

SPARTAN

Affordable, compact measurement instruments for measurement of voltage, current, temperature and bridges

Datasheet Version 2.8



Devices belonging to the SPARTAN series are compact measurement instruments with 16, 32, 64, 96 or 128 channels, for precise measurements of voltage, current, temperature and bridge.

For **isolated** measurements of **voltage** and **temperature**, the two modules **SPAR/T16** and **SPAR/U16** are available, which differ in the maximum sampling rates they provide. With these modules, the measurement inputs on the device can be the customer's choice of either **thermo-sockets**¹ and/or **DSUB-15** connector terminals. DSUB-15 terminals support Plug & Measure (Transducer Electronic Data Sheets (IEEE 1451)).

¹ Only applicable for thermocouple measurement

For measurement of **bridges**, the modules **SPAR/B16** and **SPAR/BC16** are available. The measurement inputs on SPAR/B16 are **DSUB-15** connectors which support imc Plug & Measure (Transducer Electronic Data Sheets (IEEE 1451)). Through the use of **DSUB-26-HD** connectors, SPAR/BC16 is only half as wide as SPAR/B16, but in return lacks the **TEDS** technology.

As standard SPARTAN is equipped with:

- 4 incremental counters for measurement of RPM, velocity or displacement, or for direct counting of pulses
- 16 digital inputs
- 8 digital outputs

As an option the following modules can be ordered for SPARTAN:

- Field-bus signals
- analog outputs
- more incremental counters
- more digital inputs
- more digital outputs
- sensor supply module

The operating interface software **imcDevices/imcStudio** makes the SPARTAN devices immediately ready to take measurements, and provides access to their entire functionality. For specialized tasks such as system integration in test stations, convenient user interfaces for all common programming languages such as Visual Basic™, DIAdem™ and LabVIEW™.

The SPARTAN measurement devices work in either computer-aided mode or in stand-alone mode with **UPS** (uninterrupted power supply) and **auto-activation capability**.

A **modem** (optional) transmits **SMS** or **email** messages in response to measurement results, either via Internet (GPRS) or directly. Data can be saved both on the PC and on an internal **hard drive/ Flash memory card**. SPARTAN series is equipped as standard with a CF-Card slot.

The optional software **Online FAMOS** enables the device's signal processors to perform any desired real-time computations and control functions, making the SPARTAN device into a Personal Analyzer.

Modern, intelligent **TEDS** sensors are completely supported. Conventional sensors can be retrofitted with sensor recognition inside the connector or cable (imc Plug & Measure).

Order code: Article #

SPAR/SPARTAN-1 SPAR-SPARTAN-1-ET	#1130079	portable housing for 1 module with 2 slots, except SPAR/B16 with an extended temperature range
SPAR/SPARTAN-2 SPAR-SPARTAN-2-ET	#1130080	portable housing up to 2 modules with 2 slots* with an extended temperature range
SPAR/SPARTAN-4 SPAR-SPARTAN-4-ET	#1130081	portable housing up to 4 modules with 2 slots* with an extended temperature range
SPAR/SPARTAN-6 SPAR-SPARTAN-6-ET	#1130082	portable housing up to 6 modules with 2 slots* with an extended temperature range
SPAR/SPARTAN-8 SPAR-SPARTAN-8-ET	#1130083	portable housing up to 8 modules with 2 slots* with an extended temperature range
SPAR/SPARTAN-R SPAR-SPARTAN-R-ET	#1130078	module 19" rack up to 8 modules with 2 slots* with an extended temperature range

* one unit Typ SPAR/B16 have the range of two modules

Physical structure:

SPARTAN-1(-ET)	compact, highly robust chassis, 210 x 155 x 246 (WxHxD in mm)
SPARTAN-2(-ET)	compact, highly robust chassis, 250 x 155 x 246 (WxHxD in mm)
SPARTAN-4(-ET))	compact, highly robust chassis, 332 x 155 x 246 (WxHxD in mm)
SPARTAN-6(-ET)	compact, highly robust chassis, 413 x 155 x 246 (WxHxD in mm)
SPARTAN-8(-ET)	compact, highly robust chassis, 494 x 155 x 246 (WxHxD in mm)
SPARTAN-R(-ET)	module 19" rack 427 x 133 x 310 (WxHxD in mm)

Analog modules:

	Article #	
SPAR/T16	#1130084	16-channels, isolated measurement amplifier, 2 slots per module
SPAR/T16-ET	#1131027	with an extended temperature range
SPAR/T16-TC-K	#1130085	SPAR/T16 with TC-sockets 2 pin according IEC 584 (green)
SPAR/T16-TC-K-ET	#1131028	with an extended temperature range
SPAR/U16	#1130086	16-channels, fast isolated measurement amplifier, 2 slots per module
SPAR/U16-ET	#1131029	with an extended temperature range
SPAR/U16-TC-K	#1130087	SPAR/U16 with TC-sockets 2 pin according IEC 584 (green)
SPAR/U16-TC-K-ET	#1131030	with an extended temperature range
SPAR/BC16	#1130089	16-channels, bridge- and voltage-measurement-amplifier, 2 slots per module
SPAR/BC16-ET	#1131032	with an extended temperature range
SPAR/B16	#1130088	16-channels, bridge- and voltage-measurement-amplifier, 4 slots per module
SPAR/B16-ET	#1131031	with an extended temperature range
SPAR/SEN-SUPPLY	#1130028	Sensor supply module for 16 channels, for connection type DSUB15 only, requires no additional slot
SPAR/SEN-SUPPLY-ET	#1131021	with an extended temperature range
	Article #	
SPAR/DI16-DO8-ENC4	1130090	digital multiboard with 16 dig. inputs, 8 dig. outputs and 4 incremental counter inputs, 2 slots per module

SPAR/DI16-DO8-ENC4-ET	1131033	with an extended temperature range
SPAR/DI8-DO8-ENC4-DAC4	1130091	digital multiboard with 8 dig. inputs, 8 dig. outputs, 4 incremental counter inputs and 4 analog outputs, 2 slots per module
SPAR/DI8-DO8-ENC4-DAC4-ET	1131034	with an extended temperature range
SPAR/DI16	1130092	16 digital inputs, 1 slot per module
SPAR/DI16-ET	1131035	with an extended temperature range
SPAR/DO16	1130093	16 digital outputs, 1 slot per module
SPAR/DO16-ET	1131036	with an extended temperature range
SPAR/DAC8	1130094	8 analog outputs, 1 slot per module
SPAR/DAC8-ET	1131037	with an extended temperature range
Field-bus	Article #	
SPAR/CAN2	1130095	CAN-Bus Interface, 1 slot per module
SPAR/CAN2-ET	1131038	with an extended temperature range
SPAR/LIN	1130096	LIN-Bus Interface, 1 slot per module
SPAR/LIN-ET	1131039	with an extended temperature range
SPAR/FLEXRAY	1130097	FlexRay Interface, 1 slot per module
SPAR/FLEXRAY-ET	1131040	with an extended temperature range
SPAR/ARINC	1130098	ARINC-Interface with 8 Rx channels, 1 slot per module
SPAR/ARINC-ET	1131041	with an extended temperature range

Connection terminals

- PC-connection via Ethernet TCP/IP, 10/100 MBit
- Signal connection to analog modules
 - via 15-pin DSUB clamp terminal (standard) at SPAR/T16, SPAR/U16, SPAR/B16
 - or thermo-sockets: front panel for 16 channels thermocouple Typ K; optional at SPAR/T16 and SPAR/U16
SPAR/TC-K-T, SPAR/TC-K-U (green), SPAR/TC-KY-T, SPAR/TC-KY-U, (yellow)
 - 26-pin DSUB terminal connector (4 channels per connector) with SPAR/BC16
- BNC terminal for synchronization of multiple devices. Any amount of imc devices can be run in parallel with full synchronization via an Ethernet TCP/IP network.
- DSUB terminal for external Display unit via 9-pin DSUB connector
- DSUB terminal for external modem via 9-pin DSUB connector
- REMOTE terminal for remote activation/ deactivation via 15-pin DSUB terminal
- Signal connection for Ink., DI, DO: 15-pin DSUB

