MOBILE ELECTRONICS

BOSCH REXROTH DIGITAL APPLICATION SOLUTIONS

BODAS Hardware
Modular end-to-end connectivity solution to transfer data from and to the mobile machine. Unbundled and freely selectable services consisting of device management, data management and ready to use apps for fleet management, vehicle health, remote R&D services and vehicle operation workflows.

BODAS Software
Standard application software for machine functions based on BODAS Hardware. Perfectly harmonizing with Rexroth hydraulics, BODAS Software enables ideal machine control. Including the tools for programming, parameterization and diagnosis of BODAS Hardware.

BODAS Connect
Open, scalable and freely accessible mobile electronics platform consisting of control units, connectivity devices, sensors and human machine interfaces (joysticks, displays, pedals) for mobile machines. Individual BODAS Hardware components are freely programmable and ready for BODAS Connect.
YOUR BENEFITS – ACCESS THE DIGITAL TRANSFORMATION

BODAS is a holistic ecosystem, available off the shelf, to cover your drive and control needs all from one source.

The openness and modularity of BODAS allows you to integrate and combine our system approach technology according to meet your needs and requirements.

With a high degree of flexibility and ease of use, the BODAS ecosystem design is ready to meet state of the art functionality regarding machinery directives and functional safety up to PL_d according to ISO 13849 and ISO 19014, as well as AgPL_d according to ISO 25119.

The BODAS ecosystem, through integration and use of automotive based security solutions, addresses all relevant layers to reach a secure mobile machine control and is robust against cyber attacks.

Flexible end-to-end connectivity including device management, data management and apps on the basis of the Bosch IoT Suite.

Using Bosch automotive leading edge quality and technology, BODAS offers an outstanding portfolio designed and specified by Bosch Rexroth to fulfill the mobile market requirements.
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BODAS ECOSYSTEM

How far do you want to go?

You need high-quality components?
→ BODAS Component Kit with the right environment for development.

You need a complete solution?
BODAS kit extended to our long-year expertise and solution competence.

→ BODAS Ecosystem:

The right meeting point between your machine and our components.
NEW ECU SERIES 40

Automotive based multi-core control technology
Rexroth controller RC series 40
with enhanced functionality

- Rugged design for use in mobile machinery
- Scalable platform with three pin-compatible control units (small, mid, large)
- Usable for applications with functional safety requirements
- 32 bit multi-core µC with lockstep functionality
- Hardware Security Module (HSM) integrated
- Multi-functional inputs for compatibility with many sensors and input devices
- Power outputs with enhanced diagnostics features and high currents
- Communication interfaces: CAN FD, Ethernet, LIN
- ISOBUS: RC5-6/40 hardware compliant for T-ECU
  (RC18-12/40 and RC27-18/40 planned)

RC5-6/40
RC/40 mid
RC/40 large
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EVOLUTION FROM SERIES 30 TO SERIES 40

Series 3x takeovers
- Bosch technology
- Bosch manufacturing
- EPA housing
- Connector type (fits MA8)
- EN ISO 13849 up to PLe
- SENT sensor interfaces
- C and BODAS-design

Series 3x improved
- Configurability of inputs
- ISO 25119 now up to Ag PLd
- High output currents
- Current control accuracy
- Output diagnosis
- Isobus implementation
- CCP replaced by XCP (eXTended calibration protocol)

Series 40 new
- Multi-core and lockstep µC
- Relay outputs 200 mA
- CAN FD
- Safety certification
- Easy configuration tool
- Cyber security ready (HSM)

