Operating manual

Operation Module

OM 2032
OM 2032-F
OM 2032PP
OM 2032PP-F

Edition 04/2021

- Original language German -

This operating manual is applicable for the following modules:

OM 2032, Head Module, PROFINET® IO	92390 1008
OM 2032, Sub Module	92390 1010
OM 2032 with EtherCAT®	92390 1003
OM 2032 with PROFIBUS®-DP	92390 1001
OM 2032 with Ethernet/IP®	92390 1009
OM 2032-F, Head Module	92390 1108

Important Notice

This operating manual cannot take every possible installation, operation issue or possible faults into consideration.

Should you require further information, or particular problems occur, which are not specifically covered in this operating manual then please contact Herkules-Resotec Elektronik GmbH.

Disclaimer

We have checked this documentation in the conformity with the described products. Nevertheless, discrepancies cannot be fully ruled out, therefore we cannot be held liable for the correctness of the document as a whole. The documentation is checked regularly. Corrections are added to the next publication editions.

Technical changes reserved.

Herkules-Resotec Elektronik GmbH
Eisenstr. 7, D-34225 Baunatal
Phone +49 561 / 94987-0
FAX +49 561 / 4980-89
E-Mail: info@herkules-resotec.de
www.herkules-resotec.de

0 Table of contents ..... Seite

1 Description of the operation module 1-1

2 Safety instructions 2-1
2.1 Basic safety instructions 2-1
2.2 Qualified personnel 2-2
2.3 Intended use 2-2
2.4 Special safety instructions 2-2
2.5 Instructions for fail-safe operation and checklist 2-3
2.6 Maintenance 2-12
2.7 Used danger symbols 2-12
2.8 Approvals and explanations 2-13
2.8.1 CE conformity 2-13
2.8.2 Approvals 2-13
2.8.3 EC declaration of conformity and certificates 2-13

3 Conditions for the operation of the operation module 3-1

4 Installation instructions for OM 2032 4-1
4.1 Unpacking the operation module 4-1
4.2 Fundamentals of mechanical installation fail-safe operation modules 4-1
4.3 Mechanical installation 4-3
4.4 Electrical installation 4-6
4.4.1 Fundamental description to potential equalisation 4-7
4.4.2 Pin connection for OM 2032 and OM 2032-F 4-8
4.4.3 Functional grounding connection 4-9
4.4.4 Connecting the power supply 4-9
4.4.5 DIP-Switch SW2 4-10
4.4.6 Coding switch SW1 4-10
4.4.7 Connecting the module bus 4-11
4.4.8 Connection PLC 4-11
4.4.8.1 PROFINET® connection 4-11
4.4.8.2 EtherCAT® connection 4-12
4.4.8.3 PROFIBUS-DP® connection 4-12
4.4.8.4 Ethernet/IP® connection 4-13
4.4.9 Connection of digital input and outputs X4 und X5 4-14
4.4.10 Pin assignment for fail-safe operation 4-15
4.4.11 Test outputs 4-18
4.4.12 Switch for setting the PROFIsafe target address 4-18
4.5 Offline test 4-19
4.6 Creating insertion stripes 4-20

5 Commissioning 5-1
5.1 Warning notice for the OM 2032-F 5-1
5.2 Steps to commissioning 5-3
5.3 Operation module start-up 5-3
5.4 Safety audit 5-5
5.5 Documentation 5-5

6 Control integration 6-1
6.1 Warnings for the configuration of fail-safe operation modules 6-1

6.2 PROFINET I/O® ... 6-4
6.2.1 GSDML file insertion ... 6-4
6.2.2 Assign IP adrrss and device name ... 6-4
6.2.3 Parameterization of the OM 2032 modules ... 6-4
6.2.3.1 Key numbering of the operation modules ... 6-5
6.2.3.2 Integration of the OM 2032 modules into the PROFINET network ... 6-6
6.2.3.3 LED control and bit combination OM 2032 and OM 2032-F ... 6-8
6.2.3.4 Parameterization of the LED ... 6-10
6.2.3.5 Parameterization of the keys ... 6-11
6.2.3.6 Parameterizing of the OM 2032 modules in PP mode ... 6-12
6.2.3.7 Parameterization of the LED in PP mode ... 6-14
6.2.3.8 Parameterization of the keys in PP mode ... 6-15
6.2.4 PROFIsafe® ... 6-16
6.2.4.1 Integration of the fail-safe inputs and outputs for the OM 2032-F ... 6-17
6.2.4.2 PLC process image of the fail-safe channels ... 6-18
6.2.4.3 Setting the PROFIsafe address ... 6-20
6.2.4.4 Configuring the iParameters ... 6-22
6.2.4.5 Pre-tested configuration ... 6-24
6.3 EtherCAT® ... 6-30
6.3.1 Installing the ESI file ... 6-30
6.3.2 Parameterization of the OM 2032 modules ... 6-30
6.3.2.1 Key numbering of the operating modules ... 6-30
6.3.2.2 Integration of the OM modules into the EtherCAT network ... 6-31
6.3.2.3 LED control and bit combination of OM 2032 ... 6-32
6.3.2.4 Assignment of keys and LED ... 6-33
6.3.2.5 Adjusting the parameters ... 6-34
6.4 PROFIBUS® ... 6-35
6.4.1 Installing the GSD file ... 6-35
6.4.2 Parameterization of the OM 2032 modules ... 6-35
6.4.2.1 Key numbering of the operating modules ... 6-35
6.4.2.2 Configuration of OM 2032 modules into the PROFIBUS network ... 6-36
6.4.2.3 Configuration of OM 2032 modules with GX Configurator ... 6-37
6.4.2.4 LED control and bit combination of OM 2032 with PROFIBUS-DP ... 6-41
6.4.2.5 Setting the PROFIBUS slave address ... 6-42
6.5 Ethernet/IP® ... 6-44
6.5.1 Configuration of the network addressing for the module ... 6-44
6.5.1.1 Setting the IP address via DHCP mode ... 6-44
6.5.1.2 IP address storage ... 6-46
6.5.1.3 IP address resetting ... 6-46
6.5.2 Configuration of OM 2032 with Studio 5000 Logix Designer ... 6-47
6.5.2.1 Installation of EDS file ... 6-47
6.5.2.2 Parameterization of the OM 2032 modules ... 6-50
6.5.2.3 Key numbering of the operating modules ... 6-50
6.5.2.4 Configuration of OM 2032 modules into the Ethernet/IP-network ... 6-51
6.5.2.5 Configuration of the OM 2032 controller tags ... 6-53

7 Fail-safe operation of OM 2032-F ... 7-1
7.1 Fail-safe operation ... 7-1
7.2 Safety instructions for the OM 2032-F ... 7-1
7.3 Safety functions ... 7-3
7.3.1 Reaction to actuated EMERGENCY STOP buttons or encoders ... 7-3
7.3.2 Reaction to faults in the system ... 7-3

7.4 Passivating the operation module 7-4
7.5 Fault diagnosis 7-5
7.6 LED fault diagnosis (for all OM 2032) 7-6
7.7 Depassivation of the fail-safe inputs 7-7
7.8 Response times of the OM 2032 (PROFIsafe) 7-9

8 Maintenance and Cleaning 8-1
8.1 Maintenance 8-1
8.2 Care of the keyboard foil 8-2

9 Spare parts and accessories 9-1

10 De-installation and disposal 10-1

11 Technical Data 11-1
11.1 Technical Data OM 2032 and OM 2032-F 11-1
11.2 Safety characteristics 11-2

1 Description of the operation module

The operation modules enable an extension of the control systems for automation engineering. All modules are equipped with different interfaces and can be combined and strung together.

display and control

The operational condition of your facility is displayed with the operation modules. Hence, you are able to actively control an operational production process.

time advantages during installation

Particular advantages are that the operation module replaces individually mounted and wired buttons and LEDs and are parametrised ready for operation. The installation time and the increased reliability during operation is comparatively much better than when using conventional wiring.

All operation modules are equipped with coloured keys (5-colour panel-LEDs, red, green, yellow, blue and white), each with a status-LED (red). Thus, you are able to use many different colours to show diverse combinations giving a clear indication of the feedback from the system.

You also have the possibility to name the keys with the labelling strips.

compatible mode

The operation module OM 2032 has a compatible mode so that it can be parameterized as OM 2032PP with three button colors red, green and yellow and is used as a replacement for modules that work in this mode.

The **operation module OM 2032** is comprised of:

- 32 colored backlit short-stroke keys (5 colours) each with a status-LED
- Field bus interface (optional): PROFINET®IO Device, EtherCAT®, PROFIBUS®-DP, Ethernet/IP®
- Internal Interface: RESOTEC module bus

Fig.: Operation module OM 2032

The necessary data is exchanged between the operation module and higher-level control via a communication protocol. Data from

multiple operation modules is collected, via further, internal, serial data connections, in a single operation module and can then be exchanged with the higher-level control. The OM 2032 Head Module has 16 digital inputs and 16 digital outputs.

The fail-safe operation

Fail-safe automation system

A fail-safe automation system (F-system) is used in plants with increased safety requirements.

An F-system controls production processes in such a way that a safe operating condition of the plant is achieved when the plant is switched off, taking into account the residual error probability. Thus, an immediate shutdown does not pose a risk to people or the environment.

The OM 2032-F operation module has been specially developed for fail-safe operation. In fail-safe operation, the operation module records signal states from suitable encoders and sends corresponding safety telegrams to the controller.

Safety-related protocol PROFIsafe

The PLC and operation module communicate with each other via the safety-related PROFIsafe protocol.

in these operating manual the TIA Portal (see Siemens publication) is used for project planning

By correspondingly configuring the safety functions, for example in the TIA portal with the "S7 Distributed Safety" option package, fail-safe operation is ensured with the operation module.

The fail-safe mode of the operation module differs from the standard mode essentially in that the signals are monitored for errors during communication. In the event of an error, the fail-safe channels on the operation module are set to a safe state.

The failsafe system does the following:

- 3 two-channel safe inputs,
- 1 two-channel safe output,
- System type B according to EN 61508-2, SIL 3/SILCL 3 max. achievable, PL d / category 3 achievable,
- Requirement rate high (high demand mode), PFH < 9 * 10-9 /h, DC: >90%,
- Service life: 10 years

In fail-safe operation, fail-safe sensors, e.g. E-STOP switches, can be detected via the three safe inputs and transferred to the higher-level fail-safe controller via PROFIsafe safe communication. The controller can control the fail-safe output via the same communication channel.

Included in OM 2032-F, but not part of the fail-safe system

Standard I/O and keyboard communication, as well as other control modules connected via the internal data connection, are not part of the fail-safe system and communicate independently of the fail-safe system.

The following application example shows the connection options for the OM 2032-F with EMERGENCY STOP (passive sensor), protective grille (active sensor) and motor control (indicator lamp as motor enable).

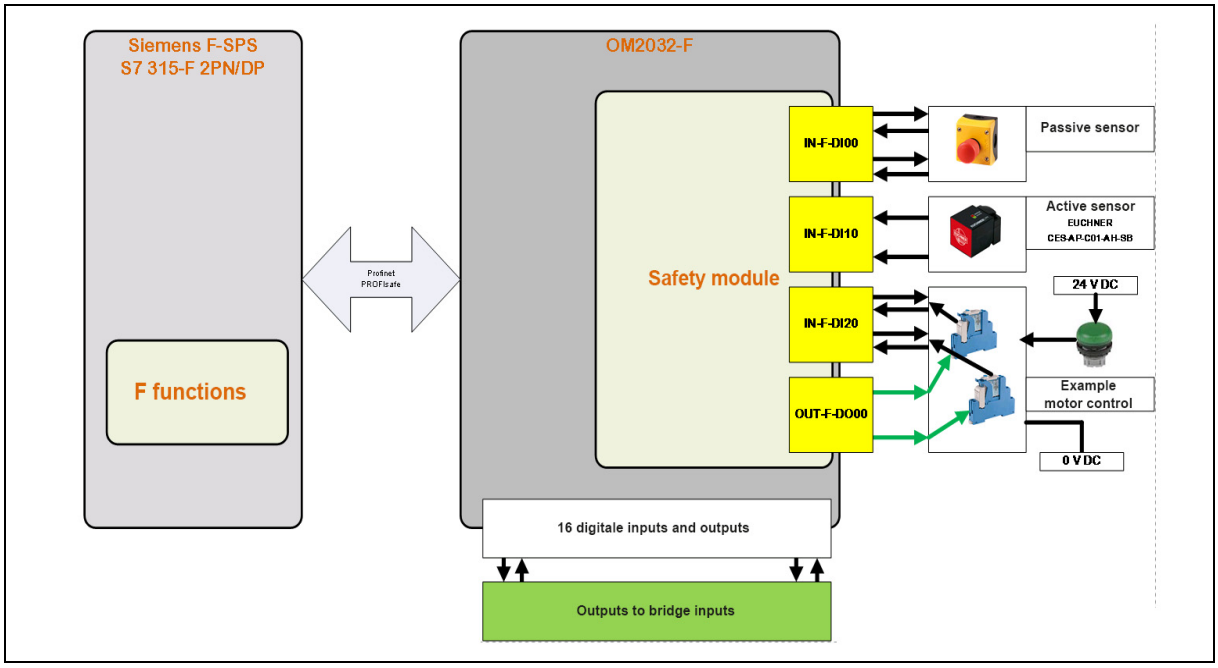


Fig. 1.2: Application example

2 Safety instructions

2.1 Basic safety instructions

This user manual is designed for technically qualified personnel who are equipped with relevant knowledge of automation technology.

Important!

This user manual is a part of the operation module and will be required for future installations. Safely store all accompanying parts and extra documents for the duration of the operation modules operation.
Pass on all documents to the next owner of the operation module.

Inform about the correct installation and commissioning!

The user manual provides all information regarding the usage and operation of the operation module when using the device in the designated way. Before you begin the installation and mounting of the operation module, first read the respective chapter of the user manual. It will help to avoid mistakes and will protect you, the operation module and connected machine from possibility of damage due to faulty connection and incorrect usage..

Warning!
Personal or material damage

- If you do not follow the safety precautions and instructional information, sources of danger can be created and safety functions may not operate accordingly. Person and material damage are potential consequences.
- Always follow the respective safety and accident prevention guidelines, regardless of the here specified safety instructions.

Warning!
Personal or material damage

- The project developer of a facility control responsible for setting up all measures to ensure that communication failures, voltage drops or power failure do not hinder a restart of the operation after a program cycle is interrupted.
  A dangerous operating state is not allowed to occur throughout the duration of the control program, including during troubleshooting, not even for a short time.

open operating equipment

- The operation module is open operating equipment. That means, it must be mounted in a switch cabinet or on a switch board and is operated from the front.
  Access to the switch cabinet or switch board must be limited by use of a key or specialised tool to prevent anyone other than qualified and approved personnel.

Electrostatic-sensitive components, do not open the operation module!

- There are ESD-sensitive components built inside the operation module which can be impaired or destroyed through electrostatic discharge. Therefore, never attempt to open the operation module yourself. Incorrect handling of the operation module can damage it. Only allow it to be repaired by a qualified specialist of Herkules-Resotec Elektronik GmbH.

2.2 Qualified personnel

Qualified personnel (all operation module)

project developer
operator
start-up and/or service engineer

A qualified person is someone who,

1. as the project developer, is familiar and qualified in the field of safety concepts in automation technology.
2. as an operator, has received instruction on the use of components within, as well as the operation of, automation technology.
3. as the start-up and/or service engineer, has a qualification and/or received instruction regarding the repair of the automation technology in question. More specifically, personnel with the authority to start up electrical circuits and devices according to the prescribed safety standards, to earth and to label.

see also chapter 2.5

Qualified personnel especially for the OM 2032-F operation modules

For safety-related applications, the personnel (commissioning and service personnel) must have competence in functional safety (standards: EN 61508 / EN 62061 / EN ISO 13849).

2.3 Intended use

The operation module can only be implemented in accordance with the product description and technical specifications. All relevant safety requirements were met in regards to the development, production, inspection and documentation.

Intended operation

Normally, there should be no danger of damage or injury to personnel or material created by the product when the handling regulation and technical safety instructions are complied to.

The detailed knowledge and correct implementation of the installation guidelines, safety instructions and functions provided in this manual are fundamental to the safety of the system.

Safety concept of the entire facility
It is mandatory to integrate all functions and the respective safety instructions of the module into the safety concept of the entire facility, in order to be able to use the described components, or operation modules, in a host of different ways.

2.4 Special safety instructions

- The safety of the operation module depends on appropriate transportation, appropriate storage, installation and usage.
- Follow the instructions for the mechanical and electrical installation to avoid damage.

Fault-clearing and setup guidelines see chapter „Installation"

- Continue to follow the instructions about fault-clearing and setup guidelines and shielding of cables.

If necessary, switch off the supply voltage of the switch cabinet

- If, during installation of the operation module in the switch cabinet, parts are accessible that are under dangerous contact voltage, switch them off before opening the switch cabinet.

- The operation module must not be turned on if condensation is present, to avoid damage to the electronics. If changing from a cold to a warm location, the device must be given 2 hours to acclimatise to the new temperature.
- Make sure that the operation module is not covered so that there is enough air circulation for cooling.
- Do not allow the operation module to be in direct sunlight for prolonged periods or to be near places where high temperatures occur (eg. Radiators, Heaters etc.).
- If the maximum permissible ambient temperature is exceeded, you must provide suitable forced ventilation, otherwise the operation module will be damaged.
- Protect the operation module against moisture or rain.
- Only use standard cables with shielding for communication interface connections.
- All plug-connections must be screwed or locked in place.
- Interface cables must not be installed near sources of strong electromagnetic interference.
- No liability will be assumed for malfunction and/or damage caused by usage of self-made cables.
- The frontal IP65 protective rating can only be reached if the operation module is mounted in a professional manner and on a flat and smooth mounting surface..

See chapter 11 Technical Data

- The power supply must remain within the stated range.
- Connect the functional earthing of the operation module with the switch cabinet grounding according to chapter 4 „Installation“.
- The operation module‘s keyboard must not be cleaned using an abrasive cleaning agent or a rough cloth. Compressed air and steam jet methods of cleaning are also not permitted.

See chapter 8

2.5 Instructions for fail-safe operation and checklist

You must not only observe the following safety instructions for fail-safe operation, but should also use them as a checklist.

S1: Specially qualified personnel for the OM 2032-F

The installation, configuration, operation and decommissioning of the OM 2032-F may only be carried out by qualified personnel with experience in the implementation and handling of safety-related applications.

S2: Application area of the OM 2032-F

The OM 2032-F is a class B product according DIN EN 55022. The OM 2032-F may only be used in the field of industrial automation of machines. It is the user's responsibility to check whether the OM 2032-F is suitable for the intended safety-related application and for the expected operating and ambient conditions. The OM 2032-F is a "conforming object" with regard to its safety-related function according to EN 61508-2 Appendix D, as it is not a safety-related system in itself.
Before the OM 2032-F can be integrated into a safety-related system, you must perform a complete hazard and risk analysis and identify the required safety functions of the OM 2032-F.

S3: Repair or modification of the operating modules

It is not allowed to repair or modify the OM 2032-F. It is not allowed to open the OM 2032-F. The identification plate secures a screw on the back of the module and should not be removed or damaged in this area.

S4: Test and documentation after device replacement

The OM 2032-F may only be replaced by authorised persons and properly instructed persons. After replacement, all safety functions of the machine must be checked and validated again and this must be documented.

S5: Safety-critical malfunctions of the OM 2032-F

Safety-critical malfunctions of the OM 2032-F that do not cause the device to assume the safe state must be reported immediately to Herkules-Resotec Elektronik GmbH. The OM 2032-F must be replaced and returned to Herkules-Resotec Elektronik GmbH.

S6: Handling of defective operation modules

The OM 2032-F must not be repaired by the user. A defective OM 2032-F must be replaced and disposed of or returned to Herkules-Resotec Elektronik GmbH. The OM 2032-F must not be opened. The identification plate secures a screw on the back of the module and must not be removed or damaged in this area.

S7: Malfunction of the operation module

In the event of a fault in the safety-related function of the OM 2032-F, the operation module must be replaced immediately and sent to Herkules-Resotec Elektronik GmbH to investigate the cause of the fault.

S8: Maximum operating time

The maximum operating time of the OM 2032-F must not exceed 10 years. It must be taken out of operation by the user 10 years after the date noted on the operation module.

S9: Operating temperature range

The temperature range of the OM 2032-F from 0...50 °C must be maintained during operation absolutely.

S10: Storage temperature range

The storage temperature range of the OM 2032-F is -40...+70 °C. Transport by air is possible.

S11: Height (operation)

The OM 2032-F is suitable for operation up to max. 2000 m above NHN.

S12: Shock test

The OM 2032-F meets the shock test according to IEC60068-2-27 test Ea: half-sine 15g peak value, 11 ms duration, three shocks in each of 3 mutually perpendicular directions to each other (a total of 18 shocks).

S13: Vibration test

The OM 2032-F meets the vibration test according to IEC60068-2-6 test Fc: sinusoidal vibration 5...8.4 Hz at 3.5 mm deflection of constant amplitude, 8.4...150 Hz at 1 g acceleration and constant amplitude; 1 oct/min with 10 frequency sweeps per axis in each of 3 mutually perpendicular directions to each other.

S14: Humidity

According to IEC60068-2-30 Db 5...95%, the OM 2032-F meets the criteria for moist heat no condensation without power supply as variant 2 at +50 °C for 2 cycles.

S15: Protection class of the housing

The OM 2032-F must be installed in a switch cabinet with at least IP54 as a backside open device.

S16: IP degree of protection of the OM 2032-F

An OM 2032-F with damaged front foil must be taken out of operation.

S17: Marking of the OM 2032-F (identification plate)

An OM 2032-F that can no longer be identified must be taken out of service. An OM 2032-F whose operating time cannot be determined must also be taken out of service.

S18: PROFIsafe certification

The OM 2032-F is PROFINET and PROFIsafe certified.

S19: Re-Certification

If an OM 2032-F is integrated in a machine / system, the following points must be made known to the end user in the safety manual of the machine / system:
Safety instructions; application examples; approved components for circuit protection; type designations of safety-related components; permissible operating modes; requirements for the end user (training); safety-relevant interfaces; restrictions; requirements for maintenance, use, assembly, installation, provision and dismantling with regard to functional safety; environmental conditions; valid standards, certificates and attestations; reporting body with regard to functional safety; requirements according to IEC 61508-2 Appendix D and IEC 61508-3 Appendix D.

S20: Diagnostic test interval

The diagnostic test interval for the two-channel safe digital inputs for passive sensors is 1 hour.
The diagnostic test interval for the two-channel safe digital output is 1 hour.

S21: : Loss of the hardware fault tolerance (HFT) in the safe state

After detection of a safety-critical fault, the OM 2032-F shall not be kept in a fail-safe state for more than 1 hour.

S22: Connection of safe digital inputs

Safety requirements SIL 3, PL d Cat 3 can be implemented by connecting a two-channel input. Additional measures for wiring the fault exclusion or the use of certified components may be necessary.

S23: Connection of single-channel safe digital inputs

Single-channel safe inputs of the OM 2032-F may only be used under special precautions for safety applications. The safe operation of a single-channel input always requires additional safety measures or fault exclusions, which must be taken into account in the overall system design.

S24: Unconnected safe digital inputs

Unconnected safe digital inputs in dual-channel mode cause the OM 2032-F to signal the inactive safe state for the input pair.

S25: Load capacity of the test outputs

The maximum constant output current at the test output pins of 0.1 A shall not be exceeded to avoid damage to the OM 2032-F hardware. It must be ensured that only modules with a total current consumption of ≤ 0.1 A are connected to the test output or that technical measures such as protective fuses are used.

S26: Temperature increase due to short circuit of the test outputs

A short circuit of the test outputs to F-GND will activate a thermal switch-off to the safe state.

S27: Connection of safe digital outputs

To achieve SIL 3, PL d Cat 3, the safe digital outputs of the OM 2032-F shall be operated and connected in dual-channel mode.

S28: Maximum output current of the safe digital outputs

The maximum output current at the test output pins of the safe digital outputs shall not exceed 500 mA to avoid damage to the OM 2032-F hardware.

S29: Short circuit of the safe digital outputs

In case of a short circuit of the digital outputs a thermal shutdown into the safe state will be issued by the OM 2032-F automatically.

S30: : Safe digital output turned off

In the turned off state (safe state) the output signal is not actively pulled to F-GND. The safe state of the safe digital outputs of the OM 2032-F is "off" (high-impedance). It is therefore not allowed to connect an external safety device or function (such as a valve or a break) that needs a 24 V level to reach the safe state.

S31: Connection of safe digital inputs and outputs

The final inspection of the machine must be carried out by the plant operator. Maximum allowed cable lengths: < 2 m unshielded, < 10 m shielded.

S32: Mounting the OM 2032-F in the switch cabinet

Observe the information on the installation cut-out and the tightening torques in the installation instructions.

S33: Mounting position

The OM 2032-F is suitable for vertical or at an angle installation in the front panel. The maximum allowed angle installation is ±30°.

S34: Functional grounding

A functional grounding must absolutely be connected.

S35: Ground concept

All safe input and safe output signals of the OM 2032-F refer to the ground signal F-GND. There shall be no switching element in the connection between ground and OM 2032-F (the ground must be permanently wired).

S36: Galvanic isolation

There is no galvanic isolation between the safe digital inputs, the safe digital outputs and the safety module itself.

S37: Ground reference of the safe digital inputs

An active sensor connected to a safe semiconductor input must have the same ground level F-GND as the OM 2032-F.

S38: Ground reference of the test outputs

The test output signals are not isolated and all use the same ground potential F-GND.

S39: Process power supply

The safe power supply of the OM 2032-F must be ensured by a 24 V-SELV / PELV power supply unit according to EN 60950-1, which limits the maximum voltage to 60 V in case of failure. The maximum constant supply voltage of 30 V must not be exceeded in order to avoid permanent damage to the safety circuits of the OM 2032-F. Maximum allowed cable lengths: < 2 m unshielded, < 10 m shielded.

S40: Reverse polarity protection

The OM 2032-F has reverse polarity protection. When commissioning or changing the power supply chain, the correct connection of the power supply must be checked.

S41: Prevention of an external short circuit of the sensor

You must prevent an external short circuit of a passive sensor by observing the rules described in standard EN 60664. You must document which error is excluded by which rule. Product or application-specific safety regulations that may apply to the external sensors and their connection must also be observed.

S42: Connection of external sensors

The cabling of the external sensors to the two-channel safe inputs of the OM 2032-F must be carried out according to the specifications from the electrical installation. Maximum allowed cable lengths: < 2 m unshielded, < 10 m shielded.

S43: Ground interruption at actors of the safe outputs

A grounding loss of the load connected to the safe digital output of the OM 2032-F shall be prevented by a hard wired ground connection to the F-GND of the OM 2032-F.

S44: Error at safe input with active sensor

If a safe input is configured for an active sensor, the OM 2032-F cannot detect the following errors:
- external short over sensor
- external short to 24 V
- external short between dual channel lines.

You must prevent these faults by observing certain rules when setting up the machine, routing the cables, etc.

S45: Switching on the operation module

If the OM 2032-F is switched on and the RUN state does not occur correctly within a maximum of 8 hours, the OM 2032-F must be restarted by switching it off and on again. A trained safety service personal must then check whether functionally safe operation is guaranteed.

S46: Operation modules outside the RUN state

The OM 2032-F shall not be operated outside the RUN state for more than 8 hours to ensure that all relevant tests are performed within the safe reaction time.

S47: Inputs (functionally safe)

Fail safe state: switched off, short-circuit proof (clock output). The sampling time is 6 ms + 2 ms for a two-channel input that switches. For each individual channel switched simultaneously, 2 ms are added (up to 16 ms if 3 dual-channel inputs switch simultaneously).

S48: Output (functionally safe)

Fail safe state: switched off
The maximum time between receipt of a safety telegram and activation of the corresponding safe digital output is 7.7 ms.

S49: PROFINET error management

The error bits reported by the OM 2032-F via PROFIsafe shall not be used to trigger the safety function of a device or system.

S50: Reset output error or input error

Each output error or input error is reset by a valid PROFIsafe message with the corresponding error reset bit.

S51: Pre-tested configuration inputs and outputs

If you are not using a pre-tested configuration, functional validation at application level is required to ensure fail-safe operation (see operating instructions). Please also observe the safety instructions S52 to S65.

S52: Configuration

Use the approved configuration tool and a verification procedure to ensure that the configuration of the safe inputs and safe outputs of the OM 2032-F meets the requirements of the safe applications.

S53: CRC by iParameterCRC

Take the iParameterCRC value of the released configuration tool.

S54: Configuration debounce filter time of safe digital inputs

The sampling time of the safe input channels incl. filter time: 6 ms + (2 ms * (n - 1)) + (x * 0.4 ms) with n: Number of simultaneously changed inputs and x: 0...255 Filter time constant (0...102 ms filter time) becomes effective when switching on as well as when switching off.

S55: Configuration channel mode of safe digital inputs

To achieve SIL 3 and PL d Cat 3, the safe input must be configured and used as a two-channel input.

S56: Configuration of consistency filter for safe digital inputs

The deactivation of the consistency filter in dual-channel operation must be carried out in accordance with the safety requirements of the active sensor. The short-circuit of a sensor in dual-channel mode for passive sensors on an input line, for example, is not detected and therefore does not lead to a fail-safe state.

S57: : Configuration consistency filter dependency on debounce time

For proper operation, the consistency filter time must be set larger than the input debounce time.

S58: Configuration test pulse outputs

Due to hardware limitations, the OM 2032-F with 3 dual channel inputs has only one configurable test output pair. This test output pair is configured via the test output signal configuration parameters of input group 1. Changing test output parameters of input group 2 or 3 has no effect.

S59: Configuration of test pulse outputs load by the sensor

The test pulse duration of 400 μs shall be used with an external test output load of ≤ 2 kOhm.

S60: Configuration channel mode of safe digital outputs

In order to use SIL 3 or PL d Cat 3 for the safe outputs of the OM 2032-F dual-channel operation must be activated.

S61: Configuration of test outputs test pulses

Output test pulses are only generated if the output is active /high. No test pulses are generated in the safe state (low, high impedance).

S62: Configuring and checking PROFINET iParameters

The documentation (and review) of the configured iParameter for a certain safe application is mandatory and requires the safe generation and storage of the iParameter dataset as a supplement for the safety assessor of the entire safety system.

S63: Test pulse outputs

When using the input mode for passive sensors (F-Txx), the OM 2032-F test outputs must be used as a power source for the external sensor for correct detection of the OM 2032-F. The test pulse length must be set to a value other than "On". The final test of the machine must be performed by the user.

S64: Parameterization of the test pulse outputs

Do not deactivate the test pulse outputs ("Off" or "On" setting) in the configuration when using the digital inputs in passive sensor mode.

