

## Integrated module with galvanically separated voltage/current output and CAN bus interface for control applications

### Features

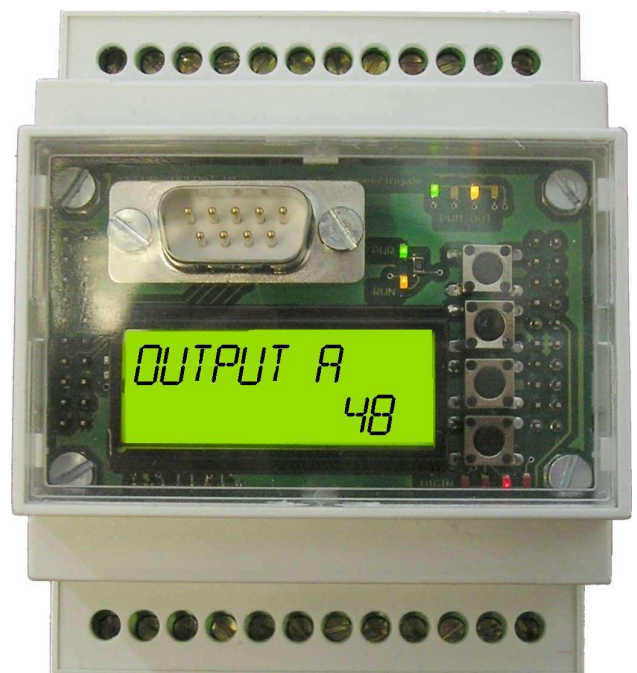
- voltage output 0-10 V
- current output 0-20 mA
- independent optocoupler output with open emitter and collector (PWM driven)
- galvanically separated inputs and outputs (except analog inputs)
- 3 analog inputs 0-10 V
- 8 V supply output for analog inputs
- 4 digital inputs 10-30 V
  - 2 frequency / duty cycle inputs
- power supply 10-30 V
- CAN bus interface
  - secure MDCAN realtime protocol
  - MDFUNC series compatible
  - MDCAN series compatible
  - NAVIO series compatible
- configurable on-chip software
  - MDFUNC<sub>I/O</sub> input vs. output matrix
    - select an input out of more than 30 sources for each output channel or link function
    - several automatic control functions (P/PID/RPM)
    - latch function
    - triple station control
    - logic functions
    - transfer function (input vs. output)
    - RS232 interface or USB interface
  - configuration and monitoring with LC display
  - comfort configuration and monitoring with free PC-Tool
    - MDFUNC<sub>I/O</sub> Tool
    - easy to use
    - more possibilities, more functions
  - firmware upgrades
- status indication by LEDs
- safety feature for AIN/CANbus cable break
- mountable on 35 mm DIN-rail
- max. cable diameter for connectors: 1.5mm<sup>2</sup> with ferrule

### Applications

Galvanically separated analog output module for mobile and marine applications, valve controls, engine controls, control systems, input/output CAN bus node

- speed request for marine or industrial engines
  - suitable for Steyr, Deutz etc. engines
- in combination with MDFUNC-PWM modules suitable for propulsion systems
  - hydraulic propulsion systems
    - RPM control
  - mechanical clutches with soft shifting
  - mechanical clutches with trolling function
    - RPM control
  - emergency controls
- hydraulic valve controls
  - simple controls
  - automatic position control
- pressure control

MD engineering GmbH can help to choose the right components and implement your application.