Optional

- Signal connection for DAC: 15-pin DSUB
- CAN-Bus connection via 9-pin DSUB connector for each device node (2 nodes) (equipped to conform to CiA Draft Standard 102 Version 2.0, CAN Physical Layer for Industrial Applications)

Power supply

- 10 V to 32 V DC supply with short-term battery buffering (UPS) or 110 V / 230 V via power adapter (included)
- Automatic measurement operation with auto-activation following power outage
- Automatic charging control
- Automatic data storage upon power outage

Operating conditions

- Operating temperature: -10°C to 55°C without condensation
Extended temperature range (operating temperature -40°C to 85°C, condensation allowed) optional
- Relative humidity: 0 .. 80 % at up to 31°C, beyond that linear decrease to 50% at 40°C¹
- Storage temperature: -20°C to 85°C
- Shock resistance: 30 g pk over 3 ms
- Shock and Vibration according IEC 61373 Cat. 1 B
Vibration: Schock:
function and stress test: up to 1 m/s² (5..150 Hz) halfsine (30 ms) up to 50 m/s²
simulated endurance test: up to 7,8 m/s² (5..150 Hz)

Software configuration

- Complete imc operating software "imcDevices" for parameterization, visualization and data storage. With Curve Window for online visualization and Report Generator for composition of measurement documentation.
For MS Windows '98, -2000, -XP, Vista, Windows 7
- Online FAMOS (Personal Analyzer) for extensive real-time calculation and control functions (optional)
- LabView® Vis interface, DIAdem® interface
- Supports direct configuration of imc CANSAS measurement modules via the CAN-Bus link (no additional CAN-Bus hardware required)²

Operating software

Min. system requirements:

- for SPARTAN devices starting from 2010 imcDevices Version 2.6 R3 SP12 is required

Included accessories

- 230/110 V power adapter (optionally with country-specific power cables)
- imcDevices installation-CD with manual (German and English) in PDF format
- Manual Getting started
- Manufacturer's calibration certificate
- 1x Ethernet network cable crossed and 1 x uncrossed
- 1x Lemo plug 1B (ACC/Power-Plug-1)
- 1x Lemo plug 2B (ACC/Power-Plug-1) only with SPARTAN-R

Measurement properties

- Sampling rates adjustable in steps of 1, 2, 5 (channel individual)
- 16-bit resolution (with internal 24-bit processing)
- Extensive, intelligent trigger functions
- Limit monitoring, storage of min, max, average, etc.

¹ In compliance with DIN-EN 61010-1

² Parametrization software required for the CANSAS modules

Measurement channels

- For details see the table at the end of this documentation
- 16, 32, 64, 96, 128 differential and isolated, analog inputs for measurement of: voltage, current, temperature or strain gauges depending on used modules
- 4 incremental inputs for measurement of RPM, displacement etc.
- 16 digital inputs
- 8 digital outputs (Open Drain)
- Synchronized simultaneous saving of all analog and digital channels
- Administration of up to 512 channels

Data storage

- Choice of removable memory medium (optional)/ internal hard drive and/or on PC
- Memory depth for pre- and post-trigger limited only by hard drive size
- Circular buffer memory operation
- Synchronized, multi-triggered capture with different sampling rates for each channel
- Optional Compact Flash memory card
- Optional IDE hard drive

Sensor power supply SPAR/SEN-SUPPLY

- Built-in sensor supply module (requires no additional slot) with selectable supply voltages. Output only via DSUB connection terminals.

Miscellaneous

- PC-independent measurement operation
- "Plug & Measure" – capable signal inputs (only DSUB-15 model)

Optional enhancements:

- Extended temperature range for operating temperatures of -40°C to 85°C with condensation allowed
- Options for Online-FAMOS
 - Online Class-counting package including histograms and Rainflow analysis
 - Online Order-tracking analysis for analyzing rotating machines
- Removable Compact Flash memory medium
Shock resistance while running: 1000 g, available upon request in extended temperature range.
For use with memory media from outside suppliers, please contact our Hotline first.
- Internal modem SPAR/WLAN
 - Analog-, ISDN- or GSM-modem for remote data transfer and remote control
- External Display unit
Available both as pure text readouts and graphical displays (color).
- GPS preparation with extra 9-pin DSUB GPS terminal
- Battery operation for approx. 8 h (dependent upon device removal)
In addition to the standard installed UPS, the module can come with a factory installed removable battery pack with Li-ion technology. Requires assembly of system in the next larger chassis type.
Operating and storage temperature for battery operation -20°C to 60°C . Not available for SPARTAN-8 model
- Field-bus option for SPAR/CAN
 - ECU protocols (KWP 2000, CCP others upon request)
 - Vector Data Import
Linkage to Vector database via the devices' CAN-Bus interface
Import of .DBC files from Vector databases

Optional accessories:

Connection terminals:

- **ACC/DSUB-U4** 15-pin DSUB clamp terminal per 4 channels for voltage measurement at **SPAR/T16; SPAR/U16**
- **ACC/DSUB-T4**, 15-pin DSUB clamp terminal per 4 channels at **SPAR/T16; SPAR/U16**. For measurement of voltages or temperatures using Pt100 and thermocouples. The clamp terminal has a built-in cold junction contact and a Pt100 for cold junction compensation.
- **ACC/DSUB-B2**, 15-pin DSUB-clamp terminal for measurement of RMA, bridge, voltage on 2 channels per plug at **SPAR/B16**
- **ACC/DSUB-I2**, 15-pin DSUB-clamp terminal for 2 channels (shunt 50 Ω). For measurement of currents of up to 50 mA (scaling factor: 0.02 A/V) at **SPAR/B16**
- **ACC/DSUB-ICP2**, 15-pin DSUB connection terminal with conditioning for 2 ICP inputs at **SPAR/B16**. For this, the internal 5 V supply voltage is used. Thus, no other voltages can be set for this module.
- **ACC/DSUB-DI4-8** 15-pin DSUB clamp terminal for 8 digital inputs
- **ACC/DSUB-DO8**, 15-pin DSUB clamp terminal for 8 digital outputs
- **ACC/DSUB-ENC4**, 15-pin DSUB clamp terminal for 4 incremental counter inputs
- **ACC/DSUB-DAC4**, 15-pin DSUB clamp terminal for 4 analog outputs
- **ACC/DSUB-I4**, 15-pin DSUB clamp terminal for each bank of 4 channels (50 Ω shunt). For measurement of currents of up to 50 mA (scaling factor: 0,02 A/V)
- **ACC/DSUB-TEDS-U4**, 15-pin DSUB clamp terminal for each bank of 4 channels. For voltage measurement. Complies with IEEE1451.4 for use with imc Plug & Measure at **SPAR/T16, SPAR/U16**
- **ACC/DSUB-TEDS-I4**, 15-pin DSUB clamp terminal for each bank of 4 channels (50 Ω shunt) at **SPAR/T16, SPAR/U16**. For measurement of currents of up to 50 mA (scaling factor: 0,02 A/V). Complies with IEEE1451.4 for use with imc Plug & Measure
- **ACC/DSUB-TEDS-T4**, 15-pin DSUB clamp terminal for each bank of 4 channels at **SPAR/T16, SPAR/U16**. For measurement of voltages or temperatures using Pt100 and thermocouples. Complies with IEEE1451.4 for use with imc Plug & Measure. The clamp terminal has a built-in cold junction contact and a Pt100 for cold junction compensation.
- **ACC/DSUB-TEDS-B2**, 15-pin DSUB-clamp terminal for 2 channels, voltage- and bridge-measurement, complies with IEEE1451.4 for use with imc Plug & Measure at **SPAR/B16**
- **ACC/DSUB-TEDS-I2**, 15-pin DSUB-clamp terminal for 2 channels (50 Ω shunt). For measurement of currents of up to 50 mA (scaling factor: 0,02 A/V), Complies with IEEE1451.4 for use with imc Plug & Measure with **SPAR/B16**
- **ACC/DSUB-ICP2-IP65**, 15-pin DSUB clamp terminal with conditioning for 2 ICP* inputs at **SPAR/B16**
- **ACC/DSUB-I2-IP65**, 15-pin DSUB-clamp terminal for 2 channels (50 Ω shunt). For measurement of currents of up to 50 mA (scaling factor: 0,02 A/V) at **SPAR/B16**
- **ACC/DSUB-TEDS-B2-IP65**, 15-pin DSUB-clamp terminal for 2 channels, voltage- and bridge-measurement, complies with IEEE1451.4 for use with imc Plug & Measure at **SPAR/B16**
- **ACC/DSUB-TEDS-I2-IP65**, 15-pin DSUB-clamp terminal for 2 channels (50 Ω shunt). For measurement of currents of up to 50 mA (scaling factor: 0,02 A/V), complies with IEEE1451.4 for use with imc Plug & Measure at **SPAR/B16**

