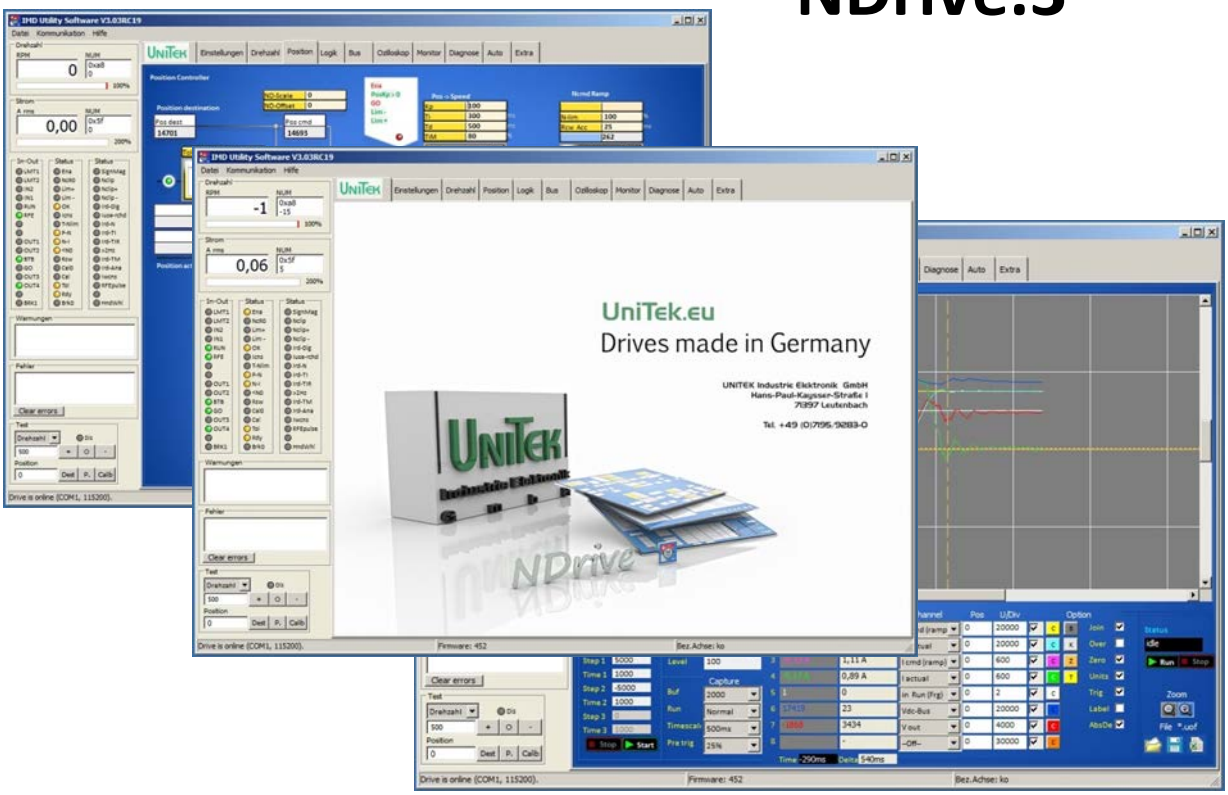
M A N U A L

PC Software Manual
for the Servo Amplifier DS, DPC
and the Battery Drives
BAMO-D, BAMOBIL-D, BAMOCAR-D

NDrive.3



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Edition / Version

2017 V 1

1 Contents

2 Basic information

2.1 History

Version	Modifications	Date
2016 / V1.1	Fax-Number / page 68 (Iq – complete)	02.08.2016
2017 / V1	Error-List / Parameter	14.11.2017

Note :
Only use NDrive3xx for units from firmware FW-350 on (from serial no. 70000)

2.2 Further manuals for digital UniTek units:

1.	MANUAL	DPC 4xx-AC DSxx, BAMO-D3, BAMOBIL-Dx	Hardware description
2.	MANUAL	DSxx, BAMO-D3, BAMOBL-Dx	Commissioning
3.	MANUAL	CAN	BUS system

Use all manuals for the planning, the installation, and the commissioning!

Included as CD version in the equipment delivery (UNITEK-DOKU-SOFT).
Online: www.unitek.eu

MANUAL includes warning and safety notes, descriptions to standards and regulations , and mechanical and electrical installation notes.

The MANUAL must be available at any time for all persons dealing with the unit.

Short symbols/terms

Servo	Digital UNITEK motor controller
Unit	Digital UNITEK motor controller
PC	Personal computer, notebook

2.3 General

The software NDrive3 is used to set-up and optimize UNITEK digital servo amplifiers (DS, DPC) and motor drives (BAMO-D, BAMOBIL-D, BAMOCAR-D).
Basic computer skills and fundamental knowledge of the Windows software are required.
The NDrive3 software and the respective manual are available on CD or via the internet.

2.4 Safety advice:

The parameters and settings of the controller (servo amplifier) and the motor are preset with the software NDrive3.
Operating parameters can be preset and changed during operation. The computer and the PC programs are not malfunction-proof.
The user must ensure that in case of malfunctions neither personnel nor machines are endangered and that the drive is stopped.

Saved data can be changed by third parties. Any imported data record must be checked prior to re-use.
Any adjustments or optimising work on the running drive must only be carried out by trained competent personnel with knowledge of drive and control engineering and computer handling.
Further to this, the safety advice for the amplifier and the drive used must be observed.
Any operation not conform to the safety guidelines is not permissible.

2.5 Operating system

NDrive will operate with WINDOWS 2000 and WINDOWS NT4, WINDOWS XP, Windows Vista

Min. required PC equipment

Processor	80486 or superior
Graphics	WINDOWS compatible
Hard drive, available capacity	3MB
Floppy disc drive	3.5“
CD drive	CD ROM
RAM, min.	8MB
Interface	COM1 or COM2 (RS232, USB adapter)

WINDOWS is a registered trademark of Microsoft Corp.

2.6 Software installation

The user software NDrive3 can be copied.
An installation program is not required.

From a CD (Compact Disc Unitek-Doku-Soft-Vx)

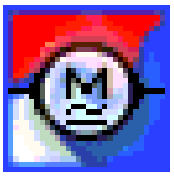
Copy the software file (NDrive-x digital Servo) from the CD to the hard drive (do not install).
Open the NDrive-x-Aktuell-Vxx,
start the software file NDrive-x-Vxx.exe with a double click.

Via the internet

Log into www.unitek.eu or www.unitek-online.de. Click software button.
Download and save the software (NDrive-x-Software.zip).
Decompress in the NDrive-x-software-Vxx and start the software file NDrive-Vxx.exe with a double click.

NDrive ICON

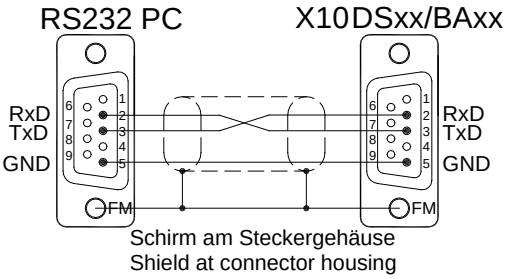
Right click on the software file NDrive-Vxx.exe. Send to the desktop.
The icon is displayed on the desktop as shortcut to NDrive-Vxx.
Double click the desktop icon to start NDrive-Vxx



Icon_32x32

2.7 Communication RS232 (COMx)

Software communication between the PC and the servo amplifier is effected via RS232.
115200 baud rate.
The connecting cable is a null modem type cable.
Do not use a null modem link cable!
Use an USB-RS232 adapter with PCs with an USB interface.
Use the USB adapter RS323 for PCs with an USB interface.
Plug and unplug the connecting cable only when the interface is disconnected.
The interface is galvanically connected to device ground (AND).



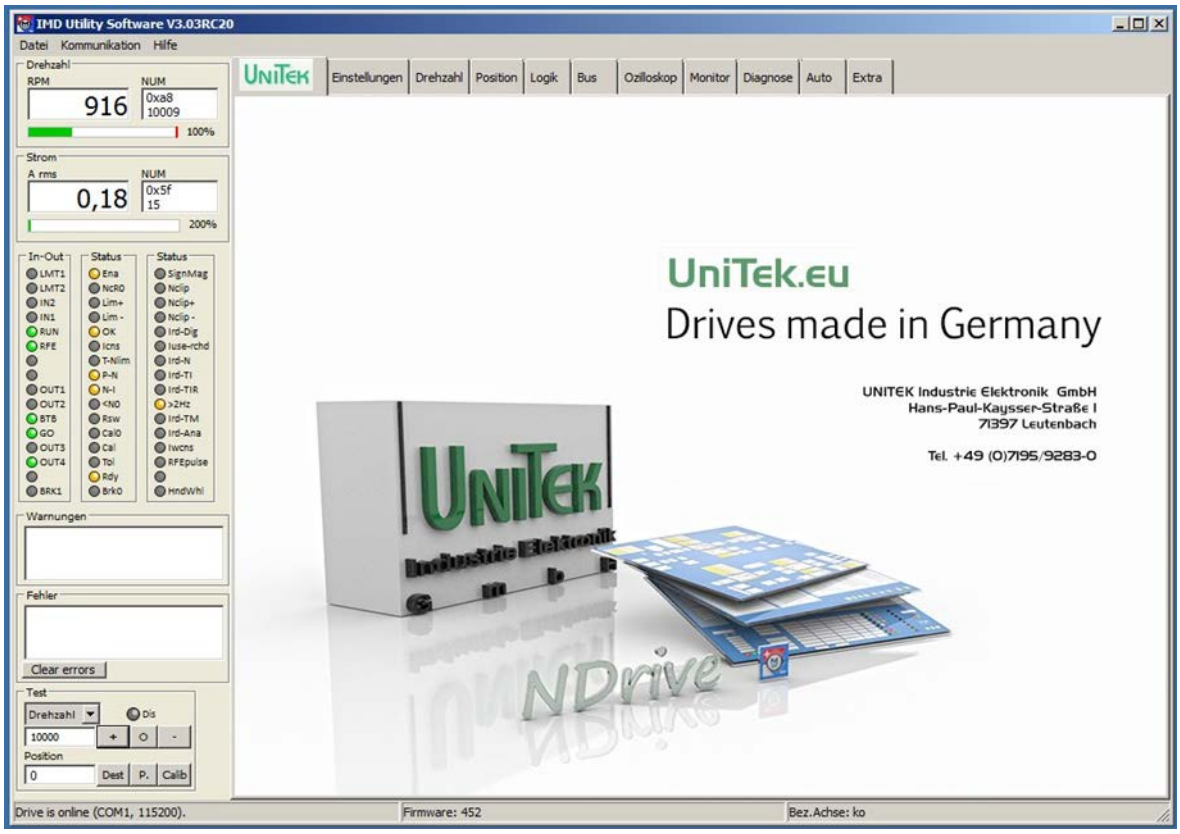
DS400-RS232-Verb.

Communication USB (COMx) (TMS-DEIF)

USB connecting cable with a xxxx connector on the device side. Baud rate 115200. Plug or unplug the connecting cable only if the interface is isolated. The interface is galvanically isolated from the device zero (AND).	

Description

3 Start screen



3.1 Description

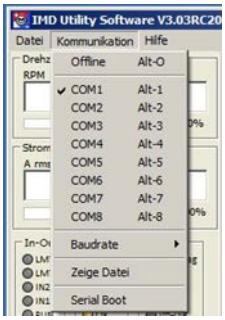
The program presents a screen consisting of two elements. A constant outer frame (grey) and an interleaved page area (blue). The pages are accessed by a horizontal tab bar running across the top of the frame

Top	Title bar, menu bar, page tabs
Left	Display of speed, current, inputs and outputs, states, errors, and test functions
Bottom	Setup states
UNITEK symbol	Link to the Unitek website

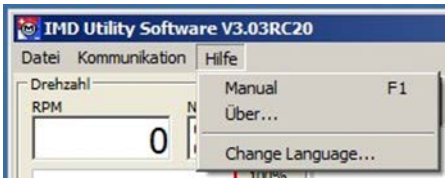
The screen surface switches between pages.
The tab structure allows for easy access of relevant data and fast switching between the pages.
The grey frame surface is constantly displayed.
The selected pages are opened across the complete blue area.
It is always possible to switch between the pages without a time delay.
Multi-page parameters are automatically transferred. Settings referring to only one page remain unaffected.

Title bar NDrive version + parameter set name

Drop-down menu for Windows commands



communication
COM-Port
Baud rate 115200



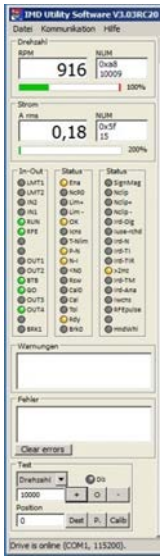
Help
Manual (NDrive3.PDF)
About (UNITEK)
Select language
(Change Language)

File Features

Load register	NDrive file*.urf	Loading of the parameter file from the pc to the unit
Save register	NDrive file*.urf	Saving of the parameter from the unit to the pc file
Import register file (*.utd.)	DRIVE file*.utd	Loading of an old (utd) parameter file from the pc to the unit
Print register	NDrive file	Printing of selected parameters (registers)
Print selected registers	Selected files	Printing of selected parameters (registers)
Script execution	(for service only)	Load protected parameters to the unit
Exit		Closing the window

Page - Register

Permanently active display and inut fields



Speed	Numeric speed display in rpm. Bar graph 0-100 % speed
Current	Numeric current display in Aeff. Bar graph 0-200% rated current
Inputs / Outputs	Display of the active inputs and outputs
States	Display of the states
Warning	Display of the warnings
Faults	Error display
Test	Only for test operation!!
Current	Numerical entry for a test current
Torque	Numerical entry for a test torque
Speed	Numeric entry of a test speed value
Position	Dest: = numeric entry of the position P(preset) = entry as actual position value and command value Calib. = Start of a reference run

Footer: Communication Firmware Axis designation

3.2 Operation

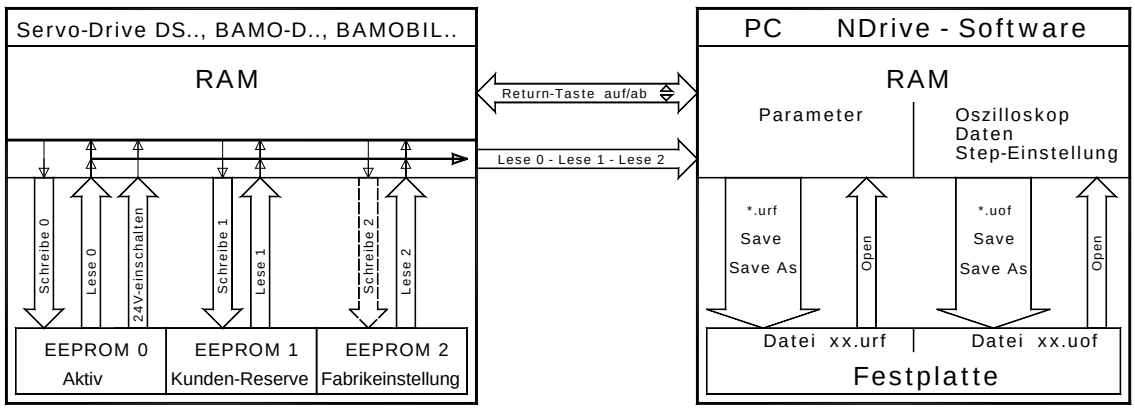
The PC user interface has a standard WINDOWS format.
Only use whole numbers and write decimals with a point.
Write positive values without a sign, negative values with a -sign.

Offline operation

There is no connection to the control unit (servo amplifier). The message 'Drive is offline' flashes in the bottom line of the frame display.
To download a parameter file click → communication → view file and use the windows browser to select and open a file (*.urf).
The parameter data are transferred to the input fields.
The data can now be optimised and saved again with → file → save register. The original file may be overwritten or a new file created.

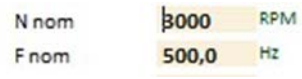
Online operation

Plug the connecting cable RS232. Switch on the PC and the control unit.
Select the baud rate of 115200.
Select the communication interface with → communication → COM1 to COM8.
When the connection is successful, the message 'Drive is online' appears in the bottom frame line.
The active drive parameter data will be imported from the drive to the PC and can be manipulated via the input fields as required.
Any changed data will be downloaded from the PC to the RAM of the drive by clicking → enter.
Tested parameters are permanently saved in the EEPROM by clicking the key field 'memory level0.1'.



3.3 Entry and selection

Click the **entry field** (left mouse button),
enter a numerical value and click → enter to save the new value into the PC RAM and the Drive RAM.



Up-Down value change
Click an input field (left mouse button).
The value can be changed via the up and down buttons.
The values are immediately updated in both device RAMs

Drop-down menu
Click the arrow button of the list box. The menu shows the available options. Scroll up or down by means of the arrow button and select an option. Selecting an option updates the variable and closes the option menu

Option buttons
Click button. The green button displays the selected function.
A tick in the button shows the selected option.

4 Help

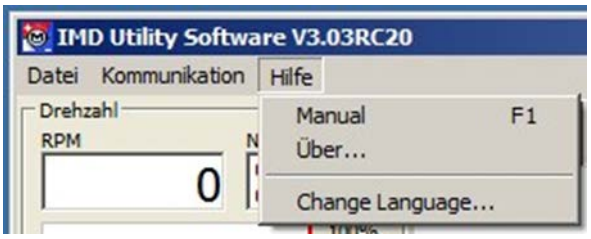
4.1 Direct help

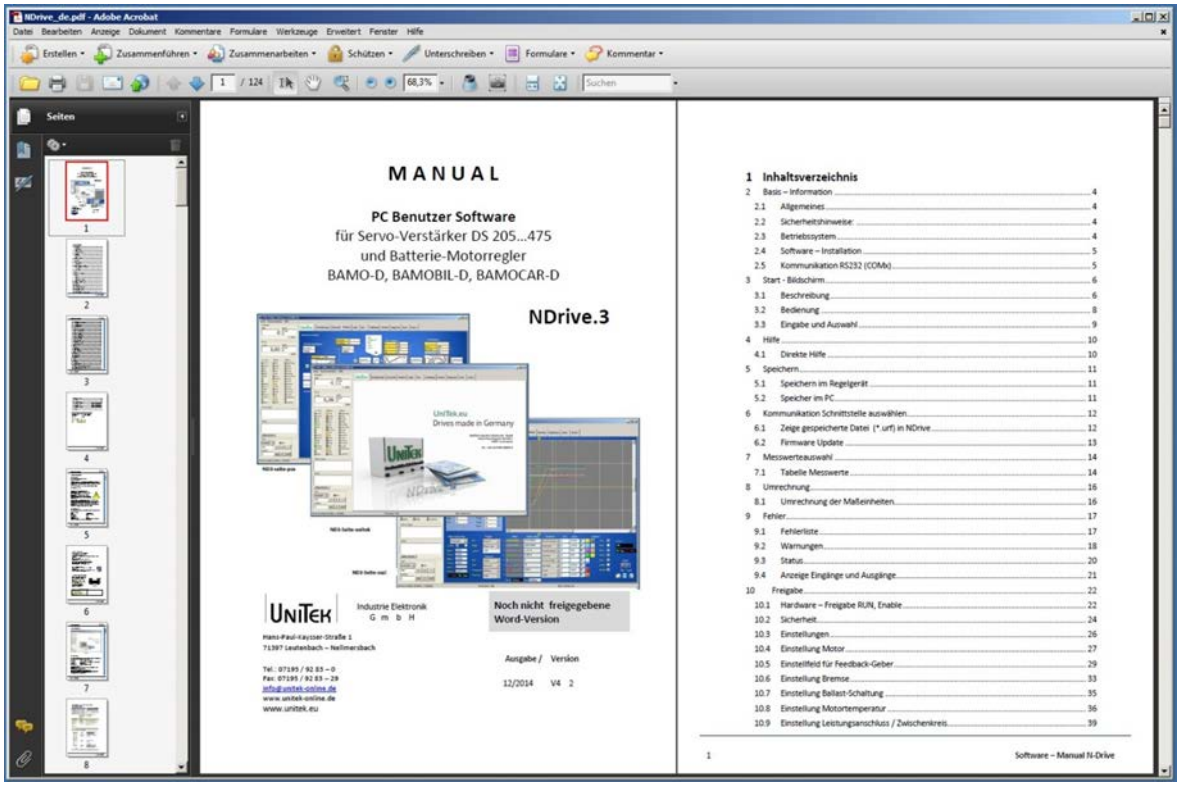
Shift the cursor to the parameter entry field or setup field and an explanation field opens.
An explanation field opens.

Hilfe-tooltip

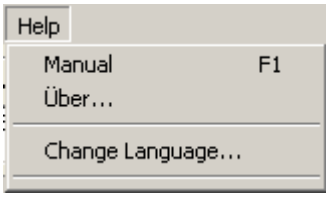
Help menu

Click ***Help.***
Click ***Manual.***
A pdf version of the manual ***Manual NDrive*** is opened. Clicking the topic in the bookmark opens the requested page.





Select language
Click ***Help***
Click ***ChangeLanguage***
A list box opens
Select the language
Restart **NDrive**



5 Storage

5.1 Storage in the controller

Download of parameter data from a PC to the controller (servo) RAM (volatile)

When there is an active communication the parameters displayed on the screen are those currently active in the drive RAM. When a value is changed, the value is directly updated in the drive RAM when the return key is pressed.
Attention: If the +24 V auxiliary voltage is switched off, the RAM data will be lost.

write / save

EEPROM (non-volatile)
Click → ***write0 (1)*** on the setting page.
The data are written into the drive EEPROM (level 0, 1).
The EEPROM level 0 contains the current parameter record which is downloaded to the drive RAM each time when the 24 V auxiliary voltage is switched on.

Note:
The data EEPROM level 2 is code protected and not visible. It is only visible with the release code.
The data of ***Write2*** are write-protected and contain the factory-set parameter set.

Transfer of parameter data from the drive (servo) to the PC

Click → ***read0 (1, 2)*** on the setting page.
The parameter data are transferred from the drive EEPROM to the drive RAM and from the drive RAM to the PC RAM

read / load

5.2 Storage to the pc

Saving the parameter data of the PC RAM to PC disks (hard drive, CD, floppy disk, etc.)

Saving parameter data in the PC (*.urf)

- via the menu bar
Click → ***file*** in the menu bar.
Click → ***save registers*** and the window is opened. Select the required folder and save with the same or a different file name.

read / load

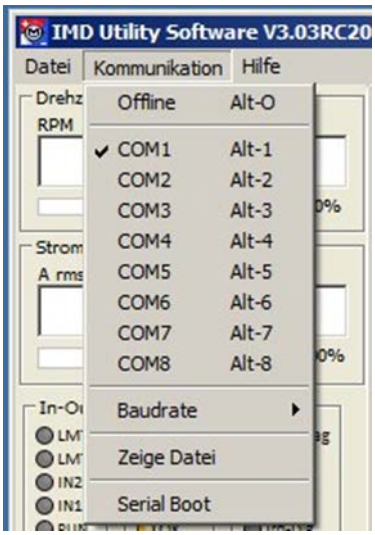
Through the button *save*
Click → ***save*** on the setting page.
The window ***save register file*** is opened. Select the required folder and save with the same or a different file name

Transfer of parameter data from PC discs (hard drive, CD, floppy disk, etc.) to the PC RAM

Click → ***download*** on the setting page and the window ***download register file*** is opened.
Select the requested folder and click → ***open*** to download the data to the NDrive
The parameters are in the RAM. In order to store them permanently, click → ***write 0*** or ***write 1*** (EEPROM).

6 Selection of the communication interface

- for online operation



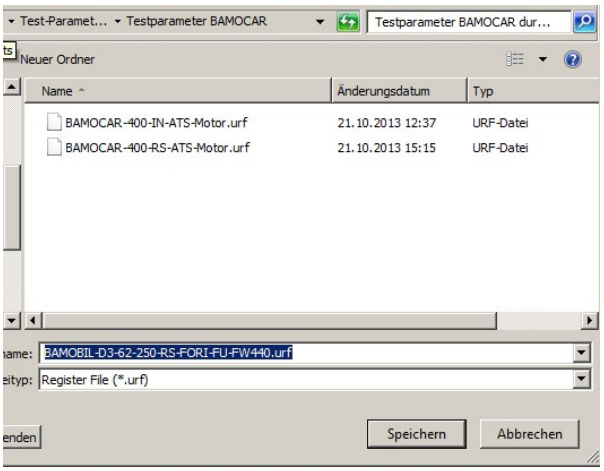
Click the menu → ***communication*** to drop down the options.
Click the requested ***COMx*** interface (Com1 to Com8) to select it. The checked interface is selected and the connection to the control unit (servo) is established.
The message ***Drive is Online (COMx)*** is displayed in the bottom screen frame.

Note:
If the data scroll in the warning or error display, the COM connection is faulty.

Stop communication
Open drop down menu ***Kommunikation.***
Click →***Offline*** .
The connection is cut off and the message **Drive is offline** is displayed in the bottom screen frame.

6.1 Display of a saved file (*.urf) in the NDrive

Click ‘view file‘.
The window ‘load register file’ opens.
Select folder.
File is loaded to the NDrive.
The parameter fields are overwritten.
The parameter data can be changed.
Save the modified and checked values with the same or a new name (*.urf) in the pc via ‘save file register‘.



6.2 Firmware update

Please use the manual **"Firmware update-2017-SD-Flash_EN.pdf.**
Then you will have an update version. The latest manual can either

Manual:

be found on the UniTek CD

UNITEK-CD-DOKU-SOFT
Folder "SOFTWARE\NDrive2-Software\Firmware update inst"

or downloaded from our homepage

www.unitek.eu or www.unitek-online.de

Destination	Download	
Download	NDrive2-Software.zip	Press "NDrive2-Software.zip" and save on PC (e.g. Downloads)
Extract	NDrive2-Software.zip	Press RM + (Extract All… / Extract Here)
Open folder	"NDrive2-Software/Firmware update inst"	

7 Measured values

7.1 Table of measured values

Measured values			
Selected values	**Function**	**Range**	**ID address**
OFF	No measured value		REGID
N cmd	Speed command value before ramp	+/- 32767	0x31
N cmd Ramp	Speed command value after ramp	+/- 32767	0x32
N actual	Speed actual value	+/- 32767	0x30
N actual-filter	Filtered speed actual value for display	+/- 32767	0xa8
N error	Speed command/actual value error	+/- 32767	0x33
I cmd	Current command value	see table	0x26
I cmd Ramp	Current command value after ramp	see table	0x22
I actual	Actual current(I)	see table	0x20
I actual-Filter	Filtered current actual value for display	see table	0x5f
Leistung	Motor power		0xf6
Pos dest	Position target	+/- 2147483647	0x6e
Pos cmd	Position command value	+/- 2147483647	0x91
Pos actual	Actual position	+/- 2147483647	0x6d
Pos error	Position command/actual value error	+/- 32767	0x70
Zero capture			0x74
I_Limit1	Digital input END1	0/1	0xe4
I_Limit2	Digital input END2	0/1	0xe5
I_Din1	Digital input 1	0/1	0xe6
I_Din2	Digital input 2	0/1	0xe7
I_Run (Frg)	Digital input control unit enable	0/1	0xe8
O_Dout1	Digital output 1	0/1	0xe0
O_Dout2	Digital output 2	0/1	0xe1
O_Dout3	Digital output 3	0/1	0xe1
O_Dout4	Digital output 4	0/1	0xe1
O_Rdy (BTB)	Drive ready message	0/1	0xe2
I_Fault	Intern. error message from the power section	0/1	0xe9
I_Regen (Ballast)	Ballast circuitry state	0/1	0xea
I_o´/u´ voltage	Over-voltage condition	0/1	0xeb
I_LossOfSignal	Resolver signal missing or faulty	0/1	0xec
O_Go	Internal enable	0/10/1	0xe3
O_Brake	Active brake	0/1	0xf2
O_Icns	Limited to continuous current	0/1	0xf3
O_Less_NO	Speed inferior to 0.1%	0/1	0xf5
O_Toler	Within position tolerance range	0/1	0xf4
Rotor	Rotor position signals (RST)	1 to 6 (0 or 7 = error	0x5c
Var1	Comparison reference value 1	+/-32767	0xd1
Var2	Comparison reference value 2	+/-32767	0xd2
Var3	Comparison reference value 3	+/-32767	0xd3
Var4	Comparison reference value 4	+/-32767	0xd4
MPOS_mech	Mechanical rotor position		0x42
MPOS_elec	Electrical motor position		0x43
Ain1	Analog input Ain1	+/-32767	0xd5
Ain2	Analog input Ain2	+/-32767	0xd6
I3_adc	Current actual value sensor 3	2048 +/- 2000	0xa9
I2_adc	Current actual value sensor 2	2048 +/- 2000	0xaa
I1_actual	Current actual value Ph1	see table	0x54
I2_actual	Current actual value Ph2	see table	0x55
I3_actual	Current actual value Ph3	see table	0x56
Iq_actual	Current actual value	0-600	0x27
Id_actual	Current actual value	0-600	0x28
Iq_error	Current actual value - command/actual val. error	0-600	0x38
Id-error	Current actual value - command/actual val. error	0-600	0x39
Idnom			0xb2
Idmin			0xb5
Ilim_inuse			0x48
DC-BUS	Bus voltage	0-32767	0xeb
Vd	Voltage		0x2a
Vq	Voltage		0x29
Vout	Output voltage		0x8a

7.2 Table / measured value

Measured values			
Selected values	**Function**	**Range**	**ID address**
Vred	Voltage limitation		0x8b
pwm1 (5/6)	Pulse width modulation phase 1	750 +/-750	0xac
pwm2 (3/4)	Pulse width modulation phase 2	750 +/-750	0xad
pwm3 (1/2)	Pulse width modulation phase 3	750 +/-750	0xae
T_Motor	Motor temperature	0-32767	0x49
T_IGBT	Output stage temperature	0-32767	0x4a
T_air	Air temperature (unit interior)	0-32767	0x4b
Ballast Count	Ballast power monitoring		0xa1
Temp-Debug	For service only		0x9a
Logic (Hz)	I/O processing frequency	0-32767	0xab
Time_1us	Time pulse 1us	1/0	0x98
***PTR1**			0xb8
***PTR2**			0xba
Unknown			

8 Conversion

8.1 Conversion of the measurement units

For position, speed, current, and command value

Some of the measured values are not converted in all formats. Numeric values (num) are indicated and processed. It must be differentiated between the values and their numeric representation when processing data such as in case of data transfers (CAN-BUS, RS232) or track and oscilloscope displays.

Position

Actual position range	Resolver	Incremental encoder
Pulses/rpm Max. value +/-2147483647 (31 Bit-1)	65536	65536
Resolution (lowest value)	16 (65536/4096 (12Bit))	65536/Ink x4
Example Feed Drive Factor 5mm/rpm	Travel 1000mm = 200 rpm 200 rpm = 13107200 Resolution = 65536/4096 = 16	Incremental encoder 2048 pulses/rpm Travel 1000mm = 200rpm 200 rpm = 1638400 Resolution 65536/8192 = 8

Speed

Actual speed range	Max. speed (Nmax) calibration	Limitation
Max. value +/- 32767 (15Bit-1)	Nmax value in the parameter field Motor and speed = 32767	Speed limiting via the parameter field 'speed limit'
Example	N max = 2000 Speed of 2000 rpm corresponds to 32767	The max. speed is limited to 1500 rpm. Limit = 32767/2000*1500 = 24575 num Die maximale Drehzahl ist auf 1500 Upm begrenzt

Current

	I 100 %	Rated current (I) calibration I-device			Peak current (I) DC disabled		Limitation
Max. value +/- 9bit	mV	Num	Aeff	A=	Num	A=	Limit set in the parameter fields ***Motor*** and ***Current***. The smallest value is valid.
DS 205/405	550	440	5	7	640	10	
DS412	800	640	12	17	920	24	
DS420	700	560	20	28	800	40	
DS450	416	328	50	70	480	100	
DS475 / BAMO-D3	416	328	75	105	480	150	
BAMOBIL-D3-50/250	870	700	25/125	35/175	1020	50/250	
BAMOBIL-D3-80	560	450	40	56	650	80	
BAMOBIL-D3-100	700	560	50	60	800	100	
BAMOBIL-D3-120	840	670	60	84	970	120	
BAMOBIL-D3-350	610	490	175	245	710	350	
BAMOBIL-D3-450	785	630	225	315	910	450	
BAMOCAR-D3-250	625	700	125	176	1020	250	
BAMOCAR-D3-400	500	560	200	282	810	400	

Command values

Position command value range	Speed command value range	Current command value range		
Max. value +/-31Bit	Max. value +/-15 Bit	Max. value +/- 9Bit		
+/- 2147483647 Num	+/- 32767 Num	DS 205/405	rated: 440	max: 640
		DS 412	rated: 640	max: 920
		DS 420	rated: 560	max: 800
		DS 450	rated: 328	max: 480
		DS 475/BAMO	rated: 328	max: 480

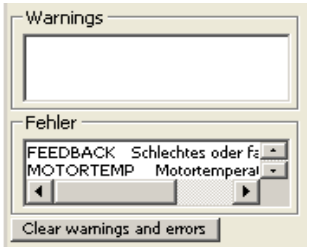
9 Errors

The error messages are displayed in the window **'Error'**.

9.1 Error list

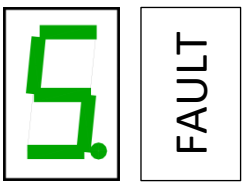
Display on the servo	Error message on the NDrive	Description	
	NOREPLY-NORS	RS232 failure. Incorrectly connected or missing connecting cable	
0	BADPARAS	Defective parameter	
1	POWER FAULT	Output stage fault	
2	RFE FAULT	Faulty safety circuit (only active for RUN)	
3	BUS TIMEOUT	Transfer fault BUS	
4	FEEDBACK	Faulty encoder signal	
5	POWERVOLTAGE	No power supply voltage	
6	MOTORTEMP	Motor temperature too high	
7	DEVICETEMP	Device temperature too high	
8	OVERVOLTAGE	Overvoltage >1.8 x UN	
9	I_PEAK	Over-current 300 %	
A	RACEAWAY	Racing (no command value, incorrect polarity)	
B	USER	User – error selection	
C	I^2R	Bleeder resistor	
D	HW_FAIL	Firmware not compatible with hardware	
E	ADC-INT	Current measuring fault	
F (device dependent)	BALLAST	Ballast circuit overload	
Flashing decimal point		Active processor	
Dark decimal point		No auxiliary voltage or unit-internal hardware fault	

LED displays on the servo



In case of an error the red LED 'fault' lights up and the error no. is indicated.
The BTB (ready) contact is opened.
The software ‚BTB message' switches from 1 to 0.
The state message ‚RDY' extinguishes.

When the enable is switched off, the error message is still displayed.



The error message deleted:
When the enable is switched on, the function 'cancel errors' is activated via a digital input or a CAN BUS.

Note:
When applying the 24V auxiliary voltage with the enable closed (FRG/RUN X1:7 aktiv) the red LED signals an error. There is no fault signal displayed in the 7-segment display.

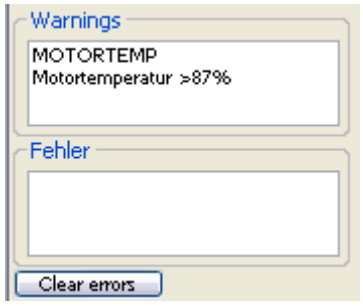
9.2 Warnings

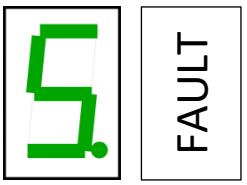
Display of the warning messages.
The warning messages are displayed in the window 'warnings'.

Display on the servo	Error message on the NDrive	Description	ID address
			REGID 0x8f
0	WARNING_0	Inconsistent device identification	Bit 16
1	ILLEGAL STATUS	Faulty RUN signal, EMI	Bit 17
2	WARNING_2	Inactive RFE signal (without RUN)	Bit 18
3			Bit 19
4			Bit 20
5	POWERVOLTAGE	Power voltage missing or too low	Bit 21
6	MOTORTEMP	Motor temperature > 87 %	Bit 22
7	DEVICETEMP	Device temperature > 87 %	Bit 23
8	OVERVOLTAGE	Overvoltage >1.5 x UN	Bit 24
9	I_PEAK	Over-current 200 %	Bit 25
A			Bit 26
B			Bit 27
C	I2R	Overload > 87 %	Bit 28
D			Bit 29
E			Bit 30
F	BALLAST (device dependent)	Ballast circuit overload > 87 %	Bit 31

LED desplays on the servo

In case of warning state the red LED changes (low-frequency) and the seven-segment display shows alternately the warning no. (red LED) and the operating state (LED dark).





