VIPA System SLIO FM 050

FM | 050-1BB40 | Manual

HB300 | FM | 050-1BB40 | GB | 15-24

VIPA
A YASKAWA COMPANY

VIPA GmbH
Ohmstr. 4
91074 Herzogenaurach
Telephone: 09132-744-0
Fax: 09132-744-1864
Email: info@vipa.com
Internet: www.vipa.com

050-1BB40_000_FM050,5,GB -

Table of contents

1 General

1.1 Copyright © VIPA GmbH

All Rights Reserved

Tel.: +49 9132 744 -0

Fax.: +49 9132 744-1864

EMail: info@vipa.de

http://www.vipa.com

Every effort has been made to ensure that the information contained in this document was complete and accurate at the time of publishing. Nevertheless, the authors retain the right to modify the information.

This customer document describes all the hardware units and functions known at the present time. Descriptions may be included for units which are not present at the customer site. The exact scope of delivery is described in the respective purchase contract.

CE Conformity Declaration

Hereby, VIPA GmbH declares that the products and systems are in compliance with the essential requirements and other relevant provisions. Conformity is indicated by the CE marking affixed to the product.

Conformity Information

For more information regarding CE marking and Declaration of Conformity (DoC), please contact your local VIPA customer service organization.

Trademarks

VIPA, SLIO, System 100V, System 200V, System 300V, System 300S, System 400V, System 500S and Commander Compact are registered trademarks of VIPA Gesellschaft für Visualisierung und Prozessautomatisierung mbH.

SPEED7 is a registered trademark of profichip GmbH.

SIMATIC, STEP, SINEC, TIA Portal, S7-300 and S7-400 are registered trademarks of Siemens AG.

Microsoft and Windows are registered trademarks of Microsoft Inc., USA.

Portable Document Format (PDF) and Postscript are registered trademarks of Adobe Systems, Inc.

All other trademarks, logos and service or product marks specified herein are owned by their respective companies.

Information product support

Contact your local VIPA Customer Service Organization representative if you wish to report errors or questions regarding the contents of this document. If you are unable to locate a customer service centre, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Telefax: +49 9132 744-1204

EMail: documentation@vipa.de

Technical support

Contact your local VIPA Customer Service Organization representative if you encounter problems with the product or have questions regarding the product. If you are unable to locate a customer service centre, contact VIPA as follows:

VIPA GmbH, Ohmstraße 4, 91074 Herzogenaurach, Germany

Tel.: +49 9132 744-1150 (Hotline)

EMail: support@vipa.de

1.2 About this manual

Objective and contents

This manual describes the FM 050-1BB40 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	050-1BB40	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
- 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.

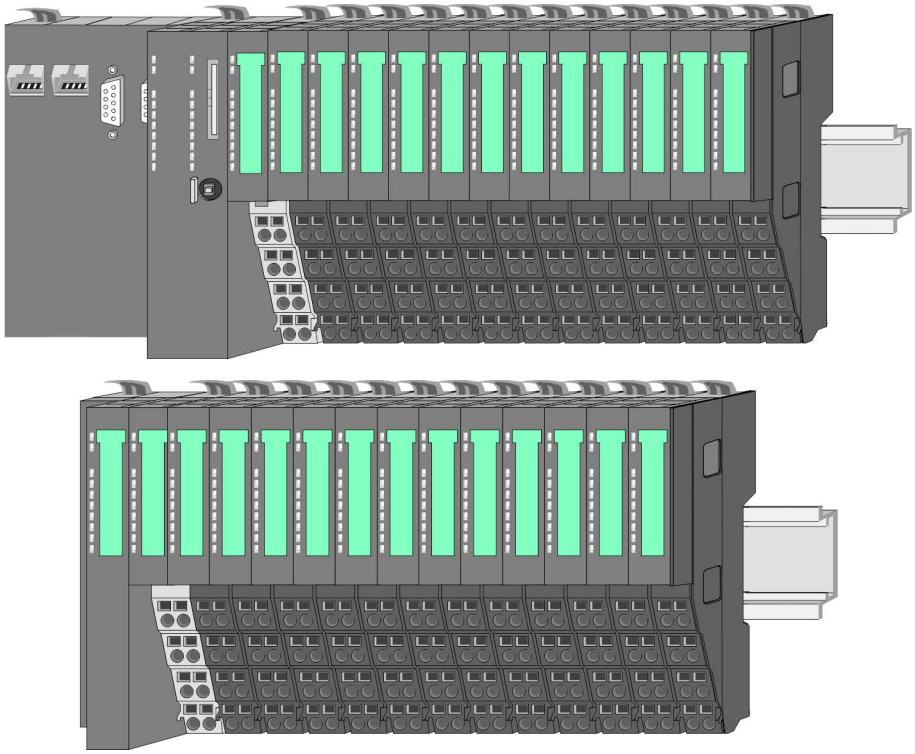
Modifying electrostatic sensitive modules you should only use soldering irons with grounded tips.

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

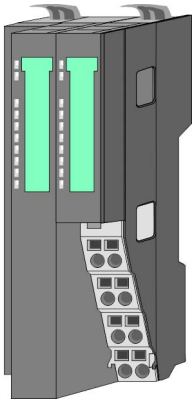
CAUTION!
Only modules of VIPA may be combined. A mixed operation with third-party modules is not allowed!

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

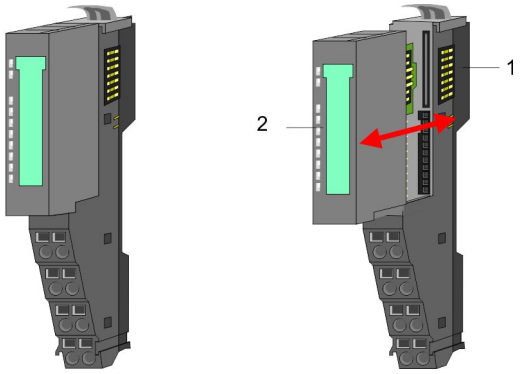


With a bus coupler bus interface and power module are integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module via the integrated power module for power supply the bus interface is supplied as well as the electronic of the connected periphery modules.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

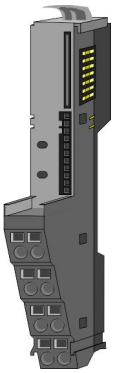
Periphery modules

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



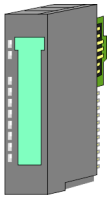
1 Terminal module
2 Electronic module

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.

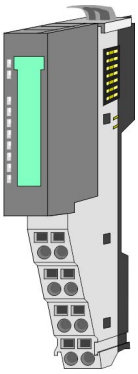
Electronic module



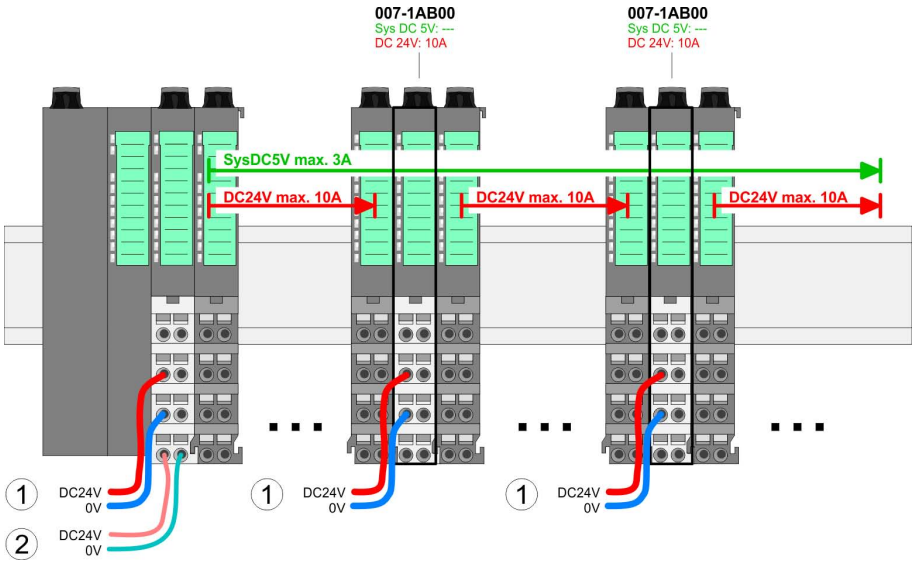
The functionality of a SLIO periphery module is defined by the *electronic module*, which is mounted to the terminal module by a safe sliding mechanism. With an error the defective module may be exchanged for a functional module with standing installation.

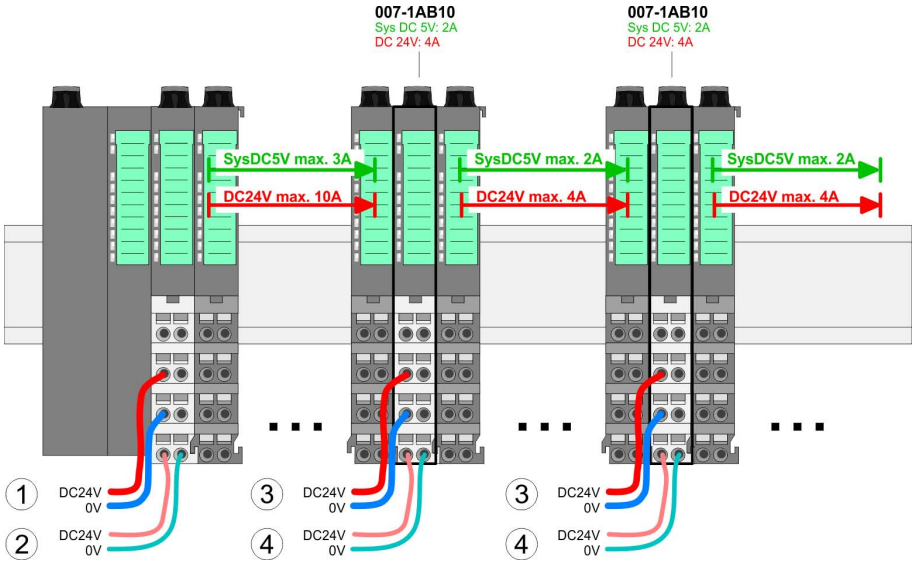
At the front side there are LEDs for status indication. For simple wiring each module shows a corresponding connection diagram at the front and at the side.