New! Series 40

Please choose!
## SERIES 40 SPECIFICATIONS

**Automotive based Multicore Control Technology**

**Rexroth Controller RC Series 40 with Enhanced Functionality**

<table>
<thead>
<tr>
<th>Processor Type / clock frequency</th>
<th>Flash Memory</th>
<th>Power outputs with CLCC</th>
<th>Power outputs non CLCC</th>
<th>Inputs</th>
<th>Functional safety</th>
<th>Software</th>
<th>Connectivity</th>
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<tbody>
<tr>
<td>RC Controller</td>
<td>HS</td>
<td>LS</td>
<td>HS</td>
<td>LS</td>
<td>Total / Sent</td>
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<td>ISO 25119</td>
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<td>6</td>
<td>30 / 8</td>
<td>PL d</td>
<td>AgPLd</td>
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<td>18-12/40 preliminary</td>
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<td>10</td>
<td>59 / 12</td>
<td>PL d</td>
<td>AgPLd</td>
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<td>27-18/40 preliminary</td>
<td>10 MB</td>
<td>3</td>
<td>15</td>
<td>59 / 12</td>
<td>PL d</td>
<td>AgPLc</td>
<td></td>
</tr>
</tbody>
</table>

**Controller**

- Controller series 40 small
- Controller series 40 mid
- Controller series 40 large
- Controller RCA-5 series 30
- Controller family series 30
- Controller RCE series 31

**Connectivity**

- Connectivity device RCU
- Angle sensor AN3
- Pressure sensor PR4
- Inertial sensor MM7.10
- Display DI4
- Camera CAM
- Electronic joystick 4THE5
Rexroth IO module: the extension of functionalities

- CANopen compliant I/O module
- Possibility to shut-off with SafeOut configuration
- High performance thanks to 32-bit TriCore technology with 270 MHz
- Robust and compact design meeting specifications for mobile applications
- High Electromagnetic Compatibility (EMC)
- Inputs and outputs with integrated diagnostic
- Central output deactivation
- Usable for applications with functional safety requirements
- Optional safety Integrated

I/O MODULE RCE10-10/31

SAFETY ON BOARD

RCE10-10/31

CANopen compliant I/O module
- Possibility to shut-off with SafeOut configuration
- High performance thanks to 32-bit TriCore technology with 270 MHz
- Robust and compact design meeting specifications for mobile applications
- High Electromagnetic Compatibility (EMC)
- Inputs and outputs with integrated diagnostic
- Central output deactivation
- Usable for applications with functional safety requirements
- Optional safety Integrated

Connecting device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE5

HOME
BODAS
ECOSYSTEM
NEW BODAS HARDWARE
TOOL CHAIN
SENSING
DISPLAY AND JOYSTICKS
SOLUTION COMPETENCE
SAFETY AND SECURITY
INTERNET OF THINGS
COMPONENTS
Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller R4A-5 series 30
Controller family series 30
Controller RCE series 31
Connectivity device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE5
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TOOL CHAIN SERIES 40 – THE APPLICATION SW DEVELOPMENT

Configure
I/O
CAN
Memory
OS

Generate
Algorithm

Build
Process

Download

OEM offline
ASW development
C / Codesys

Update ASW

Flash

SW validation

Easy
Config

cfg.h
cfg.c

BODAS
BSW

Bodas-
editor

Bodas-
service

FSP

OEM with
web front-end

Update RC configuration (e.g. harness, CAN)
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TOOL CHAIN SERIES 40 – THE EASY CONFIG (EC) CONCEPT

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TOOL CHAIN SERIES 40 –
THE BODAS SERVICE CONCEPT

OTX: Open Test sequence eXchange, ISO 13209
ODX: Open Diagnostic Data Exchange, ODX-Standard
(ASAM MCD-2D)

HOME
BODAS
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INTERNET OF THINGS
COMPONENTS
Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller RCA-5 series 30
Controller RCE series 31
Connectivity device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE3
### High measurement precision
- Stainless steel sensing element with metal thin film strain gages
- Pressure ranges: 50, 100, 280, 400, 420, 600 bar
- Sensor outputs:
  - Ratiometric 0.5 V...4.5 V
  - SENT according SAE J 2716:
- Protection class: IP67 and IP69K
- Tightening torque: up to 45 Nm