Connection terminal for SPAR/BC16 (analog inputs with HD DSUB26 connection terminals)




- **ACC/DSUB-B4**, 26-pin DSUB terminal with solder-bucket for measurement of strain gauges, bridges and voltage on each of a connector's 4-channel blocks.

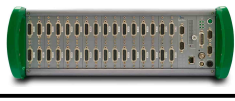
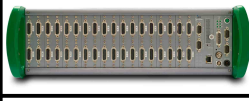

* The commonly used name ICP (Integrated Circuit Piezoelectric) is a registered trademark of the American company PCB Piecotronics.

For all devices

“√”: standard-equipped; “O” optional; “-”: not available

Datasheet Version 2.8

			
Chassis	SPARTAN-1	SPARTAN-2	SPARTAN-4
Housing type	portable housing		
Dimensions (WxHxD in mm) w/o handles and feet	210 x 155 x 246	250 x 155 x 246	332 x 155 x 246
Weight (kg)	8	9	10
Free module slots	1	2	4
Modularly upgradeable	√	√	√
Max. channels	16 (#1)(#2)	32 (#1)(#2)	64 (#1)(#2)
Power consumption (with UPS battery fully charged)	<30 W (typ. 20 W)	<40 W (typ. 30 W)	<60 W (typ. 45 W)

			
Chassis	SPARTAN-6	SPARTAN-8	SPARTAN-R
Housing type	portable housing		module rack 19"
Dimensions (WxHxD in mm) w/o handles and feet	413 x 155 x 246	494 x 155 x 246	427 x 133 x 310
Weight (kg)	11	12	8
Free module slots	6	8	8
Modularly upgradeable	√	√	√
Max. channels	96 (#1)(#2)	128 (#1)(#2)	128 (#1)(#3)
Power consumption (with UPS battery fully charged)	<90 W (typ. 65 W)	<110 W (typ. 85 W)	<110 W (typ. 85 W)

(#1) The maximum possible channel count depends on the amplifier configuration; please contact us for a detailed consultation

(#2) All terminal connections at the front of the device.

(#3) All 128 channels can only be realised on the front, if the device is not equipped with an SPAR/DI16-DO8-ENC4 or SPAR/DI8-DO8-ENC4-DAC4.

Interconnections	All SPARTAN variants
PC connector: Ethernet TCP/IP	10/100 MBit, approvable cable length for 100MBit Ethernet max. 100 m according IEEE 802
Analog inputs per module	corresponding to the signal conditioning equipment, typically imc DSUB connectors
Synchronization of multiple devices	BNC
Modem connection	1 x DSUB-9
Display connection	1 x DSUB-9
Measurement signal terminals	see description of module types

Current supply	portable housing (SPARTAN-1 to 8)	module rack 19" (SPARTAN-R)
Power supply	10 V to 32 V DC	
DC inputs LEMO typ	LEMO FGG.1B.302.CLAD62Z	LEMO FGG.2B.302.CLAD 82ZN
110 V / 230 V power adapter	✓	
Battery buffering / UPS	✓	
UPS buffer time per power outage	1 s	
Automatic charge control	✓	
Charging time to full load	24 h	
Automatic measurement operation with autostart	✓	
Auto-data saving upon power outage	✓	
Power consumption (with UPS battery fully charged)	see description of device types above	

Operating conditions	All SPARTAN variants
Operating environment (standard)	indoor
Operating temperature (standard)	-10°C to 55°C without condensation
Operating altitude	up to 2000 m
Relative humidity	80% for less than 31°C, for more than 31°C linear declining to 50%, according DIN EN61010-1
Shock resistance	Schock and Vibration according IEC 61373 Cat. 1 B Halfsine (30 ms) up to 50 m/s ² (5.. 30 g pk over 3 ms
Vibration	function and stress test up to 1 m/s ² (5.. 150 Hz) Simulated endurance test up to 7,8 m/s ² (5.. 150 Hz)
Extended temperature range (opt.)	-40°C to 85°C
Storage temperature	-20°C to 85°C

PC - software equipment	portable housing (SPARTAN-1 to 8)	module rack 19" (SPARTAN-R)
Minimum system requirements "imcDevices"	2.6R3SP12	2.6R3SP15
LabView Visualization tool	✓	✓

Factory configuration options	All SPARTAN variants
Online FAMOS - Personal Analyzer	○
Internal modem	○
Slot for compact flashcard	✓
LED-Port (6 LEDs)	✓

Device properties and hardware options	All SPARTAN variants
Maximum channel count	512, incl. analog, digital, virtual, monitor and bus channels
Maximum aggregate sampling rate	400 kHz
Time bases	2
Resolution	16 bit
Per-channel sampling rates	✓
Sampling rate adjustable in 1-, 2-, 5 steps	✓
Monitor channels	✓
Multi-triggered (multi-shot) data acquisition	✓
Extensive intelligent trigger functions	✓
arithmetic mean, min, max, mean value,	✓
extensive real-time calculation and control functions	O (with Online FAMOS - Personal Analyzer)
External hand-held terminal for display of measured data and status messages	O
External modem (PPP) for remote measurement	✓
Synchronisation via DCF77 real time radio clock	✓
Synchronisation via GPS real time radio clock	✓
External GPS signal receiver	O
Characteristic curve for temperature measurement	temperature table according IPTS-68

Data storage	All SPARTAN variants
internal hard drive	O
Compact Flash-Card Slot	✓
Software selectable storage to removable drive (option) and/or PC	✓
Software selectable storage to internal hard drive (option) and/or PC	✓
Any memory depth with pre- and post triggering	✓
Circular buffer memory	✓
Synchronous, multi-triggered records	✓

Analog modules

SPAR/T16 analog inputs

Technical Datasheet version 3.2

Parameter	typ.	min. / max.	Remarks
Inputs	16		
Measurement (DSUB)	voltage current thermocouples, RTD (Pt100)		Standard connector (ACC/DSUB-U4) Current connector (ACC/DSUB-I4) Thermo-connector (ACC/DSUB-T4)
Measurement mode (thermo sockets)	thermocouples type-K		Two pin thermo-sockets
Width	2 slots		