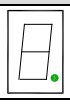
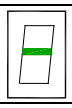
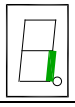
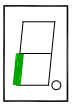
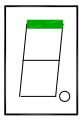
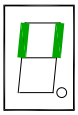
LED display on the servo

The operating state **"normal"** is signalled by a bright green seven-segment display + decimal point (display of the state).

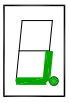
The state **"fault"** is signalled by a bright red fault LED and the seven-segment display indicates the error no.

In case of a "**warning"** state the red LED changes and the segment display shows alternately the warning no. and the state.

Display of the servo-drive state

Display	Point/segment	State		State of NDrive
	flashing dark	Processor active Auxiliary voltage missing or inherent hardware failure		
	flashing bright dark	Starting state after reset (aux. voltage 24V off-on). The first enable stops the flashing display. Drive enabled Drive disabled (not enabled)		OK = 0 OK = 1, ENA = 1 OK = 1, ENA = 0
	bright	Speed zero (standstill signal)		NO = 1
	bright	Drive revolves clockwise, N currently positive		NO = 0
	bright	Drive revolves anti-clockwise, N currently negative		NO = 0
	flashing bright dark	Motor current reduced to continuous current Icns Motor current at max. current limit I_{max} Normal operation; Motor current within the current limits		Icns = 1 Icns = 0 Icns = 0
	bright for 0.1s	Left segment: Right segment:	A new command (value) was received from the BUS or RS232 Digital input changed.	

Example: **Motor revolving clockwise**

Point flashes	=	Processor active	
Bottom segment	=	Drive enabled	
Right segment	=	Motor revolves clockwise	

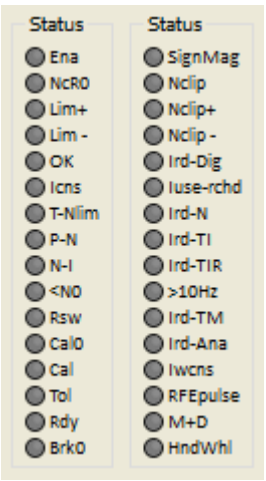
Ballast circuit
switching: The direction segment (at the right or left bottom) is switched off when the ballast circuit is switched on.

9.3 States

State display
The operating states are displayed in the window 'state'.

List of states

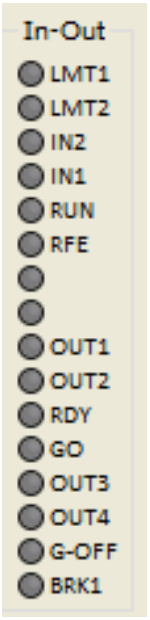
Display of the state	Function	address
		REGID 0x40
Ena	Drive enable (combination hardware RUN and Software)	Bit 0
NcR0	Speed limit to zero (Speed command still active)	Bit 1
Lim+	Limited switch Plus tripped	Bit 2
Lim-	Limited switch Minus tripped	Bit 3
OK	Drive okay (no uncontrolled control-voltage reset seen)	Bit 4
Icns	Current is limited to the continuous current level	Bit 5
T-Nlim	Speed limited torque mode active	Bit 6
P-N	Position control possible	Bit 7
N-I	Speed control possible	Bit 8
<N0	Actual speed less than 0.1 %	Bit 9
Rsw	Reference switch tripped	Bit 10
Cal0	Calibration move active	Bit 11
Cal	Calibration move completed (position calibrated)	Bit 12
Tol	Position within tolerance window	Bit 13
Rdy	Drive ready (BTB/RDY contact is closed)	Bit 14
Brk0	De-energized brake with motor active	Bit 15
SignMag	Speed internally inverted	Bit 16
Nclip	General speed limiting (if ≤ 90%) possible	Bit 17
Nclip+	Additional switchable positive speed limiting possible	Bit 18
Nclip-	Additional switchable negative speed limiting possible	Bit 19
Ird-Dig	Current limiting (switchable) reached	Bit 20
Iuse-rchd	Actual current limit reached	Bit 21
Ird-N	Current limiting (speed)	Bit 22
Ird-TI	Current derating (power-stage temperature) possible	Bit 23
Ird-TIR	Current reduced to continuous current (power-stage temperature)	Bit 24
>10 Hz	Additional current limit if frequency less than 10 Hz	Bit 25
Ird-TM	Current limiting due to motor temperature reached	Bit 26
Ird-ANA	Current derating due to analog input (if ≤90 %) possible	Bit 27
Iwcns	Current peak value warning	Bit 28
RFE pulse	Pulsed RFE –input monitoring active	Bit 29
M+D	vacant	Bit 30
HndWhl	Hand-wheel function selected	Bit 31



9.4 Display of inputs and outputs

The LEDs are bright when the positive input voltage is superior to >10 V and the output voltage is positive

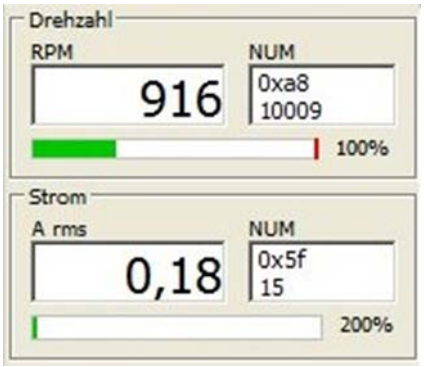
Short symbol	Function	ID-Ad.
		REGID 0xd8
LMT 1	Digital input limit 1 active	Bit 0
LMT 2	Digital input limit 2 active	Bit 1
IN 2	Digital input Din 2 active	Bit 2
IN 1	Digital input Din 1 active	Bit 3
FRG (RUN)	Hardware enable active	Bit 4
RFE	Rotating field enable	Bit 5
		Bit 6
		Bit 7
OUT 1	Digital output Dout 1 on	Bit 8
OUT2	Digital output Dout 2 on	Bit 9
BTB (Rdy)	Hardware relay, output BTB (Rdy) on	Bit 10
GO	Internal enable GO active	Bit 11
OUT 3	Digital output Dout 3 on	Bit 12
OUT 4	Digital output Dout 4 on	Bit 13
G-OFF		Bit 14
BRK1	Excited brake	Bit 15



Display of speed and current

Speed in rpm (revolutions per minute) and as numerical value from the parameter 0xa8

Current in Aeff (motor current in ampere effective / rms) and as numerical value from the parameter 0x5f



10 Enable

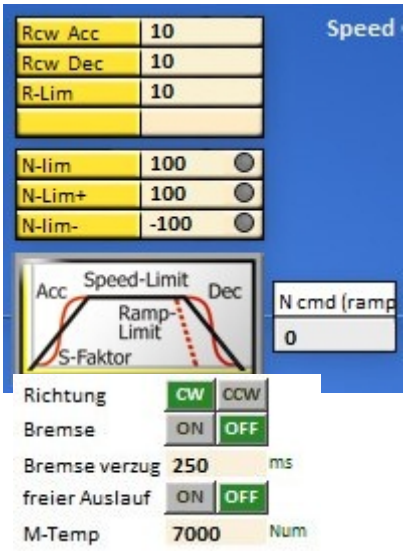
10.1 Hardware - Enable FRG/RUN

Switching on

Voltage across the enable input (X1:7, X1:G FRG/RUN) > 10 V= , <30 V=
The power stage of the drive is immediately enabled when the drive enable is switched on. The software control of the power stage is activated 2ms later. Commands such as command values, reference travel, etc. can be sent 5ms after the drive enable (RUN).
The enable state is indicated in the state field with '***Ena'***.

Switching off

Voltage across the enable input (X1:7, X1:G FRG/RUN) < 4 V=
When the enable function is switched off, the drive is electronically disabled.

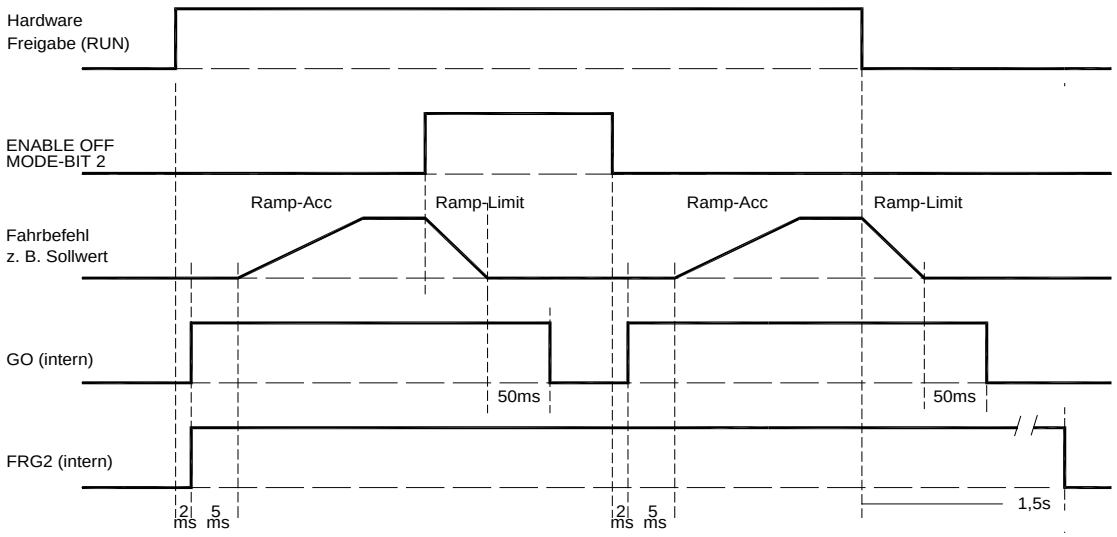


Switching off with emergency stop (free coasting Off)

The drive decelerates to standstill before it is enabled.
When the enable function is switched off, the internal speed command value ***N cmd Ramp*** is reduced to zero by means of the ***ramp limit*** which has been adjusted in the parameter field ***speed***. The power section is disabled by means of the internal command ***GO*** 50ms after the axis has come to a standstill or after the ramp time (***ramp limit***) + 50ms has elapsed.
The power stage is disabled after 1.5 s at the latest.

Switching off without emergency stop (free coasting On)

The power section is immediately disabled when the enable function is switched off.
The drive decelerates free of torque.



Enable and disable function via interfaces (CAN BUS, RS232)

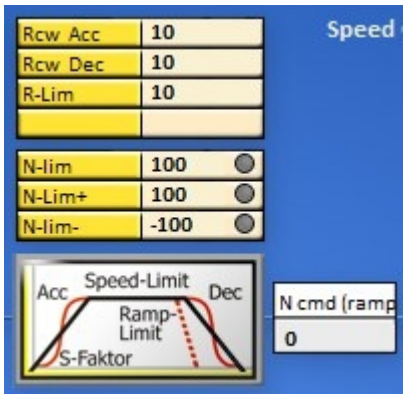
The hardware enable (FRG/RUN) and the safety input must be switched on!

Enable

By means of the command '**Not ENABLE OFF'** (MODE-BIT 0x51 Bit2=0) the amplifier is enabled without delay.

Disable

By means of the command **'ENABLE OFF'** (MODE-BIT 0x51 Bit2=1) the internal speed command value **N cmd (ramp)** is controlled to zero according to the ramp **R-Lim** adjusted in the parameter field 'speed'.



Set **R-Lim** in such a way that the drive is braked to a standstill.

50ms after the switch-off ramp time (ramp limit) has elapsed, the power section is disabled. The drive is torque-free.

Software enable of the NDrive

The hardware enable (FRG/RUN) must be switched on!

Switching field Dis
grey = Software enable = ON
red = Software enable = OFF

10.2 Safety

Safety input RFE (Rotating field enable)
Warning:

If the input of the enable or of the rotating field (FRG/RUN) enable are switched off, the drive is free (RFE) of torque. The drive could move if there is no mechanical brake or block provided.

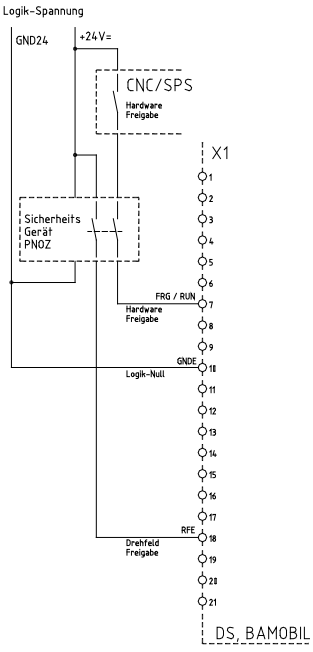
The motor conductors are **not dead**. Only the rotating field is disabled. Prior to any work or maintenance on the motor or servo-drive, the servo-drive must be completely disconnected from the mains power supply.

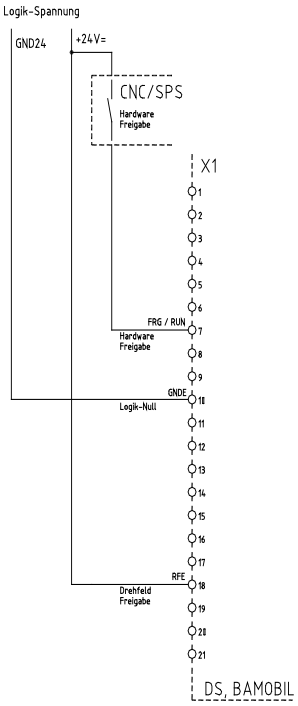
Operation with an RFE input
Two-channel disable of the enable via a safety switching device.
Enable input FRG/RUN + Rotating field enable input RFE.

Switching-on
Contacts of the safety device closed, enable FRG/RUN 0.5s after RFE.

Safety switch-off
Contacts of the safety device open:
- there is no FRG/RUN signal in the 1st disable channel to disable the PWM pulses in the processor
-there is no RFE signal in the 2nd disable channel to disable the PWM pulses at the output of the processor

Restart
Release the safety switching device.
Contacts of the safety device closed.
The motor can only move after a second disable FRG/RUN (after the rotating field enable).





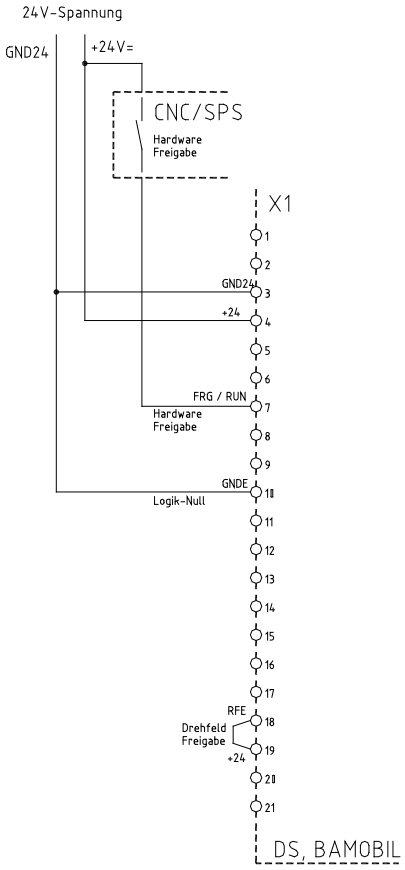
Operation without RFE input

The input RFE must be bridged with the logic voltage.

If the logic voltage corresponds to the supply voltage, the RFE input is bridged with +24 V.

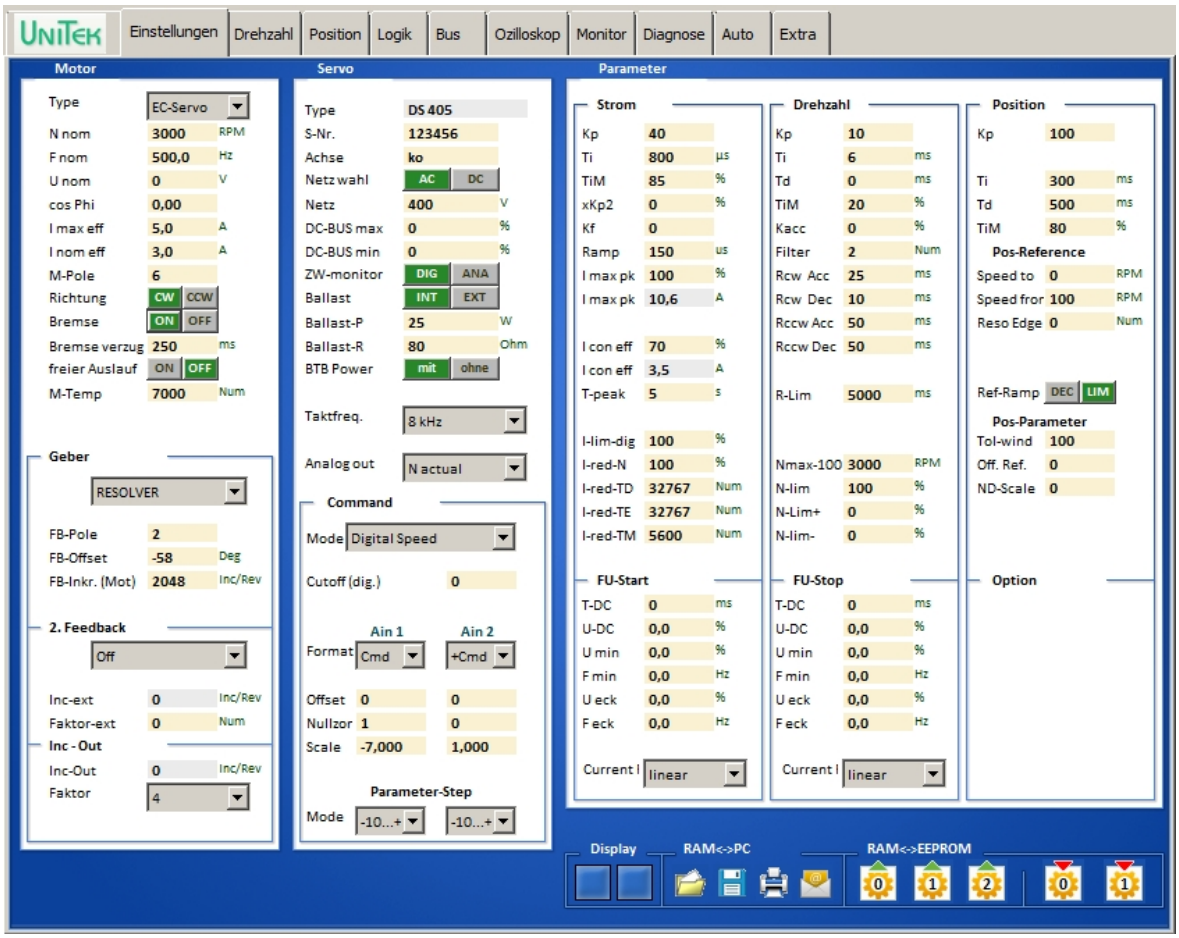
Enable FRG/RUN at least 0.5 s after the RFE signal.

Note:
In case of circular and Tyco connectors (BAMOCAR,BAMOBIL) use the plug no. of the device MANUAL.



10.3 Settings

Parameters and data input



Input fields for motor data, device data (servo) and parameter data.
Buttons for the saving functions.

The adjustments for the motor and the servo amplifier can only be made via the setting window. The parameter data can be entered via this and several other windows. The changed parameter data are immediately updated on all pages.
When a value has been changed, the new value is automatically updated on all windows.
See the detailed information for the input fields.

Note:

Prior to the first commissioning and any change of the motor type the data displayed in the setting windows must be checked with the type plate or the data sheet of the motor.

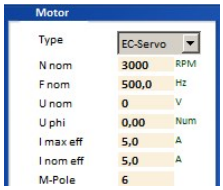
Please observe the motor specific connection guidelines!

Any changes of the set value during online operation must only be carried out by competent and qualified personnel.

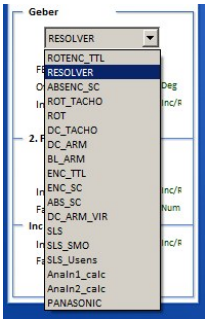
10.4 Motor setting

Setting window for the rated motor data

Motor setting parameters					
Short symbol	**Function**	**Setting range**	**Unit**	**Note**	**ID address**
Type	Select motor type				
Nnom	Rated motor speed	Type plate (600-50000)	rpm		0x59
Fnom	Rated motor frequency	20 bis 1200	Hz		0x05
Unom	Rated motor voltage	Type plate	V		0x06
Uphi	Motor power factor	Type plate	%		0x0e
I max eff	max. motor current(I)	Type plate	A		0x4d
I nom eff	Continuous motor current(I)	Type plate	A		0x4e
M- Pole	No. of motor poles	2..48	Num		0x4f
Direction	Select rotation direction	Switching field	Selection		0x5a-Bit8
Brake	Select with/without brake	Switching field	Selection		0x5a-Bit18
Brake Delay	Response time motor brake	0..500	ms		0xf1
Free coasting	Selection	Switching field			0x5a-Bit3
M-Temp	Switching point motor temperature	0 to 32767	Num		0xa3
Encoder	Selection of encoder system		Selection		
2. Feedback	Selection 2. encoder system		Selection		
Inc-Out	Output counter increment				



Motor type selection	**Motor type**
EC-Servo	Synchronous servo motor with encoder system (sensor)
FU	Asynchronous motor frequency converter without sensor
FU-Servo	Asynchronous motor AC servo vector control with speed encoder system (e.g. position encoder A,B channel)
DC	DC motor without or with DC tacho encoder

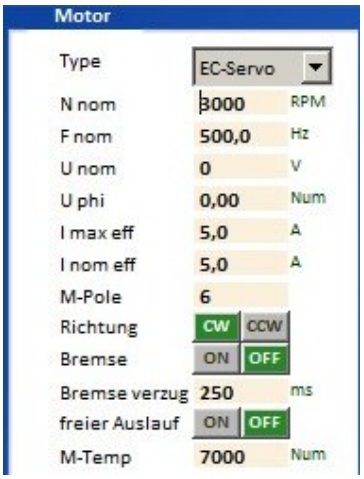


Motor type selection	**Feedback**	
EC-Servo	Feedback selection	
FU	without feedback	
FU-Servo	Feedback selection	
DC	without feedback or DC tacho	

Setting window for the rated motor data
Check type plate, data sheet, and Unitek connection specifications!

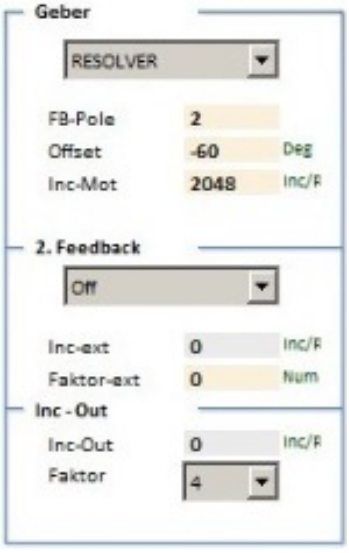
Motor

Type	Motor type selection (EC-Servo, FU , FU-Servo, DC)
N nom	Motor speed (type plate) Is used as calculation value for FU autotuning
F nom	Frequency at which the rated motor speed is reached. Only for frequency converter mode. (Type plate or motor data sheet)
U nom	Voltage for the rated motor speed Only for frequency converter mode. (Type plate or motor data sheet)
U phi	Motor power factor Only for frequency converter mode. (Type plate or motor data sheet)
I max eff	Max. permissible motor current (Type plate or motor data sheet)
I nom eff	Permissible rated continuous motor current (Type plate or motor data sheet)
M-Pole	No. of motor poles (2 x pole pairs)
Direction	Global change of the rotation direction. The command value, the actual value, and the counting direction are changed. CW clockwise rotation, CCW counter-clockwise rotation
Brake	Motor selection with/without (ON/OFF) brake. When it is set to 'without' (OFF) the switch-off delay (braking delay) is out of function.
Brake delay	Attraction delay time of the electro-mechanical brake Deceleration when no brake is connected
Free coasting	Free coasting (ON) or emergency stop braking (OFF) when the enable (FRG/RUN) is switched off
M-Temp	Switching point for the motor over-temperature message. Therewill be a warning message 6 (0x8fBit21) at 87 % MOTORTEMP > 87 % At 100 % (set value) the drive is switched off. Error message 6 (0x8f Bit6) MOTORTEMP
Note: **The parameters Imax and Inom are also written into the parameter field ' current'.** **The smaller value serves as limit.**	

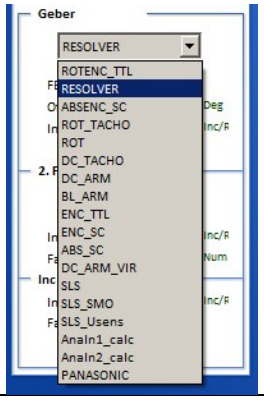


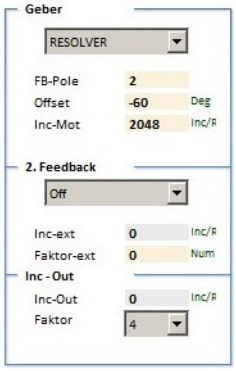
Encoder

Encoder	Encoder system selection (TTL incremental encoder, resolver, SIN/COS, DC tacho, etc.)
2nd Feedback	2nd feedback selection INC-IN, INC-OUT , HAND , SSI
Inc-Out	Setting of the output incremental signals



10.5 Setting window for the feedback encoder





RESOLVER- Encoder 10 kHz 2 Vpp	
RESOLVER	
F-Pole Offset1	No. of encoder poles 2 to 12 Correction value for the mechanical encoder setting. Polar wheel angle 0 to 360 degree Automatic detection of the offset angle = see page AUTO

Incremental encoder 5 V TTL	
ROTENC_TTL	Incremental encoder TTL with rotor position tracks
Offset Inc. Mot	Correction value for the mechanical encoder setting Automatic detection of the offset angle = see page AUTO No. of pulses per revolution
Note:	**The no. of poles of the rotor position encoder must correspond to the no. of motor poles!**
ENC-TTL	Incremental encoder TTL without rotor position tracks
Inc. Mot	No. of pulses per revolution Only for asynchronous motors or special drives

SINUS/COSINUS encoder 1 Vss	
ABSENC_SC	1 Vss-Sin/Cos encoder with Sin/Cos-commutation tracks
Offset Inc. Mot	Correction value for the mechanical encoder setting No. of pulses per revolution
ENC_SC	1 Vss-Sin/Cos encoder without commutation track
Inc. Mot	No. of pulses per revolution
ABS_SC	Sinus-Cosinus signal per motor pole pair (analog Hall sensors)
M-Pole, FG-Pole	No. of motor poles is equal to the no. of encoder poles

10.6 Setting window for the feedback encoder

ROTOR POSITION ENCODER 5 V, 15 V	
ROT_TACHO	Rotor position encoder with bl-tacho (DC tacho)
Offset	Correction value for the mechanical encoder setting.
ROT	Rotor position encoder without bl-tacho, only rotor signals
Offset	Correction value for the mechanical encoder setting.
BL-ARM	EC/AC motor without tacho
Note	**The no. of poles of the rotor position encoder must correspond to the no. of motor poles!**

Feedback for DC motors	
DC_TACHO	DC motor with tacho
Offset	120 = connection M1-M3 (0=M2-M3, -120=M1-M2)
DC-ARM	DC motor with armature voltage sensor (without tacho)
Offset	120 = M1-M3 (0=M2-M3, -120=M1-M2)
DC_ARM_VIR	Sensorless DC motor without tacho, without armature voltage measuring
Offset	120 = connection M1-M3 (0=M2-M3, -120=M1-M2)

Sensorless drives	
SLS	Sensorless AC motor without feedback encoder
	no setting
SLS_SMO	not yet available
SLS_Usens	not yet available

Parameter overview of encoder settings					
Short symbol	**Function**	**Setting range**	**Units**	**Notes**	**ID address**
FB-Pole	No. of encoder poles	2..12	num		0xa7
Offset	Phase angle correction	0 .. +/- 360	degree		0x44
Inc-Mot	Encoder resolution	1024..8192	pulse/rev.	only binary	0xa6
Voltage	DC tacho voltage		mV/RPM		
Inc-ext	Resolution of 2nd encoder		pulse/rev.		0xcfL
Factor	Multiplicator SIN/COS inc.	4..16	num		0x7e

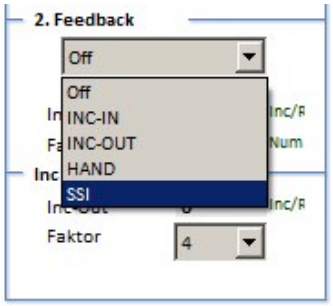
In case of changing the feedback parameters it is necessary to reset the parameter.
Write the parameter set into the EEPROM (EEPROM<->RAM) and re-read it.

read write

10.7 Setting X8 as second counter input

Selection fot the 2nd counter input (2nd feedback)+

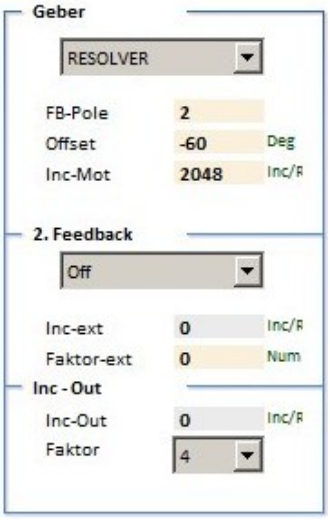
Off	input switched off
INC-IN	connected as input
INC-OUT	connected as output
Hand	Handwheel input
SSI	SSI encoder input



INC-IN Setting X8 as input for incremental encoder signals
Incremental encoder TTL 5 V A,B,N +push-pull
Bridge between X8:1 and X8:6 (X8 switched as input)
Scale (Factor-ext.):
Calculate the transmission
1 motor revolution = 65536 num (internal counter)
Faktor-ext for the adaption of the 2nd encoder (0x7e)
Encoder_2_Scale = 65536 / encoder pulses per motor revolution *4 from the 2nd encoder

Input at factor-ext. (0x7e) = Encoder_2_Scale * 16384

Example:
1 Motor revolution corresponds to 0.1 encoder revolutions
No. of encoder pulses 1000/rpm
Pulses per motor revolution 0,1*1000*4 = 400



Input at encoder_2_Scale
= 65536 / 400 = **163,840**

Input factor-ext. (0x7e)
= 163,840 * 16384 = **2684354**

Setting X8 as output for incremental encoder signals

The encoder signals from the motor (feedback) are output across the D-connector X8 as TTL encoder signals for the CNC control.

Signals: channel A, channel /A, channel B, channel /B, Kanal N, channel /N

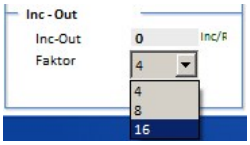
The encoder output is floating.
The voltage is supplied through the encoder cable of the CNC/PLC control.
Voltage supply +5 V ±0.2 V
The output signal corresponds to RS485.

Option: Internal supply from the servo
(LBR1+ LBR2)

Resolution:

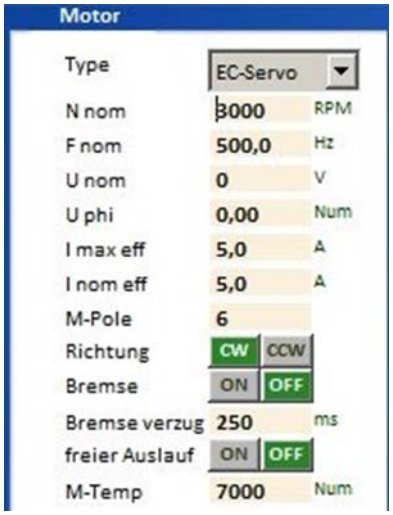
For the –RS and –SC versions the resolution can be programmed.
For –IN the output corresponds to the no. of encoder pulses.

Factor	**Mulitplication factor for the basic no. of pulses for SinCos (SC)**
Inc-Out	**Setting value for the no. of pulses for resolver**



Pulses per revolution	Resolution	Parameter
256	10 Bit	
1024	12 Bit	
4096	14 Bit	

10.8 Brake setting



Brake setting
The max. braking power of the motor is applied when the power has been switched off.
According to the electrical brake control the **brake delay** (switching on/switching off) corresponds to the respective type. (Brake delay)

A brake up to 24 V, 1 A can directly be switched by the digital output.
For braking processes with higher current or voltage values a relay must be inserted.

The brake output is activated on the page ***logic*** in the parameter field ***output*** .
Click the command **O-Break** in the drop-down menu at ***Dout 1***, ***Dout 2*** or ***Dout3*** to transfer it to the display field.

Tranfer the operand = (equal) or **!** = (not equal) in the drop-down menu by clicking it.

The switching function of the output can be selected by entering ***0*** or ***1*** into the parameter field (standard: 0)

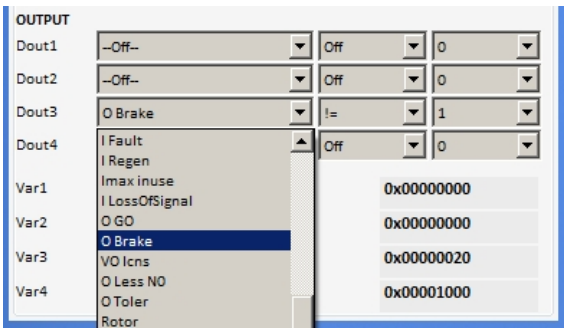
Enter the switch-off delay of the motor brake in the parameter field → ***brake delay*** (0 to 500 ms) of the input field → ***motor***.

When the brake is active, the state is displayed ***BRK1*** in the input field ***state***.

Note: Connect a recovery diode or a varistor directly to the brake connection at the motor.

Brake output on the logic side

Example	
Digital outputs	**Selection**
Dout1	not used
Dout2	not used
Dout3	The brake is disconnected from the power supply when the enable is switched off. Set the switch-off delay via the brake delay.
Dout4	not used

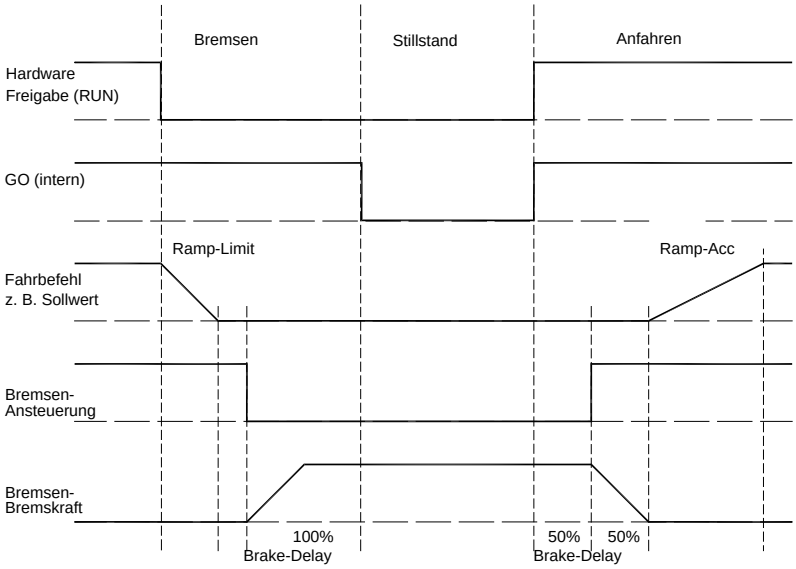


Brake function

When the drive enable is switched off or the CAN command ***ENABLE OFF*** is received, the internal speed command value ***N cmd Ramp*** will be ramped down to zero at a rate defined by ***Ramp-Limit***. After a fixed delay time of 50 ms, the ***Brake*** parameter will switch from 1 to 0. The braking power rises. After the programmed time ***Brake delay*** has passed, the internal parameter **GO** is switched to 0 and the servo is disabled (no torque applied).

