SPARTAN

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

Version 2.4

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

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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 SPART/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

Optional modules	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°C*
- Shock resistance: 30 g pk over 3 ms
- Storage temperature: -40°C to 85°C

  * In compliance with DIN-EN 61010-1

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)*

  * Parametrization software required for the CANSAS modules

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)

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.

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

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 chassitype.
  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 channals per plug at **SPAR/B16**
- **ACC/DSUB-I2**, 15-pin DSUB-clamp terminal for 2 channals (shunt 50 Ω). For measurement of currents of up to 50 mA (scaling factor: 0.02 A/V) at **SPAR/B16**

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- **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 channals, 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 channals (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 channals (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 channals, 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 channals (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**

- **ACC/DSUB-ESD**, 15-pin pass-through DSUB connector. In case of high-frequency disturbance voltage levels, this connector can be connected between the signal connector and the measurement system.

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

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 conector's 4-channel blocks.

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.

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6
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For all devices

"✓": standard-equipped; "O" optional; "-": not available   Version 2.4

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)	3,3	3,8	5,3
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 x310
Weight (kg)	6,8	8,5	8
Free module slots	6	8	8
Modularly upgradeable	✓	✓	✓
Max. channels	96 (#1)(#2)	128 (#1)(#2)	128 (#1)(#2)
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 channl count depends on the amplifier configuration; please contact us for a detailed consultation

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

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

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Current supply	All *SPARTAN* variants
Power supply	10 V to 32 V DC
DC inputs LEMO typ	LEMO FGG.1B.302.CLAD62Z
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	30 g pk over 3 ms
Extended temperature range (opt.)	-40°C to 85°C
Storage temperature	-20°C to 85°C

PC - software equipment	All *SPARTAN* variants
Operating software "imcDevices"	✓
LabView Visualization tool	✓

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

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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	✓

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Analog modules

SPAR/T16 analog inputs

Technical Datasheet module version 3.1

Parameter	typ.	min. / max.	Remarks
inputs	8		
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
 	
  at sampling rate:
  5 Hz (200 ms)
  2 Hz (500 ms)
  1 Hz (1 s)
  0,5 Hz (2 s)
	Bandwidth
	-1 dB
	
	(f_g)
	
	1,0 Hz
	1,0 Hz
	0,5 Hz
	0,25 Hz
		max.
		signal
		
		(f_s)
		
		1 Hz
		1 Hz
		0,5 Hz
		0,25 Hz
			Noise supp.
			≥ 60 dB
			
			(f_filt)
			
			50 Hz
			50 Hz
			48,5 Hz
			48,5 Hz
				aliasing only in the frequency range:
				  f_s ... f_filt
				aliasing-free for frequencies above:
				  f_filt
				(noise suppression ≥ 60 dB)

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 ($\pm$2 %)
  5 Hz to 2 Hz
  (200 to 500 ms)
  1 Hz (1 s)
	34 dB @ 49 Hz / 51 Hz
	
	68 dB @ 49 Hz / 51 Hz			

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 $\geq$2Hz (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	$\pm$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 MΩ		voltage mode (range ≤±2 V), temperature mode
	1 MΩ		voltage mode (range ≥±5 V)
	50 Ω		Current mode (current connector)
Static input current	1 nA (typ.)	10 nA (max.)	settled, during sampling
Dynamic input current	0,1 mA (typ.)	1,5 mA (max.)	peak dynamic input current value (typ. @100 mV, max. @2 V)
	30 nA (typ.)	600 nA (max.)	mean dynamic input current value (typ. @100 mV, max. @2 V)
Input current below overvoltage		1,5 mA	|Vin| > 7 V in the range ≤±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 „± 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 µV	of input range	
Non linearity	< 30 ppm		range: ±10 V	
Gain drift		6 ppm/K 36 ppm/K	ranges ≤±2 V ranges ≥±5 V	over entire temp. range
Offset drift		3 ppm/K	over entire temperature range	
Noise voltage (RTI)	<0,5 µVrms <3,0 µVpkk (<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 ≤±2 V range ≤±2 V range ≥±5 V	R_{source}= 0 Ω R_{source}= 100 Ω R_{source}= 100 Ω
Channel isolation	< 50 pF, <100 nA		Channel to protection ground (CHASSIS); Channel-to-channel	
Channel cross-talk damping	all sampling rates > 116 dB (50 Hz) > 101 dB (50 Hz)		range ≤±2 V range ≤±2 V	R_{source}= 0 Ω R_{source}= 100 Ω
Suppression of square edges on neighboring channels	>123 dB @ sampling rate 200 ms		range ≤±2 V	R_{source}= 100 Ω
Max. source impedance	5 kΩ			

