Manual

Software for
MDFUNC PWM3H-types
Version 1.41

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Introduction

This software tool is used for configuring the MDFUNC output-type modules for your application. You can use the tool together with the following MDFUNC-devices:

- PWM3- module
- DPOT- module

The Software is written to be launched in Win32-environments (2000/XP). The Software does not have to be installed. Just copy the executable file (PWMTOOL2.exe) and the MDFUNC-device-parameter-files (*.mdp) wherever you like to. Finally launch the executable file. This software is not freeware. It is only intended for the end user to configure the MDFUNC-family. You may not use it for commercial issues without licence (e.g. creating mdp-files or preparing MDFUNC modules for distribution).

Start up

When launching the application, the window which is coming up looks like this:

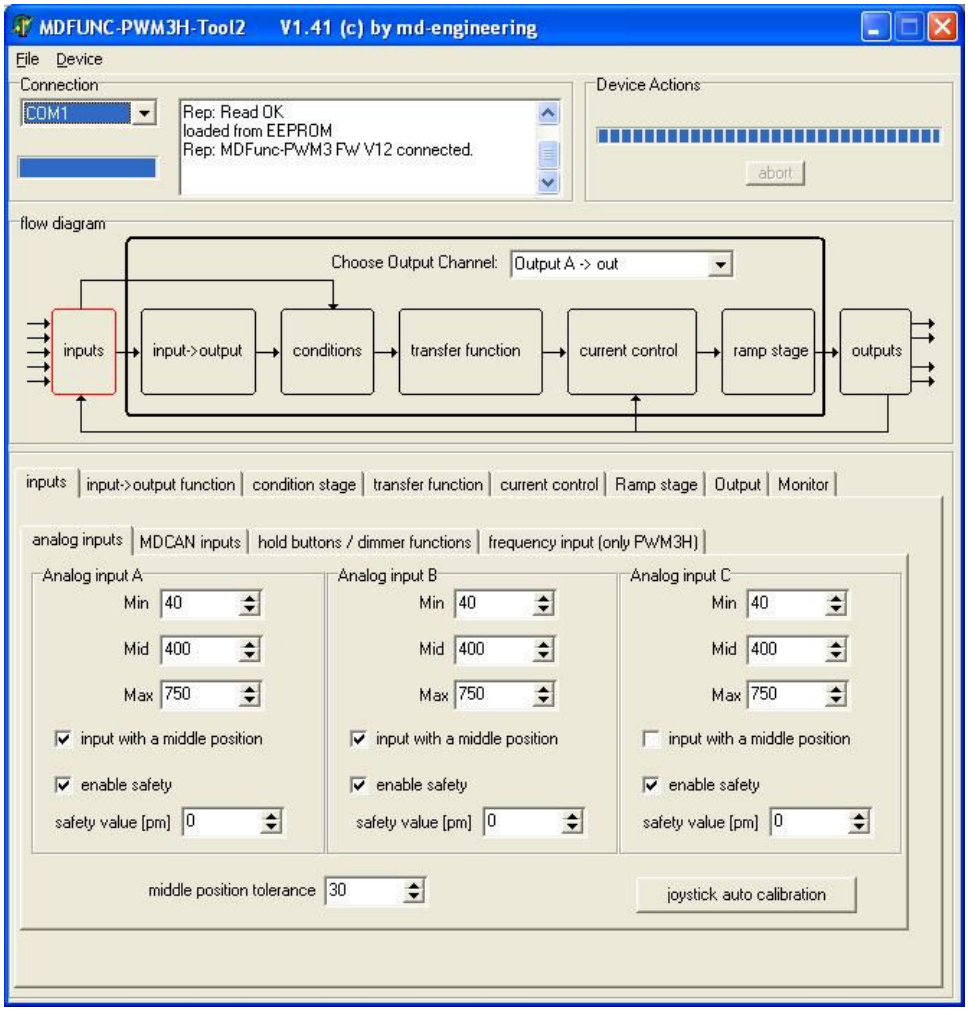

Figure 1: Start up screen

The Main-Window is separated in 5 different user panels:

- Connection
- File
- Device / Device Actions
- Flow diagram
- Parameter Settings

You can use the program in two ways:
- your PC is connected with a MDFUNC-device (you can directly edit the parameters-settings of the device)
- no device is connected (you can only edit the parameter-settings and load/save them from/to a file)

Connect your PC with a standard zero-modem to your MDFUNC module. Use one of your RS232-UART-Interface at your PC or notebook for placing the cable. If you don't have one, you can use your USB-Interface and insert a USB-to-RS232-adapter between.

Connection-Panel

When you connect your PC with a MDFUNC-Module, the software tries to find the device on it's own. The standard RS232-port is COM1. If that one is already in use, choose another port in the drop-down-combo box.

Figure 2: Connection-Panel

The connection-monitor is the small memo-notepad beside the drop-down-combo box. Here you can read information about the status of the connection. Also when writing to files, loading from files or error messages appear here.

The progress bar below the drop-down-combo box shows the connection-status of the communication between PC and MDFUNC:

- progress bar totally blue:
  the connection between PC and MDFUN is established.
  In the connection-monitor is written: **connection OK...**

- progress bar is flickering: The software tries to connect to a device, but no matching device was found. This can have several reasons:
  - connection-monitor: **connection failed...**
    The MDFUNC device could not be found. Check all cable connections and power supplies (is the RUN-LED lit on the MDFUNC, is there text on the LCD?). Check if you have selected the right COMPORT in this software.

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- connection-monitor: **YYYYYYY with version XX is not is not compatible with this software.** This means: You have connected a wrong device to your PC (e.g. MD-Gyro or an other MDFUNC module). The device named YYYYYYY with a firmware-version XX is not compatible with this software. When you have connected a MDFUNC module, which should run with this software, give us a call or take a look at our homepage to know how the device is upgradeable.

File

You can save and load whole parameter sets to a file. After pressing one of the menu entries, a normal “Win-style” file-select-menu will appear. In this way you can apply the same parameters to more than one device or keep the settings for later use.

Figure 3: File

With the **Quit** button you can close the tool.

Device

To use the entries under the menu entry **Device** it is required that the MDFUNC-device has successfully connected to your PC.

Figure 4: Device / Device Actions

Menu entries:

Read from device: Reads out all parameters from the device and refreshes the “parameter settings”-panel. It is possible that data transmission fails. The connection monitor informs you whenever a failure occurred. If an error was reported, abort the transmission and repeat the read procedure.