Brake release function

If the brake is active and drive enable is switched on, the command value is maintained at 0 and **GO** switches immediately to 1.
After 50 % of the delay time (**brake-delay)** has passed, the brake is switched off, and after the complete delay time has passed, the command value will increase at a rate defined by ***Ramp-Acc***.



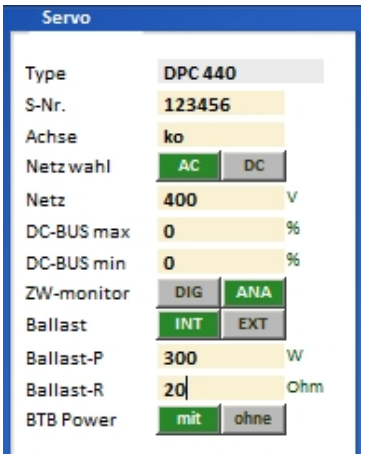
Note:

The sum of the times ***R-Lim*** plus ***brake delay*** must be inferior to 1s.
When the enable is switched-off at 1.1s the hardware of the output stage is disabled.
The electric braking is interrupted and the drive decelerates freely. When the ***R-Lim*** plus ***brake delay*** time is too long and has elapsed, the mechanical brake is triggered and stops the drive. der zu langen Zeit von ***R-Lim*** plus ***Bremse verzug***

10.9 Ballast circuit setting

For the units with a bus circuit setting (ZW monitor digital) ***DIG*** the ballast circuit is directly controlled from the hardware.
With the bus circuit setting (ZW monitor analog) ***ANA*** the ballast circuit is controlled from the TMS control board.

With an internal ballast resistance the setting parameters of the unit detection is automatically adjusted.
With an external ballast resistance the values for the resistance (ballast R) and the resistance power (ballast P) are entered as parameters.



Ballast INT = internal ballast resistor
EXT = external ballast resistor

Ballast-P Enter the resistor power in W
Ballast-R Enter the resistor power in Ohm

With an internal ballast resistance the ballast power is calculated from the data of the device type.

With an external ballast reistance the ballast power is calculated from the entered values of **Ballast-P** and **Ballast-R.**

The ballast power is displayed as **Ballast-Leistung** (0x45L) on the monitor side.

The dc bus voltage (DC-BUS dir), the ballast switching pulse (I-Regen, IBallast), and the ballast power (Ballast counter) can be shown on the oscilloscope.
Selection by means of the drop-down menu.

There will be a warning at 87% of the ballast power (ballast circuit >87 % overloaded 0x8f Bit 31) and at 100 % the device will be switched off and an error message is displayed (ballast circuit overloaded 0x8f Bit15).

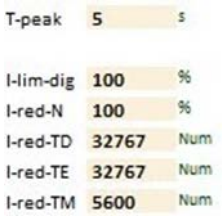
The function of the ballast circuit is displayed on the servo.
The command value directional bar of the 7-segment display (below left or right) is switched off as long as the ballast circuit is active.

10.10 Motor temperature setting

Motor temperature watchdog

Parameter motor temperature current reduction

I-red-TM 0xa2



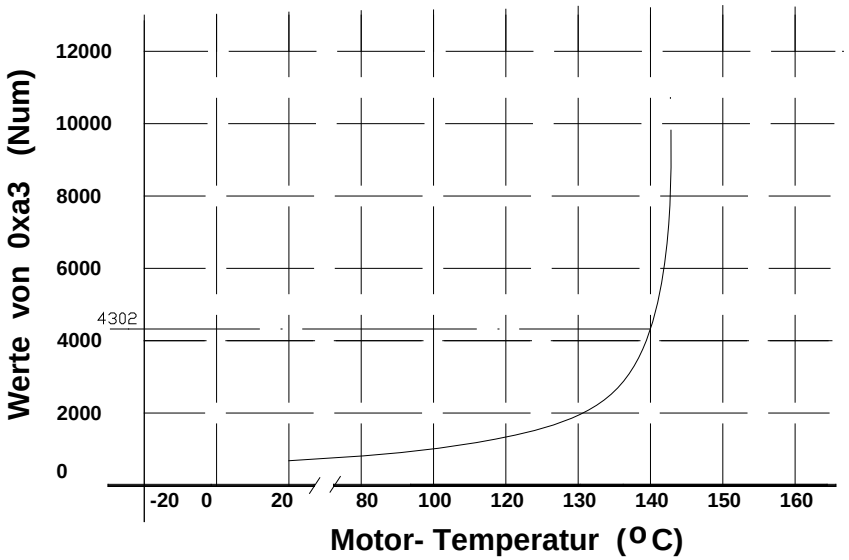
Set I-red-TM only with linear temperature sensor!

Starting from the trigger point of the motor temperature (***I-red-TM*** 0xa2) the max. current limit is linearly reduced to continuous current until the switch-off point (***M-TEMP 0xa3***).
Presetting 0xa2 = 5600
Warning ***I-MOTORTEMP*** when the set value is exceeded.

Parameter motor temperature fault switch-off
M-TEMP 0xa3
Presetting 0xa3 = 7000
Warning message at 87 % of the set M-Temp value.
Warning 6 MOTORTEMP >87 %
When the set value is exceeded, there will be the error message 6 (MOTORTEMP)

Setting with non-linear temperature sensor (PTC resistor)

only motor temperature fault switch-off M-TEMP 0xa3
Note: Temperature reduction is not possible



Example:
Error message and switch-off at 140 °C Setting M-Temp (0xa3) 4302 Num
For multiple, series connected sensors the set value is increased.

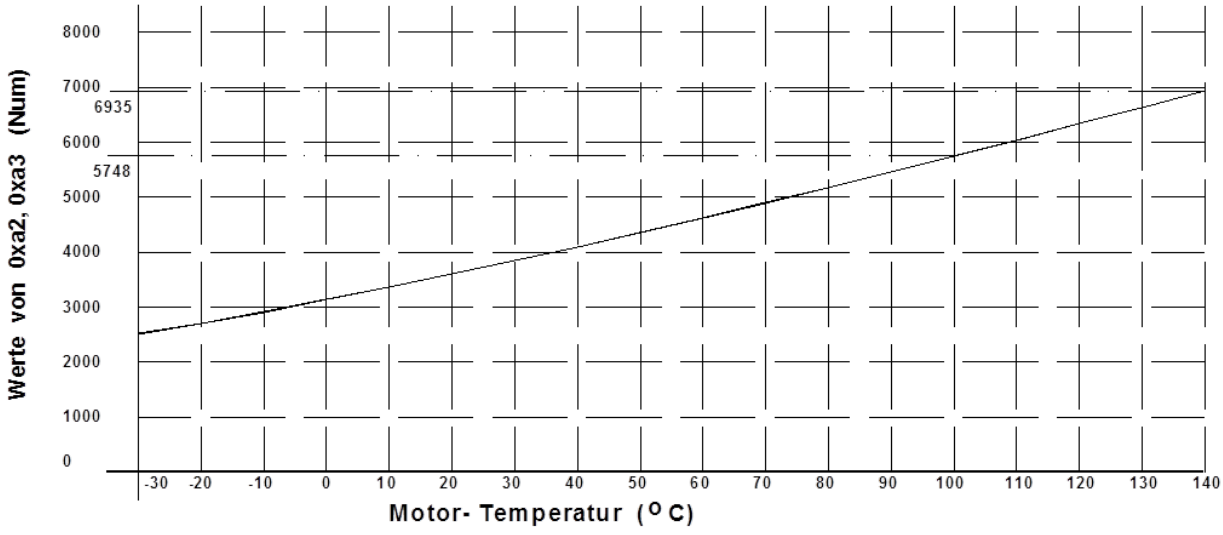
Motor temperature watchdog

Parameter overview of the motor temperature					
Short symbol	**Function**	**Setting range**	**Units**	**Notes**	**ID address**
I-red-TM	Triggering point current reduction Warning 0x8f-Bit 22 MOTORTEMP Motor temperatuer >87 %	0..32000	num	Setting parameter	0xa2
M-Temp	Switch-off point, error message 0x8f-Bit6 MOTORTEMP Motor temperature >100 %	0..32000	num	Setting parameter	0xa3
T-motor	Current motor temperature	0..32000	num	Display parameter	0x49

Motor temperature watchdog

Parameter motor temperatuer current reduction	l-red-TM	0xa2
Parameter motor temperature fault switch-off	M-TEMP	0xa3

Setting with linear sensor type KTY84

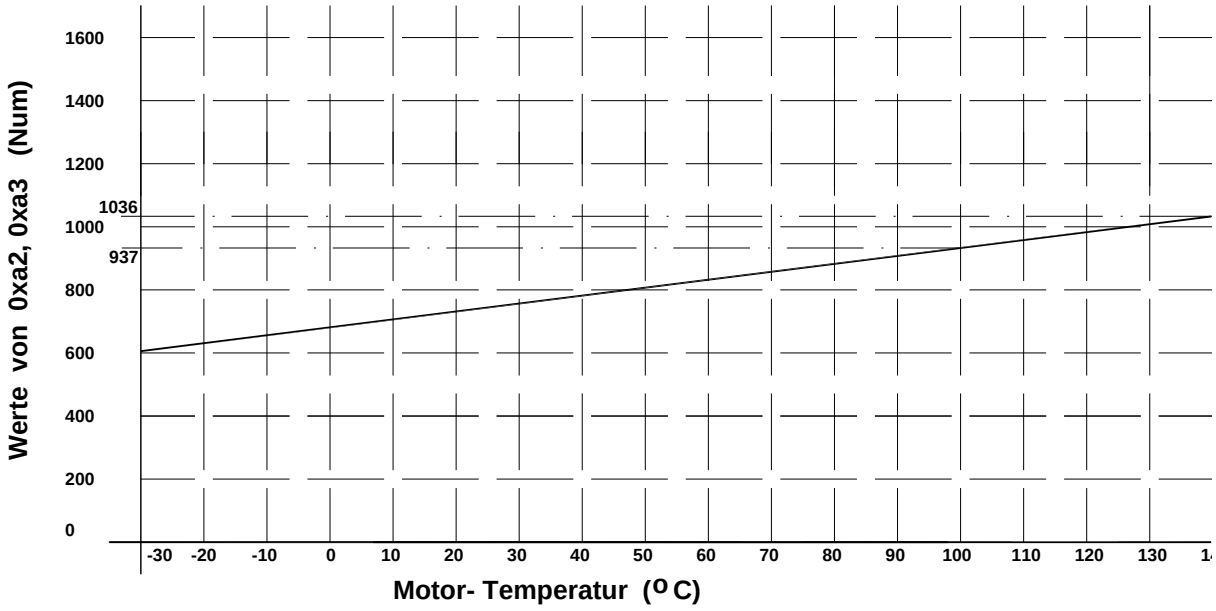


Example:

Warning and current reduction from 100 °C	Setting l-Red-TM	(0xa2) 5748num
Error message and switch-off at 140 °C	Setting M-Temp	(0xa3) 6935num

Setting with linear sensor type PT100

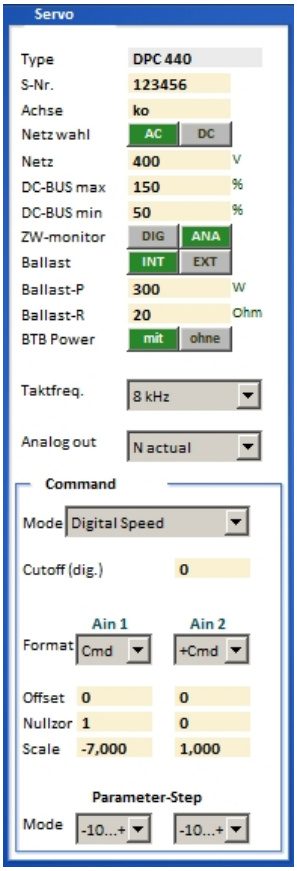
Note:
Inaccurate temperature measuring due to a flat characteristic curve and internal measuring tolerances.
An exact temperature measuring is only possible using a ballast measuring amplifier.



Example:

Warning and current reduction from 100 °C	Setting I-Red-TM (0xa2)	937num
Error message and switch-off at 140 °C	Setting M-Temp (0xa3)	1036num

10.11 Setting of the power connection/bus circuit



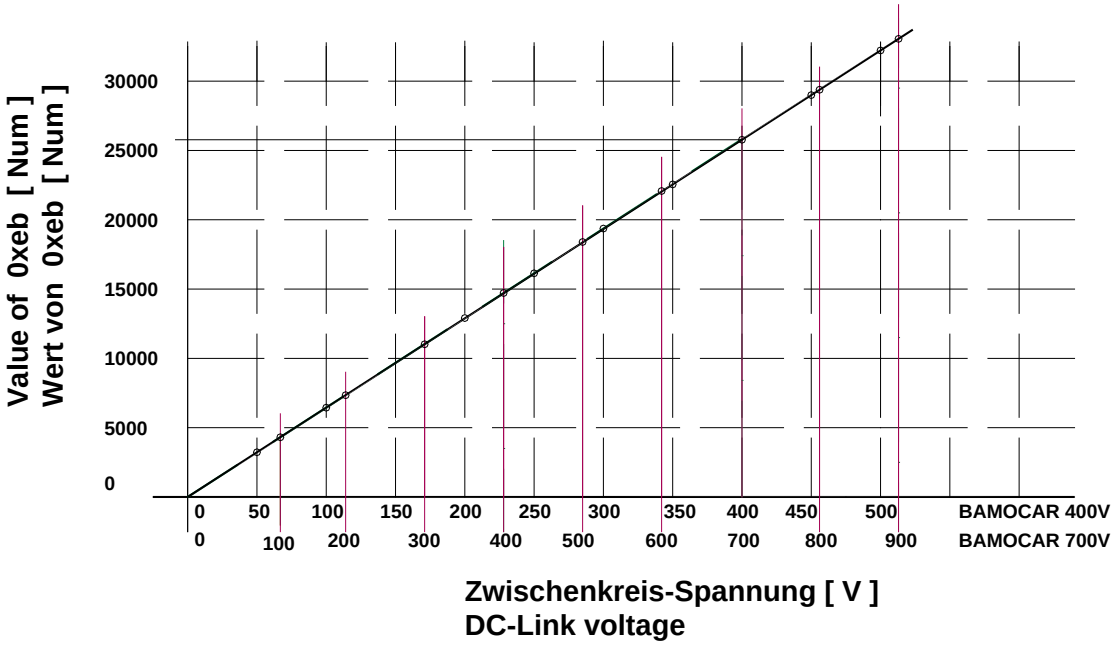
AC~, DC=
Mains power supply
Selection ac or dc voltage
Rating of the voltage supply in V

Limit of the bus circuit voltage
(Take the setting values of the hardware manual
(bus circuit voltage 0xeb)

DC-BUS max
Max. voltage limit (software).
200 % correspond to 32767 num = 2x rated voltage.
Setting value for the ballast circuit and over-voltage watchdog.
Warning at 1.5 times rated voltage
OVERVOLTAGE 0x8f-24
Error message in case of over-voltage
OVERVOLTAGE 0x8f-8, the controller is disabled.
The hardware voltage watchdog works independently from the software setting.

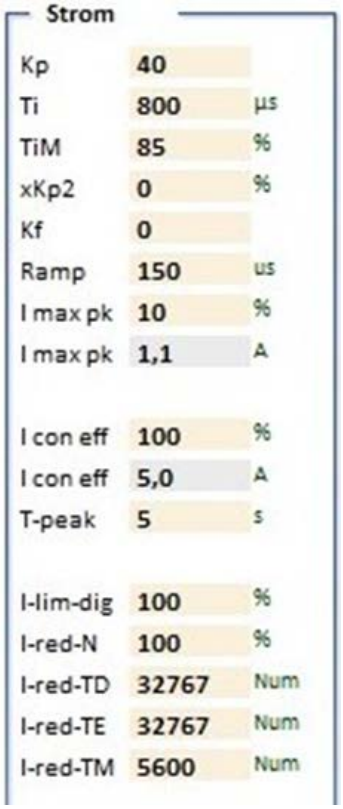
DC-BUS min
Minimum voltage limit (software).
200% correspond to 32767 num
Below the min. voltage limit the controller is disabled. In case of undervoltage the controller is disabled and the error message 'undervoltage' (power voltage) 0x8f-Bit5 is displayed.

Setting values of the hardware manual
Example: MANUAL BAMOCAR



10.12 Output stage temperature

For units with an analog recording of the output stage temperature the software watchdog can be programmed. (Take the setting values of the hardware manual (bus circuit voltage 0xeb).

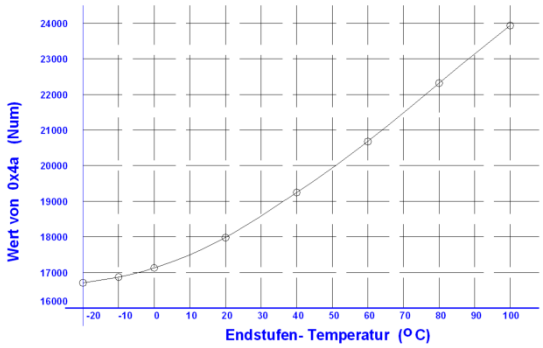


I-red-TD Setting value for the starting point of the current limit reduction depending on the output stage temperature.

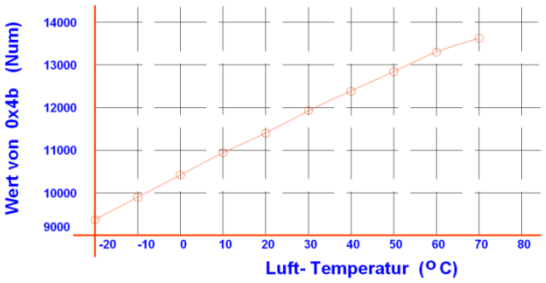
I-red-TE Max. temperature limit (software). At 85% of the max. output stage temperature a warning message **DEVICETEMP** 0x8f-23 is displayed. When the max. output stage temperature is reached, the controller is disabled and the error message ***overtemperature 0x8f-7*** is displayed.

The output stage temperature watchdog of the hardware works independantly of the software setting.

Setting values of the hardware manual
Example: MANUAL BAMOCAR



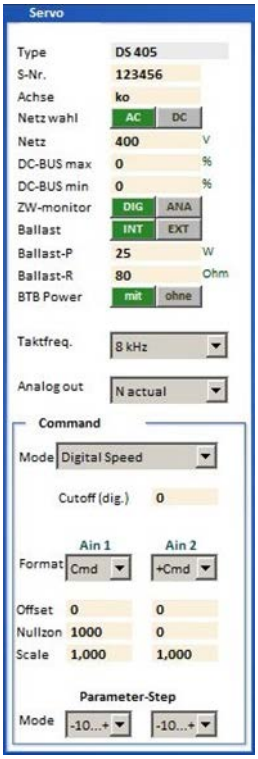
Temperatur-IGBT-Bamocar



Temperatur – Luft - Bamocar

10.13 Setting field for rated servo data

Servo setting parameters Short symbol	Function	Setting range	Units	Note	ID address
Type	Unit type	Type plate	Alpha-num		0x63
S-Nr.	Serial unit no.	Type plate	Alpha-num		0x62
Axis	Unit position identification	2 letters	Alpha-num		0xf8
Mains sel	Selection ac/dc voltage	Selection			0x5a-19
Mains	Power supply voltage	up to 480~, up to 560=	V		0x64
DC BUS max	Max. bus circuit voltage		num		0xa5 H
DC BUS min	Min. bus circuit voltage		num		0xa5 L
ZW monitor	Selection bus circuit	analog-digital			0x5a-Bit 7
Ballast	Selection ballast resistance	internal external			0x5a-Bit 1
Ballast-P	Ballast resistance power	Type plate	W		0x65-L
Ballast-R	Resistance value	5 to 100	Ohm		0x65-H
BTB/RDY	Selection field BTB	with/without bus circuit voltage			0x5a-Bit 6
Clock frequency	Drop down menu	Selection			0x5y Bit 20-22
Analog out	Drop down menu	Selection Selection			
Command	Selection field command values	analog digital			0x36 Bit 12-13



Setting field for rated servo data

Type	The controller type is displayed (changes can only be made in the factory)
S-Nr.	Serial no. is displayed (factory-set)
Achse	Axis specification 2 digits correspond to the circuit diagram of the installation (entered by the user)
Main sel.	Power supply voltage AC~/DC= is displayed (factory-set)
Mains	AC and three-phase current voltage AC (30~ to 480 V~) Battery voltage or dc mains (12 V= to 560 V=)
DC-Bus max.	Switching point bus circuit overvoltage Error OVERVOLTAGE (overvoltage >1.8 U_N) 0x8f Bit 8
DC-Bus min.	Switching point bus circuit under-voltage Error POWERVOLTAGE (missing power voltage) 0x8f Bit5
ZW monitor	Selection bus circuit watchdog digital-analog (factory-set)
Ballast	Selection list ballast resistance (internal – external)
Ballast-P	Enter the power value for an external ballast resistor. Input in Watt. In case of a ballast resistor overload a warning message is displayed. Warning BALLAST (ballast circuit <87 %) 0x8f Bit 31
Ballast-R	Enter the resistance value for an external ballast resistor. Input in Ohm. Check the min. value.
BTB-Power	BTB-Message with or without bus circuit under-voltage. **Selection w-out (without) (BTB without under-voltage watchdog)** BTB without under-voltage watchdog. When the enableand the power supply voltage are switched off the RUN/BTB message remains active. **Selection with (with) (BTB with under-voltage watchdog)** BTB with under-voltage watchdog. When the enableand the power supply voltage are switched off the RUN/BTB is deactivated.

10.14 Setting field for rated servo data

Clock frequenz

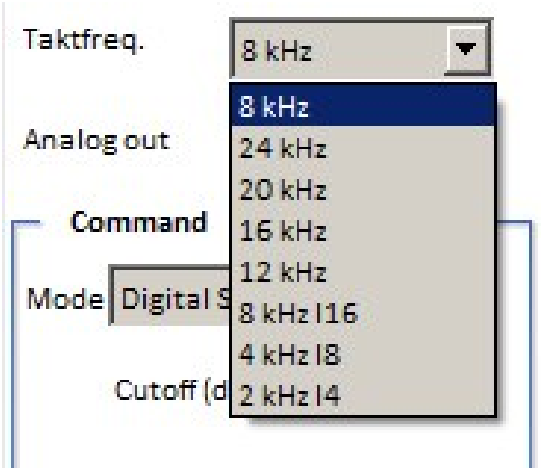
Selection of the switching frequency of the output stage
Parameter 0x5a Bit 20-22
Presetting 8 kHz
Selection via the drop-down menu

Selection :
Pulse frequency with constant calculation speed
Values: 8, 12, 16, 20, 24 kHz

Current limits reduced at pulse frequency:
2 to 8kHz 100 %
12kHz 85 %
16kHz…….. 70 %
ab 20kHz 20 %

Selection:
Pulse frequency (kHz) with a higher calculation speed (Ix).
Values: 2 kHz-I4, 4 kHz-I8, 8 kHz-I16

At the pulse frequencies 2 an 4kHz the continuous performance increases.



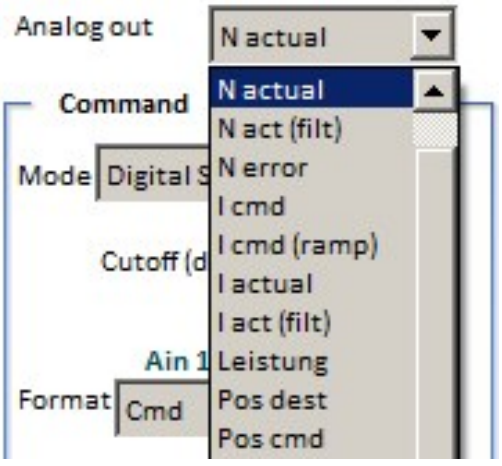
Modification of the pulse frequency
Select frequency
Save the parameter set in the EEPROM on level 0
Read the parameter set from the EEPROM level 0
The changed frequency is transferred and the current limits are reduced.

Analog out

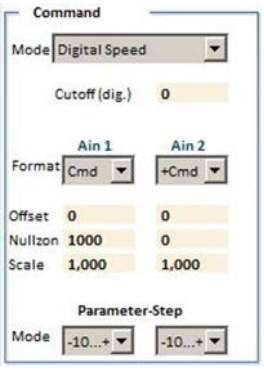
Selection of analog outputs
Selection via the drop-down menu

Analog signals
The output voltage +/- 10 V
corresponds to +/- 100 % of the selected signal.

Digital signals
Selected digital signals provide 0 or +10 V.



10.15 Command value setting



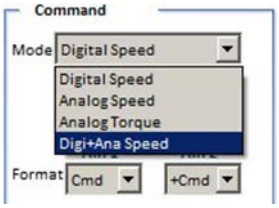
Analog inputs

Click the → **button** to open the drop-down menu.
Select the command value to be adjusted.
The selected function is highlighted in blue and it is transferred into the display by clicking it.

Cmd Mode		ID address
Digital Speed	Digital speed command value CAN-BUS, RS232, step oscilloscope	0x36-12,13 =0
Analog Speed	Analog speed command value	0x36-12,13 =2
Analog Torque	Analog torque command value, voltage +/-10V across the analog inputs AIN1 and AIN2	0x36-12,13=3
Digi+Ana Speed	Digital and analog command values are added	0x36-12,13=1

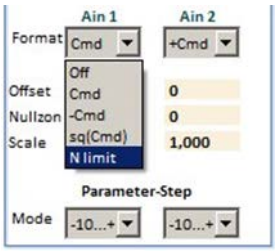
Analog Speed
Analog speed command value. Input via terminal strip X1.
Inputs Ain1 and Ain2
Max. input voltage ±11 V corresponds to ±32767 num

Analog Torque
Analog current command value. Input via terminal strip X1.
Inputs Ain1 and Ain2
Max. input voltage ±11 V corresponds to ±32767 num
This value corresponds to 200 % of the rated current



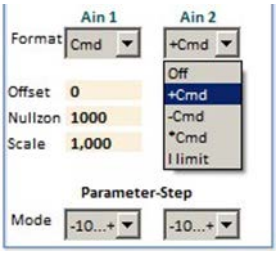
Reversal of the rotation direction for a unipolar command value with direction signal
The unipolar command value is reversed by means of the direction command (***N cmd Reverse***) via the programmed digital input. The input must be adjusted to ***N cmd Reverse*** in the parameter field 'input/output.

Standstill with an analog command value for the speed and torque
Activate *Speed Ramp 0* via a digital input or send it via the CAN BUS.



Format
The analog inputs Ain1 and Ain2 are assigned to a function via the format field.

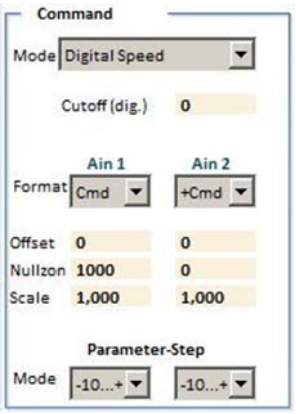
Format Ain1		ID address
Off	switched off	0x36 Bit0-1 =0
Cmd	Speed command value	0x36 Bit0-1=1
-Cmd	reversed speed command value	0x36 Bit0-1=2
sq (Cmd)	quadratical speed command value	0x36 Bit0-1 = 3
N limit	Speed limiting 0-100% for a digital speed and position control (CmdMode = digital)	0.36 Bit15



Format Ain2		ID address
Off	switched off	0x36 Bit2-3=0
Cmd	Speed command value is added to Ain1	0x36 Bit2-3 =1
-Cmd	Speed command value is subtracted from Ain1	0x36 bit2-3=2
*Cmd	Speed command value is multiplied with Ain1	0x36 Bit2-3=3
I limit	external current limiting 0-200% (for CmdMode = digital, analog speed or analog torque)	0x36 Bit14

Offset

Compensation of the command value zero error the the input is analog. With the command value OV alter the offset value such that the parameter **Ncmd Ramp** is zero.



Zero zone

At an analog command value it is possible, by means of the parameter zero zone, to set a range in which the speed is kept at standstill. (Digital capture, 327 corresponds to 1 % of the speed)

Zero zone at speed command value

The command value is switched to zero within this zone. The drive is at a standstill, no drift (no position parameter entered). For an external torque which is larger than the servo current limit the drive can be turned from the neutral position.

Zero zone at speed command value with position hold value

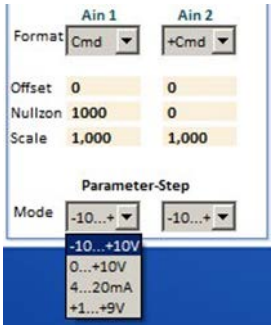
Within the zero zone the drive maintains its zero position by means of an internal position-current-control.For an external torque which is larger than the servo current limit the drive can be turned from the neutral position.When the torque is smaller the drive returns to its zero position.

Note: The parameters must be entered in the parameter field ***'position-current'***.

Note: When an analog command value is provided from a PLC/CNC position control, the value 0cut should be very low or zero.

Scale

Multiplication factor for the analog input signals.
Setting value +/- 0 to 7.500
Note: Resulting values superior to 11 V are trimmed. The result of the command value scaling is displayed on the page 'speed at' ***Ain1, 2 scaled***. (**Ain1,2 scaled = Ain1,2 on +/- Offset x scale**)



Mode

Input range for the analog command values

-10…+10	Bipolar command value +/-10 V
0….+10 V	Unipolar command value (directional sign on the page 'Logik' via ***Ncmd Reverse***)
4…20 mA	Current command value (external resistance 500 Ohm)
+1…+9	Command value with potentiometer watchdog

External current limit

The analog input Ain2 is selected as external current limit via the format adjustment ***I limit*** **.**
0 to +10 V correspond to 0-200 % of the current limit for the values programmed in the parameter field ***'current'***.

Linear ramp function

Drehzahl		
Kp	10	
Ti	6	ms
Td	0	ms
TiM	20	%
Kacc	0	%
Filter	2	Num
Rcw Acc	25	ms
Rcw Dec	10	ms
Rccw Acc	50	ms
Rccw Dec	50	ms
R-Lim	5000	ms
Nmax-100	3000	RPM
N-lim	100	%
N-Lim+	99	%
N-lim-	-100	%

Rcw-Acc Acceleration - positive rotation direction

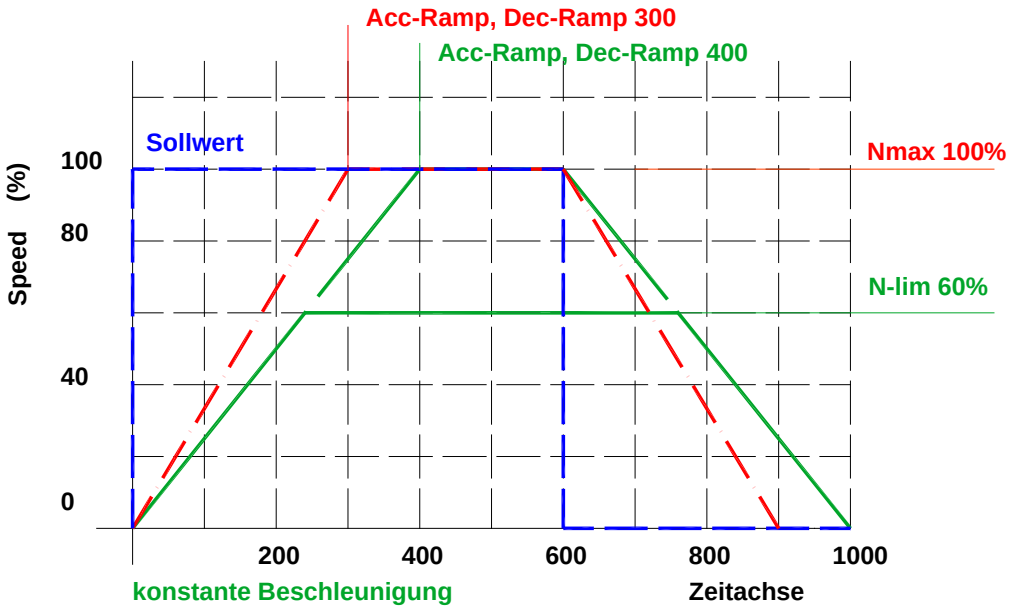
Rcw-Dec Deceleration - positive rotation direction

Rccw-Acc Acceleration - negative rotation direction (1

Rccw-Dec Deceleration - negative rotation direction (1

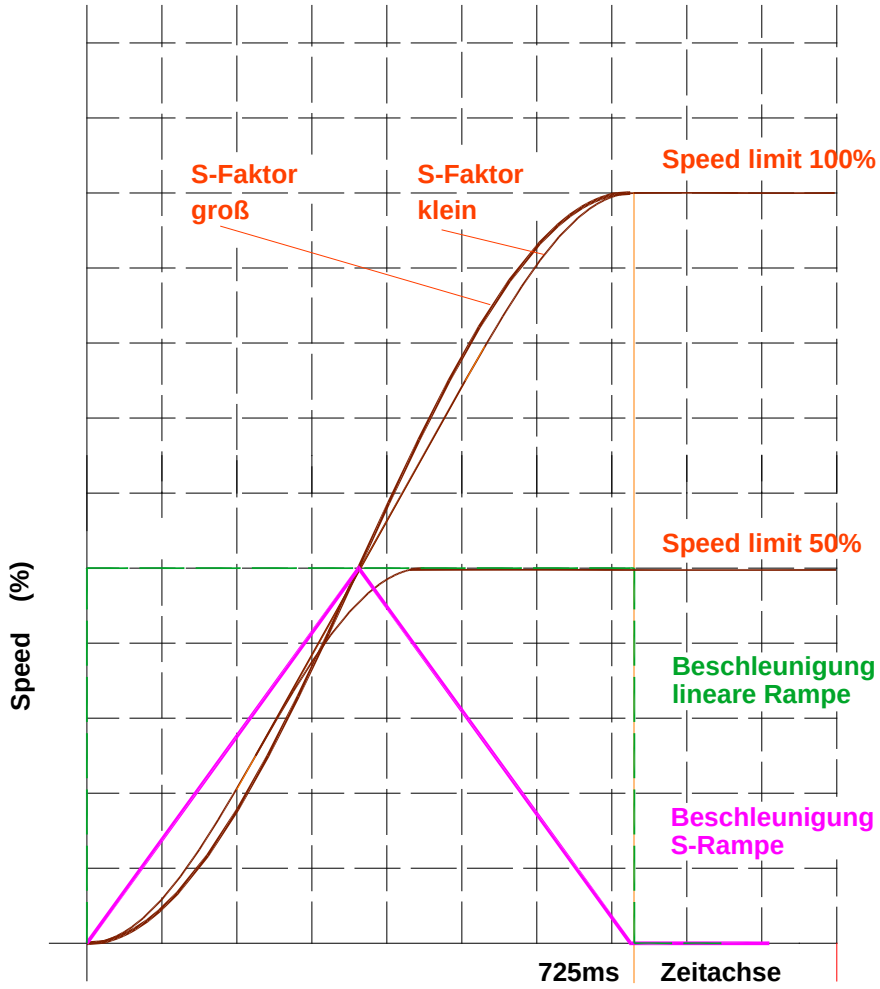
R-Lim Emergency stop, output stage switch ramp

(1 = Function not yet activated



Linear ramp
Time input for 100 % command value
Constant acceleration
Current peaks and acceleration and deceleration peaks are reduced.

S-Ramp function / not yet active



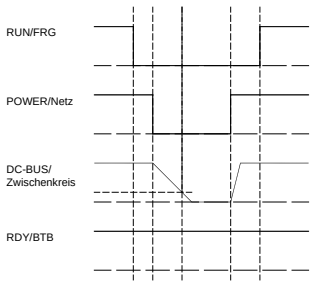
S-Ramp function

The linear time function is altered to a S-shaped function (sine^2).
The constant acceleration and deceleration is altered to continuous changing.
Jerk and current peaks are considerably reduced.

