

ESX.3xm

ESX control units

KEY FEATURES

- Control specially designed for use in harsh mobile applications
- Internally expandable with up to max. 3 expansion boards (standard variants or customer specific)
- Flexible programming in C, CODESYS V3.5 IEC61131
- Suitable for safety-related applications up to SIL 2 according to IEC 61508:2010 or PL d according to EN ISO 13849-1:2015

TECHNICAL DATA

- TriCore TC 1796 32 bit, 150 MHz
- 80 kB SRAM internal, 4 MB SRAM external
- 2 MB Flash internal, 4 MB Flash external
- 32 kB EEPROM
- 4 CAN interfaces and 1 RS232 interface (basic version without expansion boards)
- 15 inputs (basic version without expansion board)
- 8 outputs (basic version without expansion board)
- Expandable via expansion boards

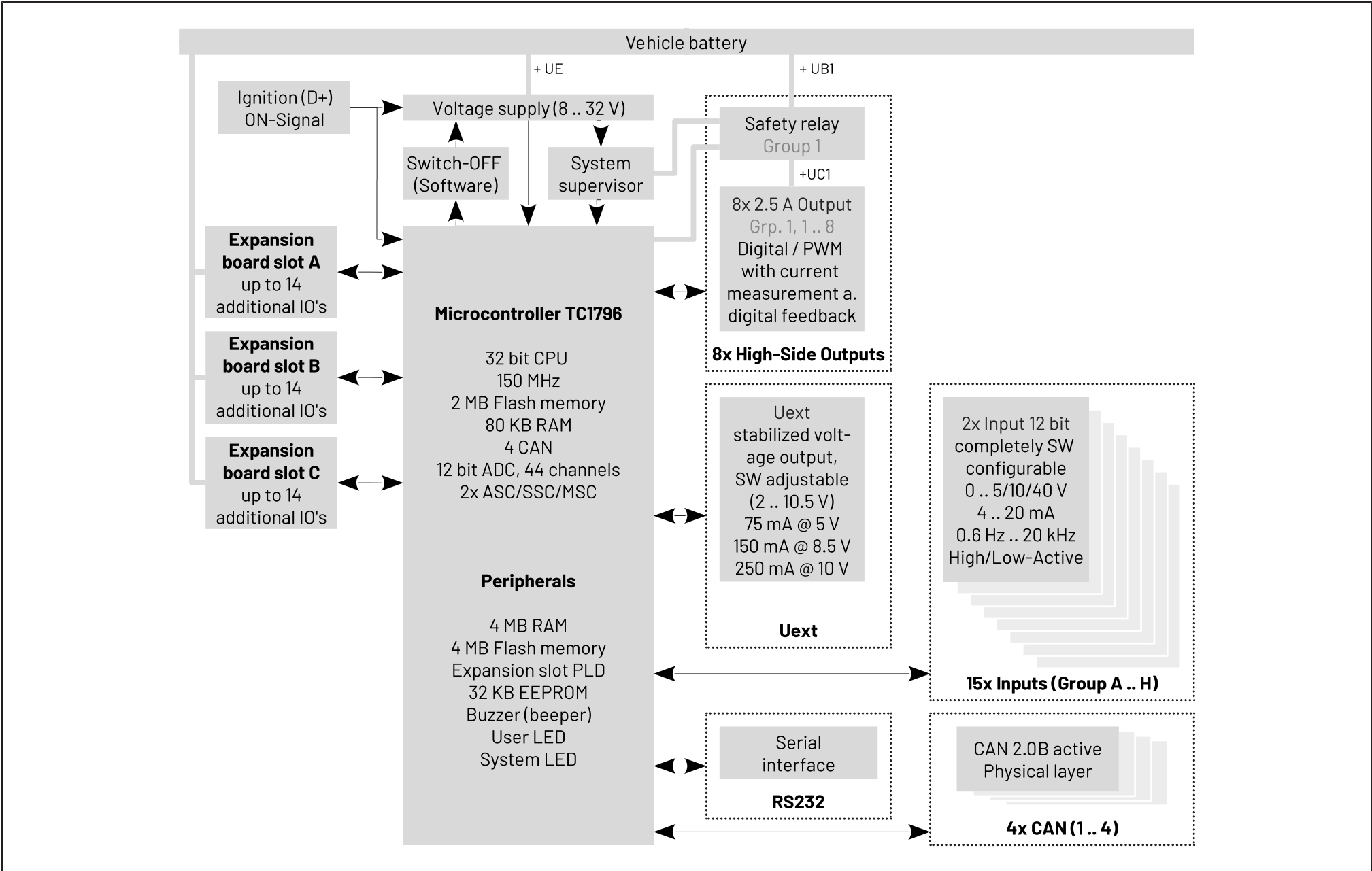
ACCESSORIES

- Debug Adapter
- Debugger
- ESX-Test-Box Adapter
- Component Deployment for C, CODESYS V3.5
- Mating plug

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BLOCK DIAGRAM



TECHNICAL DATA

Processor and Memory

Type	Properties	Features
TriCore TC 1796	32 bit	@150 MHz, separate system supervisor with programmable watchdog
SRAM	80 kB internal, 4 MB external	
