Rexroth
Bosch Group

BODAS
CAN I/O Extension Module RCE
Series 22

RE 95220/11.07   1/12
Replaces: 09.06

Technical Data Sheet

For I/O extension and for closed-
and open-loop control
of hydraulic components

Contents

Features

– Component of BODAS system for mobile applications

– Robust design meeting specifications for mobile applications

– High electromagnetic compatibility (EMC)

– Inputs and outputs with fault detection

– Central safety cut-off for all outputs

– Pulse-width-modulated (PWM) solenoid currents with adjust-
able dither frequency for minimum hysteresis

– Closed-loop control of solenoid currents, i.e. not dependent
on voltage and temperature

– Sturdy, sealed aluminum housing

– Standardized CANopen communication

Ordering Code

RC	E	12-4	/	22
01	02	03		04

Type

01	BODAS controller	RC

CAN extension module

02	I/O extension	E

Version

03	1st digit = no. of proportional outputs 2nd digit = no. of switched outputs	12-4

Series

| 04	Series 2, index 2	22

Description

The BODAS CAN I/O extension module RCE serves to provide a simple and inexpensive extension of the I/O capacity extension of the RC controllers in the event that the number of controller inputs and outputs is insufficient for the specified application.

The RCE is connected to the RC controllers via the CAN bus. The standardized CANopen protocol is used for communication between the controller and extension module. The RCE is delivered with a standardized software package; no programming of the RCE is, therefore, necessary. The RCE can be easily configured with commercially available CANopen configuration tools. This is performed via standardized CANopen routines by means of so-called Service Data Objects (SDO).

Further details can be found in operating instructions RE 95220-01-B.

