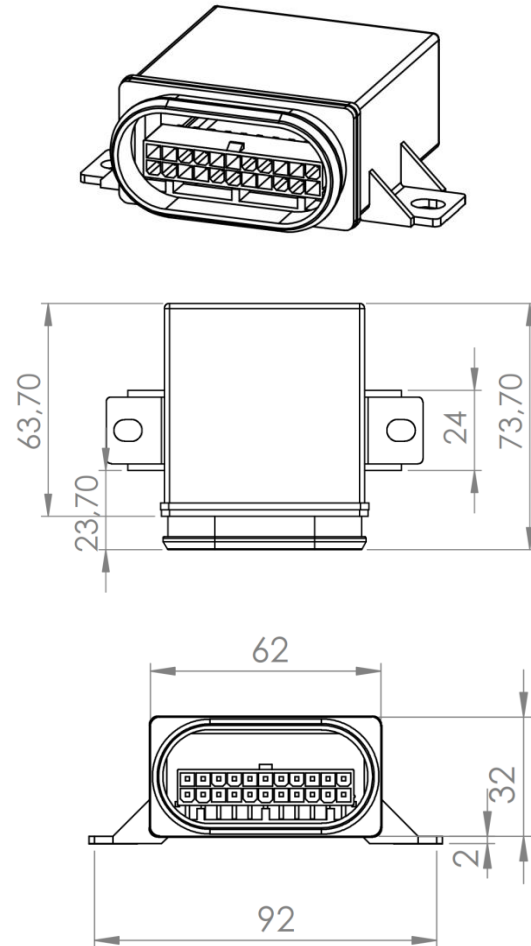




**TECHNICAL DATA**

Housing	Plastic
Connector	22-pin Molex Mini Fit Junior
Housing Dimensions	60 x 60 x 30 mm (without mounting tab)
Weight	75 g
Temperature Range (according to ISO 16750-4)	-40 to +85 °C (at +85 °C rated power see page 4)
Environmental Protection	IP53
Voltage Range	9–32 V
Nominal Voltage	12 V Code B/ 24 V Code E
Current Consumption	30 mA
Over-Current Protection	20 A
Total Inputs and Outputs	14 (6 inputs, 8 I/O's)
Inputs	<p><u>Configurable as:</u>                      Digital, positive encoder signal                      analog (0...11.4 / 33.68 V)  <u>Depending on assembly:</u>                      Digital, low side switch encoder                      signal frequency input analog input(0...24.5 mA, PT1000 sensor)</p>
Outputs	<p><u>Configurable as:</u>                      Digital, positive switching (high side)  <u>Depending on assembly:</u>                      PWM output (3 Hz...500 Hz)                      reference voltage source (5 V)</p>
Operating Voltage	9–32 V 12 V (Code C) and 24 V (Code E) ISO 16750–2 compliant
Starting Voltage	6 V
Overvoltage Protection	≥ 33 V
Undervoltage Cut-Off	5.8 V
Quiescent Current	300 µA (at 24 V); 190 µA (at 12 V)
Reverse Polarity Protection	Yes
CAN Interfaces	CAN-bus interface 2.0 A/B, ISO 11898 compliant

**TECHNICAL DRAWING (IN MM)**



**SOFTWARE/PROGRAMMING**

Programming System	MRS Developers Studio with built-in functions library, similar programming with FUP. Custom software blocks can be integrated into “C-code”. Program memory is sufficient for about 300 basic logic components.
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**REGULATORY APPROVALS AND TESTING**

CE conformity	Compliant
E1 Label	UN/ECE-R10 R3
E1 Approval	03 5385
Electrical Tests	According to ISO 16750 - 2: Short circuit protection Reverse polarity protection According to ISO 7637 - 2: Pulse 1, 2a, 2b, 3a, 3b



