Manual XENAX® Xvi 75V8S

Edition 18. March 2024

Compact Ethernet Servo Controller

Parameterization over Web browser

The integrated webserver allows a setup and parameterization over web browser. After an automatic self-check, the connected LINAX® linear motor axis, the ELAX® electric slide or the ROTAX® rotary axis can instantly be set in motion by click on the Quick Start Button.

This XENAX® Xvi 75V8S is setting new standards in terms of intuitive handling.

General

The XENAX® Xvi 75V8S Ethernet servo controller controls all series of the LINAX® linear motor axes, the ELAX® electric slide product family and the ROTAX® rotary axis. It is also possible to control servo motors series RAxx (ultra-compact rotary axes) and RT-xx (round table with hollow shaft).

Customary rotary AC/DC/EC servo motors for example from FAULHABER® or MAXON® can also be operated by the XENAX® Xvi 75V8S.

The logic supply (24V DC) and the intermediate circuit voltage (24V – 75V DC) are separately connectable. This is how “Safety Torque Off” is possible as a standard.

Master-Slave function, Force Calibration (compensation of the cogging forces in iron core linear motors) and optional “Safety” functionalities such as SS1, SS2, or SLS are further features of this compact XENAX® Xvi 75V8S servo controller.

Alois Jenny
Jenny Science AG

Contents

1 Characteristics XENAX® Xvi 75V8S

1.1 Electronics / Firmware

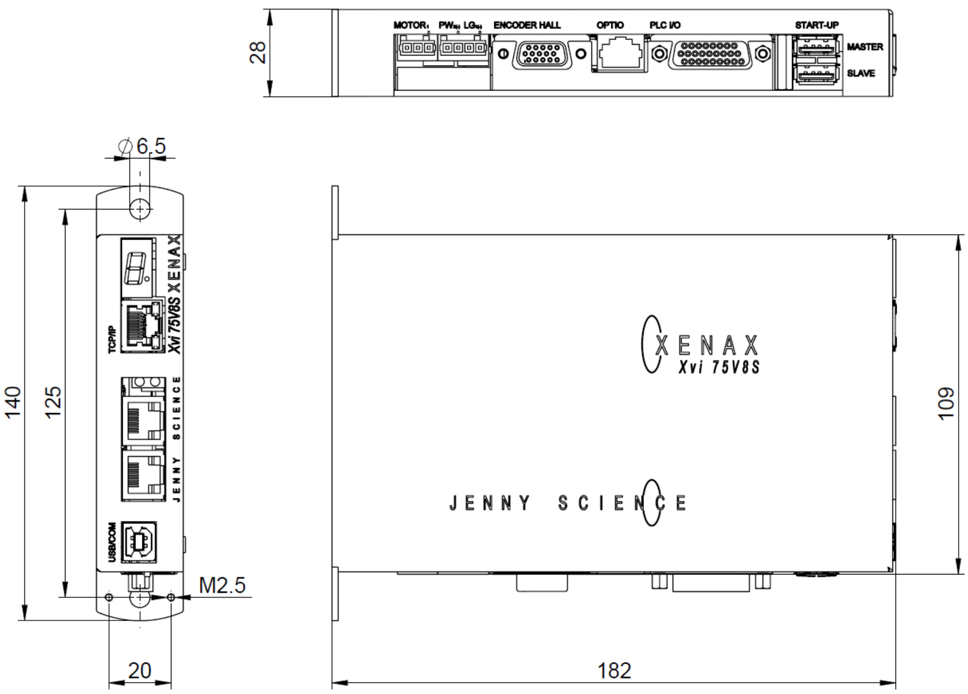
Description	Data
Interfaces	Ethernet, TCP/IP, http web server
	Puls/direction, Master Encoder, I/O
	I^2C Master/Slave, Start-up Key
	USB (standard) or RS232 (optional), CAN for Signateq® measuring amplifier
Bus, multi-axis operation	EtherCAT (CoE), DS402
	Ethernet POWERLINK, DS402
	CANopen, DS 402
	PROFINET (PROFIdrive)
	EtherNet/IP, DS402
	Ethernet Switch, TCP/IP
Operation Modes	Standard Servo (MODE 0)
	Multi axis operation (Master/Slave, Gantry)
	Electronic gear (MODE 1) optional
	Pulse/Direction (MODE 2) optional
Safety Motion Unit SMU	Security module, 2-channel monitoring
	TÜV certified
	SIL 2 Safety Integrity Level 2
	Cat 3 Category 3
	PL d Performance Level d
	MTTFd 1733313 h
Status indication	7-Segment LED
Input digital	12 x 24V Pull down
Output digital	8 x 24V, 100mA Source or 400mA Sink
Input function	8 inputs to start a function or program
Output function	8 outputs to indicate a condition
Reference for rotary motors	free to define, incl. external sensor
Index	50 motion moves (accl. / speed / distance, position)
Profile	5 extended motion profiles with 7 profile segments each.
Number of application programs via input	15, Input 9-12 binary coded (MODE >=10)
Firmware update	Over TCP/IP, Flash-memory internal
Application and parameter update	Over TCP/IP, Flash-memory internal

