isel - PSPCI

User manual for stepper motor control PSPCI Version 3

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About this manual:

The information, technical data and dimensions contained in this print have been up-to-date when published. Any eventually existing misprints and mistakes cannot be excluded however. We are thankful for any suggestion for improvement and indication of mistakes.

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Art.-Nr. 970326 BE852 10/2005

Contents

1 Introduction

1.1   Preamble

*isel*automation has been known for many years for its driving systems and CNC controls with stepper motors. Stepper motors have become globally accepted in the small and medium performance range.

They have practically become irreplaceable for driving systems with medium precision and dynamic requirements. Stepper motor controls usually do not work with closed loops, so expensive sensor- and evaluation units become dispensable. The result is a favourable cost-performance ratio among an easy assembly and initiation.

For many years we have been offering systems basing on stepper motor controls, which have been applied in many areas of production, automation, research and training.
The control PSPCI has been developed to continue this product line. It is a stepper motor control, which was implemented as PCI plug-in card for PCs. It is possible to control up to 4 axes with the help of clock and direction signals.
This manual is to serve as support for initiating the control or machine and explain the most important parameters and adjustments.

2 Description of stepper motor PCI-card *PSPCI*

2.1 System requirements

Supported System Software
- Microsoft Win 2000 Pro, WinXP Home/Pro SP2

Minimum hardware- requirements of control computer

CPU	Pentium 4 or AMD at least 1GHz
RAM	128MB RAM
Graphic/Monitor	Graphics card with resolution 800 x 600 Pixel

Recommended hardware- requirements of control computer

CPU	Pentium 4 or AMD $\geq$ 1,5GHz
RAM	$\geq$ 256 MB RAM
Graphic/Monitor	3D Graphics card with resolution 1024 x 768 Pixel or more

2.2 Assembly of control board in personal computer

For the assembly of the PCI-card PSPCI please follow the following steps:

1 Make sure there is one PCI slot unoccupied on your main board.

2 Remove the PC Casing to be able to reach the fixing screws for the PCI slot plates.

3 Now look for an unoccupied PCI bus slot.

4 Remove the according slot plate of the PCI slot.

5 Now plug the PSPCI stepper motor control into the slot. Make sure the card was plugged in correctly!

6 Fix the card with screws.

7 Close the casing of your PC.

3 Installation of drivers

The PCI card PSPCI will automatically be identified when booting Windows for the first time after the successful assembly of the card. The hardware installation assistant opens up. You will be asked to name the data carrier or the path, where the driver can be found. You will find the necessary driver on the ProNC/Remote installation- CD-Rom. Put a check mark to the option *CD-Rom*. Click on *Next*. The assistant will now automatically search for the driver on the CD-Rom and install it. Should the according driver not be found, you can search it yourself with the help of Windows hardware manager on the CD-Rom.

3.1 Technical Data

Control specific data

Number of axes	4
Inputs	3
Outputs	-
Analog output 0...V	Yes

3.2 Connecting control board to power electronics

A 37pole 1:1 cable is used as connecting cable between stepper motor control card PSPCI and performance electronics. Connect the SubD37 plug with the SubD37 socket of the PCI card. Connect the other end of this cable with the SubD37 socket to the designated plug on the circuit board for the output stages.

Pin	Signal	Pin	Signal
1	Pulse X	20	Pulse Y
2	Pulse Z	21	Pulse A
3	Pulse B	22	Direction X
4	Direction Y	23	Direction Z
5	Direction A	24	Direction B
6	+24VDC	25	+12VDC
7	User output 1	26	User output 2
8	User output 3	27	Output Spindle Start
9	Output Enable output stages	28	-------------------------------
10	GND 24V	29	positive limit switch A
11	Reference switch /negative limit switch A	30	positive limit switch Z
12	Reference switch /negative limit switch Z	31	positive limit switch Y
13	Reference switch /negative limit switch Y	32	positive limit switch X
14	Reference switch /negative limit switch X	33	positive limit switch B
15	Reference switch B	34	Analogue output 0...10V
16	Analogue GND	35	Input Stop button
17	Input Power_ok	36	User input 1
18	User input 2	37	GND 24V
19	Input Start button		

3 Initiation of machines with the adjusting software MtConfig

3.1   Introduction

MtConfig is a program to configure CNC-machines, which are navigated through Mtasc. The program does not depend on any buttons or objects visible on the screen. It configures the setting of machine and start parameters, especially for EdiTasc, ProNc and Remote-applications.

From the main-window of MtConfig you have the following options
- Configure your driver settings of the Mtdrv.ini file
- Configure the startup-variables for Mtasc.dll files stored in the Mtasc.ini file.
- Optimize and check the parameters of a running machine.

While working with MtConfig you can
- display the current <u>coordinates</u>.
- reference the axes.
- display <u>Inputs and Outputs</u>.
- issue motion commands from the editor and display values.

perform <u>manual jogging</u> with your keyboard.

Notice when using MtConfig:
- Start MtConfig only out of a folder which contains the configuration-files and MTasc.dll.
- MtConfig uses MTasc. Never start MtConfig if any running program uses Mtasc.

3.2   Starting the adjusting program

To start the adjusting program *MtConfig.exe*, you have to click on the shortcut in the startmenu after successfully installing and rebooting the computer.

Start → Programs → MtConfig PSPCI → MtConfig PSPCI

You can also start the adjusting program with the shortcut *MtConfig PSPCI* on your desktop.

3.3   The windows of MtConfig

3.3.1   The Main Window

The main window shows on the left
- at the top the toolbar along with driver information
- in the middle the list for choosing parameters and the Input pane for parameters
- at the bottom buttons for referencing and for saving your settings and closing the program

On the right side you will find helpful information related to the parameter or button selected.
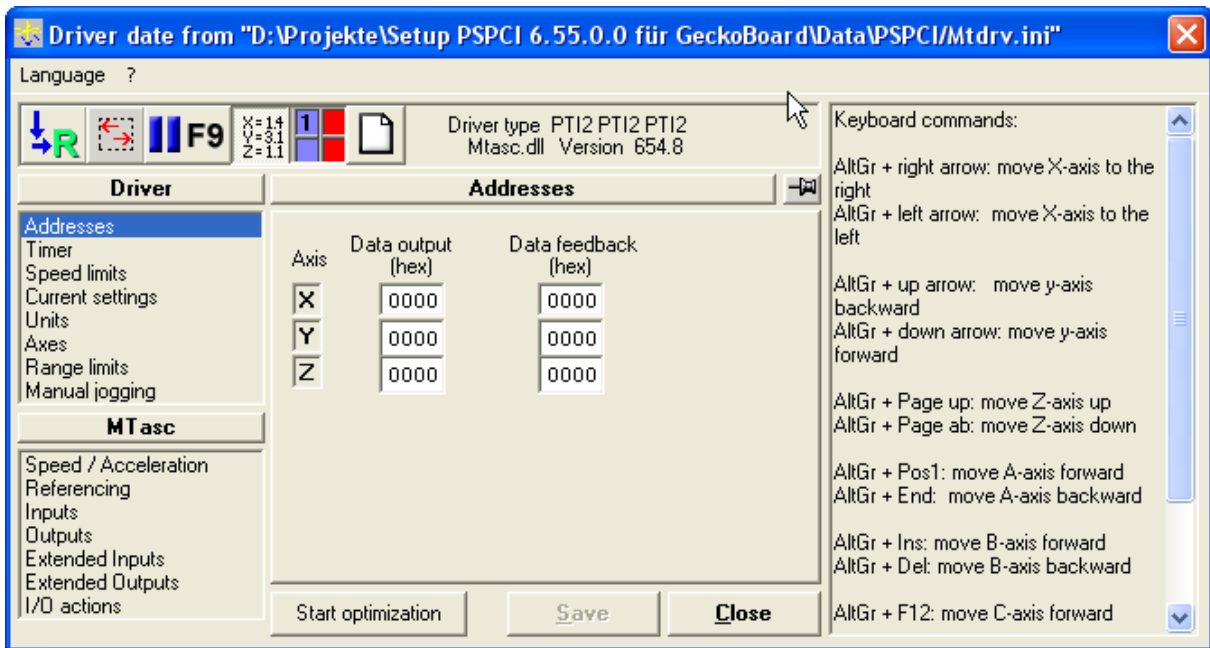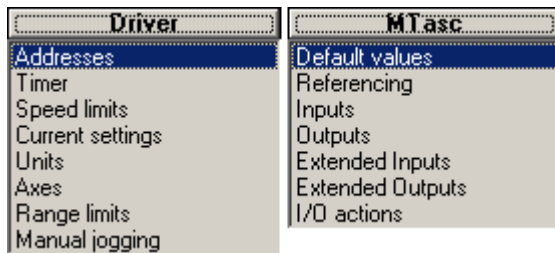

3.3.2   The Toolbar
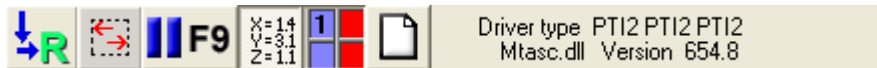
The toolbar shows the following buttons (from left to right):
- referencing of the axis
- enable/disable watching of the range limits
- Stop motion (F9)
- display coordinates
- display inputs and outputs
- open the editor

The text field to the right contains driver information, the version of both the driver and the MTasc.dll file.