Write To device: Writes all parameters from the panel “parameter settings” to the MDFUNC-device. It is also possible that data transmission fails. The connection monitor informs you whenever a failure occurred. If an error was reported, abort the transmission and repeat

the write procedure. When changing parameters while external actuators are connected to the MDFUNC module, notice that only all parameters are loaded at the next reboot of the module. Without rebooting, it is possible that unexpected behaviour of external actuators occurs.

Reset Device: Resets the processor of the MDFUNC-device. After writing to a MDFUNC-device, not all parameters will be changed at once. It is advised to reset the MDFUNC-device after writing the parameters, so that all new parameters can be applied.

The **blue Device Actions bar** on the right side shows the progress while reading or writing.

The **abort**-button below the Device Actions bar cancels the actual data transfer.

Upgrade Firmware: With this menu entry you can update the firmware of a MDFUNC module. After pressing this entry the “MD Program Updater” starts automatically. Now you can select a firmware version.

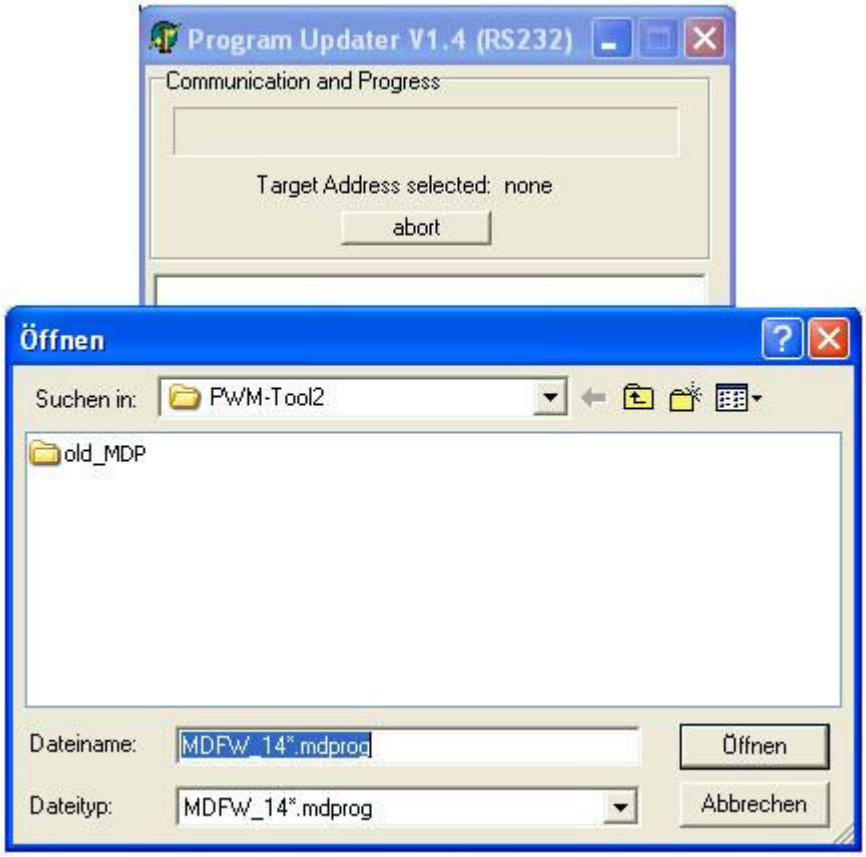

Figure 5: Firmware upgrade

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Flow diagram

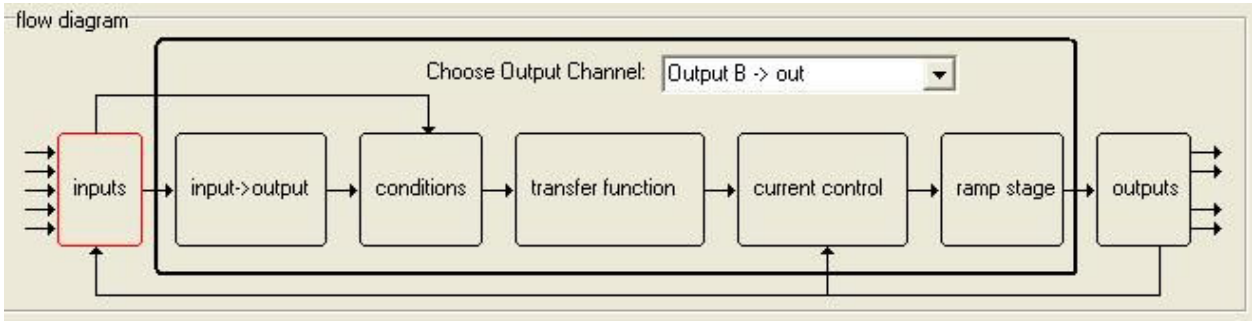
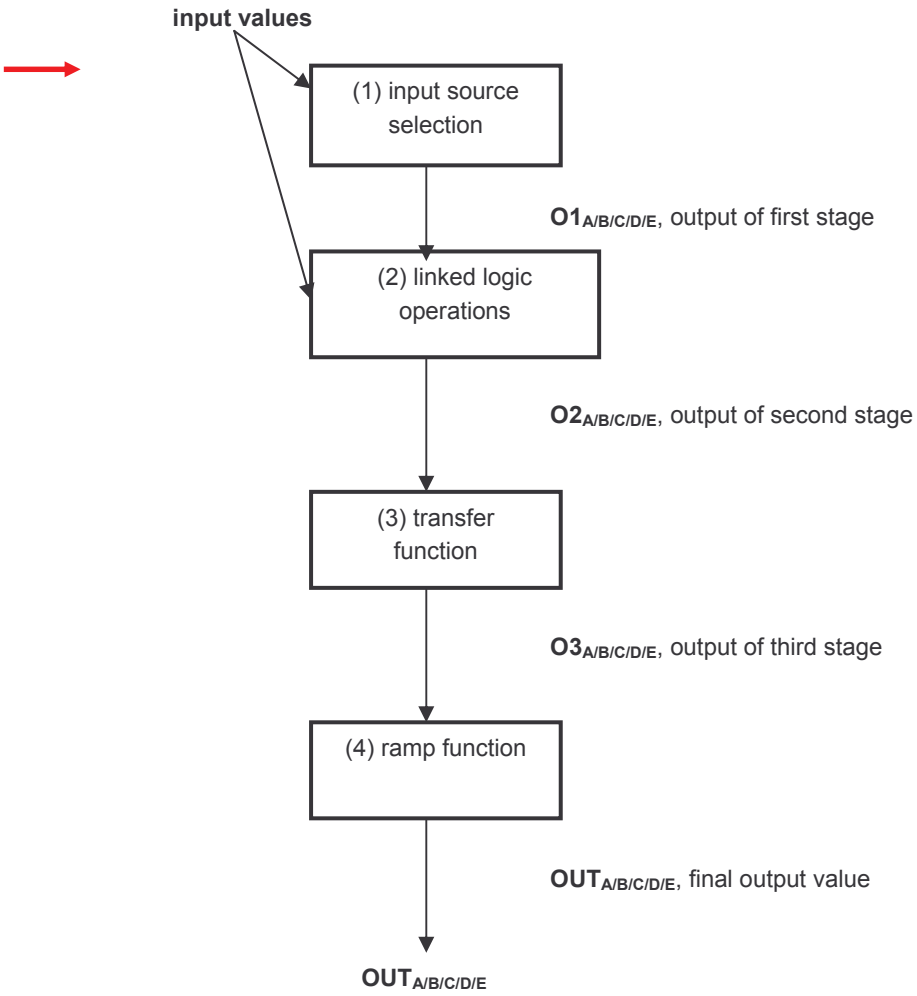


