RE 95205/2021-10-27
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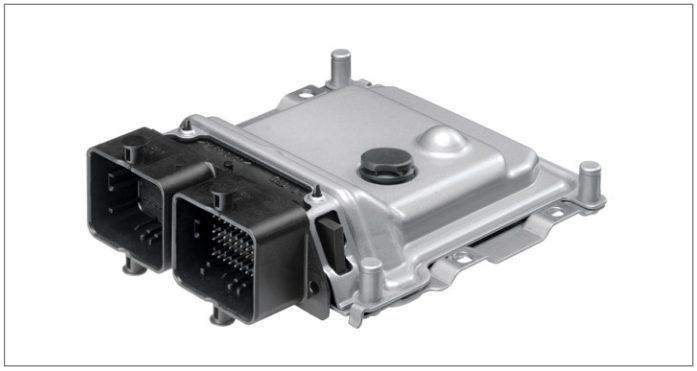
rexroth
A Bosch Company

BODAS controller RC4-5 series 30



- For the closed and open loop control of hydraulic components

Features

- High performance thanks to 32-bit TriCore processor with 80 MHz clock frequency
- Component of BODAS system for mobile applications
- Robust and compact design meeting specifications for mobile applications
- High Electromagnetic Compatibility (EMC)
- Inputs and outputs with fault detection
- Central output deactivation
- Pulse-Width-Modulated (PWM) solenoid currents for minimum hysteresis
- Closed-loop control of solenoid currents, i.e. not dependent on supply voltage and temperature

Main components

- Nine power outputs, 4 of which current-controlled
- Program sequence monitoring with watchdog
- CPU-internal flash memory with ECC fault detection
- Four independent sensor voltage supplies
- Two independent CAN bus interfaces

Contents

Ordering code

01	02		03
RC	**4-5**	**/**	**30**

Type

01	BODAS controller	**RC**

Version

02	1. Position: Number of proportional power outputs 2. Position: Number of power switching outputs	**4-5**

Series

03	Series 3, index 0	**30**

Notes:

- The BODAS controllers are not functional without software.
- In order to use the BODAS controllers, you also need:
  - BODAS standard software or
  - application-specific software
- If there is a sample label on the name plate, it is a prototype or sample, i.e. components not released for series production. Possible sample labels are:
  - SC: A
  - SC: B
  - SC: C
  - SC: S (prototype software)

Optional accessories

- **BODAS-service software**
  The windows-based PC software BODAS-service (see data sheet 95086) is used for displaying functions, errors, and system variables as well as for setting parameters via a PC. It is also used for flashing programs from a PC to the control unit.

- **C-programming interface C-API**
  The programming interface C-API (see data sheet 95115) is used for programming the BODAS controllers RC in the programming language C. All required functions that are needed for the configuration and the reading of the inputs, the control of the outputs, the use of the communication interfaces and the creation of the diagnostic information for BODAS-service are available to the user in the form of a software library. Additionally, the user needs a C-compiler, with which the created program is translated into a machine code that is readable for the BODAS controller.

- **BODAS measuring adapter MA7**
  The BODAS measuring adapter MA7 (see data sheet 95090) is used for measuring all electrical signals at the inputs, outputs and interfaces of the BODAS controller. For testing purposes, it is connected in series between the controller and the vehicle or device wiring.

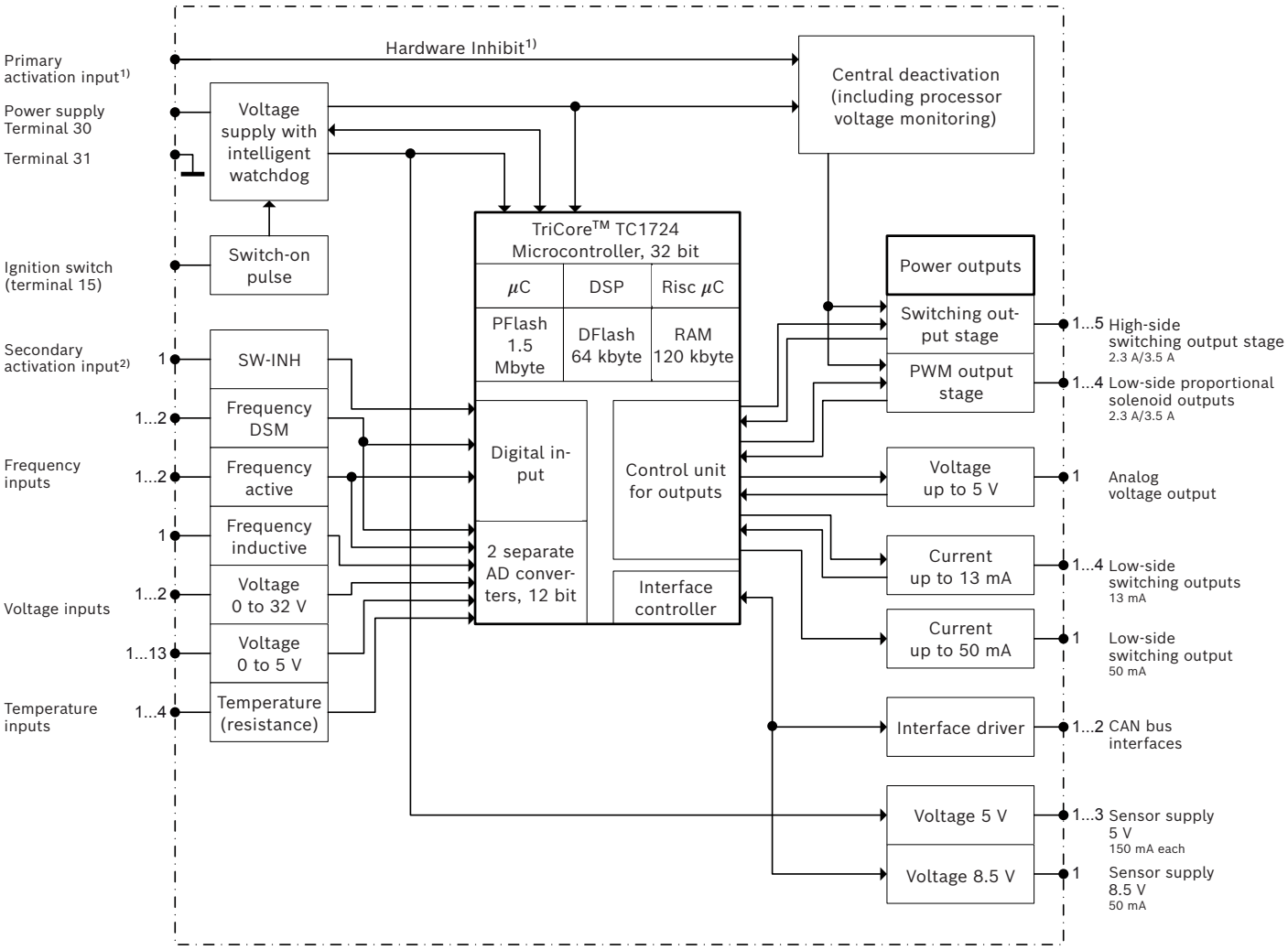
- **BODAS testbox TB3**
  The BODAS testbox TB3 is used to simulate vehicle and device functions for development and test purposes with BODAS controllers. The BODAS testbox TB3 is connected to the control unit via an adapter cable TAK7. A stencil provides specific channel designations for this control unit. See data sheet 95092 for more details.