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.



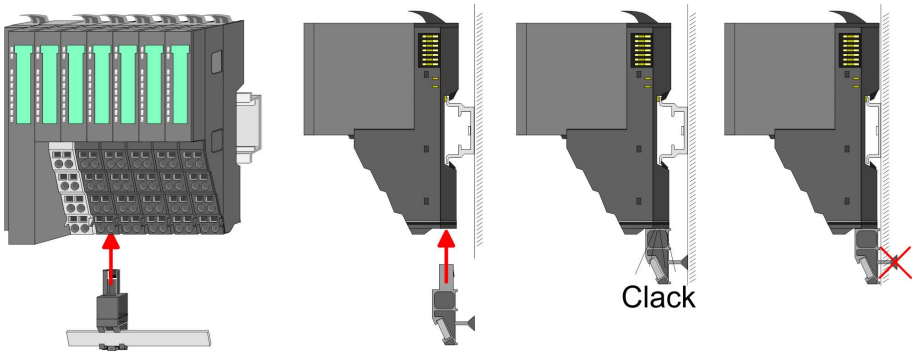


(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area
(3) DC 24V for power section supply I/O area (max. 4A)
(4) DC 24V for electronic power supply I/O area

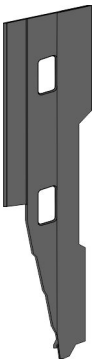
Accessories

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.

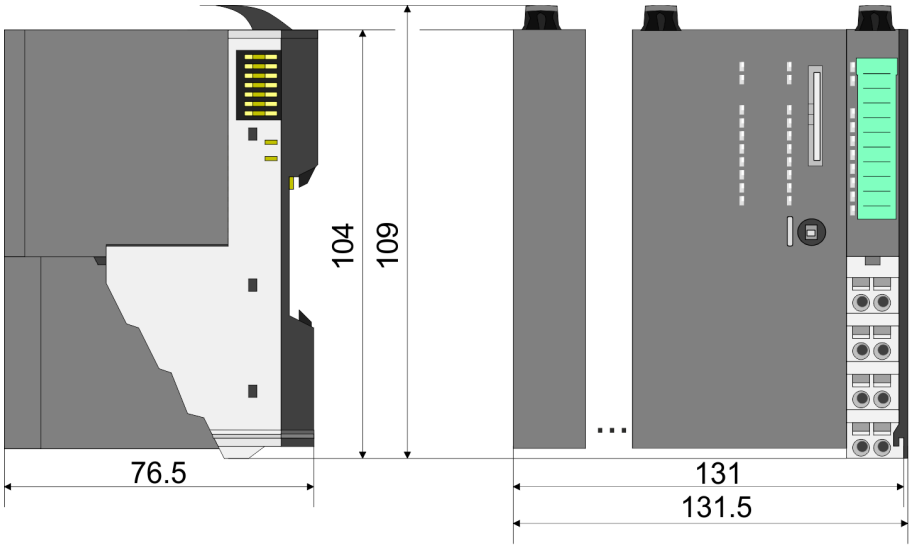
The bus cover has the order no. 000-0AA00.

Coding pins

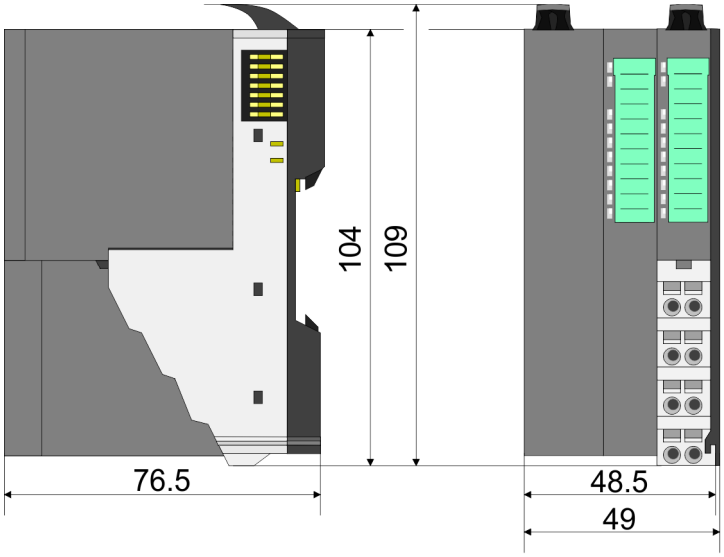
There is the possibility to fix the assignment of electronic and terminal module. Here coding pins (order number 000-0AC00) from VIPA can be used. The coding pin consists of a coding jack and a coding plug. By combining electronic and terminal module with coding pin, the coding jack remains in the electronic 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

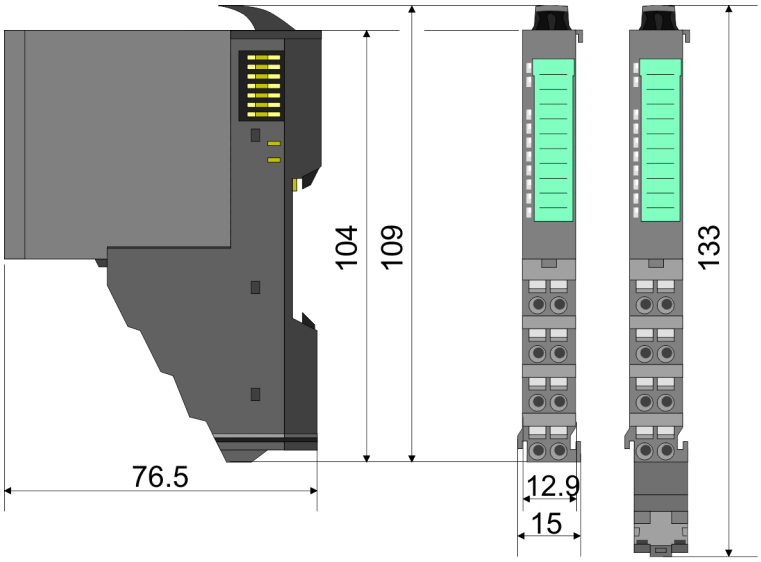
Dimensions CPU



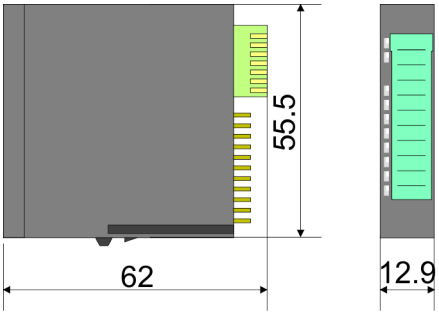
Dimensions bus coupler



Dimensions periphery module



Dimensions electronic module

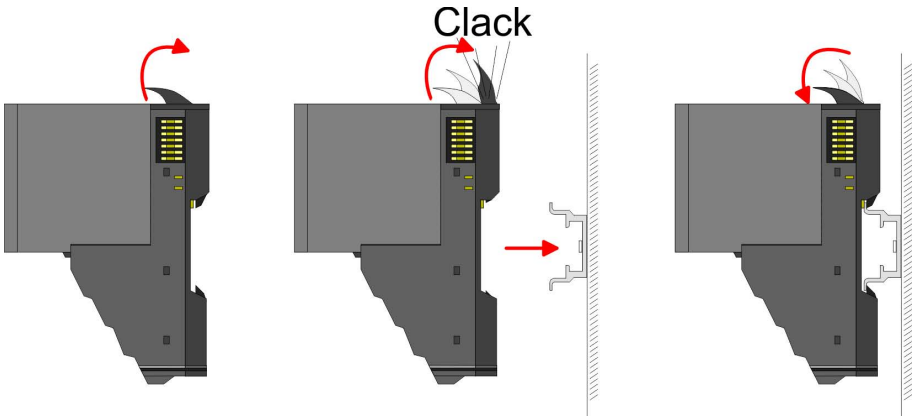


Dimensions in mm

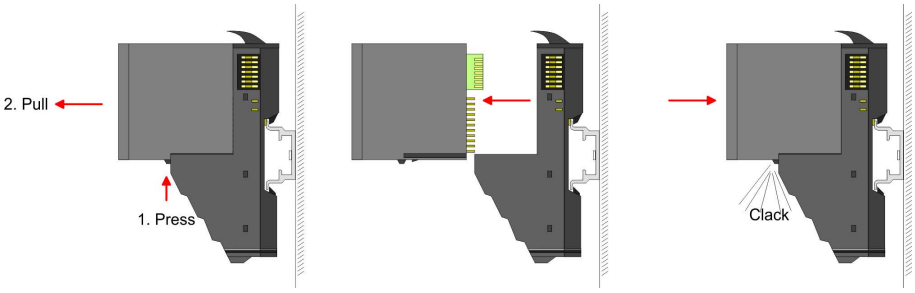
2.4 Installation

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.