Figure 6: Flow diagram

The final values of the output channels are composed like this:



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Parameter Settings

In this chapter all configuration possibilities will be explained.

General

All internal calculations are made with values from 0 to 1000 or from –1000 to 1000. So the least size is 1/1000 which is abbreviated in the following as 1 per mill or 1 pm.

Every value which you want to use with the module (e.g. controlling with frequencies or values received over the CAN-bus), should be calculated to this range.

Inputs

Basics:

The MDFUNC-modules have 3 analog inputs with 10 bit data conversion resolution. This means that each input can measure a voltage between 0 and 10 V, which will be interpreted as values from 0 to 1023. So an input signal of 10 V causes a result of 1023, an input signal of 8 V causes a result of 818.

Example: Joystick connected to an AIN-port

You have connected the wiper of a potentiometer/joystick to an analog input of the device (here AIN A). Example: moving the joystick from one side to the other you measure at the wiper-output a minimum of 0.5 V and a maximum of 7.5V. The MDFUNC-modules will measure a data conversion result with a minimum value of 51 and a maximum value of 767 (a middle position is around 409). You surely want this to be the full scale range of the input. Full scale is mapped internally like described above to values from 0 to 1000 (joystick with no middle position) or from –1000 to 1000 (joystick with a middle position). For using a joystick with middle position just click on the check-box **"input with a middle position"**.
Most joysticks with middle position have an indent at the middle position. "**middle position tolerance**"

Enter now these three values (51,409,767) in the **Min/Mid/Max**-boxes in the analog input-panel:

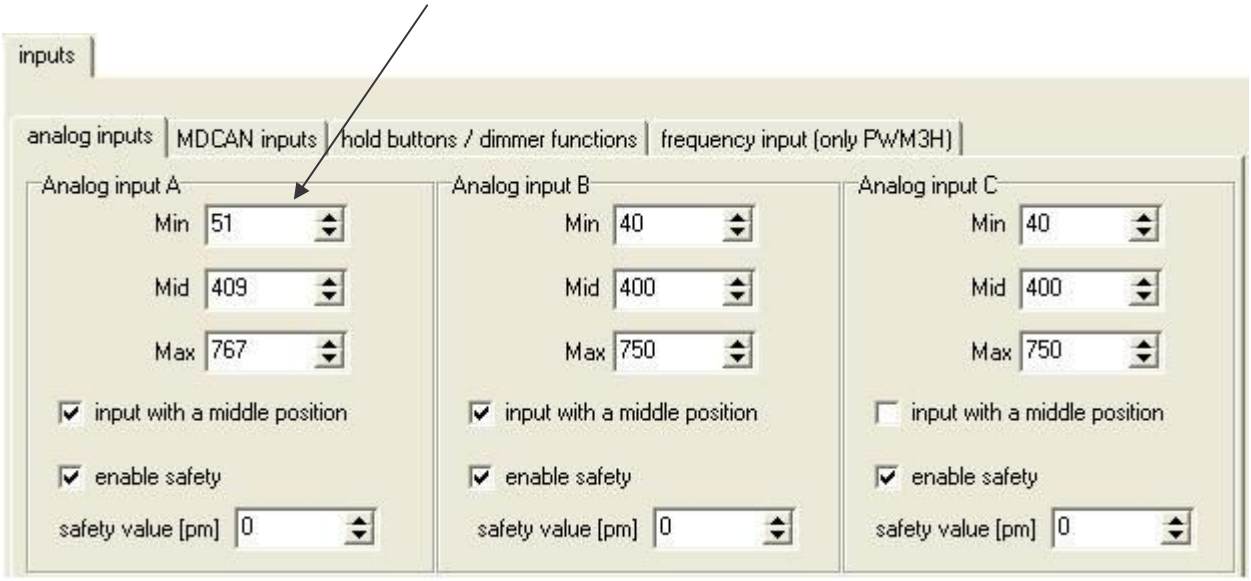

Figure 7: Analog inputs

Now “**Write Parameters**” and “**Reset Device**” to apply the changes. When you take a look at the “**Monitor**”-page, you can watch the values while moving the potentiometer. The “**scaled ADC**” values should now alter between 0 and 1000 or between –1000 and 1000 (middle position).

To avoid the risk of unexpected behaviour at a cable break of the joystick, use the “**enable safety**”–option. If you use this option, every time the input value is below the Min-value or above the Max-value, the output of the “**scaled ADC**”-value will be the “**safety value**”. To avoid e.g. power-offs at Min/Max-positions due to temperature influences increase the Max-value by ten points and decrease the Min-value by 10 points additionally.

You like it more simple?:

No problem! Below the three analog inputs-boxes there is a button called “joystick auto calibration”.

