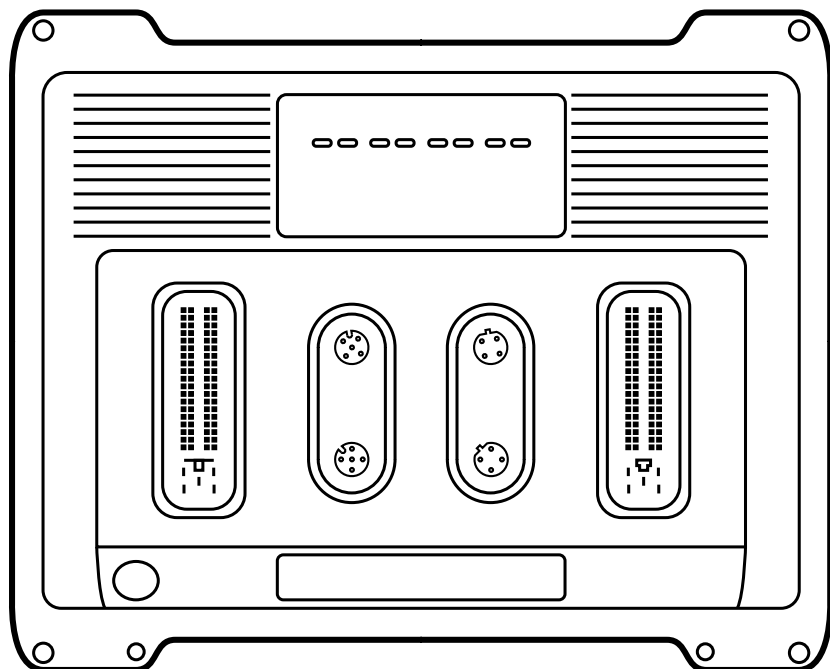


Original operating instructions
ecomatController

CR720S
CR721S

UK

80291607 / 00 02 / 2020



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1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

1.1 Symbols used

▶ Instruction

> 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



WARNING!

Warning of serious personal injury.

Death or serious irreversible injuries may result.



CAUTION!

Warning of personal injury.

Slight reversible injuries may result.

ATTENTION!

Warning of damage to property

2 Safety instructions

- The device 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 (→ 3 Functions and features).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- In case of malfunctions, please contact the manufacturer. Tampering with the unit is not allowed.
- 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.

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.

3 Functions and features

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.

- Safety controller for mobile machinery applications.
- Two separately programmable controllers:
 - safety PLC for safety-related applications
 - standard PLC for standard applications
 - CODESYS V3.5 programming system (in a version approved by ifm) for both controllers. The safe controller requires a safety SIL2 extension for CODESYS.
- For applications operating according to the normally closed principle, for which the safety functions can be implemented, the following applies: safe state = power-free state (power-free output, switched off).
- For a suitable time interval for the execution of the self-test of the controller, refer to the safety concept or the applicable product standards of the application. If no value can be determined, it is recommended to restart the device after 7 days at the latest (see programming manual, chapter Safety concept).
- For the supply of the controller (on-board system, PELV power supply): (→ 6 Electrical connection)
- Multifunctional inputs and outputs the 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 (depending on the required input and/or output type) be connected either as single or dual channel and be used as a safe device.
- Connection of sensors or actuators via CAN interfaces. Connection to other controllers via CAN. Implementation of a safe communication via CANopen safety.

- Use the device only within the limits of the technical data (→ 8 Technical data).
- Mounting location: (→ 5.1 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 CR720S and CR721S of the "ecomatController" series. The devices differ in the following features:

Feature	CR720S	CR721S
Number of inputs	60	68
Number of outputs	38	56
Number of output groups	4 (supplied via VBB _{0...3})	6 (supplied via VBB _{0...5})

3.2 Predictive incorrect use:

- Continuous operation 24/7 has not been taken into consideration for the safety-related applications.
- No use in safe applications for which the safe state is not the power-free state.
- Do not carry out safety functions on the standard PLC.
- Installation on the motor/engine is not permitted.
- No use in an environment with ionising radiation.

4 Items supplied

1 ecomatController CR72xS

1 screw for the shield connection

4 protective covers

1 original operating instructions CR72xS, ident no. 80291607

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) → 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.

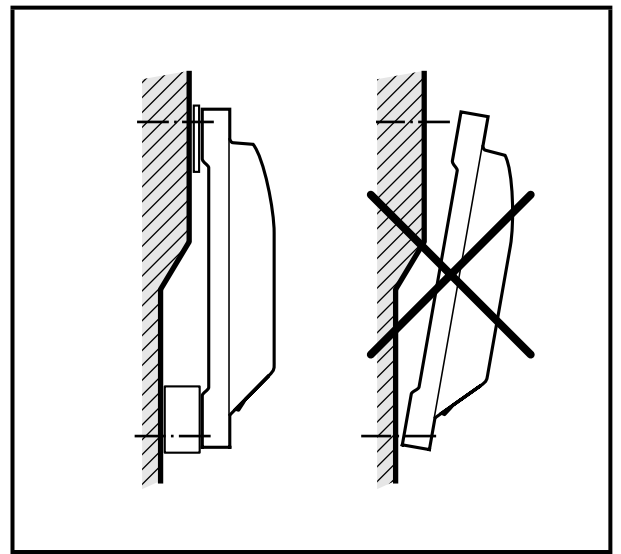
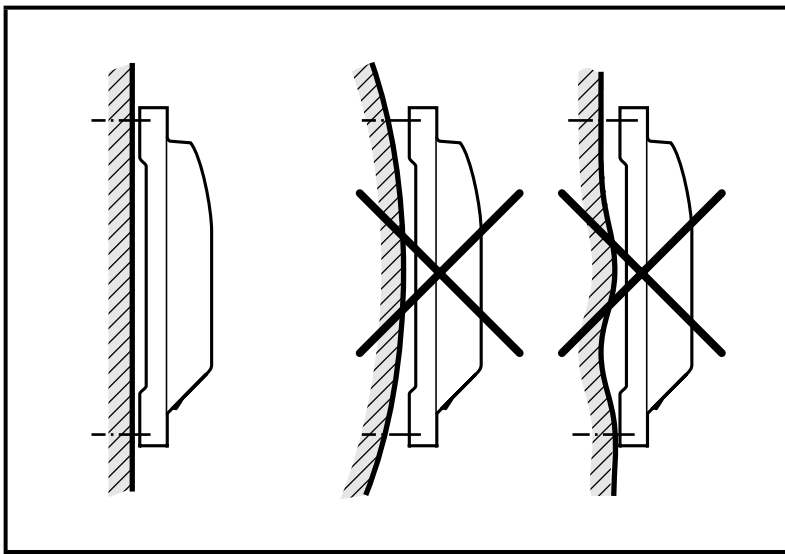
For non-mobile applications, the applicable directives are to be adhered to, taking **UK** into account the specified environmental conditions.

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.



Mounting surface

- ▶ During installation, 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.

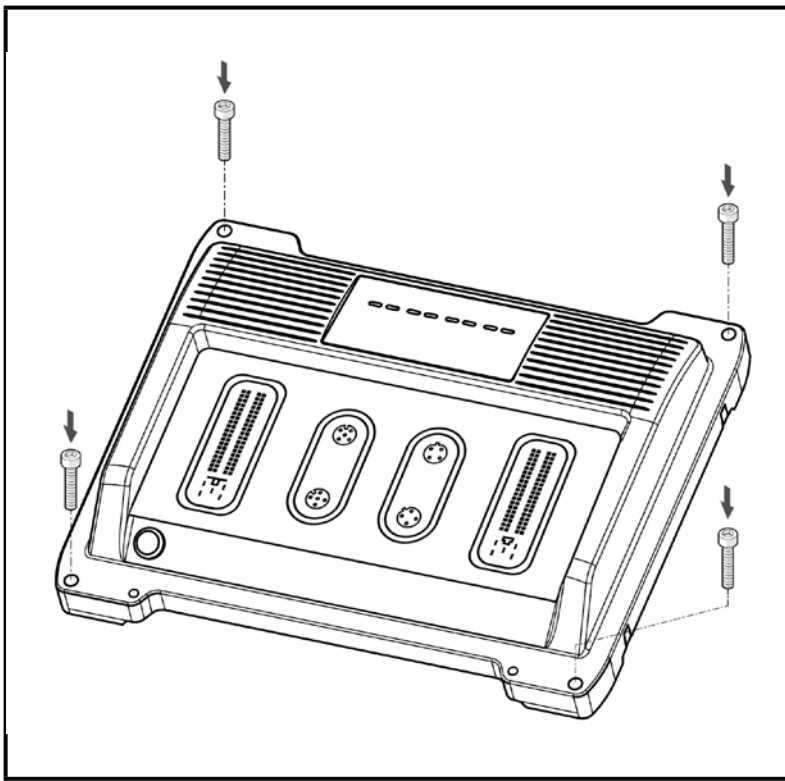
5.4 Installation position

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

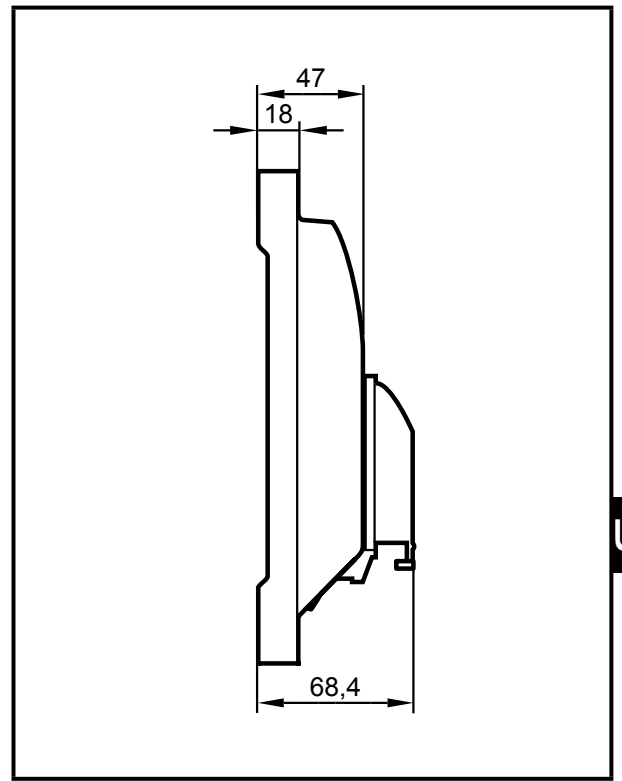
The installation position is defined by the 90° angled cable entry. The cable entries must be oriented vertically downwards to prevent moisture ingress. If this is not possible then an orientation between horizontal and vertically down is allowed.

5.5 Fastening

- ▶ Fix the controller to a flat surface using 4 zinc-plated M6 screws. Tightening torque: 10 \pm 2 Nm



Installation



Total height with the attached connector

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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.



- ▶ Provide all outgoing cables with a strain relief 200 mm behind the cable entry.

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 the standard 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).

The 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 (→ 8 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.
- ▶ Use M12 connectors with gold-plated contacts.
- ▶ The M12 connection parts in the device comply with the ingress resistance requirements of the standard EN 61076-2-101. To adhere to the protection rating, only cables certified to this standard must be used. The system architect undertakes to ensure the ingress resistance of cables they have cut to length.
- ▶ Carry out the fitting according to the indications of the cable manufacturer. The permitted maximum is 10 Nm.
- ▶ During installation, place the M12 connectors vertically so that the coupling nut will not damage the thread.
- ▶ Equip unused sockets with protective caps (included). Tightening torque: 0.8 ± 0.1 Nm
- ▶ 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.