3.3.3 Select Parameters

Driver	MTasc
Addresses	Default values
Timer	Referencing
Speed limits	Inputs
Current settings	Outputs
Units	Extended Inputs
Axes	Extended Outputs
Range limits	I/O actions
Manual jogging	

You can choose between parameters of the driver (Mtdrv.ini) and the MTasc-parameter (MTasc.ini).

3.3.4 Save and Close

If you press "Save" all changes will overwrite the original settings. It is not possible to get the original settings back after the new settings have been saved.
By pressing the "Close"-button MtConfig will be closed. You will be prompted for saving the changes if there are any.

3.3.5 The Coordinate Window

The coordinate window shows the current coordinates of the machine. Mtasc is able to manage several coordinate systems ("object coordinates"), which are based on a fixed system of machine coordinates.
If you press Shift+F1 to Shift+F7 you can change between the following displays:

Shift+F1: Display Off
Shift+F2: Object Coordinates
Shift+F3: Machine Coordinates
Shift+F4: Speed
Shift+F5: Increments (Target)
Shift+F6: Increments (Actual)
Shift+F7: Trailing Offset (Incr.)

The shown speed is a digital size.

Axes	_ □ ×
Object Coordinates	
X =	0.000
Y =	0.000
Z =	0.000
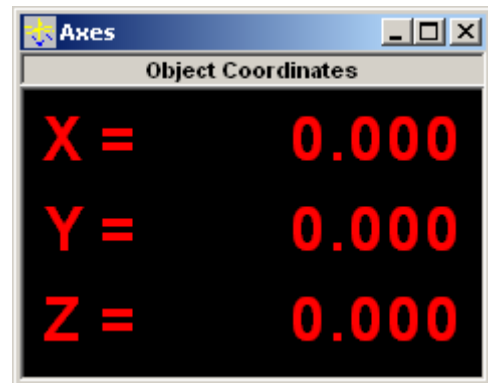
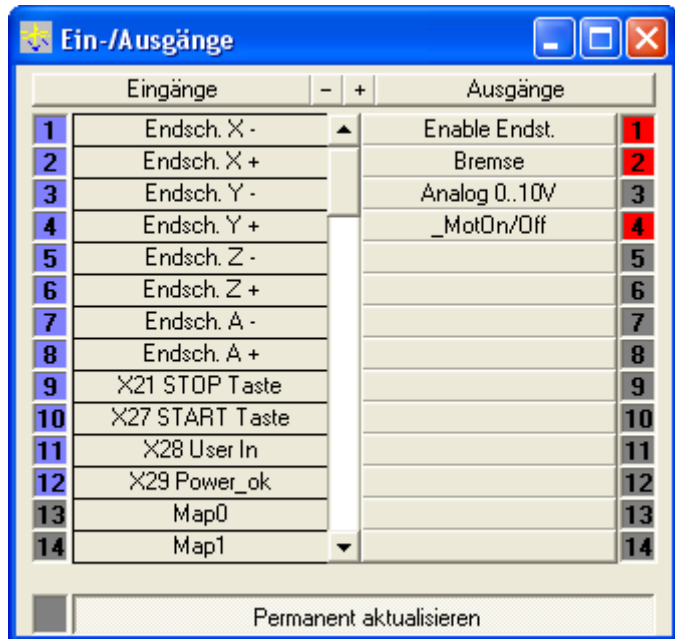### 3.3.6 Inputs/Outputs

This window shows the state of all Inputs and Outputs defined by the descriptors _InpDsc (inputs) and _OutDsc (outputs).

The number of Input/Output lines may be changed with the "+" and "-" buttons respectively. More lines can be shown using the scrollbar.

The button "Refresh continuously" switches the continuous updating of the values on or off.
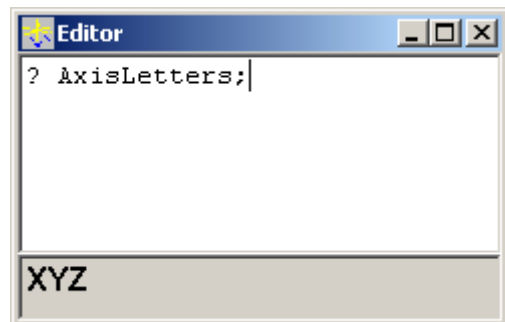
3.3.7 The Editor

The editor is used to send commands to the MTasc-interpreter. This makes it possible to test moving instructions and to display or change the parameter settings of the machine.

If you press Strg+Enter the following part of the input will be executed:
- the highlighted text, if there is any.
- the line where the keyboard cursor is located if there is no highlighted text.

The example on the right shows the input "? AxisLetters;" which is not highlighted. Strg+Enter will therefore execute the whole line and show the result - XYZ - on the bottom of the Editor.

3.3.8 Error-Status

If an errors occurs which is related to one axis the error status will be displayed in a separate window.
The error-type will be shown along with the axis on which the error occurred.
In the example the machine moved too far in negative x-direction. In this case the machine will have to be moved manually in positive x-direction. It might be necessary to reset the machine by pressing F9.
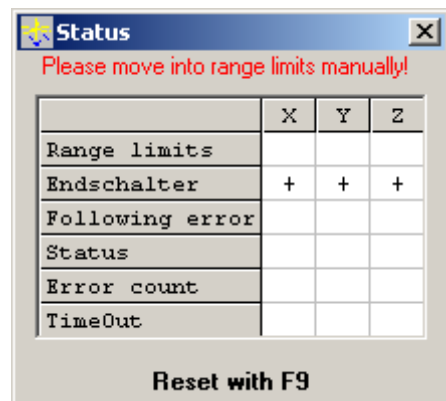
Error	Description
Range limit	The machine has moved beyond the range limit. More details see MTASC-Function **MLIMIT** in MTasc help file).
Limit switch	The machine has moved into a hardware limit switch in one or more axis. The corrosponding hardware limit switch (+,-) will be shown in the list.
Following error	The difference between desired and current position of at least one axis has exceeded some internal limit.
TimeOut	Depends on the type of the controller. Only when communicating with intelligent circuit boards.

In these cases the machine will stop immediately.
Error while using Programs (for Ex. Syntax error) will be shown in a separate window along with name and path of the file and the line in which the error occurred.

3.4   Notes

3.4.1   Referencing

When referencing the axes (in order Z, X, Y, A, B) will be moved towards one end to find the appropriate zero position.
Before referencing the following values have to be assigned:
- The output addresses for the axes
- The moving direction of the axes (axes)
- The direction used to reference (reference run)
- The functionality of the reference switch

To check if the settings are correct use manual jogging.

3.4.2   Manual Jogging

To move the machine manually use the keyboard combinations Strg+Alt+Arrow or AltGr+Arrow:

Alt + Ctrl + right arrow:	X- axis right
Alt + Ctrl + left arrow:	X- axis left
Alt + Ctrl + up arrow:	Y- axis backward
Alt + Ctrl + down arrow:	Y- axis forward
Alt + Ctrl + page up:	Z- axis up
Alt + Ctrl + page down:	Z- axis down
Alt + Ctrl + Pos1:	A- axis plus
Alt + Ctrl + End:	A- axis minus

3.5   Adjusting Parameters

For the adjustment of parameters, there is a destinction between **driver-parameters** and **Mtasc parameters.** These parameters will be explained in the following subchapters.

3.5.1   Driver Parameters

3.5.1.1   *Addresses*

The address-pane offers for each axis a field to insert a "Data-output" address and to get a "Data-feedback". Not each PC-card supports data feedback.

There should be "0000" in every field.

3.5.1.2   *Timer*

The control cycle frequency indicates how often the real-time loop is called per second. At the same rate the position of the machine is calculated.

The background frequency is used for example to configure the cycle speed of the stepper motors. The frequency must be much higher than the control cycle frequency. If a driver is in use which does not need a background frequency, enter 0.

"Delay" inserts extreme short delays into the background loop. The number entered in this field is a loop counter, the generated delay depends on the hardware.

> **The pre-adjusted value for the cycle frequency is 1000 Hz, the value for the base frequency is 100000 Hz using a step precision of a tenth step. These values should not be changed.**

Speed limits

Speed limits limit the requests which are sent to the driver by MTasc. When a request exceeds the limit, the request will be decreased accordingly. If watching of following errors is enabled all axes will be stopped when the should/is-difference is reached by at least one axis. If an axis is blocked, the other axes only move with disabled should/is-difference supervision.

The first input (X-axis) of maximum acceleration takes affect on all further axis. Other inputs for residual axis will be ignored!

The values in the figure can be used for machines with **ball screw spindles (pitch 4, 5, 10 mm).**
For **belt drive slides** (e. g. perimeter of belt pulley is 70mm and gear 2:1) **speed values** of **800 mm/sec** and **accelerations of 2000-3000 mm/sec^2** can be put in here.

The pre-adjusted value for **"Actuate Trailing Error "** is **12100**. The value for **"Speed"** is **12000**. The value for **"Speed Jump"** is **4000**.

❗ **These values should not be changed in any case!**

3.5.1.3 *Current settings*

These adjustments are not of interest for this control board. They are only mentioned for the sake of completeness.