**Description**

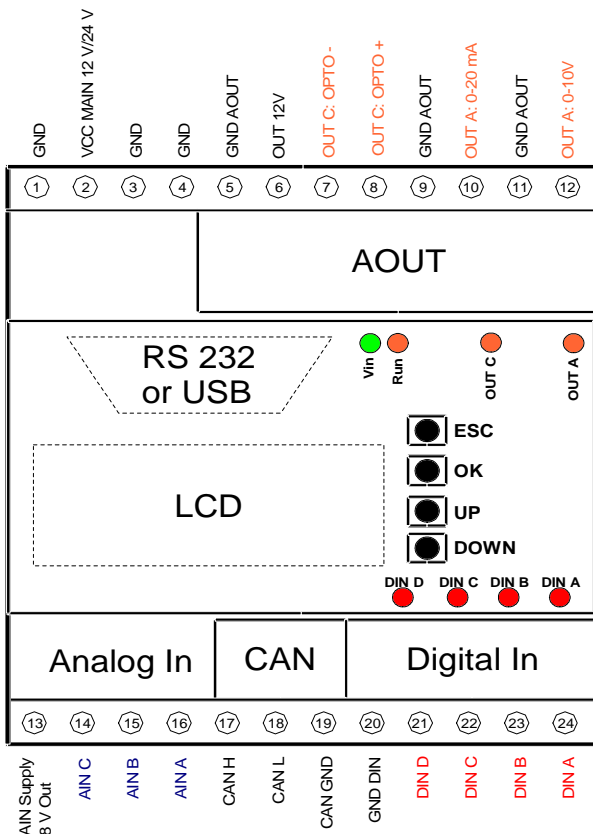
The MDFUNC-AOUT2 unit is a pre-programmed and easy to use I/O module to control all types of voltage or current inputs. Additionally the unit has an independent opto-coupler output, which can be used as an PWM output (a duty cycle can be set).

Three analog, four digital inputs and a CAN-interface are available. Two of the digital inputs can also be used for frequency measurements (i.e. read engine revolutions) or to measure the duty cycle.

The MDFUNC-AOUT2 uses the new MDFUNC<sub>I/O</sub> -engine, which offers more powerful possibilities for creating your control application. Functions like multiple station control, network control or positioning control are pre-programmed and easily accessible. The onboard LC-display has multiple language support (English, German, Dutch), offers monitoring functions and the possibility to change module parameters. For configuring the module more comfortable, the new PC-Tool MDFUNC<sub>I/O</sub> is available at the support site. A PC can be connected via RS232 serial port or via USB (hardware option).

Furthermore internal data can be displayed on the CAN-bus and multiple units can be linked to a network.

**Connection diagram**



**Connector description**

**supply**

1,3,4	GND	main system and analog input ground
2	V <sub>CC MAIN</sub>	main system supply

**inputs**

analog inputs		
16,15,14	AIN A/B/C	analog inputs
digital inputs		
24,23,22,21	DIN A/B/C/D	digital inputs
20	GND DIN	digital ground, reference potential for
CAN-Bus (I/O)		
17,18	CANH,CANL	CAN bus connectors
19	CAN GND	CAN bus ground

**outputs**

13	AIN Supply 8V	supply for passive analog devices: e.g. joysticks, potentiometers etc.
5,9,11	GND AOUT	analog output ground
6	OUT 12V	fixed analog output 12V (max. 20 mA), can be used to source the optocoupler output
12	OUTA 10 V	voltage output
10	OUTA 20 mA	current output
8,7	OPTO +/-	open optocoupler outputs

**Button description**

- UP/DOWN      switch through current menu / in/decrease a value
- OK             jump in submenu / select value for edit / accept edited value
- ESC            jump out of submenu / cancel value edit

**Software assignments**

- Output A      voltage/current output
- Output B      free, calculation channel
- Output C      optocoupler output
- Output D      free, calculation channel
- Output E      free, calculation channel

## Electrical Characteristics

(T<sub>env</sub> = 25°C)

### Power supply

Symbol	Parameter	min	typ.	max.	abs max.	Unit
V <sub>In</sub>	system power supply voltage DC	10	12/24	30	32	V
I <sub>In @ 12 V</sub>	system current (with LCD)		180			mA
I <sub>In @ 24 V</sub>	system current (with LCD)		90			mA
T <sub>env</sub>	environment temperature	-10	25	50	60	°C

### Analog Output A

- galvanically separated
- self powered (internal DC/DC converter, 12V), stabilised
- branded analog circuitry
- 12 bit DAC, for Application: 1000 steps from 0 to 10 V / from 0 to 20 mA
- startup stable output signal time: 130 ms (can be switched down to 25 ms)
- limitable output range