S65: : Parameterization of test pulses to connected actuators

Safety devices such as actuators or brakes connected to the safe digital outputs of the OM 2032-F must be stable against the configured output test pulses of the OM 2032-F. The final testing of the machine must be carried out by the user.

2.6 Maintenance

Important!

Herkules-Resotec products may only be maintained by Herkules-Resotec Customer Service or authorised personnel or companies.

Only original operation module parts or parts from Herkules-Resotec may be used.

- Part replacement may only be undertaken by qualified personnel.
- Standard components, such as fuses, must be dimensioned in accordance with the stated values.

2.7 Used danger symbols

This user guide contains warnings that are designed for your personal safety and to prevent material damage. Warnings pertaining to your personal safety are emphasised with a warning triangle. Warnings pertaining only to material damage are not indicated with a warning triangle.

The specific warnings have the following meanings:

DANGER

Indicates a high-risk immediate hazard which, if not avoided, will result in death or serious injury.

CAUTION

Indicates a potential hazard with medium risk, which can result in death or (serious) bodily harm if not avoided.

ATTENTION

Indicates a low-risk hazard which, if not avoided, could result in minor or moderate personal injury or material damage.

ATTENTION!

without warning
means that property damage can occur if the appropriate precautionary measures are not taken.

WARNING!

means that an unwanted event or condition can occur if the relevant note is ignored.

IMPORTANT!

This symbol gives important information for the proper handling of the machine. Failure to observe this note may result in malfunction of the operating module, machine or environment.

NOTE!

Under this icon you will find application tips and particularly useful information. They help you to make optimum use of all the functions of your operation module.

In the case of multiple danger warnings, the warning of the highest level will be shown.

If a warning triangle warning is warning about personnel safety then it may also be warning about material damage in the same warning.

2.8 Approvals and explanations

2.8.1 CE conformity

All guidelines applicable to the operation modules and their harmonized EN standards are met.

2.8.2 Approvals

All operation modules meet the following standards:

Pos.	Designation	Description / severity level
1	Guideline 2011/65/EU	Restriction of Hazardous Substances
2	EN 61131-2	Programmable controllers - Part 2: Equipment requirements and tests (with limitation of the operating temperature to a maximum of 50 ° C)
3	EN 55022	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement / Class B without restrictions on sales
4	EN 60529	Protection class of the front panel / IP65. Complete protection against contact, protection against the ingress of dust, protected against water spray

The OM 2032-F operation module additionally complies with the following standards:

Pos.	Designation	Description / severity level
1	Guideline 2006/42/EU	Machine Directive
2	EN 61508	Functional safety of safety-related electrical/electronic/programmable electronic systems
3	EN 61326-3-1	Electrical equipment for measurement, control, and laboratory - EMC requirements - Part 3-1: Immunity requirements for safety-related systems and for equipment intended for safety-related functions (functional safety) / FS

2.8.3 EC declaration of conformity and certificates

The declaration of conformity and a copy of the TÜV certificate can be found on our homepage:

www.herkules-resotec.de

3 Conditions for the operation of the operation module

mounting

The operation modules are designed to be integrated into switchboards or switch cabinets and require the following for trouble-free operation.

control and communication

The operation modules can be integrated into diverse automation systems by means of various communication interfaces.

TIA Portal is a registered trademark of SIEMENS AG

The configuration (integration) of the operation modules is explained in this manual on the basis of the Siemes TIA Portal programming tools.

A fail-safe automation system (F-system) controls production processes in such a way that a safe operating state of the plant is achieved when the plant is switched off, taking into account the residual error probability. Thus, an immediate shutdown does not entail any danger for people or the environment.

Fail-safe control

For fail-safe operation, you must use a fail-safe controller.

WARNING!

Safety-related communication can only be guaranteed with a controller that is fail-safe.

4 Installation instructions for OM 2032

This chapter describes all installation step to mechanically install and electrically connect your operation module.

S1: Specially qualified personnel for the OM 2032-F

Experience with safety-related applications

The installation, configuration, operation and decommissioning of the OM 2032-F may only be carried out by qualified personnel with experience in the implementation and handling of safety-related applications.

4.1 Unpacking the operation module

Check the condition of the device!

Unpack the operation module and check first the operation module's condition on arrival.

Check, in particular, that the supplied seal on the operation module is damage-free.

The delivery includes:

- Operation module
- 4 fastening elements
- Operating manual

If you find damaged parts, contact the company Herkules-Resotec GmbH. Do not under any circumstance install damaged components as this could lead to malfunction.

4.2 Fundamentals of mechanical installation fail-safe operation modules

The following points are decisive for the fail-safe mechanical installation of the OM 2032-F, and must be observed and adhered to by you:

S2: Application area of the OM 2032-F

Application area

CAUTION

The OM 2032-F is a class B product according DIN EN 55022. The OM 2032-F may only be used in the field of industrial automation of machines. It is the user's responsibility to check whether the OM 2032-F is suitable for the intended safety-related application and for the expected operating and ambient conditions. The OM 2032-F is a "conforming object" with regard to its safety-related function according to EN 61508-2 Appendix D, as it is not a safety-related system in itself.
Before the OM 2032-F can be integrated into a safety-related system, you must perform a complete hazard and risk analysis and identify the required safety functions of the OM 2032-F.

DANGER

S3: Repair or modification of the operating modules

It is not allowed to repair or modify the OM 2032-F. It is not allowed to open the OM 2032-F. The identification plate secures a screw on the back of the module and should not be removed or damaged in this area.

DANGER

S6: Handling of defective operation modules

The OM 2032-F must not be repaired by the user. A defective OM 2032-F must be replaced and disposed of or returned to Herkules-Resotec Elektronik GmbH. The OM 2032-F must not be opened. The identification plate secures a screw on the back of the module and must not be removed or damaged in this area.

DANGER

S7: Malfunction of the operation module

In the event of a fault in the safety-related function of the OM 2032-F, the operation module must be replaced immediately and sent to Herkules-Resotec Elektronik GmbH to investigate the cause of the fault.

DANGER

S8: Maximum operating time

The maximum operating time of the OM 2032-F must not exceed 10 years. It must be taken out of operation by the user 10 years after the date noted on the operation module.

Max. operating time 10 years

CAUTION

S12: Shock test

The OM 2032-F meets the shock test according to IEC60068-2-27 test Ea: half-sine 15g peak value, 11 ms duration, three shocks in each of 3 mutually perpendicular directions to each other (a total of 18 shocks).

CAUTION

S13: Vibration test

The OM 2032-F meets the vibration test according to IEC60068-2-6 test Fc: sinusoidal vibration 5...8.4 Hz at 3.5 mm deflection of constant amplitude, 8.4...150 Hz at 1 g acceleration and constant amplitude; 1 oct/min with 10 frequency sweeps per axis in each of 3 mutually perpendicular directions to each other.

DANGER

S14: Humidity

According to IEC60068-2-30 Db 5...95%, the OM 2032-F meets the criteria for moist heat no condensation without power supply as variant 2 at +50 °C for 2 cycles.

S11: Height (operation)

DANGER

The OM 2032-F is suitable for operation up to max. 2000 m above NHN.

S9: Operating temperature range

WARNING!

The temperature range of the OM 2032-F from 0...50 °C must be maintained during operation absolutely.

S10: Storage temperature range

WARNING!

The storage temperature range of the OM 2032-F is -40...+70 °C. Transport by air is possible.

S17: Marking of the OM 2032-F (identification plate)

CAUTION

An OM 2032-F that can no longer be identified must be taken out of service. An OM 2032-F whose operating time cannot be determined must also be taken out of service.

4.3 Mechanical installation

Installation requirements

The operation module can be mounted vertically or at an angle in the front plate of switch cabinet doors, switchboards, operating tables and desks. If not mounted strict vertically, the maximum allowed angle of OM 2032 in service is ± 30°.

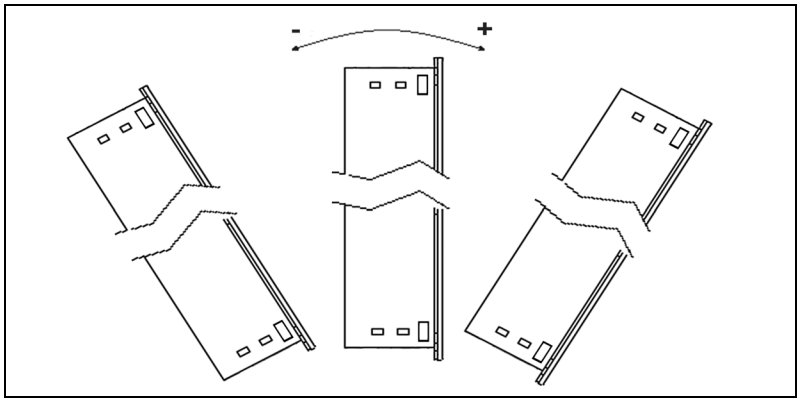


Fig. 4.1: Permissible installation dimensions

S33: Mounting position

WARNING!

The OM 2032-F is suitable for vertical or at an angle installation in the front panel. The maximum allowed angle installation is ±30°.

DANGER

S32: Mounting the OM 2032-F in the switch cabinet

Observe the information on the installation cut-out and the tightening torques in the installation instructions.

The front plate requires a cut-out before the mounting.
Additional fastening bore holes are not necessary.

Important!

Consider the following points when deciding on the installation location:

- operation module mounting height optimal for ergonomic operation,
- good illumination for reading the labels and recognising the coloured keys,
- the mounting surface must be flat, smooth and not deformable,

exact distances when installing several modules see Fig. 4.2

- There must be at least 10 mm free space on all sides to ensure adequate heat exchange

see technical data

- if the maximum permissible ambient temperature is exceeded, you must provide suitable forced ventilation, otherwise the operation module will be damaged.

DANGER

S15: Protection class of the housing

The OM 2032-F must be installed in a switch cabinet with at least IP54 as a backside open device.

The following must be adhered to to ensure the retention of the IP65 protection:

- The material of the installation site must be torsionally rigid.
- The front plate thickness must be between 2 mm and 9 mm.
- The permissible deviation of the flatness at the mounting cutout is ≤ 0,5 mm. A built-in operation module must also meet these requirements.
- The permissible surface roughness around the mounting gasket is ≤ 120 µm (R_z 120).

Make a front panel cutout in the following dimensions:

Width: 226^{-2} mm

Height: 190^{-2} mm

Mounting depth: app. 50 mm

insertion stripes

If you plan to insert the insertion strips while the operating module is installed, you may use a cutting width of max. 228 mm.

Important!

Plan enough additional space for a sufficient bending radius of the cables connected to the operation module.

If you are mounting several operation modules next to or above or below each other then the following gaps between the individual cut-out walls:

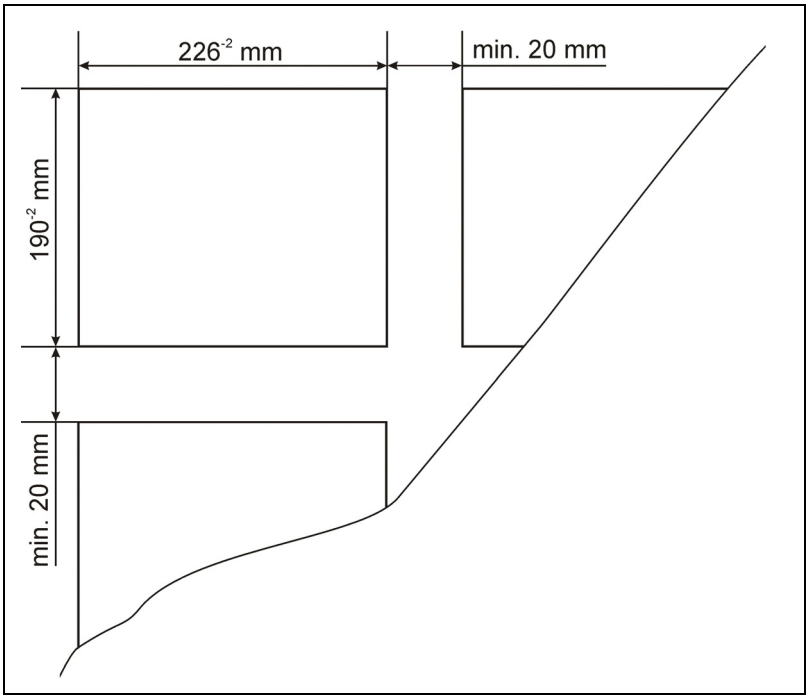


Fig. 4.2: Cut-out scheme for multi OM 2032 board

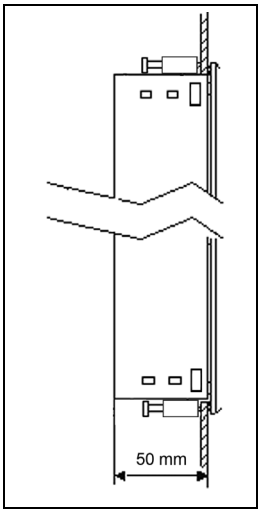
Take extra consideration of the max. permissible ambient temperature when mounting several operation modules. Ensure a sufficient dissipation of heat during operation.

Consider the ambient temperature!
See technical data

Additional ventilation may be required.

Make sure that the insertion strips are not wedged between mounting cut-out and the operation module's seal.

CAUTION



=> Place the operation module in the cut-out.

=> Mount the operation module with the fastening elements according to the assembly drawing.

=> Fasten one clamp to each of the corners of the operation module (vertical or horizontal locating bores).

=> Tighten the screws a little.

=> Control and adjust the position of the display, carefully make sure of the correct positioning over the rubber gasket.

=> Make sure that the rubber gasket of the operation module is completely positioned on the front panel.

=> Tighten the clamp screws to a torque of 0,15 ... 0,20 Nm.

If the symbol => appears in this manual, you will be prompted to operate. The result of your service is shown in italics.

Very important!

The front side IP65 protective rating can only be reached when mounted professionally and on a flat and smooth surface.

4.4 Electrical installation

Follow the correct order of electrical connection

After you have mounted the operation module according to the guidelines in the operating manual, connect the electrical connections in the following order:

- Connect the functional grounding
- Connect the power supply
- Connect the control system or other communication devices

ATTENTION!

Connect only in the stated order, otherwise the Control Module can become damaged.

Note the following:

ATTENTION!

- Only use standard cables with shielding for communication interface connections.
- All plug-connections must be screwed or locked in place!
- Interface cables must not be installed near sources of strong electromagnetic interference!
- No liability will be assumed for malfunction and/or damage caused by usage of self-made cables.
- Ensure that the contact pins are not bent.
- All plug-connector screws are dimensioned to secure against turning.

Information on wire end ferrules, stripping and cable cross section

Nominal cross section 1,5 mm^2 and stripping length 10 mm

Connection data		
Conductor cross-section	**min**	**max**
stiff	0,2 mm^2	1,5 mm^2
flexible	0,2 mm^2	1,5 mm^2
flexible with wire end ferrule without plastic sleeve	0,25 mm^2	1,5 mm^2
flexible with wire end ferrule with plastic sleeve	0,25 mm^2	0,75 mm^2
AWG	24	16
AWG acc. to UL/CUL	16	24

4.4.1 Fundamental description to potential equalisation

Potential differences

Differences in potential can occur between spatially divided parts of the facility, which can lead to high equalisation currents in the data cables and destroy the interfaces.
Equalisation currents can occur when cable shielding is grounded at both ends and are grounded at different parts of the facility.
Differences in potential can occur due to multiple different power sources being used.

ATTENTION!

The potential differences must be reduced by installing potential equalisation cables to protect the vulnerable components.

Therefore, note the following:

- The effectiveness of a potential equalisation is higher when the potential equalisation cable's impedance is lower, in other words, when the cross-section of the potential equalisation cable is larger.
- Two parts of a facility that are connected to each other by shielded data cables, grounded at each end of the shielding with a protective-conductor/earth-electrode, may only have an impedance value, of the additionally installed potential equalisation cables, max. 10 % of the shielding impedance.
- The cable cross-section must be dimensioned for the max. possible equalisation current and be made of copper or galvanised steel.
- Connect the potential equalisation cables extensively to the protective-conductor/earth-electrode and protect against corrosion.
- Clamp the data cable shielding extensively with an appropriate ring clamp to the equipotential bonding bar.
- Pay attention that the cable distance between the Control Module and equipotential bonding bar is dimensioned to be as short as possible.
- Install the potential equalisation and data cables parallel to each other and with minimal distance between them..

4.4.2 Pin connection for OM 2032 and OM 2032-F

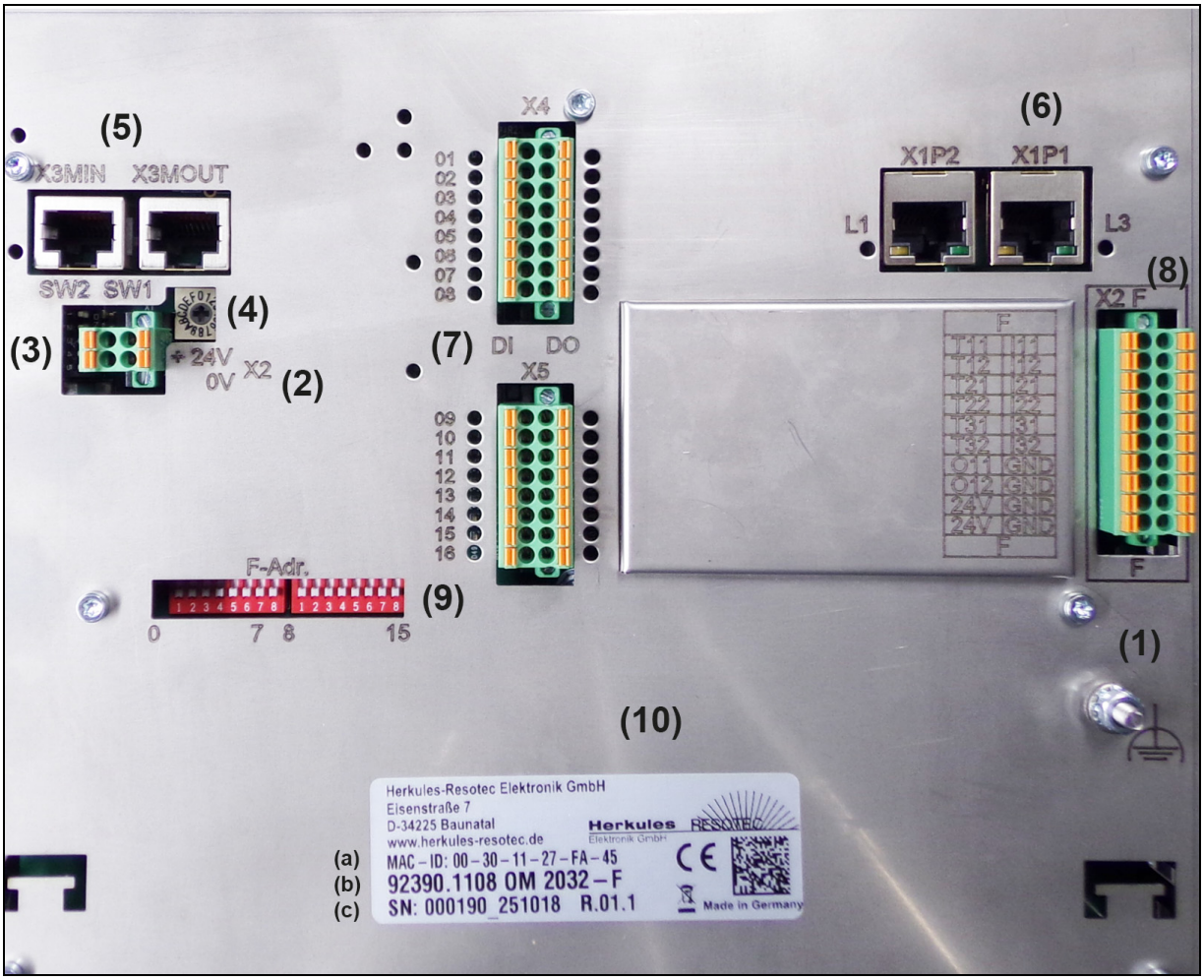


Fig.4.3: Rear side using the example of the module OM 2032-F

Terminal assignment depends on module type

Fig. 4.3 shows the maximum structure of the rear side of the module. The pin assignment (1) to (5) is the same for all module types. Depending on the device type, the other connections are located on the rear, which are explained in the corresponding chapters.

Pin connection legend:

(1) Functional grounding (all OM 2032)
(2) Power supply X2 (all OM 2032)
(3) DIP-switch SW2 (all OM 2032)
(4) Coding switch SW1 (all OM 2032)
(5) Module bus connection X3 (all OM 2032)
(6) PLC connection X1 (only OM 2032 Head Module)
(7) Digital Input/Output connections X4 and X5 (only OM 2032 Head Module)
(8) Connection of fail-safe inputs / outputs and process supply X2F (or X6F for older devices)(only OM 2032-F)
(9) DIP switch "F-Adr." for the PROFIsafe target address (only OM 2032-F) or

DIP switch "Profibus-Adr." for PROFIBUS target address.

(10) Identification plate with the following information :
(a) MAC-ID-number (only OM 2032 Head Module)
(b) Article number and device designation
(c) the first digits are the serial number,
after "_" see the production date with day, month, year

4.4.3 Functional grounding connection

S34: Functional grounding

A functional grounding must absolutely be connected.

CAUTION

- The functional grounding of the operation module must be installed according to the DIN VDE 0100 norming standard and must only be installed by qualified personnel.

=> Connect to the functional grounding to the marked grounding points (1) on the reverse side of the operation module.

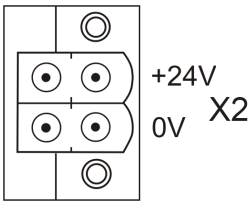
Functional grounding (1)

Cable shields are not suitable for functional grounding.
Interface modules can be damaged or destroyed if the cable for functional earthing does not have the required minimum cross-section of 4 mm².

WARNING!

4.4.4 Connecting the power supply

Voltage supply (2)



=> The cable for the voltage supply is connected to the connector pin strip. The provided four-pole clamping connector should be used.

- A 24V voltage supply must be equipped with a secure electrical disconnection of the low voltage. The maximum allowable length is 9 m.

Applies to OM 2032 and OM 2032-F

ATTENTION

For the DC 24 V supply, only use power supplies with safe electrical isolation according to IEC 364-4-41 or HD 384.04.41 (VDE 0100, part 410), e.g. according to the standards SELV (Safety Extra Low Voltage) and PELV (Protective Extra Low Voltage).

The power supply must only be within the specified voltage range of 24 V (-15 % / +20 %). Otherwise, function failures on the operation module cannot be ruled out.

Applies to potential-bound system design (PELV):

From the DC 24 V output of the power supply, connect the connection for GND 24 V to the equipotential bonding for a uniform reference potential. Select a connection point that is as central as possible.

CAUTION

S35: Ground concept

All safe input and safe output signals of the OM 2032-F refer to the ground signal F-GND. There shall be no switching element in the connection between ground and OM 2032-F (the ground must be permanently wired).

4.4.5 DIP-Switch SW2

DIP-Switch SW2 (3)

The DIP-Switch SW2 switches the bus termination and is used to change the mode.

The DIP-Switch SW2 switch number is depicted after a decimal point in the following guidelines. For the adjacent picture that would mean: SW2.1 - ON, SW2.2 - ON, SW2.3 - ON, SW2.4 - OFF und SW2.5 - OFF.

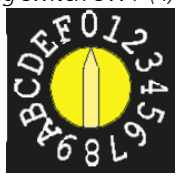
The switch settings should be set as follows:

only valid for the Head module and the last Sub module (see Fig. 4.4)

SW2.1- ON:	120 Ω Bus termination (only set to "ON" on the Head module and the last Sub module. All other modules inbetween the bus set to "OFF" (see Fig. 4.4).
SW2.2 - SW2.4:	not used
SW2.5 - ON:	is used for the PP mode
SW2.5 - OFF:	Standard mode (LED red, green, blue and status)

4.4.6 Coding switch SW1

Coding switch SW1 (4)



SW1 to 0

The coding switch SW1 is used to set the slave address of the Sub Modules (1 to 3).

The coding switch SW1 has the following special settings:

- **Position A,B,C, D:**
  not used
- **Position 0:**
  Head Module
- **Position 1 to 3:**
  Sub Module 1 to 3 (see Fig. 4.4)
- **Position 4 to 9:**
  not used/not permitted

Position E and F

There are still two special positions, E and F, which are described in chapter "Offline test".

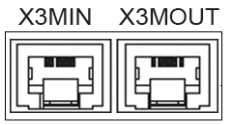
4.4.7 Connecting the module bus

WARNING!

This connection does not apply to the OM 2032 with EtherCAT®, as no submodules can be connected with this variant.

The maximum permissible length of the module bus is 9 m.

RESOTEC module bus connection (5)



=> Connect the OM 2032 operation modules as submodules for the local substructure to the module bus connection X3, as shown in Fig. 4.4.

The OM 2032-F may only be operated as a head module. Only OM 2032 may be connected as sub modules.

=> Set the DIP switch SW2.1 (3) and the coding switch SW1 (4) according to Fig. 4.4.

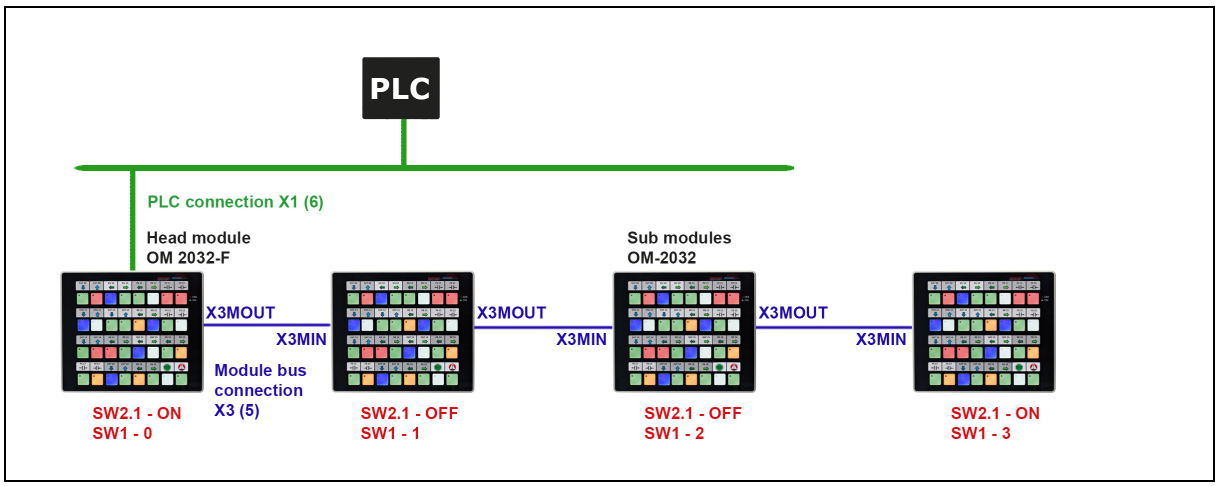


Fig. 4.4: Connection of the sub modules with standard network cable

4.4.8 Connection PLC

As you can see in Fig. 4.4, the Head Module is connected directly to the control.

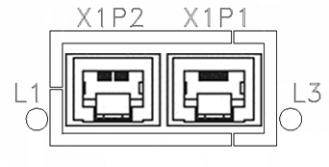
4.4.8.1 PROFINET® connection

Use only standard network cables for connection. The maximum allowed length of the network cable is 100 m.

=> Connect your PLC network cable (PROFINET® I/O) to the PLC connections.

The two LEDs on the network connector are used for the internal diagnosis and have the following meanings:

PLC connection X1(6)



L1
shows the communication status 1.

L3
shows the communication status 2.

Error-free operating status:
L1 and L3 light up green

4.4.8.2 EtherCAT® connection

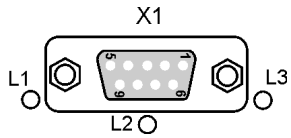
=> Connect the network cable as follows:
X1P1 = IN
X1P2 = OUT

Error-free operating status:
L1 lights green

4.4.8.3 PROFIBUS-DP® connection

The PROFIBUS connection is assigned as follows:

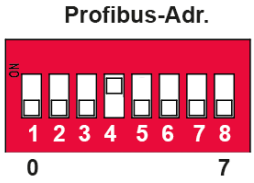
PLC connection PROFIBUS (6)



X1		
PIN	Signal name	Designation
1	-	
2	-	
3	RxD/TxD-P	Data line Plus
4	CNTR-P	Repeater direction control
5	DGND	Data ground
6	VP	+5 V supply bus termination
7	-	
8	RxD/TxD-N	Data line minus
9	CNTR-N	Repeater directional control

Switch for setting the PROFIBUS® slave address

Profibus address switch (9)



The adjacent DIP switch (9) is located on the back of the OM 2032. You must use this switch to set the PROFIBUS slave address after you have parameterized the adjustment module using the TIA Portal software and determined the address.

Further information in chapter 6.4 „PROFIBUS integration“.

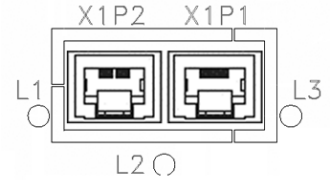
4.4.8.4 Ethernet/IP® connection

Use only standard network cables for connection. The maximum allowed length of the network cable is 100 m.

=> Connect your PLC network cable (Ethernet/IP®) to the PLC connections.

The LEDs on the network connector are used for the internal diagnosis and have the following meanings:

PLC connection Ethernet/IP® (6)



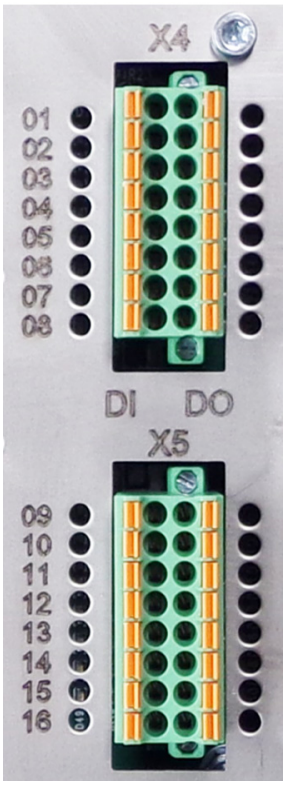
Status of LED	Meaning	Status OM 2032 Head Module
L1 flashing L2 on L3 off	System is running and waiting for the allocation of an IP-address.	System is starting without stored IP-adress with DHCP-mode (delivery status).
L1 on L2 on L3 flashing green	System is running and has no connection to the PLC (master).	System has an IP-address.
L1 on L2 on L3 on	System and communication to PLC is running.	System has an IP-address.
L1 on L2 on L3 flashing red	System is running, but with communication failure.	Communication failure with the PLC (master), e.g cable, network configuration, PLC.

