periphery modules.*

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

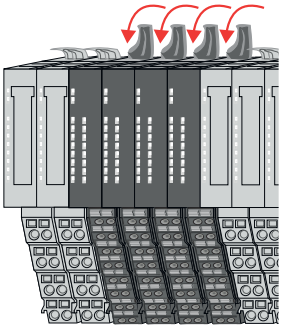
Demounting 16x periphery modules



- 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.

2.11 Easy Maintenance

Overview

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

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



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



Please note, that Easy Maintenance is not supported by the 16x periphery modules!

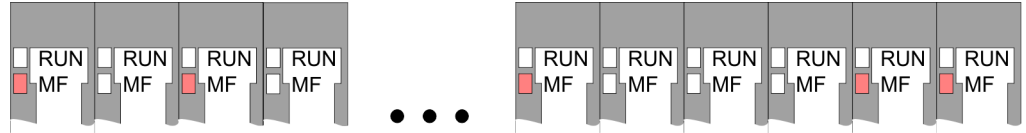
2.12 Trouble shooting - LEDs

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

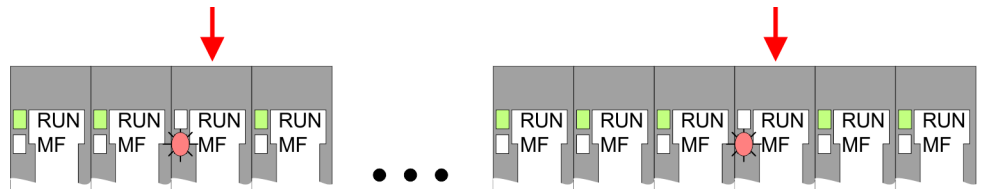


Behaviour: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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. 2.8 'Wiring power modules' page 25

Error in configuration

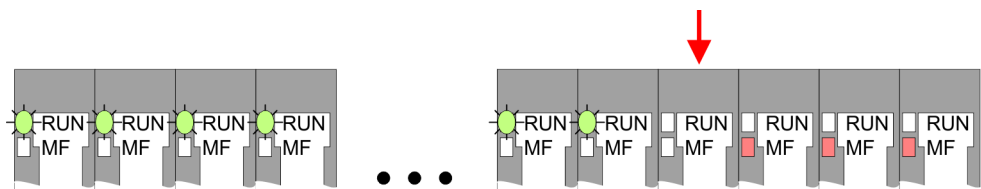


Behaviour: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

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.

2.13 Installation guidelines

General	<p>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.</p>
What does EMC mean?	<p>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.</p> <p>The VIPA 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.</p>
Possible interference causes	<p>Electromagnetic interferences may interfere your control via different ways:</p> <ul style="list-style-type: none">■ Electromagnetic fields (RF coupling)■ Magnetic fields with power frequency■ Bus system■ Power supply■ Protected earth conductor <p>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.</p> <p>There are:</p> <ul style="list-style-type: none">■ galvanic coupling■ capacitive coupling■ inductive coupling■ radiant coupling
Basic rules for EMC	<p>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.</p> <ul style="list-style-type: none">■ Take care of a correct area-wide grounding of the inactive metal parts when installing your components.<ul style="list-style-type: none">– 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.<ul style="list-style-type: none">– 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 laid isolated.
 - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favourable.
 - 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

2.14 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

General data for the System SLIO

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

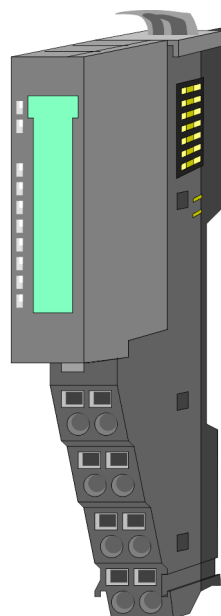
1) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

3 Hardware description

3.1 Properties

Features

- Frequency measurement module
- 2 channels 24bit, DC 24V
- Input frequency max. 600kHz (rising edge)
- Evaluation of period duration in $1\mu\text{s}$, range $1\mu\text{s} \dots 8\text{s}$
- Evaluation of frequency in mHz, range 60mHz ... 600kHz
- Evaluation of speed in rpm
- Input filter (configurable)