1.2 Performance / Options

„LG“ logic supply	24VDC ±10% / max. 1.3 A
„PW“ power supply motor	12-75VDC
3- Phase Output frequency	0-599 Hz
Nominal current	0-8A
Peak current	20A
Continuous power / dissipation loss	Typical 48V / 3A / 150W / η ≈ 85% / Pv = 22W
Temperature monitoring output stage	Shutdown at 80°C
Excess voltage – observation	> 85V
Under voltage – observation	< 10V

Ballast circuit	up to 80W
Fuse power	10AF
Motor temperature observation with LINAX®, ELAX® and ROTAX®, sensor in coils	Shutdown at 80°C
PLC Input	8 Inputs, 24V
PLC Input BCD	4 Inputs, 24V, binary coded for program selection
PLC Output	8 Outputs, 24V, Source 100mA, Sink 400mA, Source/Sink
Options	
EtherCAT (CoE)	DS402, Beckhoff®, OMRON®, TRIO® MC
POWERLINK (CoP)	DS402, B&R®
CANopen	DS402
EtherNet/IP	DS402, Allen-Bradley
PROFINET (PROFIdrive)	SIMATIC, SIMOTION, SINUMERIK
SMU Safety Functions	**STO** Safe Torque Off **SS1** Safe Stop 1 **SS2** Safe Stop 2 **SLS** Safely-Limited Speed
Start-up Key	ID number for Master Slave and application memory
Force Processes	Enabled by default
Controllable Motor-Types	LINAX®, ELAX®, ROTAX® and third party motors enabled by default

1.3 Dimensions



Dirt resistance		IP 20
Weight		Standard 840g, with bus module 880g
Case		Chrome steel
Ground plate		Chrome steel

1.4 Xvi 75V8 versus Xvi 75V8S

The XENAX® Xvi 75V8**S** is the evolution of the current model XENAX® Xvi 75V8. The new model supports all the previous functionalities of the Xvi 75V8, has the same dimensions and can therefore be replaced 1:1. For new developments we recommend to use the Xvi 78V8**S**. New products may no longer be supported with the Xvi 75V8. The Xvi 75V8**S** doesn't need JAVA and offers additional possibilities.

New possibilities Xvi 75V8S

	Xvi 75V8	**Xvi 75V8S**
Webserver base for WebMotion®	Java	HTML5
Option for measuring amplifier Signateq® with external force sensor, precise force measurement	-	Yes
Position accuracy absolute ROTAX® Rxhq	Standard	High (with correction table)
ROTAX® Virtual Multiturn functionality	-	Yes
Optimized output stage for minimal space requirement (Heat emission), can be installed directly next to each other	-	Yes
Switching for connection of third-party motors	DIP-Switch	automatic
Position detection prepared for absolute encoder	-	Yes
USB-Interface	-	Yes
RS232-Interface	Yes	optional
Pulse/Direction	Yes	optional
Electronic gear	Yes	optional
Case	Aluminium	Chrome steel
Weight	515g	840g
Product-code	0x7508	0x7509

Note:
When replacing an Xvi 75V8 with the Xvi 75V8**S** in an existing bus system, please note that the product-code is different. The corresponding development environment is required so that the new bus device can be integrated correctly. You will find instructions for this in the manual of the bus module used on our website.
www.jennyscience.ch/en/download
The application data is saved with the XENAX® Xvi 75V8S in JSON format. An application file from the Xvi 75V8 is not compatible and cannot be transferred directly. We are happy to help with the transfer.

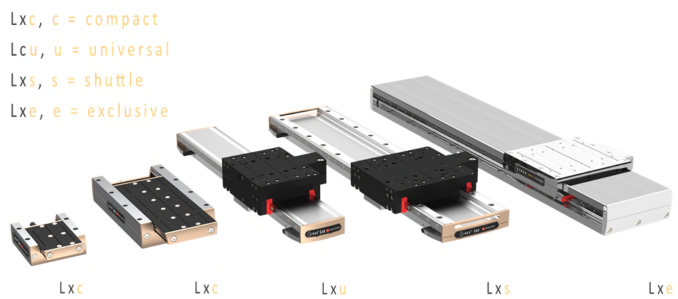
2 Controllable Motor Types

2.1 Linear Motor Axes and Electric Slides

LINAX® Linear Motors

3 phase synchronous linear motor with encoder RS422 A/A*, B/B* und Z/Z* and distance-coded reference marks.

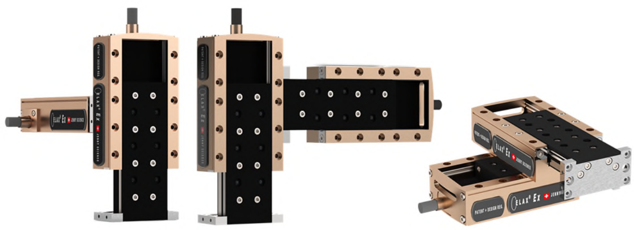
Special feature:
Linear motor identification and temperature monitoring over I²C bus.



ELAX® Electric Slides with Linear Motor

ELAX® is the evolutionary step of the widespread pneumatic slides. The great accomplishment is the patented compact integration of the linear motor in the slider case, resulting in a force/volume ratio which has hitherto never been achieved.

