



Operating instructions

ecomatController

CR0708

CR0709

HW version: V3.0.0.x

GB

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1 Preliminary note

You will find instructions, technical data, approvals, accessories and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

- ✓ Requirement
- Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

1.2 Warnings used

	ATTENTION Warning of damage to property
	CAUTION Warning of personal injury ▷ Slight reversible injuries may result.
	WARNING Warning of serious personal injury ▷ Death or serious irreversible injuries may result.

2 Safety instructions



The unit is not approved for safety-related tasks in the field of operator protection.

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.

3 Intended use

The freely programmable controllers of the "ecomatController" series are rated for use under difficult conditions: this includes an extended temperature range, strong vibration, intensive EMC interference.



This is a class A product. This product may cause radio interference in domestic areas.

► If required, take appropriate EMC screening measures.

- Controller for mobile machinery applications.
- CODESYS V3.5 programming system (in a version approved by ifm).
- For the supply of the controller (on-board system, PELV power supply): [Electrical connection](#) (→ [10](#))
- Multifunctional inputs and outputs, their operating mode (e.g. current, voltage, frequency input; PWM, digital output) and use of which can be configured in one of the controllers.
- Sensors and actuators can be connected and used (depending on the required input and/or output type).
- Connection of sensors or actuators via CAN interfaces. Connection to other controllers via CAN.
- Only use the device within the limits of the technical data: → Technical data.
- Mounting location: Installation location



For the controller, no direct connection to IT structures is intended. If this application is required, the users have to implement it (e.g. by using their own additional components).

3.1 Distinctive features

These instructions refer to the derivatives CR0708 and CR0709 of the "ecomatController" series. The devices differ in the following features:

Feature	CR0708	CR0709
Number of inputs	20	32
Number of outputs	17	28
Number of output groups	2 (supplied via VBB _{0/1})	3 (supplied via VBB _{0...2})

3.2 Predictive incorrect use

- Installation on the motor/engine is not permitted.
- No use in an environment with ionising radiation.



The unit is not approved for safety-related tasks in the field of operator protection.

4 Items supplied

1 ecomatController

1 screw for the shield connection

4 protective covers

1 operating instructions

CE Declaration of Conformity

► In the event of incomplete or damaged items supplied, please contact ifm.



Programming manual and software (firmware of the controller and programming environment) at www.ifm.com.

5 Installation

5.1 Installation location

The following installation locations are permitted:

- inside of the cabin
- body
- vehicle frame

Installation on the motor/engine is not permitted.

For non-mobile applications, the applicable directives are to be adhered to, taking into account the specified environmental conditions.

ATTENTION

Excessive current, weld slag and soiling due to welding

- ▷ Damage to the device, deterioration of the electrical safety
- ▶ Welding work on the chassis frame must only be carried out by qualified personnel.
- ▶ Remove and cover the plus and minus terminals of the batteries.
- ▶ Disconnect all contacts of the device from the on-board system prior to welding on the vehicle or machine.
- ▶ Connect the earth terminal of the welding device directly to the part to be welded.
- ▶ Do not touch the device or electric cables with the welding electrode or the earth terminal of the welding device.
- ▶ Protect the device incl. all connectors and all connection cables against weld slag and soiling.

5.2 Mounting surface



The housing must not be exposed to any torsional forces or mechanical stress.

- ▶ Use suitable compensating elements if there is no flat mounting surface available.

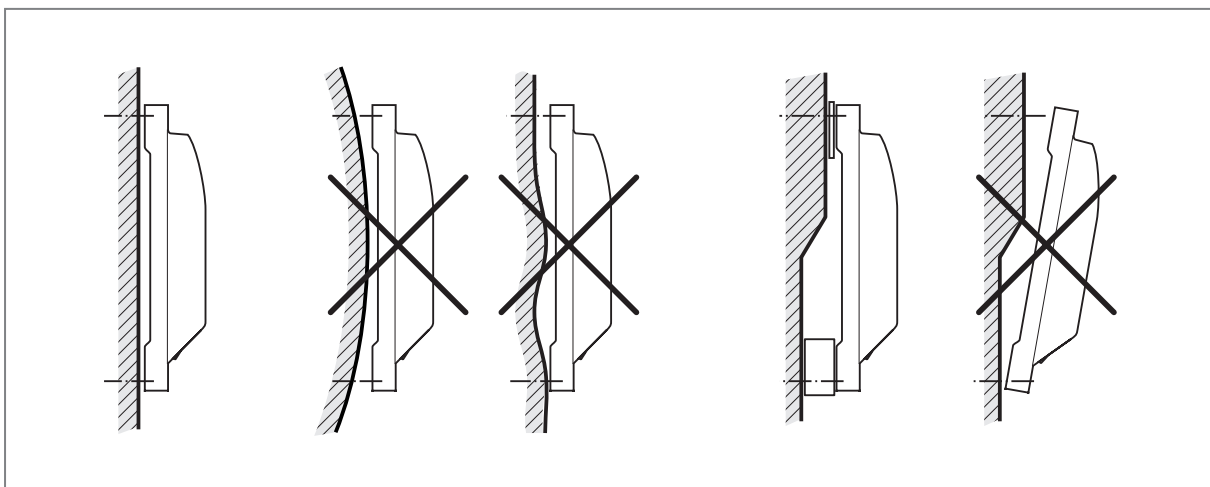


Fig. 1: Mounting surface

- During installation and replacing the device, ensure that the pollution degree is 2 or better. Pollution degree 2 is a light, common contamination which can become conductive caused by occasional condensation or hand perspiration (DIN EN 60664-1).

5.3 Heat dissipation



CAUTION

The housing can heat up considerably.

