VIPA System SLIO

IM | 053-1MT01 | Manual

HB300 | IM | 053-1MT01 | en | 19-40

Interface module Modbus/TCP - IM 053MT
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1 General

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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.

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Hereby, YASKAWA Europe 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 representative of YASKAWA Europe GmbH.

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1.2 About this manual

**Objective and contents**
This manual describes the IM 053-1MT01 of the VIPA System SLIO. It contains a description of the construction, project implementation and usage.

<table>
<thead>
<tr>
<th>Product</th>
<th>Order no.</th>
<th>as of state:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HW</td>
</tr>
<tr>
<td>IM 053MT</td>
<td>053-1MT01</td>
<td>01</td>
</tr>
</tbody>
</table>

**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.
1.3 Safety information

Applications conforming with specifications

The system is constructed and produced for:
- communication and process control
- general control and automation tasks
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

DANGER!
This device is not certified for applications in
- in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the
- project design department
- installation department
- commissioning
- operation

CAUTION!
The following conditions must be met before using or commissioning the components described in this manual:
- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware modifications only by properly trained personnel.
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

National rules and regulations apply to the disposal of the unit!
2 Basics and mounting

2.1 Safety information for users

Handling of electrostatic sensitive modules

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

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

Shipping of modules

Modules must be shipped in the original packing material.

Measurements and alterations on electrostatic sensitive modules

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

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

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

**CAUTION!**

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

2.2.1 Overview

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 colors within the system, further isolated areas may be defined for the DC 24V power section supply, respectively the electronic power supply may be extended with 2A.
2.2.2 Components

- CPU (head module)
- Bus coupler (head module)
- Line extension
- Periphery modules
- Accessories

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

**CPU 01xC**

With this CPU 01xC, the CPU electronic, input/output components and power supply are integrated to one casing. In addition, up to 64 periphery modules of the System SLIO can be connected to the backplane bus. As head module via the integrated power supply CPU electronic and the I/O components are power supplied as well as the electronic of the connected periphery modules. To connect the power supply of the I/O components and for DC 24V power supply of via backplane bus connected peripheral modules, the CPU has removable connectors. By installing of up to 64 periphery modules at the backplane bus, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

**CAUTION!**
CPU part and power module may not be separated!
Here you may only exchange the electronic module!

**CPU 01x**

With this CPU 01x, the CPU electronic and power supply are integrated to one casing. As head module, via the integrated power module for power supply, CPU electronic and the electronic of the connected periphery modules are supplied. The DC 24 power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the backplane bus, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

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

**Bus coupler**

With a bus coupler bus interface and power module is integrated to one casing. With the bus interface you get access to a subordinated bus system. As head module, via the integrated power module for power supply, bus interface and the electronic of the connected periphery modules are supplied. The DC 24 power section supply for the linked periphery modules is established via a further connection of the power module. By installing of up to 64 periphery modules at the bus coupler, these are electrically connected, this means these are assigned to the backplane bus, the electronic modules are power supplied and each periphery module is connected to the DC 24V power section supply.

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

In the System SLIO there is the possibility to place up to 64 modules in on line. By means of the line extension you can divide this line into several lines. Here you have to place a line extension master at each end of a line and the subsequent line has to start with a line extension slave. Master and slave are to be connected via a special connecting cable. In this way, you can divide a line on up to 5 lines. For each line extension the maximum number of pluggable modules at the System SLIO bus is decreased by 1. To use the line extension no special configuration is required.

Please note that some modules do not support line extensions due to the system. For more information, see the ‘System SLIO - Compatibility List’ at www.vipa.com

Periphery modules

Each periphery module consists of a terminal and an 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 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.
2.2.3 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 adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.

Bus cover

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

Coding pins

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

**Hardware revision on the front**
- The hardware revision version is printed on every System SLIO module.
- Since a System SLIO module consists of a terminal and electronics module, you will find a hardware revision on each of them.
- Authoritative for the hardware revision of a System SLIO module is the hardware revision of the electronic module. This is always located under the labeling strip of the corresponding electronic module.
- On modules without labeling strip, such as CPUs, the hardware revision is printed on the front.

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

**Hardware revision via web server**
On the CPUs and some bus couplers, you can output the hardware revision ‘HW Revision’ via the integrated web server.

2.3 Dimensions

**Dimensions CPU 01xC**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>76.5</td>
<td>Width</td>
</tr>
<tr>
<td>83</td>
<td>Height</td>
</tr>
<tr>
<td>100</td>
<td>Length</td>
</tr>
<tr>
<td>105</td>
<td>Length</td>
</tr>
<tr>
<td>147</td>
<td>Length</td>
</tr>
<tr>
<td>150</td>
<td>Length</td>
</tr>
</tbody>
</table>

Dimensions shown in the image are approximate and may vary slightly.
**Basics and mounting**

**Dimensions**

**Dimensions CPU 01x**

**Dimensions bus coupler and line extension slave**

**Dimensions line extension master**
2.4 Mounting bus coupler

Requirements for UL compliance use

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

There are locking lever at the top side of the bus coupler. For mounting and demounting these locking lever are to be turned upwards until these engage. Place the bus coupler at the mounting rail. The bus coupler is fixed to the mounting rail by pushing downward the locking levers. The bus coupler is directly mounted at a mounting rail. Up to 64 modules may be mounted. The electronic and power section supply are connected via the backplane bus. Please consider here that the sum current of the electronic power supply does not exceed the maximum value of 3A. By means of the power module 007-1AB10 the current of the electronic power supply may be expanded accordingly.
1. Mount the mounting rail! Please consider that a clearance from the middle of the mounting rail of at least 80mm above and 60mm below, respectively 80mm by deployment of shield bus carriers, exist.

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

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

2. Mount the periphery modules you want.

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

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

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

2.5.1 Wiring bus coupler

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

Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{\text{max}}$</td>
<td>30V DC</td>
</tr>
<tr>
<td>$I_{\text{max}}$</td>
<td>10A</td>
</tr>
<tr>
<td>Cross section</td>
<td>0.08 ... 1.5mm² (AWG 28 ... 16)</td>
</tr>
<tr>
<td>Stripping length</td>
<td>10mm</td>
</tr>
</tbody>
</table>
### Wiring procedure

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

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

2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm².

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

### Standard wiring

- DC 24V for power section supply I/O area (max. 10A)
- DC 24V for electronic power supply bus coupler and I/O area
For wires with a core cross-section of 0.08mm² up to 1.5mm².

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Function</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>---</td>
<td>---</td>
<td>not connected</td>
</tr>
<tr>
<td>2</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>4</td>
<td>Sys DC 24V</td>
<td>I</td>
<td>DC 24V for electronic section supply</td>
</tr>
<tr>
<td>5</td>
<td>---</td>
<td>---</td>
<td>not connected</td>
</tr>
<tr>
<td>6</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>7</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>8</td>
<td>Sys 0V</td>
<td>I</td>
<td>GND for electronic section supply</td>
</tr>
</tbody>
</table>

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

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

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

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

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

To attach the shield the mounting of shield bus carriers are necessary. The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields.

1. Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.

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

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

2.5.2 Wiring periphery modules

Terminal module terminals

CAUTION!
Do not connect hazardous voltages!

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

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

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

Wiring procedure

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

1. Insert a suited screwdriver at an 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$^2$ up to 1.5mm$^2$
3. By removing the screwdriver, the wire is securely fixed via the spring contact to the terminal.

Shield attachment

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

To attach the shield, mounting of shield bus carriers are necessary. The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields.

1. Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.
2. Put your shield bus into the shield bus carrier.
3. Attach the cables with the accordingly stripped cable screen and fix it by the shield clamp with the shield bus.

2.5.3 Wiring power modules

Terminal module terminals

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

Data

- $U_{\text{max}}$ 30V DC
- $I_{\text{max}}$ 10A
- Cross section $0.08 \ldots 1.5\text{mm}^2$ (AWG 28 ... 16)
- Stripping length 10mm
Wiring procedure

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

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

2. Insert the stripped end of wire into the round opening. You can use wires with a cross section of 0.08mm² up to 1.5mm².

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

Standard wiring

(1) DC 24V for power section supply I/O area (max. 10A)
(2) DC 24V for electronic power supply bus coupler and I/O area
For wires with a core cross-section of 0.08mm² up to 1.5mm².

<table>
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<td>not connected</td>
</tr>
<tr>
<td>2</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>4</td>
<td>Sys DC 24V</td>
<td>I</td>
<td>DC 24V for electronic section supply</td>
</tr>
<tr>
<td>5</td>
<td>---</td>
<td>---</td>
<td>not connected</td>
</tr>
<tr>
<td>6</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>7</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>8</td>
<td>Sys 0V</td>
<td>I</td>
<td>GND for electronic section supply</td>
</tr>
</tbody>
</table>

I: Input

---

CAUTION!