3.5.1.4   *Units*

Here you can configure the units in which the speed and acceleration will be measured in. There are predefined unit pairs such as "mm and seconds", "cm and seconds" and "m and minutes". You can also define your own unit by pressing "user defined".
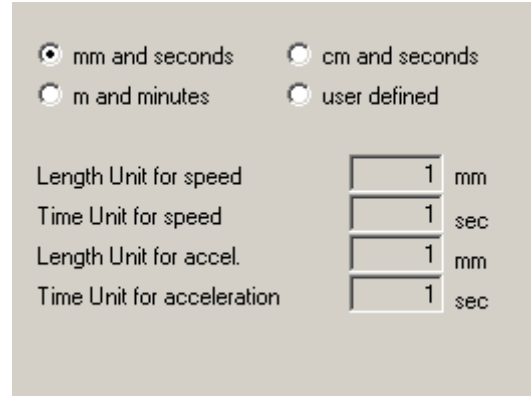
The figure on the right shows the standard adjustment of area boundaries after the installation of the driver software.

Enter the travel areas of the according axis into the according fields. You can either **experimentally ascertain** the **values** by **manual operation** or **use the traverse paths** of the **data sheet**, enclosed to the machine.

3.5.1.5   *Axes*

Here you can select the number of axes you want to use.

For each axis you indicate
- The axis letter
- Whether the axis is enabled or not.
- Alignment. The leading sign of "Move" indicates, in which direction the axis is to move with increasing increments. These leading signs should be adjusted thusly that each axis moves in manual jogging in the direction, you expect due to the keyboard-input
- The type of the axis; L/R: linear- or rotary axis
- Calibration. Indicate the distance one axis moves per increment. You can put in this value directly or click on "Formula". You will then see an input window, in which you have the opportunity to put in axis parameters.
- The reversal clearance correction is the number of increments, that has to be added to the calculated reference value so the axis is on the expected position. To ascertain the reversal clearance correction put in the value 0 and let the axis alternately go in both directions for x increments. The value, at which the axis does not yet move, is the double reversal clearance correction
- The number of axes.
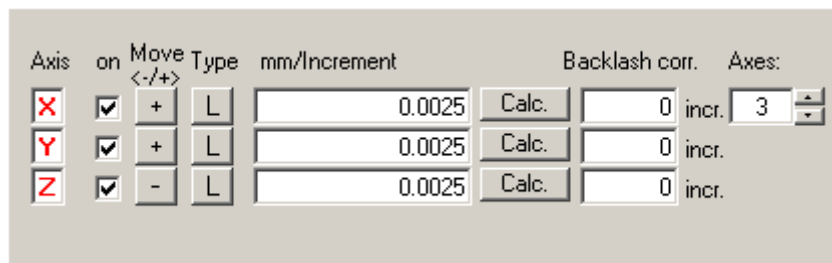
By clicking on the button „Calc" of the individual axis, you see a window in which you can configure the axis. There is a distinction between linear- and rotary axes.

Linear axes

You have to indicate the following parameters:
- pitch. You can find it on the enclosed data sheet or the label plate of the machine.
- steps per revolution. This value indicates the number of steps per revolution of the stepper motor. The most common stepper motors make 200 full steps per revolution and have a step angle of 1,8°.
- The factor for the resolution in increments/ full steps complies with the adjustment of the step resolution of the used output stage. This factor can be changed by using the pull-down menu. The standard adjustment is tenth step. **Keep this adjustment!**
- Transmission or reduction ratio. These values have to be indicated if a gear is used. The transmission/ reduction ratio is indicated through:

revolutions / output end (roe) : revolutions / motor end (rme)

Confirm the adjustments with "OK".

Rotary-/Tilting axes

You have to indicate the following parameters:
- pitch. For tilting axes the adjustment value has to be 360°.
- steps per revolution. This value indicates the number of steps per revolution of the stepper motor. The most common stepper motors make 200 full steps per revolution and have a step angle of 1,8°.
- The factor for the resolution in increments/ full steps complies with the adjustment of the step resolution of the used output stage. This factor can be changed by using the pull-down menu. The standard adjustment is tenth step. **Keep this adjustment!**
- Transmission or reduction ratio. These values have to be indicated if a gear is used. The transmission/ reduction ratio is indicated through:

revolutions / output end (roe) : revolutions / motor end (rme)

Confirm the adjustments with "OK".

3.5.1.6 *Range Limits*

The range limits define the space in which
the machine is allowed to move. All values
have to be machine coordinates.
By pressing "Set" the current position of the
machine will be used as range limit.
The supervision of the range limit will be
deactivated while referencing. It is possible to activate/ deactivate it for each individual axis
by mark the check boxes on the right.
If the range limit watching is activated and the machine crosses the border it will stop moving
immediately and report the error in the error-status window. The machine has to be moved in
a permitted area to continue.

3.5.1.7 *Manual Moving*

On this pane you can set up all needed
values for manual moving.

"minimum distance" describes the distance
the axis will move by pressing a key once.
"V max" sets the maximum speed the axis
should be able to reach.

If you press a key more than once in a short time, the speed will increase in 20 steps until it
reaches V max.

3.5.2 Mtasc-Parameters

3.5.2.1 *Feed Rate / Ramps*

On this pane you can set the speed and acceleration which will be loaded when the program starts.

The values can be changed, if needed, while MTasc is running through programs or MTasc-commands.

Milling speed	100.0	mm/sec
Rapid speed	100.0	mm/sec
Submerging speed	100.0	mm/sec
Milling accel.	500.0	mm/sec²
Rapid accel.	500.0	mm/sec²
Sumerging accel.	500.0	mm/sec²
Angle tolerance	16	º

The "Angle tolerance" indicates until which angle the machine should work as if it were a straight line. That means that until this angle no ramps will be calculated.

3.5.2.2 *Referencing*

On this pane you indicate the number of axes.

For each axis you have to indicate:
- The axis label.
- The direction of referencing.
- The distance between the referencing point and the „zero point" of the axis.
- Whether referencing takes place or not.
- The number of the input for the reference switch.
- The referencing speed. "fast" is the speed to approach the reference switch. With "slow" the axis is moved off the switch while referencing takes place.

For all axes you can select
- The sequence of the axes in which referencing takes place. To change this sequence, highlight one of the axis letters and move it with the arrow keys to the right or to the left.

The „Test"-button start the referencing for one axis.

3.5.2.3 *Inputs and Outputs*

Fixed predefined inputs and outputs can be configured in this frame. In each case one byte will be addressed. Please enter the hexadecimal offset of the basis-address in the address-field.
The mask allows the selection of the bits which should be used for input and if they should be inverted (-) or not (+). Click on the space above the diode to change the bits.

The inputs will only be read if ">" is selected. Each change of the output state will be written immediately to the corresponding address. The gained values can be re-imported through appropriate outputs by selecting ">".

The LED shows the status of the bits read:
- Deselected: grey
- Input bit "1":   red
- Input bit "0":   blue
- Non inverted bits ("+") are shown normally.
- Inverted bits ("-") are shown in an inverted mode.
- Deselected bits (" ") are shown with shadowed colours.

Inputs

The PCI card inputs are already pre-adjusted. The inputs no. 1 – 8 serve the evaluation of the *hardware limit switches*.

The classification of the limit switches must not be changed!

The inputs no. 9-11 are *user inputs*. Using these inputs it is possible to connect peripheral devices, e. g. length callipers, pressure monitors etc. to the circuit board.

These user inputs have already been pre-configured for certain peripheral devices. Depending on the machine type the according inputs are either assigned or not.

Standard Assignment:

No. 9   ... Stop button of operating unit.
No. 10 ... Start button of operating unit
No. 11 ... free user input

Before connecting new peripheral devices, please check whether the according input isn't already assigned.

Input No. 12 serves as *Power_ok s*ignal of the safety circuit module. It should not be changed under any circumstances because it is being scanned periodically by the control to evaluate a case of Emergency Stop. If there is no safety circuit module used, this input has to be connected with +24VDC.

The indicated mode MMAP of inputs no. 1-12 is the so-called Memory-MAP mode. This means that the inputs are not read directly through the hardware but through the two MAP ports. Within these MAP ports the accordingly set "-" above the LED affects the bit which is to be switched.

Ports no. 13 and 14 are the so-called Memory- MAP ports. They each define an 8-bit port with the physical addresses 0x00B0h and 0x00C0h.
The indicated mode PTI2 is the device type for the PSPCI card. You can find the description of the assignment of the inputs with MMAP mode to the Memory-Map ports on tab I/O – activities.

The following chart shows the standard configuration of the inputs with information about port numbers, addresses and bit numbers.

