

# VIPA System SLIO FM 050

**FM | 050-1BB30 | Manual**

HB300 | FM | 050-1BB30 | GB | 15-11

VIPA GmbH  
Ohmstr. 4  
91074 Herzogenaurach  
Telephone: 09132-744-0  
Fax: 09132-744-1864  
Email: [info@vipa.com](mailto:info@vipa.com)  
Internet: [www.vipa.com](http://www.vipa.com)

## Table of contents

<b>1</b>	<b>General</b> .....	<b>4</b>
1.1	Copyright © VIPA GmbH .....	4
1.2	About this manual.....	5
1.3	Safety information.....	6
<b>2</b>	<b>Basics and Assembly</b> .....	<b>8</b>
2.1	Safety information for users.....	8
2.2	System conception.....	9
2.3	Dimensions.....	13
2.4	Installation.....	15
2.5	Demounting and module exchange.....	19
2.6	Wiring.....	23
2.7	Trouble shooting - LEDs.....	27
2.8	Installation guidelines.....	27
2.9	General data.....	30
<b>3</b>	<b>Hardware description</b> .....	<b>32</b>
3.1	Properties.....	32
3.2	Structure.....	32
3.3	Technical data.....	34
<b>4</b>	<b>Deployment</b> .....	<b>38</b>
4.1	Fast introduction.....	38
4.2	In-/Output area.....	40
4.2.1	Input area 12byte .....	40
4.2.2	Output area 4byte .....	41
4.3	Parameter data.....	42
4.4	Counter functions.....	43
4.5	Diagnostic data.....	44

# 1 General

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Tel.: +49 9132 744 -0

Fax.: +49 9132 744-1864

E-Mail: [info@vipa.de](mailto:info@vipa.de)

<http://www.vipa.com>



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**1.2 About this manual****Objective and contents**

This manual describes the FM 050-1BB30 of the System SLIO from VIPA. It contains a description of the structure, project engineering and deployment.

This manual is part of the documentation package with order number VIPA HB300E\_FM and relevant for:

Product	Order number	as of state:
		HW
FM 050	050-1BB30	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
- 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 Assembly

### 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!**

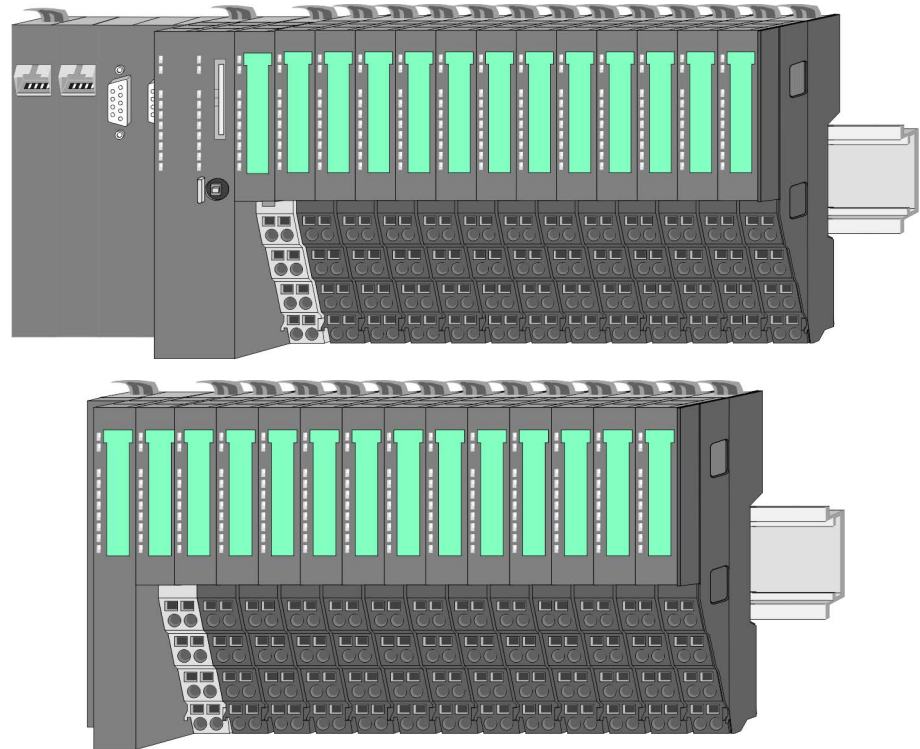
Personnel and instruments should be grounded when working on electrostatic sensitive modules.



## 2.2 System conception

### Overview

System SLIO is a modular automation system for assembly on a 35mm mounting rail. By means of the peripheral modules with 2, 4 or 8 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 is integrated to the backplane bus and defective modules may be replaced with standing wiring. By deployment of the power modules in contrasting colours 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.



### Components

- CPU (head module)
- Bus coupler (head module)
- Periphery modules
- Power modules
- Accessories



#### CAUTION!

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

**CPU**



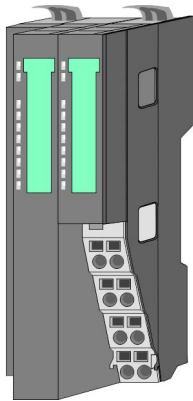
With a CPU, CPU electronic and power module are integrated to one casing. As head module via the integrated power module for power supply the CPU electronic is supplied as well as the electronic of the connected periphery modules. The DC 24 power section supply for the linked periphery modules is established via a further connection at the power module. By installing of up to 64 periphery modules at the CPU, 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 of a CPU may not be separated! Here you may only exchange the electronic module!

**Bus coupler**



With a bus coupler bus interface and power module are 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 the bus interface is supplied as well as the electronic of the connected periphery modules. The DC 24 power section supply for the linked periphery modules is established via a further connection at 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.

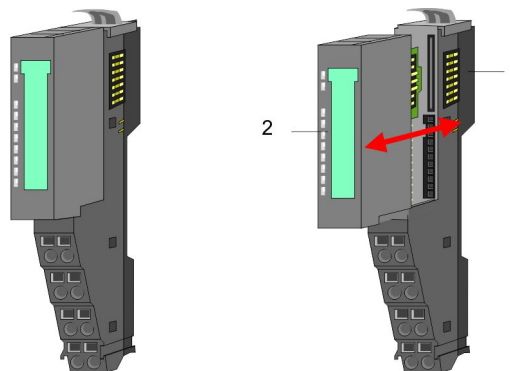


**CAUTION!**

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

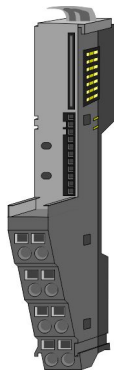
**Periphery modules**

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



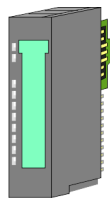
- 1 Terminal module
- 2 Electronic module

**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 SLIO system may be assembled outside of your switchgear cabinet to be later mounted there as whole system.

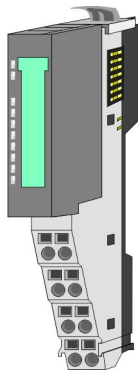
**Electronic module**



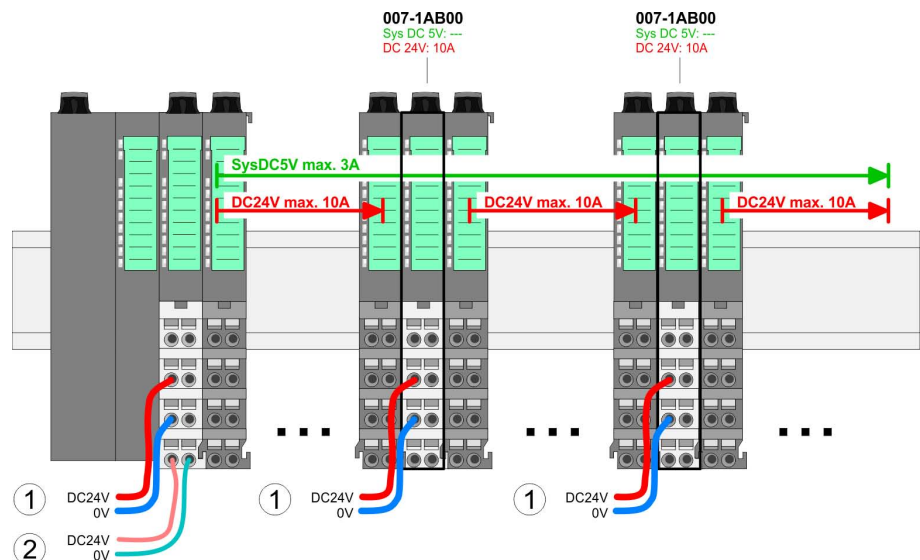
The functionality of a SLIO periphery module is defined by the *electronic module*, which is mounted to the terminal module by a safe sliding mechanism. With an error the defective module may be exchanged for a functional module with standing installation.

At the front side there are LEDs for status indication. For simple wiring each module shows a corresponding connection diagram at the front and at the side.