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

---

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

---

Fusing

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

State of the electronic power supply via LEDs

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

- If the 10A for the power section supply is no longer sufficient, you may use the power module with the order number 007-1AB00. So you have also the possibility to define isolated groups.
- The power module with the order number 007-1AB10 is to be used if the 3A for the electronic power supply at the backplane bus is no longer sufficient. Additionally you get an isolated group for the DC 24V power section supply with max. 4A.
- By placing the power module 007-1AB10 at the following backplane bus modules may be placed with a sum current of max. 2A. Afterwards a power module is to be placed again. To secure the power supply, the power modules may be mixed used.

**Power module 007-1AB00**

![Diagram of Power module 007-1AB00]

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

**Power module 007-1AB10**

![Diagram of Power module 007-1AB10]

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

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

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

To attach the shield the mounting of shield bus carriers are necessary. The shield bus carrier (available as accessory) serves to carry the shield bus to connect cable shields.

1. Each System SLIO module has a carrier hole for the shield bus carrier. Push the shield bus carrier, until they engage into the module. With a flat mounting rail for adaptation to a flat mounting rail you may remove the spacer of the shield bus carrier.

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

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

2.6 Demounting

2.6.1 Demounting bus coupler

Proceeding

**CAUTION!**

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

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

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

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

5. **Pull the bus coupler forward.**

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

7. **To mount the bus coupler put it to the left periphery module and push it, guided by the stripes, to the mounting rail.**

8. **Turn all the locking lever downward, again.**
9. Plug again the electronic module, which you have removed before.
10. Wire your bus coupler.
   ⇒ Now you can bring your system back into operation.

2.6.2 Demounting periphery modules

Proceeding

Exchange of an electronic module

1. Power-off your system.
2. Pull
3. 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.
4. For installation plug the new electronic module guided by the strips at the lower side until this engages to the terminal module.
   ⇒ Now you can bring your system back into operation.

Exchange of a periphery module

1. Power-off your system.
2. Remove if exists the wiring of the module.
3. Press the unlocking lever at the lower side of the just mounted right module and pull it forward.

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

5. Pull the module.

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

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

8. Turn the locking lever downward, again.

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

10. Wire your module.
    ⇒ Now you can bring your system back into operation.

---

**Exchange of a module group**

1. Power-off your system.

2. Remove if exists the wiring of the module group.

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

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

5. Pull the module group forward.

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

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

8. Turn all the locking lever downward, again.

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

10. Wire your module group.

⇒ Now you can bring your system back into operation.

### 2.6.2.1 Easy Maintenance

**Overview**

*Easy Maintenance* means the support for adding and removing modules during operation without having to restart the system. There is the following distinction:

- *Easy Maintenance at active* bus connection
- *Easy Maintenance at passive* bus connection

⇒ Chap. 4.6 ‘Easy Maintenance’ page 65
2.7 Trouble shooting - LEDs

General

Each module has the LEDs RUN and MF on its front side. Errors or incorrect modules may be located by means of these LEDs.

In the following illustrations flashing LEDs are marked by ☼.

Sum current of the electronic power supply exceeded

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

Reason: The maximum current for the electronic power supply is exceeded.

Remedy: As soon as the sum current of the electronic power supply is exceeded, always place the power module 007-1AB10. Chap. 2.5.3 'Wiring power modules' 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 VIPA components are developed for the deployment in industrial environments and meets high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

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 for the System SLIO

### Conformity and approval

<table>
<thead>
<tr>
<th>Conformity</th>
<th>Approval</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 2014/35/EU</td>
<td>UL</td>
<td>RoHS 2011/65/EU</td>
</tr>
<tr>
<td>Low-voltage directive</td>
<td>Refer to Technical data</td>
<td>Restriction of the use of certain hazardous substances in electrical and electronic equipment</td>
</tr>
<tr>
<td>2014/30/EU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMC directive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Protection of persons and device protection

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Electrical isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>IP20</td>
</tr>
</tbody>
</table>

- to the field bus: electrically isolated
- to the process level: electrically isolated
- Insulation resistance: -
- Insulation voltage to reference earth: -

<table>
<thead>
<tr>
<th>Inputs / outputs</th>
<th>Protective measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC / DC 50V, test voltage AC 500V</td>
<td>against short circuit</td>
</tr>
</tbody>
</table>

### Environmental conditions to EN 61131-2

<table>
<thead>
<tr>
<th>Climatic</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage / transport</td>
<td>Horizontal installation hanging</td>
</tr>
<tr>
<td></td>
<td>Vertical installation</td>
</tr>
<tr>
<td></td>
<td>Air humidity</td>
</tr>
<tr>
<td>Air humidity max.</td>
<td>Pollution Degree of pollution 2</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Installation altitude max.</td>
</tr>
<tr>
<td>Oscillation EN 60068-2-6</td>
<td>1g, 9Hz ... 150Hz</td>
</tr>
<tr>
<td>Shock</td>
<td>EN 60068-2-27 15g, 11ms</td>
</tr>
</tbody>
</table>
# Mounting conditions

<table>
<thead>
<tr>
<th>Mounting place</th>
<th>In the control cabinet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting position</td>
<td>Horizontal and vertical</td>
</tr>
</tbody>
</table>

## EMC

<table>
<thead>
<tr>
<th>Emitted interference</th>
<th>EN 61000-6-4</th>
<th>Class A (Industrial area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise immunity zone B</td>
<td>EN 61000-6-2</td>
<td>Industrial area</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-2</td>
<td>ESD</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-3</td>
<td>HF field immunity (casing)</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-6</td>
<td>HF conducted</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-4</td>
<td>Burst, degree of severity 3</td>
</tr>
<tr>
<td></td>
<td>EN 61000-4-5</td>
<td>Surge, degree of severity 3</td>
</tr>
</tbody>
</table>

* 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
- Ethernet coupler with Modbus/TCP protocol for max. 64 peripheral modules
- X1/X2: RJ45 interface 100BaseTX, 10BaseT as switch for communication via Modbus/TCP
- I/O access via up-to 8 stations
- Integrated Web server
- Online parametrization via Web server
- Automatic polarity and speed recognition (auto negotiation)
- Automatic recognition of parallel or crossed cable (auto crossover)
- Supports Easy Maintenance
- Network LEDs for link/activity and speed
- Status LEDs for Ready and Error

Order data

<table>
<thead>
<tr>
<th>Type</th>
<th>Order number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IM 053MT</td>
<td>053-1MT01</td>
<td>Modbus/TCP Ethernet coupler for System SLIO</td>
</tr>
</tbody>
</table>
3.2 Structure

053-1MT01

1. Locking lever terminal module
2. Labelling strip bus interface
3. LED status indication bus interface
4. Labelling strip power module
5. LED status indication power module
6. Backplane bus
7. DC 24V power section supply
8. Power module
9. X1: RJ45 interface for communication via Modbus/TCP (switch)
10. X2: RJ45 interface for communication via Modbus/TCP (switch)
11. Unlocking lever power module
12. Bus interface
13. Terminal
14. Address switch

3.2.1 Interfaces

CAUTION!

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

Here you may only exchange the electronic module!
For wires with a core cross-section of 0.08mm² up to 1.5mm².

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Function</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>---</td>
<td>---</td>
<td>not connected</td>
</tr>
<tr>
<td>2</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>4</td>
<td>Sys DC 24V</td>
<td>I</td>
<td>DC 24V for electronic section supply</td>
</tr>
<tr>
<td>5</td>
<td>---</td>
<td>---</td>
<td>not connected</td>
</tr>
<tr>
<td>6</td>
<td>DC 24V</td>
<td>I</td>
<td>DC 24V for power section supply</td>
</tr>
<tr>
<td>7</td>
<td>0V</td>
<td>I</td>
<td>GND for power section supply</td>
</tr>
<tr>
<td>8</td>
<td>Sys 0V</td>
<td>I</td>
<td>GND for electronic section supply</td>
</tr>
</tbody>
</table>

I: Input

2x 8pin RJ45 jacks
- The RJ45 jacks serve as interface for connection to Ethernet to communicate via Modbus/TCP.
- The interface is designed as switch.
- So that you can access your System SLIO modules via Modbus/TCP, you have to assign valid IP address data to the IM 053-1MT01. Chap. 4.3 ‘Setting the IP address’ page 49
Changes to the address switch are only accepted after a power cycle or an automatic reset. Changes during the normal operation are not recognized!

Configurations set via web server are only valid or active after a power cycle or an automatic reset if all switches of the address switch are in position "0"!