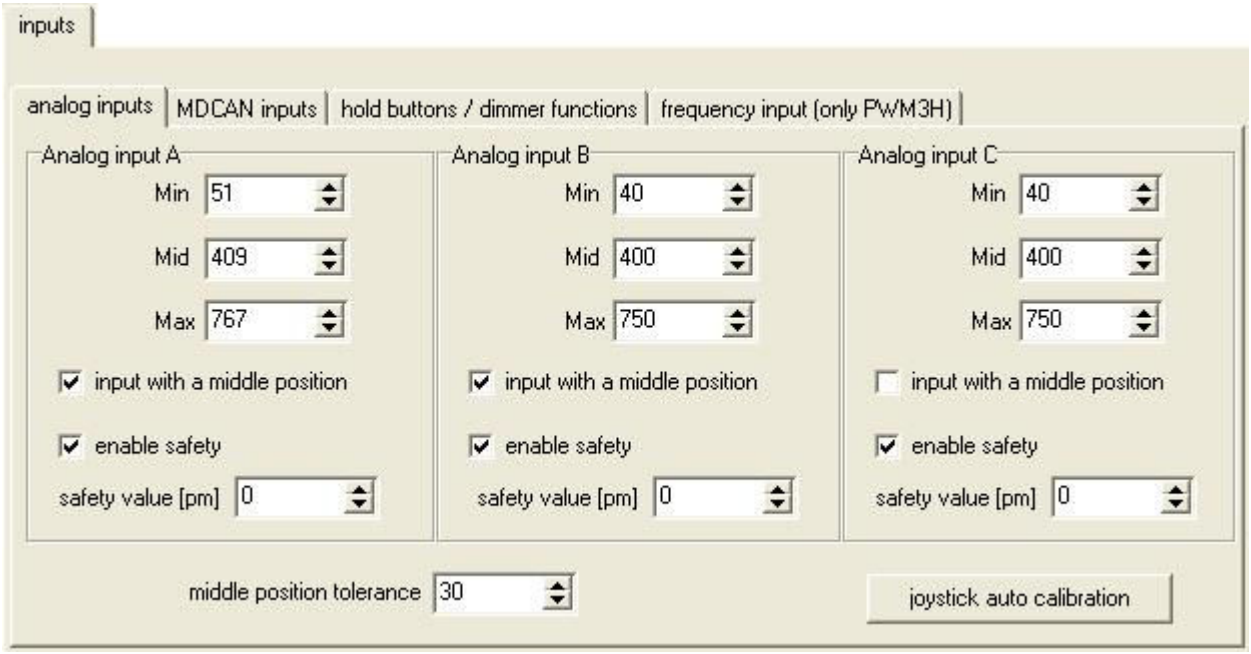

Figure 8: Joystick auto calibration

- Press this button one time
- The MDFUNC-module reports “**calibration...**” on its display (outputs are disabled while doing calibration).

The software reports:

Don’t press OK now!

Figure 9: Confirm joystick auto calibration

- Move all connected joysticks from minimum to maximum several times, fast and slowly
- Leave every joystick in the middle position (when using a joystick without middle position somewhere between minimum and maximum)
- Now press the OK-button
- The PWMtool now reads the computed values from the PWM3-device
- Now you can watch the values in the “Inputs”-page. In the “Monitor” page you can see the actual values while moving the potentiometers.

Input -> Output function

This chapter describes the main part of the MDFUNC-functionality. Here you can specify the behaviour of the module. You have multiple possibilities to influence the behaviour of the MDFUNC-module. To tap the full potential of the modules, it is very important to understand this chapter quite well.

There are 5 calculation channels implemented (OUT A to OUT E):

- The channels A to C are working directly on the physical outputs of the device (PWM-outputs)
  - these channels only react on values from 0 to 1000
  - 0 output is switched totally off
  - 1000 output is switched totally on
  - e.g. when a value of +500 is calculated on these channels, the corresponding PWM-output will cause a PWM-duty cycle of 50%
  - when using the PWM3-module, the outputs A and B are switched off, while using the frequency measurement-option!

- Channels D and E are fake-channels. When you leave other channel (OUT A to OUT C) unconnected, you may also use them also as fake-channels. Fake-channels can be used for the following features:
  - an input channel for other calculation channels
  - additional delays for input channels (AIN/CAN/OUT)
  - alter the transfer function of input channels
  - cascading CAN- (multiple source) and other values
  - Channel D and E can also calculate negative values (other channels only produce positive values)

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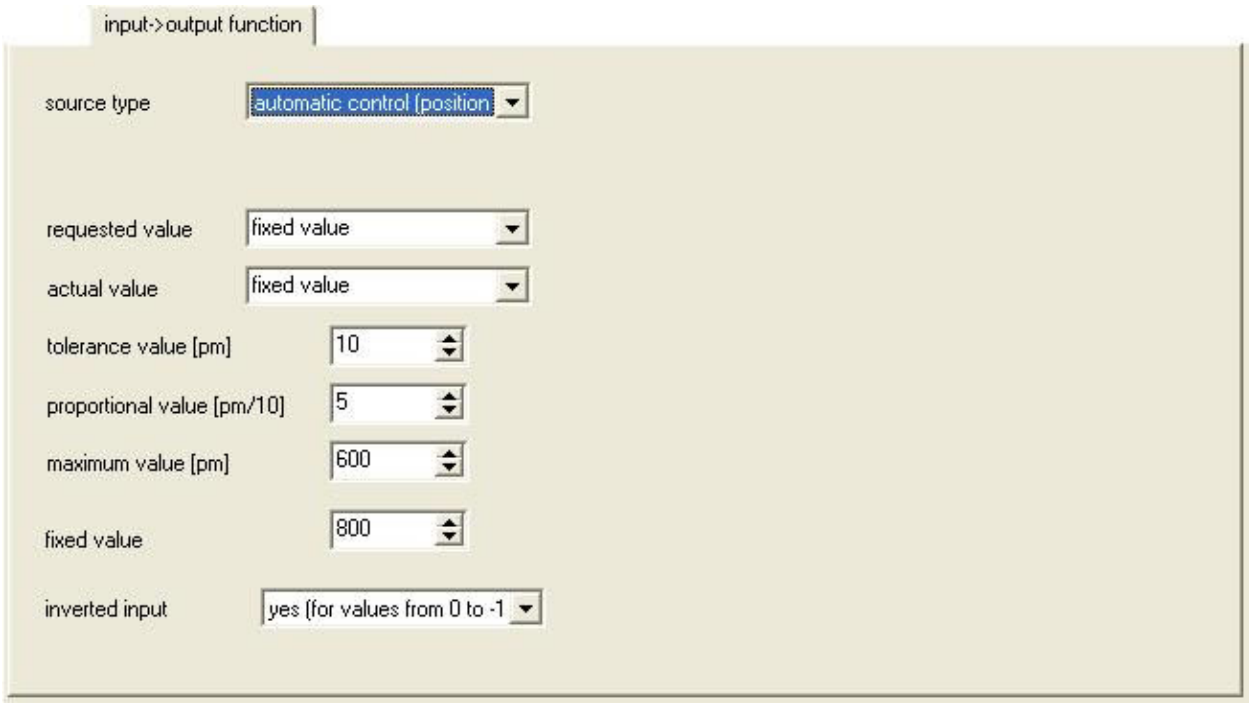


Figure 10: Input -> output function

To configure the channels at first select the **output channel**, which you want to use. This selection appears only when using the “Output/Calculation Channel”-Tab or the “Output Options-Tab”.