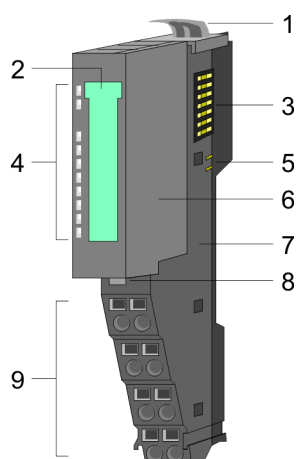


Order data

Type	Order number	Description
FM 050	050-1BB40	Frequency measurement 2x24bit DC 24V

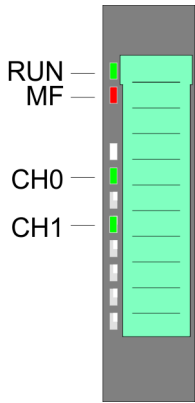
3.2 Structure

050-1BB40



- 1 Locking lever terminal module
- 2 Labeling strip
- 3 Backplane bus
- 4 LED status indication
- 5 DC 24V power section supply
- 6 Electronic module
- 7 Terminal module
- 8 Locking lever electronic module
- 9 Terminal

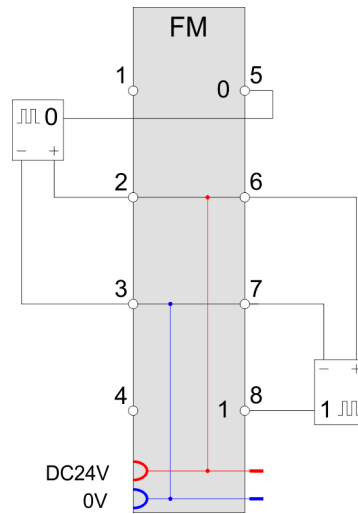
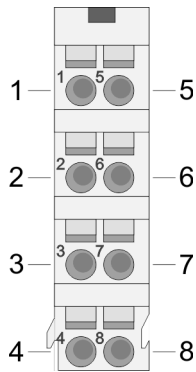
Status indication



LED		Description	
RUN	MF		
green	red		
■	■		
●	○	Bus communication is OK Module status is OK	
●	●	Bus communication is OK Module status reports an error	
○	●	Bus communication is not possible Module status reports an error	
○	○	Error at bus power supply	
X	B	Error in configuration ↗ Chap. 2.12 'Trouble shooting - LEDs' page 36	
CH0	green	●	Channel 0: pulse input triggered
	■		
CH1	green	●	Channel 1: pulse input triggered
	■		
on: ● off: ○ blinks with 2Hz: B not relevant: X			

Pin assignment

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



Pos.	Function	Type	Description
1	---	---	not connected.
2	DC 24V	O	DC 24V for encoder
3	0V	O	GND
4	---	---	not connected.
5	CH0	I	Channel 0: pulse input
6	DC 24V	O	DC 24V for encoder
7	0V	O	GND
8	CH1	I	Channel 1: pulse input

I: Input, O: Output

3.3 Technical data

Order no.	050-1BB40
Type	FM 050
Module ID	0881 2880
Current consumption/power loss	
Current consumption from backplane bus	35 mA
Power loss	0.5 W
Technical data digital inputs	
Number of inputs	2
Cable length, shielded	100 m
Cable length, unshielded	-
Rated load voltage	DC 20.4...28.8 V
Reverse polarity protection of rated load voltage	-
Current consumption from load voltage L+ (without load)	5 mA
Rated value	DC 20.4...28.8 V
Input voltage for signal "0"	DC 0...5 V
Input voltage for signal "1"	DC 15...28.8 V
Input voltage hysteresis	-
Signal logic input	-
Frequency range	-
Input resistance	-
Input current for signal "1"	3 mA
Connection of Two-Wire-BEROs possible	✓
Max. permissible BERO quiescent current	0.5 mA
Input delay of "0" to "1"	0.8 µs
Input delay of "1" to "0"	0.8 µs
Number of simultaneously utilizable inputs horizontal configuration	2
Number of simultaneously utilizable inputs vertical configuration	2
Input characteristic curve	IEC 61131-2, type 1
Initial data size	20 Byte
Technical data digital outputs	
Number of outputs	-
Cable length, shielded	-
Cable length, unshielded	-
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-