General				
Parameter	typ.		min. / max.	Remarks
Bandwidth / noise suppression max. signal frequency	Bandwidth -1 dB (fg)	max. signal (f_s)	Noise supp. ≥ 60 dB (f_filt)	aliasing only in the frequency range: f_s ... f_filt aliasing-free for frequencies above: f_filt (noise suppression ≥ 60 dB)
at sampling rate:				
5 Hz (200 ms)	1.0 Hz	1 Hz	50 Hz	
2 Hz (500 ms)	1.0 Hz	1 Hz	50 Hz	
1 Hz (1 s)	0.5 Hz	0.5 Hz	48.5 Hz	
0.5 Hz (2 s)	0.25 Hz	0.25 Hz	48.5 Hz	
Bandwidth	1 Hz			-0.01 dB
Sampling rate	max. 5 Hz (200 ms) / channel			internal: 2 Hz (500 ms) with additional Interpolation; max. allowable input signal frequency: 1Hz
Suppression @ 50 Hz (±2 %)	34 dB @ 49 Hz / 51 Hz 68 dB @ 49 Hz / 51 Hz			
5 Hz to 2 Hz (200 to 500 ms)				
1 Hz (1 s)				
Max. settling time	max. 1 s			sampling rate 5 Hz (200 ms) complete settling as a response to input step
Synchronicity (at sampling rate)	constant time offset between two equally configured channels: max. 500 ms			sampling rate ≥ 2 Hz (200 ms)
Resolution	16 Bit			
TEDS	conform IEEE 1451.4 Class II MMI			ACC/DSUB-TEDS-U4(-IP65) ACC/DSUB-TEDS-I4(-IP65) ACC /DSUB-T4(-IP65)
Isolation nominal test voltage	60 V 300 V (10 sec.)			channel to frame (CHASSIS) and channel to channel
Overvoltage protection	±60 V ESD 2 kV transient protection: automotive load dump ISO 7636, Test pulse 6			diff. input voltage, (long term) human body model Test pulse 6 with max. -250 V Ri=30 Ω, td=300 μs, tr<60 μs
Input coupling	DC, isolated (differential			electrical isolation to system-GND (frame, CHASSIS)

General			
Parameter	typ.	min. / max.	Remarks
Input impedance	10 M Ω 1 M Ω 50 Ω		voltage mode (range $\leq \pm 2$ V), temperature mode voltage mode (range $\geq \pm 5$ V) Current mode (current connector)
Static input current	1 nA (typ.)	10 nA (max.)	settled, during sampling
Dynamic input current	0.1 mA (typ.) 30 nA (typ.)	1.5 mA (max.) 600 nA (max.)	peak dynamic input current value (typ. @100 mV, max. @2 V) mean dynamic input current value (typ. @100 mV, max. @2 V)
Input current below overvoltage		1.5 mA	$ V_{in} > 7$ V in the range $\leq \pm 2$ V or device deactivated
Sensor supply voltage	+5 V, 250 mA / 4 channels		non-isolated, short-circuit proof (equipped as standard); replaceable by optional supply module with selectable voltage ranges (SUPPLY) on terminals „ \pm SUPPLY“, NOT on „+5 V / GND“, not compatible with ICP extension plug

Voltage and current measurement			
Parameter	typ.	min. / max.	Remarks
Voltage input range	± 50 mV / ± 100 mV / ± 250 mV / ± 500 mV / ± 1 V / ± 2 V / ± 5 V / ± 10 V / ± 25 V / ± 50 V / ± 60 V		
Current input range	± 1 mA / ± 2 mA / ± 5 mA ± 10 mA / ± 20 mA / ± 40 mA		with current connector (50 Ω shunt) (ACC/DSUB-I4)
Gain uncertainty	<0.025 % <0.07 %	<0.05 % <0.15 %	voltage, 23 °C current with current connector
Offset		<0.05 % <3 μ V	of input range
Non linearity	< 30 ppm		range: ± 10 V
Gain drift		6 ppm/K 36 ppm/K	ranges $\leq \pm 2$ V ranges $\geq \pm 5$ V
Offset drift		3 ppm/K	over entire temp. range
Noise voltage (RTI)	<0.5 μ Vrms <3.0 μ Vpkk (<1LSB)		sampling rate 5 Hz (200 ms)
CMRR/ IMR (isolation mode rejection)	all sampling rates > 110 dB (50 Hz) > 95 dB (50 Hz) > 65 dB (50 Hz)		range $\leq \pm 2$ V range $\leq \pm 2$ V range $\geq \pm 5$ V
Channel isolation	< 50 pF, <100 nA		$R_{source} = 0 \Omega$ $R_{source} = 100 \Omega$ $R_{source} = 100 \Omega$
Channel cross-talk damping	all sampling rates > 116 dB (50 Hz) > 101 dB (50 Hz)		Channel to protection ground (CHASSIS); Channel-to-channel
Suppression of square edges on neighboring channels	>123 dB @ sampling rate 200 ms		range $\leq \pm 2$ V range $\leq \pm 2$ V range $\leq \pm 2$ V
Max. source impedance	5 k Ω		$R_{source} = 0 \Omega$ $R_{source} = 100 \Omega$ $R_{source} = 100 \Omega$

Temperature measurement - Thermocouples			
Parameter	typ.	min. / max.	Remarks
Input range	R, S, B, J, T, E, K, L, N		compliant with IEC 584
Resolution	0.063 K (1/16 K)		
Uncertainty		< ± 0.5 K ± 0.05 %	type-K, range -150 °C to 1200 °C plus value indicated
Drift	± 0.02 K/K· ΔT_a		$\Delta T_a = T_a - 25$ °C ; T_a : ambient temperature
Uncertainty of cold junction compensation Drift of cold junction temp.	± 0.001 K/K· ΔT_j	< ± 0.15 K	ACC/DSUB-T4, $\Delta T_j = T_j - 25$ °C cold junction temperature T_j
Sensor breakage recognition	Display: "-2000 °C"		indicating unconnected input

Temperature measurement – Pt100 (RTD)			
Parameter	typ	min. / max	Remarks
Input range	-200 °C to 850 °C -200 °C to +250 °C		
Resolution	0.063 K (1/16 K)		
Uncertainty	< ± 0.1 K ± 0.05 %		-200 °C to +850 °C, 4-wire configuration plus value indicated
Drift	± 0.01 K/K· ΔT_a		$\Delta T_a = T_a - 25$ °C ; T_a : ambient temperature
Reference current (Pt100)	250 μ A		non-isolated (CHASSIS is Ground)

SPAR/U16 analog inputs

Technical Specs: Datasheet Version 3.4

Parameter	typ.	min. / max.	Remarks
Measurement modes (DSUB)	voltage thermocouple, RTD (Pt100) current current feed sensors		with thermo plug (ACC/DSUB-T4) with shunt plug (ACC/DSUB-I4) with plug (ACC/DSUB-ICP4(-IP65))
Measurement mode thermo-plug	thermocouples type-K		two pin thermo plug
Width	2 slots		

Bandwidth, Filter, TEDS			
Parameter	typ.	min. / max.	Remarks
Filter (digital) cut-off frequency, characteristic, order	1 Hz to 200 Hz		Butterworth, Bessel low pass filter: 8th order high pass filter: 4th order band pass: LP 8th and HP 4th order Anti-aliasing filter: Cauer 8.order with $f_{\text{cutoff}} = 0.4 f_a$
Bandwidth	0 Hz to 500 Hz 0 Hz to 200 Hz		-3 dB -0.2 dB
Sampling frequency	≤ 500 Hz		per channel
Resolution	16 bit		
TEDS	conform IEEE 1451.4 Class II MMI		ACC/DSUB-TEDS-U4(-IP65) ACC/DSUB-TEDS-I4(-IP65) ACC/DSUB-TEDS-T4(-IP65) ACC/DSUB-ICP-Microdot
Isolation nominal rating test voltage	60 V 300 V (10 sec.)		channel to case (chassis) and channel-to-channel not with ICP plug
Overvoltage protection	± 60 V ESD 2 kV transient protection: automotive load dump ISO 7637, Test impulse 6		differential input voltage (continuous) human body model test pulse 6 with max. -250 V $R_i=30 \Omega$, $t_d=300 \mu\text{s}$, $t_r<60 \mu\text{s}$
Input coupling configuration	DC, isolated (differential)		galvanically isolated to System-GND (case, CHASSIS)
Input impedance	10 M Ω 1 M Ω 50 Ω		range $\leq \pm 2$ V and temperature mode range $\geq \pm 5$ V and switched off current mode (shunt-plug) (ACC/DSUB-I4(-IP65))
Input current operating conditions on overvoltage condition		1 nA 1 mA	for operation $ V_{\text{in}} > 5$ V on ranges $< \pm 5$ V or device powered-down