**INPUT FEATURES - SUMMARY**

<b>Pin 3, 4, 5, 6, 7</b>	Usable as analog or digital input		Frequency Input (see <a href="#">D</a> )	Input resistance	22.6 kΩ
	Resolution	12-bit		Input frequency	± 3% accuracy at ≤ 2.2 kHz
	Accuracy	± 1 % full scale		Turn-on threshold	7 V
Voltage Input 0...11.4 V (see <a href="#">A</a> )	Input resistance	22.6 kΩ	Digital Input Positive (see <a href="#">B</a> )	Input resistance	66.6 kΩ
	Input frequency	f <sub>c</sub> *= 60 Hz		Input frequency	f <sub>c</sub> *= 40 Hz
	Accuracy	± 3 %		Turn-on threshold	19 V
Current Input 0...24.5 mA (see <a href="#">C</a> )	Input resistance	470 Ω		Turn-off threshold	14 V
	Input frequency	40 Hz			
	Conversion factor	1 mA ≅ 475 digits			
Frequency Input (see <a href="#">D</a> )	Input resistance	22.6 kΩ	<b>Pin 13,14,15,16, 18,19</b>	Usable as analog or digital input	
	Input frequency	± 3% accuracy at ≤ 2.2 kHz		Resolution	12 Bit
	Turn-on threshold	7 V		Accuracy	± 1 % full scale
	Turn-off threshold	4.5 V	Voltage Input 0...11.4 V (see <a href="#">E</a> )	Input resistance	22.6 kΩ
Digital Input Positive (see <a href="#">A</a> )	Input resistance	22.6 kΩ		Input frequency	f <sub>c</sub> *= 60 Hz
	Input frequency	f <sub>c</sub> *= 60 Hz		Accuracy	± 5 %
	Turn-on threshold	7 V	Digital Input Positive (see <a href="#">E</a> )	Input resistance	22.6 kΩ
	Turn-off threshold	4.5 V		Input frequency	f <sub>c</sub> *= 60 Hz
				Turn-on threshold	7 V
				Turn-off threshold	4.5 V
<b>Pin 2</b>	Usable as analog or digital input		<b>Pin 20,21</b>	Usable as digital input	
	Resolution	12 Bit		Resolution	12 Bit
	Accuracy	± 1 % full scale		Accuracy	± 1 % full scale
Voltage Input 0...33.68 V (see <a href="#">B</a> )	Input resistance	66.6 kΩ	Digital Input Positive (see <a href="#">E</a> )	Input resistance	22.6 kΩ
	Input frequency	f <sub>c</sub> *= 40 Hz		Input frequency	f <sub>c</sub> *= 60 Hz
	Accuracy	± 3 %		Turn-on threshold	7 V
Current Input 0...24.5 mA (see <a href="#">C</a> )	Input resistance	470 Ω		Turn-off threshold	4.5 V
	Input frequency	f <sub>c</sub> *= 40 Hz			
	Conversion factor	1 mA ≅ 475 digits			

\* f<sub>c</sub>= cutoff frequency (-3 dB)

**OUTPUT FEATURES - SUMMARY**

<b>Pin 13, 14</b>	Protective circuit for inductive loads	Optional integrated	<b>Pin 15, 16, 18, 19, 20, 21</b>	Protective circuit for inductive loads	Optional integrated
	Wire fault diagnostics	Possible via current sense		Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense		Short circuit diagnostics	Possible via current sense
Digital, Positive Switching (high side, see <a href="#">E</a> )	Switching voltage	9-32 V DC	Digital, Positive Switching (high side, see <a href="#">E</a> )	Switching voltage	9-30 V DC
	Switching current	0.02-2.5 A		Switching current	0.02-2.5 A
				Conversion factor current sense	1 Digit ≅ 2.26 mA
Short Circuit Resistance Against GND and V <sub>B</sub>	The switching-off is controlled by high-side driver (separate for each channel)		PWM-Output (see <a href="#">F</a> )	Output frequency	500 Hz
				Duty cycle	0...1000 %
				Resolution	1 ‰
				Switching current	≤ 2.5 A (see page 4)
			Short Circuit Protection Against Ground and V <sub>B</sub>	Switching-off is controlled via high side driver (separate for each channel)	