Command value limited for speed limiting

N-Lim	Speed limiting inferior to Nmax, (0 to 99 % of Nmax) Setting of max. speed at position control.
N-lim+	Speed limiting inferior to Nmax for positive rotational direction (0 to 99 %=Nmax) Activated via the logic input N clip(neg&pos)
N-lim-	Speed limiting inferior to Nmax for negative rotational direction (0 to -99 %=Nmax) Activated via the logic input N clip(neg&pos)

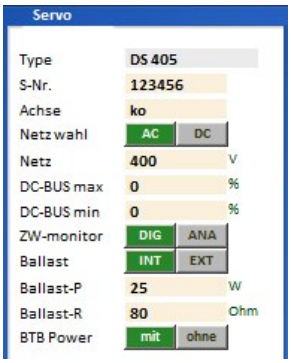
10.16 BTB / RDY setting



BTB/RDY message (relay contact)
The BTB relay contact (solid state relay) is closed when the device is ready (residual resistance 30Ohm). The BTB contact is opened when an error occurs (resistance >1 MΩ).

The state BTB/Rdy (ready) is is displayed in the state field as ***Rdy***.
The state ***'not ready/BTB*** (error)' is indicated by the red LED ***'fault'*** on the front side.

BTB and the power supply voltage
When the power supply voltage is switched off the message state can be selected via ***BTB power*** in the parameter field ***servo*** of the setting window (under-voltage watchdog).

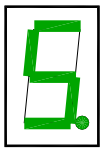


Selection BTB Power without
BTB without under-voltage watchdog.
When the enable and the power supply voltage are switched off, the message ***RUN/BTB*** remains active.

Selection BTB Power with
BTB with under-voltage watchdog.
When the enable and the power supply voltage are switched off, the message ***RUN/BTB*** is deactivated.

Error message and BTB/RDY

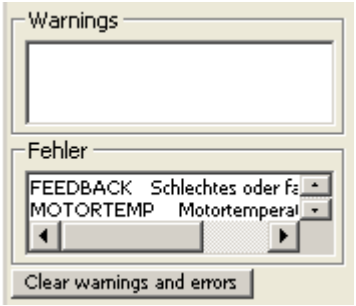
When a system-endangering error X (see list of errors) occurs, the BTB signal is switched off. The drive will immediately be disabled internally. (O_GO (OxE3) = 0)



FAULT

On the Servo:
The red LED ***'fault'*** (0x8f Bit 1) lights.
The error no. is indicated in the 7-segment display.

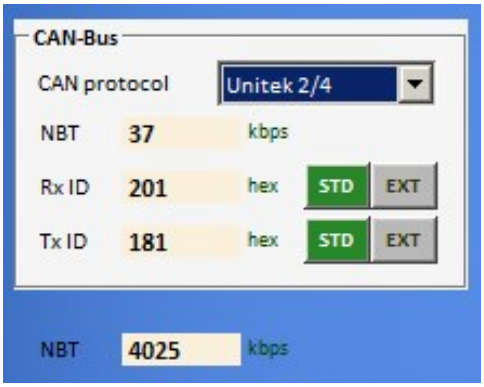
On the pc:
The error states are displayed in the field ***'fault'***.

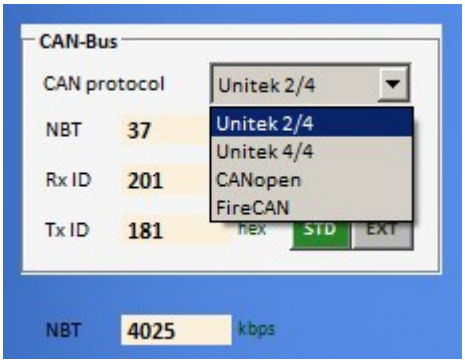


The error messages are reset:
- when the drive enable (RUN) is switched on
- when the auxiliary voltage (+24 V) is switched on
- when the parameter ***'cancel error'*** is sent (can also be programmed as digital input by page Logic)

11 CAN-BUS settings

11.1 Settings CAN-BUS





Input fields:		**Information**	
Rx ID	Receive ID	-Brp	
Tx ID	Send ID	-Sjw	
BTR	Bit rate	-Tseg1	
(Hexwert)		-Tseg2	
		-Sam	
		NBT Bit rate	(kBaud)

Selection switch

Position	0-14	15
Function	Supplementary value for the basis ID	see chapter ‘firmware download‘

The addresses for receive/send ID and the bit rate are set in the CAN bus parameter field of the setting window. Switch the auxiliary voltage off and on after changes have been made in the CAN programming!

Address	**Short symbol**	**Presetting (default)**	**ID address**
Receive address	Rx ID (COB-ID RPDO1)	0x201	0x68
Send address	Tx ID (COB-ID TRDO1)	0x181	0x69

Bit rate NBT	**BTR setting value**	**Max. cable length**	**0x73**
1000 kBaud	in prep.	20 m	
500 kBaud	0x4025	70 m	Presetting
625 kBaud	0x4014	70m	LABOD-CNC
250 kBaud	0x405C	100m	
125 kBaud	0x4325	100 m	
100 kBaud	0x4425	100 m	

11.2 Aufbau serielles Protokoll

RS 232 16 bit										
Sending from the pc to the drive								Response from the drive to the pc		
Char1	Char2	Char3	Char4	Char5	Char6	Char7		Byte 1	Byte 2	
RegID	RegID	Data	Data	Data	Data	Sync		Data	Data	
Bits 07..04	Bit s 03..00	Bits 15..12	Bits 11..08	Bits 07..04	Bits 03..00	"X"		Bits 07..04	Bits 07..04	
ascii	ascii	ascii	ascii	ascii	ascii	ascii		binary	binary	

RS 232 32 bit														
Sending from the pc to the drive											Response from the drive to the pc			
Char1	Char2	Char3	Char4	Char5	Char6	Char7	Char8	Char9	Char10	Char11	Byte1	Byte2	Byte 3	Byte4
RegID	RegID	Data	Data	Data	Data	Data	Data	Data	Data	Sync.	Data	Data	Data	Data
Bits 07..04	Bits 03..00	Bits 31..28	Bits 27..24	Bits 23..20	Bits 19..16	Bits 15..12	Bits 12..08	Bits 07..04	Bits 03..00	„X“	Bits 07..04	Bits 07..04	bits 07..04	Bits 07..04
ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	binary	binary	binary	binary

Example: Speed actual (actual speed value) 16 bit								**+/-32767 corresponds to +/-100 %**		
Sending from the pc to the drive								Response from the drive to the pc		
Char1	Char2	Char3	Char4	Char5	Char6	Char7		Byte 1	Byte 2	
RegID	RegID	Data	Data	Data	Data	Sync		Data	Data	
Bits 07..04	Bit s 03..00	Bits 15..12	Bits 11..08	Bits 07..04	Bits 03..00	"X"		Bits 07..04	Bits 07..04	
3	**D**	**0**	**0**	**3**	**0**	**X**		**lo**	**hi**	
regID read read (0x3D)		speed actual actual speed value (0x30)				ascii		value of 0x30		

11.3 Interface RS232

Changing the baud rate in the drive

Selection 9600 or 115200

Default 115200

Setting with 0x5a Bit 15 (0x8000)

Bit 15 0 corresponds to 115200
Bit 15 1 corresponds to 9600

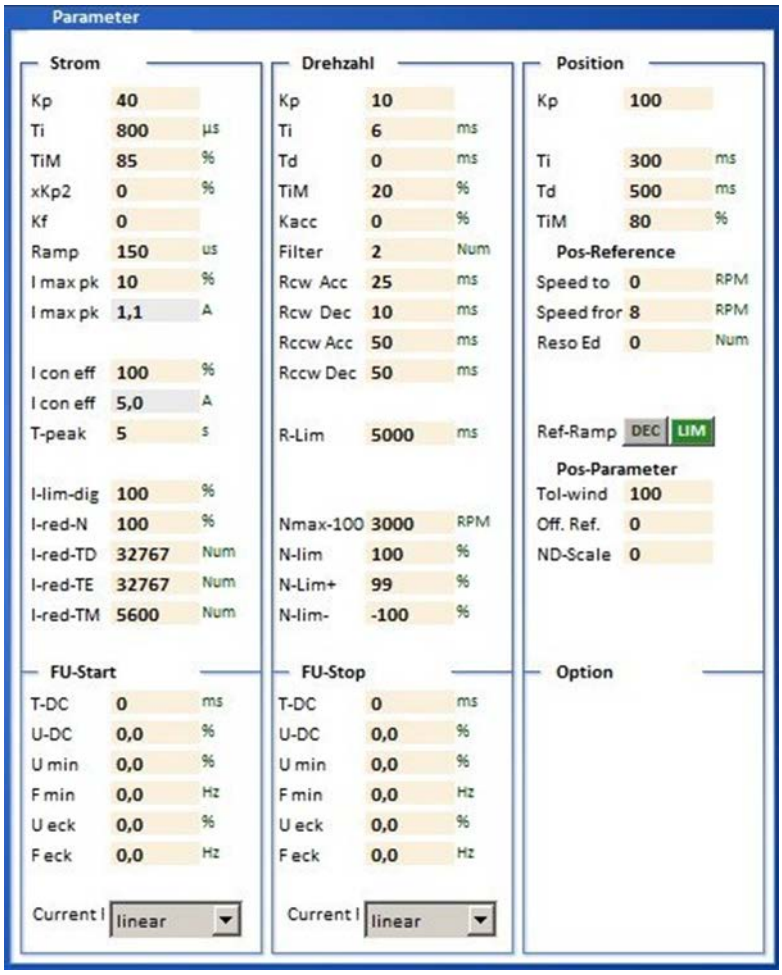
The baud rate saved in the device is display when switching on the auxiliary voltage 824V=), (after the firmware version is displayed).

Bd0 corresponds to 115200
Bd1 corresponds to 9600

First, the firmware version is displayed (e.g. 2 3 2),
then the baud rate (e.g. b d 0)

12 Parameter

12.1 Current controller parameters



Setting window for the controlling parameters. For further settings refer to the pages 'speed' and 'oscilloscope'.

Parameter	Function	Setting range	Presetting	Units	Step	ID address
Kp	Proportional amplification	0 to 100	10	Num	1=0.1	0x1c
Ti	Integration time	150 to 10000	600	ms	150	0x1d
TiM	max. integrat. time memory	0 to 100	50	%	1	0x2b
xKP2	TiM discharge amplification	0 to 100	0	%	1	0xc9
Kf	Current pilot control	0 to 30	0	Num	1	0xcb
Ramp	I command value ramp	0 to 10000	600	ms	150	0x25
I max	Current limit, peak current	up to 2x I device	2xIdevice	Apeak	0,1	0xc4
I max	Current limit, peak current	up to 2x I device	2xIdevice	Apeak	0,1	0xc4
I con	Current limit, cont. current	0 to I device	Idevice	Aeff	0,1	0xc5
I con	Current limit, cont. current	0 to I device	Idevice	Aeff	0,1	0xc5
T peak	Over-current time	0 to 30	5	s	1	0xf0
I limit (dig)	Current threshold value	0 to 100 Imax	100	%	1	0x46
I-red-N	Current reduction by speed	0 to 100	100	%	1	0x3c
I-red-TD	Start of current reduction by power stage temperature	0 to 32767	21000	num	1	0x58
I-red-TE	Stop of current reducation by power stage temperature	0 bis 32767	23000	num	1	0x4c
I-red-TM	Current reduction by motor temperature	0 bis 32767	5600	num	1	0xa2

Conversion of the current parameter values

For the digital communication via RS232 or CAN-BUS the numerical values for the rated value have to be observed. The numerical values are displayed in the track field.

Actual current range	I 100% (0xee)	Calibration rated current I-device			Peak current DC disabled		Note
Max. value +/- 9Bit	mV	num	Aeff	Apeak=	Num	Apeak=	
DS 205/403/405	550	440	5	7	640	10	
DS412	800	640	12	17	920	24	
DS420	700	560	20	28	800	40	
DS 450	416	328	50	70	480	100	
DPC 450	416	328	50	70	480	100	
DPC 460							
DS 475 / BAMO-D3	416	328	75	105	480	150	Limiting in the parameter field 'motor' and 'current'. The lower value is effective.
BAMOBIL-D3- 50/ 250	870	700	25/125	35/175	1020	50/250	
BAMOBIL-D3- 80	560	450	40	56	650	80	
BAMOBIL-D3- 100	700	560	50	60	800	100	
BAMOBIL-D3- 120	840	670	60	84	970	120	
BAMOBIL-D3- 350	610	490	175	245	710	350	
BAMOBIL-D3- 450	785	630	225	315	910	450	
BAMOCAR-D3-250	625	700	125	176	1020	250	
BAMOCAR-D3-400	500	560	200	282	810	400	

Current controller setting window

The current controller parameters are determined by the motor data such as winding inductance and winding resistance.

Note:

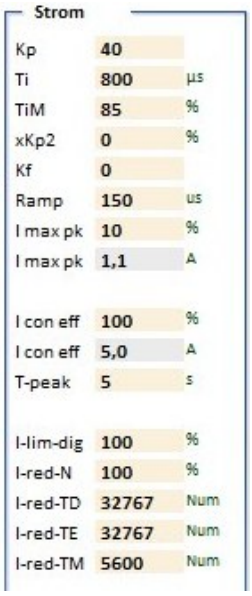
The current controller parameters may only be modified by trained and skilled personal.

Check all setting effects by means of the NDrive oscilloscope.

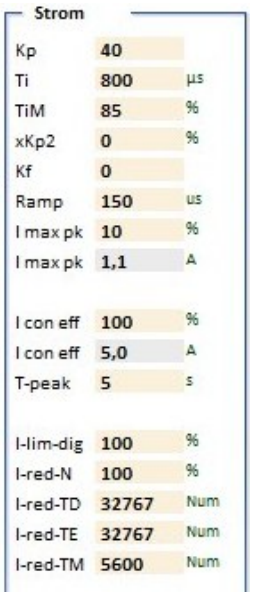
Improperly set amplification parameters may damage the controller or the drive.

Control parameters

Kp	Input for the proportional amplification in the current controller. Setting range 0 to 100 (nominal 10 to 40) Presetting 10 Formula: Kp too low: compensation error, bad dynamics, low-frequ. vibrations Kp too high: strong motor noise, high-frequency vibrations Note: overshoots on the current actual value. Optimize the amplification to min. overshoots.
Ti	Input for the integration time in the current controller. Integral – time constant Setting range 150 to 10000 (nominal 600 to 2000) Presetting 800 Ti too high: low-frequency vibrations Ti too low: high-frequency vibrations, strong vibration tendency



TiM	Max. value from the integral memory Setting range 0 to 100% (nominal 70 to 100 %) Presetting 85 % If adjusted too low, the speed (output voltage) is not reached.
xKp2	Amplification factor for the attenuation of the current actual value overshoots. Setting range 0 to 100 % (nominal 10 bis 50 %) Presetting 0% If adjusted too high, there is a risk of current oscillations.
Kf	Pilot control for the compensation of the operating delay in the controller. Setting range 0 to 100 % (nominal 10 bis 50 %) Presetting 0% If adjusted too high, there is a risk of current oscillations.
Ramp	Current increase limiting The current increase to 100 % type current iss et in µs. Setting range 0 to 100 % (nominal 10 bis 50 %) Presetting 0% If adjusted too high, there is a risk of current oscillations.
Current limits	
I max pk	Input for the peak current from 0 to 100 % 100 % = 2*I device in A pk Display in A pk in the field I max pk (A eff = 0.707x Apk)
I con eff	Input for the continuous current from 0 – 100 % device ratet currnt (I device) Display in A eff in the field I con eff below



12.2 Current reduction parameters

Static current reduction

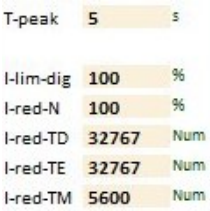
Current reduction by means of	Symbol	Function	Parameter	Range
Motor	I max eff	Peak current limiting for the motor	0x4d	0 to xxA
	I nom eff	Continuous current limiting for the motor (type plate)	0x4e	0 to xxA
Servo	I max pk	Peak current limiting for the servo	0xc4	0 to 100 % of Imax
	I nom eff	Continuous current limiting for the servo	0xc5	0 to 100 % of Icon

The respectively lower value of the peak current values and continuous current values are effective. They are displayed as current Imax (in A) in the parameter field ***'servo'*** and as icon.

Dynamic current reduction

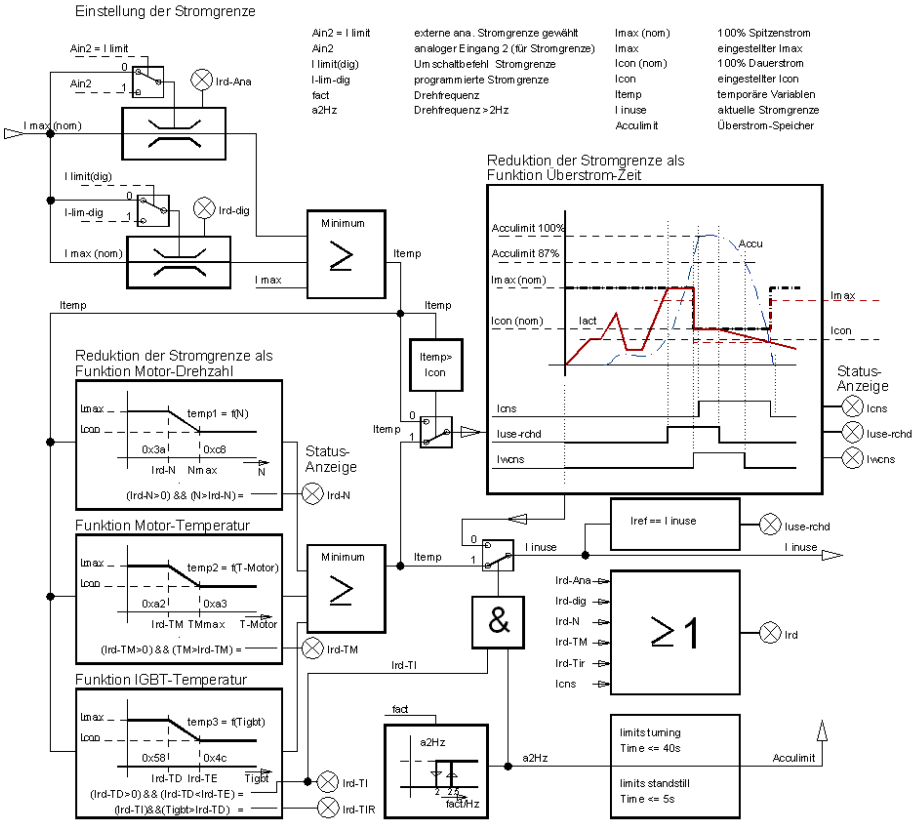
Current reduction by means of	Short symbol	Function	Parameter	Range (with 0 = off)
Time	T peak	Over-current time function	0xf0	0 to 300 s
Input (command)	I lim-dig	Reduction via digital input (CAN)	0x46	0 to 100 % Imax
Speed	I red-N	Over-current speed function	0x3c	0 to 32767 Num
Power stage temp.	I-red-TD	Start of reduction via power stage/IGBT temperature	0x58	15000 to 24000 Num
Power stage temp.	I-red-TE	End current reduction by power stage /IBGT temperature	0x4c	0 to 32763 Num
Power stage shut off		Emergency stop via the power stage temperature	(Fix)	25200 Num (83 °C)
Motor temperature	I-red-TM	Reduction via the motor temperature	0xa2 0xa3	0 to 32767

		State	Warning	Error
T peak	At a current superior to the adjusted continuous current (**Icon**) a time function is started. When the time function is elapsed the current limit is reduced to the continuous current value. Warning message in the state **Iuse-rchd** The time is set by means of the parameter ***T peak*** (0xf0). If the current is lower than the continuous current (Icon) the time memory is removed. The reset time is 2 x ***T peak***. If the output stage temperature reduction has been selected by means of the parameters ***I-redTD*** and ***I-red-TE*** the time function is switched off.			
I lim-dig	On the logic page a digital input can be programmed at ***I limit (dig)*** . If this input is activated or if a CAN command is received for this input, the current limiting is reduced to the parameter value ***I lim-dig*** (0x46) .	Ird-Dig		
I-red-N	The current limit is linearly reduced from the speed value set in the parameter ***I-red-N*** (0x3c). At rated speed the current limit corresponds to the continuous current.	Ird-N		
I-red-TD **I-red-TE**	There is a state message when the output stage temperature set in the parameter ***I-red-TD*** (0x58) is exceeded. If the temperature still increses, the current limit is reduced. When the parameter value ***I-red-TE*** (0x4c) is reached, there will be an emergency switch-off. If ***I-red-TD*** (0x58) is set to 0 or if the value of ***I-red-TE*** (0x4c) is smaller than ***I-red-TD*** (0x58), the function is switched off.	Ird-TI	DEVICETEMP > 87 % 0x8f BIT23	DEVICETEMP 0x8f Bit7
I-red-TM	There is a state message when the motor temperature set in the parameter ***I-red-TM*** (0xa2) is exceeded. If the temperature still increses, the current limit is reduced. When the parameter value ***M-Temp*** (0xa3) is reached, there will be an emergeny switch-off.	IRD-TM	MOTORTEMP > 87 % 0x8f BIT22	MOTORTEMP 0x8f Bit6

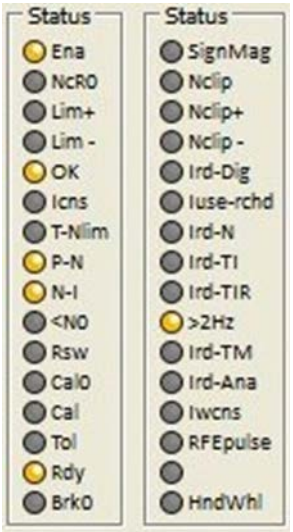


Attention: **The warning messages displayed in the field *'state'* must be observed!**
If the current limits are reduced, this might cause failures of the machine or the installation.

12.3 Current reduction functions

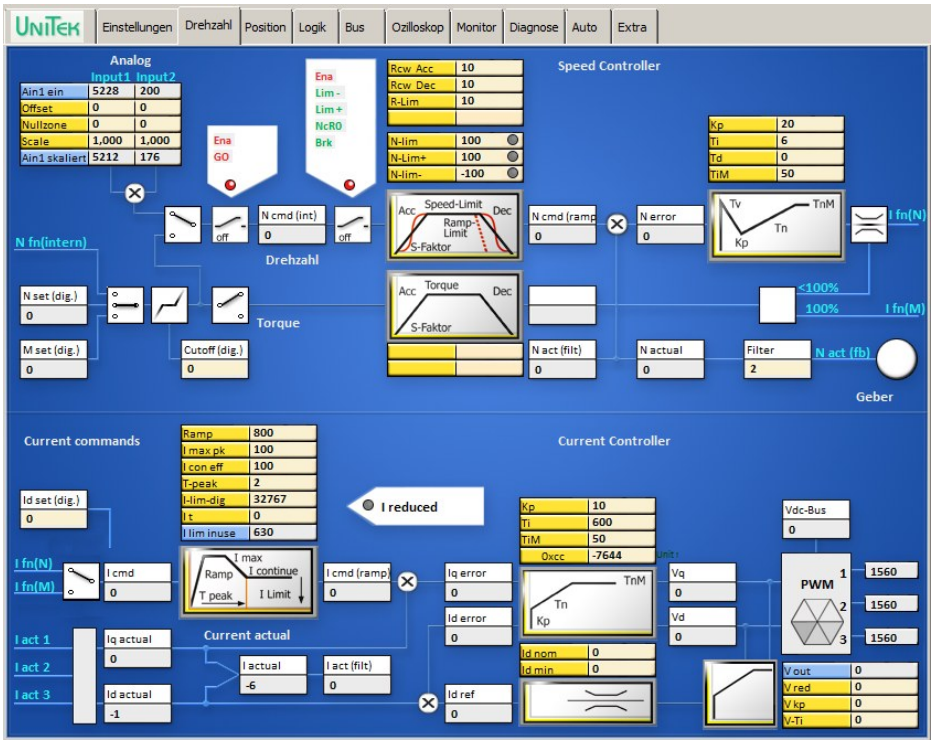


States		**address**
Ird-dig	Current limit reduced to the value programmed as Ilim(dig). Activated with 0xa5 Bit	0x40 Bit 20
Iuse-rchd	Actual current value at the current limit	0x40 Bit 21
Ird-N	The current limit is reduced when the speed is rising	0x40 Bit 22
Ird-TIR	The current limit is reduced when the output stage temperature is rising	0x40 Bit24
Ird-TI	The current limit is reduced to continuous current via the output stage temperature	0x40 Bit23
<10Hz	If the roatation frequency is smaler 10Hz (blocking protection) (0x5a, bit31=0) current limit will be reduced, (0x5y, bit 31=0) switching frequence will be set to 4 kHz.	0x40 Bit25
Ird-TM	The current limit is reduced when the motor temperature is rising	0x40 Bit26
Ird-Ana	The current limit is reduced via the analog input 2, 0 to 10V = 0 to 100% peak current	0x40 Bit 27
Iwcns	Warning - current limit accumulator (accumulator limit) charged to 87.5%.	0x40 Bit28
Icns	The current limit is reduced to continuous current	0x40 Bit5
Measured values (monitor)		
Tmotor	Active motor temperature	0x49
Tigbt	Active output stage temperature	0x4a
Tair	Active air temperature in the servo	0x4b
Irda	Active current limit	0x48



12.4 Current controller parameters

Speed window (current)

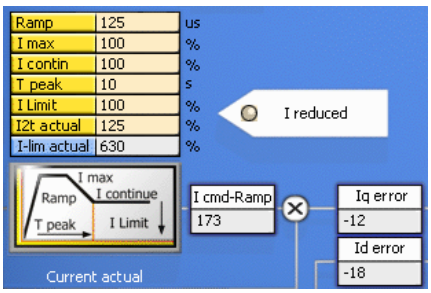


Current controller

Block diagram with input fields for the control parameters and display fields for numeric values.

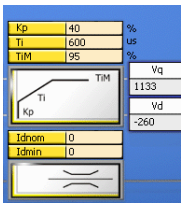
Command values (current)	The current command valueis provided by:		ID address
I Spd	Speed controller output		
I Tor	Torque command value after ramp		
I Pos	Position controller output (Pos -> current)		
I man	Fixed input	input	0x21
I cmd	Current command value	display	0x26
I cmd-Ramp	Current command value after ramp and limiting	display	0x22
Actual values (current)			
Iq actual	Active current	display	0x27
Id actual	Reactive current	display	0x28
I act	Summary current	display	0x20
I act monitor	Summary current after display filter	display	0x5f
Stromregel-Werte			
Iq error		display	0x38
Id error		display	0x39
Id ref		display	0x23
Vq		display	0x29
Vd		display	0x2a
DC-BUS	Bus voltage	display	0xeb
V out	Output voltage	display	0x8a
V red			0x8b
V kp			0xac
V Ti			0x8d

Setting field Ramp Parameters are also on the page 'settings'		
Parameter	**Function**	**Address**
Ramp	I-command value ramp	0x25
I max pk	Peak current Apeak	0xc4
I con eff	Continuous current	0xc5
Tpeak	Time peak current	0xf0
I-lim-dig	Current reduction with input	0x46
I t	Load	0x61
I lim inuse	Display current reduction	0x48



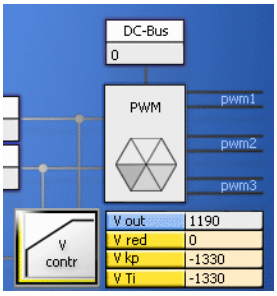
The current command value (I cmd) is processed in the setting field (ramp). The current increase (ramp), the peak current (Imax), the continuous current (Icontin), and the peak current time (T peak) are set.
The summarized current reductions through speed, current, and temperature are displayed at I limit and I lim actual.
At reeduced current the LED Ireduced lights. The result of the current command value processing is shown in the display field 'current command value after ramp' (I cmd-Ramp).

Setting field - Current controller Parameters are also on the page 'settings'		
Parameter	**Function**	**Address**
Kp	Proportional amplification	0x1c
Ti	Integration time	0x1d
TiM	Max. integration time memory	0x2b
???	???	0xcc
Setting field - Field control		
Id nom		0xb2
Id min		0xb5
V red	Field weakening from % Vout	0x8b
V kp	Amplification field weakening	0x8c
V Ti	Integration time field weakening	0x8d



The current actual values (I-Ist1, I-Ist2, I-Ist3) are evaluated as Iq-actual and Id-actual. The displayed current actual value (I act monitor) is obtained from the current actual value (I actual) by means of a filter.
The Iq and Id errors are processed in the current controller by means of the amplification parameters (Kp, Ti, TiM).
The reference value for the Id control is generated via the vector control feedback.

PWM Display Parameters are also on the page 'settings'		
Parameter	**Function**	**Address**
Vdc-Bus		0xeb
V out		0x8a
PWM1	PWM level	0xac
PWM2	PWM level	0xad
PWM3	PWM level	0xad

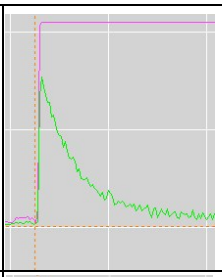
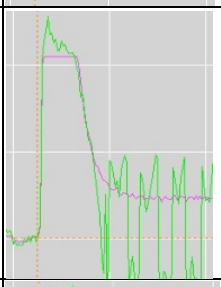
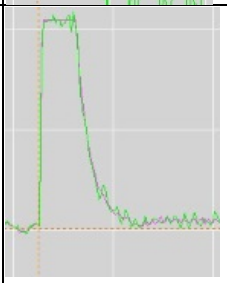
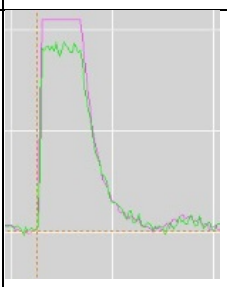
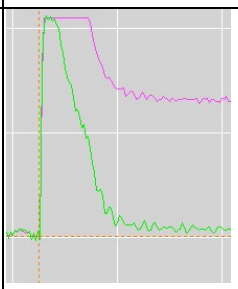


The PWM pulses for the output stage circuit are generated from the current controller output signals Vq and Vd.

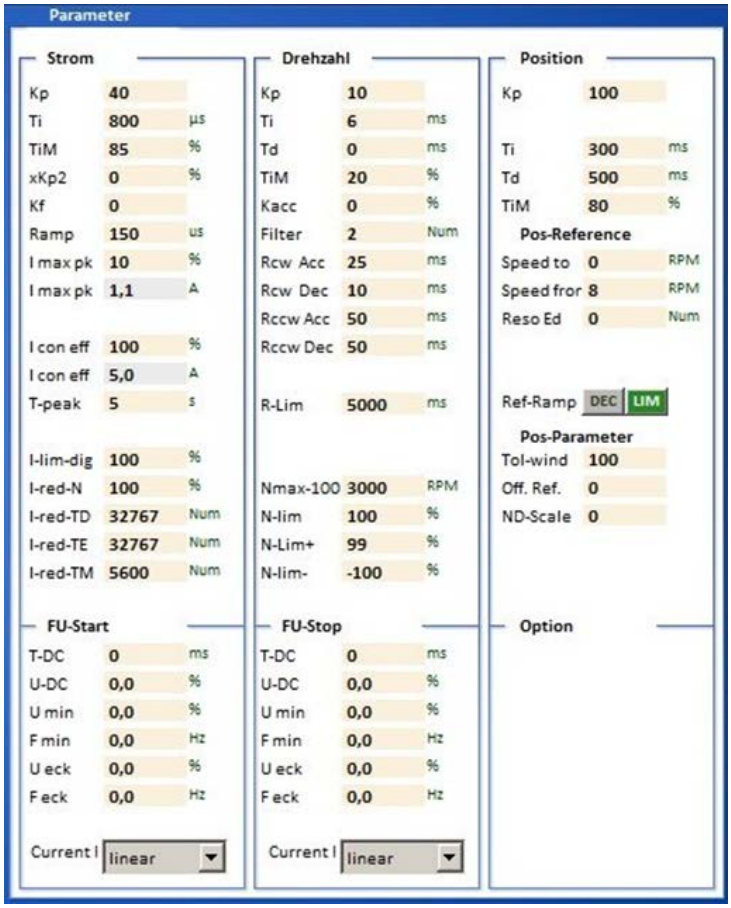
Setting of the current controller amplification

The current controller parameters may only be modified by trained and skilled personal. Setting the current controller is only necessary for unidentified motors. Preset a step function for free-running motors. View the current command value *(I cmd*) and the actual current value (*I actual*) at the oscilloscope. **The actual value must always be smaller than the command value**.

Setting of the parameter (Current, Kp, Ti, TIM)

KP value too small The difference between the current command value (*Icmd*) and actual current value (*Iactual*) is to large. The max. torque is not reached at high speeds.	
KP value to high The actual current value overshoots the current command value. Rough operation and motor noise.	
Correct KP value Actual current value does not oscillate. The difference between the current command value (Icmd) and actual current value (Iactual) is optimal (correction error <5 %)	
Integral part Parameter Ti too large.	
Integral part Parameter TiM too small. The speed is not reached at max. speed and max. current.	