Map-Port	Eing.-Nr.	Typ	Adresse	Bit-Maske		Bit-Nr.	Funktion
0	1	MMAP	virtuell	0x01		0	Limit Switch X -
	2	MMAP	virtuell	0x02		1	Limit Switch X +
	3	MMAP	virtuell	0x04		2	Limit Switch Y -
	4	MMAP	virtuell	0x08		3	Limit Switch Y+
	5	MMAP	virtuell	0x10		4	Limit Switch Z -
	6	MMAP	virtuell	0x20		5	Limit Switch Z +
	7	MMAP	virtuell	0x40		6	Limit Switch A -
	8	MMAP	virtuell	0x80		7	Limit Switch A +
1	9	MMAP	virtuell	0x01		8	Input Stop switch
	10	MMAP	virtuell	0x02		9	Input Start switch
	11	MMAP	virtuell	0x04		10	User Input
	12	MMAP	virtuell	0x08		14	Input Power_ok
	13	PTI2	0x00B0	0xFF		0 - 7	Map-Port 0
	14	PTI2	0x00C0	0xFF		8 - 12	Map-Port 1

Changes should only be made regarding the description of the user inputs. Changes of addresses and bits can result a faultily behaviour of the control.
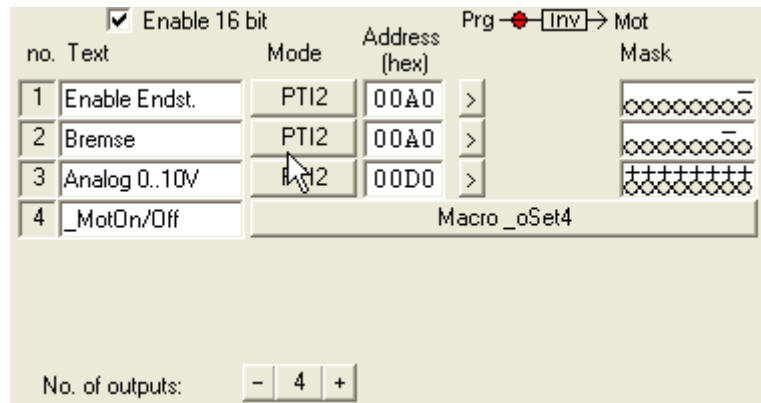
Outputs

Version 3 of the PSPCI card has no user outputs. User outputs must be realized with an external I/O Modul.

Output no. 1 and 2 are automatically set by the PCI-card. They serve to release the brake of the axes (if existing) and to "Enable" the power of the amplifiers.

Output no. 4 is a virtual output, which used by the Mtasc driver. It serves the controlled operation of the physical outputs Nor. 1, 2.

Output no. 3 defines the output descriptor for the analoque output port of the PSPCI card. The software integration of the analoque port takes place with the involvement of the IO modul DLL "IoMtasc.dll".

The following chart shows the standard configuration of the outputs with information about port numbers, addresses and bit numbers.

Nr.	Typ	Adresse	Bit-Maske	Inv. Bit-Maske	Funktion
1	PTI2	00A0h	0x01	0x00	Output Enable amplifiers
2	PTI2	00A0h	0x02	0x00	Output Brake
3	PTI2	00D0h	0xFF	0x00	Analogue output 0..10V (Port)
4	PTI1	0020h	------------------	----	_ MotOn/Off (virtual output)

> **Changes should only be made regarding the description of the user ouputs. Changes of addresses and bits can result faultily behaviour of the control.**

3.5.2.4 *Extended Inputs / Outputs*

Extended Inputs

The expanded inputs serve the transfer of the user inputs, adjusted in MtConfig to ProNC/ Remote. Eight inputs comply here with an extended input (input port). The following information has to be indicated:

- Type. Here has to be indicated MMAP as type of control. This can be chosen by clicking on the input field.
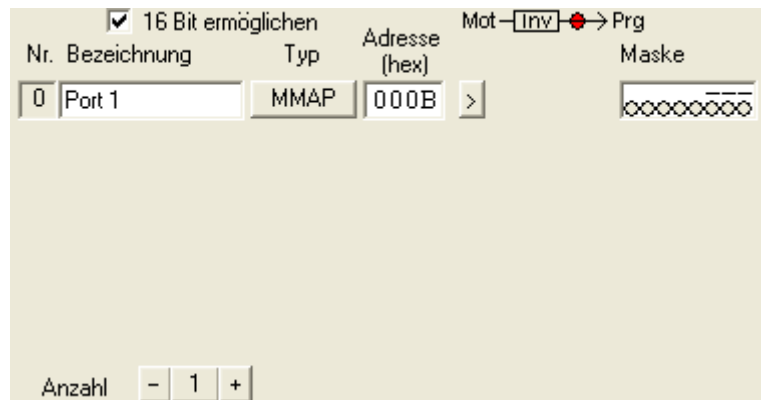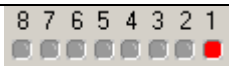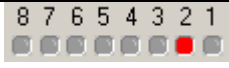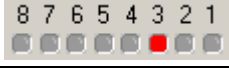
- Address of ports. In this case the adress is MAP-port adress.(Map 1).
- With the mask you can indicate which bits will be used for the input and whether the bits should be inverted (-) or not (+). The inputs will only be read if ">" is activated. Each change of the initial state is immediately written to the complying address.
- The number of expanded inputs can be chosen between 0 and 6 and is saved in the file Mtasc.ini under the key "n=". If "n=-1" is written in the according section of Mtasc.ini, the expanded inputs are not displayed.

The light emitting diodes indicate the condition of the imported bit string.

- Not imported: grey
- Input "1":   red
- Input "0":   blue
- Directly imported bits ("+") are displayed normally.
- Inverted bits ("-") are displayed inverted.
- Faded out bits (" ") are displayed as un-logged.

The following chart shows the pre-adjusted configuration of the expanded inputs.

Port No. 1 with address 00C0h, Map-Port 1 (Map1) with device type PTI2

Bit / Addr.	Application	Logical Port	Plug
1 / 0x01h	Input Stop button	I1.1 8 7 6 5 4 3 2 1	X21
2 / 0x02h	Input Start button	I2.2 8 7 6 5 4 3 2 1	X27
3 / 0x04h	User Input	I2.3 8 7 6 5 4 3 2 1	X28
6 / 0x20h	Input Power_ok	----------------------------	X29

Mask of both ports

Port No.	Type	Adress	Bit-Mask	Map-Port
1	PTI2	000Bh	0x07 ooooo■■■	1 (Map1)

The mask of the expanded inpu serve the signalling of the conditions in ProNC/ Remote. The extended input are displayed as a super-imposed bit string within the I/O direct access window. Only those inputs are displayed correctly which have been marked (provided with + or -) with the mask of the extended input.

Changes should not be made here!

Extended Output

In version 3 of the PSPCI you don't have to configure a extended output port because no outputs are available.

3.5.2.5 *I/O- Actions*

Please read the following descriptions thoroughly. A change of the parameters can result in a dysfunction of the PSPCI card and thus your machine.

You should not change the pre-adjusted values!!!!

In I/O-activities you can define and adjust the monitoring of hardware limit switches.
In other words, the assignment of the physical input addresses of the card to the „virtual" inputs, which signal the condition of the limit switch if taking place here.

To every MAP-Port there is a fixed index, a start bit and a number of bits assigned. In this case the MAP ports with the physical addresses 0x00B0h and 0x00C0h (no.1 AdrB0 no.2 Adr.C0) are defined with the input descriptors no. 13 and 14. The inputs

defined on these MAP ports reflect the current condition of the physical inputs of the PSPCI card. The six check boxes serve the configuration of the cache, writing and reading direction. Only the first check box on the left is of interest. By checking the box the MAP port is activated.

The entries from no. 3 to no. 10 define the actual assignment of the physical inputs to the MAP-Ports. For each limit switch (limit switch -, limit switch +) the input descriptor no., descriptor bit no., map index, map bit no. and the number of bits to be operated have to be indicated here. The configuration has already been adjusted for five axes. You should not change the values. Only the first check box on the left with the complying entry is of interest.

By deactivating the check boxes of no. 3 – 10 you can deactivate the monitoring of the hardware limit switches.

In this configuration the two hardware limit switches of the y-axis are deactivated for example.


limit switch Y- and Y+ deactivated

3.6   Configuration of axis direction

In this chapter the configuration of the X-, Y- and Z axis direction will be explained. Due to the different constructions and arrangements of the axis on machines and systems, the standard adjustments for the axis direction have to be changed.

As a basic principle two different types of machines have to be distinguished:

➢ **Gantry units (e. g. EuroMod P Series)**

The machine table (Y axis) carries the clamping plate for the work piece. It moves in positive Y direction from the tool tip when moving towards the operator.
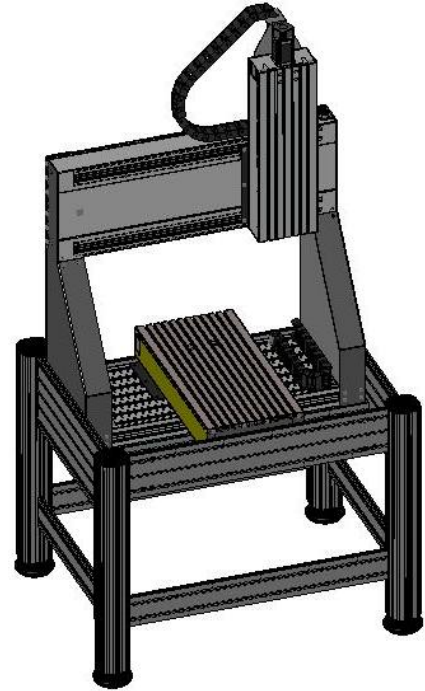
➢ **Flatbed units (e.g. EuroMod F Series, FlatCom Series, OverHead Series)**

The clamping area for the work piece is solidly fixed on the machine frame. A Y-movement of the tool in positive direction (+Y) goes away from the operator.
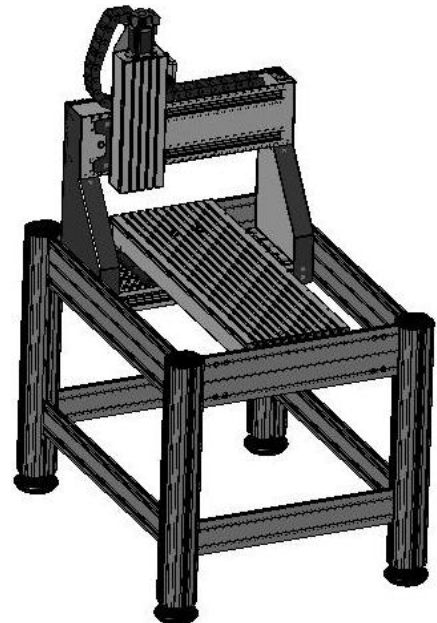
For both types the axis direction has to be considered regarding the tool tip, so the coordinate system adds up to a „right-system". (right-hand-rule).