### Compact design

### Temperature Signal via SENT

### Robust speed sensor
- Hall-effect sensor for contactless speed measuring
- Frequency range: 0 Hz to 20 kHz
- Dual-frequency signal available
- Two versions of shaft length: 18.4 and 32 mm
- Temperature range: -40 ... +125 °C

### Pressure resistance up to 10 bar
- IP67 / IP69K Protection

### Connected objects
- Connectivity device RCU
- Angle sensor AN3
- Pressure sensor PR4
- Inertial sensor MM7.10
- Display DI4
- Camera CAM
- Electronic joystick 4THE5
MOBILE ELECTRONICS

SENSING

MM7.10

Basis for automation
6D inertial signals
Flex. Network integration

- All signals provided by CAN 2.0 B - ISO 11898
- Operating temperature: -40 ... + 85 °C
- Small and compact size
- Protection class: IP6K7
- Configurable settings
- Baud, CAN Identifier length
- CAN ID’s, CAN update rate

AN3

Temperature compensated
Cost effective
Up to IP69K

- Hall-effect measuring technology (contact-less, wear-free)
- Rotatable through 360 °
- Measuring range: ± 28 ° ... ± 44 °
- Sensor signal: 10 % ... 90 % U supply
- Protection class: IP67 and IP69K
- Further angle ranges possible upon request
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HMI: DI4 DISPLAY AND JOYSTICKS

BODAS-Display DI4
Freely programmable with Codesys V3.5.x

- 7 inch display, resolution 800 x 480 px., 500 cd/m²
- 6+6 softkeys, 2x hardkeys, 1x Rotary push button
  - 2x CAN 2.0B up to 1 Mbit/s
- 2x Analog Video (PAL/NTSC) incl. 12 Volt supply
  - 1x USB 2.0 Full-speed OTG
  - 3x analog/digital-in + 2 x digital-out
  - 1x acoustic speaker / 1 x audio out
  - 3x single color + 1 x multi color LED
- Ambient light sensor for adaption of illumination
- Variable illumination of buttons, icon, encoder
- Additional features Pro-Variant:
  - Touch, Ethernet

4THE5 Electronic Joystick with embedded cross check by 2 μcontrollers.

- 20 ms refresh time on actuation
  Optional 10 or 5 ms
- J1939 Std or J1939 Enhanced w/ CheckSum
  CAN Open or BRM Std.
- Ratiometric output (Linked to supply level)
  Reverse 0,7 V – Neutral 2,5 V – Front 4,3 V
- PWM SIGNAL
  Frequency 500Hz
  Output duty cycle (5 – 50 – 95 %)

BODAS Home Ecosystem
New BODAS Hardware Tool Chain
Sensing Display and Joysticks Solution Competence
Safety and Security Internet of Things Components

Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller RCE-5 series 30
Controller family series 30
Controller RCE series 31
Connectivity device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE5
MOBILE ELECTRONICS

HMI: JOYSTICKS

HF Finger Tip Joysticks
- 1, 2 and 3 axis option
- Push button handle options
- J1939 Std or CAN Open outputs
- 5 million cycles
- Shallow mounting depth < 1 inch
- Integrated connector

HG Hand Grip hall effect joystick
- Rugged Hand operation
- Multifunction grip and push button options
- 1, 2 and 3 axis option (x, y, z)
- J1939 Std or CAN Open outputs
- Variable spring tensions available
- 10 million cycles
- DT04 connector
How far do you want to go?