Block Circuit Diagram
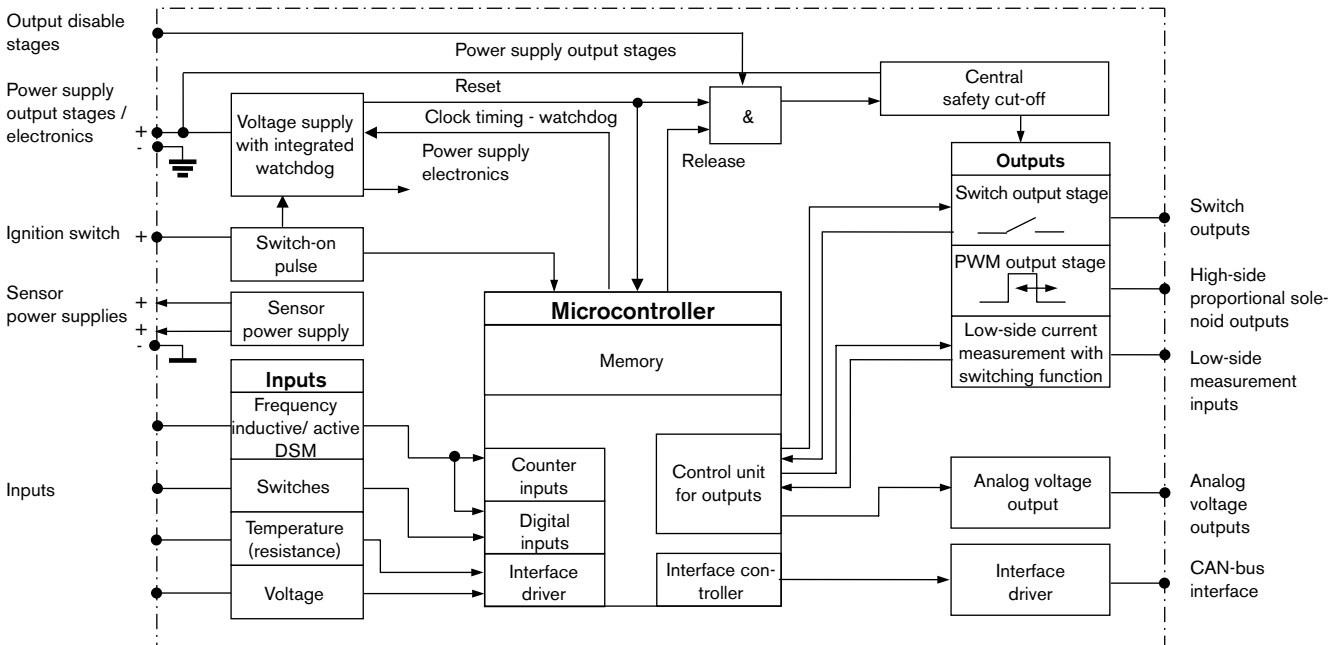
Technical Data

Controller		RCE12-4/22
Nominal voltage	12 and 24 V	✓
Residual ripple (DIN 40839, Part 1)	max. ± 2 V	✓
Supply voltage, permitted range	8 - 32 V	✓
Current consumption		
Without load, max.	mA	500
With load, max.	A	18
Fuse		
Internal:		–
External:	AT	20
Constant voltage source		
E.g. for setpoint potentiometer 1 - 5 kΩ	5 V ± 0.1 V, 100 mA	1
Constant voltage source		
E.g. for setpoint potentiometer 1 - 5 kΩ	8 V ± 0.4 V, 100 mA	1
Analog voltage inputs[1]		
(may also be used as switch input)	0 - 5 V	10
	0 - 8 V	5
Analog resistor inputs	900 - 1800 Ω	2
Switch inputs		
High active	low < 1.5 V; high > 4.5 V	7
Low active	low < 1.5 V; high > 4.5 V	7
Frequency inputs		
DSM 1-10	0 - 13.5 kHz	2
Proportional solenoid outputs (PWM)		
Current range	0 - 2.3 A	12
Pulsation frequency	100, 167, 250 Hz	
Switched outputs (MOSFET)		
	max. 10 mA	2
	max. 2 A	4
Analog voltage outputs		
	0 - 5 V	1
	0 - 10 V	1
Interfaces		
CAN 2.0 B	ISO 11898	1
Fault detection for cable break and short circuit		
Analog inputs[2]		✓
Proportional solenoid outputs		✓
Protection against short circuit of the inputs and outputs		
Against supply voltage and ground[3][4]		✓
Reverse-connect protection		
Power supply / battery[5]		3 [3]

[1] Switchable with supply voltage
[2] With sensor signal 0.5 - 4.5/7.5 VDC
[3] The frequency inputs and resistor inputs are not continuously protected against short circuits to the battery voltage of 24 V.
[4] Voltages greater than those applied to supply pins 1, 27, 41 must not be applied to the outputs.
[5] The external fuse trips in the event of voltage reversal.

Technical Data

Controller		RCE12-4/22
Electromagnetic compatibility		
Spurious interference (motor vehicles directive 95/54/EG)	100 V_{RMS}/m; (details on request)	✓
Line-bound interference (ISO 7637-1/-2/-3)	Values on request	✓
Load dump	70 V	✓
Max. dissipation power	W at 32 V	8.0
Operating temperature, case	-40 to +85°C (-40 to 185°F)	✓
Storage temperature, case	-40 to +85°C (-40 to 185°F)	✓
Vibration resistance:		
Sinusoidal vibration (IEC 60068-2-6)	Values on request	✓
Random-shaped vibration (IEC 60068-2-64, ISO 16750-3)	Values on request	✓
Shock resistance:		
Transport shock (IEC 60068-2-27)	15 g; 11 ms per spatial axis x, y, z and 6 x in each direction (pos./neg.)	✓
Continuous shock (IEC 60068-2-29)	25 g; 6 ms per spatial axis x, y, z and 1000x in each direction (pos./neg.)	✓
Resistance to moisture (IEC 60068-2-30Db; Variant 2)	95% (+25 to +55°C)	✓
Resistance to salt spray (IEC 60068-2-11)	72 h, 35°C, 5% NaCl	✓
Type of protection (DIN / EN 60529)[1] Without / with mounted mating connector	IP54k / IP65	✓
Case material	Diecast aluminum	✓
Weight	Approx. kg	0.7
Outer dimensions	Length (in mm)	187
	Width (in mm)	202
	Height (in mm)	45
Mating Connector	52-pin	1
	28-pin	1

