

ESX-3XL

ESX Control Units

KEY FEATURES

- Control unit specially designed for use in harsh mobile applications
- Internally expandable with up to max. 6 expansion boards (standard variants or customer specific)
- Flexible programming in C, CODESYS V3.5 IEC61131 or Matlab
- J1939/ CANopen/ ECSP (ESX CAN Safety Protocol)
- 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 external
- 2 MB Flash internal, 4 MB Flash external
- 32 kB EEPROM
- 4 CAN interfaces and 1 RS232 interface (basic version without expansion board)
- 28 inputs (basic version without expansion board)
- 24 outputs (basic version without expansion board)
- Expandable via expansion boards

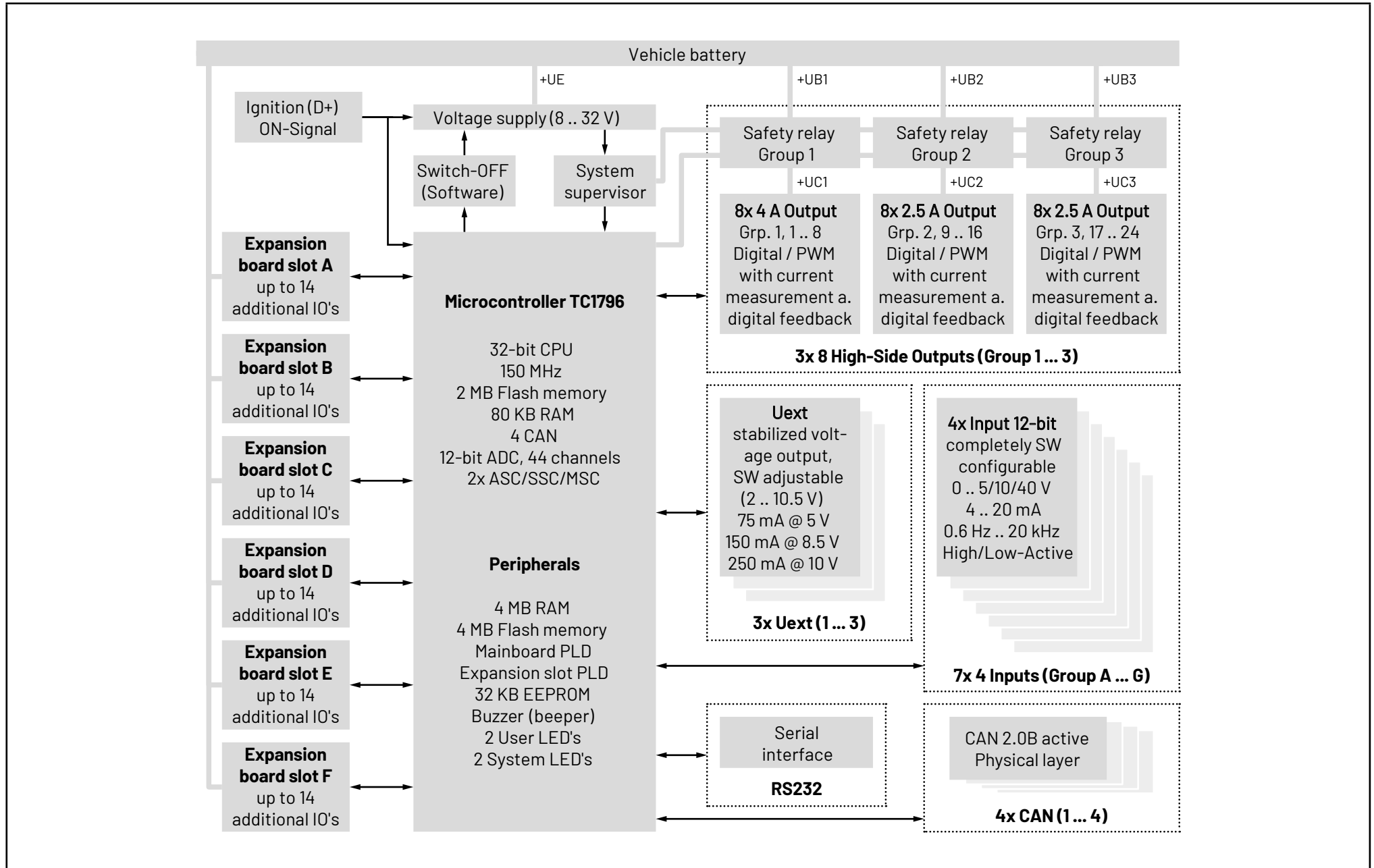
ACCESSORIES

- Debug Adapter
- Debugger
- ESX-Test-Box Adapter
- Component Deployment for C, CODESYS V3.5 and Matlab
- 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 1MBit/s
RS232	1	programmable baud rate up to 115 kBit/s
Expansion Possibilities	6 modules	for additional inputs and outputs or other functionalities

