

# 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
- 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

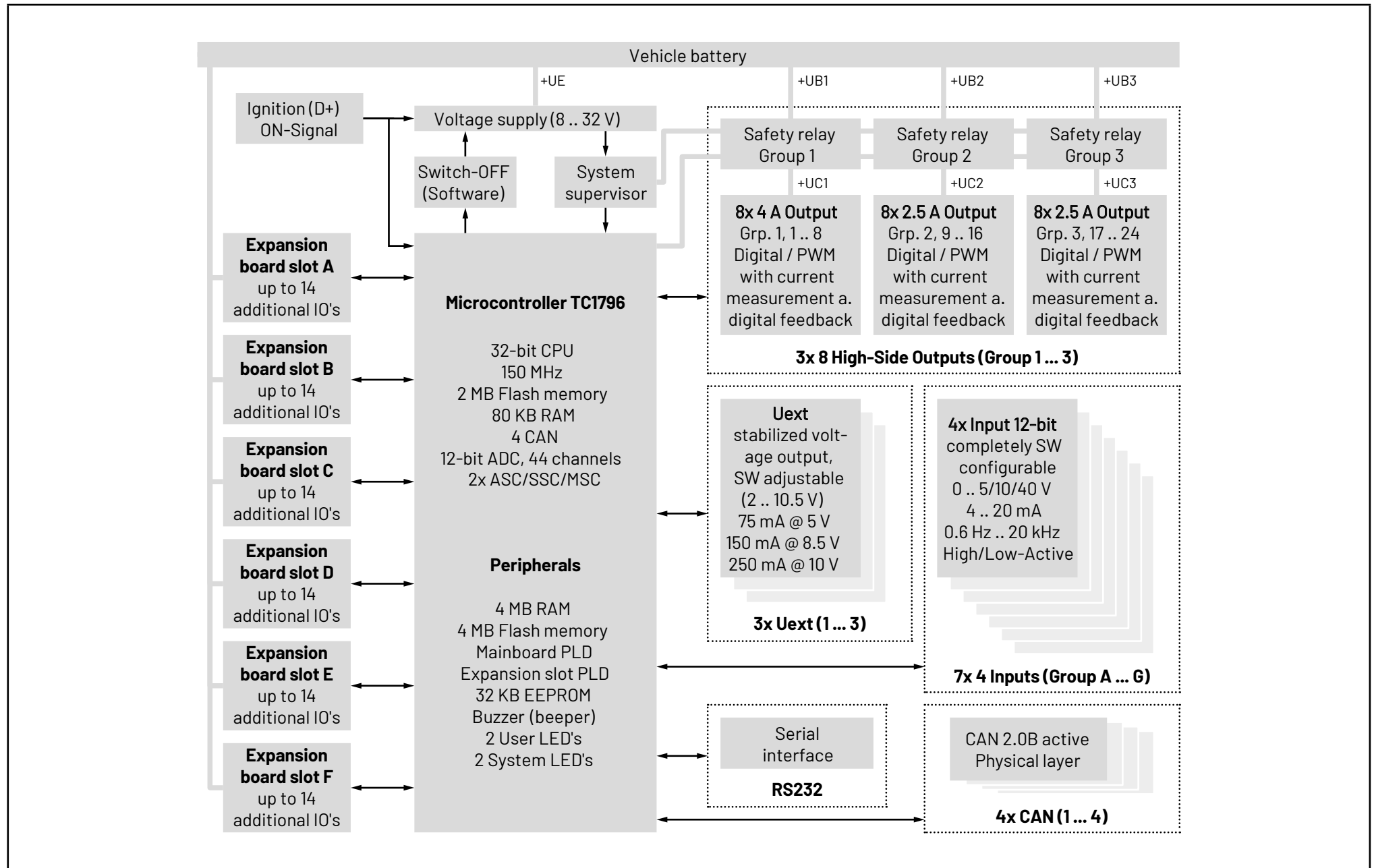
- Debug Adapter
- Debugger
- ESX-Test-Box Adapter
- Component Deployment for C, CODESYS V3.5
- Mating plug