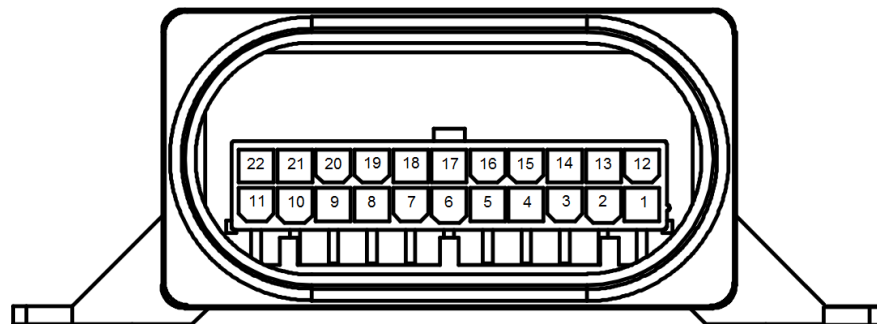
**PIN ASSIGNMENT POWER SUPPLY AND INTERFACES**

Pin	Description	Pin	Description
1	Ground/contact 31 according to DIN 72552	9	CAN-bus high
8	Battery/ignition contact 15 according to DIN 72552	10	CAN-bus low
12	Supply voltage for output pins 13 through 16, operating voltage for CPU	11	RS 485 - A/RS232 Tx/ground (assembly option, otherwise not connected)
17	Supply voltage for output pins 18 through 21, operating voltage for CPU	22	RS-485 - B/RS232 Rx/5 VREF (assembly option, otherwise not connected)

**PIN ASSIGNMENT IN- AND OUTPUTS**

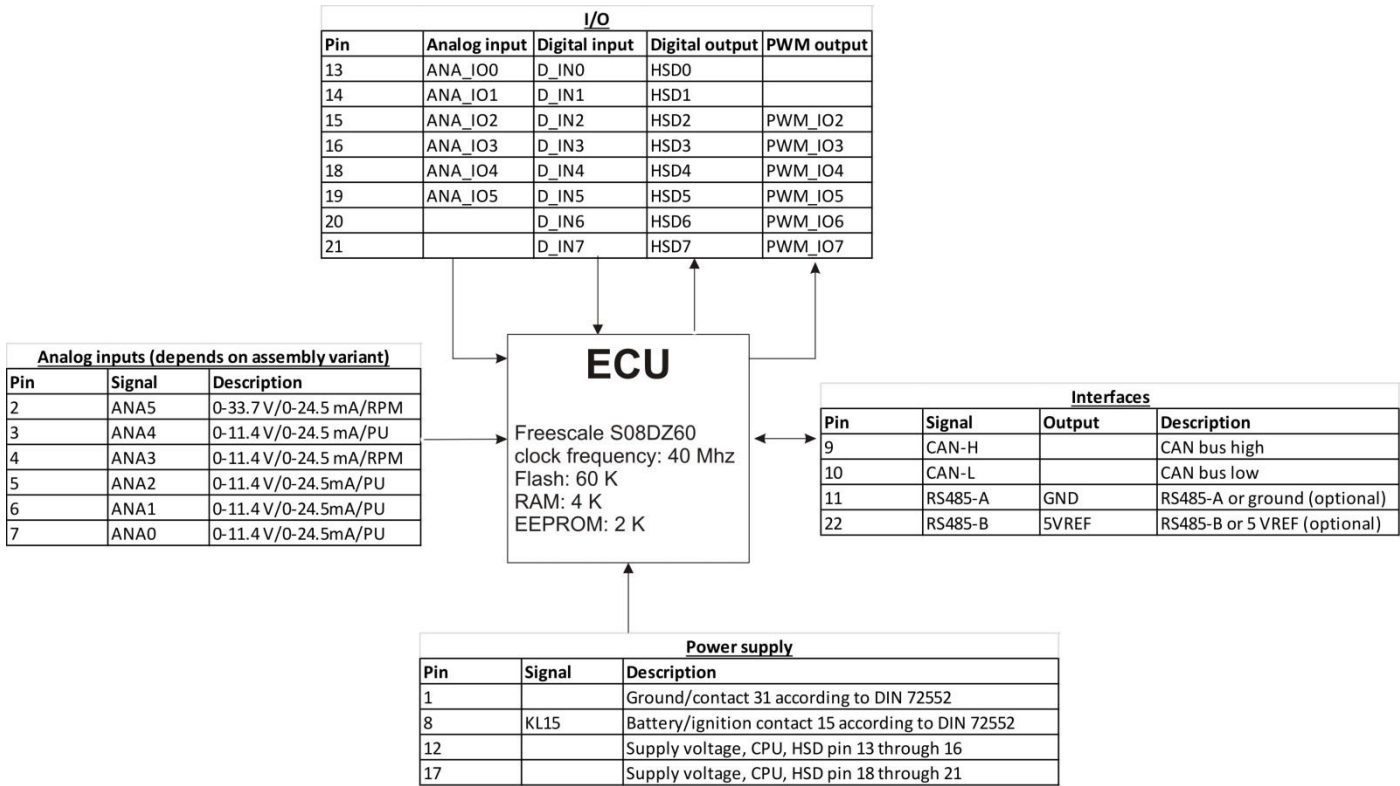
The alternative functions like frequency/current/pull-up or PT1000-inputs depends on the assembly variants (see table on page 5).