[1] Taking installation notes into account

Connection Diagram RCE12-4/22
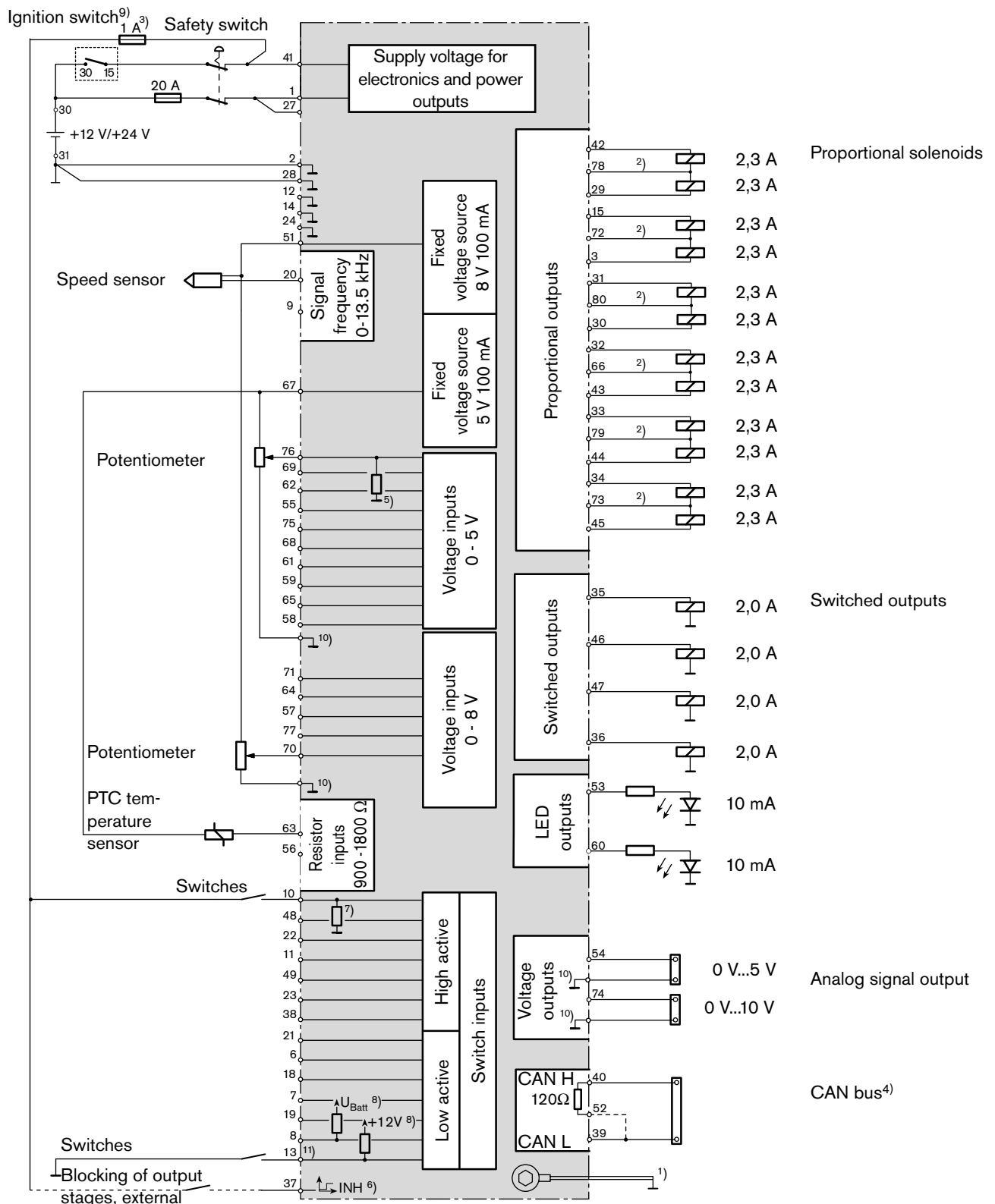
1) Short, low-resistance connection from a case screw to the device ground or vehicle ground

2) Common return line to controller for each pair of solenoids

3) Separate fuses for switches and sensors necessary

4) CAN bus: termination resistor 120 Ω necessary

5) All voltage inputs with pull-down as shown for pin 76.