All products mentioned here are available from Bosch Rexroth.
Further information can be found on the Internet at:
www.boschrexroth.com/mobile-electronics

Description

The BODAS controller RC4-5/30 is a universal controller for mobile working machines.
State-of-the-art 32-bit TriCore technology, a clock frequency of 80 MHz and numerous I/O functions give the controller a high power density in a very compact housing.
The controller is used for the programmable control of proportional and switching solenoids and of additional electrical switching functions. Typical applications are electrohydraulically actuated work functions, travel drives and transmission controls.
Internally the BODAS controller RC4-5/30 contains a powerful 32-bit TriCore microprocessor TC1724, all input and output circuitry, and a power supply unit for operation in mobile machines with 12 or 24 volt nominal supply voltages.
With 9 power outputs, 6 small signal outputs, a total of 30 input channels, 4 constant voltage sources and two CAN buses for communication in the vehicle, the RC4-5/30 controllers form a powerful platform for controlling mobile working machines.
The four current-controlled, pulse-width-modulated (PWM) outputs are used in particular for controlling proportional solenoids. The current control keeps the set-point current constant without hysteresis even if the supply voltage or temperature of the solenoid changes.
The PWM outputs match the electrical proportional control of Rexroth axial piston units and valves.
Five switching outputs can be used for switching solenoids, relays or other electrical consumers.
Of the input channels, five are used to measure frequency signals. Two of these inputs are configured for active frequency sensors. Two other frequency inputs are specified for the intelligent Rexroth DSM1-10 speed sensors with integrated diagnosis function. An inductive speed sensor can be connected at the fifth frequency input.
Four resistance inputs are used, for example, to directly connect temperature sensors.
The other inputs can be used for measuring analog voltages or as switching inputs.
The inputs are protected against overvoltage and electrical interference. The voltage inputs can be monitored to detect cable breaks or short circuits.
CAN bus interfaces are available with all BODAS controllers RC for exchanging data with other bus users or electronic systems (e.g. controller RC, joystick, engine control unit, display).
Two independent CAN bus interfaces, each of which can be operated with various protocols, are available in the RC4-5/30 BODAS controller. Communication with a service tool is also conducted via one of the two CAN interfaces. The RC4-5/30 controller is supported as standard by the Rexroth tool BODAS-service.
An application interface in the form of a C-API is available for programming the controller. This allows the software developer to concentrate on the important functions of his machine without having to become immersed in the details of the TriCore technology and the hardware of the controller.
With the BODAS-service software, the programs can be quickly and simply downloaded to the controller via the Flash module. Extensive service functions, such as diagnostics, parameter setting or display of process variables are available via the graphical Windows interface of BODAS-service. This enables simple parameter setting and diagnosis in order to place the machine in service quickly and safely.
The BODAS controllers RC were developed specifically for use in mobile working machines and satisfy corresponding protection requirements regarding ambient temperatures, water and dust ingression, shock and vibration as well as Electromagnetic Compatibility (EMC). BODAS controllers RC and corresponding software in combination with pumps, motors, valves, sensors, input devices and actuators from Rexroth make for complete system solutions.

Block circuit diagram



Abbreviations	
µC	Microcontroller
DSP	Digital signal processor
RISC	Reduced instruction set computer
PFlash	Program flash
DFlash	Data flash (e.g. for parameter storage)
RAM	Random Access Memory

1) Input that is independent of the microcontroller, for the central enabling/deactivation of the power outputs.
2) Input for the central activation/deactivation of the power outputs.

Technical data

Nominal voltage		**RC4-5 series 30**
Nominal battery voltage		12 V or 24 V
Supply voltage, permissible range		8 V to 29 V temporarily up to 32 V
Current consumption		
in the 12 V vehicle electrical system, without load		150 mA
in the 24 V vehicle electrical system, without load		90 mA
Fuses		
internal		none
External in supply path		max. 15 A
Constant voltage source		
150 mA	5 V ±4 %	3
50 mA	8.5 V ±10 %	1
Analog voltage inputs, total (can be used as a switching input, partly as alternative function)		28
0 to 5 V		18
0 to 32 V		10
Digital switching inputs		1
Resistance inputs		
	10 Ω to 20 kΩ	4
Frequency inputs total		5
Active sensors	from 0 to 20 kHz,	2
DSM	from 0 to 20 kHz	2
Inductive sensors	from 500 Hz to 10 kHz	1
Analog voltage output		
	0.05 V to 5 V	1
Proportional solenoid output, total		4
Current-controlled low-side PWM output stage	0 to 2.3 A, PWM to 1 kHz	2
	0 to 3.5 A, PWM to 1 kHz	2
Digital output stages total		5
Non-current-controlled high-side PWM output stage	max. 2.3 A, PWM to 250 Hz	1
	max. 3.5 A, PWM to 250 Hz	4
Low-side driver output		5
Low-side driver output, current-limited	up to 13 mA	4
	up to 50 mA	1
Interfaces		
CAN 2.0 B, ISO 11898, max. 500 kBaud		2
Fault detection in the event of cable break and short circuit		
Inputs		*
Outputs		*
CAN		*
Protection against short circuits[1] **to supply voltage and ground** (Requirement: controller is powered and switch-on signal at terminal 15 is on High is active)		
Inputs		*
Outputs, except OUT_14[1]		*
CAN[1]		**to ground only**

1) The output OUT_14 and the CAN interfaces are not permanently protected against short circuit to battery voltage.

