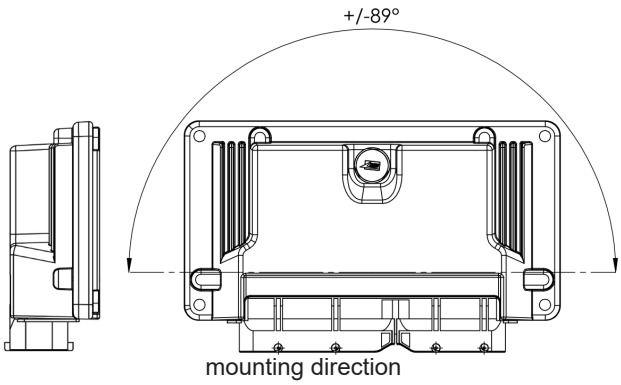


DESCRIPTION

The versatile M3600 is both controller and gateway. With the up to 39 inputs and outputs, you have many options to control various components.

TECHNICAL DATA

Housing	Aluminum casing with cooling fins
Connector	Tyco AMPMODU WP 121 pins
Housing dimensions	95.1 x 179 x 39.3 mm (housing) 110.4 x 179 x 39.3 mm (incl. plug)
Weight	480 g
Temperature range acc. to ISO 16750-4	-40 °C...+85 °C
Environmental protecti-on acc. to ISO 20653	IP68 when using the covers in the connector kit and the cable harness sheath acc. to the accessories list **CAUTION! Follow the mechanical instructions!**
Current consumption	67 mA
Over-current protection	40 A (see page 3)
Total inputs and outputs	38 (18 inputs; 10 I/O's; 10 outputs, 4 are PWM capable with integrated current measurement INA)
Inputs	**Configurable as:** Digital, positive encoder signals Analog (0…11.4 / 33.68 V) Digital, negative encoder signals Frequency inputs
Outputs	**Configurable as:** Digital, positive switching (High-Side) **Depends on the equipment:** PWM output up to 500 Hz Constant voltage source 5 V Const. current source max. 200mA
Supply voltage	9...32 V 12 V (Code B) and 24 V (Code E), acc. to ISO 16750-2
Starting voltage	8 V
Overvoltage protection	≥ 33 V
Undervoltage cut-off	8 V
Quiescent current	3.35 mA (24 V); 0.3 mA (12 V)
Reverse polarity protect.	yes
CAN Interfaces	CAN Interface 2.0 A/B, ISO 11898 compliant
Baudrate	Up to max. 1000 kbps default: 125 kbps

REGULATORY APPROVALS AND TESTING

E1 Label	ECE-R10 Rev. 5
E1 type approval	06 8037
Electrical tests	**According to ISO 16750-2 or -4:** Reverse polarity Disconnection pin/connector Superimposed alternating voltage Slow decrease and increase of supply voltage Momentary drop in supply voltage Reset behaviour at voltage drop Load test at T_{max} at +85 °C Long term overvoltage at T_{max}-20 °C Operation/storage test at T_{min} Operation/storage test at T_{max} **According to ISO 7637-2:** Pulse 1, 2a, 2b, 3a, 3b, 4

SOFTWARE/PROGRAMMING

Programming System

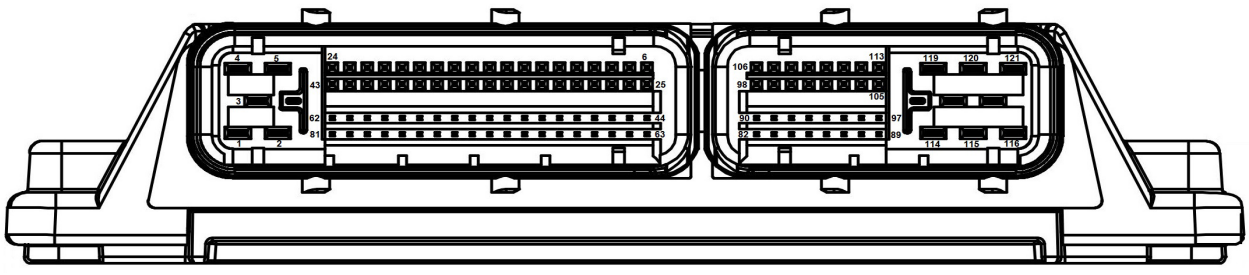
MRS APPLICS STUDIO
The Applics Studio is the new development and tool platform for our assemblies. Program your MRS controls quickly and easily with our stand-alone software. The focus is on your application.

For extended storage capacity from 32k you need the Codewarrior license. Download the paid license easily and securely from NXP.