Special feature:
Linear motor identification and temperature monitoring over I²C bus.



2.2 Servo Motors in our Product Line

ROTAX® Rotary motor axes

Whether you choose the ROTAX® Rxvp with direct connection options to ELAX® linear motor slides and LINAX® linear motor axes or you go for the ROTAX® Rxhq 50 with enormous torque despite its small dimensions and the 12 mm diameter hollow shaft – the compact ROTAX® rotary motor axes from Jenny Science all work precisely, can be used flexibly and are robust in application. The XENAX® servo controller identifies the ROTAX® rotary axis and configures the controller parameters automatically.

Lafert, RAxx, RTxx

AC-Servo motors with encoder A/A*, B/B* and Z/Z* and hall sensors e.g.
AEG B28 D4 0,4Nm, 6000 U/min.
Optionally available with brakes for vertical applications.

2.3 Customary Servo Motors

Faulhaber®, Maxon®

AC / DC / EC brushless servo motors with incremental encoder RS422 A/A*, B/B* and Z/Z* and hall sensors, as well as DC brush-type servo motors with incremental encoder.

For brushless AC/EC servo motors there are hall signals and incremental encoder necessary.

FAULHABER GROUP

maxon motor

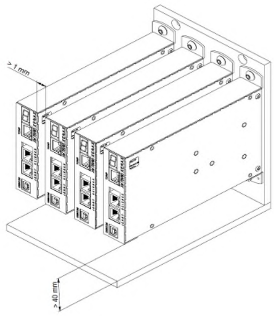
3 Hardware and Installation

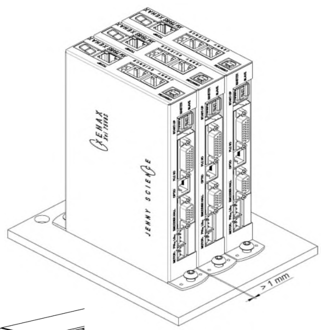
3.1 Environmental Conditions

Storage and transport	No outdoor storage. Warehouses have to be well ventilated and dry. Temperature from -25°C up to +55°C
Temperature while operating	5°C -50°C environment, (above 40°C, nominal current reduced to 6A)
Humidity while operating	10-90% non-condensing
Air conditioning	No external air conditioning needed; integrated heat sink.
MTBF	> 120’000h for housing internal temperature of < 50°C

3.2 Assembly and Installation

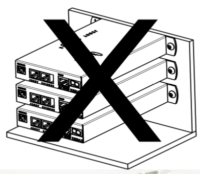
Assembly with two screws on an electrically conductive rear wall e.g. the back wall of a switch cabinet.

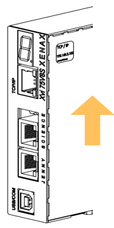




For a series mounting, the devices can be mounted directly next to each other. A distance of more than 1mm between the devices, which is advantageous for the removal and mounting of a device, is not necessary.
The distance to the base plate must be at least 40mm.

We recommend mounting the devices in vertical orientation with the 7-segment display at the top to ensure a good cooling air circulation.

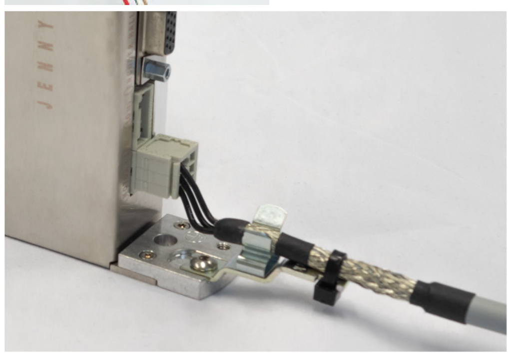




Where space is limited:
Package with 5 XENAX® Servo controllers mounted on a base plate with a common connection for the power supply.

When operating with a power supply motor above 60VDC, the XENAX® Servo controller must be mounted in an electrical control cabinet and the XENAX® Servo controller must be connected to protective earth using the shielding clamp (Art. No. 130.09.00) for motor cable.

When operating with a power supply motor below or equal 60VDC, a SELV/PELV power supply has to be used or XENAX® Servo controller must be connected to protective earth using the shielding clamp (Art. No. 130.09.00) for motor cable.



4 Functional Safety - TÜV certified

Consult also the TUTORIAL Video
Tutorial 3: Functional Safety (SMU) TÜV certified
on our website. In this video we demonstrate and explain the functions of the TÜV certified SMU (Safety Motion Unit) for functional safety.

4.1 Hardware Requirements

In order to use the TÜV certified safety functions a XENAX® Servo controller equipped with an optional Safety Motion Unit (SMU) is needed.

The SMU module has to be ordered by the client with a separate article number.

XENAX® Servo controllers can only be upgraded to SMU at Jenny Science.
SMU modules will only be supplied when mounted into a XENAX® Servo controller.

Legal Note:
In case of any modification or attempts of modification on the hardware by third parties, the TÜV certification is no longer guaranteed and Jenny Science declines all liability.