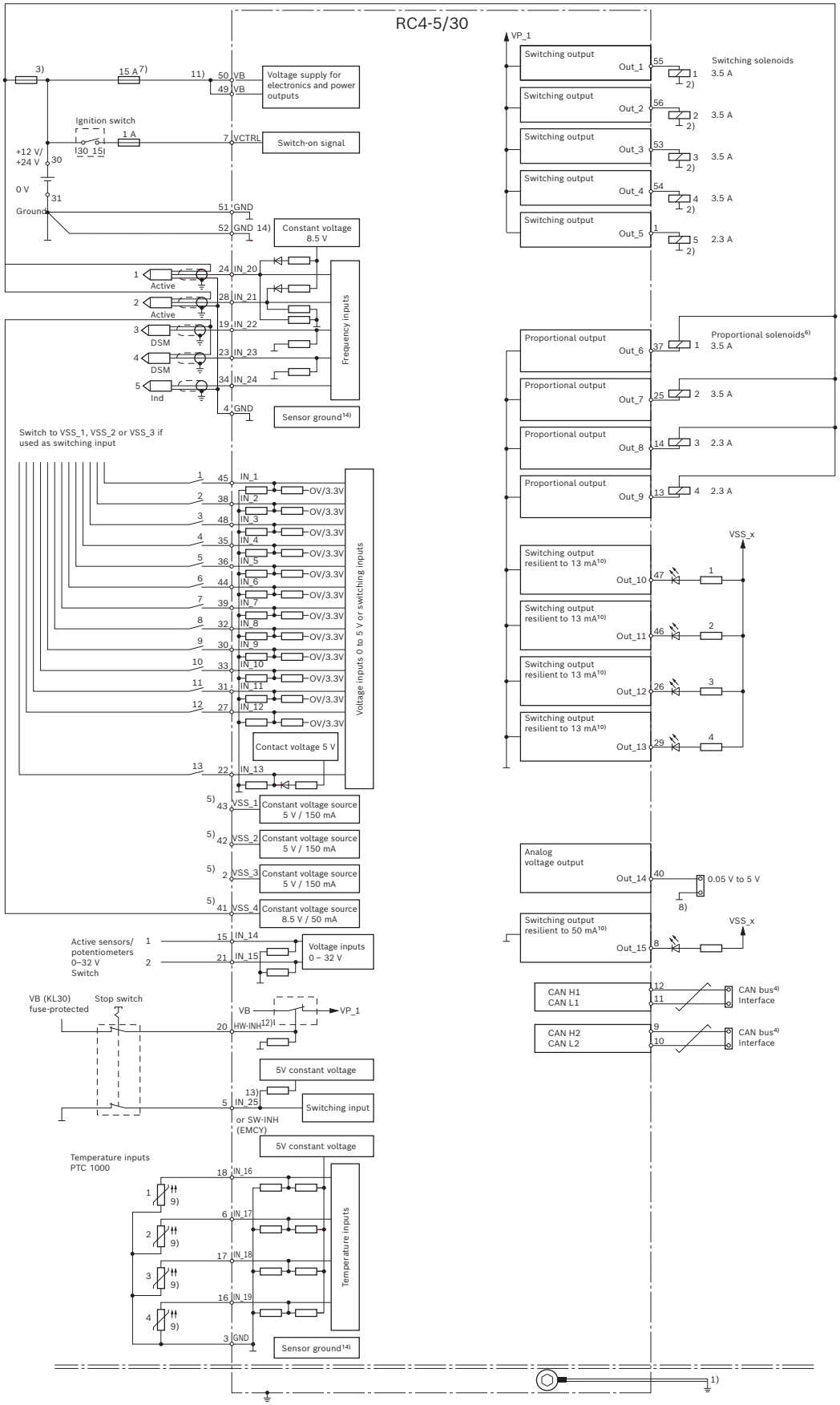
Reverse polarity protection		**RC4-5 series 30**
Power supply / battery[1)]		–
Microcontroller		
		SAK-TC1724
Clock frequency		
	MHz	80
Internal memory capacity in microcontroller		
RAM	kB	120 kByte
DFlash	kB	64 kByte
PFlash	kB	1.5 MByte
Software installation		
Download in PFlash		✓
Electromagnetic compatibility		
Spurious interference (ISO 11452-2)	200 MHz to 2 GHz: 140 V/m	*
Spurious interference (ISO 11452-4)	BCI 20 MHz to 400 MHz: 100 mA	*
Load dump with 12 V battery voltage		*
Load dump with 24 V battery voltage (ISO 7637-2: 2004)	Us = +123 V	*
Electrostatic Discharge ESD (DIN EN 60068-2-30Db; version **2)**		
Out of service, class C	Contact and air	8 kV
In service, class C	Contact / air	6 kV / 8 kV
Maximum power dissipation		
Electronics		approx. 3 W
Outout stages		approx. 15 W
Permissible operating temperature, housing		
With mounting point on cooling surface <= +60 °C (+140 °F)		–40 to +85 °C (–40 to +185 °F)
Storage temperature, housing		
Maximum permissible housing temperature momentary, passive:		–40 to +105 °C (–40 to +221 °F)
Vibration resistance, broadband noise oscillations (ISO 16750-3: 2007)		
	57.9 m/s^2, 10 bis 2000 Hz, 32 h per axis	*
	10 Hz: 18 $(m/s^2)^2/Hz$	
	20 Hz: 36 $(m/s^2)^2/Hz$	
	30 Hz: 36 $(m/s^2)^2/Hz$	
	180 Hz: 1 $(m/s^2)^2/Hz$	
	2000 Hz: 1 $(m/s^2)^2/Hz$	
Shock resistance Transport shock (IEC 60068-2-27: 2010)		
	a = 30 *g*; t = 11 ms per spatial axis x, y, z and in each direction (pos./neg.)	*
Moisture resistance (DIN EN 60068-2-30Db; version **2)**		
	90–96 % (+25 °C to +55 °C)	*

1) Reverse polarity protection can be realized by the external fuse

Combined salt spray and moisture test (DIN EN 60068-2-52Kb)		**RC4-5 series 30**
	Salt spray 4x 2 h, 5 % NaCl	*
	Followed by 22 h storage at 40 °C and 93% humidity	
	72 h storage at room temperature	
Type of protection (ISO 20653) with installed mating connector[1)]	IP65, IP66 with protected pressure equalizing element	*
Housing material		
Cover	Aluminium sheet AlMg3	*
Base	Aluminium sheet AlMg3	*
Weight		approx. 0.2 kg
Outer dimensions Without mating connector, with multipoint connector	Length (in mm)	140
	Width (in mm)	123
	Height (in mm)	43
Mating connector	56-pin	1[2)]

1) While following the installation instructions
2) Second connector chamber not used