INPUT FEATURES - SUMMARY

Pin 6, 7, 102, 106	Analog inputs 0…33 V Resolution	 12 Bit
Voltage input 0...33 V (see A)	Input resistance Input frequency Accuracy	22.3 ± 0.3 kΩ f_g*= 6 Hz ± 5 %
Pin 8	Analog inputs or frequency inputs Resolution	 12 Bit
Voltage input 0...11.3 V (see B)	Input resistance Input frequency Accuracy	22 ± 1 kΩ f_g*= 6 Hz ± 3 %
Frequency input (via use of the digital input, programming via usercode.c see B)	Input resistance Accuracy Factor	22 ± 1 kΩ to 3.2 kHz ± 3 % (measured with square wave signal with 10VPeak) Frequency = 4 x digits
Pin 9	Analog inputs 0…11.3 V Resolution	 12 Bit
Voltage input 0...11.3 V (see C)	Input resistance Input frequency Accuracy	22 ± 1 kΩ f_g*= 6 Hz ± 3 %
Pin 13, 14, 32, 33	PT200/PT1000 Sensor Input Resolution	 12 Bit
Pull-up Input (see D)	Pull-up resistance Input frequency	1 kΩ f_g*= 6 Hz
Pin 19, 38, 40, 42, 43	Analog- or digital input Resolution	 12 Bit
Voltage input 0…11.3 V (see E)	Input resistance Input frequency Accuracy	22.3 ± 0,3 kΩ f_g*= 6 Hz ± 3 % max.
Digital input Positive (see E)	Input resistance Input frequency Turn-on threshold Turn-off threshold	22,6 ± 0,2 kΩ f_g*= 6 Hz 7 V 7 V
Pin 21, 23, 24	Analog inputs 0…33 V Resolution	 12 Bit
Voltage input 0...33 V (see E)	Input resistance Input frequency Accuracy	22.3 ± 0.3 kΩ f_g*= 6 Hz ± 5 %
Digital input Positive (see E)	Input resistance Input frequency Turn-on threshold Turn-off threshold	22.3 ± 0.3 kΩ f_g*= 6 Hz Pin 21 = 19.4 V Pin 23 = 21 V Pin 24 = 13.5 V Pin 21 = 19.2 V Pin 23 = 21 V Pin 24 = 13.5 V
Pin 56, 58, 60, 62, 75, 77, 79, 81	IOs (analog- or digital input) Resolution	 12 Bit
Voltage input 0…11.3 V (see F)	Input resistance Input frequency Accuracy	15 kΩ f_g*= 6 Hz ± 5 %
Digital input Positive (see F)	Input resistance Input frequency Turn-on threshold Turn-off threshold	16.5 kΩ f_g*= 6 Hz 7 V 7 V
Pin 116, 121	IOs (Analog inputs 0…11.3 V) Resolution	 12 Bit
Digital input 0…11.3 V(see F)	Input resistance Input frequency Accuracy	22 ± 1 kΩ fg*= 6 Hz ± 3 %
Pin 108	Input for inductive rotary encoder sensors Resolution	 12 Bit
Voltage input 0...5 V (see B) Max. Amplitude 6.5 V	Accuracy	± 3 % up to 200 Hz

*f_g= cutoff frequency (-3 dB amplitude) when using the analog input



OUTPUT FEATURES - SUMMARY

Pin 48, 50, 52, 54, 56, 58, 60, 62, 75, 77, 79, 81 (VNQ5050)	Protective circuit for inductive loads	Optionally integrated
	Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense
Digital, positive switching (high side; see F and G)	Switching voltage Switching current Conversion factor current sense	9...32 V DC 0.02...2.5 A** 1 Digit 0.9 ± 0.1 mA
Short circuit resistance against GND and VS	Switching-off is controlled by high side driver for each output channel	

Pin 67, 69, 71, 73 (VNQ5050 with PWM and INA current sense)	Protective circuit for inductive loads	Optionally integrated
	Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense
Digital, positive switching (high side; see H)	Switching voltage Switching current Conversion factor current sense	9...32 V DC 0.02...2.5 A** 1 Digit 0.9 ± 0.1 mA
PWM-Output (see H)	Output frequency Duty cycle Resolution Switching current	500 Hz 0…100 % 1 ‰ Up to 2.5A** (see page 5)
Short circuit resistance against GND and VS	Switching-off is controlled by high side driver for each output channel	

Pin 44, 111	Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense
	Short circuit resistance against GND and V_S	Yes, according ISO 16750-2:2012
Digital Output (see I)	Connection possibility for external Panel up to max. 200 mA**	

Pin 114 (BTS650)	Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense
	Short circuit resistance against GND and V_S	Yes
Digital, positive switching (High-Side; see H)	Switching voltage Switching current Conversion factor current sense	9...32 V DC 0.02...10 A** 1 Digit 0.9 ± 0.1 mA

Pin 116, 121 (BTS6143)	Wire fault diagnostics	Possible via current sense
	Short circuit diagnostics	Possible via current sense
	Short circuit resistance against GND and V_S	Yes
Digital, positive switching (high side; see F)	Switching voltage Switching current Conversion factor current sense	9-32 V DC 0.02-10 A** 1 Digit 1.2 ± 0.1 mA

****ATTENTION: The maximum current load capacity of the total module amounts 40 A, if the terminals 30_1 (pin 119) and 30_2 (pin 120) are connected.**

PIN ASSIGNMENT POWER SUPPLY AND INTERFACES

Pin	Description
15	CAN2-H
16, 17, 18	RS 485 B
20	CAN1-L
22	CAN0-H
27	5V sensor output
34	CAN2-L
35, 36, 37	RS 485 A
39	CAN1-H
41	CAN0-L
98	5V sensor output

