



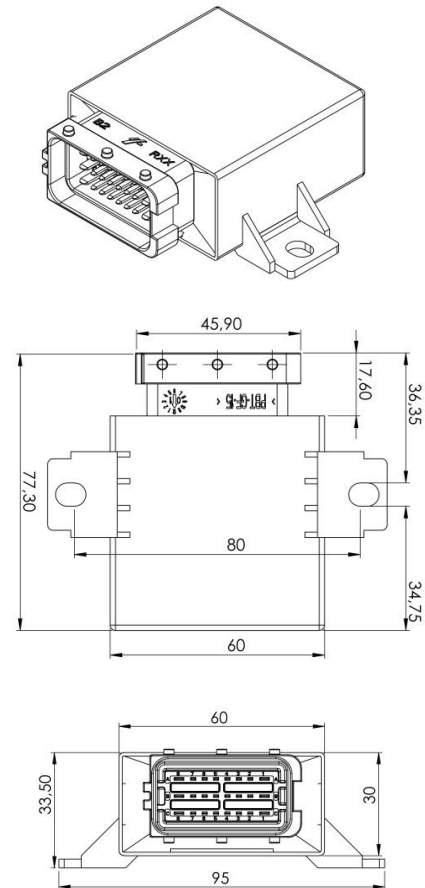
TECHNICAL DATA

Housing	Moulded plastic, sealed
Connector	Sicma 211 PL249S0005
Housing Dimensions	60 x 60 x 30 mm (without tabs and connector) 95 x 77.3 x 33.5 mm (incl. tabs and connector)
Weight	167 g
Temperature Range (ISO 16750-4 compliant)	-40 to +85 °C (at +85 °C rated power see page 4)
Environmental Protection	IP68
Current Consumption	30 mA
Over-Current Protection	20 A
Total Inputs and Outputs	16 (6 analog inputs, 2 digital inputs, 8 I/O's)
Inputs	<u>Configurable as:</u> Digital, positive encoder signal Analog input (0...11.4 V) Digital, low side switch encoder signal Analog input (0...24.5 mA, 10 kΩ Pull-up)
Outputs	<u>Configurable as:</u> Digital output, positive switching (high side) PWM output (3 Hz...500 Hz)
Operating Voltage	9–32 V 12 V (Code C) and 24 V (Code E) ISO 16750–2 compliant
Starting Voltage	8 V
Oversvoltage Protection	≥ 33 V
Undervoltage Cut-Off	8 V
Quiescent Current	138 µA (at 24 V); 875 µA (at 12 V)
Reverse Polarity Protection	Yes
CAN Interfaces	CAN-bus interface 2.0 A/B, ISO 11898-2 compliant
Baud Rate	60 kbps... 1000 kbps default: 125 kbps

SOFTWARE/PROGRAMMING

Programming System	MRS Developers Studio
	MRS Developers Studio with built-in functions library, similar to programming with FUP. Custom software blocks can be integrated into "C-code". Program memory is sufficient for about 300 basic logic components.

TECHNICAL DRAWING (IN MM)



REGULATORY APPROVALS AND TESTING

CE conformity	compliant
E1 Label	UN/ECE-R10 04
E1 Approval	05 7992
Electrical Tests	According to ISO 16750 – 2/ 16750-4: Short circuit protection Reversed voltage Pin/connector interruption Oversvoltage at +65 °C Operation/storage test at +85 °C Operation/storage test at -40 °C Superimposed alternating voltage Slow decrease and increase of supply voltage Momentary drop in supply voltage Reset behavior at voltage drop Tests According to ISO 7637 - 2: Pulse 1, 2a, 2b, 3a, 3b