Proportional Control

When you like to have a simple **proportional** or **bistable** (on/off) control, select the proportional control in the “**source type**”-combo box.

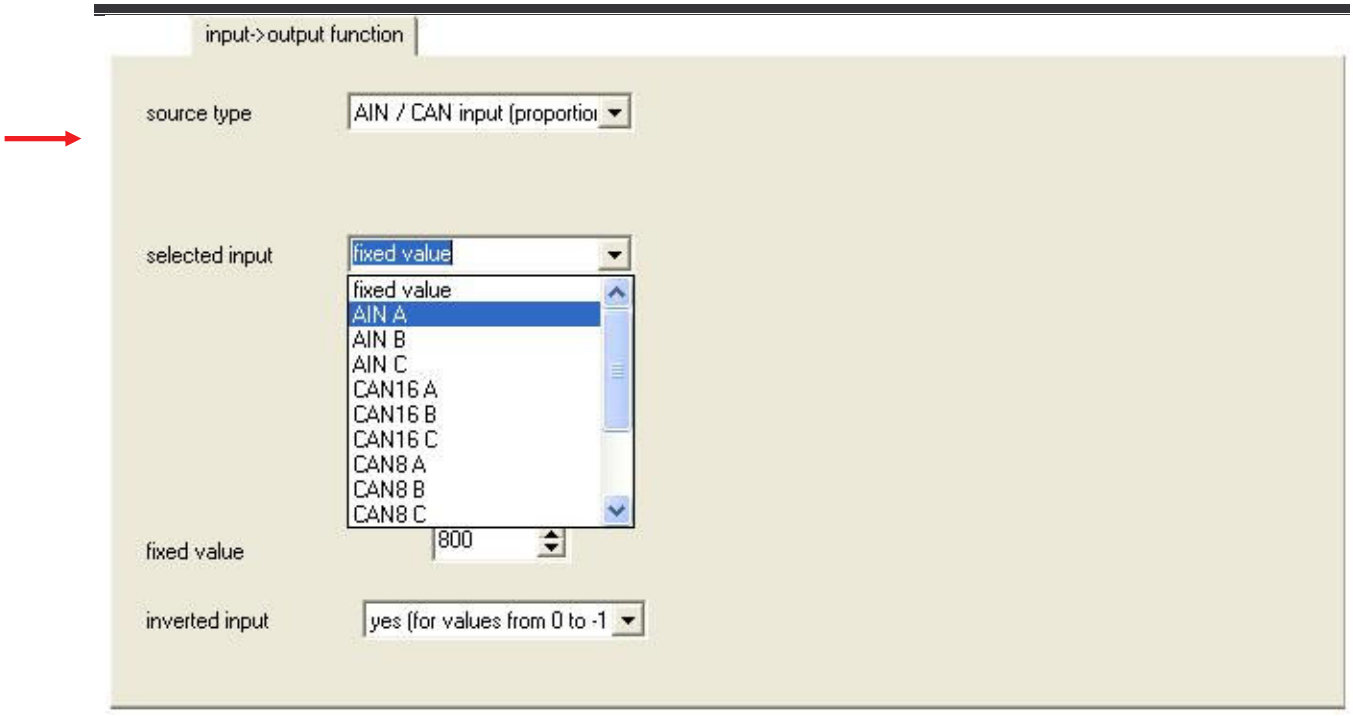


Figure 11: Input -> output function - proportional control

After selecting the source type, select the input source with the "**selected input**"-combo box.
Input sources are:

- fixed value
- AIN A
- AIN B
- AIN C
- CAN16 A
- CAN16 B
- CAN16 C
- CAN8 A
- CAN8 B
- CAN8 C
- Channel A
- Channel B
- Channel C
- Channel D
- Channel E

Pay attention, when using CAN16-items, that they are scaled to the range –1000 to 1000. When you've chosen "fixed value", enter a value in the "**fixed value**" field.

The value of the **selected input** will now be taken over to the output value of the first stage **O1 A/B/C/D/E.**

For example: $O1_A$= AIN A

The values of the channels A,B and C can only be positive (negative values are taken over as zero).

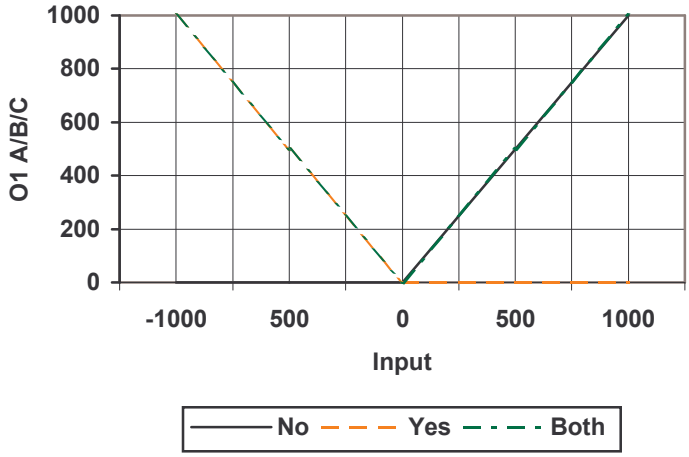
In many cases it is necessary to invert the value (e.g. –569 to 569). This can be done by selecting in the "**inverted input**"-combo box the value "**yes**".

For example: $O1_A$= -1*AIN A

Also it is possible to use the absolute value of the input. So negative values get positive, positive values keep positive. This can be done by selecting in the "**inverted input**"-combo box the value "**both**".

For example: $O1_A$= abs(AIN A)

In the graph below you can see the output O1 for all "**inverted input**"-switches.



effects of the "**inverted input**" switch on the output $O1_{A/B/C}$ in relation to the input value

In this way it is very simple to build a proportional control from different inputs. See an example for proportional controls with three outputs in the DEMOS named "**proportionals.mdp**" and compare the settings for the channels A,B and C. !"§

To get a **bistable control** for your output, you can choose between three ways:

- change the offset and gain setting in the ramp-function (explained in !"§) so that only two states for the final output are possible. Remove also the ramp itself by setting ramp-up and ramp-down to 1000 pm.
- choose a fixed value and use the boolean functions (AND, AND NOT) and select the input source in the boolean expression.
- choose the input source as the **selected input,** use the **linked logic operations** to compare (bigger than, smaller than) this value with the "**compare value**" and use the "OR"-value as the O2-value.

You can find an example for the three bistable control-methods in the DEMOS called "**bistables.mdp**".!"§

A combined example how to use the PWM3-module as a "bow thruster control" for boats is prepared in "**bowthrust_single_simple.mdp**". !"§

Condition stage

With the logic operations you can influence the behaviour of the output channel additionally to the "**input source selection**". There are two stages of operations, which will be applied to O1 one after another.