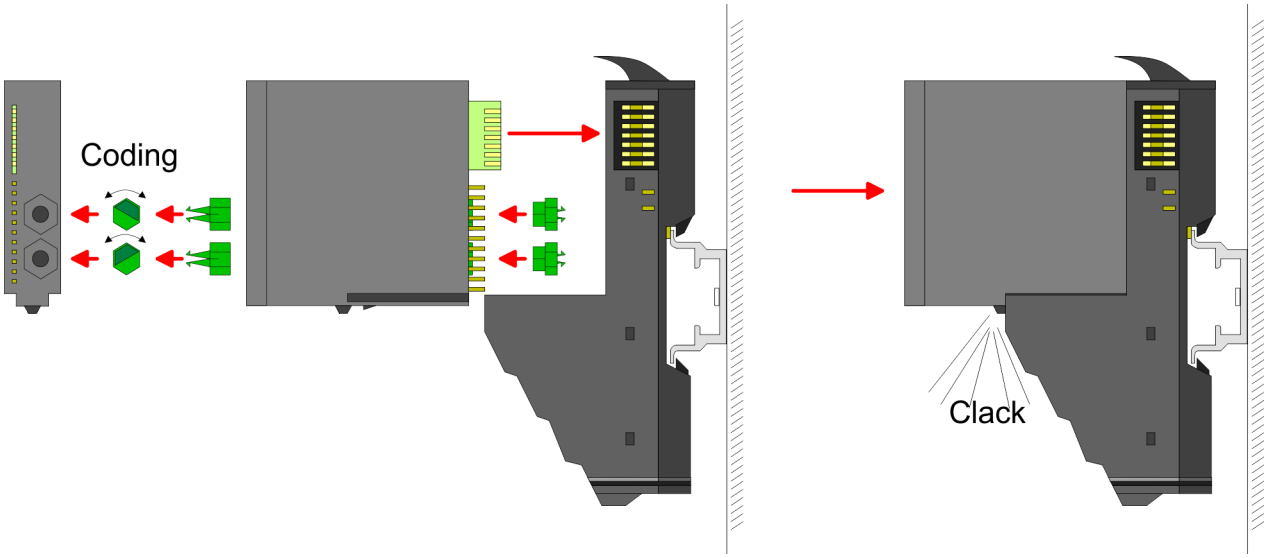


For the exchange of a electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module. For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.



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.

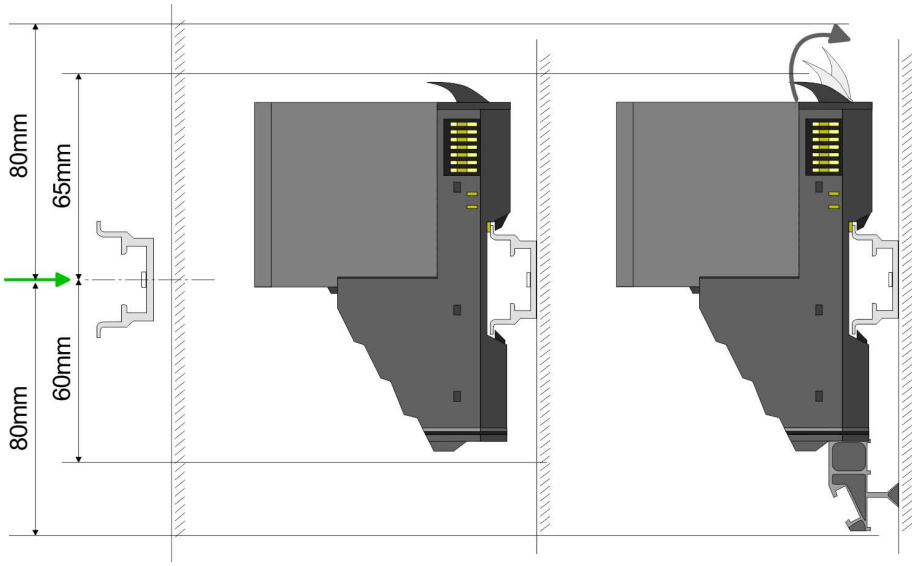
CAUTION!
Please consider that when replacing an already coded electronic module, this is always be replaced by an electronic module with the same coding.

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

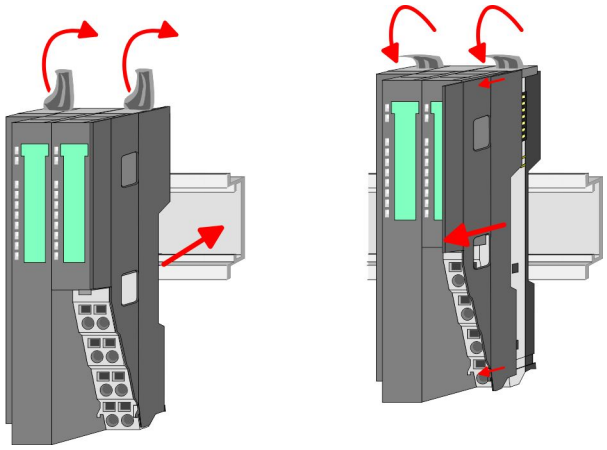
The modules were directly be mounted to the mounting rail and so connected to the backplane bus and the power supply for the electronic and power section. Up to 64 modules may be mounted. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. 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.

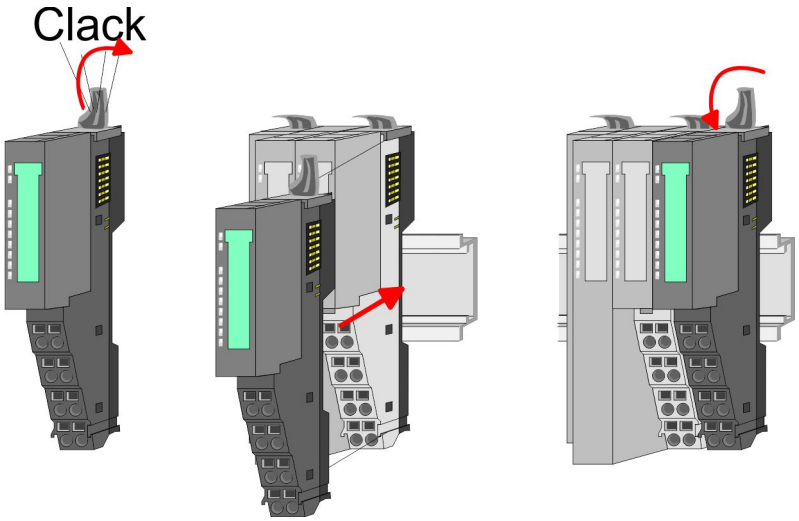
Mounting Head module (e.g. bus coupler)



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.

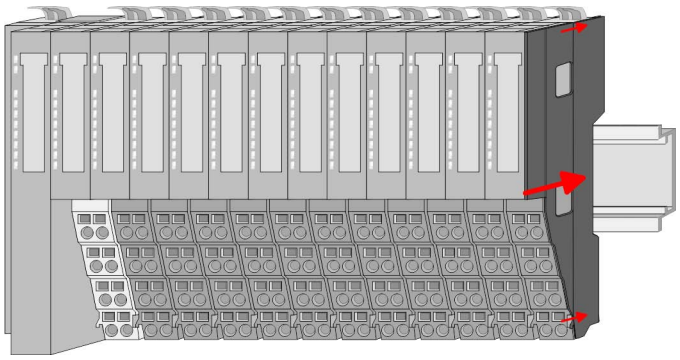
2. Before mounting the periphery modules you have to remove the bus cover at the right side of the Head module by pulling it forward. Keep the cover for later mounting.

Mounting periphery modules



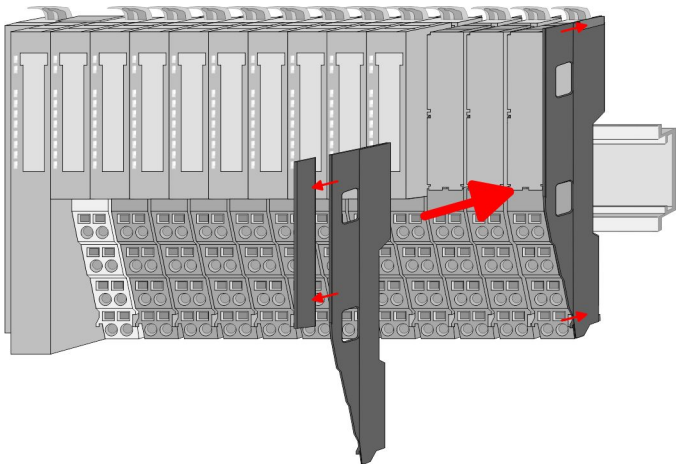
→ Mount the periphery modules you want.

Mounting the bus cover



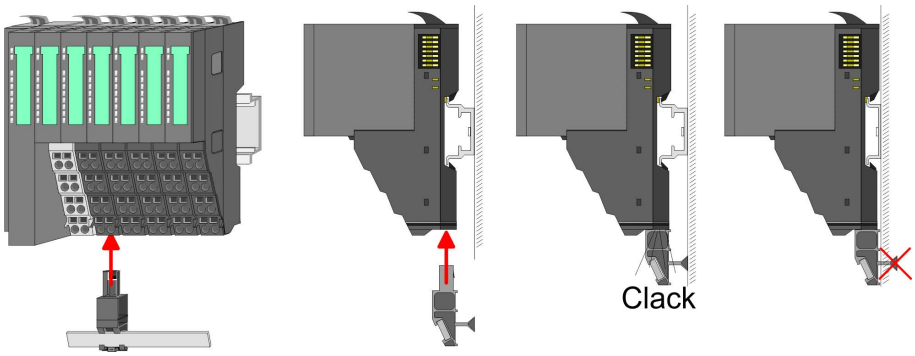
→ After mounting the whole system, to protect the backplane bus connectors at the last module you have to mount the bus cover, now.