The address switch serves for the following settings:

- Selection of the address usage
- Presetting of the IP address
- Activation of the web server

### Position | Description
--- | ---
1 | DHCP client
   - 0 = disabled
   - 1 = enabled

2 | 1
   - $2^0 = 1$

3 | 2
   - $2^1 = 2$

4 | 4
   - $2^2 = 4$

5 | 8
   - $2^3 = 8$

6 | 16
   - $2^4 = 16$

7 | 32
   - $2^5 = 32$

8 | Web server
   - 0 = disabled
   - 1 = enabled

**IP address data for Modbus/TCP:**
Subnet mask: 255.255.255.0
IP address: 192.168.1.x
with $x = \text{decimal value from position 2} \ldots \text{7}$

**Ranking for the IP address configuration**

- The switch for DHCP activation pos. 1 has the highest priority.
- If there is no DHCP server, the IP address (192.168.1.x) set at the switches pos. 2 ... 7 is used.
- If no address is set, i.e. all set to "0", the stored IP address (default 10.0.0.1) is used.

### Essential switch settings

<table>
<thead>
<tr>
<th>Position</th>
<th>State</th>
<th>Behavior at start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ... 7</td>
<td>0</td>
<td>Default setting</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>Via web server set configuration is valid (default 10.0.0.1). The web server is activated.</td>
</tr>
<tr>
<td>1 ... 8</td>
<td>0</td>
<td>Via web server set configuration is valid (default 10.0.0.1). The web server is de-activated.</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>DHCP client is activated. The IP address data are requested via DHCP. If there is no DHCP server, the IP address set at the switches (192.168.1.x) will be used.</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>DHCP client is de-activated.</td>
</tr>
</tbody>
</table>
### 3.2.2 LEDs

#### LEDs power module

<table>
<thead>
<tr>
<th>Position</th>
<th>State</th>
<th>Behavior at start-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1</td>
<td>Web server is activated.</td>
</tr>
<tr>
<td>2 ... 7</td>
<td>[1 ... 63]</td>
<td>IP address data for Modbus/TCP:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Subnet mask: 255.255.255.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ IP address: 192.168.1.x</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with x = decimal value from position 2 ... 7</td>
</tr>
</tbody>
</table>

#### LEDs bus interface

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>green</td>
<td>Bus interface is power supplied</td>
</tr>
<tr>
<td>SF</td>
<td>red</td>
<td>System error: Error on System SLIO bus</td>
</tr>
<tr>
<td>MT</td>
<td>yellow</td>
<td>Maintenance</td>
</tr>
<tr>
<td>SB</td>
<td>green</td>
<td>Communication via System SLIO bus</td>
</tr>
<tr>
<td>MB</td>
<td>green</td>
<td>Communication via Modbus/TCP</td>
</tr>
<tr>
<td>SPD</td>
<td>green</td>
<td>Transfer speed (100Mbit/s or 10Mbit/s)</td>
</tr>
<tr>
<td>L/A1</td>
<td>green</td>
<td>Port 1: Link/Activity</td>
</tr>
<tr>
<td>L/A2</td>
<td>green</td>
<td>Port 2: Link/Activity</td>
</tr>
</tbody>
</table>
## Hardware description

### Structure > LEDs

<table>
<thead>
<tr>
<th>PWR</th>
<th>SF</th>
<th>MT</th>
<th>SB</th>
<th>MB</th>
<th>SPD</th>
<th>L/A(1/2)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="yellow" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Init</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>DHCP discovery</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Update config</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Run</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Commissioning</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Maintenance</strong></td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Firmware update</strong>¹</td>
</tr>
<tr>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="red" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><img src="image" alt="green" /></td>
<td><strong>Error</strong></td>
</tr>
</tbody>
</table>

### Operating modes 46

| X | X | X | X | X | X | X | The Ethernet coupler is power supplied. |
| X | X | X | X | X | X | X | The Ethernet coupler communicates without error via Ethernet |
| X | X | X | X | X | X | X | No Modbus/TCP communication is possible |
| X | X | ![2Hz](image) | X | X | X | BASP (Bescheiver-Ausgabe-Sperre i.e. command output disable) is activated |
| X | X | ![2Hz](image) | X | X | X | Configuration is in progress |
| X | ![5Hz](image) | X | X | X | X | Ethernet coupler is located, the identification was initiated by the user and takes 10s. |
| X | X | X | X | X | X | Speed: 100MBit/s |
| X | X | X | X | X | X | Speed: 10MBit/s |
| X | X | X | X | X | X | Error: Power OFF-ON required |

¹ LEDS blink alternately
### 3.3 Technical data

<table>
<thead>
<tr>
<th>Order no.</th>
<th>053-1MT01</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>IM 053MT</td>
</tr>
<tr>
<td><strong>Module ID</strong></td>
<td>-</td>
</tr>
</tbody>
</table>

#### Technical data power supply

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (rated value)</td>
<td>DC 24 V</td>
</tr>
<tr>
<td>Power supply (permitted range)</td>
<td>DC 20.4...28.8 V</td>
</tr>
<tr>
<td>Reverse polarity protection</td>
<td>✓</td>
</tr>
<tr>
<td>Current consumption (no-load operation)</td>
<td>95 mA</td>
</tr>
<tr>
<td>Current consumption (rated value)</td>
<td>0.95 A</td>
</tr>
<tr>
<td>Inrush current</td>
<td>3.9 A</td>
</tr>
<tr>
<td>$I^2t$</td>
<td>0.14 A²s</td>
</tr>
<tr>
<td>Max. current drain at backplane bus</td>
<td>3 A</td>
</tr>
<tr>
<td>Max. current drain load supply</td>
<td>10 A</td>
</tr>
<tr>
<td>Power loss</td>
<td>3 W</td>
</tr>
</tbody>
</table>

#### Status information, alarms, diagnostics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Status display</td>
<td>yes</td>
</tr>
<tr>
<td>Interrupts</td>
<td>yes, parameterizable</td>
</tr>
<tr>
<td>Process alarm</td>
<td>yes, parameterizable</td>
</tr>
<tr>
<td>Diagnostic interrupt</td>
<td>yes, parameterizable</td>
</tr>
<tr>
<td>Diagnostic functions</td>
<td>yes, parameterizable</td>
</tr>
<tr>
<td>Diagnostics information read-out</td>
<td>possible</td>
</tr>
<tr>
<td>Supply voltage display</td>
<td>green LED</td>
</tr>
<tr>
<td>Service Indicator</td>
<td>yellow LED</td>
</tr>
<tr>
<td>Group error display</td>
<td>red SF LED</td>
</tr>
<tr>
<td>Channel error display</td>
<td>none</td>
</tr>
</tbody>
</table>

#### Hardware configuration

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Racks, max.</td>
<td>1</td>
</tr>
<tr>
<td>Modules per rack, max.</td>
<td>64</td>
</tr>
<tr>
<td>Number of digital modules, max.</td>
<td>64</td>
</tr>
<tr>
<td>Number of analog modules, max.</td>
<td>64</td>
</tr>
</tbody>
</table>

#### Communication

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fieldbus</td>
<td>Modbus / TCP/IP</td>
</tr>
<tr>
<td>Type of interface</td>
<td>Ethernet 10/100 MBit</td>
</tr>
<tr>
<td>Connector</td>
<td>2 x RJ45</td>
</tr>
<tr>
<td>Topology</td>
<td>-</td>
</tr>
<tr>
<td>Electrically isolated</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Order no.</strong></td>
<td><strong>053-1MT01</strong></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Number of participants, max.</td>
<td>-</td>
</tr>
<tr>
<td>Node addresses</td>
<td>-</td>
</tr>
<tr>
<td>Transmission speed, min.</td>
<td>10 Mbit/s</td>
</tr>
<tr>
<td>Transmission speed, max.</td>
<td>100 Mbit/s</td>
</tr>
<tr>
<td>Address range inputs, max.</td>
<td>1 KB</td>
</tr>
<tr>
<td>Address range outputs, max.</td>
<td>1 KB</td>
</tr>
<tr>
<td>Number of TxPDOs, max.</td>
<td>-</td>
</tr>
<tr>
<td>Number of RxPDOs, max.</td>
<td>-</td>
</tr>
<tr>
<td>Supported profile</td>
<td>-</td>
</tr>
<tr>
<td>Supported transfer cycle</td>
<td>-</td>
</tr>
<tr>
<td>Cyclic data size per node</td>
<td>-</td>
</tr>
<tr>
<td>Max. Number of nodes</td>
<td>-</td>
</tr>
<tr>
<td>Supported communication method</td>
<td>-</td>
</tr>
<tr>
<td>Supported command &quot;Cyclic&quot;</td>
<td>-</td>
</tr>
<tr>
<td>Supported command &quot;Event driven&quot;</td>
<td>-</td>
</tr>
<tr>
<td>Supported command &quot;Message&quot;</td>
<td>-</td>
</tr>
</tbody>
</table>

**Datasizes**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input bytes</td>
<td>-</td>
</tr>
<tr>
<td>Output bytes</td>
<td>-</td>
</tr>
<tr>
<td>Parameter bytes</td>
<td>-</td>
</tr>
<tr>
<td>Diagnostic bytes</td>
<td>-</td>
</tr>
</tbody>
</table>