Parameter	typ.	min. / max	Remarks
Auxiliary supply voltage current internal resistance	+5 V >0.26 A 1.0 Ω	$\pm 5\%$ >0.2 A <1.2 Ω	with ICP-extension plug independent of optional sensor supply, short circuit proof power per DSUB-plug

Voltage and current measurement			
Parameter	typ.	min. / max.	Remarks
Voltage input ranges	$\pm 50 \text{ mV} / \pm 100 \text{ mV} / \pm 250 \text{ mV} /$ $\pm 500 \text{ mV} / \pm 1 \text{ V} / \pm 2 \text{ V} / \pm 5 \text{ V} /$ $\pm 10 \text{ V} / \pm 25 \text{ V} / \pm 50 \text{ V} / \pm 60 \text{ V}$		
Current input ranges	$\pm 1 \text{ mA} / \pm 2 \text{ mA} / \pm 5 \text{ mA}$ $\pm 10 \text{ mA} / \pm 20 \text{ mA} / \pm 40 \text{ mA}$		with shunt-plug (Shunt 50Ω) (ACC/DSUB-I4)
Gain uncertainty	$< 0.025 \%$ $< 0.07 \%$	$< 0.05 \%$ $< 0.15 \%$	voltage, $25 \text{ }^\circ\text{C}$ current with shunt-plug
Offset uncertainty	2 LSB		
Non-linearity	$< 120 \text{ ppm}$		range $\pm 10 \text{ V}$
Gain drift		6 ppm/K 50 ppm/K	ranges $\leq \pm 2 \text{ V}$ ranges $\geq \pm 5 \text{ V}$ over full temperature range
Offset drift		2.5 ppm/K	over full temperature range
Input voltage noise	2.5 μVrms 20 μVpp		bandwidth 0.1 Hz to 1 kHz; range: $\pm 50 \text{ mV}$
IMR (isolation mode rejection)	$> 145 \text{ dB}$ (50 Hz) $> 70 \text{ dB}$ (50 Hz)		range $\leq \pm 2 \text{ V}$ range $\geq \pm 5 \text{ V}$ $R_{\text{source}} = 0 \Omega$
Channel isolation	$> 1 \text{ G}\Omega$, $< 40 \text{ pF}$ $> 1 \text{ G}\Omega$, $< 10 \text{ pF}$		channel-to-ground (housing) channel-to-channel
Channel isolation (crosstalk)	$> 165 \text{ dB}$ (50 Hz) $> 92 \text{ dB}$ (50 Hz)		range $\leq \pm 2 \text{ V}$ range $\geq \pm 5 \text{ V}$ $R_{\text{source}} \leq 100 \Omega$

Temperature measurement - thermocouples			
Parameter	typ.	min. / max.	Remarks
Measurement range	R, S, B, J, T, E, K, L, N		according IEC 584
Resolution	0.063 K (1/16 K)		
Measurement uncertainty		$\leq \pm 0.6 \text{ K}$ $\leq \pm 1.0 \text{ K}$	type K, range $-150 \text{ }^\circ\text{C}$ to $1200 \text{ }^\circ\text{C}$ else
Temperature drift	$\pm 0.02 \text{ K/K} \cdot \Delta T_a$		$\Delta T_a = T_a - 25 \text{ }^\circ\text{C} $ ambient temperature T_a
Uncertainty of cold junction compensation		$< \pm 0.15 \text{ K}$	ACC/DSUB-T4 $\Delta T_j = T_j - 25 \text{ }^\circ\text{C} $
Temperature drift	$\pm 0.001 \text{ K/K} \cdot \Delta T_j$		cold junction temperature T_j

Temperature measurement – Pt100			
Parameter	typ.	min. / max.	Remarks
Measurement range	$-200 \text{ }^\circ\text{C}$ to $+850 \text{ }^\circ\text{C}$ $-200 \text{ }^\circ\text{C}$ to $+250 \text{ }^\circ\text{C}$		
Resolution	0.063 K (1/16 K)		
Measurement uncertainty	$\leq \pm 0.2 \text{ K}$ $\leq \pm 0.05 \%$		$-200 \text{ }^\circ\text{C}$ to $+850 \text{ }^\circ\text{C}$, 4-wire connection plus of reading
Temperature drift	$\pm 0.01 \text{ K/K} \Delta T_a$		$\Delta T_a = T_a - 25 \text{ }^\circ\text{C} $; ambient temp. T_a
Sensor feed (Pt100)	250 μA		

SPAR/B(C)16 analog inputs

Technical Specs: Datasheet Version 3.4

Parameter	typ.	min. / max	Remarks
Inputs		16	
SPAR/B16 Measurement modes	<ul style="list-style-type: none"> • Bridge sensors • Bridge: strain gauges • Voltage measurement • Current measurement • Current-fed sensors, ICP 		ACC/DSUB-B2 ACC/DSUB-I2 Shunt-plug ACC/DSUB-ICP2 (*ICPT [™] -, Deltatron [®] -, Piezotron [®] -Sensors)
SPAR/BC16 Measurement modes	<ul style="list-style-type: none"> • Bridge sensors • Bridge: strain gauges • Voltage measurement 		HD-DSUB26
Width		2 slots 4 slots	SPAR/BC16 SPAR/B-16

Bandwidth, Filter, TEDS			
Parameter	typ.	min. / max.	Remarks
Filter (digital) cut-off frequency characteristic, order		1 Hz to 200 Hz	Butterworth, Bessel (digital) low pass or high pass filter 8th order band pass, LP 4th and HP 4th order Anti-aliasing filter: Cauer 8.order with $f_{\text{cutoff}} = 0.4 f_s$
Bandwidth		0 Hz to 200 Hz	-3 dB
Sampling frequency		≤500 Hz	per channel
Resolution		16 bit	
TEDS only SPAR/B16		conform IEEE 1451.4 Class II MMI	ACC/DSUB-TEDS-B2(-IP65) ACC/DSUB-TEDS-I4(-IP65)

Sensor supply 5 V - only with SPAR/B16 (DSUB-15)			
Parameter	typ.	min. / max	Remarks
Auxiliary supply voltage current internal resistance	+5 V >0.26 A 1.0 Ω	±5% >0.2 A <1.2 Ω	with ICP-extension plug independent of integrated sensor supply, short circuit proof power per DSUB-plug