Pin	Signal	Description	Pin	Signal	Description
2	ANA5 D_ANA5	Analog input 5; 0-33.68 V Can also be used as digital input	15	ANA_IO2 / D_IN2 OUT_HSD2	Analog/digital input IO2; 0-11.4 V Or digital output DO2 with PWM capability
3	ANA4 D_ANA4	Analog input 4; 0-11.4 V Can also be used as digital input	16	ANA_IO3 / D_IN3 OUT_HSD3	Analog/digital input IO3; 0-11.4 V Or digital output DO3 with PWM capability
4	ANA3 D_ANA3	Analog input 3; 0-11.4 V Can also be used as digital input	18	ANA_IO4 / D_IN4 OUT_HSD4	Analog/digital input IO4; 0-11.4 V Or digital output DO4 with PWM capability
5	ANA2 D_ANA2	Analog input 2; 0-11.4 V Can also be used as digital input	19	ANA_IO5 / D_IN5 OUT_HSD5	Analog/digital input IO5; 0-11.4 V Or digital output DO5 with PWM capability
6	ANA1 D_ANA1	Analog input 1; 0-11.4 V Can also be used as digital input	20	D_IN6 OUT_HSD6	Digital input IO6; 0-11.4 V Or digital output DO6 with PWM capability
7	ANA0 D_ANA0	Analog input 0; 0-11.4 V Can also be used as digital input	21	D_IN7 OUT_HSD7	Digital input IO7; 0-11.4 V Or digital output DO7 with PWM capability
13	ANA_IO0 / D_IN0 OUT_HSD0	Analog/digital input IO0 Or digital output DO0			
14	ANA_IO1 / D_IN1 OUT_HSD1	Analog/digital input IO1; 0-11.4 V Or digital output DO1			





PIN FEATURE MAP



PERFORMANCE TESTS HIGH-SIDE DRIVER VNQ5050AK

**Test without PWM**

Endurance tests at +85 °C for digital outputs (max. 2 channels per high side driver)

Test No. 1	4 outputs with 2.5 A per channel
Test No. 2	3 outputs with 2.5 A 1 output with 3.5 A
Test No. 3	2 outputs with 2.5 A per channel 2 outputs with 3.5 A per channel
Test No. 4	3 outputs with 3.5 A per channel 1 output with 2.5 A