12.5 Speed controller parameters



1 NDrive-Einstellungen-Para-alles-2

Setting window for the speed controller parameters

For further settings please refer to the pages ***'speed'*** and ***'oscilloscope'***

Parameter	Function	Setting range	Presetting	Units	Step	ID address
KP	Proportional amplification	0 to 200	50	num	1=0.1	0x2c
Ti	Integration time	1 to 100	10	ms	0.75	0x2d
Tv	Rate time	1 to 1000	0	ms	0.75	0x2e
TiM	Max. integration time memory	0 to 100	50	%	1	0x3b
Kacc	Acceleration amplification	0 to 100	0	%	1	0x5b
Filter	Speed - actual value filter	0 to 10	5	Num	1	0x5e
Ramp-sel						
Rcw-Acc	Speed command value ramp, acceleration	0 to 10000	100	ms	0.75	0x35
Rcw-Dec	Speed command value ramp, deceleration	0 to 10000	100	ms	0.75	0xed
Rccw-Acc	Speed command value ramp, acceleration	0 to 10000	100	ms	0.75	0x35
Rccw-Dec	Speed command value ramp, deceleration	0 to 10000	100	ms	0.75	0xed
R-Lim	Min. speed command value ramp	0 to 10000	10	ms	0.75	0xc7
N max 100%	Max. speed (for 32767 Num)	600 to 50000	3000	RPM	1	0xc8
N-Lim	Speed limit	0 to 100	100	%	1	0x34
N-lim +	Positive speed limit	0 to 100	100	%	1	0x3f
N-lim-	Negative speed limit	0 to 100	100	%	1	0x3e

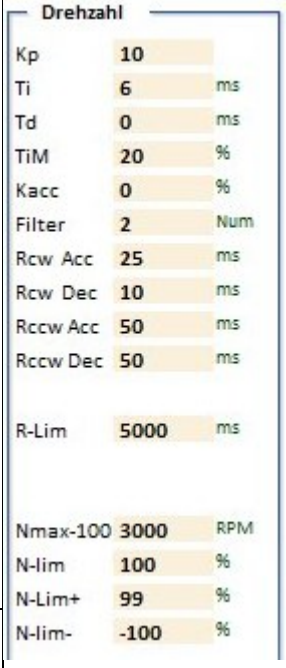
Actual speed value range	Calibration speed n-max	Limiting
Max. value +/-32767 (15Bit-1)	Nmax value set in the parameter fields = 32767 = 100 %	Limiting via the parameter field ***speed with N-Lim***

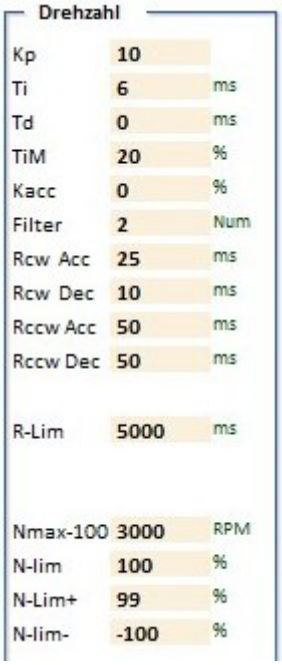
Setting field for the speed controller

The amplification parameters KP, Ti, Td, and TiM of the speed controller must be adapted to the drive conditions of the drive and optimized.
(also see MANUAL commissioning instructions)

Amplification parameters

Parameter	
Kp	Input for the proportional amplification in the speed controller. Setting range 0 to 200 (nominal 10 to 80) Presetting 40 **Formula:** Kp too low: compensation error, bad dynamics, low-frequ. vibrations Kp too high: strong motor noise, high-frequency vibrations Optimize the amplification to min. overshoots.
Ti	Input for the integration time in the current controller. Integral – time constant Setting range 150 to 10000 (nominal 600 to 2000) Presetting 800 Ti too high: low-frequency vibrations Ti too low: high-frequency vibrations, strong vibration tendency
Td	Input for the presetting time in the current controller. Differential – time constant Setting range 3 to 100ms (nominal 6 to 20) Presetting 6 Ti too high: high-frequency vibrations, strong vibration tendency
TiM	Max. value from the integral memory Setting range 0 to 100% (nominal 20 to 50 %) Presetting 20 % If adjusted too low, the speed is not reached.
Kacc	Dynamic acceleration value directly to the current controller. Setting range 0 to 100 % (nominal 10 to 50 %) Presetting 0 % If adjusted too high there is a risk of current oscillations.
Filter	Filter for the actual speed value. Zero without filter, 10 is the max. filter effect. Low filter values: motor noise may occur High filter values: low-frequency vibrations may occur



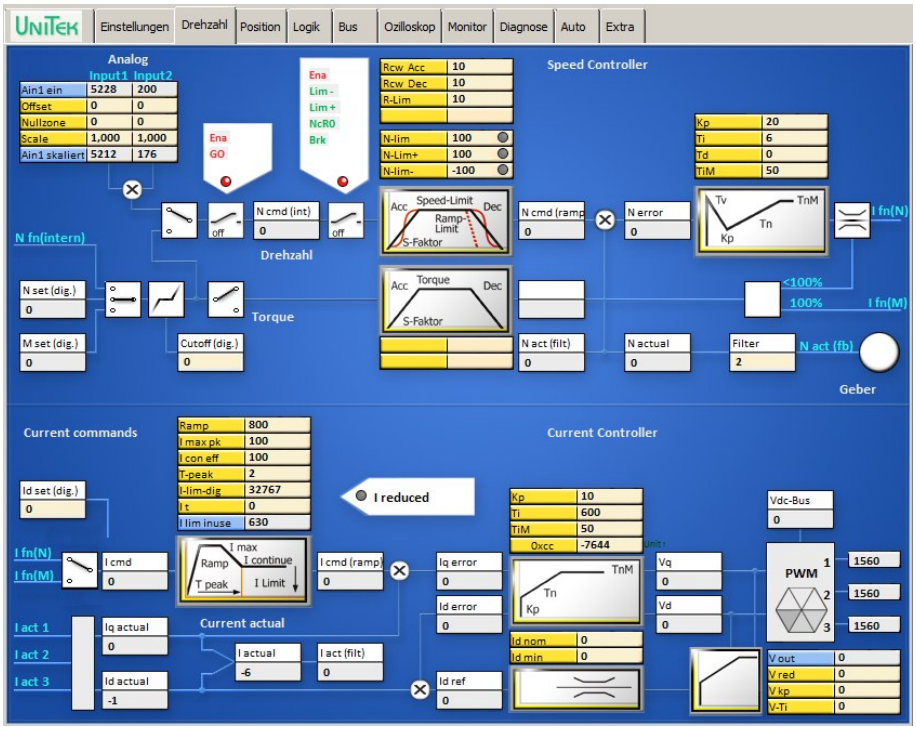


Speed command value ramp

Rcw-Acc	Acceleration ramp, positive direction of rotation for speed and position control (can be selected for the reference run)
Rcw-Dec	Deceleration ramp, positive direction of rotation only for speed control. Set to <10 ms for position control.
Rccw-Acc	Acceleration ramp, negative direction of rotation for speed and position control Acceleration ramp for torque control.
Rccw-Dec	Deceleration ramp, negative direction of rotation only for speed control. Set to <10 ms for position control. Deceleration ramp for torque control.
R-Lim	Minimum braking ramp at limit switch an emergency stop (can be selected for the reference run).
Speed limits	
N max-100	Maximum speed. The set value corresponds to the num. value of +/-32767 equals 100 %.
N-Lim	Speed limiting by means of Nmax, (0 to 99 % of Nmax) Max. speed setting for position control. At torque control as speed limiting 0 to 99 %, at 100 % the speed limiting is not effective.
N-lim+	Speed limiting inferior to Nmax for a positive rotation direction (0 to 99 % of Nmax) Activated via logic input N clip (neg&pos) **For electric vehicle** **Brake Car** Setting on the logic page (digital input): Current limit for braking current at torque command value zero
N-lim-	Speed limiting inferior to Nmax for a positive rotation direction (0 to 99 % of Nmax) Activated via logic input N clip (neg&pos) **For electric vehicle** **Brake Car** Setting on the logic page (digital input): Current limit for braking current at braking switch active.

12.6 Speed controller parameters

Page ‘Speed’ (Speed controller)



Schematic diagram with input windows for control parameters and display windows for numerical values

Speed command values		The speed command value is provided by:	ID address
Analog	IN1 / IN2	Analog input 1	0xd5 L / 0xd6 L
Offset	IN1 / IN2	Correction of the zero point error	0x2f L / 0xd7 L
Cutoff	IN1 / IN2		0x50 / 0x53
Scale	IN1 / IN2	Scale for the input value	0x2f H / 0xd7H
Analog int	IN1 / IN2	Processed command value	0xd5 H / 0xd6 H
Dig-Torque		digital torque command value	0x90
Dig-Speed		digital speed command value	0x31
Dig-Cutoff			0x1e
N-Pos		Position controller output Pos->Speed	
Actual value			
Speed actual		Speed actual value signal	
Filter		Filter for the speed actual value	0x5e
N actual		Speed actual value signal for the control	0x30
N act monitor		Speed actual value signal for the display	0xy8

Speed control values		
Ncmd Ramp	Speed command value for the control	0x32
N actual	Actual speed value for the control	0x30
N error	Speed command value minus actual value	0x33

Display input field for analog command values

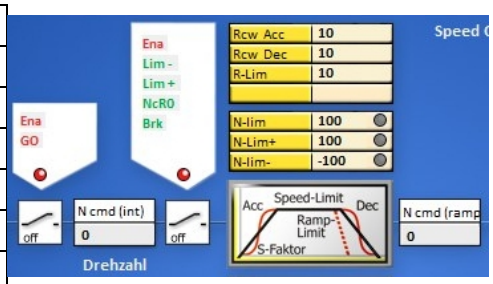
Parameter	Function	Input 1(Ain1)	Input2 (Ain2)
Ain x on	Terminal voltage in num (32767)	0xd5L	0xd6L
Offset	Offset correction input amplifier	0x2fL	0x2fL
Zero zone	Command value - zero range	0x50	0x53
Scale	Amplification factor	0x2fH	0xd7H
Ain x scaled	Processed command value Ain x sc. = Ain x on +/- Offset x Scale	0xd5H	0xd6H

Display input field for analog command values

The direct input values of Input1 and Input2 are displayed under Analog IN.
These signals are processed by means of the parameters offset, cutoff and scale. The result is displayed under 'Analog int'.
It is possible to select either the analog or the digital command value by means of the selection switch 'analog' and 'digital'. When both switches are closed, the digital and the analog command value are added.
The sum at Ncmd must be equal or inferior to 32767 Num.
The digital command values can be entered as digital speed, digital torque, or they are provided by the position controller (NPos).

Switch field1 (controlled by means of digital inputs)

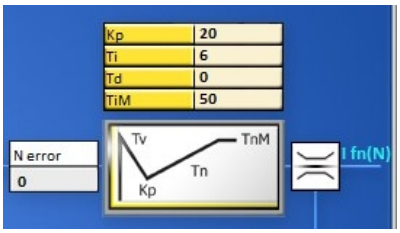
Command	green function	
Enable	Enable hardware+software	
GO	Internal enable (output stage)	
Lim -	Limit switch minus	
Lim +	Limit switch plus	
Nc RO	Command value zero	
Brake	Brake	
Speed - ramps		
Rcw Acc	Acceleration ramp right	0x35L
Rcw Dec	Braking ramp right	0xedL
R-Lim	Emergency stop ramp	0xc7
Command value limits		
N-Lim	Speed limit inferior to 100%	0x34
N-Lim+	Speed limit right (positive)	0x3f
N-Lim-	Speed limit left (negative)	0x3e



The speed command value is only transmitted (green) at enable (*Enable*) and internal enable (GO). It is shown in the display field 'speed command value' (*N cmd*).
Switching field 2
When the enable (Ena), the limit switches *(Lim-, Lim+),* not speed=0, and not brake are switched (green), the speed command value (*N cmd*) in the setting field (ramp) is processed.
Ramp field
The acceleration ramp (*Ramp-Acc*), the deceleration ramp (*Ramp-Dec*), the limit switches 'emergency stop' ramp (*Ramp-Limit*), and the speed limits (*speed-limit, N-limit+, N-limit-*) are set.
The result is shown in the display field 'speed command value after ramp' (*N cmd-Ramp*).

Speed controller parameters
(Parameters are also on the page 'settings')

Parameters		Address
Kp	Proportional amplification	0x2c
Ti	Integration time (integral part)	0x2d
Td	Presetting time (differential part)	0x2e
TiM	Max. value integral memory (Ti)	0x3b



The actual speed value (s*peed actual*) is displayed after the filter in the field 'actual speed value' (*N actual*). At the mix point the actual speed value is subtracted from the speed command value.
The result is shown in the display field 'speed error' (*N error*).

The speed correction error is processed in the speed controller (*PID amplifier*). The proportional amplification (*Kp*), the integral part (*Ti*), the differential part (*Td*), and the memory limit for the speed controller are set.

12.7 Speed controller optimization

Setting of the speed controller amplification

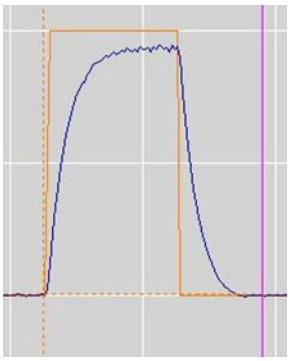
The setting of the speed controller is determined by the load, the friction and the inertia presented by the driven axis.
Preset a step function to optimise the settings by monitoring the response at a step input.

The oscilloscope window incorporates a step generator for testing.
Monitor the speed command value ***(N cmd-ramp)*** and the actual speed value ***(N actual)*** on the oscilloscope. For further information refer to the commissioning manual.

Speed controller adjustment of the parameter Kp without integral component (Ti = 0)

KP too low
(Timax = 0)
The difference between the speed command value (Ncmd-Ramp) and the actual speed value (N actual) is too large.

The speed command value is not reached and the acceleration is too weak.
The drive reacts smoothly to command value changes and it can be rotated at standstill.



KP too high
(Timax = 0)
The actual speed value overshoots the speed command value significantly.
Rough operation, strong tendency to vibrations (even at standstill), and motor noise.

Correct KP value
(Timax = 0)
The difference between the speed command value and the actual speed value is optimal (control error approx. < 5%).
Remaining errors can be eliminated by means of the integral adjustment.

Speed controller setting parameters Kp, Ti und TiM

Setting integral part (optimal Kp value)
Ti value too low
Short overshoots with tendency to high-frequency oscillations.
Ti value too high
Long overshoots with tendency to low-frequency oscillations.

Adjust the correction error (overshooting) to minimum by means of the parameter ***TiM***. Select the Tim value as small as possible.

Optimally set speed controller

Kp value, Ti value are optimal
No overshooting of the speed.

TiM value optimal
There is no speed error occuring.

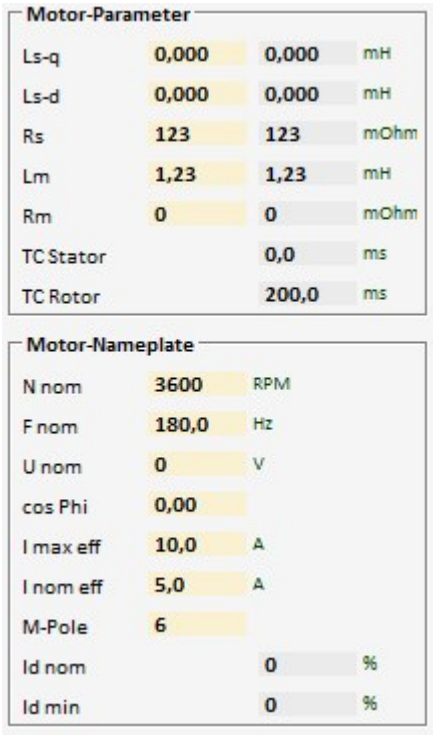
13 Field weakening at synchronous motors

13.1 Field weakening mode

The field weakening mode at synchronous motors with surface magnets is only possible within a small range (max factor 1.2) and thus, not economically viable.
At synchronous motors with integrated magnets (salient-pole machines) it is possible to achieve speed ranges up to the factor 4. At optimal rating the motor and the servo can in this case be dimensioned smaller.

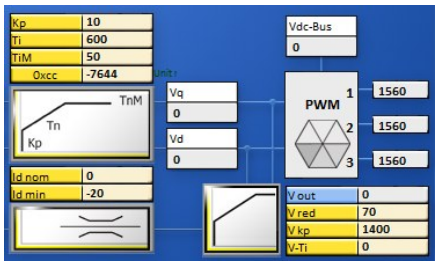
Note:

If the field weakening (power supply switch-off, error switch-off, etc.) fails at max. speeds, the motor can generate high induced voltages.
For devices connected to the power supply the threshold voltage is 400 V or 800 V. For battery-driven devices the counter voltage must always be inferior to the battery voltage.
If the devices or batteries have no external protective circuit they may be destroyed in case of motor overvoltages.
Presettings
Motor dates



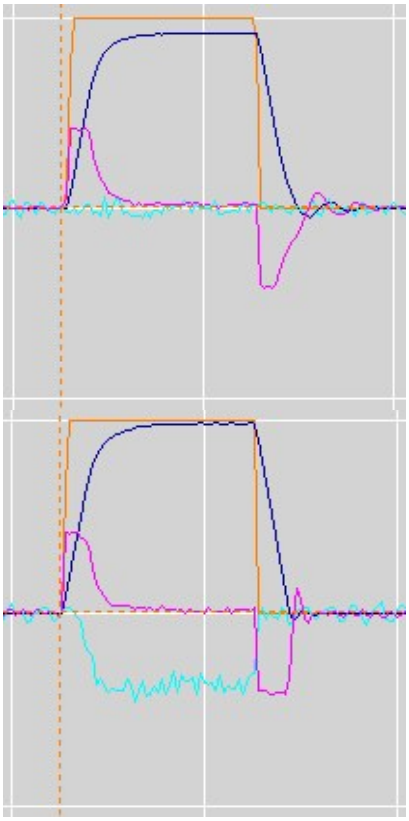
Setting parameters - Field weakening

Parameter		Address
Id nom	nominal Id-current 100 %	0xb2
Id min	min. Id-current -50 to -80 % from set current at motor I nom eff	0xb5
V red	Output voltage for the field weakening (90 to 50 %)	0x8b
V Kp	Control amplification for the field weakening (500-2000)	0x8c
V Ti	Rated time field control (0-2000) Note: tendency to oscillate	0x8d



Without field weakening

The speed (blue characteristic) is not reached at max. output voltage.
Id –current (light blue characteristic) is controlled to zero.
After the acceleration to the braking (idle speed operation) the Iq –current (red characteristic) is at a low value.

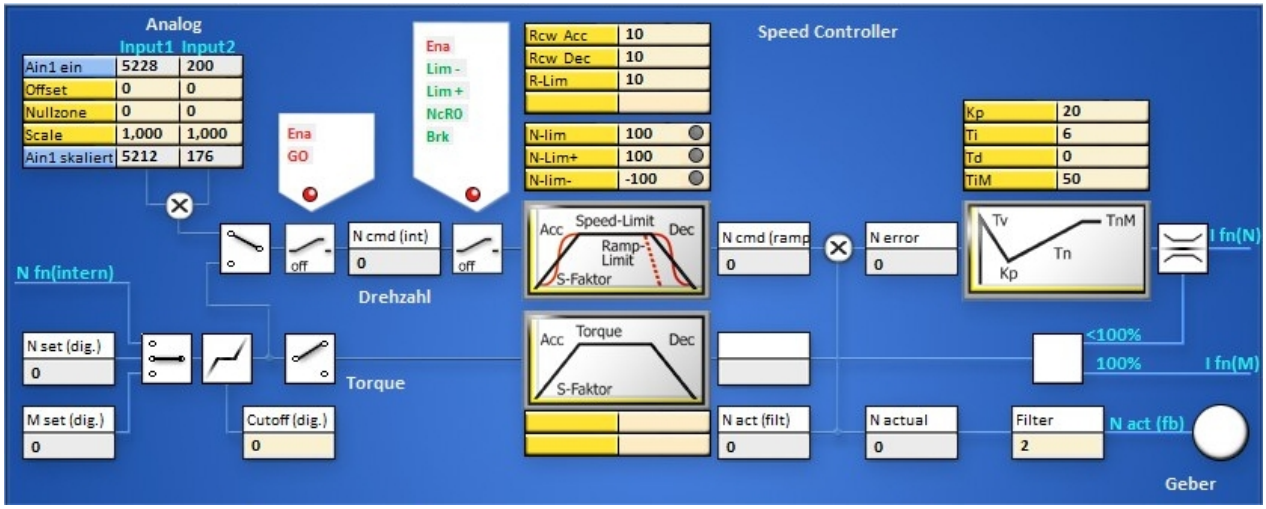


With field weakening

The speed (blue characteristic) is reached.
Id-current (light blue characteristic) is compensated during the field weakening.
At motors with surface magnets a high Id current flows for only a small increase in speed.
After the acceleration to the braking (idle speed operation) the Iq –current (red characteristic) is at a low value.

14 Torque control

14.1 Torque control

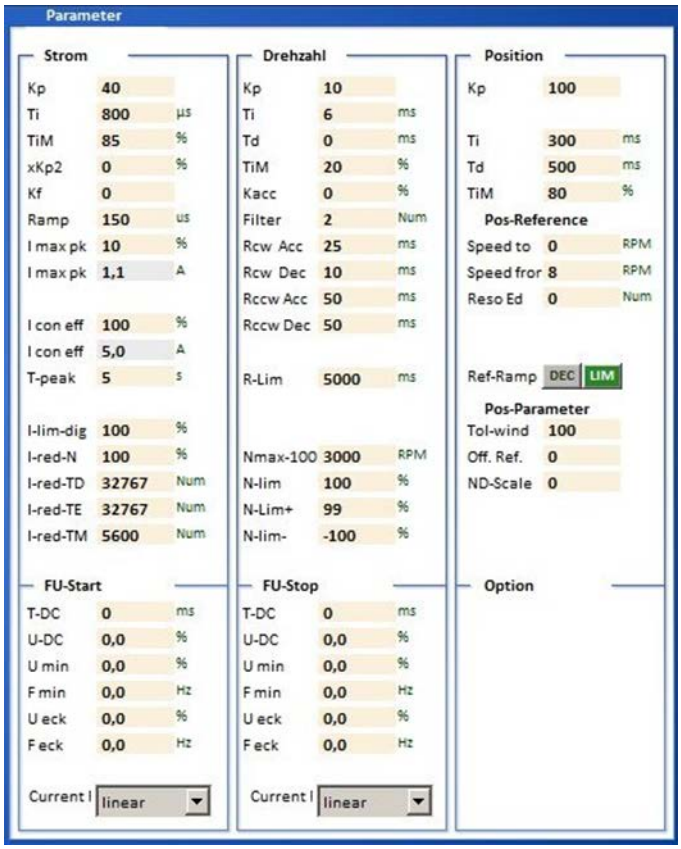


Analog or digital command value as torque command value.
Analog command value 10 V or digital command value (0x90 = 32767num) correspond to 100 % Imax
The torque command value signal is directly transmitted to the current converter via the torque ramps (M R-Acc, M R-Dec).

When there is no speed limiting (**N-lim 100**) the idle speed is only limited by the max. voltage.
When the speed limit < 99 % the speed controller starts limiting.
Analog 1 skaliert or ***M set (dig)*** display the torque command value.
Ncmd and ***Ncmd (ramp)*** display the numerical value of the limiting (0..99 %=0..32350)
Amplification parameter in the speed controller Kp> 20, Parameter TiM =0 (no integral value)

15 Position controller parameters

15.1 Setting of the position controller



Setting window for the position controller parameters.

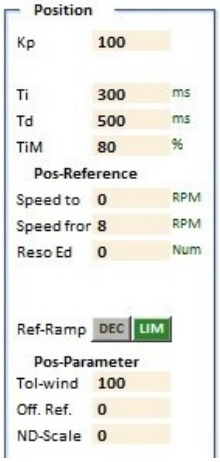
For further settings please refer to the pages 'position' and 'oscilloscope'.

Position speed						
Parameter	**Function**	**Setting range**	**Presetting**	**Units**	**Step**	**ID address**
Kp	Proportional amplification	0 to 200	70	num	1=0.1	0x6a
Z Factor						
Ti	Integration time	1 to 100	0	ms	0.75	0x6b
Tv	Rate time	1 to 1000	0	ms	0.75	0x6c
TiM	Max. integration time memory	0 to 100	0	%	1	0x71

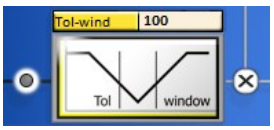
Reference position						
Parameter	**Function**	**Setting range**	**Presetting**	**Units**	**Step**	**ID address**
Speed to	Speed compared to the reference position	10 to 32000	3000	num	1	0x76
Speed from	Loop speed	10 to 2000	500	num	1	0x77
Reso Ed						0x75
Dec-Ramp	Switching of 'ramp acc' or 'limit'					0x78

Parameter position						
Paramter	**Function**	**Setting range**	**Presetting**	**Units**	**Step**	**ID address**
Tol window	Window - position message	0 to 2000	100	num	1	0x79
Ref- Off	Zero offset	0 to +/-32676	0	num	1	0x72
ND-Scale						

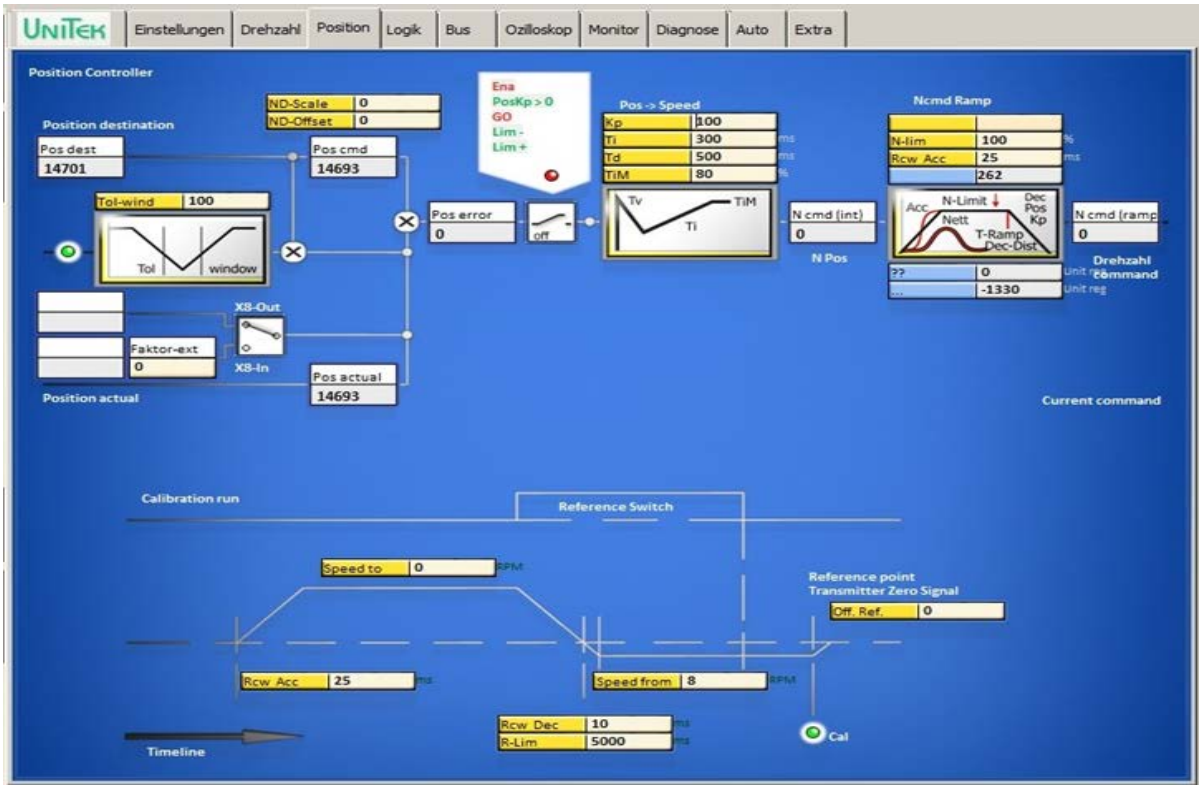
Pos->Speed
The amplified position error is the speed command value.



Proportional control amplification		Address
KP	Proportional amplification position control circuit. Determines the slope of the deceleration ramp. Formel	0x6a
Note: The position control is switched off when no KP-vaue is entered.		
Dynamical control amplification (only effective in the target range)		
Ti	Integral part	0x6b
Td	Differential part	0x6c
TiM	Threshold value integral part	0x71
Pos reference run		
The zero point of the incremental measuring system is determined by means of the reference run.		
Speed to	Speed to the limit switch. The limit switch is passed depending on the speed.	0x76
Speed from	Reverse speed back to the zero pulse. (loop speed)	0x77
Reso Ed		0x75
Ref-Ramp	The ramp of the reference run is selected from the ramps RCW-Acc and Ramp-lim.	Selection
Pos parameters		
Tol window	Position tolerance window (numerical value)	0x79
Reference Offset	Mechanical zero offset (numerical value)	0x72
ND-Scale		0x7c
One motor revolution corresponds to the numerical value of 65536.		
The position command values or the parameter values which are sent from the control via RS232 or CAN are immediately processed.		



Position setting window



Position controller

Block diagram with the input fields for the control parameters and display fields for numeric values.

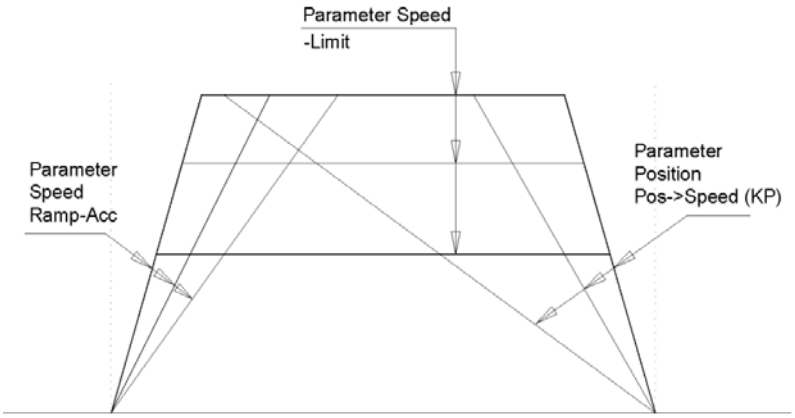
The position error *Pos error* is calculated at the summing point by subtracting the actual position value (pos actual) from the position target value (pos dest). If the error is inferior to the adjusted tolerance value, this state will be displayed in the field 'tol'. At enable the position target value (pos dest) is proceeded as position command value (pos cmd). The position error is calculated at the summing point by subtracting the actual position value (pos actual) from the position command value (pos cmd). The resulting error value is displayed in the field 'speed error' (N error).

When the enable states (Ena, GO), the output stage switches (Lim-, Lim+), and the position control amplification (posKp>0) are active (green), the position error (pos error) represents the input to the *Pos -> Speed and Pos -> Current* controllers. For both controllers the proportional amplification (Kp), the integral term (Ti), the differential term (Td), and the memory limiting for the integral term (Tim) are adjusted. This results in the current command value (I pos).

Reference run (Reference traverse)

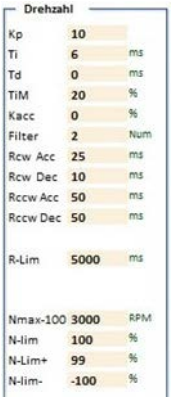
Block diagram with the input fields for the control parameters and display fields for numeric values.

Settings		Displays	
Speed to	Speed to the reference switch	Ramp Acc	Acceleration to speed (ref. switch)
Speed from	Reverse speed from switch to zero pulse	Ramp Dec	Deceleration to reverse speed (selection 'dec-ramp')
Offset	Mechanical zero offset	Ramp-Limit	Deceleration to reverse speed limit



N-Drive2-NDrive-Pos-funktionen

Acceleration:
Rcw-Acc Acceleration time tb to max. speed in ms.
Acceleration a = v / tb



Constant run:
N-Lim Speed limit < max. speed.
(max. speed (100 %) = 32767 num)

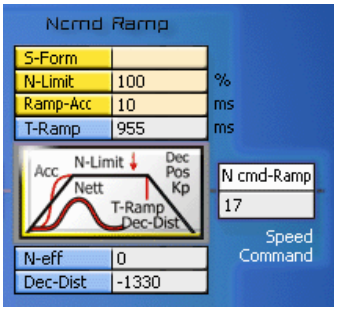
Deceleration:
Rcw-Dec For position control, adjust to < 10 ms

Setting via the parameter window '*position*'
(Pos->Speed KP). The slope of the deceleration results from the proportional amplification.

Deceleration time
T Ramp **(tv)** from max. speed (32767 num) to zero, displayed in ms in the window 'position'

Deceleration a in m/s²
a = v / tv v = max. velocity in m/s
tv = deceleration time (T Ramp) in s

Example v = 3m/s, tv = 0.261 a = 3 / 0.261 = 11.5 m/s²



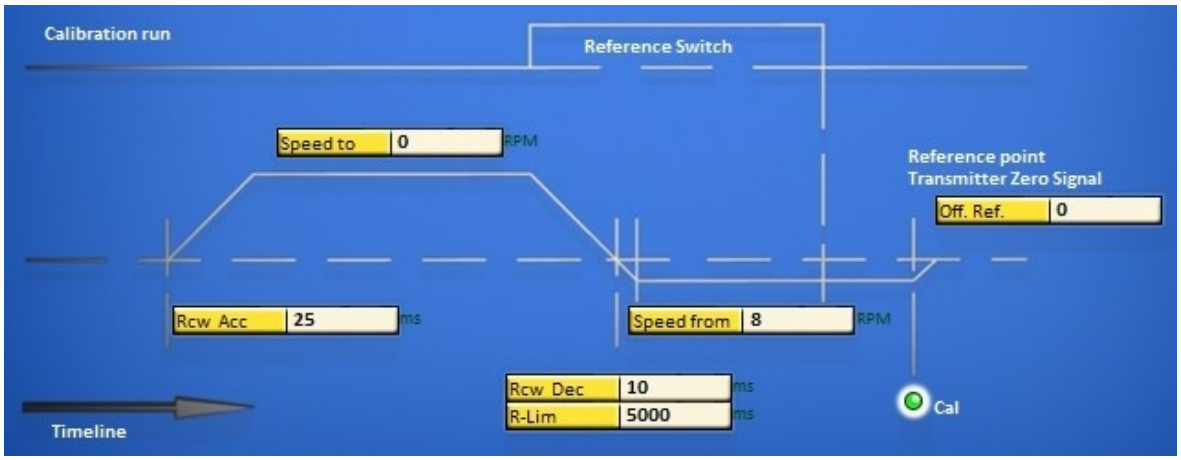
Calculating Kp from a given speed and deceleration time
Kp = √ a x 2603 / v **Kp = √ 11.5 x 2603 / 3 = 99.9 %**
Ramp target distance
s = v² / s x a s = 9/ 2x 11.5 = 0.391 m

Conversion of the units for position control

Actual position value range	Resolver	Incremental encoder
Pulses/rpm	65536 pro rpm	65536 pro rpm
Max. value +/-2147483647 (31Bit-1)		
Resolution (smallest value)	16 (65536/4096 (12Bit))	65536/Ink x4
Example	Travel 1000 mm = 200rpm	Incremental encoder 2048 inc./rpm
Positioning axis	200rpm = 13107200	Travelg 1000mm = 200Upm
5mm slope/rpm	Resolution 65536/4096 = 16	200rpm = 1638400
		Resolution 65536/8192 = 8

15.2 Reference run

A reference run is initiated in order to determine the axis reference position.

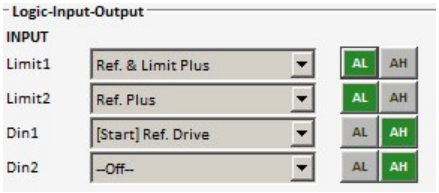


Speed to	Speed, moving to the limit switch. The limit switch is passed depending on the speed.	0x76
Speed from	Speed, reverse run to the limit switch rising edge (Reso) or to the zero pulse after the limit switch rising edge (Inc.). (loop speed)	0x77
Reso Ed	Correction value at Reso. Enter measurement value 'zero capture'	0x75
Dec-Ramp	Set the switch for the ramp at speed reversion from 'speed to' to 'speed from'.	Selection
Rcw Acc	The ramp programmed at RCW-Acc is used.	0x35 L
R-Lim	The ramp programmed at RCW-Lim is used.	0x7c

The reference switches are selected in the parameter field 'digital inputs'. After the machine and the enable (RUN) are switched on, the reference run ***(Start Ref Drive)*** is started via a digit input (Din1, Din2) or the interface (CAN-BUS, RS232 0x78).

Note:
Driving commands such as ***Start Ref drive, N cmd*** , etc. are recognized only after 5ms after the enable.
Close or send the enable first, then send the driving commands.

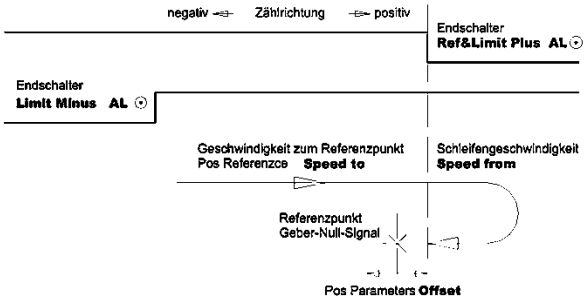
Reference run
The drive runs to the limit switch at the speed 'speed to', passes the limit switch at loop speed 'speed from' and returns. With a reference switch the drive runs in a positive direction loop, and in a negative direction double loop. The device position zero point is set after the limit switch rising edge at the incremental encoder zero signal. At the resolver the absolute value of the position (within half a motor revolution) is saved at the limit switch rising edge (zero capture).
The mechanical zero point can be shifted in positive or negative direction by means of the parameter 'Offset'.

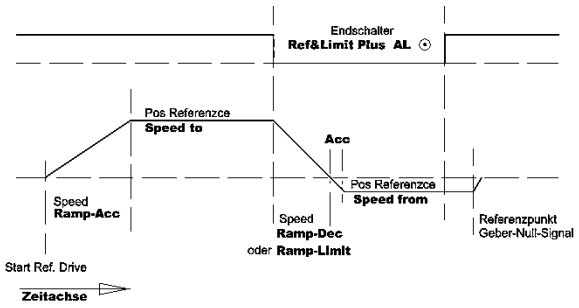


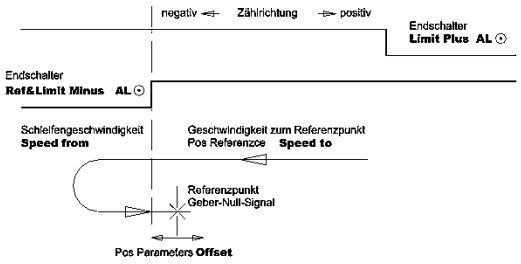
Reference switch	
Ref&LimitPLUS	Limit switch - positive rotation direction is the reference switch
Ref&LimitMinus	Limit switch - negative rotation direction is the reference switch
RefPLUS	The switch rising edge in positive rotation direction is the reference switch independently from the limit switches

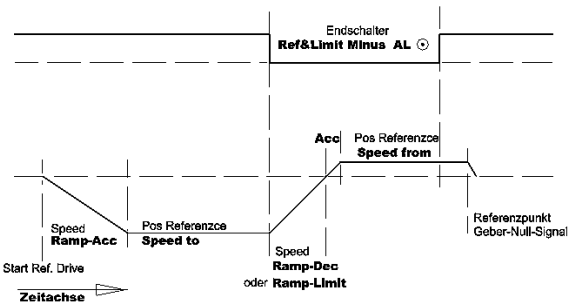
Via the selection window ***Dec-Ramp*** (parameter field servo) the delay is switched from ***Ramp-Limit*** to ***Ramp-Dec*** when changing from ***Speed to*** to ***Speed from***.