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



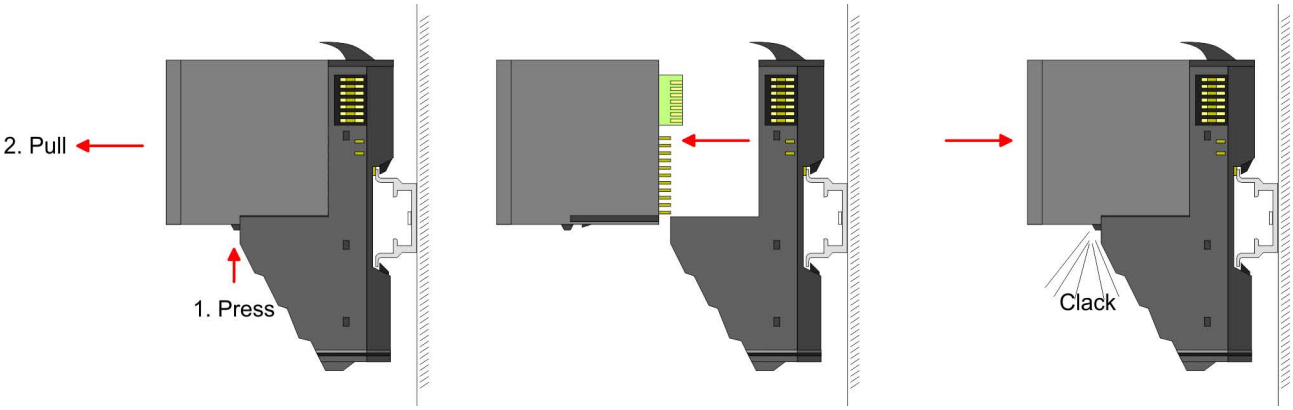
→ The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields. The shield bus carrier is mounted underneath the terminal of the terminal module. With a flat mounting rail for adaption to a flat mounting rail you may remove the spacer of the shield bus carrier.

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

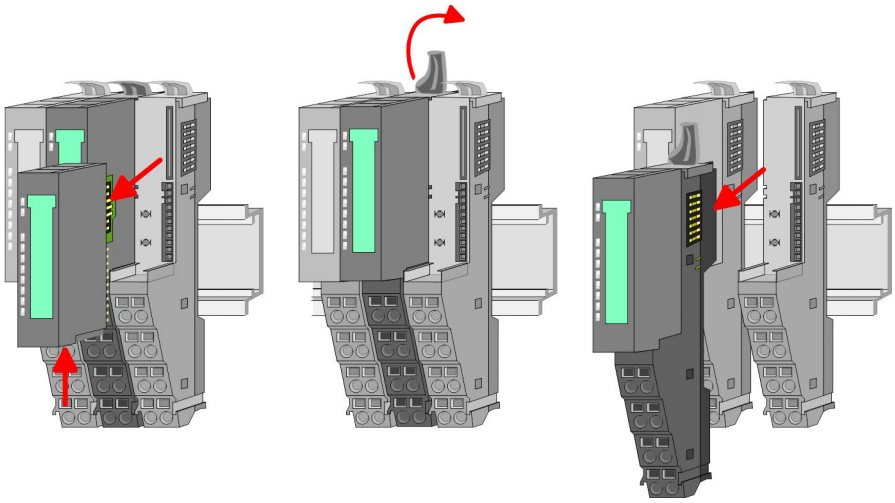


1. → For the exchange of an electronic module, the electronic module may be pulled forward after pressing the unlocking lever at the lower side of the module.

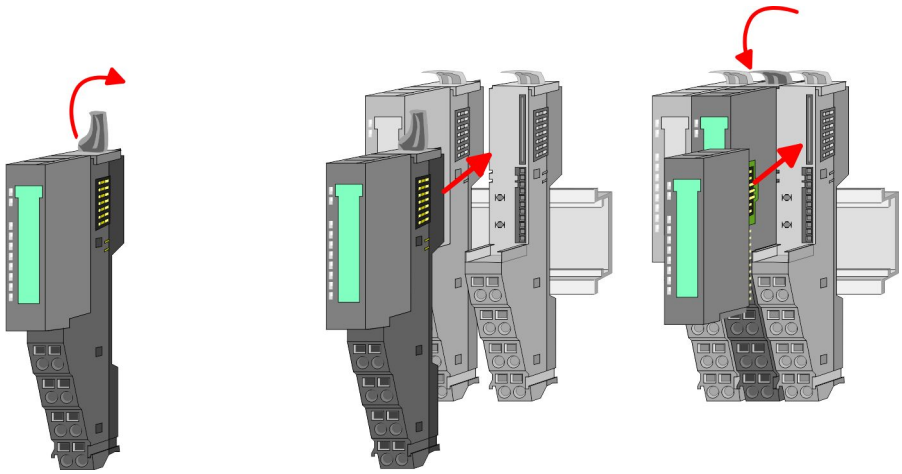
2. → For installation plug the electronic module guided by the strips at the lower side until this engages audible to the terminal module.

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.



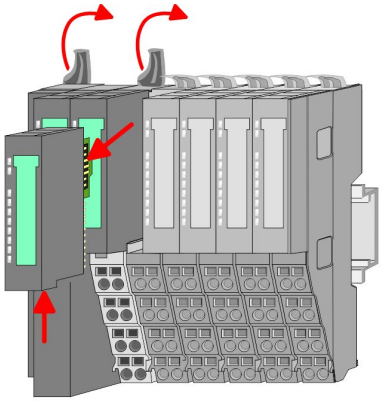
5. For mounting turn the locking lever of the module to be mounted upwards.
6. To mount the module put it to the gap between the both modules and push it, guided by the stripes at both sides, to the mounting rail.
7. Turn the locking lever downward again.
8. Plug again the electronic module, which you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

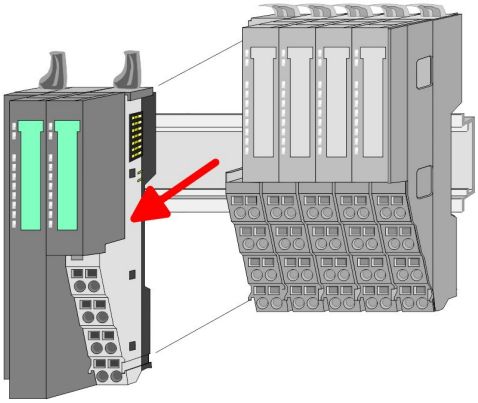
Exchange of a head module (e.g. bus coupler)

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

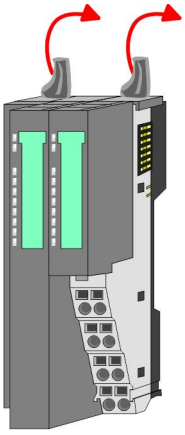
Here you may only exchange the electronic module!

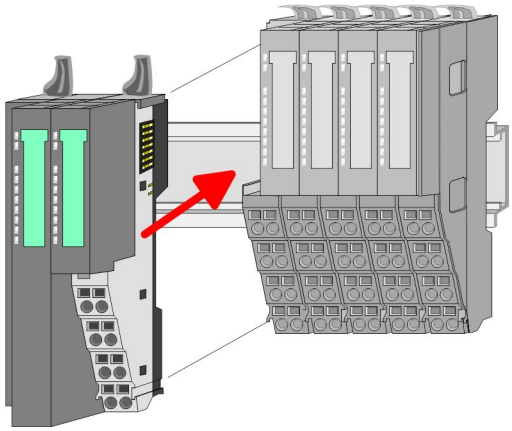
1. Remove if exists the wiring of the head module. *Chapter 2.6 'Wiring' on page 23*.

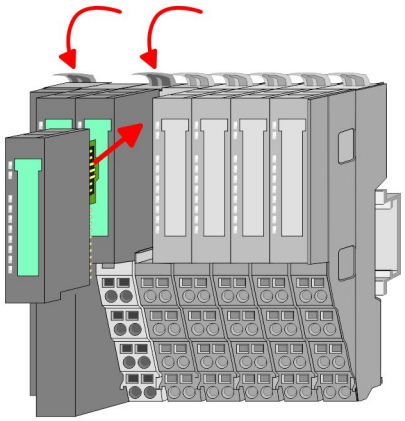




2. Press the unlocking lever at the lower side of the just mounted right module and pull it forward.
3. Turn all the locking lever of the head module to be exchanged upwards.
4. Pull the head module forward.



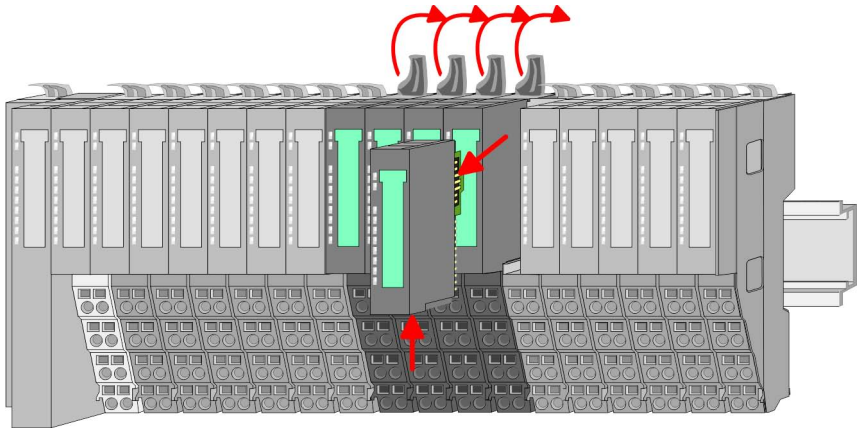




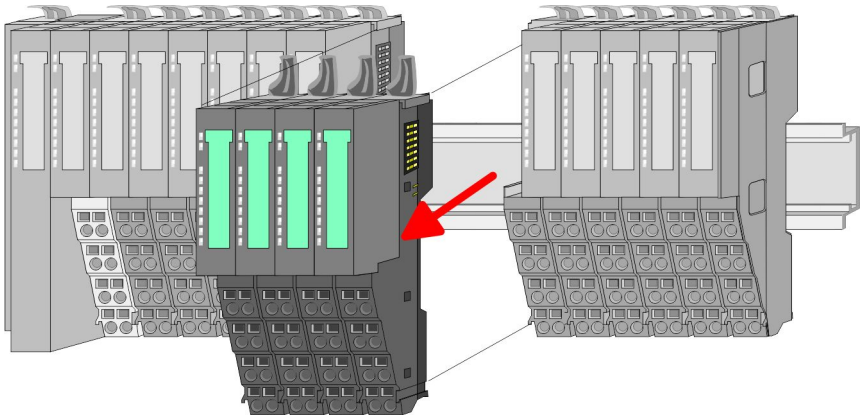
5. For mounting turn all the locking lever of the head module to be mounted upwards.
6. To mount the head module put it to the left module and push it, guided by the stripes, to the mounting rail.
7. Turn all the locking lever downward again.
8. Plug again the electronic module, which you have removed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

Exchange of a module group

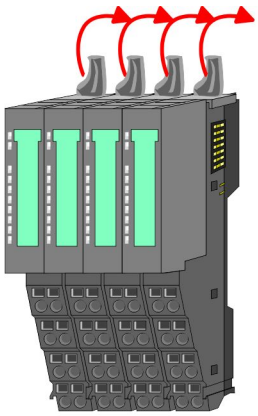
1. Remove if exists the wiring of the module group. *Chapter 2.6 'Wiring' on page 23*.