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		$<\pm0,5$ K $\pm0,05$ %	type-K, range -150 °C to 1200 °C plus value indicated
Drift	$\pm0,02$ 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.	$\pm0,001$ K/K·ΔT_j	$<\pm0,15$ 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	$<\pm0,1$ K $\pm0,05$ %		-200 °C to +850 °C, 4-wire configuration plus value indicated
Drift	$\pm$ 0,01 K/K· ΔT_a		$\Delta T_a=|T_a$ -25 °C|; T_a: ambient temperature
Reference current (Pt100)	250 µA		non-isolated (CHASSIS is Ground)

SPAR/U16 analog inputs

Technical Datasheet module version 3.2

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

General			
Parameter	typ.	min. / max.	Remarks
Filter cut-off frequency characteristic, order	1 Hz to 200 Hz		Butterworth, Bessel (digital) low pass filter: 8th order high pass filter: 4th order band pass: LP 8th and HP 4th order AAF: Cauer 8.order with fcutoff = 0,4 fa
Bandwidth	0 Hz to 200 Hz		-0,2 dB
Sampling frequency	$\leq$500 Hz		per channel
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	$\pm$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 Ri=30 Ω, td=300 µs, tr<60 µs
Input coupling configuration	DC, isolated (differential)		galvanically isolated to System-GND (case, CHASSIS)
Input impedance	10 MΩ 1 MΩ 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
			|Vin| > 5 V on ranges < $\pm$5 V
			or device powered-down

Auxiliary supply	+5 V (max. 160 mA / plug) not isolated		e.g. for ICP-extension plug

Voltage and current measurement			
Parameter	**typ.**	**min. / max.**	**Remarks**
Voltage input ranges	±50 mV / ±100 mV / ±250 mV / ±500 mV ±1 V/ ±2 V / ±5 V / ±10 V / ±25 V /±50 V / ±60 V		
Current input ranges	±1 mA / ±2 mA / ±5 mA ±10 mA / ±20 mA / ±40 mA		with shunt-plug (Shunt 50 Ω) (ACC/DSUB-I4(-IP65))
Gain uncertainty	< 0,025 % < 0,07 %	< 0,05 % < 0,15 %	voltage, 23 °C current with shunt-plug
Offset uncertainty	2 LSB		
Non-linearity	<120 ppm		range ±10 V
Gain drift		6 ppm/K 50 ppm/K	ranges ≤± 2 V over full ranges ≥± 5 V 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:±50 mV
IMR (isolation mode rejection)	> 145 dB (50 Hz) > 70 dB (50 Hz)		range ≤ ± 2 V R_{source} = 0 Ω range ≥ ± 5 V
Channel isolation	>1 GΩ, < 40 pF > 1 GΩ, < 10 pF		channel-to-ground (protection ground) channel-to-channel
Channel isolation (crosstalk) Channel-to-channel	> 165 dB (50 Hz) > 92 dB (50 Hz)		range ≤ ± 2 V R_{source} ≤ 100 Ω range ≥ ± 5 V

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		<±0,6 K <±1,0 K	type K, range -150 °C to 1200 °C else
Temperature drift	±0,02 K/K·ΔT_a		ΔT_a= $\vert T_a$ -25 °C$\vert$ ambient temperature T_a
Uncertainty of cold junction compensation Temperature drift	±0,001 K/K·ΔT_j	< ±0,15 K	ACC/DSUB-T4 ΔT_j = $\vert T_j$ -25°C$\vert$ cold junction temperature T_j