4.4.9 Connection of digital input and outputs X4 and X5

Maximum allowed cable lengths < 2 m unshielded, < 10 m shielded.

The digital input and outputs have the following assignment:

Connection of digital input and outputs (7)



Contact	DI	DO
01	Digital input 1	Digital output 1
02	Digital input 2	Digital output 2
03	Digital input 3	Digital output 3
04	Digital input 4	Digital output 4
05	Digital input 5	Digital output 5
06	Digital input 6	Digital output 6
07	Digital input 7	Digital output 7
08	Digital input 8	Digital output 8
09	Digital input 9	Digital output 9
10	Digital input 10	Digital output 10
11	Digital input 11	Digital output 11
12	Digital input 12	Digital output 12
13	Digital input 13	Digital output 13
14	Digital input 14	Digital output 14
15	Digital input 15	Digital output 15
16	Digital input 16	Digital output 16

The LEDs next to the connectors show the status of the respective input and outputs.

Important!

The reference potential of the digital inputs and outputs is 0 V of the supply connection X2.

4.4.10 Pin assignment for fail-safe operation

Three fail-safe, two-channel inputs and one fail-safe, two-channel output are available for fail-safe operation. The following safety instructions must be observed when connecting the fail-safe inputs and outputs:

S22: Connection of safe digital inputs DANGER

Safety requirements SIL 3, PL d Cat 3 can be implemented by connecting a two-channel input. Additional measures for wiring the fault exclusion or the use of certified components may be necessary.

S23: Connection of single-channel safe digital inputs DANGER

Single-channel safe inputs of the OM 2032-F may only be used under special precautions for safety applications. The safe operation of a single-channel input always requires additional safety measures or fault exclusions, which must be taken into account in the overall system design.

S24: Unconnected safe digital inputs *WARNING!*

Unconnected safe digital inputs in dual-channel mode cause the OM 2032-F to signal the inactive safe state for the input pair.

S27: Connection of safe digital outputs CAUTION

To achieve SIL 3, PL d Cat 3, the safe digital outputs of the OM 2032-F shall be operated and connected in dual-channel mode.

S28: Maximum output current of the safe digital outputs CAUTION

The maximum output current at the test output pins of the safe digital outputs shall not exceed 500 mA to avoid damage to the OM 2032-F hardware.

S29: Short circuit of the safe digital outputs *WARNING!*

In case of a short circuit of the digital outputs a thermal shutdown into the safe state will be issued by the OM 2032-F automatically.

S30: : Safe digital output turned off CAUTION

In the turned off state (safe state) the output signal is not actively pulled to F-GND. The safe state of the safe digital outputs of the OM 2032-F is "off" (high-impedance). It is therefore not allowed to connect an external safety device or function (such as a valve or a break) that needs a 24 V level to reach the safe state.

S31: Connection of safe digital inputs and outputs

The final inspection of the machine must be carried out by the plant operator. Maximum allowed cable lengths < 2 m unshielded, < 10 m shielded.

WARNING!

S36: Galvanic isolation

There is no galvanic isolation between the safe digital inputs, the safe digital outputs and the safety module itself.

CAUTION

S37: Ground reference of the safe digital inputs

An active sensor connected to a safe semiconductor input must have the same ground level F-GND as the OM 2032-F.

CAUTION

S42: Connection of external sensors

The cabling of the external sensors to the two-channel safe inputs of the OM 2032-F must be carried out according to the specifications from the electrical installation. Maximum allowed cable lengths < 2 m unshielded, < 10 m shielded.

DANGER

S43: Ground interruption at actors of the safe outputs

A grounding loss of the load connected to the safe digital output of the OM 2032-F shall be prevented by a hard wired ground connection to the F-GND of the OM 2032-F.

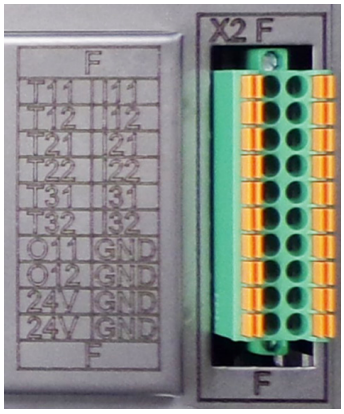
Connect the OM 2032-F according to the illustration on the side, which is located on the back of the OM 2032-F at the connection socket.

Connection of fail-safe inputs / outputs (8)

The connections of the inputs and outputs in the table and at connector X2F (or X6F if it is an older device) must be connected via sensors and actuators.

Chapter 6.2.4 contains pre-tested configurations and connection examples.

And that means:



Contact	Meaning	Contact	Meaning
F-T11	Test output 11	F-I11	Input 11
F-T12	Test output 12	F-I12	Input 12
F-T21	Test output 21	F-I21	Input 21
F-T22	Test output 22	F-I22	Input 22
F-T31	Test output 31	F-I31	Input 31
F-T32	Test output 32	F-I32	Input 32
F-O11	Output 11	F-GND	Ground connection
F-O12	Output 12	F-GND	Ground connection
F-24V	Connection 24 VDC	F-GND	Ground connection
F-24V	Connection 24 VDC	F-GND	Ground connection

The galvanically isolated process supply is provided via the connections F-24V and F-GND of a 24 V-SELV / PELV power supply unit.
Maximum allowed cable lengths < 2 m unshielded, < 10 m shielded.

Connect the device power supply via connection X2 (see chapter 4.4.4).

S39: Process power supply

DANGER

The safe power supply of the OM 2032-F must be ensured by a 24 V-SELV / PELV power supply unit according to EN 60950-1, which limits the maximum voltage to 60 V in case of failure. The maximum constant supply voltage of 30 V must not be exceeded in order to avoid permanent damage to the safety circuits of the OM 2032-F. Maximum allowed cable lengths < 2 m unshielded, < 10 m shielded.

4.4.11 Test outputs

CAUTION

S25: Load capacity of the test outputs

The maximum constant output current at the test output pins of 0.1 A shall not be exceeded to avoid damage to the OM 2032-F hardware. It must be ensured that only modules with a total current consumption of ≤ 0.1 A are connected to the test output or that technical measures such as protective fuses are used.

CAUTION

S26: Temperature increase due to short circuit of the test outputs

A short circuit of the test outputs to F-GND will activate a thermal switch-off to the safe state.

WARNING!

S38: Ground reference of the test outputs

The test output signals are not isolated and all use the same ground potential F-GND.

4.4.12 Switch for setting the PROFIsafe target address

On the back of the OM 2032-F there are also two DIP switches F-address, which you must use to set the PROFIsafe target address after you have parameterized the operation module using the TIA Portal software and determined the address.

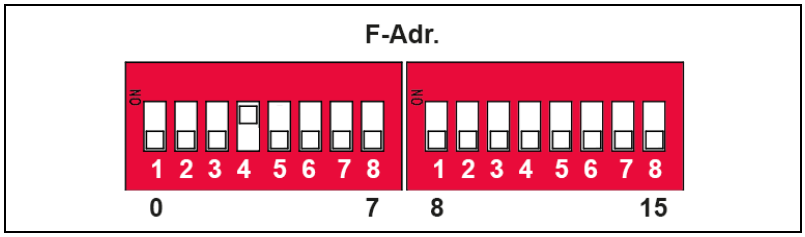


Fig. 4.5: DIP switch for setting the PROFIsafe target address

For further information, refer to chapter 6.2.3.10, PROFIsafe integration.

4.5 Offline test

SW1 (4) position F

- **Position F:**
  The input and display options are demonstrated in this mode. Set the rotary switch to "F" and restart your operation module. The operation module is now in offline test. Pressing keys changes the colours of the keys. The control LED illuminates as long as the key is pressed.

SW1 (4) position E

- **Position E:**
  The operation module group can be tested in this mode. Pressing a key on one of the Sub Modules will illuminate an LED on the Head Module. Pressing a key on the Head Module will show on the Sub Modules.
  The Head Module is programmed in the following way:
  Set the rotary switch SW1 on the Head Module to "E". Do not change the Sub Modules.
  The display is the same on all operation modules.

Status:

The module online status is indicated by the status LEDs in the keys.

- Status-LED key 1 - operation module 0 (Head Modul, always on)
- Status LED key 2 - operation module 1
- :
- Status LED key 4 - operation module 3

Testing the keys:

The keys are mapped via the red LEDs (outputs).

- Red LED key 1 - key 1 (input 1)
- Red LED key 2 - key 2 (input 2)
- :
- Red LED key 32 - key 32 (input 32)

4.6 Creating insertion stripes

You have the option to label the keys according to the project. Create insertion stripes with the following dimension:

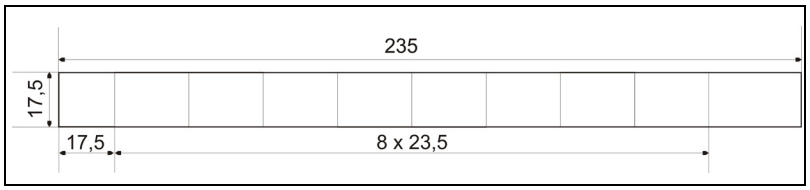


Fig. 4.5: Insertion stripes dimensions

You can insert the insertion stripes in the installed condition, as long as the front material is < 3.5mm thick. If the material is thicker then the Control Module must be demounted.

=> Give the template a name and then print out the label.

Respect the material thickness of the label insertion stripes.

Make sure that the chosen insertion stripe label material is rigid enough. This is necessary for the insertion of the stripes. The max. permissible thickness of the label insertion stripe is 0.15mm.

=> Cut out the label insertion stripe.

=> Cut the edges of the label insertion stripe for easy insertion.

=> Remove the old label stripe if applicable.

=> Insert the new label insertion stripe until it is fully inserted. *The label will stick out of the end of the insertion sheath by about 4 cm.*

A fixing of the label insertion stripe is not necessary.

5 Commissioning

5.1 Warning notice for the OM 2032-F

S1: Specially qualified personnel for the OM 2032-F

The installation, configuration, operation and decommissioning of the OM 2032-F may only be carried out by qualified personnel with experience in the implementation and handling of safety-related applications.

S2: Application area of the OM 2032-F

CAUTION

The OM 2032-F is a class B product according DIN EN 55022. The OM 2032-F may only be used in the field of industrial automation of machines. It is the user's responsibility to check whether the OM 2032-F is suitable for the intended safety-related application and for the expected operating and ambient conditions. The OM 2032-F is a "conforming object" with regard to its safety-related function according to EN 61508-2 Appendix D, as it is not a safety-related system in itself.
Before the OM 2032-F can be integrated into a safety-related system, you must perform a complete hazard and risk analysis and identify the required safety functions of the OM 2032-F.

S4: Test and documentation after device replacement

CAUTION

The OM 2032-F may only be replaced by authorised persons and properly instructed persons. After replacement, all safety functions of the machine must be checked and validated again and this must be documented.

S5: Safety-critical malfunctions of the OM 2032-F

DANGER

Safety-critical malfunctions of the OM 2032-F that do not cause the device to assume the safe state must be reported immediately to Herkules-Resotec Elektronik GmbH. The OM 2032-F must be replaced and returned to Herkules-Resotec Elektronik GmbH.

S6: Handling of defective operation modules

DANGER

The OM 2032-F must not be repaired by the user. A defective OM 2032-F must be replaced and disposed of or returned to Herkules-Resotec Elektronik GmbH. The OM 2032-F must not be opened. The identification plate secures a screw on the back of the module and must not be removed or damaged in this area.

DANGER

S8: Maximum operating time

The maximum operating time of the OM 2032-F must not exceed 10 years. It must be taken out of operation by the user 10 years after the date noted on the operation module.

DANGER

S23: Connection of single-channel safe digital inputs

Single-channel safe inputs of the OM 2032-F may only be used under special precautions for safety applications. The safe operation of a single-channel input always requires additional safety measures or fault exclusions, which must be taken into account in the overall system design.

WARNING!

S24: Unconnected safe digital inputs

Unconnected safe digital inputs in dual-channel mode cause the OM 2032-F to signal the inactive safe state for the input pair.

CAUTION

S25: Load capacity of the test outputs

The maximum constant output current at the test output pins of 0.1 A shall not be exceeded to avoid damage to the OM 2032-F hardware. It must be ensured that only modules with a total current consumption of ≤ 0.1 A are connected to the test output or that technical measures such as protective fuses are used.

CAUTION

S27: Connection of safe digital outputs

To achieve SIL 3, PL d Cat 3, the safe digital outputs of the OM 2032-F shall be operated and connected in dual-channel mode.

WARNING!

S29: Short circuit of the safe digital outputs

In case of a short circuit of the digital outputs a thermal shutdown into the safe state will be issued by the OM 2032-F automatically.

CAUTION

S30: : Safe digital output turned off

In the turned off state (safe state) the output signal is not actively pulled to F-GND. The safe state of the safe digital outputs of the OM 2032-F is "off" (high-impedance). It is therefore not allowed to connect an external safety device or function (such as a valve or a break) that needs a 24 V level to reach the safe state.

S41: Prevention of an external short circuit of the sensor

CAUTION

You must prevent an external short circuit of a passive sensor by observing the rules described in standard EN 60664. You must document which error is excluded by which rule. Product or application-specific safety regulations that may apply to the external sensors and their connection must also be observed.

5.2 Steps to commissioning

If the symbol => appears in this manual, you will be prompted to operate. The result of your service is shown in italics..

- The device must have be at room temperature before installation commences. In case of thawing, the device must be left to dry before it is turned on.
- To prevent overheating of the device during operation, it must not be placed in direct sunlight and the ventilation slits must not be covered.

=> First inspect the electrical and mechanical installation.

=> Make sure in particular that the cable layout and shielding is correct.

=> Check the switch position of the operation module.

S16: IP degree of protection of the OM 2032-F

WARNING!

An OM 2032-F with damaged front foil must be taken out of operation.

The operation module is now ready for operation.

5.3 Operation module start-up

=> Turn on the power supply.
The ON LED (green) and the ERR LED (red) light up. The outputs are off.

All key LEDs are illuminated in white one after the other and switched off again.
Now the ON-LED (green) lights up, the ERR-LED (red) flashes. The operation module is ready for operation and is waiting for communication with the PLC.

If the operation module does not start, the wiring may not be correct. Check the electrical installation.

Behaviour in case of communication errors or faulty data:

The outputs and the key LEDs are switched off.

DANGER

S7: Malfunction of the operation module

In the event of a fault in the safety-related function of the OM 2032-F, the operation module must be replaced immediately and sent to Herkules-Resotec Elektronik GmbH to investigate the cause of the fault.

CAUTION

S20: Diagnostic test interval

The diagnostic test interval for the two-channel safe digital inputs for passive sensors is 1 hour.
The diagnostic test interval for the two-channel safe digital output is 1 hour.

DANGER

S21: : Loss of the hardware fault tolerance (HFT) in the safe state

After detection of a safety-critical fault, the OM 2032-F shall not be kept in a fail-safe state for more than 1 hour.

IMPORTANT!

S31: Connection of safe digital inputs and outputs

The final inspection of the machine must be carried out by the plant operator. Maximum allowed cable lengths: < 2 m unshielded, < 10 m shielded.

CAUTION

S37: Ground reference of the safe digital inputs

An active sensor connected to a safe semiconductor input must have the same ground level F-GND as the OM 2032-F.

DANGER

S45: Switching on the operation module

If the OM 2032-F is switched on and the RUN state does not occur correctly within a maximum of 8 hours, the OM 2032-F must be restarted by switching it off and on again. A trained safety service personal must then check whether functionally safe operation is guaranteed.

DANGER

S46: Operation modules outside the RUN state

The OM 2032-F shall not be operated outside the RUN state for more than 8 hours to ensure that all relevant tests are performed within the safe reaction time.

5.4 Safety audit

S40: Reverse polarity protection

DANGER

The OM 2032-F has reverse polarity protection. When commissioning or changing the power supply chain, the correct connection of the power supply must be checked.

5.5 Documentation

S19: Re-Certification

NOTE!

If an OM 2032-F is integrated in a machine / system, the following points must be made known to the end user in the safety manual of the machine / system:
Safety instructions; application examples; approved components for circuit protection; type designations of safety-related components; permissible operating modes; requirements for the end user (training); safety-relevant interfaces; restrictions; requirements for maintenance, use, assembly, installation, provision and dismantling with regard to functional safety; environmental conditions; valid standards, certificates and attestations; reporting body with regard to functional safety; requirements according to IEC 61508-2 Appendix D and IEC 61508-3 Appendix D.

S44: Error at safe input with active sensor

CAUTION

If a safe input is configured for an active sensor, the OM 2032-F cannot detect the following errors:
- external short over sensor
- external short to 24 V
- external short between dual channel lines.

You must prevent these faults by observing certain rules when setting up the machine, routing the cables, etc.

6 Control integration

6.1 Warnings for the configuration of fail-safe operation modules

S1: Specially qualified personnel for the OM 2032-F

The installation, configuration, operation and decommissioning of the OM 2032-F may only be carried out by qualified personnel with experience in the implementation and handling of safety-related applications.

S2: Application area of the OM 2032-F

CAUTION

The OM 2032-F is a class B product according DIN EN 55022. The OM 2032-F may only be used in the field of industrial automation of machines. It is the user's responsibility to check whether the OM 2032-F is suitable for the intended safety-related application and for the expected operating and ambient conditions. The OM 2032-F is a "conforming object" with regard to its safety-related function according to EN 61508-2 Appendix D, as it is not a safety-related system in itself.
Before the OM 2032-F can be integrated into a safety-related system, you must perform a complete hazard and risk analysis and identify the required safety functions of the OM 2032-F.

S19: Re-Certification

NOTE!

If an OM 2032-F is integrated in a machine / system, the following points must be made known to the end user in the safety manual of the machine / system:
Safety instructions; application examples; approved components for circuit protection; type designations of safety-related components; permissible operating modes; requirements for the end user (training); safety-relevant interfaces; restrictions; requirements for maintenance, use, assembly, installation, provision and dismantling with regard to functional safety; environmental conditions; valid standards, certificates and attestations; reporting body with regard to functional safety; requirements according to IEC 61508-2 Appendix D and IEC 61508-3 Appendix D.

S47: Inputs (functionally safe)

CAUTION

Fail safe state: switched off, short-circuit proof (clock output). The sampling time is 6 ms + 2 ms for a two-channel input that switches. For each individual channel switched simultaneously, 2 ms are added (up to 16 ms if 3 dual-channel inputs switch simultaneously).

CAUTION

S48: Output (functionally safe)

Fail safe state: switched off
The maximum time between receipt of a safety telegram and activation of the corresponding safe digital output is 7.7 ms.

DANGER

S49: PROFINET error management

The error bits reported by the OM 2032-F via PROFIsafe shall not be used to trigger the safety function of a device or system.

ATTENTION

S50: Reset output error or input error

Each output error or input error is reset by a valid PROFIsafe message with the corresponding error reset bit.

CAUTION

S51: Pre-tested configuration inputs and outputs

If you are not using a pre-tested configuration, functional validation at application level is required to ensure fail-safe operation (see operating instructions). Please also observe the safety instructions S52 to S65.

DANGER

S52: Configuration

Use the approved configuration tool and a verification procedure to ensure that the configuration of the safe inputs and safe outputs of the OM 2032-F meets the requirements of the safe applications.

DANGER

S53: CRC by iParameterCRC

Take the iParameterCRC value of the released configuration tool.

CAUTION

S54: Configuration debounce filter time of safe digital inputs

The sampling time of the safe input channels incl. filter time: 6 ms + (2 ms * (n - 1)) + (x * 0.4 ms) with n: Number of simultaneously changed inputs and x: 0...255 Filter time constant (0...102 ms filter time) becomes effective when switching on as well as when switching off.

WARNING!

S55: Configuration channel mode of safe digital inputs

To achieve SIL 3 and PL d Cat 3, the safe input must be configured and used as a two-channel input.

S56: Configuration of consistency filter for safe digital inputs

CAUTION

The deactivation of the consistency filter in dual-channel operation must be carried out in accordance with the safety requirements of the active sensor. The short-circuit of a sensor in dual-channel mode for passive sensors on an input line, for example, is not detected and therefore does not lead to a fail-safe state.

S57: : Configuration consistency filter dependency on debounce time

CAUTION

For proper operation, the consistency filter time must be set larger than the input debounce time.

S58: Configuration test pulse outputs

ATTENTION

Due to hardware limitations, the OM 2032-F with 3 dual channel inputs has only one configurable test output pair. This test output pair is configured via the test output signal configuration parameters of input group 1. Changing test output parameters of input group 2 or 3 has no effect.

S59: Configuration of test pulse outputs load by the sensor

ATTENTION

The test pulse duration of 400 μs shall be used with an external test output load of ≤ 2 kOhm.

S60: Configuration channel mode of safe digital outputs

WARNING!

In order to use SIL 3 or PL d Cat 3 for the safe outputs of the OM 2032-F dual-channel operation must be activated.

S61: Configuration of test outputs test pulses

CAUTION

Output test pulses are only generated if the output is active /high. No test pulses are generated in the safe state (low, high impedance).

S62: Configuring and checking PROFINET iParameters

CAUTION

The documentation (and review) of the configured iParameter for a certain safe application is mandatory and requires the safe generation and storage of the iParameter dataset as a supplement for the safety assessor of the entire safety system.

S63: Test pulse outputs

CAUTION

When using the input mode for passive sensors (F-Txx), the OM 2032-F test outputs must be used as a power source for the external sensor for correct detection of the OM 2032-F. The test pulse length must be set to a value other than "On". The final test of the machine must be performed by the user.

CAUTION

S64: Parameterization of the test pulse outputs

Do not deactivate the test pulse outputs ("Off" or "On" setting) in the configuration when using the digital inputs in passive sensor mode.

CAUTION

S65: : Parameterization of test pulses to connected actuators

Safety devices such as actuators or brakes connected to the safe digital outputs of the OM 2032-F must be stable against the configured output test pulses of the OM 2032-F. The final testing of the machine must be carried out by the user.

6.2 PROFINET® I/O

TIA Portal is a registered trademark of SIEMENS AG.

The configuration of the operation modules is described using the project engineering tool TIA Portal as an example. Only the steps that are specific to the OM modules are explained.

only TIA Portal-trained staff

For basic information and further descriptions, refer to the TIA manual. We assume that only trained personnel who are familiar with the TIA Portal will configure the operation modules.

6.2.1 Installing the GSDML file

Install GSDML file

If not yet performed, the valid GSDML file "GSDML-V2.32-RESOTEC-0303-OM2032-20170314" for the operation module must first be installed in TIA Portal. Thereby:

V2.32 GSDML Version
20170314 Version of the GSDML file "Year Month Day"

The GSDML file is available on the CD or can be downloaded from our website.

6.2.2 Assigning the IP adress and the device name

see TIA manual

The operation module can be found, designated an IP address and given a device name, through e.g. TIA Portal, as soon as you have installed it in the PROFINET network.

6.2.3 Parameterization of the OM 2032 modules

To operate the operation module, you must perform parameterization steps in TIA Portal and on the operation module.

IMPORTANT!

In order to operate the operation module in standard mode, the DIP switch SW2.5 must be set to OFF. If you need the PP mode, the DIP switch SW2.5 must be set to ON (see chapter 4.4.5).

first parameterization for all OM operation modules

Since you must select your desired operation module in TIA Portal for parameterization, the software then only displays the input options for this operation module type.

Parameterization of the OM 2032PP see chapter 6.2.3.6

The description of the parameterization therefore applies to all OM 2032 operation module types in the first chapters and then the special parameterization options for the OM 2032-F, OM 2032PP and OM 2032PP-F are described in extra chapters.

6.2.3.1 Key numbering of the operation modules

The OM 2032 operation module has 32 keys with LED RGB key illumination and one status LED in each key.

As a head module it has 16 digital inputs and outputs and the OM 2032-F also has 3 safe inputs and 1 safe output.

Fig. 6.1: Operation module OM 2032/OM 2032-F.

For the OM 2032PP and OM 2032PP-F operation modules, the numbering of the keys also corresponds to that of Fig. 6.1. The colours blue and white are not supported for these operation module types.

6.2.3.2 Integration of the OM 2032 modules into the PROFINET network

Basic information and further descriptions must be obtained from the TIA manual.

In order to parameterize an operation module properly, you must have detailed knowledge about the TIA Portal project engineering tool. This chapter only describes the parameter settings specific to the operation module.

Special parameter settings are described in later chapters.

The parameterization of the operation modules is explained using the example of an OM 2032. For the OM 2032-F, OM 2032PP and OM 2032PP-F, the parameterization is the same.

IMPORTANT! Password for the security program

As soon as you want to integrate or edit an OM 2032-F or OM 2032PP-F, you need the password to edit the safety program.

If the symbol => appears in this manual, you will be prompted to operate. The result of your service is shown in italics.

=> Select the desired sub module in the hardware catalog (1) and drag it into the work area (2).
A symbol image of the operation module appears in (2).

=> Connect the operation module e.g. to the PLC.
The connection is drawn in (2).

Information about the selected object is displayed in area (5).

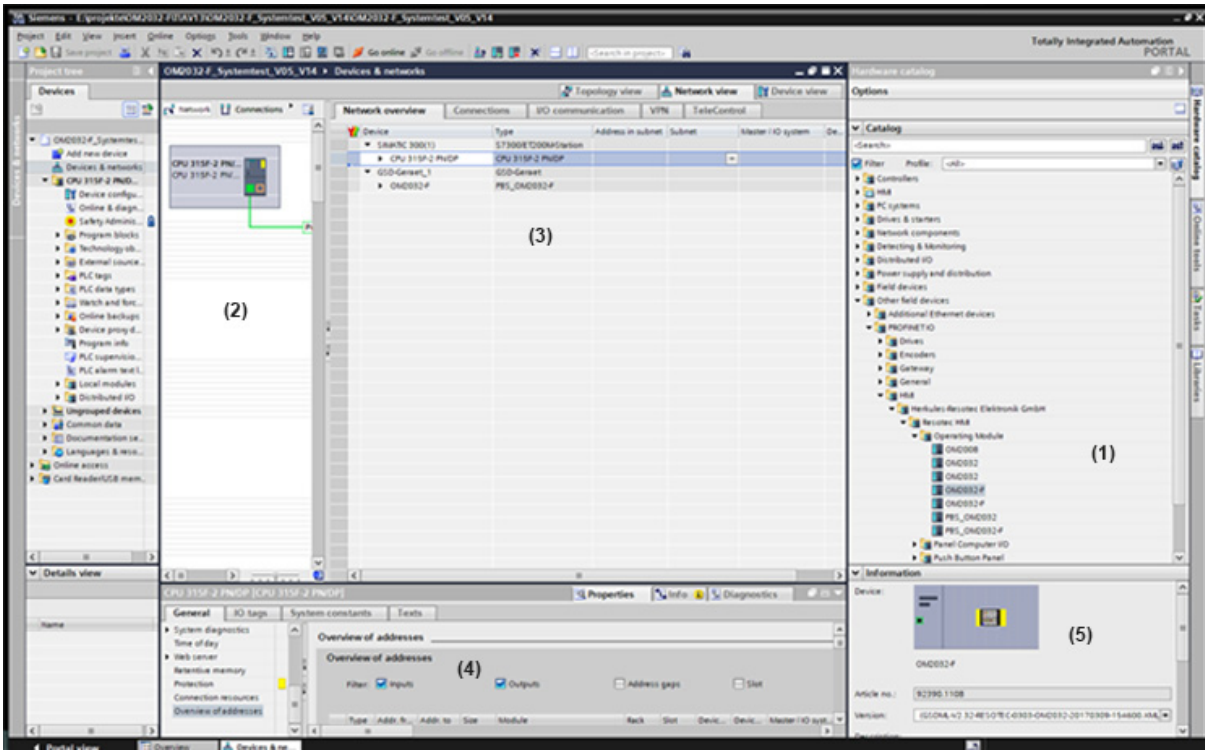


Fig. 6.2: Project view (example)

=> Click on the tab "Device overview".
The device overview (Fig.6.3) appears.

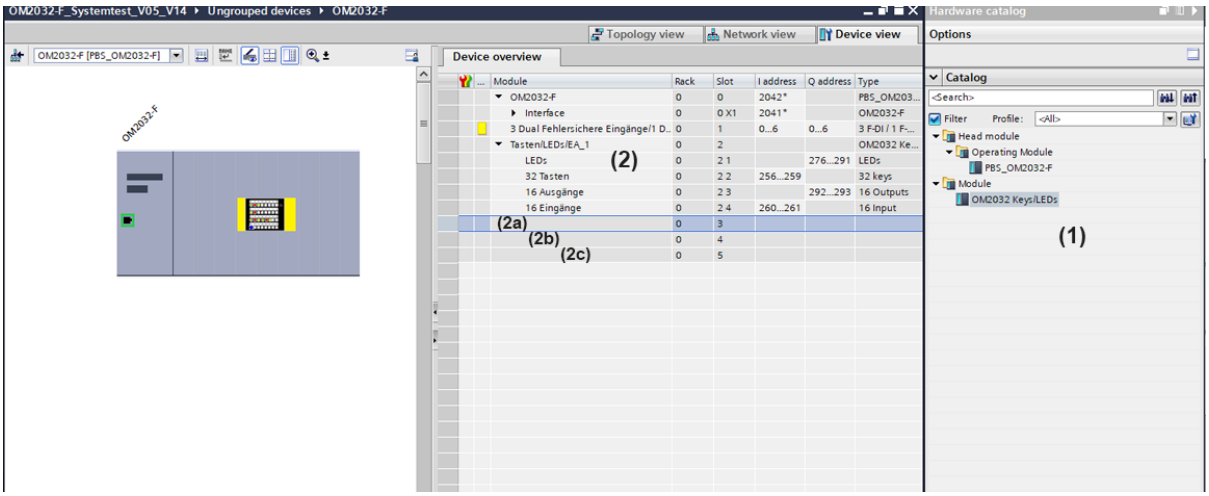


Fig. 6.3: Device overview head module connection

The operation module selected from the hardware catalog (1) (in Fig. 6.3 it is a head module) is displayed in area (2).

If the selected operation module is a head module, the three possible sub-modules can be added to the lines (2a) to (2c).

=> Select the desired operation module in the hardware catalog (1) and drag it to line (2a).
It is displayed in the line.

=> Proceed in the same way with the max. 2 further sub-modules.

