FAG

FAG SmartController

User manual

SCHAEFFLER

Imprint

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Translation of the original user guide.
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Contents

1 General

1.1 About this guide

This guide describes how to install and use the FAG SmartController and the separate touchscreen display, and contains important information about using the devices safely and correctly. Please read through this guide carefully before commissioning the device, and keep it for future reference.

Make sure that

- This guide is available to all users of the device
- If the product is passed on to other users, that this guide is also passed on with it
- Additions and amendments provided by the manufacturer 87 are always attached to this guide.

Further information

As an external device, the FAG SmartController can be configured in the SmartWeb software for up to 25 FAG SmartCheck devices. Not just the FAG SmartCheck device but also the FAG SmartWeb software are documented in a dedicated handbook.

Definitions

- Product: the FAG SmartController complete with separate touchscreen display as described in this handbook.
- User: person or organisation capable of putting the product into operation and using it.
- Qualified person: a person who, by virtue of their relevant training and experience, is qualified to identify risks and avoid potential hazards that may be caused by the operation or maintenance of a product.

Symbols used

This symbol indicates
- *Helpful additional information and*
- *Device settings or practical tips that will help you to perform activities more efficiently.*

Cross-reference symbol 5 : this symbol refers to a page in the manual that provides further information. If you are reading the manual in PDF format on a screen, clicking the word to the left of the cross-reference symbol will take you straight to the section in question.

1.2 Hazard symbols and signal words

Hazard symbols used in this guide

Safety information and warnings are identified by specific, standardised hazard symbols. If no specific symbol applies, a general hazard symbol is used.

General hazard symbol

DANGER   ***The nature and source of the hazard are specified here***

Measures to prevent the hazard are explained here.

Specific hazard symbols

DANGER   ***DANGER FROM ELECTRICAL CURRENT!***

This symbol indicates a danger from electric shock that can cause personal injury or even death, or damage to property.

Signal words used in this guide

Signal words indicate the severity of the hazard that occurs if the measures to reduce the hazard are not taken.

- **Caution**: Minor damage to property may occur.
- **Warning**: Minor personal injury or severe damage to property may occur.
- **Danger**: Personal injury may occur. There is a risk of fatal injury in particularly severe cases.

1.3 Safety information

The FAG SmartController is manufactured in accordance with recognised standards and guidelines (see the Declaration of Conformity in the Appendix 88) and is safe to operate. Nevertheless, the device can pose unavoidable residual hazards to users and third parties or to property, therefore it is imperative that all of the safety information given in this guide is observed. The generally applicable safety and accident prevention regulations must also be taken into account. Failure to do so may result in the health and life of persons being put at risk, or cause damage to property. The safety information in this guide applies in the Federal Republic of Germany. In other countries, the relevant national regulations apply.

According to its intended use, the FAG SmartController does not fall under EC Machine Directive 2006/42/EC.

The FAG SmartController may only be used for information purposes. It may not be used to deactivate or control any processes.

Safety-relevant regulations

During project planning, installation, commissioning, maintenance and inspection of the FAG SmartController, the applicable regulations relating to safety and accident prevention must be observed for the specific application scenario. Please observe the following regulations in particular (not exhaustive):

- **VDE regulations**
  - VDE 0100 Regulations for setting up high-voltage systems with a nominal voltage up to 1000 V
  - VDE 0105 Operation of high-voltage systems
  - VDE 0113 Electrical systems with electronic equipment
  - VDE 0160 Electrical systems with electronic equipment
  - VDE 0550/0551 Regulations for transformers
  - VDE 0700 Safety of electrical equipment for domestic and similar purposes
  - VDE 0860 Safety regulations for mains-operated electronic equipment and associated accessories for domestic and similar use
- **Fire prevention regulations**
- **Accident prevention regulations**
  - VBG no. 4: Electrical systems and equipment

This guide differentiates between

- **General safety information**, which applies to the whole guide and is listed in this chapter

and

- **Specialised safety information**, which you will find in each chapter, either at the start or accompanying individual actions

Operating personnel

The FAG SmartController may only be installed, operated and maintained by authorised qualified electricians who have received training in accordance with the applicable, relevant regulations.

General safety information

The following hazard warning notes are to be viewed as a general guideline for use of the FAG SmartController. It is essential to observe these notes for project planning, installation and operation of the SmartController.

DANGER:

- Observe the safety and accident prevention regulations that apply for the specific application scenario. Before installing, connecting and opening the assemblies, components and devices, ensure that the system is de-energised.

- Assemblies, components and devices must be installed in an insulated housing with a suitable cover and safety devices.

- For devices with a fixed mains connection, a mains isolator switch for all of the pins and a fuse must be installed in the building.

- Check the live cables and lines to which the devices are connected regularly for insulation faults and signs of breakage. Should a fault be detected in the wiring, the devices and their cables must be de-energised immediately and the defective wiring must be renewed.

- Before bringing the equipment back into operation, check whether the permissible mains voltage range correlates with the local mains voltage.

- Take the necessary measures to ensure that an interrupted program can be started again in the correct manner following voltage dips and power failures. No hazardous operating conditions may occur even for a short period.

- Earth leakage protection devices compliant with DIN VDE 0641 part 1-3 are inadequate as sole protection in the event of indirect contact in conjunction with programmable logic controllers. Here, additional or other protective measures must be taken.

- EMERGENCY STOP devices compliant with EN60204/IEC 204 VDE 0113 must remain effective in all operating modes of the FAG SmartController. Unlocking or releasing the EMERGENCY STOP device must not result in the system being restarted in an uncontrolled or undefined manner.

- To ensure that a line or wire breakage on the signal side cannot lead to undefined conditions in the controller, relevant safety measures must be taken on the hardware and software side.

- When using the modules, strict adherence to the nominal data for electrical and physical parameters must always be observed. The FAG SmartController and the touchscreen display must not be used for safety-relevant tasks or for critical switching operations! This applies in particular when these tasks or switching operations have health and safety implications.

Notes for avoiding damage from electrostatic discharge

Electrostatic discharge from the human body to components of the FAG SmartController or to the touchscreen display can damage modules and assemblies of the FAG SmartController as well as the touchscreen display. When handling the device, observe the following notes:

CAUTION:

- Touch an earthed metallic object to discharge yourself of any static charge before touching the modules of the FAG SmartController or the touchscreen display.

- Wear insulating gloves to touch the activated FAG SmartController or the display, e.g. when performing a visual inspection as part of the maintenance routine.

- If the air humidity is low, do not wear clothes made from synthetic fibres as these become electrostatically charged easily in such conditions.

2 Product description

About the FAG SmartController

The FAG SmartController is a programmable logic controller which is optimised for use with FAG SmartCheck devices. You can use the SmartController to call up a maximum of four analogue input signals with four different measurement ranges, a maximum of four digital pulse input signals and a maximum of four digital logic input signals. An Ethernet connection as well as a Modbus TCP server facilitate connection for up to 25 FAG SmartCheck devices. The connected FAG SmartCheck devices are used to evaluate the input signals and calculate an overall alarm status; digital outputs allow the overall alarm status to be called up. The FAG SmartController is supplied with a separate touchscreen display that provides a user-friendly means of accessing settings options and that displays the overall alarm status via LED lighting.

The communication parameters and the program versions of the SmartController are aligned for use with FAG SmartCheck devices so that, after commissioning, the SmartController can work smoothly with the FAG SmartCheck devices that have been set-up accordingly.

> *The FAG SmartController can be extended and adapted to meet your individual requirements. Contact a customer support representative at FAG Industrial Services GmbH with your alteration requirements.*

2.1 Intended use

The FAG SmartController is intended exclusively for the following functions:

- Connection of four analogue input signals, as current or voltage depending on the set measurement range
- Connection of four digital pulse input channels
- Connection of four digital logic input channels
- Connection of three digital alarm outputs
- Use of the Modbus TCP server for virtual input signals from a maximum of 25 FAG SmartCheck devices
- Use of the Modbus TCP server for virtual output signals that transfer the alarm status for a maximum 25 FAG SmartCheck devices
- Connection to the Ethernet in order to communicate with the connected FAG SmartCheck devices
- Display of the overall alarm status as well as various settings options via the separate touchscreen display

> *The FAG SmartController must not be used to switch safety-relevant applications.*

The FAG SmartController complete with touchscreen display may be operated only within the limitations of use as specified under Technical data 9 .

Any other or additional use of the device is deemed to be not intended; the user bears sole risk for such use. The user is responsible for the intended use of the device. This also includes observing this guide.

2.2 Modifications by the user

The user must not make any modifications to the FAG SmartController or touchscreen display.

The user bears responsibility for any modifications! If you find a fault on your FAG SmartController or touchscreen display, please contact our Support 87 team.

2.3 Technical data

⚠️ *The FAG SmartController must not be used in measurement voltage categories II, III or IV.*

General	
Means of attachment	Top hat rail assembly
Power supply	100-240 VAC 50/60 Hz
Power draw max.	130 VA
Humidity	5-90 % non-condensing
Operating temperature	0-55°C
Operating altitude	<2000 m
Safety class	IP20
Dimensions	156.5 mm x 98 mm x 117 mm
Weight	915 g
Display	Separate touchscreen display; see below
Interfaces	• USB (currently not used) • Ethernet 10/100 Mbit
Battery type	Q6BAT
Inputs	
Analogue inputs	Depending on the setting, four analogue inputs for: • 0-10 V • +/-10 V • 0-20 mA • 4-20 mA
Input resistances	With current input: 250 Ohm With voltage input: 1 M Ohm
Digital inputs	• 4 digital speed inputs (pulse inputs 24 V) • 4 digital logic inputs (static, 24 V)
Speed range	60 rpm up to 30,000 rpm
Virtual inputs	25 virtual inputs via Modbus TCP
Outputs	
Digital outputs	5 digital outputs (24 V) • 3x alarm status • 1x Keep-Alive • 1x FAG SmartCheck device not available
Virtual outputs	• 25x alarm status of connected FAG SmartCheck devices via Modbus TCP • Overall alarm status of SmartController via Modbus TCP
Separate touchscreen display	
Means of attachment	Mounting on a panel (e.g. door to a switch cabinet) or mounting on a DIN rail
Display	Flat screen with the following characteristics: • Monochrome • 3.8" with a resolution of 320x128 pixels • Colour LED lighting
Control element	Touchscreen
Humidity	5-90 % non-condensing
Operating temperature	0-55°C
Operating altitude	< 2000 m
Power supply	24 V DC (+/-10%)
Power draw	Max. 2.6 W

Safety class	IP67F Please note the differing safety class of the FAG SmartController (IP20).
Dimensions	113 mm x 74 mm x 32 mm
Weight	200 g (without mounting materials)
Interface	Ethernet 10/100 Mbit

*Subject to technical modifications!*

2.4 Scope of delivery

Scope of delivery

- FAG SmartController, comprising mains unit module, CPU module, analogue input module complete with terminal block and end plate
- Printed FAG SmartController user documentation (in German and English)
- Product CD with
  - FAG SmartController user documentation in PDF format
  - Mitsubishi handbooks in PDF format
- Terminal strip for digital inputs/outputs
- Connecting cable for terminal strip
- 1 SD card complete with firmware (supplied inserted in the SD card slot of the controller)
- 1 metre network cable
- 2 securing clips for mounting on DIN rail
- Separate touchscreen display with:
  - Installation fittings for mounting the touchscreen display on a panel
  - Seal for mounting the touchscreen display on a panel
  - Adapter plate for mounting the touchscreen display on a DIN rail, plus 4 corresponding screws
 - 1 metre network cable RJ-45 (modular)

The FAG SmartController is made up of several modules that are connected to each other. Should you need to submit any queries, please provide the serial number of the CPU module as reference. This can be found on the front of the module on the lower edge:
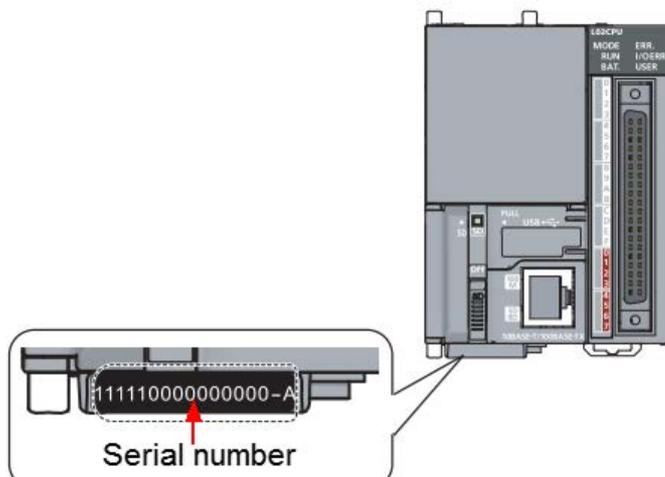
Serial number

The serial number comprises a 15 digit number, followed by a letter with a hyphen, e.g. 111110000000000-A.

The serial number along with the version and other information can also be found on the identification plate on the side wall of the module:

Serial number

Version

Details on compliance with standards and regulations
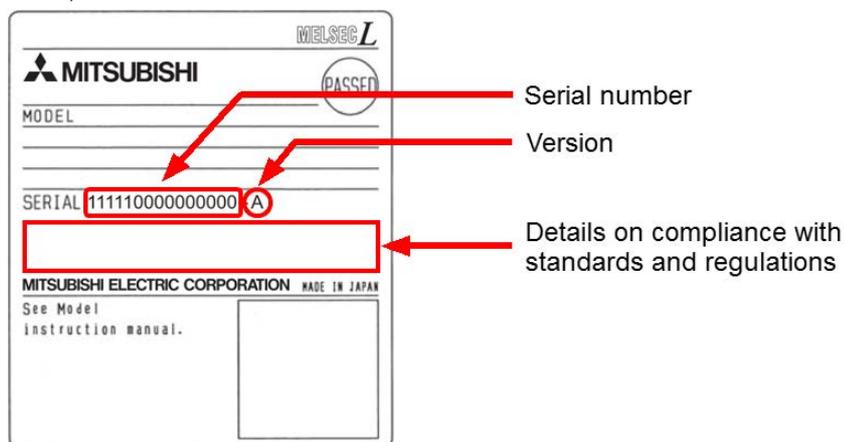
3 Installation of the SmartController module

Important details about installation of the FAG SmartController can be found in the following sections.

Ensure that the device is free from damage prior to installation.

In case of doubt, consult a qualified electrician or contact your customer support representative at FAG Industrial Services GmbH.

3.1 Installation details for the SmartController module

Installation site

Install the FAG SmartController in a IP66 housing on a DIN rail. When doing so, make sure that all of the environmental conditions for operation are adhered to, good ventilation is ensured for cooling, and all components are easily accessible for maintenance purposes.

Installation material

When installing the FAG SmartController, note the following:
- **Details about the DIN rail**
  - Width: 35 mm
  - Suitable models: TH35-7.5Fe, TH35-7.5Al, TH35-15Fe
- **Securing clips**

  To secure the FAG SmartController laterally on the DIN rail, two suitable securing clips are required. The securing clips are included in the scope of delivery.
- **Cross-head screwdriver and flat-head screwdriver**

  You need cross-head and flat-head screwdrivers in order to join the connections.
- **Tools and material for pulling on ferrules**

Environmental conditions at the installation site

Note the following environmental conditions for the FAG SmartController:
- The ambient temperature must be between 0°C and +55°C.
- The humidity must be between 5% and 90 % of the relative atmospheric moisture.
- Avoid the following installation sites:
  - Locations where condensation accumulates due to sudden temperature changes
  - Locations with easily flammable gases
  - Locations with a high level of conductive dust (iron filings, oil mist, mist, salt vapours or organic solvents)
  - Locations with direct sunlight
  - Locations with strong magnetic fields or high voltage fields
  - Locations at which powerful sound waves and shock waves can make their way directly into the FAG SmartController
- When using mobile phones, maintain a minimum distance of 25 cm to the FAG SmartController

Position in the switch cabinet

To ensure good ventilation and to make it easier to maintain/service the device, the following minimum distances should be adhered to between the FAG SmartController and the top and bottom of the switch cabinet:
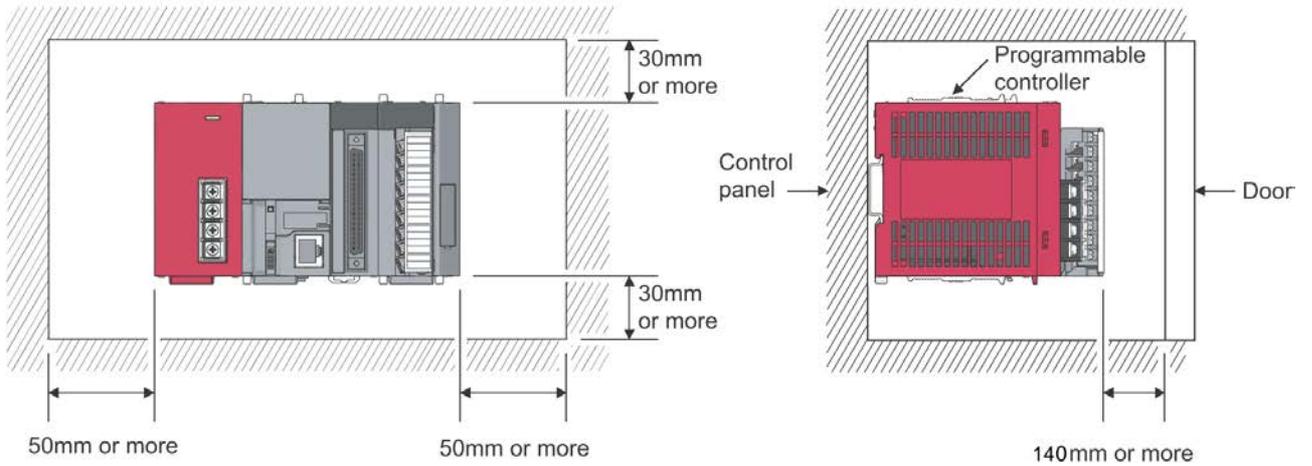
When installing the FAG SmartController, make allowance for additional space so that the terminal strip can be fitted.

3.2 Mounting the FAG SmartController on a DIN rail

DANGER

Switch off the power supply

Before performing any installation and connection activities, ensure that the power supply to the FAG SmartController is switched off, including external power sources.

Securing the DIN rail

The FAG SmartController is mounted on a DIN rail. Observe the following distances when attaching the DIN rail:

- Distance of attachment bolts in the switch cabinet: max. 200 mm
- Distance between the end of the rail (left or right) and the next securing bolt: max. 30 mm
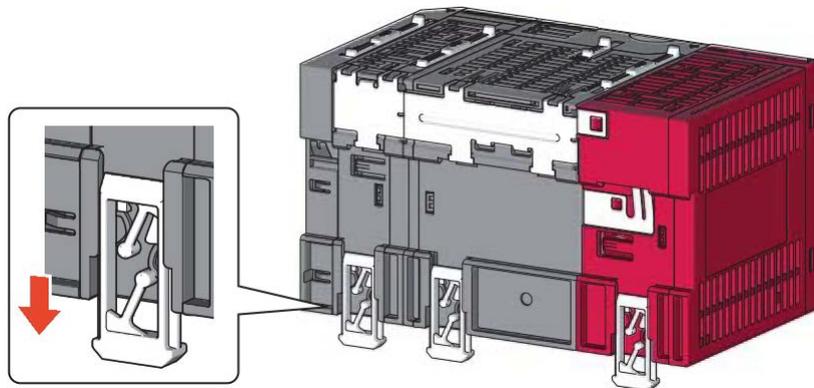
The following illustration shows the dimensions of the DIN rail as well as the requirements for the attachment distances:
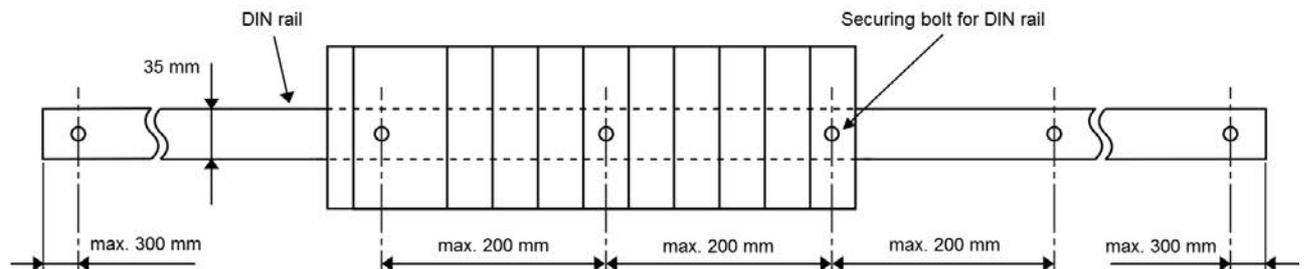


Installation of the FAG SmartController

Proceed as follows in order to mount the FAG SmartController on the DIN rail:

1. Pull the tabs on the rear lower edge of the FAG SmartController downwards until they engage:

2. Fit the device with the upper securing mechanism - i.e. with the recess on the back - on the DIN rail and push the device against the DIN rail into the correct position:
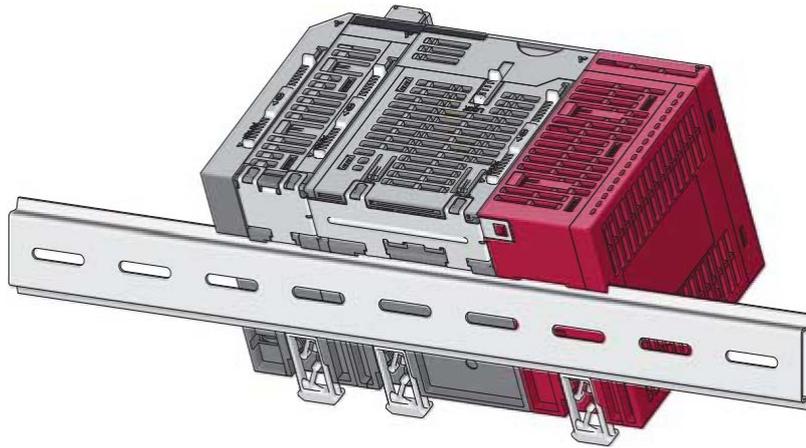
3. Lock the tabs: to do this, push them upwards until they engage. If the tabs are not easily accessible, you can use a tool.
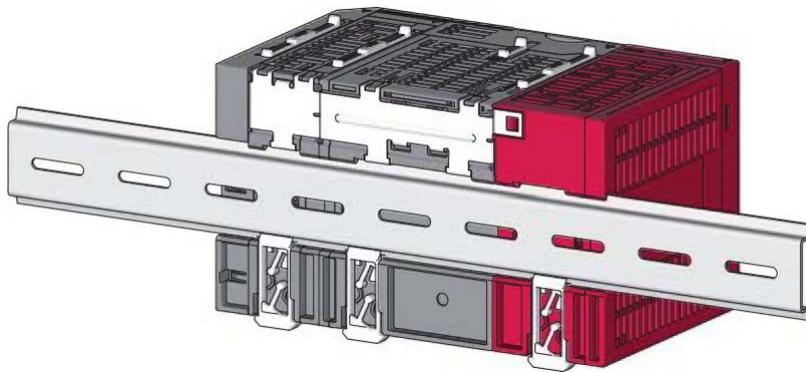
4. Place the securing clips on the DIN rail and secure them.