Order no.	050-1BB40
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-
Lamp load	-
Parallel switching of outputs for redundant control of a load	-
Parallel switching of outputs for increased power	-
Actuation of digital input	-
Switching frequency with resistive load	-
Switching frequency with inductive load	-
Switching frequency on lamp load	-
Internal limitation of inductive shut-off voltage	-
Short-circuit protection of output	-
Trigger level	-
Number of operating cycle of relay outputs	-
Switching capacity of contacts	-
Output data size	12 Byte
Technical data counters	
Number of counters	2
Counter width	24 Bit
Maximum input frequency	600 kHz
Maximum count frequency	600 kHz
Mode incremental encoder	-
Mode pulse / direction	-
Mode pulse	-
Mode frequency counter	✓
Mode period measurement	✓
Gate input available	-
Latch input available	-
Reset input available	-
Counter output available	-
Status information, alarms, diagnostics	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no

Technical data

Order no.	050-1BB40
Diagnostics information read-out	possible
Module state	green LED
Module error display	red LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	-
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	-
Max. potential difference between Mana and Mintern (Uiso)	-
Max. potential difference between inputs and Mana (Ucm)	-
Max. potential difference between inputs and Mintern (Uiso)	-
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	20
Output bytes	12
Parameter bytes	8
Diagnostic bytes	20
Housing	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Net weight	55 g
Weight including accessories	55 g
Gross weight	70 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 Fast introduction

Frequency range

Limits	Value
Lower frequency limit	60mHz
Upper frequency limit	600kHz
Min. pulse time	800ns
Min. pause time	800ns

Address areas

Input area

At CPU, PROFIBUS and PROFINET the input area is embedded to the corresponding address area.

IX - Index for access via CANopen

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

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PERIOD_CH0	4	Channel 0: Measured time value	5460h/s	01h
+4	FM_RISING_EDGES_CH0	4	Channel 0: Number of pulses	5461h/s	02h
+8	FM_PERIOD_CH1	4	Channel 1: Measured time value	5460h/s+1	03h
+12	FM_RISING_EDGES_CH1	4	Channel 1: Number of pulses	5461h/s+1	04h
+16	FM_STATUS_CH0	2	Channel 0: State	5462h/s	05h
+18	FM_STATUS_CH1	2	Channel 1: State	5462h/s+1	06h

FM_STATUS_CHx State

Bit	Name	Function
7 ... 0	-	reserved
8	STS_FM	is set if the according channel is enabled.
15 ... 9	-	reserved

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PRESET_PERIOD_CH0	4	Channel 0: Measurement period	5660h/s	01h
+2	FM_PRESET_PERIOD_CH1	4	Channel 1: Measurement period	5660h/s+1	02h
+8	FM_CONTROL_CH0	2	Channel 0: Control word	5661h/s	03h
+10	FM_CONTROL_CH1	2	Channel 1: Control word	5661h/s+1	04h

**FM_CONTROL_CHx
Control word**

Bit	Name	Function
7 ... 0	-	reserved
8	CTRL_FM_START	Start frequency measurement
9	CTRL_FM_STOP	Stop frequency measurement
15 ... 10	-	reserved

Parameters

DS - Record set for access via CPU, PROFIBUS and PROFINET

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
-	1	reserved	00h	01h	3100h	01h
CH0_FLT	1	Channel 0: Input filter	00h		3101h	02h
-	1	reserved	00h		3102h	03h
CH1_FLT	1	Channel 1: Input filter	00h		3103h	04h

Frequency measurement via VIPA specific functions With the following VIPA specific functions, you can control the System SLIO frequency measurement module:

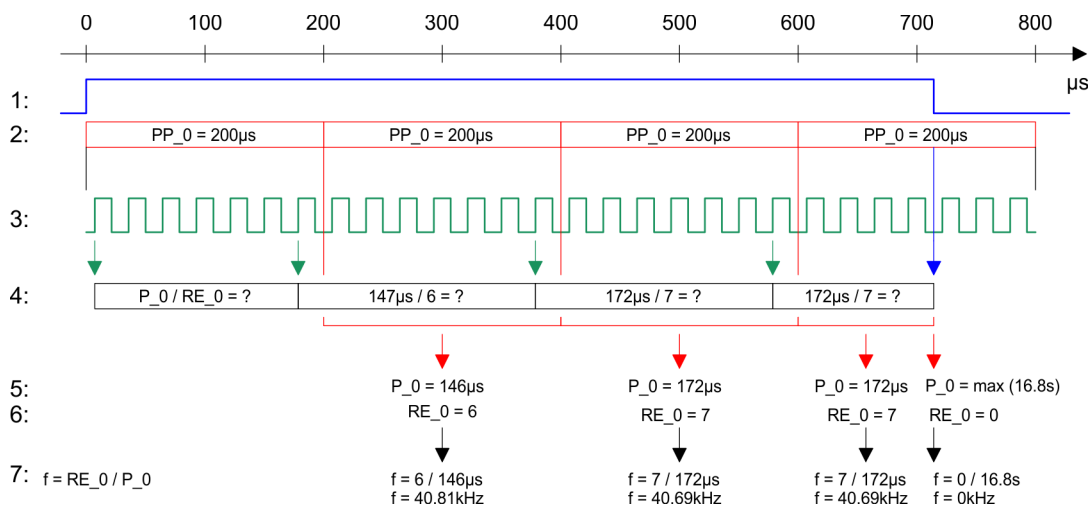
Function	Symbol	Comment
FC 300	FM_SET_CONTROL	Function to control the frequency measurement with integrated consistent access.
FC 301	FM_GET_PERIOD	Function to calculate the period duration with integrated consistent access.
FC 302	FM_GET_FREQUENCY	Function to calculate the frequency with integrated consistent access.
FC 303	FM_GET_SPEED	Function to calculate the rotational speed with integrated consistent access.