6) Levels ≥ 5 V block the output stages (proportional and switched outputs)

7) All high-active switch inputs with internal pull-down as shown for pin 10.

8) Pin 13 has a pull-up to 12 V, all other low-active switch inputs have a pull-up to U_{Batt}

9) The terminals are labeled according to DIN 72 552. This does not apply for the controller.

10) Use pins 12, 14 or 24 as signal ground for analog and frequency signals.

11) Pin 13 is not detected as low if this pin is open when switching on

Overview of Functions

Pin	Description	Main function	Alternative functions
21, 6, 18, 7, 19, 8, 13	**Digital input** DI_1 - DI_7	**Digital input** Switching thresholds 1.5 V / 4.5 V Input resistance DC to V_KL30: 10 kΩ	
10, 48, 22, 11, 49, 23, 38	**Digital input** DI_8 - DI_14	**Digital input** Switching thresholds 1.5 V / 4.5 V Input resistance DC to GND 10 kΩ	
20, 9	**DSM frequency input** FI_1, FI_2	**Frequency input for Rexroth DSM sensors** Frequency evaluation including additional information such as direction of rotation and error monitoring up to 13.5 kHz (max. tooth pulsation frequency 6.5 kHz)	**Digital input (only in 12-V electrical system)** Switching thresholds 1.5 V / 4.5 V Input resistance DC to GND 200 Ω
76, 69, 62, 55, 75, 68, 61, 59, 65, 58	**Analog voltage input** AI_8 - AI_17	**Analog voltage input** Measuring range 0 - 5 V Resolution 10 bit (5.4 mV) Input resistance DC to GND 110 kΩ Limit frequency filter 370 Hz	**Digital input** Switching thresholds 1.5 V / 4.5 V Input resistance DC to GND 110 kΩ
71, 64, 57, 77, 70	**Analog voltage input** AI_1 - AI_5	**Analog voltage input** Measuring range 0 - 8 V Resolution 10 bit (8.6 mV) Input resistance DC to GND 119 kΩ Limit frequency filter 250 Hz	**Digital input** Switching thresholds 1.5 V / 4.5 V Input resistance DC to GND 119 kΩ
63, 56	**Temperature input** AI_6, AI_7	**Temperature measurement by means of resistance measurement of connected Bosch temperature sensors** Evaluation of passive temperature sensors with PTC measuring resistors	
42, 29, 15, 3, 31, 30	**PWM output stage** PO_1 - PO_6 (PWM 1 - PWM 6)	**PWM output stage** High-side switch, PWM carrier frequency 1 kHz, dither frequency programmable via software Integrated suppression diode for inductive kickback Max. current 2.3 A Pulse duty factor 0 - 95%	
32, 43, 33, 44, 34, 45	**PWM output stage** DO_1 - DO_6 (PWM 7 - PWM 12)	**PWM output stage** High-side switch, PWM carrier frequency 500 Hz, dither frequency programmable via software Integrated suppression diode for inductive kickback Max. current 2.3 A Pulse duty factor 0 - 100%	**Switch output stage** Diagnostics-compatible Actuated time 100%