**Housing**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>PPE / PPE GF10</td>
</tr>
<tr>
<td>Mounting</td>
<td>Profile rail 35 mm</td>
</tr>
</tbody>
</table>

**Mechanical data**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (WxHxD)</td>
<td>48.5 mm x 109 mm x 76.5 mm</td>
</tr>
<tr>
<td>Net weight</td>
<td>160 g</td>
</tr>
<tr>
<td>Weight including accessories</td>
<td>160 g</td>
</tr>
<tr>
<td>Gross weight</td>
<td>175 g</td>
</tr>
</tbody>
</table>

**Environmental conditions**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>0 °C to 60 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-25 °C to 70 °C</td>
</tr>
</tbody>
</table>

**Certifications**

<table>
<thead>
<tr>
<th>Certification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL certification</td>
<td>yes</td>
</tr>
<tr>
<td>KC certification</td>
<td>yes</td>
</tr>
</tbody>
</table>
4 Deployment

4.1 Basics

General

Typical field bus systems are divided into master and slave systems. Master systems are CPs, coupled to a CPU, allowing remote programming res. visualization of the according CPU as well as the data transfer between several TCP/IP participants. Slave systems on the other hand are "data collectors" that deliver the I/O data of the connected modules to the requesting master. The Ethernet coupler described in this chapter is a slave system. For the communication happens via TCP/IP, the slave system is referred to as server and a master as client. The VIPA Ethernet coupler allows you to connect up to 64 modules of your System SLIO via Ethernet. Up to 8 clients may communicate simultaneously with the Ethernet coupler.

Automatic address mapping

After startup of the Ethernet coupler the modules connected to the backplane bus are determined and mapped to his address area. With address mapping there is an area for input and an area for output data. Using the integrated Web server, you have access to the current mapping. Here you can also parameterize your modules.

Communication

The Ethernet coupler is connected with the modules via the backplane bus. It collects their data and places this as "server" (slave) at the disposal of the superordinated "client" (master system). The communication happens via TCP/IP with leading Modbus/TCP protocol. Vice versa, the Ethernet coupler receives the data, addressed to it by IP address and port, and transfers it to its output periphery.

Protocols

Protocols define rules or standards for communication. The so called ISO/OSI layer model is generally accepted for the standardization of computer communication. The layer model is based upon seven layers with guidelines for the deployment of hard- and software.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Function</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 7</td>
<td>Application Layer (application)</td>
<td>Modbus/TCP</td>
</tr>
<tr>
<td>Layer 6</td>
<td>Presentation Layer (presentation)</td>
<td></td>
</tr>
<tr>
<td>Layer 5</td>
<td>Session Layer (session)</td>
<td></td>
</tr>
<tr>
<td>Layer 4</td>
<td>Transport Layer (transport)</td>
<td>TCP</td>
</tr>
<tr>
<td>Layer 3</td>
<td>Network Layer (network)</td>
<td>IP</td>
</tr>
<tr>
<td>Layer 2</td>
<td>Data Link Layer (security)</td>
<td></td>
</tr>
<tr>
<td>Layer 1</td>
<td>Physical Layer (bit transfer)</td>
<td></td>
</tr>
</tbody>
</table>

Telegram structure

```
MAC/DLL   IP    TCP   API ...
```

14 Byte 20 Byte 20 Byte Length depends on protocol

MAC/DLL

While the Ethernet physics covers with its standard signal levels Layer 1, MAC/DLL covers the conditions of the security layer (Layer 2). With MAC (Medium Access Control) / DLL (Data Link Layer) the communication happens at the lowest Ethernet level using MAC addresses. Every Ethernet communication participant has a MAC address that must be unique at the network. The deployment of MAC addresses specifies source and destination unambiguously.
The Internet Protocol covers the network layer (layer 3) of the ISO/OSI layer model. The main purpose of IP is to send data packages from one station to another, passing several other stations. This data packages are referred to as datagrams. The IP does neither serve the according sequence nor the deliverance at the receiver. For the unambiguous distinction between sender and receiver, 32bit addresses are used (IP addresses) that are normally written in four octets of each 8bit, e.g. 172.16.192.11. One octet may represent numbers between 0 and 255. A part of the address specifies the network, the rest identifies the single stations in the network. The proportions of network part and station part is floating and depends on the network size.

TCP

The TCP (Transmission Control Protocol) puts directly upon the IP and covers therefore the transport layer (layer 4) of the ISO/OSI layer model. TCP is a connection orientated end-to-end protocol and serves the logical connection between two partners. TCP ensures the sequential correct and reliable data transfer. Every datagram is preceded by a header of at least 20 octets that contains, among others, the serial number for the according sequence. This causes that within a network, the single datagrams may reach their destination on different ways.

API

API means Application Programming Interface. API covers the conditions of the Application Layer (Layer 7). Here, the header and user data of the according protocols are stored. The Ethernet coupler uses the Modbus/TCP protocol, described further below.

Modbus/TCP

Modbus/TCP is a Modbus-RTU protocol, put upon TCP/IP. The Modbus protocol is a communication protocol supporting a hierarchic structure with one master and several slaves. Modbus/TCP extends Modbus to a client server communication where several client may access a server. For the addressing happens by means of the IP addresses, the address integrated in the Modbus telegram irrelevant. Furthermore, the check sum is not required because the sequence insurance happens via TCP/IP. After the request of a client, this awaits the answer of the server for a configurable time. Modbus/TCP exclusively uses the RTU format. Every byte is transferred as one sign. This enables a higher data pass-through than the Modbus-ASCII format. The RTU time supervision is omitted for the header contains the size of the telegram length to be received. Data that are transferred via Modbus/TCP may contain bit and word information. At bit chains, the highest bit is send first, i.e. in a word it is at the most left position. At words, the highest byte is send first. The access to a Modbus slave happens via function codes that are described in detail in this chapter further below.

4.2 Operating modes

Overview

The Ethernet coupler can assume operating states which it also indicates via its LEDs. These states are described below.
After PowerON, the Ethernet coupler is in **Init** state. Here, the Ethernet coupler performs a self-test and the system is initialized. If successful, the Ethernet coupler automatically switches to either **DHCP discovery** or **Update config**, depending on the setting of the address switch.

**DHCP discovery**

The Ethernet coupler changes to this state as soon as an IP configuration is requested via DHCP. In this state, the Modbus/TCP server is stopped and BASP (Befehls-Ausgabe-Sperre, i.e. command output dis-able) becomes active and thus process data communication is stopped. After assigning the IP address data, it automatically changes to the state **Update config**. If no IP address could be determined via DHCP, the Ethernet coupler automatically restarts and changes to the **Init** state.
In this state, the Ethernet coupler checks the module configuration and transfers the corresponding parameters to the connected modules. If no errors occur, the Ethernet coupler automatically switches to Run.

In the Run state, BASP is deactivated and process data communication is started via the System SLIO backplane bus. The Ethernet coupler copies the output data received from the client (master system) to its output modules and forwards the input values to the client.

Only in this state is it possible to save and delete the configuration in the Ethernet coupler. Here you can parametrize the Ethernet coupler and the connected modules via the web server. This will disable BASP. Only in this state is write access to the process output data possible via the web server. In this state Modbus/TCP requests are returned with an error. Also, you can only perform a firmware update via the web server in this state. For the firmware update, the Ethernet coupler switches to the state Firmware update.

Please note that the outputs are reset when changing to and from the "Commissioning" state.

In this state, a firmware update is performed. This activates BASP and stops the process data communication. Modbus/TCP requests are returned with an error. After the firmware update a restart takes place and the Ethernet coupler changes to the state Init. If no firmware update could be done, the Ethernet coupler changes to the state Update config.

Condition that exists when at least one of the following criteria is met:

- Configuration not valid
- Parametrization is incorrect
- Ethernet cable was removed
- Timeout on Modbus/TCP communication

This activates BASP and stops the process data communication. Modbus/TCP requests are returned with the corresponding error.
4.3 Setting the IP address

Setting possibilities

- Setting the IP address via web page
- Setting the IP address via address switch
- Setting the IP address via SPEED7 Modbus Tool

- With the IM 053MT you should always use a static IP address.
- If the IM 053MT is configured via DHCP, this must provide a valid gateway address, otherwise the IP address is not accepted!
- When using a DHCP server, make sure that the IP address assignment (lease) in the DHCP server is not changed. Otherwise, after a restart, the IM 053MT cannot be found by the master.

4.3.1 Setting the IP address via web page

Delivery state

On delivery the Modbus/TCP coupler has the following settings:

- Password and module parameter are deleted.
- On delivery, the switches pos. 2 ... 7 of the address switch are set to '0'.
  - Subnet mask: 255.255.255.0
  - IP address: 10.0.0.1

If the systems are in the same IP circle, you can use this address to access the web page.