Connection diagram



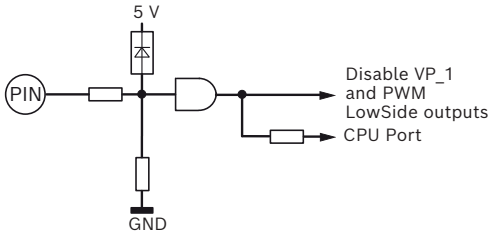
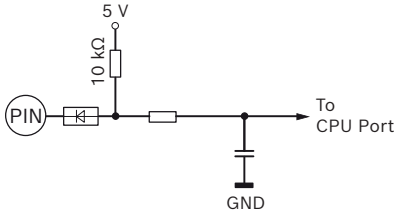
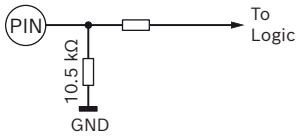
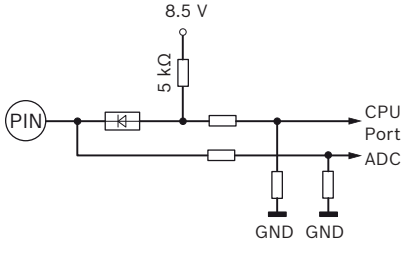
For footnotes, see page 9

Note

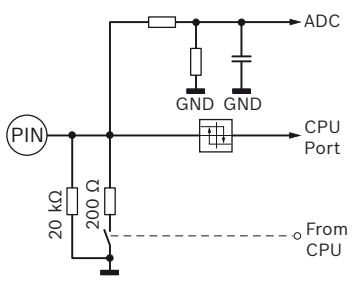
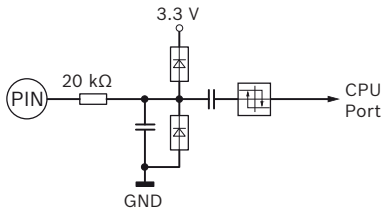
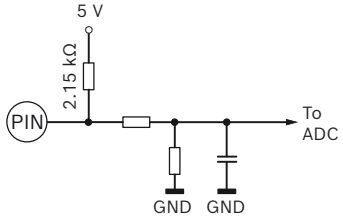
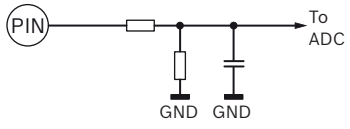
- To switch off the system in emergencies, the power supply to the controller must be disconnected by an emergency-stop switch.
  The emergency-stop switch must be installed in an easily accessible position for the operator.
  Safe braking must be ensured when the emergency stop function is activated.
- All GND pins are connected together on the printed circuit board. Maximum permissible currents depend on the contacts used (pins 51 and 52: MQS 1.5 CB; pins 3 and 4: BCB 0.6) and on the lines used.
- Lines to the controller must not be routed close to other power-conducting lines in the device.
- The proportional solenoids must not be wired with spark-suppression diodes.
  Switching solenoids at the outputs of the controller do not need to be connected to spark-suppression diodes.
  Other switched inductive consumers in the system must be equipped with spark-suppression diodes.
- For information about mating connectors and contacts, please refer to Bosch offer drawing 1 928 A00 443.
- The illustrated fuses act as line protection.

1) Short, low-resistance connection from a case screw to the vehicle ground.
2) Own ground connection to battery (chassis possible).
3) Separate fuse protection for sensors supplied from UBat, and solenoids switched to ground. Fuse configuration specific to application (in particular current needed and line cross section).
4) CAN bus: 120 Ω termination resistor and twisted line necessary.
5) Constant voltage sources can be used as sensor supply or switching voltage for switches/push-buttons.
6) The power line to consumers switched to ground must be fused, see 3.
7) Can be adjusted to the actual current consumption of the consumers and must be adjusted to the permissible rating of the lines and pins.
8) Independent ground connection of the current source to the battery, controller ground possible.
9) Can be used as switching inputs.
10) Alternatively, can be used as input.
11) If deactivated during operation, data will not be saved in the non-volatile memory and there will be no after run.
12) First deactivation channel:
    In deactivation state, the main switch for the power supply to the high-side output stages is opened by the hardware and the low-side output stages are deactivated.
13) Second deactivation channel:
    If used as SW-INH, main switch opened and low-side output stages deactivated by the software.
14) Terminal 31 (ground supply) and sensor ground are joined at a star point in the controller and are connected to the housing.

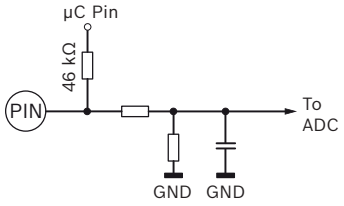
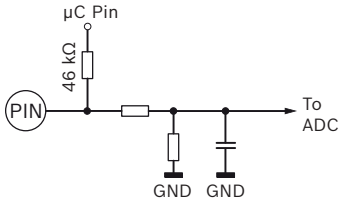
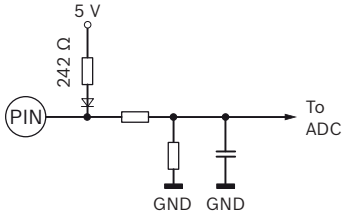
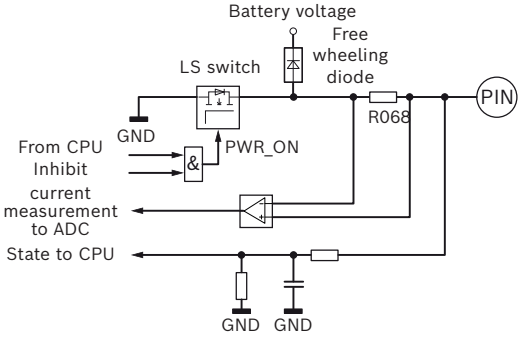
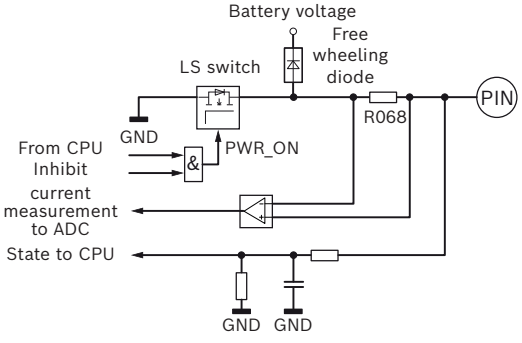
Overview of the functions