**Test with PWM**

Endurance tests at +85 °C for PWM outputs with f=200 Hz (max. 2 channels per high side driver)

Test No. 1	4 outputs with 2.5 A per channel
Test No. 2	3 outputs with 3.5 A per channel 1 output with 3.5 A
Test No. 3	2 outputs with 2.5 A per channel 2 outputs with 3.5 A per channel

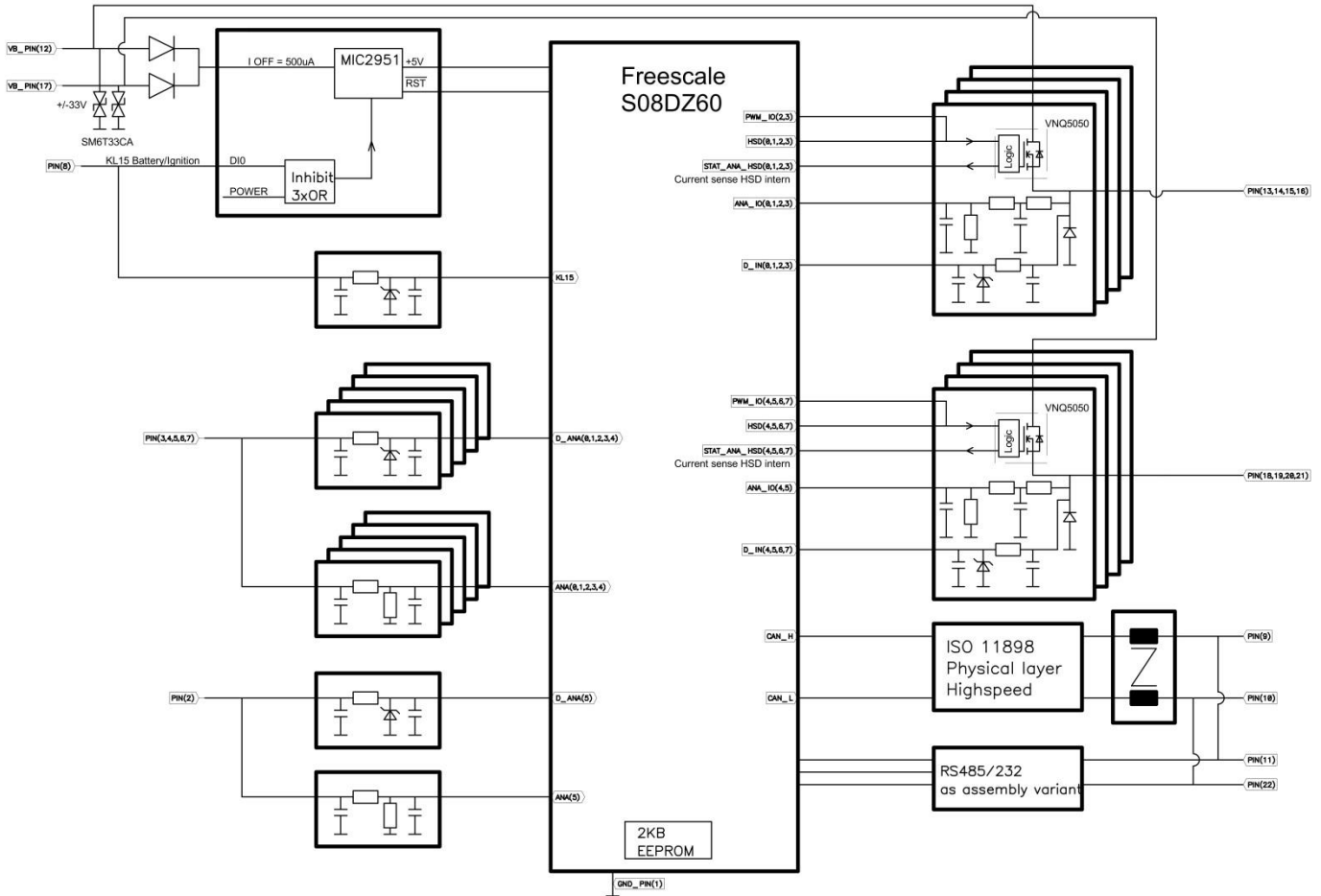


ASSEMBLY VARIANTS AND ORDERING INFORMATION

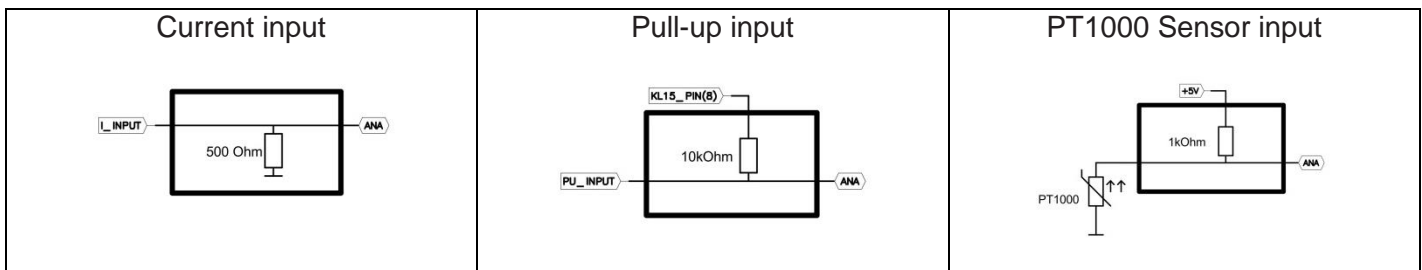
	INPUT PINS						OUTPUTS PINS		CAN BUS		INTERFACE		DC/DC
	A Voltage 0 – 11.4 V	B Voltage 0 - 33 V	C Current 0 - 24 mA	D Frequency Hz	Sensor inputs 10 kΩ pull-up PT1000 Sensor 1 kΩ pull-up		E I/O's (can be used as analog or digital inputs or as digital outputs)	F PWM ≤ 500 Hz	High Speed	Low Speed	RS485	RS232	5 Volt Reference
1.033.300.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21		X				
1.033.302.00	3,5,6,7			2,4			13,14,15,16,18,19,20,21		X				
1.033.303.00	3,4	2	5,6,7				13,14,15,16,18,19,20,21		X				
1.033.304.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				
1.033.305.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				22/11
1.033.306.00	3,4	2	5,6,7				13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				
1.033.308.00			2,3,4,5,6,7				13,14,15,16,18,19,20,21		X				
1.033.309.00	3,5,6,7			2,4			13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				
1.033.30B.00	3,4	2			5,6,7		13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				22/11
1.033.30D.00	3,4	2				5,6,7	13,14,15,16,18,19,20,21		X				
1.033.30E.00	3,5,6,7			2,4 (4.5 V both)			13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				
1.033.30K.00	3,5,6,7			2,4			13,14,15,16,18,19,20,21	15,16,18,19,20,21	X				22/11
1.033.30L.00	4,5 (5: 0-5 V only)	2,3				6,7	13,14,15,16,18,19,20,21		X				
1.033.30N.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21		X				22/11 (3 V only)
1.033.310.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21			X			
1.033.320.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21		X		X		
1.033.330.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21		X			X	
1.033.33J.00		2				3,4,5,6,7	13,14,15,16,18,19,20,21		X			X	
1.033P.300.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21		X + CANOpen				
1.033P.305.00	3,4,5,6,7	2					13,14,15,16,18,19,20,21	15,16,18,19,20,21	X + CANOpen				22/11