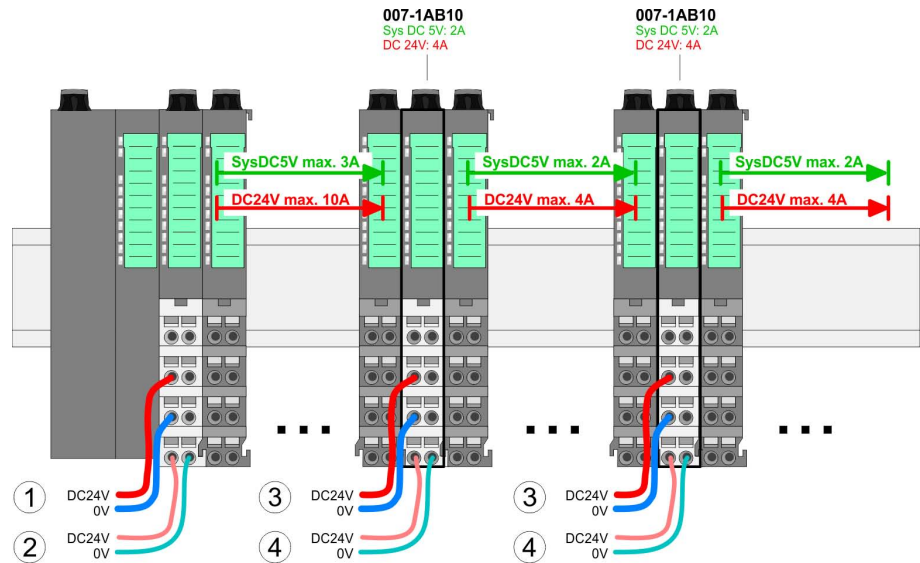
**Power module**



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.



System conception



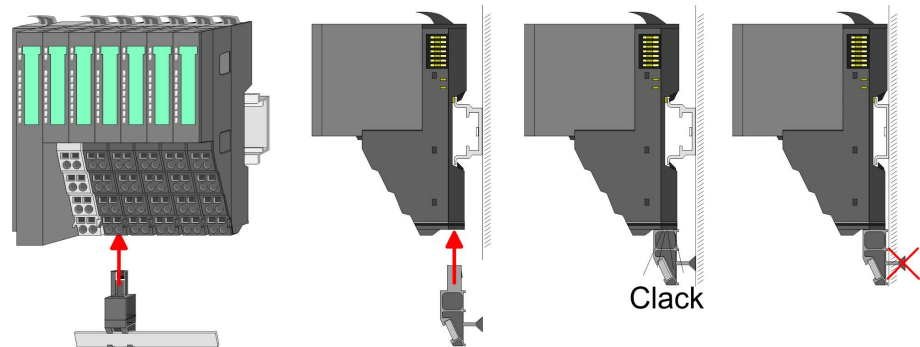
- (1) DC 24V for power section supply I/O area (max. 10A)
- (2) DC 24V for electronic power supply bus coupler and I/O area
- (3) DC 24V for power section supply I/O area (max. 4A)
- (4) DC 24V for electronic power supply I/O area

Accessories

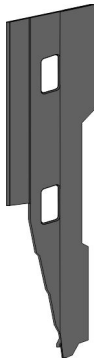
Shield bus carrier



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



**Bus cover**



With each bus coupler, 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 bus coupler before mounting a 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.

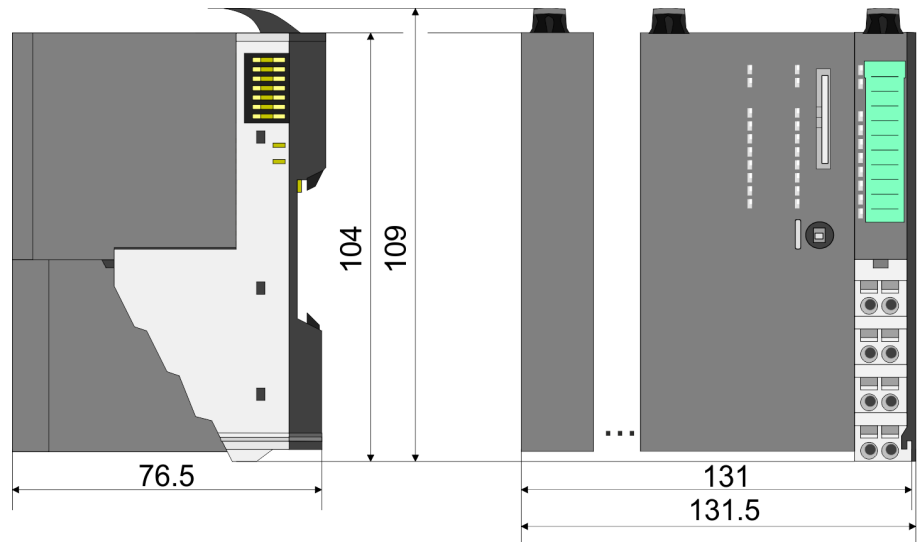
**Coding pins**



There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) from VIPA 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.

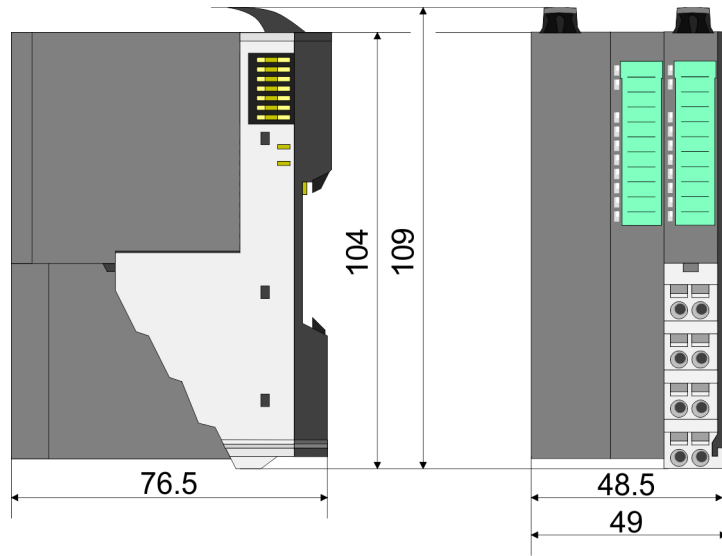
**2.3 Dimensions**

**Dimensions CPU**

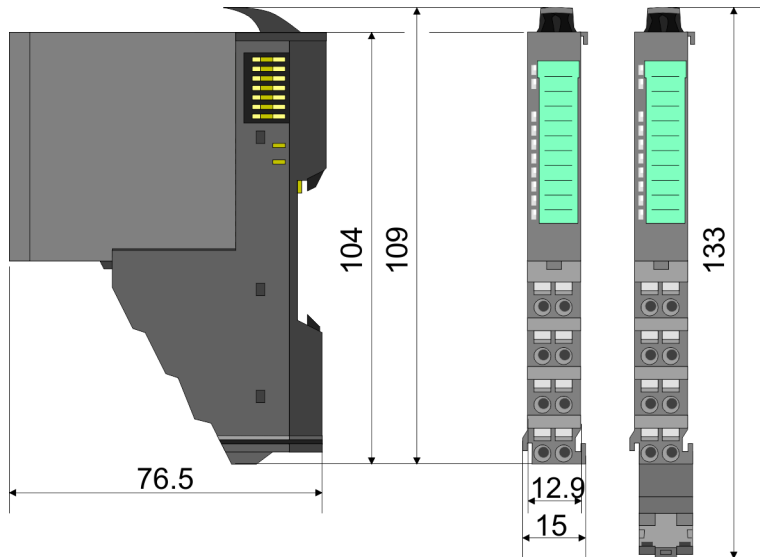


Dimensions

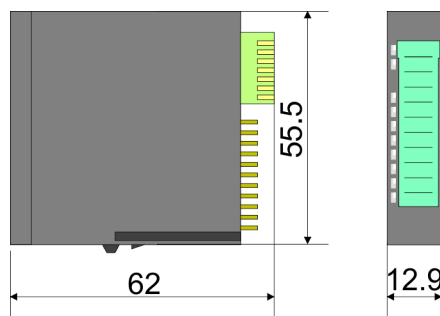
**Dimensions bus coupler**



**Dimensions periphery module**



**Dimensions electronic module**

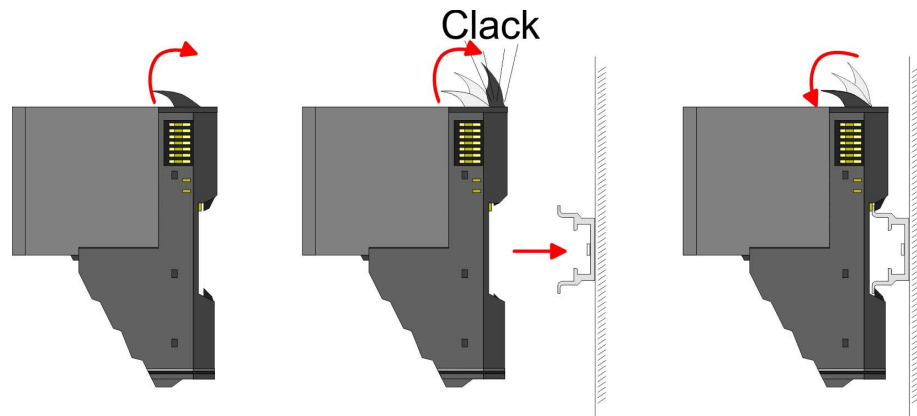


Dimensions in mm

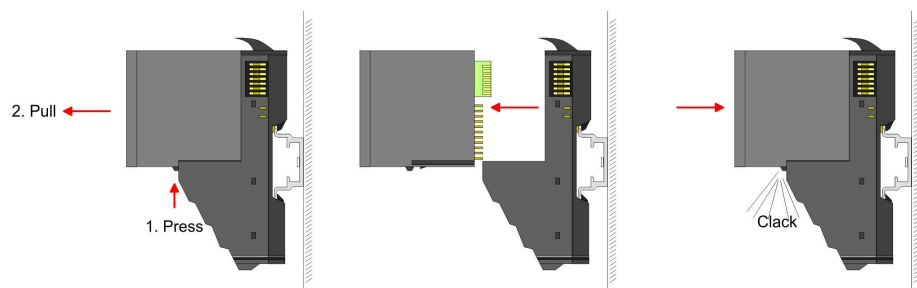
## 2.4 Installation

### Functional principle

There is a locking lever at the top side of the terminal module. For mounting and demounting this locking lever is to be turned upwards until this engages audible. Now the module may be pulled forward. For mounting plug 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.