Functional Safety
SIL 2, PL d, Cat. 3

4.2 Safety Standards

EN 61508-1:2010 **EN 61508-2:2010** **EN 61508-3:2010** Functional safety of electrical/ electronic/programmable safety-related systems		**SIL 2** Safety Integrity Level 2
EN ISO 13849-1:2015 Safety of machinery, Safety-related parts of control systems		**Cat 3** Category 3 **PL d** Performance Level d
EN 61800-5-2:2017 Adjustable speed electrical power drive systems		Safety Functions: **STO** Safe Torque Off **SS1** Safe Stop 1 **SS2** Safe Stop 2 **SLS** Safely-Limited Speed

4.3 Basic Conditions

Motor Types		Functional Safety with SMU can be used for all LINAX®, ELAX® and ROTAX® motor families, as well as rotary brushless motors with different A/B/Z encoder signals. Rotary brush type DC motors are not subject to the functional safety. Note1: For vertical mounted linear axis, weight compensation must be used for safety functions SS2 and SLS. The safety function SBC (Safe Break Control) is not available. Note2: Rotative motors operating suspended loads are excluded from SS2 and SLS safety functions.
Commissioning		The configuration assessment has to be warranted by the client for each modification of the functional safety and its parameters through commissioning.
Period of use		The maximum period of use for operating with functional safety with SMU is 20 years.
Continuous operation		The XENAX® servo controller must be switched off at least once a year.
Wiring		The length of the connection cables must not exceed 30m per connection cable.

4.4 Technical Data Safety

Reaction time of the security inputs (until activation of a safety function)		< 4ms
Probability of a dangerous failure per hour (PFH)		PFH = 51.7 * 10^{-9} 1/h
Activation of a safety function		Switching on two channel to 0V One-channel switched safety inputs lead to turn off of the power stage and requires a restart of the XENAX® servo controller.
Level of safety inputs		>21.0V safety input inactive < 2.0V safety input active Voltage levels outside of these limits are prohibited.
Hierarchy of safety functions		Hierarchy / Safety Functions: 4 – STO Safe Torque Off 3 – SS1 Safe Stop 1 2 – SS2 Safe Stop 2 1 – SLS Safely Limited Speed Safety functions of higher hierarchy levels overdrive the ones below.

Hierarchy	Safety Functions	
4	STO	Safe Torque Off
3	SS1	Safe Stop 1
2	SS2	Safe Stop 2
1	SLS	Safely Limited Speed

Safety functions of higher hierarchy levels overdrive the ones below.

Deceleration ramps for SS1 Profile Position Mode and Cyclic Synchronized Position Mode (RT-Ethernet)		 Trough parameter ED (Emergency Deceleration)
Deceleration ramps for SS2 Profile Position Mode Cyclic Synchronized Position Mode (RT-Ethernet		 With Parameter ED (Emergency Deceleration) Indicated by superior master controller
Deceleration ramps for SLS Profile Position Mode Cyclic Synchronized Position mode (RT-Ethernet)		 After speed infringements through parameter ED (Emergency Deceleration) Indicated by superior master controller

4.5 Safety Functions

The inputs for the safety functions are located at the PLC I/O (26-Pin D-Sub) connection of the XENAX® servo controller (INPUTS 1 - 8). The individual safety functions can be freely configured to the corresponding inputs. Details on the pin assignment can be found in chapter 6.2.8 PLC I/O.

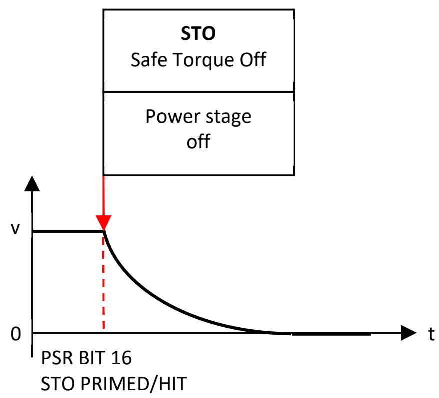
4.5.1 STO, Safe Torque Off

According IEC 61800-5-2

Immediate shut-down of the output stage.

Error 90 is generated if the power stage was switched on at the time of STO.

Parameter:
None

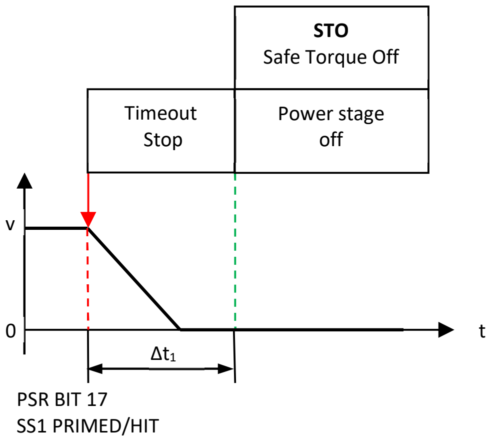


4.5.2 SS1, Safe Stop 1

Stop followed by shut-down of the output stage (Stop category 1)

Error 90 is generated if the power stage was switched on at the time of SS1.