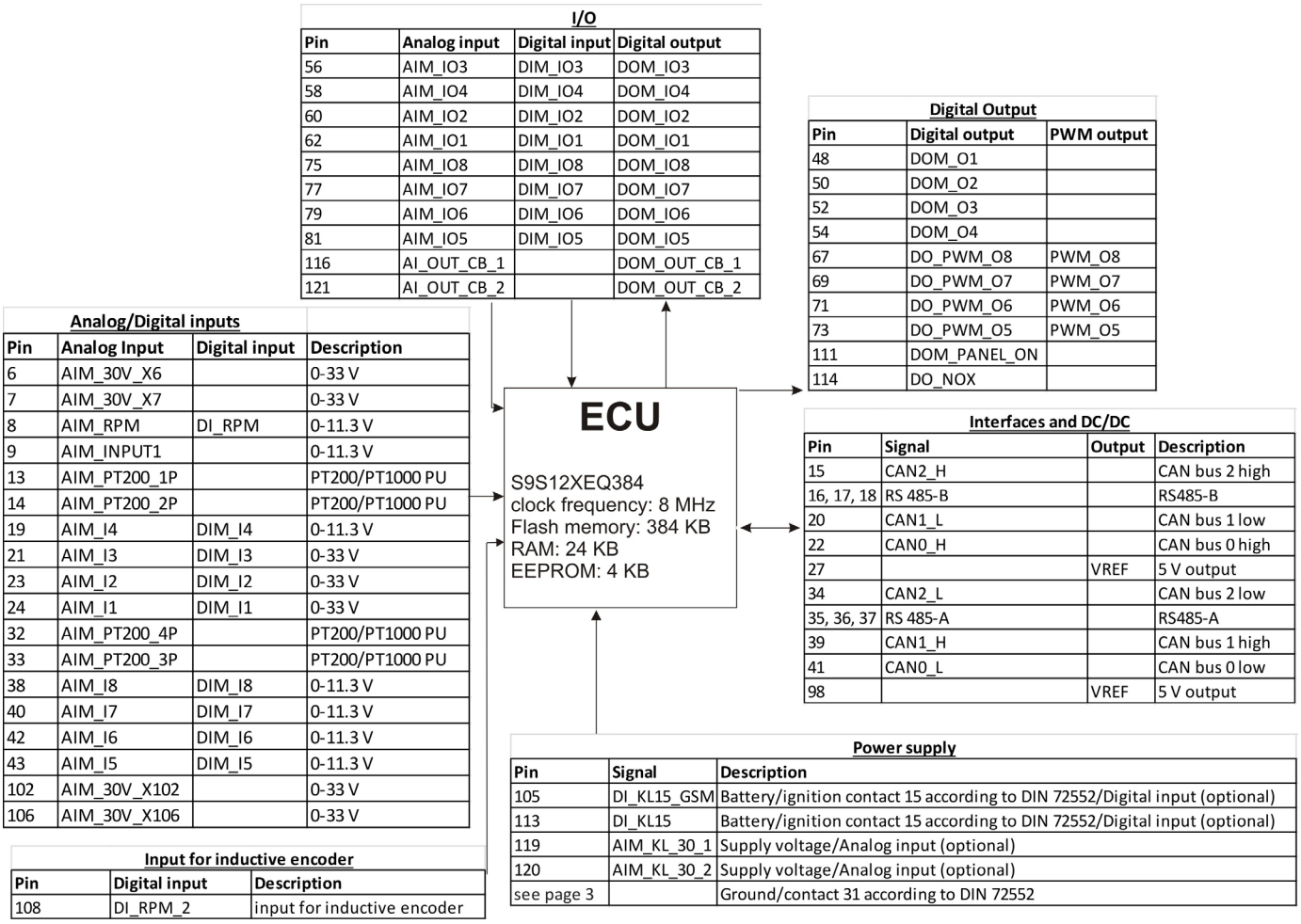
Pin	Description
105	Battery/ignition contact KL 15 GSM, optional as DI
113	Battery/ignition contact KL 15, optional as DI
119	KL 30_1: supply voltage for outputs and supply voltage for CPU
120	KL 30_2: supply voltage for outputs and supply voltage for CPU
1, 3, 4, 10, 11, 12, 28, 29, 30, 31, 45, 46, 47, 49, 51, 53, 55, 57, 59, 61, 63, 64, 65, 66, 68, 70, 72, 74, 76, 78, 80, 82, 83, 84, 85, 86, 89, 90, 91, 92, 93, 94, 97, 99, 100, 101, 103, 115, 117, 118	Ground