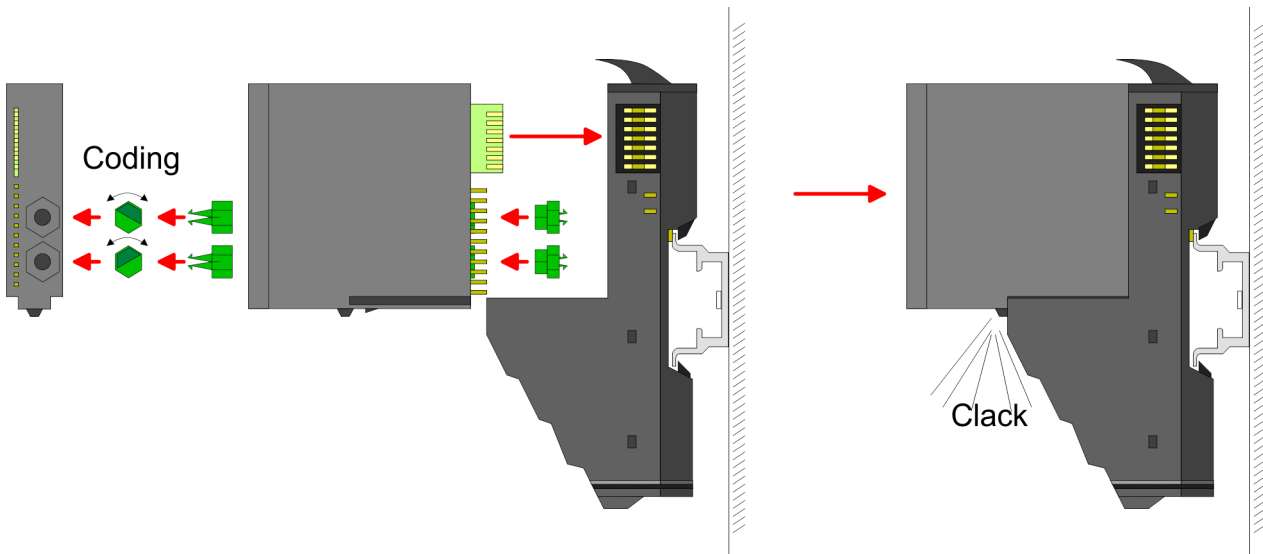
For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



### Coding



There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) from VIPA 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.

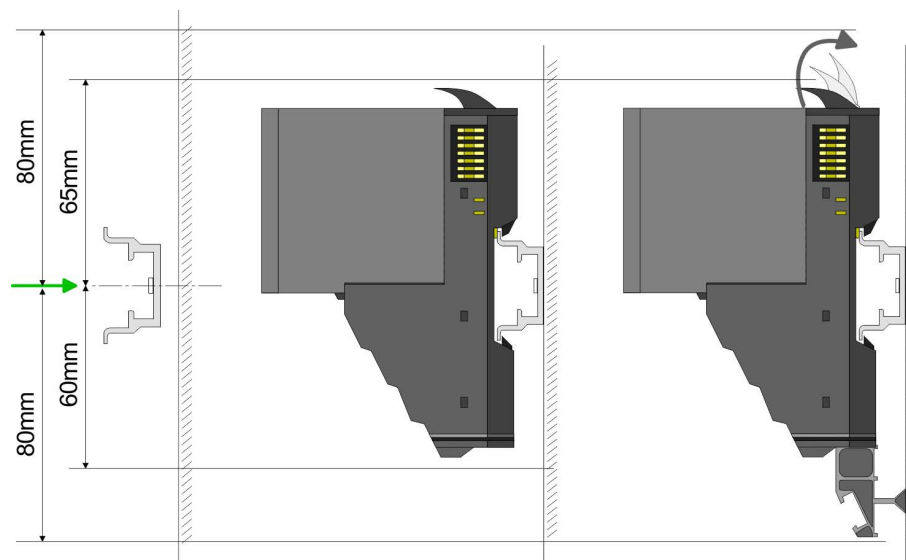
Even with an existing coding on the terminal module, you can plug an electronic module without coding. The user is responsible for the correct usage of the coding pins. VIPA assumes no liability for incorrectly attached electronic modules or for damages which arise due to incorrect coding!

**Mounting Proceeding**

The modules were directly be mounted to the mounting rail and so connected to the backplane bus and the power supply for the electronic and power section. 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 with 2A. ↪ *Chapter 2.6 'Wiring' on page 23*

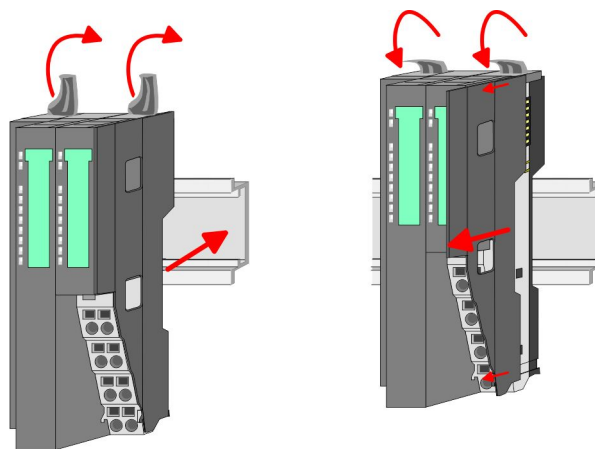


## Mounting rail



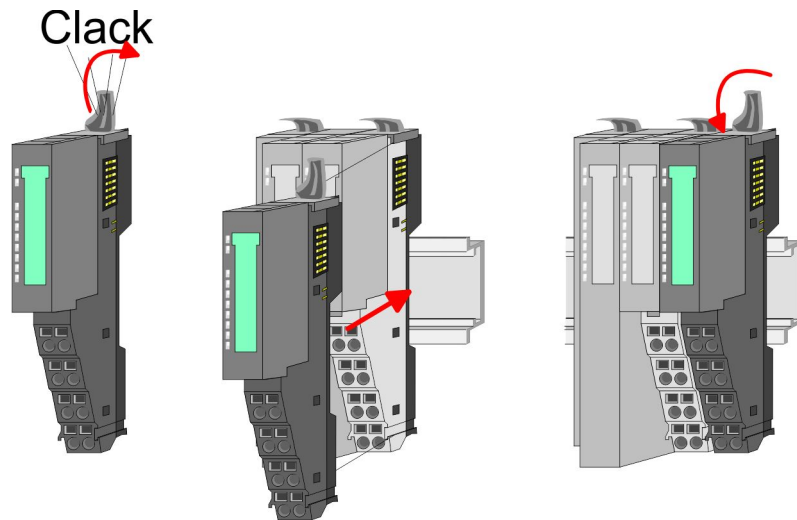
- ➔ Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.

## Mounting Head module (e.g. bus coupler)



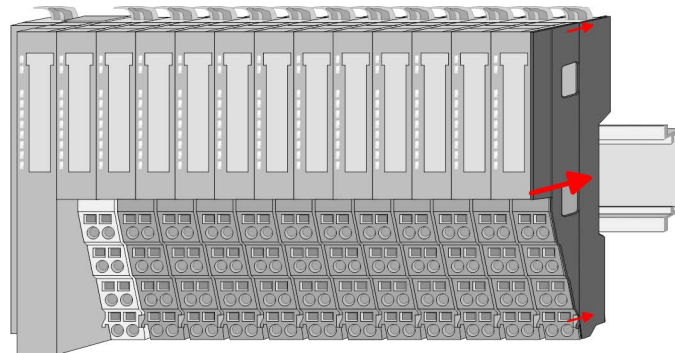
1. ➔ Start at the left side with the head module (e.g. bus coupler). For this turn both locking lever upwards, put the head module to the mounting rail and turn both locking lever downward.
2. ➔ Before mounting the periphery modules you have to remove the bus cover at the right side of the Head module by pulling it forward. Keep the cover for later mounting.