Flash	2 MB internal flash, 4 MB external	
EEPROM	32 kB	

Communication Interfaces

Type	Max. Quantity	Configuration
CAN	4	2.0 B, full CAN, low-/high speed up to 1 MBit/s
RS232	1	Programmable baud rate up to 115 kBit/s
Expansion Possibilities	3 modules	For additional inputs and outputs or other functionalities

Inputs – Base Configuration

Type	Max. Quantity	Possible Configuration	Measurement	Options/Dependencies
Multi Function Inputs	15	Analog	4 mA ... 20 mA or 0 V ... 5 V / 10 V / 40 V	12 Bit, cut off frequency 100 Hz, short circuit protected, inbuilt diagnosis
	15	Digital	High / low active	Short circuit protected, inbuilt diagnosis
	15	RPM/frequency	High / low active	Cut off frequency 20 kHz, short circuit protected, inbuilt diagnosis
Incremental Inputs	3	Incremental encoder		(2 channels each) cut off frequency 20 kHz, short circuit protected

Outputs – Base Configuration (All Outputs are Short Circuit Protected)

Type	Max. Quantity	Possible Configuration	Range	Characteristics	Features
Digital/PWM-outputs with current measurement	8		2,5 A	High-side, 0 % ... 100 %	Short circuit protected, built-in diagnosis
Voltage output	1	Independent, regulated voltage supplies	5 V ... 10 V		