→ BODAS Software Solutions: The right meeting point between your requirements and our expertise.
**MOBILE ELECTRONICS**

**SOLUTION COMPETENCE WITH MASAR ARCHITECTURE**

*MASAR = Modular Application Software Architecture*

---

**Standardization**
Set of structure, patterns, design decisions and rules applicable to all application software layers. Easily linked to model based development

**Easy Access**
Centralized error management allows easy modification without compromising safety. No ambiguity ensures programmers use every function in the same way

**Reusable**
AUTOSAR-conform (HW independent SW development) to increase software reusability and reduce R&D cost

**Customer Value**
Flexible and easy step into BODAS SW world according to customer need and strategy. MASAR architecture supports simultaneous engineering and modern development strategy (e.g., MATLAB/Simulink) for SW quality assurance

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**Controller**
- Controller series 40 small
- Controller series 40 mid
- Controller series 40 large
- Controller RC4-5 series 30
- Controller family series 30
- Controller RCE series 31

**Connectivity**
- Connectivity device RCU

**Sensor**
- Angle sensor AN3
- Pressure sensor PR4
- Inertial sensor MM7.10

**Display**
- Display Di4

**Electronic joystick**
- Electronic joystick 4THE5

---

**Device Encapsulation**
Base – Controller Configuration
API – Controller Abstraction

**Customer**
Integrate own application SW
Request MASAR template

**Device**
Eng, Tra, PT

**Vehicle**
Pwr On, Os, Hw, Proc, Val, Dbg, Dev, Lib, DevInp, DevOutp

---

**Masar**
M odular A pplication S oftware A rchitecture
MOBILE ELECTRONICS

SAFETY AND SECURITY – BODAS CYBER SECURITY

SECURITY
protects machines from humans (attackers)

SAFETY
protects humans from machines

A security attack can lead to safety issues

Please choose!
SAFETY AND SECURITY – BODAS CYBER SECURITY

Why is security important?
One example: Tractor Implement Management

Layer 1: Individual ECU
- Protect integrity of ECU SW & data
- Hardware Security Module (HSM)

Layer 2: In-vehicle network
- Protect integrity of critical in-vehicle signals

Layer 3: E/E-Architecture
- Protect and separate domains by E/E architectures and gateways

Layer 4: Connected vehicle
- Vehicle firewalls and security standards for communication and external interfaces

Source: aef-online.org
SAFETY AND SECURITY – SAFETY COMPETENCE

Consultancy
From concept to series production. Rexroth supports customer development process and optimize the cost for safety functionality

Training
Transfer knowledge and competency in functional safety, from process to application, to customer design team

Moderation
Rexroth has deep knowledge in international norms of various application. Rexroth has expertise to provide moderation in risk assessment

Product Safety Instructions
“How to do safety”

MTTFd and DC Values

Functional Safety
Fault avoidance
Fault detection
Fault control

Expertise

Experience

Application know-how to balance between safety and machine availability

Consultancy
Training
Moderation
IoT OVERVIEW: CONNECTED OFF-HIGHWAY SOLUTION
THE OPEN END-TO-END IoT STACK
EXAMPLES OF IoT APPS

1. VEHICLE TRACKING
2. REMOTE FLASHING FOTA
3. MONITOR MECHANICS
4. MONITOR HYDRAULICS

PACKAGES
Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller series 30
Controller family series 30
Controller RCE series 31
Connectivity device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display Di4
Camera CAM
Electronic joystick 4THE5
MOBILE ELECTRONICS

BODAS CONTROLLER SERIES 40 SMALL: RC5-6/40

Technical data
- STMicroelectronics SPC58 with 200 MHZ
- Programmable in C and Codesys
- Compact housing with one connector chamber
- Nominal voltage 12 V / 24 V
- All power outputs up to 4 A
- Highly configurable inputs (digital, voltage, resistance, current)
- Up to 8 SENT inputs
- 1x LIN master
- 8 switching outputs up to 200 mA, e.g. for relais
- Constant voltage sources: 3 x 5 V, 1 x 10 V
- Diagnostics / flashing with BODAS-service tool

Characteristics
- Multifunctional Inputs total: 30
- Current controller power outputs: 5
- Digital outputs: 6
- Analog outputs: 8
- CAN / CAN-FD bus interfaces: 2
- ISOBUS interface: 1
MOBILE ELECTRONICS