Temperature measurement – Pt100			
Parameter	**typ.**	**min. / max.**	**Remarks**
Measurement range	-200 °C to +850 °C -200 °C to +250 °C		
Resolution	0,063 K (1/16 K)		
Measurement uncertainty	<±0,2 K <±0,05 %		-200 °C to +850 °C, 4-wire connection plus of reading
Temperature drift	±0,01 K/K ΔT_a		ΔT_a=$\vert T_a$ -25 °C$\vert$; ambient temp. T_a
Sensor feed (Pt100)	250 µA		

SPAR/B(C)16 analog inputs

Technical Datasheet module version 3.1

Parameter	typ.	min. / max	Remarks
SPAR/B16 Measurement modes	• Bridge sensors • Bridge: strain gauges • Voltage measurement • Current measurement • Current-fed sensors, ICP		ACC/DSUB-B2 ACC/DSUB-I2 Shunt-plug ACC/DSUB-ICP2 (*ICP™-, Deltatron®-, Piezotron®-Sensors)
SPAR/BC16 Measurement modes	• Bridge sensors • Bridge: strain gauges • Voltage measurement		HD-DSUB26
Width	2 slots 4 slots		SPAR/BC16 SPAR/B-16

General			
Parameter	**typ.**	**min. / max.**	**Remarks**
Filter cut-off frequency characteristic, order	1 Hz to 200 Hz		digital low-, high-, bandpass 8th order Bessel Butterworth, 6th order
Bandwidth	0 Hz to 200 Hz		-3 dB
Sampling frequency	≤500 Hz		per channel
Resolution	16 bit		
SPAR/B16 only TEDS	conform IEEE 1451.4 Class II MMI		ACC/DSUB-TEDS-B2(-IP65) ACC/DSUB-TEDS-I4(-IP65)
Auxiliary supply SPAR/B16 only 5 V (Vcc) (pin 17 at DSUB plug)	± 5 % no load		Short circuit proof independent of integrated sensor supply module SUPPLY

Errors and changes excepted   **15**
For more information, contact:
Berlin: +49 - 30 - 46 70 90 - 0

Voltage measurement			
Parameter	**typ.**	**min./ max**	**Remarks**
Input ranges	$\pm$10 V, $\pm$5 V, $\pm$2,5 V, $\pm$1 V... $\pm$5 mV		
Surge protection		$\pm$40 V	permanent
Input coupling	DC		
Input configuration	differential		
Input impedance	20 MΩ	$\pm$1 %	differential
Gain uncertainty drift	0,02 % +10 ppm/K$\cdot\Delta T_a$	$\leq$0,05 % +30 ppm/K$\cdot\Delta T_a$	of reading ΔT_a=|T$_a$ -25°C|; ambient temp: T$_a$

Offset
    uncertainty
 	
    drift
	
	0,02 %
	
	$\pm$0,7 µV/K$\cdot\Delta T_a$
	$\pm$0,1 µV/K$\cdot\Delta T_a$
		
		$\leq$0,05 %
		$\leq$0,06 %
		$\pm$6 µV/K$\cdot\Delta T_a$
		$\pm$1,1 µV/K$\cdot\Delta T_a$
			of range, in ranges:
			>$\pm$ 50 mV
			$\leq\pm$ 50 mV
			$\pm$ 10 V to $\pm$ 0,25 V
			$\leq\pm$ 0,1 V
			ΔT_a=|T$_a$ -25 °C|
			ambient temp T$_a$