Securing clip
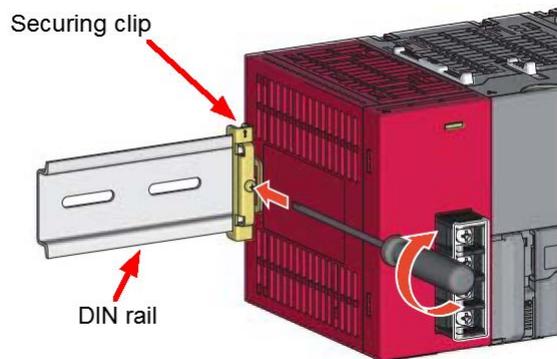
DIN rail

You can now connect inputs and outputs, establish the Ethernet connection and supply the device with power.

To remove the FAG SmartController again from the DIN rail, perform the aforementioned steps in the reserve order.

3.2.1 Dimensions of the SmartController module

The following illustrations show the FAG SmartController from different perspectives with dimensions accurate to the millimetre.
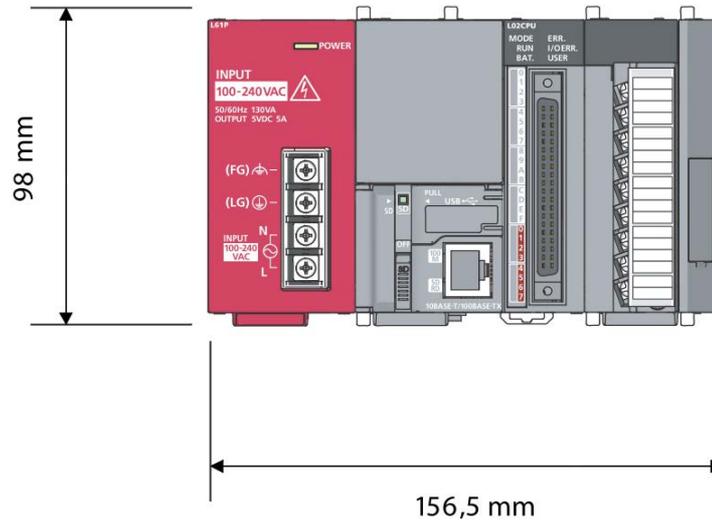
Basic dimensions of the FAG SmartController, front view

Viewed from the front, the mains unit module can be seen on the left, followed by the CPU module and the analogue input module as well as the end plate.

Basic dimensions of the FAG SmartController, side view

The side view shows how far the connections protrude, particularly the terminal block, and how the side area of the FAG SmartController is dimensioned.
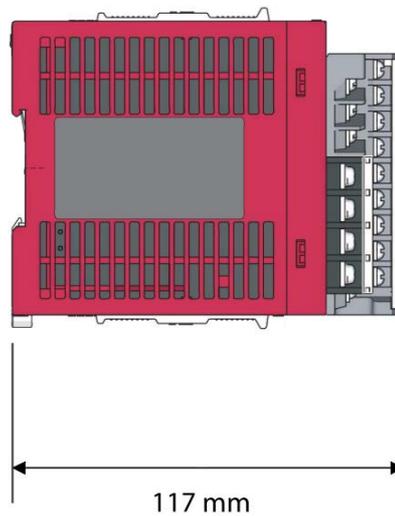
Once the FAG SmartController has been mounted on the DIN rail, the basic lateral dimension, i.e. the device including DIN rail, is 120 mm.

Basic dimensions of the terminal strip

The following illustration shows the dimensions of the terminal strip, which is also included in the scope of delivery.
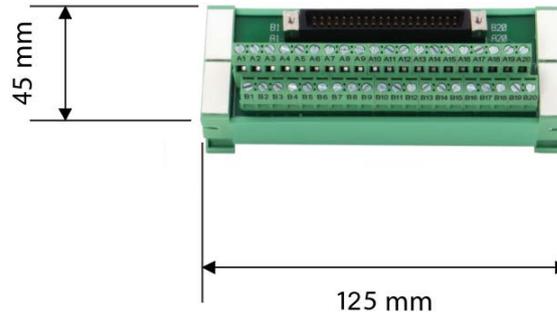
4 Installation of the touchscreen display

Important details about installation of the touchscreen display can be found in the following sections.

> ⚠️ *Ensure that the device is free from damage prior to installation.*
>
> *In case of doubt, consult a qualified electrician or contact your customer support representative at FAG Industrial Services GmbH.*

## 4.1 Installation details for the touchscreen display

Installation site

You can mount the touchscreen display either on a panel 21 or on a DIN rail 22 together with the SmartController modules. When doing so, make sure that all of the environmental conditions for operation are adhered to, good ventilation is ensured for cooling, and all components are easily accessible for maintenance purposes.

Materials for mounting the touchscreen display on a panel

When mounting the display on a panel, please note the following:

- **Details of the panel (e.g. door to a switch cabinet)**
  - Panel thickness: max. 5 mm
  - The panel must be undamaged, even and not distorted, meaning that it must also remain watertight once the touchscreen display has been mounted
  - The panel must be stable
  - A cut-out for the touchscreen display must be created on the panel using the following dimensions:
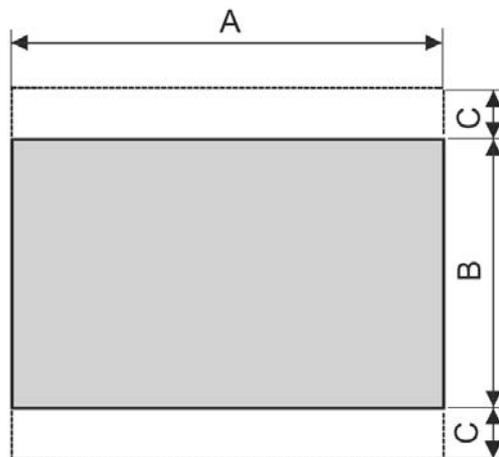
A	B	C
105 mm (tolerance +1.0)	66 mm (tolerance +1.0)	At least 13 mm

- **Installation fittings and seal**

  In order to secure the touchscreen display in the panel cut-out, the appropriate installation fittings and a seal are required. Both are included in the scope of delivery.
- **Cross-head screwdriver**

  A cross-head screwdriver is required to tighten the fittings.

Materials for mounting the touchscreen display on a DIN rail

When mounting the display on a DIN rail, please note the following:

- **DIN rail adapter with four screws**

  To mount the display on a DIN rail, a DIN rail adapter must be fitted to the display using four screws. Both are included in the scope of delivery.

  Further details on the materials used to mount the touchscreen display on a DIN rail can be found in the section

entitled **Installation details for the SmartController module** 12 .

- **Cross-head screwdriver**

  A cross-head screwdriver is required to tighten the screws.

### Environmental conditions at the installation site

Please note the following environmental conditions for the touchscreen display:

- The humidity must be between 5% and 90 % of the relative atmospheric moisture.

- The ambient temperature must be between 0°C and +55°C.

- Differing ambient temperature: If the touchscreen display is fitted on a panel with an angle outside the range of 60° to 105°, the ambient temperature must be a maximum of 40°; please refer to the following illustration:
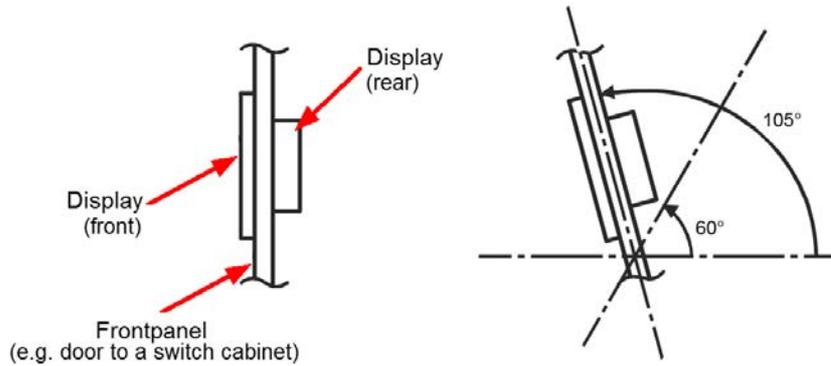
Minimum distances when mounting the touchscreen on a panel

- Adhere to the following minimum distances between the front edge of the touchscreen display and the edge of the panel:
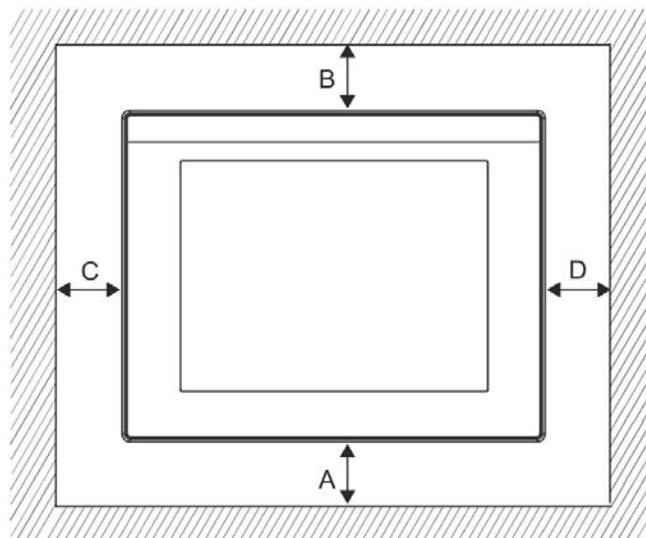
Area	Device that produces radiated noise/heat in the vicinity	No device that produces radiated noise/ heat in the vicinity
A	At least 50 mm	At least 20 mm
B	At least 50 mm	At least 20 mm
C	At least 50 mm	At least 20 mm
D	At least 50 mm	At least 20 mm

- Adhere to the minimum distance between the rear of the touchscreen display and other devices. The following illustration also shows how thick the panel must be:
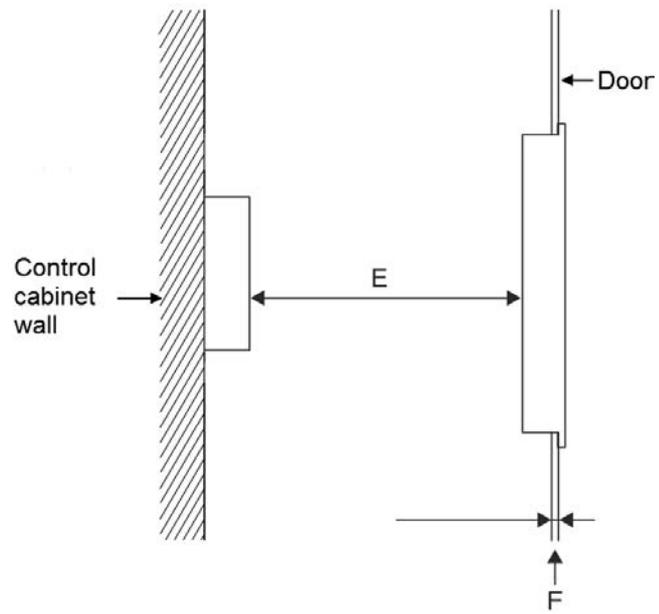
Area	Distance/dimension
E	• Device that produces radiated noise/heat in the vicinity: at least 80 mm • Otherwise: at least 20 mm
F	1–5 mm

4.2 Installing the touchscreen display

DANGER   ***Switch off the power supply***

*Prior to installation and connection, switch off the power supply to the touchscreen display, including any other external power sources.*

Mounting the touchscreen display on a panel

The touchscreen display can be mounted on a panel, such as the door to a switch cabinet. To do this, proceed as follows:

1. Create the appropriate cut-out in the panel. The necessary dimensions can be found in the section entitled **Dimensions of the touchscreen display** 23.

2. Slide the supplied seal onto the rear of the touchscreen display until the seal slots into the mounting groove:
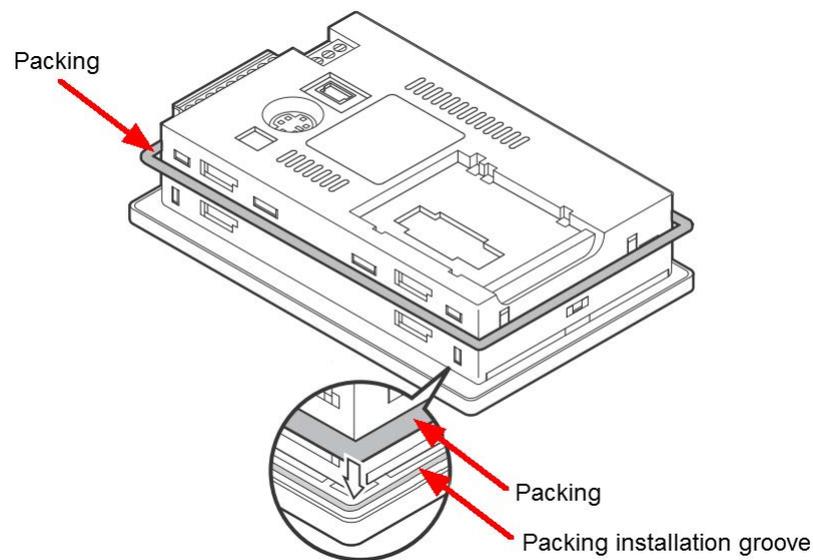
3. Insert the touchscreen display into the panel cut-out from the front:
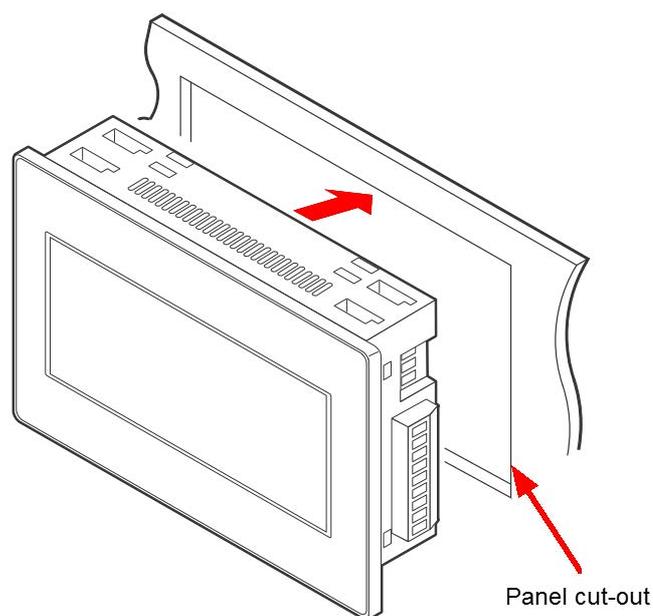
4. Assemble the supplied installation fittings. The following installation diagram shows how installation fittings are inserted into the openings provided for this purpose (**1**). To secure the fittings in position, first slide each fitting to the rear of the display (**2**) and then to the left (**3**):

Mounting screw · Installation fitting · ① ② ③
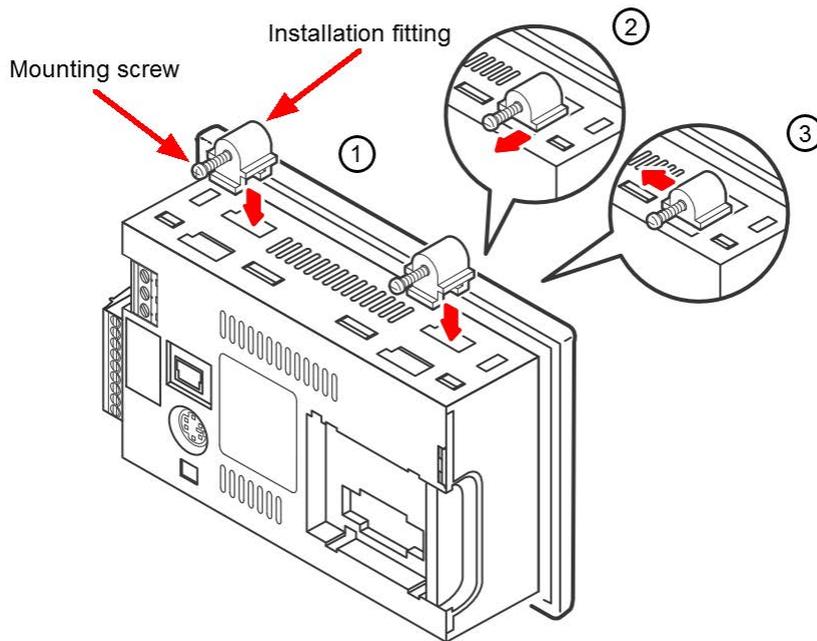
5. Tighten the four screws of the installation fittings to a torque of 0.20 Nm to 0.25 Nm.

6. Remove the protective film attached to the display area.

7. The touchscreen display can then be connected to the FAG SmartController and the power supply 41.

Tighten the screws of the installation fittings to the specified torque of 0.20 Nm to 0.25 Nm:

- *If the torque is too low, the touchscreen display may become loose. In addition, this may prevent the seal from being fully functional under certain circumstances.*

- *If the torque is too high, the touchscreen display and/or the panel may be distorted. As a result, the display quality of the touchscreen and the precision with which information can be entered may be impaired. In addition, this may prevent the seal from being fully functional under certain circumstances.*

Mounting the touchscreen display on a DIN rail

The touchscreen display can be mounted on a DIN rail alongside the FAG SmartController modules. To do this, proceed as follows:
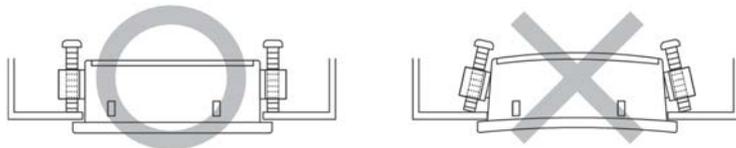
1. Use four screws to attach the DIN rail adapter to the rear of the touchscreen display. To secure, tighten the screws by hand. Both the adapter and the screws are included in the scope of delivery.

2. Hang the display on the DIN rail using the securing mechanism and lock the tabs. Details on this step can be found in the section entitled **Mounting the FAG SmartController on a DIN rail** 14.

3. Remove the protective film attached to the display area.

4. The touchscreen display can then be connected to the FAG SmartController and the power supply 41.

To remove the touchscreen display from the panel or from the DIN rail, perform the steps described above in reverse order.

The installation fittings (used to mount the touchscreen display on a panel) are also removed in reverse order:
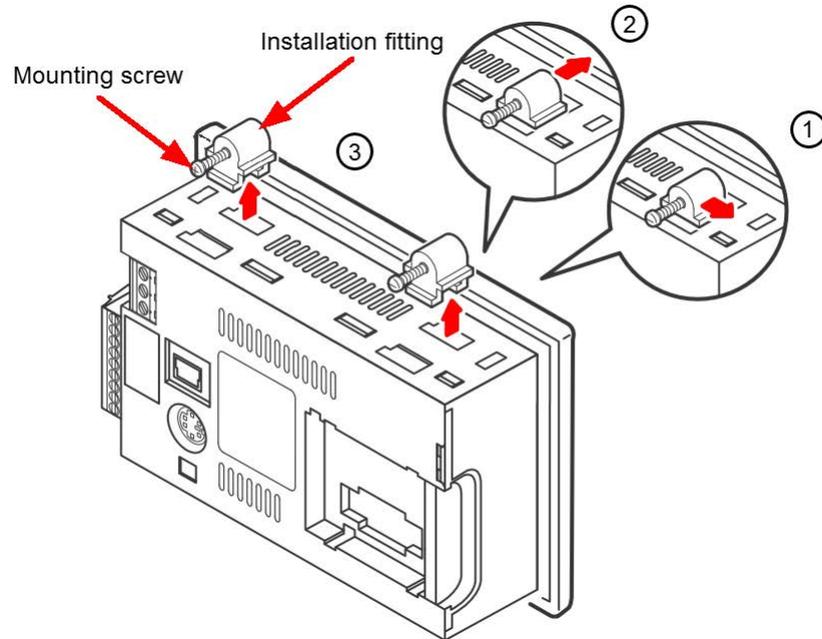
4.2.1 Dimensions of the touchscreen display

The following illustrations show the touchscreen display from different perspectives and with dimensions that are accurate to within a millimetre.

The required space for installing and connecting the touchscreen display also depends on the type of connecting wire used. The required dimensions may therefore differ from those specified.

When installing and connecting the touchscreen display, pay attention to the connection dimensions and the cable bending radius.