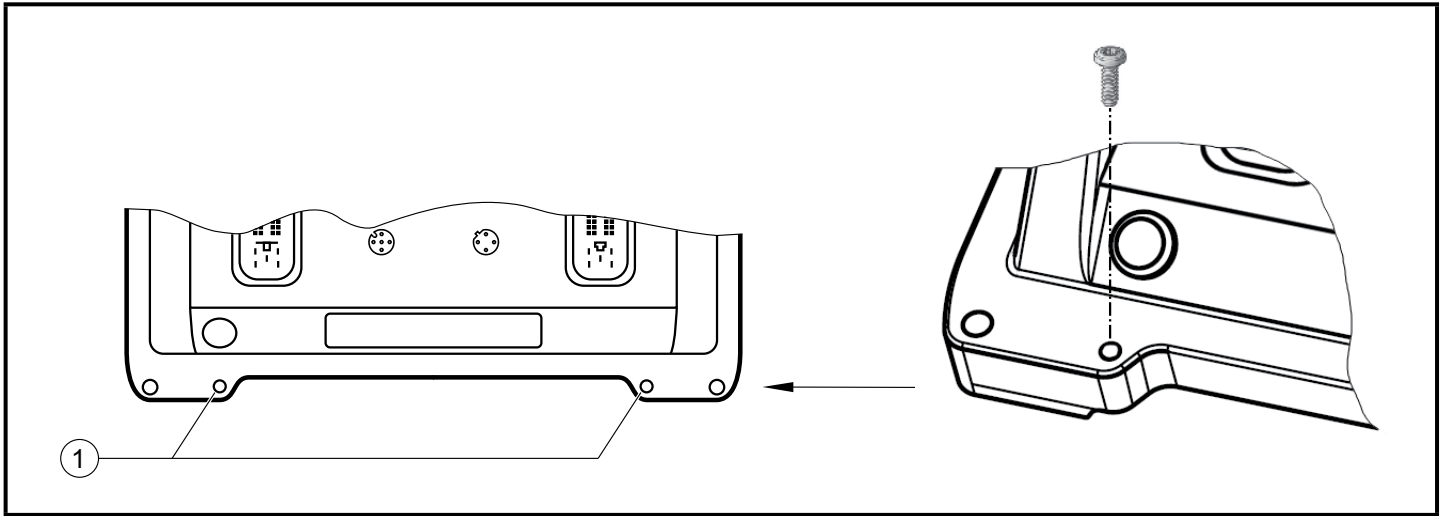
The ingress resistance of cables that users have cut to length must be guaranteed.

- ▶ Use twisted-pair cables for the CAN connection.
 - ▶ For the Ethernet connection, use at least a category 5 cable (Cat 5).
- The RS-232 interface serves only as a service interface (e.g. for firmware updates).

- ▶ Provide all outgoing cables with a strain relief 200 mm behind the cable entry.

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6.3 Shield connection



1: Holes for shield connection



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

Otherwise the safety 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: $3.0 \pm 0,2$ 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.

Connection	Nominal value fuse	Required triggering characteristics
VBB ₁₅	2 A	$T_{\text{fuse}} \leq 120$ s at max. 6.25 A
VBB ₃₀	2 A	$T_{\text{fuse}} \leq 120$ s at max. 6.25 A
VBB ₀	15 A	-
VBB ₁	≤ 15 A	-
VBB ₂	≤ 15 A	-

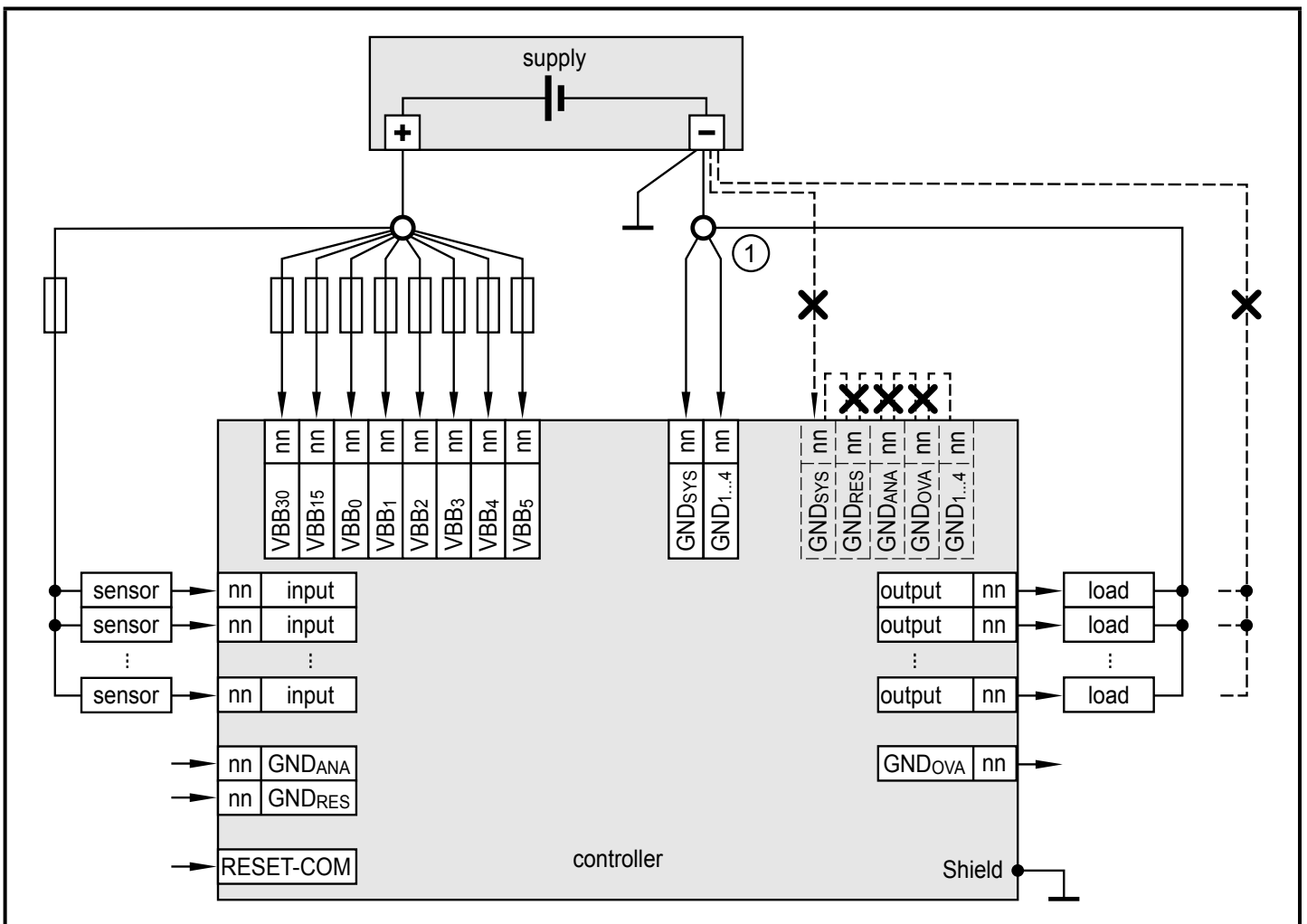
Connection	Nominal value fuse	Required triggering characteristics
VBB ₃	≤ 15 A	-
VBB ₄ (only with CR721S)	≤ 15 A	-
VBB ₅ (only with CR721S)	≤ 15 A	-
Inputs / input groups	2 A	T _{fuse} ≤ 120 s at max. 6.25 A



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

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6.5 Laying of the supply and signal cables



Connection of the supply and signal cables (X = not permitted), example CR721S
 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.



WARNING!

Faulty laying of the supply and signal cables

- > Deterioration of the safety function and EMC
- ▶ Basically lay all supply and signal cables separately.
- ▶ 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 safety function
- ▶ Always connect VBB_0 .

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 $GND_{1...4}$ 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!