4.3.2 Setting the IP address via address switch

Ranking for the IP address configuration

- The switch for DHCP activation pos. 1 has the highest priority.
- If there is no DHCP server, the IP address (192.168.1.x) set at the switches pos. 2 ... 7 is used.
- If no address is set, i.e. all switches pos. 2 ... 7 are set to "0", the stored IP address (default 10.0.0.1) is used.

If your systems are in the same IP circle, you can access the IM 053MT via the IP address.

4.3.3 Setting the IP address via SPEED7 Modbus Tool

The Speed7 Modbus Tool can be found in the service area of www.vipa.com at 'Downloads ➔ Software ➔ Parametrization Software'. With the SPEED7 Modbus Tool the Ethernet coupler may be identified within the network, assigned with IP address data or reset to factory settings. Every Ethernet coupler, which was found in the local network by means of a broadcast, is listed. With several Ethernet coupler in the system the search may be limited by product name, serial number or MAC address. For the search, your systems do not have to be in the same IP circle.
4.4 Access to the Ethernet coupler

4.4.1 Overview

The following illustration shows the Ethernet coupler access possibilities.
4.4.2 SPEED7 Modbus Tool

The Speed7 Modbus Tool may be found in the service area of www.vipa.com via ‘Downloads ➔ Software ➔ Parameterize tools’. Load and execute this program. With the SPEED7 Modbus Tool the Ethernet coupler may be identified within the network, assigned with IP address data or reset to factory settings. In the following these functions are more described.

Searching the Ethernet coupler

Every Ethernet coupler, which was found in the local network by means of a broadcast, is listed. With several Ethernet coupler in the system the search may be limited by product name, serial number or MAC address.

Localizing the Ethernet coupler

With [Locate] a listed Ethernet coupler may be localized. During the localization the MT LED flashes for 10s on the corresponding Ethernet coupler for clear identification.

IP address assignment

With [Assign IP] you may assign to a listed Ethernet coupler IP address data. You get valid IP address parameters from your system administrator.

If the IM 053-1MT01 has been protected with a password via the integrated web server, a [WP] (WriteProtected) is attached to the product name. In this case, a new IP assignment via VSCP is not possible. ≡ Chap. 4.4.3 ‘Web server’ page 52

System dependent, a password query is not possible with the SPEED7 Modbus Tool.

Factory reset

A factory reset is only possible during the localization within 10s and takes place with the following approach:

1. Chose from the search list of Ethernet couplers the Ethernet coupler, which is to be reset to factory settings.

2. Click at [Locate].
   ⇒ The MT LED of the corresponding IM 053-1MT01 flashes.

3. For the factory reset now you have to click at [Factory RESET] within 10s.
   ⇒ The Ethernet coupler is reset to delivery state.

Delivery state:

- Ethernet coupler has default parameters
- Password and module parameters are deleted
- IP address: 10.0.0.1
- Subnet mask: 255.255.255.0
4.4.3 Web server

4.4.3.1 Access

Delivery state

On delivery the Modbus/TCP coupler has the following settings:

- Password and module parameter are deleted.
- On delivery, the switches pos. 2 … 7 of the address switch are set to 0.
  - Subnet mask: 255.255.255.0
  - IP address: 10.0.0.1

If the systems are in the same IP circle, you can use this address to access the web page.

Changing the IP address

To change the IP address you have the following possibilities:

- Changing by means of the SPEED7 Modbus Tool
- By shortly changing the IP address of the PC network card (described below).

To change the IP address of the Modbus/TCP coupler the communicating systems must be in the same IP circuit. For this you have to shortly change the IP address of your PC network card. Please consider that this is only possible as a user with administrative rights. Otherwise, contact your system administrator. The adaptation happens with the following proceeding:

1. Connect your Modbus/TCP coupler via Ethernet with the network card of your PC and switch-on the power supply of the Modbus/TCP coupler.
2. Call the ‘Network setting’ of the ‘Control Panel’.
3. Open the ‘Properties’ of your network adapter and open the properties dialog of ‘Internet protocol TCP/IP’.
4. Write down the IP address settings.
5. Now enter an IP address, which differs in the last number of 10.0.0.1 such as 10.0.0.2 and the subnet mask 255.255.255.0. If IP address data just exist, you can add the new as additional data.
6. Confirm your input and close all the dialogs.
   - Now you can access the web server of the Modbus/TCP coupler. Here you have the possibility to change the IP address data via the register ‘IP’.
7. Open, after you have adjusted the IP address data at the Modbus/TCP coupler via the web server, on your PC the properties dialog of ‘Internet protocol TCP/IP’ again, enter the original IP address data, confirm your entries and close all the dialogs.
   - If the systems are in the same IP circle, you can access the web server of the Modbus/TCP coupler.
4.4.3.2 Structure of the web page of the web server

The web page is built dynamically and depends on the number of modules, which are connected to the Ethernet coupler.

1. Module list: IM 053MT and System SLIO modules in installed order
2. Functions for the module selected in the module list
3. Information respectively input area of the corresponding function

4.4.3.3 Web page of the selected Ethernet coupler

Tab: **Info**

Here order number, serial number and firmware version of the IM 053MT are listed.

Tab: **Data**

Here, the process data of the IM 053MT and of the modules are shown.
Here you can change the current parameters of the IM 053MT.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Data type</th>
<th>Area</th>
<th>Default value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link monitoring</td>
<td>BOOL</td>
<td>TRUE/FALSE</td>
<td>FALSE</td>
<td>Link monitoring Ethernet</td>
</tr>
<tr>
<td>Communication timeout [ms]</td>
<td>UINT_32</td>
<td>0 … 30000</td>
<td>0</td>
<td>Timeout Ethernet communication</td>
</tr>
<tr>
<td>IO cycle [µs]</td>
<td>UINT_32</td>
<td>0</td>
<td>1000</td>
<td>System SLIO bus cycle</td>
</tr>
</tbody>
</table>

- **Link monitoring**
  - As soon as both Ethernet cables are pulled with enabled Link monitoring, the communication is finished by the IM 053MT, BASP (Befehls-Ausgabe-Sperre, i.e. command output disable) is activated and this is indicated with flashing SB LED. Link monitoring reacts only when both Ethernet cables are pulled.

- **Communication timeout**
  - At Communication Timeout [ms] you can specify a timeout value for Ethernet communication in ms.
  - If there is no Modbus/TCP communication for the specified time, BASP is set on the System SLIO bus.
  - With the value 0, you can deactivate the time monitoring.

- **IO cycle**
  - With IO cycle, you can specify the cycle for the System SLIO bus within which the I/O image is to be refreshed.
  - With the value 0 you can set the maximum possible cycle time (no delay).

**Tab: Diagnosis**

- **Configuration State**
  - Deviations between the setpoint and actual configuration are shown here (OK: no deviation).

- **Diagnosis Entries**
  - Here all pending diagnostic messages are shown.

- **Diagnosis Buffer**
  - Here the content of the diagnostics buffer is listed.

**Tab: Security**

All functions for the writing access to the Ethernet coupler can be secured by a password.

**Tab: IP**

Here you may assign to your Ethernet coupler IP address data. For valid IP address data please contact your system administrator.
On delivery the Modbus/TCP coupler has the following settings:
- Password and module parameter are deleted.
- On delivery, the switches pos. 2 … 7 of the address switch 40 are set to ‘0’.
  - Subnet mask: 255.255.255.0
  - IP address: 10.0.0.1

If the systems are in the same IP circle, you can use this address to access the web page P address allows you to access the web page of the integrated web server 52 and change the IP address data accordingly via tab ‘IP’.

Tab: Firmware

With this function you can perform a firmware update.

**CAUTION!**
- When installing a new firmware you have to be extremely careful. Under certain circumstances you may destroy the IM 053-1MT01, for example if the voltage supply is interrupted during transfer or if the firmware file is defective. In this case, please call the YASKAWA Hotline!
- Please regard that the version of the update firmware has to be different from the existing firmware otherwise no update is executed.

Please note that a firmware update is only possible if the Ethernet coupler is in the Commissioning state.

1. You can find current firmware versions at www.vipa.com in the service area.
2. Select the Px000326.pkg file for download and load it into your working directory.
3. Select the Configuration tab and activate ‘Activate Commissioning mode’.
4. Select the ‘Firmware’ tab.
5. Navigate to your work directory and load the file Px000326.pkg to the IM 053-1MT01.

  - After the package has been completely transferred to the IM 053-1MT01 the firmware update starts automatically. Here the SF and MT LEDs blink.
  - During this process, the IM 053-1MT01 must never be disconnected from the power supply!

6. The firmware update of the IM 053-1MT01 is finished, when the LEDs SF and MT are no longer blinking.
  ⇒ After the firmware update a restart takes place and the Ethernet coupler changes to Init state. If no firmware update could be done, the Ethernet coupler changes to the state Update config.