Basic dimensions of the touchscreen display as viewed from the front and from above

These illustrations show the front dimensions of the display area, the thickness of the display element and the dimensions of the connection block for the power supply.
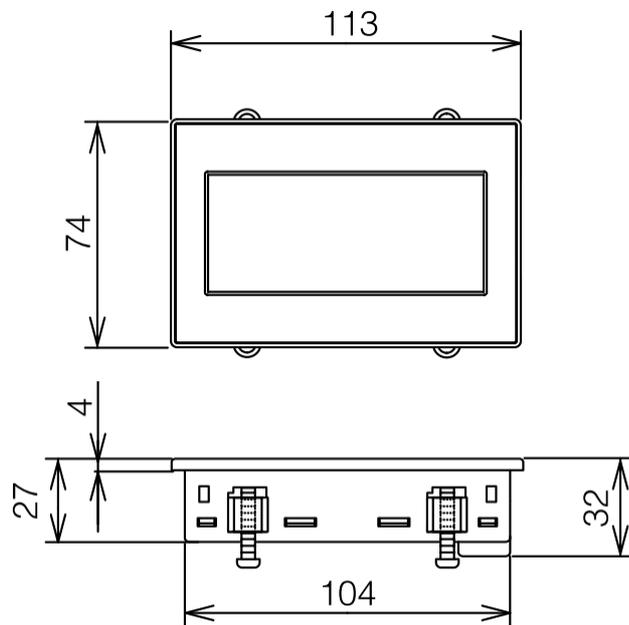
Basic dimensions of the touchscreen display as viewed from behind and from the side

The rear basic dimensions show the dimensions of the installation fittings and the distances between them, as well as the side area of the touchscreen display.
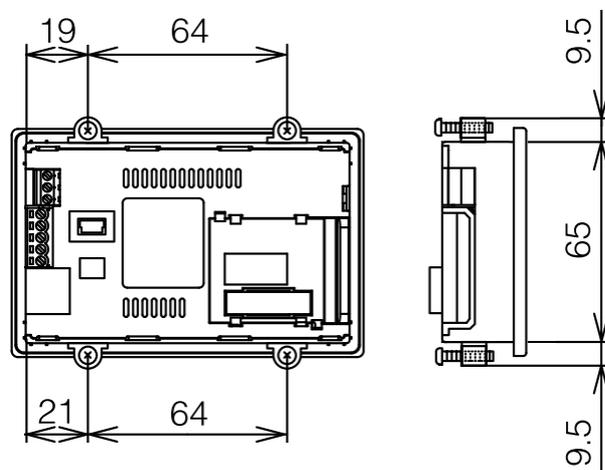
5 Layout, connections and fittings

Via the connections of the FAG SmartController, you can supply power to the device, virtually connect up to 25 FAG SmartCheck devices and also connect analogue as well as digital input/output signals. Settings options and system responses can be found in the separate touchscreen display.
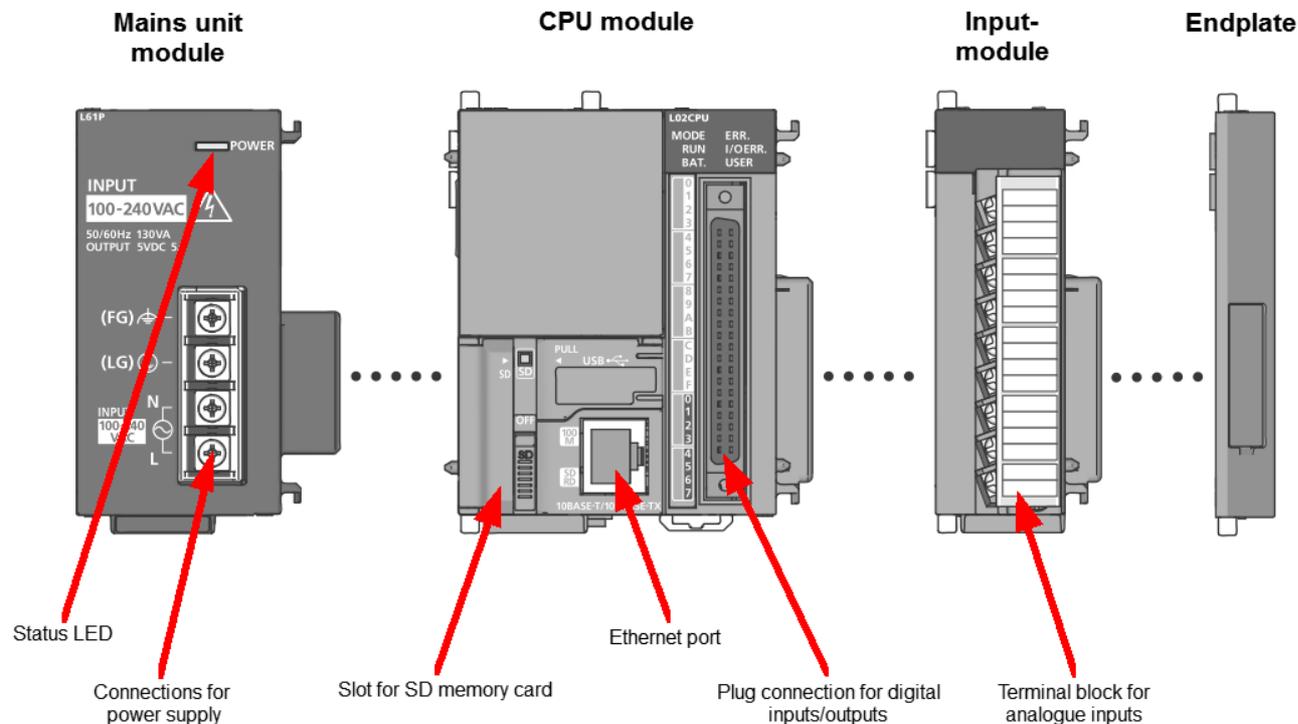
The following diagram shows an overview of the device layout, its individual modules and the position of the connections and control elements:

The FAG SmartController features the following components and functions:

- **Mains unit module**

  The connections for the power supply are located on the mains unit module. The mains unit is designed for an alternating voltage of 110-240 V. In addition, an LED indicates the status of the mains unit.

- **CPU module**

  The CPU module features the slot for the SD memory card. The SD card contains the firmware of the FAG SmartController and is already inserted on delivery. The CPU module also includes the Ethernet interface. The integrated digital inputs and outputs can be used via the plug connection.

- **Analogue input module**

  The four analogue signals can be connected to the terminal block of the analogue input module.

- **End plate**

  The end plate serves as a means of protecting the side of the SmartController.

- **Separate touchscreen display (not shown above)**

  The touchscreen display can be used to set various program parameters and call up the system status. The display features a connection to the power supply as well as an Ethernet port, which is used to establish the connection to the FAG SmartController. The following image shows an overview of these connections on the rear of the touchscreen display:
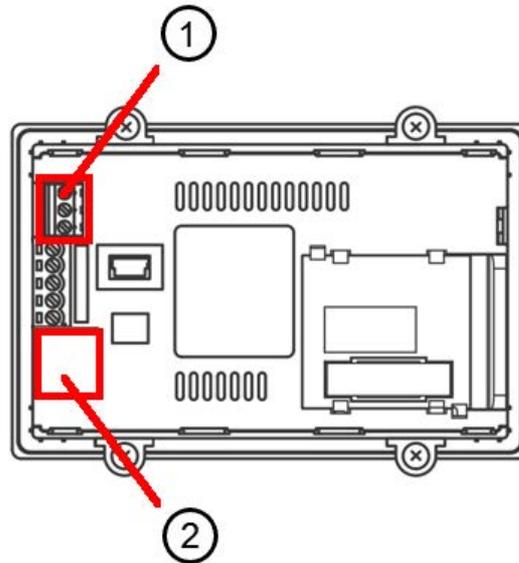
- **Connection 1**: Power supply
- **Connection 2**: Ethernet interface

An overview of how you can connect the FAG SmartController can be found in the section **Overview of connections and fittings** 26 .

Important notes that must be observed when connecting the inputs can be found in the section **Connection notes** 27 .

Details about the assignment of the individual connections can be found in the section **Connection details** 30 .

Notes and details on connecting the touchscreen display can be found in the section entitled **Connecting the touchscreen display** 41 .

5.1 Overview of connections and fittings

To use the functions and connections of the FAG SmartController and the touchscreen display, proceed as follows:

1. Mount the SmartController 14 in the desired position.

2. Mount the separate touchscreen display 21 in the desired position and connect it 41 .

3. Consider how you wish to make use of the analogue inputs, the digital inputs and outputs as well as the virtual connection of up to 25 SmartCheck devices.

4. Once you know how the connections and functions of the FAG SmartController are going to be used, prepare the relevant accessories for the connections. You can find details on the various connection options in the following sections:

   - **Connecting analogue inputs** 34
   - **Connecting digital inputs and outputs** 36
   - **Connecting the power supply** 38
   - **Starting a program** 40
   - **Connecting to the network** 41
   - **Connecting FAG SmartCheck devices** 43 . The Ethernet connection is used to connect up to 25 FAG SmartCheck devices. For communication with the higher level controllers, a Modbus TCP server is used. Details about this can also be found in this section.

5. Once you have commissioned the SmartController, the control elements of the mains unit module 60 , the CPU module 61 , the analogue input module 65 and the touchscreen display 66 are available to you.

6. In the event of a power failure, the SmartController features a battery 64 as a buffer.

Important notes that must be observed when connecting the inputs can be found in the section **Connection notes** 27 .

Details about the pin assignment of the individual connections can be found in the section **Connection details** 30 .

⚠

- *The FAG SmartController may only be prepared for use by persons who are verifiably qualified to do so in accordance with the relevant rules and regulations.*
- *Ensure that the FAG SmartController is de-energised while work is being performed on it.*

5.2 Connection notes

When creating the connections, please observe the notes detailed below.

Connecting the power supply

- Separate the power supply connection of the FAG SmartController from the supply of the inputs and outputs and from the supply of the other devices.
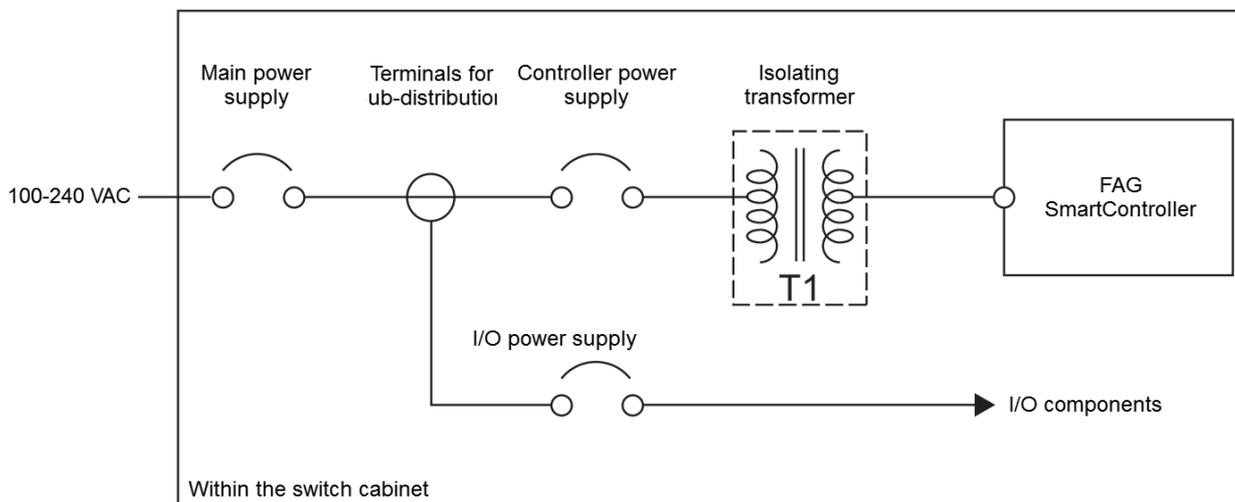
- For configuration of a circuit breaker or fuse, take account not only of the rated current draw but also the activation current of the mains unit module. The triggering current of the circuit breaker should be selected in a such a way that the system is isolated from the power supply network safely in the event of an excessive current draw. If a single FAG SmartController is used, the deactivation current of the circuit breaker or fuse is approx. 10 A.

- Route the mains lines (100-240 VAC) and lines for direct voltage in two separate strands. Bundle the cables by twisting them or attaching them together with cable ties. Keep the connections to the modules as short as possible.

- For the mains lines (100-240 VAC) and the lines for direct voltage, use the maximum possible cross-section (max. 2 mm²) in order to minimise any voltage drop.

- The mains lines and the lines for direct voltage supply (24 VDC) must not be routed in a strand together with the lines of the main circuit or the I/O signal lines (high voltages, high currents). Where possible, a minimum distance of 100 mm between the lines should be observed.

- If faults occur in the voltage supply network due to activation surges or other line-related malfunctions, an isolating transformer must be connected in between for the purposes of insulation.

- For direct voltage supply of the modules, a mains unit of category 2 must be used.

- Mount or close all protective covers of the terminal blocks once the connections have been made. Do not touch any live parts of the modules.

- Configure your system in such a way that the maximum output current of the mains unit module for the voltage supply is not exceeded by 5 VDC. Details about the technical data of the mains unit module can be found in the section **Technical data** .

- To protect against excess voltage (e.g. lightning strike), overvoltage suppressors should be used:
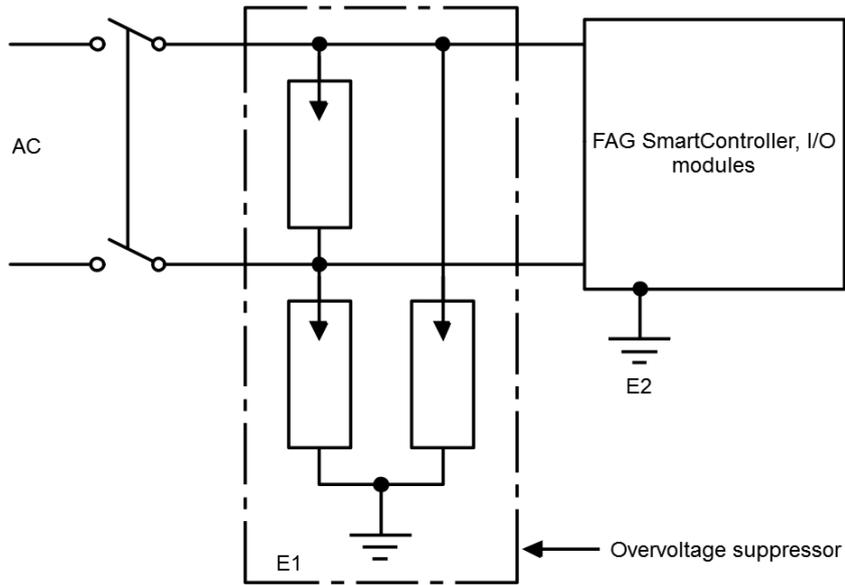
CAUTION

- *The earth of the overvoltage protection **E1** and that of the FAG SmartController **E2** must be laid so that they are separate from each other.*
- *Select the type of overvoltage protection so that the permissible voltage fluctuations do not trigger the safety feature.*

- If I/O signals lead to outside areas, insulate them using relays.
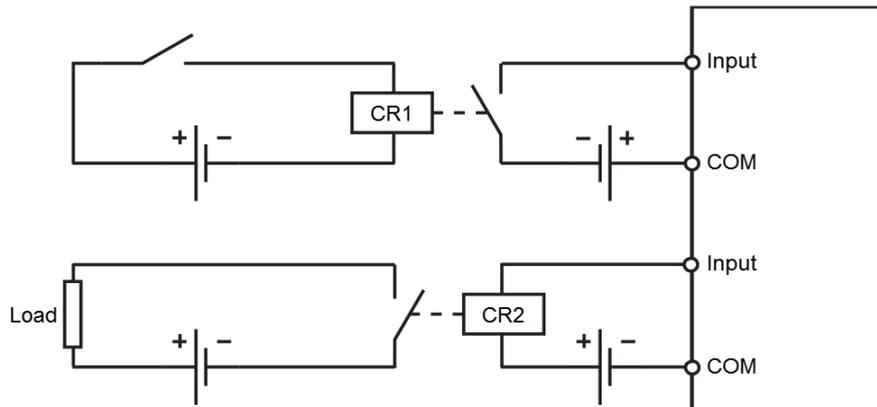
Connection of external peripherals to the inputs and outputs

- The wires for the input and output terminals may have a cross-section of 0.3 to 0.75 mm².
- The wires for the inputs and outputs should always be routed separately from each other.
- Routing of the I/O signal lines must be such that a minimum spacing of 100 mm to mains voltage and high-voltage lines of the main circuits is maintained. If this is not possible, shielded lines must be used. Earthing of the shielding is usually on the module side.
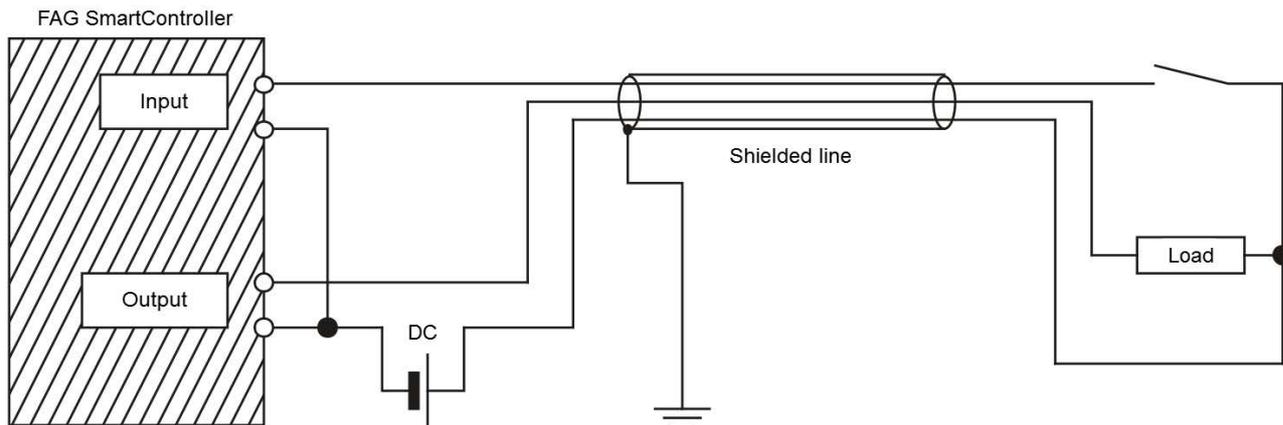
- If the connections run through metallic pipes or cable trays, these must be earthed.
- Lines that carry input or output signals (24 VDC) must be routed separately from lines that are charged with alternating voltage (100-240 VAC).

> *Where lines are longer than 200 m, performance loss may be experienced as a result of the line capacity, which could falsify the input signals.*

Earthing

- Earth the FAG SmartController separately from other devices if possible via the FG and LG terminal. The earthing should be category 3 and the earth resistance should be max. 100 Ohm.
- If independent earthing is not possible, follow the middle example in the following diagram to create a common earth point. Earthing as shown in the example on the right should be avoided:
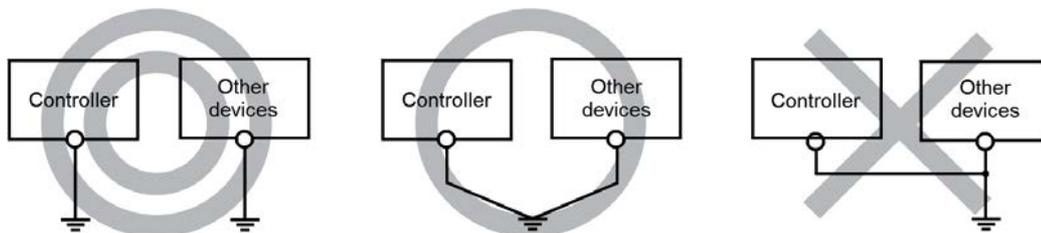
- For earthing, use wires that have a cross-section of at least 2 mm². The connecting point should be as close to the FAG SmartController as possible. The line length should be no more than 30 cm.

Shielding

If a FAG SmartController communicates with peripheral devices, shielded data cables must be used for the connections. The shielding should be braided copper wire. The tightness of the braid is decisive for effective shielding. When routing the data cables, ensure the following:

- Adhere to the bending regulations specified by the cable manufacturer as otherwise the shielding could split open.
- The shielding is connected to the line on one side.
- Do not solder any wires to the shielding when connecting.

Analogue signal transmission

Perform a low-frequency, analogue signal transmission over short distances using a two-core, shielded cable. Potential differences are possible between the reference conductors of the sender and receiver, which is why potential isolating components are used (transformer, optocouplers etc.).

Digital signal transmission

For digital signal transmission, note the technical data of the interface in relation to the transmission rate and transmission distance to ensure uninterrupted signal transmission.

5.3 Connection details

Using the connections of the FAG SmartController, connect the digital inputs and outputs, the analogue inputs and also the power supply.

Power supply   Digital inputs/outputs   Analogue inputs
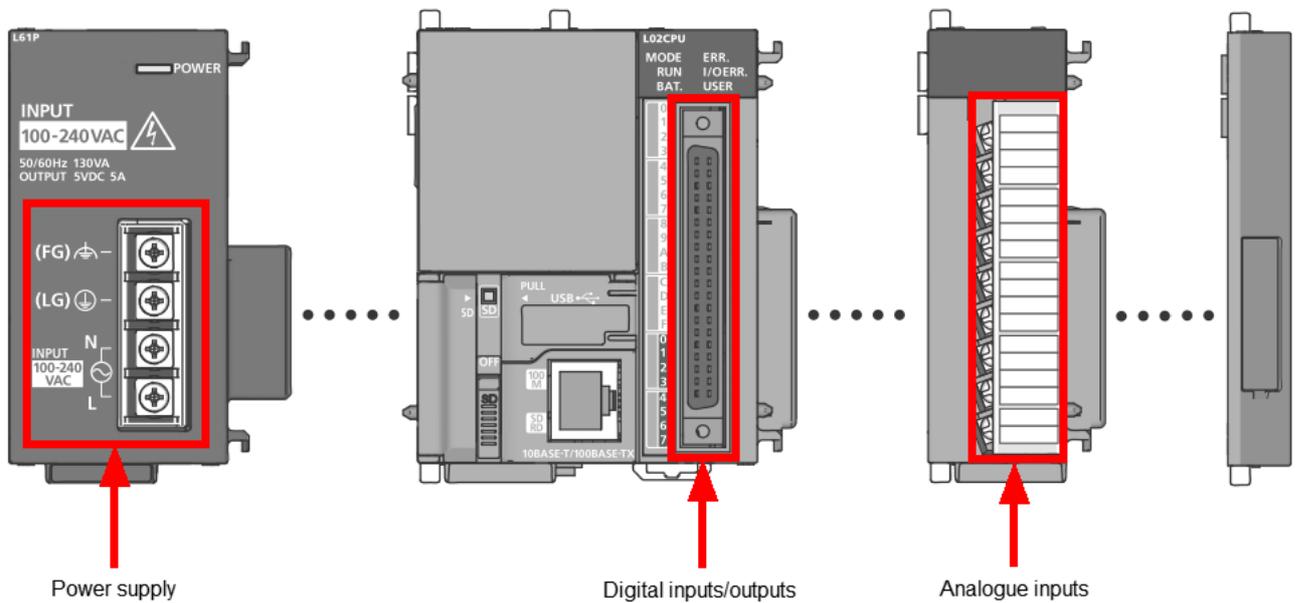
Details about the assignment of the cables required for the digital inputs/outputs 31, the analogue inputs 32 and the power supply 33 can be found in the following sections.