Mounting periphery modules



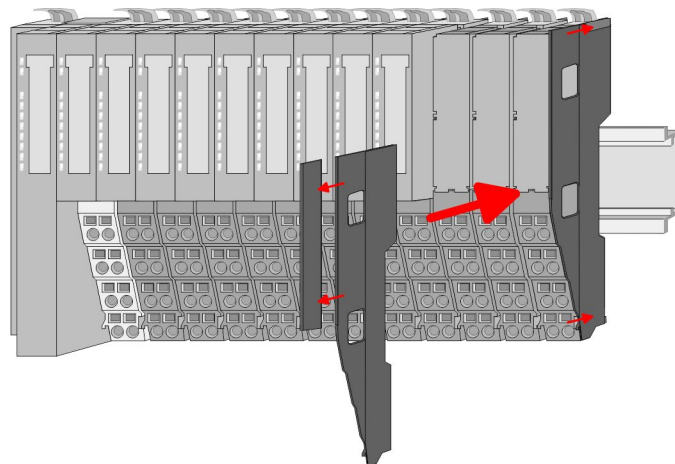
➔ Mount the periphery modules you want.

Mounting the bus cover



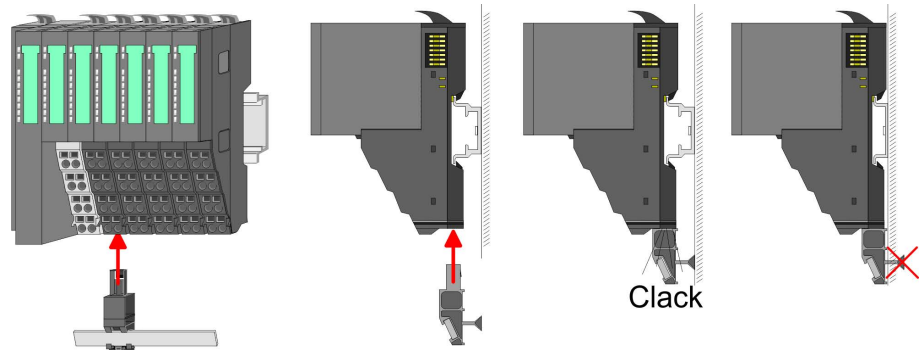
➔ After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now.

Mounting the bus cover at a clamp module



➔ If the last module is a clamp module, for adaptation the upper part of the bus cover is to be removed

Mounting shield bus carrier



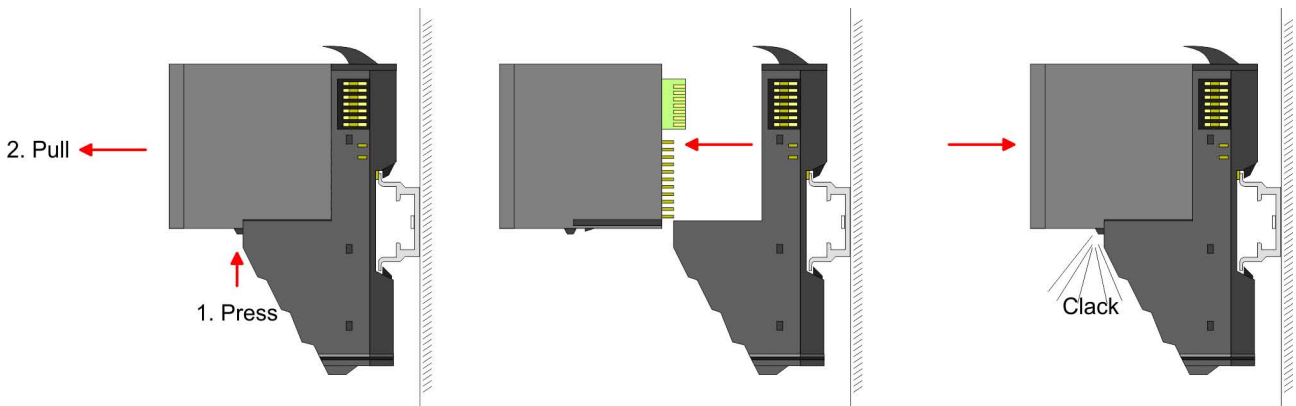
➔ The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.

2.5 Demounting and module exchange

Proceeding

With demounting and exchange of a module, head module (e.g. bus coupler) or a group of modules for mounting reasons you have always to remove the electronic module of the just mounted right module. After the mounting it may be plugged again.

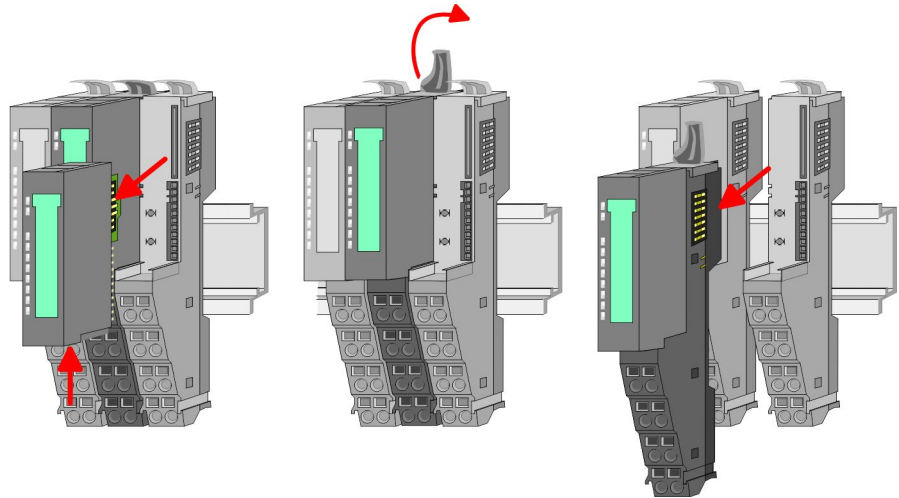
Exchange of an electronic module



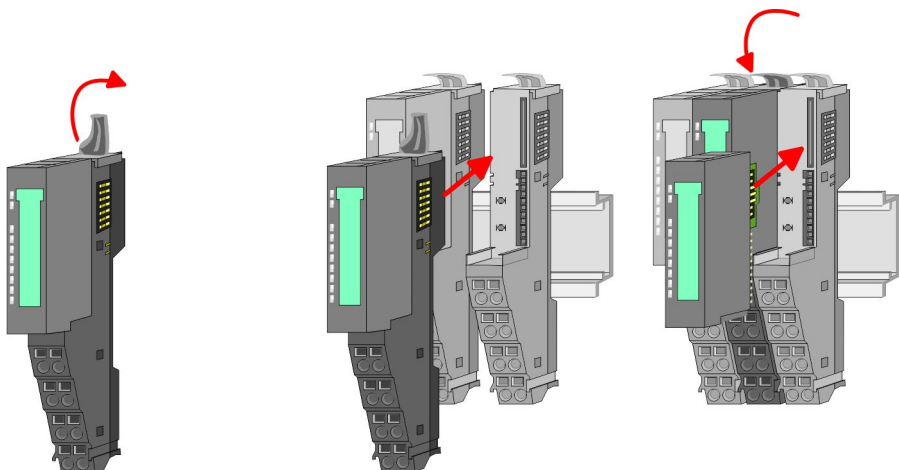
1. ➔ For the exchange of an electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.
2. ➔ For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.

Exchange of a module

1. ▶ Remove if exists the wiring. ↪ *Chapter 2.6 'Wiring' on page 23.*



2. ▶ Press the unlocking lever at the lower side of the just mounted right module and pull it forward.
3. ▶ Turn the locking lever of the module to be exchanged upwards.
4. ▶ Pull the module forward.



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. ▶ Plug again the electronic module, which you have removed before.

Exchange of a head module (e.g. bus coupler)