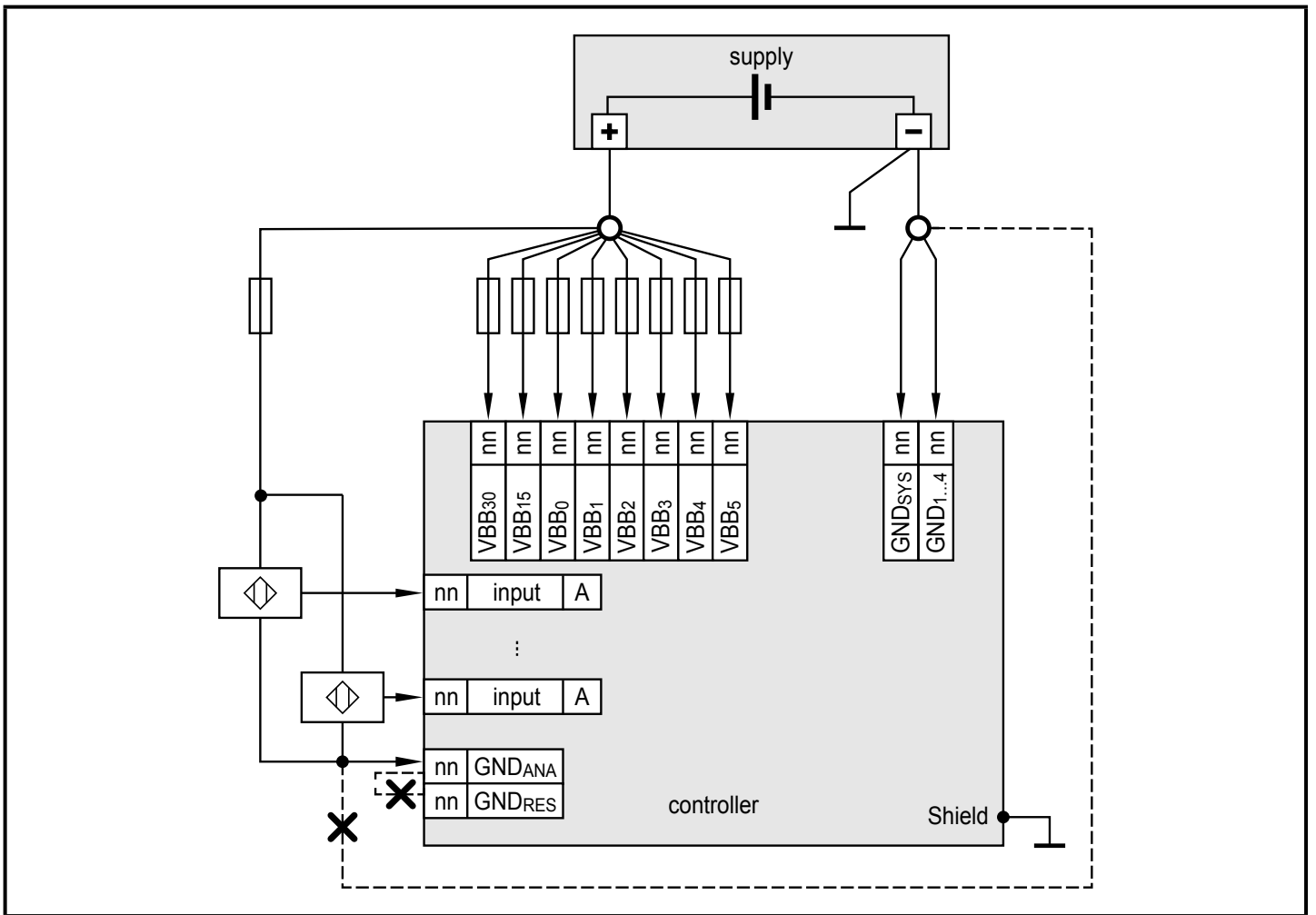
Wrong connection of the GND connections

- > Loss of the safety 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

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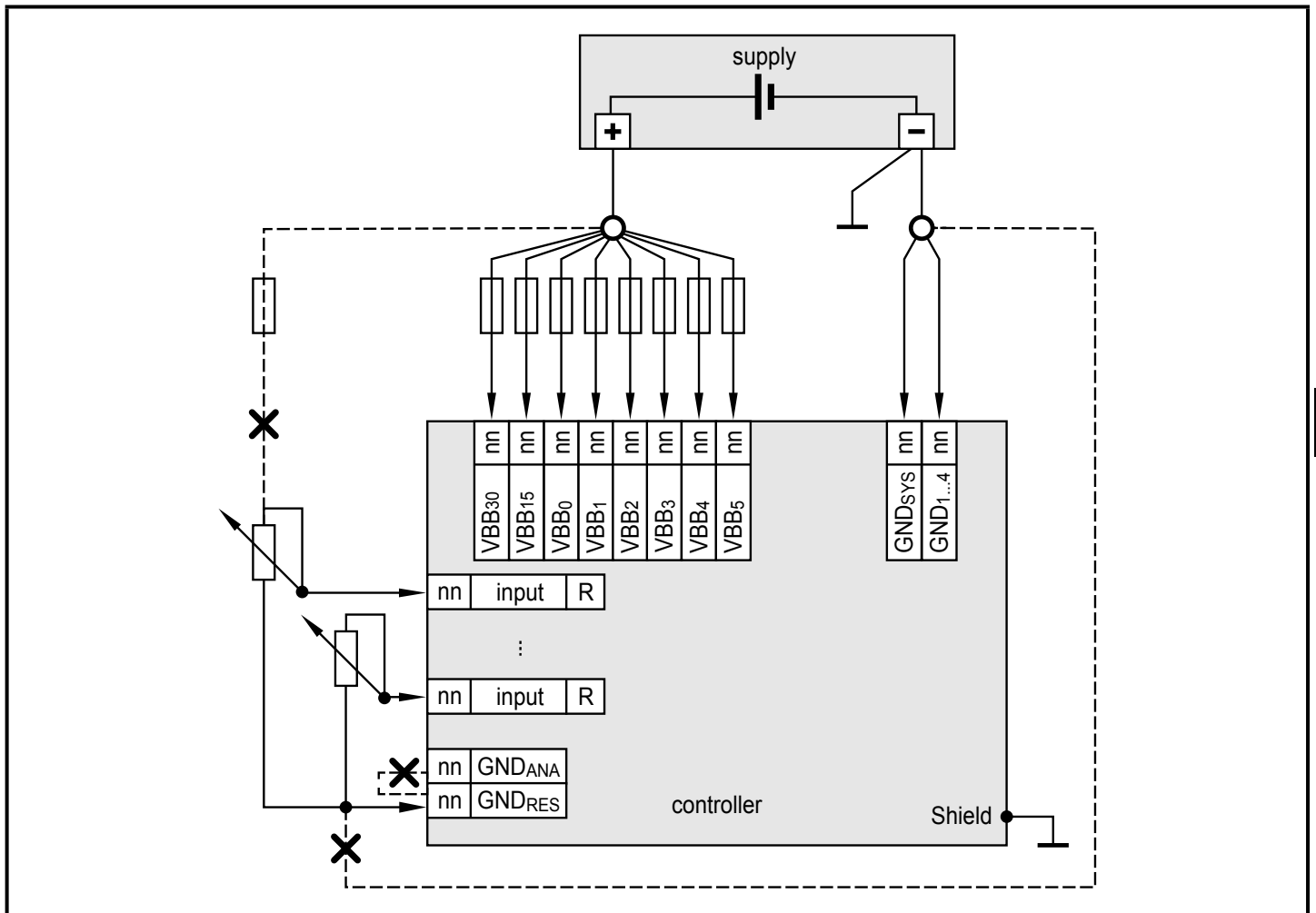
Abbreviation	Input / output type
A	analogue
B_H	binary high side (CSO)
B_L	binary low side (CSI)
$FRQ_{L/H}$	frequency/pulse inputs configurable low side (CSI) / high side (CSO)
PWM_H	pulse width modulation high side (CSO)
PWM_L	pulse width modulation low side (CSI)
PWM_I	pulse width modulation current-controlled
R	resistor input
$VBB_{0...5}$	supply output group
VBB_{30}	supply controller



Connection of the analogue inputs (A), example CR721S

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

6.7 Resistor inputs

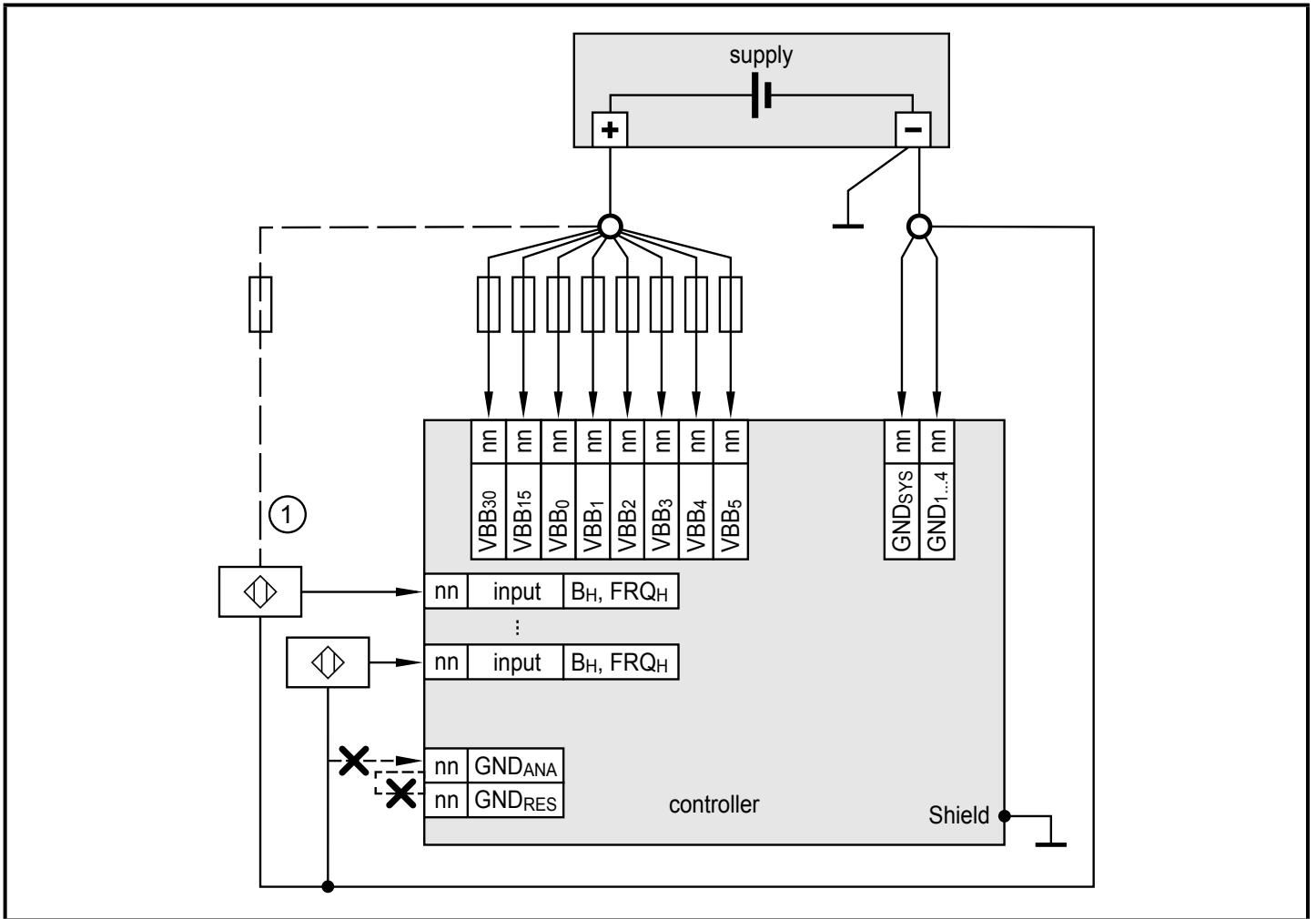


Connection of the resistor inputs (R), example CR721S

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

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6.8 High-side digital inputs (CSO)

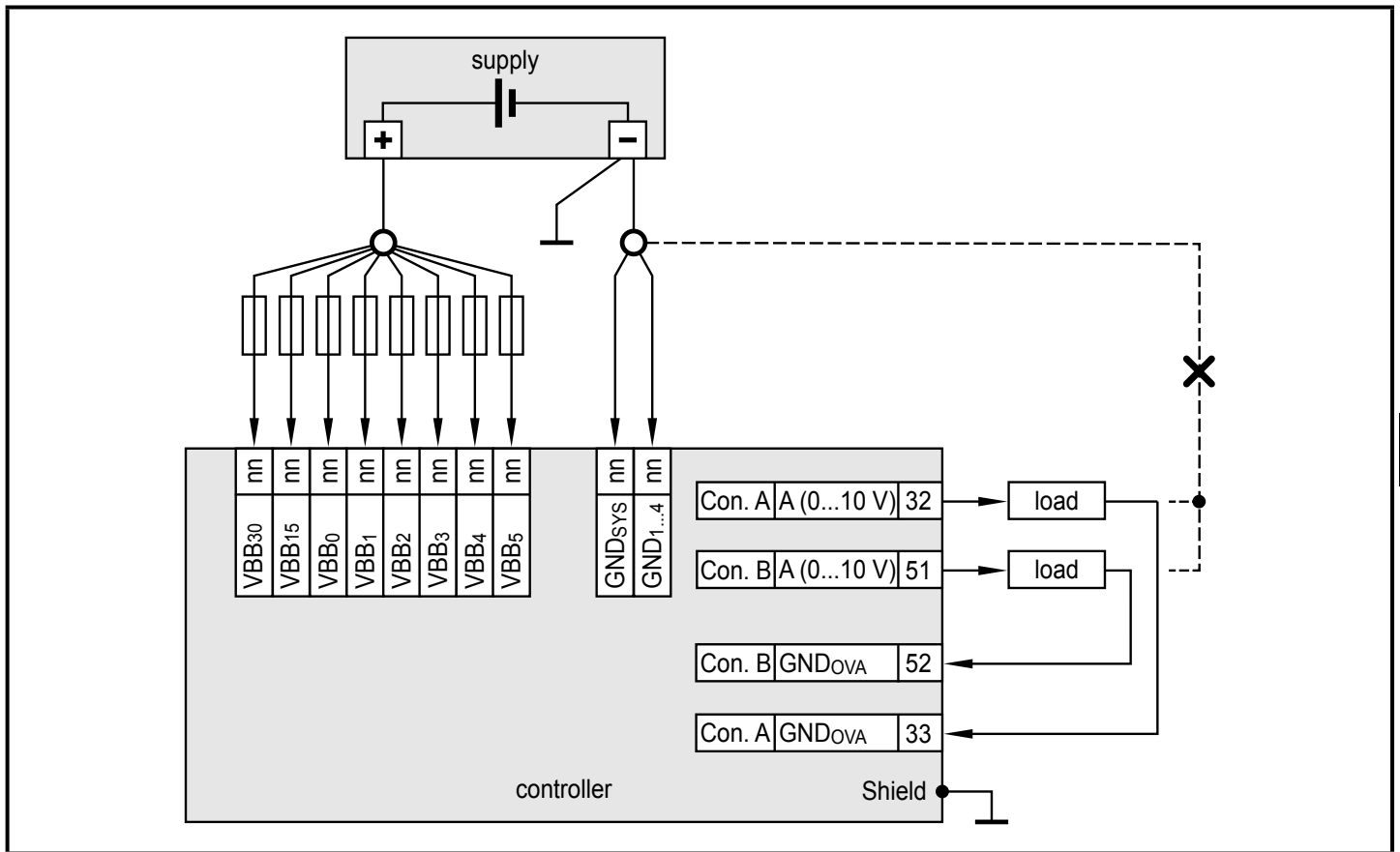


Connection of the high-side inputs (B_H , FRQ_H), example CR721S

1: Connection for 3-wire sensors

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

6.9 Analogue outputs



Connection of the analogue outputs (A), example CR721S

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 (→ 8 Technical data).