Details on connecting the separate touchscreen display can be found in the section entitled **Connecting the touchscreen display** 41.
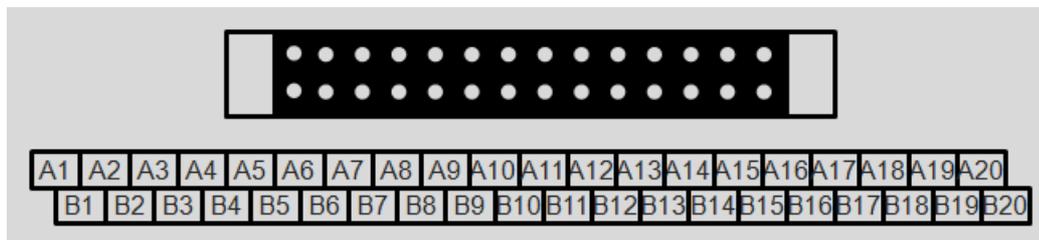
Digital inputs/outputs

The digital inputs and outputs can be accessed via the plug connection on the CPU module:

The pin assignment for the digital outputs and inputs is as follows:

No.	Assignment
Pin assignment for digital outputs	
A2	Keep-Alive signal of the FAG SmartController
A5	Pre-alarm
B1/A1	+24 V (connection for external power source)
B2	FAG SmartCheck device unavailable
B4	Main alarm
B5	No alarm
Pin assignment for digital pulse inputs	
A15	Input 4: Signal -
A17	Input 4: Signal +
A18	Input 3: Signal -
A20	Input 3: Signal +
B15	Input 2: Signal -
B17	Input 2: Signal +
B18	Input 1: Signal -
B20	Input 1: Signal +
Pin assignment for digital logic inputs	
A09	Input 8: Signal +
A10	Input 6: Signal +
B09	Input 7: Signal +
B10	Input 5: Signal +
B11/A11	All inputs: Signal -

Analogue inputs

The analogue inputs are accessible via the connection terminals on the analogue input module:
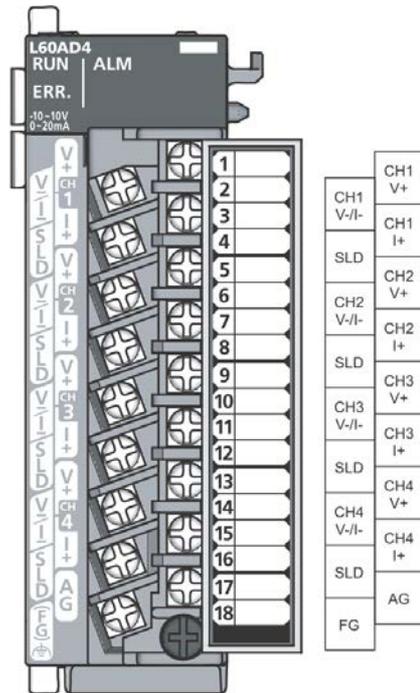
Number of connection terminal	Signal name	
1	CH1	V+
2		V-/I-
3		I+
4		SLD
5	CH2	V+
6		V-/I-
7		I+
8		SLD
9	CH3	V+
10		V-/I-
11		I+
12		SLD
13	CH4	V+
14		V-/I-
15		I+
16		SLD
17	AG	
18	FG	

Power supply

You connect the power supply to the connection terminals of the mains unit module:
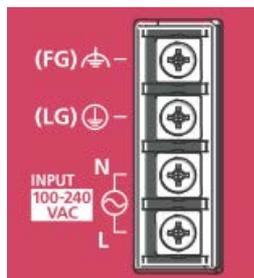
The assignment of the connection terminals is as follows:

Name of connection terminal	Function
FG	Earth connection of the PCB shielding
LG	Earth connection for the mains filter
INPUT: N and L	Mains voltage connections

5.4 Analogue inputs

You can use up to four analogue inputs via the FAG SmartController. The measurement range of the analogue inputs can be set via the touchscreen display. You can choose between the measurement ranges 0–10 V, +/-10 V, 0–20 mA or 4–20 mA. The measurement range selected by default is 0–10 V.

The resolution of the input channels is as follows:

Measurement range	Value range	Resolution
0–10 V	0-20,000	500 µV
-10 V to +10 V	-20,000 to +20,000	500 µV
0-20 mA	0-20,000	2 µA
4-20 mA	0-20,000	2 µA

Please note the following regarding the input channels:

- The frequency of the additional signals may not exceed 5 Hz.
- The input resistances are 1 MOhm when using voltage inputs and 250 Ohm when using current inputs.
- The maximum permissible short-term voltage range of the inputs is ±15 V
- The maximum permissible short-term current range of the inputs is 30 mA.

They connect the analogue inputs on the terminal block 34 of the analogue input module.

Circuit diagrams for the voltage and current signals can be found in the section **Circuit diagram for analogue inputs** 35.

Important notes that must be observed when connecting the inputs can be found in the section **Connection notes** 27.

Details about the pin assignment of the individual connections can be found in the section **Connection details** 32.

5.4.1 Connecting analogue inputs

Important notes about connecting the inputs

- To connect the 18-pin terminal block, use only a solder-free connecting method.
- For the 18-pin terminal block, use flexible wiring with the following property:
    - Wire cross-section of 0.3-0.75 mm² (AWG22 to 18)
    - External diameter of max. 2.8 mm
    - With copper conductor
    - Temperature-resistant to at least 75°C.
- Tighten the screws of the modules to the torques specified in the following table. Loose screws can cause short-circuits, mechanical faults or malfunctions:

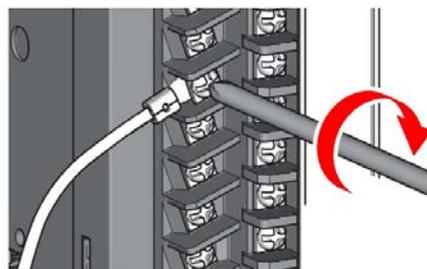| Screw	Torque
Screws of connecting terminals (M3)	0.42 to 0.58 Nm
Fixing screw of terminal block (M3.5)	0.66 to 0.89 Nm

Connecting wiring on the terminal block

1. Strip the insulation off the end of the wire.
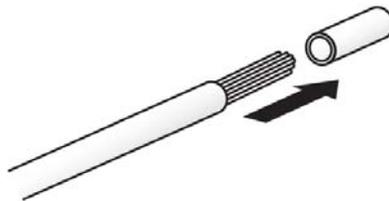
2. Push a ferrule onto the stripped end of the wire and firmly press it in place.
3. Secure the wire at the respective terminal of the terminal block using the screw.

5.4.2 Circuit diagram for analogue inputs

Depending on the selected program, voltage or current signals can be connected to the analogue inputs. The corresponding circuit diagrams can be found in the following sections.

Circuit diagram for voltage signals

The following illustration shows the connection of four voltage signals to the analogue input module.
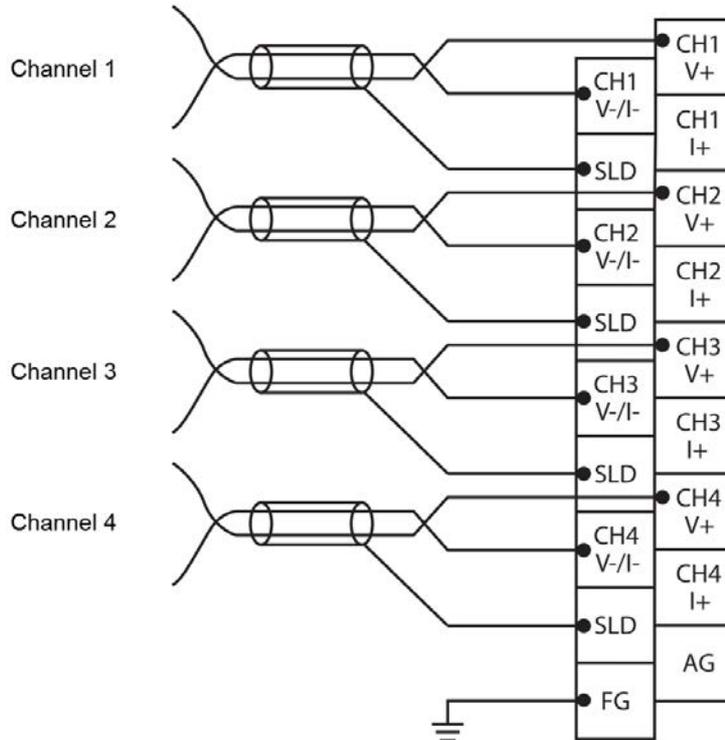
Circuit diagram for current signals

The following illustration shows the connection of four current signals to the analogue input module. The additional bridge between V+ and I+ is of importance here:

The following illustration, showing the circuit of the analogue inputs, highlights why a bridge between V+ and I+ is necessary with current inputs:
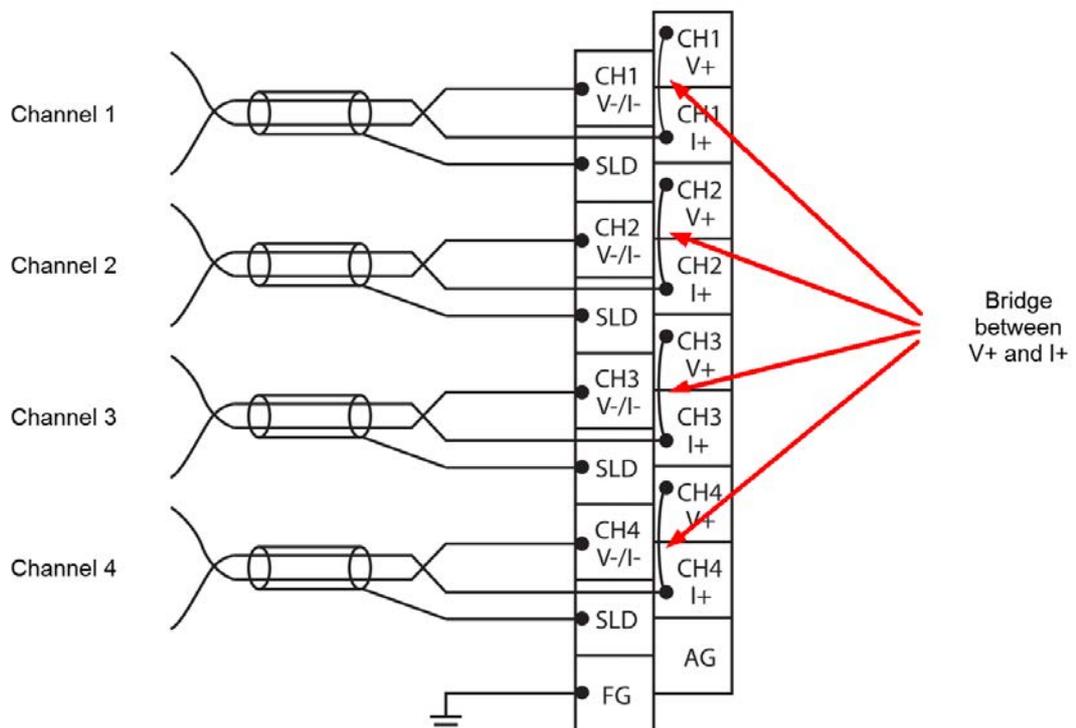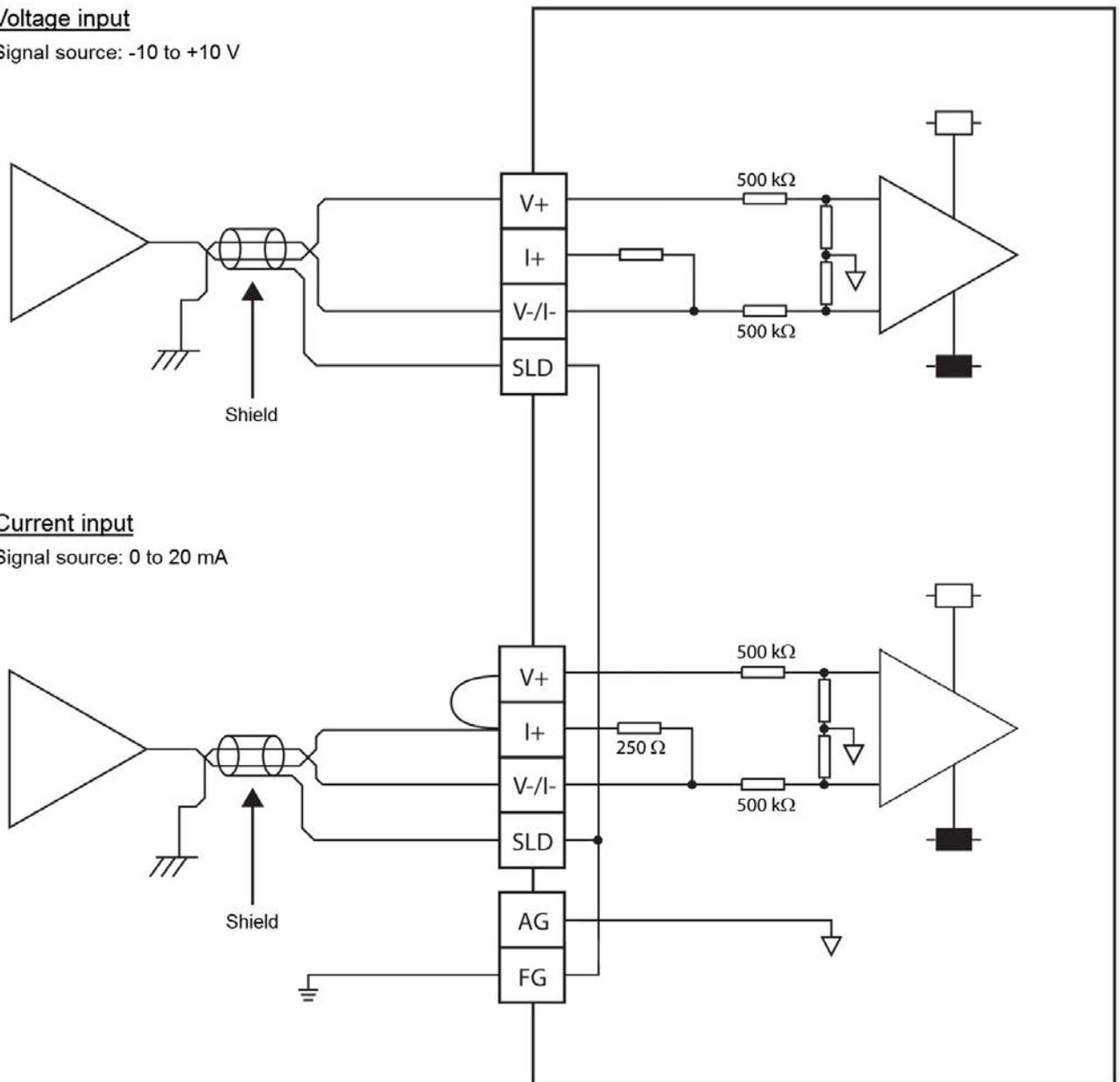
Voltage input

Signal source: -10 to +10 V

Shield

V+
I+
V-/I-
SLD

500 kΩ
500 kΩ

Current input

Signal source: 0 to 20 mA

Shield

V+
I+
V-/I-
SLD
AG
FG

250 Ω
500 kΩ
500 kΩ

5.5 Digital inputs/outputs

Up to five digital outputs, four digital pulse inputs and four digital logic inputs can be used via the FAG SmartController.
The five digital outputs have the following functions:

- Three digital outputs report the overall alarm status of the SmartController as **No Alarm**, **Pre-Alarm** or **Main Alarm**
- One digital output reports the Keep-Alive signal
- One digital output reports that a registered FAG SmartCheck device is no longer available.

The four digital pulse inputs have the following functions:

- The digital inputs evaluate the positive edges of a speed sensor and calculate the speed in revolutions per minute
- The maximum input frequency is 500 Hz (30,000 rpm with 1 pulse/revolution)
- The minimum input frequency is 1 Hz (60 rpm with 1 pulse/revolution).
- The level of the input signal must be between 20-24 V for high.
- The maximum error is +/-6 rpm
- The resolution of the speed signal is 1 rpm. If several pulses occur per revolution, the number of pulses must be set using the touchscreen display 72.

The four digital logic inputs have the following functions:

The digital logic inputs can be used to identify statuses. For example, if a 24-V high level is present at a logic input, a fixed value (1000) is recorded in the corresponding register. As is the case for the other additional signals of the FAG SmartController, this register can be used via the FAG SmartCheck as a virtual additional channel. In conjunction with a measurement condition that monitors the additional signal and that has set a corresponding activation threshold, it is then possible to respond to a boolean signal.

This capability means that it is possible to respond to certain situations indicated by a digital signal from the process control. Such situations could include a difference in the direction of rotation or a load indicator, for example.

Circuit diagrams for the inputs/outputs can be found in the sections **Circuit diagram for digital outputs** 37 and **Circuit diagram for digital inputs** 38. The status of the digital inputs and outputs is indicated by the status LEDs of the CPU module 62.

The outputs and inputs are connected via the plug connection on the CPU module. To do this, you can use the connecting cable supplied and the associated terminal strip.
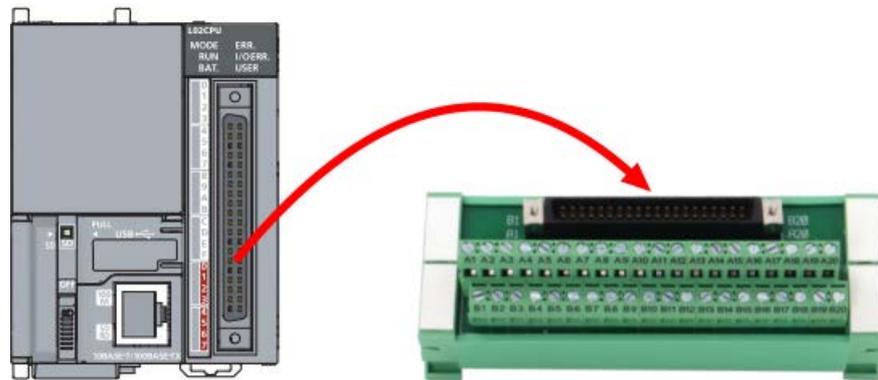
5.5.1 Circuit diagram for digital outputs

The circuit diagram for the digital outputs is as follows:
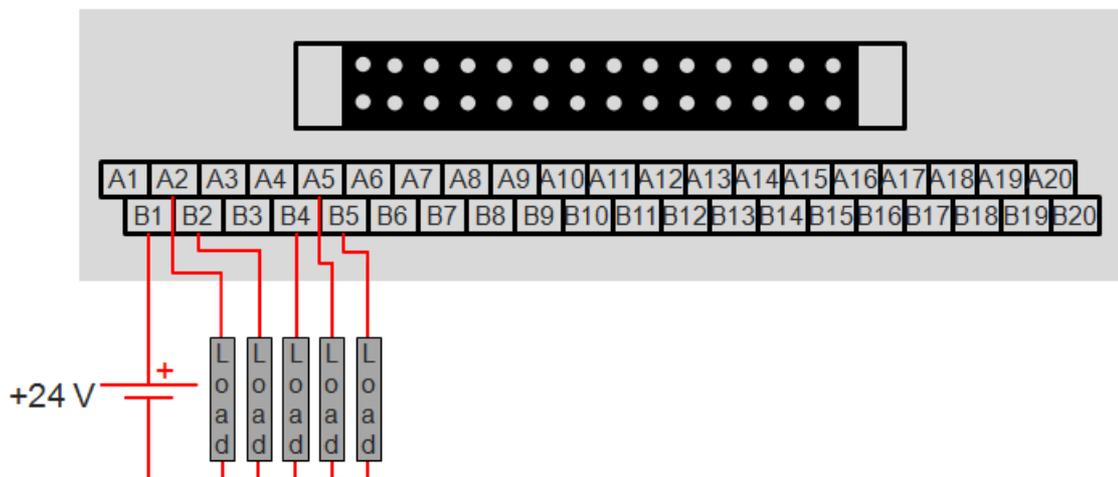
5.5.2 Circuit diagram for digital inputs

The circuit diagram for the digital pulse inputs is as follows:
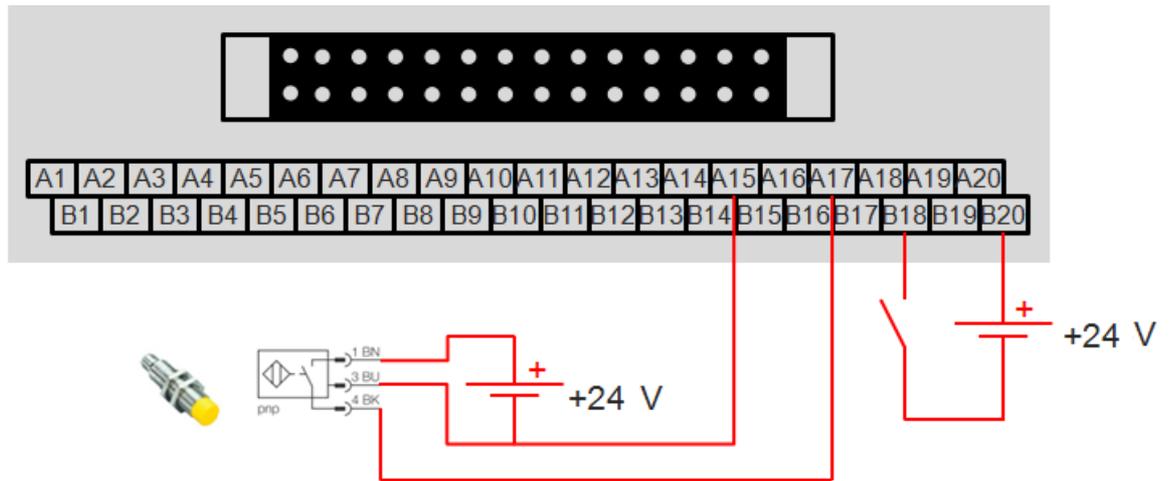
The circuit diagram for the digital logic inputs is as follows:
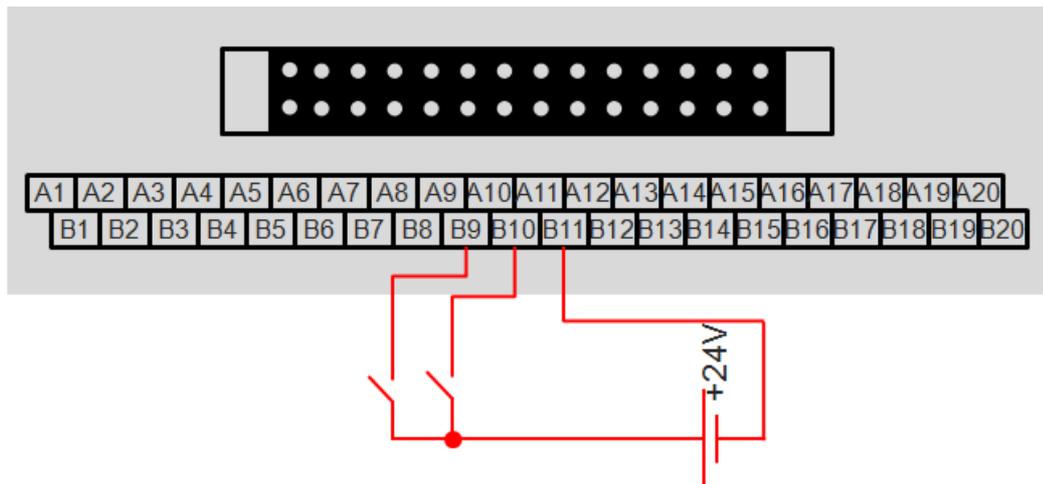
5.6 Connecting the power supply

Notes on the power supply of the separate touchscreen display can be found in the section entitled Connecting the touchscreen display 41.