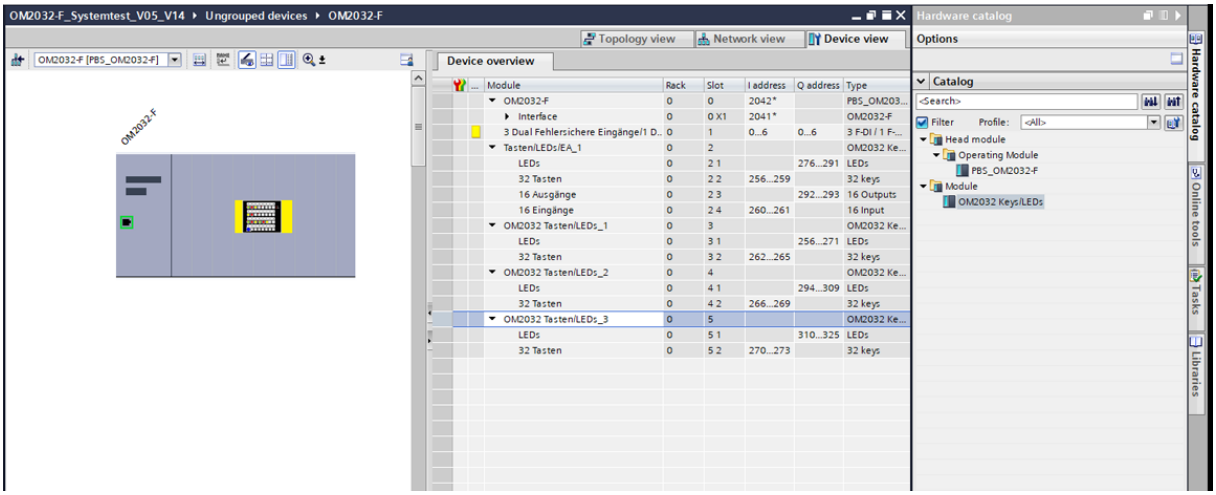


Fig. 6.4: Device overview with one head module and the max. three possible sub-modules

6.2.3.3 LED control and bit combination for OM 2032 and OM 2032-F with PROFINET

The keys and inputs are read in cyclically every 5 ms. The LEDs and outputs are updated every 10 ms.

Each key has a red status LED and RGB LEDs for key illumination. The following bit combinations are used to control the RGB LEDs. For all other combinations, the key illumination is switched off.

Bit red x	Bit green x	Bit blue x	LED control
1	0	0	red
0	1	0	green
0	0	1	blue
1	1	0	yellow
1	1	1	white

"PLC address"; keyboard illustration and digital inputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	key
01	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	key
02	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	key
03	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	key
Digital inputs only in head module									
00	**E08**	**E07**	**E06**	**E05**	**E04**	**E03**	**E02**	**E01**	digital input
01	**E16**	**E15**	**E14**	**E13**	**E12**	**E11**	**E10**	**E09**	digital input

"PLC address"; LED illustration and digital outputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	LED control
00	8	7	6	5	4	3	2	1	LEDs 1 to 8, red
01	8	7	6	5	4	3	2	1	LEDs 1 to 8, green
02	8	7	6	5	4	3	2	1	LEDs 1 to 8, blue
03	8	7	6	5	4	3	2	1	LEDs 1 to 8, status
04	16	15	14	13	12	11	10	9	LEDs 9 to 16, red
05	16	15	14	13	12	11	10	9	LEDs 9 to 16, green
06	16	15	14	13	12	11	10	9	LEDs 9 to 16, blue
07	16	15	14	13	12	11	10	9	LEDs 9 to 16, status
08	24	23	22	21	20	19	18	17	LEDs 17 to 24, red
09	24	23	22	21	20	19	18	17	LEDs 17 to 24, green
10	24	23	22	21	20	19	18	17	LEDs 17 to 24, blue
11	24	23	22	21	20	19	18	17	LEDs 17 to 24, status
12	32	31	30	29	28	27	26	25	LEDs 25 to 32, red
13	32	31	30	29	28	27	26	25	LEDs 25 to 32, green
14	32	31	30	29	28	27	26	25	LEDs 25 to 32, blue
15	32	31	30	29	28	27	26	25	LEDs 25 to 32, status
Digital outputs only in head module									
00	A08	A07	A06	A05	A04	A03	A02	A01	Digital output
01	A16	A15	A14	A13	A12	A11	A10	A09	Digital output

6.2.3.4 Parameterization of the LED

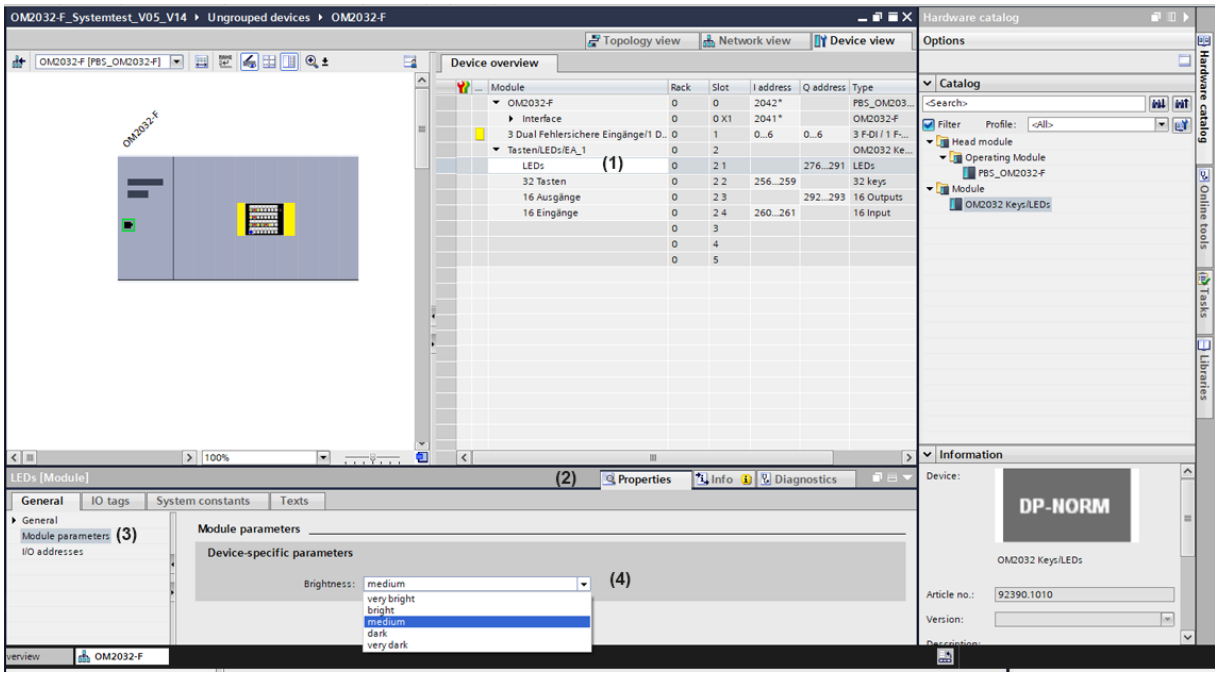


Fig. 6.5: Selection of the LED brightness

=> To change the brightness of the LED, click in line (1) and in the inspector window (2) on "Module parameters" (3).
The selection "Brightness" (4) is opened.

Adjustable is: very bright, bright, medium, dark or very dark. The default setting is "medium".

6.2.3.5 Parameterization of the keys

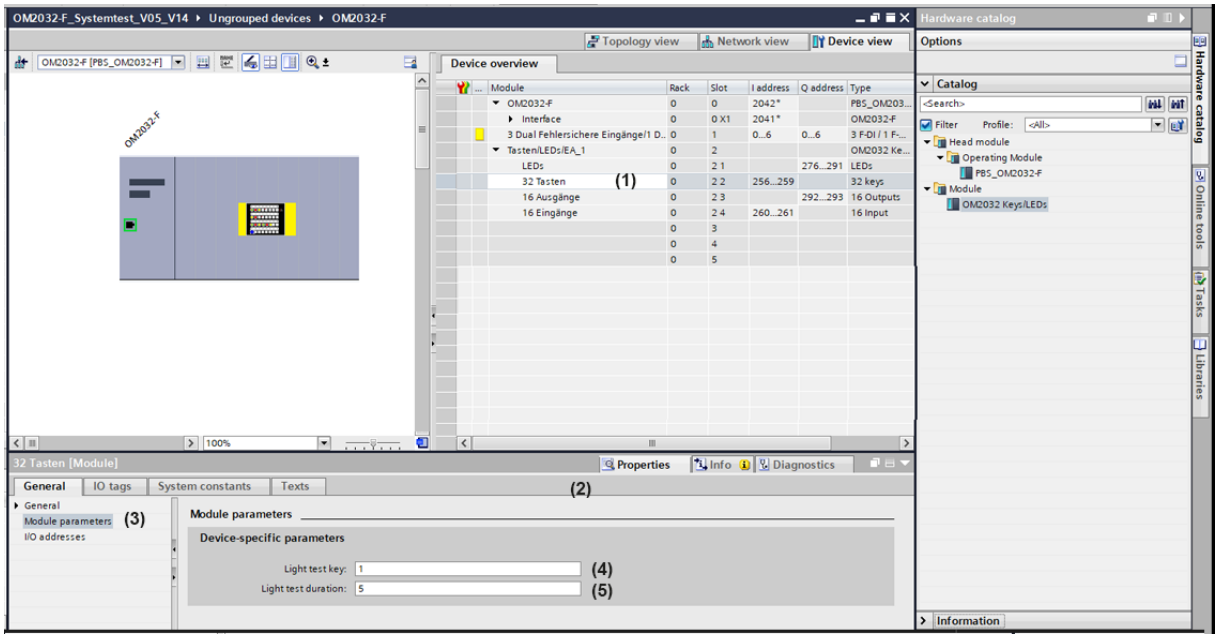


Fig. 6.6: Setting the lamp test

=> To parameterize the lamp test, click in the line "32 keys" (1) and in the inspector window (2) on "Module parameters" (3). *The selections "Light test key" (4) and "Light test duration" (5) are opened.*

The following parameters can be set:

- „Light test key“:
  Here you select the number of the desired key. You can set a number between 0 and 32, where 0 means that no key is used for the lamp test.
- „Light test duration“:
  A value range of 0...60 s can be set. Value "0" means no lamp test. The default setting is 5 s.

Parameterization of the digital inputs and outputs

The digital inputs and outputs of the operation module are fixed and do not have to be parameterized.

Digital inputs and outputs do not have to be parameterized!

6.2.3.6 Parameterizing of the OM 2032 modules in PP mode

IMPORTANT!

To operate the adjustment module in the PP mode, the DIP switch SW2.5 must be set to ON (see chapter 4.4.5).

Key assignment OM 2032PP

Key colours red, green, yellow

The OM 2032PP has the key colors red, green and yellow and thus the following key assignments result:

"PLC address"; keyboard illustration and digital inputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
n+00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	Key
n+01	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	Key
n+02	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	Key
n+03	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	Key
n+04	**E08**	**E07**	**E06**	**E05**	**E04**	**E03**	**E02**	**E01**	Digital input
n+05	**E16**	**E15**	**E14**	**E13**	**E12**	**E11**	**E10**	**E09**	Digital input

"PLC address"; LED illustration and digital outputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	LED control
n+00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	LEDs 1 to 8, red
n+01	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	LEDs 1 to 8, green
n+02	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	LEDs 9 to 16, red
n+03	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	LEDs 9 to 16, green
n+04	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	LEDs 17 to 24, red
n+05	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	LEDs 17 to 24, green
n+06	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	LEDs 25 to 32, red
n+07	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	LEDs 25 to 32, green
n+08	**A08**	**A07**	**A06**	**A05**	**A04**	**A03**	**A02**	**A01**	Digital output
n+09	**A08**	**A07**	**A06**	**A05**	**A04**	**A03**	**A02**	**A01**	Digital output
n+10	**A16**	**A15**	**A14**	**A13**	**A12**	**A11**	**A10**	**A09**	Digital output
n+11	**A16**	**A15**	**A14**	**A13**	**A12**	**A11**	**A10**	**A09**	Digital output

Example for the control of LED 1				
	Bit states			
Bit 0 in Byte n + 00 (red)	1	0	1	0
Bit 0 in Byte n + 01 (green)	0	1	1	0
Control	red	green	Configurable - Green flashing - Yellow - Yellow flashing - Red flashing	out

Example for the control of digital output A01				
	Bit states			
Bit 0 in Byte n + 08	1	0	1	0
Bit 0 in Byte n + 09	0	1	1	0
Control	on	2 Hz	0,5 Hz	out

6.2.3.7 Parameterization of the LED in PP mode

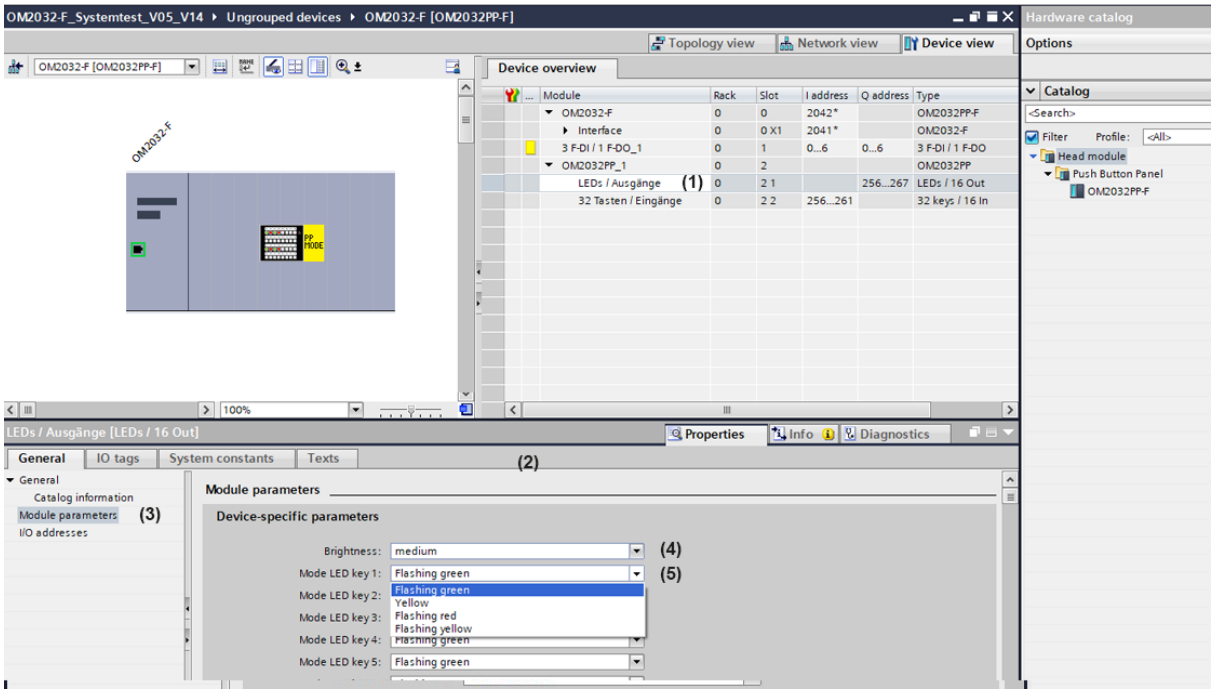


Fig. 6.7: Selection of LED brightness and color mode

=> To determine the brightness of the LED, click in the line (1) and in the inspector window (2) on "Module parameters" (3). *The selection "Brightness" (4) is opened.*

Adjustable is: very bright, bright, medium, dark or very dark . The default setting is "medium"..

=> To determine the mode of the LED, click in the line (1) and in the inspector window (2) on "Module parameters" (3). *The selection "Mode LED key X" will be opened.*

You can select the mode of each button individually. Here you have the possible selection of the LED colors and whether this should flash.

6.2.3.8 Parameterization of the keys in PP mode

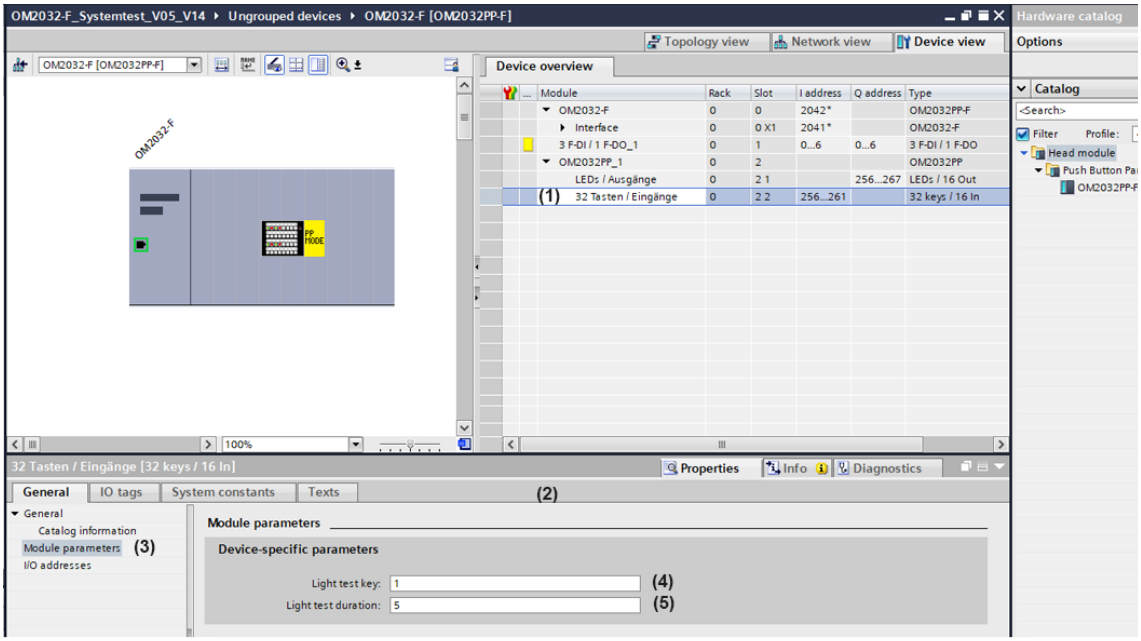


Fig. 6.8: Setting the lamp test

=> To parameterize the lamp test, click in the line "32 Tasten/Eingänge" (1) and in the inspector window (2) on "Module parameters" (3).
The selections "Light test key" (4) and "Light test duration" (5) are opened.

The following parameters can be set:

- "Light test key":
  Here you select the number of the desired key. You can set a number between 0 and 32, where 0 means that no key is used for the lamp test.
- „Light test duration“:
  A value range of 0...60 s can be set. Value "0" means no lamp test. The default setting is 5 s.

Parameterization of the digital inputs and outputs

The digital inputs and outputs of the operation module are fixed and do not have to be parameterized.

Digital inputs and outputs do not have to be parameterized!

6.2.4 PROFIsafe®

ATTENTION!

Password for the parameterization of the fail-safe operation module

The prerequisite for the parameterisation of the fail-safe operation module is knowledge of the safety instructions in chapter 6.1.
You will also need the password to edit the safety program.

=> As soon as you want to parameterize a fail-safe operation module, the window for entering the password appears.

=> Enter the appropriate password.

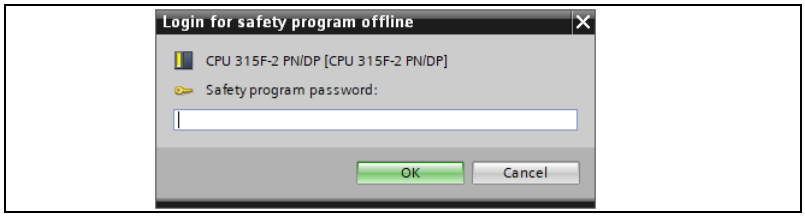


Fig. 6.9: Password entry

The integration of the operation module and the settings for the LED and the keys are carried out as described in Chap. 6.2.3.1 to 6.2.3.7.

6.2.4.1 Integration of the fail-safe inputs and outputs for the OM 2032-F

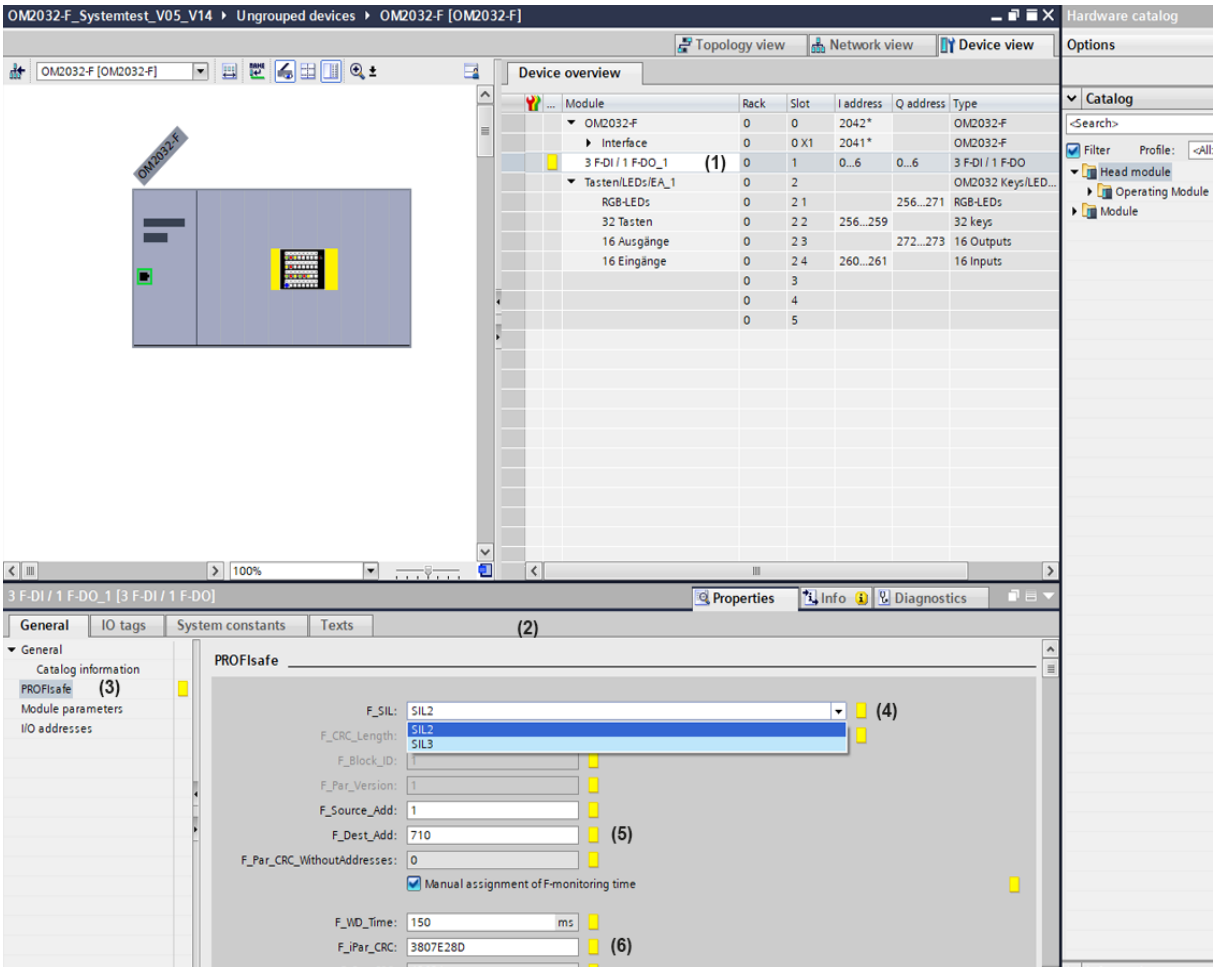


Fig. 6.10: PROFIsafe integration OM 2032-F

=> To parameterize the PROFIsafe integration, click in line (1) and in the inspector window (2) on "PROFIsafe" (3).
The necessary input options are displayed.

To (4):
Here you can select the security level.

To (5):
Enter the desired PROFIsafe target address here (see next page).

To (6):
Enter the iPar CRC here. Pre-tested iParameters CRC are listed in chapter 6.2.4.5

6.2.4.2 PLC process image of the fail-safe channels

The fail-safe channels at slot 1 occupy seven bytes in the input area and seven bytes in the output area of the fail-safe controller in the process image:

"PLC address", input range					
Byte	Bit	Single channel		Dual channel	
0	0	**FDI1.1**	input	**FDI1**	input
	1	**FDI1.2**	input	not used	
	2	**FDI2.1**	input	**FDI2**	input
	3	**FDI2.2**	input	not used	
	4	**FDI3.1**	input	**FDI3**	input
	5	**FDI4.2**	input	not used	
	6	not used			
	7	not used			
1	0	**EDI1.1**	error status	**EDI1**	error status
	1	**EDI1.2**	error status	not used	
	2	**EDI2.1**	error status	**EDI2**	error status
	3	**EDI2.2**	error status	not used	
	4	**EDI3.1**	error status	**EDI3**	error status
	5	**EDI4.2**	error status	not used	
	6	not used			
	7	not used			
2	0	**EDO1.1**	error status	**EDO1**	error status
	1	**EDO1.2**	error status	not used	
	2	not used			
	3	not used			
	4	not used			
	5	not used			
	6	not used			
	7	not used			
3	PROFIsafe Control Byte				
4	PROFIsafe CRC2				
5					
6					

"PLC address", output range					
Byte	Bit	Single channel		Dual channel	
0	0	**FDO1.1**	output	**FDO1**	output
	1	**FDO1.2**	output	not used	
	2	not used			
	3	not used			
	4	not used			
	5	not used			
	6	not used			
	7	not used			
1	0	**ERDI1.1**	reset error status	**ERDI1**	reset error status
	1	**ERDI1.2**	reset error status	not used	
	2	**ERDI2.1**	reset error status	**ERDI2**	reset error status
	3	**ERDI2.2**	reset error status	not used	
	4	**ERDI3.1**	reset error status	**ERDI3**	reset error status
	5	**ERDI4.2**	reset error status	not used	
	6	not used			
	7	not used			
2	0	**ERDO1.1**	reset error status	**ERDO1**	reset error status
	1	**ERDO1.2**	reset error status	not used	
	2	not used			
	3	not used			
	4	not used			
	5	not used			
	6	not used			
	7	not used			
3	PROFIsafe Control Byte				
4	PROFIsafe CRC2				
5					
6					

6.2.4.3 Setting the PROFIsafe address

In the example Fig. 6.10 the value for the parameter "F_Dest_Add" is 710.

If you insert the operation module into TIA Portal, you must assign a PROFIsafe target address to uniquely identify the module. The PROFIsafe target address is the value of the parameter "F_-Dest_Add"..

For setting the DIP switch, the rear of the operation module must be accessible..

On the back of the OM 2032-F there are two DIP switches with which you must set the PROFIsafe target address.

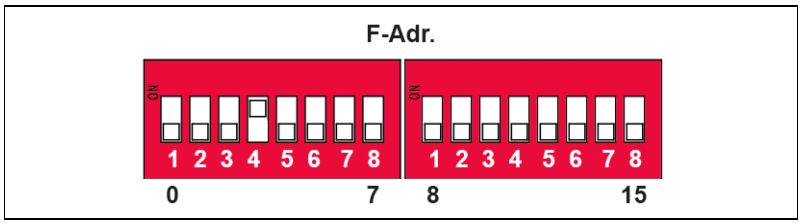


Fig. 6.11: DIP switch for setting the PROFIsafe target address

ATTENTION!

Make sure that the operation module is de-energized while setting the PROFIsafe target address with the DIP switch.

The OM 2032-F takes the set PROFIsafe target address into account as soon as it is switched on again.

ATTENTION!

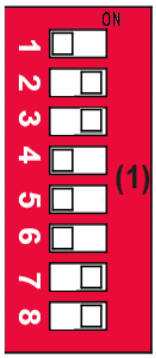
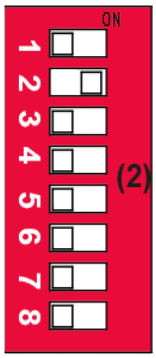
The PROFIsafe target address of the operation module must be unique throughout the communication network and stations. A maximum of 65534 PROFIsafe target addresses may be assigned for the OM 2032-F.
If you change the TIA program so that the PROFIsafe target address changes, you must also adjust the switching positions of the DIP switch on the operation module accordingly.

For the example (Fig. 6.10) from the beginning of the chapter, the binary address for "710" applies:

Related setting at DIP switch (1) and (2): 01100011 01000000

- 1 = Switching position "ON
- 0 = Switching position "OFF"..

Set the DIP switch on the back of the OM 2032-F as follows:

Switch	Switch	Bit number	Value	Address
	1	0	1	0
	2	1	2	2
	3	2	4	4
	4	3	8	0
	5	4	16	0
	6	5	32	0
	7	6	64	64
	8	7	128	128
	1	8	256	0
	2	9	512	512
	3	10	1024	0
	4	11	2048	0
	5	12	4096	0
	6	13	8192	0
	7	14	16384	0
	8	15	32768	0
	PROFIsafe target address			710

The adjacent switching positions correspond to binary address 710.

The PROFIsafe target address is the sum of the values in the right column. The operating module can now be uniquely identified by the set PROFIsafe target address.

6.2.4.4 Configuring the iParameters

CAUTION

S62: Configuring and checking PROFINET iParameters

The documentation (and review) of the configured iParameter for a certain safe application is mandatory and requires the safe generation and storage of the iParameter dataset as a supplement for the safety assessor of the entire safety system.