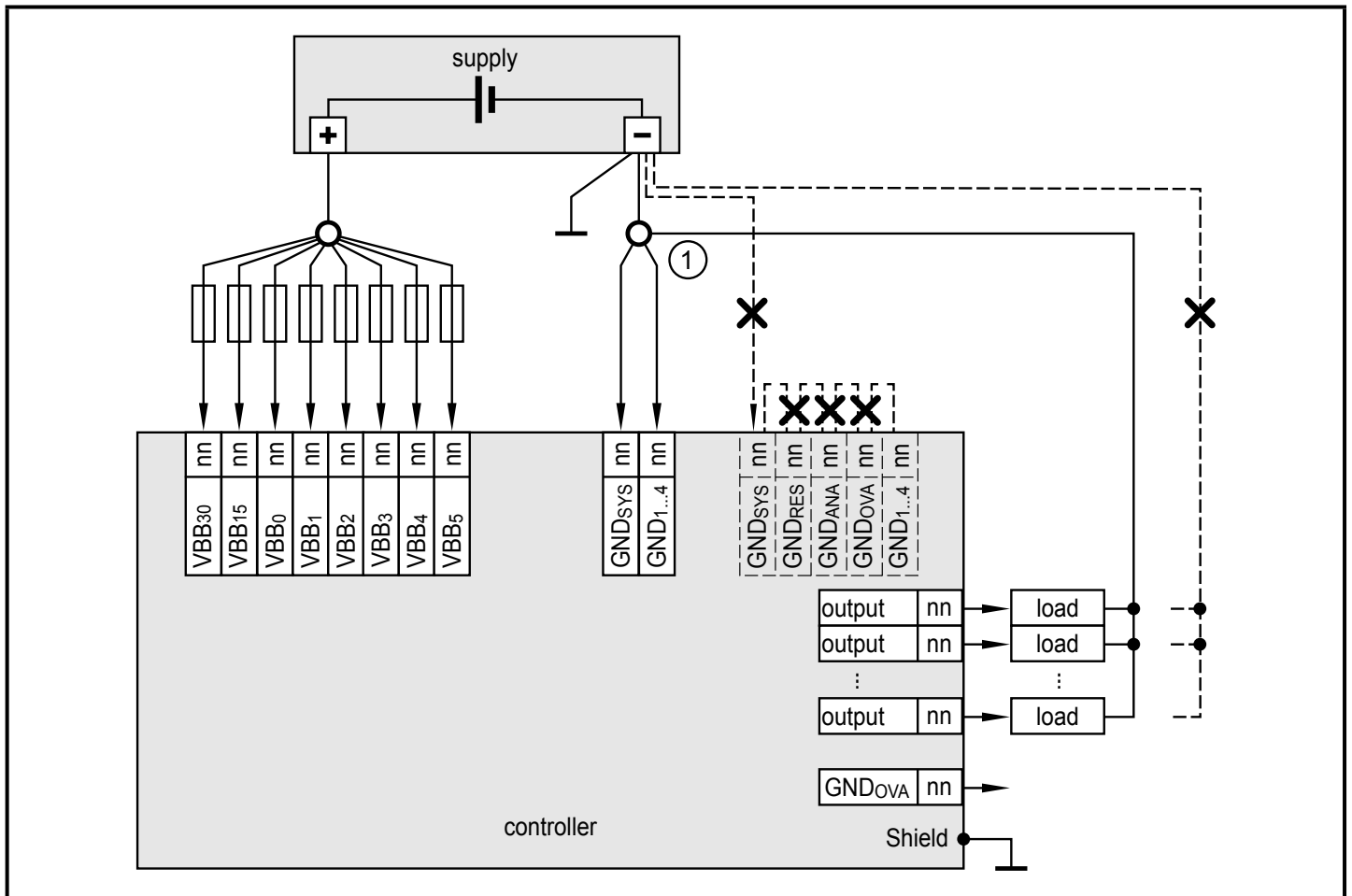
► Connect the GND of the load to GND_{OVA}.

Do not connect the 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



Connection of the high-side digital outputs (PWM_H , B_H), example CR721S

1: GND star point



WARNING!

- Interruption of all GND power supply connections and simultaneously
- loads at the outputs connected to GND

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 the safety 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:

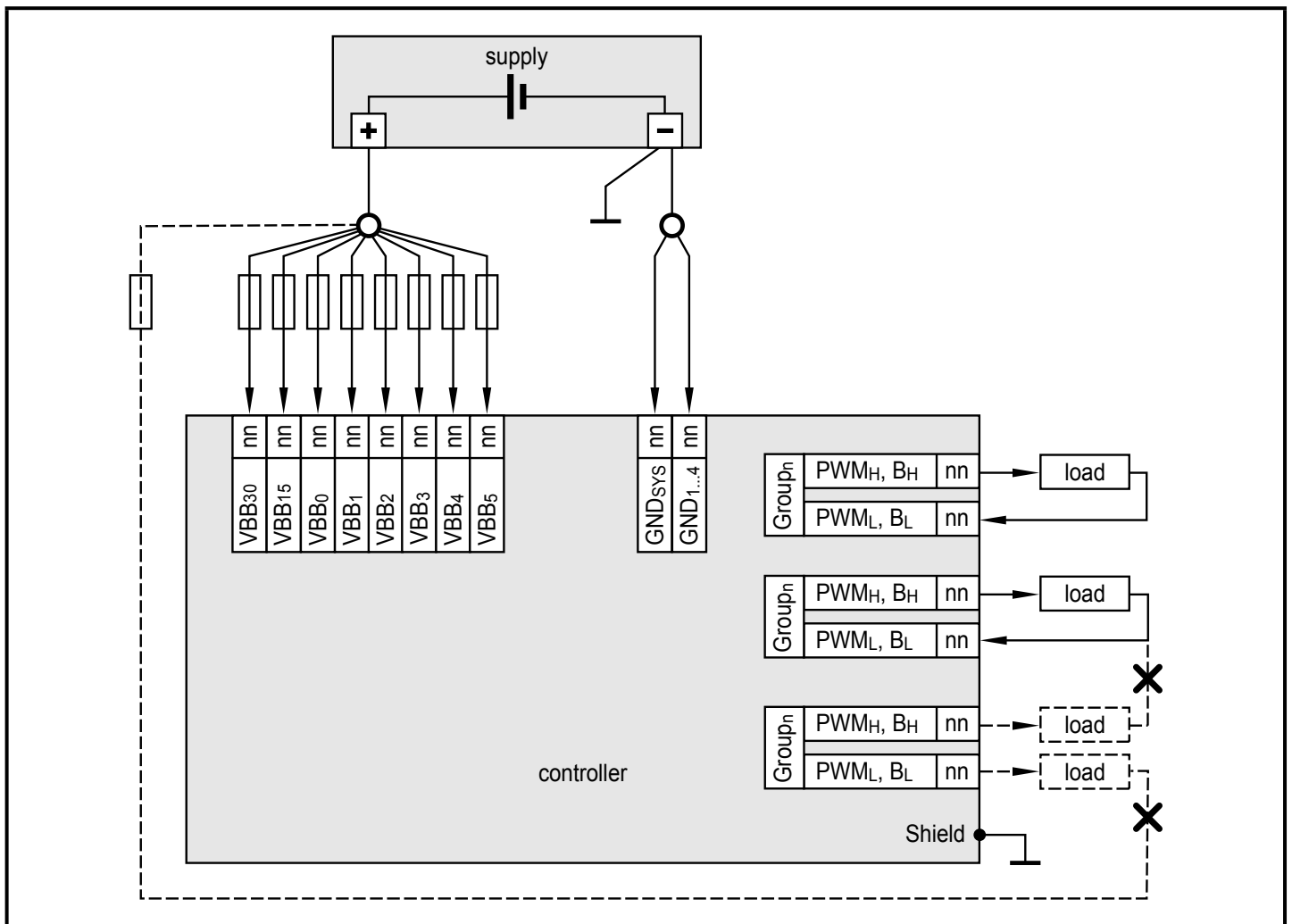
- resistive loads
- capacitive loads (adapt diagnostic settings to the load, see programming manual)
- inductive loads

The connected load must not exceed the maximum permissible values of the respective output (→ 8 Technical data).



Deviating connections are not permitted.

6.11 Digital / PWM outputs, H-bridge



Connection of the low-side digital outputs (PWL, BL), example CR721S

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 (→ 8 Technical data).

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



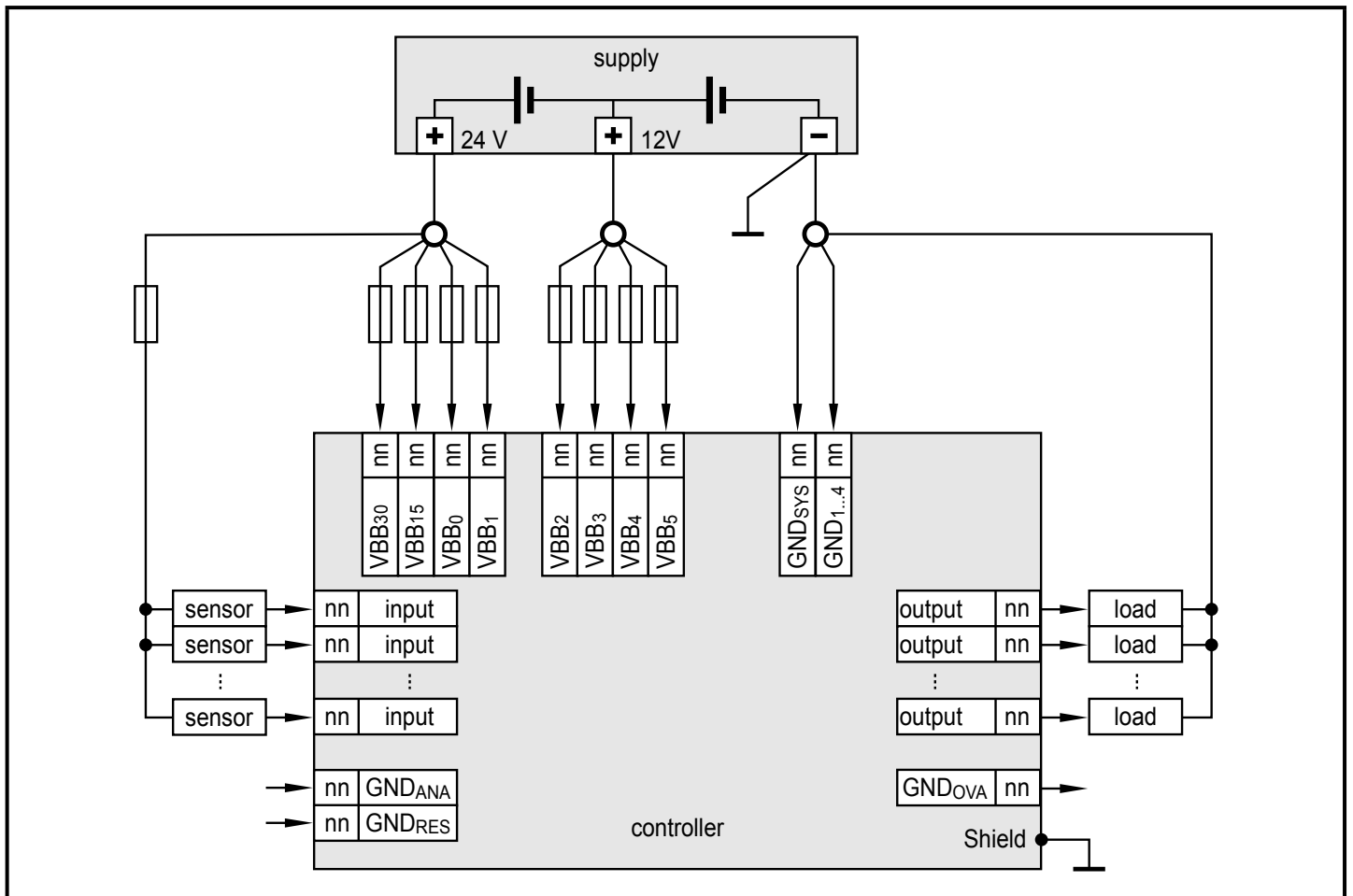
Deviating connections are not permitted.

6.12 Mixed operation (12 V / 24 V)



In case of supply via PELV, mixed operation is not permitted.

Mixed operation is only permitted in case of supply via the on-board system.



Example connection to 24 V and 12 V power supply combined, example CR721S

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

- ▶ VBB_0 , VBB_{30} and VBB_{15} must be connected to the common star point.

7 Set-up

7.1 Interfaces and system requirements



The users are responsible for the safe 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.

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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 people should be familiar with the CODESYS software and the CODESYS Safety SIL2 extension.