The mains unit for the power supply of the FAG SmartController is designed for 110-240 V alternating voltage.

- *To connect the power supply, use cables with the largest possible cross-section (max. 2 mm²). Twist these cables at the connecting terminals.*
- *To prevent short-circuits, which could be caused by loose screws, use solder-free clamping shoes with insulation sleeves.*
- *Observe the following regarding the LG and FG terminals:*
  - *The LG and FG terminals must be connected and earthed.*
  - *Both terminals may only be connected with an earth.*
  - *If the LG and FG terminals are connected without an earth, the FAG SmartController could respond sensitively to faults. Since the LG terminal is not potential-free, there is also a risk of electric shock in the event of contact with conducting parts or surfaces.*

Observe the following when connecting the power supply. A detailed circuit diagram can be found in the **Circuit diagram for the power supply** 40 section.

- To connect the terminal block to the mains unit module, use only a solder-free connecting method. Use insulated ferrules with an insulating hose of max. 0.8 mm thickness. These prevent short-circuits should any of the screws be loose. Up to two lines with ferrules can be connected to one terminal.
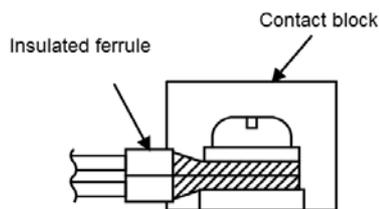
- Only use approved ferrules and only secure these using the original assembly tool from the manufacturer.
- To connect the mains unit module, use flexible lines with a wiring cross-section of 0.75–2 mm² (AWG18 to 14), a copper conductor and a temperature resistance of at least 75°C.
- Tighten the screws of the connecting terminals to a torque of 0.66 to 0.89 Nm. Loose screws can cause short-circuits, mechanical faults or malfunctions.
- Only run voltages that lie within the values specified in the technical data through the input terminals of the modules. An incorrect voltage can lead to malfunctions or destruction of the connected modules.
- To supply the mains unit, select a power source that provides sufficient current to run the system.

Observe the special rules for electromagnetic compatibility (EMC) and the low voltage directive when connecting the power supply.

5.6.1 Circuit diagram for the power supply

The circuit diagram for the power supply is as follows:
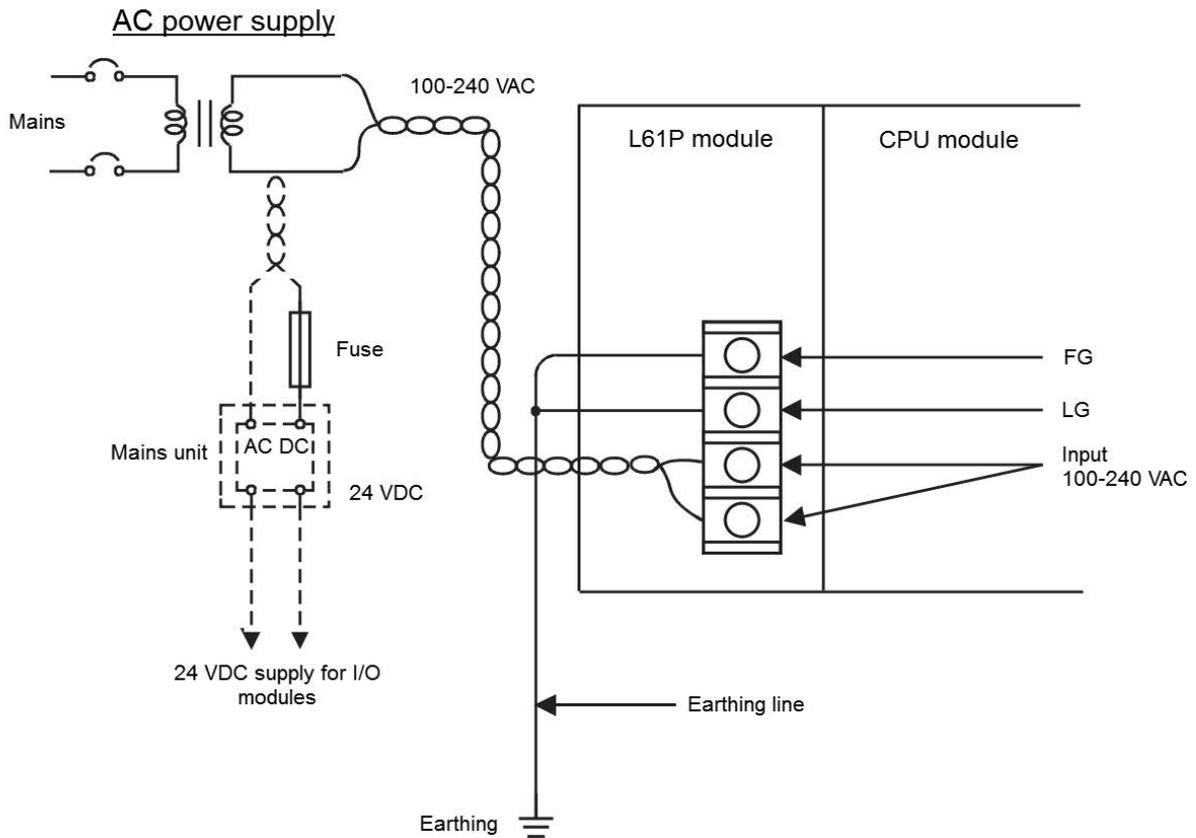
5.7 Starting a program

To start the FAG SmartController, move the RESET/STOP/RUN switch 63 to the **RUN** position.

- *The SD card is supplied inserted in the SD card slot of the controller.*
- *Never format the SD memory card using a personal computer.*
- *If, while accessing the SD memory card, the power supply is interrupted, the CPU module is reset (**RESET**) or the memory card is removed, it may no longer be possible to read the data on the memory card or the data may be incomplete. Exit the SD memory card first before switching off the power supply, resetting the CPU module (**RESET**) or removing the memory card. In general, we recommend that the SD memory card is removed only to perform a firmware update.*

5.8 Connecting to the network

The FAG SmartController has an Ethernet port located on the bottom of the CPU module.
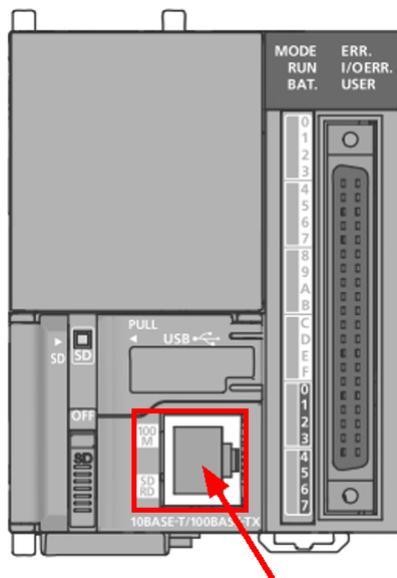
As soon as the FAG SmartController is connected to the network, you can establish a connection to a maximum of 25 FAG SmartCheck devices 43. For this purpose, the network parameters of the FAG SmartController have the following factory default settings:

- **IP address**: 192.168.1.240
- **Sub-netmask**: 255.255.255.0
- **IP address of Gateway**: 192.168.1.1 - This setting is needed if communication beyond the network boundary is desired.

> *The IP address can be changed using the touchscreen display 73.*

5.9 Connecting the touchscreen display

To use the touchscreen display, it must first be connected to the FAG SmartController and supplied with power. Relevant details can be found in the following sections.

Connecting the touchscreen display with the FAG SmartController

As soon as the FAG SmartController and the touchscreen display are connected by means of a switch, the default settings allow the two devices to find each other. The factory default settings for the network parameters are as follows:

FAG SmartController
- **IP address**: 192.168.1.240
- **Sub-netmask**: 255.255.255.0

Touchscreen display
- **IP address**: 192.168.1.241
- **Sub-netmask**: 255.255.255.0

After the SmartController and the touchscreen display have found each other, the IP address and the address range can be changed via the display function **Settings > Network** 73.

Connecting the power supply

The mains unit for the power supply of the touchscreen display is designed for 24 V DC.
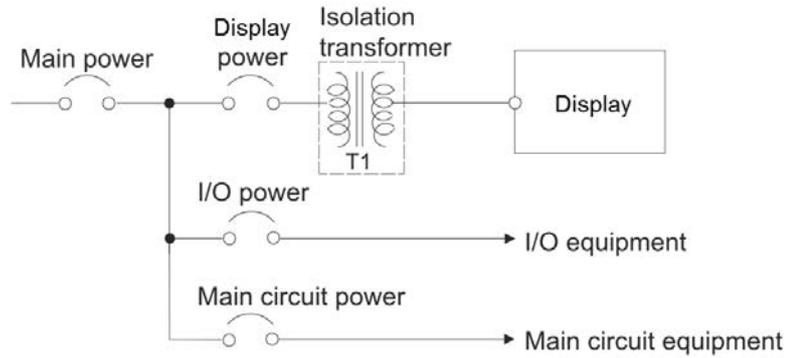
IMPORTANT	• To connect the power supply, use cables with the largest possible cross-section (max. 2 mm²). Twist these cables at the connecting terminals.
	• To prevent short-circuits, which could be caused by loose screws, use solder-free clamping shoes with insulation sleeves.

5.9.1 Circuit diagram for the power supply for the display

The circuit diagram for the power supply of the touchscreen display is as follows:
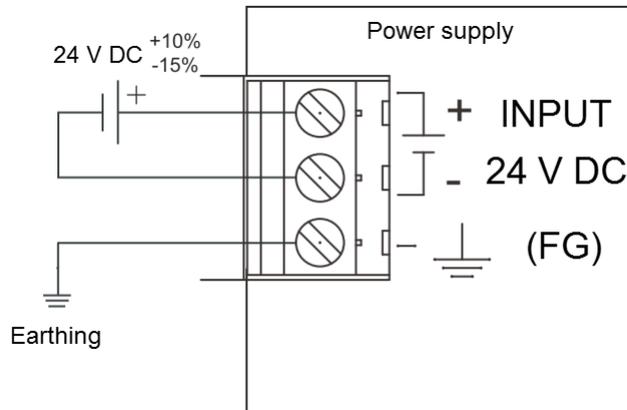
5.10 Connecting FAG SmartCheck devices

The FAG SmartController features a Modbus TCP server. When the device is connected to the network, you can transfer the input signals for up to 25 FAG SmartCheck devices via the Modbus protocol. Furthermore, the alarm status of the connected FAG SmartCheck devices can be called up as well as the overall alarm status of the SmartController.

The virtual inputs and outputs of the connected FAG SmartCheck devices are created in the **Signed Word** format (16 bit word, signed). Coding of the individual alarm status as well as the overall alarm status is as follows:

- 1 = No alarm
- 2 = Pre-alarm
- 3 = Main alarm

The Modbus TCP port is 502. The Modbus registers are created as follows:

Register	Description
1 - 25	Input register of the Modbus TCP server
26 - 50	Output register of the Modbus TCP server for the alarm status of the connected FAG SmartCheck devices
51	Overall alarm status of the FAG SmartController under consideration of all FAG SmartCheck devices.

Details about assignment of the input registers can be found in the section **Register assignment, inputs** 77 .

Details about assignment of the output registers can be found in the section **Register assignment, outputs** 78 .

Details about Modbus registers and functions for programming can be found in the section **Available Modbus registers and functions** 79 .

Configuring FAG SmartCheck devices

When the FAG SmartController is connected to the network, you can connect up to 25 FAG SmartCheck devices can be connected and use the virtual inputs and outputs. To do this, open the FAG SmartWeb software for each FAG SmartCheck device in a browser and perform the following steps:

- Create the FAG SmartController as an external device 44.
- Create an external input for the external device. Depending on the system constellation, this could be an analogue input 46, a digital input 50 or a virtual input (Modbus) 56.
- Create an external output for the external device 58.

  Details about these steps can be found in the following sections.

- Once you have configured the connection via the FAG SmartWeb software, the corresponding page in the software must be similar to the one shown above.
- Finally, you can test the connection between the FAG SmartCheck device and the FAG SmartController by clicking on 🌀.

5.10.1 Creating an external device

In order to be able to accept the data from the FAG SmartController as an input signal, you must create the SmartController in the FAG SmartWeb software as an external device and inform the SmartCheck device of the network data of the SmartController.

Proceed as follows:

1. In the FAG SmartWeb software, under **Configuration**, open the area **External devices**:

2. Under **External devices**, click on **Add** ➕.

3. In the **Add external device** window, enter the necessary specifications:

You have to make the following entries here:

Name	This is where you specify the name under which the external device is to appear in the SmartWeb software.
Device type	The entry **Mitsubishi controller** is shown here automatically.
IP address	The factory default setting for the IP address of the FAG SmartController is: **192.168.1.240**
Port	The port of the FAG SmartController is set as follows: **2200**
Protocol	Choose the **TCP** protocol here.
Transfer mode	Choose the **Binary** transfer mode here.

4. Click on **OK** to save the external device.

5.10.2 Creating an external analogue input

The FAG SmartCheck device receives information about process parameters in the FAG SmartController via external inputs. The following sections describe how to create the analogue input and also offer two detailed application scenarios.

You create an analogue external input as follows:

1. On the left side of the expanded overview, select the external device to which you would like to add an input.

2. Under **External inputs for an external device: [name of your SmartController]**, click on **Add ✚**.

3. Enter the requisite details in the **Add external input** window:

You must define the following here:

Name	Here, specify the name under which the external input is to appear in the SmartWeb software.
Start register	Specify the register here that is to be read out 77.
Register type	Here, specify the format 77 of the data that can be found in the **start register**.
Unit group and **Unit**	This is where you specify the physical value and measurement unit into which the value from the controller is to be converted.
Polling interval	This is where you specify how often the value is to be queried from the controller.
Register value	Initially, these fields are filled automatically as soon as you have selected a **Register type**. Then make the following changes: **Register value min.: 0** **Register value max: 20,000** These specifications correspond to the measuring range of the analogue inputs.
Signal value	Use these settings to determine the range within which the measurement values should lie. First enter a minimum value **Min**. Then enter a maximum value **Max** or define the factor with which the calculated signal should be scaled in the **Scaling** field. Both the diagram and the values of the respective other field are then

adjusted automatically.

4. Click on **OK** to save the analogue external input.

Example 1: Analogue input for temperature signal

You have attached a temperature sensor to your machine that reports the process temperature as an analogue voltage signal. The sensor has an output of 0-10 V; 0 V equate to 20°C and 10 V equate to 100°C.

Connect this temperature sensor to the 1st analogue input of the FAG SmartController as follows:

- The wire with the voltage signal is connected to CH1-V+.
- The earth connection of the sensor is connected to CH1-V-/I-.

The FAG SmartController converts the output voltage of the temperature sensor and makes it available as register values in the ZR25 register. They can be read out there by the FAG SmartCheck devices connected.

The register values equate to the following:

- 0 with 0 V
- 20,000 with a measuring range end value of 10 V

This results in the following assignment:

- 20°C --> 0 V --> 0
- 100 °C --> 10 V --> 20,000

To ensure that the temperature signal is used in the correct manner, the following settings are necessary in the **Add external input** window:

Name	Specify the name here with which the external input is to appear in the SmartWeb software, e.g. the name of the temperature sensor.
Start register	Specify the register **ZR25** here.
Register type	Specify the register type **INT** here.
Unit group and **Unit**	Specify **Temperature** here as the unit group and **°C** as the unit.

Polling interval	Define here how often the value from the controller is to be queried, e.g. every second **1 sec**.
Register value	Initially, these fields are filled automatically as soon as you have selected a **Register type**. Then make the following changes: **Register value min.: 0** **Register value max: 20,000**
Signal value	With these settings, you determine the range of the calculated signal values. In the example, these values are as follows: **Min: 20** **Max: 100** **Scaling: 0.004**

Example 2: Analogue input for speed signal

You have added a speed sensor with current output to your system. This current output is operated in the 4-20 mA mode as follows:

- 4 mA equate to a speed of 0 rpm
- 20 mA equate to a speed of 3000 rpm.

Connect this speed sensor to the 1st analogue input of the FAG SmartController as follows:

- The + wire of the sensor must be attached to CH1-I+
- The earth connection must be attached to CH1-V-/I-.
- The terminals CH1-I+ and CH1-V+ must be connected using a wire jumper.

The FAG SmartController converts the output current of the speed sensor and makes it available as register values in ZR25 register. They can be read out there by the FAG SmartCheck devices connected.

The register values equate to the following:

- 0 with 4 mA
- 20,000 with a measuring range end value of 20 mA

This results in the following assignment:

- 0 rpm --> 4 mA --> 0
- 3000 rpm --> 20 mA --> 20,000

To ensure that the speed signal is used correctly, the following settings in the **Add external input** window are necessary:

Name	Here, specify the name under which the external input is to appear in the SmartWeb software, e.g. the name of the speed sensor
Start register	Specify the register **ZR25** here.
Register type	Specify the register type **INT** here.
Unit group and **Unit**	Specify **Frequency/speed** here as the unit group and **RPM** as the unit.
Polling interval	Define here how often the value from the controller is to be queried, e.g. every second **1 sec**.
Register value	Initially, these fields are filled automatically as soon as you have selected a **Register type**. Then make the following changes: **Register value min.: 0** **Register value max: 20,000**
Signal value	With these settings, you determine the range of the calculated signal values. In the example, these values are as follows: **Min: 0** **Max: 3,000** **Scaling: 0.15**

5.10.3 Creating an external digital pulse input

The FAG SmartCheck device receives information about process parameters in the FAG SmartController via external inputs. The following section describes how to create the digital pulse input and also provides two detailed application scenarios.

You create a digital external pulse input as follows:

1. Perform steps 1 and 2 as specified for the analogue external input 46.
2. Enter the requisite details in the **Add external input** window:

You must define the following here:

Name	Here, specify the name under which the external input is to appear in the SmartWeb software.
Start register	Specify the register here that is to be read out 77.
Register type	Here, specify the format 77 of the data that can be found in the **start register**.
Unit group and **Unit**	This is where you specify the physical value and measurement unit into which the value from the controller is to be converted, such as **Frequency/speed** and **RPM** for example.
Polling interval	This is where you specify how often the value is to be queried from the controller.
Register value	Initially, these fields are filled automatically as soon as you have selected a **Register type**. Then perform the changes as necessary**.**
Signal value	Use these settings to determine the range within which the measurement values should lie. First, enter a minimum value **Min.** and then a maximum value **Max.** Both the diagram and the values of the respective other field are then adjusted automatically.
	Set the **Scaling** field to **1**. The pulses per revolution 72 are set via the touchscreen display of the SmartController.

3. Click on **OK** to save the digital external input.

Example 1: Digital input for speed signal (without scaling)

The speed of your machine is picked up by a sensor with switch output. The input shaft has a single marking to record the speed. The attached sensor thus generates a single 24 V impulse for each revolution of the shaft. The speed range of the machine is variable from 0 rpm to 3000 rpm.