Pin[1)]	Description	Main function	Alternative function
49, 50	**Voltage supply** VB (terminal 30)	**Power supply for electronics and output stages** Nominal battery voltage 12 V DC or 24 V Operating range 8 V to 29 V, temporarily permissible 32 V	
51, 52	**Vehicle ground** GND (terminal 31)	**Supply ground** (internally connected to pins 3 and 4)	
3, 4	**Internal sensor ground** GND	**Sensor ground** (internally connected to pins 51 and 52)	
20  	**Hardware Inhibit** HW-INH	**Primärer activation input** Hardware deactivation function for all power output stages Activation level > 7.9 V Deactivation level < 2.8 V	
5  	**Software Inhibit** SW-INH or switching input IN_25	**Secondary activation input** Activation with low level Deactivation with high level	**Digital switching input** High level > 2.0 V Low level < 0.5 V Pull-up 10 kΩ to 5 V
7  	**Ignition switch** VCTRL (terminal 15)	**Digital input** Switch on controller with level > 8 V up to supply voltage VB Pull-down 10.5 kΩ	
24, 28  	**Active frequency input** IN_20, IN_21	**Frequency input for active sensors** Cut-off frequency filter 22 kHz Frequency measurement up to 20 kHz Level low < 1.5 V Level high > 4 V, ≦ VB Pull-up 5 kΩ to 8.5 V Pull-down 40 kΩ	**Analog input** Measuring range: 0 to 32 V Resolution: 12 bit Digital input Level configurable in software up to 32 V Pulse counter input Pulse width measurement Measurement of pulse/ pause ratio

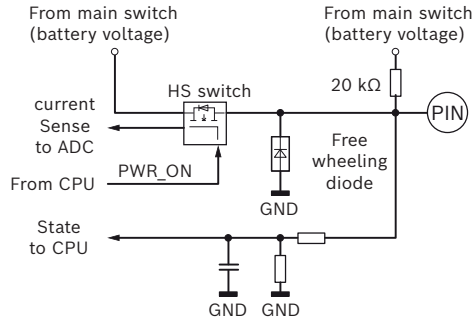
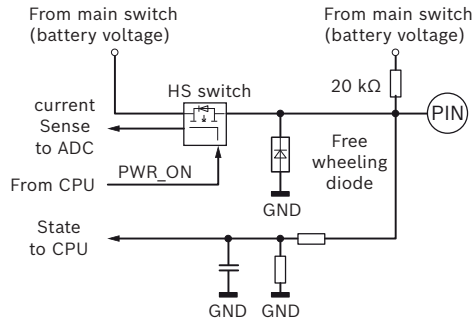
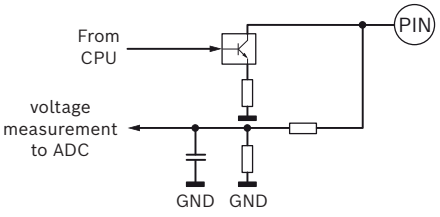
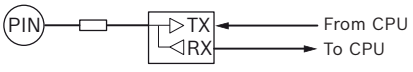
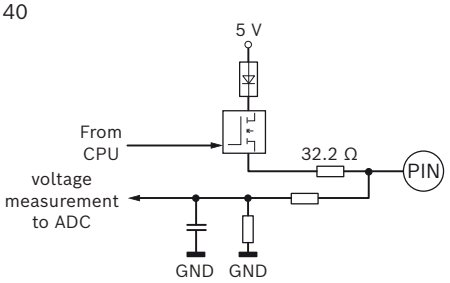
1) Pin numbers in bold type are for MQS 1.5-CB contacts; others are for BCB 0.6 contacts

Pin[1)]	Description	Main function	Alternative function
19, 23 	**DSM frequency input** IN_22, IN_23	**Frequency input** **for Rexroth DSM sensors** Cut-off frequency filter 26 kHz Frequency measurement up to 20 kHz Evaluation of additional information such as direction of rotation and fault monitoring possible Switching thresholds 7 mA / 14 mA Internal resistance 200 Ω to ground VSS_4 can be used as power supply for DSM frequency sensors.	**Frequency input** for active sensors that switch to High (type PNP) Level Low < 1.7 V Level High > 2.2 Pull-down 10 kΩ Analog input Measuring range: 0 to 32 V Resolution: 12 bit Digital input Level configurable in software up to 32 V Pulse counter input Pulse width measurement Measurement of pulse/pause ratio
34 	**Induktive frequency input** IN_24	**Frequency input** **for inductive frequency sensors** Frequency measurement from 500 Hz to 10 kHz to 1 V_{RMS} AC	**Pulse counter input** Pulse width measurement Measurement of pulse/pause ratio
18, 6, 17, 16 	**Resistance input** IN_16, IN_17, IN_18, IN_19	**Temperature measurement** via resistance measurement of connected NTC/PTC temperature sensors from 10 Ω to 20 kΩ Support from Rexroth Temperature sensors TSF and TSA Pull-up 2.15 kΩ to 5 V Pull-down 120 kΩ Frequency limit 230 Hz	**Analog input** Measuring range: 0 to 5 V Resolution: 12 Bit Digital input Level configurable in software up to 5 V
15, 21 	**Analog input** IN_14, IN_15	**Analog input** Measuring range: 0 to 32 V Resolution: 12 bit Pull-down 50 kΩ Frequency limit 500 Hz	**Digital input** Level configurable in software up to 32 V

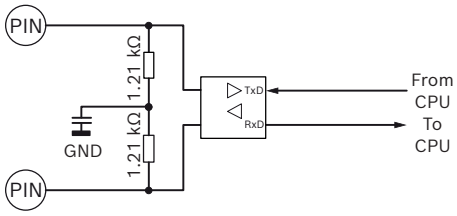
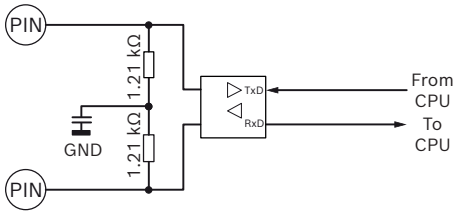
1) Pin numbers in bold type are for MQS 1.5-CB contacts; others are for BCB 0.6 contacts

Pin[1)]	Description	Main funktion	Alternative function
45, 38, 48, 35, 36, 44 	**Analog Input** IN_1 bis IN_6	**Analog Input** Measuring range: 0 to 5 V Resolution: 12 bit If µC pin is switched to 3.3 V: Pull-up 46 kΩ Pull-down 129 kΩ If µC pin is switched to ground: Pull-down 33 kΩ Frequency limit 230 Hz	**Digital input** Level configurable in software up to 5 V
39, 32, 30, 33, 31, 27 	**Analog Input** IN_7 bis IN_12	**Analog Input** Measuring range: 0 to 5 V Resolution: 12 bit If µC pin is switched to 3.3 V: Pull-up 46 kΩ Pull-down 250 kΩ If µC pin is switched to ground: Pull-down 39 kΩ Frequency limit 120 Hz	**Digital input** Level configurable in software up to 5 V
22 	**Analog Input** IN_13	**Analog Input** Measuring range: 0 to 5 V Resolution: 12 bit Pull-up 242 Ω via diode to 5 V Pull-down 230 kΩ Frequency limit 200 Hz	**Digital input** Level configurable in software up to 5 V
37, 25 	**PWM output stage** OUT_6, OUT_7	**Closed-loop current controlled Low side** PWM output stage Pulse frequency configurable in software in defined steps from 50 Hz to 1 kHz Duty cycle 0 % to 100 % Max. current 3.5 A Can only be operated if the main switch VP_1 is activated	
14, 13 	**PWM output stage** OUT_8, OUT_9	**Closed-loop current controlled Low side** PWM output stage Pulse frequency configurable in software in defined steps from 50 Hz to 1 kHz Duty cycle 0 % to 100 % Max. current 2.3 A Can only be operated if the main switch VP_1 is activated	