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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

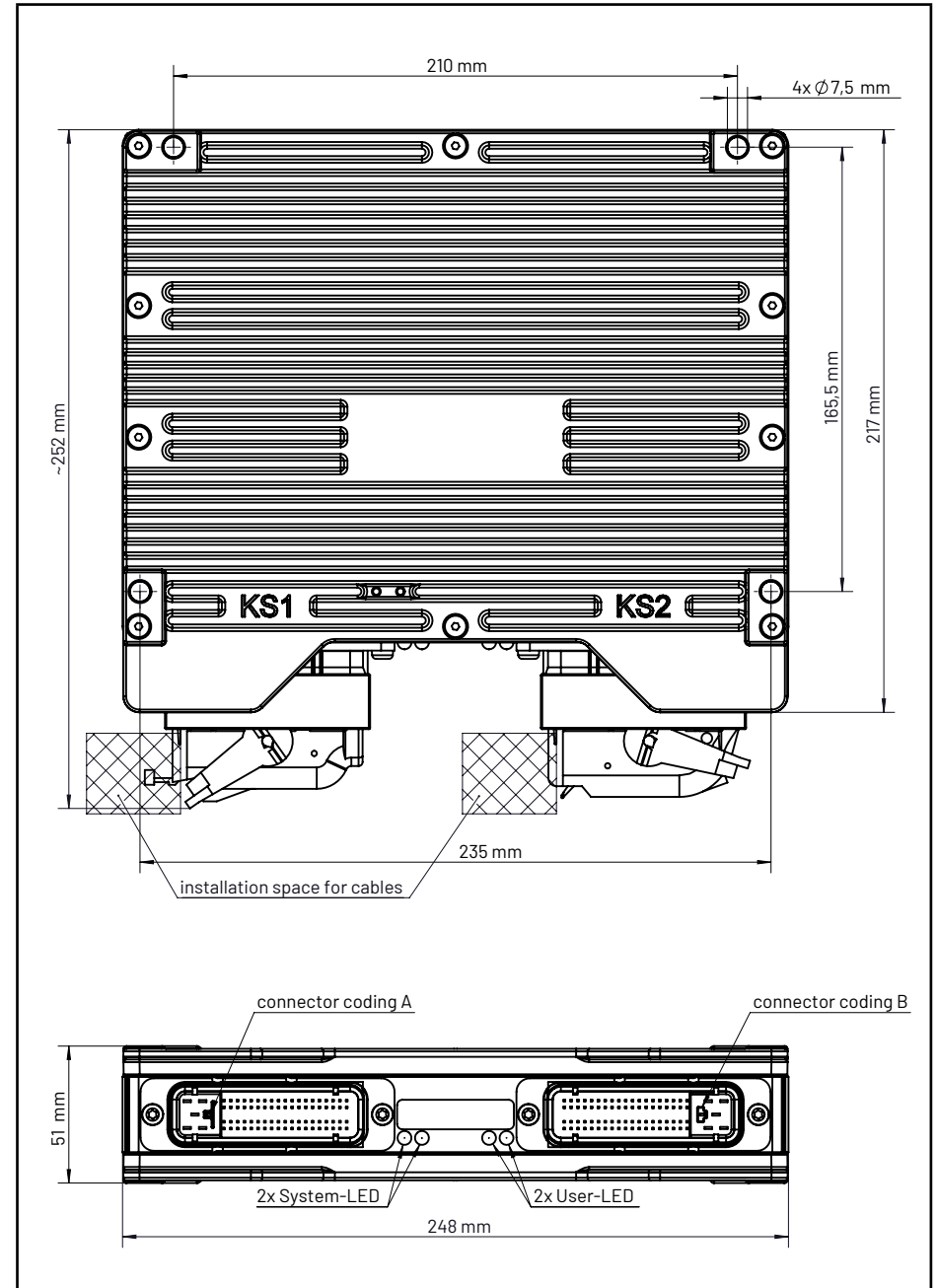
Type	Max. Quantity	Features
Expansion possibilities	6 modules	each serving up to 14 Inputs/Outputs, e.g. for digital or analog I/Os PVG outputs for Danfoss-Valves, inputs for encoders, motor bridges, communication interfaces or customer specific design