The switch output of the speed sensor is connected to the 1st digital input of the FAG SmartController on the terminal strip as follows:

- The + wire of the impulse signals is placed on the B20 terminal.
- The earth connection is placed on the B18 terminal.

The FAG SmartController stores the measured speed in the ZR29 register: it can be read out there by the connected FAG SmartCheck devices.

Due to the fact that only one pulse per revolution is used, the scaling setting does not have to be adjusted using the touchscreen display of the SmartController: The default value is **1 pulse/revolution**.

To ensure that the speed signal is used correctly, the following settings in the **Add external input** window are necessary:

Example 2: Digital input for speed signal (with scaling)

The speed of your machine is picked up by a sensor with switch output. The input shaft has four markings to record the speed. The attached sensor thus generates four 24 V impulses for each revolution of the shaft. The speed range of the machine is variable from 0 rpm to 3000 rpm.

The switch output of the speed sensor is connected to the 1st digital input of the FAG SmartController on the terminal strip as follows:

- The + wire of the impulse signals is placed on the B20 terminal.
- The earth connection is placed on the B18 terminal.

The FAG SmartController stores the measured speed in the ZR29 register: it can be read out there by the connected FAG SmartCheck devices.

Unlike in **example 1**, several impulses are used for each revolution. Therefore, the scaling setting must be adjusted accordingly via the touchscreen display of the SmartController. Details on this step can be found in the section entitled **Control elements of the touchscreen display > Settings** 72.

To ensure that the speed signal is used correctly, the following settings in the **Add external input** window are necessary:

5.10.4 Creating an external digital logic input

The digital logic inputs can be used to identify statuses and to respond to certain situations indicated by a digital signal from the process control. The following section describes how to create the digital logic input and also provides two detailed application scenarios.

You create a digital external logic input as follows:

1. Perform steps 1 and 2 as specified for the analogue external input 46.

2. Enter the requisite details in the **Add external input** window:

Edit external input

FAG SmartWeb

Name :	Logical signal
Start register :	ZR37
Register type :	INT
Unit group :	No unit	Unit :	-
Polling interval :	1 s

Signal value :

Max. [-] :
1,001.0

Scaling :
1.0

Min. [-] :
0.0

Min. register value : 0.0

Max. register value : 1,001.0

OK   Cancel

You must define the following here:

Name	Here, specify the name under which the external input is to appear in the SmartWeb software.
Start register	Specify the register here that is to be read out 77.
Register type	Here, specify the format 77 of the data that can be found in the **start register**.
Unit group and **Unit**	Set **Unit** to **-**. As a result, the field for **Unit group** remains empty.
Polling interval	This is where you specify how often the value is to be queried from the controller.
Register value	Initially, these fields are filled automatically as soon as you have selected a **Register type**. Then perform the changes as necessary**.**
Signal value	Use these settings to determine the range within which the measurement values should lie. First enter a minimum value **Min**. Then enter a maximum value **Max** or define the factor with which the calculated signal should be scaled in the **Scaling** field. Both the diagram and the values of the respective other field are then adjusted automatically.

3. Click on **OK** to save the digital external input.

Example 1: Evaluating the direction of rotation using a logic signal

In the 0–10 V mode, your process control issues the speed of a motor via an analogue input signal. If you would also like the direction of rotation to be factored into the evaluation alongside the speed, the SmartCheck device must be used to perform measurements on a motor that is running in a clockwise direction only.

Your process control issues the following digital signals:

- High level for clockwise rotation
- Low level for anticlockwise rotation

In the mode 0–10 V, deal with the analogue input signal in the same way as described in the example for analogue input signals 46. The digital logic signal is connected to the fifth digital input of the FAG SmartController on the terminal strip as follows:

- The signal from the control is wired to terminal B10
- The common reference potential is wired to terminal B11/A11

The FAG SmartController then converts the logic signal into a readable format. The signal can be read out from the FAG SmartCheck device in register ZR37. The register values are assigned as follows:

Value	Level	Direction of rotation
0	Low level	Anticlockwise rotation
1000	High level	Clockwise rotation

To enable the signal to be further processed correctly, the scaling factor in the external input must be set to 1.

To ensure that the logic signal is used correctly, the following settings in the **Add external input** window are necessary:

Example 2: Using a logic signal as a measurement condition

If you would like to use the logic signal from example 1 as a measurement condition, the measurement must be performed on a motor that is running in a clockwise direction only. To perform this step, use the values recorded in the register for the respective levels:

- **Clockwise rotation**: The input has a high level; the value 1000 is recorded in register ZR37
- **Anticlockwise rotation**: The input has a low level; the value 0 is recorded in register ZR37

Using the corresponding measurement condition allows you to specify the **Lower threshold** and **Upper threshold** to determine the range in which the measurement will be performed. In the below example, this range is between **999** and **1001**:

- For a high level (clockwise rotation), register ZR37 contains the value 1000. Due to the fact that this value is within the validity range of 999–1001 for the measurement condition, the measurement is activated.
- For a low level (anticlockwise rotation), register ZR37 contains the value 0. Due to the fact that this value is outside the validity range of 999–1001 for the measurement condition, the measurement is not activated.

To ensure that the logic signal is used as a measurement condition correctly, the following settings in the **Add measurement condition** window are necessary:

5.10.5 Creating an external virtual input

The FAG SmartCheck device receives information about process parameters in the FAG SmartController via external inputs. The following section describes how to create the virtual input and also offers a detailed application scenario.

You create a virtual external input as follows:

1. Perform steps 1 and 2 as specified for the analogue external input 46.

2. Enter the requisite details in the **Add external input** window:

You must define the following here:

Name	Here, specify the name under which the virtual external input is to appear in the SmartWeb software.
Start register	Specify the register here that is to be read out 77. For the virtual input, it is the register that is reserved for this FAG SmartCheck device.
Register type	Here, specify the format 77 of the data that can be found in the **start register**.
Unit group and **Unit**	This is where you specify the physical value and measurement unit into which the value from the controller is to be converted.
Polling interval	This is where you specify how often the value is to be queried from the controller.
Register value	These fields are filled automatically as soon as you have selected a **Register type**. Usually, the values **Min. register value** and **Max. register value** do not have to be adapted.
Signal value	Use these settings to determine the range within which the measurement values should lie. First enter a minimum value **Min**. Then enter a maximum value **Max** or define the factor with which the calculated signal should be scaled in the **Scaling** field. Both the diagram and the values of the respective other field are then adjusted automatically.

3. Click on **OK** to save the virtual external input.

Example: Virtual input for machine load specification

From a process control, the machine load is to be relayed to the connected FAG SmartCheck devices via the Modbus TCP. The load is relayed as a percentage. The Modbus TCP server expects a Signed Word; in this case, therefore, it is not a floating point number. The percentage can only be relayed as a full number between 0-100%.

The higher level controller, i.e. the Modbus TCP client, writes the load specification to the Modbus register no. 1 of the FAG SmartController 77, which is the Modbus TCP server. This value is visible in the ZR0 register for the FAG SmartCheck device. Since in this case it is already a scaled specification, the **scaling** in the **Add external input** window is set to 1.

To ensure that the machine load specification is used correctly via the 1st virtual input, the following settings are necessary in the **Add external input** window:

5.10.6 Creating external outputs

Using the external outputs, you can define the characteristic values for which an alarm status is to be relayed to the FAG SmartController. You can also determine here the registers of the SmartController that will be written to in this process.

Proceed as follows:

1. On the left-hand side of the expanded overview, select the SmartController for which you would like to create external outputs.
2. Under **External outputs for an external device: [name of your SmartController]**, click on **Create** 🔍 to open the wizard. It will guide you through the creation process in two steps.
3. In the first step, you must **select registers and characteristic values**:

You have the following options:

Start register	Specify the first register of the register block⎡78⎤ in which the alarm status of this FAG SmartCheck device is to be stored.
Update interval	Specify here how often the alarm status is to be relayed to the FAG SmartController.
Characteristic value selection	Select the following characteristic values here: • **Communication status** • **Device status**
Alarm status/Value	For the two characteristic values specified above, select the **Alarm status** here that will then be relayed to the FAG SmartController.

4. Click on **OK** to move to the second step. This is where you **specify the register name**:

The register names in the table are generated automatically from the names of the characteristic values.

5. Click on **OK** to close the wizard and confirm the configuration with external outputs.

6 Control elements of the SmartController module

In addition to the means of connection that are described in the sections of the chapter **Layout, connections and fittings** 25, the individual modules of the FAG SmartController feature additional control elements, such as switches and LEDs. Details can be found in the following sections.

The FAG SmartController is a device comprising several modules. When the device is delivered, these are already connected together, which means they can be mounted and put to use straight away.

Should it be necessary to separate the modules, there are connecting latches on the top of the modules for this purpose, which you have to slide open:
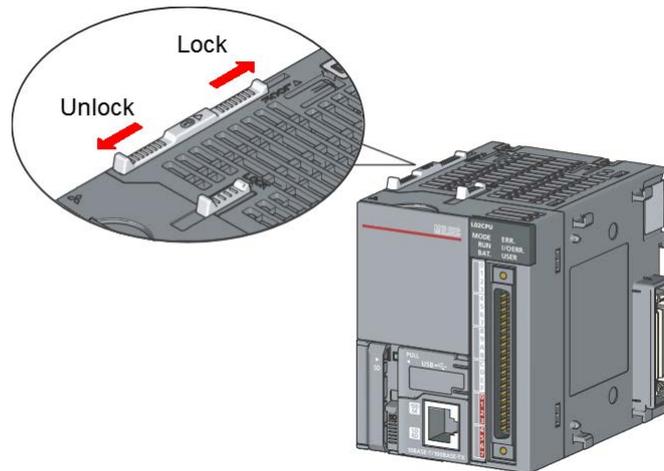
Accordingly, you have to slide the connecting latches in the opposite direction if you want to connect the modules together again.

6.1 Control elements of the mains unit

The following diagram provides an overview of the mains unit module. The only control element here is the status LED for the mains unit module:
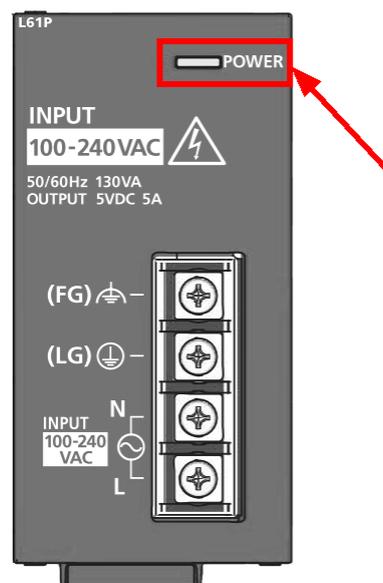
The status LED indicates the status of the mains unit as follows:

LED is on	The mains unit is working normally
LED is off	There is no mains voltage or the hardware is faulty.

6.2 Control elements of the CPU module

The following diagram provides an overview of the CPU module and shows where the control elements are positioned:
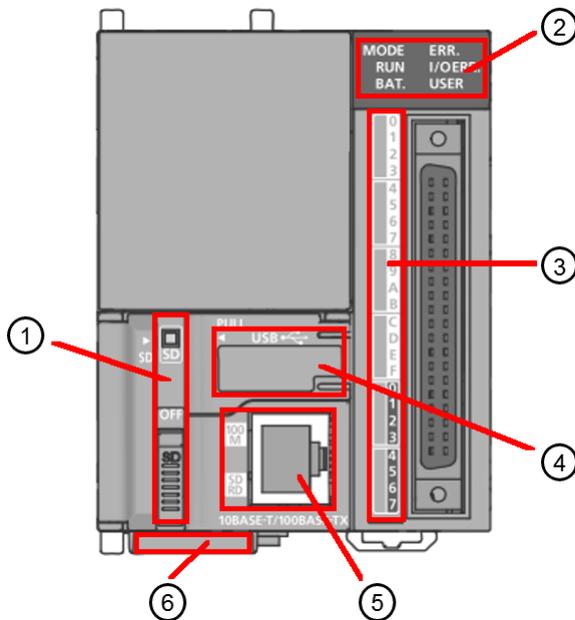
The position numbers denote the following control elements. Details about the individual control elements can be found in the sections below.

Item	Control element
1	SD LED and SD switch 61
2	Status LEDs of the CPU module 62
3	Status LEDs of the digital inputs and outputs 62
4	**RESET/STOP/RUN switch** 63 under the cover. The USB connection is also located under the cover.
5	Status LEDs on the Ethernet port 64
6	Battery compartment 64 (on the underside)

1. SD LED and SD switch

Located on the right next to the SD memory card slot is the status LED of the SD memory card as well as the locking switch for the SD memory card:

The following information and functions can be found here:

SD LED	This LED indicates the status of the SD card:
	• **Lit green:** The SD memory card is in operation.
	• **Flashes green:** The SD memory card is being prepared for operation.
	• **Not lit:** The SD memory card is not being used.
OFF switch	If you push this switch to the **OFF** position, access to the SD memory card is prevented. You can then remove the SD memory card from the slot or insert it into the slot.

2. Status LEDs of the CPU module

The status LEDs at the top right of the CPU module inform you of the operating mode and status as well as faults in the CPU module. They also inform you of the status of the battery.

You can find the following information here:

MODE	This LED indicates the operating mode of the CPU module:
	• **Lit green:** Normal mode
	• **Flashing green:** One of the following functions is active:
	▪ Forced activation of the ext. inputs/outputs
	▪ Execution-dependent parameter test
	▪ Loading of a program version from the SD memory card
RUN	This LED indicates the battery status of the CPU module:
	• **Lit green:** Normal mode
	• **Flashing green:** When the CPU module is in **STOP** status, data is being saved to the FAG SmartController. The CPU module then adopts the **RUN** status without being reset.
	• **Not lit:** The CPU-module is in **STOP** status or there is a fault.
BAT	This LED indicates the status of the battery:
	• **Flashes yellow:** The battery is discharged or not connected
	• **Not lit:** Normal mode
ERR	This LED indicates the fault status of the CPU module:
	• **Lit red:** There is a fault in the system but operation is still possible.
	• **Flashing red:** There is a fault in the system and the module has stopped working.
	• **Not lit:** Normal mode
I/O ERR	This LED indicates the fault status of the digital inputs/outputs:
	• **Lit red:** Fault in digital inputs/outputs
	• **Not lit:** Normal mode
USER	This LED does not light up in normal mode.

3. Status LEDs of the digital inputs and outputs

The status LEDs next to the plug connection for the digital inputs/outputs inform you of the status of each output and input:

You can find the following information here:

IN 0 to IN F (white background)	These LEDs indicate the input status of the digital inputs/outputs: • **Lit green:** The respective input signal has a high level. • **Not lit:** The respective input signal has a low level.
OUT 0 to OUT 7 (highlighted in red)	These LEDs indicate the output status of the digital inputs/outputs: • **Lit green:** The respective output signal has a high level. • **Not lit:** The respective output signal has a low level.

4. RESET/STOP/RUN switch

Beneath the cover of the USB port is the **RESET/STOP/RUN** switch that is used to determine the operating mode of the FAG SmartController:
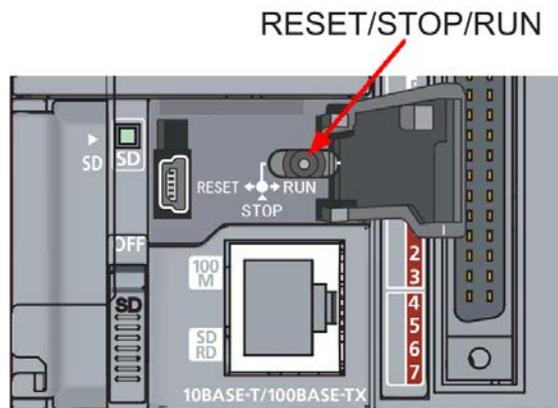
The switch offers the following functions:

RUN	Move the switch to this position to start the FAG SmartController.
STOP	Move the switch to this position to stop the FAG SmartController.
RESET	Move the switch to this position to reset the CPU module.

5. LEDs of the Ethernet port

Located right beside the Ethernet port are two LEDs that indicate the status of data communication and data transfer:
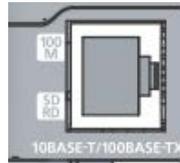
The following information and functions can be found here:

100M	This LED indicates the data transfer status: • **Lit green:** The data transfer rate is 100 MBit/s. • **Not lit:** The data transfer rate is 10 MBit/s or there is no network connection.
SD/RD	This LED indicates the data communication status: • **Lit green:** Data is being sent or received. • **Not lit:** No communication is taking place.

6. Battery

The battery compartment is located on the underside of the CPU module. If the power supply fails, the battery saves the FAG SmartController time as well as the most recently received data. The status of the battery is indicated via the **BAT**-LED on the CPU module (see above 62).

In the factory default setting, the battery is connected.
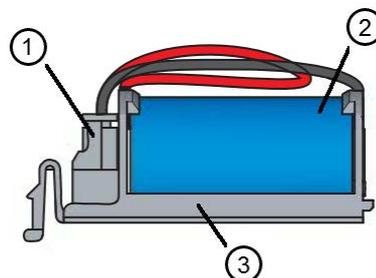
No.	Description	
1	Battery connecting socket	The battery is connected 81 to the CPU module via a plug connector.
2	Battery	The battery and its connecting wire are attached to the battery holder.
3	Battery holder	The battery holder is inserted in the dedicated opening on the underside of the CPU module. From here you can also remove it again to replace a discharged battery 81.

6.3 Control elements of the analogue input module

The following diagram provides an overview of the analogue input module. The only control element here is the cover for the terminal block:
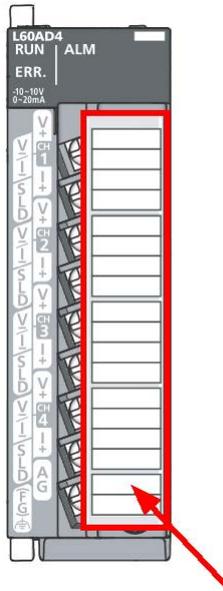
The terminal block cover serves to prevent contact, which would otherwise cause an electric shock. You can mark the adhesive label on the cover to designate the individual terminal clamps.

7 Control elements of the touchscreen display

You must first connect the touchscreen display with the SmartController and connect it to the power supply. The display then shows a menu containing different monitoring and settings options via its control elements.

General navigation options

The touchscreen display responds to touch. By touching the screen with your fingers, you can navigate through the pages of the menu and call up further settings options. Depending on the location within the menu, the following general navigation options are available:

Control element	Description
←	Press this button to jump to the next level up in the menu.
⌂	Press this button to jump to the main screen 68.
← →	If these symbols appear at the bottom right of the display, there is a previous page and a next page. Press → to display the next page. Press ← to return to the previous page.
▬1▬	Fields with a black background indicate that there are settings options available. Press this field to open a keypad and select the desired setting.
Keypad	When you press a field for which you are able to select settings, a keypad opens: The following applies: • Press a number to display it in the numbers field. • **+/-** changes the sign that precedes the number. **.** introduces decimal places. • **ESC** closes they keypad without any changes being applied. • **AC** deletes all numbers in the numbers field. • **DEL** deletes the last number entered. • **ENT** confirms and applies your changes.

> *The specific control elements of the main screen* 68 *—which is also the home screen—are described in detail in a separate section.*

Key menu items

The main screen and its buttons provide you with direct access to the following menu items:

Menu item	Description
Main screen 68	The main screen appears as soon as the touchscreen display is connected to the SmartController and the power supply. All other key menu items—along with their monitoring and settings functions—can be accessed from this screen. The overall status of the system can also be seen at a glance.
Monitor 69	The **Monitor** menu item provides access to the monitoring of all inputs and outputs connected to the FAG SmartController.
Settings 71	The **Settings** menu item allows you to change the settings for the FAG SmartController and the touchscreen display.

Dashboards 76 (for FAG SmartCheck devices)	The **SmC...** menu items allow you to display the status of the respective FAG SmartCheck devices.