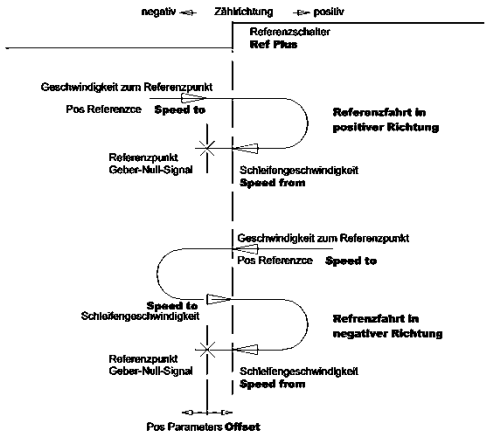
Reference run functions

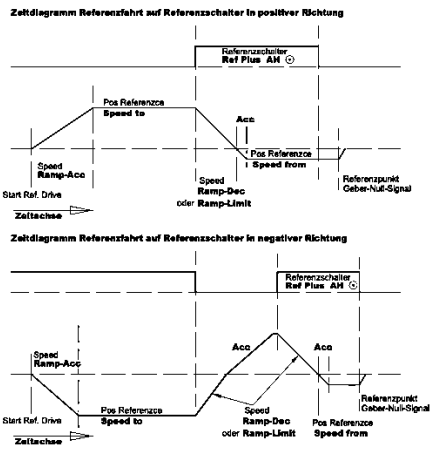








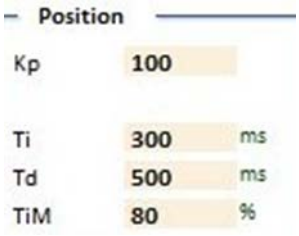




15.3 Position controller optimization

Amplification setting Pos->Speed

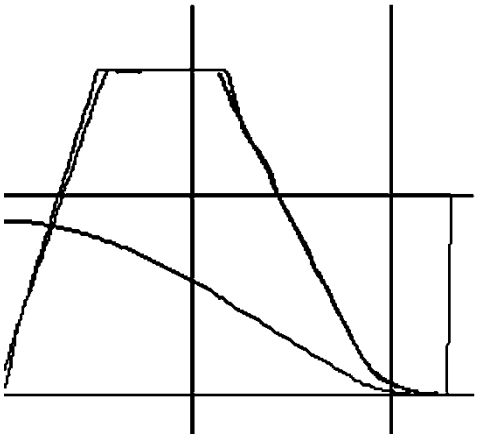
The amplified position error provides the speed command value.



Proportional control amplification

Kp	The proportional amplification for the position controller determines the slope of the deceleration ramp.
Note:	The position control is switched off when no Kp value is entered.
Dynamic control amplification, (only effective during ramp-up to final position)	
Ti	Integral component
Tv	Differential component
TiM	Threshold value - integral component
T Ramp	Position ramp time, ramp-up to final position, Delay time (in ms) from max. speed.

Complete presentation



Position run

Acceleration is determined by the parameter ***Ramp Acc.***

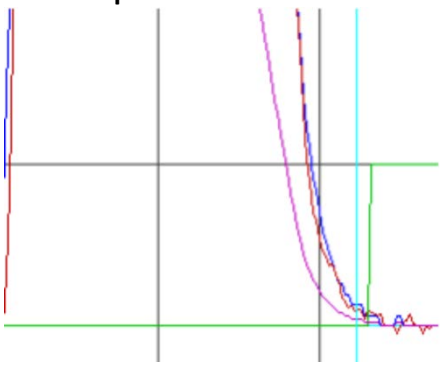
A travel at even speed is determined by means of the parameters ***Speed Limit***.

The ramp-up to final position is determined by the ***Kp*** amplification of the position controller. The deceleration time from 100 % speed to zero speed is displayed in the field '***T Ramp***'.

A small Kp amplification results in a long deceleration ramp. A high Kp amplification results in a short, steep deceleration ramp. If the Kp amplification is too high, the axis will overshoot and oscillate in the target position.

The optimal time ramp is as long as possible and as short as necessary.

Detailed presentation



Position parameters

Tol window	Position tolerance window (numeric value) When **pos-actual < tol window** the output **O Toler** is set to 1 and displayed as state '**Tol**'
Reference Offset	Zero position shift (numerical value) The mechanical zero position is shifted in positive or negative direction.

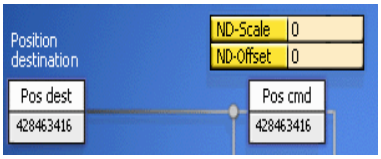
One motor revolution corresponds to a numerical value of 65555.

The position command values or parameter values sent from the controller via the RS232 or the CAN are immediately executed.

15.4 Position scaling

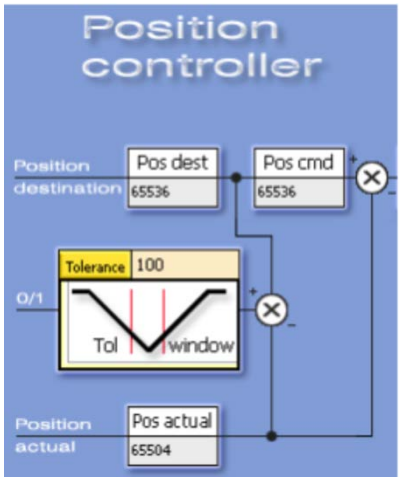
Display factor for the position values

The display of the values for Pos dest, Pos cmd, and Pos actual is adjusted by means of the parameter ND-Scale (0x7c, Pos-display factor) in the window 'position'.
At zero the display corresponds to the numerical value (1 motor revolution = 65536 num).



Adaption of the display to the feed value

Calculate the conversion factor necessary for converting the feed distance to motor revolutions.
For the display this factor must be multiplied by the constant 65536.000 (corresponds to 1.000 mm per revolution).



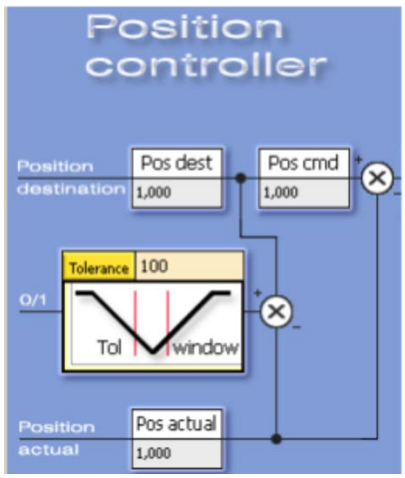
Example: distance in mm

Slope 5 mm
Gear i=20
Conversion factor for one revolution 1/5 *20 = 4

Position display factor 65536.000* 4 = 262144.000

NDrive scale = 262144.000

Displayed value in mm for *Pos dest*, *Pos cmd,* and *Pos actual*



Example: angle in degree

Transmission: 1 degree = 10 motor revolutions

Conversion factor for one revolution = 10

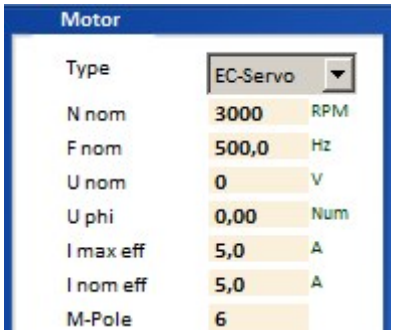
Position display factor 65536.000* 10 = 655360.000

NDrive scale = 655360.000

Displayed value in degree for *Pos dest*, *Pos cmd,* and *Pos actual*

16 Frequency converter parameters

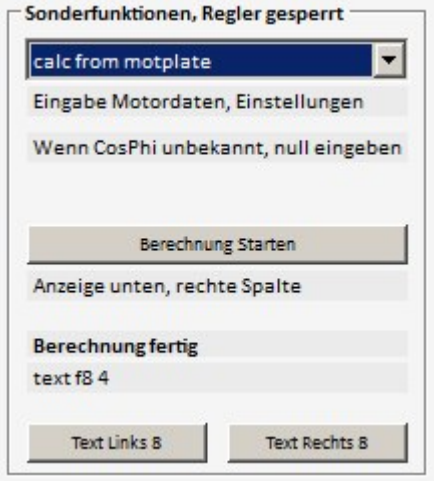
Frequency control without feedback encoder
Setting field for the frequency converter in the field motor
motor values(FU)



For standard motors with mains operation the data for 50/60 Hz operation and star-delta circuit are often written on the type plate. These data are internationally standardized.
For motors with converter mode the rated operating point is at a fixed frequency, usually above the 50/60 Hz power supply frequency.
Further data are not always completely indicated by the manufacturers.
Partly the rated speed at the rated operating point (rated frequency, rated load) is not indicated or cosphi is not indicated.
Partly the values are unclearly specified, e.g. voltage refered to phase to phase (terminal voltage) or the phase voltage (terminal to star point) or dc bus voltage. Please check the manufacturer data and dimensions carefully (V, VAC, VDC, A, Arms, etc).

Rated data	Designation NDrive	Motor example 50Hz	Motor example 60Hz	Dim.
Power supply frequency	Fnom	50	60	Hz
Rated power		0.56	0.63	kW
Rated voltage	Unom	220-240, 360-420	255-275, 440-486	V
Rated current	Inom	2.33-2.25, 1.35-1.30	2.26-2.18, 1.30-1.26	A
Rated speed	Nmom	2820	3385	rpm
Cosphi	Cosphi	0.85	0.85	

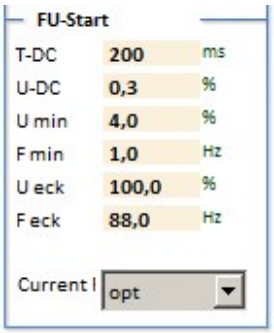
By means of the drive internal function ’calc from motplate’ and using the above mentioned rated data it is possible to determine further values for the motor model.
(Page ‘Auto’ in NDrive or see table further below).
The updating of the display in the NDrive is effected during the offline-online process. (Switch off and on again the RS232 communication.)



16.1 Frequency converter parameters

Setting window for the frequency converter control parameters

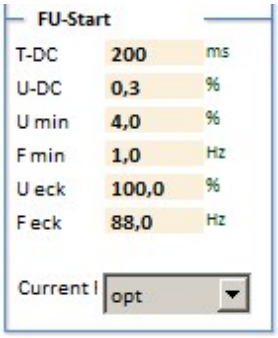
Parameter	Function	Setting range	Presetting	Unit	Step	Id address
FU start						
T-DC	Pre-magnetization time	10 to 2000	250	ms	1	0x07 L
U-DC	Pre-magnetization dc voltage	0 to 20	5	%	1	0x08 L
U min	Minimal voltage (boost)	0 to 100	10	%	1	0x0a L
F min	Minimal frequency	0 to 100.0	10,0	Hz	0.1	0x0b L
U eck	Maximale voltage	0 to 100.0	100.0	%	0.1	0x0c L
F eck	Frequency at max. voltage	1 to 1000.0	50.0	Hz	0.1	0x0d L



Description FU start

T-DC	Pre-magnetization time Delay between the switch-on and the start of the frequency.
U-DC	Pre-magnetization dc value
Umin	Minimal voltage (boost) at motor standstill. U/F characteristic is raised.
Fmin	Minimal frequency at motor standstill.
U eck	Maximal output voltage at base freuquency.
F eck	Base frequency for a max. output voltage.
Current I	

Parameter	Function	Setting range	Presetting	Unit	Step	Id address
FU stop						
T-DC	Braking current time	10 to 2000	0	ms	1	0x07 H
U-DC	dc value for the dc braking	0 to 20	0	%	1	0x08 H
U min	Minimal voltage (boost)	0 to 100	0	%	1	0x0a H
F min	Minimal frequency	0 to 100.0	0	Hz	0.1	0x0b H
U eck	Maximale voltage	0 to 100.0	0	%	0.1	0x0c H
F eck	Frequency at max. voltage	1 to 1000.0	0	Hz	0.1	0x0d HL



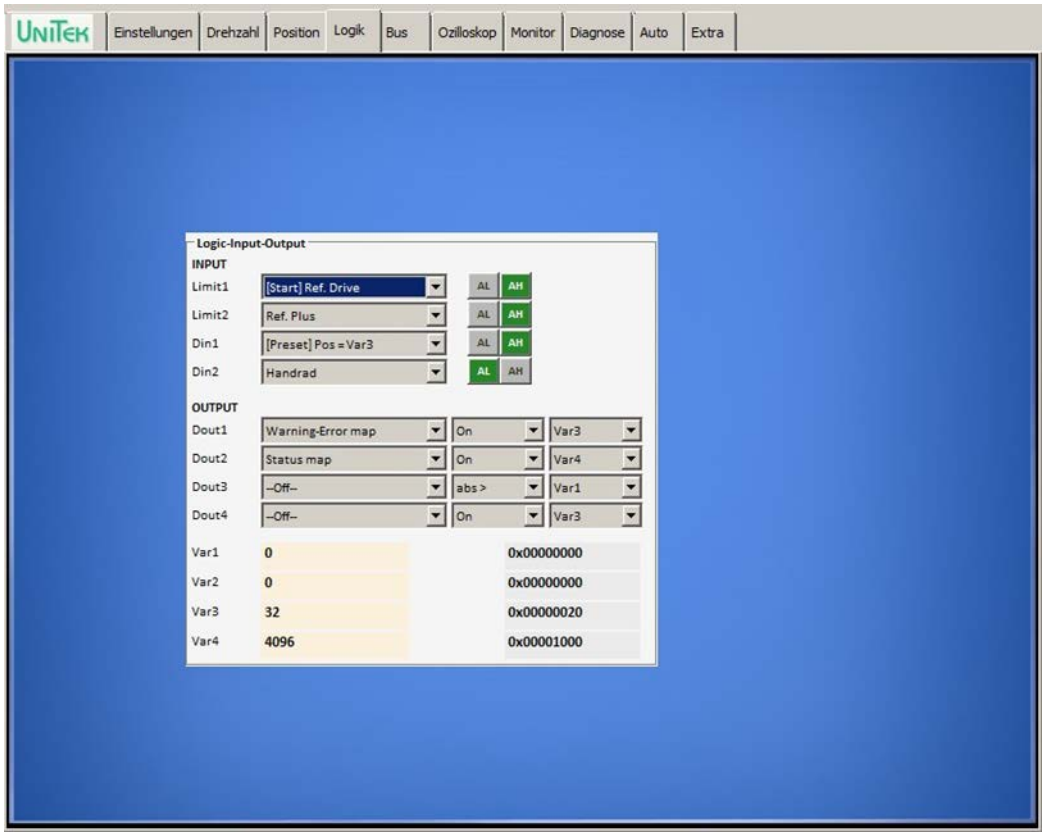
Description FU stop

T-DC	Braking current time Delay between the reaching of F-DC and the switch-off of the current feed.
U-DC	Pre-magnetization dc value
Umin	Minimal voltage (boost) at motor standstill. U/F characteristic is raised.
Fmin	Minimal frequency at motor standstill.
U eck	Maximal output voltage at base freuquency.
F eck	Base frequency at stop operation
Current I	

17 Logic

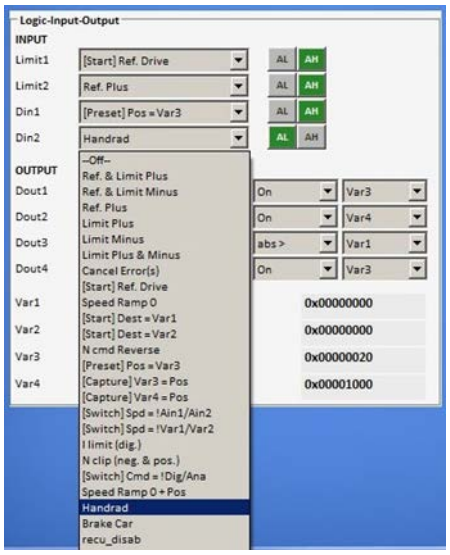
17.1 Logic setting window

Preliminary setting window for digital inputs and outputs



Inputs	
Limit1	Programmable digital input, with preference given to an output stage switch and reference switch
Limit2	Programmable digital input, with preference given to an output stage switch and reference switch
Din1	Programmable digital input
Din2	Programmable digital input
Outputs	
Dout1	Programmable digital output (operant and comparison variable)
Dout2	Programmable digital output (operant and comparison variable)
Dout3	Programmable digital output (operant and comparison variable)
Dout4	Programmable digital output (operant and comparison variable) Dout4 is not available for all units
Var1 bis Var4	Comparison variable

17.2 Digital inputs



Digital inputs
Select function
Click the down arrow to open a drop-down menu showing a list of function options. Click the required option. The selected function is highlighted in blue and is transferred to the display field by clicking it.

Select the switching functions
AL = Active Low (e.g. output stage switch)
AH = Active High

Saving
The function is saved in the RAM and activated by pressing the **'enter'** key.

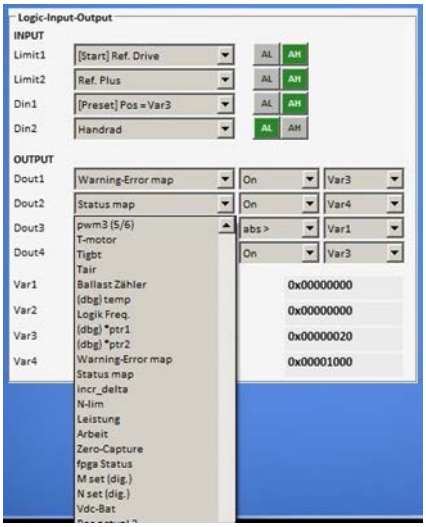
The state of the output stage switches inputs Limit1and Limit2 are displayed in the field 'state' as **Lim+** and **Lim-**..

Example	
Digital inputs	**Function selected**
Limit1	Output stage switch (+) as reference switch (AL active low)
Limit2	Output stage switch (Al active low)
Din1	Start reference travel (AH active high)

Zuordnung-Eingänge	**Funktion**
Ref & Limit Plus	Limit switch positive direction is also the reference switch
Ref & Limit Minus	Limit switch negative direction is also the reference switch
Ref Plus	Referen ce switch positive direction
Limit Plus	Limit switch positive direction
Limit Minus	Limit switch negative direction
Limit Plus &Minus	Limit switch positive and negative direction
Cancel Error(s)s	Delete error memory
[Start]Ref Drive	Start reference run
Speed Ramp 0	Speed command value internally switched to 0 (during speed 0 active)
[Start] Dest > Var1	Position variable1 is started
[Start]Dest > Var2	Position variable2 is started
Ncmd Reverse	Command value polarity is switched over
[Preset] Pos = Var3	Actual position value is set to variable3
[Capture] Var 3 = Pos	Sets the variable 3 as position (target) and travels to the position
[Capture]Var 4 = Pos	Sets the variable 4 as position (target) and travels to the position
[Switch] Spd Ain1 / Ain2	Switching-over command ‘command value Ain1 or Ain2‘
[Switch] Spd !Var1 / !Var2	Switching-over command ‘command value Ain1 or Ain2‘
I limit (dig)	Current limiting to I limit
N clip (neg & pos)	Speed limiting to N clip
[Switch]Cmd = !Dig/Ana	Addition command value digital +analog setting Command Mode Digi+Ana Speed
Speed Ramp 0 +Pos	
Hand wheel	Incremental command value from the hand-wheel encoder (2nd counter input)
Brake Car	Regenerative braking function Current setting at N-Lim+ and N-Lim-
recu_disab	Regenerative braking function switched off
rising bank1,falling bank2	PARA_UPDATE
[Start] Dest = Var1,2,3,4	Pos_kombi
[Start] cw = Var1,2,3,4	Cw_kombi

The inputs **End1, End2** (Limit1, Limit2) are default set to output stage switch function.
However, it is possible to assign them to any of the input functions **Din1, Din 2** available.

17.3 Digital outputs



Digital outputs
The parameter selected in the first column of the drop-down menu are compared with the variables in the third column by means of the operands (second column).
The logic result of the comparison is given at the selected digital output as low (<1 V) or high (>10 V) value..

Click the arrow keys to open the drop-down menu. Select the assignment. The selected function is highlighted in blue and transferred to the display field by clicking it.
.

The output functions can be modified during operation. The function is saved in the RAM and activated by pressing the 'enter' key.

Example	
Digital outputs	**Selected function**
Dout1	Current superior to variable 3
Dout2	Speed equal to variable 4

Note: When inductances are connected (relays, brakes, etc.) connect an over-voltage protective device such as recovery coils or varistors. The output driver is switched off in case of over-voltages.

Assignment of the output parameters (selection)	**Function**	**ID address**
I_cmd	Current (I) command value (Speed controller output)	0x26
I_actual	Current(I) actual value	0x20
N cmd Ramp	Speed command value	0x32
N actual	Speed actual value	0x30
Pos cmd	Position command value	0x6e
Pos actual	Position actual value	0x6d
I_error	Current(I) error	0x23
N error	Speed error	0x33
Pos error	Position error	0x70
Brake	Brake control signal	0xF2
All parameters of the list 'measured value selection' can be assigned to the respective outputs.		

Operands	**Function**	
Off	off	
On	on	
1Hzz	Test	
=	equal	
!=	not equal	
>	superior to	
<	inferior to	
abs>	Absolut valuesuperior to	
abs<>	Absolut value inferior to	
tol>	Tolerance input TOL-wind	
Tol<	Tolerance input TOL-wind	
>=	superior or equal to	
<=	inferior or equal to	
hyst>=	Hysteresis at >=	
Hyst<=	Hysteresis at <=	
window	Tolerance window +/-25 %	

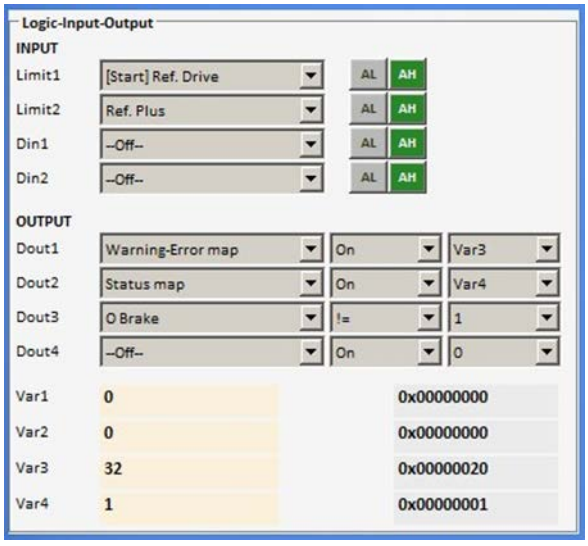
Variable	**Function**	**ID address**
0	Logic signal zero	
1	Logic signal 1	
VAR1	Numerical value of the entered variable fields	0xd1
VAR2		0xd2
VAR3		0xd3
VAR4		0xd4
Ain1	Numerical value of the voltages across the analog inputs	
Ain2		

Outputs assigned on Status-Map and Warn-Err-Map

Display of the	Function	ID address	
state		0x40	Dec
Ena	Enable drive	Bit 0	1
NcR0	Speed command value = 0 (drive stopped)	Bit 1	2
Lim+	Limit switch plus assigned	Bit 2	4
Lim-	Limit switch minus assigned	Bit 3	8
OK	Drive ok (no uncontrolled control-voltage reset seen)	Bit 4	16
Icns	Current is limited to the continuous current level	Bit 5	32
T-Nlim	Speed-limited torque mode active	Bit 6	64
P-N	Position control possible	Bit 7	128
N-I	Speed control possible	Bit 8	256
<N0	Acutal speed less than 0.1% (standstill)	Bit 9	512
Rsw	Reference switch tripped	Bit 10	1024
Cal0	Calibration move active	Bit 11	2048
Cal	Calibration move completed (position calibrated)	Bit 12	4096
Tol	Position within tolerance window	Bit 13	8192
Rdy	Drive is ready (BTB/TDY contact is closed)	Bit 14	16384
Brk0	De-energized brake with motor active	Bit 15	32768
SignMag	Speed internally inverted	Bit 16	65534
Nclip	General speed limiting (if ≤ 90 %) possible	Bit 17	131072
Nclip+	Additional switchable positive speed limiting possible	Bit 18	262144
Nclip-	Additional switchable negative speed limiting possible	Bit 19	524288
Ird-Dig	Current limiting (switchable) reached	Bit 20	1048576
Iuse-rchd	Actual current limit reached	Bit 21	2097152
Ird-N	Current limited (speed)	Bit 22	4194304
Ird-TI	Current derating (power-stage temperature) possible	Bit 23	8388608
Ird-TIR	Current limited to the continuous current (power-stage temperatue)	Bit 24	16777216
> 10 Hz	Additional current limit if frequency less than 10 Hz	Bit 25	33554432
Ird-TM	Current limit due to motor temperature reached	Bit 26	67108864
Ird-ANA	Current derating due to analog input (if ≤ 90 %) possible	Bit 27	134217728
Iwcns	Current peak value warning	Bit 28	
RFEpulse	Pulsed RFE-input monitoring active	Bit 29	
M+D	free	Bit 30	
HndWhl	Hand-wheel function selected		

State to digital outputs

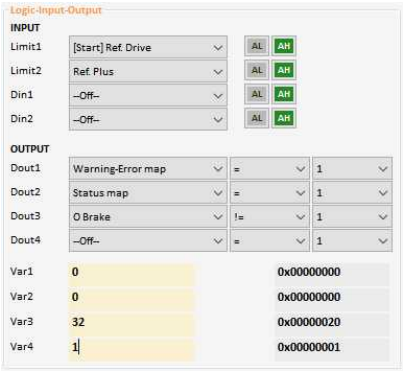
Set output (Dout1, 2, 3) onto the Status-Map via the drop down menu.
Set function to ***= (inverted on !=)***
Select variable.
Select state values (Dec) from the table (multiple state values possible) and write them into the selected variable (Var1-Var4).



Example:
Feedback that the drive is enabled.
Output 2

Dout2 , Status-Map , On
Variable Var4
State value Dec=1 (drive enabled)

17.4 Logic links



Fault or warning signals to digital outputs.
Set output (Dout1, 2, 3) onto the Warn-Err-Map via the drop down menu. Set function to = (Invertiert auf !=). Select variable. Select Warn-Err values (Dec) from the table (multiple values possible) and write them into the selected variable (Var1-Var4).

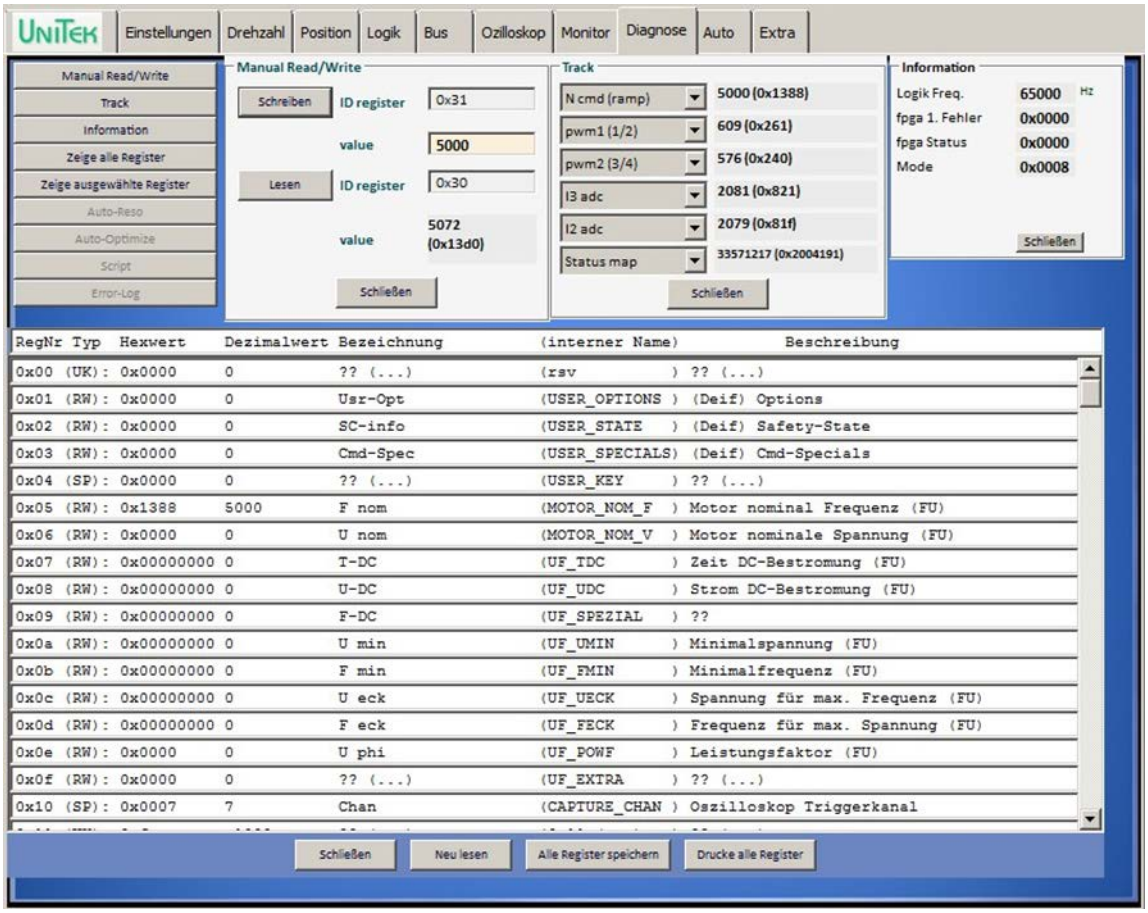
Example:
Feedback that the power voltage supply is switched on.
Dout1 , Warn-Err-Map , On
Variable Var3
Error value Dec=32 (POWERVOLTAGE , no power supply voltage)

Display on the servo	Fault message on NDrive	Description	ID address	
	NOREPLY-NoRS	RS232 interface not plugged or disturbed		
			REGID0x8f	Dec
0	BADPARAS	Defective parameter	Bit 0	1
1	POWER FAULT	Output stage fault	Bit 1	2
2	RFE FAULT	Defective safety circuit	Bit 2	4
3	BUS TIMEOUT	Transmission fault BUS	Bit 3	8
4	FEEDBACK	Faulty encoder signal	Bit 4	16
5	POWERVOLTAGE	No power supply voltage	Bit 5	32
6	MOTORTEMP	Motor temperature too high	Bit 6	64
7	DEVICETEMP	Device temperature too high	Bit 7	128
8	OVERVOLTAGE	Overvoltage >1.8 x UN	Bit 8	256
9	I_PEAK	Over-current 300 %	Bit 9	512
A	RACEAWAY	Racing (without command value, wrong direction)	Bit 10	1024
B	USER	User - Fault selection	Bit 11	2048
C	I2R	Overload	Bit 12	4096
D	RESERVE		Bit 13	8192
E	ADC-Int	Current measuring fault	Bit 14	16384
F	BALLAST	Overload of the ballast circuit	Bit 15	32768

Display on the servo	Fault message on NDrive	Description	ID address	
			REGID0x8f	Dec
0	WARNING_0	Inkonsistent device identification	Bit 16	65534
1	ILLEGAL STATUS	RUN signal	Bit 17	131072
2	WARNING_2	FE signal inactive	Bit 18	262144
3			Bit 19	524288
4			Bit 20	1048576
5	POWERVOLTAGE	Power supply voltage missing or too low	Bit 21	2097152
6	MOTORTEMP	Motor temperature > 87 %	Bit 22	4194304
7	DEVICETEMP	Device temperature > 87%	Bit 23	8388608
8	OVERVOLTAGE	Overvoltage >1.5 x UN	Bit 24	16777216
9	I_PEAK	Over-current 200 %	Bit 25	33554432
A			Bit 26	67108864
B			Bit 27	134217728
C	I2R	Overload > 87 %	Bit 28	268435456
D			Bit 29	536870912
E			Bit 30	1073741824
F	BALLAST (unit dependent)	Overload of the ballast circuit >87 %	Bit 31	

18 Diagnosis

18.1 Diagnosis window



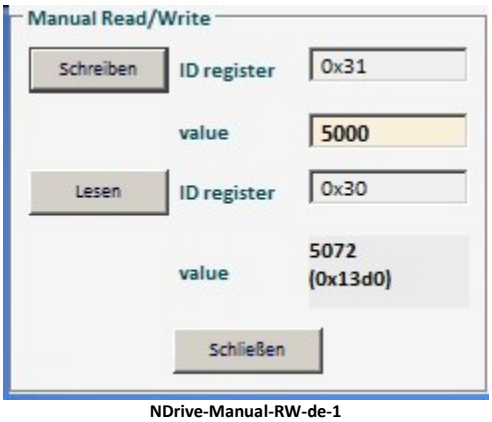
NDrive-Diagnose-alles-1

Setting window for the diagnosis

Manual Read / Write	Direct read or write of the parameter values
Track	Display of the numeric value of the selected parameter
Information	Information about transfer errors
Zeige alle Register	Parameter list with parameter Ids
Zeige ausgewählte Register	List of all parameters selected and their parameter Ids
Auto-Reso	see page AUTO
Auto-optimize	see page AUTO
Fehler-Historie	not yet implemented
Script	not yet implemented

18.2 Manual read/write

Direct reading and entering of the parameter values
Note: only for service!

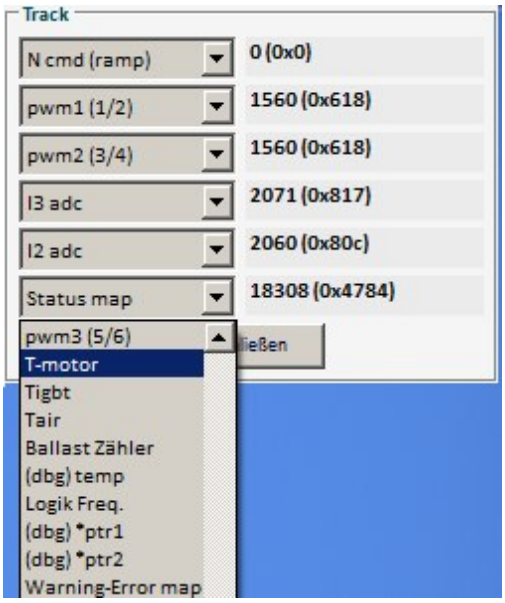


NDrive-Manual-RW-de-1

Reading parameters:

Enter the parameter address into the input field ***ID register.***	
Key ***lesen***	Click it Below the input field the parameter designation and its contents is displayed as numerical and hex value.
Writing parameters:	
Enter the parameter address into the input field ***ID register.*** Enter the value for the selected parameter in the input field ***Value***.	
Click key 'write' The parameter values are immediately transferred.	

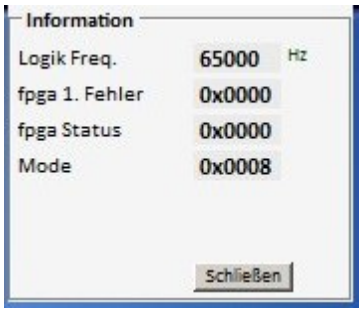
18.3 Track display field



Track
Display of the parameter values

The numerical values and hex values (0x…) of the selected parameters are displayed in the track display.
Click the arrow key to open the scroll menu for the selection of a parameter value.
Teh value is selected by means of the arrow keys or the scroll bar in the scroll field.
The selected value is highlighted in blue. When the value is selected the scroll field closes.