INPUT FEATURES - SUMMARY

Pin A3, A4, A5, A6, B6, C4	Analog inputs Resolution	12-bit	Pin B1, B8, C1, C2, C3, C8	I/Os Resolution	12-bit
Voltage Input 0...11.4 V (see A)	Input resistance Input frequency Accuracy	22.6 kΩ f _c *=70 Hz ± 3 %	Voltage input 0...11.3 V (see E)	Input resistance Input frequency Accuracy	15 kΩ f _c *=70 Hz ± 3 %
Current Input 0...24.5 mA (see B)	Input resistance Input frequency Conversion factor	500 Ω 45 Hz 1 mA ≅ 482 ± 2 digits	Pin C6, C7	I/Os Resolution Accuracy	12 Bit ± 1 % full scale
Pull-up Input (see C)	Pull-up resistance	10 kΩ	Voltage input 0...11.4 V (see E)	Input resistance Input frequency	15 kΩ f _c *=70 Hz
Pin B3, B5	Digital input Resolution	12-bit			
Digital Input Positive (see D)	Turn-on threshold Turn-off threshold	6.6 V 4.7 V			

* f_c= cutoff frequency (-3 dB)

OUTPUT FEATURES - SUMMARY

Pin C6, C7	Protective circuit for inductive loads Wire fault diagnostics Short circuit diagnostics	Optional integrated Possible via current sense Possible via current sense	Pin B1, B8, C1, C2, C3, C8	Protective circuit for inductive loads Wire fault diagnostics Short circuit diagnostics	Optional integrated Possible via current sense Possible via current sense
Digital, Positive Switching (high side, see E)	Switching voltage Switching current	9-32 V DC 0.02-2.5 A	Digital, Positive Switching (high side, see E)	Switching voltage Switching current Conversion factor current sense pins B1, C1, C2, C3 Conversion factor current sense pins B8, C6, C7, C8	9-32 V DC 0.02-2.5 A 1 Digit ≅ 2.2± 0,1 mA 1 Digit ≅ 1.2± 0,1 mA
Short Circuit Resistance Against GND and V _B	The switching-off is controlled by high-side driver (separate for each channel)		PWM-Output (see F)	Output frequency Duty cycle Resolution Switching current	500 Hz 0...1000 ‰ 1 ‰ ≤ 2.5 A (see page 4)
	Short Circuit Protection Against Ground and V _B		Short Circuit Protection Against Ground and V _B	Switching-off is controlled via high side driver (separate for each channel)	



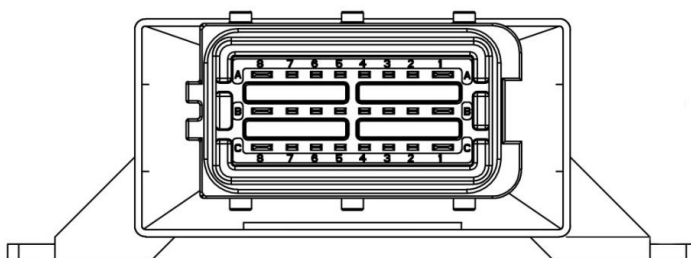
PIN ASSIGNMENT POWER SUPPLY AND INTERFACES

Pin	Description	Pin	Description
A1	Supply voltage for output pins B1, C1, C2, C3 operating voltage for CPU	B2	RS-485 - B / RS-232 Rx interface (assembly option see page 5)
A2	RS-485 - A / RS-232 Tx interface (assembly option see page 5)	B4	CAN-bus high
A7	5 V VREF	B5	Battery/ignition contact 15 according to DIN 72552, optional as DI (see page 5)
A8	Supply voltage for output pins B8, C6, C7, C8, operating voltage for CPU	B7	Ground/contact 31 according to DIN 72552
		C3	CAN-bus low