Tab: Configuration

Each System SLIO module has an unique identification number - module ID. The modules are listed on the web server by means of their module ID. As soon as a module is configured, the ID of the corresponding module is listed. In this dialog field you have the possibility to store the current module configuration or to import a module configuration. With [Delete] the parameterization of all the modules may be deleted in the Ethernet coupler.
Activate Commissioning mode
- With [Activate], the Ethernet coupler enters the Commissioning state.
  - When changing to the "Commissioning" state, all outputs are reset.
  - BASP (Befehlsausgabesperre i.e. command output disable) is not activated, i.e. all module outputs can be controlled and the inputs can be read.
- In the Commissioning state you have the following options:
  - Outputs can be set via the web page in the 'Data' tab of the selected module.
  - Parameters can be written via the web page in the 'Parameter' tab of the selected module.
  - You can perform a firmware update.
- With [Deactivate] you leave the Commissioning state
  - When leaving Commissioning all outputs are reset.
  - BASP is activated, i.e. all module outputs are switched off and the inputs are not read.

**CAUTION!**
- Please consider that controlling of output values represents a potentially dangerous condition.
- As long as Commissioning state is activated, set variables retain their value.
- Commissioning state should only be used for test purposes respectively for troubleshooting.

Export Station Configuration
- With [Save] a window is opened and shows the configuration as XML. Select 'File ➔ Safe as' and save the current configuration as XML file.

Import Station and Modules Configuration
- Select with [Search...] the according XML file and load this with [Load]. While loading the parameters of the IM 053MT and the modules are loaded.

Import Modules Configuration
- Select with [Search...] the according XML file and load this with [Load]. While loading only the parameters of the modules are loaded. The parameters of the IM 053MT further exist.

Save Configuration of all Modules
- With [Save] the current configuration is stored in the IM 053MT. If the current module ID deviates from the just configured module ID of the stored configuration of the IM 053MT after a system start-up, the IM 053MT does not go into RUN and shows the error on its web server.

Delete Configuration of all Modules
- With [Delete] the configuration in the IM 053MT may be deleted.

*Only there is a configuration for a module, this may be used to check preset and current configuration. If the current configuration differs from the preset (e.g. module was removed) the system reports an error and does not go to RUN. If there is no preset module configuration and the current configuration is changed during operation, the IM 053MT performs a restart and switches again to RUN.*
4.4.3.4 Web page with selected module

### Tab: Info
Here order number, serial number and firmware version of the according module are listed.

### Tab: Data
At Data the states of the inputs respectively outputs are listed. In addition, you can directly control the outputs of the corresponding module.

### Tab: Parameter
If available the parameter data of the corresponding module may be shown and changed if necessary.

### Tab: Diagnosis
- Configuration State
  - The current configuration status is shown here.
- Diagnosis Entries
  - Here all pending diagnostic messages are shown.
- Diagnosis Buffer
  - Here the content of the diagnostics buffer is listed.

### Expert View
[Expert View] takes you to the advanced "Expert View".
4.4.4 C-/Socket programming

The Modbus/TCP server is accessed via port 502. Via simple C program it is possible to transfer data between PC and Ethernet coupler with Modbus/TCP. For the deployment of the Ethernet couplers at a PC you should have a thorough knowledge in C programming, especially in socket programming. In the following the steps of programming are shown.

1. Start Microsoft Socket System
   - `WSAStartup (wVersionRequested, &wsaData);`

2. Reserve Socket resources for TCP
   - `m_lsock = socket (AF_INET, SOCK_STREAM, 0);`

3. Establish connection to external device
   - `SockAddr.sin_port = htons (m_wPort);SockAddr.sin_addr.S_un.S_addr = inet_addr (m_szIpAddress);connect (m_lsock, (LPSOCKADDR) &SockAddr, sizeof (SockAddr));`
4. For write res. read access you have to build up telegrams according to the protocol and store them in sndBuf. sndBufLen contains the number of bytes to be sent.

<table>
<thead>
<tr>
<th>Action</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send sndBuf (Request)</td>
<td>send(m_lsock, (char *)sndBuf, sndBufLen, 0);</td>
</tr>
<tr>
<td>Receive telegram in rcvBuf</td>
<td>recv(m_lsock, (char *)rcvBuf, sizeof(rcvBuf), 0);</td>
</tr>
</tbody>
</table>

5. Close socket again
   
   ```c
   closesocket(m_lsock);
   ```

### 4.4.5 Modbus utility

The access is via port 502 at the Modbus/TCP server. Modbus utility means all tools and programs that have a Modbus/TCP interface. For example, you may find the demo tool "ModbusScan32" from WinTech for download at www.win-tech.com.
4.5 Accessing the System SLIO

4.5.1 Overview

So that you can access the System SLIO modules with Modbus/TCP, you have to assign valid IP address data to the Ethernet coupler. *Chap. 4.4.3 Web server* page 52

In the following you will find the description of accessing the following System SLIO areas via Modbus/TCP.

- I/O area
- Parameter data
- Diagnostics data

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

**Usage of the modules CP 040-1BA00 respectively CP 040-1CA00**

- Depending on the system you may use a maximum of 16 System SLIO modules of CP 040-1xA00.
- Otherwise, this could cause bus errors!

**Please consider the System SLIO power and clamp modules do not have any module ID. These may not be recognized by the Ethernet coupler and so are not listed and considered during slot allocation. Further within Modbus/TCP the slots are designated as Modbus/TCP-Slot. The counting always begins with 0.**

4.5.2 Address-Mapping

To individually call the connected peripheral modules, certain addresses in the Ethernet coupler have to be assigned to them. For input and output area, the Ethernet coupler has an address range of each 1024 byte. The address allocation (also called mapping) happens automatically and may not be influenced. The mapping may be seen via the web server of the coupler.

**Rules**

At boot-up, the Ethernet coupler assigns automatically addresses for its in-/output periphery following these rules:

- All modules are mapped from left (Ethernet coupler) to right in ascending sequence starting with address 0.
- It is separated between in- and output area (if a module has in- and output data, these are stored at different addresses).
- There is no separation between digital and analog data. The Ethernet coupler creates cohere areas for in- and output data.

**A description of the in- and output areas that are occupied by a module is to find in the concerning module description. Please regard that modules that are occupying more than 1 byte like e.g. analog modules, are automatically stored starting with an even address.**
Example

[Diagram of VIPA System SLIO Deployment showing address mapping for Modbus/TCP-Slot 0 to 4, with input and output areas labeled separately.]
4.5.3 Accessing I/O area

Normally the access with Modbus happens by means of the ranges 0x, 1x, 3x and 4x. 0x and 1x gives you access to digital bit areas and 3x and 4x to analog word areas. For the VIPA IM 053-1MT01 is not differentiating digital and analog data, the following assignment is valid:

0x - Bit area for master output
   Access via function code 01h, 05h, 0Fh

1x - Bit area for master input
   Access via function code 02h

3x - Word area for master input
   Access via function code 04h, 17h

4x - Word area for master output
   Access via function code 03h, 06h, 10h, 16h, 17h
4.5.4 Accessing parameter data

- With the first start-up modules, which were parameterizable, operate with their default parameters.
- If you want to change parameters the Ethernet coupler respectively the corresponding modules may be parameterized via the integrated web server. Chap. 4.4.3 'Web server' page 52
- Here by means of the corresponding Modbus/TCP-Slot parameter may be viewed and changed.

Parametrization is only possible in the Commissioning state.

 Chap. 4.2 'Operating modes' page 46
4.5.5 Accessing diagnostics data

- If configured System SLIO modules provide interrupt data on failure.
- As soon as one or more modules report an interrupt, the interrupt data of the appropriate slot location is received and acknowledged by the Ethernet coupler. After that the bit assigned to the Modbus/TCP Slot is set in the internal alarm information image and the corresponding interrupt data are stored.

Please note that automatic acknowledgement (AutoAcknowledge) is always activated in the Ethernet coupler. This means that received interrupts are immediately acknowledged by the System SLIO bus. This can overwrite older interrupt data of the same module. Here you have to ensure a corresponding temporary storage.

- In System SLIO we distinguish between hardware interrupt and diagnostic interrupt.
- To distinguish there is a 64bit wide field (bit 0 = Modbus/TCP Slot 1 to bit 63 = Modbus/TCP Slot 64) in the diagnostic image each for hardware and diagnostics interrupt. Then for each slot 16byte hardware interrupt data or 32byte diagnostics interrupt data are following.
- To acknowledge the diagnostics and hardware interrupt status may be write accessed. The alarm data may only be read.