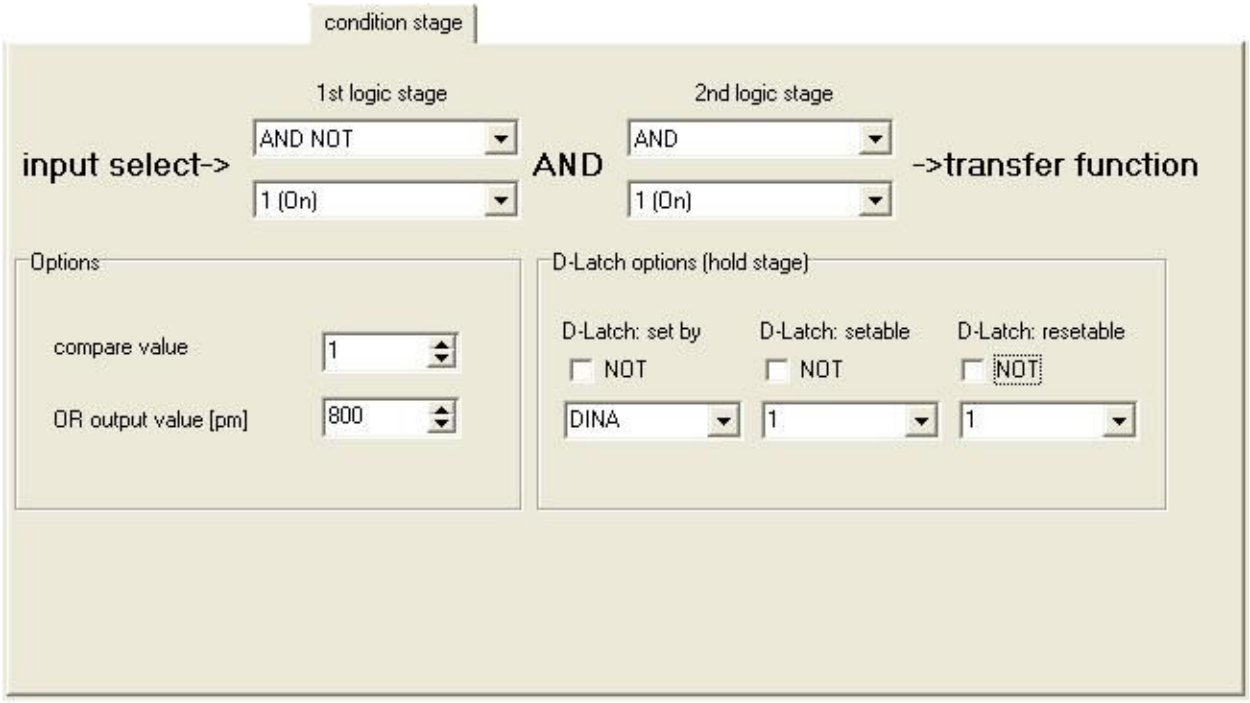


Figure 12: Condition stage

possible logic expressions:

- AND
  - pipes the O1-value to O2 unchanged, when the selected boolean-input is high (not zero)
  - sets the O2-value to zero when the boolean-input is low (zero)
- AND NOT
  - pipes the O1-value to O2 unchanged, when the selected boolean-input is low
  - sets the O2-value to zero when the boolean-input is high
- OR
  - when the selected boolean-input is high, the "**OR-value**" will be assigned to O2. When O1 is bigger than the "**OR-value**", O1 will be assigned to O2.
  - when the selected boolean-input is low, O1 will be assigned to O2.
- OR NOT
  - when the selected boolean-input is low, the "**OR-value**" will be assigned to O2. When O1 is bigger than the "**OR output value [pm]**", O1 will be assigned to O2.
  - when the selected boolean-input is high, O1 will be assigned to O2.
- input bigger than
  - when the value O1 is bigger than the "**compare value**", the "**OR-value**" will be assigned to O2
  - when the value O1 is smaller or equal to the "**compare value**", the O2-value will be set to zero
- input smaller than
  - when the value O1 is smaller than the "**compare value**", the "**OR-value**" will be assigned to O2

- when the value O1 is bigger or equal to the “**compare value**”, the O2-value will be set to zero

example:
For example: you like to have an proportional output signal only when the digital input DIN A is “high” (interlock function).

first: comparing
after that and
possible boolean-inputs :

- 1 (On)
- DIN A
- DIN B
- DIN C
- DIN D
- Can8 A
- Can8 B
- Can8 C
- compare value
- D-Latch
- abs(Out A / compare value)
- abs(Out B / compare value)
- abs(Out C / compare value)
- abs(Out D / compare value)
- abs(Out E / compare value)

D-Latch

example:
On-Off switching with button

abs
example:
- deadzone

delay in combination with ramp

Transfer function

With the transfer function you can adjust the performance between the input values and the output values. You can select between three specified functions, linear- (1:1), square- (quad), exponential (exp) function or you can adjust an own function.