Details on the individual menu items can be found in the following sections. The overall menu structure appears as follows:
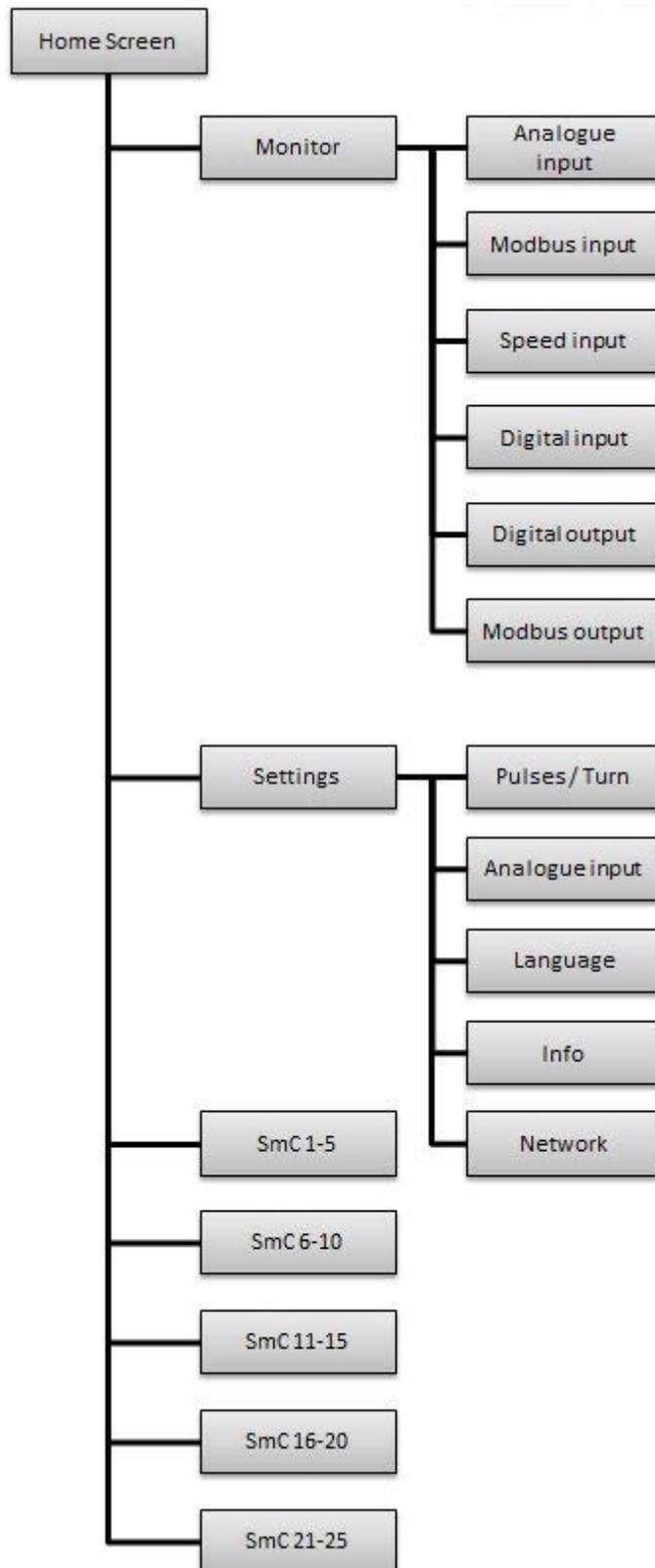
7.1 Main screen

The main screen appears as soon as the touchscreen display is connected to the SmartController and the power supply. All other key menu items—along with their monitoring and settings functions—can be accessed from this screen. The overall status of the system can also be seen at a glance:

The following information and functions can be found here:

Overall status of the system

The overall status of the system is displayed in the main area of the touchscreen display. In addition to the overall alarm status, the overall status of the system indicates any communication problems affecting the SmartCheck devices or any fault statuses for the analogue inputs (4–20 mA). Specifically, the following is shown here:

Overall alarm status

The overall alarm status of the SmartController is determined from the individual alarm statuses of the connected FAG SmartCheck devices. Here, the highest alarm status is always output as the overall alarm status. In the touchscreen display, the following combinations of backlighting and message are shown:

- White, **No Status**: No SmartCheck device is registered ⃞ 76 or all registered SmartCheck devices are no longer reporting. If an exclamation mark also appears, at least one registered SmartCheck device has failed or is no longer available.
- Green, **No Alarm**: There are no alarm statuses or communication problems present.
- Orange, **Pre-Alarm**: At least one SmartCheck device is showing a pre-alarm.
- Red, **Main Alarm**: At least one SmartCheck device is showing a main alarm.

Communication problem: !

The exclamation mark indicates that at least one registered SmartCheck device has no longer been recorded in its register in the FAG SmartController for more than three minutes.

Status of analogue inputs: Loop

This message can only appear if you have created an analogue input with 4–20 mA. In such cases, **Loop** indicates that the measured value has fallen below 4 mA.

Buttons

There are buttons next to and below the display for the overall status. These buttons are used to access further monitoring and settings options:

- **Monitor** ⃞ 69: The **Monitor** menu item provides access to the monitoring of all inputs and outputs connected to the FAG SmartController.
- **Settings** ⃞ 71: The **Settings** menu item allows you to change the settings for the FAG SmartController and the touchscreen display.
- **SmC 1–25** ⃞ 76: The **SmC...** menu items allow you to display the status of the respective FAG SmartCheck devices.

Details on using the individual monitoring and settings options can be found in the following sections.

7.2 Monitor

If you press the **Monitor** button on the main screen, the following page opens:
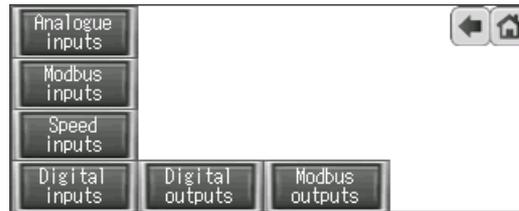
On this page, you can directly display the contents of the FAG SmartController registers for each individual input and output. In particular, this option makes it easier to commission the device. Details on the different options can be found in the following sections.

Analogue inputs

Press this button to open the following display:

You can find the following information here:

AI channel	Here you will find the channel number of the respective analogue input.
Value	Here you will find the current conversion value of the input. The value range is between 0 and 20,000/±20,000.
Mode	Here you will find the respective operating mode, i.e. 0–10 V, +/-10 V, 0–20 mA or 4–20 mA.
Loop	This message indicates that the current signal has fallen below 4 mA in the operating mode 4–20 mA.

Modbus inputs

Press this button to open the following display:

You can find the following information here:

Modbus 1–25	Here you will find the number of the respective Modbus input register. Press the arrow ➡ at the bottom right of the display to show Modbus input registers 15–25.
Value	Here you will find the value located in the respective Modbus register.

Speed inputs

Press this button to open the following display:
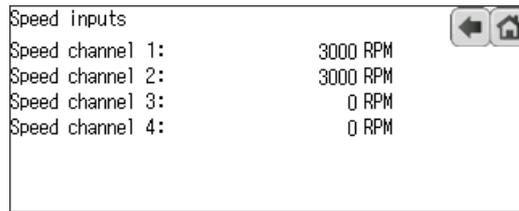
```
Speed inputs                          ← ⌂
Speed channel 1:            3000 RPM
Speed channel 2:            3000 RPM
Speed channel 3:               0 RPM
Speed channel 4:               0 RPM
```

You can find the following information here:

Speed channel 1–4:   Here you will find the number of the respective speed channel, i.e. the number of the digital pulse input.

n rpm   Here you will find the currently calculated speed of the respective channel.

This calculation is the basis for setting the pulses per revolution. This setting can be specified and changed separately for each channel. Relevant details can be found in the section entitled **Settings** 71.

Digital inputs

Press this button to open the following display:
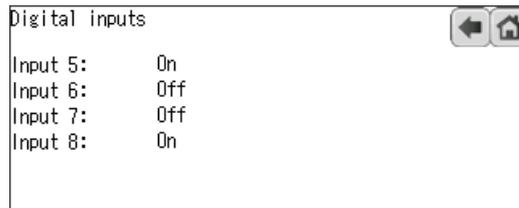
```
Digital inputs                        ← ⌂
Input 5:     On
Input 6:     Off
Input 7:     Off
Input 8:     On
```

You can find the following information here:

Input 5–8   Here you will find the number of the respective digital logic input.

Off/On   Here you will find the current switching status of the respective digital logic input.

Off = 0 V (low level)

On = 24 V (high level)

Digital outputs

Press this button to open the following display:
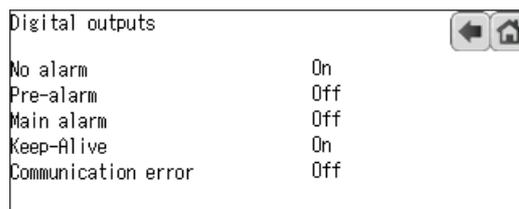
```
Digital outputs                       ← ⌂
No alarm               On
Pre-alarm              Off
Main alarm             Off
Keep-Alive             On
Communication error    Off
```

You can find the following information here:

Name of the digital output   Here you will find the alarm status assigned to the respective output.

Off/On	Here you will find the current switching status of the respective digital output: **Off** = 0 V (low level) **On** = 24 V (high level)

Modbus outputs

Press this button to open the following display:

```
Modbus outputs
Modbus 1:      1    Modbus 8:     0
Modbus 2:      2    Modbus 9:     0
Modbus 3:      3    Modbus 10:    0
Modbus 4:      0    Modbus 11:    0
Modbus 5:      0    Modbus 12:    0
Modbus 6:      0    Modbus 13:    0
Modbus 7:      0    Modbus 14:    0
```

You can find the following information here:

Modbus 1-26	Here you will find the number of the respective Modbus output register. Press the arrow ➡ at the bottom right of the display to show Modbus output registers 15–26.
Value	Here you will find the value located in the respective Modbus register. Registers 1–25 contain the value for the alarm status of the individual FAG SmartCheck devices. Register 26 contains the value for the overall alarm status of the FAG SmartController. The values have the following meanings: 0 = No Status 1 = No alarm 2 = Pre-alarm 3 = Main alarm

7.3 Settings

If you press the **Settings** button on the main screen, the following page opens:

```
Pulse/
revolution
Analogue
inputs
Language
Info    Network
```

The buttons allow you to access the individual settings options, such as setting the pulses/revolution for calculating the rotational speed or setting the operating mode for the analogue inputs. Details on the settings options can be found in the following sections.

> *The settings for **Pulses/revolution**, **Analogue inputs** and **Language** are applied during runtime and saved. It is not necessary to restart the system, and no further action is required from you.*
>
> *However, this is not the case when setting the IP address of the FAG SmartController 73 via **Network**. Information on this step can be found in the relevant section below.*

Pulses/revolution

Press this button to open the following settings window:

Speed channel	Speed	Pulse/revolution
1	3000	1
2	3000	1
3	3000	1
4	3000	1

The following information and functions can be found here:

Speed channel	Here you will find the channel number of the respective digital pulse input.
Speed	Here you will find the currently calculated speed.
Pulses/revolution	Here you will find the number of pulses per revolution that is currently set. By default, all digital pulse inputs are preset to **1 pulse/revolution**.
	Press the value to change this setting. Performing this step opens a keypad 66 in which a different number for the pulses/revolution can be set and confirmed by pressing **ESC**.

Analogue inputs

Press this button to open the following settings window:

AI channel	Mode				
1	0-10V	0-10V	+-10V	0-20mA	4-20mA
2	0-10V	0-10V	+-10V	0-20mA	4-20mA
3	0-10V	0-10V	+-10V	0-20mA	4-20mA
4	0-10V	0-10V	+-10V	0-20mA	4-20mA

The following information and functions can be found here:

AI channel	Here you will find the channel number of the respective analogue input.
Mode	Here you will find the operating mode that is currently set. By default, the operating mode is preset to **0—10 V**.
Buttons	Here you will find a button for every supported operating mode. Press a button to change the current operating mode. The following options are available for each channel:

- 0-10 V
- +/-10 V
- 0-20 mA
- 4-20 mA

The measurement range covers the values 0–20,000 for the operating modes **0—10 V**, **0—20 mA** and **4—20 mA**.

0 V/0 mA/4 mA ≙ 0

10 V/20 mA ≙ 20,000

For the operating mode ±10 V, the measurement range covers -20,000 to 20,000:

-10 V ≙ -20,000

10 V ≙ 20,000

Language

Press this button to open the following settings window:

Here you will find a national flag that functions as a button for every supported display language. Press this button to change the current language setting accordingly. The default setting is English.

Currently, the touchscreen display of the FAG SmartController can be operated in eight languages:

- German
- English
- Spanish
- French
- Dutch
- Italian
- Chinese
- Portuguese

Info

Press this button to display information on the firmware version of the SmartController and the touchscreen display:
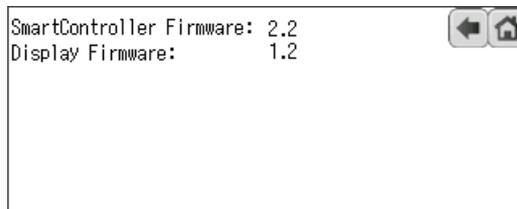
Network

Press this button if you would like to change the IP address of the FAG SmartController. Here you can either only change the IP address 73 or also define a new address range 75 for the IP address. Relevant details can be found in the following sections.

Changing the IP address

1. Press the fields with a black background to enter the correct value for the **SmartController IP**:
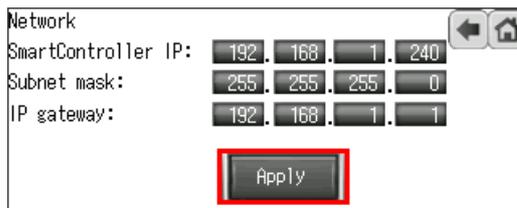
2. Press **Apply** to confirm the changes. Use the navigation elements in the upper right-hand corner to return to the main screen.
3. Press the screen in the upper right-hand corner of the main screen to open the main menu of the display. There is no symbol to press to perform this action:

4. In the main menu of the display, press **Comm. Setting**.

5. In the **Comm. Setting** window, press **Ethernet setting:**

6. In the **Channel Setting** window, there is only one option: Press **CH 1**:
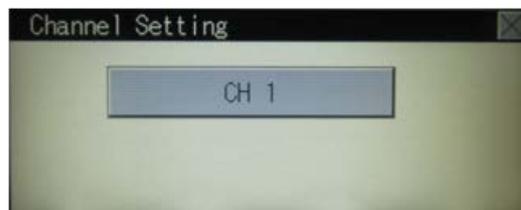
7. In the **Ethernet setting** window, you can now correct the IP address of the SmartController. To perform this step, press the last column entitled **IP Address** and enter the correct value.
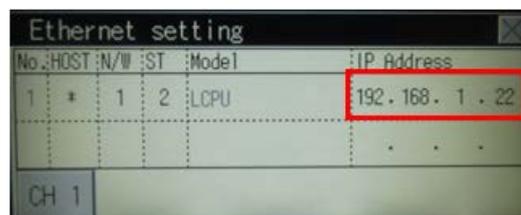
All other information must remain unchanged.

8. Close the **Ethernet setting** window by pressing the **X** in the top right-hand corner and confirm the security prompt by pressing **YES:**
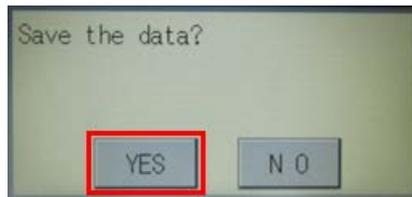
The display then automatically starts the reboot process.

9. Finally, perform a **RESET** | 63 | on the CPU module of the FAG SmartController:

The process for changing the IP address is now complete.

Changing the IP address and the address range

If the address range is changed as well as the IP address of the SmartController, you must also change the IP address of the display. To do this, proceed as follows:

1. Perform steps 1–9 from the section entitled **Changing the IP address** | 73 |.

2. Press the screen again in the upper right-hand corner of the main screen to open the main menu of the display. Then press **Comm. Setting**:

3. In the **Comm. Setting** window, press **GOT IP Address:**

4. In the **GOT IP Address** window, enter the necessary information:
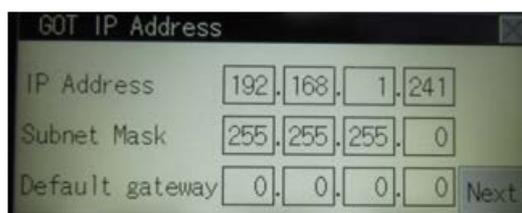
5. Close the **GOT IP Address** window by pressing the **X** in the top right-hand corner and confirm the security prompt by pressing **YES**:
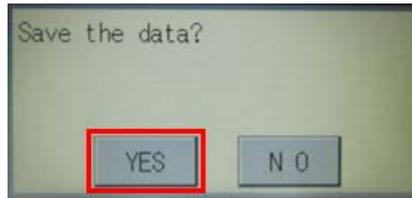
The display then automatically starts the reboot process.

The process for changing the IP address and the address range is now complete.

7.4 Dashboards for FAG SmartCheck devices

Pressing one of the **SmC...** buttons on the main screen opens the dashboard with the status and the configuration version of the corresponding five FAG SmartCheck devices. In the following example, the dashboard for the buttons **SmC 1–5** are shown:

The following information and functions can be found here:

SmartCheck	Here you will find the number of the FAG SmartCheck device. Numbers are determined by the register assignment of the output register⌐78⌐.
Status	Here you will find the alarm status of the respective SmartCheck device, i.e. **No Status**, **No Alarm**, **Pre-Alarm** or **Main Alarm**.
Config. version	Here you will find the configuration version currently set. This version is required to enable communication between the SmartCheck and the FAG SmartController. By default, the **Config. version** is initially set to **0**: As a result, the SmartCheck device is not registered and no status is evaluated.
	To replace the default setting with the correct version number, press the number. Pressing the number opens a keypad⌐66⌐, which is used to enter the desired number. Confirm the number by pressing **ESC**.
	The correct configuration version is found in the FAG SmartWeb software under **External devices**:
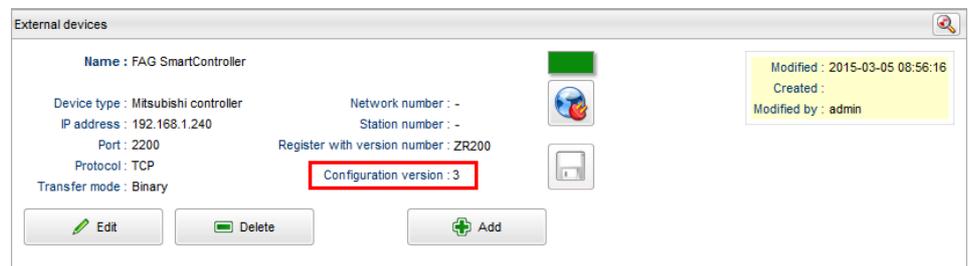
!	An exclamation mark at the end of the row indicates that the SmartCheck device is registered—i.e. **Config. version > 0**—but is no longer reporting. In such instances, an exclamation mark is displayed after approximately three minutes. The status also changes to **No Status**.

To deregister a registered FAG SmartCheck device from the SmartController, the config. version must be set to 0.

8   Further information

In the following sections, you can find detailed information about the registers of the Modbus TCP server and about the registers that the connected FAG SmartCheck devices read from and write to.

8.1 Register assignment, inputs

The following table lists register assignments of the inputs of the FAG SmartController. The **Start register** column tells you what you need to enter in the field of the same name when creating an external input 46 for an FAG SmartCheck device.

Start register	Data type	Description
ZR0	Signed Word	Modbus input register 1
ZR1	Signed Word	Modbus input register 2
ZR2	Signed Word	Modbus input register 3
ZR3	Signed Word	Modbus input register 4
ZR4	Signed Word	Modbus input register 5
ZR5	Signed Word	Modbus input register 6
ZR6	Signed Word	Modbus input register 7
ZR7	Signed Word	Modbus input register 8
ZR8	Signed Word	Modbus input register 9
ZR9	Signed Word	Modbus input register 10
ZR10	Signed Word	Modbus input register 11
ZR11	Signed Word	Modbus input register 12
ZR12	Signed Word	Modbus input register 13
ZR13	Signed Word	Modbus input register 14
ZR14	Signed Word	Modbus input register 15
ZR15	Signed Word	Modbus input register 16
ZR16	Signed Word	Modbus input register 17
ZR17	Signed Word	Modbus input register 18
ZR18	Signed Word	Modbus input register 19
ZR19	Signed Word	Modbus input register 20
ZR20	Signed Word	Modbus input register 21
ZR21	Signed Word	Modbus input register 22
ZR22	Signed Word	Modbus input register 23
ZR23	Signed Word	Modbus input register 24
ZR24	Signed Word	Modbus input register 25
ZR25	Signed Word	Local analogue input 1
ZR26	Signed Word	Local analogue input 2
ZR27	Signed Word	Local analogue input 3
ZR28	Signed Word	Local analogue input 4
ZR29	Signed DWord	Local digital speed input 1
ZR31	Signed DWord	Local digital speed input 2
ZR33	Signed DWord	Local digital speed input 3
ZR35	Signed DWord	Local digital speed input 4
ZR37	Signed Word	Local digital input 5 (logical)
ZR38	Signed Word	Local digital input 6 (logical)
ZR39	Signed Word	Local digital input 7 (logical)
ZR40	Signed Word	Local digital input 8 (logical)

8.2 Register assignment, outputs

The following table lists register assignments of the outputs of the FAG SmartController. The **Modbus register** column provides information for programmers of higher level controllers. The **Start register** column tells you what you need to enter in the field of the same name when creating a configuration with external outputs for an FAG SmartCheck device 58.

Start register	Data type	Description
ZR100	Signed Word	Output register of device SmartCheck 1
ZR200	Signed Word	Output register of device SmartCheck 2
ZR300	Signed Word	Output register of device SmartCheck 3
ZR400	Signed Word	Output register of device SmartCheck 4
ZR500	Signed Word	Output register of device SmartCheck 5
ZR600	Signed Word	Output register of device SmartCheck 6
ZR700	Signed Word	Output register of device SmartCheck 7
ZR800	Signed Word	Output register of device SmartCheck 8
ZR900	Signed Word	Output register of device SmartCheck 9
ZR1000	Signed Word	Output register of device SmartCheck 10
ZR1100	Signed Word	Output register of device SmartCheck 11
ZR1200	Signed Word	Output register of device SmartCheck 12
ZR1300	Signed Word	Output register of device SmartCheck 13
ZR1400	Signed Word	Output register of device SmartCheck 14
ZR1500	Signed Word	Output register of device SmartCheck 15
ZR1600	Signed Word	Output register of device SmartCheck 16
ZR1700	Signed Word	Output register of device SmartCheck 17
ZR1800	Signed Word	Output register of device SmartCheck 18
ZR1900	Signed Word	Output register of device SmartCheck 19
ZR2000	Signed Word	Output register of device SmartCheck 20
ZR2100	Signed Word	Output register of device SmartCheck 21
ZR2200	Signed Word	Output register of device SmartCheck 22
ZR2300	Signed Word	Output register of device SmartCheck 23
ZR2400	Signed Word	Output register of device SmartCheck 24
ZR2500	Signed Word	Output register of device SmartCheck 25

8.3 Modbus register and functions

For programming, you can use the following Modbus functions:

Modbus function code	Modbus function
03h	Read Holding Register
04h	Read Input Register
06h	Write Single Register
10h	Write Multiple Registers
17h	Read/Write Multiple Registers

The following Modbus registers are available:

Modbus register	Description
1	Modbus input register 1
2	Modbus input register 2
3	Modbus input register 3
4	Modbus input register 4
5	Modbus input register 5
6	Modbus input register 6
7	Modbus input register 7
8	Modbus input register 8
9	Modbus input register 9
10	Modbus input register 10
11	Modbus input register 11
12	Modbus input register 12
13	Modbus input register 13
14	Modbus input register 14
15	Modbus input register 15
16	Modbus input register 16
17	Modbus input register 17
18	Modbus input register 18
19	Modbus input register 19
20	Modbus input register 20
21	Modbus input register 21
22	Modbus input register 22
23	Modbus input register 23
24	Modbus input register 24
25	Modbus input register 25
26	Output register of device SmartCheck 1
27	Output register of device SmartCheck 2
28	Output register of device SmartCheck 3
29	Output register of device SmartCheck 4
30	Output register of device SmartCheck 5
31	Output register of device SmartCheck 6
32	Output register of device SmartCheck 7
33	Output register of device SmartCheck 8
34	Output register of device SmartCheck 9
35	Output register of device SmartCheck 10
36	Output register of device SmartCheck 11

37	Output register of device SmartCheck 12
38	Output register of device SmartCheck 13
39	Output register of device SmartCheck 14
40	Output register of device SmartCheck 15
41	Output register of device SmartCheck 16
42	Output register of device SmartCheck 17
43	Output register of device SmartCheck 18
44	Output register of device SmartCheck 19
45	Output register of device SmartCheck 20
46	Output register of device SmartCheck 21
47	Output register of device SmartCheck 22
48	Output register of device SmartCheck 23
49	Output register of device SmartCheck 24
50	Output register of device SmartCheck 25
51	Alarm status of the FAG SmartController

9   Maintenance and repair

If you detect a fault with the FAG SmartController, please contact the Support 87 team.