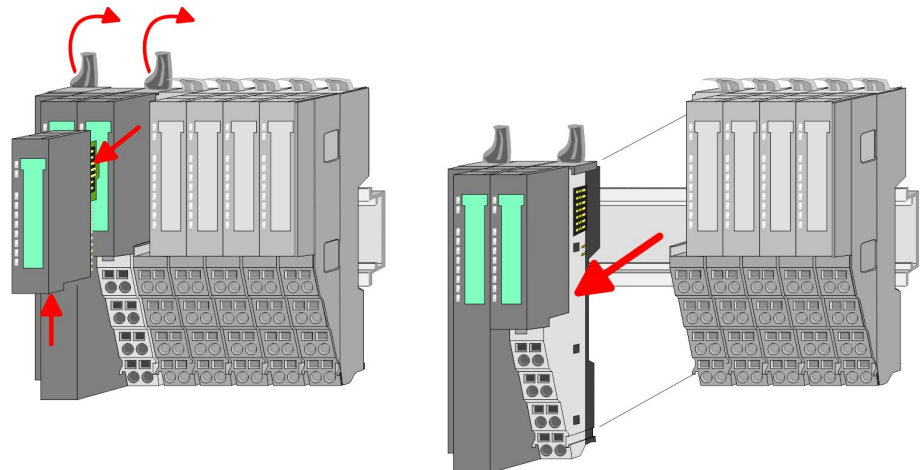


**CAUTION!**

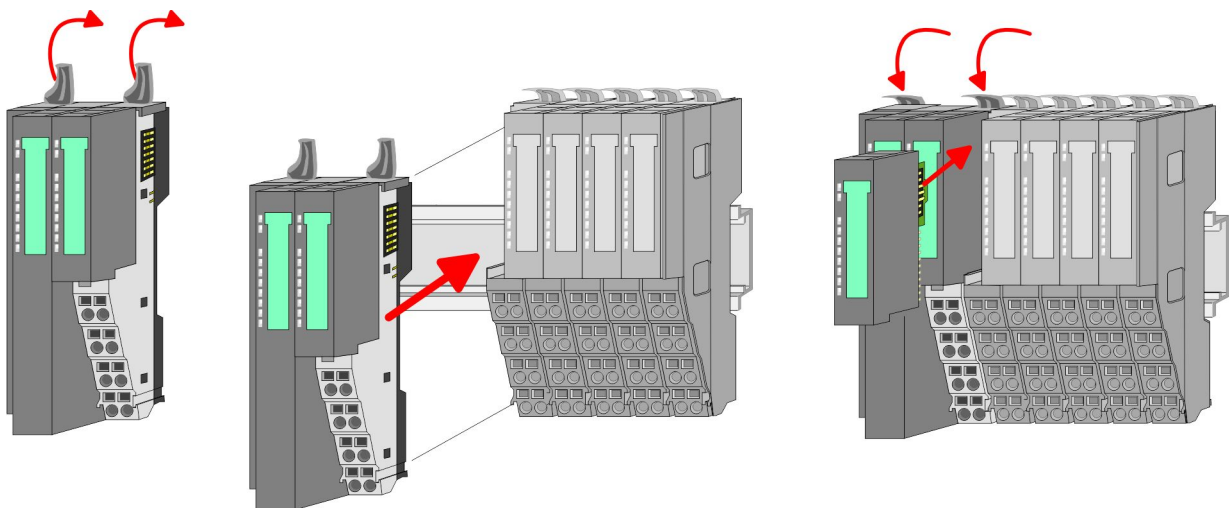
Bus interface and power module of a head module may not be separated!

Here you may only exchange the electronic module!

1. ➤ Remove if exists the wiring of the head module. ↪ *Chapter 2.6 'Wiring' on page 23.*



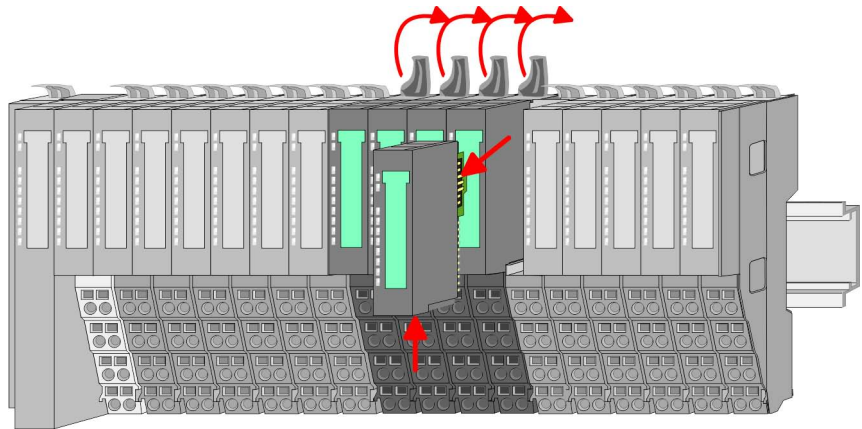
2. ➤ Press the unlocking lever at the lower side of the just mounted right module and pull it forward.
3. ➤ Turn all the locking lever of the head module to be exchanged upwards.
4. ➤ Pull the head module forward.



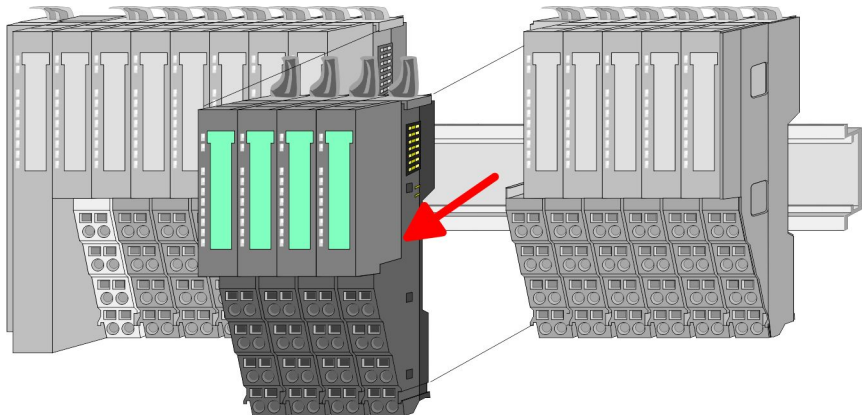
5. ➤ For mounting turn all the locking lever of the head module to be mounted upwards.
6. ➤ To mount the head module put it to the left module and push it, guided by the stripes, to the mounting rail.
7. ➤ Turn all the locking lever downward again.
8. ➤ Plug again the electronic module, which you have removed before.

Exchange of a module group

1. ▶ Remove if exists the wiring of the module group. ↪ *Chapter 2.6 'Wiring' on page 23.*

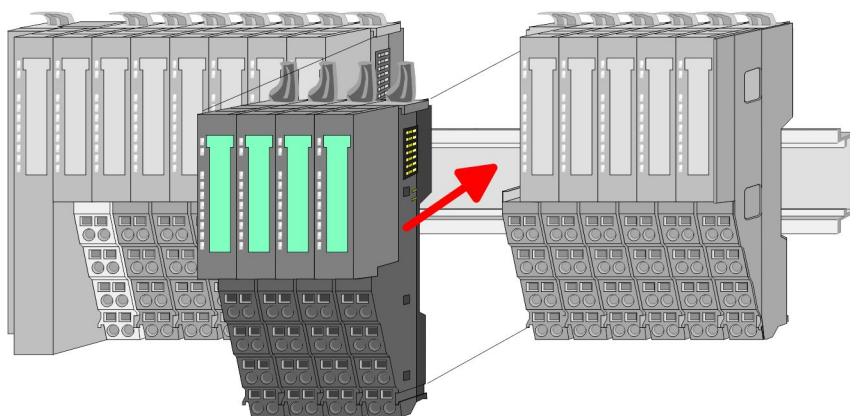
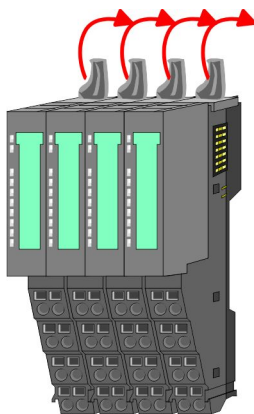


2. ▶ Press the unlocking lever at the lower side of the just mounted right module of the module group and pull it forward.



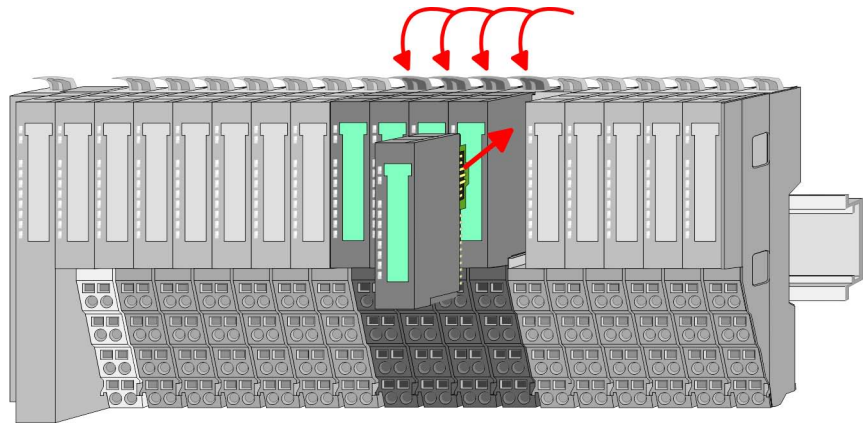
3. ▶ Turn all the locking lever of the module group to be exchanged upwards.

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. Plug again the electronic module, which you have removed before.