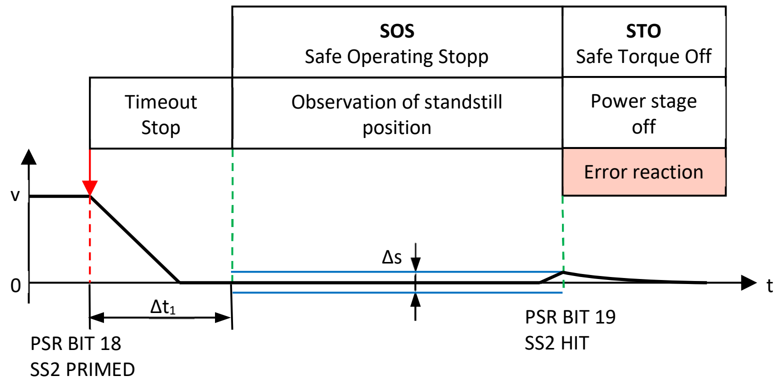
Parameter:		
Timeout Stop	Δt_1	Standard 300ms



4.5.3 SS2, Safe Stop 2

Stop while remaining in stop position, axis remains under power, power stage active. Then observation of stop-position, status SOS (Safe Operating Stop). If exceeding the position limit, STO will be triggered. Shut-down of the output stage (stop category 2)

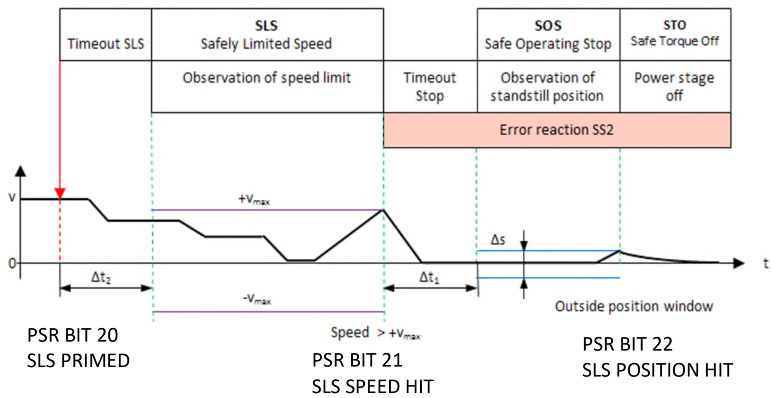
Parameter		
Timeout Stop	$\Delta t1$	Standard 300ms
Position window	Δs	Standard +-2500 Inc



4.5.4 SLS, Safely Limited Speed

Observation of a safe speed. If Safety Limited Speed (SLS) is exceeded, Safe Stop (SS2) while observing the position window. If position window is exceeded as well, then triggering STO, shut-down of the output stage. Adjustment of speed during SLS time out has to be specified by user.

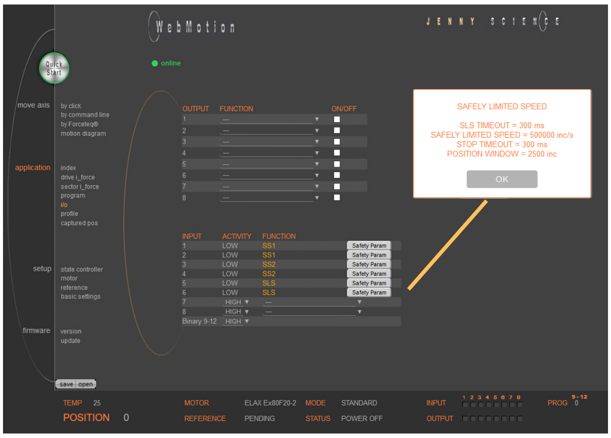
Parameter:		
Timeout SLS	Δt_2	Standard 300ms
Safely Limited Speed	v_{max}	Standard +-50'000 Inc/s
Timeout Stop	Δt_1	Standard 300ms
Position window	Δs	Standard +-2500 Inc



4.6 Functional Safety Parameterization in WebMotion®

4.6.1 Display Active Safety Parameters

The defined Safety Functions and parameters are shown in WebMotion® in the menu *application/io*. This safety information can only be read, not modified.



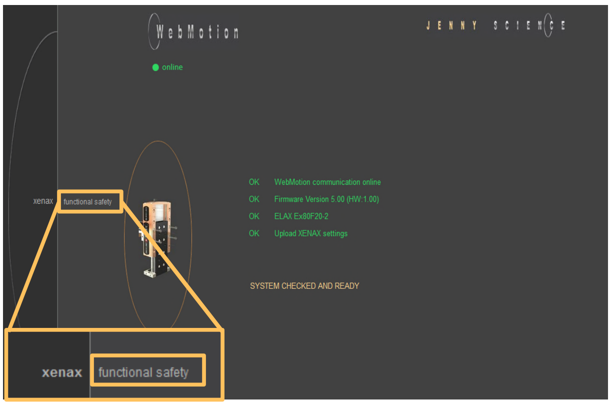
The parameters of the Safety Functions can be made visible by pressing „Safety Param“.

Please refer to chapter 11 WebMotion® for further explanations on WebMotion® interface.