### Voltage output

Symbol	Parameter	min	typ.	max.	abs max.	Unit
U <sub>out</sub>	analog output voltage	0	-	10.75	-	V
R <sub>out</sub>	output impedance	230	235	240	-	Ω
R <sub>L,min</sub>	minimum load resistance	7	10	-	-	kΩ
I <sub>max @ 10 V</sub>	maximum current to reach 10 V output	-	-	1.5	-	mA
I <sub>max</sub>	short circuit current, self limited	-	-	45	-	mA
U <sub>n,pk-pk</sub>	Ripple and noise (20 MHz Bandwidth, peak to peak)	-	120	-	-	mV
U <sub>n,rms</sub>	Ripple and noise (20 MHz Bandwidth, rms)	10	17	25	-	mV

### Current output

Symbol	Parameter	min	typ.	max.	abs max.	Unit
I <sub>out</sub>	analog output current	0	-	21.5	-	mA
R <sub>out</sub>	output impedance	48	50	52	-	Ω
R <sub>L,min</sub>	maximum load resistance			500	-	Ω
U <sub>max</sub>	open circuit	11,8	12	12,6	-	V

### Analog Output C

- galvanically separated
- PWM frequencies: 30 Hz, 120 Hz, 245 Hz, 490 Hz, 975 Hz, 3900 Hz
- output stage of optocoupler Vishay: ILD206
  - emitter: OPTO+
  - collector OPTO-
  - for details please refer to datasheet ILD206
- on-state input LED-current = 5 mA
- compatible with Caterpillar ADEM-II-6, ADEM-II-16 EMC, PEEC 3

### Digital Inputs A/B/C/D/E/F/G/H

- inputs galvanically separated

Symbol	Parameter	min	typ.	max.	abs max.	Unit
V <sub>DIN,H</sub>	voltage for high level	3.5	12/24	28	32	V
V <sub>DIN,L</sub>	voltage for low level	-0.5	0	2.5	-	V
t <sub>S,DIN</sub>	turn on/off time (sample time)	-	1	3	-	ms
I <sub>DIN @ 24 V</sub>	current per channel	1.0 <sup>1</sup>	11.0 <sup>2</sup>	12	-	mA
f <sub>DINA</sub>	input frequency range	5	-	5000	7000	Hz
f <sub>rDINA</sub>	input frequency resolution	1 <sup>3</sup>	-	14 <sup>3</sup>	-	Hz
Δf <sub>DINA</sub>	input frequency deviation	-	0.5	2	-	%
t <sub>fDINA,stop</sub>	frequency measurement stop time	200	300	500	-	ms
d <sub>C<sub>DINA</sub></sub> <sup>4</sup>	input duty cycle range	3.0	-	97.0	-	%
d <sub>C<sub>rDINA</sub></sub> <sup>4</sup>	input duty cycle resolution	0.1	-	0.4	-	%
Δd <sub>C<sub>DINA</sub></sub> <sup>4</sup>	input duty cycle deviation	-	0.5	3	-	%

<sup>1</sup> @ V<sub>DIN</sub> = 3.5 V

<sup>2</sup> optocoupler: 5.5 mA, LED: 5.5 mA

<sup>3</sup> 1 Hz resolution up to 300 Hz; 14 Hz resolution at 5 kHz

<sup>4</sup> accuracy of duty cycle measurement depends on the signal's slew rate and frequency

**Attention:** input frequencies above 7 kHz slows down the performance of the MDFUNC-ADIN.

### Analog Inputs A/B/C

- averaged values
- overvoltage protected input

Symbol	Parameter	min	typ.	max.	abs max.	Unit
V <sub>AIN</sub>	analog input voltage	0	-	10	11	V
R <sub>AIN</sub>	input impedance	50 <sup>4</sup>	94	110	-	kΩ
f <sub>sample</sub>	internal register update frequency	-	400	-	-	Hz

<sup>4</sup> input impedance decreases, when V<sub>AIN</sub> is higher than 11.2 V

### AIN supply output

- V<sub>sup,AIN</sub> = 8 V
- I<sub>sup,AIN,max</sub> = 90 mA
- output not galvanically separated