Inputs – Base configuration

Type	Max. Quantity	Configuration	Measurement	Options/Dependencies
Multi Function Inputs	28	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
	28	Digital	high / low active	short circuit protected, inbuilt diagnosis
	28	RPM/frequency	high / low active	cut off frequency 20 kHz, short circuit protected, inbuilt diagnosis
Incremental Inputs	4	incremental encoder		(2 channels each) cut off frequency 20 kHz, short circuit protected

Outputs – Base configuration

Type	Max. Quantity	Configuration Range	Property	Features
Digital/ PWM-outputs with current measurement	8	4 A	high-side, 0 % ... 100 %	short circuit protected, built-in diagnosis
	16	2,5 A	high-side, 0 % ... 100 %	short circuit protected, built-in diagnosis
Voltage Output	3	independent, regulated voltage supplies	5 V ... 10 V	

Inputs/Outputs

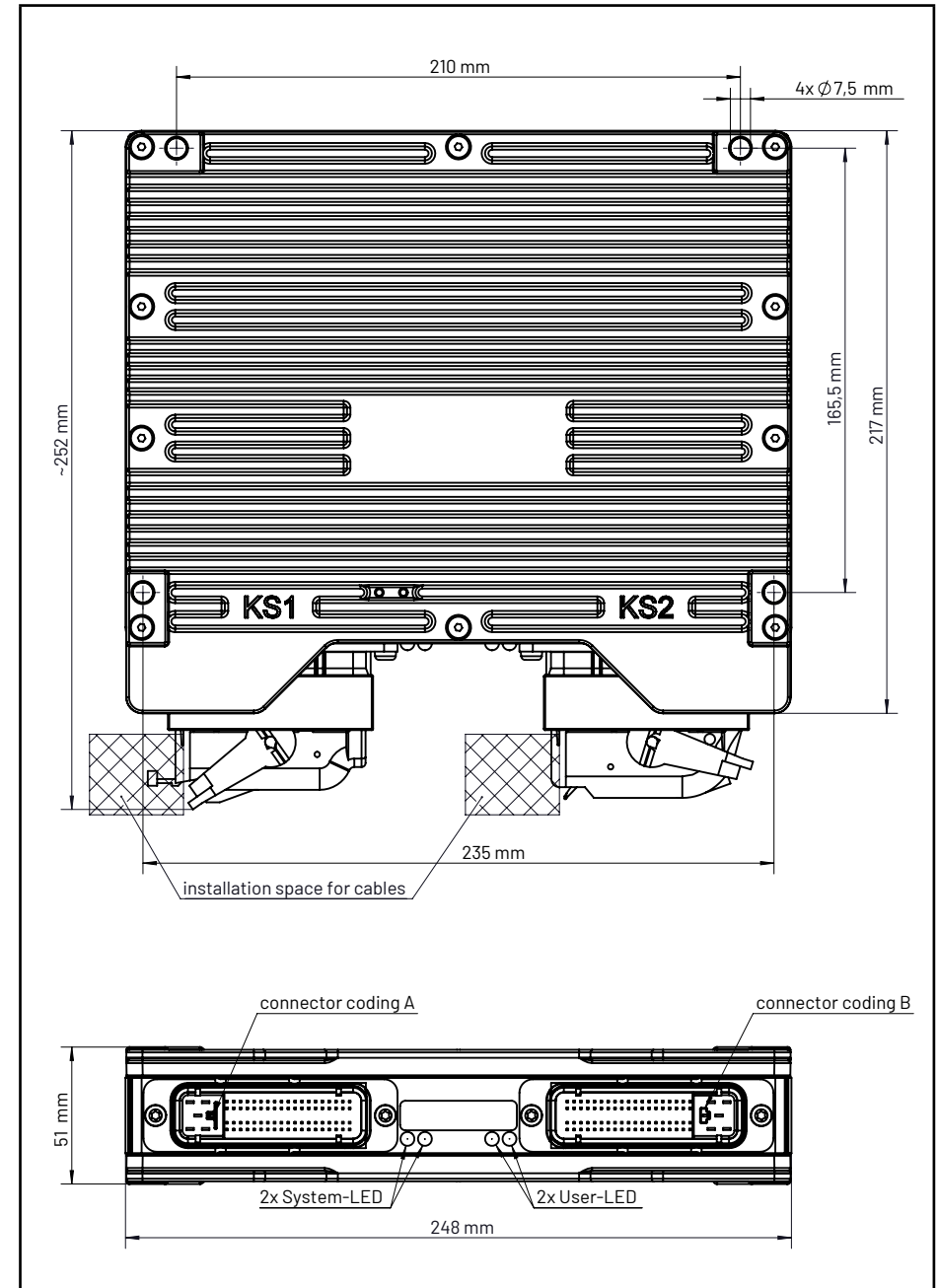
Type	Max. Quantity	Features
Expansion possibilities	6 modules	each serving up to 14 Inputs/Outputs, e.g. for digital or analog I/Os PVG outputs for Danfoss-Valves, inputs for encoders, motor bridges, communication interfaces or customer specific design