If the XENAX® servo controller contains a Safety Motion Unit (SMU) but no parameters are assigned, the following message appears: “SMU not active, no parameter set”. The button directs to the page where the parameters are set.

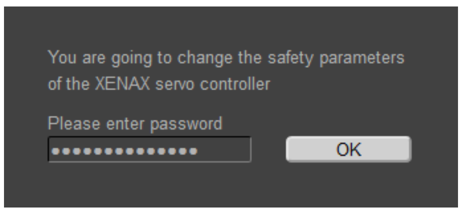
4.6.2 Modification of Safety Parameters

The safety parameters can be modified with WebMotion® and the functional safety login:

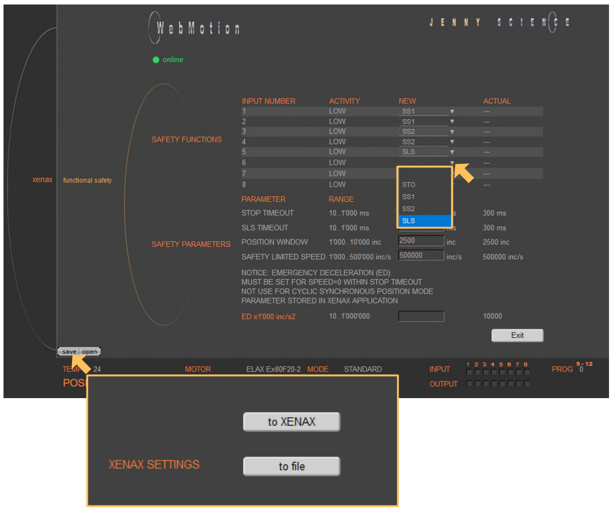


Enter IP address of the XENAX® servo controller and add „/SAFETY.html“ in Web browser.
E.g. http://192.168.2.190/SAFETY.html

Password: **SafetyXvi75V8S**
„OK“



Note: Please pay attention to capital and small letters.



Actual
Current safety parameters of XENAX® servo controller with SMU.

New
This is where new safety parameters can be selected from the drop down menu. They are activated in XENAX® servo controller by pressing „save“.

save
to XENAX®:
The modified safety parameters are being sent to XENAX® / SMU. The active parameters are visible in the column XENAX®.

to File:
The safety parameters on the SMU are saved into a file.

open
Safety parameters can also be loaded from a pc file. In order to be activated on the XENAX® servo controller, the parameters have to be saved by pressing on the *save* → *to XENAX*.

ED x 1000
The Parameter ED „Emergency Deceleration“ muss be set as big, that STOP and SLS Timeout can be hold by stopping.

By pressing „EXIT“ you exit functional safety and get back to WebMotion®.

Note: The Signal of an active safety function has to be operated by a higher level control system.

5 UL

For UL-conformity, the XENAX® servo controllers need to be used with the Brake Energy Converter from Jenny Science AG to guarantee voltage levels during dynamic braking within DVC A Levels.

Please refer Manual_Brake_Energy_Converter.pdf

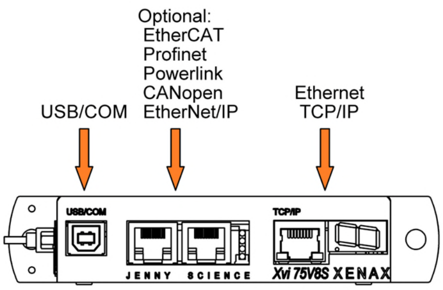
5.1 UL-Ratings

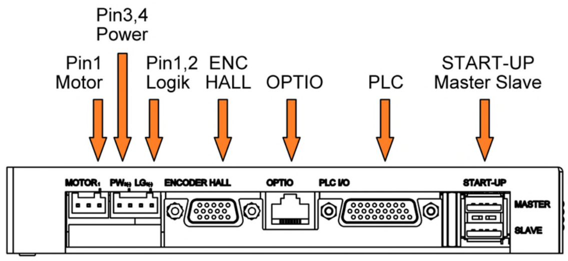
Description		Data
Input (PW) Input (LG) Output (Motor)		24 – 36 VDC max. 6.93 A 15.59A peak 24 VDC max 1.3 A 0 – 25.5V ac, 3phase, 5.7A, 18A peak
Power Supply		These products are intended for operation within circuits not connected directly to the supply mains (galvanically isolated from the supply).
		The XENAX® Servocontroller/s need to be used with the Brake Energy Converter to stay within the 36 DVC A Limits
		Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. **For Canada (ENG):** Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part I. **For Canada (F):** Des protections intégrées, à relais statique, contre les court circuits, ne protègent pas contre les circuits de dérivation. Une protection contre les circuits de dérivation doit être fournie conformément au code canadien de l'électricité, Partie I.
Maximum Surrounding Air Temperature		+ 45°C
Temperature Wago Connectors		-60°C … 100°C
Temperature Rating of field installed conductors		-25°C … 80°C
Motor Overload Protection for motors other than the LINAX® / ELAX® / ROTAX® Motors		External or Remote Motor Overload Protection and overtemperature sensing need to be provided.
Motor Overload Protection for the LINAX® / ELAX® / ROTAX® Motors		The proper connection and the rating of the load imposed by the equipment on the protector contacts. Power output: 0-25.5 VAC, 3 phase, 5.7 A, 18 A peak
UL File Nr.		E477533, Link to file, Link to file Canada

6 Electrical Connections

Note:
To disconnect or connect the electrical components at the electrical connectors, the power supply must be disconnected.