PIN ASSIGNMENT IN- AND OUTPUTS

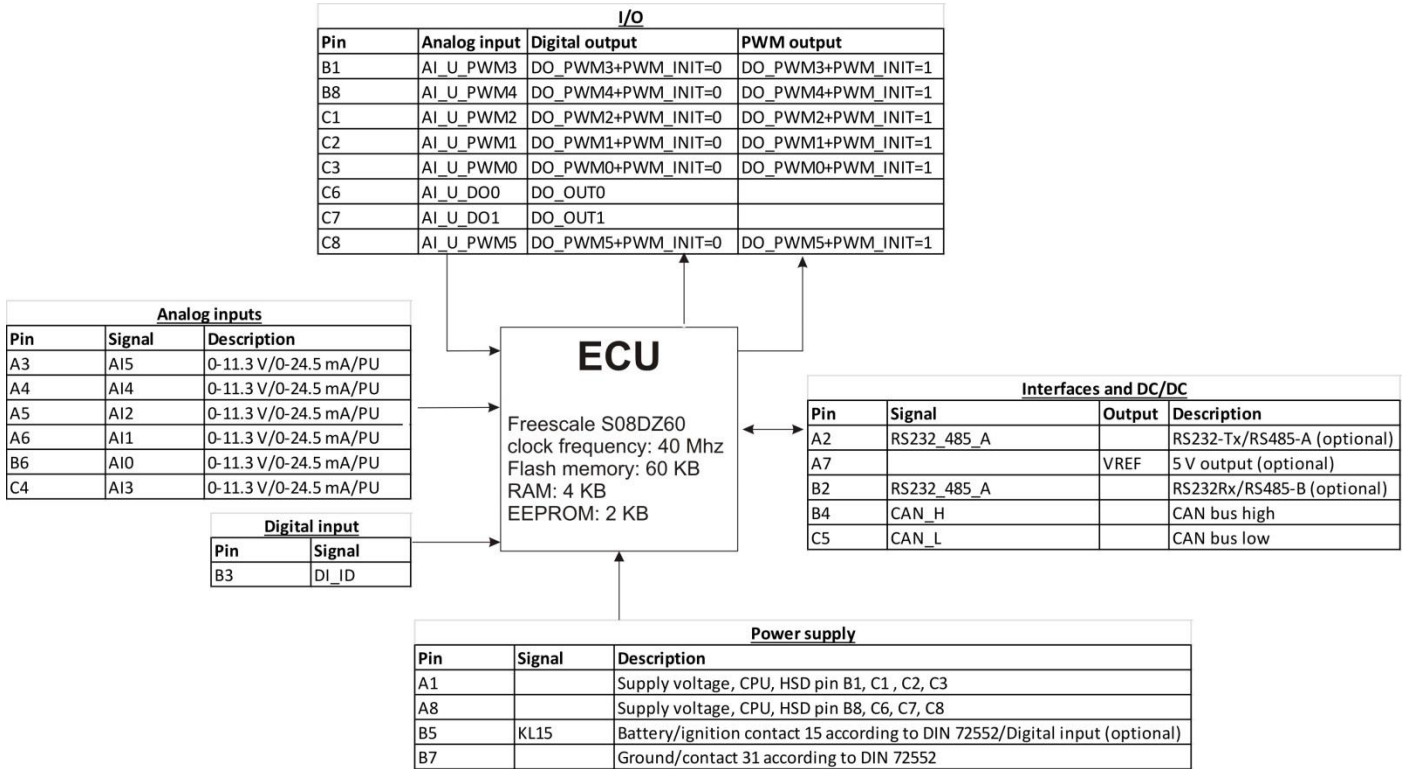
Alternative functions like frequency/current or pull-up inputs are depending on assembly options (see table on page 5).

