MORPHEUS Manual

Jochen Stahn

Important telephone numbers:		PSI	private
Jochen Stahn	1st instrument responsible	2518	(0) 056 4502588
Jay Padiyath	2nd instrument responsible	3037	
Stephan Fischer	crane driver (more than 1 t)	4118	
MORPHEUS cabin		3188	
MORPHEUS instrument		3180	
RITA II instrument		3007	

Version: July 28, 2004

Table 1: Names and aliases of selected devices (motorised stages and magnets) on MORPHEUS.

controller /number	slot	device-name	description	aliases				remarks
	1	**D1R**	**D**iaphragm **1** **R**ight		S1R			
A/2	2	**D1L**	**D**iaphragm **1** **L**eft		S1L			
	3	**D2R**	**D**iaphragm **2** **R**ight		S2R			
	4	**D2L**	**D**iaphragm **2** **L**eft		S2L			
	5	**D3R**	**D**iaphragm **3** **R**ight		S3R			
	6	**D3L**	**D**iaphragm **3** **L**eft		S3L			
	7	**DxT**	**D**iaphragm **x=1-3** **T**op					see 2.5.3
	8	**DxB**	**D**iaphragm **x=1-3** **B**ottom					see 2.5.3
	9	**UTZ**	**U**-yoke **T**ranslation **Z**	A6				
	10	**UTY**	**U**-yoke **T**ranslation **Y**	A5				
	1	**STH**	**S**ample **TH**eta	A3	SOM	TH	OM	
B/3	2	**STT**	**S**ample **T**wo**T**heta	A4	S2T	TTH	2T	
	3	**STX**	**S**ample **T**ranslation **X**		STU			
	4	**STY**	**S**ample **T**ranslation **Y**		STL			
	5	**SGX**	**S**ample **G**oniometer **X**		SGU			
	6	**SGY**	**S**ample **G**oniometer **Y**		SGL			
	7	**UTT**	**U**-yoke **T**wo**T**heta			MGU	U2T	†
	9	**SCX**	**S**ample **C**radle **X**		SCH			
	10	**SCY**	**S**ample **C**radle **Y**		SPH	ATX		
	11	**PO1**	**PO**lariser **1**			POL		
	12	**PO2**	**PO**lariser **2**			ANA		
	1	**MTH**	**M**onochromator **TH**eta	A1	MOM			
C/4	2	**MTT**	**M**onochromator **T**wo**T**heta	A2	M2T			
	3	**MTX**	**M**onochromator **T**ranslation **X**		MTU			ir
	4	**MTY**	**M**onochromator **T**ranslation **Y**		MTL			ir
	5	**MGX**	**M**onochromator **G**oniometer **X**					ir
	7	**MFV**	**M**onochromator **F**ocusing **V**ertical			MCV		
	1	**PFF**	**P**olarizer **F**lipper **F**lipper					
7	2	**PFC**	**P**olarizer **F**lipper **C**ompensation					
	3	**AFF**	**A**nalyzer **F**lipper **F**lipper					see ??
	5	**SCZ**	**S**ample **C**urrent **Z**				SBZ	‡
8		**TECS**						
	1	**DC1**	**D**irect **C**urrent motor **1**					
9	2	**DC2**	**D**irect **C**urrent motor **2**					
	3	**DC3**	**D**irect **C**urrent motor **3**					
	4	**DC4**	**D**irect **C**urrent motor **4**					
10		**IPS**	**I**ntelligent **P**ower **S**upply					

ir instrument-responsible only

† UTT measures in mm, U2T in degree

‡ SCZ measures the current/A, SBZ the magnetic field/Gauß

Contents

Chapter 1

Short guide

In this chapter only standard features of MORPHEUS are explained such as polarised reflectometry and single crystal diffraction. For more complicated set-ups please refer to `http://lns00.psi.ch/sics/morpheus.htm`.

1.1 Introduction to SICS

SICS means SINQ Instrument Control System. SICS is a client server system. This means there are at least two programs necessary to run the experiment. The first is the SICServer which does the actual instrument control work. A user rarely needs to bother about this server program as it is meant to run all the time.
In principle all you need to do is to find out a device position, to drive a device, to reset its zero-position and to scan it. These items are explained in the following sections. Here "device" stands for all motors, currents, voltages, temperatures, etc.
Convention for type-setting in this manual:

- normal, explaining text is written in Roman;
- the names of devices or fields are written in CAPITAL SANS SERIF;
- the value related to a DEVICE is set in small sans serif;
- what has to be typed is in `typewriter font`;
- <*value*> stands for a required, variable entry;
- `[`<*value*>`]` stands for an optional, variable entry;
- entrances marked with SICS are meant to be written in the command line in the SicsClient;
- entrances marked with term are meant to be written on the console (e. g. in a xterm);

e.g. to drive ω to 5.63° the abstract command is
SICS `dr` <*device*> <*value*>
with *device* = STH and *value* = 5.63°
what you really enter is
SICS `dr sth 5.63`

1.2 Start SICS

1. Check, if the SICServer is running:
   term ps -A | grep SICS
   should report at least one line ending with
   term ... SICServer morpheus.tcl.
   If not, type
   term startsics
   For this you'll have to be user MORPHEUS on the computer morpheus.psi.ch.
2. Start the SicsClient:
   term sics&
   a new window will open.
3. Activate SICS via the pull down menu in the SicsClient:
   Connect / MORPHEUS

and authorise:
User Parameters / Set Rights
standard user name and password are `morpheususer` and `03lns1`.

4. Start the status-window:
term morpheusstatus&

5. Activate the status-window via the pull down menu:
Connect / MORPHEUS

1.2.1 six

six is an alternative to the standard Java SICS commandline client.
Why an alternative SICS client?

- it is much faster
- it does not need the X Window System
- it connects automatically to the instrument, if you are logged in to the instrument computer

It has the full functionality of the standard commandline client, but no graphical interface. This means:

- you can not (and have not to) use the mouse
- there are no colors to distinguish commands, responses and errors
- instead of clicking on the interrupt button, you have to enter "stop"
- the history is only accessible with the arrow keys

The new version

- displays the SICS status
- has a slightly different mechanism for authorisation: you have to enter SICS username and password the first time you use it

1.3 Drive Devices and Check Settings

The current value of a device is reported by just typing its name (see table 1, page ii):
SICS <*device*>

There are hardware and software limits for all motors! These can be checked for an individual motor by typing
SICS <*device*> list
To change the software limits or to define a new zero position type:
SICS <*device*> softlowerlim <*value*>
SICS <*device*> softupperlim <*value*>
SICS <*device*> softzero <*value*>
BE CAREFUL WITH THIS!
The hardware limits can not be changed!

Set a value for the actual position of a device (redefinition of the zero-position):
SICS sp <*device*> <*value*>

Drive a device to a value:
SICS dr[ive] <*device*> <*value*>
Drive several devices at the same time:
SICS dr[ive] <*device1*> <*value1*> <*device2*> <*value2*> [etc.]