The people should also have knowledge of the following topics:

- requirements on safety-related 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 Technical data

8.1 CR720S

8.1.1 Mechanical and electric data

CR720S

ecomatController/98

IEC 61508:2010 SIL 2
IEC 62061:2005 + A1:2012 +
A2:2015 SIL CL 2
if used as safety controller

Suited for requirements up to:
PL d (ISO 13849-1:2015)
AgPL d (ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

98 inputs/outputs

4 CAN interfaces

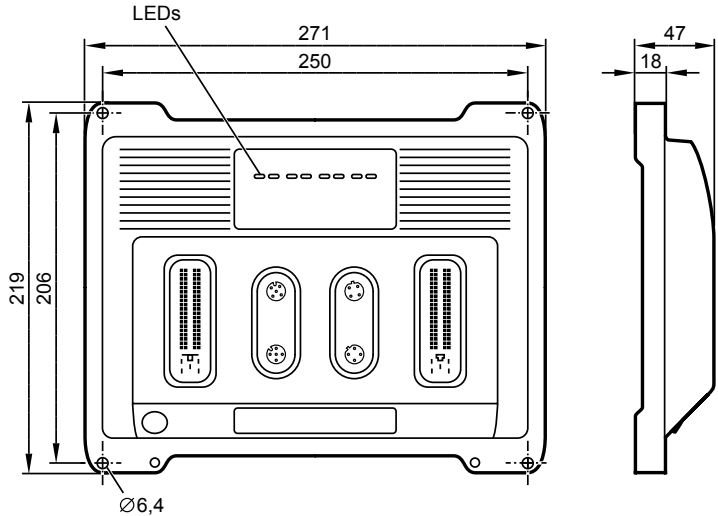
Ethernet interface

CODESYS 3.5

8...32 V DC

CE

E1



Technical data

Mechanical data

Housing

Dimensions (H x W x D)

Installation

Connection

Weight

Housing/storage temperature

Max. perm. relative humidity

Height above sea level

Polution degree

Protection rating

Electrical data

Input/output channels, total

Inputs

Controller as a black-box system

for the implementation of a central or decentralised system design

closed, screened metal housing with screw fixing

219 x 271 x 47 mm

fixing with 4 M6 screws

2 x connector 81 poles, locked, mechanical reverse polarity and reversal protection
type Tyco / AMP

contacts AMP-Junior-Timer, crimp connection 0.5/0.75/2.5 mm²

2 x M12 connector 4 poles, D-coded

2 x M12 connector 5 poles, A-coded

shield connection Ø 4 mm for self-tapping screw

1.6 kg

-40...85 °C / -40...85 °C

90 % (not condensing)

max. 3000 m

2

IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted
M12 connectors/sealing caps)

98 (60 inputs / 38 outputs)

configurable, with diagnostic capability
24 x A (0...10/32 V, 0...20 mA, ratiometric) / B_L

16 x FRQ_{L/H} (≤ 30 kHz) / B_{L/H}

4 x R (0.016...30 kOhm) / B_L

8 x B_L (impedance ≤ 10 kOhm)

8 x B_L (impedance ≤ 3.2 kOhm)

CR720S	Technical data
Outputs	configurable, with diagnostic capability 8 x PWM _{H/L} / PWM _I / B _{H/L} (20...2000 Hz, 4.0 A, H-bridge) 4 x PWM _H / PWM _I / B _H (20...2000 Hz, 4.0 A) 12 x PWM _H / PWM _I / B _H (20...2000 Hz, 2.5 A) 12 x PWM _H / B _H 2.5 A 2 x A (0...10 V)
Sensor supply	1 x 0/5/10 V, max. 2 W configurable
Operating voltage Overvoltage	8...32 V DC 36 V for t ≤ 10 s
Reverse polarity protection	yes, in case of supply via the on-board system (battery)
Power consumption VBB ₃₀	8 W
CAN interfaces 0...3 Baud rate Communication profile	CAN interface 2.0 A/B, ISO 11898 20 kbit/s...1 Mbit/s (default 250 kbit/s) CANopen, CiA DS 301 V4.2, CiA DS 401 V1.4 / SAE J 1939 / free protocol CANopen Safety for safe data transmission
Serial interface Baud rate Topology	RS-232 9.6...115.2 kbit/s (default 115.2 kbit/s) point-to-point (max. 2 participants); master-slave connection
Ethernet interface Transmission rate Protocols	1 interface with integrated switch and 2 ports 10/100 Mbit/s TCP/IP, UDP/IP, Modbus UDP
Processor	32-bit TriCore CPU Infineon AURIX™
Device monitoring	overvoltage and undervoltage monitoring watchdog function (extended safety monitoring to IEC 62061 and ISO 13849) checksum test for program and system excess temperature monitoring
Process monitoring concept	second switch-off way per output group via semiconductor switch
Physical memory	flash: 9 Mbytes RAM: 2.7 Mbytes non-volatile memory: 10 kBytes
Memory allocation	Memory can be allocated for safe and non-safe applications see programming manual www.ifm.com
Software/programming	
Programming system	CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)
Light indicators	
Status LED	2 x two-colour LED (R/G) for SYS0 and SYS1
Ethernet LED	2 x LED (G) for ETH0 and ETH1
Application LED	4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

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Operating states system

LED SYS0		LED SYS1		System state
Colour	State	Colour	State	
–	off	–	off	no operating voltage
green	5 Hz	–	off	no operating system loaded
red	on	–	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green/ yellow	2 Hz	green/ yellow	2 Hz	update

Operating states PLC / application

LED	Co- lour	State	Description	
SYS0	green	on	standard PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	safety PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transmission	
ETH1	green	flashing	data transmission Ethernet	
		on	Ethernet connection ok, no data transmission	
APP0	red	on	status display of the application, freely program- mable	
... APP3	green	on	status display of the application, freely program- mable	
	blue	on	status display of the application, freely program- mable	

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2
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Component	PFH _o [1/h]
Input, external, single channel	< 4.0 x 10 ⁻⁹
Input, external, dual channel	< 5.0 x 10 ⁻¹⁰
Logic	< 1.0 x 10 ⁻⁷
Output, external, single channel	< 2.0 x 10 ⁻⁸
Output, external, dual channel	< 1.0 x 10 ⁻⁹

Lifetime: 20 years

Other characteristic values: see SISTEMA library at ifm.com for download

8.1.2 Test standards and regulations

CR720S	Technical data	
Test standards and regulations		
CE marking	EN IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC) Immunity
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 marking	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55 °C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40 °C / 93 % RH Test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508 parts 1-7	Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, only one chemical permitted at a time

UK

8.1.3 ST A and ST B / input characteristics

CR720S

ST A: **ST B:**
IN0100...0103 **IN1100...1103**
IN0200...0203 **IN1600...1603**
IN0600...0603
IN0700...0703

Multifunction inputs analogue / digital (IN MULTIFUNCTION-A)

Current input 0 ... 20 mA (A)

Voltage input 0...10 V (A)

Voltage input 0...32 V (A)

Voltage input ratiometric (A)

Digital input (B_L)
(default)

ST A: **ST B:**
IN0000...0003 **IN1000...1003**
IN0500...0503 **IN1500...1503**

Digital inputs, frequency measurement (IN FREQUENCY-B)

Frequency input (FRQ_{L/H})

ST A and ST B / input characteristics

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1 % FS

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1 % FS

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1 % FS

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Range diagnostics min./max.	1 V / 0.95 VBB ₃₀ (default)
Accuracy	± 1 % FS

Resolution	12 bits
------------	---------

Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Accuracy	± 10 μs

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 k Ω
Input frequency	< 330 Hz
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

ST A:

IN0400...0401
IN0900...0901

Digital / resistor inputs
(IN RESISTOR-B)

Digital input (B_L)
(default)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break

Input resistance	3.2 k Ω
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016...30 k Ω
Accuracy	± 2 % FS: 0.016...3 k Ω ± 5 % FS: 3...15 k Ω ± 10 % FS: 15...30 k Ω
Range diagnostics min./max.	0 Ω / 31 k Ω (default)

ST B:

IN1200... 1203
IN1700... 1703

Digital inputs
(IN DIGITAL-A)

Digital input (B_L)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 10 k Ω
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break

Input resistance	10 k Ω
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

ST A: **ST B:**
IN0300... 0301 **IN1300... 1303**
IN0800... 0801

**Digital inputs 2-wire sensor
(IN DIGITAL-B)**

Digital input (B_L)

RESET-COM

Abbreviations

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 3.2 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Input resistance	3.2 kΩ
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Accuracy B _L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB ₃₀ (default)

Switch-on level	> 0,7 VBB ₃₀
Switch-off level	< 0,3 VBB ₃₀
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs!
(programming manual "ecomatController CR720S")

- 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)
- PWM_I pulse width modulation current-controlled
- R resistor input
- VBB_{0..3} supply output group
- VBB₃₀ supply controller

8.1.4 ST A and ST B / output characteristics

CR720S

ST A: ST B:
 OUT0006...0007 OUT0306...0307
 OUT0106...0107
 OUT0206...0207

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Digital output (B_H)
 (default)

Digital output (B_L)

PWM output (PWM_H)

PWM output (PWM_L)

Current-controlled output (PWM_I)

ST A and ST B / output characteristics

Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to the programming manual detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Functions	as H-bridge
-----------	-------------

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	$\geq 3 \Omega$ (at 12 V DC) $\geq 6 \Omega$ (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

UK

CR720S**ST A and ST B / output characteristics**

ST A: **ST B:**
OUT0008 **OUT0308**
OUT0108
OUT0208
Digital / PWM outputs 4.0 A
(OUT PWM-40-A)

Digital output (B_{Hi})
(default)

PWM output (PWM_{Hi})

Current-controlled output (PWM_{Li})

ST A: **ST B:**
OUT0000 **OUT0300**
OUT0002 **OUT0302**
OUT0004 **OUT0304**
OUT0100
OUT0102
OUT0104
OUT0200
OUT0202
OUT0204
Digital / PWM outputs 2.5 A
(OUT PWM-25-A)

Digital output (B_{Hi})
(default)

PWM output (PWM_{Hi})

Switching voltage	8...32 V DC
Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 4 A (default)
-----------------------------	---------------------

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	$\geq 3 \Omega$ / (at 12 V DC) $\geq 6 \Omega$ / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 2.5 A (default)
-----------------------------	-----------------------

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

Current-controlled output (PWM_i)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2.5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω / (at 12 V DC) ≥ 9.6 Ω / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:
OUT0001
OUT0003
OUT0005
OUT0101
OUT0103
OUT0105
OUT0201
OUT0203
OUT0205

ST B:
OUT0301
OUT0303
OUT0305

Digital outputs 2.5 A
(OUT PWM-25-B)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Digital output (B_{ii})
 (default)

Range diagnostics min./max.	0 A / 2.5 A (default)
-----------------------------	-----------------------

PWM output (PWM_{ii})

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:
OUT3000
Sensor supply
(OUT SUPPLY-A)

For sensors and joysticks
 0 V / 5 V, 400 mA / 10 V, 200 mA, accuracy ± 5 %
 Minimum current 10 mA
 Short-circuit proof and overload protected

UK

ST A: **ST B:**
OUT3001 **OUT3002**
Analogue outputs
(OUT VOLTAGE-A)

Output groups VBB_{0...3}

Load current per output group

Internal semiconductor switches

Short-circuit strength to GND

Abbreviations

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	± 5 % FS
Step response time 10...90 %	< 1.8 ms

≤ 12 A

One switch in series of 9 semiconductor outputs each
 Forced controlling by means of hardware
 and additional controlling by means of user program

Switching current	0.1...12 A
Current diagnostics (excessive current)	> 12 A

Outputs are switched off via the output driver

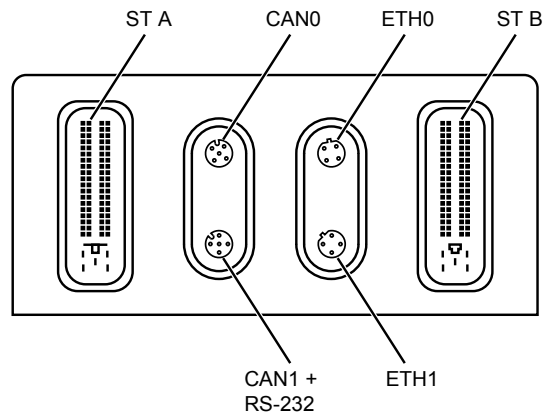
- A analogue
- B_H binary high side (CSO)
- B_L binary low side (CSI)
- PWM_H pulse-width modulation high side (CSO)
- PWM_L pulse-width modulation low side (CSI)
- PWM_I pulse-width modulation current-controlled
- VBB_{0...3} supply output group
- VBB₃₀ supply controller