Function	Symbol	Comment
FC 310	FM_CONTROL	Function to control the frequency measurement
FC 311	FM_CALC_PERIOD	Function to calculate the period duration
FC 312	FM_CALC_FREQUENCY	Function to calculate the frequency
FC 313	FM_CALC_SPEED	Function to calculate the rotational speed

4.2 Principle of operation

Overview The FM module is a frequency measurement module with 2 channels. For measurement DC 24V Signals can be connected to the channels. The module can be accessed via process image or by means of handling blocks.

Frequency measurement The following diagram shows the timing of the frequency measurement on the example of channel 0:



In-/Output area > Input area 20byte

1. Measurement active:
 FM_CONTROL_CH0: CTRL_FM_START = 1:
 Measurement is started
 FM_CONTROL_CH0: CTRL_FM_STOP = 1:
 Measurement is stopped
2. Measurement period (here 200µs), preset via FM_PRESET_PERIOD_CH0 (PP_0).
3. Signal to be measured, which is connected to channel 0.
4. The 1. rising edge within the measurement period starts counting of the rising edges and time measurement. With the end of the measurement period end counting and time measurement.
5. Measured value in the previous measurement period [125ns]. By dividing the value by 8, you get the value in µs.
6. Measured time value and number of rising edges of the previous measurement period.
7. The frequency [kHz] can be determined by dividing number of edges and measured time value [µs].

Only as long the measurement is active, the measured values are represented as FM_PERIOD_CH0 (P_0) and FM_RISING_EDGES_CH0 (RE_0) in the input process image. Otherwise FM_PERIOD_CH0 = 16.8s and FM_RISING_EDGES_CH0 = 0.

4.3 In-/Output area

4.3.1 Input area 20byte

Input area

At CPU, PROFIBUS and PROFINET the input area is embedded to the corresponding address area.

IX - Index for access via CANopen

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

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PERIOD_CH0	4	Channel 0: measured time value	5460h/s	01h
+4	FM_RISING_EDGES_CH0	4	Channel 0: number of pulses	5461h/s	02h
+8	FM_PERIOD_CH1	4	Channel 1: measured time value	5460h/s+1	03h
+12	FM_RISING_EDGES_CH1	4	Channel 1: number of pulses	5461h/s+1	04h
+16	FM_STATUS_CH0	2	Channel 0: status	5462h/s	05h
+18	FM_STATUS_CH1	2	Channel 1: status	5462h/s+1	06h

FM_PERIOD_CHx
Period duration

The measured time value is the time between the last rising edge of the previous measuring period and the last rising edge of the current measuring period. This value is represented with 125ns resolution, this means divided by 8 you get the value in μs .

Max. value: $134217720 \times 125\text{ns} = 16777215\mu\text{s}$

FM_RISING_EDGES_CHx
Number of pulses

Number of pulses (positive edge) of the measured time value. Always the number of pulses of the previous measurement is shown.

FM_STATUS_CHx State

Bit	Name	Function
7 ... 0	-	reserved
8	STS_FM	is set if the according channel is enabled.
15 ... 9	-	reserved

4.3.2 Output area 12byte

Output area

At CPU, PROFIBUS and PROFINET the output area is embedded to the corresponding address area.