Voltage measurement			
Parameter	typ.	min./ max	Remarks
Input ranges	$\pm 10 \text{ V}, \pm 5 \text{ V}, \pm 2.5 \text{ V}, \pm 1 \text{ V} \dots \pm 5 \text{ mV}$		
Surge protection		$\pm 40 \text{ V}$	permanent
Input coupling	DC		
Input configuration	differential		
Input impedance	$20 \text{ M}\Omega$	$\pm 1 \%$	differential
Gain uncertainty	0.02 %	$\leq 0.05 \%$	of reading (25°C)
drift	$+10 \text{ ppm/K} \cdot \Delta T_a$	$+30 \text{ ppm/K} \cdot \Delta T_a$	$\Delta T_a = T_a - 25^\circ\text{C} $; ambient temp: T_a
Offset uncertainty	0.02 %	$\leq 0.05 \%$ $\leq 0.06 \%$	of range, in ranges (25°C) $> \pm 50 \text{ mV}$ $\leq \pm 50 \text{ mV}$
drift	$\pm 0.7 \text{ }\mu\text{V/K} \cdot \Delta T_a$ $\pm 0.1 \text{ }\mu\text{V/K} \cdot \Delta T_a$	$\pm 6 \text{ }\mu\text{V/K} \cdot \Delta T_a$ $\pm 1.1 \text{ }\mu\text{V/K} \cdot \Delta T_a$	$\pm 10 \text{ V to } \pm 0.25 \text{ V}$ $\leq \pm 0.1 \text{ V}$ $\Delta T_a = T_a - 25^\circ\text{C} $ ambient temp T_a
Non-linearity	10 ppm	$\leq 50 \text{ ppm}$	
Common mode rejection ranges: $\pm 10 \text{ V to } \pm 50 \text{ mV}$ $\pm 25 \text{ mV to } \pm 5 \text{ mV}$	$> 110 \text{ dB}$ $> 138 \text{ dB}$	$> 90 \text{ dB}$ $> 132 \text{ dB}$	Common mode voltage (DC..60 Hz): test voltage: $\pm 10 \text{ V}_m$
Noise (RTI)	$0.6 \text{ }\mu\text{Veff}$ $0.14 \text{ }\mu\text{Veff}$	$1.0 \text{ }\mu\text{Veff}$ $0.26 \text{ }\mu\text{Veff}$	bandwidth 0,1 Hz to 1 kHz 0.1 Hz to 10 Hz

Bridge measurement			
Parameter	typ.	min. / max.	Remarks
Measurement modes	full bridge half bridge quarter bridge		5 V bridge excitation voltage only
Input ranges bridge supply: 10 V	$\pm 2000000 \text{ }\mu\text{m/m} \dots \pm 1000 \text{ }\mu\text{m/m}$ $\pm 1000 \text{ mV/V}, \pm 500 \text{ mV/V},$ $\pm 200 \text{ mV/V}, \pm 100 \text{ mV/V}$... $\pm 0.5 \text{ mV/V}$		with strain gauge with quarterbridge: $\pm 10 \text{ mV/V to } \pm 0.5 \text{ mV/V}$
bridge supply: 5 V	$\pm 1000 \text{ mV/V}, \pm 500 \text{ mV/V},$ $\pm 200 \text{ mV/V}, \pm 100 \text{ mV/V}$... $\pm 1 \text{ mV/V}$		all modes
bridge supply: 2.5 V	$\pm 1000 \text{ mV/V}, \pm 500 \text{ mV/V},$ $\pm 200 \text{ mV/V}, \pm 100 \text{ mV/V}$... $\pm 2 \text{ mV/V}$		as an option
Input impedance	$20 \text{ M}\Omega$	$\pm 1 \%$	differential, full bridge
Gain uncertainty	0.02 %	$\leq 0.05 \%$	of reading
Offset uncertainty	0.01 %	$\leq 0.02 \%$	of input range after automatic bridge balancing
Bridge excitation voltage	10 V 5 V 2.5 V	$\pm 0.5 \%$	as an option
Min. bridge impedance	120 Ω , 10 mH full bridge		
Max. bridge impedance	60 Ω , 10 mH half bridge 5 k Ω		
Internal quarter bridge completion	120 Ω , 350 Ω		internal, switched per software
automatic shunt calibration	0.5 mV/V	$\pm 0.2 \%$	for 120 Ω and 350 Ω
Cable resistance for bridges	$< 6 \text{ }\Omega$		10 V excitation 120 Ω

(without return line)	< 12 Ω	5 V excitation	120 Ω
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Current measurement			
Parameter	typ.	min./ max	Remarks
Input ranges	± 50 mA, ± 20 mA, ± 10 mA, ± 5 mA, ± 2 mA, ± 1 mA		with 50 Ω shunt in terminal plug ACC/ DSUB-I2 or with 120 Ω internally
Over load protection		± 60 mA	permanent
Input configuration	single-end differentiell		with 120 Ω internally or 50 Ω shunt in terminal plug (ACC/DSUB-I2)
Gain: uncertainty drift	0.02 % +15 ppm/K $\cdot\Delta T_a$	$\leq 0,06$ % $\leq 0,1$ % +55 ppm/K $\cdot\Delta T_a$	of reading plus uncertainty of 50 Ω shunt
Offset: uncertainty	0.02 %	$\leq 0,05$ %	of range

Noise (current)	0.6 nA _{eff} 0.15nA _{eff}	10nA _{eff} 0.25nA _{eff}	bandwidth: 0.1 Hz to 1 kHz 0.1 Hz to 10 Hz
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Sensor supply $\pm VB$				
Parameter	typ. (min/max)			Remarks
Configuration options	5 ranges			The sensor supply module always got 5 selectable voltage ranges. Default ranges: +5 V to +24 V
Output voltage	Voltage	Current	Power	set jointly for a group of eight channels optional upon request, +12 V or +15 V can be replaced by +2.5 V
	+2.5 V	580 mA	1.5 W	
	+5.0 V	580 mA	2.9 W	
	+10 V	300 mA	3.0 W	
	+12 V	250 mA	3.0 W	
	+15 V	200 mA	3.0 W	
	+24 V	120 mA	2.9 W	
	± 15 V	190 mA	3.0 W	optional upon request, +15 V can be replaced by ± 15 V
Isolation	non isolated			output to case (CHASSIS)
Short-circuit protection	unlimited duration			to reference ground of output voltage
Accuracy of output voltage	<0.25 % (typ.) <0.5 % (max.) <0.9 % (max.).			at terminals, no load 25 °C 25 °C over entire temp. range
compensation of cable resistances	3-wire adjustment: SENSE line on return line (-VB: supply ground)			Calculated compensation for bridges (no voltage adjustment) Prerequisites: symmetric feed and return lines
Efficiency	typ. 72 % typ. 66 %			10 V, to 15 V 5 V
Max. capacitive load	>4000 μ F >1000 μ F >300 μ F			2.5 V to 10 V 12 V, 15 V 24 V

SPAR/SEN_SUPPLY sensor supply module

Optional sensor supply for SPAR/T16 and SPAR/U16

Technical datasheet version 3.1

Parameter	Value (typ./ max.)			Remarks
Configuration options	5 adjustable ranges			The sensor supply module always got 5 selectable voltage ranges. Default ranges: +5 V to +24 V
Output voltage	Voltage (+2.5 V) +5.0 V +10 V +12 V +15 V +24 V (±15 V)	Current 580 mA 580 mA 300 mA 250 mA 200 mA 120 mA 190 mA	Netpower 1.5 W 2.9 W 3.0 W 3.0 W 3.0 W 2.9 W 3.0 W	upon request, +12 V can be replaced by +2,5 V set globally for groups of eight channels at SPAR/U16 or 16-channel groups at SPAR/T16 upon request, +15 V can be replaced by ±15 V
Isolation Standard: option, upon request:	non isolated isolated			output to case (CHASSIS) nominal rating: 50 V, Test voltage (10 sec.): 300 V, not available with option ±15 V.
Short-circuit protection	unlimited duration			to output voltage reference ground
Accuracy of output voltage	<0.25% (typ.) <0.5% (max.) <0.9% (max.)			at terminals, no load 25°C 25°C over entire temperature range
Efficiency	typ. 72% typ. 66% typ. 55% typ. 50%			10 V to 24 V none isolated 5 V 10 V to 24 V isolated 5 V
Max. capacitive load	>4000 µF >1000 µF >300 µF			2.5 V to 10 V 12 V, 15 V 24 V

SPAR/DI16-DO8-ENC4

Digital multiboard with 16 digital inputs, 8 digital outputs, 4 inputs for incremental encoder.

This modul needs 2 slots.