Overview of Functions

Pin	Description	Main function	Alternative functions
35, 46, 47, 36	**Switch output stage** DO_7 - DO_10	**Switch output stage** High-side switch Integrated suppression diode for inductive kickback Max. current 2.0 A	
78, 72, 80, 66, 79, 73	**Analog current input** PO2_1 - PO2_6 PO2_1: PWM 1, PWM 2 PO2_2: PWM 3, PWM 4 PO2_3: PWM 5, PWM 6 PO2_4: PWM 7, PWM 8 PO2_5: PWM 9, PWM 10 PO2_6: PWM 11, PWM 12	**Analog current measurement input** Measuring range 0 - 2.5 A Load 100 mΩ Resolution 10 bit (2.6 mA) Limit frequency filter 250 Hz	
54	**Analog voltage output** AO_1	**Analog voltage output** Voltage range 0 - 5 V Resolution 10 bit (4.9 mV) Load capacity 5 mA	
74	**Analog voltage output** AO_2	**Analog voltage output** Voltage range 0 - 10 V Resolution 10 bit (9.8 mV) Load capacity 5 mA	
53, 60	**Signal output** DOL_1, DOL_2	**Signal output** High-side switch Max. current 10 mA	
67	**Sensor supply** V_SS_1	**Sensor supply** Output voltage 5.0 V Precision 2% Load capacity 100 mA	
51	**Sensor supply** V_SS_2	**Sensor supply, can be switched off** Output voltage 8.0 V Precision 5% Load capacity 100 mA	
37	**Output enable[1]** DI_15	**Digital input** Levels ≥ 5 V cause output stages to be blocked Input resistance DC to GND 100 kΩ	
40, 39, 52	**CAN interface** CAN1_H, CAN1_T, CAN1_L	**CAN interface** CAN 2.0B, 1 Mbaud Termination resistor 120 Ω (through connection of CAN1_T and CAN1_L)	

[1] Independent input for release/shutdown of the power outputs.

Dimensions RCE12-4/22
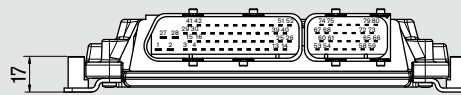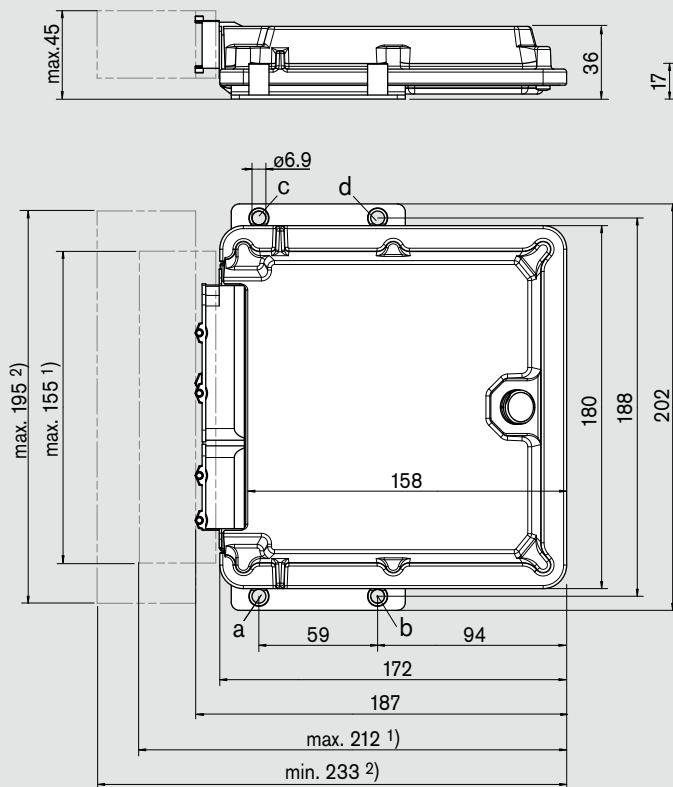
Fixing:

– The BODAS CAN I/O extension module must be fixed at 4 points (a, b, c, and d).

– Tightening torque MA = 8 ± 2 Nm for fixing the BODAS CAN I/O extension module with M6 screws.

– Tightening torque applies for mounting without washer. The equivalent tightening torque must be calculated when using washers.

– Rexroth's approval is required if mounting is different from above.