Pin	Signal	Description	Pin	Signal	Description
A3	AI5 DO_PU5 DO_PD5	Analog input 5; 0-11.3 V Can also be used as: 10 kΩ pull-up Current sense 24.5 mA	B8	AI_U_PWM4 DO_PWM4	Analog input 4; 0-11.3 V Can also be used as digital output with PWM capability
A4	AI4 DO_PU4 DO_PD4	Analog input 4; 0-11.3 V Can also be used as: 10 kΩ pull-up Current sense 24.5 mA	C1	AI_U_PWM2 DO_PWM2	Analog input 2; 0-11.3 V Can also be used as digital output with PWM capability
A5	AI2 DO_PU2 DO_PD2	Analog input 2; 0-11.3 V Can also be used as: 10 kΩ pull-up Current sense 24.5 mA	C2	AI_U_PWM1 DO_PWM1	Analog input 1; 0-11.3 V Can also be used as digital output with PWM capability
A6	AI1 DO_PU1 DO_PD1	Analog input 1; 0-11.3 V Can also be used as: 10 kΩ pull-up Current sense 24.5 mA	C3	AI_U_PWM0 DO_PWM0	Analog input 0; 0-11.3 V Can also be used as digital output with PWM capability
B1	AI_U_PWM3 DO_PWM3	Analog input 3; 0-11.3 V Can also be used as digital output with PWM capability	C4	AI3 DO_PU3 DO_PD3	Analog input 3; 0-11.3 V Can also be used as: 10 kΩ Pull-Up Current sense 24.5 mA
B3	DI_ID	Digital input	C6	AI_U_DO0 DO_OUT0	Analog input 0; 0-11.4 V Can also be used as digital output
B6	AI0 DO_PU0 DO_PD0	Analog input 0; 0-11.3 V Can also be used as: 10 kΩ pull-up Current sense 24.5 mA	C7	AI_U_DO1 DO_OUT1	Analog input 1; 0-11.4 V Can also be used as digital output
			C8	AI_U_PWM5 DO_PWM5	Analog input 5; 0-11.3 V Can also be used as digital output with PWM capability





PIN FEATURE MAP



PERFORMANCE TESTS HIGH-SIDE DRIVER VNQ5050AK

Test without PWM

	Test. No.	Load	Endurance
Endurance tests at +85 °C for digital outputs (max. 2 channels per high side driver)	1	4 x 2.5 A	Continuous
	2	3 x 2.5 A 1 x 3.5 A	30 minutes
	3	2 x 2.5 A 2 x 3.5 A	15 minutes
	4	1 x 2.5 A 3 x 3.5 A	10 minutes
	5	2 x 5 A	5 minutes

Test with PWM

	Test No.	Load	Endurance
Endurance tests at +85 °C for PWM outputs with frequency=200 Hz and 90 % duty cycle (max. 2 channels per high side driver)	1	4 x 2.0 A	Continuous
	2	4 x 2.5 A	10 minutes
	3	1 x 3.5 A 3 x 2.5 A	2 minutes
	4	2 x 3.5 A	2 minutes