- ▷ Risk of burns
- During installation, ensure sufficient heat dissipation.
- Measure maximum device heating in the application. The maximum housing temperature indicated in the data sheet must not be exceeded.
 - ▷ If housing temperatures presenting a danger to people are reached:
- Cover housing to prevent unintentional contact.
- Apply warning for hot surfaces visibly on the device.

5.4 Installation position

In wet environments, install the controller ensuring that no liquid remains on the connectors.

The installation position is defined by the 90° angled cable entry. The cable entries must be oriented vertically downwards to prevent moisture ingress. If this is not possible then an orientation between horizontal and vertically down is allowed.

5.5 Fastening

Fix the controller to a flat surface using 4 zinc-plated M6 screws.

Tightening torque: 10 ± 2 Nm

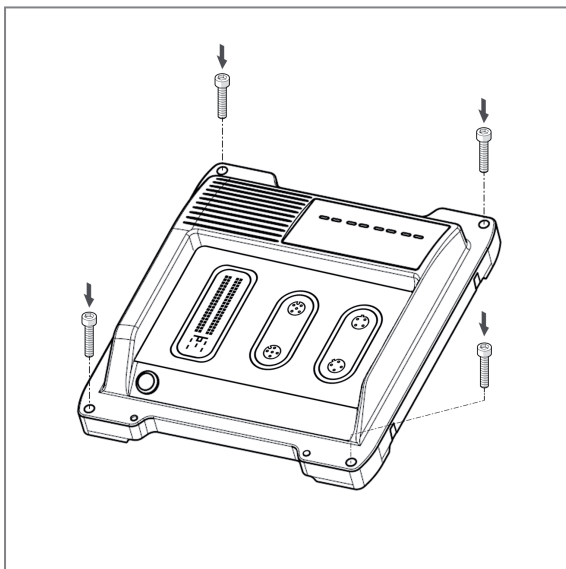


Fig. 2: Installation

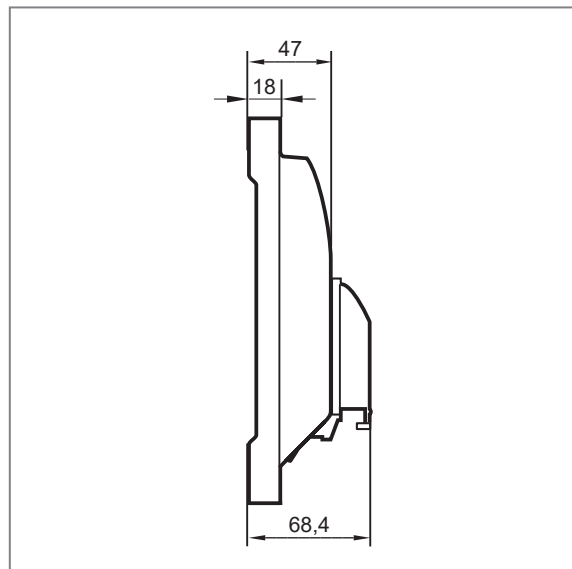


Fig. 3: Total height with the attached connector

ATTENTION

Contact corrosion between the mounting screws and the housing

▷ Damage to the device

▶ Do not use stainless steel screws or nickel-plated screws.

▶ Use zinc-plated screws.

▶ In very corrosive environments such as extremely salty air, use screws with surface finishing on a zinc/nickel basis with thick-film passivation and sealing.

6 Electrical connection



- ▶ Disconnect the machine from the mains supply before installation; if necessary, also disconnect any independently supplied input / output load circuits.
- ▶ Observe the national and international regulations for the installation of electrical equipment.
- ▶ Observe the requirements according to EN 60204.

Accessible surfaces of the device are insulated from the circuits with basic insulation to IEC 61010-1 (secondary circuit with max. 32 V DC, supplied from the mains circuit up to 300 V of overvoltage category II).

GND of the supply is connected via EMC suppression capacitors on the shield connection (metal housing) of the device.

The external wiring has to be carried out in a way that ensures the required separation from other circuits.

6.1 Wiring

Wiring: Technical data



The connection terminals may only be supplied with the signals indicated in the technical data / on the device label and only the approved accessories from ifm may be connected.



Only connect the connector pins as shown in the pin layout. Unspecified connector pins remain unconnected. The unconnected connector pins need to have sealing of the individual cores.

ATTENTION

Absence of reverse polarity protection

- ▷ Reverse polarity protection is only ensured in case of supply via the on-board system (via a battery), if the polarity of the supply is reversed as a whole (battery connected incorrectly). The basic principle of the reverse polarity protection is that the upstream fuses are quickly switched off in case of excessive current. In case of supply via PELV, reverse polarity protection is not ensured.
- ▷ Damage to the device
- ▶ Ensure that the ends of the cables are properly connected to the connector before connecting the latter to the device, also in case of supply via the on-board system.



The device is designed for supply via a mobile on-board system (12/24 V DC nominal voltage) or protective low voltage PELV according to the technical data and national regulations. The supply is directly transferred to the connected sensors/actuators without electrical separation.

- ▶ Connect all required supply lines, GND connections and the shield connection.

6.2 Connection technology



Observe all notes on connection technology.

- ▶ Note the device label.

The threaded connections in the device correspond to the M12 standard. To ensure compliance with the specified protection rating, only cables that comply with this standard may be used. In the case of self-assembled cables, the system manufacturer is responsible for the protection rating.

- ▶ Use connectors with gold-plated contacts.
- ▶ Use twisted-pair cables for CAN connections.

- ▶ During installation, place the connectors vertically so that the coupling nut will not damage the thread.
- ▶ Observe the coding of the connectors during installation.