8.1.5 Connectors

CR720S

Technical data

Connectors



CAN0

M12 socket, 5 poles, A-coded

- 1: not used
- 2: not used
- 3: GND_COM
- 4: CAN0_H
- 5: CAN0_L



CAN1 + RS-232

M12 socket, 5 poles, A-coded

- 1: RS-232_TxD
- 2: RS-232_RxD
- 3: GND_COM
- 4: CAN1_H
- 5: CAN1_L



ETH0 / ETH1

M12 socket, 4 poles, D-coded

- 1: TxD+
- 2: RxD+
- 3: TxD-
- 4: RxD-



ST A

AMP, 81 poles, A-coded

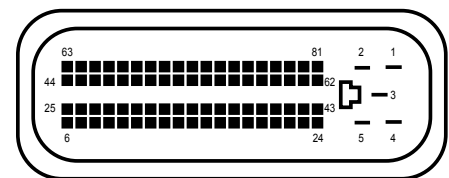
- 1-81: see wiring
- ST A



ST B

AMP, 81 poles, B-coded

- 1-81: see wiring
- ST B



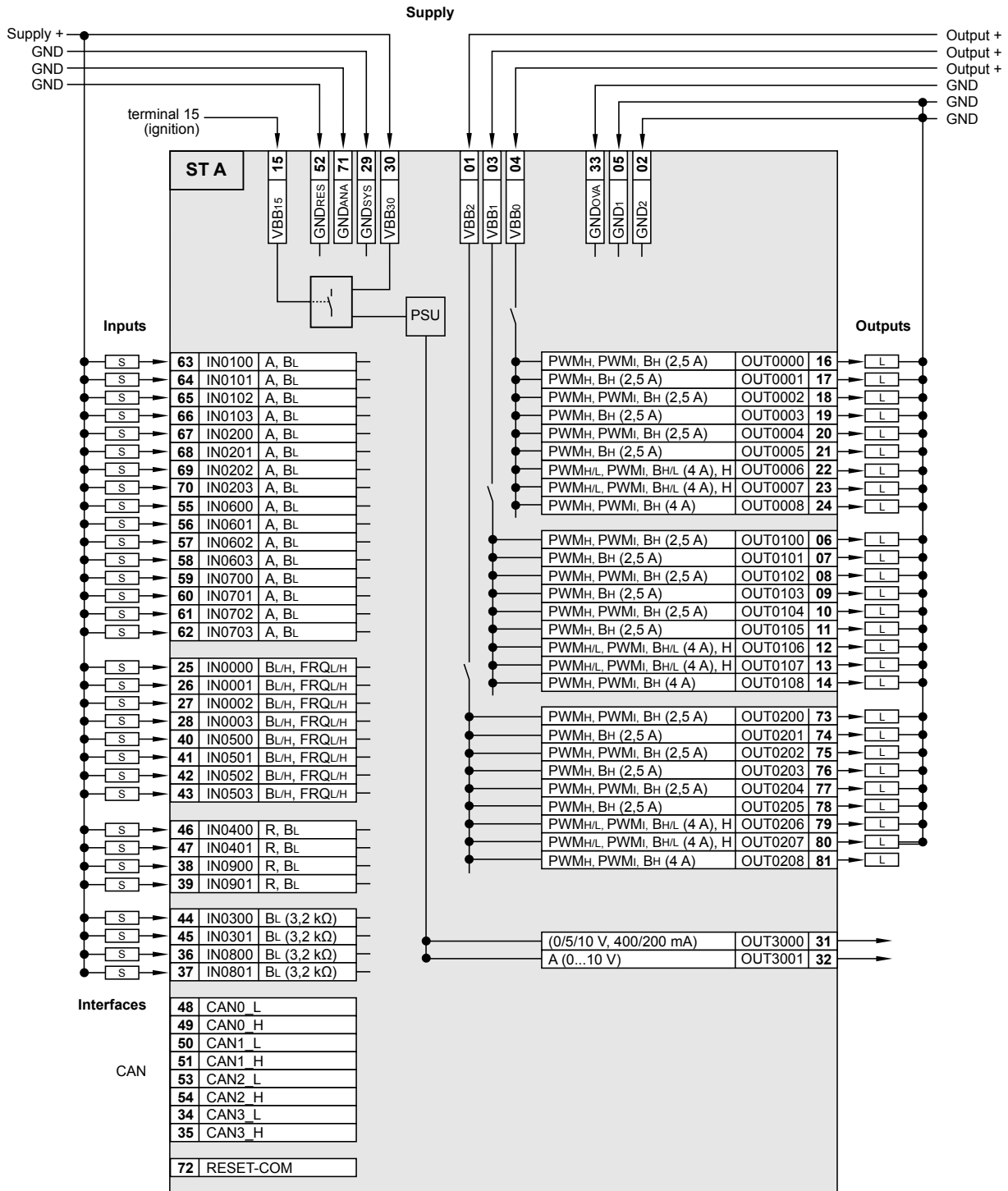
8.1.6 ST A / wiring

CR720S

Technical data

Wiring

ST A



Abbreviations

- 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)
- H H-bridge function
- PSU power supply for the system
- PWM_H pulse-width modulation high side (CSO)
- PWM_L pulse-width modulation low side (CSI)
- PWM_I pulse-width modulation current-controlled
- R resistor input
- VBB_{0...3} supply output group
- VBB₃₀ supply controller

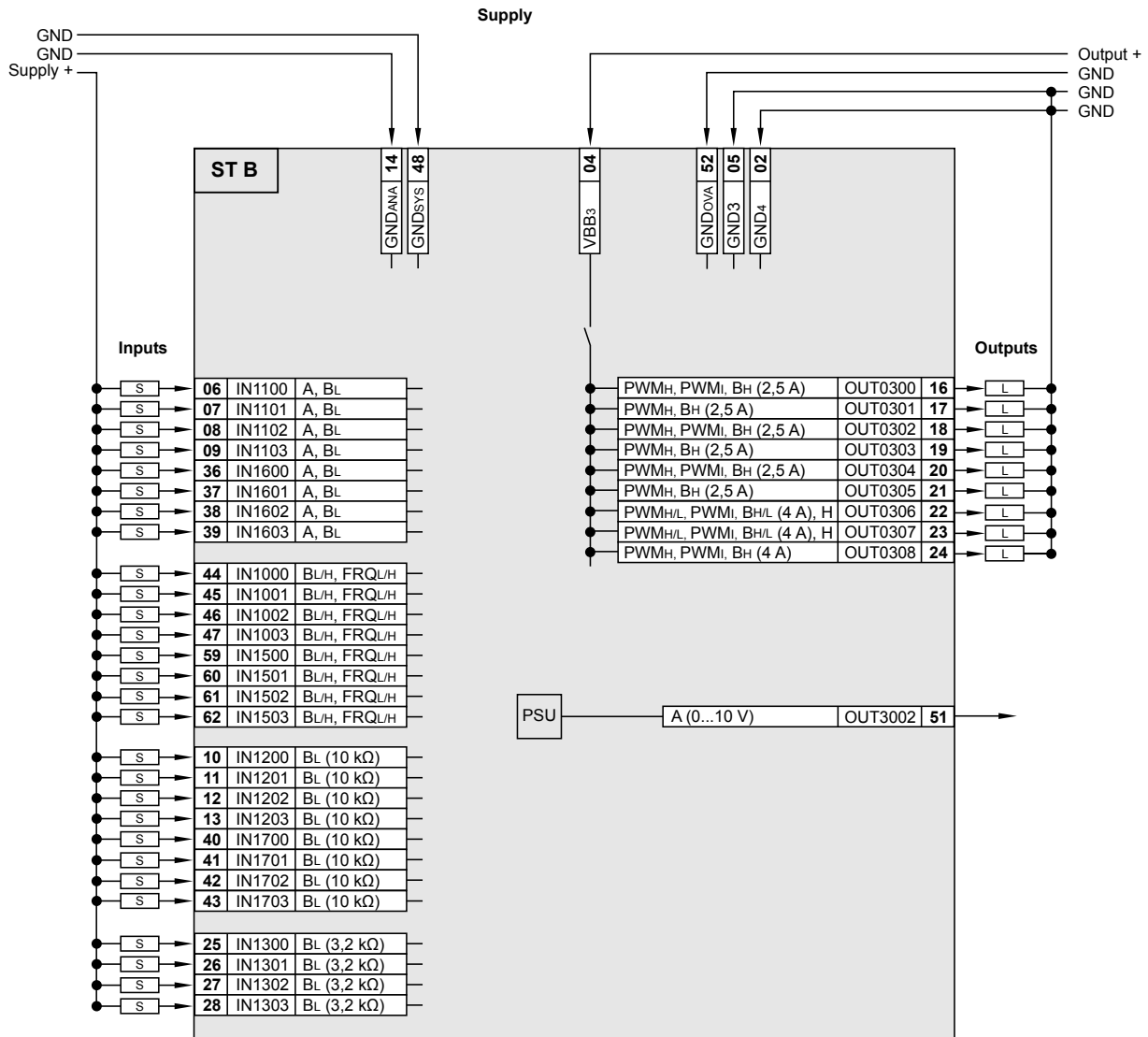
8.1.7 ST B / wiring

CR720S

Technical data

Wiring

ST B



Abbreviations

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)
H	H-bridge function
PSU	power supply for the system
PWM _H	pulse-width modulation high side (CSO)
PWM _L	pulse-width modulation low side (CSI)
PWM _I	pulse-width modulation current-controlled
R	resistor input
VBB _{0...3}	supply output group
VBB ₃₀	supply controller

UK

8.2 CR721S

8.2.1 Mechanical and electric data

CR721S

ecomatController/124

IEC 61508:2010 SIL 2

IEC 62061:2005 + A1:2012 +
A2:2015 SIL CL 2

if used as safety controller

Suited for requirements up to:

PL d (ISO 13849-1:2015)

AgPL d (ISO 25119:2018,
DIN EN 16590:2014)

32-bit CPU TriCore processor

124 inputs/outputs

4 CAN interfaces

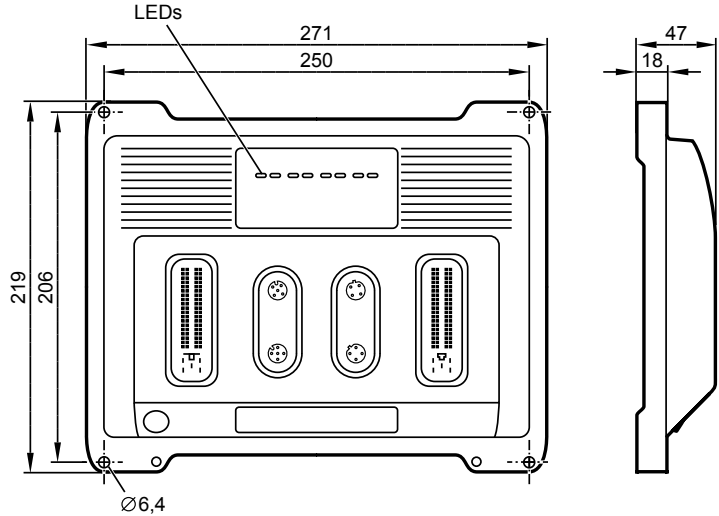
Ethernet interface

CODESYS 3.5

8...32 V DC

CE

E1



Technical data

Mechanical data

Housing

Dimensions (H x W x D)

Installation

Connection

Weight

Housing/storage temperature

Max. perm. relative humidity

Height above sea level

Degree of soiling

Protection rating

Electrical data

Input/output channels, total

Inputs

Controller as black box system

for the implementation of a central or decentralised system design

closed, screened metal housing with screw fixing

219 x 271 x 47 mm

fixing with 4 M6 screws

2 x connector 81 poles, locked, mechanical reverse polarity and reversal protection
type Tyco / AMP

contacts AMP-Junior-Timer, crimp connection 0.5/0.75/2.5 mm²

2 x M12 connector 4 poles, D-coded

2 x M12 connector 5 poles, A-coded

shield connection Ø 4 mm for self-tapping screw

1.6 kg

- 40...85 °C / - 40...85 °C

90 % (not condensing)

max. 3000 m

2

IP 65 / IP 67 (for inserted connectors with individually sealed cores and inserted
M12 connectors/sealing caps)

124 (68 inputs / 56 outputs)

configurable, with diagnostic capability
24 x A (0...10/32 V, 0...20 mA, ratiometric) / BL

16 x FRQ_{LH} (≤ 30 kHz) / BL/H

4 x R (0.016...30 kOhm) / BL

16 x B_L (impedance ≤ 10 kOhm)

8 x B_L (impedance ≤ 3.2 kOhm)

CR721S**Technical data**

Outputs

configurable, with diagnostic capability
 12 x PWM_{H/L} / PWM_I / B_{H/L} (20...2000 Hz, 4.0 A, H-bridge)
 6 x PWM_H / PWM_I / B_H (20...2000 Hz, 4.0 A)
 18 x PWM_H / PWM_I / B_H (20...2000 Hz, 2.5 A)
 18 x PWM_H / B_H 2.5 A
 2 x A (0...10 V)