BODAS CONTROLLER SERIES 40 MID: RC18-12/40

Technical data
- Infineon TC389, 300 MHz
- Programmable in C and Codesys
- Compact housing with 2 connector chamber
- Nominal voltage 12 V / 24 V
- Power outputs up to 3/4 A
- Highly configurable inputs (digital, voltage, resistance, current)
- Up to 8 SENT inputs
- 1x LIN master
- 1x Ethernet 100 Base T1
- 8 switching outputs up to 200 mA, e.g. for relais
- Constant voltage sources: 3 x 5 V, 1 x 10 V
- Diagnostics / flashing with BODAS-service tool

Characteristics
- Multifunctional Inputs total: 59
- Current controller power outputs: 18
- Digital outputs: 12
- Analog outputs: 8
- CAN / CAN-FD bus interfaces: 3
- ISOBUS interface: 1

Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller RCE-4 series 30
Controller RCE family series 30
Controller product series 31
Connectivity device RCU
Angle sensor AN3
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE5
MOBILE ELECTRONICS

BODAS CONTROLLER SERIES 40 LARGE: RC27-18/40

Technical data
- Infineon TC389, 300 MHz
- Programmable in C and Codesys
- Compact housing with 2 connector chamber
- Nominal voltage 12 V / 24 V
- Power outputs up to 3/4 A
- Highly configurable inputs (digital, voltage, resistance, current)
- Up to 8 SENT inputs
- 1x LIN Master
- 1x Ethernet 100 Base T1
- 8 switching outputs up to 200 mA, e.g. for relays
- Constant voltage sources: 3 x 5 V, 1 x 10 V
- Diagnostics / flashing with BODAS-service tool

Characteristics
- Multifunctional Inputs total: 59
- Current controller power outputs: 27
- Digital outputs: 18
- Analog outputs: 8
- CAN bus interfaces: 3
- ISOBUS interface: 1
BODAS CONTROLLER RC4-5 SERIES 30

Technical data

- 32-bit CPU TC1724 @ 80 MHz
- Programmable in C
- Compact housing with one connector chamber
- Nominal voltage 12 V / 24 V
- Power outputs up to 2.3 A or 3.5 A
- Protection class IP66
- Frequency inputs: active, inductive, Rexroth DSM
- 4 temperature/resistance inputs
- Switching output up to 50 mA, e.g. for LED
- Constant voltage sources: 3 x 5 V, 1 x 8.5 V
- Deactivation with inhibit
- Diagnostics / flashing with BODAS-service tool

Characteristics

- Inputs total 30
- PWM outputs 4
- Digital outputs 5
- Analog outputs 1
- CAN bus interfaces 2
## Technical data
- Pin compatible controller family for universal use
- 32-bit CPU TC1797 @ 180 MHz
- Programmable in C and BODAS-design
- Suitable for safety functions up to PLd according to EN ISO 13849
- Suitable for safety functions up to AgPLc according to ISO 25119
- Stop function with Pl.e
- Nominal voltage 12 V / 24 V
- Power outputs from 2.2 A to max. 4.1 A
- Protection class IP65
- Frequency inputs: active, inductive, Rexroth DSM
- 4 temperature/resistance inputs
- Constant voltage sources: 2 x 5 V, 1 x 10 V
- Deactivation with inhibit
- Wake pin
- Diagnostics / flashing with BODAS-service tool

## Characteristics
<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Inputs total</td>
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<tr>
<td>PWM outputs</td>
<td>up to 28</td>
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<tr>
<td>Digital outputs</td>
<td>up to 14</td>
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<tr>
<td>Analog outputs</td>
<td>up to 5</td>
</tr>
<tr>
<td>CAN bus interfaces</td>
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## Connectors
- Controller series 40 small
- Controller series 40 mid
- Controller series 40 large
- Controller RC4-5 series 30
- Controller RCE series 31
- Connectivity device RCU
- Angle sensor AN2
- Pressure sensor PR4
- Inertial sensor MM7.10
- Display DI4
- Camera CAM
- Electronic joystick 4THE5
**BODAS CONTROLLER RCE 10-10/31**