1.4 Standard Scans

before a scan is started

The first part of header of the scan-files looks like this:

```
*************************** TOPSI Data File ********************************
Original Filename     =  /home/TOPSI/data/2002/morpheus049992002.dat
Title                 =  Piezoeffekt in  Quarz,  (300),  T=RT,  U=+2000V
User                  =  J. Stahn
Sample Name           =  SiO2 (100)
File Creation Date    =  2002-10-25 10:04:19
Last Scan Command     =  sscan sth 56.8 56.8 3000 80000
****************************************************************************
```

where the following parameters were given by the user:
SICS title Piezoeffekt in Quarz, (300), T=RT, U=+2000V
SICS user J. Stahn
SICS sample SiO2 (100)
If no entry is made, the previous one (maybe by someone else) is used. According to these entries and your notes in the log-book your scans can be found again within the about 6000 files stored by the end of the year. So please don't forget them!

One also has to define which mode of triggering is required. It is possible to count on time or on monitor counts:
SICS scan mode timer
or
SICS scan mode monitor
Read the actual setting:
SICS counter getmode

1.4.1 just count

To count for n seconds or for n counts in the monitor enter:
SICS co ti <n>
or
SICS co mn <n>

1.4.2 step-scan of one or more devices

A step-scan is performed for DEVICE from ***device*** $=$ *start*
to ***device*** $=$ *end*
in ***points*** $- 1$ steps.
To scan more than one device at a time, the sequence <*DEVICE*> <***start***> <***end***> has to be repeated for every device.

SICS `sscan` $\underbrace{\langle \mathit{DEVICE} \rangle\ \langle \mathit{start} \rangle\ \langle \mathit{end} \rangle}_{\mathrm{n}\times}$ <***points***> <***preset***>

preset is the value of the preset for triggering the scan. For scan mode timer its in seconds, for monitor in counts.
e.g. ω-scan from $0.0°$ to $2.0°$ in 20 steps with 2000 counts in the monitor:
SICS `sscan sth 0.0 2.0 21 2000`
e.g. $\omega/2\theta$-scan from $\omega = 0.0°$ to $\omega = 0.2°$ in 40 steps with 2000 counts in the monitor:
SICS `sscan sth 0.0 0.2 stt 0.0 0.4 41 2000`

1.4.3 center-scan of one device

A center-scan is performed for DEVICE from ***center*** $-$ ***steps*** $\times$ ***width***
to ***center*** $+$ ***steps*** $\times$ ***width***
in $2 \times$ ***steps*** steps.
SICS `cscan` <*DEVICE*> <***center***> <***width***> <***steps***> <***preset***>

e.g. ω-scan around $5.0°$ with 20 steps to either side of step width $0.1°$ and with 4000 counts in the monitor:
SICS `cscan sth 5.0 0.1 20 4000`

1.4.4 where the scans are saved

Every scan made is saved and a copy is made immediately after the end of the scan (even if interrupted) to the directory
`/home/MORPHEUS/data/2004/`<***thousands***>`/`
where <***thousands***> gives the 3 leading digits of the file number, e.g. 003 for all filenumbers 3000 to 3999.
It can be copied somewhere else via `ssh` with the command
term scp morpheuslnsg@morpheus.psi.ch:data/2004/<***thousands***>/<***file***> <***path***>/<***file'***>
where the default filename <***file***> is formed by the instrument name, followed by the year, “n” and a 6 digit integer number containing the scan-number, and the suffix `.dat` (e.g. `morpheus2004n004132.dat`).

A copy of each file is made to the common archive
`/afs/psi.ch/project/sinqdata/`<*year*>`/`<*instrument*>`/`<*thousands*>`/`<*file*>

1.5 Apertures

For the diaphragms D1, D2 and D3 the following short-cuts exist:
SICS `dah` <***width1***> <***width2***> <***width3***>
and
SICS `dav` <***hight1***> <***hight2***> <***hight3***>
where ***width1*** and ***hight1*** are the horizontal and vertical apertures of the first diaphragm, respectively, and so on. (The abbreviations mean “**D**iaphragm **A**perture **V**ertical / **H**orizontal”)
For `dav` driving takes up to 5 minutes!
Please see also section 2.5.3.

1.6 The MORPHEUS Knigge

It would be nice if all MORPHEUS users take care for the following items to fulfil formal requirements, to prevent damaging of the instrument and to make it easier for the next users (and me)...

before the experiment

- actualise safety-sheet
- insert experiment data-sheet

log book entrances

- user name
- date and duration of the measurements
- what is measured?
- experimental set-up (micro-guide, sample magnet, etc.)
- which data files were created (at least from ... to ...)?
- changes in the set-up (e.g. from UTT to STT)
- changes of the wavelength (MTH)
- adjustments with the LASER
- damages, errors, ...
- state of the instrument at the end (diaphragms, alignment, changes)

at the end

- drive UTT, STH, ... to 0
- store tools and equipment away
- make sure that there's nothing on the blue table
- take away your samples

The three-axis spectrometer **TASP** at the end of beam guide 14 has a higher priority than MORPHEUS! This means you have to respect their wavelength requirements and eventually change MTH! Also, **if you will not measure for a longer period, please change the wavelength to 5.8 Å** (SICS `dr mth -60`).

Merci vielmal!

Jochen Stahn

Chapter 2

Set-up options of MORPHEUS

2.1 Specifications and characteristic measures

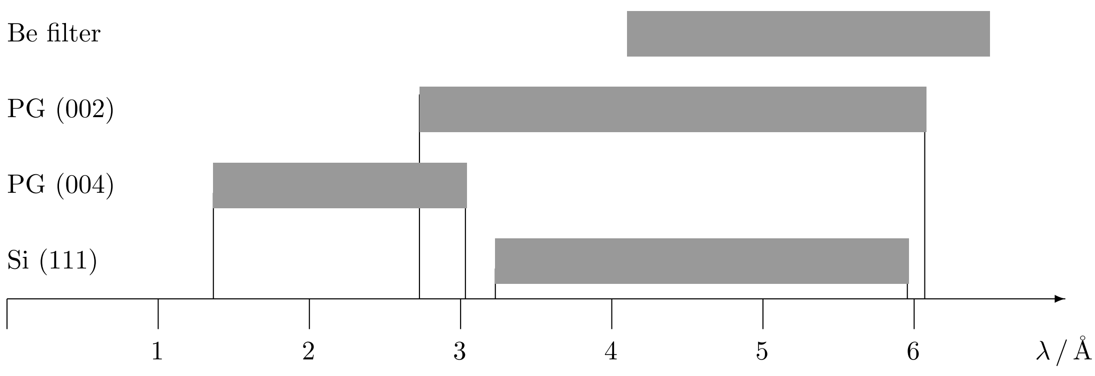
2.1.1 monochromator and wavelength-ranges

Pyrolytic Graphite (002) on Si $< 111 >$ (miss-cut $+7.22°$):
$2\,d_{\mathrm{PG}(002)} = 6.708\,\text{Å}$,
$2\,d_{\mathrm{Si}(111)} = 6.271\,\text{Å}$.