Non-linearity	10 ppm	$\leq$50 ppm	
Common mode rejection ranges: $\pm$10 V to $\pm$50 mV $\pm$ 25 mV to $\pm$5 mV	>110 dB >138 dB	>90 dB >132 dB	common mode test voltage: $\pm$ 10 V$_=$
Noise (RTI)	0,6 µVeff 0,14 µVeff	1,0 µVeff 0,26 µVeff	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	± 2000000 µm/m ... ± 1000 µm/m		with strain gauge
bridge supply: 10 V	± 1000 mV/V, ± 500 mV/V, ± 200 mV/V, ± 100 mV/V ... $\pm 0,5$ mV/V		with quarterbridge: ± 10 mV/V to $\pm 0,5$ mV/V
bridge supply: 5 V	± 1000 mV/V, ± 500 mV/V, ± 200 mV/V, ± 100 mV/V ... ± 1 mV/V		all modes
bridge supply: 2,5 V	± 1000 mV/V, ± 500 mV/V, ± 200 mV/V, ± 100 mV/V ... ± 2 mV/V		as an option
Input impedance	20 MΩ	± 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	$\pm 0,5$ %	
	5 V		
	2,5 V		as an option
Min. bridge impedance	120 Ω, 10 mH full bridge		
	60 Ω, 10 mH half bridge		
Max. bridge impedance	5 kΩ		
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 resistence for bridges (without return line)	< 6 Ω		10 V excitation 120 Ω
	< 12 Ω		5 V excitation 120 Ω

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		with 120 Ω internally
	differentiell		or 50 Ω shunt in terminal plug (ACC/DSUB-I2)
Gain:	0,02 %	$\leq 0,06$ %	of reading
uncertainty		$\leq 0,1$ %	plus uncertainty of 50 Ω shunt
drift	+15 ppm/K$\cdot \Delta T_a$	+55 ppm/K$\cdot \Delta T_a$	
Offset: uncertainty	0,02 %	$\leq 0,05$ %	of range

Noise (current)	0,6 nA$_{eff}$	10nA$_{eff}$	bandwidth: 0,1 Hz to 1 kHz
	0,15nA$_{eff}$	0,25nA$_{eff}$	0,1 Hz to 10 Hz

Errors and changes excepted   17
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Sensor supply 5 V			
Parameter	**typ.**	**min. / max.**	**Remarks**
add. sensor supply			power per DSUB-connector
voltage	+5 V	$\pm$ 5 %	no load
current	>0,26 A	>0,2 A	current limit; short circuit proof
impedance	1,0 Ω	<1,2 Ω	

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 all eight channels
	+2,5 V	580 mA	1,5 W	optional upon request, +12 V or +15 V can be replaced by +2,5 V
	+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	
	$\pm$15 V	190 mA	3,0 W	optional upon request, +15 V can be replaced by $\pm$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.)			at terminals, no load
	<0,5 % (max.)			25 °C 25 °C
	<0,9 % (max).			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 %			10 V, to 15 V
	typ. 66 %			5 V
Max. capacitive load	>4000 µF			2,5 V to 10 V
	>1000 µF			12 V, 15 V
	>300 µF			24 V

Errors and changes excepted   **18**
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SPAR/SEN_SUPPLY sensor supply module

Optional sensor supply for SPAR/T16 and SPAR/U16

Technical datasheet module 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	Current	Netpower	
	+2,5 V	580 mA	1,5 W	option upon request, +12 V can be replaced by +2,5 V
	+5,0 V	580 mA	2,9 W	
	+10 V	300 mA	3,0 W	set globally for groups of eight channels at SPAR/U16 or 16-channel groups at SPAR/T16
	+12 V	250 mA	3,0 W	
	+15 V	200 mA	3,0 W	
	+24 V	120 mA	2,9 W	
	$\pm$15 V	190 mA	3,0 W	option upon request, +15 V can be replaced by $\pm$15 V
Isolation Standard:	non isolated			output to case (CHASSIS)
option, upon request:	isolated			nominal rating: 50 V, Test voltage (10 sec.): 300 V, not available with option $\pm$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

Incremental encoder channels

Technical Datasheet module version 2.2

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 (-IP65)
Sampling rate	50 kHz / channel (max.)		
Time resolution of measurement	31,25 ns		Counter frequency: 32 MHz
Data resolution	16 bits		
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 per channel
Hysteresis	min. 100 mV		adjustable per channel
Analog bandwidth	500 kHz		-3 dB (full power)
Analog filter	Bypass (no Filter), 20 kHz, 2 kHz, 200 Hz		adjustable (per-channel) 2nd order Butterworth
Switching delay	500 ns		Modulation: 100 mV squarewave
CMRR	70 dB 60 dB	50 dB 50 dB	DC, 50 Hz 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)