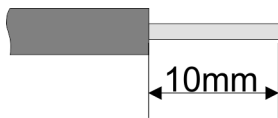
## 2.6 Wiring Connectors

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



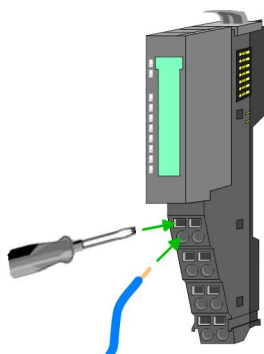
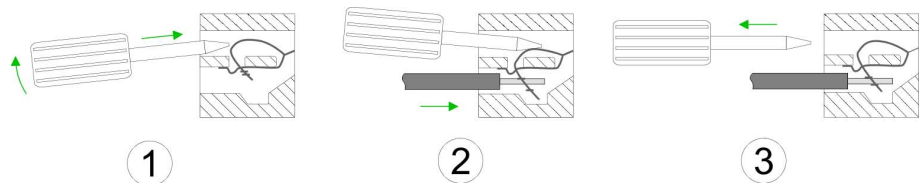
$U_{max}$ : 240V AC / 30V DC

$I_{max}$ : 10A

Cross section: 0.08 ... 1.5mm<sup>2</sup> (AWG 28 ... 16)

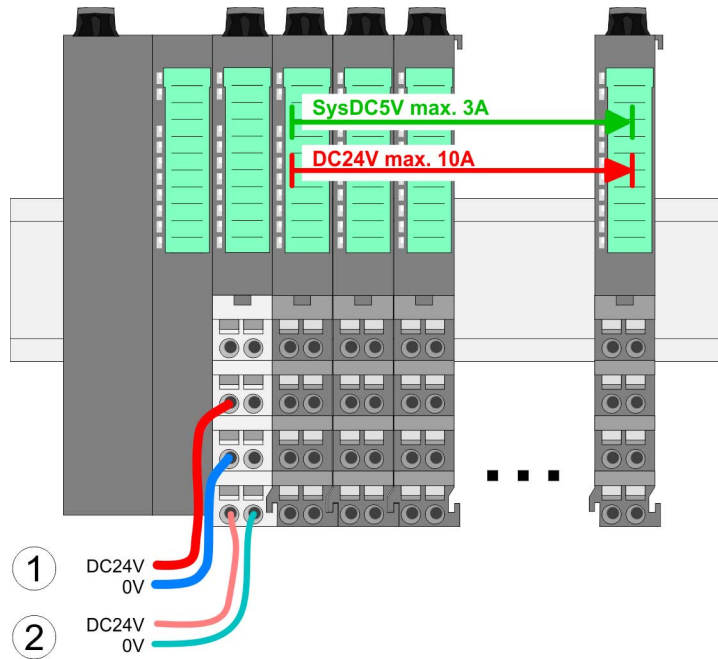
Stripping length: 10mm

### Wiring procedure



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 0.08mm<sup>2</sup> to 1.5mm<sup>2</sup>.
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

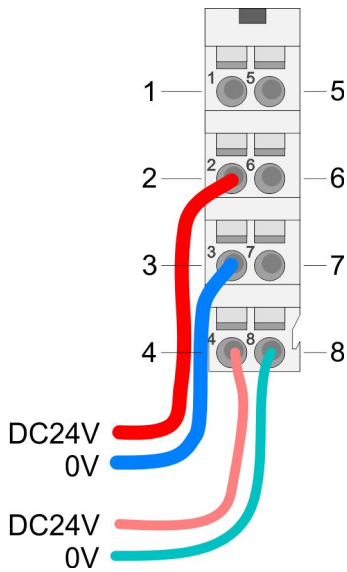
Standard wiring



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

PM - Power module

For wires with a core cross-section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



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.

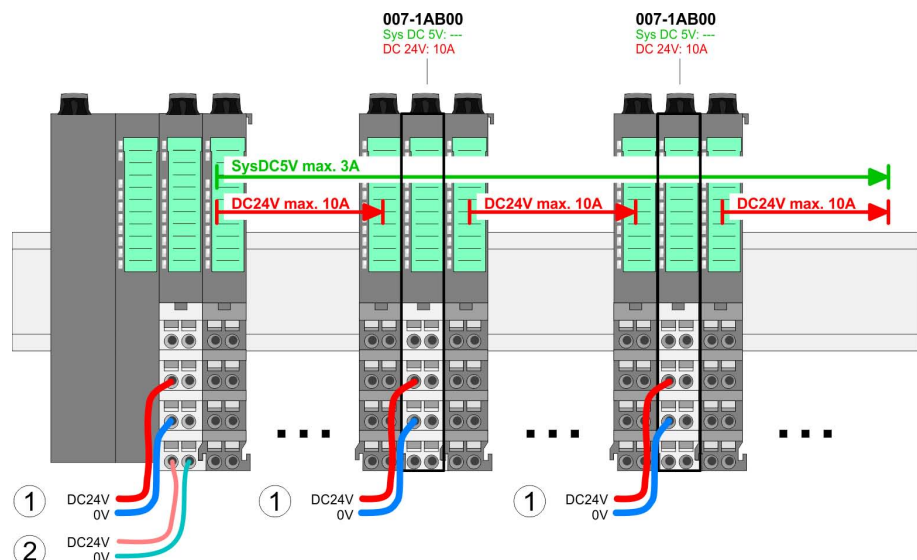
**Deployment of the power modules**

If the 10A for the power section supply is no longer sufficient, you may use the power module from VIPA with the order number 007-1AB00. So you have also the possibility to define isolated groups.

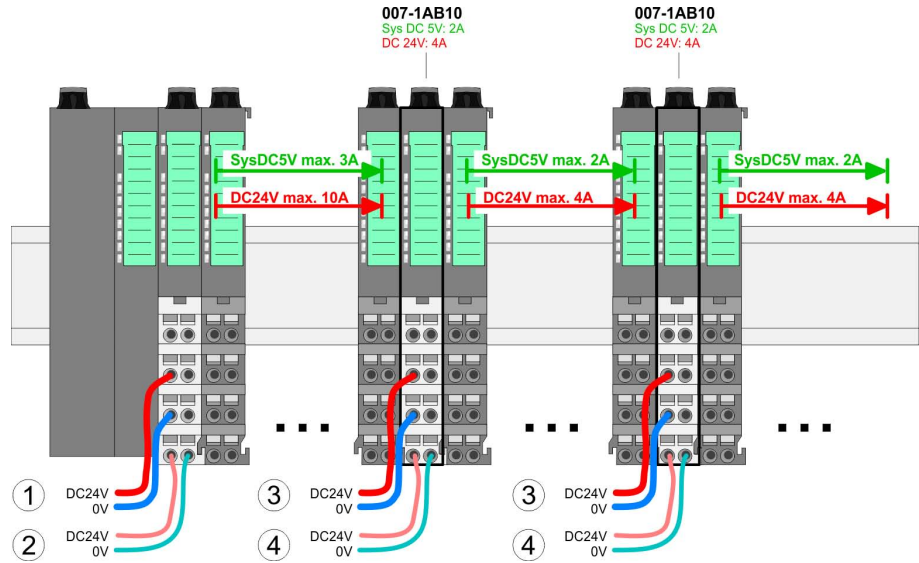
The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with 4A.

By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards the power module 007-1AB10 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

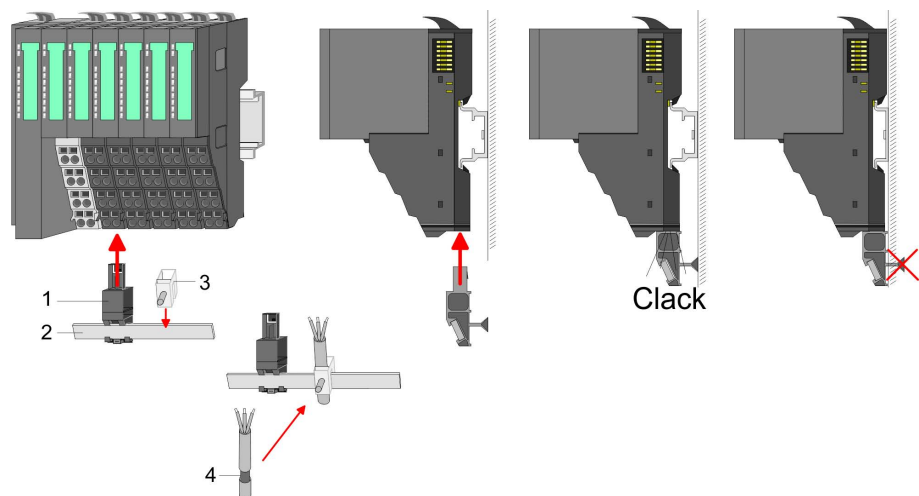
**Shield attachment**

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.

The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.

After mounting the shield bus carrier with the shield bus, the cables with the accordingly stripped cable screen may be attached and fixed by the shield clamp.