If sockets in the device:

- ▶ Tighten the cable plug using 1.3 ± 0.1 Nm.
- ▶ Cover unused connections with protective covers. Tightening torque: 1.3 ± 0.1 Nm
- ▶ Provide all outgoing cables with suitable strain relief after a maximum of 200 mm. Observe the minimum bending radius of the cables (→ information from the cable manufacturer).
- ▶ Use 81-pole connectors with individually sealed cores to ensure protection rating IP 67.



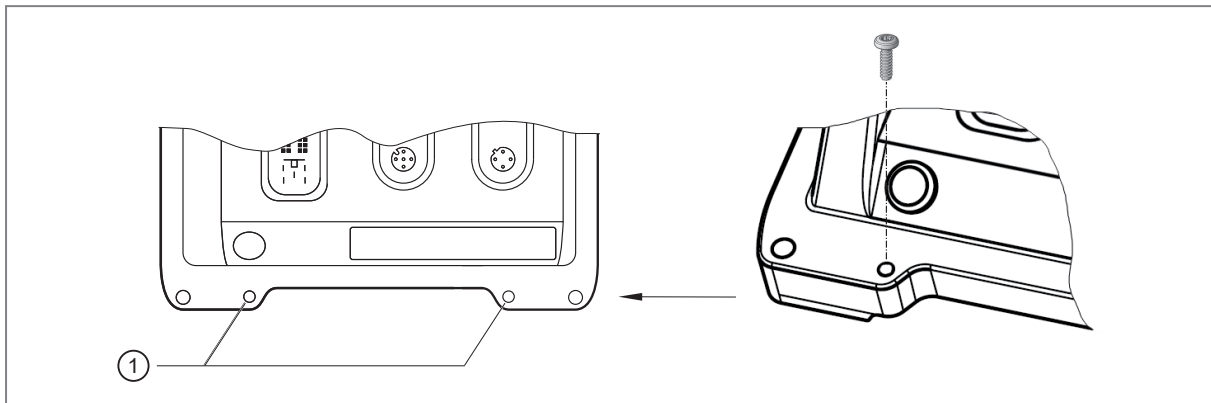
Only connect the 81-pole connectors when the supply voltage is disconnected. "Hot plugging" is not permitted.

The ingress resistance of cables that users have cut to length must be guaranteed.

- ▶ For the Ethernet connection, use a minimum category 5 (Cat 5) cable.

The RS-232 interface serves only as a service interface (e.g. for firmware updates).

6.3 Shield connection



1: Holes for shield connection



To ensure the protection of the device against electrical interference and to ensure the correct function of the device, the housing has to be connected to the body / GND of the supply using the shortest possible route.

Otherwise the correct function is not ensured!

- ▶ Connect the device to the ground of the vehicle using the M4 self-tapping screw (included).



Only use the supplied screw for the shield connection on the device to avoid corrosion. Tightening torque: 3.0 ± 0.2 Nm

To avoid contact corrosion on the shield connection of the device, do not use any stainless steel, copper or nickel-plated materials for the bolting element!

6.4 Fuses

- ▶ The individual electric circuits must be protected in order to protect the whole system. Automotive spade-type fuses are recommended.



All supply lines of the inputs can be protected within the input groups.

Connection	Nominal value fuse	Required triggering characteristics
VBB ₁₅	2 A	$T_{\text{fuse}} \leq 120 \text{ s at max. } 6.25 \text{ A}$
VBB ₃₀	2 A	$T_{\text{fuse}} \leq 120 \text{ s at max. } 6.25 \text{ A}$
VBB ₀	15 A	-
VBB ₁	$\leq 15 \text{ A}$	-
VBB ₂ (only with CR0709)	$\leq 15 \text{ A}$	-
Inputs / input groups	2 A	$T_{\text{fuse}} \leq 120 \text{ s at max. } 6.25 \text{ A}$