You can perform the following maintenance/service measures yourself:

Problem	Possible solution
The status LED **BAT** flashes yellow.	Replace the battery 81 or ensure that the one used is connected correctly.

> - *The FAG SmartController may only be maintained by persons who are verifiably qualified to do so in accordance with the relevant rules and regulations.*
> - *Ensure that the FAG SmartController is de-energised while work is being performed.*

Cleaning the FAG SmartController and the touchscreen display

When cleaning the outside of the FAG SmartController and the display, please note the following:

- Disconnect the device from the mains.
- Clean the device using a clean, lint-free cloth. For the touchscreen display, a neutral detergent or ethanol can be used as an alternative.

CAUTION

Damage to the device from improper handling!

Do not use chemical solvents such as acetone, nitro thinners or similar products as these solvents may damage the device housing.

Do not use sprayable solvents. These solvents can cause the touchscreen display or the peripheral devices to malfunction.

9.1 Changing the battery

DANGER

Ensure that the FAG SmartController is de-energised while the battery is being changed.

1. Remove the FAG SmartController from the DIN rail.
2. Open the battery compartment on the underside of the CPU module and remove the battery holder that the battery is secured to.
3. Detach the battery connecting wire from the battery holder and disconnect the plug connection of the battery to the CPU module. Remove the battery from the battery holder.
4. Insert the new battery in the battery holder and fit the connector of the connecting wire into the socket of the CPU module. Affix the connecting wire to the plug connector in the battery holder.
5. Insert the battery holder in the CPU module and close the battery compartment.
6. Then mount the FAG SmartController to the DIN rail again.

Socket of the CPU module ③

Connector of the battery ④

② ⑤

Battery holder

CPU module
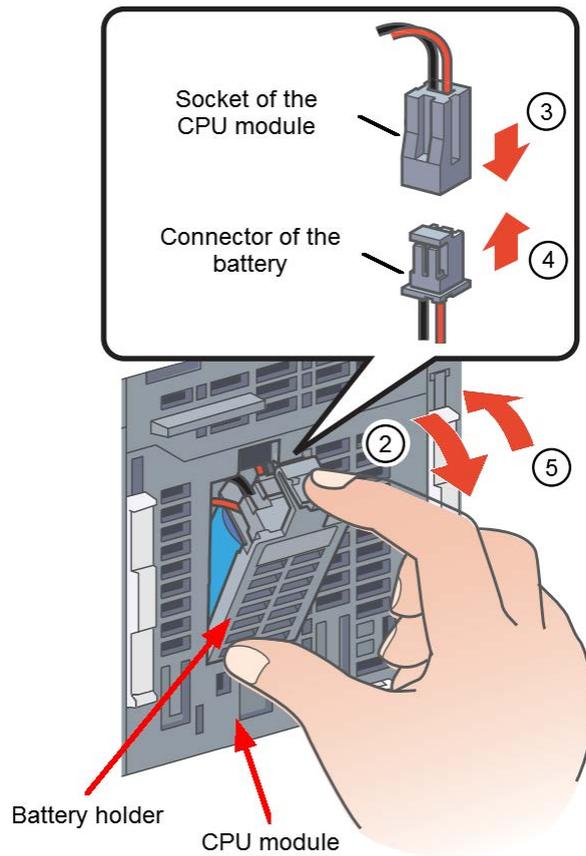
9.2 Inserting or replacing the SD card

During a firmware update, the SD card must be removed and re-inserted. To do this, proceed as follows:

1. Move the sliding switch next to the SD card slot to **OFF** so that the control lamp goes out.
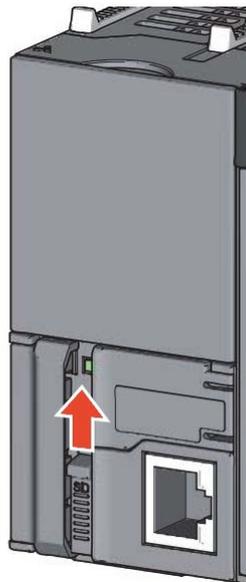
2. Open the cover of the slot and press the SD card to release it. Then remove the card.
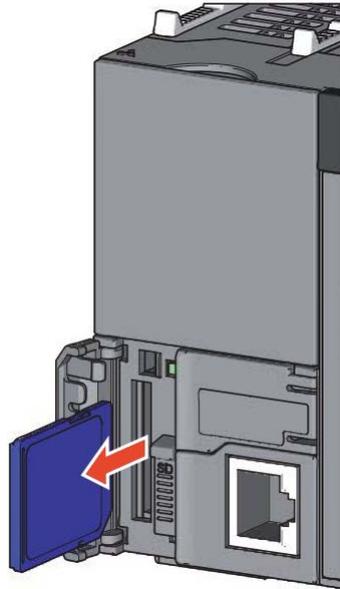
3. Insert the desired SD card in the card slot and close the cover again.
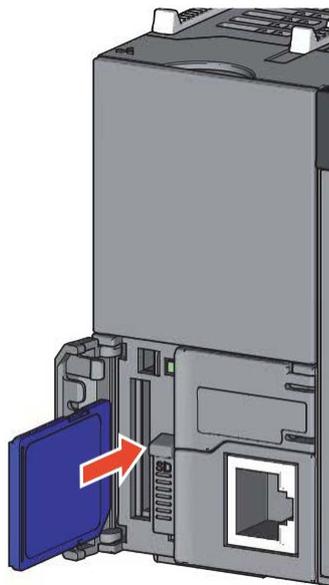
4. Move the sliding switch back to the **ON** position:
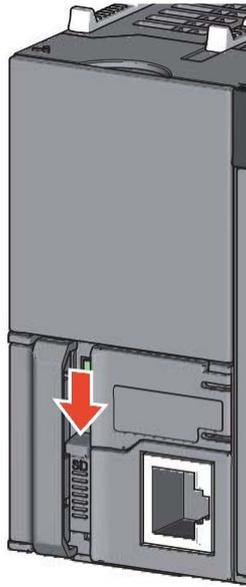
5. Open the cover on the right next to the **SD** LED. The **RESET/STOP/RUN** switch is located here.

6. Hold the **RESET/STOP/RUN** switch in the **RESET** position until the red **ERR** LED flashes.
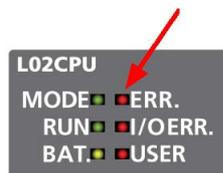
7. Then move the switch back to the **RUN** position.

10 Decommissioning and disposal

Decommissioning

If the FAG SmartController can no longer be operated safely, the device must be decommissioned and secured against inadvertent operation. The device can no longer be operated safely if it:

- Exhibits visible signs of damage
- Ceases to function
- Has been stored under damaging conditions
- Has been exposed to severe stresses in transit

Disposal

The FAG SmartController and its associated components must not be disposed of as household waste as they contain electronic components that require specialist disposal measures. Please return the device and/or components to us so that we can ensure they are disposed of in an environmentally friendly manner and in accordance with the relevant regulations. By returning old devices, you will be making an important contribution to protecting our environment.

11 Contact/support information

Contact

FAG Industrial Services GmbH

Kaiserstraße 100
52134 Herzogenrath
Germany

Tel.: +49 (0) 2407 9149-66
Fax: +49 (0) 2407 9149-59
Support: +49 (0) 2407 9149-99

Website: www.schaeffler.com/services
Further information: www.FAG-SmartCheck.com
Contact: industrial-services@schaeffler.com

Please send all correspondence directly to FAG Industrial Services GmbH!

A subsidiary of
Schaeffler Technologies AG & Co. KG

PO Box 1260
97419 Schweinfurt
Germany

Georg-Schäfer-Straße 30
97421 Schweinfurt
Germany

Support

Support: +49 (0) 2407 9149-99

Email: support.is@schaeffler.com

We provide support services for the FAG SmartController, the FAG SmartCheck device and the associated products. A detailed description of the type and scope of the support services we provide can be found online at www.FAG-SmartCheck.com.

The FAG SmartController can be extended and adapted to meet your individual requirements. Contact a customer support representative at FAG Industrial Services GmbH with your alteration requirements.

12 CE Declaration of Conformity

FAG SmartController device

Electromagnetic Compatibility Directive

EC Declaration of Conformity

Manufacturer: Mitsubishi Electric Corporation, Nagoya Works
Address: 1-14, 5-chome, Yada-Minami, Higashi-ku, Nagoya
                   461-8670,Japan

Products: Type: Programmable Controller
                           (Open Type equipment, Installation category II)
                   Model: L-Series
                           (Applicable units identified in Appendix)

These products comply with the following European directives:

Directive	Name
2004/108/EC	Electromagnetic Compatibility Directive

Further details of conformity to these directives are contained in the appendices (BCN-P9999-0593).

Authorised Signature:

T. Takahashi
Senior Manager, FA System Department

Date: (signature)

10.5.2010

Authorised Representative: Mitsubishi Electric Europe BV
in the European Community   Gothaer Str. 8, 40880 Ratingen, Germany
through Responsible person
Signature:

A. Ganz
Division Manager,
FA European Development Center
FA European Business Group

Date: *28.5.2010*   (signature)

The appendices are part of this declaration. This declaration certifies the conformity with the directives mentioned, but does not contain any warranted qualities. The installation, usage and safety directions of the product documentation have to be observed.

BCN-P9999-0592-A

Appendix

L-Series Programmable Controllers

Range of products:

L02CPU	6	L60TCTT4BW	6	LD75D2	6	LX28	6
L02CPU-CM	6	L60TCTT4BW-CM	6	LD75D2-CM	6	LX28-CM	6
L02CPU-P	6	L61P	6	LD75D4	6	LX40C6	6
L02CPU-P-SET	6	L61P-CM	6	LD75D4-CM	6	LX40C6-CM	6
L02CPU-SET	6	L63P	6	LD75P1	6	LX41C4	6
L02SCPU	6	L63P-CM	6	LD75P1-CM	6	LX41C4-CM	6
L02SCPU-CM	6	L63SP	6	LD75P2	6	LX42C4	6
L02SCPU-P	6	L63SP-CM	6	LD75P2-CM	6	LX42C4-CM	6
L06CPU	6	L6ADP-R2	6	LD75P4	6	LY10R2	6
L06CPU-P	6	L6ADP-R2-CM	6	LD75P4-CM	6	LY10R2-CM	6
L1MEM-2GBSD	6	L6DSPU	6	LH42C4NT1P	6	LY20S6	6
L1MEM-4GBSD	6	L6DSPU-C-CM	6	LH42C4NT1P-CM	6	LY20S6-CM	6
L26CPU	6	L6EC	6	LH42C4PT1P	6	LY40NT5P	6
L26CPU-BT	6	L6EC-ET	6	LH42C4PT1P-CM	6	LY40NT5P-CM	6
L26CPU-BT-CM	6	L6EC-ET-CM	6	LJ51AW12AL	6	LY40PT5P	6
L26CPU-BT-SET	6	L6EXB	6	LJ61BT11	6	LY40PT5P-CM	6
L26CPU-P	6	L6EXB-CM	6	LJ61BT11-CM	6	LY41NT1P	6
L26CPU-PBT	6	L6EXE	6	LJ61CL12	6	LY41NT1P-CM	6
L26CPU-PBT-SET	6	L6EXE-CM	6	LJ61CL12-CM	6	LY41PT1P	6
L60AD2DA2	6	LC06E	6	LJ71C24	6	LY41PT1P-CM	6
L60AD4	6	LC06E-CM	6	LJ71C24-CM	6	LY42NT1P	6
L60AD4-2GH	6	LC10E	6	LJ71C24-R2	6	LY42NT1P-CM	6
L60AD4-CM	6	LC10E-CM	6	LJ71C24-R2-CM	6	LY42PT1P	6
L60DA4	6	LC30E	6	LJ71E71-100	6	LY42PT1P-CM	6
L60DA4-CM	6	LC30E-CM	6	LJ71GF11-T2	6		
L60TCRT4	6	LD62	6	LJ71GF11-T2-CM	6		
L60TCRT4-CM	6	LD62-CM	6	LJ72GF15-T2	6		
L60TCRT4BW	6	LD62D	6	LJ72GF15-T2-CM	6		
L60TCRT4BW-CM	6	LD62D-CM	6	LJ72MS15	6		
L60TCTT4	6	LD75D1	6	LX10	6		
L60TCTT4-CM	6	LD75D1-CM	6	LX10-CM	6		

The conformity of the above mentioned products with the regulations of the directive 2004/108/EC for Electro-magnetic Compatibility is shown by the application of a Technical Construction File. This is supported by selected product tests to the following EMC standards directly and indirectly (when Generic EMC standards are used).

Note1: The mentioned products must be used as directed by the associated documentation in order to provide full compliance.
Note2: Above mentioned products include both coated[1] and non-coated products, and both of them are tested against the EMC standard.
[1] PCB corrosion preventive coating

Harmonized European Standards

Reference No.	Date of Issue
EN61131-2	2007

Modules marked with a mark 6 have been tested to EN61131-2(2007)

Signature *Hirokazu Nomoto*

Hirokazu Nomoto
Manager, FA Development Section 4
FA Systems Dept.1

Revision record
Z   27 March 2013   L02SCPU-P、L06CPU-P、L26CPU-P added to the list.
AA 02 April 2013   LH42C4NT1P、LH42C4NT1P-CM、LH42C4PT1P、
                    LH42C4PT1P-CM added to the list.
AB 03 April 2013   L63SP、L63SP-CM added to the list.

BCN-P9999-0593-AB

EC Declaration of Conformity

Manufacturer:	Mitsubishi Electric Corporation, Nagoya Works
Address:	1-14, 5-chome, Yada-Minami, Higashi-ku, Nagoya 461-8670,Japan

Products: Type: Programmable Controller
(Open Type equipment, Installation category II)
Model: L-Series
(Applicable units identified in Appendix)

These products comply with the following European directives:

Directive	Name
2006/95/EC	Low Voltage Directive

Further details of conformity to these directives are contained in the appendices(BCN-P9999-0595).

Authorised Signature:

T. Takahashi
Senior Manager, FA System Department

Date: (signature)

10 . 6 . 2010

Authorised Representative: Mitsubishi Electric Europe BV
in the European Community   Gothaer Str. 8, 40880 Ratingen, Germany
through Responsible person
Signature:

H. Pütz
Executive Vice President &
Deputy Product Marketing Director,
FA European Business Group
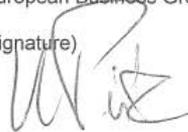
Date: 01-06-2010   (signature)

The appendices are part of this declaration. This declaration certifies the conformity with the directives mentioned, but does not contain any warranted qualities. The installation, usage and safety directions of the product documentation have to be observed.

BCN-P9999-0594-A

Appendix

L-Series Programmable Controllers

Range of products:

L02CPU	6	L60TCTT4BW	6	LD75D2	6	LX28	6
L02CPU-CM	6	L60TCTT4BW-CM	6	LD75D2-CM	6	LX28-CM	6
L02CPU-P	6	L61P	6	LD75D4	6	LX40C6	6
L02CPU-P-SET	6	L61P-CM	6	LD75D4-CM	6	LX40C6-CM	6
L02CPU-SET	6	L63P	6	LD75P1	6	LX41C4	6
L02SCPU	6	L63P-CM	6	LD75P1-CM	6	LX41C4-CM	6
L02SCPU-CM	6	L63SP	6	LD75P2	6	LX42C4	6
L02SCPU-P	6	L63SP-CM	6	LD75P2-CM	6	LX42C4-CM	6
L06CPU	6	L6ADP-R2	6	LD75P4	6	LY10R2	6
L06CPU-P	6	L6ADP-R2-CM	6	LD75P4-CM	6	LY10R2-CM	6
L1MEM-2GBSD	6	L6DSPU	6	LH42C4NT1P	6	LY20S6	6
L1MEM-4GBSD	6	L6DSPU-C-CM	6	LH42C4NT1P-CM	6	LY20S6-CM	6
L26CPU	6	L6EC	6	LH42C4PT1P	6	LY40NT5P	6
L26CPU-BT	6	L6EC-ET	6	LH42C4PT1P-CM	6	LY40NT5P-CM	6
L26CPU-BT-CM	6	L6EC-ET-CM	6	LJ51AW12AL	6	LY40PT5P	6
L26CPU-BT-SET	6	L6EXB	6	LJ61BT11	6	LY40PT5P-CM	6
L26CPU-P	6	L6EXB-CM	6	LJ61BT11-CM	6	LY41NT1P	6
L26CPU-PBT	6	L6EXE	6	LJ61CL12	6	LY41NT1P-CM	6
L26CPU-PBT-SET	6	L6EXE-CM	6	LJ61CL12-CM	6	LY41PT1P	6
L60AD2DA2	6	LC06E	6	LJ71C24	6	LY41PT1P-CM	6
L60AD4	6	LC06E-CM	6	LJ71C24-CM	6	LY42NT1P	6
L60AD4-2GH	6	LC10E	6	LJ71C24-R2	6	LY42NT1P-CM	6
L60AD4-CM	6	LC10E-CM	6	LJ71C24-R2-CM	6	LY42PT1P	6
L60DA4	6	LC30E	6	LJ71E71-100	6	LY42PT1P-CM	6
L60DA4-CM	6	LC30E-CM	6	LJ71GF11-T2	6		
L60TCRT4	6	LD62	6	LJ71GF11-T2-CM	6		
L60TCRT4-CM	6	LD62-CM	6	LJ72GF15-T2	6		
L60TCRT4BW	6	LD62D	6	LJ72GF15-T2-CM	6		
L60TCRT4BW-CM	6	LD62D-CM	6	LJ72MS15	6		
L60TCTT4	6	LD75D1	6	LX10	6		
L60TCTT4-CM	6	LD75D1-CM	6	LX10-CM	6		

The conformity of the above mentioned products with the regulations of the directive 2004/108/EC for Electro-magnetic Compatibility is shown by the application of a Technical Construction File. This is supported by selected product tests to the following EMC standards directly and indirectly (when Generic EMC standards are used).

Note1: The mentioned products must be used as directed by the associated documentation in order to provide full compliance.
Note2: Above mentioned products include both coated[1] and non-coated products, and both of them are tested against the EMC standard.
[1] PCB corrosion preventive coating

Harmonized European Standards

Reference No.	Date of Issue
EN61131-2	2007

Modules marked with a mark 6 have been tested to EN61131-2(2007)

Signature *Hirokazu Nomoto*

Hirokazu Nomoto
Manager, FA Development Section 4
FA Systems Dept.1

Revision record

Z	27 March 2013	L02SCPU-P, L06CPU-P, L26CPU-P added to the list.
AA	02 April 2013	LH42C4NT1P、LH42C4NT1P-CM、LH42C4PT1P、LH42C4PT1P-CM added to the list.
AB	03 April 2013	L63SP、L63SP-CM added to the list.

BCN-P9999-0593-AB

FAG SmartController Display

Electromagnetic Compatibility Directive

EC Declaration of Conformity   CE

Document No.	JY997D61601A

Manufacturer: Mitsubishi Electric Corporation, Himeji Works,
Address: 840 Chiyoda-Machi, Himeji, Hyogo, 670-8677 Japan.
     Phone: +81-79-298-8842   FAX: +81-79-298-7352

Authorized Representative established within the Community:
     Mitsubishi Electric Europe B.V. (MEU)
Address: Gothaer Str.8, 40880 Ratingen, Germany

Products   Type : Graphic Operation Terminal
     Models : GT2103 models

     (EMC applicable units identified in Appendix 1)

The above mentioned products comply with the following European directives:

Directive	Remark
2004/108/EC	Electromagnetic Compatibility Directive (EMC)

Further particulars about the conformity with these directives are contained in the appendices.
CE-marking was first applied July 2014 for EMC.

Writer: Masahiro Hirata (GOT Design Section Group)
Place: Mitsubishi Electric, Himeji Works, Himeji, Japan   Date: 2 July, 2014

Signature of representative
for the Manufacturer: Takao Moriyama *Takao Moriyama*
     (Himeji Works Industrial Apparatus Divisional Manager)
     Date: 2014. 7. 4

Signature of representative
for the Authorized Representative: Hartmut Puetz
     (Mitsubishi Electric Europe B.V., FA European Business Group, Product Marketing Director)
Place: Mitsubishi Electric Europe B.V. - European Business Group, Ratingen, Germany
     Date: 29.7. 2014

The appendices are part of this declaration. This declaration certifies the conformity with the directives mentioned, but does not contain any warranted qualities. The installation, usage and safety directions of the product documentation have to be observed.

MITSUBISHI ELECTRIC

Page 1 of 2

Modification History

Subject Document: GT2103 models Declaration of Conformity
Reference number: JY997D61601A

This is an additional sheet to identify any changes to the associated Declaration of Conformity. This sheet does not form any direct part of the declaration and is not for issue with the declaration. This sheet is for Mitsubishi Electric internal control and management of the declaration.

Date of new issue	New revision letter	Changes
July 2014	A	First Issue

MITSUBISHI ELECTRIC