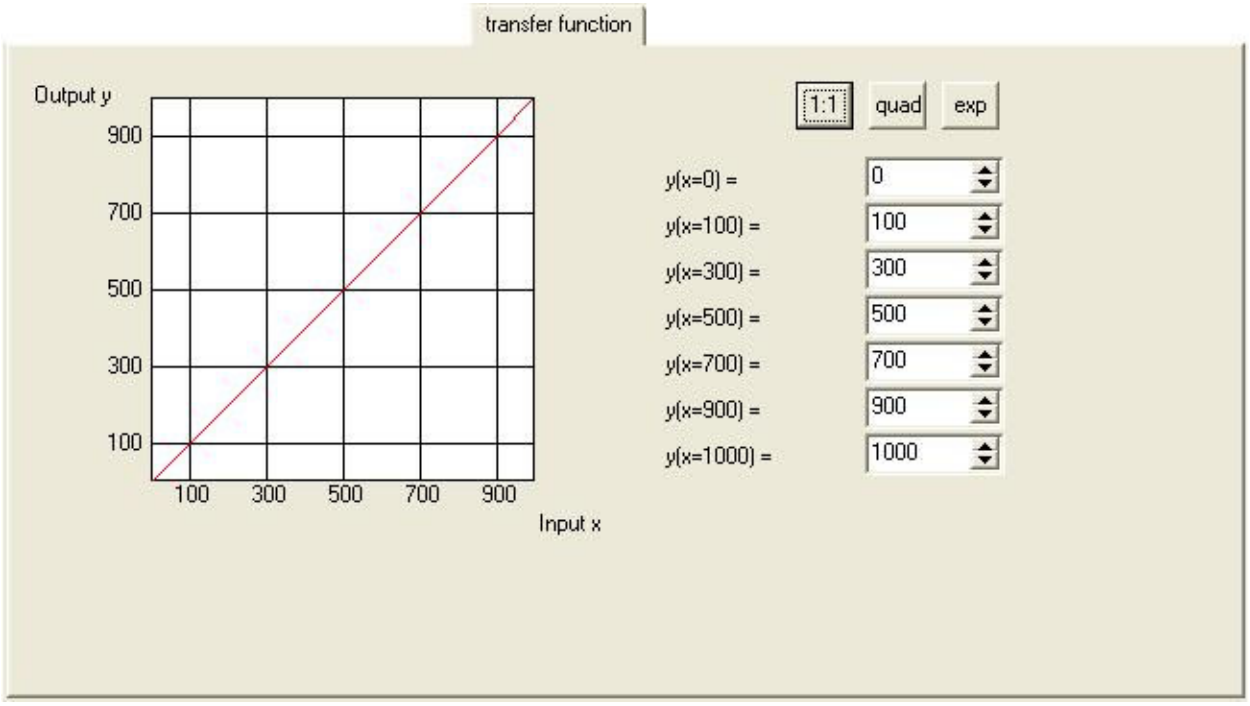


Figure 13: Transfer function

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Current control

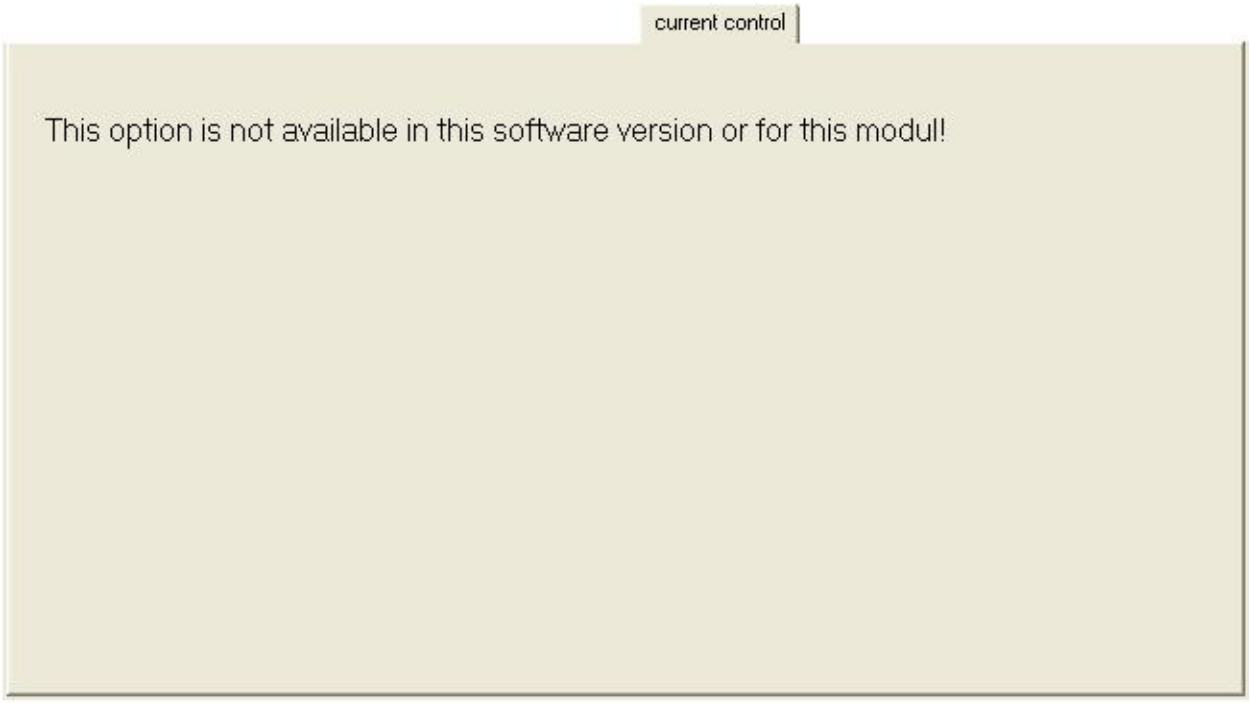

Figure 14: Current control

Ramp stage