**Technical data**
- 32-bit CPU TC1793 @ 270 MHz
- Nominal voltage 12 V / 24 V
- Power outputs up to 3 A or 4 A
- Protection class IP65
- Frequency inputs: active or Rexroth DSM
- 4 temperature/resistance inputs
- Inputs for SAE J2716 SENT
- Constant voltage sources: 1 x 5 V, 1 x adjustable
- Deactivation with inhibit

**Characteristics**
<table>
<thead>
<tr>
<th>Inputs total</th>
<th>41</th>
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<tr>
<td>Power Outputs</td>
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<tr>
<td>Of which current-controlled</td>
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<td>Analog outputs</td>
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<td>CAN bus interfaces</td>
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</tbody>
</table>

**Components**
- Controller series 40 small
- Controller series 40 mid
- Controller series 40 large
- Controller RC4-5 series 30
- Controller family series 30
- Controller RCE series 31
- Connectivity device RCU
- Angle sensor AN3
- Pressure sensor PR4
- Inertial sensor MM7.10
- Display DI4
- Camera CAM
- Electronic joystick 4THE5
## Technical data

<table>
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<tr>
<td>Analog Inputs</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

## Characteristics

- Cortex A8, 800 MHz; 512 MB DDR3, 1GB NAND Flash
- Linux Kernel; Debian file system
- Container based device management engine
- IP67
- -40°C to +85°C ambient

1) from Q1/2020 onwards
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ANGLE SENSOR AN3

Technical data

- Hall-effect measuring technology
  (contact-less, wear-free)
- Rotatable through 360 °
- Measuring range: ± 28 ° ... ± 44 °
  - Further ranges on request
- Operating voltage: 5 ± 0.5 V
- Sensor signal: 0.1 ... 0.9 Usupply
- Operating temperature: -30 °C ... +80 °C
- EMC: 100 V/m @ 1 MHz ... 1000 MHz
- Protection class: IP67 and IP69K

Characteristics

- Angle sensor with no mechanical end stop
- Integrated electronic with temperature compensation
- Sensor signal prevents from 180 ° turned axis orientation

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BODAS PRESSURE SENSOR PR4

Technical data

- Stainless steel sensing element with metal thin film strain gages
- Thread: SAE-4, SAE-6, G1/4, 14 x 1.5 mm;
- Pressure range:
  - 0...50 / 0...100 / 0...280 bar
  - 0...400 / 0...420 / 0...600 bar
  - others on request
- Sensor signals:
  - Ratio metric 0.5 V...4.5 V @ 5 V supply
  - SENT according to SAE J 2716
  - Sensor supply: 5 V ± 0.25 V
  - Operating temp: -40 °C ... +125 °C
  - Protection class: IP67 and IP69K
  - Connector: Bosch Compact 1.1, others on request
  - To be mounted with a socket wrench
  - Tightening torque: 45 Nm ± 10 %

Characteristics

- High measuring precision & reliability
- Resistant to media
- Low signal sensitivity to mounting torque
- Easy assembly, vibration-resistant, high thermal stability

BODAS PRESSURE SENSOR PR4
- High measuring precision & reliability
- Resistant to media
- Low signal sensitivity to mounting torque
- Easy assembly, vibration-resistant, high thermal stability

Controller series 40 small
Controller series 40 mid
Controller series 40 large
Controller RC4-5 series 30
Controller family series 30
Controller RCE series 31
Connectivity device RCU
Angle sensor AND
Pressure sensor PR4
Inertial sensor MM7.10
Display DI4
Camera CAM
Electronic joystick 4THE5
BODAS INERTIAL SENSOR MM7.10