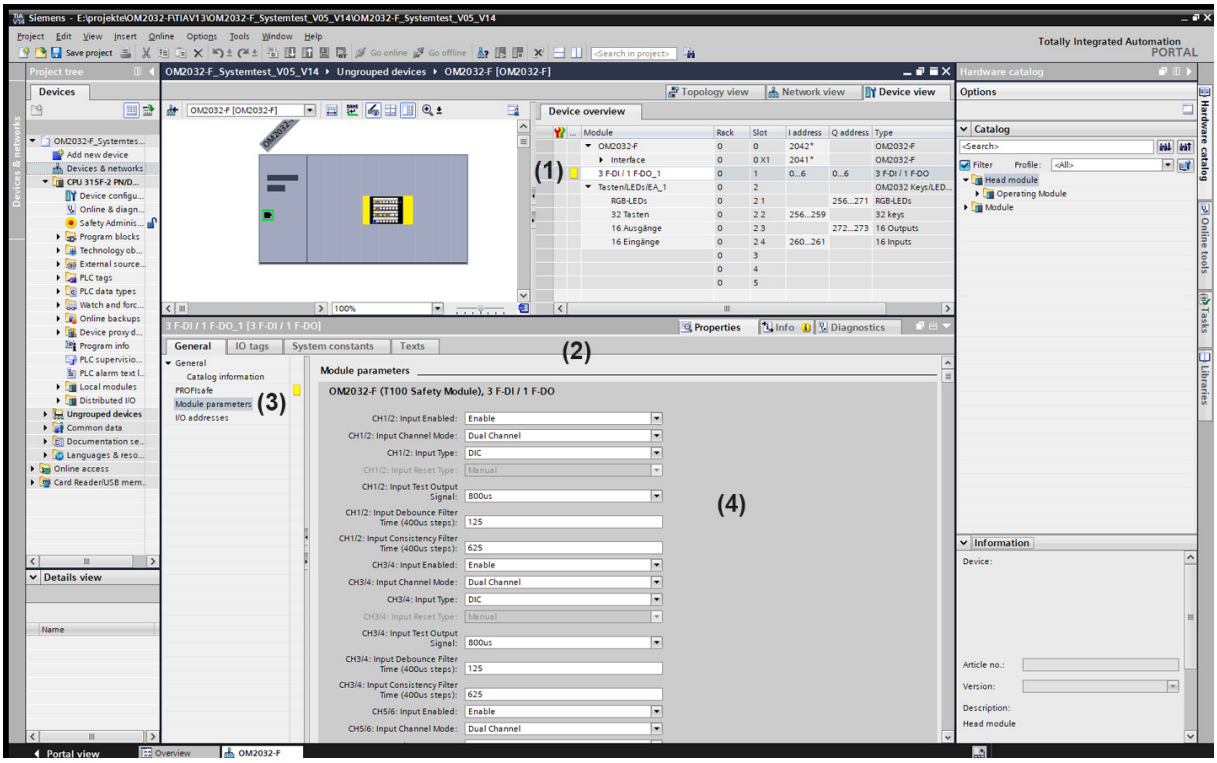


Fig. 6.12: Selecting the input mask "3 F-DI/1 F-DO_1"

=> To set the module parameters, click on "3 F-DI/1 F-DO_1" in the device overview (1) and in the inspector window (2) click on "Module parameters" (3).
The input mask "OM2032-F (T100 Safety Module) 3 F-DI/1 F-DO_1" (4), in which you can set your parameters, is opened.

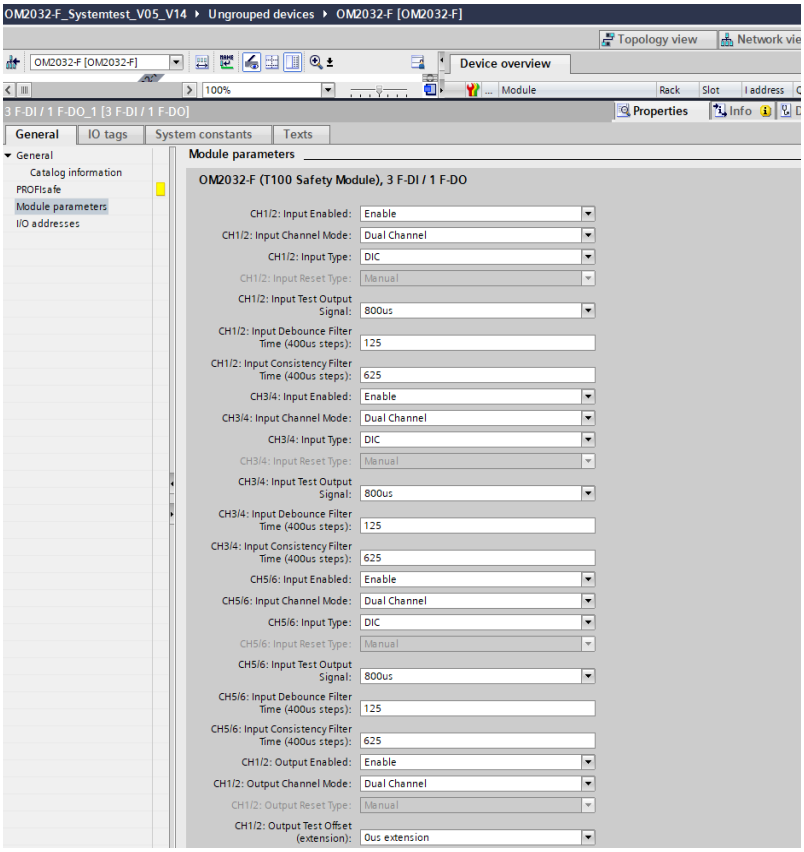


Fig. 6.13: Entry mask "3 dual fail-safe inputs..."

For proper operation, you must configure the following iParameter values:

Parameter input	Size	Description / value
Input Enabled	1 Bit	0: switched off 1: switched on
Input Channel Mode	1 Bit	0: single channel 1: dual channel
Input Type	1 Bit	0: active sensor 1: passive sensor
Input Reset Type	1 Bit	0: manuell
Input Test Output Signal	3 Bit	Test pulse length 0...5: pulse extension by x*400 µs 6: TO always off 7: TO always on
Reserviert	1 Bit	
Input Debouncing Filter Time	8 Bit	Debounce filter time in 400 µs steps, 0...255
Input Consistency Filter Time	16 Bit	Consistency check time in 2-channel mode in x*400 µs 0: Consistency check deactivated 1...2^{16}: x*400 µs

Parameter output	Size	Description / value
Output Enabled	1 Bit	0: switched off 1: switched on
Output Channel Mode	1 Bit	0: single channel 1: dual channel
Output Reset Type	1 Bit	0: manuell
Reserviert	1 Bit	
Output Test Signal (extension)	4 Bit	Output test pulse length x*400 µs 0...15

6.2.4.5 Pre-tested configuration

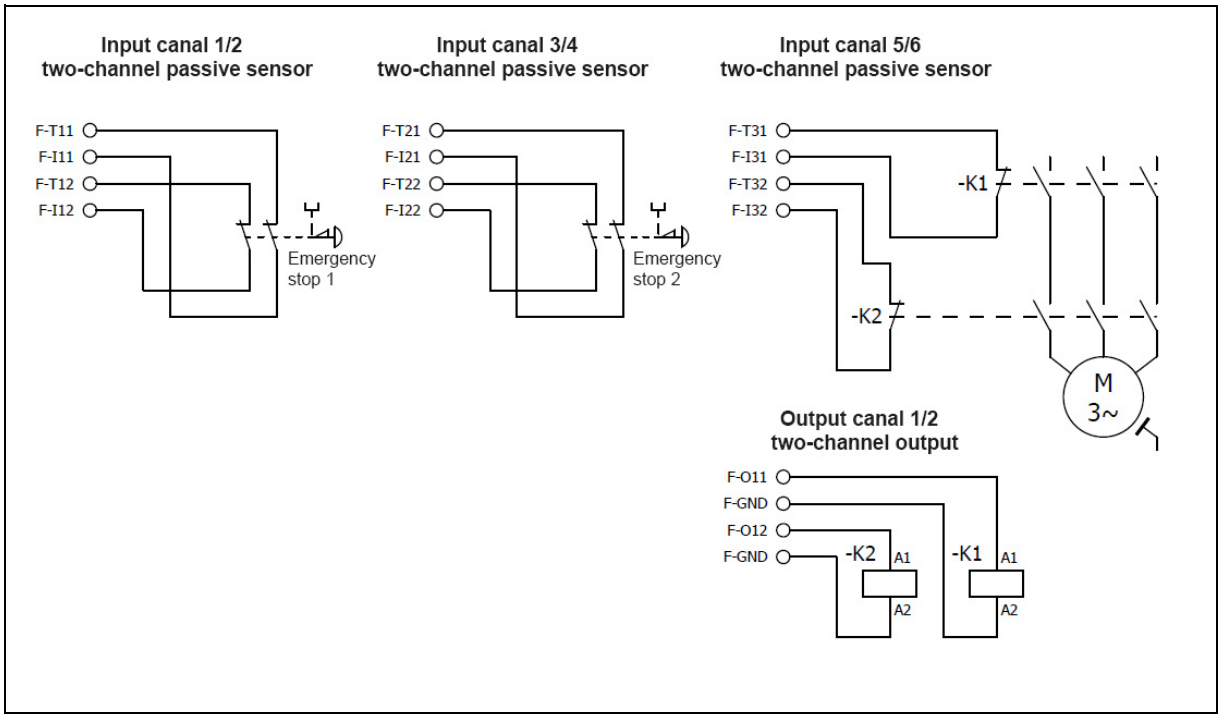
The configuration settings already described allow a large number of parameter variations. The following tables contain lists of pre-tested configurations along with their approved iPar CRC values.

CAUTION

These configurations are tested and can be used by you. If you wish to use other configurations, this requires functional validation at the user level to ensure proper operation of the entire safety function.

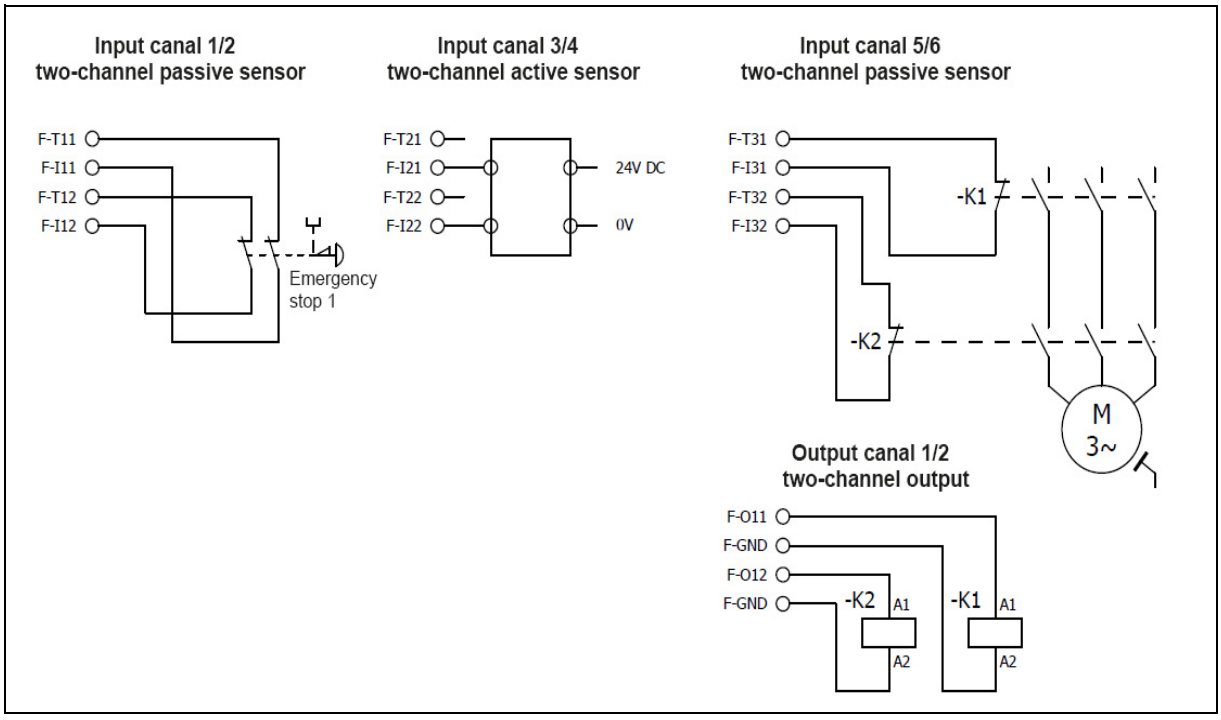
Canal 1/2, 3/4 and 5/6 as two-channel passive sensor and two-channel output

Parameter	CH 1/2	CH 3/4	CH 5/6
Input Enabled	Switched on	Switched on	Switched on
Input Channel Mode	Two-channel	Two-channel	Two-channel
Input Type	Passive sensor	Passive sensor	Passive sensor
Input Reset Type	Manual	Manual	Manual
Input Test Output Signal	800 µs	800 µs	800 µs
Input Debouncing Filter Time	125	125	125
Input Consistency Filter Time	625	625	625
	CH 1/2	**iParameter CRC**	
Output Enabled	Switched on	**3807E28D**	
Output Channel Mode	Two-channel		
Output Reset Type	Manual		
Output Test Signal (extension)	0 µs		



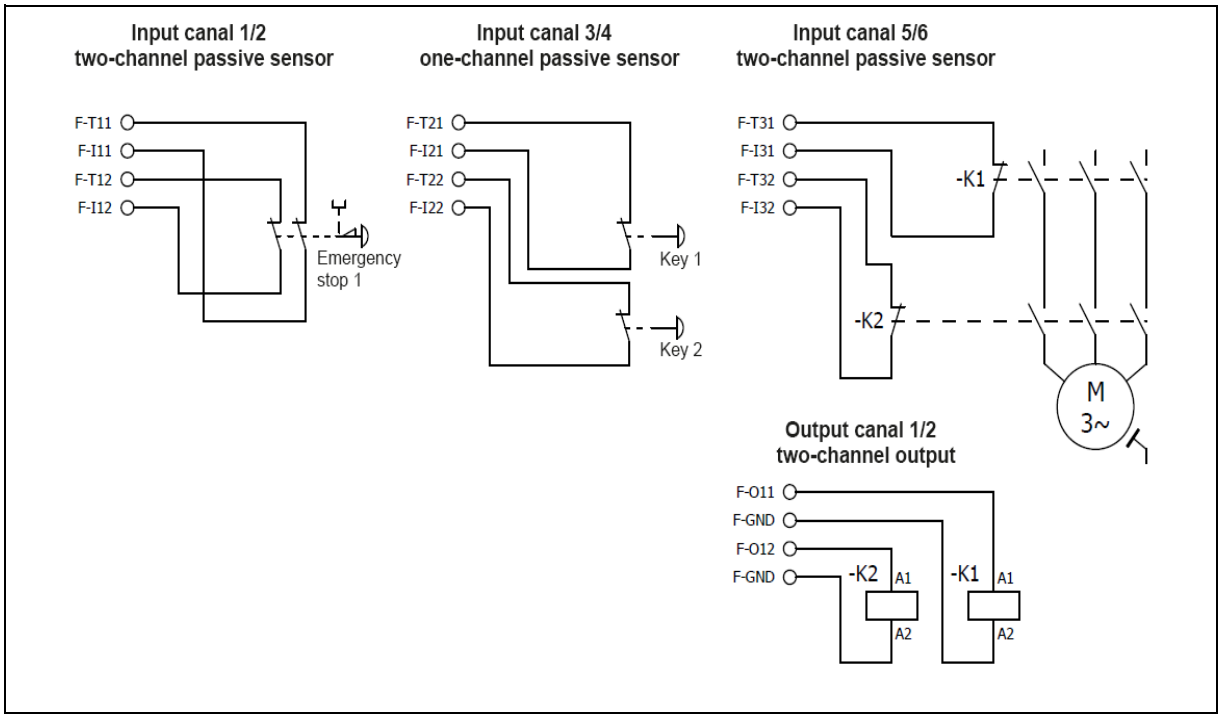
Canal 1/2 and 5/6 as two-channel passive sensor, 3/4 two-channel active sensor and two-channel output

Parameter	CH 1/2	CH 3/4	CH 5/6
Input Enabled	Switched on	Switched on	Switched on
Input Channel Mode	Two-channel	Two-channel	Two-channel
Input Type	Passive sensor	Active sensor	Passive sensor
Input Reset Type	Manual	Manual	Manual
Input Test Output Signal	800 µs	800 µs	800 µs
Input Debouncing Filter Time	125	0	125
Input Consistency Filter Time	625	25	625
	CH 1/2	**iParameter CRC**	
Output Enabled	Switched on	**8575A796**	
Output Channel Mode	Two-channel		
Output Reset Type	Manual		
Output Test Signal (extension)	0 µs		



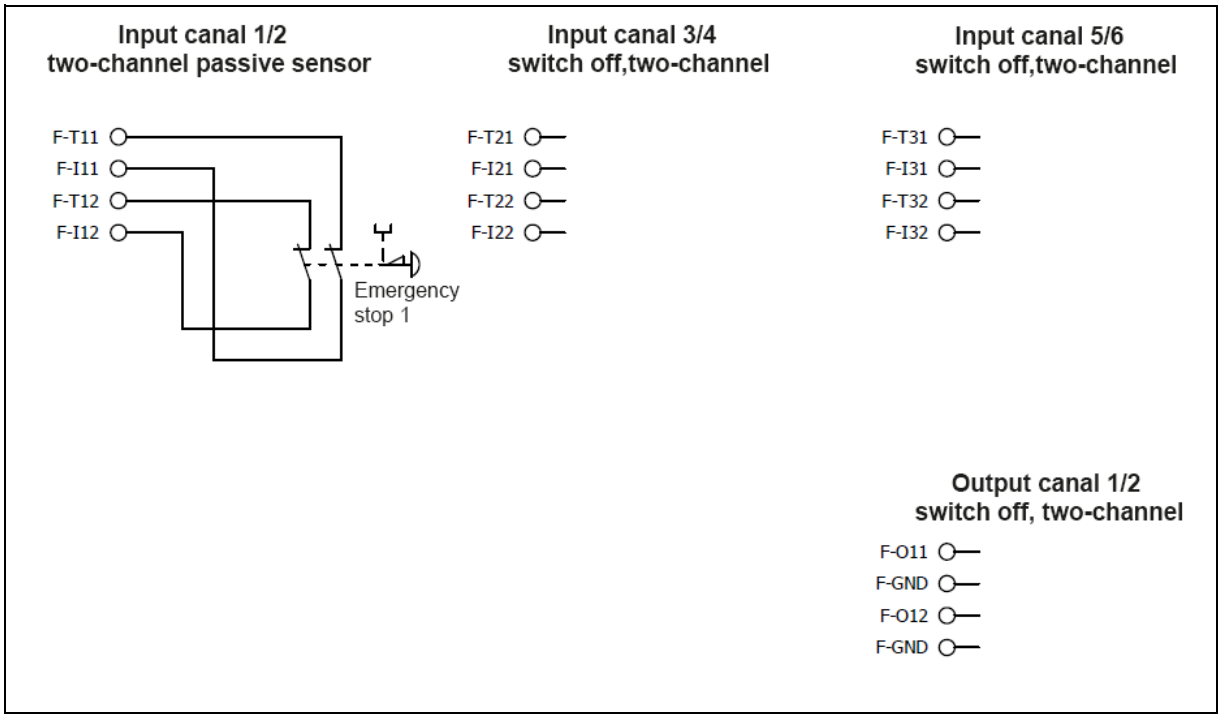
Canal 1/2 and 5/6 as two-channel passive sensor, 3/4 one-channel passive sensor and two-channel output

Parameter	CH 1/2	CH 3/4	CH 5/6
Input Enabled	Switched on	Switched on	Switched on
Input Channel Mode	Two-channel	One-channel	Two-channel
Input Type	Passive sensor	Passive sensor	Passive sensor
Input Reset Type	Manual	Manual	Manual
Input Test Output Signal	800 µs	800 µs	800 µs
Input Debouncing Filter Time	125	125	125
Input Consistency Filter Time	625	0	625
	CH 1/2	**iParameter CRC**	
Output Enabled	Switched on	**D85A11F9**	
Output Channel Mode	Two-channel		
Output Reset Type	Manual		
Output Test Signal (extension)	0 µs		



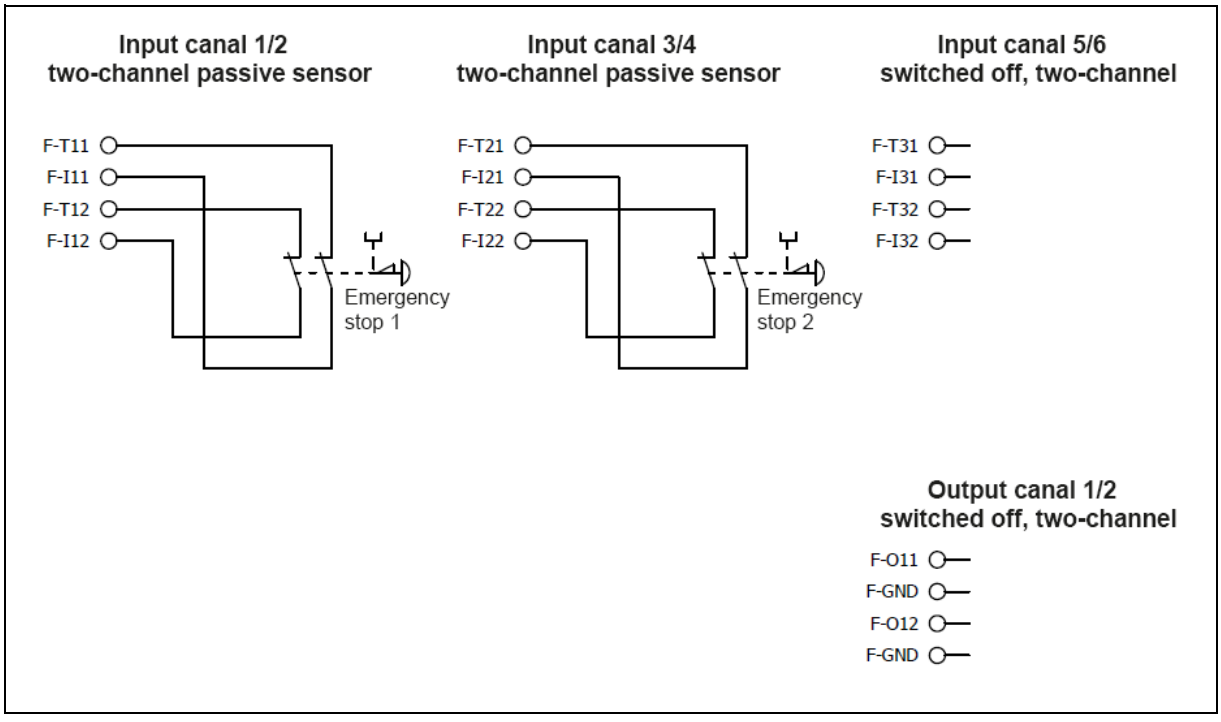
Canal 1/2 as two-channel passive sensor, 3/4 and 5/6 output switched off

Parameter	**CH 1/2**	**CH 3/4**	**CH 5/6**
Input Enabled	Switched on	Switched off	Switched off
Input Channel Mode	Two-channel	Two-channel	Two-channel
Input Type	Passive sensor	Passive sensor	Passive sensor
Input Reset Type	Manual	Manual	Manual
Input Test Output Signal	800 µs	800 µs	800 µs
Input Debouncing Filter Time	125	125	125
Input Consistency Filter Time	625	625	625
	CH 1/2	**iParameter CRC**	
Output Enabled	Switched off	**62745688**	
Output Channel Mode	Two-channel		
Output Reset Type	Manual		
Output Test Signal (extension)	0 µs		



Canal 1/2 and 3/4 as two-channel passive sensor, 5/6 and output switch off

Parameter	CH 1/2	CH 3/4	CH 5/6
Input Enabled	Switched on	Switched on	Switched off
Input Channel Mode	Two-channel	Two-channel	Two-channel
Input Type	Passive sensor	Passive sensor	Passive sensor
Input Reset Type	Manual	Manual	Manual
Input Test Output Signal	800 µs	800 µs	800 µs
Input Debouncing Filter Time	125	125	125
Input Consistency Filter Time	625	625	625
	CH 1/2	**iParameter CRC**	
Output Enabled	Switched off	**CA664F85**	
Output Channel Mode	Two-channel		
Output Reset Type	Manual		
Output Test Signal (extension)	0 µs		



6.3 EtherCAT®

TwinCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany..

The configuration of the operation modules is described using the project engineering tool TwinCAT® as an example. Only the steps that are specific to the OM modules are explained.

only TwinCAT-trained staff

For basic information and further descriptions, refer to the TwinCAT manual. We assume that only trained personnel who are familiar with the TwinCAT will configure the operation modules.

6.3.1 Installing the ESI file

Install ESI file

Copy the ESI file Herkules-Resotec GmbH_180629.xml into the corresponding ESI directory. For example for TwinCAT® 3 into the directory:

C:\TwinCAT\3.1\Config\Io\EtherCAT

6.3.2 Parameterization of the OM 2032 modules

IMPORTANT!

In order to operate the operation module in standard mode, the DIP switch SW2.5 must be set to OFF. If you need the PP mode, the DIP switch SW2.5 must be set to ON (see chapter 4.4.5).

6.3.2.1 Key numbering of the operating modules

The OM 2032 operation module has 32 keys with LED RGB key illumination and a status LED in each key.

Fig. 6.14: Operation module OM 2032.

6.3.2.2 Integration of the OM modules into the EtherCAT network

To properly parametrize an operation module as an EtherCAT® device, you must have detailed knowledge of the configuration tool, e.g. TwinCAT®3. Only the operator module-specific parameter settings are described in this chapter.

Basic information and further descriptions must be obtained from the TwinCAT manual.

=> Select the desired operation module in the hardware catalog according to Fig. 6.15.

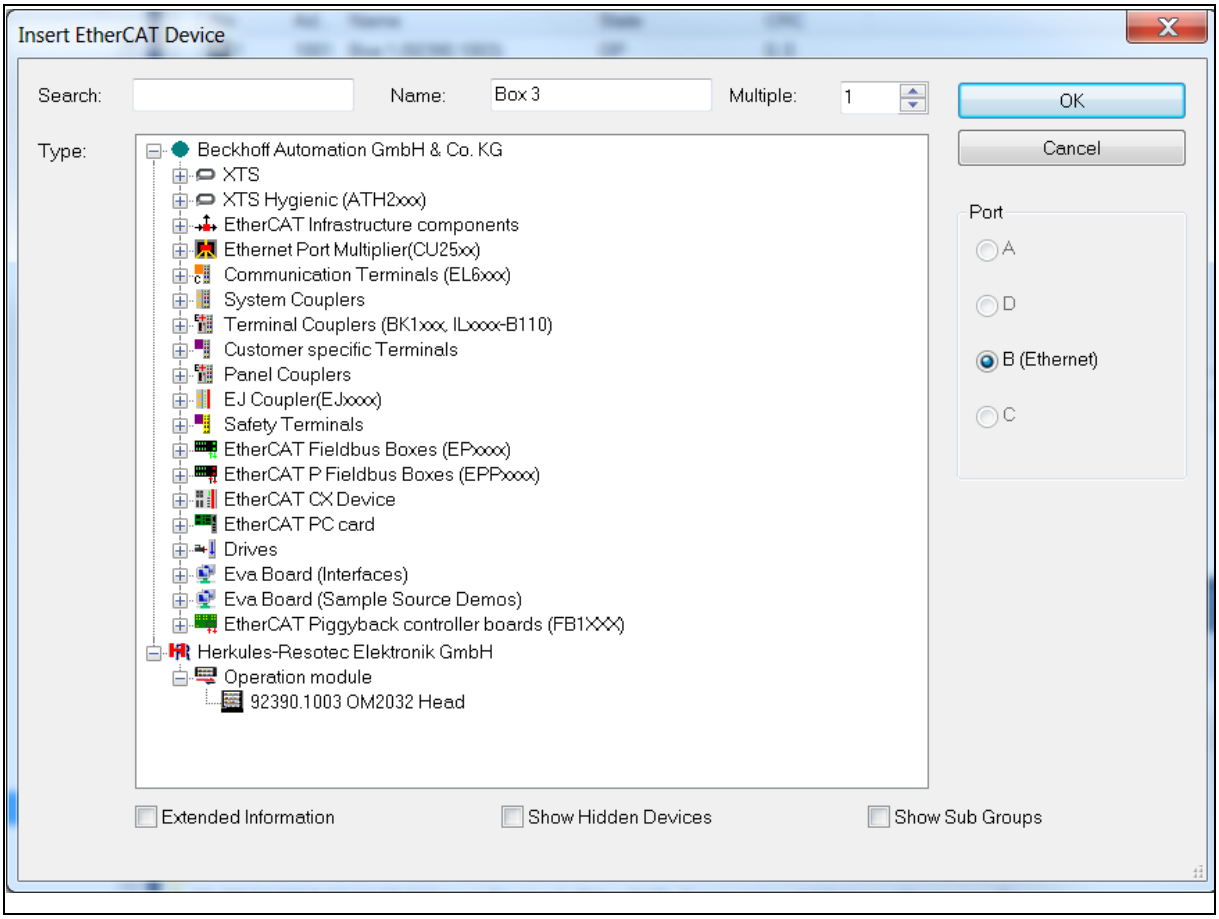


Fig. 6.15: Integrating the OM 2032 module into TwinCAT® 3.

6.3.2.3 LED control and bit combination of OM 2032

The keys are read in cyclically every 5 ms. The LEDs are updated every 10 ms.

Each key has a red status LED and RGB LEDs for key illumination. The following bit combinations are used to control the RGB LEDs. For all other combinations, the key illumination is switched off.

"PLC address"; Keyboard Illustration									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	Key
01	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	Key
02	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	Key
03	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	Key

Bit Red x	Bit Green x	Bit Blue x	LED control
1	0	0	red
0	1	0	green
0	0	1	blue
1	1	0	yellow
1	1	1	white

"PLC address"; LED illustration and digital outputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	LED control
00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**LEDs 1 to 8, red**
01	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**LEDs 1 to 8, green**
02	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**LEDs 1 to 8, blue**
03	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**LEDs 1 to 8, status**
04	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**LEDs 9 to 16, red**
05	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**LEDs 9 to 16, green**
06	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**LEDs 9 to 16, blue**
07	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**LEDs 9 to 16, status**
08	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**LEDs 17 to 24, red**
09	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**LEDs 17 to 24, green**
10	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**LEDs 17 to 24, blue**
11	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**LEDs 17 to 24, status**
12	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	**LEDs 25 to 32, red**
13	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	**LEDs 25 to 32, green**
14	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	**LEDs 25 to 32, blue**
15	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	**LEDs 25 to 32, status**

6.3.2.4 Assignment of keys and LED

Assign the keys and LEDs to your operation module using the corresponding screen page of TwinCAT® 3.