TECHNICAL DATA

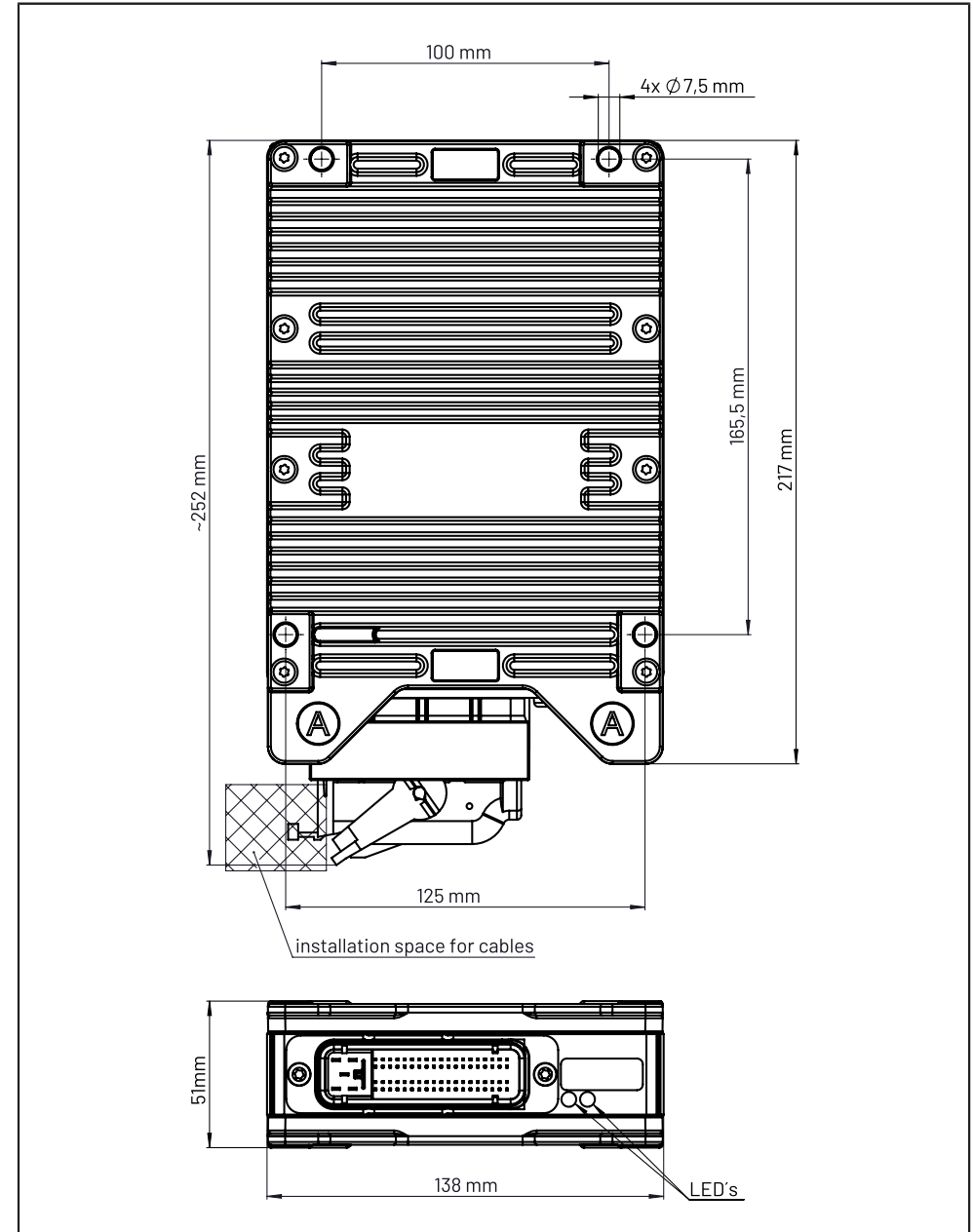
Additional Inputs/Outputs

Type	Max. Quantity	Features
Expansion possibilities	3 modules	Each serving up to 14 Inputs/Outputs, e.g. for digital or analog I/Os, PVG outputs for Danfoss valves, inputs for encoders, motor bridges, communication interfaces or customer specific design

Mechanical Data

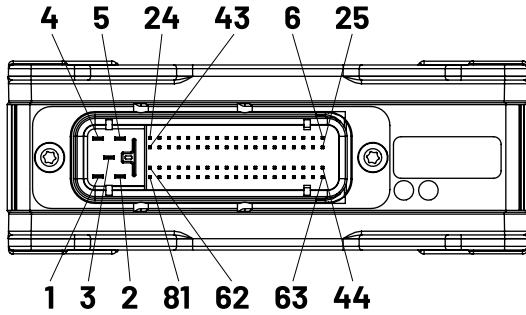
Component	Description	Value
Supply Voltage	Direct current (DC)	8 ... 32 V
Current - Consumption	Without external load	< 350 mA at 12 V supply voltage < 200 mA at 24 V supply voltage
	Standby (ignition off)	< 1 mA
Temperature	Housing temperature	-40 °C ... +85 °C (-40 °F ... +185 °F)
Connector	Automotive type (Tyco/AMP)	81 Pins
Indicators	4 LED (dual color), buzzer	1 x for system status and 1 x freely programmable
Housing	Die-cast aluminum	GORE-TEX® membrane for pressure equalization
Dimensions		138 mm x 217 mm x 51 mm
Weight		About 1.5 kg (3.3 lbs)
Degree of Protection		IP67 and IP69k