XENAX® Xvi 75V8S





6.1 Plug Arrangement

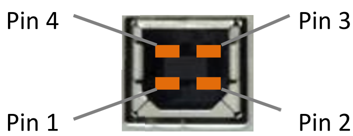
Description	Plug Type
RS232	USB-B socket
Real time Ethernet (optional)	*2 x RJ45 socket with status LED*
CANopen (optional)	*9 Pol socket D-Sub*
Ethernet TCP/IP	*RJ45 socket with status LED*
MOTOR	3 pole plug Wago, pitch 3,5mm
POWER / LOGIK	4 pole plug Wago, pitch 3,5mm
ENCODER HALL	15 pole plug D-Sub High Density
OPTIO	8 pole socket RJ45
PLC I/O	26 pole plug D-Sub High Density
START-UP / MASTER-SLAVE	2 x 4 pole plug USB-A

6.2 Plug Pin Configuration

6.2.1 USB/COM

USB-B Socket
A standard USB connection is implemented here by default. Optionally, a serial RS232 communication can be realised via the USB-B socket. On request, the controller can be ordered with the corresponding assembly variant.

USB Socket	XENAX®	PC/SPS
1	N.C.	
2	RX	TX
3	TX	RX
4	GND	GND



6.2.2 Motor Plug 3 Phase

Wago 3 Pole Plug	LINAX® / ELAX® 3 Phase	Servo motor 3 Phase	DC Motor
1	U (white)	U	DC +
2	V (brown)	V	DC -
3	W (green)	W	

6.2.3 Logic and Power Supply

The typical POWER supply is 24V DC. For the stronger LINAX® F40 / F60 axes with high masses (>2kg) or high dynamics (>1.5m/s) a POWER supply of 48V or 72V DC is applicable. The current consumption per axis can be up to 8A and 20A peak per axis. Depending on mass in motion, profile and power supply voltage.

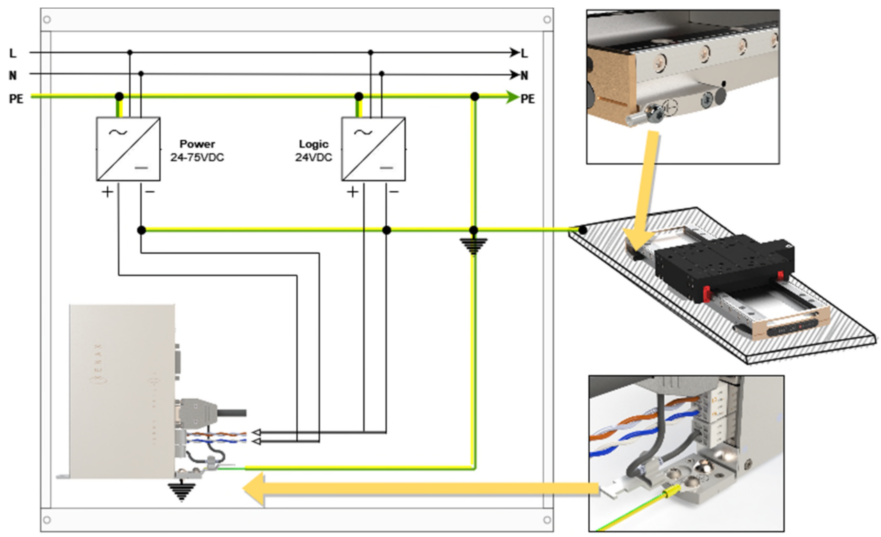
4 Pole Female Wago 734-104 for cross-section up to 1.5mm^2		
1	0, GND	Adapter logic
2	24V DC	
3	0, GND	Adapter power
4	12-75V DC	

For a fuse protection of the power supply, it must be considered that a short peak current of 8A can be reached for the rotating field adjustment.

For a detailed calculation of the required power supply in your application, please contact our support www.jennyscience.ch/en/Service.

Important:

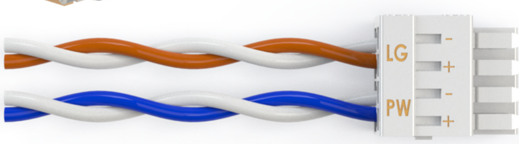
- The **0 volt** connection of the logic supply (pin 1) and the 0 volt connection of the power supply (pin 3) have to be connected to the ground/chassis star point of the switch cabinet.
- The **base plate** of the Lxs/Lxu motors must be connected to the GND/chassis star point of the switch cabinet.
- The **XENAX® servo controller** must be screwed onto a conductive background, which is connected to the GND/chassis star point of the switch cabinet. The motor cable must be connected to the shield clamp.



Note:

If the Lxs/Lxu is mounted on a non-conductive base plate (e.g. granite), the protective earth must be connected directly to the motor.

In case of emission sensitivity, it is recommended to twist the supply cable for logic and power.