– Installation point: evenness of mounting surface ⬭ 0.5

– The wiring harness should be fixated mechanically in the area in which the controller is installed (spacing < 150 mm).
The wiring harness should be fixated such that a phase excitation with the controller occurs (e.g. at the controller mounting point).

If the mounting surface is not sufficiently even, place flexible compensating elements (e.g. rubber washers) between the fixing points of the BODAS controller and the mounting surface.

[1]) Space required for mating connector

[2]) Space required for plugging and unplugging the mating connector

Installation Position
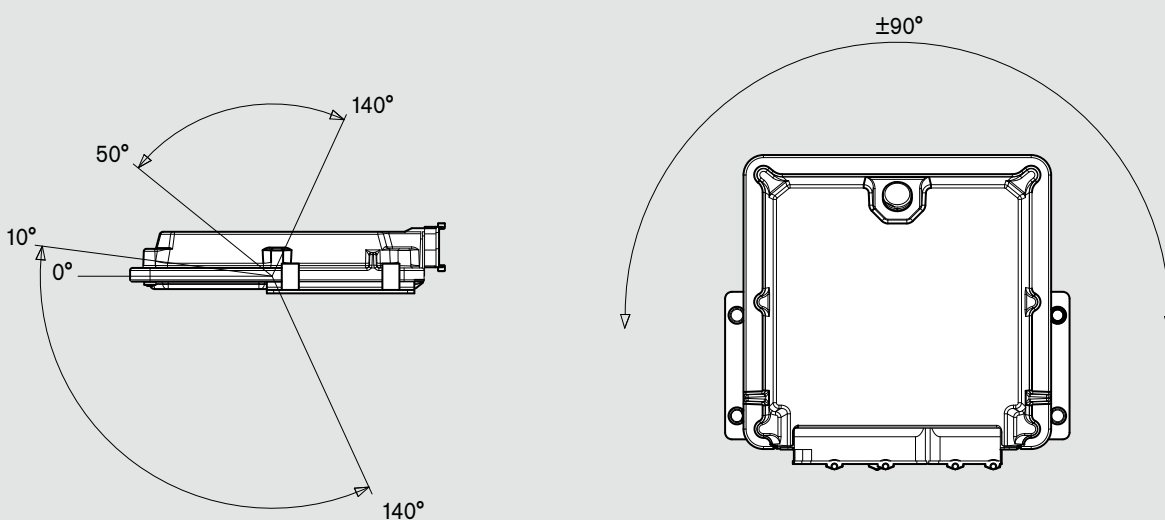
Note:

Installation position only permissible with specified angular range.

Mating Connector

Order designations for mating connector, consisting of:

Designation	AMP No.	Number for AMP-Tyco MT2/JPT	
		52-pin ID No R902602414	28-pin ID No R902602415
Junior-Power-Timer-contacts	0-0964285-2	4	–
Single-wire seals JPT	0-0963293-1	4	–
Micro-Timer-2 contacts	0-0964275-2	48	28
Single-wire seals MT2	0-0964972-1	48	28
Basic unit MT2/JPT; 52-pin	0-1393450-3	1	–
Basic unit MT2; 28-pin	0-1393436-2	–	1
Cover	0-1393454-7	1	–
Cover	0-1393454-2	–	1
Leakage dummy plugs F.D3,6-MT2	0-0963531-1	40	–

The mating connectors are not included in supply.

The mating connectors are available from Rexroth as a kit with all materials under the following material numbers:

– Mating connector kit 52-pin: Mat. no. R902602414

– Mating connector kit 28-pin: Mat. no. R902602415

Recommended line

Recommended connection lines for contacts 1, 2, 27 and 28:

– Cross section 1.0 mm² (16 AWG with thin insulation)

– Outer diameter: 2.0 mm - 2.7 mm

Recommended connection lines for the other contacts (except for 1, 2, 27 and 28):

– Cross section 0.5 mm² (20 AWG)