TECHNICAL DATA

System Data

Type	Property	Values
Supply Voltage	Direct Current (DC)	8...32 V
Current Consumption	Without external load	< 350 mA at 12 V supply voltage
	Standby (ignition off)	< 200 mA at 24 V supply voltage
Temperature	Chassis Temperature	< 1 mA
		-40 °C ... +85 °C (-40 °F ... +185 °F)
Connector	Automotive Type (Tyco/AMP)	2 x 81 Pins
Indicators	4 LED (dual color)	4 x for system status
	Buzzer	
Housing	Die-cast aluminum	GORE-TEX® Membrane for pressure equalization
Dimensions		248 mm x 217 mm x 51 mm
Weight		Ca. 2.5 kg (5.5 lbs)
Degree of Protection		IP67 and IP69k
Certificates and Compliance	Qualified to the applicable standards for automotive, agricultural and construction industries	
		CE

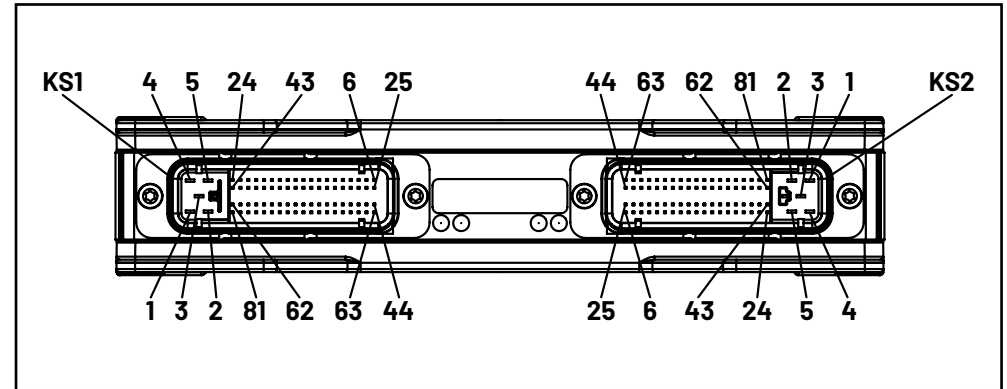
TECHNICAL DRAWING



PIN ASSIGNMENT

Pin assignment 81 pin connector KS1:

Pin	Description	Pin	Description
KS1-1	Expansion slot C - IO pin 14 (e.g. power supply)	KS1-25	Ignition (KL15)
KS1-2	Ground mainboard	KS1-26	CAN bus 1 (low)
KS1-3	Expansion slot A - IO pin 14 (e.g. power supply)	KS1-27	CAN bus 1 (low)
KS1-4	Expansion slot B - IO pin 14 (e.g. power supply)	KS1-28	Multi Function input 15
KS1-5	Power supply pin for outputs 1..8 (High-Side 4 A)	KS1-29	Multi Function input 11
KS1-6	Power supply electronic	KS1-30	Multi Function input 7
KS1-7	CAN bus 1 (high)	KS1-31	Multi Function input 3
KS1-8	CAN bus 1 (high)	KS1-32	High-Side PWM output 1 (4 A)
KS1-9	Multi Function input 14	KS1-33	High-Side PWM output 2 (4 A)
KS1-10	Multi Function input 10	KS1-34	Expansion slot A - IO pin 11
KS1-11	Multi Function input 6	KS1-35	Expansion slot A - IO pin 7
KS1-12	Multi Function input 2	KS1-36	Expansion slot A - IO pin 3
KS1-13	High-Side PWM output 5 (4 A)	KS1-37	Expansion slot B - IO pin 12
KS1-14	High-Side PWM output 6 (4 A)	KS1-38	Expansion slot B - IO pin 8
KS1-15	Expansion slot A - IO pin 10	KS1-39	Expansion slot B - IO pin 4
KS1-16	Expansion slot A - IO pin 6	KS1-40	Expansion slot B - IO pin 13 (e.g. free- wheeling current)
KS1-17	Expansion slot A - IO pin 2	KS1-41	Expansion slot C - IO pin 9
KS1-18	Expansion slot B - IO pin 11	KS1-42	Expansion slot C - IO pin 5
KS1-19	Expansion slot B - IO pin 7	KS1-43	Expansion slot C - IO pin 1
KS1-20	Expansion slot B - IO pin 3	KS1-44	RS232 1 (Tx/D)
KS1-21	Expansion slot C - IO pin 12	KS1-45	CAN bus 2 (high)
KS1-22	Expansion slot C - IO pin 8	KS1-46	CAN bus 2 (high)
KS1-23	Expansion slot C - IO pin 4	KS1-47	Analog ground (related to pin 66, Uext1)
KS1-24	Expansion slot C - IO pin 13 (e.g. free- wheeling current)	KS1-48	Multi Function input 12
		KS1-49	Multi Function input 8
		KS1-50	Multi Function input 4
		KS1-51	High-Side PWM output 3 (4 A)

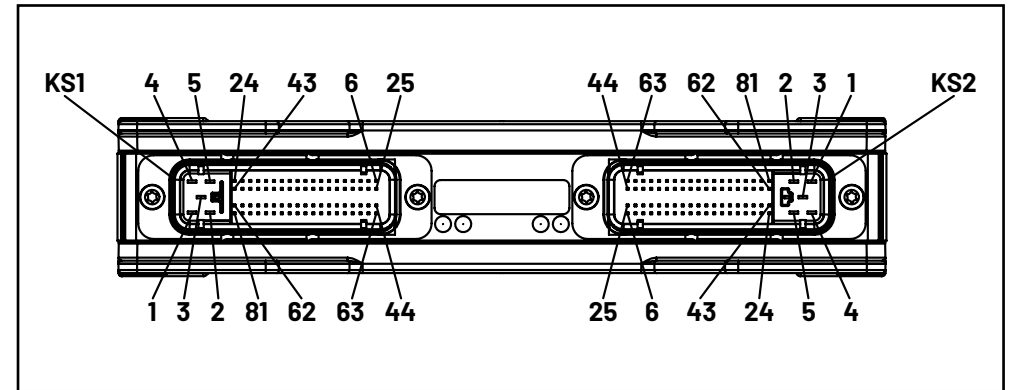


Pin	Description	Pin	Description
KS1-52	High-Side PWM output 4 (4 A)	KS1-68	Multi Function input 9
KS1-53	Expansion slot A - IO pin 12	KS1-69	Multi Function input 5
KS1-54	Expansion slot A - IO pin 8	KS1-70	Multi Function input 1
KS1-55	Expansion slot A - IO pin 4	KS1-71	High-Side PWM output 7 (4 A)
KS1-56	Expansion slot A - IO pin 13 (e.g. free- wheeling current)	KS1-72	High-Side PWM output 8 (4 A)
KS1-57	Expansion slot B - IO pin 9	KS1-73	Expansion slot A - IO pin 9
KS1-58	Expansion slot B - IO pin 5	KS1-74	Expansion slot A - IO pin 5
KS1-59	Expansion slot B - IO pin 1	KS1-75	Expansion slot A - IO pin 1
KS1-60	Expansion slot C - IO pin 10	KS1-76	Expansion slot B - IO pin 10
KS1-61	Expansion slot C - IO pin 6	KS1-77	Expansion slot B - IO pin 6
KS1-62	Expansion slot C - IO pin 2	KS1-78	Expansion slot B - IO pin 2
KS1-63	RS232 1 (Rx/D)	KS1-79	Expansion slot C - IO pin 11
KS1-64	CAN bus 2 (low)	KS1-80	Expansion slot C - IO pin 7
KS1-65	CAN bus 2 (low)	KS1-81	Expansion slot C - IO pin 3
KS1-66	Regulated voltage output 1 (e.g. sensor supply)		
KS1-67	Multi Function input 13		

PIN ASSIGNMENT




Pin assignment 81 pin connector KS2:

Pin	Description	Pin	Description
KS2-1	Expansion slot E - IO pin 14 (e.g. power supply)	KS2-24	Expansion slot F - IO pin
KS2-2	Power supply pin for outputs 17..24 (High-Side 2.5 A)	KS2-25	CAN bus 4 (high)
KS2-3	Expansion slot D - IO pin 14 (e.g. power supply)	KS2-26	Regulated voltage output 3 (e.g. sensor supply)
KS2-4	Expansion slot F - IO pin 14 (e.g. power supply)	KS2-27	Multi Function input 18
KS2-5	Power supply pin for outputs 9..16 (High-Side 2.5 A)	KS2-28	Multi Function input 22
KS2-6	CAN bus 4 (low)	KS2-29	Multi Function input 26
KS2-7	Analog ground (related to pin 26, Uext3)	KS2-30	High-Side PWM output 10 (2.5 A)
KS2-8	Multi Function input 19	KS2-31	High-Side PWM output 14 (2.5 A)
KS2-9	Multi Function input 23	KS2-32	High-Side PWM output 18 (2.5 A)
KS2-10	Multi Function input 27	KS2-33	High-Side PWM output 22 (2.5 A)
KS2-11	High-Side PWM output 11 (2.5 A)	KS2-34	Expansion slot D - IO pin 13 (e.g. free- wheeling current)
KS2-12	High-Side PWM output 15 (2.5 A)	KS2-35	Expansion slot D - IO pin 4
KS2-13	High-Side PWM output 19 (2.5 A)	KS2-36	Expansion slot D - IO pin 8
KS2-14	High-Side PWM output 23 (2.5 A)	KS2-37	Expansion slot D - IO pin 12
KS2-15	High-Side PWM output 24 (2.5 A)	KS2-38	Expansion slot E - IO pin 3
KS2-16	Expansion slot D - IO pin 3	KS2-39	Expansion slot E - IO pin 7
KS2-17	Expansion slot D - IO pin 7	KS2-40	Expansion slot E - IO pin 11
KS2-18	Expansion slot D - IO pin 11	KS2-41	Expansion slot F - IO pin 2
KS2-19	Expansion slot E - IO pin 2	KS2-42	Expansion slot F - IO pin 6
KS2-20	Expansion slot E - IO pin 6	KS2-43	Expansion slot F - IO pin 10
KS2-21	Expansion slot E - IO pin 10	KS2-44	CAN bus 3 (low)
KS2-22	Expansion slot F - IO pin 1	KS2-45	Analog ground (related to pin 64, Uext2)
KS2-23	Expansion slot F - IO pin 5	KS2-46	Multi Function input 17
		KS2-47	Multi Function input 21
		KS2-48	Multi Function input 25
		KS2-49	High-Side PWM output 9 (2.5 A)



Pin	Description	Pin	Description
KS2-50	High-Side PWM output 13 (2.5 A)	KS2-66	Multi Function input 20
KS2-51	High-Side PWM output 17 (2.5 A)	KS2-67	Multi Function input 24
KS2-52	High-Side PWM output 21 (2.5 A)	KS2-68	Multi Function input 28
KS2-53	Expansion slot D - IO pin 1	KS2-69	High-Side PWM output 12 (2.5 A)
KS2-54	Expansion slot D - IO pin 5	KS2-70	High-Side PWM output 16 (2.5 A)
KS2-55	Expansion slot D - IO pin 9	KS2-71	High-Side PWM output 20 (2.5 A)
KS2-56	Expansion slot E - IO pin 13 (e.g. free- wheeling current)	KS2-72	Expansion slot D - IO pin 2
KS2-57	Expansion slot E - IO pin 4	KS2-73	Expansion slot D - IO pin 6
KS2-58	Expansion slot E - IO pin 8	KS2-74	Expansion slot D - IO pin 10
KS2-59	Expansion slot E - IO pin 12	KS2-75	Expansion slot E - IO pin 1
KS2-60	Expansion slot F - IO pin 3	KS2-76	Expansion slot E - IO pin 5
KS2-61	Expansion slot F - IO pin 7	KS2-77	Expansion slot E - IO pin 9
KS2-62	Expansion slot F - IO pin 11	KS2-78	Expansion slot F - IO pin 13 (e.g. free- wheeling current)
KS2-63	CAN bus 3 (high)	KS2-79	Expansion slot F - IO pin 4
KS2-64	Regulated voltage output 2 (e.g. sensor supply)	KS2-80	Expansion slot F - IO pin 8
KS2-65	Multi Function input 16	KS2-81	Expansion slot F - IO pin 12