PIN ASSIGNMENT INPUTS AND OUTPUTS

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

Pin	Signal	Description
6	AIM_30V_X6	Analog input 0...33 V
7	AIM_30V_X7	Analog input 0...33V
8	AIM_RPM DI_RPM 0	Frequency input Digital input 0...11.3 V
9	AIM_INPUT1	Analog input 0...11.3 V
13	AIM_PT200_1P	Pull-up input PT200/PT1000
14	AIM_PT200_2P	Pull-up input PT200/PT1000
19	AIM_I4 DIM_I4	Analog input 0...11.3 V or digital input 0...11.3 V
21	AIM_I3 DIM_I3	Analog input 0...33 V or digital input
23	AIM_I2 DIM_I2	Analog input 0...33 V or digital input
24	AIM_I1 DIM_I1	Analog input 0...33 V or digital input
32	AIM_PT200_4P	Pull-up input PT200/PT1000
33	AIM_PT200_3P	Pull-up input PT200/PT1000
38	AIM_I8 DIM_I8	Analog input 0...11.3 V or digital input 0...11.3 V
40	AIM_I7 DIM_I7	Analog input 0...11.3 V or digital input 0...11.3 V
42	AIM_I6 DIM_I6	Analog input 0...11.3 V or digital input 0...11.3 V
43	AIM_I5 DIM_I5	Analog input 0...11.3 V or digital input 0...11.3 V
48	DOM_O1 AIM_CUR_O1	Digital output O1 with current sense
50	DOM_02 AIM_CUR_O2	Digital output O2 with current sense
52	DOM_03 AIM_CUR_O3	Digital output O3 with current sense
54	DOM_04 AIM_CUR_O4	Digital output O4 with current sense
56	AIM_IO3 DIM_IO3 DOM_IO3 AIM_CUR_IO3	Analog input IO3 0...11.4 V or digital input or digital output with current sense
58	AIM_IO4 DIM_IO4 DOM_IO4 AIM_CUR_IO4	Analog input IO4 0...11.4 V or digital input or digital output with current sense
60	AIM_IO2 DIM_IO2 DOM_IO2 AIM_CUR_IO2	Analog input IO2 0...11.4 V or digital input or digital output with current sense
62	AIM_IO1 DIM_IO1 DOM_IO1 AIM_CUR_IO1	Analog input IO1 0...11.4 V or digital input or digital output with current sense
67	DO_PWM_O8 PWM_O8 AI_SENS_PWM_O8	Digital output DO8 with PWM capability and INA current sense
69	DO_PWM_O7 PWM_O7 AI_SENS_PWM_O7	Digital output DO7 with PWM capability and INA current sense
71	DO_PWM_O6 PWM_O6 AI_SENS_PWM_O6	Digital output DO6 with PWM capability and INA current sense
73	DO_PWM_O5 PWM_O5 AI_SENS_PWM_O5	Digital output DO5 with PWM capability and INA current sense
75	AIM_IO8 DIM_IO8 DOM_IO8 AIM_CUR_IO8	Analog input IO8 0...11.4 V or digital input or digital output with current sense
77	AIM_IO7 DIM_IO7 DOM_IO7 AIM_CUR_IO7	Analog input IO7 0...11.4 V or digital input or digital output with current sense
79	AIM_IO6 DIM_IO6 DOM_IO6 AIM_CUR_IO6	Analog input IO6 0...11.4 V or digital input or digital output with current sense
81	AIM_IO5 DIM_IO5 DOM_IO5 AIM_CUR_IO5	Analog input IO5 0...11.4 V or digital input or digital output with current sense
102	AIM_30V_X102	Analog input 0...33 V
106	AIM_30V_X106	Analog input 0...33 V
108	DI_RPM_2	Input for inductive rotary encoders
111	DOM_PANEL_ON AI_VCC_PANEL	Digital output VB Panel with max. 200 mA Analog input 0...13.7 V
114	DO_NOX AI_NOX	Digital output NOX with current sense
116	AI_OUT_CB_1 DOM_OUT_CB_1 AI_CUR_CB_1	Analog input 0...11.3 V or digital output CB1 with current sense
121	AI_OUT_CB_2 DOM_OUT_CB_2 AI_CUR_CB_2	Analog input 0...11.3 V or digital output CB1 with current sense

PIN - FEATURE MAP



I/O

Pin	Analog input	Digital input	Digital output
56	AIM_IO3	DIM_IO3	DOM_IO3
58	AIM_IO4	DIM_IO4	DOM_IO4
60	AIM_IO2	DIM_IO2	DOM_IO2
62	AIM_IO1	DIM_IO1	DOM_IO1
75	AIM_IO8	DIM_IO8	DOM_IO8
77	AIM_IO7	DIM_IO7	DOM_IO7
79	AIM_IO6	DIM_IO6	DOM_IO6
81	AIM_IO5	DIM_IO5	DOM_IO5
116	AI_OUT_CB_1		DOM_OUT_CB_1
121	AI_OUT_CB_2		DOM_OUT_CB_2

Digital Output

Pin	Digital output	PWM output
48	DOM_O1	
50	DOM_O2	
52	DOM_O3	
54	DOM_O4	
67	DO_PWM_O8	PWM_O8
69	DO_PWM_O7	PWM_O7
71	DO_PWM_O6	PWM_O6
73	DO_PWM_O5	PWM_O5
111	DOM_PANEL_ON	
114	DO_NOX	

Analog/Digital inputs

Pin	Analog Input	Digital input	Description
6	AIM_30V_X6		0-33 V
7	AIM_30V_X7		0-33 V
8	AIM_RPM	DI_RPM	0-11.3 V
9	AIM_INPUT1		0-11.3 V
13	AIM_PT200_1P		PT200/PT1000 PU
14	AIM_PT200_2P		PT200/PT1000 PU
19	AIM_I4	DIM_I4	0-11.3 V
21	AIM_I3	DIM_I3	0-33 V
23	AIM_I2	DIM_I2	0-33 V
24	AIM_I1	DIM_I1	0-33 V
32	AIM_PT200_4P		PT200/PT1000 PU
33	AIM_PT200_3P		PT200/PT1000 PU
38	AIM_I8	DIM_I8	0-11.3 V
40	AIM_I7	DIM_I7	0-11.3 V
42	AIM_I6	DIM_I6	0-11.3 V
43	AIM_I5	DIM_I5	0-11.3 V
102	AIM_30V_X102		0-33 V
106	AIM_30V_X106		0-33 V

Interfaces and DC/DC

Pin	Signal	Output	Description
15	CAN2_H		CAN bus 2 high
16, 17, 18	RS 485-B		RS485-B
20	CAN1_L		CAN bus 1 low
22	CAN0_H		CAN bus 0 high
27		VREF	5 V output
34	CAN2_L		CAN bus 2 low
35, 36, 37	RS 485-A		RS485-A
39	CAN1_H		CAN bus 1 high
41	CAN0_L		CAN bus 0 low
98		VREF	5 V output

Input for inductive encoder

Pin	Digital input	Description
108	DI_RPM_2	input for inductive encoder

Power supply

Pin	Signal	Description
105	DI_KL15_GSM	Battery/ignition contact 15 according to DIN 72552/Digital input (optional)
113	DI_KL15	Battery/ignition contact 15 according to DIN 72552/Digital input (optional)
119	AIM_KL_30_1	Supply voltage/Analog input (optional)
120	AIM_KL_30_2	Supply voltage/Analog input (optional)
see page 3		Ground/contact 31 according to DIN 72552