TECHNICAL DRAWING



PIN ASSIGNMENT

Pin Assignment 81 Pin Connector:



Pin Assignment 81 Pin Connector:

Pin	Description
1	Expansion slot C - IO pin 14 (e.g. power supply)
2	Ground mainboard
3	Expansion slot A - IO pin 14 (e.g. power supply)
4	Expansion slot B - IO pin 14 (e.g. power supply)
5	Power supply pin for outputs 1 ... 8 (High-Side 2.5 A)
6	Power supply electronic
7	CAN bus 1 (high)
8	CAN bus 3 (high)
9	Multi Function input 14
10	Multi Function input 10
11	Multi Function input 6
12	Multi Function input 2
13	Digital-/ PWM-Output 5
14	Digital-/ PWM-Output 6
15	Expansion slot A - IO pin 10
16	Expansion slot A - IO pin 6
17	Expansion slot A - IO pin 2
18	Expansion slot B - IO pin 11
19	Expansion slot B - IO pin 7
20	Expansion slot B - IO pin 3

Pin Assignment 81 Pin Connector:

Pin	Description
21	Expansion slot C - IO pin 12
22	Expansion slot C - IO pin 8
23	Expansion slot C - IO pin 4
24	Expansion slot C - IO pin 13
25	Ignition (KL15)
26	CAN bus 1 (low)
27	CAN bus 3 (low)
28	Multi Function input 15
29	Multi Function input 11
30	Multi Function input 7
31	Multi Function input 3
32	Digital-/ PWM-Output 1
33	Digital-/ PWM-Output 2
34	Expansion slot A - IO pin 11
35	Expansion slot A - IO pin 7
36	Expansion slot A - IO pin 3
37	Expansion slot B - IO pin 12
38	Expansion slot B - IO pin 8
39	Expansion slot B - IO pin 4
40	Expansion slot B - IO pin 13

PIN ASSIGNMENT

Pin Assignment 81 Pin Connector:

Pin	Description
41	Expansion slot C - IO pin 9
42	Expansion slot C - IO pin 5
43	Expansion slot C - IO pin 1
44	RS232 (TxD)
45	CAN bus 2 (high)
46	CAN bus 4 (high)
47	Analog ground (related to pin 66, U _{ext1})
48	Multi Function input 12
49	Multi Function input 8
50	Multi Function input 4
51	Digital-/ PWM-Output 3
52	Digital-/ PWM-Output 4
53	Expansion slot A - IO pin 12
54	Expansion slot A - IO pin 8
55	Expansion slot A - IO pin 4
56	Expansion slot A - IO pin 13
57	Expansion slot B - IO pin 9
58	Expansion slot B - IO pin 5
59	Expansion slot B - IO pin 1
60	Expansion slot C - IO pin 10

Pin Assignment 81 Pin Connector:




Pin	Description
61	Expansion slot C - IO pin 6
62	Expansion slot C - IO pin 2
63	RS232 (RxD)
64	CAN bus 2 (low)
65	CAN bus 4 (low)
66	Regulated voltage output 1 (e.g. sensor supply)
67	Multi Function input 13
68	Multi Function input 9
69	Multi Function input 5
70	Multi Function input 1
71	Digital-/ PWM-Output 7
72	Digital-/ PWM-Output 8
73	Expansion slot A - IO pin 9
74	Expansion slot A - IO pin 5
75	Expansion slot A - IO pin 1
76	Expansion slot B - IO pin 10
77	Expansion slot B - IO pin 6
78	Expansion slot B - IO pin 2
79	Expansion slot C - IO pin 11
80	Expansion slot C - IO pin 7

Pin Assignment 81 Pin Connector:

Pin	Description
81	Expansion slot C - IO pin 3

QUALIFICATION

Compliance Information

Standard	Description
ISO/IEC 17050-1	 Conformity
94/9/EC	 Conformity (available on request, please contact your local sales representative)
KBA (Kraftfahrt-Bundesamt)	 Certification This approved device can be used on any vehicle type with the following restrictions: All vehicle types with a 12 V respectively 24 V - electrical wiring and battery(-) at the body
ISO 13766	Earth-moving machinery - Electromagnetic compatibility
DIN EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal power supply
DIN EN ISO 14982	Agricultural and forestry machines - Electromagnetic compatibility - Test methods and acceptance criteria
FCC, 47 CFR Part 15, Subpart B	Correspondence with FCC Docket 92-152 'Harmonisation of Rules for Digital Devices Incorporated International Standards' under terms of CISPR 22
RoHS	Restriction of Hazardous Substances

The ESX.3xm is manufactured in accordance to IPC standards.

DETAILED QUALIFICATION

EMC Industrial (CE)

Standard	Test Description
EN 61000-6-3:2005 (EN 55011:2003)	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (CE mark) 150 kHz - 1 GHz Group 1 Class A (with expansion boards, class B limits exceeded only at 400 kHz and 650 kHz) 150 kHz - 1 GHz Group 1 Class B (without expansion boards)
EN 61000-6-2:2006-03 (former EN 50082-2)	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards: Immunity for industrial environments (CE mark) ESD (EN 61000-4-2) 330 W / 150 pF, Contact: +/- 4 kV, Air: +/- 8 kV Radio frequency (EN 61000-4-3) 80 MHz - 2700 MHz, 10 V/m, AM, horizontal + vertical Burst (EN 61000-4-4) Supply: +/- 2 kV; 5/50 ns; 5 kHz Signal: +/- 2 kV; 5/50 ns; 5 kHz Surge (EN 61000-4-5) Supply: +/- 0.5 kV; 1.2/50 µs Signal: +/- 1 kV; 1.2/50 µs Conducted disturbance (EN 61000-4-6) 0.15 MHz - 80 MHz, 10 V, 80% AM sine wave 1 kHz

DETAILED QUALIFICATION

EMC Automotive

Standard	Test Description
2006/28/EG (Cispr25, DIN EN 55025)	Emission 150 kHz to 3 GHz, 1 m, 120 kHz bandwidth
ISO 11452-5:2002-04 ISO 11452-2:2000-03	Immunity Stripline: 150 kHz - 400 MHz 200 V/m, 80% AM sine wave 1kHz; absorber lined chamber: 200 MHz - 3 GHz, 200 V/m, AM
ISO7637-2:2004-09	Road vehicles, electrical disturbance by conduction and coupling Voltage transient emissions
DIN40839-1:1992-10	Pulse 1 (24 V): -600 V, 50 Ω, 5000 pulses Pulse 1 (12 V): -300 V, 5000 pulses Pulse 2a (24 V): +50 V, 2 Ω, 5000 pulses Pulse 2b (24 V): +20 V, 10 pulses Pulse 2b (12 V): +10 V, 10 pulses Pulse 3a (24 V): -200 V, 1 hr. Pulse 3b (24 V): +200 V, 1 hr. Pulse 4 (24 V): -16 V, 2 pulses Pulse 4 (12 V): -7 V, 2 pulses Pulse 5a: +70V, 100ms, 2 Ω, 2 pulses
ISO 7637-3:2007	Road vehicles, electrical disturbance by conduction and coupling (data, signal), test level 4 Pulse a: -80 V, 1 hr. Pulse b: +80 V, 1 hr.
ISO 10605:2008	Electrostatic discharge, test level 4
IEC / CISPR 25:2008 EN 55025:2008	Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices 0.15 MHz to 108 MHz
ISO 13766:2006	Earth-moving machinery - electromagnetic compatibility

EMC Automotive

Standard	Test Description
DIN EN 13309:2010	Construction machinery - electromagnetic compatibility of machines with internal power supply
DIN EN 14982:2009	Agricultural and forestry machines - electromagnetic compati- bility