Sensor supply

1 x 0/5/10 V, max. 2 W configurable

For the number of inputs/outputs and configuration options also see the wiring diagrams

Operating voltage
Overvoltage

8...32 V DC
 36 V for t ≤ 10 s

Reverse polarity protection

yes, in case of supply via the on-board system (battery)

Power consumption VBB₃₀

8 W

CAN interfaces 0...3
Baud rate
Communication profile

CAN interface 2.0 A/B, ISO 11898
 20 Kbit/s...1 Mbit/s (default 250 Kbit/s)
 CANopen, CiA DS 301 V4.2, CiA DS 401 V 1.4 /
 SAE J 1939 / free protocol
 CANopen Safety for safe data transmission

Serial interface
Baud rate
Topology

RS-232
 9.6...115.2 Kbit/s (default 115.2 Kbit/s)
 point-to-point (max. 2 participants); master-slave connection

Ethernet interface
Transmission rate
Protocols

1 interface with integrated switch and 2 ports
 10/100 Mbit/s
 TCP/IP, UDP/IP, Modbus UDP

Processor

32-bit TriCore CPU Infineon AURIX™

Device monitoring

overvoltage and undervoltage monitoring
 watchdog function
 (extended safety monitoring according to IEC 62061 und ISO 13849)
 check sum test for program and system
 excess temperature monitoring

Process monitoring concept

second switch-off way per output group via semiconductor switch

Physical memory

flash: 9 Mbytes
 RAM: 2.7 Mbytes
 remanent memory: 10 kBytes

Memory allocation

Memory can be allocated for safe and non-safe applications
 see programming manual
www.ifm.com

Software/programming

Programming system

CODESYS version 3.5 with SIL 2 extension (IEC 61131-3)

Indicators

Status LED

2 x two-colour LED (R/G) for SYS0 and SYS1

Ethernet LED

2 x LED (G) for ETH0 and ETH1

Application LED

4 x three-colour LED (R/G/B) for APP0, APP1, APP2 and APP3, programmable

Operating states system

LED SYS0		LED SYS1		System state
Colour	State	Colour	State	
–	off	–	off	no operating voltage
green	5 Hz	–	off	no operating system loaded
red	on	–	off	hardware error (fatal error+)
red	on	red	on	system error (fatal error)
green/ yellow	2 Hz	green/ yellow	2 Hz	Update

Operating states PLC / application

LED	Co- lour	State	Description	
SYS0	green	on	standard PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
SYS1	green	on	safe PLC	no application
		2 Hz		run
	red	10 Hz		error application (serious error)
	yellow	2 Hz		debug run
		on		debug stop
ETH0	green	flashing	data transmission Ethernet	
		on	Ethernet connection OK, no data transfer	
ETH1	green	flashing	data transmission Ethernet	
		on	Ethernet connection OK, no data transfer	
APP0	red	on	status display of the application, freely program- mable	
... APP3	green	on	status display of the application, freely program- mable	
	blue	on	status display of the application, freely program- mable	

Safety-related characteristics

Safety Integrity Level Claim Limit	SIL CL	2
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Component	PFH ₀ [1/h]
Input, external, single channel	<4.0 x 10 ⁻⁹
Input, external, dual channel	<5.0 x 10 ⁻¹⁰
Logic	<1.0 x 10 ⁻⁷
Output, external, single channel	<2.0 x 10 ⁻⁸
Output, external, dual channel	<1.0 x 10 ⁻⁹

Lifetime: 20 years

Other characteristic values: see SISTEMA library at ifm.com for download

8.2.2 Test standards and regulations

CR721S	Technical data	
Test standards and regulations		
CE marking	EN IEC 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
	EN 61000-6-2	Electromagnetic compatibility (EMC) Immunity
	EN 61000-6-4	Electromagnetic compatibility (EMC) Emission
	EN 61010	Safety requirements for electrical equipment for measurement, control and laboratory use
E1 marking	UN/ECE-R10	Noise emission Noise immunity with 100 V/m
Electrical tests	ISO 7637-2	Pulse 1, severity level: IV; function state C Pulse 2a, severity level: IV; function state A Pulse 2b, severity level: IV; function state C Pulse 3a, severity level: IV; function state A Pulse 3b, severity level: IV; function state A Pulse 4, severity level: IV; function state A Pulse 5, severity level: III; function state A (data valid for the 24 V system) Pulse 4, severity level: III; function state A (data valid for the 12 V system)
Climatic tests	EN 60068-2-30	Damp heat, cyclic Upper temperature 55°C, number of cycles: 6
	EN 60068-2-78	Damp heat, steady state Test temperature 40°C / 93% RH, Test duration: 21 days
	EN 60068-2-52	Salt spray test Severity level 3 (vehicle)
Mechanical tests	ISO 16750-3	Test VII; vibration, random Mounting location: vehicle body
	EN 60068-2-6	Vibration, sinusoidal 10...500 Hz; 0.72 mm/10 g; 10 cycles/axis
	ISO 16750-3	Bump 30 g/6 ms; 24,000 shocks
Safety-related tests	IEC 61508 Parts 1-7	Functional safety of electrical/electronic/programmable electronic safety-related systems
	EN 62061	Safety of machinery - Functional safety of electrical, electronic and programmable safety-related control systems
Chemical resistance	ISO 16750-5	AA, BA, BD, CC, DB, DC, DD, only one chemical permitted at a time

UK

8.2.3 ST A and ST B / input characteristics

CR721S

ST A: **ST B:**
IN0100...0103 **IN1100...1103**
IN0200...0203 **IN1600...1603**
IN0600...0603
IN0700...0703

Multifunction inputs analogue / digital (IN MULTIFUNCTION-A)

Current input 0 ... 20 mA (A)

Voltage input 0...10 V (A)

Voltage input 0...32 V (A)

Voltage input ratiometric (A)

Digital input (B_L)
(default)

ST A: **ST B:**
IN0000...0003 **IN1000...1003**
IN0500...0503 **IN1500...1503**

Digital inputs, frequency measurement (IN FREQUENCY-B)

Frequency input (FRQ_{L/H})

ST A and ST B / input characteristics

Resolution	12 bits
Input frequency	< 330 Hz
Measuring ranges	0...10 V, 0...32 V, 0...20 mA, ratiometric, binary low side
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Input resistance	298 Ω
Range diagnostics min./max.	0 mA / 20 mA (default)
Accuracy	± 1.5 % FS

Input resistance	67.6 kΩ
Range diagnostics min./max.	0 V / 10 V (default)
Accuracy	± 1 % FS

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 V / 32 V (default)
Accuracy	± 1 % FS

Input resistance	51.0 kΩ
Range diagnostics min./max.	0 ‰ / 1000 ‰ (default)
Accuracy	± 1 % FS

Input resistance	9.5 kΩ
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Range diagnostics min./max.	1 V / 0.95 VBB ₃₀ (default)
Accuracy	± 1 % FS

Resolution	12 bits
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Input resistance	10 kΩ
Input frequency	≤ 30 kHz
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Accuracy	± 10 μs

Digital input ($B_{L/H}$)
(default: B_L)

Input resistance	10 k Ω
Input frequency	< 330 Hz
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L / B_H	± 1 % FS / ± 3 % FS
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

ST A:

IN0400...0401
IN0900...0901

Digital/ resistor inputs
(IN RESISTOR-B)

Digital input (B_L)
(default)

Resolution	12 bits
Input frequency	< 330 Hz
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break

Input resistance	3.2 k Ω
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

Resistor input (R)

Measuring current	< 2.0 mA
Measuring range	0.016...30 k Ω
Accuracy	± 2 % FS: 0.016...3 k Ω ± 5 % FS: 3...15 k Ω ± 10 % FS: 15...30 k Ω
Range diagnostics min./max.	0 Ω / 31 k Ω (default)

ST B:

IN1200... 1203
IN1400... 1403
IN1700... 1703
IN1800... 1803

Digital inputs
(IN DIGITAL-A)

Digital input (B_L)

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 10 k Ω
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to V_{BB} and short circuit to GND / wire break

Input resistance	10 k Ω
Switch-on level	> 0.7 $V_{BB_{30}}$
Switch-off level	< 0.3 $V_{BB_{30}}$
Accuracy B_L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 $V_{BB_{30}}$ (default)

ST A: **ST B:**
IN0300... 0301 **IN1300... 1303**
IN0800... 0801

**Digital inputs 2-wire sensor
(IN DIGITAL-B)**

Digital input (B_L)

RESET-COM

Abbreviations

Resolution	12 bits
Input frequency	< 330 Hz
Impedance	≤ 3.2 kΩ
Range diagnostics	configurable minimum and maximum values for the measuring range to detect short circuit to VBB and short circuit to GND / wire break

Input resistance	≤ 3.2 kΩ
Switch-on level	> 0.7 VBB ₃₀
Switch-off level	< 0.3 VBB ₃₀
Accuracy B _L	± 1 % FS
Range diagnostics min./max.	1 V / 0.95 VBB ₃₀ (default)

Switch-on level	> 0,7 VBB ₃₀
Switch-off level	< 0,3 VBB ₃₀
Accuracy	± 5 % FS

Observe the notes on the configuration of the inputs/outputs!
(programming manual "ecomatController CR721S")

- 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)
- PWM_I pulse width modulation current-controlled
- R resistor input
- VBB_{0..5} supply output group
- VBB₃₀ supply controller

8.2.4 ST A and ST B / output characteristics

CR721S

ST A: ST B:
 OUT0006...0007 OUT0306...0307
 OUT0106...0107 OUT0406...0407
 OUT0206...0207 OUT0506...0507

Digital / PWM outputs
4.0 A, H-bridge
(OUT PWM-40-BRIDGE-A)

Digital output (B_H)
 (default)

Digital output (B_L)

PWM output (PWM_H)

PWM output (PWM_L)

Current-controlled output (PWM_I)

ST A and ST B / output characteristics

Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND according to programming manual detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Switching voltage	8...32 V DC
Range diagnostics min./max.	0 A / 4 A (default)

Functions	as H-bridge
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Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Output frequency	20...500 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	$\geq 3 \Omega$ (at 12 V DC) $\geq 6 \Omega$ (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

UK

CR721S**ST A and ST B / output characteristics**

ST A: **ST B:**
OUT0008 **OUT0308**
OUT0108 **OUT0408**
OUT0208 **OUT0508**
Digital / PWM outputs 4.0 A
(OUT PWM-40-A)

Digital output (B_{Hi})
(default)

PWM output (PWM_{Hi})

Current-controlled output (PWM_{Li})

ST A: **ST B:**
OUT0000 **OUT0300**
OUT0002 **OUT0302**
OUT0004 **OUT0304**
OUT0100 **OUT0400**
OUT0102 **OUT0402**
OUT0104 **OUT0404**
OUT0200 **OUT0500**
OUT0202 **OUT0502**
OUT0204 **OUT0504**
Digital / PWM outputs 2.5 A
(OUT PWM-25-A)

Digital output (B_{Hi})
(default)

PWM output (PWM_{Hi})

Switching voltage	8...32 V DC
Switching current	0.025...4 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 %
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 4 A (default)
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Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 4 A (default)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...4 A
Setting resolution	1 mA
Control resolution	2 mA
Load resistance	$\geq 3 \Omega$ / (at 12 V DC) $\geq 6 \Omega$ / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 4 A (default)

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	1 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 2.5 A (default)
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Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

Current-controlled output (PWM_i)

Output frequency	20...2000 Hz (per channel)
Control range	0.05...2.5 A
Setting resolution	1 mA (at 20...250 Hz)
Control resolution	2 mA
Load resistance	≥ 4.8 Ω / (at 12 V DC) ≥ 9.6 Ω / (at 24 V DC)
Accuracy	± 1.5 % FS (for inductive loads)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:	ST B:
OUT0001	OUT0301
OUT0003	OUT0303
OUT0005	OUT0305
OUT0101	OUT0401
OUT0103	OUT0403
OUT0105	OUT0405
OUT0201	OUT0501
OUT0203	OUT0503
OUT0205	OUT0505

Digital outputs 2.5 A
(OUT PWM-25-B)

Digital output (B_{ii})
(default)

PWM output (PWM_{ii})

Switching voltage	8...32 V DC
Switching current	0.025...2.5 A
Protective circuit for inductive loads	integrated
Accuracy current feedback	5 % FS
Diagnostics current feedback	configurable minimum and maximum values to detect short circuit and wire break
Diagnostics status feedback	detection of short circuit to VBB and short circuit to GND detection TRUE: ≥ 3 V detection FALSE: ≤ 1 V

Range diagnostics min./max.	0 A / 2.5 A (default)
-----------------------------	-----------------------

Output frequency	20...2000 Hz (per channel)
Pulse/pause ratio	1...1000 ‰ (adjustable via software)
Resolution	1 ‰ FS (at 20...250 Hz)
Range diagnostics min./max.	0 A / 2.5 A (default)

ST A:

OUT3000

Sensor supply
(OUT SUPPLY-A)

ST A:

OUT3001

ST B:

OUT3002

Analogue outputs
(OUT VOLTAGE-A)Output groups VBB_{0...5}

Load current per output group

Internal semiconductor switches

Short-circuit strength to GND

Abbreviations

for sensors and joysticks
0 V, / 5 V, 400 mA / 10 V, 200 mA, accuracy $\pm 5\%$
minimum current 10 mA
short-circuit proof and overload protected

Current rating	< 5 mA
Output voltage	0...10 V
Accuracy	$\pm 5\%$ FS
Step response time 10...90 %	< 1.8 ms

 ≤ 12 A

One switch in series of 9 semiconductor outputs each.
Forced controlling by means of hardware
and additional controlling by means of user program.