PINS - WITHOUT EXTERNAL CONNECTION

Pins
2, 5, 25, 26, 87, 88, 95, 96, 104, 107, 109, 110, 112

PERFORMANCE TESTS HIGH-SIDE-DRIVER OUTPUTS (MAXIMUM RATINGS)

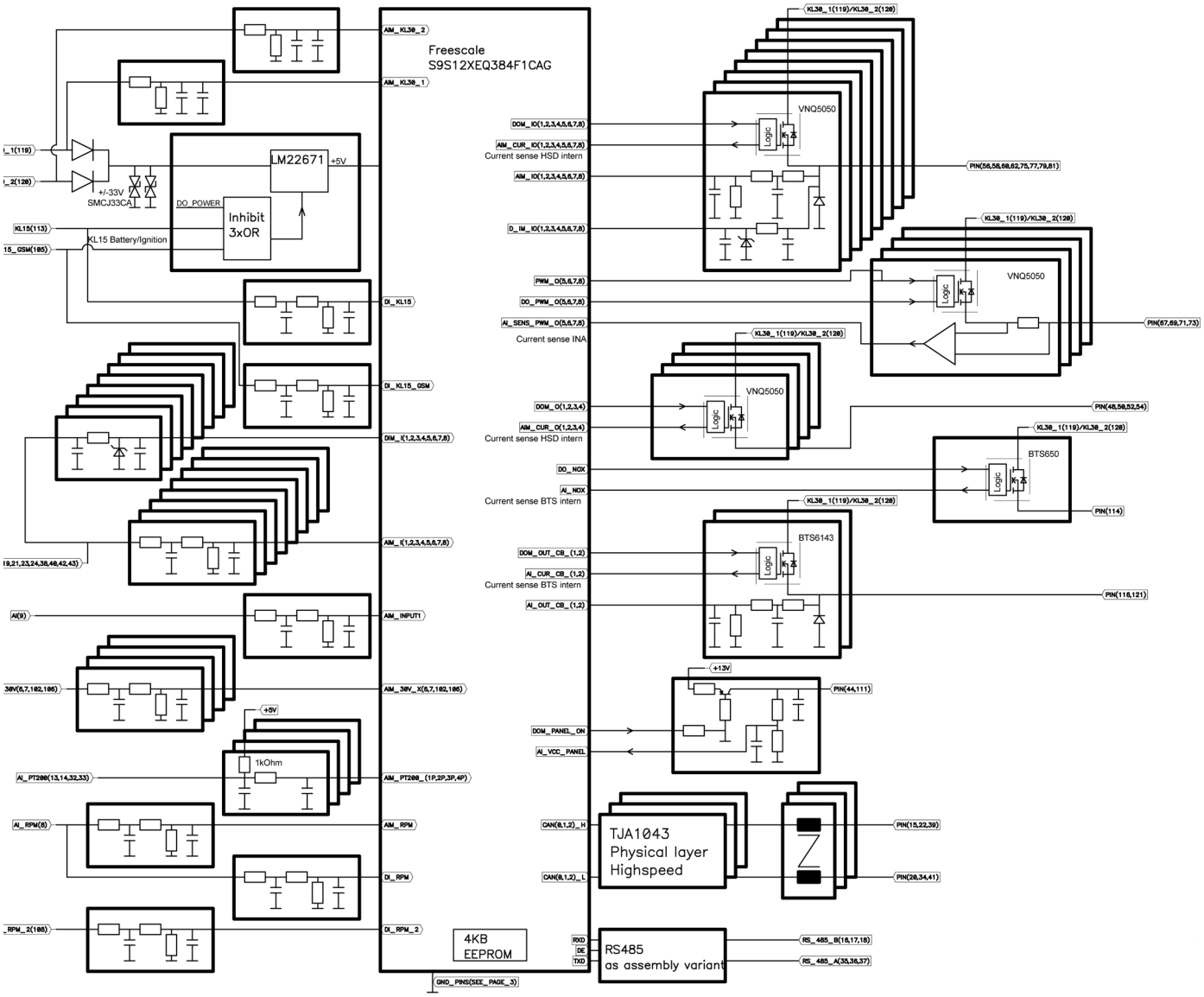
Test without PWM (max. 2 channels per high side driver)
T = 85 °C

Load	Switched Outputs	Endurance [min]
4 x 4 A	O1-O8; IO1-IO8	5
2 x 5 A	O7, IO7	continuous
15 A	IO_CB1	continuous
15 A	IO_CB2	5
22 A	NOX_B_P	5
4 x 3 A	O1,O2,O3,O4	continuous

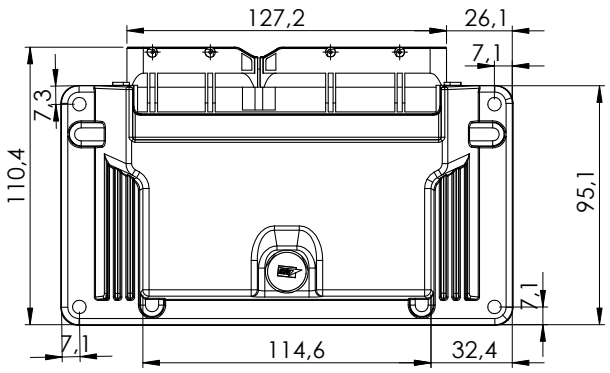
Test with PWM (max. 2 channels per high side driver)
T = 85 °C
PWM (200Hz, Duty cycle 90%)