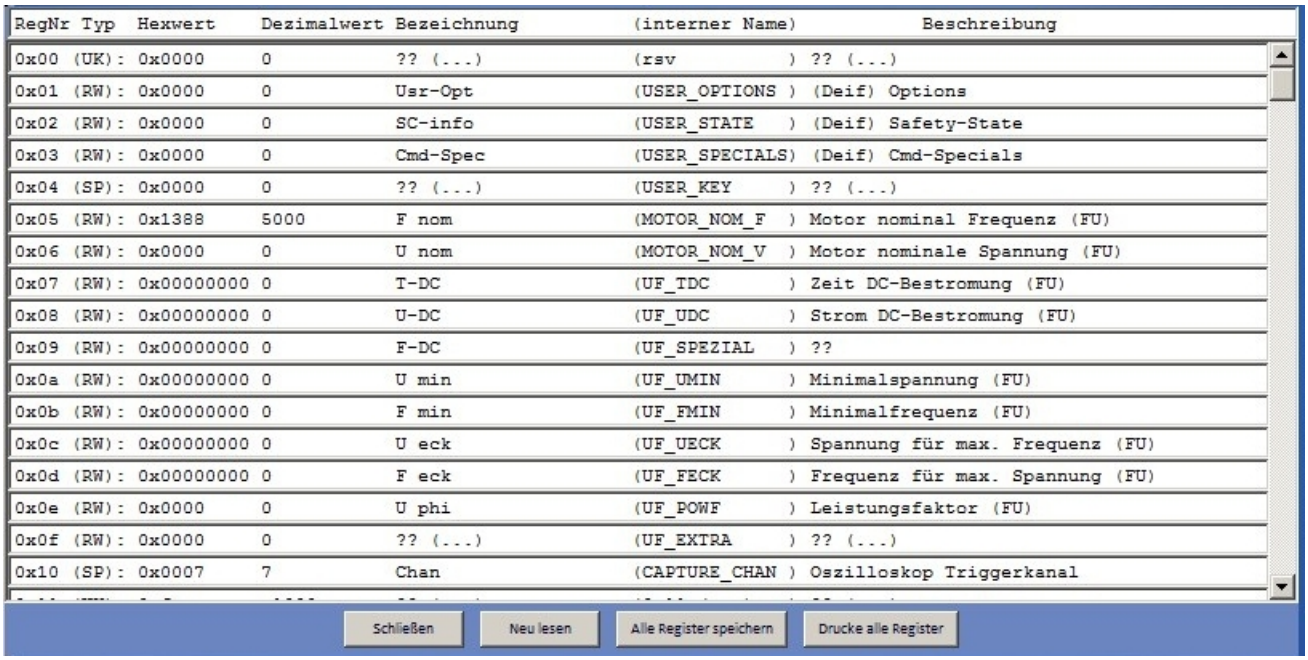
Note:
Alle parameter values can also be displayed on the oscilloscope



Information
Display for current states (no input possible)

Foreground	Speed of the foreground program
Motor pos spikes	Actual speed value error
RS232 resync	Transmission error RS232
CAN overruns	Transmission error CAN-BUS
Mode	Mode bit setting

18.4 Information



Display field for registers

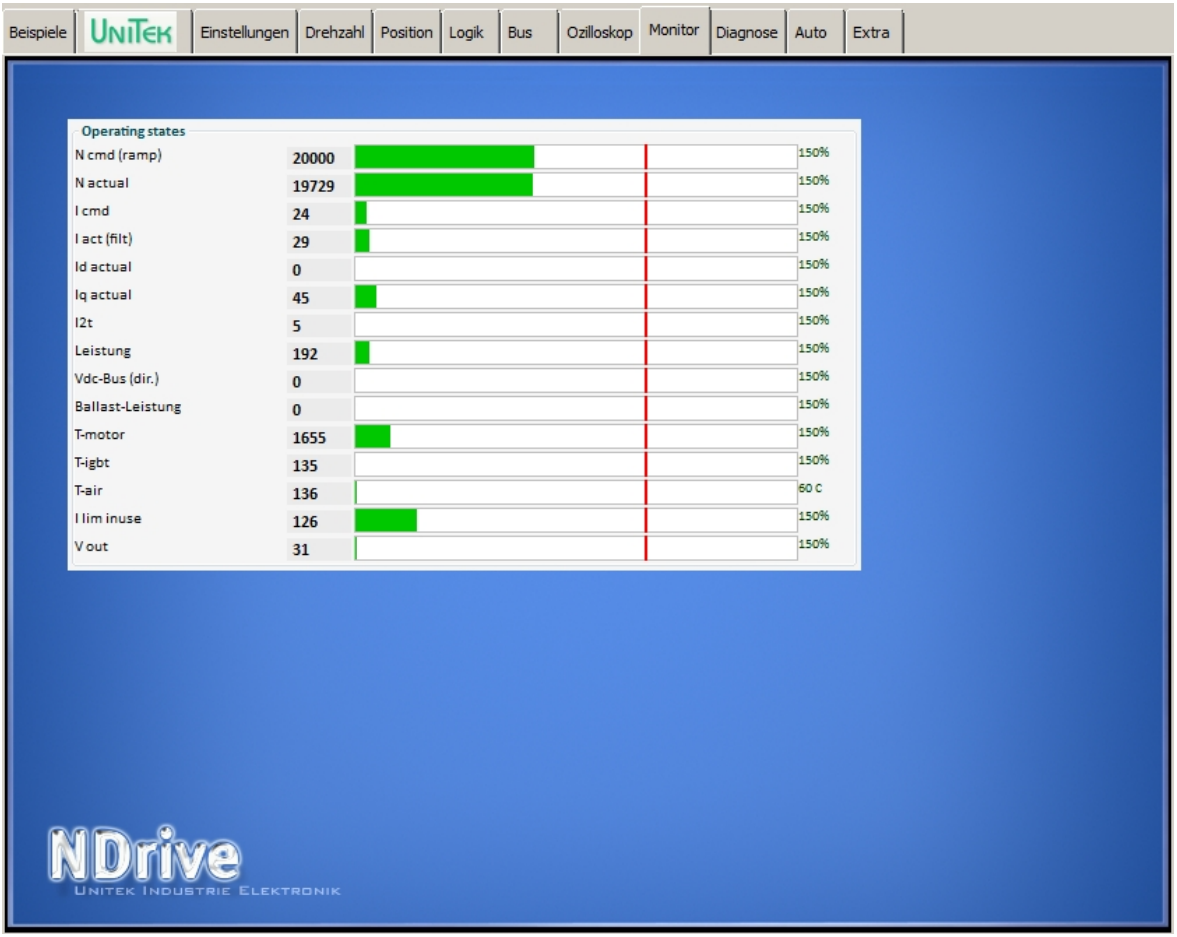
Show all registers	All 255 registers are shown in a table. The register contents cannot be modified.
Show selected registers	Only the registers which are important for the user are display in a table. The registers can be selected via the file ‘Reglist.txt‘. The register contents cannot be modified.

Selection in the footer

Close	Display field is closed
Re-read	The parameter values are read again from the servo.
Save registers	The displayed registers are written into a file.
Print registers	The displayed registers are printed.

19 Monitor

19.1 Measured values



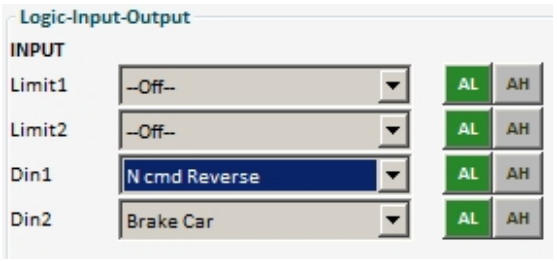
States	Function	Unit	Range	ID address
Ncmd Ramp	Speed command value after ramp and limit	num	0 to +/-32767	0x32
N actual	Actual speed value	num	0 to +/-32767	0x30
Icmd Ramp	Current command value after ramp and limit	num	0 to 600	0x26
Iact monitor	Actual current value (filtered)			
I actual D	Actual current value D (reactive current)	num	0 to 600	0x28
I actual Q	Actual current value Q (active current)	num	0 to 600	0x27
I2t	Capacity I2xt	num	0 to 4000	0x45_L
P-Motor	Motor power	num	0 to 4000	0xf6
DC-BUS	Bus circuit voltage	num	0 to +/-32767	0xeb
P-Regen	Ballast power	num	0 to 4000	0x45_H
Tmotor	Effective motor temperature	num	0 to 32767	0x49
Tigbt	Effective output stage temperature	num	0 to 32767	0x4a
Tair	Effective air temperature in the servo	num	0 to 32767	0x4b
Ireda	Effective current limit	num	0 to 600	0x48
Vout	Output voltage	num	0 to 4000	0x8a

20 Options

20.1 Recuperation for vehicles (Brake Car)

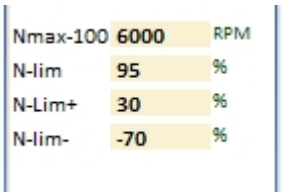
Setting BAMOCAR parameter 'Brake Car' at torque control

Only positive torque command value
Activate function on the page 'logic'
Set a digital input to '***Brake Car'***.
(Select ***Brake Car*** via the drop-down menu)



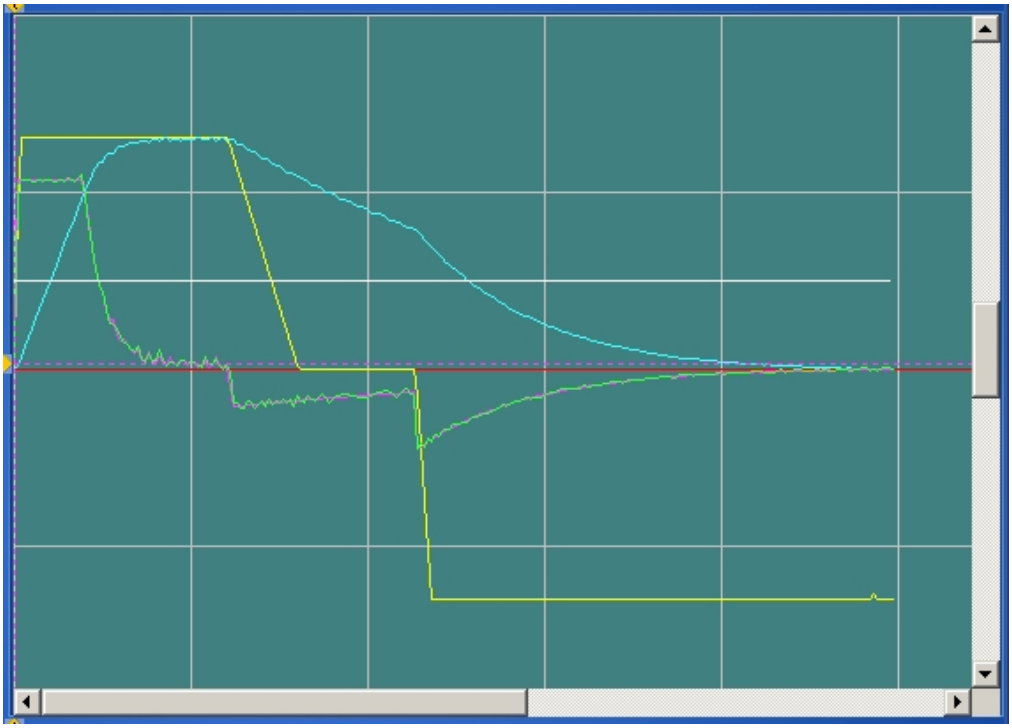
Switched on at Din2 = higher braking torque

Enter the values on the page 'settings/parameters/speed
Input parameters : ***Nmax*** speed value for 100% speed
Input parameters : ***N-lim*** speed limiting at torque control



Braking current at torque command value 0 (minimal braking torque)
Input parameters: ***N-lim+*** (Function changed for minimal braking torque)

Braking current at switched-on brake pressure-contact (e.g. brake light)
Input parameters: ***N-lim-*** (Function changed for increased braking torque)

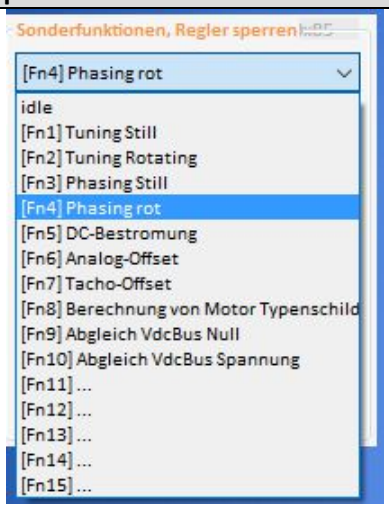


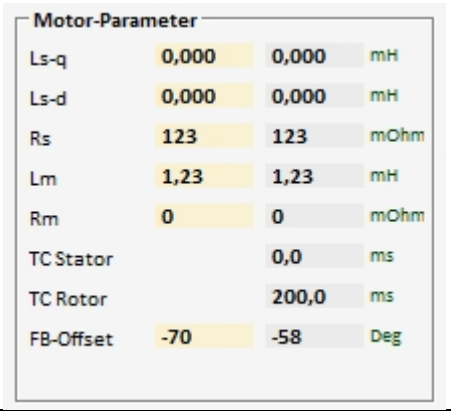
Rotation direction at Brake Car

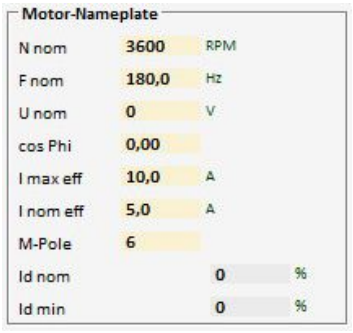
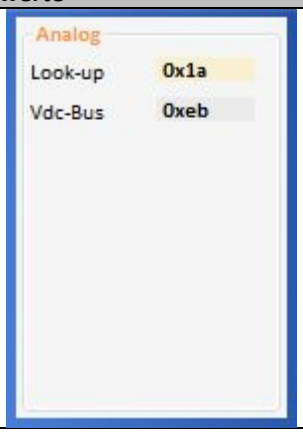
The torque command value must always be positive.
Changing the rotation direction at analog command value via ***Scale.***
(positive value = rotating clockwise, negative value = rotating anti-clockwise).
Changing the rotation direction at digital and analog command value.
Select a digital input (e.g. Din1) on the page 'Logik' as ***N cmd reverse.***
The direction of rotation can be selected by means of the switch position.

21 Automatic setting functions

21.1 Setting window Auto

Special function	Function	Description	ID
	idle		0x85
	tuning still	not used	0
	tuning rotating	not used	1
	phasing still	not used	2
	phasing red	Automatic reading of the rotor angle (Reso-Offset)	4
	DC-current	Fixed current feed angle. Set by means of Reso-Offset	
	Analog-Offset	Automatic adjustment of the analog inputs	6
	Tacho-Offset	Automatic adjustment of the segment offset at bl-Tacho	7
	Calc from motplate	Calculation of the motor data acc. to the type plate	8

Motor parameters	Function	Description	ID
	Ls-q	Stator leakage inductance in µH (without comma), at ACIM Lsd = Lsq	0xb1
	Ls-d		0xbb
	Rs	Stator resistance in mΩ (without comma)	0xbc
	Lm	Main inductance in 10 µH (without comma)	0xb3
	R-r	Rotor resistance in mΩ (without comma)	0xb4
	TC-Stator		0xb6
	TC-Rotor	Lm/Rr in ms (without comma), rotor time constant	0xbd
	FB-Offset	Encoder offset angle	0x44

Motor Typenschild	Function	Description	
	N nom	Rated speed at rated voltage	
	F nom	Rated frequencies at rated voltage	
	U nom	nominal voltage	
	Cos Phi		
	I max eff	Motor peak current effective	
	I nom eff	Motor continuous current effective	
	M-Pole	Motor -Pole	
	Id nom	reactive current	
	Id min	Minimum reactive current	
Messwerte			
	Look-up	DC connection voltage in V	0x1a
	Vdc-Bus	DC link voltage Num	0xeb

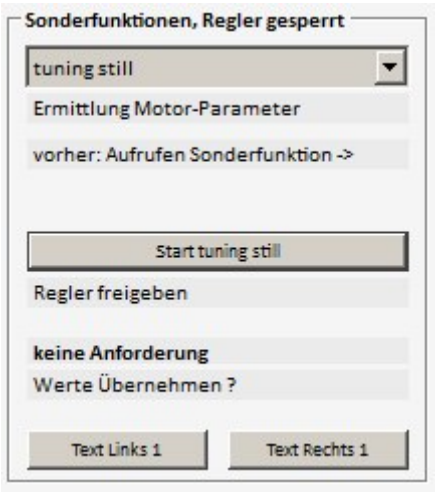
Note:

For the automatic adjustment **Command Mode** must be set of **Digital Speed.**

After the execution of the auto-functions the correct values must be saved on the EEPROM level0.

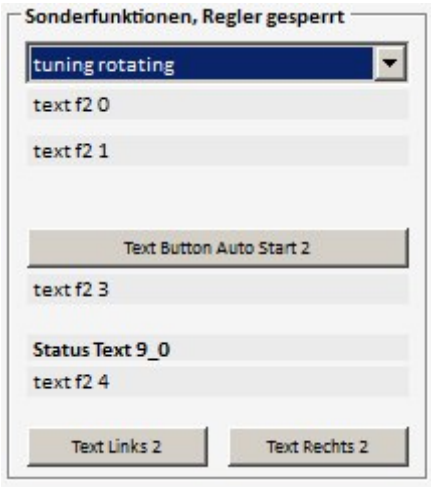
Do not used functions which have not been released (currently ‘tuning still, tuning rotating, pasing still’).

21.2 Tuning still (0x85-1)



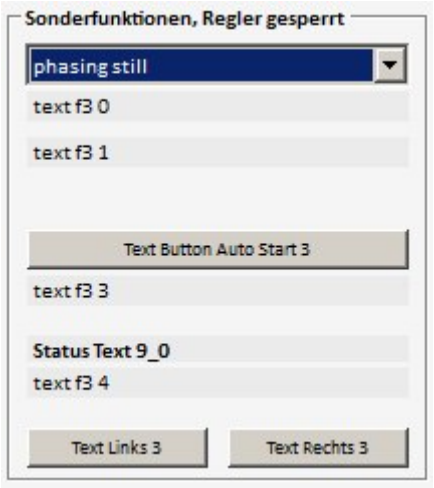
Function not yet released

21.3 Tuning rotating (0x85-2)



Function not yet released

21.4 Phasing still (0x85-3)

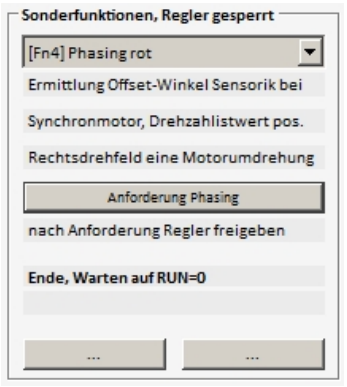


Function not yet released

21.5 Measuring the encoder offset (phase angle)

Execution of phasing red (0x85 -4)

Check the no. of motor poles (MOTOR-Pole) and correct, if necessary.
Limit the motor current:
Set the parameter ***Inom eff*** in the field 'motor' to max. 30 % of the rated current value.

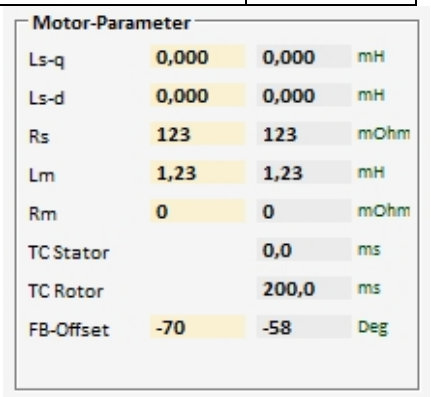


Set the rotation speed:
Set the parameter ***Speed from*** in the field 'pos-reference'
to 3 % of the rated speed.
Apply the power supply to the device**, Enable open**

Function	Message at NDrive	7-segment display
Click function - request phasing		
Switch on enable within 10 s	Wait for RUN= 1 (enable)	40
Enable closed	Current ramp	41
Current built up (rotation starts)	Rated value reached	42
	Output rotating field	
Pole angle and reading of the no. of motor poles executed	End	43
Correct end	End, wait for RUN=0 (switch off FRG)	49
Error switch-off		
Enable switched off during the measuring process	Error	47
Time out , measuring time exceeded		48

During the automatic phase angle reading the states are shown in the 7-segment display of the device (sequence: 4-0, 4-1, 4-2, 4-3, 4-9).

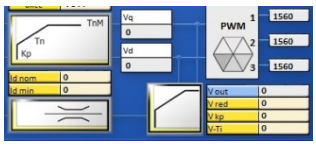
When the no. of motor poles and the connection are correct, the motor rotates clockwise for one revolution (electric periode (360degree) x no. of poles/2).
If the motor rotates more than one revolution, the no. of poles is too high. If it is less than one revolution, the no. of poles is too small.
If the motor rotates anti-clockwise check the motor connection.

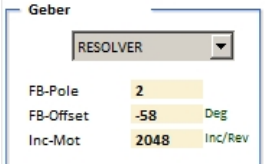


At **End, Wait for RUN=0** (49) the result is transmitted to the parameter ***FB-Offset*** (0x44). Switch off enable.
After reading EEPROM level 0 the value is correctly displayed in 'Feedback Offset'.
Set the motor current limiting and the reference run again to the original values.
Write the data into the EEPROM level 0!!

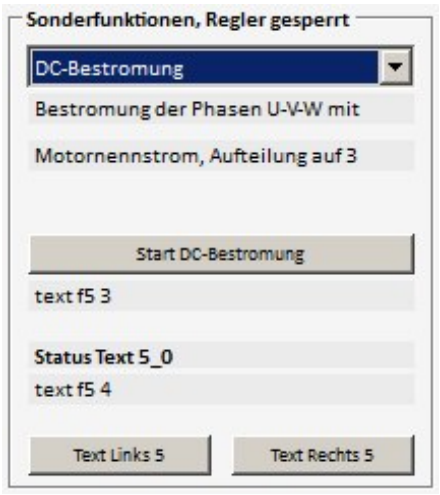
old value new value

Checking the encoder offset setting, fine adjustment
Operate the motor without load at approx. 50 of the rated speed.
Read the value on the page 'speed at the parameter Vd (0x2a).
IF the value is superior to 100, adjust this value to minimum by means of slight changes in 'setting encoder offset (page 'settings 0x44).
Read the changed value to the EEPROM level0.

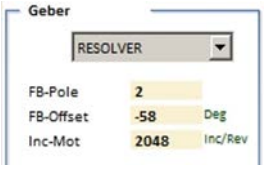




21.6 Preset current feed angle (0x85 – 5)/fixed motor position (0x85-5)

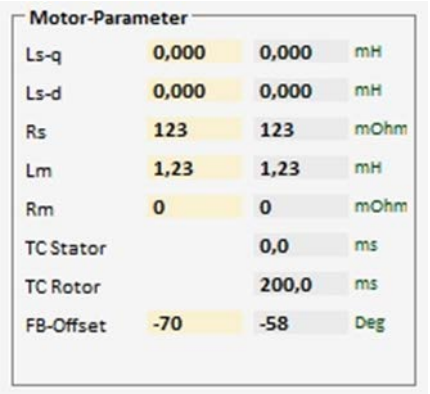


When a current feed angle is preset (angle) the rotor (motor shaft) is moved into this angle and held.
Reduce the current limit for the rated current ***Inom eff*** to 30 %.
(DC current feed is controlled to rated current, no rotating field).
The function is started as follows:
Preset the requested angle by means of the parameter ***FB-Offset*** (0x44) on the page 'settings'.



Apply the power supply to the device, enable open

Function	**Description**	**7-segment display**
Click the function 'start dc current feed'. Switch on enable	The motor shaft rotates to the preset angle.	
	The motor shaft stops at the new angle.	---- ----



As long as the enable is closed, a new angle can be preset in the field 'motor parameter ***FB-Offset'*** on the left (yellow field).
When opening the enable, the function is stopped.

Note :

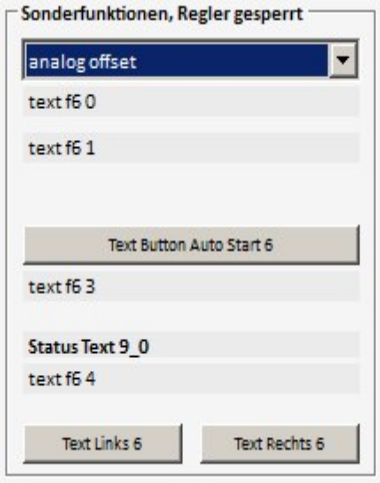
For further motor operation the correct value for FB-Offset must be entered and saved (level 0).
If the FB-Offset value is incorrect, the drive may rotate or move uncontrolled!

21.7 Analog offset (0x85 -6)

Offset adjustment of the analog inputs.

Execute function

Apply voltages across the device, enable open



Function	Message at NDrive	7-segment display
Click function 'start analog offset' Switch on enable		60
Correct end		69
Error switch-off		
Enable switched on during the measuring process		66

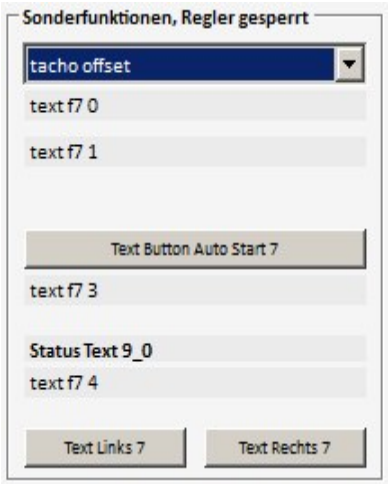
When the adjusting process is started, 6-0 is shown in the 7-segment display.
The adjusting process is finished when 6-9 is displayed.

21.8 Tacho offset (0x85 -7)

Adjustment of the segment offset error at brushless tacho systems.

Execute function

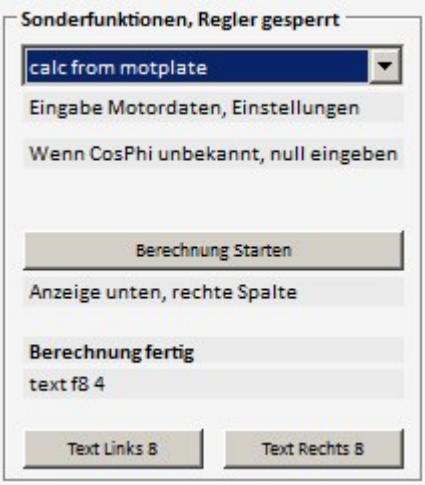
Apply voltages across the device, enable open



Function	Message at NDrive	7-segment display
Click function 'start analog offset' Switch on enable		70
Correct end		79
Error switch-off		
Enable switched on during the measuring process		76
Movement at the rotor detected		77
No tacho connected		78

When the adjusting process is started, 7-0 is shown in the 7-segment display.
The adjusting process is finished when 7-9 is displayed.

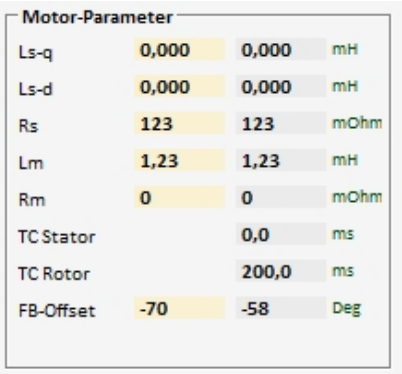
21.9 Calc from Motorplate (0x85-8)



Calculation of the motor data for asynchronous motors

Enter the motor data of the type plate or the motor data sheet into the left column (highlighted in yellow).

After the calculation is finished the resulting values are displayed in the right column and saved in the device.



Function	Description	ID
Ls-q	Stator leakage inductance in µH (without comma), at ACIM Lsd = Lsq	0xb1
Ls-d		0xbb
Rs	Stator resistance in mΩ (without comma)	0xbc
Lm	Main inductance in 10µH (without comma)	0xb3
R-r	Rotor resistance in mΩ (without comma),	0xb4
TC-tator		0xb6
TC-Rotor	Lm/Rr in ms (without comma), rotor time constant	0xbd

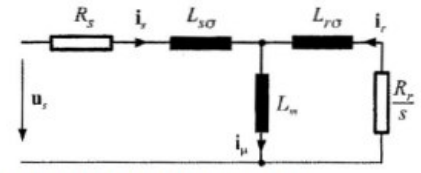


Bild 1: T-Modell, stationary,[2]

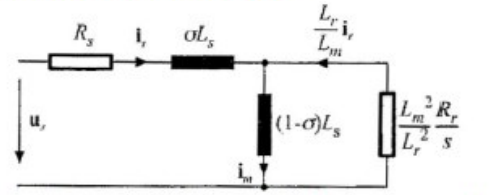


Bild 2: inverses Gamma Modell, stationary,[2]

Rs Stator resistor
ir Current in rotor
Lm Main inductance
Lrσ Rotor leakage induct.
im Magnetization current
Rr Rotor resistance
Lsσ Stator leakage induct.
iµ Current through Lm
σ Complete leakage fact.

General information

Various literature display motor models which are identical in principle. Abbreviations used in the diagrams may vary. Differences can only be found concerning physically measurable quantities (T-model) or further abstraction for simplified calculation models (inverse gamma model).
Some manufacturers provide additional data such as no. of poles, idle current at a specified idle voltage (= magnetization current), ohmic resistance of the stator winding, stator impedance at a specified frequency, as well as values referring to rotor quantities.
These manufacturer data are usually correct and helpful. The real, physical quantities can be measured through direct measuring for stator values and through indirect measuring for rotor values, i.e. by measuring the retroactive effect on the stator.
The graphic representation of the motor models does partly not refer to the real, physical quantity but to converted quantities.

Basic procedure
At operating mode FU (page setting ‘type‘) for new or unknown motors it is possible to check the following assignment first: positive speed command value = clockwise rotating field U, V, W = clockwise rotation = positive actual speed value. Set the values on page ‘settings’ FU left field after U/f-characteristic. Operation in the rated point without load results approx. in the magnetization current.

Optimization procedure
Connect a load machine with aprox. 20 to 50 % rated torque.
Setting of a corresponding torque on the scope side of the NDrive (step generator to torque, drive enabled).
Thus, a stationary speed is adjusted.

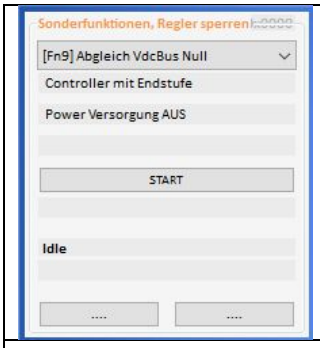
The Lm or Rr value can be changed when the machine rotates (T-rotor = Lm/Rr).
The result is immediately effective in the control. The target is to optimize the T-rotor to a higher speed at the same load. At operation this results in a smaller current consumption at the same load torque.
The value of the T-rotor (in ms) is not updated by the NDrive until the offline-online process.

At a second stage Idnom (NDrive page ‘speed‘) can be varied, field weakening not active (Vred = 0). This can be noticed during standstill (current = magnetization current). When the machine rotates thisvalue is also immediately effective. The target is again a higher speed at the same load. At operation this results in a higher final speed when reaching the voltage limit (max. modulation).
Compare the values achieved from the tests with existing manufacturer values. Save them and reset the drive (off-on) . Check the values and functions again.

21.10 VdcBus Adjustment

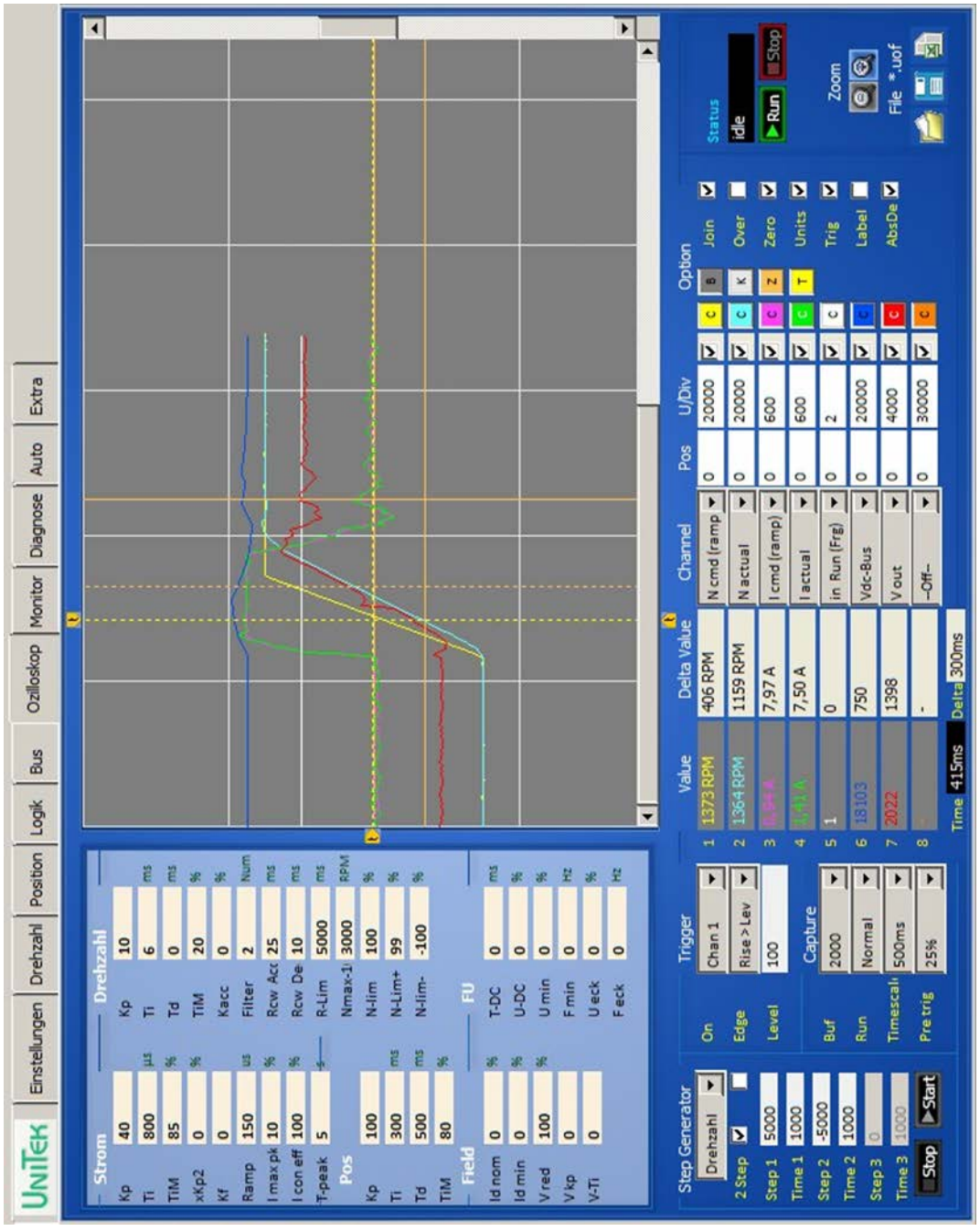
From firmware FW466 onwards
The calibration is made in the factory.
In case a component is exchanged it is necessary to re-adjust again.

Adjustment of measuring errors errors oft he bus circuit voltage measurement.

	**Zero point adjustment** No power supply voltage! Bus circuit 0 V (to be short-circuit.) Start adjustment via key „START“. After approx. 4 seconds the value for VdcBus=0 is calculated.
  	**Slope error adjustment** After the 0 adjustment it is necessary to adjust the slope error. **With bus circuit voltage without ripple:** Measure the bus circuit voltage by means of a voltmeter and register the value in Kalibr. Start the adjustment. After approx. 4 sec. the measurement value for VdcBus is displayed (Num). **In case there is no exact bus circuit voltage available:** Adjustment without power supply voltage: Bus circuit voltage = 0 V Enter 0 V in the field „calibration“ and start the adjustment. Save the determined measured values permanently by means of the EPROM-STORE.