BLOCK FUNCTION DIAGRAM



BLOCK FUNCTION DIAGRAM ASSEMBLY VARIANTS





ACCESSORIES

Description	Order Number
Programming Tool MRS Developer Studio	1.100.100.09
Cable Set CAN I/O	106817
Connector Package CAN I/O	106940
Rubber Boot for Cable Set	102892
PCAN-USB Interface	105358

Contact Information

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2149 Winners Circle  
Dayton, OH 45404  
Email: [info@mrs-electronic.com](mailto:info@mrs-electronic.com)  
Phone: +1 937.259.4300  
Visit @ [www.mrs-electronic.com](http://www.mrs-electronic.com)





### GENERAL PROVISIONS

- Safe operation of series production equipment may not be guaranteed if samples or prototypes are used.
- Wiring examples provided by MRS Electronic, Inc.® do not imply any endorsement, responsibility, or liability for the overall system performance.
- Incorrect wiring may result in unexpected or inconsistent signals at the outputs of the control device.
- Potential hazards during operation of equipment cannot be excluded when using incorrect software programs or parameter settings in the control device.
- To avoid a loss of manufacturer's warranty, installation, modification, or exchange of product firmware or software has to be performed by MRS Electronic, Inc.® personnel or a qualified professional contractor.
- It is prohibited to open, modify or repair the control device. Modifications or repairs may result in hazardous malfunctions of the device.  
**Maintenance and repair should be performed by MRS Electronic, Inc.® personnel only.**
- It is not permitted to apply voltage to device terminals other than the power terminals if the power supply of the control device is shut down or disconnected. If the power supply is shut down, it is important that power to the control device, power amplifiers, and external sensors is shut down simultaneously.
- In case of failure or malfunction of the control device, please ensure that this condition of the device does not result in a hazardous malfunction of the overall system. Such unintended system behavior may lead to personnel injuries or serious property damage.
- System design, installation, and commissioning of electrical systems must only be performed by a qualified professional who is familiar with the components used and the overall system.
- Unforeseeable hazards may be caused by the machinery during commissioning and maintenance of the control device. To prevent such events, please ensure that the machinery is always in a safe state.
- Faulty components or components with malfunction must not be used. If components fail or show signs of malfunction, they have to be replaced or repaired immediately.
- Control devices that are used for software development and have been flashed more than 500 times with software updates must not be used in commercial machinery.

### INSTALLATION RECOMMENDATIONS

- Do not install the control device close to components which emit considerable amounts of heat.
- Ensure that water cannot get inside the control device by properly sealing all cables and wires.
- Always install the control device with the connector(s) pointing downwards allowing for condensation water to drain off.

### WIRING AND CABLE ROUTING RECOMMENDATIONS

- Electrical and power terminals of the control device have to be sourced by the same electric circuit.
  - Connect the product only when wires/cables are de-energized.
  - Mechanically secure the cable harness in close range of the installation location of the control device. Fix and adjust the cable harness for in-phase mechanical motion with the control device.
  - It is not allowed to bridge PWM outputs together.
  - Power levels of the sensor inputs may be amplified as a result of external wiring because they are designed as power supply and not as power sink. Amplified power levels may lead to unforeseeable malfunction and in case of permanent operation to damage of the control device.
  - The high-side outputs cannot be connected externally with battery.
- Special information for proportional magnets and solenoid switches or other switched inductive loads:
- The electronic circuitry must only be validated with the proportional valve connected.

### INTENDED USE

- If there are no restrictions for specific applications in this datasheet, the control device is designed for applications in mobile working machines.
- Use the control device only within the technical limits stated in this datasheet, especially with respect to voltages, currents, temperature, vibration, shock or any other specified environmental conditions.

### NOT INTENDED USE

- If the control unit is used in any other way than described in the paragraph "INTENDED USE", it is not an intended use.
- Any use or application of the control device in explosive environments is prohibited.
- The manufacturer's warranty is void for any damages resulting from unintended use and/or arbitrary modifications which are not expressly indicated in this datasheet.