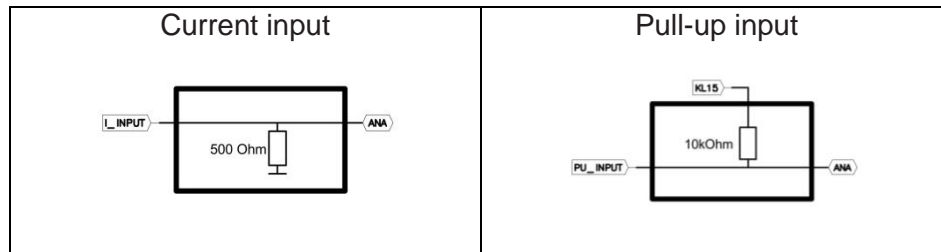
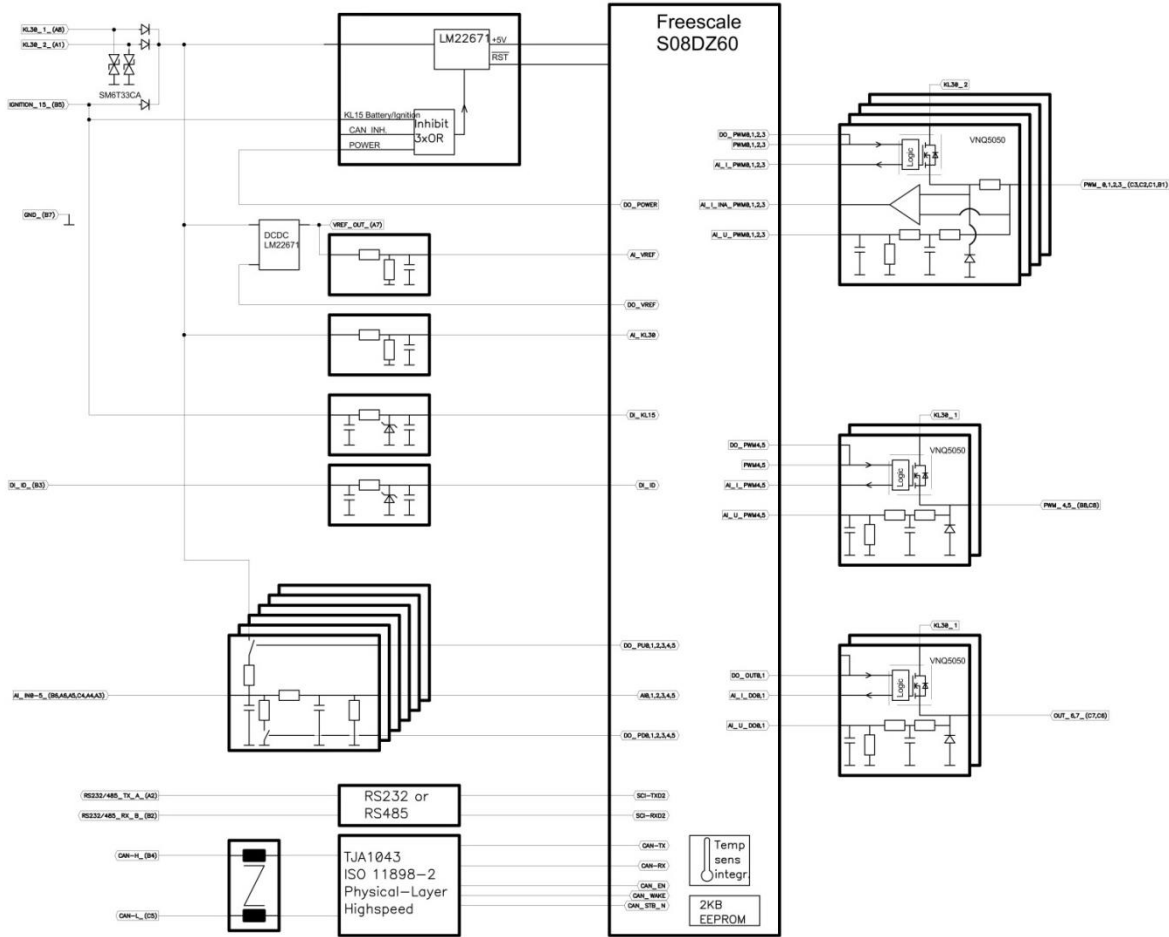


ASSEMBLY OPTIONS AND ORDER INFORMATION

Order Number	Inputs					Outputs	CAN-bus		Serial Interface		DC/DC
	A	B	C	D	E	F	High Speed	Low Speed	RS485	RS232	5 V Reference
	Voltage 0 – 11.4 V	Voltage 0 – 33.7 V	Sensor input 10 kΩ Pull-up	Digital input	I/Os (can be used as analog or digital inputs or as digital outputs)	PWM ≤ 500 Hz					
1.128.301.1000	A3, A4, A5, A6, B6, C4	A3, A4, A5, A6, B6, C4	A3, A4, A5, A6, B6, C4	B3	B1, B8, C1, C2, C3, C6, C7, C8	B1, B8, C1, C2, C3, C8	X			X	X



BLOCK FUNCTION DIAGRAM





ACCESSORIES

Description	Order Number
Programming Tool MRS Developers Studio	1.100.100.09
Programming Cable Set CAN I/O WP	110490
Connector Package CAN I/O WP	110421
Rubber Boot for Cable Set	102892
PCAN-USB Interface	105358
Crimp Terminals 2.8 mm/1-2.5 mm ²	109947
Crimp Terminals 1.5 mm/1.3-2. mm ²	109949
Dummy FCI Filler Plug	110268
Automotive Cable FLRY 2 x 0.50 mm ² white/green SL20	113085

CONTACT INFORMATION

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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.