22 Oscilloscope

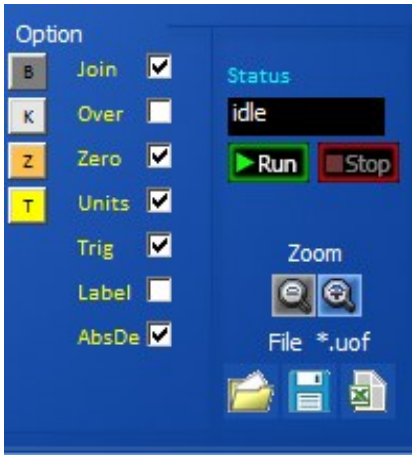
22.1 Overview



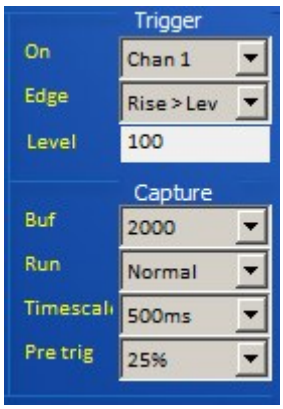
22.2 Oscilloscope settings

Screen functions

Trigger settings



Option	Time basis (per grid)
Join	Pixels connected
Over	The display remains and is over-written
Zero	Zero line visible
Units	Display as num or real values
Trig	Trigger line visible
Label	Channel designation visible
AbsDe	
Screen colours	
B	Oscilloscope background
K	Oscilloscope grid
Z	Oscilloscope zero line
T	Oscilloscope trigger line



		Function
State	**Colour**	Status idle
waiting (0)	red	Display of the last recording and waiting for a new triggering
waiting (xx)	green	triggered, data are saved
reading	blue	Reading of the data from the drive to the pc
drawing		Display of the data on the oscilloscope screen
idle	white	Frozen data after 'Stop capture'

Run Stop		Run Stop
Run		The oscilloscope recording is focused via the key field 'run capture'. The recording is started at the next triggering signal.
Stop		The recording is cancelled via 'stop capture' and the display is frozen.

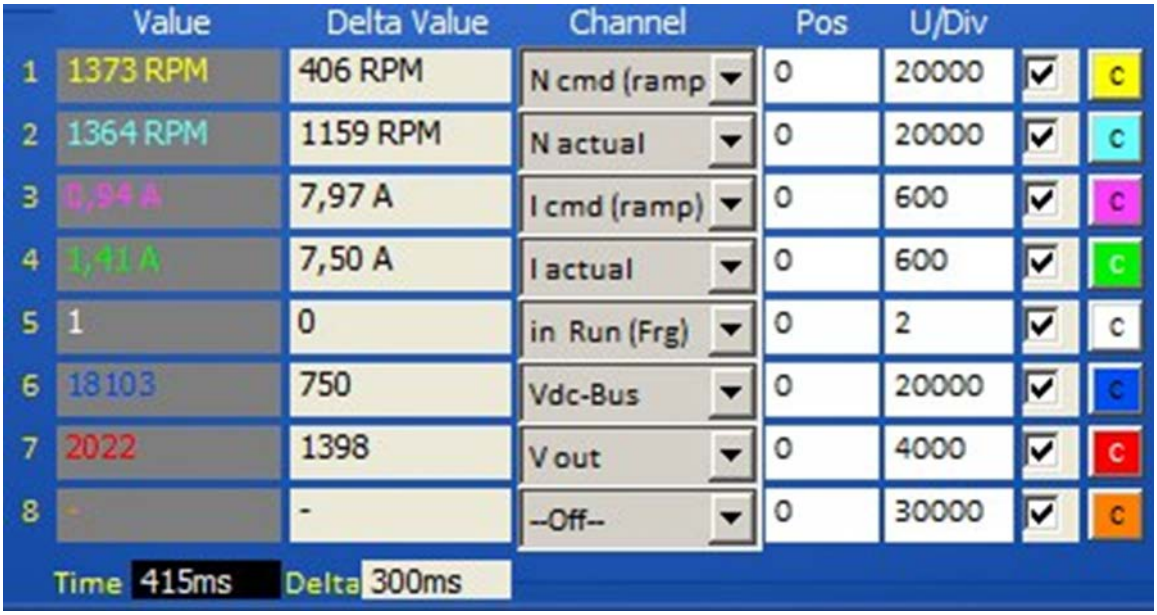
Zoom		Zoom
Zoom +		The screen content is enlarged
Zoom -		The screen content is reduced

File		File *.uof
File left		Load the oscilloscope file from the pc
File middle		Save the oscilloscope file into the pc
File right		Save the oscilloscope file as excel file

Trigger		
On		Selection of the channel for the trigger function
Edge		Selection of the trigger function
Level		Trigger level (numerical)

Capture		
Buf		Resolution, horizontal pixels for all switched-on channels
Run		Selection trigger switching function
Timescale		Time unit per horizontal grid line
Pre trig		Horizontal shifting of the trigger line. Measured value display before the trigger line.

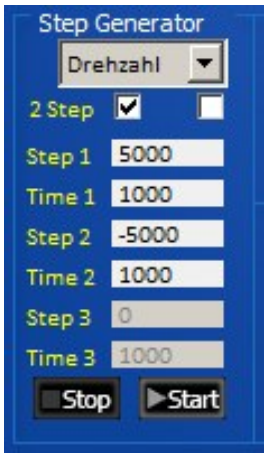
22.3 Arrow key for the channel selection



Field	Function
Value	Value at the first cursor line (numerical or real)
Time	Time from the trigger line to the first cursor line
Delta Value	Difference values from the first to the second cursor
Delta (Time)	Difference time from the first to the second cursor
Channel:	All measured values from the selection table can be displayed on the oscilloscope. The drop-down menu opens by clicking the arrow key. The required measured value is selected and assigned to the channel no. The channel is switched off at 'off'. **Channels which are not required must always be switched off! (Off)**
Pos:	The value of 100 corresponds to a horizontal grid line. E.g.: At value 50 the zero line of the selected channel is shifted upwards by half a square.
U/Div:	Units for a horizontal grid line. E.g.: U/Div = 32768 at N cmd Ramp. (N max parameter = 3000 rpm) The numerical value (32768) of the speed command value corresponds to a horizontal line at 3000 rpm. At cursor request a horizontal line equals 100. Thus, the cursor value 100 corresponds to a speed of 3000.
Switch cabinet	The display of the channel is switched on and off. The switched-off channel remains in the background and is also saved.
Channel colours	A colour selection window is opened by clicking the colour key C. Select the new channel colour and accept it by clicking 'ok'.

22.4 Trigger settings

Test generator for the selection of command values in rectangle functions



NDrive-Oszi-Step-Drehzahl-1

Selection	
Current	Generator function is the current command value
Torque	Generator function is the torque command value
Speed	Generator function is the speed command value
Position	Generator function is the position command value
2Step	Selection 2 or 3 Step
Functions	
Step1	Value1 for current, speed, or distance
Time1	Time for value 1
Step2	Value 2 for current, speed, or distance
Time2	Time for value 2
Stop 3	Standstill value for current, speed, or distance
Time 3	Stopp time
Start Stop	Starts or stops the generator function
Note: The time inputs (time) may vary acc. to the pc for values >2000.	

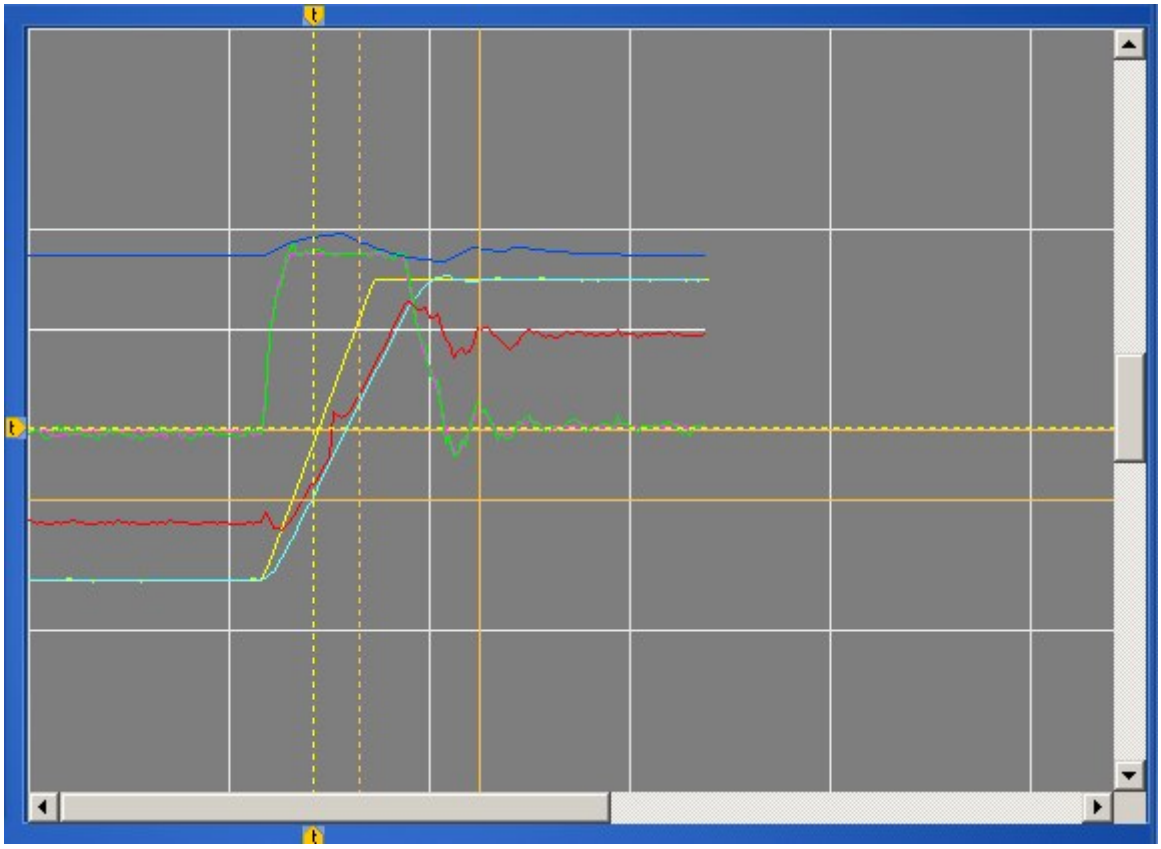
Command value step functions are preset by means of the test generator. The ramps are determined via the parameter settings for the current and speed controller. When the controller enable (RUN/Frg) is active, the drive is started by clicking the field ‘start’ and it is stopped by clicking ‘stop’. The functions can be selected as current, torque, speed, or position values. The value for ‘stop’ at current, torque, and speed should be 0 for standstill. ‘Stop‘ can also be used like ‘step(1,2)‘.

Note: Maximal values for step1, step2, and stop	
At current	+/- 330
At torque	+/- 32767
At speed	+/- 32767
At position	+/- 2147483647
At time	32767

Particular attention

If the travel distance is limited it has to be ensured that the travel distance of the test settings is within the machine limits.
At the test setting ‘current’ and ‘torque’ the drive may rotate at max. speed.
Over-speed may be achieved at field weakening.

22.5 Display of measured values



The recording of the measured values is displayed with the selected colours.

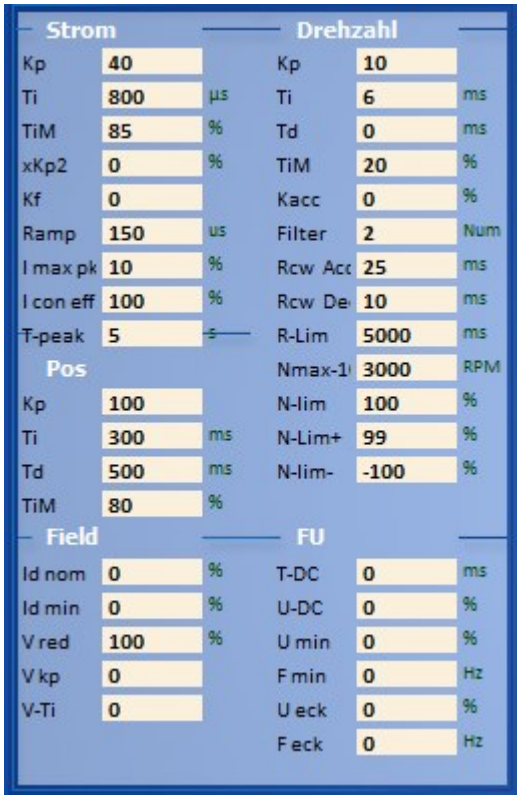
The first vertical **trigger line** is tagged with an arrow symbol at the upper and lower edge of the screen.
The second vertical line is the first **cursor line.**
The active second cursor is displayed as horizontal and vertical crossline.

The measured values at the first vertical **cursor line** are displayed at **value** and saved.
The measured value at the **second cursor (crossline)** are displayed in the fields **delta value** as difference values to the values at the first cursor.

The time from trigger line to the first cursor line is displayed at time.
The time between the first cursor line and the second cursor line is displayed at **delta time.**

If the box **units** is ticked the displayed values are transformed from numerical to real values.

22.6 Parameters on the oscilloscope page



The parameters of the page ‘oscilloscope‘ can be changed during the test function.
The modifications are transferred to the current parameter set.

The result is immediately displayed on the oscillioscope screen after the next triggering.

22.7 Test operation

Test
Setting : Command mode = digital speed
Direct input and execution of speed or torque.
Selection via the drop-down menu.
Dis : Software enable
(only if hardware enable is active)

Position in numerical values.

Speed or torque
Enter the speed value. The entered speed is immediately processed when the key + or - is clicked.
The command value is internally set to zero when the ‘stop’ key is clicked.

Position
Enter the position value. When clicking the key ‘dest.‘ the drive travels immediately at the speed selected at Nmax(Nlim) to the entered position. When clicking the key ‘calib.‘ the drive travels a reference cycle.
The entered position is imported as actual position and command value position via the key P.

Note :
Only for test function. The functions are directly executed!

23 Parameters

23.1 Parameter tables

Motor value settings

Short symbol	Function	Setting range	Units	Note	REGID address
Type	see type				
N nom	Rated motor speed	Type plate	rpm		0x59
F nom	Rated frequency	Type plate	0.1 Hz		0x05
U nom	Rated voltage	Type plate	1 V		0x06
U phi	Cosinus Phi	Type plate	Dec		0x0e
I max	Max. motor current	Type plate	0.1 A		0x4d
I nom	Continuous motor current	Type plate	0.1 A		0x4e
M-Pole	No. of motor poles	2..48	num		0x4f
Direction	Global rotation direction	Switch			0x5a.8
Brake	Brake with/without	Switch			0x5a.9
Brake Delay	Brake delay	0 to 1000	ms		0xf1
coast stop	Coasting when not enabled				0x5a.3
Feedback	see motor options	Selection			0x4a.--
F- Pole	No. of feedback encoder poles	2..12	num		0xa7
Offset	Phase angle feedback	0 .. 360	0.1 degree		0x44
Inc-Mot	Incremental encoder resolution	1024..8192	pulses/rpm		0xa6
2.Feedback	see motor options	Selection			0x4a.--
Inc-Out	see motor options	Selection			0x4a.--

Motor Type

Short symbol	Function		Address
Motor type			**REGID 0xa4**
EC (sinusoidal)	Synchronous servo motor sinusoidal voltage	0	Bit 8..10
AC (induction)	Asynchronous motor	1	
DC	DC motor	2	
EC (trapezoidal)	Synchronous servo motor trapezoidal voltage	3	

Motor - Optionen

Short symbol	Function		Address
Feedback			**REGID 0xa4**
ROTENC_TTL	Incremental encoder TTL 5 V with rotor position tracks	0	Bit 0…4
RESOLVER	Resolver	1	
ABSENC_SC	Incremental encoder Sin/Cos 1Vss with commutation track	2	
ROT_TACHO	Rotor position encoder with brushless tacho	3	
ROT	Rotor position encoder (without tacho)	4	
DC_TACHO	DC tacho generator	5	
DC_ARM	Armature voltage (internal)	6	
BL_ARM	EC-AC-motor without tacho	7	
ENC_TTL	Incremental encoder TTL 5 V without rotor position	8	
ENC_SC	Incremental encoder Sin/Cos 1Vss without commutation track	9	
ABS_SC	Incremental encoder Sin/Cos 1Vss per motor pole pair	10	
DC_ARM_VIR	Without sensor (DC motor without tacho, without armature voltage measuring)	11	
SLS	Without sensor	12	
SLS_SMO	not activated	13	
SLS_Usens	not activated	14	
Analn1-calc	not activated	15	
Analn2-calc	not activated	16	
PANA	Serial encoder system	17	

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2. Feedback	Function		Address
Off		0	Bit 5..7
INC-IN	X8 as position input	1	
INC-OUT	X8 display only	2	
HAND	X8 as handwheel input	3	
Inc-Out			
Factor	Output factor with SINCOS		
Inc-Out	Output with resolver		

Servo settings

Short symbol	Function	Setting range	Units	Note	REGID address
Type	Display of the unit type				0x67
SNr.	Display of the serial no.	Type plate			0x62
Achse	Axis designation	Customer			0xf8
Mains sel	Voltage selection dc/ac	Switch			0x5a-19
Mains	Power voltage supply	Type plate	1 V		0x64
DC-BUS max	max. bus circuit voltage		1 %		0xa5H
DC-BUS min	min. bus circuit voltage		1 %		0xa5L
ZW-Monitor	Bus circuit measurement dig./anal.	Switch			0x5a-7
Regen	Internal/external ballast resistance	Switch			0x5a-1
Regen-P	Ballast resistance power		1 W		0x65L
Regen-R	Ballast resistance value(Ohm)		1 Ω		0x65H
BTB Power	BTB message with/without power voltage	Switch			0x5a-6
Takfreq.	see clock frequency	Selection			
Analog Out	Selection drop-down list	Selection			

Clock frequency settings

Short symbol	Function		Address REGID
Clock frequency			**0x5a**
8kHz		0	Bit 20...22
24kHz		1	
20kHz		2	
16kHz		3	
12kHz		4	
8kHz I16	internal 16 kHz	5	
4kHz I8	internal 8 kHz	6	
2kHz I4	internal 4 kHz	7	

Command (command values)

Short symbol	Function	Setting range	Units	Note	REGID address
Mode	see command mode	Selection			
Cutoff-digital-cmd	Zero-zone digital command value	+/-32767	Num		0x1e
Format Ain1, Ain2	see command format	Selection			
Offset Ain1	Command value offset analog input 1	+/-32767	Num		0x2fL
Cutoff Ain1	Zero-zone command value analog input 1	+/-32767	Num		0x50
Scale Ain1	Scaling command value analog input 1	+/-32767	Num		0x2fH
Offset Ain2	Command value offset analog input 2	+/-32767	Num		0x2fL
Cutoff Ain2	Zero-zone command value analog input 2	+/-32767	Num		0x50
Scale Ain2	Scaling command value analog input 2	+/-32767	Num		0x2fH
Mode Ain1, Ain2	see Ain1, Ain2 mode	Selection			

Command mode

Short symbol	Function		Address
Command mode			**REGID 0x36**
Digital Speed	Digital speed command value of RS232 or BUS	0	Bit 12...13
Analog Speed	Analog speed command value	1	
Analog Torque	Analog torque command value	2	
Digi + Ana Speed	Digital plus analog command value	3	

Command format

Short symbol	Function		Address
Command format Ain 1			**REGID 0x36**
Off	Open, not used	0	Bit 0...1
Cmd	Analog command value 1	1	
-Cmd	Analog command value 1 negated	2	
sq(cmd)	Analog command value 1 quadratic	3	
N-Limit	Analog input 1 as speed limit		Bit 15
Command format Ain2			Bit 2...3
Off	Open, not used	0	
+Cmd	Analog command value 2 added to the analog command value 1	1	
-Cmd	Analog command value 2 subtracted from the analog command value 1	2	
* Cmd	Analog command value 2 multiplied by the analog command value 1	3	
I-Limit	Analog input 2 as current limit		Bit 14

Command mode range

Short symbol	Function		Address
Mode range Ain1			**REGID 0x36**
-10...+10V	Command value plus-minus max. 10 V	0	Bit 4...5
0...+10V	Command value plus max. 10 V	1	
4...20mA (+2V...+10V)	Command value 4 to 20 mA at 500 Ohm	2	
Mode Range Ain2			Bit 8..9
-10...+10V	Command value plus-minus max. 10 V	0	
0...+10V	Command value plus max. 10 V	1	
4...20mA (+2V...+10V)	Command value 4 to 20 mA at 500 Ω	2	

Current controller parameter

Command values, actual values, control errors (current)

Short symbol	Function	Setting range	Units	Note	REGID address
I man	Manual current command value	+/- 2048	Num		0x21
I cmd	Current command value	+/-2048	Num		0x26
I cmd ramp	Current command value after ramp	+/-2048	Num		0x22
Iq actual	Actual active current value	+/-2048	Num		0x20
Id actual	Actual reactive current value	+/-2048	Num		0x28
I act	Total current - actual value	+/-2048	Num		0x20
I act monitor	Total current - actual value after display filter	+/-2048	Num		0x5f
Iq error	Active current control fault	+/-2048	Num		0x38
Id error	Reactive current control fault	+/-2048	Num		0x39
Id ref	Reference value	+/-2048	Num		0x23

Current limits, ramps

Short symbol	Function	Setting range	Units	Note	REGID address
+I max	Current limit peak current positive	0...100	%		0xc4
+I con	Current limit continuous current positive	0...100	%		0xc5
-I max	Current limit peak current negative	0...100	%		
-I con	Current limit continuous current negative	0...100	%		
Tpeak	Tiem peak current	0...30000	ms		0xf0
I-lim-dig	Current limit switched via input	0..100	%		0x46
I-red-N	Current limit controlled via speed	0...100	%		0x3c
I-red-TD	Current limit controlled via output stage temperature	0..32767	Num		0x58
I-red TE	Current limit controlled via rms current (I2t)	0..32767	Num		0x4c
I-red-TM	Current limit controlled via motor temperature	0..32767	Num		0xa2
I2t actual	Display rms current + time	0..32767	Num		0x25
I-lim actual	Display resulting current limit	0..32767	Num		0x48

Output stage voltages

Short symbol	Function	Setting range	Units	Note	REGID address
Vq	Internal calculated value FOC				0x29
Vd	Internal calculated value FOC				0x2a
Vout	Output voltage	0 to 4096			0x8a
Vred	Starting point field weakening				0x8b
Vkp	P amplification field weakening				0x8c
VTi	I time field weakening				0x8d
DC-Bus	Bus circuit voltage	0 to 32767			0xeb

Control parameters of the current controller

Short symbol	Function	Setting range	Units	Note	REGID address
KP	Proportional amplification	0 to 200	num	1=0.1	0x1c
Ti	Integration time	300 to 2000	ms	150	0x1d
TiM	Max. integration time memory	0 to 100	%	1	0x2b

Speed controller parameters

Command value, actual value, speed, torque

Short symbol	Function	Setting range	Units	Note	REGID address
Analog int Ain1	Analog input 1 internally processed				0xd5H
Analog int Ain2	Analog input 1 internally processed				0xd6H
Dig-Speed	Digital speed command value				0x31
Dig-Torque	Digital torque command value				0x90
N cmd	Speed command value	+/-32767	num		0x5d
N cmd Ramp	Speed command value after ramp	+/-32767	num		0x32
N actual	Actual speed value	+/-32767	num		0x30
N act monitor	Actual speed value after display filter	+/-32767	num		0xa8
N error	Speed control fault	+/-32767	num		0x33

Limits, ramps, speed, torque

Short symbol	Function	Setting range	Units	Note	REGID address
Ramp-sel	see selection ramp sel		Selection		
RCW-Acc	Acceleration positive speed	0...30000	ms		0x35L
RCW-Dec	Deceleration positive speed	0...30000	ms		0xedL
RCCW-Acc	Acceleration negative speed	0...30000	ms		0x35H
RCCW-Dec	Deceleration negative speed	0...30000	ms		0xedH
S-Form	see selection ramp form		Selection		
RCW-Lim	Delay emergency stop	0...30000	ms		0xc7
Nmax 100%	max. speed for 100%	600 to 50000	rpm		0xc8
N-Lim	Speed limiting	0...100	%		0x34
N-Lim+	Positive speed limiting	0...100	%		0x3f
N-Lim-	Negative speed limiting	0...100	%		0x3e
Filter	Speed actual value filter	0..7	num		0x5e

Control parameters of the speed controller

Short symbol	Function	Setting range	Units	Note	REGID address
KP	Proportional amplification	0 to 200	Num	1=0.1	0x2c
Ti	Integration time	5 to 100	ms	0.75	0x2d
Td	Rate time	1 to 10000	ms	0.75	0x2e
TiM	Max. integration time memory	0 to 100	%	1	0x3b

Position controller parameters

Reference run

Short symbol	Function	Setting range	Units	Note	REGID address
Speed to	Speed to the reference position	10 to 32000	num	1	0x76
Speed from	Loop speed	10 to 2000	num	1	0x77
Reso Ed					0x75
Dec-Ramp	Acc Ramp or Limit Ramp	Switch			

Position controller Pos->Speed

Short symbol	Function	Setting range	Units	Note	REGID address
KP	Proportional amplification	0 to 200	num	1=0.1	KP
Z-Faktor					Z-Faktor
Ti	Integration time	10 to 500	ms	0.75	Ti
Td	Rate time	500 to 10000	ms	0.75	Td
TiM	Max. integration time memory	0 to 100	%	1	TiM

Position controller parameters

Short symbol	Function	Setting range	Units	Note	REGID address
Tol-wind	Proportional amplification	0 to 100	num	1=0.1	0xc9
Ref- Off	Zero offset	0 +/- 2147483647	num	1	0x72
ND-Scale	Display - factor		num	1	0xcb
ND-Offset	Display - offset		num	1	0xcd
Pos dest	Position target				0x6e
Pos cmd	Position command value				0x91
Pos actual	Actual position value				0x6d
Pos error	Position control fault				0x70
Inc-Out	Increment output				
Inc-ext	Increment 2. feedback				
Faktor-ext	Factor 2. feedback				0x7e

Frequency converter parameters

Frequency converter (FU) settings

Short symbol	Function	Setting range	Units	Note	REGID address
Start					
T-DC	dc magnetization time		ms		0x07L
I-DC	dc magnetization		1 %		0x08L
Umin	min. voltage		0.1 %		0x0aL
F min	min. frequency		0.1 Hz		0x0bL
U eck	Voltage at rated speed		0.1 %		0x0cL
F eck	Frequency at rated voltage		0.1 Hz		0x0dL
Stop					
T-DC	dc magnetization time		ms		0x07H
I-DC	dc magnetization		1 %		0x08H
Umin	min. voltage		0.1 %		0x0aH
F min	min. frequency		0.1 Hz		0x0bH
U eck	Voltage at rated speed		0.1 %		0x0cH
F eck	Frequency at rated voltage		0.1 Hz		0x0dH
F-sh	see F-shape				

F-shape frequency converter settings

Short symbol	Function		Address
			REGID 0x0f
F-sh Start			Bit 1..2
linear	presently only linear	0	
quad/2		1	
quad		2	
opt		3	
F-sh Stop	presently only linear		
linear			
quad/2			
quad			
opt			

Logic parameters

Logic BIT

Short symbol	Function	Address
		REGID 0xD8
Limit 1	Digital input limit 1 active	Bit 0
Limit 2	Digital input limit 2 active	Bit 1
Din 2	Digital input Din 2 active	Bit 2
Din 1	Digital input Din 1 active	Bit 3
FRG (RUN)	Hardware enable active	Bit 4
		Bit 5
		Bit 6
		Bit 7
Dout 1	Digital output Dout 1 connected	Bit 8
Dout 2	Digital output Dout 2 connected	Bit 9
BTB (Rdy)	Hardware relay output BTB-Rdy connected	Bit 10
GO	Internal enable GO active	Bit 11
Dout 3	Digital output Dout 3 connected	Bit 12
Dout 4	Digital output Dout 4 connected	Bit 13
		Bit 14
		Bit 15

Logic comparison variable

Short symbol	Function	Setting range	Units	Note	REGID address
0	Logic signal zero	1/0	Logic		
1	Logic signal one	1/0	Logic		
VAR1	Numerical value of the entered variable fields	+/-32767	num		0xd1
VAR2					0xd2
VAR3					0xd3
VAR4					0xd4
Ain 1	Analog value input Ain1	+/-32767	num		
Ain 2	Analog value input Ain2	+/-32767	num		

Interface settings

CAN-BUS

Short symbol	Function	Setting range	Units	Note	REGID address
Rx ID	Receiving address		dec.	Default 201	0x68
Tx ID	Sending address		dec.	Default 181	0x69
BTR	Transmission rate	see table	hex		0x73

Messages, errors, warning messages

Error BIT

Error message	Fault		Address
NOREPLY-No RS	RS232 interface not plugged-in or faulty		
			REGID 0x8f
BADPARAS	Parameter damaged		Bit 0
POWER FAULT	Output stage fault		Bit 1
RFE FAULT	Defective safety circuit (only active with RUN)		Bit 2
BUS TIMEOUT	Transmission fault BUS		Bit 3
FEEDBACK	Faulty encoder signal		Bit 4
POWERVOLTAGE	Missing power voltage supply		Bit 5
MOTORTEMP	Motor temperature too high		Bit 6
DEVICETEMP	Device temperature too high		Bit 7
OVERVOLTAGE	Overvoltage >1.8 x UN		Bit 8
I_PEAK	Over-current 300 %		Bit 9
RACEAWAY	Racing (without command val., wrong direction)		Bit 10
USER	User – fault selection		Bit 11
I^2R	Overload		Bit 12
RESERVE			Bit 13
HW-FAIL	Firmware is not compatible with the hardware		Bit 14
BALLAST (device dependent)	Overload of the ballast circuit		Bit 15

Warning BIT

Error message	Fault		Address
			REGID 0x8f
WARNING_0	Inconsistent device determination		Bit 16
ILLEGAL STATUS	RUN signal disturbed, EMI		Bit 17
WARNING_2	RFE signal inactive (without RUN)		Bit 18
			Bit 19
			Bit 20
POWERVOLTAGE	Power voltage too low or missing		Bit 21
MOTORTEMP	Motor temperature >87 %		Bit 22
DEVICETEMP	Device temperature >87 %		Bit 23
OVERVOLTAGE	Overvoltage >1.5 x UN		Bit 24
I_PEAK	Over-current 200 %		Bit 25
			Bit 26
			Bit 27
I2R	Overload >87 %		Bit 28
			Bit 29
			Bit 30
BALLAST (device dependent)	Overload of the ballast circuit >87 %		Bit 31

State BIT

State display	Description	Address
		REGID 0x40
Ena	Drive enable (Hardware enable)	Bit 0
NCR0	Speed command value = 0 (drive stopped)	Bit 1
Lim+	Limit switch plus assigned	Bit 2
Lim-	Limit switch minus assigned	Bit 3
OK	Drive in order (no uncontrolled reset)	Bit 4
Icns	Current limit reduced to continuous current	Bit 5
T-Nlim	Speed limited torque mode	Bit 6
P-N	Position control	Bit 7
N-I	Speed control	Bit 8
<N0	Speed inferior to 0.1 %	Bit 9
Rsw	Reference input selected	Bit 10
Cal0	Reference run (Bit 11+Bit12 = Ref. loop travel)	Bit 11
Cal	Reference position identified	Bit 12
Tol	Position within tolerance window	Bit 13
Rdy	Ready (BTB,Rdy)	Bit 14
Brk	active brake	Bit 15
SignMag	inverted command value	Bit 16
Nclip	Speed limiting via switch	Bit 17
Nclip+	Positive speed limiting via switch	Bit 18
Nclip-	Negative speed limiting via switch	Bit 19
Ird-Dig	Current limiting via switch	Bit 20
Iuse-rchd	Active current reduction	Bit 21
Ird-N	Current reduction via speed	Bit 22
Ird-TI	Current reduction via output stage temperature	Bit 23
Ird-TIR	Current limiting to continuous current via output stage temperature	Bit 24
>2Hz	Current reduction for frequencies inferior to 2Hz	Bit 25
Ird-TM	Current reduction via motor temperature	Bit 26
Ird-ANA	Current limiting via analog input 2	Bit 27
Iwcns	Current value Ixt superior to 87 %	Bit 28
RFE-plus		Bit 29
rsvd2:1		Bit 30
Handrad	Handwheel input selected	Bit 31

Measured values

Short symbol	Function	Unit	Range	ID address
Ncmd Ramp	Speed command value after ramp and limit			0x32
N actual	Actual speed value			0x30
Icmd Ramp	Current command value after ramp and limit			0x26
I actual D	Actual current value D			0x28
I actual Q	Actual current value Q			0x27
I2t	Capacity I2xt			0x45_L
P-Motor	Motor power			0xf6
DC-BUS	Bus circuit voltage			0xeb
P-Regen				0x45_H
Tmotor	Effective motor temperature			0x49
Tigbt	Effective output stage temperature			0x4a
Tair	Effective air temperature in the servo			0x4b
Ireda	Effective current limit			0x48

Switch and selection settings
Mode BIT

Short symbol	Function	Address
		REGID 0x51
Reserve		Bit 0
SPEED = 0	Drive stop	Bit 1
ENABLE OFF	Drive disabled	Bit 2
CANCEL CAL-CYCLE	Reference run stopped	Bit 3
d(status)->CAN		Bit 4
I-clip on	Current limit in % of the type current active	Bit 5
N-clip on	Speed limiting (positive and negative)	Bit 6
Mix ana on	Digital plus analog speed command value	Bit 7
Allow sync		Bit 8
Handwheel	2. feedback as handwheel	Bit 9

Core option BIT

Short symbol	Function	Address
		REGID 0x5a
DC-BUS-comp	Analog measured bus circuit value influences Uout	Bit 0
BALLAST_EXT	External ballast resistor	Bit 1
TJ_SPECIAL	Sensor specialties	Bit 2
coast stop	Coast Stop active, coasting to standstill	Bit 3
IISTINVERSE	Inverted actual current value polarity (factory-setting active for DS450, BAMO-D3)	Bit 4
REFSOFT	Reverse ramp for reference run set from Limit to ‚Dec'	Bit 5
NOUESP_BTB	BTB signal also at under-voltage error messages	Bit 6
ANA_UESP	Analog ZW-voltage watchdog	Bit 7
BTB_DELAY	Enable delay	Bit 8
Hxinv	Inverted sequence of the Hall signals	Bit 9
H2inv	Hall signal 2 inverted	Bit 10
OL_comp	Sensor specialties	Bit 11
MotorType	Motor selection	Bit 12
MotorType	Motor selection	Bit 13
ANA_0up	Measuring range (Vdc bus, Vdc-Bat) 0 to 5 V (0 = 2.5 to 5 V)	Bit 14
lowbd	Interface RS232 9600 Baud	Bit 15
S-ramp	Selection ‚S-ramp' active	Bit 16
4-ramp	Selection ‚4 ramps' active	Bit 17
MotBrake	Selection ‚with brake' active	Bit 18
ACDC		Bit 19
PWM-Frequenz	Clock frequency setting	Bit 20
PWM-Frequenz	Clock frequency setting	Bit 21
PWM-Frequenz	Clock frequency setting	Bit 22
NTC		Bit 23
delta	Motor phase triangle	Bit 24
DC_1QdirVolt	DC 1-quadrant, direct voltage regulation PWM	Bit 25
DC_field	DC field controller	Bit 26
DEAD_2	Dead band *2	Bit 27
block	Block current at ROT feedback	Bit 28
DC_1QMV	DC 1-quadrant, min. switching losses	Bit 29
DC_1Q3P	DC 1-quadrant, no High-Side, parallel -UB switch	Bit 30
Frd<10Hz	<10 Hz switching frequence set to 4 kHz	Bit 31

Monitor parameters

Short symbol	Function	Unit	Range	ID address
Ncmd Ramp	Speed command value after ramp and limit	num	0 to +/-32767	0x32
N actual	Actual speed value	num	0 to +/-32767	0x30
Icmd Ramp	Current command value after ramp and limit	num	0 to 600	0x26
Iact monitor	Actual current value (filtered)			
I actual D	Actual current value D (reactive current)	num	0 to 600	0x28
I actual Q	Actual current value Q (active current)	num	0 to 600	0x27
I2t	Capacity I2xt	num	0 to 4000	0x45_L
P-Motor	Motor power	num	0 to 4000	0xf6
DC-BUS	Bus circuit voltage	num	0 to +/-32767	0xeb
P-Regen	Ballast power	num	0 to 4000	0x45_H
Tmotor	Effective motor temperature	num	0 to 32767	0x49
Tigbt	Effective output stage temperature	num	0 to 32767	0x4a
Tair	Effective air temperature in the servo	num	0 to 32767	0x4b
Ireda	Effective current limit	num	0 to 600	0x48
Vout	Output voltage	num	0 to 4000	0x8a