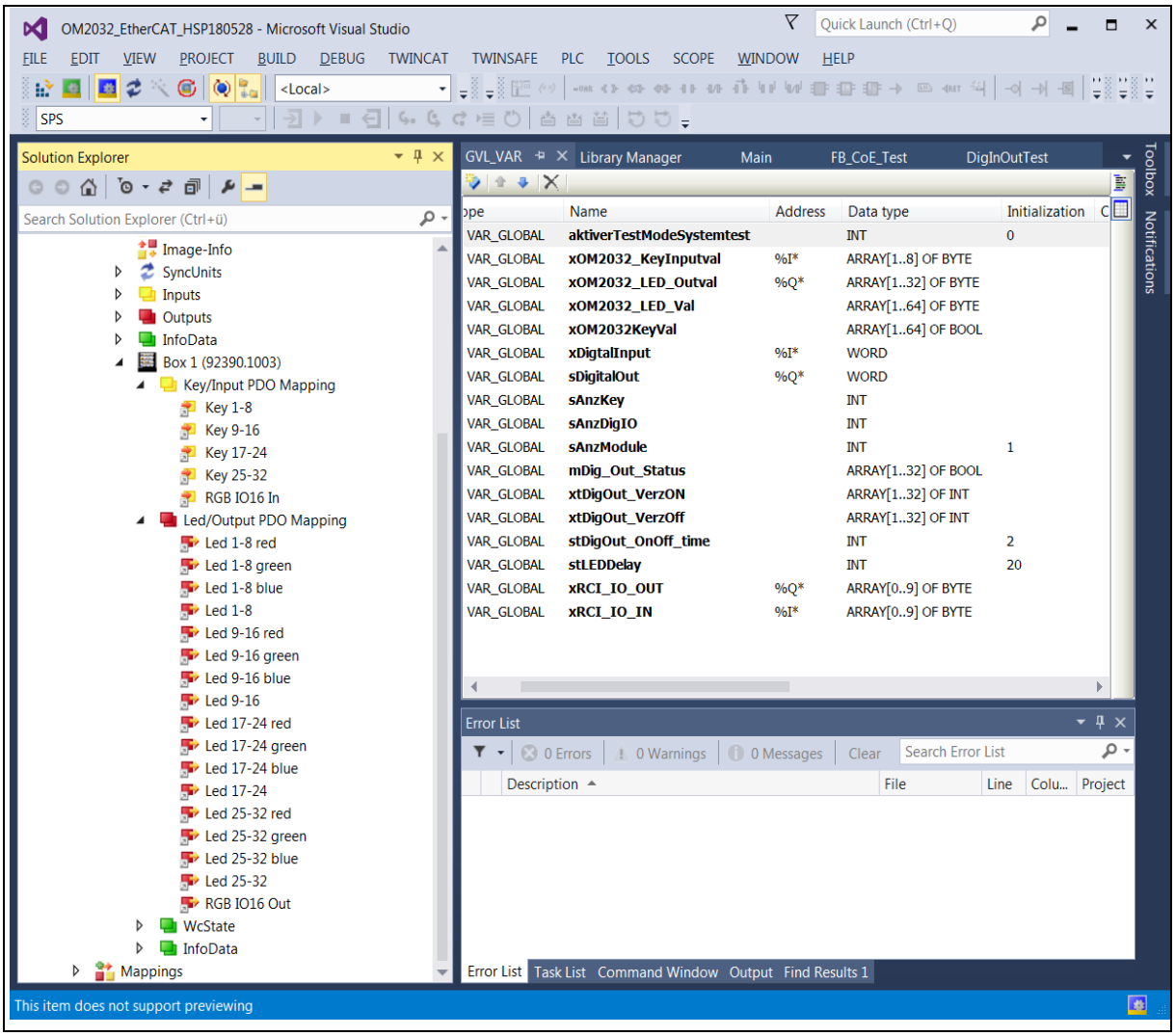


Fig. 6.16: Integration of buttons and LEDs in TwinCAT® 3.

6.3.2.5 Adjusting the parameters

LED parameter: Adjustment of brightness between 10 = 10 % and 100 = 100 % .

Key parameter:
Subindex 001: Determination of the test key 0 to 32 (0 = no key test parameterized)
Subindex 002: Setting the duration of the test key 1 to 59 s

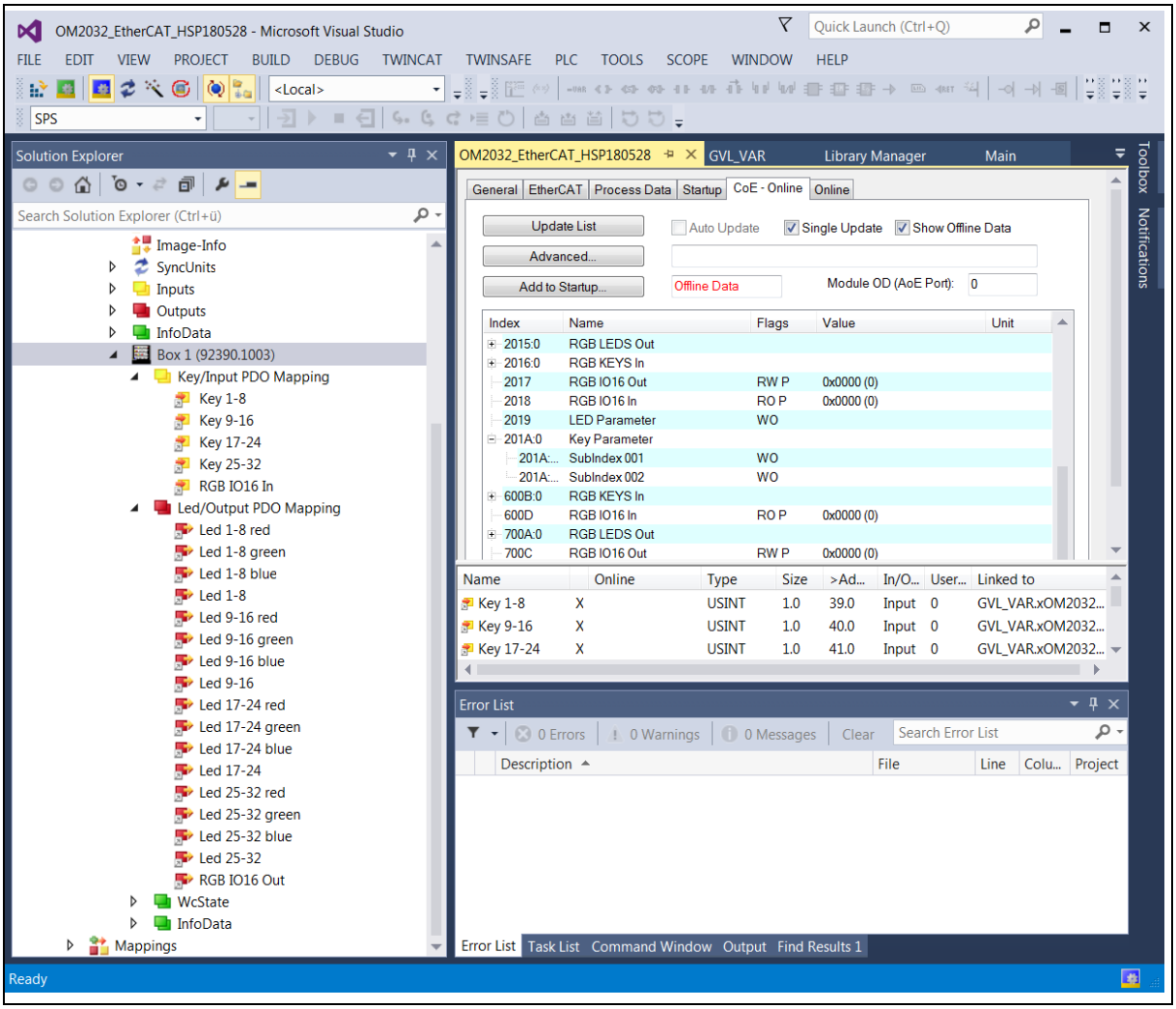


Fig. 6.17: Parameter view OM 2032 in TwinCAT® 3.

6.4 PROFIBUS®

The integration of the operation modules is described using the project engineering tool TIA Portal and GX Configurator-DP as examples. Only the steps that are specific to the OM modules are explained.

TIA Portal is a registered trademark of SIEMENS AG
GX Configurator-DP is a registered trademark of Mitsubishi Electric Europe B.V

For basic information and further descriptions, refer to the TIA Portal and GX Configurator-DP manuals. We assume that only trained personnel who are familiar with the TIA Portal or GX Configurator-DP will configure the operation modules.

only TIA Portal-trained personnel

6.4.1 Installing the GSD file

Install GSD file

If not yet executed, the valid GSD file, e.g. "OM2032.gsd" must be installed for the adjustment module in TIA Portal or GX Configurator-DP.

The GSD file can be found on the CD or downloaded from our website.

6.4.2 Parameterization of the OM 2032 modules

To operate the operation module, you must perform parameterization steps in TIA Portal and on the operation module.

IMPORTANT!

In order to operate the operation module in standard mode, the DIP switch SW2.5 must be set to OFF. If you need the PP mode, the DIP switch SW2.5 must be set to ON (see chapter 4.4.5).

first parameterization for all OM operation modules

Since you must select your desired operation module in TIA Portal for parameterization, the software then only displays the input options for this operation module type.

6.4.2.1 Key numbering of the operating modules

As a head module it has 16 digital inputs and outputs.

The OM 2032 operation module has 32 keys with LED RGB key illumination and a status LED in each key.

Fig. 6.18: Operation module OM 2032.

6.4.2.2 Configuration of OM 2032 modules into the PROFIBUS network

Basic information and further descriptions must be obtained from the TIA manual.

In order to parameterize an operation module properly, you must have detailed knowledge of the TIA Portal project engineering tool. This chapter only describes the parameter settings specific to the operation module.

see also chapter 6.2.3.2

=> Select the desired adjustment module in the hardware catalog (1) and connect the adjustment module e.g. to the controller.

=> Click on the "Device view" tab.
The device overview (Fig.6.19) appears.

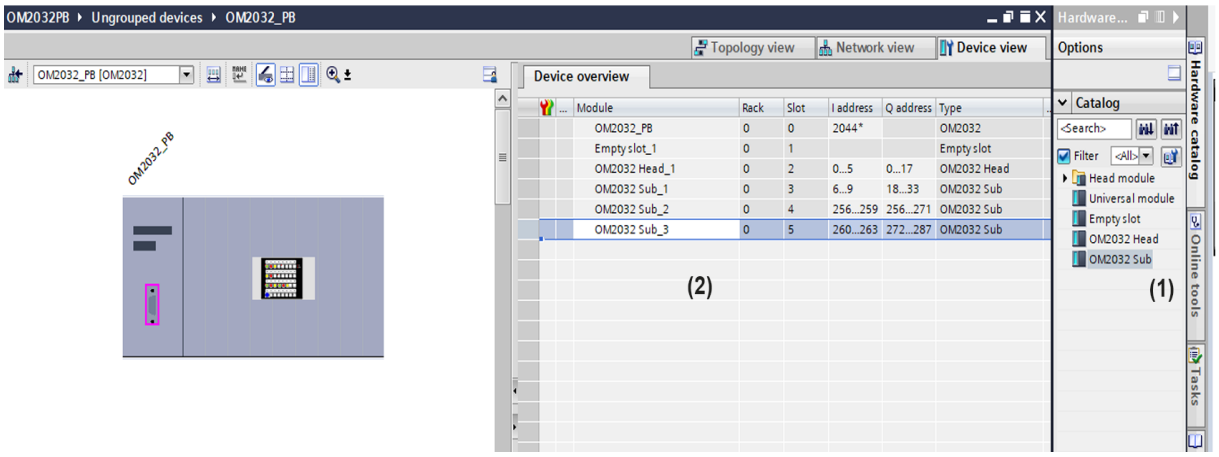


Fig. 6.19: Device overview

To (1) Catalog:
The following modules are displayed in the hardware catalog (1):
- Universal module
- Empty slot
- OM 2032 Head
- OM 2032 Sub

WARNING!

Universal module

The universal module is not used

To (2) Device overview:
The device overview shows the maximum module structure:
- Slot 1: Empty slot
- Slot 2: OM 2032 Head-Modul
- Slot 3: OM 2032 Sub-Modul
- Slot 4: OM 2032 Sub-Modul
- Slot 5: OM 2032 Sub-Modul

The minimum module structure consists of:
- Slot 1: Empty slot
- Slot 2: OM 2032 Head-Modul

WARNING!

Slot 1

The slot 1 (Slot 1) must always be occupied with an Empty slot

6.4.2.3 Configuration of OM 2032 modules with GX Configurator

Basic information and further descriptions must be obtained from the GX Configurator manual.

For the configuration of the PROFIBUS network it is necessary that you have detailed knowledge of the GX Configurator-DP. This chapter only describes the specific parameter settings for the OM 2032 operation modules.

=> Add the OM 2032 as PROFIBUS slave to your PROFIBUS master system (2) from the GSD view (1) by Drag&Drop.

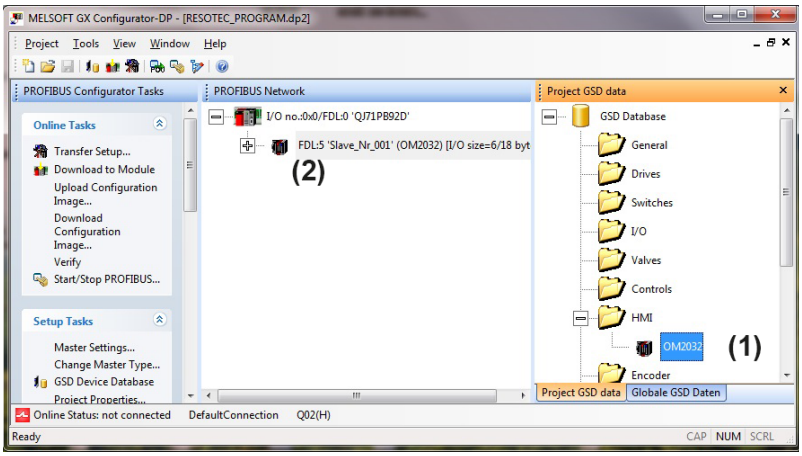


Fig. 6.20: GSD view

=> Open the "Slave Settings" dialog either by double-clicking on the icon or via the configuration menu or via the context menu (right mouse button).
The „Slave Setting“ dialog (Fig. 6.21)opens.

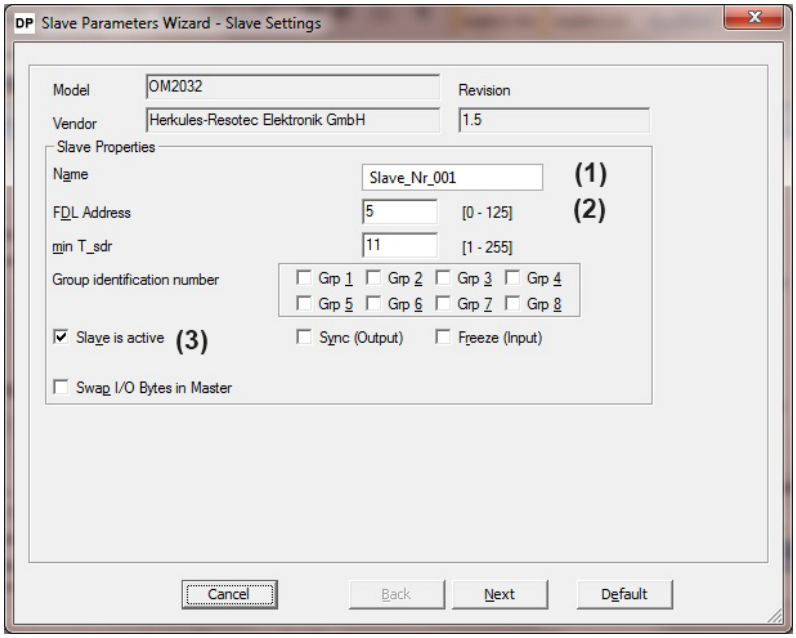


Fig. 6.21: Dialog „Slave Settings“

=> Set the following parameters (Fig. 6.21) here:
(1) Name: Text, name of the PROFIBUS station
(2) FDL_address: Number between 1 and 125, this is the slave address of the OM 2032. **Attention**: This number must match the hardware address of the device. (see chapter 6.4.5)
(3) Slave is active: Control box, switch on

Attention

=> Click on button "Next".
The dialog „Slave Modules“ (Fig. 6.22) appears.

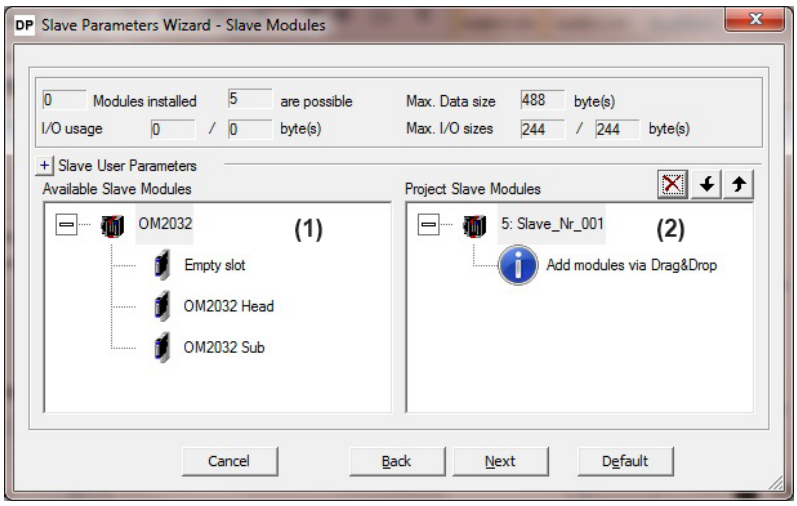


Fig. 6.22: Dialog „Slave Modules“

=> Depending on the requirements, add the available modules from the left side (1) into the slots of your configured slave (2) by drag&drop.
The corresponding module appears in (2).

Attention

Attention:
It is essential that you follow the required sequence here. The 1st slot always must be an "Empty slot", the 2nd slot always must be an OM 2032 head module. Only one head module may be configured per slave. You can then insert up to three OM 2032 sub modules. Depending on the number of OM 2032 head and sub modules, the required I/O range changes automatically.

You can see examples on the next page.

Example (Fig 6.23): OM 2032 configuration (1) with one head module (32 keys).

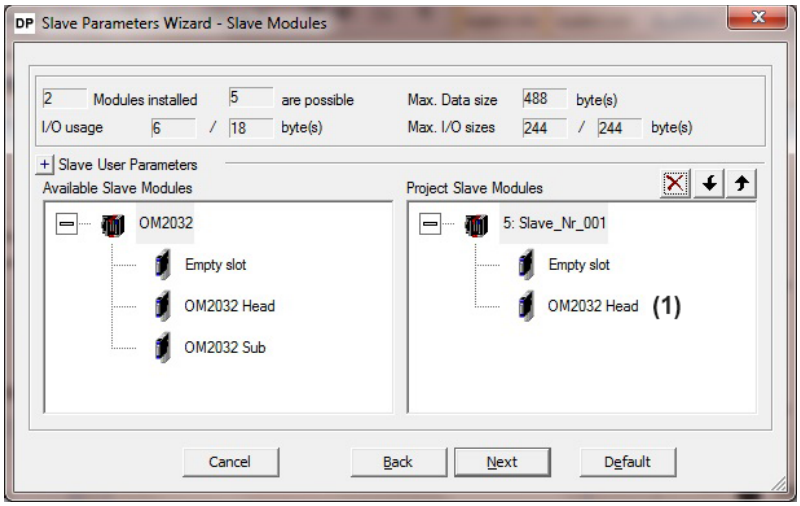


Fig. 6.23: Dialog „Slave Modules“, with one head module

Example (Fig. 6.24): OM 2032 configuration (1) with one head module and 3 sub-modules (128 keys in total).

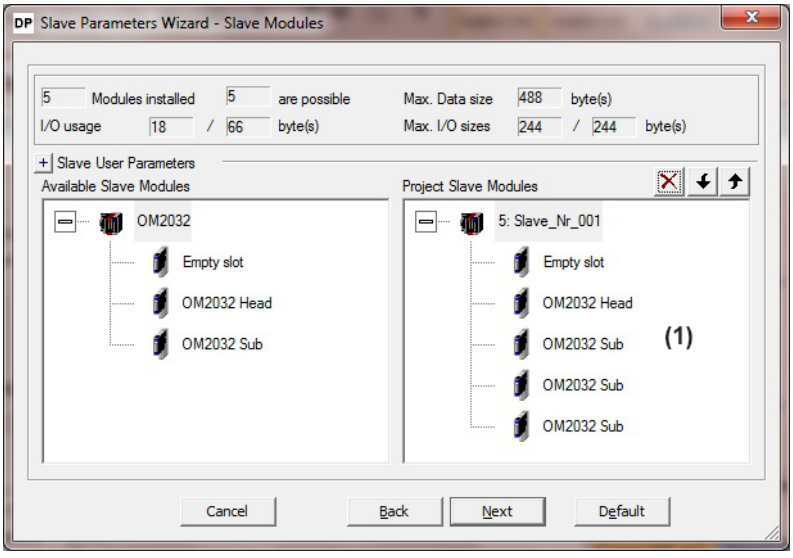


Fig. 6.24: Dialog „Slave Modules“, with one head module and three sub modules

=> If you have finished the desired configuration, click on the "Next" button.
The dialog „Slave User Parameters“(Fig. 6.25) appears.

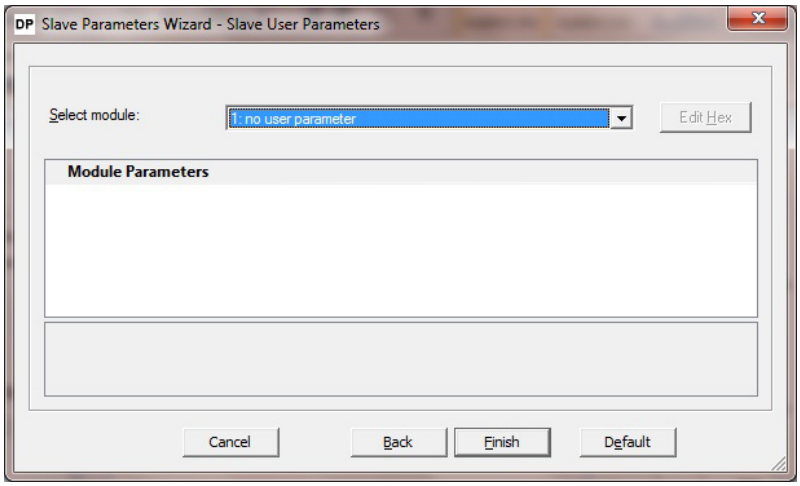


Fig. 6.25: Dialog „Slave User Parameters“

=> Click on the "Exit" button in this dialog.
The following dialog (Fig. 6.26)will then appear.

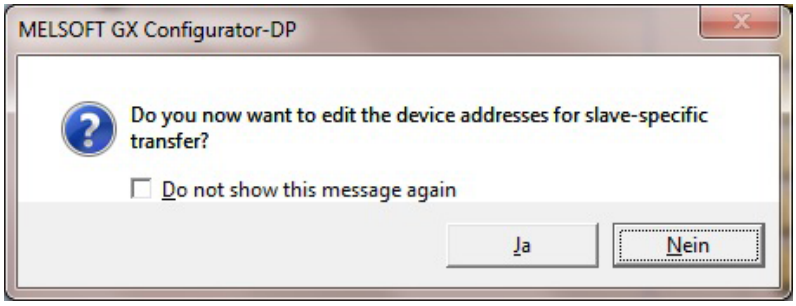


Fig. 6.26: Dialog „Configurator-DP“

=> Click on „Ja“.
The following dialog (Fig. 6.27) appears.

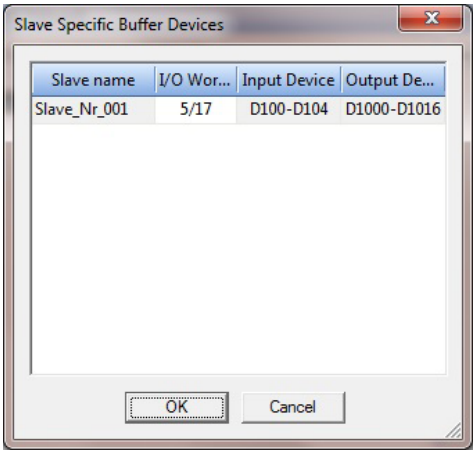


Fig. 6.27: Dialog „Slave Specific Buffer Devices“

=> Here you can now edit the input and output addresses for data exchange with the OM 2032.

See also chapter 6.4.4

6.4.2.4 LED control and bit combination of OM 2032 with PROFIBUS-DP

The keys and inputs are read in cyclically every 5 ms. The LEDs and outputs are updated every 10 ms.

Each key has a red status LED and RGB LEDs for key illumination. The following bit combinations are used to control the RGB LEDs. For all other combinations, the key illumination is switched off.

Bit red x	Bit green x	Bit blue x	LED control
1	0	0	red
0	1	0	green
0	0	1	bue
1	1	0	yellow
1	1	1	white

"PLC address"; keyboard illustration and digital inputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
00	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	Key
01	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	Key
02	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	Key
03	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**	Key
Digital inputs only in head module									
04	**E08**	**E07**	**E06**	**E05**	**E04**	**E03**	**E02**	**E01**	Digital input
05	**E16**	**E15**	**E14**	**E13**	**E12**	**E11**	**E10**	**E09**	Digital input

"PLC address"; LED illustration and digital outputs									
Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	LED control
00	8	7	6	5	4	3	2	1	LEDs 1 to 8, red
01	8	7	6	5	4	3	2	1	LEDs 1 to 8, green
02	8	7	6	5	4	3	2	1	LEDs 1 to 8, blue
03	8	7	6	5	4	3	2	1	LEDs 1 to 8, status
04	16	15	14	13	12	11	10	9	LEDs 9 to 16, red
05	16	15	14	13	12	11	10	9	LEDs 9 to 16, green
06	16	15	14	13	12	11	10	9	LEDs 9 to 16, blue
07	16	15	14	13	12	11	10	9	LEDs 9 to 16, status
08	24	23	22	21	20	19	18	17	LEDs 17 to 24, red
09	24	23	22	21	20	19	18	17	LEDs 17 to 24, green
10	24	23	22	21	20	19	18	17	LEDs 17 to 24, blue
11	24	23	22	21	20	19	18	17	LEDs 17 to 24, status
12	32	31	30	29	28	27	26	25	LEDs 25 to 32, red
13	32	31	30	29	28	27	26	25	LEDs 25 to 32, green
14	32	31	30	29	28	27	26	25	LEDs 25 to 32, blue
15	32	31	30	29	28	27	26	25	LEDs 25 to 32, status
Digital outputs only in head module									
16	A08	A07	A06	A05	A04	A03	A02	A01	Digital output
17	A16	A15	A14	A13	A12	A11	A10	A09	Digital output

6.4.2.5 Setting the PROFIBUS slave address

If you insert the operation module into TIA Portal, you must assign a PROFIBUS slave address to uniquely identify the module.

For setting the DIP switch, the rear of the operating module must be accessible.

On the back of the OM 2032 there is a DIP switch with which you have to set the PROFIBUS slave address.

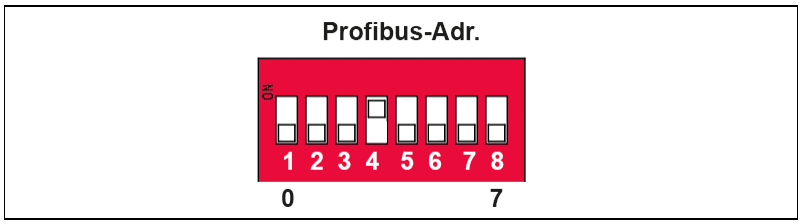
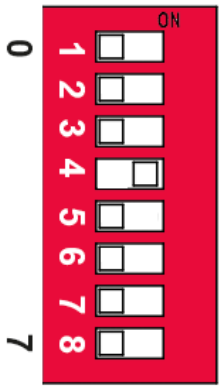


Fig. 6.28: DIP switches for setting the PROFIBUS slave address

The following applies to the example (Fig. 6.20):

DIP switch 4 = ON
DIP switch 1, 2, 3, 5, 6, 7, 8 = OFF
Binär = 00001000, adress: 8

Switch	Switch	Bit number	Value	Adress
	1	0	1	0
	2	1	2	0
	3	2	4	0
	4	3	8	8
	5	4	16	0
	6	5	32	0
	7	6	64	0
	8	7	128	0
	PROFIBUS-Slave adress			8

6.5 Ethernet/IP®

Studio 5000® is a registered trademark of Rockwell Automation, Inc.

The integration of the operation modules is described using the engineering tool Studio 5000® and related programs as examples. Only the specific functions for the OM modules are decribed.

only Studio 5000®-trained personnel

For basic information and further descriptions, refer to the Studio 5000 manuals. We assume that only trained personnel who are familiar with the Studio 5000 will configure the operation modules.

6.5.1 Configuration of the network addressing for the module

6.5.1.1 Setting the IP address via DHCP mode

Delivery status

For setting the IP address of the module, you need a DHCP server (e.g. BOOTP/DHCP Server). In delivery status the DHCP mode is activated and the system is waiting for the allocation of an IP address.

=> Connect your module via Ethernet cable to your PC.

=> Start the DHCP program.

Status of LED	Meaning	Status module
LED 1 flashing LED 2 on LED 3 off	System is running and waiting for the allocation of an IP address.	System is starting without stored IP-address with DHCP-Mode or BOOTP

The following window appears:

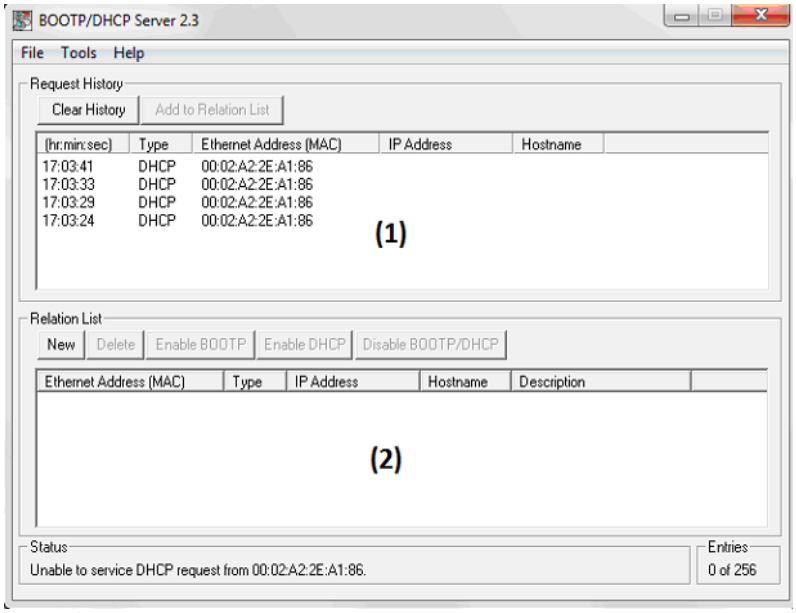


Fig. 6.29: Selection of the module

=> Select your desired module from the list (1) "Request History" (Fig. 6.29) by double click.
The "New Entry" window appears.