Load	Switched Outputs	Endurance [min]
5 A	O8	continuous
4 x 2.5 A	O5,O6,O7,O8	continuous
4 x 3 A	O5,O6,O7,O8	5

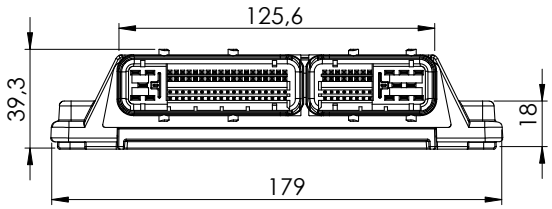
BLOCK FUNCTION DIAGRAM



TECHNICAL DRAWING IN MM, TOLERANCES ACCORDING TO ISO 2768-1 V



front view



bottom view

ASSEMBLY OPTIONS AND ORDER INFORMATION

Order number	Inputs						Outputs			CAN bus		Serial interface	DC/DC
										High-Speed	CAN open		
	A Voltage 0...33 V	B Voltage or frequency	C Voltage 0...11.3V	D Pull up 1kΩ	E Voltage or digital	F I/O´s (optionally as Analog-/digital input or digital output)	G Digital output	H Digital output or PWM ≤ 500 Hz	I Power supply ext. panel				5 Volt Ref.
1.300.300.00	6, 7, 102, 106	8	9, 108	13, 14, 32, 33	19, 21, 23, 24, 38, 40, 42, 43	56, 58, 60, 62, 75, 77, 79 ,81, 116, 121	48, 50, 52, 54, 114	67, 69, 71, 73	111	X		RS485	27, 98
1.300P.300.00	6, 7, 102, 106	8	9, 108	13, 14, 32, 33	19, 21, 23, 24, 38, 40, 42, 43	56, 58, 60, 62, 75, 77, 79 ,81, 116, 121	48, 50, 52, 54, 114	67, 69, 71, 73	111		X	RS485	27, 98

ACCESSORIES

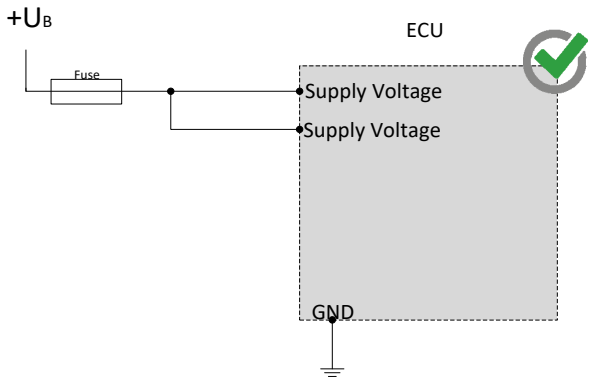
Description	Order number
Programming tool MRS Developers Studio	1.100.100.09
Connector package M3600	114159
Crimp terminals Timer Junior 1.50 – 2.50 mm²	107665
Single seal Junior Power Timer 1.5 mm²	107304
Crimp terminal MQS 0.50 – 0.75 mm²	109949
PCAN-USB Interface	105358
Cable set M3600 for programming	501246
Cavity Plug package for M3600 CAN PLC	300972
Cable harness sheath	Available from independent retailers

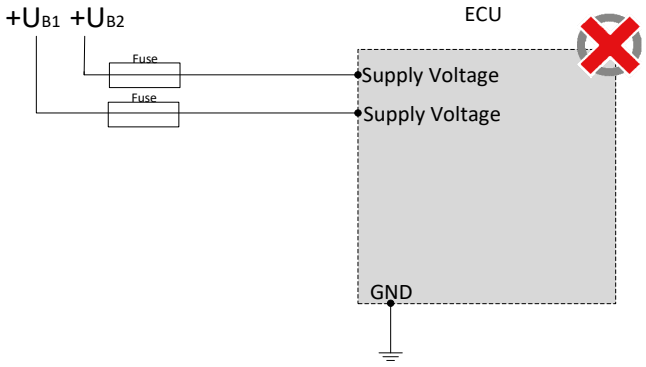
MANUFACTURER

MRS Electronic GmbH & Co. KG
Klaus-Gutsch-Str. 7
78628 Rottweil
Germany

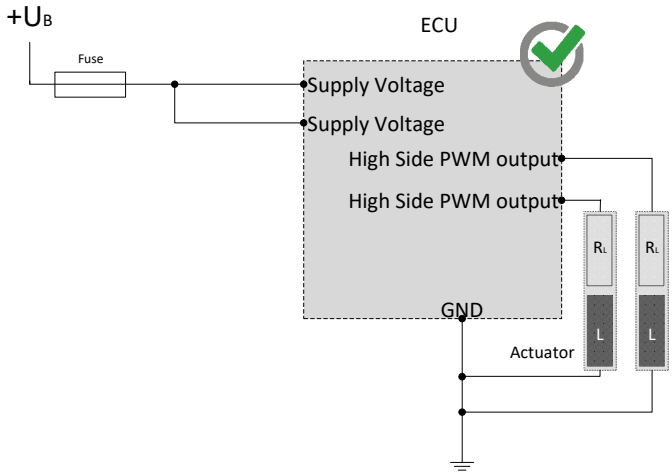
WIRING AND CABLE ROUTING RECOMMENDATIONS