### Diagnostics

<table>
<thead>
<tr>
<th>Address</th>
<th>Function Code</th>
<th>Access to</th>
</tr>
</thead>
<tbody>
<tr>
<td>4001h ... 4040h</td>
<td>0x01</td>
<td>Bit access to hardware interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>4001h: Hardware interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x05</td>
<td>... 4040h: Hardware interrupt state Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>4001h ... 4200h</td>
<td>0x04</td>
<td>Word access to hardware interrupt data:</td>
</tr>
<tr>
<td></td>
<td>0x17</td>
<td>4001h ... 4008h: Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x0F</td>
<td>... 41F8h ... 4200h: Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>4001h ... 4008h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 1</td>
</tr>
<tr>
<td>4009h ... 4010h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 2</td>
</tr>
<tr>
<td>41F8h ... 4200h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>5001h ... 5040h</td>
<td>0x01</td>
<td>Bit access to diagnostics interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>5001h: Diagnostics interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x05</td>
<td>... 5040h: Diagnostics interrupt state Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>5001h ... 5400h</td>
<td>0x04</td>
<td>Word access to diagnostics interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x17</td>
<td>5001h ... 5010h: Diagnostics interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x0F</td>
<td>... 53F0h ... 5400h: Diagnostics interrupt state Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>5001h ... 5010h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 1</td>
</tr>
<tr>
<td>5011h ... 5020h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 2</td>
</tr>
<tr>
<td>53F0h ... 5400h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 64</td>
</tr>
</tbody>
</table>
4.6 Easy Maintenance

Overview

*Easy Maintenance* means the support for adding and removing System SLIO modules during operation without having to restart the system. There are the following behaviors:

- As soon as a module is removed, the IM 053-1MT01 detects this and switches automatically to *Maintenance* state. In this state, all input and output data become invalid. By re-plugging the module or a compatible module, the *Maintenance* state is left again.

- As soon as a module is added to the existing modules, the IM 053-1MT01 detects this and automatically refreshes its reference configuration.

> Please always replace only one module in your configuration.

4.6.1 Examples

4.6.1.1 Module is removed

**Module is part of a saved configuration**

If a module is removed, which is part of the stored configuration, the IM 053-1MT01 behaves as follows:

1. The IM 053-1MT01 switches automatically to *Maintenance* state.
2. The process data communication is ended.
   - The SF LED blinks.
   - The MT LED lights up.

**Module is not part of a saved configuration**

If a module is removed which is not part of the saved configuration, the IM 053-1MT01 behaves as follows:

1. The System SLIO backplane bus is refreshed.
2. The process data communication is interrupted for the duration of the bus scan and then resumed.
   - The SF LED remains off.
   - The MT LED lights up.

4.6.1.2 Compatible module is added again

If a compatible module is inserted into the slot of a previously removed module during an active bus connection, the IM 053-1MT01 behaves as follows:

1. The System SLIO backplane bus is refreshed.
2. The process data communication is interrupted for the duration of the bus scan and then resumed.
   - The SF LED turns off.
   - The MT LED lights up.
4.6.1.3 Incompatible module is added again

If an incompatible module is inserted into the slot of a previously removed module, the IM 053-1MT01 behaves as follows:

1. The IM 053-1MT01 switches automatically to Maintenance state.
2. The process data communication is ended.
   - The SF LED blinks.
   - The MT LED turns off.

4.6.1.4 Unconfigured modules are added to the existing modules

If one or more modules, which are not configured, are added to the existing modules during an active bus connection, the IM 053-1MT01 behaves as follows:

1. The System SLIO backplane bus is refreshed.
2. The process data communication is interrupted for the duration of the bus scan and then resumed.
   - The SF LED remains off.
   - The MT LED remains off.
4.7 Firmware update

- Please note that a firmware update is only possible if the Ethernet coupler is in the Commissioning state.
- You can apply a firmware update via the integrated web server.  

4.8 Replace Modbus/TCP IM 053-1MT00 with IM 053-1MT01

- The Modbus/TCP Ethernet coupler IM 053-1MT01 is compatible with the IM 053-1MT00 if the configuration of the IM 053-1MT00 is not imported.

Adapting the configuration file

Since the product name is evaluated within the configuration file during import, inappropriate configurations are rejected and not adopted. For the import of a configuration file this can be adapted accordingly:

1. Open the configuration file to be imported in a text editor.
2. Search for the entry `product="VIPA 053-1MT00"`
3. Change the entry to `product="VIPA 053-1MT01"`
4. Save the configuration file and load it into your IM 053-1MT01 by means of the web page.
   ⇒ The configuration is applied and the IM 053-1MT01 is restarted.
4.9 Modbus/TCP

General

Modbus/TCP is a Modbus protocol put upon TCP/IP, where the IP address serves the addressing. Modbus/TCP allows a client-server-communication, several clients may be provided from one server.

Telegram structure incl. TCP/IP

The request telegrams sent by a master and the respond telegrams of the slave have the same structure:

<table>
<thead>
<tr>
<th>Modbus/TCP</th>
<th>Slave address</th>
<th>Function code</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>6byte header with number of following bytes</td>
<td>1byte data</td>
<td>1byte data</td>
<td>max. 254byte</td>
</tr>
</tbody>
</table>

Modbus/TCP header (6byte)

For send and receive telegrams, Modbus/TCP uses a header of 6byte with the following structure:

<table>
<thead>
<tr>
<th>Byte</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Transaction identifier (High byte)</td>
<td>Is sent back by the server (user-defined)</td>
</tr>
<tr>
<td>1</td>
<td>Transaction identifier (Low byte)</td>
<td>Is sent back by the server (user-defined)</td>
</tr>
<tr>
<td>2</td>
<td>Protocol identifier (High byte)</td>
<td>Always 0</td>
</tr>
<tr>
<td>3</td>
<td>Protocol identifier (Low byte)</td>
<td>Always 0</td>
</tr>
<tr>
<td>4</td>
<td>Length field (High byte)</td>
<td>Always 0 because messages &lt; 256byte</td>
</tr>
<tr>
<td>5</td>
<td>Length field (Low byte)</td>
<td>Number of following bytes</td>
</tr>
</tbody>
</table>

Normally, byte 0 ... 4 have the value 0. You may also increase byte 0 and 1 in the slave and thus establish an additional control.
4.10 Modbus function codes

Naming convention

Modbus has some naming conventions:

- Modbus differentiates between bit and word access; Bits = "Coils" and Words = "Register".
- Bit inputs are referred to as "Input-Status" and bit outputs as "Coil-Status".
- Word inputs are referred to as "Input-Register" and word outputs as "Holding-Register".

Range definitions

Normally the access with Modbus happens by means of the ranges 0x, 1x, 3x and 4x. 0x and 1x gives you access to digital bit areas and 3x and 4x to analog word areas.

For the VIPA modules is not differentiating digital and analog data, the following assignment is valid:

- 0x - Bit area for master output
  - Access via function code 01h, 05h, 0Fh
- 1x - Bit area for master input
  - Access via function code 02h
- 3x - Word area for master input
  - Access via function code 04h, 17h
- 4x - Word area for master output
  - Access via function code 03h, 06h, 10h, 16h, 17h

Overview

With the following Modbus function codes a Modbus master can access a Modbus slave. The description always takes place from the point of view of the master:

<table>
<thead>
<tr>
<th>Code</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01h</td>
<td>Read n Bits</td>
<td>Read n bits of master output area 0x</td>
</tr>
<tr>
<td>02h</td>
<td>Read n Bits</td>
<td>Read n bits of master input area 1x</td>
</tr>
<tr>
<td>03h</td>
<td>Read n Words</td>
<td>Read n words of master output area 4x</td>
</tr>
<tr>
<td>Code</td>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>04h</td>
<td>Read n Words</td>
<td>Read n words master input area 3x</td>
</tr>
<tr>
<td>05h</td>
<td>Write 1 Bit</td>
<td>Write 1 bit to master output area 0x</td>
</tr>
<tr>
<td>06h</td>
<td>Write 1 Word</td>
<td>Write 1 word to master output area 4x</td>
</tr>
<tr>
<td>0Fh</td>
<td>Write n Bits</td>
<td>Write n bits to master area 0x</td>
</tr>
<tr>
<td>10h</td>
<td>Write n Words</td>
<td>Write n words to master area 4x</td>
</tr>
<tr>
<td>16h</td>
<td>Mask 1 Word</td>
<td>Mask 1 word in master output area 4x</td>
</tr>
<tr>
<td>17h</td>
<td>Write n Words and Read m Words</td>
<td>Write n words into master output area 4x and the respond contains m read words of the master input area 3x</td>
</tr>
</tbody>
</table>

**Byte sequence in a word**

<table>
<thead>
<tr>
<th>1 word</th>
</tr>
</thead>
<tbody>
<tr>
<td>High byte</td>
</tr>
</tbody>
</table>

**Respond of the coupler**

If the slave announces an error, the function code is sent back with a "OR" and 80h. Without an error, the function code is sent back.

**Coupler answer:**

<table>
<thead>
<tr>
<th>Function code OR 80h</th>
<th>Error &amp; error number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function code</td>
<td>OK</td>
</tr>
</tbody>
</table>

If the slave announces an error, the function code is sent back with a "OR" and 80h. Without an error, the function code is sent back.