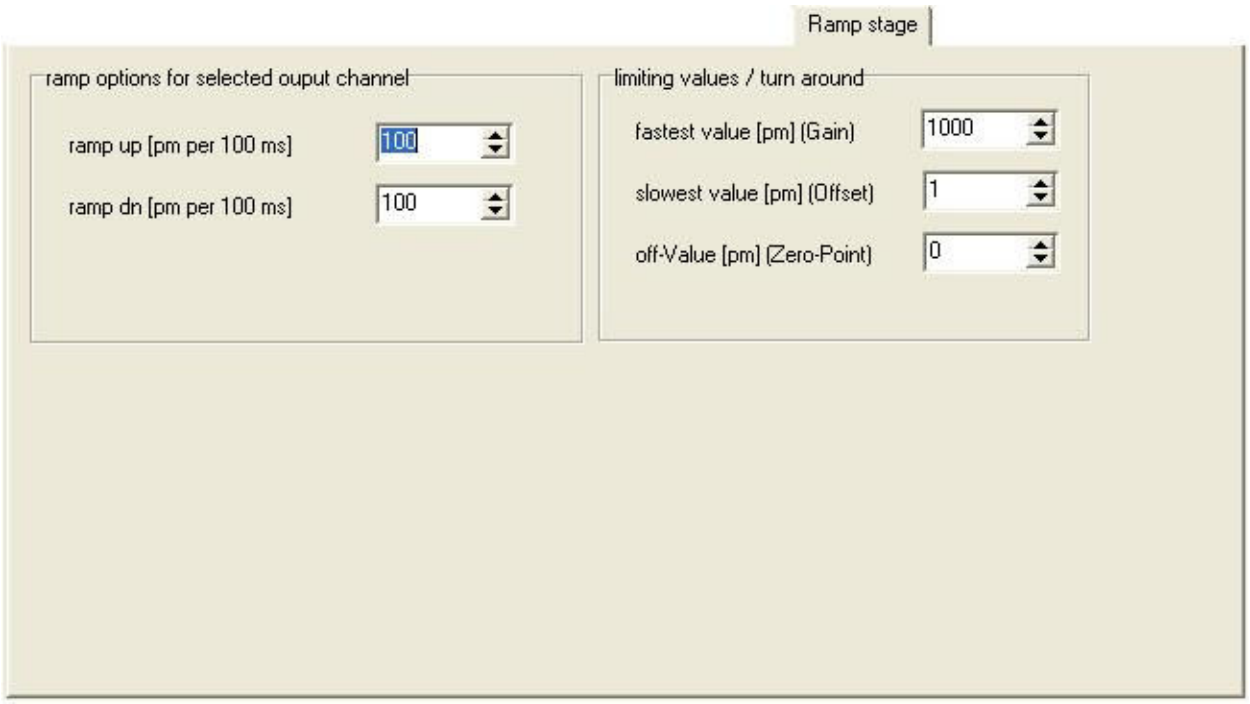

Figure 15: Ramp stage

Outputs

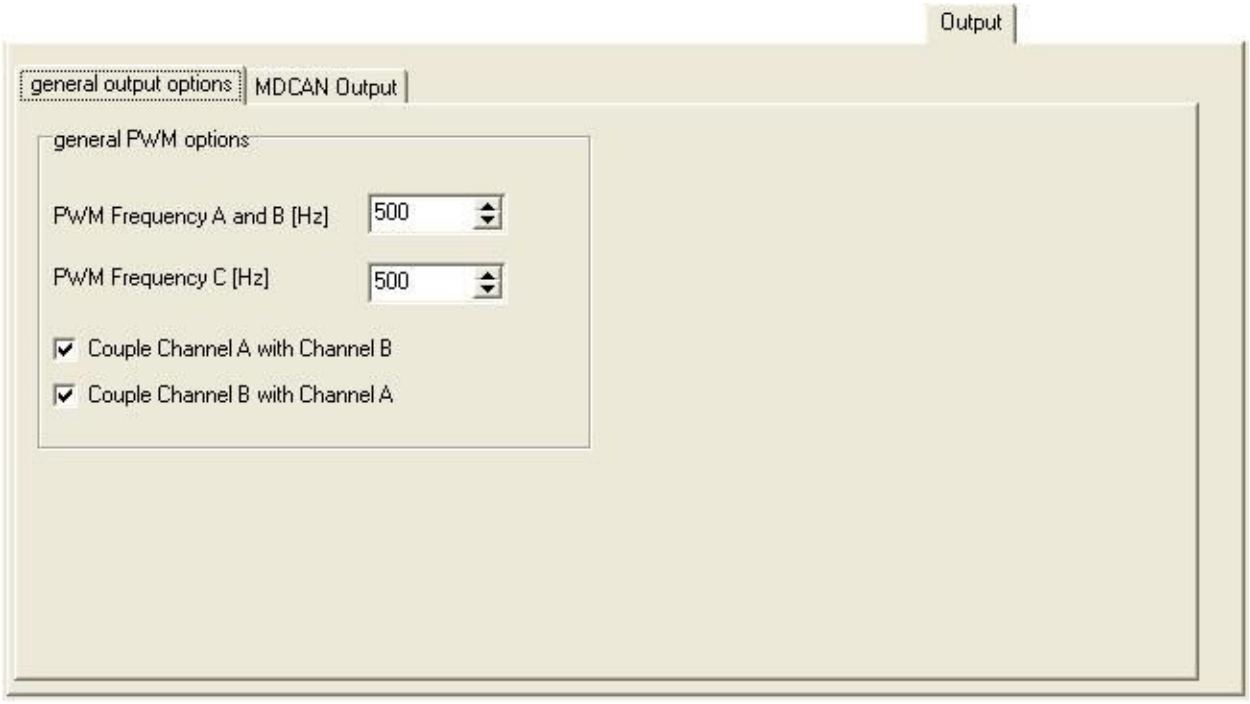

Figure 16: Output - general output options

Monitor

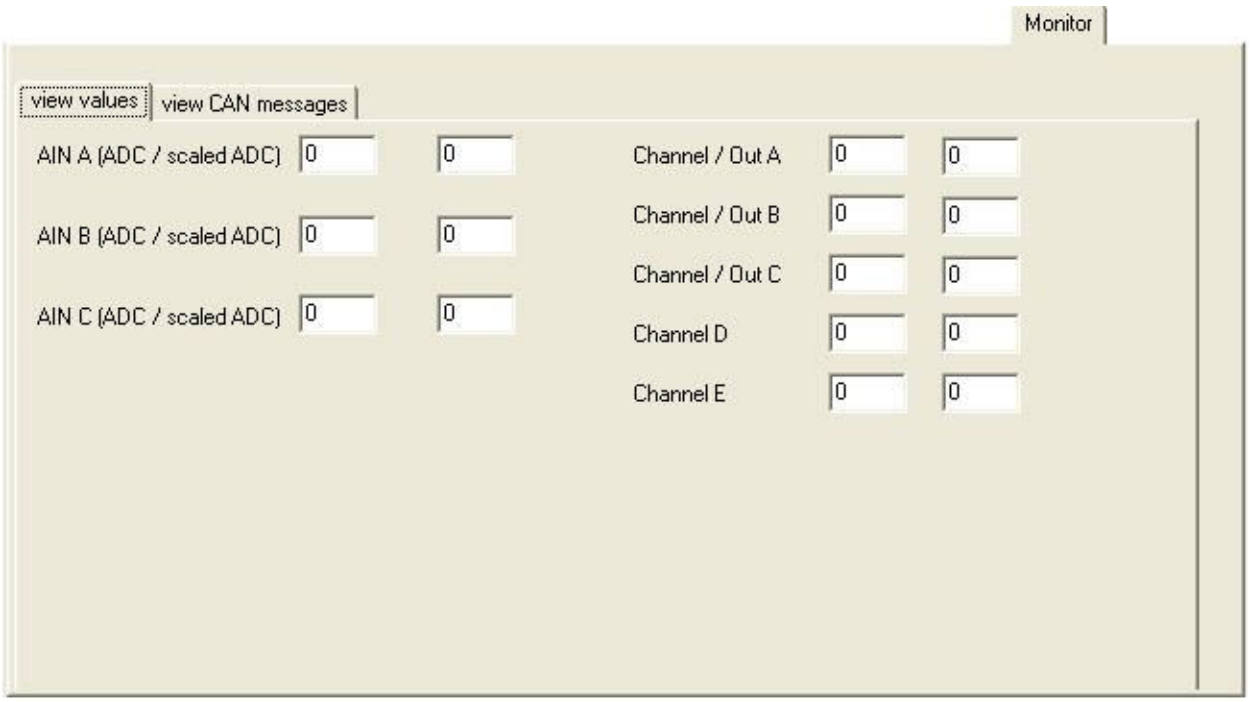

Figure 17: Monitor - view values