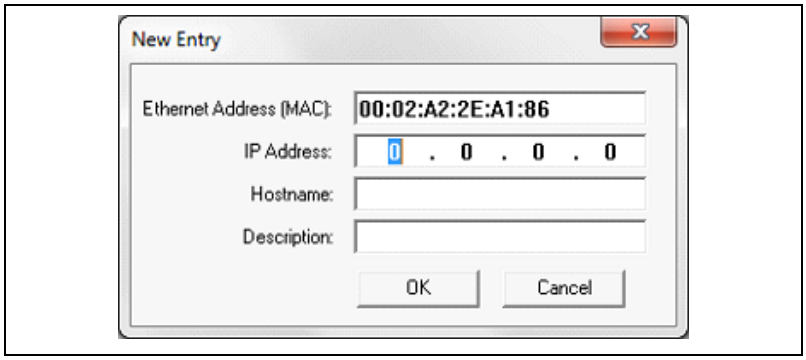


Fig. 6.30: "New Entry" window before entering the IP address

=> Enter the chosen IP address for your module in the mask "IP Address", e.g. 192.168.192.30, and select "OK".

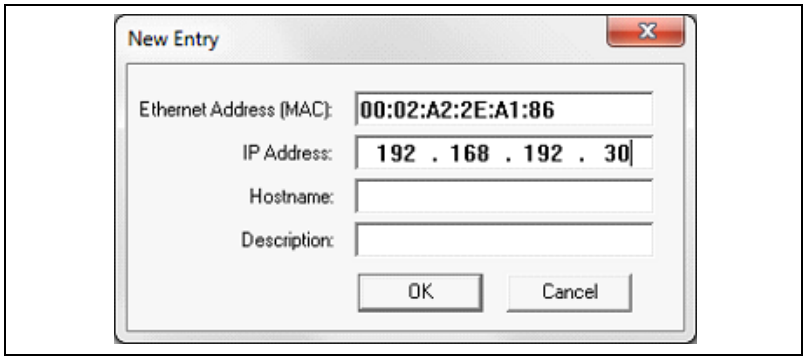


Fig. 6.31: "New Entry" window after entering the IP address

After closing the New Entry window, the DHCP server window appears again (Fig. 6.29). In list (1) (Request History) and list (2) (Relation List) the module with the assigned IP address appears. LED 1 (back of module) is on.

Status of LED	Meaning	Status OM 2032 Head Module
L1 on L2 on L3 flashing green	The entered IP address from DHCP or BOOTP is activated.	System has an IP-address.
L1 on L2 on L3 on	System and communication to PLC are running.	System has an IP-address Ethernet/IP interface is running
L1 on L2 on L3 flashing red	Communication error	Communication error

6.5.1.2 IP address storage

To save the configuration of the IP address, the BOOTP mode or DHCP mode must be disabled.

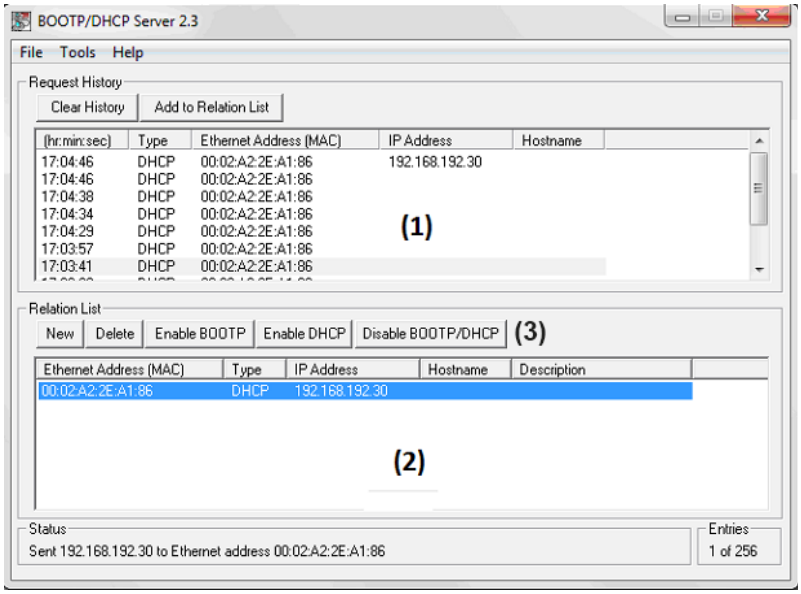


Fig. 6.32: Deactivation of the BOOTP/DHCP mode

=> Select your module in list (2) "Relation List".
It is shown with a blue background.

=> Press button (2) "Disable BOOTP/DHCP“.
The BOOTP/DHCP mode is disabled.

The module then starts up with the set IP address at Power On. This selection can be executed several times.

Important!
The IP address must be active in the module, see the LED description (chapter 6.5.1.1).

You can save the list of IP addresses.

6.5.1.3 IP address resetting

In order to be able to assign a different IP address to the module, the module must be reset so that it starts again with the DHCP mode. There are two different ways:

Using the DHCP server (e.g. BOOTP/DHCP server 2.3)

=> Start the DHCP program and load the list of assigned IP addresses into the program.
The assigned IP addresses are displayed in the list (2) (Relation List). (Fig. 6.33).

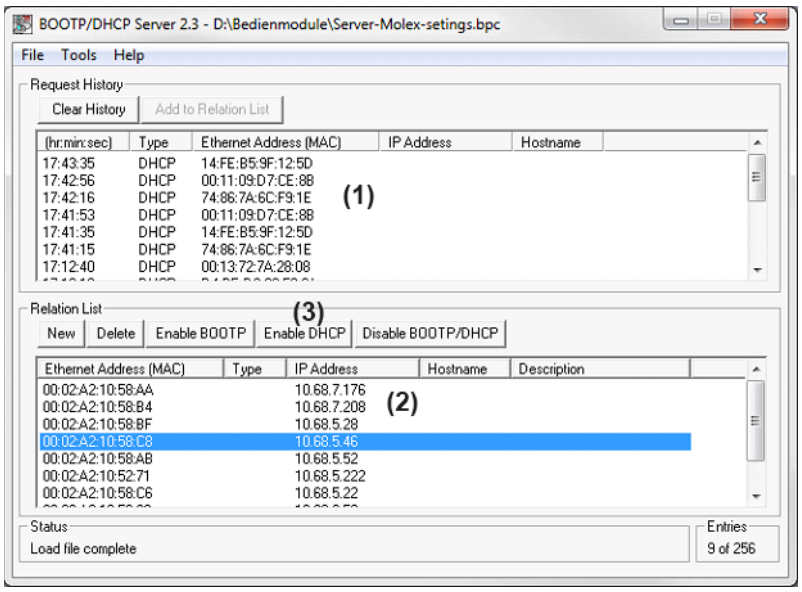


Fig. 6.33: BOOTP/DHCP server with list of IP addresses

=> Select your module from the list (2).
It is shown with a blue background.

=> Press the button (3) "Enable DHCP“.
The DHCP mode is activated.

The module then starts up at Power On in DHCP mode and waits for the assignment of an IP address.

Now a new IP address can be assigned according to chapters 6.5.1.1 and 6.5.1.2.

6.5.2 Configuration of OM 2032 with Studio 5000 Logix Designer

6.5.2.1 Installation of EDS file

Install the EDS-file **OM2032_92390_1009.EDS** in your PLC (Master) programming software und configure the Ethernet/IP network.

only Studio 5000®-trained personnel

=> Open the Tool EDS Wizard and follow the installation process.
The following windows appear (Fig. 6.34 to Fig. 6.38).

=> Choose the file OM2032_923901009.EDS in window Fig. 6.34.

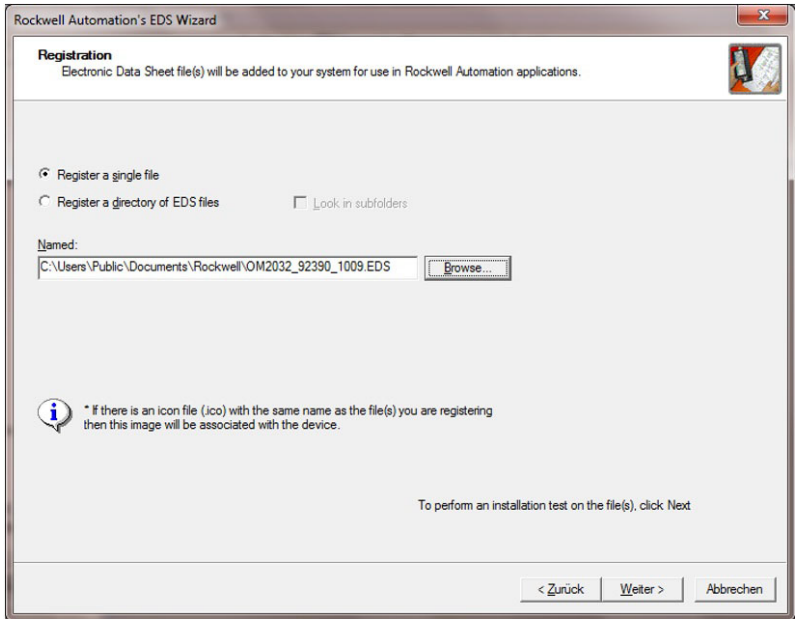


Fig. 6.34

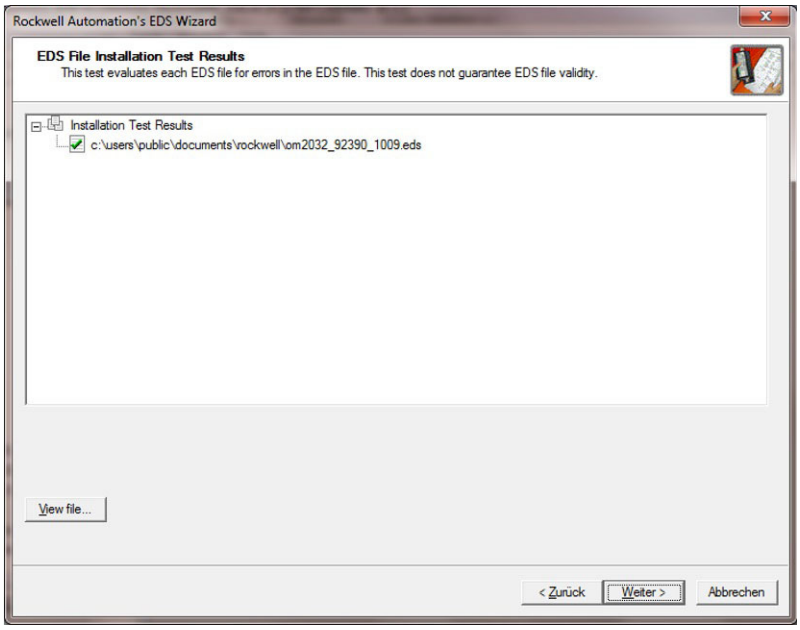


Fig. 6.35

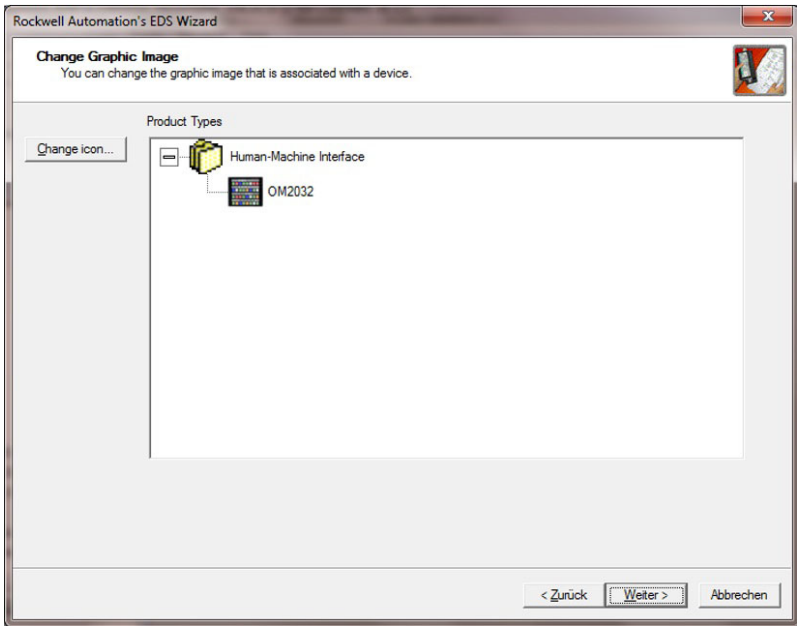


Fig. 6.36

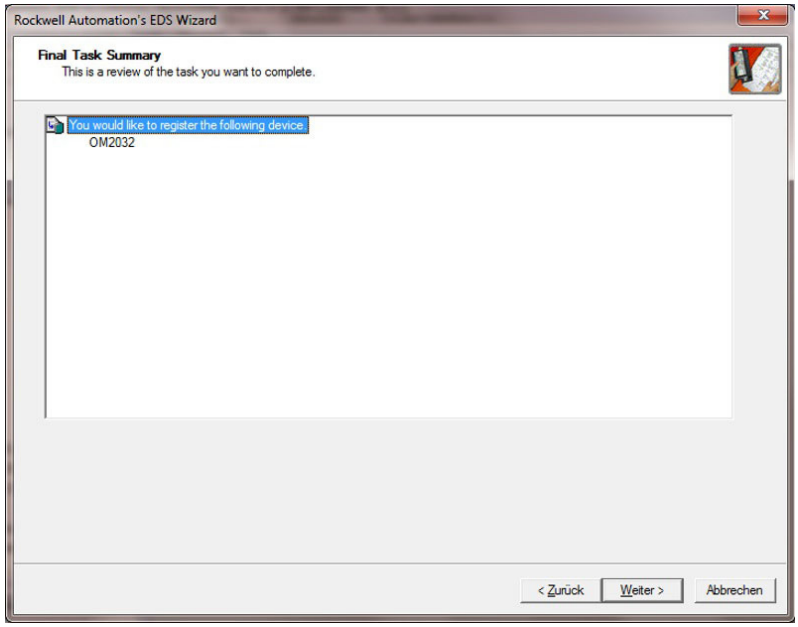


Fig. 6.37

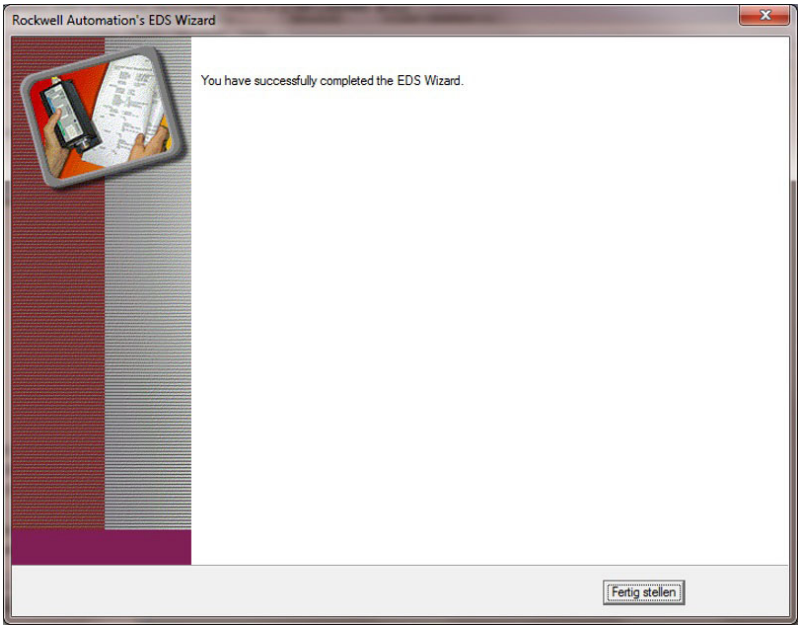


Fig. 6.38

6.5.2.2 Parameterization of the OM 2032 modules

IMPORTANT!

In order to operate the operation module in standard mode, the DIP switch SW2.5 must be set to OFF. If you need the PP mode, the DIP switch SW2.5 must be set to ON (see chapter 4.4.5).

6.5.2.3 Key numbering of the operating modules

As a head module it has 16 digital inputs and outputs.

The OM 2032 operation module has 32 keys with LED RGB key illumination and a status LED in each key.

Fig. 6.39: Operation module OM 2032.

The following bit combinations will be used to control the RGB

LED. For all other combinations, the key light is off.

Take care that the switch SW2.5 is OFF in this mode.

Bit Red x	Bit Green x	Bit Blue x	LED color
1	0	0	red
0	1	0	green
0	0	1	blue
1	1	0	yellow
1	1	1	white

6.5.2.4 Configuration of OM 2032 modules into the Ethernet/IP-network

In order to parameterize an operation module properly, you must have detailed knowledge of the Studio 5000 engineering tool. This chapter only describes the parameter settings specific to the operation module.

For basic information and further descriptions, refer to the Studio 5000 manuals.

=> Open your project with the Studio 5000 Logix Designer.
The window Fig. 3.40 appears.

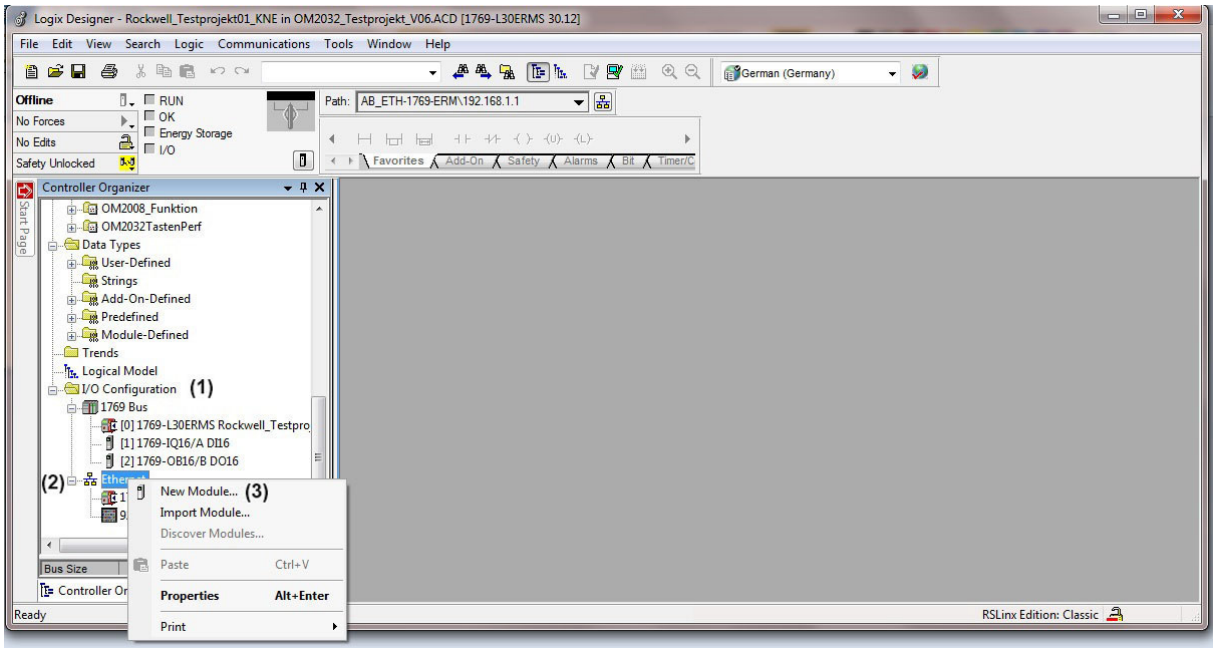


Fig. 6.40: Studio 5000 Logix Designer

=> Add a new module OM 2032 in the I/O Configuration (1) with click on „Ethernet“ (2) and „New Module“ (3).
The following window appears.

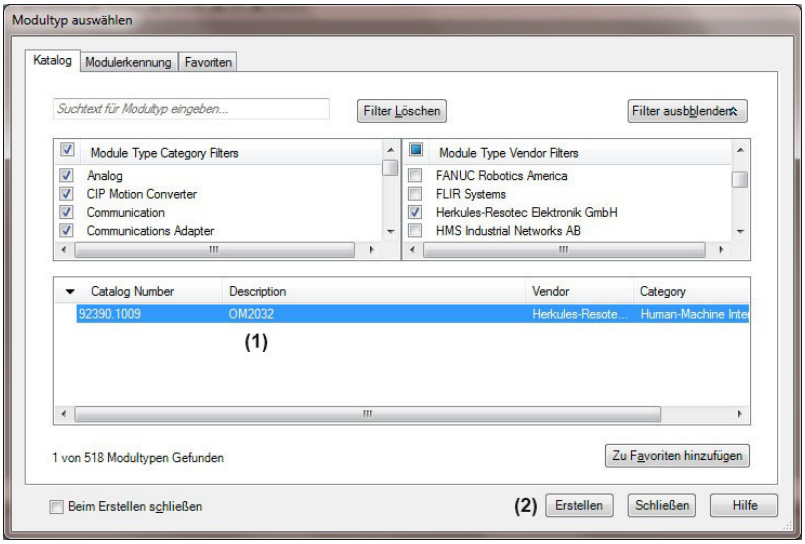


Fig. 6.41: Module selection

=> Select your module in (1) and klick on the button (2).
The following window appears.

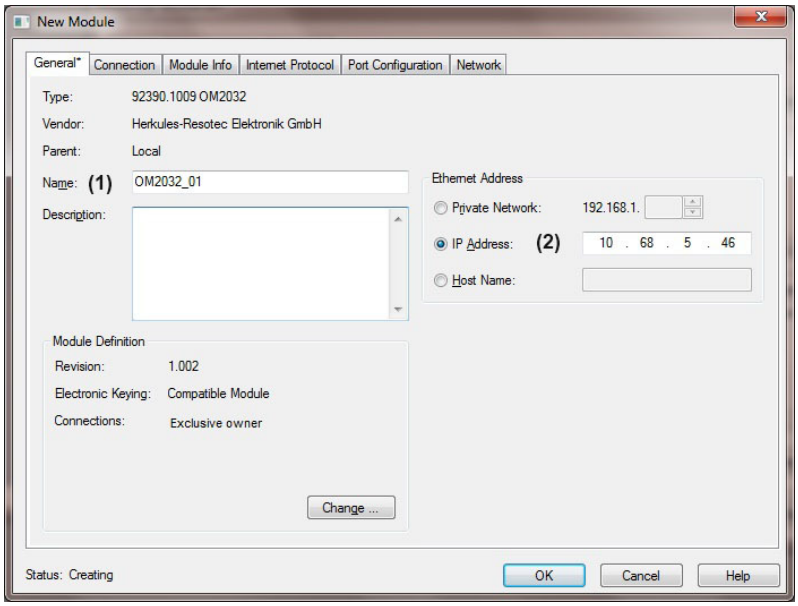


Fig. 6.42: New Module

=> In this dialog you have to assign the device name (1) and the IP address (2) which must be the same as you have configured before via DHCP.

Afterwards the OM 2032 module integrated in your Ethernet/IP network.

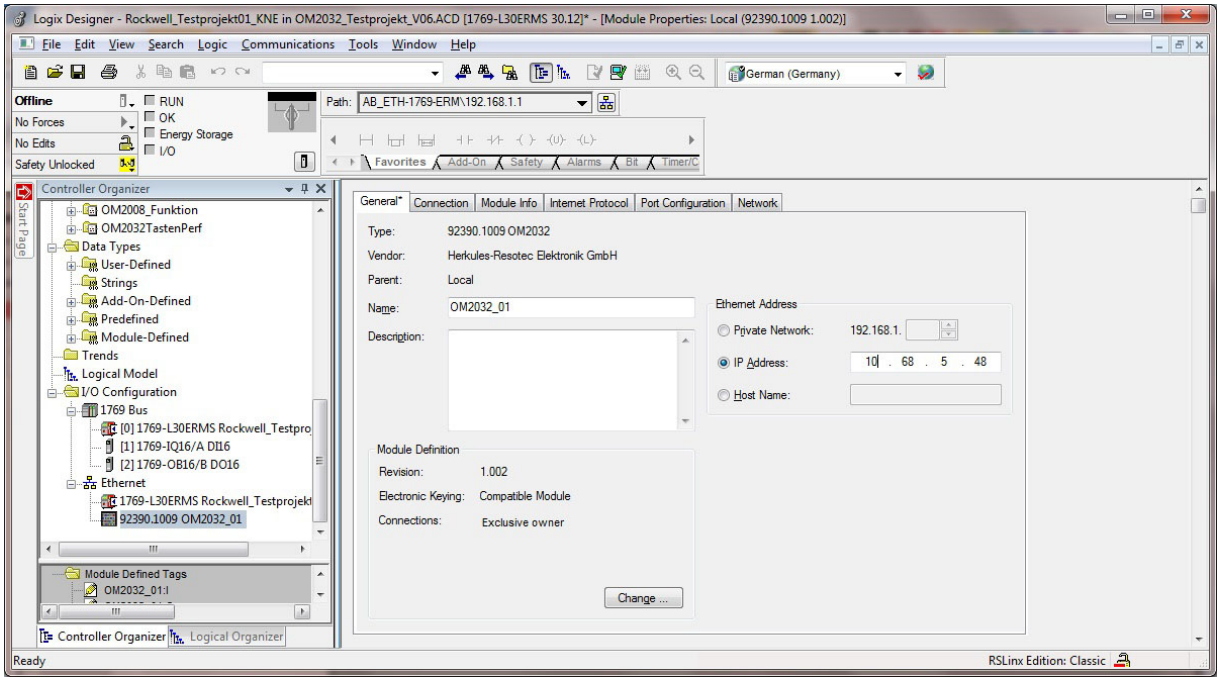


Fig. 6.43: Studio 5000 Logix Designer with integrated module

6.5.2.5 Configuration of the OM 2032 controller tags

The configuration is intended for a maximum possible expansion of 4 OM 2032 in total on one IP-address, which is 1 head module and max. 3 sub modules (Fig. 6.44). For the input area you can use up to 18 byte and for the output area you can use up to 66 byte.

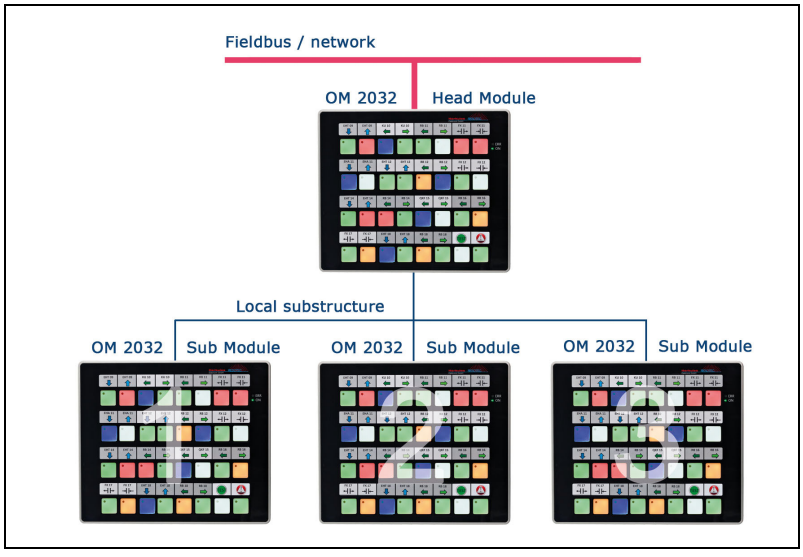


Fig.6.44: OM 2032 system structure

=> Configure now the controller tags as shown below (see Fig. 6.45).

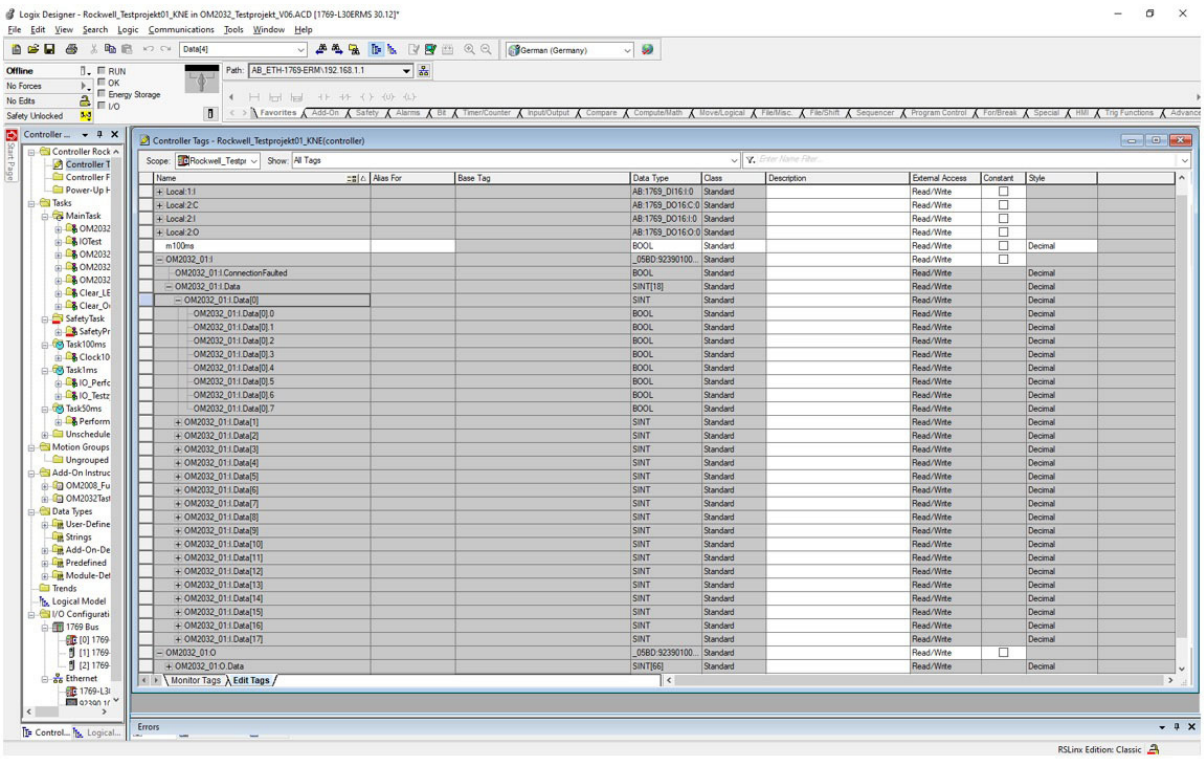


Fig. 6.45: Controller tags

The table below shows the assignment of the IO areas to the key and IO signals of the OM 2032.