Digital Inputs

Technical Datasheet module 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 μA	
Switching threshold	1,5 V (±200 mV) 8 V (±300 mV)	5 V mode 24 V mode
Switching time	< 20 μs	
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 module 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.) TTL 24 V-logic open-drain	*HIGH* 15 mA 22 mA ---	*LOW* 0,7 A 0,7 A 0,7 A	external clamp diode needed for inductive load
Output voltage TTL 24 V-logic (U_{ext} = 24 V)	*HIGH* >3,5 V >23 V	*LOW* $\leq$0,4 V $\leq$0,4 V	for load current: $I_{high,}$ = 15 mA, $I_{low,} \leq$ 0,7 A $I_{high,}$ = 22 mA, $I_{low,} \leq$ 0,7 A
Switching time	<100μs		
Connector plug	1x DSUB-15 / 8 Bit		ACC/DSUB-DO8

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 needs 2 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** [20]. 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	$<\pm5$ mV	$<\pm10$ mV	-40 °C to 85 °C
Offset uncertainty	$<\pm2$ mV	$<\pm4$ mV	-40 °C to 85 °C

SPAR/DI16 digital inputs

Technical Datasheet module version 3.1

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 µs	
Input current	max. 500 µA	
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 module version 3.1

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_{ext} -0,8 V		internal isolated supply voltage by means of connecting an external supply voltage U_{ext} with "HCOM", U_{ext} = 5 V to 30 V

Max. output current (typ.)
    TTL
    24 V-logic
    open-drain
	HIGH
	15 mA
	22 mA
	--- 	
		LOW
		0,7 A
		0,7 A
		0,7 A
			external inverse diode needed with inductive load

Output voltage
    TTL
    24 V-logic (U_{ext} = 24 V)
	HIGH
	>3,5 V
	>23 V
		LOW
		0,5 Ω * I_{low}
		0,5 Ω * I_{low}
			with load current:
			I_{high}, = 15 mA, I_{low}, $\leq$0,7 A
			I_{high}, = 22 mA, I_{low}, $\leq$0,7 A

Switching time	<165 μs		

SPAR/DAC8 analog outputs

Technical Datasheet module version 3.1

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

Errors and changes excepted   **25**
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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 ms/m as of imcDevices Version 2.6 R1
Terminator resistor	124 Ω	switchable by software for each node
Parameterize per CANSAS	CAN2	
Max. sustainable overvoltage	$\pm$50 V	to System ground (protection ground)

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)

FlexRay Interface

Technical Datasheet Version 3.1

Parameter	Value (min / max)	Remarks
Number of clusters	1	
Connector	1x DSUB-9 per card	
Transfer protocol	FlexRay protocol specification v2.1	
Baud rate	2,5 / 5,0 or 10,0 MBit	each FlexrayChannel separately adjusted
Data throughput	Max. 30 kSamples/s	per card
Max. sustainable overvoltage	±50 V	to System ground (protection ground)

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)

Synchronization and time base

Technical Datasheet Version 2.4

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 bis +85 °C operating temp.
Ageing		±10 ppm	at 25°C, 10 years

time base per device without external synchronization				
Parameter	GPS	DCF77	IRIG-B	NTP
Supported format			B002 B000, B001, B003*	version 4 (downwards compatible)
Precision	±1 µs			<5 ms after ca. 12 h
Jitter (max.)	±8 µs			
Voltage level	TTL	5 V TTL Pegel LOW active	5 V TTL Pegel	---
Input resistance	1 kΩ (pull up)	20 kΩ (pull up)		---
Input connector	DSUB-9	BNC connector "SYNC" short circuit proof, not isolated		Ethernet
Shield potential input		system ground		---

*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	BNC connector "SYNC"		
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	1 sec.	at 25°C ambient temp. 5 to 30 sec selectable the duration of a *continuous* 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		single-end, not isolated, BNC
	4		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	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

Errors and changes excepted
For more information, contact:
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30