QUALIFICATION

Norm	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
ISO13766	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

DETAILED QUALIFICATIONS

EMC industrial (CE)

Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (CE mark) EN 61000-6-3:2005 (EN 55011:2003)
 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)

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards: Immunity for industrial environments (CE mark) EN 61000-6-2:2006-03 (former EN 50082-2)

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 QUALIFICATIONS

EMC automotive

Road vehicles, electrical disturbance by conduction and coupling Pulse 1 (24 V): -600 V, 50 W, 5000 pulses Pulse 1 (12 V): -300 V, 5000 pulses Pulse 2a (24 V): +50 V, 2 W, 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 h Pulse 3b (24 V): +200 V, 1 h Pulse 4 (24 V): -16 V, 2 pulses Pulse 4 (12 V): -7 V, 2 pulses Pulse 5a: +70V, 100ms, 2 W, 2 pulses	ISO 7637-2:2004-09, DIN 40839-1:1992-10
Road vehicles, electrical disturbance by conduction and coupling (data, signal), test level 4 Pulse a: -80 V, 1h Pulse b: +80 V, 1h	ISO 7637-3:1995, DIN 40839-1:1992-10
Electrostatic Discharge (automotive) test level 4 2 kW / 150 pF, 2 kW / 330 pF, Contact: +/- 8 kV, Air: +/- 15 kV Packaging and handling: Contact: +/-8 kV, Air: +/- 15 kV	ISO 10605:2001-12
Limits and methods of measurement of radio disturbance; characteristics for the protection of receivers used on board vehicles 0.15 MHz to 108 MHz	IEC/CISPR 25:2002, EN 55025:2003-11, DIN VDE 0879-2:1999-03
Earth-moving machinery - Electromagnetic compatibility	ISO 13766:2006-05
Construction machinery - Electromagnetic compatibility of machines with internal electrical power supply	DIN EN 13309:2000-11
Agricultural and forestry machines - Electromagnetic compatibility - Test methods and acceptance criteria	DIN EN ISO 14982:14982

Electrical tests

Safety of machinery - electr. equipment of machines	EN 60204-1:2008-01
Superimposed alternating voltage	ISO 16750-2:2006
Slow decrease and increase of supply voltage	
Momentary drop in supply voltage	
Reset behavior at voltage drop	
Starting profile	
Overvoltage	ISO 16750-2
Reversed voltage case 2	ISO 16750-2
Ground reference and supply offset	ISO 16750-2
Open circuit test - Single line interruption	ISO 16750-2
Open circuit test - Multiple line interruption	ISO 16750-2
Short circuits - signal lines	ISO 16750-2
Short circuits - load lines	ISO 16750-2

DETAILED QUALIFICATIONS

Climatic and mechanical tests

IP Protection classes IP67, IP69K	EN 60529:2000-09, DIN 40050-9:1993-05
Cold (storage and operational)	ISO 16750-4:2006 (IEC 60068-2-1:1995-03)
Dry heat (storage and operational)	ISO 16750-4:2006 (IEC 60068-2-2/A2 1995-01)
Damp heat constant	ISO 16750-4:2006 (IEC 60068-2-78:2002-09)
Change of temperature Na	ISO 16750-4:2006 (IEC 60068-2-14:2000-08)
Road vehicles - Environmental conditions and testing for electrical and electronic equipment: Mechanical loads - Random vibration - Test VII	ISO 16750-3:2007-08
Change of temperature Nb	ISO 16750-4:2006 (IEC 60068-2-14:2000-08)
Shock	ISO 16750-3:2006 (IEC 60068-2-27:1995-03)
Bump	IEC 60068-2-29:1995-03
Damp heat cyclic	ISO 16750-4:2006 (IEC 60068-2-38-Z/AD:2000-02)
Free fall	ISO 16750-3:2006
Paints and varnishes - Determination of resistance to humidity	EN ISO 6270-2:2007-10
Sodium chloride	ISO 16750-4:2006 (IEC 60068-2-52:2000-02)
Road vehicles - Environmental conditions and testing for electrical and electronic equipment: Chemical loads	ISO 16750-5:2003-12

Climatic and mechanical tests

Flowing mixed gas corrosion test	ISO 16750-4:2006 (IEC 60068-2-60:1995-12)
Temperature step test	ISO 16750-4
Solarradiation	DIN EN 60068-2-5