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 7000h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Addr.	Name	Bytes	Function	IX	SX
+0	FM_PRESET_PERIOD_CH0	4	Channel 0: Measurement period	5660h/s	01h
+4	FM_PRESET_PERIOD_CH1	4	Channel 1: Measurement period	5660h/s+1	02h
+8	FM_CONTROL_CH0	2	Channel 0: control word	5661h/s	03h
+10	FM_CONTROL_CH1	2	Channel 1: control word	5661h/s+1	04h

FM_PRESET_PERIOD_CHx
Measurement period

Enter here as measurement period the time window for the frequency measurement. It is specified as a 23bit value with a resolution of $1\mu\text{s}$.

Range of values: $1\mu\text{s} \dots 8388607\mu\text{s}$

FM_CONTROL_CHx
Control word

Bit	Name	Function
7 ... 0	-	reserved
8	CTRL_FM_START	Start frequency measurement
9	CTRL_FM_STOP	Stop frequency measurement
15 ... 10	-	reserved

4.3.3 Determining the magnitude of the measurement period

The frequency measurement module measures the time between the last rising edge of the previous measurement period and the last rising edge of the current measurement period and counts rising edges during this time. The tolerance of the frequency measurement is $\pm 1\mu\text{s}$ per measurement period. You can increase the accuracy by increasing the time window of the *measurement period* MP. But this increases the time to provide the measured data. The rule is: The longer the *measurement period* MP, the smaller the measurement error F_{max} and the greater the delay of the measurement result. The size of the time window of the *measurement period* MP must have more than twice of the expected *period duration* PD of the input signal. If the *period duration* PD of the input signal is unknown, the *measurement period* MP must be set to maximum value. The *measurement period* MP can be determined by specifying a maximum valid measurement error F_{max} in % by means of the following formula:

$$\text{MP} = 100 / F_{\text{max}} [\mu\text{s}]$$

here it is mandatory: $\text{MP} > 2 \times \text{PD}$

Example

The following table shows the *measurement period* MP in response to the expected *period duration* PD of the input signal and the maximum valid measurement error F_{max} :

Measurement period MP						
Input signal		valid measurement error F_{max} in %				
f in kHz	PD in μs	10	1	0.1	0.01	0.001
600	1.67	10	100	1000	10 000	100 000
250	4.00	10	100	1000	10 000	100 000
100	10.00	10	100	1000	10 000	100 000
10	100.00	- *	- *	1000	10 000	100 000
5	200.00	- *	- *	1000	10 000	100 000
1	1000.00	- *	- *	- *	10 000	100 000

*) prohibited, since $\text{MP} \leq 2 \times \text{PD}$

4.4 Parameter data

DS - Record set for access via CPU, PROFIBUS and PROFINET

IX - Index for access via CANopen

SX - Subindex for access via EtherCAT with Index 3100h + EtherCAT-Slot

More can be found in the according manual of your bus coupler.

Parameters

Name	Bytes	Function	Default	DS	IX	SX
---	1	reserved	00h	01h	3100h	01h
CH0_FLT	1	Channel 0: Input filter	00h		3101h	02h
---	1	reserved	00h		3102h	03h
CH1_FLT	1	Channel 1: Input filter	00h		3103h	04h

CHx_FLT Input filter

Byte	Bit 7 ... 0
0	<ul style="list-style-type: none"> ■ <i>Bit 7 ... 0: Input filter</i> <ul style="list-style-type: none"> – 0x00: 600kHz (Default) – 0x01: 250kHz – 0x02: 100kHz – 0x03: 60kHz – 0x04: 30kHz – 0x06: 10kHz – 0x07: 5kHz – 0x08: 2kHz – 0x09: 1kHz

- By presetting an input frequency you can specify a filter for the according input. E.g. signal peaks of a faulted input signal may be filtered by means of a filter.

4.5 VIPA specific blocks

4.5.1 Include VIPA library

Overview

The VIPA specific blocks can be found in the service area of www.vipa.com as library download file at Downloads > VIPA LIB. The library is available as packed zip file. As soon as you want to use VIPA specific blocks you have to import them into your project. Execute the following steps:

1. ➤ Extract FX000019_Vxxx.zip
2. ➤ "Retrieve" the library
3. ➤ Open library and transfer blocks into the project

Unzip FX000019_Vxxx.zip

➔ Start your un-zip application with a double click on the file FX000019_Vxxx.zip and copy the file VIPA.ZIP to your work directory. It is not necessary to extract this file, too.