– Outer diameter: 1.9 mm - 2.1 mm

Safety Notes

• General instructions:
   – Reliable operation cannot be guaranteed if samples or prototypes are used in series production machines.
   – The suggested circuits do not imply any technical liability for the system on the part of Rexroth.
   – Incorrect connections could cause unexpected signals at the outputs of the controller.
   – Dangerous malfunctions may result if the control electronics are opened or modified or the wiring repaired without authorization.
   – In addition, the application-specific documents (connection diagrams, software descriptions, etc.) are to be observed.
   – To switch off the system in emergencies, the power supply to the electronics must be disconnected with a safety switch.
      The safety switch must be installed in an easily accessible position for the operator.
      The system must be designed in such a way that actuating the safety switch ensures safe braking.
   – 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 the components used and with the
      complete system.
   – Unexpected dangers may be present at the machine during commissioning of the RC. For this reason, before
      commissioning the system, you must ensure that the vehicle and the hydraulic system are in a safe condition.
      Make certain that no persons are present in the danger zone of the machine.
   – No components that are defective or not working properly should be used. If components fail and/or exhibit malfunction,
      repair must be carried out immediately.
   – The controller RC warms up above regular ambient temperature during operation. To prevent risks due to high
      temperatures, it should be attached and protected before it is touched.
   – Incorrect programming of the RC may create potential sources of danger while the machine is in operation.
      It is the responsibility of the machine manufacturer to determine dangers of this type in a risk assessment and to bring them
      to the attention of the end user. Rexroth assumes no liability for risks of this type.
   – Make sure that the controller 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.

• Conventional use:
   – The controller RC 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 RC must generally occur within the operating ranges specified and released in this data sheet,
      particularly with regard to voltage, 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 complete system.
   – Damages which result from improper use and/or from unauthorized, unintended interventions in the device not described
      in this data sheet render all warranty and liability claims with respect to the manufacturer void.

• Notes on the installation point and position:
   – Do not install the controller near parts which generate considerable heat (e.g. exhaust).
   – Install the controller in such a way that the connector is pointing downwards. This ensures that any condensation water
      can drain.
   – A sufficiently large distance to radio systems must be maintained.
   – All connectors must be unplugged from the electronics during electrical welding operations.
   – The controller must not be electrostatically charged, e.g. during painting operations.
   – Radio equipment and mobile telephones must not be used in the driver's cab without a suitable antenna or near the
      control electronics.
   – Cables/wires must be sealed individually to prevent water from entering the controller.

• Notes on transport and storage:
   – Controllers must be stored in mean relative humidity of 60% at a temperature
      between -10°C and +30°C. Briefly, for 100 hours, a storage temperature range of -20°C to +40°C is permissible.
   – After a storage time of more than 5 years, the controller must be examined by the manufacturer before it is used.
   – The controller must not be used if it has been dropped, as damage that is not visible could still affect its reliability.

Safety Notes

• Notes on circuitry and on wiring:
  – The lines used for speed sensors are to be shielded. The shield must be connected to the electronics on one side or to the machine or vehicle ground via a low-resistance connection.
  – Cables to the electronics must not be routed close to other power-conducting lines in the machine or vehicle.
  – The electronics and the power outputs of a controller must be fed from the same power source.
  – The wiring harness should be fixated mechanically in the area in which the controller is installed (spacing < 150mm).
    The wiring harness should be fixated such that a phase excitation with the controller occurs
    (e.g. at the controller mounting point).
  – When wiring the output stages, the maximum cumulative output current for each output stage group should be noted. The cumulative output current means a permanent, simultaneous actuation of the output stages.

• Notes on proportional solenoids and switching solenoids and other switched inductive consumers:
  – The electronics may only be tested with the proportional solenoids connected.
  – The proportional solenoids must not be wired with suppression diodes.
  – Switching solenoids at the outputs of the controller RC do not need to be connected to suppression diodes.
  – Other inductive loads that are in the system but not connected to the controller RC must be connected to suppression diodes.

Safety features in the RCE

– Faults in the supply voltage 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 all proportional and switched outputs in the event of disturbances to the program execution.

Product-specific notes

– Via the release input, the output stages (proportional and switched outputs) are switched off independent of the CAN bus.