HWFM of Graphite (002): !!!°

The normal of the scattering plane of the Pyrolytic Graphite monochromator is parallel to the y axes of its coordinate system in the zero-position MTH $= 0$. Since the angles MTH and MTT are defined to be positive in the direction counter clockwise when seen from the top, they are negative in the accessible range!

Reflection	MTH	ω	λ
PG (002)	$-24° \to -65°$	$24° \to 65°$	$2.728\,\text{Å} \to 6.081\,\text{Å}$
PG (004)	$-24° \to -65°$	$24° \to 65°$	$1.365\,\text{Å} \to 3.042\,\text{Å}$
Si (111)	$-24° \to -65°$	$31° \to 72°$	$3.230\,\text{Å} \to 5.965\,\text{Å}$



2.1.2 hardware ranges

STH	$-173° \to +185°$
STT	$-130° \to +133°$
DxR	$-1\,\mathrm{mm} \to 12\,\mathrm{mm}$
DxL	$-1\,\mathrm{mm} \to 12\,\mathrm{mm}$
DxT	$0\,\mathrm{mm} \to 30\,\mathrm{mm}$
DxB	$0\,\mathrm{mm} \to 30\,\mathrm{mm}$

2.1.3 distances

monochromator ———	sample position	1937 mm	standard
		1500 mm	minimum
		2040 mm	maximum
sample position ———	detector	1816 mm	maximum
D1 ———	D2	670 mm	standard
D2 ———	sample position	430 mm	standard
Tanzboden ———	beam height	1488 mm	
X95-profile (top) ———	beam height	227 mm	
STH ———	beam height	400 mm	
STH+spacer ———	beam height	250 mm	
STH+spacer+STX ———	beam height	205 mm	
STH+spacer+STX+STY ———	beam height	160 mm	
STH+spacer+STX+STY+SGY ———	beam height	106 mm	
STH+spacer+STX+STY+SGY+SGX	beam height	60 mm	
STH+STX ———	beam height	345 mm	
STH+STX+STY ———	beam height	300 mm	
tracks on the 2θ-arm ———	beam height	mm	

The following sketches show the standard set-up of MORPHEUS for polarised reflectometry (page 9), multi reflectivity (page 13) and single crystal diffraction (page 14). In all cases the settings are MTT $= -90$ ($\lambda = 4.74$ Å), STT $= 0$ and the side-view is seen from Villigen (or better from DMC).

Convention for the coordinate systems:
each component (translation, rotation) has it's own coordinate system, where

- the z axes is normal to the floor, the positive direction is upwards (for the zero-position of rotation devices);
- the x axes is parallel to the beam (for the zero-position of rotation devices);
- the y axes is defined by $\mathbf{y} = \mathbf{z} \times \mathbf{x}$;
- the sign of a rotation is given by the *right hand rule*.

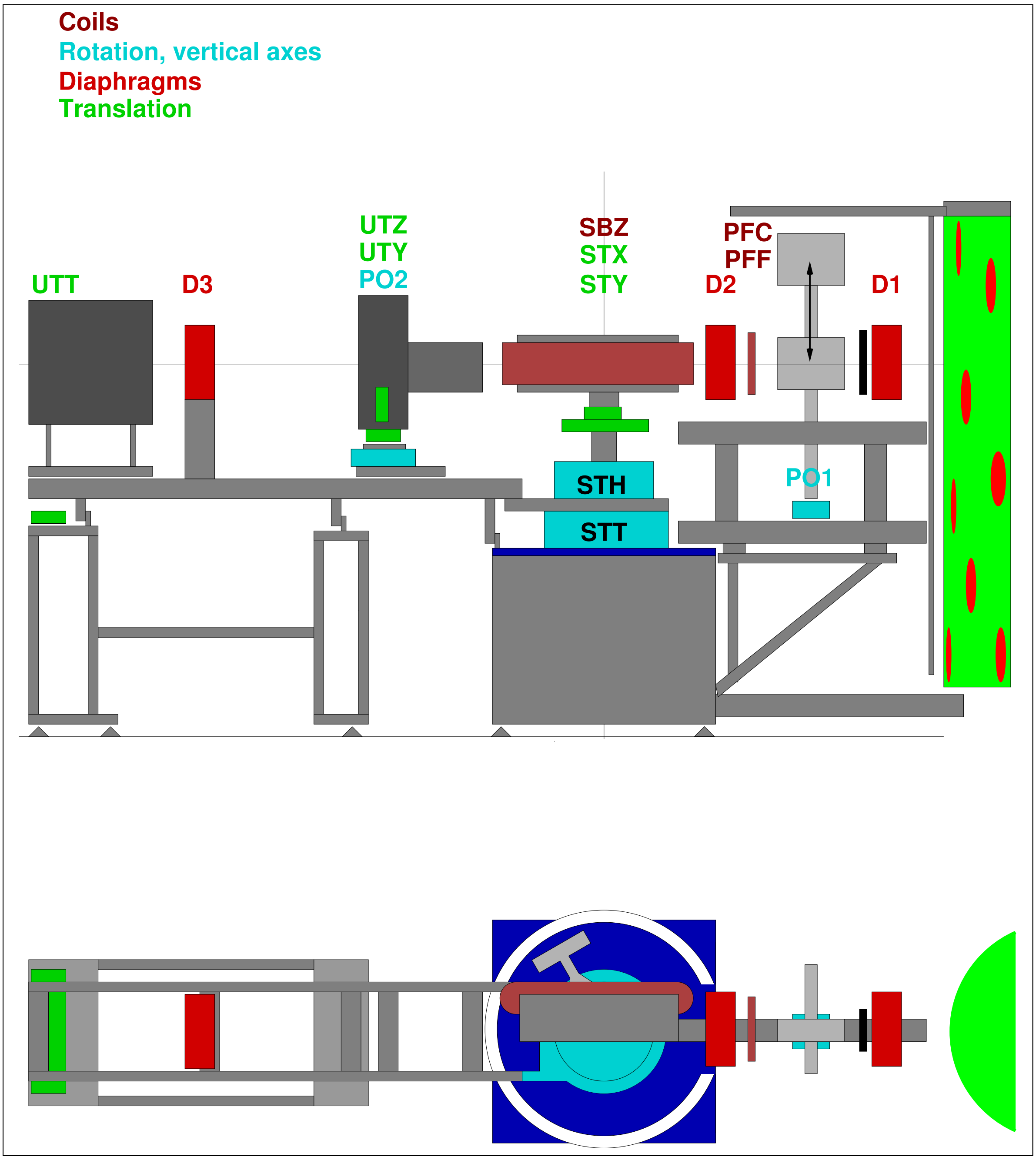
2.1.4 standard set-ups

reflectivity		single	CTI /
unpolarised	polarised	crystal	furnace
		G	
	magnet	SGX	CTI
F	R	SGY	D
E	E	E	C
D	D	D	H
C	C	C	SGY
STX	STX	STX	STX
STY	STY	STY	STY
B	B	B	B
A	A	A	A
ω-table			

A	X95-profile
B	base plate for STY
C	adapter plate
D	z-translation stage
E	adapter plate
F	support for sample holder
G	sample holder (gallows)
R	adapter plate

2.2 Polarised Reflectometry set-up

This set-up allows to measure the specular and off-specular reflectivity and the transmission of samples with sizes in between several cm^2 and $60 \times 15\,cm^2$. A beam of up to 1 mm width can be polarised with a transmission olarizer. The spin-state is selected with a Mezei-type spin flipper. The spin-analysis is performed with a remanent transmission polariser.
2θ-range (for $\lambda = 4.74$ Å): $-5° < 2\theta < 133°$
dynamic range: 5 to 6 orders of magnitude



In this set-up the drive UTT is not used.
Options: instead of the long detector-arm (as sketched) it is possible to use the short arm with the better-shielded detector.