Assignment of axis directions

The assignment of the moving axes regarding the operating position is:

➢ For flatbed units
  - X-axis = transverse axis (+X to the right; -X to the left)
  - Y-axis = longitudinal axis (+Y away from operator; -Y towards operator)
  - Z-axis = lifting axis (+Z upward; -Z downward)

➢ For gantry units
  - X-axis = transverse axis (+X to the right; -X to the left)
  - Y-axis = longitudinal axis (-Y away from operator; +Y towards operator)
  - Z-axis = lifting axis (+Z upward; -Z downward)

The procedure to initiate the axis is explained in the subchapters of each machine type.

3.6.1   Starting point

- **Please check all adjustments of drivers and Mtasc parameters of the previous chapters.**

- **Check if the ports on the circuit board are correctly:**
  - ✓ Are the motor cables plugged in correctly?
  - ✓ Are the signal cables for limit switches and brake plugged in correctly?
  - ✓ Are the signal cables of the SK module plugged in correctly?
  - ✓ Are the inputs and outputs connected according to the standard assignment?

- **Check the power supply of limit switches and circuit boards:**
  - ✓ Do the LED of the output stages glow?
  - ✓ Is the power button pushed?

Please use the delivered documentation of your machine to do the inspection. (circuit diagram, manual etc.)

3.6.2   Adjusting the axis- and reference directions of gantry units

Follow the instructions for the initiation of the individual axes.

3.6.2.1   *X-Axis*

1) Click on the button **„I/O – Actions"** in MtConfig. Deactivate the hardware limit switch of the X axis by removing the check in the first check box of the left. (also see chapter: 3.5.2.5 I/O- Actions)

2) Now move to the field „Axes" within the driver parameters. Check the alignment by manually moving the X axis. Therefore use the short cut **Alt + Ctrl + left arrow** and **Alt + Ctrl + right arrow**

The following picture shows the correct axis alignment.
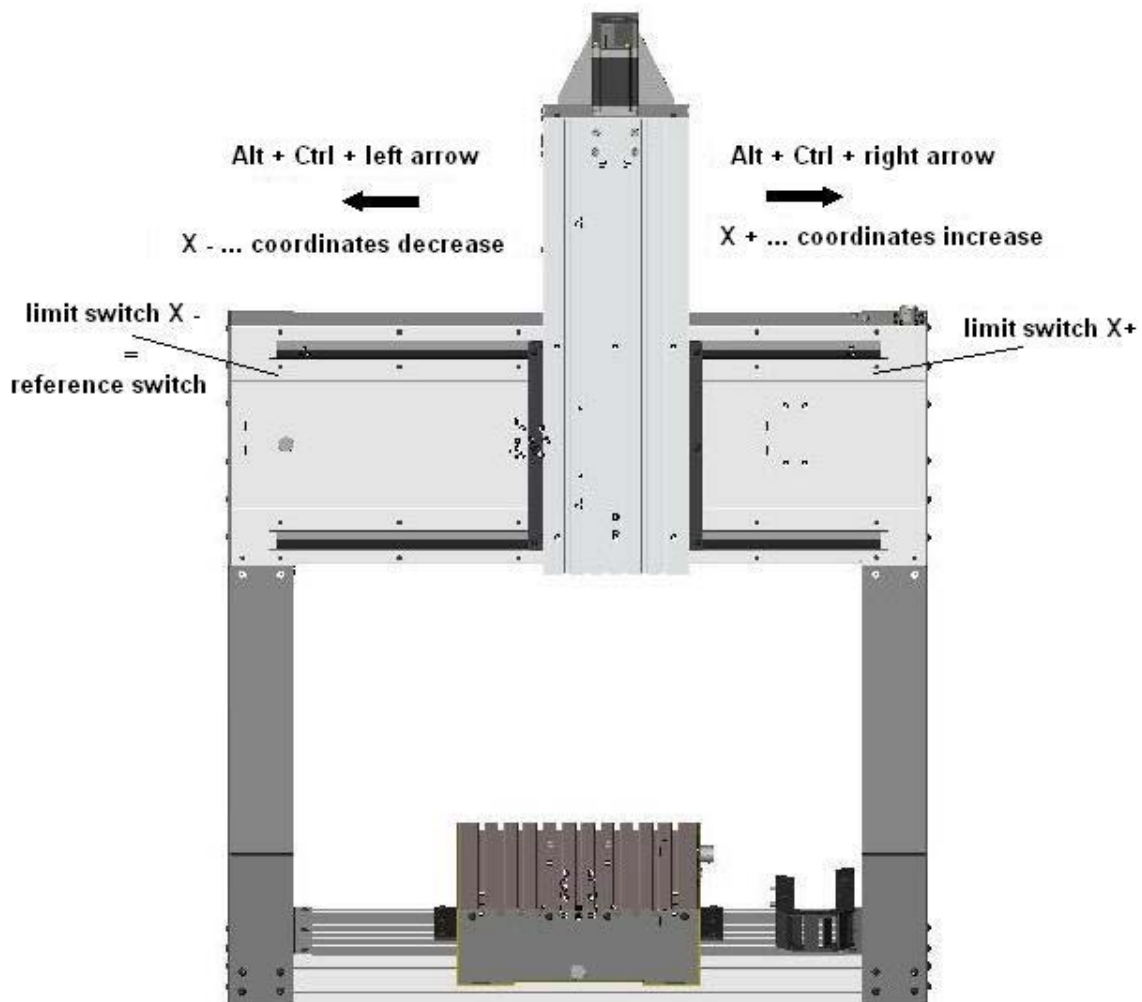
In case the X axis does not move as shown in the picture, please change the direction of the axis by pushing the button for the direction of the axis.

Click the button "Save" in the main window of MtConfig to save the new adjustments. Check the alignment again.

Now the referencing direction of the axis has to be adjusted. **Make sure the axis is not in a limit switch position.** To do this you have to go to the adjusting field "referencing". The hardware limit switches of each axis are fixed and should not be changed by means of the configuration program.
Please take a look at the window for the inputs and outputs. The first two entries are:

Both limit switches are plugged in correctly if the left LED next to the entry is blue in inactive condition.

3) Move the X-axis by pushing **Alt + Ctrl + left arrow slowly** to the **left** in the direction of the **limit switch. -**. While moving, watch the display of the inputs, in particular **input no. 1 limit switch X -**.**Now** move **until** the **blue LED** for **limit switch X- goes out**.

   Should this not be the case and the LED for limit switch X+ goes out instead, you have to exchange the wiring of the signal cables for the limit switches on the circuit board. This means you have to exchange limit switch X- and X+ for the X axis.

   As soon as the LED for limit switch X- is out, please move to the opposite direction away from the limit switch. Now the LED has to be blue again.

   Repeat **this step** again for the **other limit switch**. Move the axis by pushing **Alt + Ctrl + right arrow.** Also check the functioning of the limit switch.

4) After you have checked both hardware limit switches, you have to adjust the referencing direction. For this purpose you have to move the axis to the middle of the traverse range. Click on "Test" all the way on the right within the entry field of the according axis. Watch the movement of the axis. If the axis moves to the **left in direction of limit switch X**-, the **referencing direction is adjusted correctly**. Now you have to check the reference input, that is to be used for **referencing**. In this case **input no. 1 limit switch X-** serves as **reference switch**. (see picture above)
   If the axis does not move in the right direction, please cancel the referencing of axis by
   pushing F9 or the button . Now invert the referencing direction by pushing the
   button . Save the adjustments.
   Repeat the referencing to check the adjustments again.