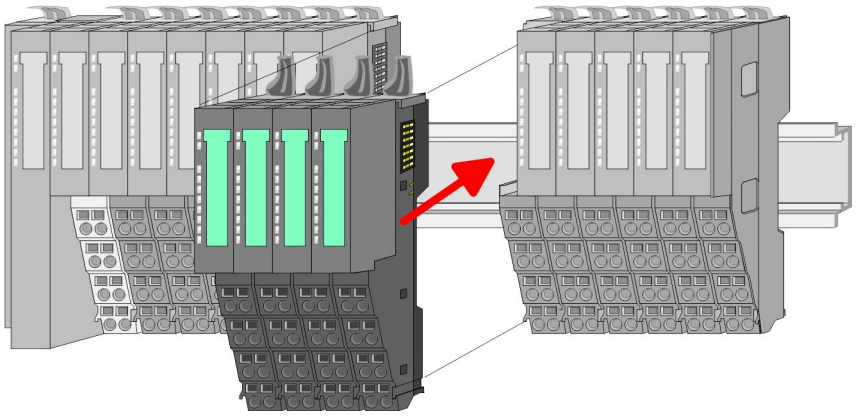


2. Press the unlocking lever at the lower side of the just mounted right module of the module group and pull it forward.

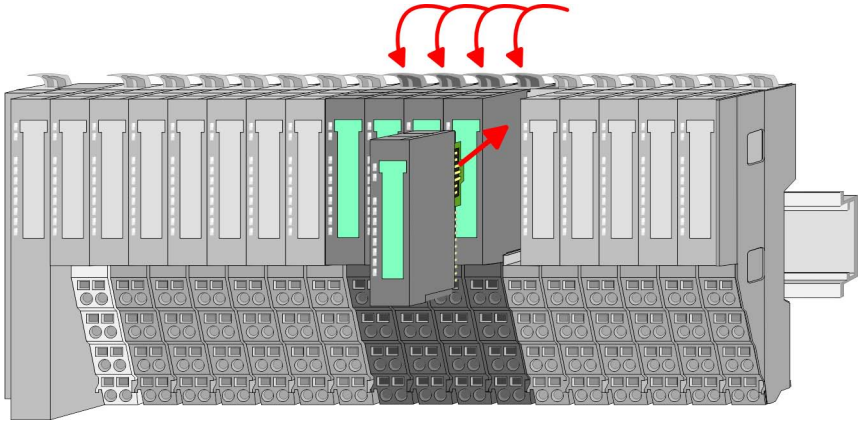


3. Turn all the locking lever of the module group to be exchanged upwards.
4. Pull the module group forward.





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

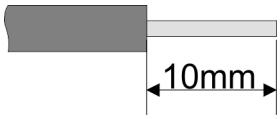
Connectors

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



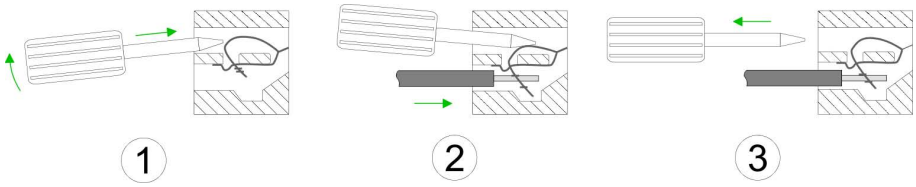
U_{max}: 240V AC / 30V DC

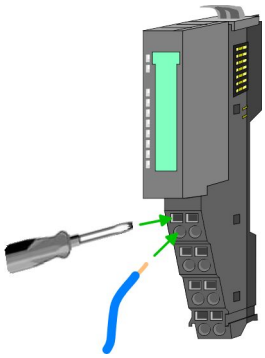
I_{max}: 10A

Cross section: 0.08 ... 1.5mm^2 (AWG 28 ... 16)

Stripping length: 10mm

Wiring procedure



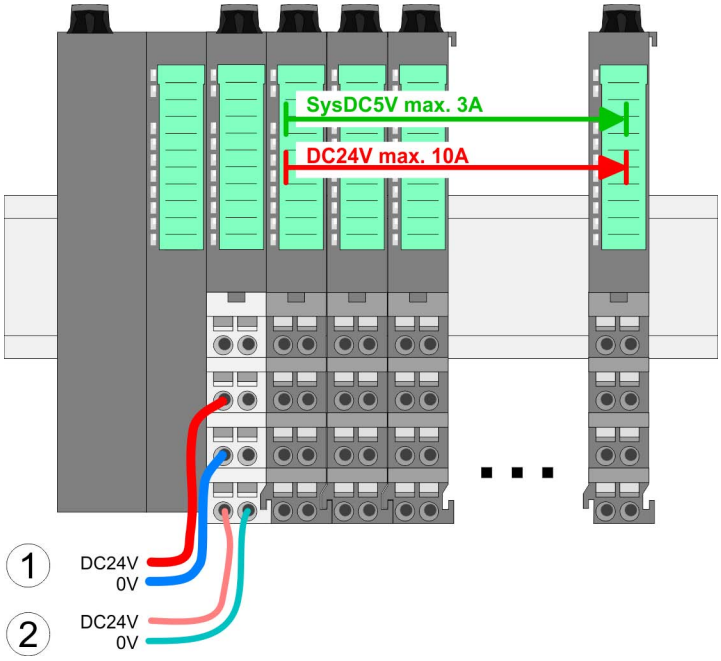


1. Insert a suited screwdriver at an angel into the square opening as shown. Press and hold the screwdriver in the opposite direction to open the contact spring.

2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm^2 to 1.5mm^2.

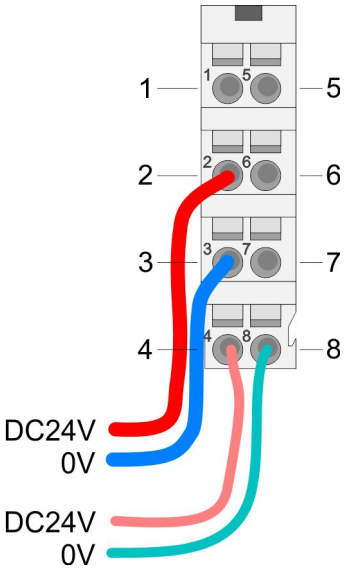
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

Standard wiring



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

PM - Power module



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

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

I Input

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

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

Fusing

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

State of the electronic power supply via LEDs

After PowerON of the System SLIO the LEDs RUN respectively MF get on so far as the sum current does not exceed 3A.

With a sum current greater than 3A the LEDs may not be activated.

Here the power module with the order number 007-1AB10 is to be placed between the peripheral modules.

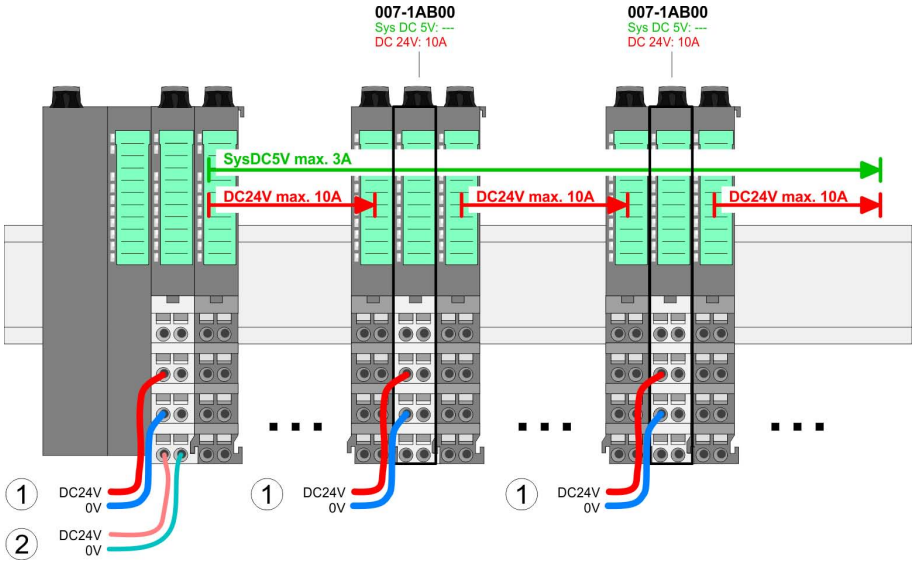
Deployment of the power modules

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.