2.2.1 installation of the polarised reflectometry set-up

1. start-configuration:
   sthsoftzero = 0
   sth = 0
   empty ω-table
2. mount the black X95-bar on the ω-table
   and on this the slider with STY and STX, flushed towards the area entrance
3. connect the cables to STX and STY and switch the power-supplies on (if necessary)
4. mount the z-translation stage and the base for the sample magnet
5. carefully put the sample-magnet on the base (with the crane!)
   the open side of the magnet should point towards Villigen
   unhook the crane!
6. connect the cables of the magnet:
   - water cooling
   - power-supply, earth and controller
   - sample sucker
7. drive to $\lambda = 4.74$ Å
   SICS `dr lambda -4.74`
8. insert Be-filter: look at subsection 2.5.1
9. place the spin-flipper in between polariser and second diaphragm
10. put the polariser to its lower position
11. the alignment of the polariser is explained in section 2.2.4

2.2.2 removal of the polarised reflectometry set-up

1. switch off magnet power-supplies
2. put the polariser to its upper position
3. disconnect the spin-flipper
4. unmount spin-flipper
5. disconnect cables of the semple magnet
   - water cooling
   - power-supply, earth and controller
   - sample sucker
6. remove sample magnet (with the crane!) and store it under the shielding towards the NCR shutter
7. reset the STH zero position
   SICS `sth softzero 0`
   SICS `dr sth 0`
8. eventually disconnect the cables to STX and STY and unmount these together with the X95-bar

2.2.3 water-supply for the sample magnet

If the cooling-water circuit for the sample magnet is interrupted for more than about 5 sec, the pump stops. In the right rack the LED “water cooling” is blinking.
To “re-animate” it you'll have to go to the heat exchanger which is sited behind TASP next to the back-side of SANS I. press the red button “Störung” and then the green button “Betrieb”. Wait an instant to make sure it is running stable.

2.2.4 polariser adjustment

It is assumed, that the polarising supermirrors are already adjusted within the polariser magnet. All numbers given below correspond to $\lambda = 4.74\,\text{Å}$, for other wavelengths you may have to chose other values.
The flipping current pff depends on the wavelength chosen, while the compensation current pfc depends on the field of the sample magnet SBZ.

1. insert hardware
   (a) if needed, the Be-filter should be inserted first (2.5.1, page 15)
   (b) put the polariser magnet to the upper position
   (c) insert spin-flipper in between polariser and second diaphragm (D2) as close to the sample as possible
   connect flipper and compensator cables (PFF and PFC)
   (d) put the polariser magnet to the lower position
2. align the polariser
   (a) drive the detector into the direct beam and close the diaphragms
   SICS dr stt 0
   SICS dah 0.8 0.8 2
   (b) drive the sample out off the beam
   (c) scan the polariser
   SICS cscan pol 0 0.1 15 2000
   go to the center of the obtained symmetrical curve and define it as zero:
   SICS dr pol <*center*>
   SICS sp pol 0
3. insert and align the test sample
   (a) incline the polariser to get an unpolarised beam:
   SICS dr pol 1.2
   (b) adjust the test sample: STY and STH (**??**) (if possible take a well known polarising multilayer or supermirror) and go to a well polarising position ω in reflectivity mode:
   SICS dr sth $<\omega>$ stt $<2\omega>$
4. adjust the flipping- and compensation-field
   (a) incline the polariser to get a polarised beam:
   SICS dr pol 0.6
   (b) saturate the sample and go to the required sample field strength (!!!):
   SICS dr sbz 80
   SICS dr sbz <*sample field strength*>
   (c) switch the flipping field on (pff $\approx 0.6\,\text{A}$ for $\lambda = 4.74\,\text{Å}$):
   SICS dr pff 0.6
   (d) scan the compensation field and go to the maximum:
   SICS sscan pfc 0 2 21 2000
   SICS dr pfc <*maximum*>
   (e) scan the flipping field and go to the maximum:
   SICS sscan pff 0 2 21 2000
   SICS dr pff <*maximum*>
   (f) repeat items (e) and (f) until the result is self-consistent.

5. adjust the polariser POL

   (a) scan POL with PFF and PFC on and off, respectively
   SICS `dr sbz <sample field> pff <flipper current> pfc <compensation current>`
   SICS `cscan pol 0 0.1 15 2000`
   SICS `dr sbz <value> pff 0 pfc 0`
   SICS `cscan pol 0 0.1 15 2000`
   or quasi-simultaneously:
   SICS `polscan 0 0.1 15 2000 <sample field> <flipper c.> <compensation c.>`

   (b) calculate the flipping ratio and decide which value of POL you want. Find a compromise between flipping ratio and intensity