Retrieve library

1. ➤ To retrieve your library for the SPEED7-CPU's, start the SIMATIC manager from Siemens. Open the dialog window for archive selection via 'File ➔ Retrieve'. Navigate to your work directory.
2. ➤ Choose VIPA.ZIP and click at [Open].
3. ➤ Select a destination folder where the blocks are to be stored.
4. ➤ With [OK] the extraction is started.

Open library and transfer blocks into the project

1. ➤ Open the library after the extraction.
 2. ➤ Open your project and copy the necessary blocks from the library into the directory "blocks" of your project.
- ⇒ Now you have access to the VIPA specific blocks via your user application.



Are FCs used instead of SFCs, so they are supported by the VIPA SPEED7 CPUs starting from firmware 3.6.0.

4.5.2 FC 300 ... 303 - Frequency measurement SLIO consistent

Overview

The following VIPA specific functions are used to control the System SLIO frequency measurement modules, which are connected via PROFIBUS, PROFINET or EtherCAT. The usage with EtherCAT is only possible at an VIPA EtherCAT CPU. By this functions SFC 14 - DPRD_DAT respectively SFC 15 - DPWR_DAT for consistent read respectively write access to the data are internally called. Error messages of these blocks are reported by the parameter *ERROR*.

Function	Symbol	Comment
FC 300	FM_SET_CONTROL	Function to control the frequency measurement with integrated consistent access.
FC 301	FM_GET_PERIOD	Function to calculate the period duration with integrated consistent access.

Function	Symbol	Comment
FC 302	FM_GET_FREQUENCY	Function to calculate the frequency with integrated consistent access.
FC 303	FM_GET_SPEED	Function to calculate the rotational speed with integrated consistent access.

4.5.3 FC 310 ... 313 - Frequency measurement SLIO

Overview

The following VIPA specific functions are used to control the System SLIO frequency measurement modules, if the consistency of the data are ensured by the bus protocol and consistent reading respectively writing with SFC 14 respectively SFC 15 is not possible. Within the functions there are "FM_..." parameters, whose content is to be consistently connected to the corresponding input or output area of the frequency measurement module by means of the bus system. By calling the appropriate function the corresponding "FM_..." parameters are automatically filled by the function.

Function	Symbol	Comment
FC 310	FM_CONTROL	Function to control the frequency measurement
FC 311	FM_CALC_PERIOD	Function to calculate the period duration
FC 312	FM_CALC_FREQUENCY	Function to calculate the frequency
FC 313	FM_CALC_SPEED	Function to calculate the rotational speed

4.6 Diagnostic data

Overview

So this module does not support process interrupts, the diagnostics data serve for information about this module.

DS - Record set for access via CPU, PROFIBUS and PROFINET. The access happens by DS 01h. Additionally the first 4 bytes may be accessed by DS 00h.

IX - Index for access via CANopen. The access happens by IX 2F01h. Additionally the first 4 bytes may be accessed by IX 2F00h.

SX - Subindex for access via EtherCAT with Index 5005h.

More can be found in the according manual of your bus coupler.

Name	Bytes	Function	Default	DS	IX	SX
ERR_A	1	reserved	00h	01h	2F01h	02h
MODTYP	1	Module information	18h			03h
ERR_C	1	reserved	00h			04h
ERR_D	1	reserved	00h			05h
CHTYP	1	Channel type	76h			06h

Diagnostic data

Name	Bytes	Function	Default	DS	IX	SX
NUMBIT	1	Number diagnostics bits per channel	00h			07h
NUMCH	1	Number channels of the module	02h			08h
CHERR	1	reserved	00h			09h
CH0ERR... CH7ERR	8	reserved	00h			0Ah ... 11h
DIAG_US	4	µs ticker	00h			13h

MODTYP Module information

Byte	Bit 7 ... 0
0	<ul style="list-style-type: none"> ■ Bit 3 ... 0: Module class <ul style="list-style-type: none"> – 1000b: Function module ■ Bit 4: set at channel information present ■ Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	<ul style="list-style-type: none"> ■ Bit 6 ... 0: Channel type <ul style="list-style-type: none"> – 76h: Counter module ■ Bit 7: reserved

NUMBIT Diagnostic bits

Byte	Bit 7 ... 0
0	Number of diagnostics bits of the module per channel (here 00h)

NUMCH Channels

Byte	Bit 7 ... 0
0	Number of channels of the module (here 02h)

DIAG_US µs ticker

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

ERR_A/C/D, CHERR, CHxERR reserved

Byte	Bit 7 ... 0
0	reserved