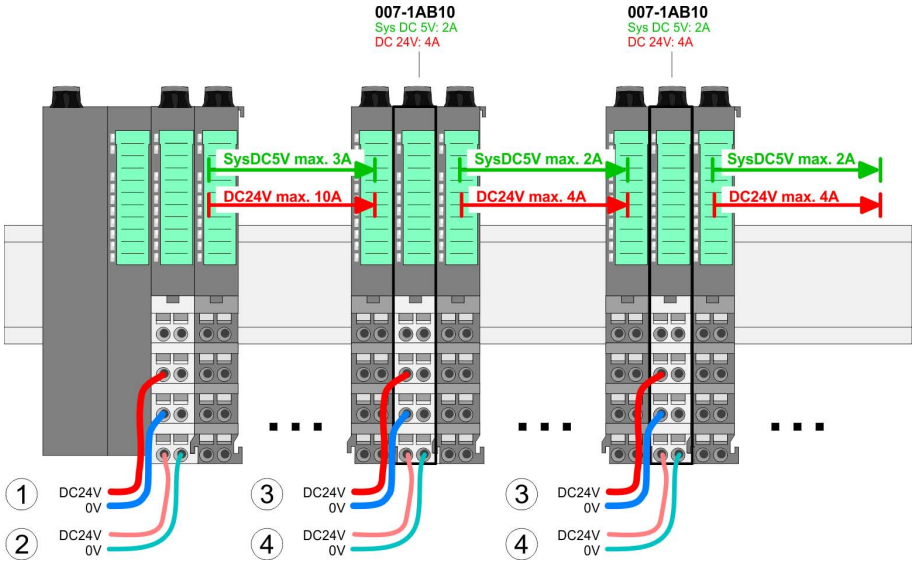
The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with 4A.

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

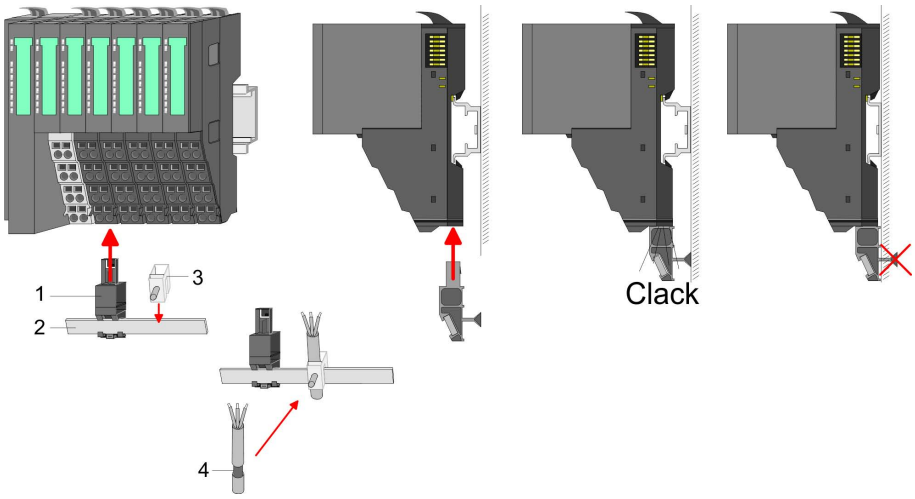
Shield attachment

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

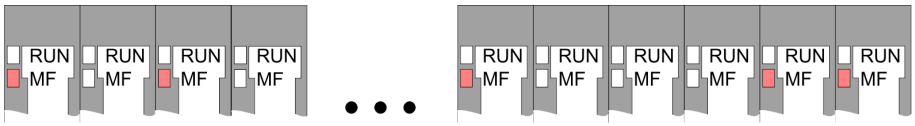
2.7 Trouble shooting - LEDs

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

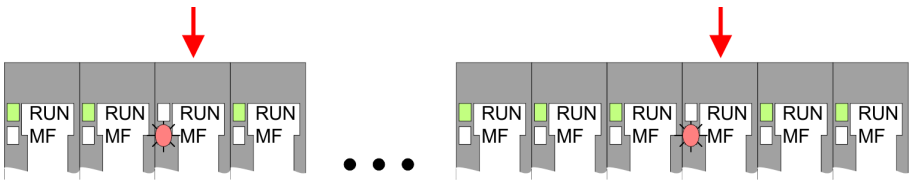


Behaviour: After PowerON the RUN LED of each module is off and the MF LED of each module is sporadically on.

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

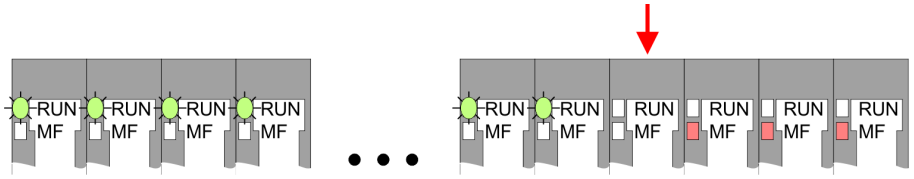


Behaviour: After PowerON the MF LED of one module respectively more modules flashes. The RUN LED remains off.

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 µA) are transferred.
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metallised plugs for serial couplings. Fix the isolation of the data line at the plug rack. Do not lay the isolation on the PIN 1 of the plug bar!
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to your PLC and don't lay it on there again!

CAUTION!

Please regard at installation!

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

Remedy: Potential compensation line

2.9 General data

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 *

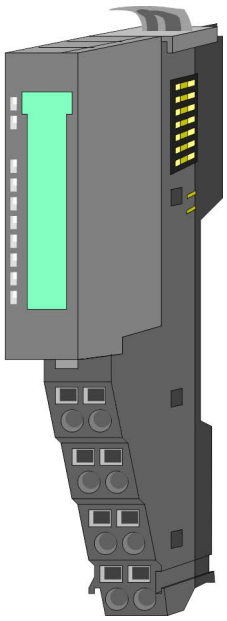
*) Due to the high-energetic single pulses with Surge an appropriate external protective circuit with lightning protection elements like conductors for lightning and overvoltage is necessary.

3 Hardware description

3.1 Properties

Features

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

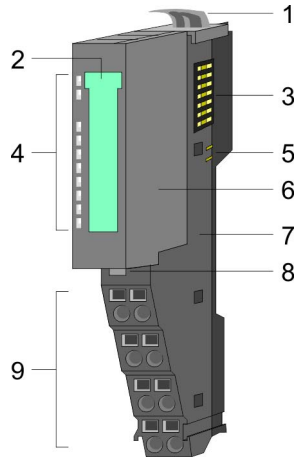


Order data

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

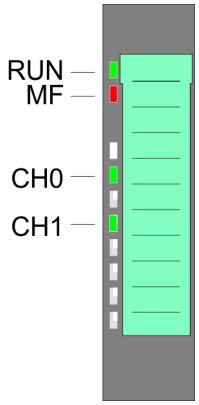
3.2 Structure

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



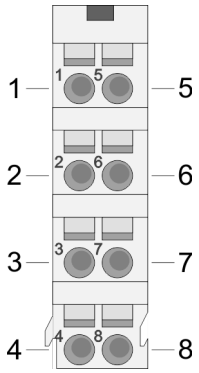
LED		Description
RUN green	MF red	
●	○	Bus communication is OK Module status is OK
●	●	Bus communication is OK Module status reports an error
○	●	Bus communication is not possible Module status reports an error
○	○	Error at bus power supply
X	B	Error in configuration *Chapter 2.7 'Trouble shooting - LEDs' on page 27*

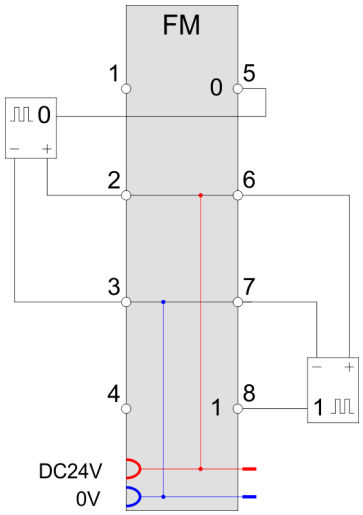
CH0	green	●	Channel 0: pulse input triggered
CH1	green	●	Channel 1: pulse input triggered

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

Order no.	050-1BB40
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	-
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)	-
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	-

Order no.	050-1BB40
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
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	-

Order no.	050-1BB40
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
Weight	60 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	in preparation

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

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

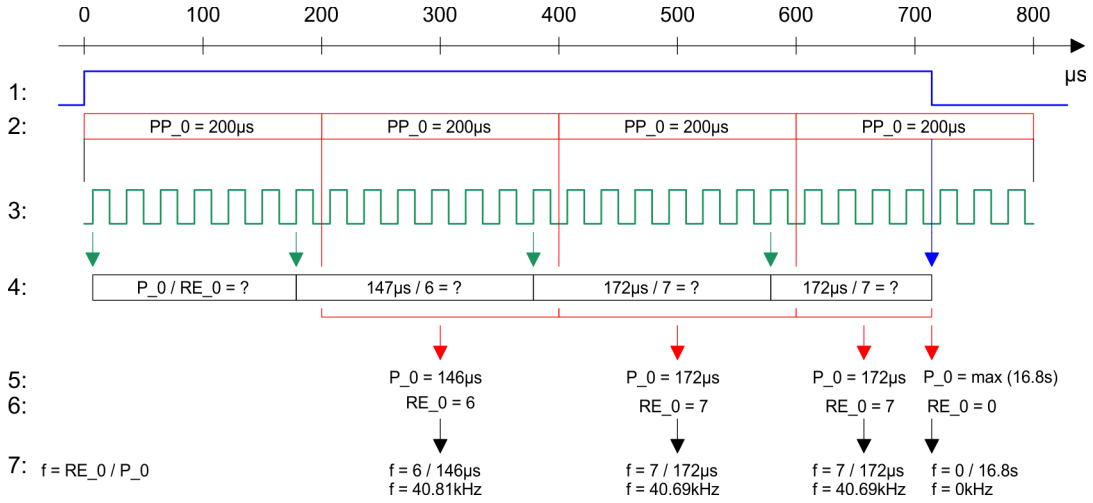
4.2 Principle of operation

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:



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 (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	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

Addr.	Name	Bytes	Function	IX	SX
+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 x 125ns = 16777215µs

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 (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	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 1µs.