6.5 Laying of the supply and signal cables

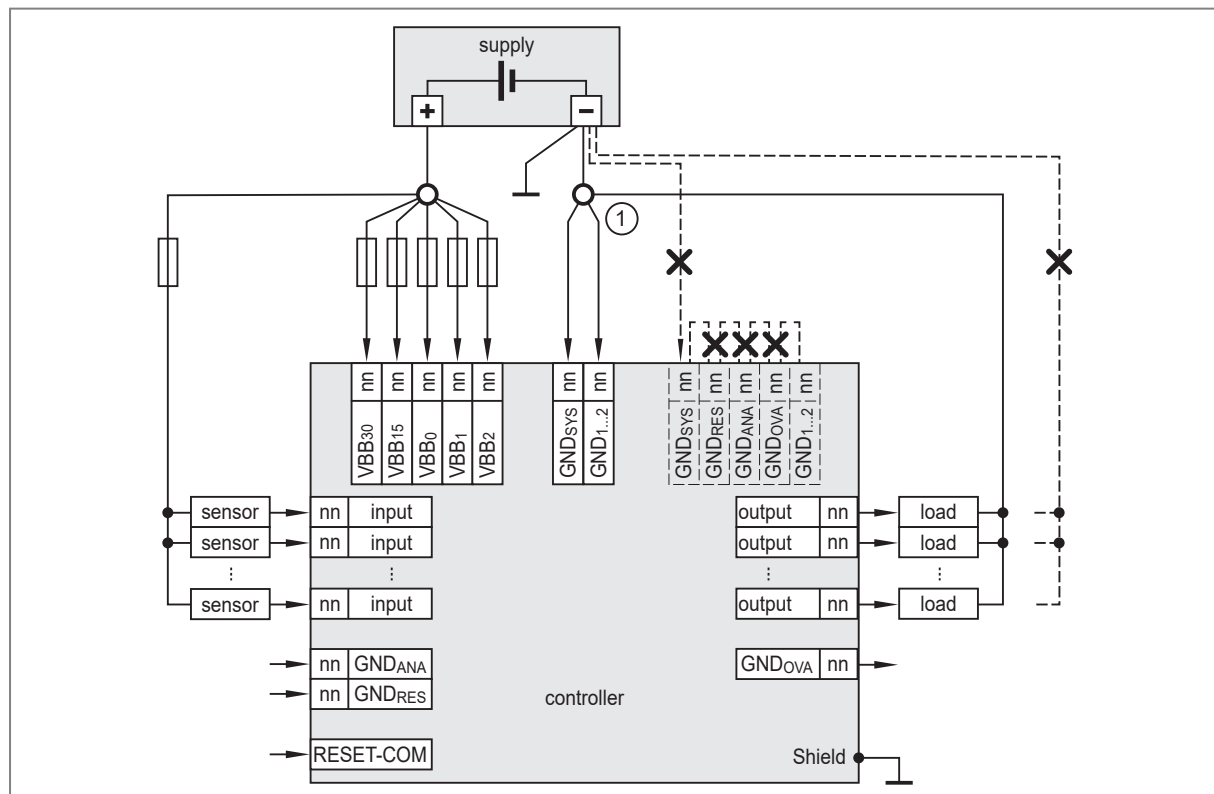


Fig. 4: Connection of the supply and signal cables (X = not permitted), example CR0709

1: GND star point



Bridging of connections in the connectors is not permitted.

RESET-COM is a service input (see programming manual).

► For the operation of the controller, connect RESET-COM to the GND star point ①.



Faulty laying of the supply and signal cables

▷ Deterioration of EMC may occur

- Lay all supply and signal cables separately to maintain application/EMC integrity
- Connect supply and ground cables to the controller and the sensors/actuators via the respective common star point.



If a prewired connection cable is used, remove the cores with unused signal inputs and outputs.

Provide the unconnected signal inputs with sealing of the individual cores. Unconnected cores or core loops are not permitted.

In case of signal failures, operate inputs with shielded cables. Connect the shields to the shield connection on one side.

**WARNING**

Load dump and surge

- ▷ Destruction of the device or deterioration of the function
- ▶ Always connect VBB₀.

The CAN bus is internally protected against short circuit to VBB and GND.



For CAN cables ≥ 30 m, ensure appropriate protection against surge (e. g. shielded cables).

6.5.1 GND connections

- ▶ Connect the GND_{1...2} and GND_{SYS} connections individually to the common GND star point.
- ▶ Connect the GND connections of the sensors of the high-side digital inputs (CSO) and the actuators (loads) to the common GND star point.

**WARNING**

Wrong connection of the GND connections

- ▷ Loss of the correct function, the measurement accuracy and EMC possible
- ▶ Do not connect the GND_{ANA}, GND_{RES} and GND_{OVA} connections to the common GND star point, but to the GND of the signal source or of the connected device.

6.6 Analogue inputs

Abbreviation	Input / output type
A	Analogue
B _H	Binary high side (CSO)
B _L	Binary low side (CSI)
FRQ _{L/H}	Frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM _H	Pulse-width modulation high side (CSO)
PWM _L	Pulse-width modulation low side (CSI)
PWMI	Pulse width modulation current-controlled
R	Resistor input
VBB _{0...2}	Supply output group
VBB ₁₅	Switching the VBB ₃₀ via ignition-starter switch
VBB ₃₀	Supply controller

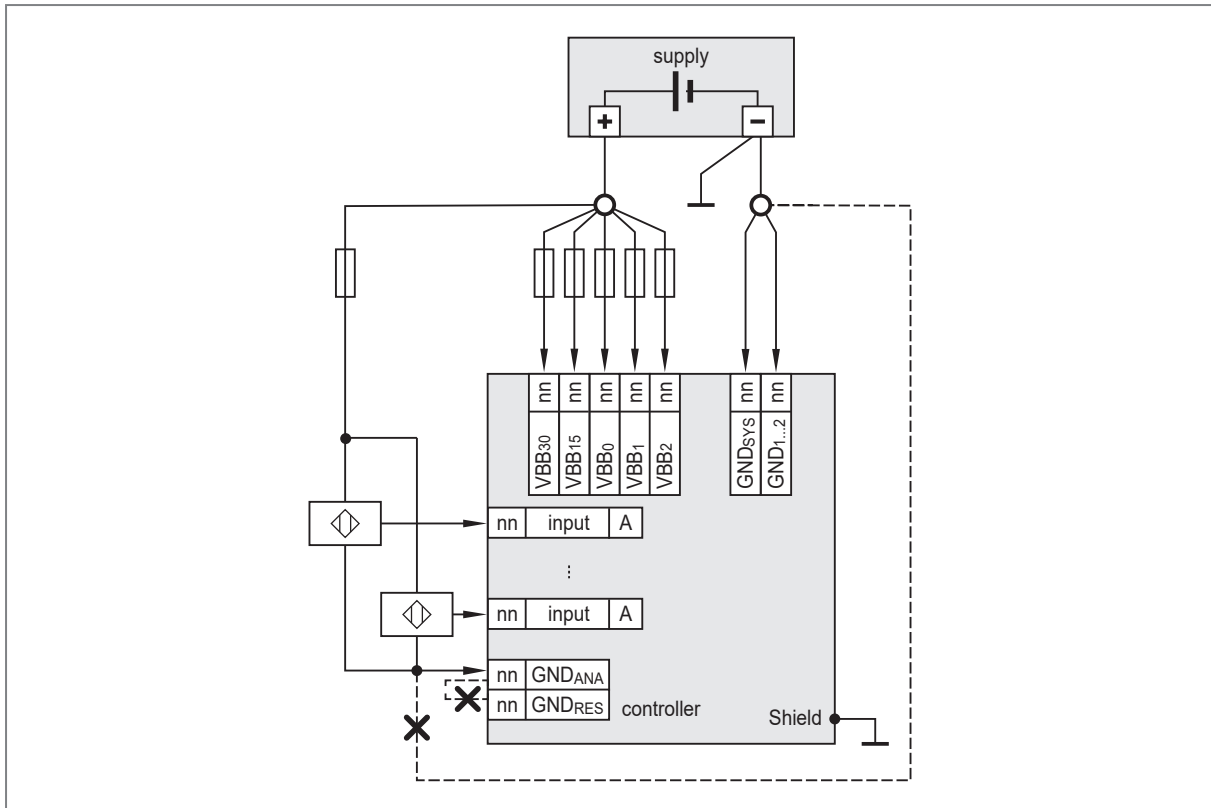


Fig. 5: Connection of the analogue inputs (A), example CR0709

- Connect GND_{ANA} to GND of the signal source.
Do not connect GND_{ANA} to other GND connections or the common GND star point.