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

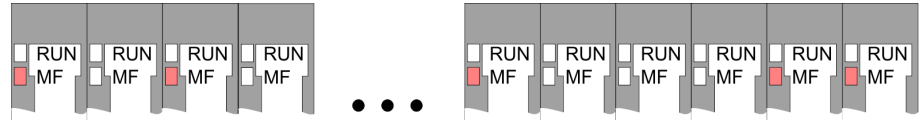
## 2.7 Trouble shooting - LEDs

### 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

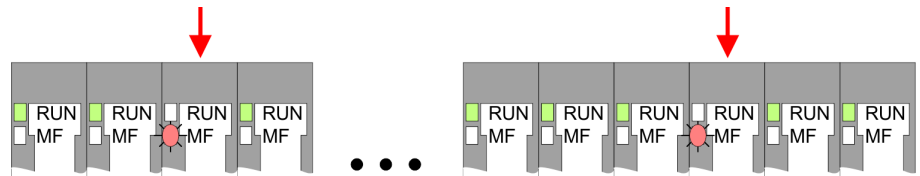


**Behaviour:** After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

**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. ☞ Chapter 2.6 'Wiring' on page 23.

### Error in configuration

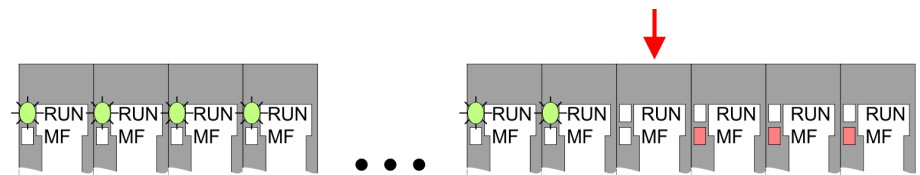


**Behaviour:** After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

**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 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 of VIPA 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 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  $\mu\text{A}$ ) 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

General data

## 2.9 General data

Conformity and approval		
Conformity		
CE	2006/95/EG	Low-voltage directive
	2004/108/EG	EMC directive
Approval		
UL	UL 508	Approval for USA and Canada
others		
RoHS	2011/65/EU	Product is lead-free; 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	EN 61131-2	0...+60°C
Vertical installation	EN 61131-2	0...+60°C
Air humidity	EN 60068-2-30	RH1 (without condensation, rel. humidity 10... 95%)
Pollution	EN 61131-2	Degree of pollution 2
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, installation class 3 *

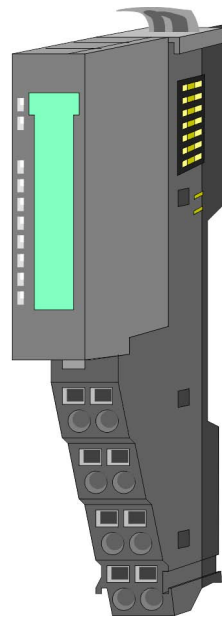
\*) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

### 3 Hardware description

#### 3.1 Properties

**Features**

- 2 counter 32bit (AB) invertible, DC 24V
- Counting frequency max. 400kHz (AB 1/2/4-fold evaluation or pulse and direction)
- Input filter (configurable)
- Diagnostics function

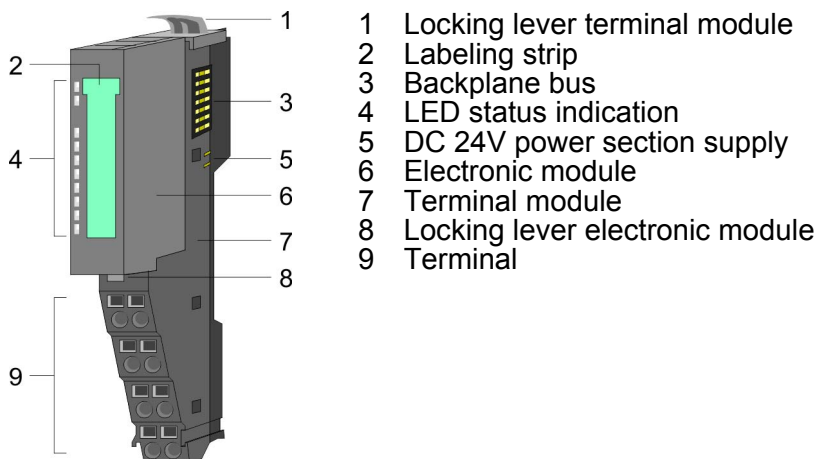


**Bestelldaten**

Type	Order number	Description
FM 050	VIPA 050-1BB30	Counter module eco 2x32Bit DC 24V

#### 3.2 Structure

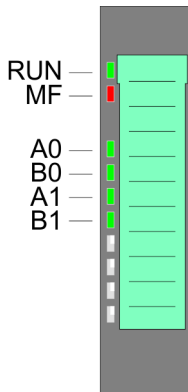
**050-1BB30**



- 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



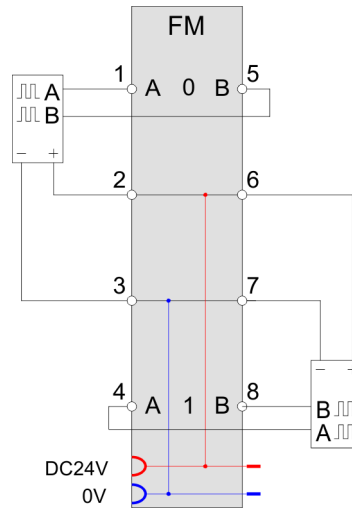
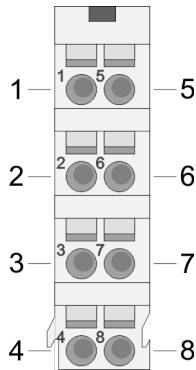
Status indication



LED		Description
RUN green ■	MF 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 ↪ <i>Chapter 2.7 'Trouble shooting - LEDs' on page 27</i>
A0	green ■	● Counter 0: Digital input 1 A0/pulse is set
B0	green ■	● Counter 0: Digital input 5 B0/direction is set
A1	green ■	● Counter 1: Digital input 4 A1/pulse is set
B1	green ■	● Counter 1: Digital input 8 B1/direction is set
on: ●   off: ○   blinks with 2Hz: B   not relevant: X		

**Pin assignment**

For wires with a cross section of 0.08mm<sup>2</sup> up to 1.5mm<sup>2</sup>.



Pos.	Function	Type	Description
1	A0	I	Counter 0: A / pulse Pulse input for counter signal respectively track A of an encoder for 1-, 2- or 4-fold evaluation.
2	DC 24V	O	DC 24V for encoder
3	0V	O	GND
4	A1	I	Counter 1: A / pulse Pulse input for counter signal respectively track A of an encoder for 1-, 2- or 4-fold evaluation.
5	B0	I	Counter 0: B / direction direction signal respectively track B of an encoder (invertible via parameterization).
6	DC 24V	O	DC 24V for encoder
7	0V	O	GND
8	B1	I	Counter 1: B / direction direction signal respectively track B of an encoder (invertible via parameterization).

I: Input, O: Output

**3.3 Technical data**

<b>Order no.</b>	<b>050-1BB30</b>
Type	FM 050
Module ID	08C4 388B
<b>Current consumption/power loss</b>	

Order no.	050-1BB30
Current consumption from backplane bus	75 mA
Power loss	0.9 W
<b>Technical data digital inputs</b>	
Number of inputs	4
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)	15 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	-
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	4
Number of simultaneously utilizable inputs vertical configuration	4
Input characteristic curve	IEC 61131-2, type 1
Initial data size	12 Byte
<b>Technical data digital outputs</b>	
Number of outputs	-
Cable length, shielded	-
Cable length, unshielded	-
Rated load voltage	-
Current consumption from load voltage L+ (without load)	-
Output delay of "0" to "1"	-
Output delay of "1" to "0"	-
Minimum load current	-

Technical data

Order no.	050-1BB30
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	4 Byte
<b>Technical data counters</b>	
Number of counters	2
Counter width	32 Bit
Maximum input frequency	100 kHz
Maximum count frequency	400 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	-
<b>Status information, alarms, diagnostics</b>	
Status display	yes
Interrupts	no
Process alarm	no
Diagnostic interrupt	no
Diagnostic functions	no
Diagnostics information read-out	possible
Module state	green LED

<b>Order no.</b>	<b>050-1BB30</b>
Module error display	red LED
Channel error display	none
<b>Isolation</b>	
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
<b>Datasizes</b>	
Input bytes	12
Output bytes	4
Parameter bytes	12
Diagnostic bytes	20
<b>Housing</b>	
Material	PPE / PPE GF10
Mounting	Profile rail 35 mm
<b>Mechanical data</b>	
Dimensions (WxHxD)	12.9 mm x 109 mm x 76.5 mm
Weight	60 g
<b>Environmental conditions</b>	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
<b>Certifications</b>	
UL508 certification	yes

## 4 Deployment

### 4.1 Fast introduction

#### Counter range

Limits	Valid range of values
Lower counter limit	-2 147 483 648 ( $-2^{31}$ )
Upper counter limit	+2 147 483 647 ( $2^{31}-1$ )

The maximum counter frequency is 400kHz.

#### Address areas

##### Input area

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

IX - Index for access via CANopen

SX - Subindex (6000h + EtherCAT-Slot) for access via EtherCAT

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

Addr.	Name	Bytes	Function	IX	SX
+0	CV_I	4	Counter 0: Counter value	5400h/s	01h
+4	CV_II	4	Counter 1: Counter value	5400h/s+1	02h
+8	CSTS_I	2	Counter 0: Counter status	5402h/s	03h
+10	CSTS_II	2	Counter 1: Counter status	5402h/s+1	04h

##### 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 (7000h + EtherCAT-Slot) for access via EtherCAT

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

Addr.	Name	Bytes	Function	IX	SX
+0	CCTRL_I	2	Counter 0: Control word	5602h/s	01h
+2	CCTRL_II	2	Counter 1: Control word	5602h/s+1	02h

**CSTS\_I CSTS\_II**  
**Counter status**

Bit	Name	Function
0 ... 1	-	reserved
2	STS_SW-GATE	Status software gate (set when <i>SW gate</i> is active)
3 ... 4	-	reserved
5	STS_GATE	Status internal gate (set when internal gate is active)
6	-	reserved
7	STS_C_DN	Status set at counter direction backward
8	STS_C_UP	Status set at counter direction forward
9 ... 10	-	reserved
11	STS_OFLW*	Status is set at overflow
12	STS_UFLW*	Status is set at underflow
13	STS_ZP*	Status is set at zero run
14 ... 15	-	reserved

\*) The bits remain set until reset with RES\_SET (bit 6 control word).