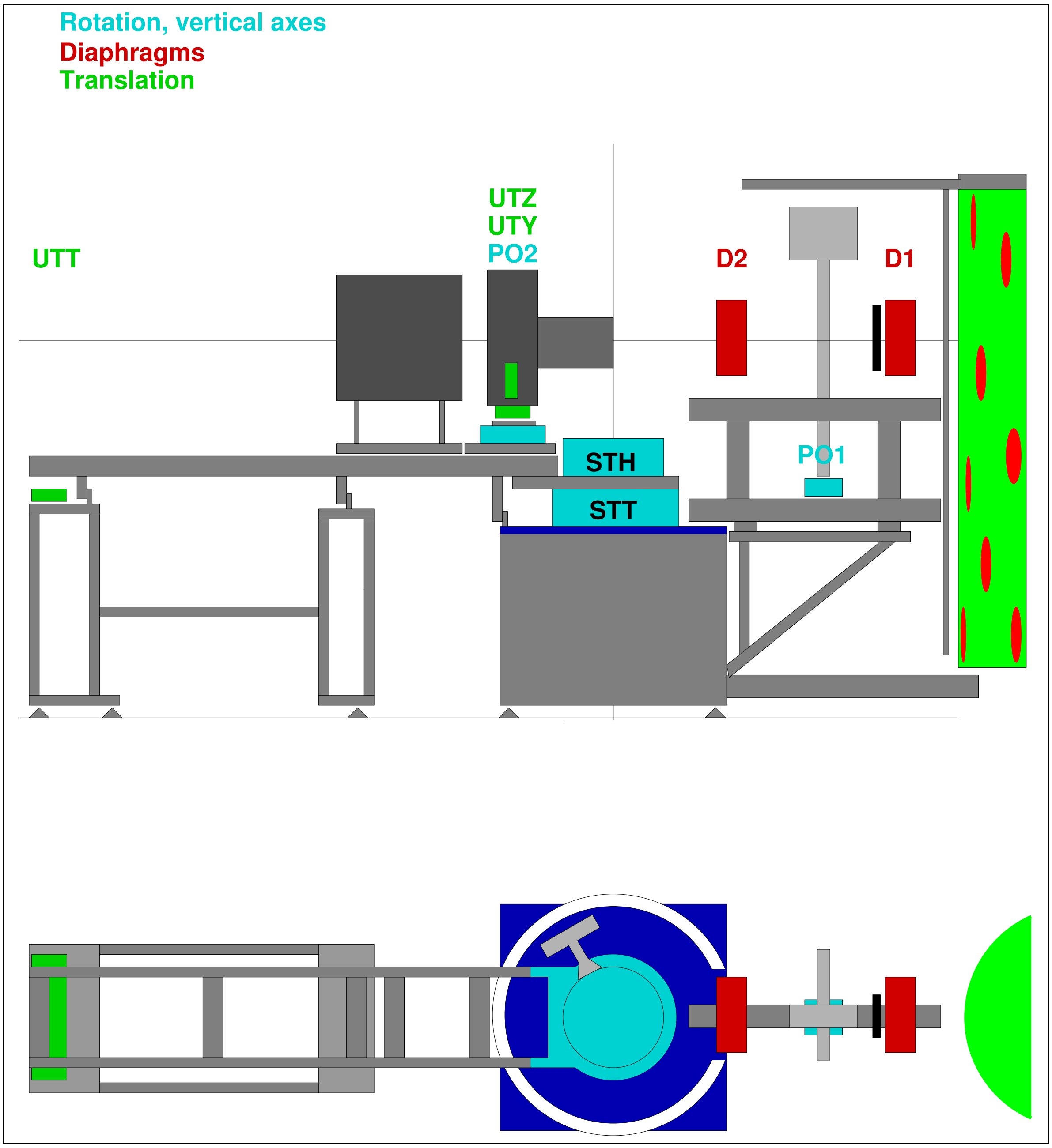
   (c) drive POL to the optimal value
   SICS `dr pol <optimal value>`

6. eventually repeat items 4(e), 4(f) and 5 until the result is self-consistent.

That's it!

2.3 Muley-Reflection set-up

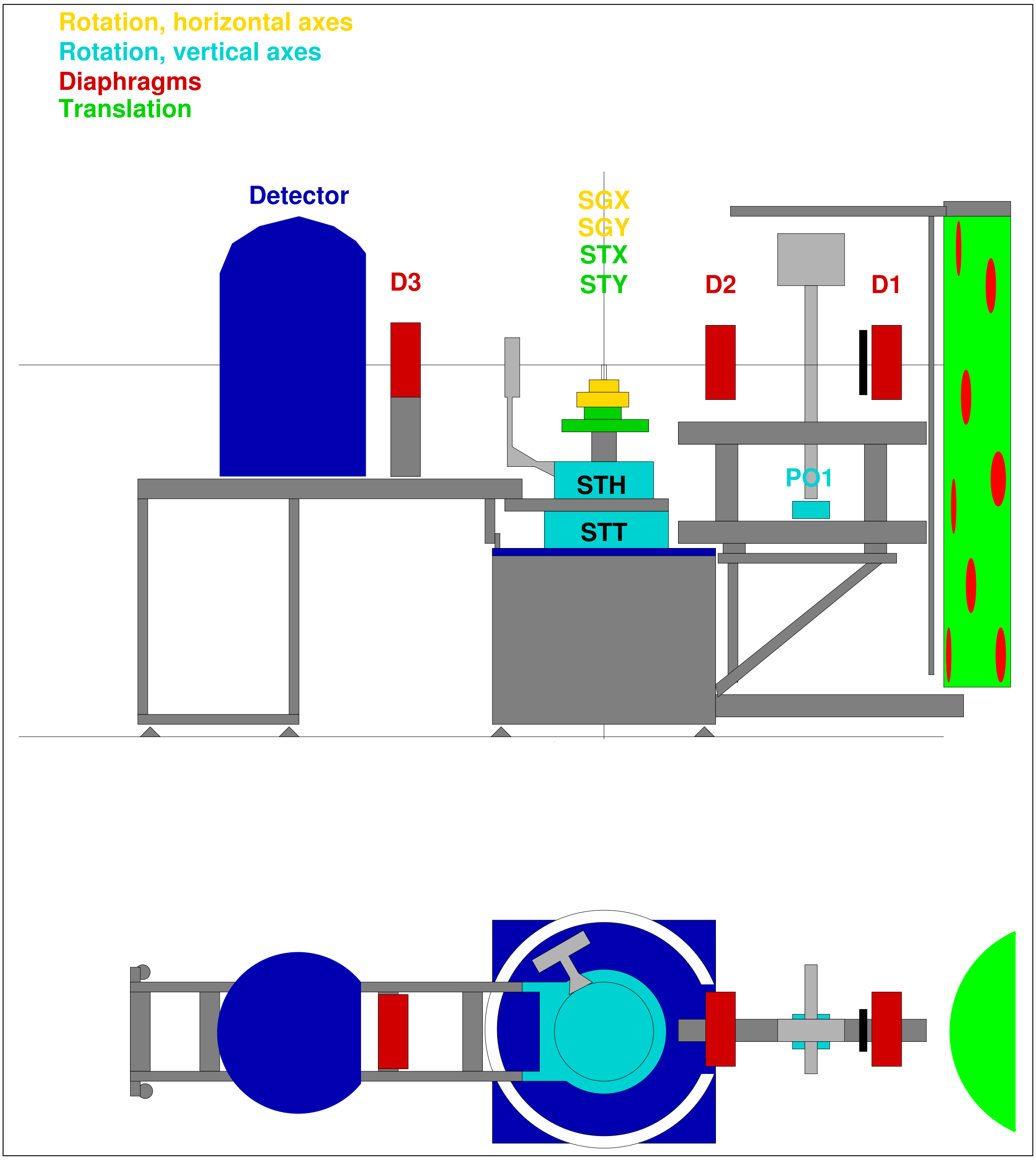
This set-up is used to measure simultaneously the reflectivity of two super-mirrors of equal sizes and reflecting properties over the full surface.
The samples are inserted in the u-yoke with a distance of about 1 mm. The opening towards the monochromator of the so-formed channel has to be centred on the STT-axis. The 2θ rotation is performed with the drive UTT (STH and STT are not used). STT has to be decoupled, see section 2.5.2.
2θ-range: ca. $4°$
resolution: $\Delta\, 2\theta < 0.001°$



A polarisation-analysis for this set-up is not yet implemented.