Technical data
- Measures following inertial signals (5D):
  - Longitudinal acceleration aX
  - Lateral acceleration aY
  - Vertical acceleration aZ
  - Roll rate ΩX
  - Yaw rate ΩZ
  - Pitch Rate ΩY
- Supply voltage: 7 ... 16 V (supply by BODAS RC)
- All signals provided by CAN
- CAN 2.0 B - ISO 11898
- Operating temperature: -40 °C ... +85 °C
- Protection class: IP6K7
- Standard 4-pin TYCO connector
- Configurable settings
  - Baud rate (125 / 250 / 500 / 1000 kBaud)
  - CAN Identifier length (11 / 29 bit)
  - CAN IDs
  - CAN update rate: 5, 10, 20 ms
  - Low pass filter settings: 15, 30, 60 Hz

Characteristics
- 6D inertial sensor
- Small and compact size
- Bosch automotive quality
- Operating time: 10,000 h
BODAS DISPLAY DI4

Technical data

- HMI and control-SW freely programmable with Codesys V3.5 development environment
- 800 MHz processor iMX6 Solo, 2 GB flash memory and 512 MB RAM
- Operation: 12 x soft key, 2 x hard key, rotary/push encoder, optionally touch (DI4-Pro)
- 1 USB 2.0 and 2 CAN-Bus 2.0B interfaces
- 2 video interfaces for the connection of analog video cameras (PAL/NTSC)
- Nominal voltage 12 V / 24 V
- Protection class IP6K5
- Type approval according to UN ECE R10 (E1)
- Integrated ambient light sensor
- 4 status LEDs (1 multi-color, 3 single-color)
- Real-time clock with power reserve (500 h)
- DI4 Professional additionally features touch operation and Ethernet interface

Characteristics

- Universally usable display and operation unit
- 7" WVGA color display (800 x 480 px)
- Numerous integrated interfaces plus I/Os
- Flashing of BODAS RC-controllers via USB interface without additional service equipment
### BODAS CAMERA CAM

**Technical data**

- 2 variants available, opening angle horizontal:
  - 100° (Professional)
  - 120° (Standard)
- \( \frac{1}{4} \)" CMOS sensor, signal NTSC
- Sensor resolution 640 x 480 pixel
- Switchable mirror function
- Nominal voltage 12 V / 24 V
- Temperature range -40 °C ~ +85 °C
- Protection class IP69k
- Power consumption with activated heating ~ 3.5 watt
- SW-based picture correction with Pro variant (reduced „fish-eye-effect“)
- Strongly reduced „blooming“ effect caused by direct light

**Characteristics**

- State-of-the-art CMOS color-camera
- Robust and compact
- Self activating integrated heating
- Flexible positioning with ball-element integrated in the camera
4THE5 ELECTRONIC JOYSTICK

Technical data
- Compact and robust
- Smooth transition to electronification
- Reduced transmission and refresh rates
- Prefeels, Agile deadband options
- Software detents available
- Switches, rocker and rollers on handgrip directly piloted by the base
- Input stage and output stage protected (ESD, overvoltage, short circuit) - Vbat or 5 V / 12 V regulated

Characteristics
- Output signal: CAN, Voltage, PWM
- Performance level: PLb, PLC, PLd (SIL2)
- Operating voltage: 5 V to 36 V
- Operating T°: -20 °C to + 80 °C
- Protection: IP67 (electronics)
4THE5 ELECTRONIC JOYSTICK

- Handgrip shell as today, available on EC3000+, EC3500+, EC4000
- Tamper proof, capacitive technology
- To manage engine idle speed
- Effective with or w/o glove
- ISO 13849, Performance Level c
- Compatible with 4THE5 4x
- Output
  - Digital
  - Polarized (Short circuit detect)
  - Supply voltage = 5-36 V

Characteristics

- To inhibit actuation when no hand on grip
- To manage engine idle speed