**CCTRL\_I CCTRL\_II** Con-  
**trol word**

Bit	Name	Function
0 ... 1	-	reserved
2	SW_GATE_SET	sets the software gate
3 ... 5	-	reserved
6	RES_SET	resets the bits STS_OFLW, STS_UFLW and STS_ZP with <b>edge 0-1</b>
7 ... 9	-	reserved
10	SW_GATE_RESET	resets the software gate
11 ... 15	-	reserved

**Parameters**

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

IX - Index for access via CANopen

SX - Subindex (3100h + EtherCAT-Slot) for access via EtherCAT

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

In-/Output area > Input area 12byte

Name	Bytes	Function	Default	DS	IX	SX
CH0A	1	C0: Input frequency track A	02h	01h	3100h	01h
CH1B	1	C0: Input frequency track B	02h	01h	3101h	02h
CH2A	1	C1: Input frequency track A	02h	01h	3102h	03h
CH3B	1	C1: Input frequency track B	02h	01h	3103h	04h
MODE2_I	1	C0: Counter mode 2*	00h	80h	3104h	05h
MODE3_I	1	C0: Counter mode 3*	00h	80h	3105h	06h
MODE2_II	1	C1: Counter mode 2*	00h	82h	3106h	07h
MODE3_II	1	C1: Counter mode 3*	00h	82h	3107h	08h

\*) This parameter may only be transferred at STOP state.

**Control counter**

The counter is controlled via the internal gate (I gate). The I gate corresponds to the software gate (SW gate).

**SW gate:**

Open (activate):

in user program by edge 0-1 SW\_GATE\_SET in the *control word*.

Close (deactivate):

in user program by edge 0-1 SW\_GATE\_RESET in the *control word*.

**4.2 In-/Output area**

**4.2.1 Input area 12byte**

**Input area**

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

IX - Index for access via CANopen

SX - Subindex (6000h + EtherCAT-Slot) for access via EtherCAT

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

Addr.	Name	Bytes	Function	IX	SX
+0	CV_I	4	Counter 0: Counter value	5400h/s	01h
+4	CV_II	4	Counter 1: Counter value	5400h/s+1	02h
+8	CSTS_I	2	Counter 0: Counter status	5402h/s	03h
+10	CSTS_II	2	Counter 1: Counter status	5402h/s+1	04h



**CV\_I CV\_II Counter value**

The *counter value* always contains the current value of the corresponding counter.

**CSTS\_I CSTS\_II Counter status**

Bit	Name	Function
0 ... 1	-	reserved
2	STS_SW-GATE	Status software gate (set when <i>SW gate</i> is active)
3 ... 4	-	reserved
5	STS_GATE	Status internal gate (set when internal gate is active)
6	-	reserved
7	STS_C_DN	Status set at counter direction backward
8	STS_C_UP	Status set at counter direction forward
9 ... 10	-	reserved
11	STS_OFLW*	Status is set at overflow
12	STS_UFLW*	Status is set at underflow
13	STS_ZP*	Status is set at zero run
14 ... 15	-	reserved

\*) The bits remain set until reset with RES\_SET (bit 6 control word).

**4.2.2 Output area 4byte**

**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 (7000h + EtherCAT-Slot) for access via EtherCAT

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

Addr.	Name	Bytes	Function	IX	SX
+0	CCTRL_I	2	Counter 0: Control word	5602h/s	01h
+2	CCTRL_II	2	Counter 1: Control word	5602h/s+1	02h

Parameter data

**CCTRL\_I CCTRL\_II Control word**

Bit	Name	Function
0 ... 1	-	reserved
2	SW_GATE_SET	sets the software gate
3 ... 4	-	reserved
5	COUN- TERVAL_SET	resets counter to zero
6	RES_SET	resets the bits STS_OFLW, STS_UFLW and STS_ZP <b>edge 0-1</b>
7 ... 9	-	reserved
10	SW_GATE_RESET	resets the software gate
11 ... 15	-	reserved

**4.3 Parameter data**

Via parameterization you may define among others:

- Input filter
- Counter operating mode res. behavior

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

IX - Index for access via CANopen

SX - Subindex (3100h + EtherCAT-Slot) for access via EtherCAT

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

**Parameter**

Name	Bytes	Function	Default	DS	IX	SX
CH0A	1	C0: Input frequency track A	02h	01h	3100h	01h
CH1B	1	C0: Input frequency track B	02h	01h	3101h	02h
CH2A	1	C1: Input frequency track A	02h	01h	3102h	03h
CH3B	1	C1: Input frequency track B	02h	01h	3103h	04h
MODE2_I	1	C0: Counter mode 2*	00h	80h	3104h	05h
MODE3_I	1	C0: Counter mode 3*	00h	80h	3105h	06h
MODE2_II	1	C1: Counter mode 2*	00h	82h	3106h	07h
MODE3_II	1	C1: Counter mode 3*	00h	82h	3107h	08h

\*) This parameter may only be transferred at STOP state.

**CHxx Input frequency**

Byte	Funktion	Mögliche Werte
0	Input frequency C0 track A	<ul style="list-style-type: none"> <li>■ 02h: 100kHz</li> <li>■ 03h: 60kHz</li> <li>■ 04h: 30kHz</li> <li>■ 06h: 10kHz</li> <li>■ 07h: 5kHz</li> <li>■ 08h: 2kHz</li> <li>■ 09h: 1kHz</li> <li>Other values are not permissible!</li> </ul>
1	Input frequency C0 track B	
2	Input frequency C1 track A	
3	Input frequency C1 track B	

- *Input frequency* allows you to preset a filter for I1, I4, I5 and I8. With the help of filters you may e.g. filter signal peaks at a blurred input signal.

**MODE2\_I/II C0/C1:  
Counter mode 2**

Byte	Bit 7 ... 0
0	<ul style="list-style-type: none"> <li>■ <i>Bit 2 ... 0: 0 (fix)</i></li> <li>■ <i>Bit 3: Count direction track B inverted</i> <ul style="list-style-type: none"> <li>– 0 = No (not inverted)</li> <li>– 1 = Yes (inverted)</li> </ul> </li> <li>■ <i>Bit 7 ... 4: 0 (fix)</i></li> </ul>

**MODE3\_I/II C0/C1:  
Counter mode 3**

Byte	Bit 7 ... 0
0	<ul style="list-style-type: none"> <li>■ <i>Bit 2 ... 0: Signal evaluation</i> <ul style="list-style-type: none"> <li>– 000b = Counter de-activated</li> <li>– 001b = Rotary encoder single (at A and B)</li> <li>– 010b = Rotary encoder double (at A and B)</li> <li>– 011b = Rotary encoder quadruple (at A and B)</li> <li>– 100b = Direction (pulse at A and direction at B)</li> </ul> </li> <li>■ <i>Bit 7 ... 3: 0 (fix)</i></li> </ul>

- At de-activated counter the further parameter settings are ignored.

**4.4 Counter functions**

**Overview**

The counters of the 050-1BB30 are continuous counter, whose direction may be preset by the parameterization. The counters serve e.g. for distance measuring with incremental encoder. The activation res. de-activation of the counter happens via an internal gate (I gate). The I gate corresponds to the software gate (SW gate). The SW gate is opened (activated) via your user application by an edge 0-1 of the bit SW\_GATE\_SET of the *control word* in the *output area*. The software gate is closed (de-activated) by an edge 0-1 of the bit SW\_GATE\_RESET. With an edge 0-1 at SW gate the counter is reset to 0. The following states influence the I gate:

SW gate	influences I gate
0	0
1	1
with edge 0-1	1

### Count continuously

Each counter always starts at 0. When the counter counts forward and reaches the upper count limit and another counting pulse in positive direction arrives, it jumps to the lower count limit and counts from there on. When the counter counts backwards and reaches the lower count limit and another counting pulse in negative direction arrives, it jumps to the upper count limit and counts from there on. The count limits are set to the maximum count range.

Limits	Valid value range
Lower count limit	-2 147 483 648 ( $-2^{31}$ )
Upper count limit	+2 147 483 647 ( $2^{31} - 1$ )

With *overflow* or *underflow* the status bits STS\_OFLW respectively STS\_UFLW are set. These bits remain set until these are reset with RES\_SET in the *control word*.



## 4.5 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 (5005h) for access via EtherCAT.

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	reserviert	00h			05h
CHTYP	1	Channel type	76h			06h
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"> <li>■ Bit 3 ... 0: Module class                             <ul style="list-style-type: none"> <li>– 1000b: Function module</li> </ul> </li> <li>■ Bit 4: set at channel information present</li> <li>■ Bit 7 ... 5: reserved</li> </ul>

**CHTYP Channel type**

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

**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

Diagnostic data

ERR\_A/C/D CHERR,  
CHxERR reserved

Byte	Bit 7 ... 0
0	reserved