6.7 Resistor inputs

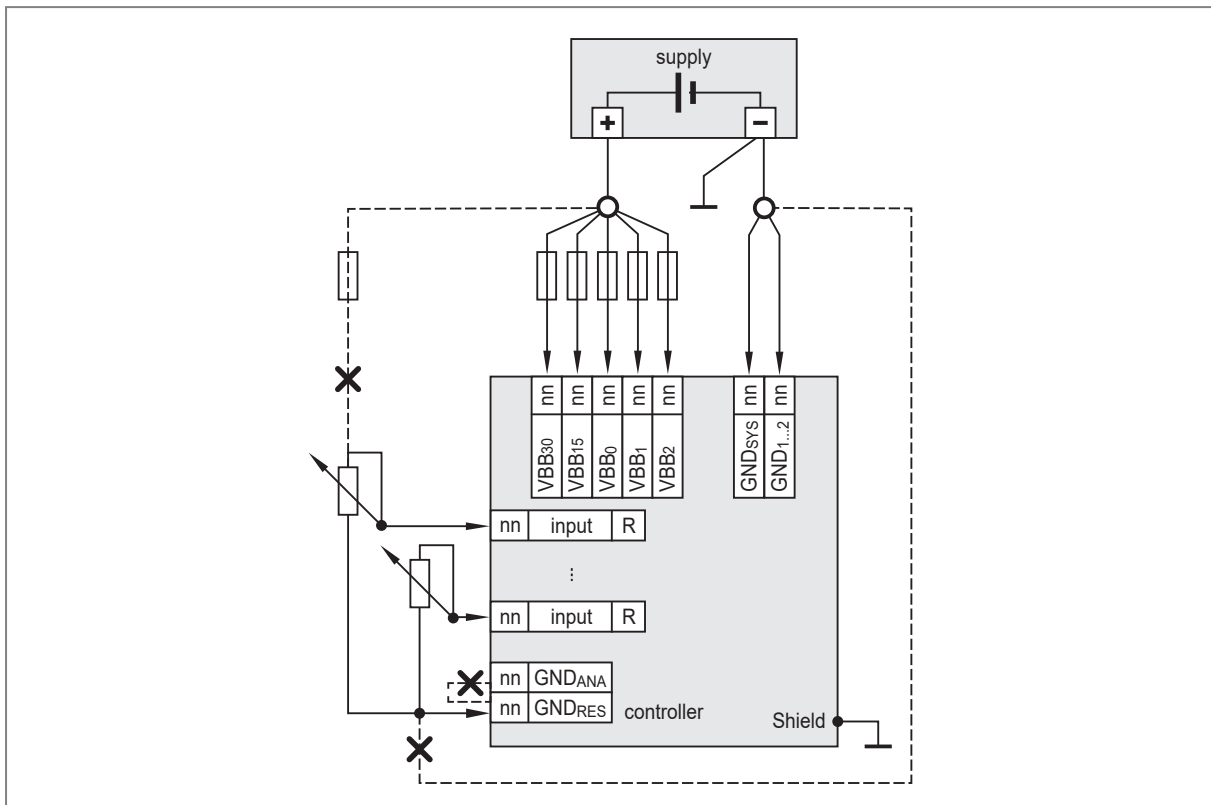


Fig. 6: Connection of the resistor inputs (R), example CR0709

- Connect GND_{RES} to GND of the signal source.
Do not connect GND_{RES} to other GND connections or the common GND star point.
Do not connect resistor inputs to a VBB.