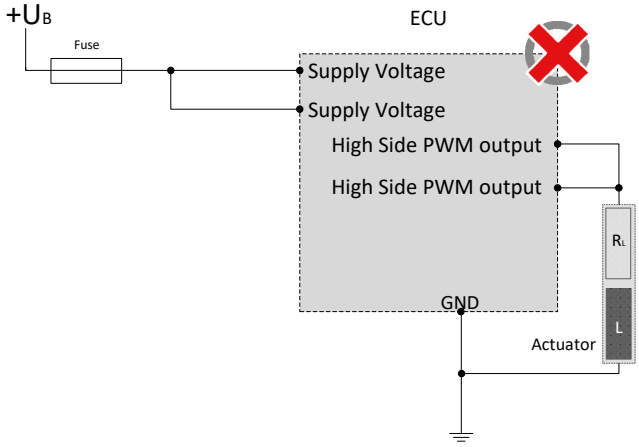
The electronic system and the power outputs of a control unit must be supplied by the same power supply system.



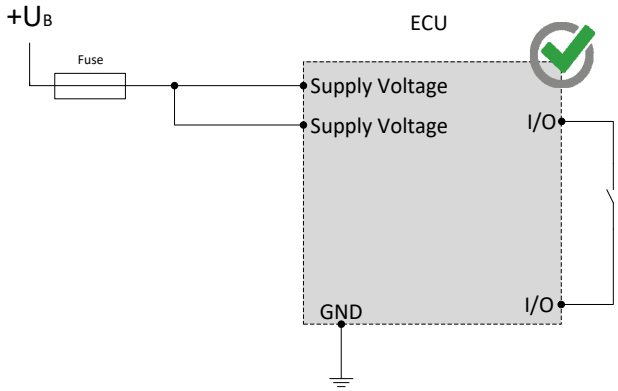


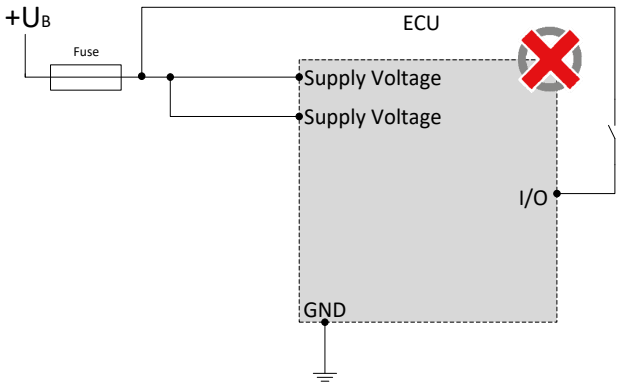
PWM outputs may not be connected with each other or bypassed.





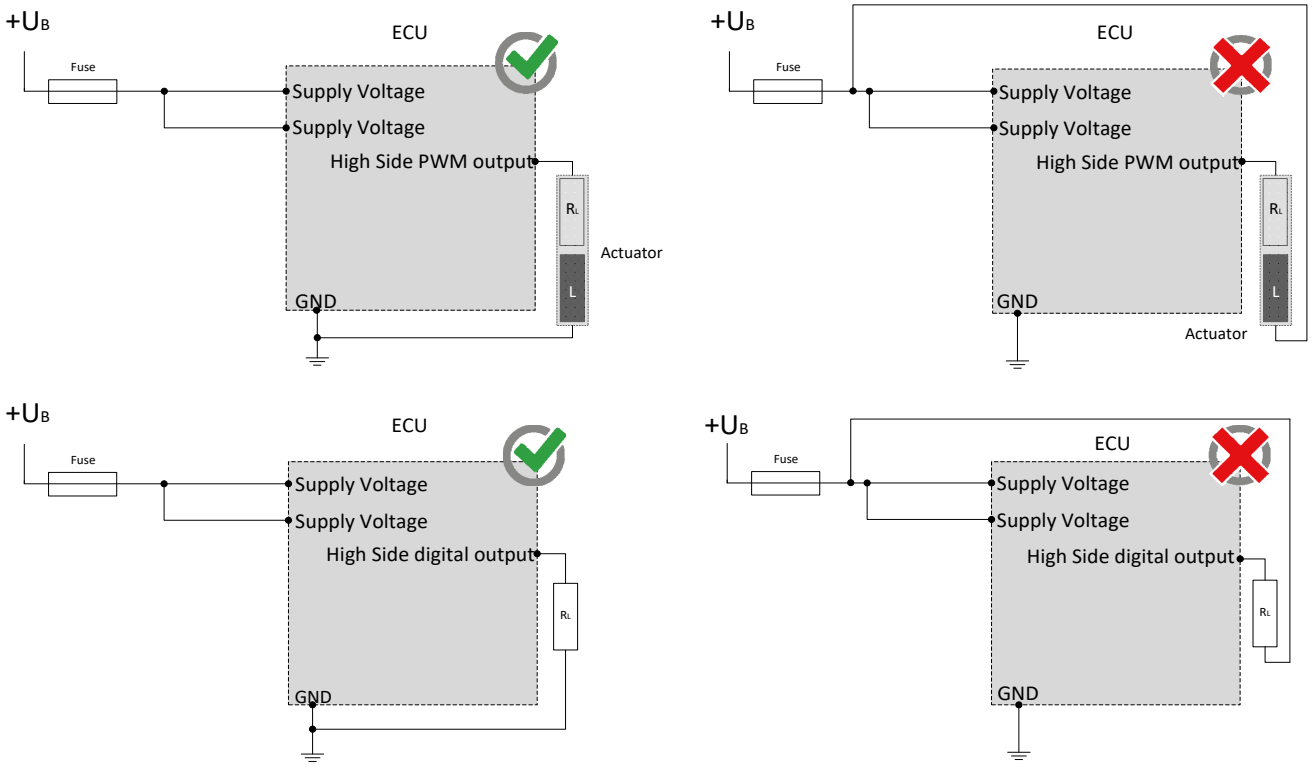
The pins (I/Os) can be used in combination and may not be switched externally against supply voltage.