Switching current	0.1...12 A
Current diagnostics (excessive current)	> 12 A

Outputs are switched off via the output driver

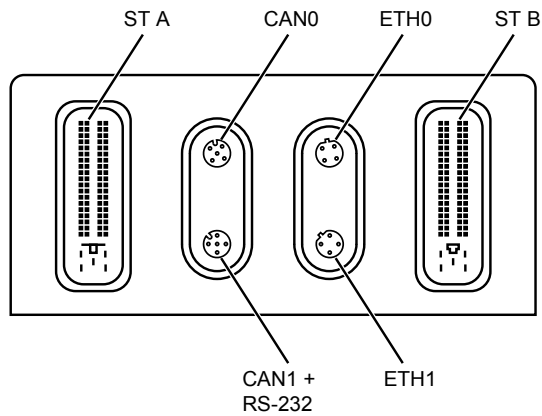
A analogue
B_H binary high side (CSO)
B_L binary low side (CSI)
PWM_H pulse-width modulation high side (CSO)
PWM_L pulse-width modulation low side (CSI)
PWM_I pulse-width modulation current-controlled
VBB_{0...5} supply output group
VBB₃₀ supply controller

8.2.5 Connectors

CR721S

Technical data

Connectors



CAN0

M12 socket, 5 poles, A-coded

- 1: not used
- 2: not used
- 3: GND_COM
- 4: CAN0_H
- 5: CAN0_L



CAN1 + RS-232

M12 socket, 5 poles, A-coded

- 1: RS-232_TxD
- 2: RS-232_RxD
- 3: GND_COM
- 4: CAN1_H
- 5: CAN1_L



ETH0 / ETH1

M12 socket, 4 poles, D-coded

- 1: TxD+
- 2: RxD+
- 3: TxD-
- 4: RxD-



ST A

AMP, 81 poles, A-coded

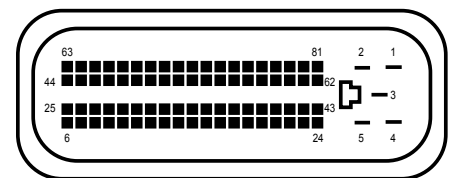
- 1-81: see wiring
- ST A



ST B

AMP, 81 poles, B-coded

- 1-81: see wiring
- ST B



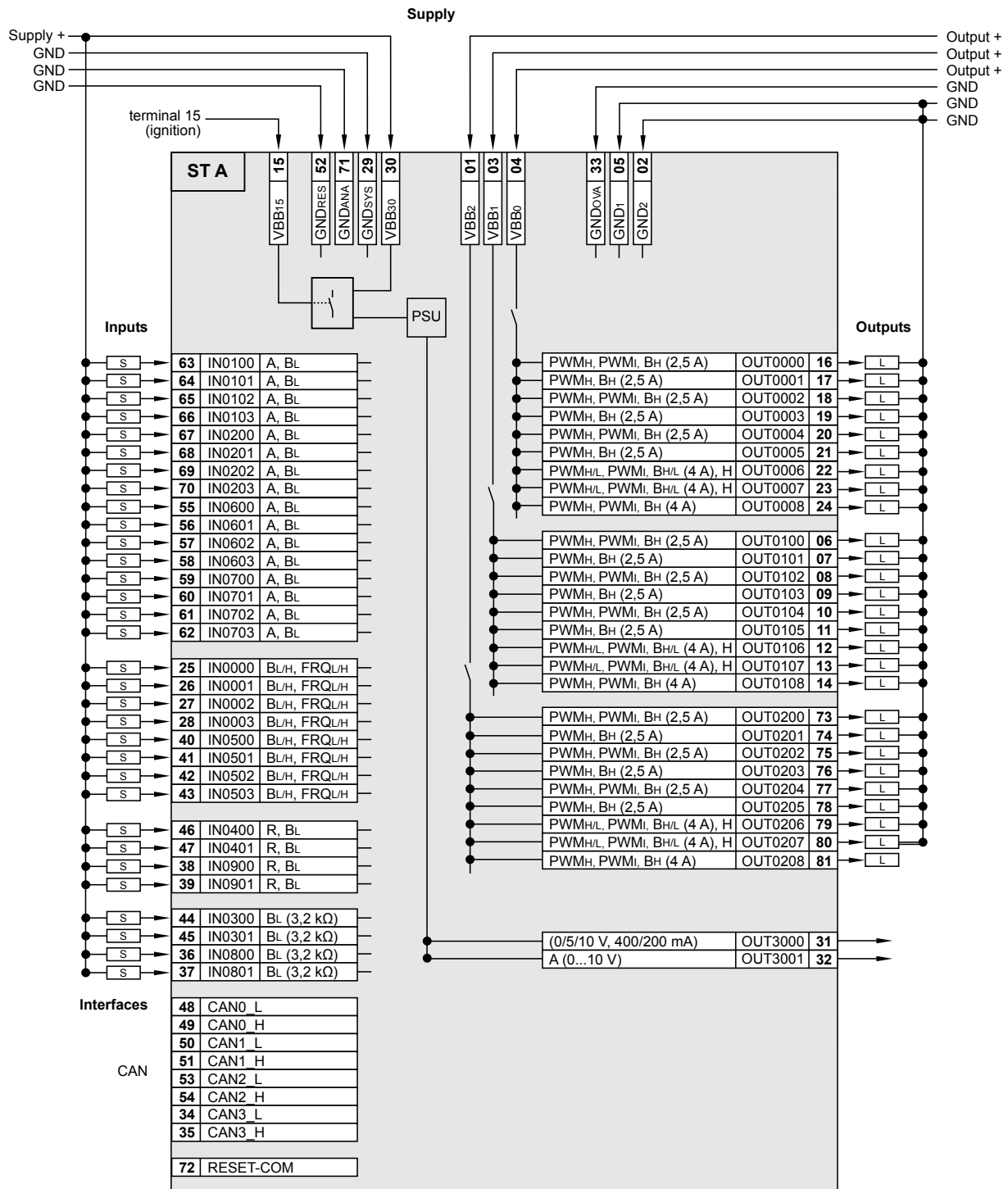
8.2.6 ST A / wiring

CR721S

Technical data

Wiring

ST A



Abbreviations

- 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)
- H H-bridge function
- PSU power supply for the system
- PWM_H pulse-width modulation high side (CSO)
- PWM_L pulse-width modulation low side (CSI)
- PWM_i pulse-width modulation current-controlled
- R resistor input
- VBB_{0...5} supply output group
- VBB₃₀ supply controller

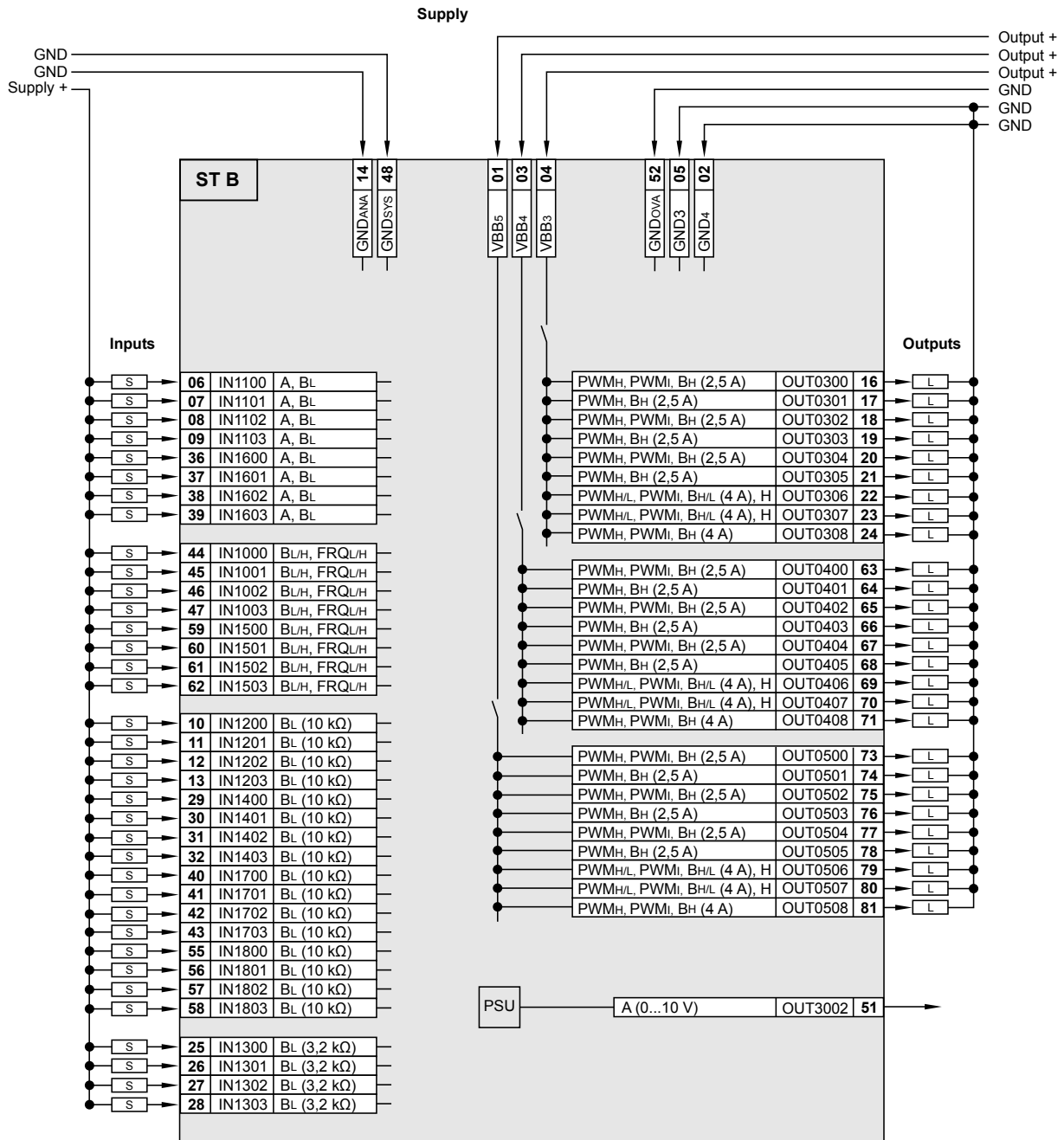
8.2.7 ST B / wiring

CR721S

Technical data

Wiring

ST B



Abbreviations

- 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)
- H H-bridge function
- PSU power supply for the system
- PWM_H pulse-width modulation high side (CSO)
- PWM_L pulse-width modulation low side (CSI)
- PWM_I pulse-width modulation current-controlled
- R resistor input
- VBB_{0...5} supply output group
- VBB₃₀ supply controller

9 Maintenance, repair and disposal

The device is maintenance-free.

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

10 Approvals/standards

Test standards and regulations (→ 8 Technical data)

The EU declaration of conformity and approvals can be found at:
www.ifm.com