6.8 High-side digital inputs (CSO)

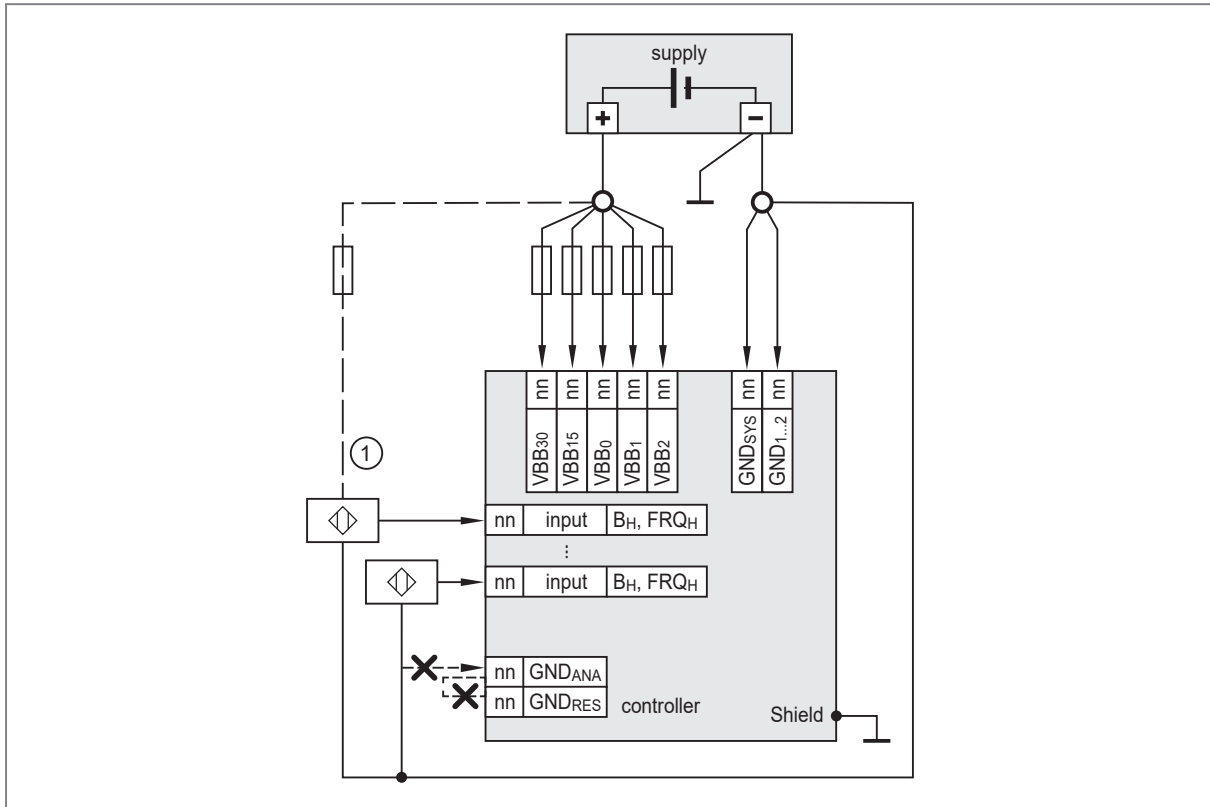


Fig. 7: Connection of the high-side inputs (BH, FRQH), example CR0709

1: Connection for 3-wire sensors

- Connect GND of the signal source to the common GND star point.
Do not connect GND of the signal source to GND_{RES} or GND_{ANA} .

6.9 Analogue outputs

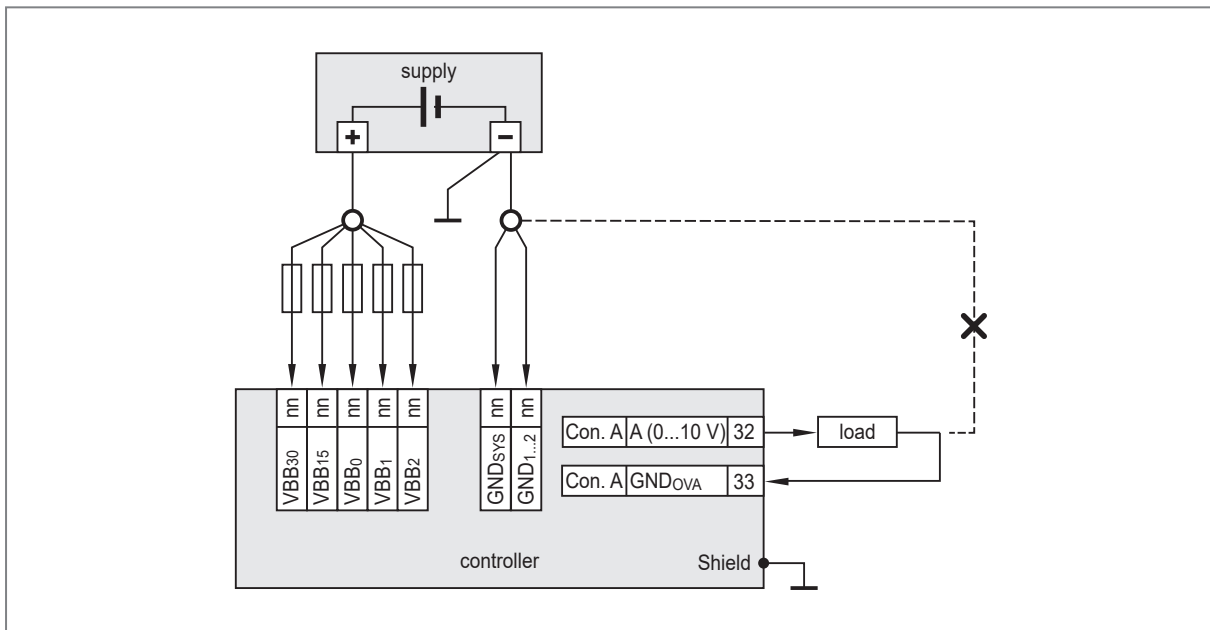


Fig. 8: Connection of the analogue outputs (A), example CR0709

The controller can be connected to the following loads:

- resistive loads

The connected load must not exceed the maximum permissible values of the respective output (→ Technical data).

- Connect GND of the load to GND_{OVA}.
Do not connect GND of the load to other GND connections or to the common GND star point.



Deviating connections are not permitted.