# 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 < 200 mA at 24 V supply voltage
	Standby (ignition off)	< 1 mA
Temperature	Chassis Temperature	-40 °C ... +85 °C (-40 °F ... +185 °F)
Connector	Automotive Type (Tyco/AMP)	2x 81 Pins
Indicators	4 LED (dual color) Buzzer	2x for system status and 2x freely programmable
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

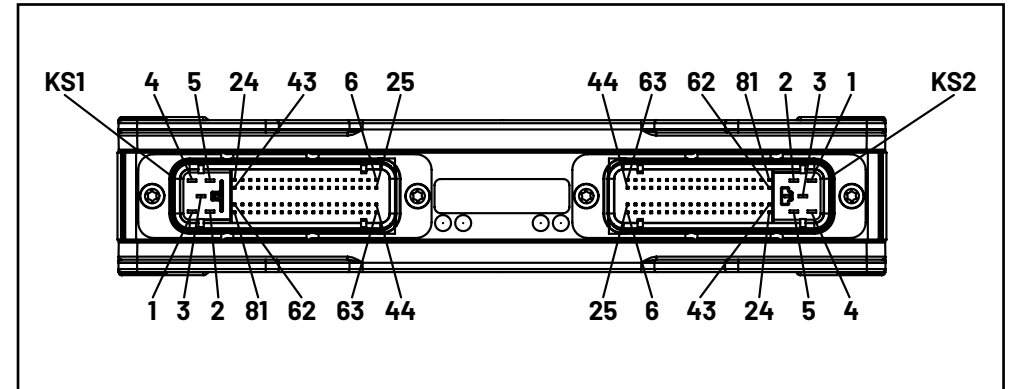
# TECHNICAL DRAWING



# 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 (TxD)
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)

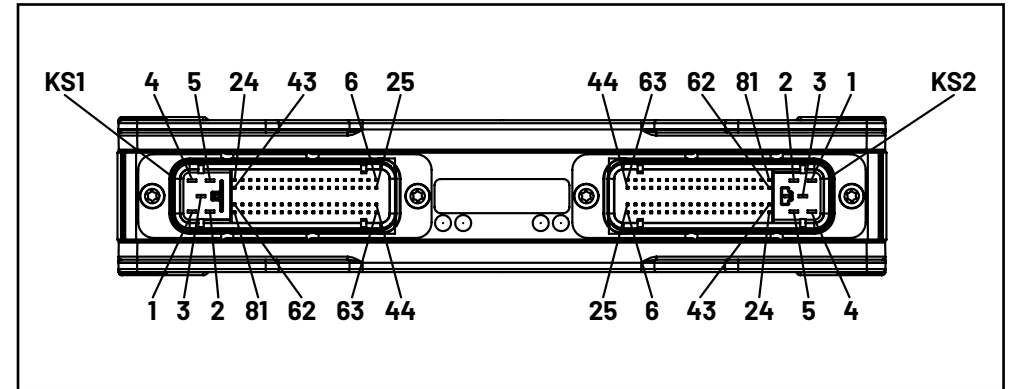


Pin	Description	Pin	Description
KS1-52	High-Side PWM output 4 (4 A)	KS1-68	Multi Function input 9
KS1-53	Expansion slot A - IO pin 12	KS1-69	Multi Function input 5
KS1-54	Expansion slot A - IO pin 8	KS1-70	Multi Function input 1
KS1-55	Expansion slot A - IO pin 4	KS1-71	High-Side PWM output 7 (4 A)
KS1-56	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 (RxD)	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