Technical Specs

16 digital inputs / 4 digital outputs / 4 incremental encoder inputs

Digital Inputs

Technical Datasheet version 2.2

Parameter	Value (typ. / min.max.)	Remarks
Channels	16	common ground reference for each 4-channel group, isolated from the other input group
Configuration options	TTL or 24 V input voltage range (selected globally for 8-channel groups)	configurable at the DSUB jumper from LCOM to LEVEL activates TTL-mode LEVEL unconn. activates 24 V-mode
Sampling rate	10 kHz	per channel
Isolation strength	± 150 V	to system ground (tested ± 200 V)
Input configuration	differential	isolated mutually and from supply
Input current	max. 500 μ A	
Switching threshold	1.5 V (± 200 mV) 8 V (± 300 mV)	5 V mode 24 V mode
Switching time	< 20 μ s	
Supply HCOM	5 V max. 100 mA	Reference at Level otherwise electrically isolated from system
Connection terminals	DSUB-15	ACC/DSUB-DI4-8

Digital Outputs

Technical Datasheet version 2.2

Parameter	Value (typ. / min.max.)		Remarks
Channels / bits	8 bit		Group of 8 bits, galvanically isolated as a whole, common reference potential ("LCOM") for each group
Isolation strength	±50 V		to system ground (protection ground)
Output configuration	totem pole (push-pull) or open-drain		configurable by wire jumper ("ODRN" – "LCOM") in the connector plug
Output level	TTL or max. $U_{ext} - 0,8$ V		internal, galvanically isolated supply voltage by connecting an external supply voltage U_{ext} with "HCOM", $U_{ext} = 5$ V to 30 V
State following system start	High resistance (high-Z)		Independent of output configuration (OPDRN-pin)!
Activation of the output stage following system start	upon first preparation of measurement		with initial states which can be adjusted in the experiment (High / Low) in the selected output configuration (OPDRN-pin)
Max. output current (typ.)	<i>HIGH</i>	<i>LOW</i>	external clamp diode needed for inductive load
TTL	15 mA	0,7 A	
24 V-logic open-drain	22 mA ---	0,7 A 0,7 A	
Output voltage	<i>HIGH</i>	<i>LOW</i>	for load current:
TTL	>3,5 V	≤0,4 V	$I_{high} = 15$ mA, $I_{low} \leq 0,7$ A
24 V-logic ($U_{ext} = 24$ V)	>23 V	≤0,4 V	$I_{high} = 22$ mA, $I_{low} \leq 0,7$ A
Switching time	<100µs		
Connector plug	1x DSUB-15 / 8 Bit		ACC/DSUB-DO8

Incremental encoder channels

Parameter	Value (typ. / max)		Remarks
Channels	4 + 1 (5 tracks)		Four single-tracks or combining two single-into two-track encoders One index track
Measurement modes:	Displacement, Angle, Events, Time, Frequency, Velocity, RPMs		
Connection terminals	1x DSUB-15		ACC/DSUB-ENC4
Sampling rate	50 kHz / channel (max.)		
Time resolution of measurement	31.25 ns		Counter frequency: 32 MHz
Data resolution	16 bit		
Frequency stability	<100 ppm deterioration <±5 ppm / year		
Input configuration	differential		
Input impedance	100 kΩ		
Input voltage range	±10 V		(differential)
Common mode input range	max. +25 V, min. -11 V		
Switching threshold	-10 V to +10 V		adjustable (global for all channels)
Hysteresis	min. 100 mV		adjustable (global for all channels)
Analog bandwidth	500 kHz		-3 dB (full power)
Analog filter	Bypass (no Filter), 20 kHz, 2 kHz, 200 Hz		adjustable (per-channel) 2 nd order Butterworth
Switching delay	500 ns		Modulation: 100 mV squarewave
CMRR	70 dB	50 dB	DC, 50 Hz

Parameter	Value (typ. / max)		Remarks
	60 dB	50 dB	10 kHz
Gain uncertainty	<1 %		of input voltage range @ 25 °C
Offset uncertainty	<1 %		of input voltage range @ 25 °C
Frequency stability	<100 ppm		deterioration <±5 ppm / year
Overvoltage strength	±50 V		to system ground
Sensor supply	+5 V, 300 mA		not isolated (reference: GND, CHASSIS)

SPAR/DI8-DO8-ENC4-DAC4

Digital multiboard with 8 digital inputs, 8 digital outputs, 4 inputs for incremental encoder and 4 analog outputs.

This module occupies two slots.

The technical data for the digital inputs and outputs, as well as for the incremental counter, match those of the module [SPAR/DI16-DO8-ENC4](#)^[19]. However, the number of digital inputs and digital outputs is limited to 8.

Analog outputs

Parameter	Value (typ. / min.max.)		Remarks
Channels	4		
Connection terminals	1x DSUB-15 / 4 channels		ACC/DSUB-DAC4
Output level	±10 V		
Load current	±10 mA /channel max.		
Resolution	16 Bit		
Non-linearity	±2 LSB	±3 LSB	
Max. output frequency	50 kHz		
Analog bandwidth	50 kHz		-3dB, low pass 2. order
Gain uncertainty	<±5 mV	<±10 mV	-40 °C to 85 °C
Offset uncertainty	<±2 mV	<±4 mV	-40 °C to 85 °C

SPAR/DI16 digital inputs

Technical Datasheet version 3.2

Parameter	Value (min./ max.)	Remarks
Channels	16	common ground reference for each 4-channel group, isolated from the other input group
Configuration options	TTL or 24 V input voltage range	configurable at the DSUB jumper from LCOM to LEVEL activates TTL-mode LEVEL unconn. activates 24 V-mode
Connection terminals	2x DSUB-15	ACC/DSUB-DI4-8
Input configuration	differential	isolated mutually and from supply
Isolation strength	± 150 V	to system ground (tested 200 V)
Sampling rate	10 kHz	per channel
Switching time	<20 μ s	
Input current	max. 500 μ A	
Switching threshold	1.7 V (± 200 mV) 7 V (± 300 mV)	5 V mode 24 V mode
Sensor supply	5 V max. 100 mA	isolated (HCOM reference ground is LCOM)

SPAR/DO16 digital outputs

Technical Datasheet version 3.2

Parameter	typ.	min./ max.	Remarks
Channels	16		two 8-bit groups, isolated, common reference potential ("LCOM") for a group
Terminal connection	DSUB-15		ACC/DSUB-DO8(-IP65)
Isolations strength	± 50 V		to system ground (protection ground)
Output configuration	totem pole (push pull) or open-drain		configurable with wire jumper ("ODRN" - "LCOM") in the connector pod
State following system start	High resistance (high-Z)		Independent of output configuration (OPDRN-pin)!
Activation of the output stage following system start	upon first preparation of measurement		with initial states which can be adjusted in the experiment (High / Low) in the selected output configuration (OPDRN-pin)
Output level	TTL or max. $U_{\text{ext}} - 0.8$ V		internal isolated supply voltage by means of connecting an external supply voltage U_{ext} with "HCOM", $U_{\text{ext}} = 5$ V to 30 V
Max. output current (typ.) TTL 24 V-logic open-drain	<i>HIGH</i> 15 mA 22 mA ---	<i>LOW</i> 0.7 A 0.7 A 0.7 A	external inverse diode needed with inductive load
Output voltage TTL 24 V-logic ($U_{\text{ext}} = 24$ V)	<i>HIGH</i> >3.5 V >23 V	<i>LOW</i> $0.5 \Omega * I_{\text{low}}$ $0.5 \Omega * I_{\text{low}}$	with load current: $I_{\text{high}} = 15$ mA, $I_{\text{low}} \leq 0.7$ A $I_{\text{high}} = 22$ mA, $I_{\text{low}} \leq 0.7$ A
Switching time	<165 μ s		