1) If the referencing was successfully completed, save all adjustments. Activate the hardware limit switch monitoring for the axis within the entry field I/O-activities by checking the first check box. (see also chapter: 3.5.2.5 I/O- Actions). Save the adjustments again.
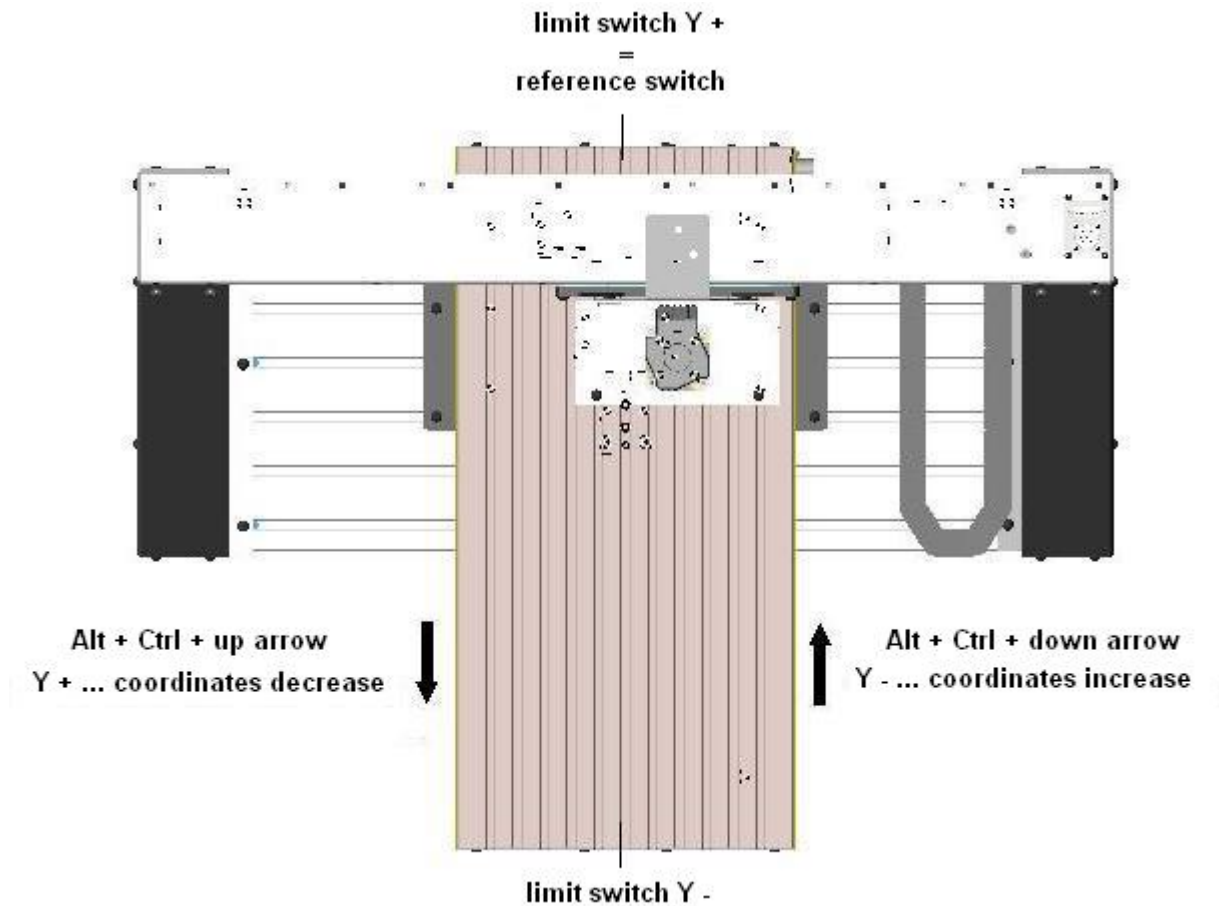
You can now configure the next axis.

3.6.2.2 *Y-Axis*

1) Click on the button **„I/O – Actions"** in MtConfig. Deactivate the hardware limit switch of the Y axis by removing the check in the first check box of the left. (also see chapter: 3.5.2.5 I/O- Actions)

2) Now move to the field „Axes" within the driver parameters. Check the alignment by manually moving the Y axis. For this use the short cut **Alt + Ctrl + up arrow** and **Alt + Ctrl + down arrow.**

    The following picture shows the correct axis alignment.

    In case the Y axis does not move as shown in the picture, please change the direction of the axis by pushing the button ⊞ for the direction of the axis.

    Click the button "Save" in the main window of MtConfig to save the new adjustments. Check the alignment again.

Now the referencing direction of the axis has to be adjusted. **Make sure the axis is not in a limit switch position.** To do this you have to go to the adjusting field "referencing". The hardware limit switches of each axis are fixed and should not be changed by means of the configuration program.
Please take a look at the window for the inputs and outputs. Entry no. 3 and 4 is:

Both limit switches are plugged in correctly if the left LED next to the entry is blue in inactive condition.

3) Move the Y-axis by pushing **Alt + Ctrl + up arrow slowly** forwardly towards you in the direction of the **limit switch. -**. While moving, watch the display of the inputs, in particular **input no. 4 limit switch Y +**.**Now** move **until** the **blue LED** for **limit switch Y+ goes out**.

Should this not be the case and the LED for limit switch Y- goes out instead, you have to exchange the wiring of the signal cables for the limit switches on the circuit board. This means you have to exchange limit switch Y+ and Y- for the Y axis.

As soon as the LED for limit switch Y+ is out, please move to the opposite direction away from the limit switch. Now the LED has to be blue again.

Repeat **this step** again for the **other limit switch**. Move the axis by pushing **Alt + Ctrl + + down arrow.** Also check the functioning of the limit switch.

After you have checked both hardware limit switches, you have to adjust the referencing direction. For this purpose you have to move the axis to the middle of the traverse range. Click on "Test" all the way on the right within the entry field of the according axis. Watch the movement of the axis. If the axis moves **forwardly towards you in direction of limit switch Y+**, the **referencing direction is adjusted correctly**. Now you have to check the reference input, that is to be used for **referencing**. In this case **input no. 4 limit switch Y+** serves as **reference switch**. (see picture above)
If the axis does not move in the right direction, please cancel the referencing of axis by pushing F9 or the button . Now invert the referencing direction by pushing the button . Save the adjustments.
Repeat the referencing to check the adjustments again.

4) If the referencing was successfully completed, save all adjustments. Activate the hardware limit switch monitoring for the axis within the entry field I/O-activities by checking the first check box. (see also chapter: 3.5.2.5 I/O- Actions). Save the adjustments again.

You can now configure the next axis.

3.6.2.3 *Z-Axis*

1) Click on the button **"I/O – Activities"** in MtConfig. Deactivate the hardware limit switch of the Z axis by removing the check in the first check box of the left. (also see chapter: 3.5.2.5 I/O- Acti)

2) Now move to the field "Axes" within the driver parameters. Check the alignment by manually moving the Z axis. For this use the short cut **Alt + Ctrl + page up** and **Alt + Ctrl + page down**

   The following picture shows the correct axis alignment.
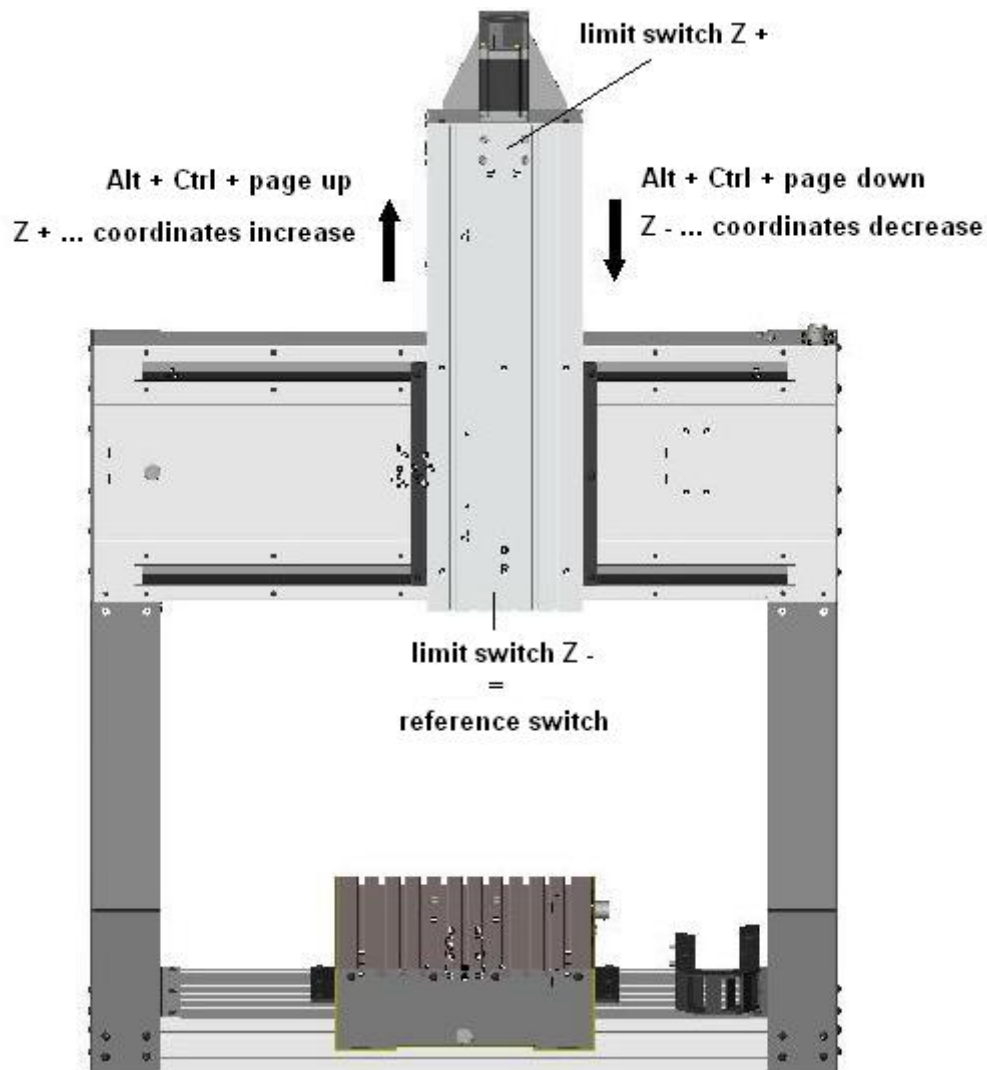
In case the Z axis does not move as shown in the picture, please change the direction of the axis by pushing the button 🔲 for the direction of the axis.