1) Pin numbers in bold type are for MQS 1.5-CB contacts; others are for BCB 0.6 contacts

Pin[1)]	Description	Main function	Alternative function
55, 56, 53, 54 	**Switching output stage** OUT_1, OUT_2, OUT_3, OUT_4	**High-side switching output stage** with current sensing max. 3.5 A Central power supply via VP_1	**Open-loop controlled PWM output stage** with current sensing Duty cycle 0 % to 100 % Pulse frequency configurable in software in defined steps up to 250 Hz max. 3.5 A Central power supply via VP_1
1 	**Switching output stage** OUT_5	**High-side switching output stage** with current sensing max. 2.3 A Central power supply via VP_1	**Open-loop controlled PWM output stage** with current sensing Duty cycle 0 % to 100 % Pulse frequency configurable in software in defined steps up to 250 Hz max. 2.3 A Central power supply via VP_1
47, 46, 26, 29 	**Small signal-switching output** OUT_10, OUT_11, OUT_12, OUT_13	**Low-side driver output** Limited to 13 mA (current limitation in case of overload) e.g. for LED with external resistor	**Analog input** (when driver output is deactivated) Measuring range: 0 to 30 V Resolution: 12 Bit Pull-down 31 kΩ Frequency limit 860 Hz
8 	**Small signal-switching output** OUT_15	**Low-side driver output** Limited to 50 mA (current limitation in case of overload) e.g. for LED with external resistor	
40 	**Analog output** OUT_14	**Analog voltage output** Output signal 0.05 V to 5 V Minimum 5 kΩ external ohmic resistance required (<= 1 mA)	**Analog input** (when driver output is deactivated) Measuring range: 0 to 5 V Resolution: 12 Bit Pull-down ~20 kΩ Frequency limit 550 Hz

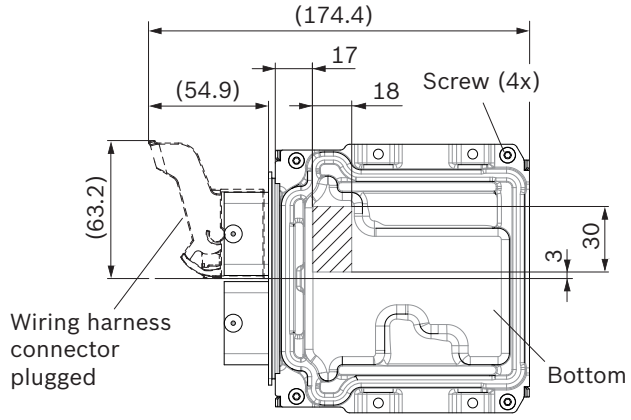
1) Pin numbers in bold type are for MQS 1.5-CB contacts; others are for BCB 0.6 contacts

Pin[1)]	Description	Main function	Alternative function
43, 42, 2	**Sensor supply** VSS_1, VSS_2, VSS_3	**Power supply for external sensors** Output voltage 5 V Accuracy ±4 % Load capacity 150 mA The sensor supplies must not be operated or bridged in parallel.	
41	**Sensor supply** VSS_4	**Power supply for external sensors** Output voltage 8.5 V at supply voltage of at minimum 9.5 V Accuracy ±10 % Load capacity 50 mA In particular used as power supply for DSM frequency sensors	
12, 11 	**CAN interface** CAN1_H, CAN1_L	**CAN interface** CAN 2.0 B, up to 500 kBaud External termination resistor 120 Ω in the CAN bus required Standard diagnosis interface with 250 kBaud factory setting	
9, 10 	**CAN interface** CAN2_H, CAN2_L	**CAN interface** CAN 2.0 B, up to 500 kBaud External termination resistor 120 Ω in the CAN bus required	

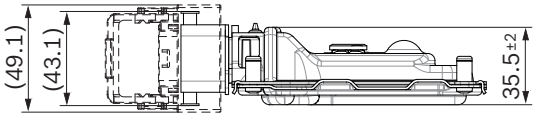
1) Pin numbers in bold type are for MQS 1.5-CB contacts; others are for BCB 0.6 contacts