Module	Data Byte	Inputs
OM 2032 Head	Data[0]	Key 1 … 8
OM 2032 Head	Data[1]	Key 9 … 16
OM 2032 Head	Data[2]	Key 17 … 24
OM 2032 Head	Data[3]	Key 25 … 32
OM 2032 Head	Data[4]	Input 0 … 7
OM 2032 Head	Data[5]	Input 8 … 15
OM 2032 Sub 1	Data[6]	Key 1 … 8
OM 2032 Sub 1	Data[7]	Key 9 … 16
OM 2032 Sub 1	Data[8]	Key 17 … 24
OM 2032 Sub 1	Data[9]	Key 25 … 32
OM 2032 Sub 2	Data[10]	Key 1 … 8
OM 2032 Sub 2	Data[11]	Key 9 … 16
OM 2032 Sub 2	Data[12]	Key 17 … 24

OM 2032 Sub 2	Data[13]	Key 25 … 32
OM 2032 Sub 3	Data[14]	Key 1 … 8
OM 2032 Sub 3	Data[15]	Key 9 … 16
OM 2032 Sub 3	Data[16]	Key 17 … 24
OM 2032 Sub 3	Data[17]	Key 25 … 32

Module	Data Byte	Outputs	LED color
OM 2032 Head	Data[0]	Key 1 … 8	**Red**
OM 2032 Head	Data[1]	Key 1 … 8	**Green**
OM 2032 Head	Data[2]	Key 1 … 8	**Blue**
OM 2032 Head	Data[3]	Key 1 … 8	Status LED
OM 2032 Head	Data[4]	Key 9 … 16	**Red**
OM 2032 Head	Data[5]	Key 9 … 16	**Green**
OM 2032 Head	Data[6]	Key 9 … 16	**Blue**
OM 2032 Head	Data[7]	Key 9 … 16	Status LED
OM 2032 Head	Data[8]	Key 17 … 24	**Red**
OM 2032 Head	Data[9]	Key 17 … 24	**Green**
OM 2032 Head	Data[10]	Key 17 … 24	**Blue**
OM 2032 Head	Data[11]	Key 17 … 24	Status LED
OM 2032 Head	Data[12]	Key 25 … 32	**Red**
OM 2032 Head	Data[13]	Key 25 … 32	**Green**
OM 2032 Head	Data[14]	Key 25 … 32	**Blue**
OM 2032 Head	Data[15]	Key 25 … 32	Status LED
OM 2032 Head	Data[16]	Output 0 … 7	
OM 2032 Head	Data[17]	Output 8 … 15	
OM 2032 Sub 1	Data[18]	Key 1 … 8	**Red**
OM 2032 Sub 1	Data[19]	Key 1 … 8	**Green**
OM 2032 Sub 1	Data[20]	Key 1 … 8	**Blue**
OM 2032 Sub 1	Data[21]	Key 1 … 8	Status LED
OM 2032 Sub 1	Data[22]	Key 9 … 16	**Red**
OM 2032 Sub 1	Data[23]	Key 9 … 16	**Green**
OM 2032 Sub 1	Data[24]	Key 9 … 16	**Blue**
OM 2032 Sub 1	Data[25]	Key 9 … 16	Status LED
OM 2032 Sub 1	Data[26]	Key 17 … 24	**Red**
OM 2032 Sub 1	Data[27]	Key 17 … 24	**Green**
OM 2032 Sub 1	Data[28]	Key 17 … 24	**Blue**
OM 2032 Sub 1	Data[29]	Key 17 … 24	Status LED
OM 2032 Sub 1	Data[30]	Key 25 … 32	**Red**

OM 2032 Sub 1	Data[31]	Key 25 … 32	**Green**
OM 2032 Sub 1	Data[32]	Key 25 … 32	**Blue**
OM 2032 Sub 1	Data[33]	Key 25 … 32	Status LED
OM 2032 Sub 2	Data[34]	Key 1 … 8	**Red**
OM 2032 Sub 2	Data[35]	Key 1 … 8	**Green**
OM 2032 Sub 2	Data[36]	Key 1 … 8	**Blue**
OM 2032 Sub 2	Data[37]	Key 1 … 8	Status LED
OM 2032 Sub 2	Data[38]	Key 9 … 16	**Red**
OM 2032 Sub 2	Data[39]	Key 9 … 16	**Green**
OM 2032 Sub 2	Data[40]	Key 9 … 16	**Blue**
OM 2032 Sub 2	Data[41]	Key 9 … 16	Status LED
OM 2032 Sub 2	Data[42]	Key 17 … 24	**Red**
OM 2032 Sub 2	Data[43]	Key 17 … 24	**Green**
OM 2032 Sub 2	Data[44]	Key 17 … 24	**Blue**
OM 2032 Sub 2	Data[45]	Key 17 … 24	Status LED
OM 2032 Sub 2	Data[46]	Key 25 … 32	**Red**
OM 2032 Sub 2	Data[47]	Key 25 … 32	**Green**
OM 2032 Sub 2	Data[48]	Key 25 … 32	**Blue**
OM 2032 Sub 2	Data[49]	Key 25 … 32	Status LED
OM 2032 Sub 3	Data[50]	Key 1 … 8	**Red**
OM 2032 Sub 3	Data[51]	Key 1 … 8	**Green**
OM 2032 Sub 3	Data[52]	Key 1 … 8	**Blue**
OM 2032 Sub 3	Data[53]	Key 1 … 8	Status LED
OM 2032 Sub 3	Data[54]	Key 9 … 16	**Red**
OM 2032 Sub 3	Data[55]	Key 9 … 16	**Green**
OM 2032 Sub 3	Data[56]	Key 9 … 16	**Blue**
OM 2032 Sub 3	Data[57]	Key 9 … 16	Status LED
OM 2032 Sub 3	Data[58]	Key 17 … 24	**Red**
OM 2032 Sub 3	Data[59]	Key 17 … 24	**Green**
OM 2032 Sub 3	Data[60]	Key 17 … 24	**Blue**
OM 2032 Sub 3	Data[61]	Key 17 … 24	Status LED
OM 2032 Sub 3	Data[62]	Key 25 … 32	**Red**
OM 2032 Sub 3	Data[63]	Key 25 … 32	**Green**
OM 2032 Sub 3	Data[64]	Key 25 … 32	**Blue**
OM 2032 Sub 3	Data[65]	Key 25 … 32	Status LED

7 Fail-safe operation of OM 2032-F

7.1 Fail-safe operation

OM 2032-F
fail-safe encoders
fail-safe control

In fail-safe operation, the OM 2032-F detects the switching states of the suitable fail-safe encoders and sends corresponding safety telegrams to the fail-safe control in which a safety program is running.
The fail-safe controller and the operation module communicate with each other via the safety-related protocol "PROFIsafe".

The following safety instructions are important for fail-safe operation:

7.2 Safety instructions for the OM 2032-F

S3: Repair or modification of the operating modules

DANGER

It is not allowed to repair or modify the OM 2032-F. It is not allowed to open the OM 2032-F. The identification plate secures a screw on the back of the module and should not be removed or damaged in this area.

S4: Test and documentation after device replacement

CAUTION

The OM 2032-F may only be replaced by authorised persons and properly instructed persons. After replacement, all safety functions of the machine must be checked and validated again and this must be documented.

S5: Safety-critical malfunctions of the OM 2032-F

DANGER

Safety-critical malfunctions of the OM 2032-F that do not cause the device to assume the safe state must be reported immediately to Herkules-Resotec Elektronik GmbH. The OM 2032-F must be replaced and returned to Herkules-Resotec Elektronik GmbH.

S6: Handling of defective operation modules

DANGER

The OM 2032-F must not be repaired by the user. A defective OM 2032-F must be replaced and disposed of or returned to Herkules-Resotec Elektronik GmbH. The OM 2032-F must not be opened. The identification plate secures a screw on the back of the module and must not be removed or damaged in this area.

S7: Malfunction of the operation module

CAUTION

In the event of a fault in the safety-related function of the OM 2032-F, the operation module must be replaced immediately and sent to Herkules-Resotec Elektronik GmbH to investigate the cause of the fault.

S18: PROFIsafe certification

The OM 2032-F is PROFINET and PROFIsafe certified.

NOTE!

S19: Re-Certification

If an OM 2032-F is integrated in a machine / system, the following points must be made known to the end user in the safety manual of the machine / system:
Safety instructions; application examples; approved components for circuit protection; type designations of safety-related components; permissible operating modes; requirements for the end user (training); safety-relevant interfaces; restrictions; requirements for maintenance, use, assembly, installation, provision and dismantling with regard to functional safety; environmental conditions; valid standards, certificates and attestations; reporting body with regard to functional safety; requirements according to IEC 61508-2 Appendix D and IEC 61508-3 Appendix D.

CAUTION

S44: Error at safe input with active sensor

If a safe input is configured for an active sensor, the OM 2032-F cannot detect the following errors:
- external short over sensor
- external short to 24 V
- external short between dual channel lines.

You must prevent these faults by observing certain rules when setting up the machine, routing the cables, etc.

DANGER

S45: Switching on the operation module

If the OM 2032-F is switched on and the RUN state does not occur correctly within a maximum of 8 hours, the OM 2032-F must be restarted by switching it off and on again. A trained safety service personal must then check whether functionally safe operation is guaranteed.

DANGER

S46: Operation modules outside the RUN state

The OM 2032-F shall not be operated outside the RUN state for more than 8 hours to ensure that all relevant tests are performed within the safe reaction time.

7.3 Safety functions

During fail-safe operation, safety functions are activated in the OM 2032-F and in the safety program of the fail-safe controller that detect and react to faults.

In the following cases, the safety functions must bring the relevant part of the plant into a safe operating state:

- The EMERGENCY STOP button has been pressed.
- An encoder has been actuated.
- A diagnosable error has been detected.

S20: Diagnostic test interval

CAUTION

The diagnostic test interval for the two-channel safe digital inputs for passive sensors is 1 hour.
The diagnostic test interval for the two-channel safe digital output is 1 hour.

S21: : Loss of the hardware fault tolerance (HFT) in the safe state

DANGER

After detection of a safety-critical fault, the OM 2032-F shall not be kept in a fail-safe state for more than 1 hour.

7.3.1 Reaction to actuated EMERGENCY STOP buttons or encoders

If the EMERGENCY STOP button or an encoder has been activated, the associated bit is sent to the controller in a safety-related manner. The control program evaluates whether the EMERGENCY STOP button or encoder has been actuated.

IMPORTANT!

The user defines which reactions this bit triggers in the controller and thus in the system.
Your tasks include:

- Project the required reactions for the control system that are appropriate for the EMERGENCY STOP.
- Initiate measures to eliminate the cause of an EMERGENCY STOP.
- To configure the start-up behaviour after an EMERGENCY STOP.

You must describe the reaction to an EMERGENCY STOP or to the actuation of the encoder, measures and starting behavior in the system documentation.

7.3.2 Reaction to faults in the system

In the event of an error, the F-channels of the operation module are passivated. This means that "0" is detected at all fail-safe digital inputs.

Required safe operating status

The system must be designed in such a way that the required safe operating state is achieved. It is up to you to identify the measures to be taken for fault analysis and rectification.

IMPORTANT!

The operation module is only allowed to be integrated into the control process when the causes of the errors have been eliminated.

After integration, the process values are available again at the digital fail-safe inputs.

DANGER

S5: Safety-critical malfunctions of the OM 2032-F

Safety-critical malfunctions of the OM 2032-F that do not cause the device to assume the safe state must be reported immediately to Herkules-Resotec Elektronik GmbH. The OM 2032-F must be replaced and returned to Herkules-Resotec Elektronik GmbH.

7.4 Passivating the operation module

As soon as the operation module detects an error in fail-safe operation (e.g. interruption, incorrect wiring), the OM 2032-F signals this error automatically and all fail-safe channels are switched to a safe operating state. This causes the fail-safe channels of the OM 2032-F to be passivated.

Note!

If the operation module is passivated, the substitute value "0" is always assigned to all fail-safe digital inputs instead of the process values. You cannot parameterize the substitute value.

Detected errors are registered in the diagnostic buffer of the fail-safe controller and communicated to the safety program in the fail-safe controller.

Saving errors

The operation module cannot save the error permanently. If you switch off the operation module and switch it on again, only a continuing error is detected during start-up. If you want to save the errors, program your safety program accordingly.

The following cases result in the operation module being passivated:

- After switching on the operation module.
- In case of a parameterization error.
- Error in the PROFIsafe parameters, e.g. "F_WD_Time" (F_monitoring time) selected too short.
- In the event of an error in PROFIsafe communication between fail-safe controller and operation module.
- In case of a hardware error, e.g. wire break, short circuit, discrepancy error, internal error of the operation module.

Identify passivation

If you want to know whether the operation module is passivated, access the variable "PASS_OUT" of the F peripheral DB. The variable can have the following values:

- 0 = Operation module not passivated
- 1 = Operation module passivated

Reintegrate OM 2032-F

After passivating the OM 2032-F, the error must be diagnosed and corrected. The operation module can then be reintegrated.

7.5 Fault diagnosis

Diagnostic functions

All diagnostic functions, i.e. displays and messages, are not safety-critical and therefore not safety-related, i.e. the diagnostic functions are not tested internally.

Diagnostic functions are not safety critical

Diagnostic functions of the OM 2032-F

The fail-safe operation module provides a non-parameterizable diagnostic function. The diagnosis is always active and is automatically forwarded from the operation module to the controller in the event of an error and made available, for example, by TIA Portal.

The diagnostic function sends the following diagnoses to the controller:

- Communication error
  The communication between the operation module as IO-Device and the controller as IO-Controller is disturbed.
- Parameterization error
  Error in the PROFIsafe parameters.

Read out diagnostic information

To determine the cause of the error, open the assembly diagnosis in TIA.

Detailed information can be found in the TIA manual

Diagnosis of PROFIsafe Errors

When diagnosing PROFIsafe errors, access the "DIAG" variable of the F peripheral DB.

Detailed information can be found in the TIA manual

Operation module in case of critical error

In the event of a critical error in the operation module which leads to a failure of the OM 2032-F, the operation module behaves as follows:

- The connection to PROFINET is interrupted and the fail-safe channels are passivated.
- No diagnostics are sent from the operation module.
  In TIA Portal, the standard diagnosis "Module faulty" or "Module not present" is reported in the module diagnosis.

7.6 LED fault diagnosis (for all OM 2032)

Diagnosis_LED on the front of the device

Two diagnostic LEDs, "ERR" and "ON", are located on the right front side, in the upper area of the operation module.

With the help of these LEDs you can perform a diagnosis in the fault case and correct the fault if necessary. The following LED times apply for flashing cycles:

- Time: LED on 300 ms
- Time: LED off 200 ms
- Time: break 2000 ms

ERR-LED	ON-LED	OM 2032-F head module	OM 2032 sub module	Description / error handling
Off	Off	No power supply	No power supply	Check the correct cable connection and power supply.
Flashing cycle 1x	On	Hardware error / device defective	Hardware error / device defective	Send the operation module back to Herkules-Resotec Elektronik GmbH.
Flashing cycle 2x	On	PROFINET diagnosis is on	---	Diagnosis is on: - Overload - Submodule failed (CAN bus or power supply)
Flashing cycle 3x	On	SW1 not in position 0	---	The address must be set correctly (to 0). After troubleshooting you have to perform a RESET (SYSTEM/Network).
Flashing cycle 4x	On	SW1 incorrectly set	SW1 incorrectly set	The address must be set correctly (Head module = 0, Sub module = 1...3). After troubleshooting, you must perform a RESET (SYSTEM/Network).
Flashing cycle 5x	On	---	Module not configured in the PLC	Include your module
Flashing at 1 Hz intervals	On	---	Communication to head module	Automatically fixed when communication is active again.
Flashing at 2 Hz intervals	On	Communication to the PLC disturbed / established	Communication to the PLC disturbed / established	Automatically remedied when communication is active again
Alternate flashing: the ERR LED and the ON LED light up alternately		Flashing request from project planning tool	---	Only active if the engineering tool makes a request to the OM 2032-F

7.7 Depassivation of the fail-safe inputs

In order to return the OM 2032-F to its normal operating state after troubleshooting, a depassivation routine is carried out via the PLC program.

The networks shown below can be used for this purpose. It does not matter whether you use two-channel or single-channel inputs.

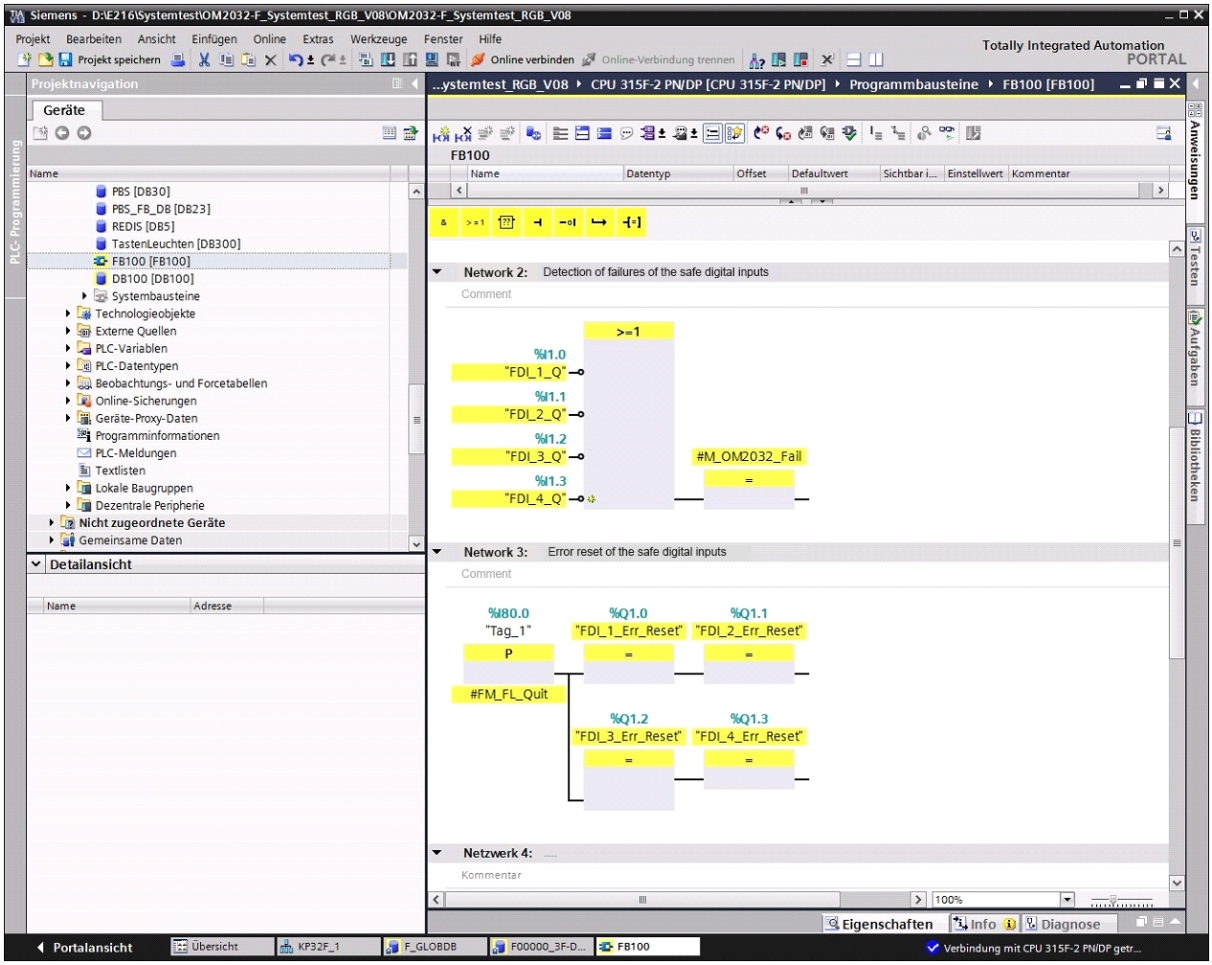


Fig. 7.1: Example of depassivation in TIA Portal

In the example (Fig. 7.1) 4 safety channels are listed. With a single-channel input, the associated bits of the channel are monitored and reset (in this example %I1.0 to %I1.3 and %Q1.0 to %Q1.3).

When using two channels at one input, it is sufficient to monitor or reset the first bit (in this example I1.0, I1.2 and Q1.0, Q1.2).

Network 2: Detection of failures of the safe inputs

Here the input signals %I1.0 to %I1.3 are evaluated and an error bit is generated.

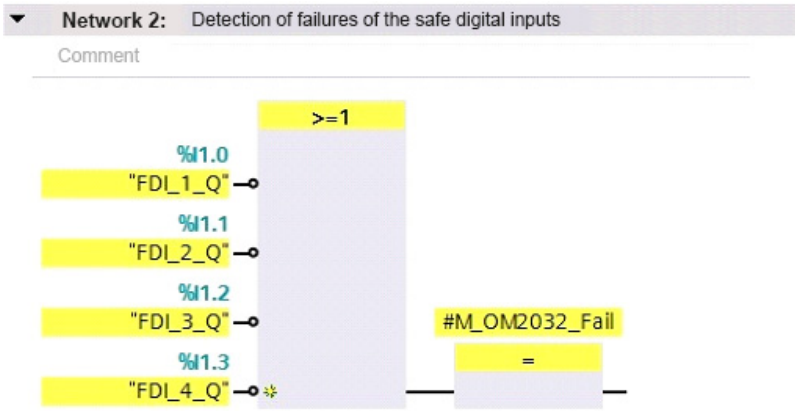


Fig. 7.2: Network 2

Network 3: Error reset of the safe inputs

The affected fail-safe inputs are reset by means of an edge signal.

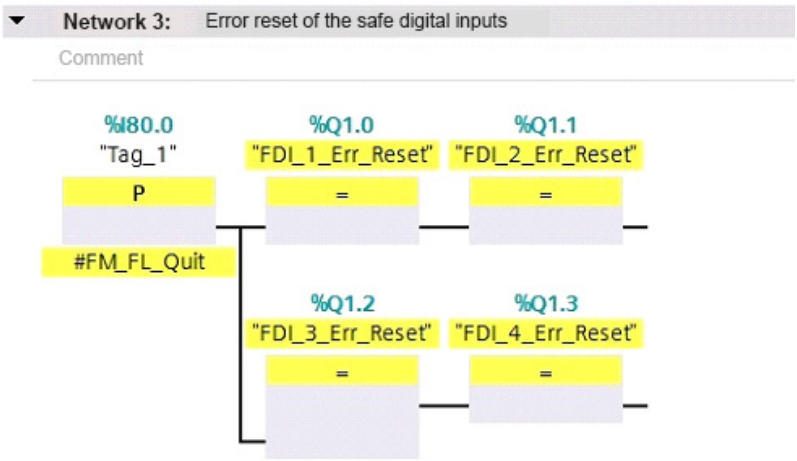


Fig. 7.3: Network 3

Finishing passivation

WARNING!

As soon as you have eliminated the error that led to the passivation of the OM 2032-F, you must reintegrate the operation module. For the reintegration of the OM 2032-F a user acknowledgement in the safety program may be necessary.

After reintegration, the process values for the safety program are made available again on the fail-safe channels of the operating module.

7.8 Response times of the OM 2032 (PROFIsafe)

Influence reaction time

You must include the reaction time of your operation module in the calculation of the reaction time of the entire system.

- Reaction time of the fail-safe channel
  The response time is the time between a signal change at the digital input and the safe provision of the safety telegram on PROFINET.
- Response time of the operating module
  The actual reaction time lies between the shortest and the longest reaction time.

When planning the plant, you must always calculate with the longest reaction time. Information on reaction time can also be found in the chapter "Technical data“.

see chapter 11

Response times

S47: Inputs (functionally safe)

CAUTION

Fail safe state: switched off, short-circuit proof (clock output). The sampling time is 6 ms + 2 ms for a two-channel input that switches. For each individual channel switched simultaneously, 2 ms are added (up to 16 ms if 3 dual-channel inputs switch simultaneously).

S48: Output (functionally safe)

CAUTION

Fail safe state: switched off
The maximum time between receipt of a safety telegram and activation of the corresponding safe digital output is 7.7 ms.

Herkules-Resotec Elektronik GmbH
Eisenstraße 7
D-34225 Baunatal
Telefon:+49 (561) 9 49 87-0
Fax:+49 (561) 49 80-89
E-Mail: info@herkules-resotec.de
Internet: www.herkules-resotec.de

8 Maintenance and Cleaning

8.1 Maintenance

The operation modules are maintenance free. Cyclical maintenance work is therefore not necessary.

However, you should clean the keyboard foil of the operation module at regular intervals or if necessary.

Cleaning the keyboard foil see chapter 8.2

For the OM 2032-F, however, the following safty instructions must be followed:

S3: Repair or modification of the operating modules

DANGER

It is not allowed to repair or modify the OM 2032-F. It is not allowed to open the OM 2032-F. The identification plate secures a screw on the back of the module and should not be removed or damaged in this area.

S4: Test and documentation after device replacement

CAUTION

The OM 2032-F may only be replaced by authorised persons and properly instructed persons. After replacement, all safety functions of the machine must be checked and validated again and this must be documented.

S5: Safety-critical malfunctions of the OM 2032-F

DANGER

Safety-critical malfunctions of the OM 2032-F that do not cause the device to assume the safe state must be reported immediately to Herkules-Resotec Elektronik GmbH. The OM 2032-F must be replaced and returned to Herkules-Resotec Elektronik GmbH.

S6: Handling of defective operation modules

DANGER

The OM 2032-F must not be repaired by the user. A defective OM 2032-F must be replaced and disposed of or returned to Herkules-Resotec Elektronik GmbH. The OM 2032-F must not be opened. The identification plate secures a screw on the back of the module and must not be removed or damaged in this area.

S7: Malfunction of the operation module

CAUTION

In the event of a fault in the safety-related function of the OM 2032-F, the operation module must be replaced immediately and sent to Herkules-Resotec Elektronik GmbH to investigate the cause of the fault.

DANGER

S8: Maximum operating time

The maximum operating time of the OM 2032-F must not exceed 10 years. It must be taken out of operation by the user 10 years after the date noted on the operation module.

CAUTION

S17: Marking of the OM 2032-F (identification plate)

An OM 2032-F that can no longer be identified must be taken out of service. An OM 2032-F whose operating time cannot be determined must also be taken out of service.

NOTE!

S19: Re-Certification

If an OM 2032-F is integrated in a machine / system, the following points must be made known to the end user in the safety manual of the machine / system:
Safety instructions; application examples; approved components for circuit protection; type designations of safety-related components; permissible operating modes; requirements for the end user (training); safety-relevant interfaces; restrictions; requirements for maintenance, use, assembly, installation, provision and dismantling with regard to functional safety; environmental conditions; valid standards, certificates and attestations; reporting body with regard to functional safety; requirements according to IEC 61508-2 Appendix D and IEC 61508-3 Appendix D.

8.2 Care of the keyboard foil

Avoid scratching or damaging the keyboard foil

The operation module's keyboard foil must not be cleaned using an abrasive cleaning agent or a rough cloth. Compressed air and steam jet methods of cleaning are also not permitted.

Only use a soft cloth and mild cleaning agent to avoid damage to the keyboard.

CAUTION

Do not under any circumstance clean the keyboard, of e.g. fingerprints or dirt, while the device is operational, as this could lead to unwanted operation.

=> Turn off the module.

=> Apply the mild cleaning agent to the soft cloth and gently rub the keyboard foil.
Do not pour or spray any liquid directly onto the keyboard foil.

9 Spare parts and accessories

The following spare parts and accessories are deliverable:

Description		Article number
Spare parts		
OM 2032-F	OM 2032-F, Head Module	92390 1108
OM 2032	Operation module Head Module, PROFINET®IO Device Sub Module EtherCAT® connection PROFIBUS®-DP Ethernet/IP®	 92390 1008 92390 1010 92390 1003 92390 1001 92390 1009
Accessories		
	Connecting cables for OM Sub Module	92641
	Adapter cable PP17 / PP17-F	
	Fastening elements	
	Plug connector	

10 De-installation and disposal

Deinstall the device in the following way:

=> Switch off the device by disconnecting the power supply. The operation module is not equipped with an off button.

=> Disconnect the electrical connections and the power supply.

=> Remove the device from the front plate of the control panel or from the switch cabinet.

Only qualified personnel are allowed to disassemble and dispose of the Control Module.

Disposal

=> The operation module is made of various different materials. Under no circumstance can it be disposed of in domestic waste.

=> Electrical devices must be disposed of in accordance with the local regulations on waste electrical and electronic equipment.

11 Technical Data

11.1 Technical Data OM 2032 and OM 2032-F

Buttons	
Short-stroke keys with insertion strips	32
LED 5-colored (red, green, yellow, blue, white)	32
Status LED	32 plus 2 additional info LED
Interfaces	
Resotec module bus (max 3 Sub Modules)	2 x RJ45 (max. bus length 9 m)
Digital I/O (only Head Modules)	16 inputs, 16 outputs Voltage: 24 VDC, max. output current: 100 mA
OM 2032-F (only for PROFINET®): fail-safe digital I/O (safety)	3 safety inputs, 1 safety output, each with two channels (SIL3)
Fieldbus interfaces	
PROFINET® IO Device	Module (option), 2 x RJ45 incl. switch
Ethernet/IP® Device	Module (option), 2 x RJ45 incl. switch
EtherCAT® Slave	Module (option), 2 x RJ45
PROFIBUS®-DP Slave	Module (option), 1 x 9-pol. SUB-D
Electrical Connection	
Power supply	24 V DC, -15 % to +20 % acc. to EN 61131-2
Current drawn (without load)	< 300 mA
Power consumption	approx. 7,5 W
Protection	
Front	IP 65 acc. to EN 60529
Rear	IP 20 acc. to EN 60529
Environmental Conditions	
Operating temperature	0 to 50 °C
Storage temperature	-20 to 60 °C
Relative humidity (without condensation)	<80 %
Housing	
Overall dimensions (W x H) in mm	240 x 204

Cut-out dimensions (W x H) in mm	226^{-2} x 190^{-2}
Mounting depth	Approx. 50 mm without connector
Front pane	Aluminum front panel with design foil
Housing lid	Stainless steel
Weight	Approx. 1,2 kg

11.2 Safety characteristics

	IEC 61508 Safety integrity level	**EN ISO 13849-1 Performance level**
Dual channel passive input	SIL 3	PL d / Cat. 3
Dual channel active input	SIL 3	PL d / Cat. 3
Dual channel output	SIL 3	PL d / Cat. 3
Single channel passive input	SIL 3 (Requires additional external security measures.)	PL d / Cat. 2 (Requires additional external security measures.)
Single channel output	SIL 1 (Not allowed without additional external security measures.)	PL c / Cat. 1 (Not allowed without additional external security measures.)
	SFF	**PFH**
Dual channel passive input	99.60 %	$2.44 * 10^{-9}$ 1/h
Dual channel active input	99.60 %	$2.44 * 10^{-9}$ 1/h
Dual channel output	99.63 %	$2.46 * 10^{-9}$ 1/h
Single channel passive input	99.67 %	$4.47 * 10^{-9}$ 1/h
Single channel output	79.78 %	$1.89 * 10^{-7}$ 1/h
	Dual channel mode	**Single channel mode**
Hardware fault tolerance (HFT)	1	0

Diagnostic Coverage DC	>90 %
Proof-test interval (PT)	10 years
Self-test interval	1 hour
MTTFd Dual channel input and output	>100 years
Service life	max. 10 years