2.4 Single Crystal Diffraction set-up

For single crystal diffraction there are two possible options:
— for small tilting angles (±20°) the use of the goniometer SGX and SGY on top of the translations STY, STX and the manual z-stage is possible (as shown in the sketch;
— for more complicated problems a Euler-cradle can be mounted directly on the ω-table to form a full 4-circle diffractometer. The χ- and ϕ-rotations are called SCH and SPH, respectively.



Optionally the long detector-arm with the u-yoke can be used. The u-yoke allows to insert and rotate an additional optical device as a collimator or an analyser.

2.5 Special equipment

2.5.1 Be-filter

The Be-filter should be kept permanently at low temperature! So even if you don't use it make sure it is functioning. The temperature and liquid N_2 supply are controlled by the device in the right rack. There you can read the actual temperature. If the Be-filter gets warm, please inform the beam line scientist (or Roman Büege (4299) or Stephan Fischer (4188)).

insert the Be-filter

1. close the main-shutter of beam guide 14
   (if possible inform the users on TASP)
2. move monitor and first diaphragm towards the sample position (be careful with the cables!)
3. remove the black shielding
4. remove all inserts behind the shutter
5. insert the Boron-Carbide/Aluminium blade behind the shutter
6. insert the Be-filter
7. mount the ash-tray underneath the Be-filter and put the spill in it
8. insert Boron-Carbide/Aluminium blades to reduce the beam
9. mount the black shielding (as tight as possible)
10. move the first diaphragm and the monitor back towards the shutter
11. open the main-shutter of beam guide 14

remove the Be-filter

1. close the main-shutter of beam guide 14
   (if possible inform the users on TASP)
2. lift the polariser magnet to the upper position
3. move monitor and first diaphragm towards the sample position (be careful with the cables!)
4. remove the black shielding
5. take out the Be-filter and place it on the wooden base below
6. unmount the ash tray and position it on the floor
   put the spill in it
7. remove the Boron-Carbide/Aluminium blade in front of the shutter
8. insert whatever you need, normally the adapter for the collimators and at least some Boron-Carbide/Aluminium slits to reduce the background
9. mount the black shielding (as tight as possible)
10. move the first diaphragm and the monitor back towards the shutter
11. open the main-shutter of beam guide 14

2.5.2 remarks about the 2θ-arm

There are two principle modes to perform the 2θ movement of the detector:

- **2θ rotation with stt**:
  The lower of the two Huber rotation stages does the work. For the movement the 2θ-arm is lifted by air cushions. Accessible is in principle the range $-130° < 2\theta < 130°$ (This range is restricted by the neutron guide, the stairs and maybe by sample environment).

  For this mode, the STT drive has to be coupled. This can be checked with the command
  SICS `sttc`

- **2θ rotation with utt**:
  The rotation is performed by the translation stage at the end of the 2θ-arm. The accuracy is higher and the time between two measurements is shorter — but the range is limited to $\approx \pm 2.5°$ (exact values depend on the zero position).

  For this mode, the STT drive has to be decoupled. This can be checked with the command
  SICS `sttc`

To switch **from stt to utt** one has to perform these steps:

1. Open screw at the left of the STT housing;
2. Pull the lever at the left end of the STT housing;
3. Push in the black knob on top of the STT housing.

To switch **from utt to stt** one has to perform these steps:

1. Put the 2θ-arm on air cushions: press the buttons "local" and "air cushion 2 theta" on the small gray box right of the lower Huber rotation stage;
2. Pull the black knob on top of the STT housing;
3. Push the lever at the left end of the STT housing carefully — maybe you'll have to rotate the 2θ-arm manually — until the gear is completely caught by the spindle.
4. Fasten — carefully! — the screw at the left of the STT housing;
5. Switch off the air cushions by pressing the buttons "air cushion 2 theta" and "local".

It is possible to **drive the 2θ arm manually** to a wanted position (or out of the way) by performing the steps mentioned above and just pushing or pulling the arm while the air cushions are active.

2.5.3 the diaphragms

There are 3 diaphragms on MORPHEUS which can be controlled by the computer. All horizontal blades, namely D1R, D1L, D2R, D2L, D3R and D3L are encoded and have individual motor cards (and therefor addresses, see table 1).

The vertical blades (DxT and DxB, $x = 1, 2, 3$) are not encoded and there is only one motor card for the three upper (DxT) and one for the three lower blades (DxB)! For this reason a reference run is performed automatically each time a blade in an other diaphragm is driven. This takes a couple of seconds! **The vertical blades should be moved one by one!** (i.e. by using the command SICS `dr[ive]` <*blade*> <*value*> without further devices).

It is possible to drive the blades into one another. This will destroy the diaphragm! — So: please don't do it!

The slit width is given by the sum of corresponding blade positions.
E.g. to adjust the first horizontal slit to 1 mm, type
SICS `dr[ive] d1r 0.5 d1l 0.5`

To save time and typing, it is possible to use the command shortcuts `dah` for horizontal apertures and `dav` for vertical apertures:
SICS `dah` <*value1*> <*value2*> <*value3*>
drives the diaphragms D1, D2 and D3 to the apertures value1, value2 and value3. The same is true for
SICS `dav` <*value1*> <*value2*> <*value3*>
but here driving takes up to 5 minutes.

2.5.4 temperature controller / TECS

Activate TECS:
term starttecs
Call TECS:
term tecs

TECS plot TECS return
Activate TECS within the SicsClient:
SICS `tecs on`
check temperature:
SICS `tt`
set temperature:
SICS `dr[ive] tt` <*value*>
Set a delay time (e.g. to make sure the temperature is stable): SICS `wait` <*time in seconds*>

2.5.5 cryomagnet controller / IPS

IPS (*intelligent power supply*) allows to switch and change the strenghth of the magnetic field of the cryomagnets MA02 and MA09.
Activate IPS within the SicsClient:
SICS `ips on`
check settings:
SICS `ips list`
drive field:
SICS `ips set` <*value*>

2.5.6 magnet controller

If necessary, the magnet controller can be invoked in SICS for each magnet (power supply) individually by typing

SICS	`evfactory new pff el755 lnsa07 4000 7 1`	(Flipper 1)
SICS	`evfactory new pfc el755 lnsa07 4000 7 2`	(Compensator 1)
SICS	`evfactory new aff el755 lnsa07 4000 7 3`	(Analyser)
SICS	`evfactory new afc el755 lnsa07 4000 7 4`	(not yet active)
SICS	`evfactory new sbz el755 lnsa07 4000 7 5`	(Sample magnet)

The status (current through the magnet in Ampere) can then be obtained with
SICS <*magnet*>
and changed by
SICS `dr[ive]` <*magnet*> <*value*>
where <*magnet*> is one of `pff`, `pfc` or `sbz`.
The value entered is the nominal current through the coils in Amps (A). Allowed ranges are –2.0 A to 2.0 A for `pff` and `pfc`, and –100 A to 100 A for `sbz`.