### CAN bus interface

- galvanically separated
- connectors with CANH and CANL
- max. bus length: 40 m..1000 m
- selectable CAN bus speed: 50, 125, 250, 500, 1000 kBit/s
- blinking RUN-LED and blinking antenna symbol on LCD, when bus OK
- 3 free 16 bit inputs (MDCAN protocol)
- 3 free 8 bit inputs (MDCAN protocol)
- MDCAN protocol output (10 Hz):
  - analog inputs A/B/C
  - digital inputs (A/B/C/D)
  - frequency input (DINA)
  - latch status results (A/B/C/D/E)
  - output channels (A/B/C/D/E)

## RS232 connection

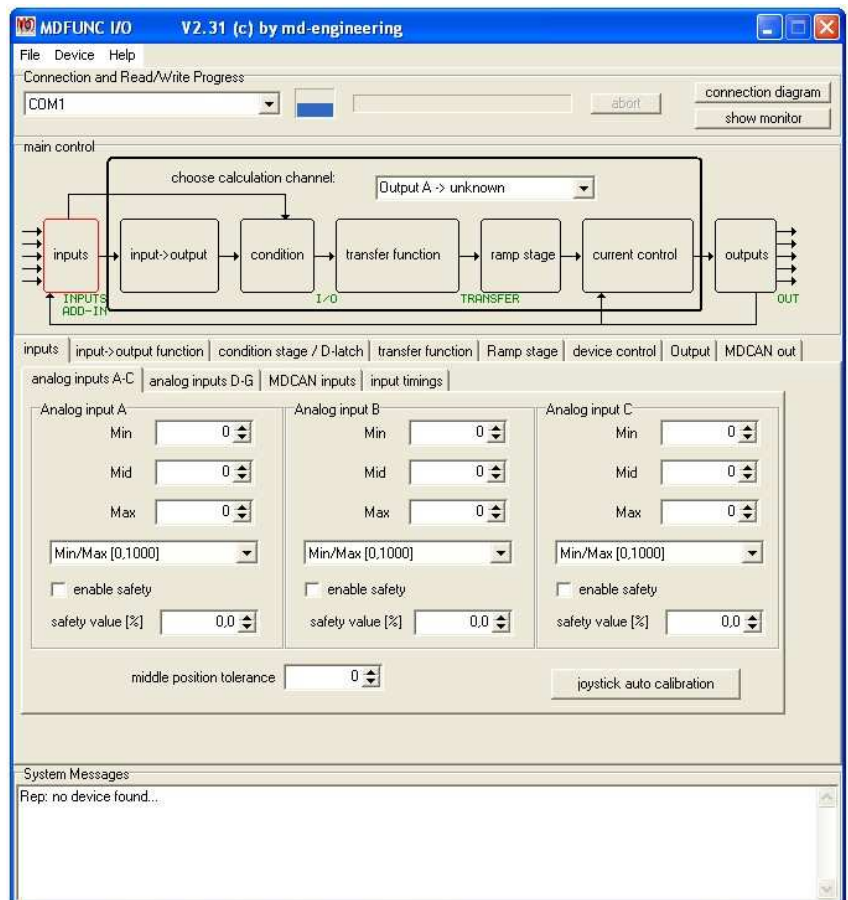
- not galvanically separated  
**ATTENTION** when using PC with grounded outlet power supply  $GND_{PC}$  must have the same potential as  $GND_{PWM3}$ . If the difference is more than 100 mV you can damage the AOUT2 and your PC. Best use a laptop powered by battery.
- SUB-D 9 pin male connector on board
- connect common zero modem cable to port (also possible with "USB/RS232" adapter)
- data connection: 57600,8,N,1