Click the button "Save" in the main window of MtConfig to save the new adjustments. Check the alignment again.

Now the referencing direction of the axis has to be adjusted. **Make sure the axis is not in a limit switch position.** To do this you have to go to the adjusting field "referencing". The hardware limit switches of each axis are fixed and should not be changed by means of the configuration program. Please take a look at the window for the inputs and outputs. Entry no. 5 and 6 is:

Both limit switches are plugged in correctly if the left LED next to the entry is blue in inactive condition.

3) Move the Z-axis by pushing **Alt + Ctrl + page up slowly** up in the direction of the **limit switch. +**. While moving, watch the display of the inputs, in particular **input no. 6 limit switch Z+**. **Now** move **until** the **blue LED** for **limit switch Z+ goes out**.

    Should this not be the case and the LED for limit switch Z- goes out instead, you have to exchange the wiring of the signal cables for the limit switches on the circuit board. This means you have to exchange limit switch Z- and Z+ for the Z axis.

    As soon as the LED for limit switch Z+ is out, please move to the opposite direction away from the limit switch. Now the LED has to be blue again.

    Repeat **this step** again for the **other limit switch**. Move the axis by pushing **Alt + Ctrl + page down.** Also check the functioning of the limit switch.

4) After you have checked both hardware limit switches, you have to adjust the referencing direction. For this purpose you have to move the axis to the middle of the traverse range. Click on "Test" all the way on the right within the entry field of the according axis. Watch the movement of the axis. If the axis moves **up in direction of limit switch Z+**, the **referencing direction is adjusted correctly**. Now you have to check the reference input, that is to be used for **referencing**. In this case **input no. 6 limit switch Z+** serves as **reference switch**. (see picture above)

    If the axis does not move in the right direction, please cancel the referencing of axis by pushing F9 or the button . Now invert the referencing direction by pushing the button . Save the adjustments.
    Repeat the referencing to check the adjustments again.

5) If the referencing was successfully completed, save all adjustments. Activate the hardware limit switch monitoring for the axis within the entry field I/O-activities by checking the first check box. (see also chapter: 3.5.2.5 I/O- Actions). Save the adjustments again.

3.6.3 Adjusting the axis- and reference direction of flatbed units

Follow the instructions for the initiation of the individual axes.
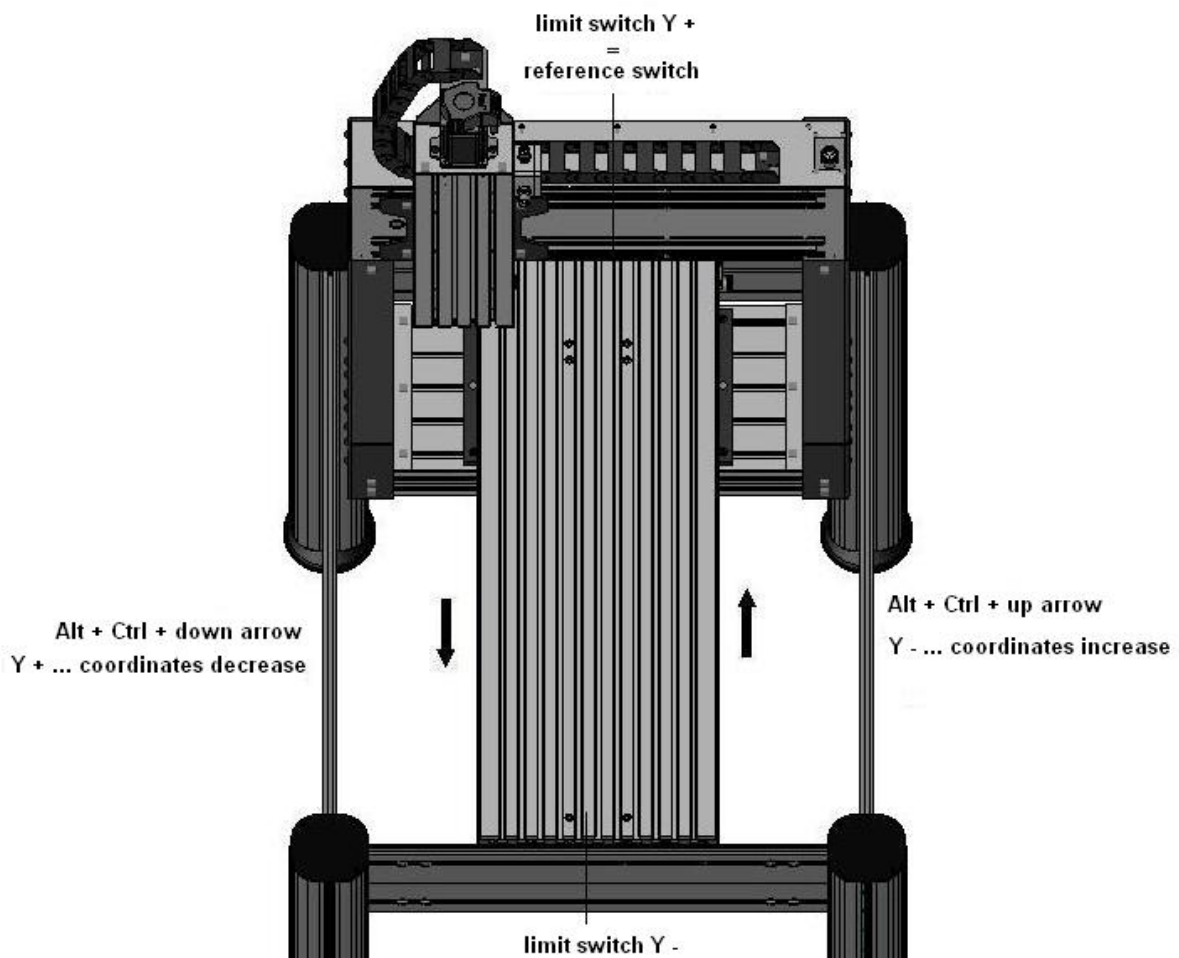
3.6.3.1 *X-Axis*

Please read the initiating instruction of the X-axis for gantry units and follow the steps. (see chapter 3.6.2.1 X-Axis)

3.6.3.2 *Y-Axis*

1) Click on the button **„I/O – Activities"** in MtConfig. Deactivate the hardware limit switch of the Y axis by removing the check in the first check box of the left. (also see chapter: 3.5.2.5 I/O- Actions)

2) Now move to the field „Axes" within the driver parameters. Check the alignment by manually moving the Y axis. For this use the short cut **Alt + Ctrl + up arrow** and **Alt + Ctrl + down arrow.**
   The following picture shows the correct axis alignment.

In case the Y axis does not move as shown in the picture, please change the direction of the axis by pushing the button ⊞ for the direction of the axis. Click the button "Save" in the main window of MtConfig to save the new adjustments. Check the alignment again.

Now the referencing direction of the axis has to be adjusted. **Make sure the axis is not in a limit switch position.** To do this you have to go to the adjusting field "referencing". The hardware limit switches of each axis are fixed and should not be changed by means of the configuration program.
Please take a look at the window for the inputs and outputs. Entry no. 3 and 4 is:

Both limit switches are plugged in correctly if the left LED next to the entry is blue in inactive condition.

6) Move the Y-axis by pushing **Alt + Ctrl + up arrow slowly** forwardly towards you in the direction of the **limit switch. -**. While moving, watch the display of the inputs, in particular **input no. 4 limit switch Y +**.**Now** move **until** the **blue LED** for **limit switch Y+ goes out**.

   Should this not be the case and the LED for limit switch Y- goes out instead, you have to exchange the wiring of the signal cables for the limit switches on the circuit board. This means you have to exchange limit switch Y+ and Y- for the Y axis.

   As soon as the LED for limit switch Y+ is out, please move to the opposite direction away from the limit switch. Now the LED has to be blue again.

   Repeat **this step** again for the **other limit switch**. Move the axis by pushing **Alt + Ctrl + down arrow.** Also check the functioning of the limit switch.

   After you have checked both hardware limit switches, you have to adjust the referencing direction. For this purpose you have to move the axis to the middle of the traverse range. Click on "Test" all the way on the right within the entry field of the according axis. Watch the movement of the axis. If the axis moves **forwardly towards you in direction of limit switch Y+**, the **referencing direction is adjusted correctly**. Now you have to check the reference input, that is to be used for **referencing**. In this case **input no. 4 limit switch Y+** serves as **reference switch**. (see picture above)
   If the axis does not move in the right direction, please cancel the referencing of axis by pushing F9 or the button . Now invert the referencing direction by pushing the button . Save the adjustments.
   Repeat the referencing to check the adjustments again.

7) If the referencing was successfully completed, save all adjustments. Activate the hardware limit switch monitoring for the axis within the entry field I/O-activities by checking the first check box. (see also chapter: 3.5.2.5 I/O- Actions). Save the adjustments again.

You can now configure the next axis.