Range of values: 1µs ... 8388607µs

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 ± 1µs 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:

$MP = 100 / F_{max}$ [µs]

here it is mandatory: MP > 2 x 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 MP ≤ 2 x PD

4.4 Parameter data

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.

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	■ *Bit 7 ... 0: Input filter* – 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-CPUs, 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

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 EtherCAT CPU from VIPA.

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.
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.

4.5.2.1 FC 300 - FM_SET_CONTROL

Description

The System SLIO Frequency measurement module is controlled by the FC 300 FM_SET_CONTROL. By this function the SFC 15 - DPWR_DAT for consistent write access of data is called. Here error messages of the block are reported by *ERROR*.

4.5.2.1.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
ENABLE_FM	INPUT	BOOL	I, Q, M, D, L	Enable frequency measurement
LADDR_OUT	INPUT	WORD	I, Q, M, D, L	Logical base address
PRESET_CH0	INPUT	DINT	I, Q, M, D, L	Channel 0: Measurement period
PRESET_CH1	INPUT	DINT	I, Q, M, D, L	Channel 1: Measurement period
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)

ENABLE_FM

With setting *ENABLE_FM* the *measuring periods*, which were preset by PRESET_CH0/1, are transferred to the channels and the measurement of both channels are started. Both frequency meters are stopped by resetting *ENABLE_FM*.

Only while ENABLE_FM is set, evaluated values can be retrieved from the module. Otherwise you get the error message that the channels are disabled.

LADDR_OUT

Configured base address of the output area of the System SLIO frequency measurement module, which is to be written to. The address must be in hexadecimal notation.

(Example: Address 100: *LADDR_OUT* : = W#16#64).

PRESET_CHx

Enter here the measurement period in µs for the corresponding channel.

Range of values: 1µs ... 8 388 607µs

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

ERROR (Return value)

The following code can be reported:

Code	Description
0x0000	No error
0x80D2	Channel 0: Input value measurement period ≤ 0
0x80D3	Channel 1: Input value measurement period ≤ 0

Code	Description
0x80D4	Channel 0: Input value measurement period > 8 388 607µs
0x80D5	Channel 1: Input value measurement period > 8 388 607µs

4.5.2.1.2 Errors of the internally called SFC 15

Code	Description
0x808x	System error on the bus coupler
0x8090	*LADDR_OUT* is wrong, possible reasons: ■ there is no module configured on this address ■ limitation of the length of consistent data was not considered ■ Basic address in parameter *LADDR_OUT* was not entered in hexadecimal type
0x8093	There is no bus coupler existing for *LADDR_OUT*, from which consistent data can be read.
0x80A0	An access error was detected during peripheral access.
0x80B0	System error on the bus coupler
0x80B1	Specified length of the source area does not correspond to the configured user data length.
0x80B2	System error on the bus coupler
0x80B3	System error on the bus coupler
0x80C1	The data from the previous read request on the module are not processed by the module, yet.
0x80C2	System error on the bus coupler
0x80Fx	System error on the bus coupler
0x85xy	System error on the bus coupler
0x8xyy	General error information For details, please refer to OPL_SP7 "Integrated Standard SFCs" at "General and Specific Error Information RET_VAL".

4.5.2.2 FC 301 - FM_GET_PERIOD

Description

With the FC 301 FM_GET_PERIOD, you can calculate the period duration of the input signals of both channels. By this function internally SFC 14 - DPRD_DAT for consistent reading of user data is called. Here, the error messages of the function block are returned by *ERROR*.

4.5.2.2.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
LADDR_IN	INPUT	WORD	I, Q, M, D, L	Logical base input address
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)
PERIOD_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Period duration
PERIOD_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Period duration

LADDR_IN

Configured base address of the input area of the System SLIO frequency measurement module, which is to be read from. The address must be in hexadecimal notation.

(Example: Address 100: *LADDR_IN*: = W#16#64).

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

PERIOD_CHx

Currently determined period duration of the corresponding channel.

ERROR (Return value)

The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80DC	Channel 0: Measured time value < 0
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFFF
0x80E0	Channel 0: Determined number of edges = 0
0x80E1	Channel 1: Determined number of edges = 0
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

4.5.2.2.2 Error of the internal called SFC 14

Code	Description
0x808x	System error on the bus coupler
0x8090	*LADDR_IN* is not correct, possible reasons: ■ there is no module configured on this address ■ limitation of the length of consistent data was not considered ■ Basic address in parameter *LADDR_IN* was not entered in hexadecimal type
0x8093	There is no bus coupler existing for *LADDR_IN*, to which consistent data can be written.
0x80A0	An access error was detected during peripheral access.
0x80B0	System error on the bus coupler
0x80B1	Specified length of the source area does not correspond to the configured user data length.
0x80B2	System error on the bus coupler
0x80B3	System error on the bus coupler
0x80C1	The data from the previous write request on the module are not processed by the module, yet.
0x80C2	System error on the bus coupler
0x80Fx	System error on the bus coupler
0x85xy	System error on the bus coupler
0x8xyy	General error information For details, please refer to OPL_SP7 "Integrated Standard SFCs" at "General and Specific Error Information RET_VAL".

4.5.2.3 FC 302 - FM_GET_FREQUENCY

Description

With the FC 302 FM_GET_FREQUENCY, you can calculate the frequency of the input signals of both channels. By this function internally SFC 14 - DPRD_DAT for consistent reading of user data is called. Here, the error messages of the function block are returned by *ERROR*.

4.5.2.3.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
LADDR_IN	INPUT	WORD	I, Q, M, D, L	Logical base input address
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)

Parameter	Declaration	Data type	Memory block	Description
FREQUENCY_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Frequency
FREQUENCY_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Frequency

LADDR_IN

Configured base address of the input area of the System SLIO frequency measurement module, which is to be read from. The address must be in hexadecimal notation.

(Example: Address 100: *LADDR_IN*: = W#16#64).

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

FREQUENCY_CHx

Currently determined frequency of the corresponding channel in mHz.

ERROR (Return value)

The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80DA	Channel 0: Measured time value = 0
0x80DB	Channel 1: Measured time value = 0
0x80DC	Channel 0: Measured time value < 0
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFF
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E6	Channel 0: Frequency > 600kHz
0x80E7	Channel 1: Frequency > 600kHz
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

4.5.2.3.2 Error of the internal called SFC 14

Code	Description
0x808x	System error on the bus coupler
0x8090	*LADDR_IN* is not correct, possible reasons: ■ there is no module configured on this address ■ limitation of the length of consistent data was not considered ■ Basic address in parameter *LADDR_IN* was not entered in hexadecimal type
0x8093	There is no bus coupler existing for *LADDR_IN*, to which consistent data can be written.
0x80A0	An access error was detected during peripheral access.
0x80B0	System error on the bus coupler
0x80B1	Specified length of the source area does not correspond to the configured user data length.
0x80B2	System error on the bus coupler
0x80B3	System error on the bus coupler
0x80C1	The data from the previous write request on the module are not processed by the module, yet.
0x80C2	System error on the bus coupler
0x80Fx	System error on the bus coupler
0x85xy	System error on the bus coupler
0x8xyy	General error information For details, please refer to OPL_SP7 "Integrated Standard SFCs" at "General and Specific Error Information RET_VAL".

4.5.2.4 FC 303 - FM_GET_SPEED

Description

With the FC 303 FM_GET_SPEED, you can calculate the rotational speed of the input signals of both channels. By this function internally SFC 14 - DPRD_DAT for consistent reading of user data is called. Here, the error messages of the function block are returned by *ERROR*.

4.5.2.4.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
LADDR_IN	INPUT	WORD	I, Q, M, D, L	Logical base input address
RESOLUTION_CH0	INPUT	DINT	I, Q, M, D, L	Channel 0: Resolution of the sensor

Parameter	Declaration	Data type	Memory block	Description
RESOLUTION_CH1	INPUT	DINT	I, Q, M, D, L	Channel 1: Resolution of the sensor
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	return value (0 = OK)
SPEED_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Rotational speed
SPEED_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Rotational speed

LADDR_IN

Configured base address of the input area of the System SLIO frequency measurement module, which is to be read from. The address must be in hexadecimal notation.

(Example: Address 100: *LADDR_IN*: = W#16#64).

RESOLUTION_CHx

Enter here the resolution in increments per revolution for the corresponding channel .

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

SPEED_CHx

Currently determined rotational speed of the corresponding channel in revolutions per minute (rpm).

ERROR (Return value)

The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80D6	Channel 0: Input value RESOLUTION_CH0 = 0
0x80D7	Channel 1: Input value RESOLUTION_CH1 = 0
0x80D8	Channel 0: Input value RESOLUTION_CH0 < 0
0x80D9	Channel 1: Input value RESOLUTION_CH1 < 0
0x80DA	Channel 0: Measured time value = 0
0x80DB	Channel 1: Measured time value = 0
0x80DC	Channel 0: Measured time value < 0

Code	Description
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFFF
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E6	Channel 0: Determined rotational speed > max (DINT)
0x80E7	Channel 1: Determined rotational speed > max (DINT)
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

4.5.2.4.2 Error of the internal called SFC 14

Code	Description
0x808x	System error on the bus coupler
0x8090	*LADDR_IN* is not correct, possible reasons: ■ there is no module configured on this address ■ limitation of the length of consistent data was not considered ■ Basic address in parameter *LADDR_IN* was not entered in hexadecimal type
0x8093	There is no bus coupler existing for *LADDR_IN*, to which consistent data can be written.
0x80A0	An access error was detected during peripheral access.
0x80B0	System error on the bus coupler
0x80B1	Specified length of the source area does not correspond to the configured user data length.
0x80B2	System error on the bus coupler
0x80B3	System error on the bus coupler
0x80C1	The data from the previous write request on the module are not processed by the module, yet.
0x80C2	System error on the bus coupler
0x80Fx	System error on the bus coupler

Code	Description
0x85xy	System error on the bus coupler
0x8xyy	General error information For details, please refer to OPL_SP7 "Integrated Standard SFCs" at "General and Specific Error Information RET_VAL".