6.10 Digital / PWM outputs

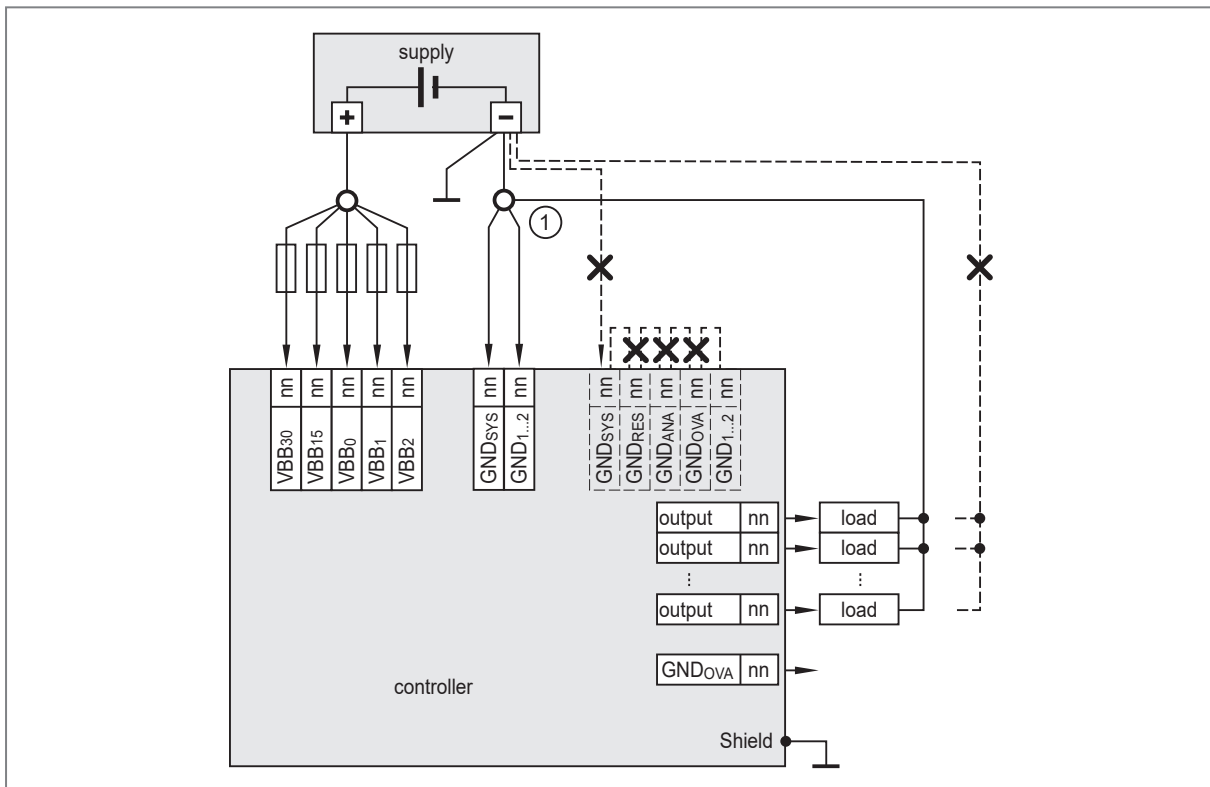


Fig. 9: Connection of the high-side digital outputs (PWMH, BH), example CR0709

1: GND star point



WARNING

- common interruption of all GND power supply connections and simultaneously
- loads connected to GND which are connected to outputs

This may cause fault currents to flow through the controller and load which lead to an undefined state of the controller and the system.

▷ Loss of correct function

► Always connect the ground lead of the controller and the loads (actuators) via the common GND star point ① (see image above).

▷ This ensures that in case the line to the battery is interrupted, the loads are no longer connected to GND, either.

The controller can be connected to the following loads:

- resistive loads
- capacitive loads (adapt diagnostic settings to the load, see programming manual)
- inductive loads

The connected load must not exceed the maximum permissible values of the respective output (→ Technical data).



Deviating connections are not permitted.

6.11 Digital / PWM outputs, H-bridge

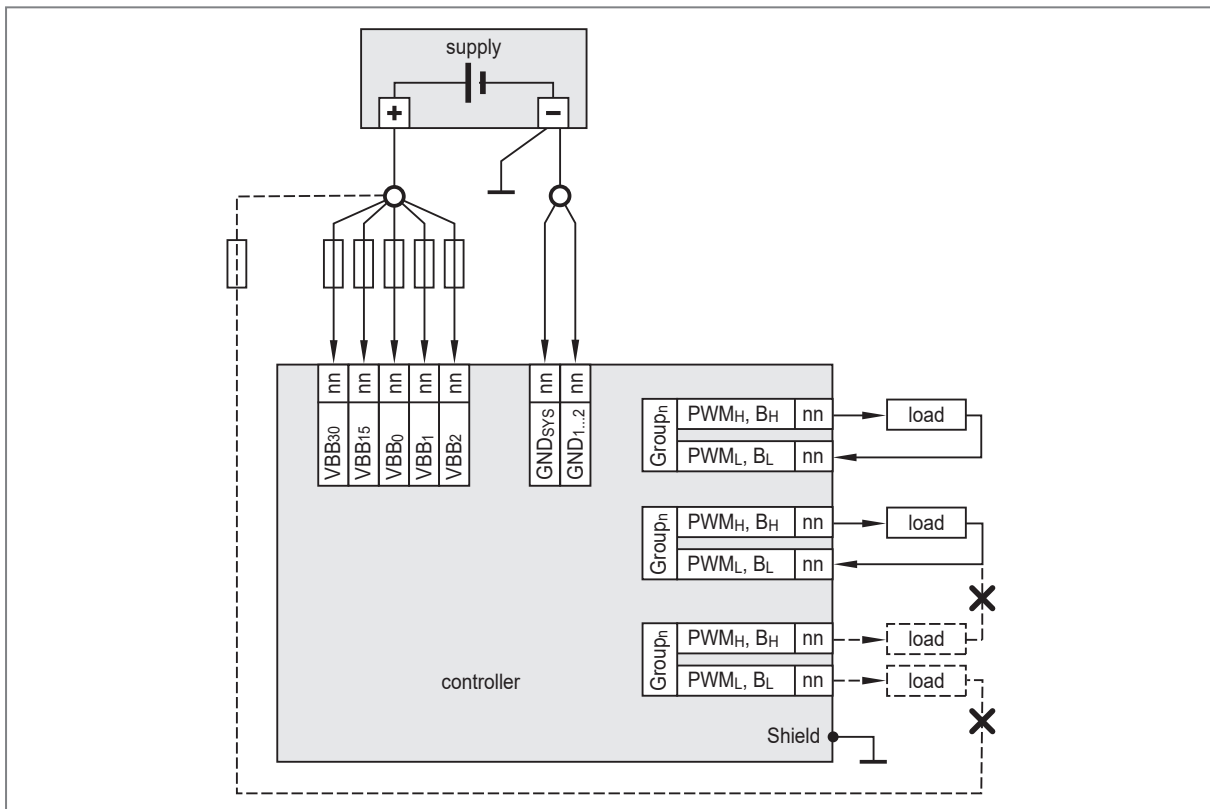


Fig. 10: Connection of the low-side digital outputs (PWML, BL), example CR0709

The controller can be connected to the following loads:

- resistive loads
- capacitive loads (adapt diagnostic settings to the load, see programming manual)
- inductive loads

The connected load must not exceed the maximum permissible values of the respective output (→ Technical data).

- Supply low-side outputs (B_L) via a high-side output (B_H) of the same output group.



Deviating connections are not permitted.

6.12 Mixed operation (12 V / 24 V)



Mixed operation is not permissible when supplied by PELV.

Mixed operation only permissible when supplied by on-board system.

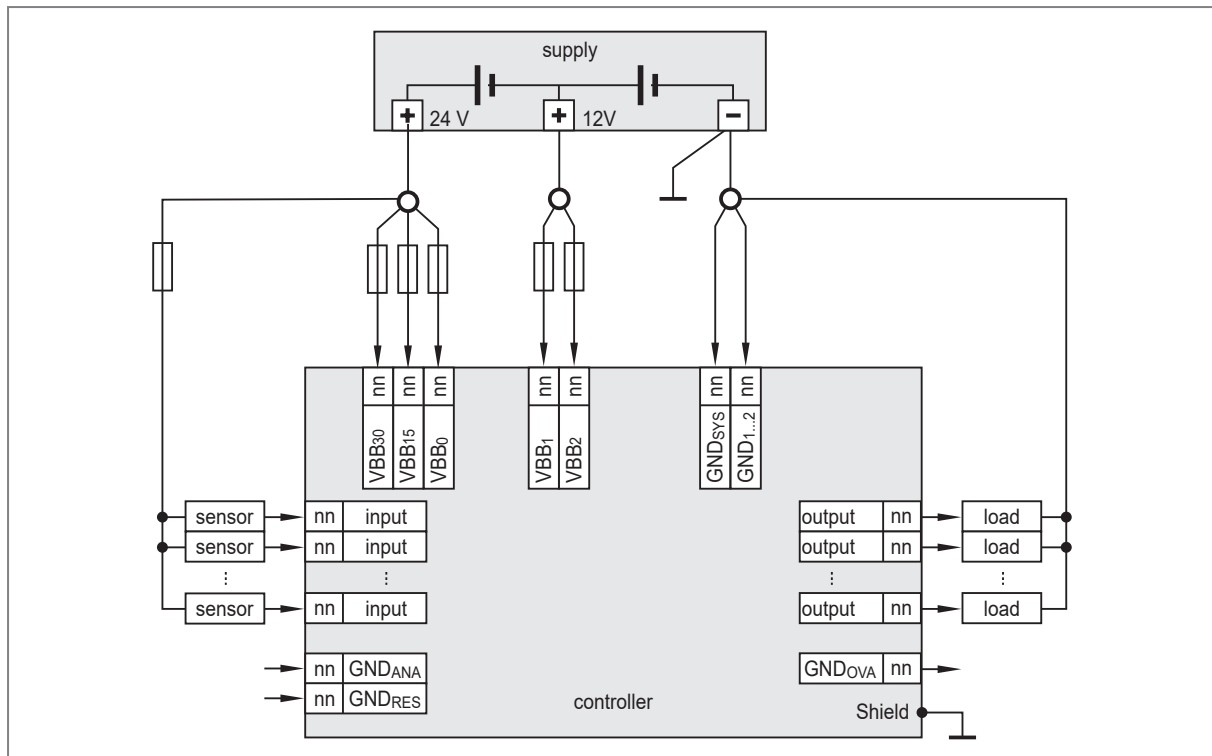


Fig. 11: Example connection to 24 V and 12 V power supply combined, example CR0709

The operation of the output groups is possible with different supply voltages.

► VBB₀, VBB₃₀ and VBB₁₅ must be connected to the common star point.

7 Set-up

7.1 Interfaces and system requirements



The users are responsible for the correct function of the application programs which they created themselves. If necessary, they must additionally carry out an approval by corresponding supervisory and test organisations according to the national regulations.

The programmer creates the application program with the IEC 61131-3 compliant CODESYS programming system and loads the applications via the Ethernet, RS-232 or CAN interface to the controller. For the required information about installation and set-up, see the programming manual.

Required components:

- Suitable CODESYS version
- CODESYS plug-ins
- CODESYS package for the controller
- Firmware (note: check firmware version!)
- Release notes

To program the controller, the persons should be familiar with the CODESYS software.

Moreover, they should be familiar with the following topics:

- Requirements on programming
- Required user-specific standards

7.2 Required documentation

In addition to the CODESYS programming system, the following documents are required for programming and set-up of the device:

- CODESYS V3.5 programming manual

The manuals can be downloaded from the internet:
www.ifm.com

CODESYS online help:
www.ifm.com (in the download space with registration)

8 Maintenance, repair and disposal

The unit is maintenance-free.

- ▶ Contact ifm in case of malfunction.
- ▶ Do not open the housing as the unit does not contain any components which can be maintained by the user. The unit must only be repaired by the manufacturer.
- ▶ Clean the device using a dry cloth.
- ▶ Dispose of the unit in accordance with the national environmental regulations.