SPAR/DAC8 analog outputs

Technical Datasheet version 3.2

Parameter	Value (typ./ min.max.)		Remarks
Channel count	8		analog
Output level	±10 V		
Terminal connections	2x DSUB-15 / 8 channels or 8x BNC		ACC/DSUB-DAC4 (-IP65) with CRSL/DAC-8-BNC
Load current	±10 mA max.		
Resolution	16-bit		
Linearity	max. 4 LSB 14-bit no missing codes		
Max. output frequency	50 kHz		
Analog bandwidth	50 kHz		-3 dB, low-pass 2nd order
Accuracy	±4 LSB (16-bit)		25°C
Offset error	<10 mV	<17 mV	25°C
Offset drift	0.06 mV / K		
Overall offset error		<20 mV	over entire temperature range
Gain error	<0.29 %		25°C
Gain drift	25 ppm / K		
Total gain error		<0.8 %	over entire temperature range

Field-bus

Table for possible Field-bus / Synthesizer Card Combinations

	CAN	CAN2	LIN	J1587	ARINC	XCPoE	Flexray	PROFIBUS	SYNTH1..3	SYNTH4
CAN	ok	X	X	ok	X	X	X	X	ok	X
CAN2	X	ok	ok	X	ok	ok	ok	ok	ok	ok
LIN	X	ok	ok	X	ok	ok	ok	ok	ok	ok
J1587	ok	X	X	ok	X	X	X	X	ok	X
ARINC	X	ok	ok	X	ok	ok	ok	ok	ok	ok
XCPoE	X	ok	ok	X	ok	ok	ok	ok	ok	ok
PROFIBUS	X	ok	ok	X	ok	ok	ok	ok	ok	ok
SYNTH1..3 (old)	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
SYNTH4 (new)	X	ok	ok	X	ok	ok	ok	ok	ok	ok

CAN-BUS Interface

Technical Datasheet version 3.1

Parameter	Value (min / max)	Remarks
Number of CAN-nodes	2	
Connector	2x DSUB-9 per card	for each of CAN_IN / CAN_OUT
Transfer protocol	CAN High Speed 1 MBaud (ISO 11898) CAN Low Speed 125 KBaud (ISO 11519)	default switchable per software With CAN2 , each node can be configured by software as CAN High Speed or CAN Low Speed.
Max. cable length at transfer rate: CAN CAN2	15 m at 1000 kBit/s 80 m at 500 kBit/s 25 m at 1000 kBit/s 90 m at 500 kBit/s	CAN High Speed cable delay 5.7 ns/m as of imcDevices Version 2.6 R1
Terminator resistor	124 Ω	switchable by software for each node
Parameterize per CANSAS	CAN2	imcDevices 2.6 R3 necessary or higher and optional CANSAS Software
Max. sustainable overvoltage	±50 V	to System ground (protection ground)

Note the possible combinations with [other modules](#) ²⁶.

LIN-BUS Interface

Technical Datasheet version 3.1

Parameter	Value (min / max)	Remarks
Number of LIN-nodes	2	
Connector	2x DSUB-9 per card	LIN_IN / LIN_OUT respectively
Transfer protocol	LIN 2.0, LIN 1.3 1-20 kBaud adjustable as desired	Both LIN-specifications can run on a bus simultaneously.
Max. sustainable overvoltage	±50 V	to System ground (protection ground)

Note the possible combinations with [other modules](#) ²⁶.

FlexRay Interface

Technical Datasheet version 3.2

Parameter	Value (min / max)	Remarks
Number of clusters	1	1x channel A+B
Connector	1x DSUB-9 per card	optionally with two connectors
Transfer protocol	FlexRay protocol specification v2.1	
Baud rate	2.5 / 5.0 or 10.0 MBit	
Data throughput		per card
FlexRay	Max. 30 kSamples/s	
FlexRay2	Max. 60 kSamples/s	
Max. sustainable overvoltage	±50 V	to System ground (protection ground)

Note the possible combinations with [other modules](#) ²⁶.

ARINC-Bus Interface

Technical Datasheet version 3.1

Parameter	Value (min / max)	Remarks
Number of Rx-channels	8	
Connector	freely selectable	by means of adapter connector
Transfer protocol	ARINC 429 Low (12.5 kbit/s) High (100 kbit/s)	
Max. voltage for each Rx connection	±29 V	to System ground (protection ground)
Max. sustainable overvoltage	±50 V	to System ground (protection ground)

Note the possible combinations with [other modules](#) ²⁶.

Synchronization and time base

Technical Datasheet Datasheet Version 2.8

Parameter	value typical	min. / max.	Remarks
time base per device without external synchronization			
not balanced (default)		± 50 ppm	at 25°C (accuracy of internal time base)
Drift	± 20 ppm	± 50 ppm	-40 °C to +85 °C operating temp.
Ageing		± 10 ppm	at 25°C, 10 years

time base per device with external synchronization signal				
Parameter	GPS	DCF77	IRIG-B	NTP
Supported formats	NMEA / PPS*		B002 B000, B001, B003**	version 4 (downwards compatible)
Precision	± 1 µs			< 5 ms after ca. 12 h
Jitter (max.)	± 8 µs			
Voltage level	TTL (PPS*) RS232 (NMEA)	5 V TTL level	5 V TTL level	---
Input resistance	1 kΩ (pull up)	20 kΩ (pull up)		---
Input connector	DSUB-9 connector "GPS" not isolated	BNC connector "SYNC" short circuit proof, not isolated		Ethernet
Shield potential input		system ground		---

*PPS (pulse per second): signal is necessary, **using BCD information only

Synchronization with DCF77 for several devices (Master/Slave)			
Max. cable length		200 m	BNC cable RG58
Max. number of devices		20	slaves only
Common mode	0 V		theses device must have the same ground voltage level, otherwise signal quality problems (signal edges) may result. Remedy see ISOSYNC
Voltage level	5 V		
DCF input/output	connector "SYNC"		BNC
Shield potential, IRIG-input	system ground		

ISOSYNC with different potentials			
Isolation strength	1000 V		1 minute
Delay	5 µs		@ 25°C
Temperature range		-35°C to +80°C	

UPS

Parameter	Value (min / max)	Remarks
Input supply	10 V to 32 V _{DC}	
Internal battery voltage	24 V	
Buffer time constant		at 25°C ambient temp. 5 to 30 sec selectable the duration of a <i>continuous</i> outage which triggers device deactivation. Other configurations upon request
Effective buffer capacity	≥15 Wh	typ. 23°C, battery fully charged
Minimum charging time for 1 min. buffer duration	≤10 min.	for empty battery @ 23°C
Charging time ratio	buffer time * (total power/ 12 W)	
Charging time for empty battery	24 h	device activated!

ACC/DSUB-ICP2-BNC, ACC/DSUB-ICP2-MICRODOT

Parameter	typ.	min. / max.	Remarks
Compatible channel types	SPAR/U16		Adapter for BNC to DSUB-15 Amplifiers with four channels per DSUB15 support channel 1 and 3 only
Inputs	2 4		single-end, not isolated, BNC ACC/DSUB-ICP2-MICRODOT
Input coupling	ICP		current source, 1st order high-pass
TEDS	conformant to IEEE 1451.4 Class I MMI		sensor with current feed
Measurement with ICP™-, DELTATRON®-, PIEZOTRON®-sensors1			
Max. input voltage		±35 V	long-term, to system ground
Input impedance	0,33 MΩ 0,91 MΩ	± 5%	depends on input range groups of the measurement inputs used
Ground impedance	145 Ω	± 10 Ω	resistance from the BNC shield to the device ground
High-pass cutoff frequency ACC/DSUB-ICP2-BNC, - MICRODOT	2,2 Hz 0,80 Hz	± 10%	-3 dB, depends on input range groups of the measurement inputs used
Constant current	4,2 mA	± 10%	
Voltage swing	25 V	>24 V	
Current source internal resistance	280 kΩ	>100 kΩ	in parallel with input impedance