3.6.3.3   *Z-Axis*

Please read the initiating instruction of the Z-axis for gantry units and follow the steps. (see chapter 3.6.2.1 Z-Axis)

3.7   Optimising

Within the optimising window the parameters for the motor control are indicated and
optimised.
The axes can be moved separately or coupled within a given travel distance, while the
parameters are being adjusted. The monitoring window always opens together with the
optimising window. Within the monitoring window the track data of the moving axes are
graphically displayed.
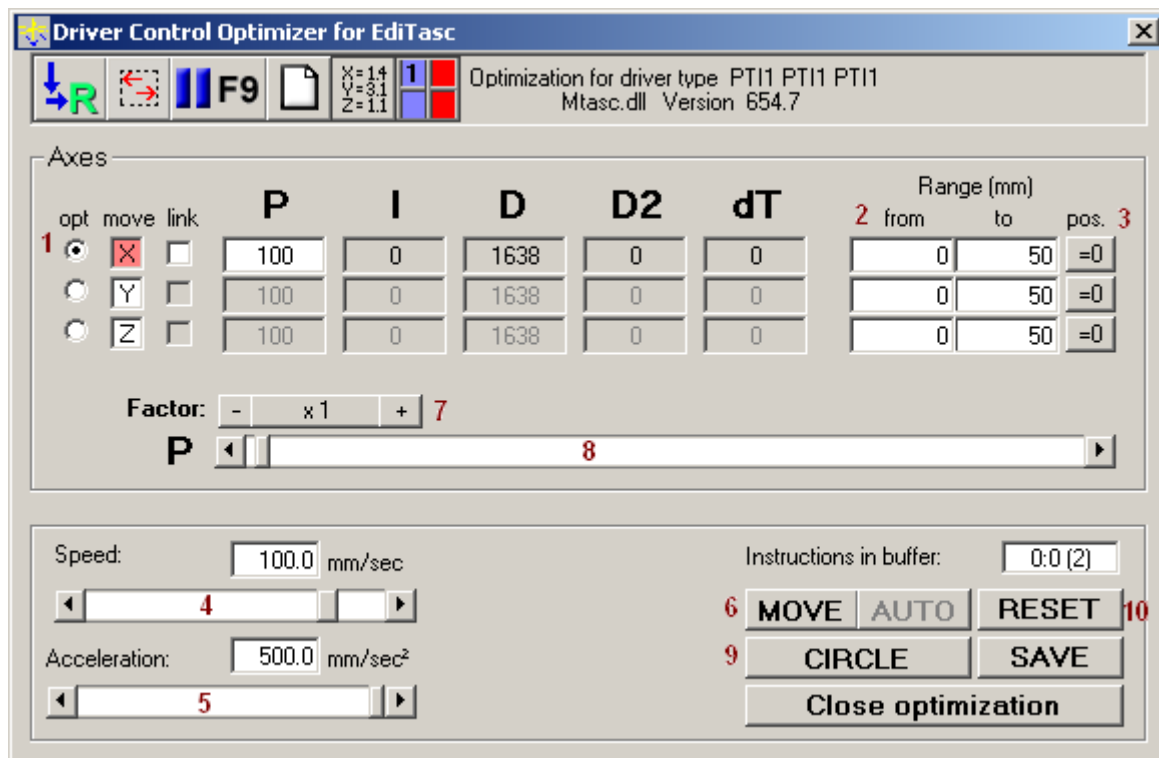
3.7.1   Procedure

1   Choose the axis which is to be optimised (**1**)**.**
2   Adjust the travel range (**2**).
3   Move to the position which is to be the 0 position, if necessary do so by manual jogging.
4   If necessary reset the current position of the machine with "=0" (**3**).
5   Adjust the speed with the slide control. (**4**). The speed can also be changed while moving.
6   If necessary, adjust the acceleration. (**5**)
7   Start the movement by clicking on "MOVE" (**6**).
8   You can change the parameters during the moving process. To do so, click into the field,
    whose value you want to change and enter a new value or use the slide control. (**8**).
9   If necessary, adapt the multipliers accordingly (**7**).
10 By clicking on "Circle" (**9**) (not available in automatic mode) the machine is forced to
    make a circle for two of the three axes X, Y and Z. You chose the axes within the column
    "Move".

11 A change of the travel range during the moving process affects later because the moving command cache **(10)** can still contain moving commands. Empty this cache by clicking on "RESET", this way the cache is emptied and the motor control reset.

12 You save the newly adjusted values with "Save". If values have been changed, you will be asked whether the new values are to be saved when leaving the optimising window.

3.7.2   Further details for the optimisation

If the parameters have to be completely recalibrated, it is useful to reset the D- and I values (if available) and increase the P values until the machine runs with a „fixed" noise without becoming loud.

After that the D-controller will be raised until the target/actual deviation displayed in the monitoring window are minimal. This process can be automatically supported by clicking on „AUTO"

If both values are adjusted, the I-controller (if available) can be used for fine tuning. The I value is only sensible if using a closed loop. It is usually used for axes with high mechanical friction.

3.7.3 The monitor window
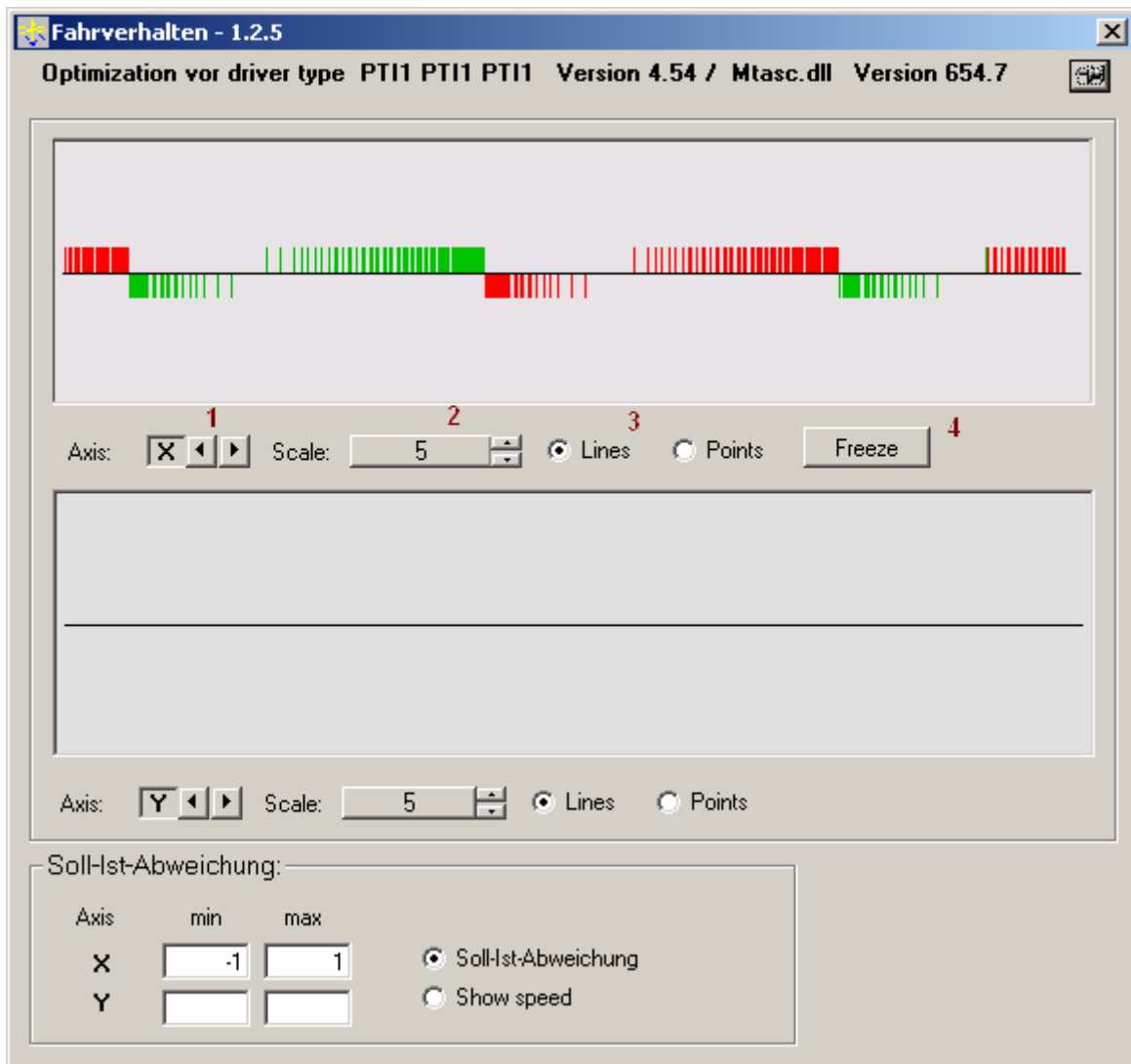
Within the monitoring window either the target/actual deviations or optionally the speeds of up to two axes are graphically displayed at the same time.

The display is two coloured: **Green** is for movement in positive direction and **red** for movement in negative direction of the individual axis. If the shown values are above the horizontal line the current machine velocity is lower than the target velocity.

Adaptations:

1) Select the axes with the Axis selection (**1**).
2) Change the maximum value of the scale with the scale factor (**2**).
3) Select between bar and point display with the display selection (**3**).
4) If you stop the display, (**4**), another button "Details" appears (not visible here), and a block of the upper line is marked by a case.
5) The contents of this case is displayed with a tenfold resolution in the lower line. The detail block can be adapted by moving the case with the mouse.