The actual field strength close to the center of the 100 A magnet can be estimated approximately from the graphs in Fig. 2.1.

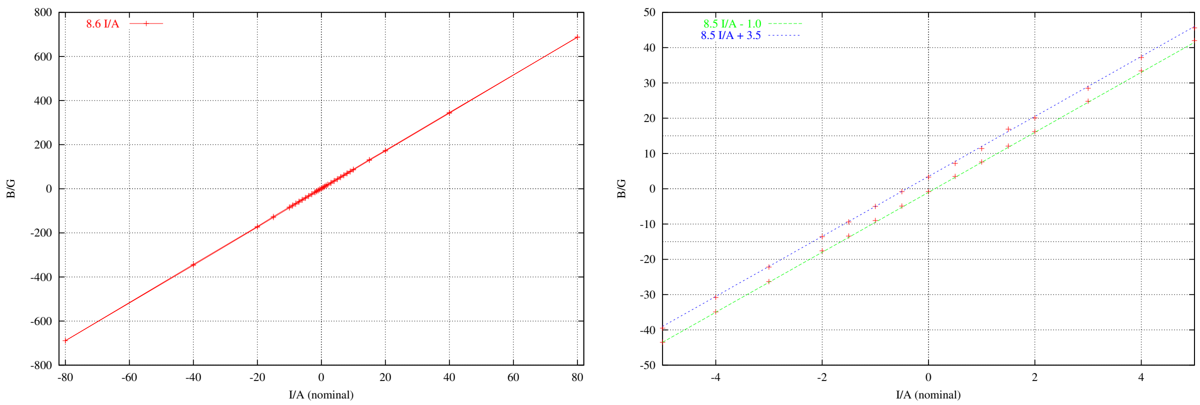


Figure 2.1: Hysteresis of the 1000 G / 100 A sample magnet. Measured 10 mm away from the 'normal' position of the sample surface! The lines of regression are $B/\mathrm{G} = 8.6 \cdot I/\mathrm{A}$, $B/\mathrm{G} = 8.5 \cdot I/\mathrm{A} + 3.5$ and $B/\mathrm{G} = 8.5 \cdot I/\mathrm{A} - 1$.

2.6 This damned . . . doesn't work! Why?

- UTT doesn't work!
  Check, if STT *is decoupled:* SICS `sttc`

- STT doesn't work!
  Check, if STT *is coupled:* SICS `sttc`

- no motor is drivable!
  Maybe, the SPS is "local". You can check that by typing SICS `remote` *. If so, type* SICS `remote 1` *to take control back to SICS.*
  Maybe the controllers are "local". In this case some of the green buttons on the controllers (left rack) are lighted. Call the local support!

- One motor is not drivable. Errormessage:
  SICS `WARNING: Trying to fix: ERROR: HW:EL734_BAD_STP`
  SICS `...`
  SICS `ERROR: cannot start device` *DEVICE*
  This motor is not enabled in the left rack. You can figure out which switch is the right one, by searching the name of the motor on the small white labels in the rack. On that label there's as well a number, telling you, which switch in the three rows above is responsible. It should be on "enable".

Chapter 3

Direct access to the motor controller

The sics commands SICS mot<*x*> give the opportunity to check or change the parameters of the motor controllers. It is also possible, to run a motor or to perform reference runs. By using these commands you can destroy a lot! So, please use it only when you are sure what to do. Other ways ask the instrument responsible!

Syntax:

SICS mot<*x*> send <*key*> <*slot*> [<*val1*> [<*val2*>]]

with	*x*	a, b or c the name of the controller	tables 3.2a to 3.2c or table 1
	key	the parameter to be set/read or the action to be performed	table 3.1
	slot	the slot-number of the device at controller *x*	tables 3.2a to 3.2c or table 1;
	val1	the first value for parameter/action *key*	table 3.1
	val2	the second value for parameter/action *key*	table 3.1

Example: Drive STT to $2\theta = 30°$

SICS motb send p 2 30

Table 3.1: (next page:) Parameters and commands for the step motor controller EL734. All parameters can be checked just by typing the controller name, the parameter key and the slot number. To modify the values append the new value(s).

	key	*slot*	value	type	unit	meaning
parameter	mn	*m*	[*val1*]	text		motor name
	ec	*m*	[*val1 val2*]	int		encoder mapping (type/number)
	ep	*m*	[*val1*]	int		encoder magic parameter
	a	*m*	[*val1*]	int	digits	precision
	fd	*m*	[*val1 val2*]	int		encoder gearing (number/denom)
	fm	*m*	[*val1 val2*]	int		motor gearing (number/denom)
	d	*m*	[*val1*]	real	deg?	inertia tolerance
	e	*m*	[*val1 val2*]	int	kHz/s	start/stop ramp
	f	*m*	[*val1*]	int		open loop/closed loop (0/1)
	g	*m*	[*val1*]	int	ms/s	start/stop frequency
	h	*m*	[*val1 val2*]	real	deg/mm	low/high software limits
	j	*m*	[*val1*]	int	ms/s	top speed
	k	*m*	[*val1*]	int		reference mode : –11 low limit + index is reference point. –1 low limit is reference point. 0 absolute encoder 1 high limit is reference point. 2 separate reference point. 11 high limit + index is reference point. 12 separate + index is reference point.
	l	*m*	[*val1*]	int	ms	backlash
	m	*m*	[*val1*]	int	es	position tolerance
	q	*m*	[*val1*]	?		reference switch width
	t	*m*	[*val1*]	int		one-sided operation flag (0 = no)
	v	*m*	[*val1*]	int		null point
	w	*m*	[*val1*]	int		air cushion dependency
	z	*m*	[*val1*]	int	es	circumf. of encoder
commands	am			hex	#	active motors, status
	u	*m*	[*val1*]	real	deg	set actual value (v recalculated)
	uu	*m*		real	deg	set actual value (v unchanged)
	ud	*m*		hex	ds	read actual value
	p	*m*		real	deg	read last target value
	p	*m*	[*val1*]	real	deg	drive motor to target value
	pd	*m*	[*val1*]	hex	ds	drive motor to target value
	pr	*m*	[*val1*]	int	ms	drive motor d steps
	n	*m*				drive free from end switch
	s	[*m*]				stop [all] motor[s]
	r	*m*				reference run (u changed)
	rf	*m*				reference run (u unchanged)
	ff	*m*	[*val1*]	int	ms/s	drive forward with ramp and frequency *val1*
	fb	*m*	[*val1*]	int	ms/s	drive backward with ramp and frequency *val1*
	sf	*m*	[*val1*]	int	ms/s	drive forward with frequency f
	sb	*m*	[*val1*]	int	ms/s	drive backward with frequency f
	ac	*m*		int	#	status air cushions (on/of: 1/0)
	ac	*m*	[*val1*]	int	#	de-/activate air cushions (0/1)
	so	*m*	[*val1*]	int	#	set output high/low (1/0)
	ri			bin	#	read all inputs
	ri	*m*		int	#	read input m
	msr	*m*		hex	#	run status m
	ss	*m*		hex	#	show status flags ...
	de	*m*				set default all parameters
	echo		[*val1*]	int	#	0 host-mode without echo 1 terminal-mode with echo 2 host-mode, messages delayed
	rmt		*val1*	int	#	set remote flag (1/0)
	rmt			int	#	read remote (0: offline, 1: host-port active)
	%					stop all motors, reset with default parameters
	?					help
	?c					command list
	?m					message list
	?p					parameter list

deg=degree, ms=motor steps, ms/s=motor steps per second, es=encoder steps, ds=!!!