4.5.3 FC 310 ... 313

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

4.5.3.1 FC 310 - FM_CONTROL

Description

The System SLIO Frequency measurement module is controlled by the FC 310 FM_CONTROL. Since this FC does not internally call a block for consistent write access of data, you have to ensure consistent data transfer in your system.

4.5.3.1.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
ENABLE_FM	INPUT	BOOL	I, Q, M, D, L	Enable frequency measurement
PRESET_CH0	INPUT	DINT	I, Q, M, D, L	Channel 0: Measurement period

Parameter	Declaration	Data type	Memory block	Description
PRESET_CH1	INPUT	DINT	I, Q, M, D, L	Channel 1: Measurement period
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	return value (0 = OK)
FM_PRESET_PERIOD_CH0	OUTPUT	DWORD	I, Q, M, D, L	Setpoint value for frequency measurement module output address: +0
FM_PRESET_PERIOD_CH1	OUTPUT	DWORD	I, Q, M, D, L	Setpoint value for frequency measurement module output address: +4
FM_CONTROL_CH0	OUTPUT	WORD	I, Q, M, D, L	Setpoint value for frequency measurement module output address: +8
FM_CONTROL_CH1	OUTPUT	WORD	I, Q, M, D, L	Setpoint value for frequency measurement module output address: +10

ENABLE_FM

With setting *ENABLE_FM* the corresponding CONTROL is generated and issued via *FM_CONTROL_CHx*. The measurement of both channels is started as soon as the content of *FM_CONTROL_CHx* was consistent transferred by the bus system to the frequency measurement module. The measurement of both channels is stopped by resetting *ENABLE_FM*, after *FM_CONTROL_CHx* was consistent transferred to the frequency measurement module.

Only as long as the frequency meters are started, evaluated values can be retrieved from the module. Otherwise you get the error message that the channels are disabled.

PRESET_CHx

Enter here the measurement period in µs for the corresponding channel.

Range of values: 1µs ... 8 388 607µs

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

FM_PRESET_PERIOD_CHx

This parameter contains the measuring period for channel 0 respectively channel 1. The content is to be consistent connected with address +0 respectively +4 of the output area of the frequency measurement module, via the according bus system.

FM_CONTROL_CHx

This parameter contains CONTROL, which is generated by *ENABLE_FM*. The content for channel 0 respectively channel 1 is to be consistent connected with address +8 respectively +10 of the output area of the frequency measurement module, via the according bus system.

ERROR (Return value)

The following code can be reported:

Code	Description
0x0000	No error
0x80D2	Channel 0: Input value measurement period ≤ 0
0x80D3	Channel 1: Input value measurement period ≤ 0
0x80D4	Channel 0: Input value measurement period > 8 388 607µs
0x80D5	Channel 1: Input value measurement period > 8 388 607µs

4.5.3.2 FC 311 - FM_CALC_PERIOD

Description

With the FC 311 FM_CALC_PERIOD, you can calculate the period duration of the input signals of both channels. Since this FC does not internally call a block for consistent read access of data, you have to ensure consistent data transfer in your system.

4.5.3.2.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
FM_PERIOD_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +0
FM_PERIOD_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +4

Parameter	Declaration	Data type	Memory block	Description
FM_RISING_EDGES_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +8
FM_RISING_EDGES_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +12
FM_STATUS_CH0	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +16
FM_STATUS_CH1	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +18
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)
PERIOD_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Period duration
PERIOD_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Period duration

FM_PERIOD_CHx

This parameter contains the measured time value of channel 0 respectively channel 1. The content is to be consistent connected with address +0 respectively +4 of the input area of the frequency measurement module, via the according bus system.

FM_RISING_EDGES_CHx

This parameter contains the determined number of rising edges for channel 0 respectively channel 1. The content is to be consistent connected with address +8 respectively +12 of the input area of the frequency measurement module, via the according bus system.

FM_STATUS_CHx

This parameter contains the status of channel 0 respectively channel 1. The content is to be consistent connected with address +16 respectively +18 of the input area of the frequency measurement module, via the according bus system.

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

PERIOD_CHx Currently determined period duration of the corresponding channel in 100ns.

ERROR (Return value) The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80DC	Channel 0: Measured time value < 0
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFFF
0x80E0	Channel 0: Determined number of edges = 0
0x80E1	Channel 1: Determined number of edges = 0
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

4.5.3.3 FC 312 - FM_CALC_FREQUENCY

Description With the FC 312 FM_CALC_FREQUENCY, you can calculate the period duration of the input signals of both channels. Since this FC does not internally call a block for consistent read access of data, you have to ensure consistent data transfer in your system.

4.5.3.3.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
FM_PERIOD_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +0
FM_PERIOD_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +4
FM_RISING_EDGES_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +8
FM_RISING_EDGES_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +12
FM_STATUS_CH0	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +16
FM_STATUS_CH1	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +18
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)
FREQUENCY_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Calculated frequency
FREQUENCY_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Calculated frequency

FM_PERIOD_CHx This parameter contains the measured time value of channel 0 respectively channel 1. The content is to be consistent connected with address +0 respectively +4 of the input area of the frequency measurement module, via the according bus system.

FM_RISING_EDGES_CHx This parameter contains the determined number of rising edges for channel 0 respectively channel 1. The content is to be consistent connected with address +8 respectively +12 of the input area of the frequency measurement module, via the according bus system.

FM_STATUS_CHx This parameter contains the status of channel 0 respectively channel 1. The content is to be consistent connected with address +16 respectively +18 of the input area of the frequency measurement module, via the according bus system.

DONE Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

FREQUENCY_CHx Currently determined frequency of the corresponding channel in mHz.

ERROR (Return value) The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80DA	Channel 0: Measured time value = 0
0x80DB	Channel 1: Measured time value = 0
0x80DC	Channel 0: Measured time value < 0
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFF
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E6	Channel 0: Frequency > 600kHz
0x80E7	Channel 1: Frequency > 600kHz
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

4.5.3.4 FC 313 - FM_CALC_SPEED

Description With the FC 313 FM_CALC_SPEED, you can calculate the velocity of the input signals of both channels. Since this FC does not internally call a block for consistent read access of data, you have to ensure consistent data transfer in your system.

4.5.3.4.1 Parameters

Parameter	Declaration	Data type	Memory block	Description
FM_PERIOD_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +0
FM_PERIOD_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +4
FM_RISING_EDGES_CH0	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +8
FM_RISING_EDGES_CH1	INPUT	DWORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +12
FM_STATUS_CH0	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +16
FM_STATUS_CH1	INPUT	WORD	I, Q, M, D, L	Actual value of frequency measurement module input address: +18
RESOLUTION_CH0	INPUT	DINT	I, Q, M, D, L	Channel 0: Resolution of the sensor
RESOLUTION_CH1	INPUT	DINT	I, Q, M, D, L	Channel 1: Resolution of the sensor
DONE	OUTPUT	BOOL	I, Q, M, D, L	Ready signal (TRUE = OK)
ERROR	OUTPUT	WORD	I, Q, M, D, L	Return value (0 = OK)
SPEED_CH0	OUTPUT	DINT	I, Q, M, D, L	Channel 0: Calculated rotational speed
SPEED_CH1	OUTPUT	DINT	I, Q, M, D, L	Channel 1: Calculated rotational speed

FM_PERIOD_CHx This parameter contains the measured time value for channel 0 respectively channel 1. The content is to be consistent connected with address +0 respectively +4 of the input area of the frequency measurement module, via the according bus system.

FM_RISING_EDGES_CHx

This parameter contains the determined number of rising edges for channel 0 respectively channel 1. The content is to be consistent connected with address +8 respectively +12 of the input area of the frequency measurement module, via the according bus system.

FM_STATUS_CHx

This parameter contains the status of channel 0 respectively channel 1. The content is to be consistent connected with address +16 respectively +18 of the input area of the frequency measurement module, via the according bus system.

RESOLUTION_CHx

Enter here the resolution in increments per revolution for the corresponding channel.

DONE

Ready signal of the function

- TRUE: Function was finished without error.
- FALSE: Function is not active respectively there is an error.

SPEED_CHx

Currently determined rotational speed of the corresponding channel in revolutions per minute (rpm).

ERROR (Return value)

The following codes can be returned:

Code	Description
0x0000	No error
0x80D0	Channel 0 not in status active
0x80D1	Channel 1 not in status active
0x80D6	Channel 0: Input value RESOLUTION_CH0 = 0
0x80D7	Channel 1: Input value RESOLUTION_CH1 = 0
0x80D8	Channel 0: Input value RESOLUTION_CH0 < 0
0x80D9	Channel 1: Input value RESOLUTION_CH1 < 0
0x80DA	Channel 0: Measured time value = 0
0x80DB	Channel 1: Measured time value = 0
0x80DC	Channel 0: Measured time value < 0
0x80DD	Channel 1: Measured time value < 0
0x80DE	Channel 0: Measured time value > 0x7FFFFF
0x80DF	Channel 1: Measured time value > 0x7FFFFF
0x80E2	Channel 0: Determined number of edges < 0
0x80E3	Channel 1: Determined number of edges < 0
0x80E4	Channel 0: Determined number of edges > 0xFFFFFF
0x80E5	Channel 1: Determined number of edges > 0xFFFFFF
0x80E6	Channel 0: Determined rotational speed > max (DINT)

Code	Description
0x80E7	Channel 1: Determined rotational speed > max (DINT)
0x80E8	Channel 0: No valid measurement within the entered measurement period.
0x80E9	Channel 1: No valid measurement within the entered measurement period.

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 (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	reserved	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	■ Bit 3 ... 0: Module class – 1000b: Function module ■ Bit 4: set at channel information present ■ Bit 7 ... 5: reserved

CHTYP Channel type

Byte	Bit 7 ... 0
0	■ Bit 6 ... 0: Channel type – 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