Electrical Tests

Standard	Test Description
EN 60204-1:2008-01	Safety of machinery - electrical equipment of machines
ISO 16750-2:2010	Superimposed alternating voltage Slow decrease and increase of supply voltage Momentary drop in supply voltage Reset behavior at voltage drop Starting profile Supply voltage cranking, Level I, II, III, IV for code B devices without relevant functions to vehicle operation during cranking
ISO 16750-2	Overvoltage 36 V for 1 hr. at +65 °C
ISO 16750-2	Reversed voltage - case 2 28 V: Duration: 1 Min.
ISO 16750-2	Open circuit tests - Single line interruption Interruption of each single Output for 10 s ± 1 s
ISO 16750-2	Open circuit tests - Multiple line interruption Supply voltage completely removed from DUT for 10 s ± 1s
ISO 16750-2	Short circuits - signal lines Connect every In- and Output to U _{max} and GND for 1 minute
ISO 16750-2	Short circuit - supply lines To load circuits duration: 5 minutes

DETAILED QUALIFICATION

Climatic and Mechanical Tests

Standard	Test Description
EN 60529:2000-09, DIN 40050-9:1993-05	IP Protection classes IP 67, IP 69K
ISO16750-4:2006 (IEC 60068-2-1:1995-03)	Environmental testing: Cold (storage and operational) 24 hrs. at -40 °C
ISO16750-4:2006 (IEC 60068-2-2/A2 1995-01)	Environmental testing: Dry heat (storage and operational) +85 °C, storage: 48 hrs., operation: 96 hrs.
ISO16750-4:2006 (IEC 60068-2-78:2002-09)	Environmental testing: Damp heat steady state 21 days with 40 °C and 93% r. h.
ISO16750-4:2006 (IEC 60068-2-14:2000-08)	Environmental testing: Change of temperature Na From -40 °C to +85 °C, 100 cycles, dwell time 1hr., temp. change rate ≤ 30 s
ISO 16750-3:2007-08	PSD random vibration with temperature superimposition (Test VII) 10 Hz-2000 Hz, 32 hrs. for each plane
ISO16750-4:2006 (IEC 60068-2-14:2000-08)	Environmental testing: Change of temperature Nb From -40 °C to +85 °C, 30 cycles
ISO16750-3:2007 (IEC 60068-2-27:1995-03)	Environmental testing: Shock 50 g/11ms, sine wave, 10 shocks/ axis
DIN EN 60068-2-27	Environmental testing: Bump Bump, 30 g/6ms, sine wave, 1000 shocks/axis
ISO16750-4:2006 (IEC 60068-2-38-Z/ AD:2000-02)	Environmental testing: Damp heat cyclic From +25 °C to 65 °C with 93% r. h. 10 cycles (each cycle 24 hrs.), five cycles with freeze phase (-10 °C)
ISO16750-3:2006	Environmental testing: Free fall 1 m free fall on steel plate, 6 axis
EN ISO 6270-2:2007-10	Paints and varnishes - Determination of resistance to humidity

Climatic and Mechanical Tests

Standard	Test Description
	8 hrs. / 16 hrs. cyclic, 4 days
ISO16750-4:2006 (IEC 60068-2-52:2000-02)	Sodium chloride 5% NaCl, Level 5, test duration 28 days
ISO 16750-5:2003-12	Road vehicles - Environmental conditions and testing for elec- trical and electronic equipment: Chemical loads
ISO16750-4:2006 (IEC 60068-2-60:1995-12)	Flowing mixed gas corrosion test Sulfur dioxide SO2, Hydrogen sulfide H2S, Nitrous oxide NO2, Chlorine Cl2
DIN EN 60068-2-6	Vibration sinusoidal 10 Hz...2000 Hz, 1 oct/min, 5 g, 10 cycles, bidirectional
ISO 16750-4	Temperature step test Starting from 20 °C to TMIN, then to TMAX, in 5 °C steps; duration: 16 hrs (-40 °C to +85 °C)
ISO 16750-1 Annex B	Life test (Weibull) 54 days at 105 °C in operation