Dimensions

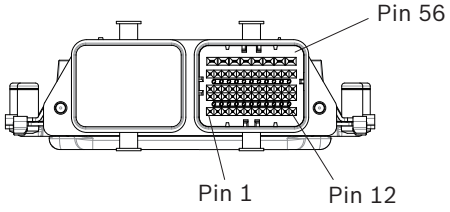
View from below



Long-side side view



Side view of connector side with pulled connector



Plan view

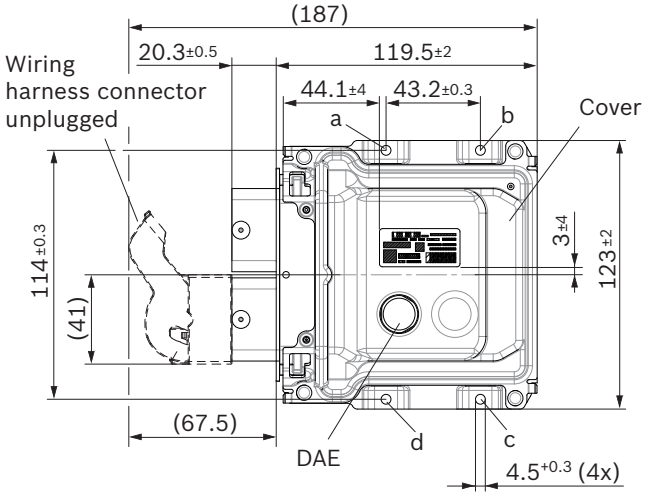


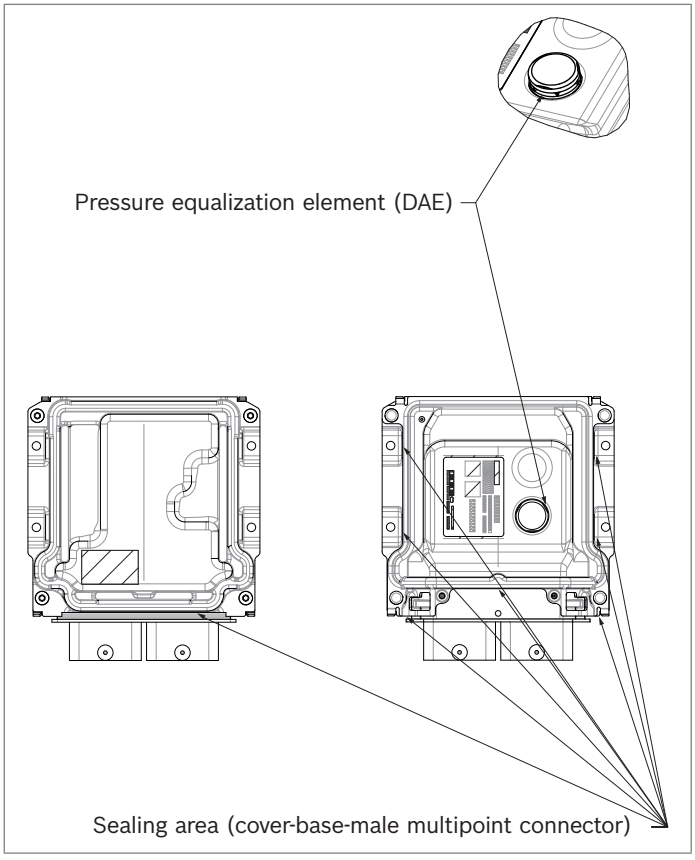
Illustration not to scale

Mounting

- The BODAS controller must be fastened at 4 points (a, b, c and d).
- The 4 mounting points must have an evenness of 0.5 mm.
- The upper limit for surface pressure on the screwing areas of the controller is 140 N/mm².
- Recommended screws M4 with head diameter ≥ 7 mm
- Tightening torque with washer 3.0 Nm, without washer 2.5 Nm
- The BODAS controller must be mounted in the vehicle in such a way that it does not bounce against other vehicle parts and additional fastening elements of the controller.
- A distance of at least 1 mm over the entire surface must be maintained between the bottom of the controller and the mounting surface. The distance should be less than 10 mm. If the control unit is not mounted with a bracket, it should be mounted with four distance bolts that guarantee this distance and prevent the bottom plate from bending in the area of the screw holes.
- It must be ensured that the screw fitting cannot come loose unexpectedly.
- The wiring harness should be fixated mechanically in the area in which the controller is installed (spacing < 100 mm).
- The wiring harness should be fixated so that in-phase excitation with the controller occurs.
- The wiring harness connector is not included in the scope of supply.
- Bosch Rexroth's consent is required if fixing is different from above.

Installation position

The installation position must be chosen such that no standing or continuously flowing water can occur in the area of the pressure equalization element (DAE) and the sealings.
The pressure equalization element (DAE) and the sealing area must not be immersed in water.
The controller must not bounce when mounted in the vehicle.



Mating connector

A 56-pin module from Bosch is used as wiring harness connector. The 1928xxx numbers stated below are Bosch designations. Technical details about these document and part numbers are available at www.bosch-connectors.com.

Installation specification	1928 A01 41M
Technical customer documentation	1928 A01 40T
Offer drawing (assembly)	1928 A00 443

The following parts are required for assembling a wiring harness connector:

Designation	Version	Part number	Manufacturer	Number
Contact carrier, code 13	Wire outlet left	1928 405 161	Bosch	1
	Wire outlet right	1928 405 217	Bosch	
Cover	Outlet up	1928 405 164	Bosch	1
	Outlet straight	1928 405 163	Bosch	
Secondary lock		1928 405 165	Bosch	1
Holding plate		1928 405 162	Bosch	1
Wire tie		1928 401 713	Bosch	1
Contact BCB 0.6	Line cross section in mm^2 0.35 mm^2 – 0.5 mm^2 Insulation diameter in mm 1.2 – 1.6 (FLR-B)	1928 492 555	Bosch	up to 48[1)]
	Line cross section in mm^2 0.75 Insulation diameter in mm 1.7 – 1.9 (FLR-B)	1928 492 556	Bosch	
Contact MQS 1.5-CB	Line cross section in mm^2 0.75 – 1.5 Insulation diameter in mm 1.7 – 2.4 (FLR)	1241608-1	TE connectivity (www.te.com)	up to 8[1)]
Dummy contact BCB 0.6 blue		1928 405 239	Bosch	[1)]
Dummy contact MQS 1.5-CB green		1928 405 240	Bosch	[1)]

For part numbers of tools (crimping tongs, contact removal tools, etc.), see Bosch offer drawing.

1) Free contact chambers are to be sealed with dummy contacts to ensure water-tightness.

Mating connector sets with the following content are available under Rexroth part number R917008789 for the manual assembly of wiring harness connectors for laboratory or small-series requirements:

Designation	Version	Part number	Manufacturer	Number
Contact carrier, code 13	Wire outlet right	1928 405 217	Bosch	1
Cover	Outlet straight	1928 405 163	Bosch	1
Secondary lock		1928 405 165	Bosch	1
Holding plate		1928 405 162	Bosch	1
Contact BCB 0.6	Line cross section in mm^2 0.35 – 0.5 Insulation diameter in mm 1.2 – 1.6 (FLR-B)	1928 492 555	Bosch	48
Contact MQS 1.5-CB	Line cross section in mm^2 0.75 – 1.5 Insulation diameter in mm 1.7 – 2.4 (FLR)	1241608-1	TE connectivity (www.te.com)	8
Dummy contact BCB 0.6 blue		1928 405 239	Bosch	30
Dummy contact MQS 1.5-CB green		1928 405 240	Bosch	4

Delivered loose in a PE bag. Not suitable for processing by a machine.