- 01h: Function number is not supported
- 02h: Addressing errors
- 03h: Data errors
- 04h: System SLIO bus is not initialized
- 07h: General error
## Read n Bits 01h, 02h

Code 01h: Read n bits of master output area 0x.  
Code 02h: Read n bits of master input area 1x.

### Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address1. bit</th>
<th>Number of bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x 0 0 0 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Number of read bytes</th>
<th>Data 1. byte</th>
<th>Data 2. byte</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1byte</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>max. 252byte</td>
</tr>
</tbody>
</table>

## Read n words 03h, 04h

03h: Read n words of master output area 4x.  
04h: Read n words master input area 3x.

### Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address word</th>
<th>Number of words</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x 0 0 0 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Number of read bytes</th>
<th>Data 1. word</th>
<th>Data 2. word</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x x 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>max. 126words</td>
</tr>
</tbody>
</table>
### Write 1 bit 05h

Code 05h: Write 1 bit to master output area 0x.

A status change is via "Status bit" with following values:

- "Status bit" = 0000h → Bit = 0
- "Status bit" = FF00h → Bit = 1

#### Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address bit</th>
<th>Status bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>6byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

#### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address bit</th>
<th>Status bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>6byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

### Write 1 word 06h

Code 06h: Write 1 word to master output area 4x.

#### Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address word</th>
<th>Value word</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>6byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

#### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address word</th>
<th>Value word</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>6byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>
Write n bits 0Fh

Code 0Fh: Write n bits to master output area 0x.
Please regard that the number of bits are additionally to be set in byte.

Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address1 bit</th>
<th>Number of bits</th>
<th>Number of bytes</th>
<th>Data 1. byte</th>
<th>Data 2. byte</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
</tr>
</tbody>
</table>

Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address1 bit</th>
<th>Number of bits</th>
<th>Number of bytes</th>
<th>Data 1. byte</th>
<th>Data 2. byte</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
</tr>
</tbody>
</table>

Write n words 10h

Code 10h: Write n words to master output area 4x.

Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address1 word</th>
<th>Number of words</th>
<th>Number of bytes</th>
<th>Data 1. word</th>
<th>Data 2. word</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
</tr>
</tbody>
</table>

Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address1 word</th>
<th>Number of words</th>
<th>Number of bytes</th>
<th>Data 1. word</th>
<th>Data 2. word</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
</tr>
</tbody>
</table>

Mask a word 16h

Code 16h: This function allows to mask a word in the master output area 4x.

Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address word</th>
<th>AND Mask</th>
<th>OR Mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>1word</td>
</tr>
</tbody>
</table>

x = any number of bytes.
### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Address word</th>
<th>AND Mask</th>
<th>OR Mask</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0 0 0 8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
<td>1word</td>
</tr>
</tbody>
</table>

### Write n words and Read m words 17h

Code 17h: This function allows to write n words to the master output area 4x and read m words from the master input area 3x with one request.

#### Command telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Read address</th>
<th>Read number words</th>
<th>Write address</th>
<th>Write number words</th>
<th>Write number bytes</th>
<th>Write Data 1.word</th>
<th>Write Data 2.word</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1Wort</td>
<td>1Wort</td>
<td>1word</td>
<td>1word</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
<td></td>
</tr>
</tbody>
</table>

max. 122words

#### Respond telegram

<table>
<thead>
<tr>
<th>Modbus/TCP-Header</th>
<th>Slave address</th>
<th>Function code</th>
<th>Read number bytes</th>
<th>Read Data 1. word</th>
<th>Read Data 2. word</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>x</td>
<td>0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1byte</td>
<td>1word</td>
<td>1word</td>
<td></td>
</tr>
</tbody>
</table>

max. 126words
### Register allocation

#### I/O data

<table>
<thead>
<tr>
<th>Address</th>
<th>Access to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x: 0001h ... 2000h</td>
<td>Bit access to input area</td>
</tr>
<tr>
<td>3x: 0001h ... 0200h</td>
<td>Word access to input area</td>
</tr>
<tr>
<td>0x: 0001h ... 2000h</td>
<td>Bit access to output area</td>
</tr>
<tr>
<td>4x: 0001h ... 0200h</td>
<td>Word access to output area</td>
</tr>
</tbody>
</table>

#### Status information

The status information in the register area 3001h ... 3003h provides status information about the System SLIO. You have read-only access to the status registers.

<table>
<thead>
<tr>
<th>Address</th>
<th>Function Code</th>
<th>Access to</th>
</tr>
</thead>
<tbody>
<tr>
<td>3001h</td>
<td>0x01</td>
<td>BASP state</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>0: BASP is not set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: BASP is set</td>
</tr>
<tr>
<td>3002h</td>
<td>0x01</td>
<td>Collection bit for process interrupt, if at least one process interrupt has not yet been acknowledged by the IM 053MT/module</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td></td>
</tr>
<tr>
<td>3003h</td>
<td>0x01</td>
<td>Collection bit for diagnostic interrupts if at least one diagnostic interrupt has not yet been acknowledged by the IM 053MT/module</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td></td>
</tr>
</tbody>
</table>

#### Diagnostics

<table>
<thead>
<tr>
<th>Address</th>
<th>Function Code</th>
<th>Access to</th>
</tr>
</thead>
<tbody>
<tr>
<td>4001h ... 4040h</td>
<td>0x01</td>
<td>Bit access to hardware interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>4001h: Hardware interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x05</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4040h: Hardware interrupt state Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>4001h ... 4200h</td>
<td>0x04</td>
<td>Word access to hardware interrupt data:</td>
</tr>
<tr>
<td></td>
<td>0x17</td>
<td>4001h ... 4008h: Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x0F</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>41F8h ... 4200h: Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>4001h ... 4008h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 1</td>
</tr>
<tr>
<td>4009h ... 4010h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 2</td>
</tr>
<tr>
<td>41F8h ... 4200h</td>
<td>04h</td>
<td>16byte hardware interrupt data Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>5001h ... 5040h</td>
<td>0x01</td>
<td>Bit access to diagnostics interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x02</td>
<td>5001h: Diagnostics interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x05</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5040h: Diagnostics interrupt state Modbus/TCP Slot 64</td>
</tr>
<tr>
<td>5001h ... 5400h</td>
<td>0x04</td>
<td>Word access to diagnostics interrupt state:</td>
</tr>
<tr>
<td></td>
<td>0x17</td>
<td>5001h ... 5010h: Diagnostics interrupt state Modbus/TCP Slot 1</td>
</tr>
<tr>
<td></td>
<td>0x0F</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>53F0h ... 5400h: Diagnostics interrupt state Modbus/TCP Slot 64</td>
</tr>
</tbody>
</table>
### Register allocation

<table>
<thead>
<tr>
<th>Address</th>
<th>Function Code</th>
<th>Access to</th>
</tr>
</thead>
<tbody>
<tr>
<td>5001h ... 5010h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 1</td>
</tr>
<tr>
<td>5011h ... 5020h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 2</td>
</tr>
<tr>
<td>53F0h ... 5400h</td>
<td>04h</td>
<td>32byte diagnostics data from Modbus/TCP Slot 64</td>
</tr>
</tbody>
</table>
4.12 LED status indication

**General**  
The LEDs installed to display the status allow extensive diagnostics during the PowerON procedure as well as during operation. The result of the diagnosis is determined by the combination of the different LEDs and the current operating mode.

<table>
<thead>
<tr>
<th>PWR</th>
<th>SF</th>
<th>MT</th>
<th>SB</th>
<th>MB</th>
<th>SPD</th>
<th>L/A(1/2)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>green</td>
<td>red</td>
<td>yellow</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>green</td>
<td>Init</td>
</tr>
<tr>
<td>x</td>
<td>2Hz</td>
<td>2Hz</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>DHCP discovery</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td></td>
<td>2Hz</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Update config</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Run</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1Hz</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Commissioning</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Maintenance</td>
<td></td>
</tr>
<tr>
<td>1Hz</td>
<td>1Hz</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Firmware update¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2Hz</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Error</td>
<td></td>
</tr>
</tbody>
</table>

### Operating modes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>The Ethernet coupler is power supplied.</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>The Ethernet coupler communicates without error via Ethernet</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The Ethernet coupler is ready for Modbus/TCP communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No Modbus/TCP communication is possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2Hz</td>
<td>X</td>
<td>BASP (Befehls-Ausgabe-Sperre i.e. command output disable) is activated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>There is no physical connection to Ethernet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2Hz</td>
<td>X</td>
<td>Configuration is in progress</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5Hz</td>
<td></td>
<td></td>
<td>Ethernet coupler is located, the identification was initiated by the user and takes 10s.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Speed: 100MBit/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Speed: 10MBit/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Error: Power OFF-ON required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) LEDs blink alternately

---

**Deployment**

**LED status indication**

---

HB300 | IM | 053-1MT01 | en | 19-40
Appendix
Content

A History of changes........................................................................................................ 80
## A History of changes

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-40</td>
<td>The manual was new created.</td>
</tr>
</tbody>
</table>