## USB connection

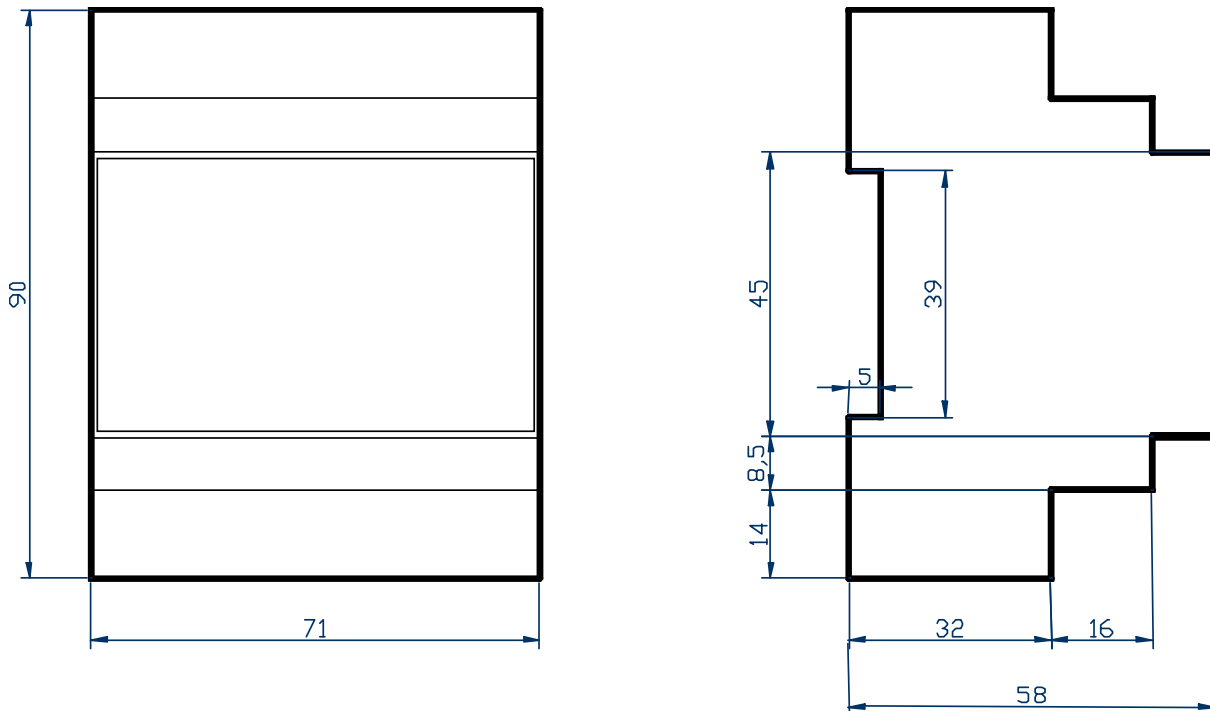
- not galvanically separated  
**ATTENTION** when using PC with grounded outlet power supply  $GND_{PC}$  must have the same potential as  $GND_{PWM3}$ . If the difference is more than 100 mV you can damage the AOUT2 and your PC. Best use a laptop powered by battery.
- Mini-USB connector 5 pin on board
- USB 1.1 standard
- connect AOUT2 with common Mini-USB cable to your PC
- on board USB/RS232 adapter, device will appear as COM-port on your PC
- RS232 data connection: 57600,8,N,1
- driver for free download

## Setup Program: MDFUNC-I/O Tool Version 2.3

- more possibilities, better overview
- easy user interface
- free input-output combinations
- inputs from local analog inputs, digital inputs, CAN bus inputs or system outputs for feedback
- boolean operations, latch function
- CAN bus inputs/outputs
- Input vs. Output transfer function
- Ramp functions with gain and offset limitation
- monitor functions
- load/save settings from/to file
- special functions: automatic control, multiple station control
- Requirements:
  - Win2000/XP
  - CPU with 600 MHz or higher
  - COM port or USB port



**Package dimensions (in mm)**



**Order codes**

**AOUT2 with RS232 connector**  
MDFUNC-AOUT2-RS232-LCD

**AOUT2 with USB-connector**  
MDFUNC-AOUT2-USB-LCD

**RS232-PC connection cable**  
MDCABLE-RS232-ZERO

**USB-PC connection cable**  
MDCABLE-MiniUSB

Please ask for special device programming, other CAN protocol stacks or our "low cost solutions" (e.g. not galvanically separated or no LCD).

**Support**

Get datasheets, drivers, firmware, software and examples from:

<http://www.md-engineering.de/produkte/mdfunc/main.html>