Safety instructions

General instructions

- External measures in the vehicle are required to implement commonly used safety standards for mobile working machines with the RC4-5/30 controller. If necessary, please contact Bosch Rexroth in this regard.
- Reliable operation cannot be guaranteed if samples or prototypes are used in series production machines.
- The proposed circuits do not imply any technical liability for the system on the part of Bosch Rexroth.
- Incorrect connections could cause unexpected signals at the outputs of the controller.
- Incorrect programming or parameter settings on the controller may create potential dangers while the machine is in operation. It is the responsibility of the machine manufacturer to determine dangers of this type in a danger analysis and to bring them to the attention of the end user. Bosch Rexroth shall assume no liability for dangers of this kind.
- The component firmware/software must be installed and removed by Bosch Rexroth or by the authorized partner concerned in order to uphold the warranty.
- It is not permissible to open the controller or to modify or repair the controller. Modification or repairs to the wiring could result in dangerous malfunctions. Repairs to the controller may only be performed by Bosch Rexroth or by an authorized partner.
- A stop switch can be used for deactivation of the controller (refer to the connection diagram).
- When the electronics is not energized no pins must be connected to a voltage source. Thus, when the current supply is switched off, the supply for the electronics, the output stages and the external sensor supply have to be switched off together.
- Make sure that the controller´s configuration does not lead to safety-critical malfunctions of the complete system in the event of failure or malfunction. This type of system behavior may lead to danger to life and/or cause much damage to property.
- System developments, installations and commissioning of electronic systems for controlling hydraulic drives must only be carried out by trained and experienced specialists who are sufficiently familiar with both the components used and the complete system.
- While commissioning and maintenance the controller (with BODAS Tools) the machine may pose unforeseen dangers. Before commissioning the system, you must therefore ensure that the vehicle and the hydraulic system are in a safe condition.
- Make sure that nobody is in the machine‘s danger zone.
- No defective or incorrectly functioning components may be used. If the components should fail or demonstrate faulty operation, repairs must be performed immediately.
- Controllers used to develop software may only be installed in series production machines if it can be guaranteed that these controller have not been flash-programmed with new software more than 500 times. Controllers that have been programmed more than 1000 times are not to be installed in series production machines.

Notes on the installation location and position

- Do not install the controller close to parts that generate considerable heat (e.g. exhaust).
- Radio equipment and mobile telephones must not be used in the driver‘s cab without a suitable antenna or near the control electronics.
- A sufficiently large distance to radio systems must be maintained.
- All connectors must be unplugged from the electronics during electrical welding and painting operations.
- Cables/wires must be sealed individually to prevent water from entering the device.
- The controller must not be electrostatically charged, e.g. during painting operations.
- The controller will heat up beyond normal ambient temperature during operation. To avoid danger caused by high temperatures, it should be protected against contact.
- Install the controller in such a way that the connector is not pointing upwards. This ensures that any condensation water that may form can flow out.
- Standing or permanently running water is not permitted anywhere near the circumferential sealing (cover/base/connector) or the pressure equalizing element (DAE).
- The housing must be wired to vehicle ground in order to comply with EMC guidelines. Metallic screws must be used to create a connection to vehicle ground.
- The controller must be fixed with metallic screws to provide a good thermal connection between the housing and the cooling surface (heat sink)

Notes on transport and storage

- If it is dropped, the controller must not be used any longer as invisible damage could have a negative impact on reliability.
- Controllers must be stored at a temperature between –40 °C and +40 °C. Up to 1000 hrs are permissible between +40 °C and +85 °C. Up to 200 hrs are permissible between +85 °C and +105 °C. Air humidity up to 96% at 55 °C.
- After a storage time of more than 5 years, the controller must be examined by the manufacturer.

Notes on wiring and circuitry

- The electronics and the power outputs of a controller must be fed from the same power source.
- Lines to the speed sensors must be designed as short as possible and be shielded. The shielding must be connected on one side to the electronics or to the machine or vehicle ground via a low-resistance connection.
- The controller may only be wired when it is de-energized.
- Lines to the electronics must not be routed close to other power-conducting lines in the machine or vehicle.
- The wiring harness should be fixated mechanically in the area in which the controller is installed (spacing < 100 mm). The wiring harness should be fixated so that in-phase excitation with the controller occurs (e.g. at the controller mounting points).
- If possible, lines should be routed in the vehicle interior. If the lines are routed outside the vehicle, make sure that they are securely fixed.
- Lines must not be kinked or twisted, must not rub against edges and must not be routed through sharp-edged ducts without protection.
- Lines are to be routed with sufficient distance from hot or moving vehicle parts.
- PWM outputs (OUT_6 to OUT_9) must not be connected to each other or bridged. No light bulbs are to be operated at these outputs.
- None of the sensor supplies VSS_x is to be connected to one or more sensor supply VSS_x.
- The sensor supplies VSS_x can be "pulled up" by external connection, e.g. the application of a higher voltage, because they operate only as a voltage source but not as a voltage sink. Pulling up a sensor supply may result in unexpected malfunctions and damage of the controller in lasting operation.
- The "high side" (OUT_1 to OUT_5) outputs must not be externally connected to battery.

Note on proportional and switching solenoids and other wired inductive consumers

- The proportional solenoids must not be wired with spark-suppression diodes.
- Switching solenoids at the outputs of the controller do not need to be connected to spark-suppression diodes.
- The electronics may only be tested with the proportional solenoids connected.
- Other switched inductive loads that are in the system but not connected to the controller must be connected to spark-suppression diodes. The same applies to relays if these have the same power supply as the controller.

Intended use

- The controller is designed for use in mobile working machines provided no limitations / restrictions are made to certain application areas in this data sheet.
- Operation of the controller must generally occur within the operating ranges specified and released in this data sheet, particularly with regard to voltage, current, temperature, vibration, shock and other described environmental influences.
- Use outside of the specified and released boundary conditions may result in danger to life and/or cause damage to components which could result in consequential damage to the mobile working machine.

Improper use

- Any use of the controller other than that described in chapter "Intended use" is considered to be improper.
- Use in explosive areas is not permissible.
- Damages which result from improper use and/or from unauthorized, interference in the component not described in this data sheet render all warranty and liability claims with respect to the manufacturer void.

Use in safety-related functions

- The customer is responsible for performing a risk analysis of the mobile working machine and determining the possible safety-related functions.
- In safety-related applications, the customer is responsible for taking suitable measures for ensuring safety (sensor redundancy, plausibility check, emergency switch, etc.).
  For example, a suitable assignment of input values (e.g. by connecting the acceleration pedal signal to two independent analog inputs) can be used to detect faults and to activate specially programmed reactions. Special measures may be initiated if the plausibility check shows deviations between the setpoint values and the values read back by the microcontroller.
- Please consult Bosch Rexroth if you require product data for a safety assessment of the machine.
  - Notes about all controllers in the API description (manual) must be observed.

Safety features in the BODAS controller

- Faults in the voltage supply are detected by internal monitoring.
- All output signals can be monitored by the microcontroller with the appropriate software.
- For service purposes, the controllers can be operated with all power outputs de-energized.
- The internal watchdog module centrally switches off the power supply of all proportional and switching outputs in the event of disturbances to the program execution.

Further information

- In addition, the application-specific documents (connection diagrams, software descriptions, etc.) are to be observed.
- Further information about the BODAS controllers can be found at www.boschrexroth.com/mobile-electronics

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