Table 3.2: Motor parameters for controllers A/2 (page 23), B/3 (page 24), and C/4 (page 25). The meaning of the abbreviations is given in table 3.1.

Table 3.2a: Motor parameters for controller A/2

A/2	mn	ec		ep	a	fd		fm		d	e	f	g	h		j	k	l	m	q	t	v	w	z
1	D1R	1	1	1	3	500	1	2000	1	0.1	20	1	300	-25.000	33.000	5000	1	0	3	0.000	0	16651	0	0
2	D1L	1	2	1	3	500	1	2000	1	0.1	20	1	300	-25.000	32.000	5000	1	0	3	0.000	0	16000	0	0
3	D2R	1	3	1	3	500	1	2000	1	0.1	20	1	300	-25.000	31.500	5000	1	0	3	0.000	0	15802	0	0
4	D2L	1	4	1	3	500	1	2000	1	0.1	20	1	300	-25.000	31.000	5000	1	0	3	0.000	0	15602	0	0
5	D3R	1	5	1	3	500	1	2000	1	0.1	20	1	300	-25.000	30.500	4000	1	0	10	0.000	0	15447	0	0
6	DL3	1	6	1	3	500	1	2000	1	0.1	20	1	300	-25.056	31.744	5000	1	0	10	0.000	0	15971	0	0
7	D1-3T	0	0	1	3	500	1	2000	1	0.1	20	0	300	-202.000	198.000	5000	1	0	1	0.000	0	58400	0	0
8	D1-3B	0	0	1	3	500	1	2000	1	0.1	20	0	300	-204.200	195.800	5000	1	0	1	0.000	0	60600	0	0
9	UTZ	1	7	1	3	-100	1	200	1	0.1	20	1	300	-159.000	17.700	1000	11	0	1	0.000	0	-1715	0	0
10	UTY	1	8	1	3	-200	1	200	1	0.1	20	1	300	-145.960	394.040	1000	-11	0	1	0.000	0	289	0	0
11	RES	0	0	1	3	1000	1	1000	1	0.1	20	0	300	-180.000	360.000	1000	0	0	1	0.000	0	0	0	0
12	RES	0	0	1	3	500	1	1000	1	0.1	20	0	300	-180.000	360.000	1000	0	0	1	0.000	0	0	0	0

Table 3.2b: Motor parameters for controller B/3

B/3	mn	ec		ep	a	fd		fm		d	e	f	g	h		j	k	l	m	q	t	v	w	z
1	STH	3	1	13	3	-131072	360	1000	1	0.1	20	1	300	-250.000	250.000	6000	0	0	1	0.000	0	-60933	0	0
2	STT	1	5	1	3	170300	100	1000	1	0.1	1	1	300	-128.266	134.734	1000	12	0	2	0.000	0	-4126	2	0
3	STX	1	1	1	3	-100	1	200	1	0.1	20	1	300	-178.270	361.730	1000	11	0	1	0.000	0	-1842	0	0
4	STY	1	2	1	3	-100	1	200	1	0.1	20	1	300	-185.830	354.170	1000	11	0	1	0.000	0	-1544	0	0
5	SGX	1	3	1	3	500	1	500	1	0.1	20	1	300	-20.000	20.000	1000	-11	0	1	0.000	0	-9417	0	0
6	SGY	1	4	1	3	-500	1	500	1	0.1	20	1	300	-19.930	20.070	1000	-11	0	1	0.000	0	9933	0	0
7	UTT	1	6	1	3	100	1	200	1	0.1	20	1	300	-95.000	97.000	1000	11	0	1	0.000	0	9317	0	0
8	RES	0	0	1	3	1000	1	1000	1	0.1	20	0	300	/	/	1000	0	0	1	0.000	0	0	0	0
9	SCX	0	0	1	3	1000	1	1000	1	0.1	4	0	1500	/	/	5000	1	0	1	0.000	0	10250	0	0
10	SCY	0	0	1	3	500	1	500	1	0.1	4	0	500	/	/	5000	-1	0	1	0.000	0	0	0	0
11	P01	0	0	1	3	1000	1	1000	1	0.1	20	0	300	-180.000	360.000	4000	0	0	1	0.000	0	0	0	0
12	P02	1	7	1	3	500	1	1000	1	0.1	20	1	300	-223.926	136.074	2000	-11	0	1	0.000	0	-21963	0	0

Table 3.2c: Motor parameters for controller C/4

C/4	mn	ec		ep	a	fd		fm		d	e	f	g	h		j	k	l	m	q	t	v	w	z
1	MTH	1	1	1	3	500	1	1000	1	0.1	20	1	300	-100.000	-23.250	1000	-11	0	1	0.000	0	-56773	0	0
2	MTT	3	1	1	3	4096	1	5000	1	0.1	1	1	300	-100.000	-30.000	1500	0	20	20	0.000	0	-11782851	2	0
3	MTX	2	3	1	3	-256	5	400	1	0.1	20	1	300	-14.239	13.761	1000	0	0	1	0.000	0	-4415	0	0
4	MTY	2	4	1	3	256	5	400	1	0.1	20	1	300	-5.351	14.649	1000	0	0	1	0.000	0	-6001	0	0
5	MGY	0	0	1	3	1000	1	1000	1	0.1	20	0	300	-5.050	4.950	1000	0	0	1	0.000	0	-2050	0	0
6	RES	0	0	1	3	1000	1	1000	1	0.1	20	0	300	-180.000	360.000	1000	0	0	1	0.000	0	0	0	0
7	MFV	2	7	1	3	-480	1	20000	1	0.1	20	1	2000	-2.500	12.000	5000	0	0	1	0.000	0	-6469	0	0
8	RES	0	0	1	3	1000	1	1000	1	0.1	20	0	300	-180.000	360.000	1000	0	0	1	0.000	0	0	0	0

Morpheus

The Greek god of dreams. He lies on a ebony bed in a dim-lit cave, surrounded by poppy. He appears to humans in their dreams in the shape of a man. He is responsible for shaping dreams, or giving shape to the beings which inhabit dreams. Morpheus, known from Ovid's Metamorphoses, plays no part in Greek mythology. His name means "he who forms, or molds" (from the Greek morphe), and is mentioned as the son of Hypnos, the god of sleep.

Sources:
1. Encyclopedie van de Mythologie.
2. Prisma van de mythologie.