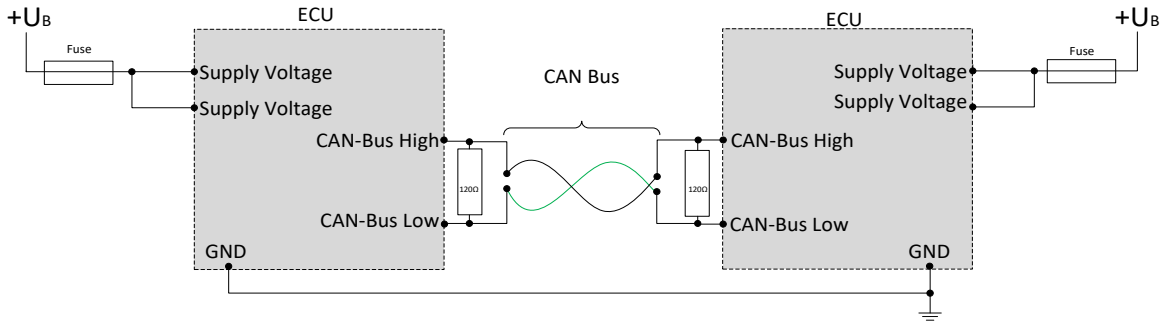


WIRING AND CABLE ROUTING RECOMMENDATIONS

Higside outputs may only be switched to ground.



The CAN bus communication is the main communication between the control unit and the vehicle. Therefore, connect the CAN bus with special care and check the correct communication with the vehicle to avoid undesired behavior.



To comply with the IP protection class, the wiring harness attached to the mating connector must be routed through the cable harness sheath and the mating connector must be connected to the control unit. The cover included in the connector kit must then be closed over the mating connector. The cable harness sheath must be secured in the groove in the cover using cable ties.

SAFETY AND INSTALLATION INFORMATION

It is essential to read the instructions in full thoroughly before working with the device.

Please note and comply with the instructions in the operating instructions and the information in the device data sheet, see www.mrs-electronic.de

Staff qualification: Only staff with the appropriate qualifications may work on this device or in its proximity.

SAFETY

WARNING! Danger as a result of a malfunction of the entire system.
Unforeseen reactions or malfunctions of the entire system may jeopardise the safety of people or the machine.

- Ensure that the device is equipped with the correct software and that the wiring and settings on the hardware are appropriate.

WARNING! Danger as a result of unprotected moving components.
Unforeseen dangers may occur from the entire system when putting the device into operation and maintaining it.

- Switch the entire system off before carrying out any work and prevent it from unintentionally switching back on.
- Before putting the device into operation, ensure that the entire system and parts of the system are safe.
- The device should never be connected or separated under load or voltage.

CAUTION! Risk of burns from the housing.
The temperature of the device housing may be elevated.

- Do not touch the housing and let all system components cool before working on the system.

PROPER USE

The device is used to control or switch one or more electrical systems or sub-systems in motor vehicles and machines and may only be used for this purpose. The device may only be used in an industrial setting.

WARNING!Danger caused by incorrect use.
The device is only intended for use in motor vehicles and machines.

- Use in safety-related system parts for personal protection is not permitted.
- Do not use the device in areas where there is a risk of explosion.

Correct use:

- operating the device within the operating areas specified and approved in the associated data sheet.
- strict compliance with these instructions and no other actions which may jeopardise the safety of individuals or the functionality of the device.

Obligations of the manufacturer of entire systems

It is necessary to ensure that only functional devices are used. If devices fail or malfunction, they must be replaced immediately.

System developments, installation and the putting into operation of electrical systems may only be carried out by trained and experienced staff who are sufficiently familiar with the handling of the components used and the entire system.

It is necessary to ensure that the wiring and programming of the device does not lead to safety-related malfunctions of the entire system in the event of a failure or a malfunction. System behaviour of this type can lead to a danger to life or high levels of material damage.

The manufacturer of the entire system is responsible for the correct connection of the entire periphery (e.g. cable cross sections, correct selection/ connection of sensors/actuators).

Opening the device, making changes to the device and carrying out repairs are all prohibited. Changes or repairs made to the cabling can lead to dangerous malfunctions. Repairs may only be carried out by MRS.

Installation

The installation location must be selected so the device is exposed to as low a mechanical and thermal load as possible. The device may not be exposed to any chemical loads.

Install the device in such a manner that the plugs point downwards. This means condensation can flow off the device. Single seals on the cables/leads must be used to ensure that no water gets into the device.

Putting into operation

The device may only be put into operation by qualified staff. This may only occur when the status of the entire system corresponds to the applicable guidelines and regulations.

FAULT CORRECTION AND MAINTENANCE

NOTE The device is maintenance-free and may not be opened.

- If the device has damage to the housing, latches, seals or flat plugs, it must be taken out of operation.

Fault correction and cleaning work may only be carried out with the power turned off. Remove the device to correct faults and to clean it.

Check the integrity of the housing and all flat plugs, connections and pins for mechanical damage, damage caused by overheating, insulation damage and corrosion. In the event of faulty switching, check the software, switches and settings.

Do not clean the device with high pressure cleaners or steam jets. Do not use aggressive solvents or abrasive substances.