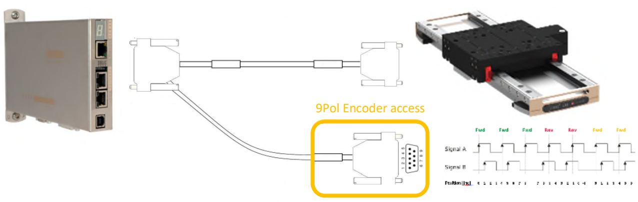


6.2.4 Encoder and Hall Signals

15 pole D-Sub socket	Signal	Description
1	GND	Together, for encoder and hall 0V supply, only 1 pin
2	5V Encoder	150 mA for encoder supply
3	Encoder A	Pull up 2,7kΩ to 5V, differential input 26LS32
4	Encoder A*	Middle level: pull up 2,7kΩ to 5V, Pull down 2,2kΩ, differential input 26LS32, 330Ω internal between Pin3/4
5	Encoder B	Pull up 2,7kΩ to 5V, differential input 26LS32
6	Encoder B*	Middle level: pull up 2,7kΩ to 5V, pull down 2,2kΩ, differential input 26LS32, 330 Ω internal between Pin5/6
7	Encoder Z	Pull up 2,7kΩ to 5V, differential input 26LS32
8	Encoder Z*	Middle level: pull up 2,7kΩ to 5V, pull down 2,2kΩ, differential input 26LS32, 330 Ω E internal between Pin7/8
9	HALL 1	Pull up 2,7kΩ to 5V, differential input 26LS32
10	HALL 1*	Middle level: Pull up 2,7kΩ to 5V, pull down 2,2kΩ, differential input 26LS32
11	HALL 2 / -TMP	Pull up 2,7kΩ to 5V, differential input 26LS32 / over temperature signal motor
12	HALL 2*	Middle level: Pull up 2,7kΩ to 5V, Pull down 2,2kΩ, differential input 26LS32
13	HALL 3 / I2C_SCL	Pull up 2,7kΩ auf 5V, differential input 26LS32 / I2C clock
14	HALL 3*	Middle level: Pull up 2,7kΩ to 5V, pull down 2,2kΩ, differential input 26LS32
15	5V Hall / I2C_SDA	5V, 150 mA / I2C data signal

6.2.5 Y-Cable for Encoder access

By using a pre-assembled Y-cable to access the differentially routed A, B and Z signals, cameras, for example, can be triggered precisely. The cable is available from Jenny Science AG.
The signal is to be analysed in quadrature.



9 pole D-Sub socket	Signal	Description
1	GND	Together, for encoder and hall 0V supply, only 1 pin
2	NC	Not connected
3	A	Output Encoder A
4	A*	Output Encoder A*
5	B	Output Encoder B
6	B*	Output Encoder B*
7	Z	Output Encoder Z
8	Z*	Output Encoder Z*
9	NC	Not connected

6.2.6 Definition of Rotating Direction for Servo Motors

	Sight on front surface motor shaft, turn the shaft clockwise, the meter has to count upwards
Switch encoder A/B Switch +/- motor power	Switch rotating direction for DC brush type servo motors
Switch encoder A/B Switch hall1 with hall3 Switch winding-phase 1 and phase 2	Switch rotating direction for 3phase brushless servo motors
Phase 1 to phase 2, 2 to 3 and 3 to 1 Hall 1 to hall2, 2 to 3 and 3 to 1	Switch phase connection for brushless servo motors without change of rotating direction

6.2.7 OPTIO CAN, Pulse/Dir, Second Encoder Channel

A CAN interface for communication with the Signateq® measuring amplifier is implemented as standard. It is possible to have a Pulse/Dir or a second encoder channel instead.

CAN (standard)
for communication with the Signateq® measuring ampl.

Signal	RJ45	OPTIO
GND intern	Pin 1	GND
5V intern	Pin 2	5V
CAN High Line	**Pin 4**	**CANH**
CAN Low Line	**Pin 5**	**CANL**

Pulse/Dir (optional)

Enter settings in menu *setup / basic settings*: PULSE / DIRECTION CONTROL, MODE 2, Parameter MODE and INC PER PULSE

Signal	RJ45	OPTIO
GND internal	Pin 1	GND
5V internal	Pin 2	5V
Pull up 2,7kΩ to 5V, differential input 26LS32	**Pin 3**	**PULS**
Pull up 2,7kΩ to 5V, differential input 26LS32	**Pin 4**	**DIRECTION**
Middle level: Pull up 2,7kΩ to 5V, pull down 2.2kΩ, differential input 26LS32	**Pin 5**	**DIRECTION***
Middle level: Pull up 2,7kΩ to 5V, pull down 2.2kΩ, differential input 26LS32	**Pin 6**	**PULS***

Second Encoder channel (optional)

ENCODER 2
Electronic gear, MODE 1,
Parameter SYNCH RATIO 10 = 1:1

Signal	RJ45	OPTIO
GND intern	Pin 1	GND
5V intern	Pin 2	5V
Pull up 2,7kΩ to 5V, differential input 26LS32	**Pin 3**	**A**
Pull up 2,7kΩ to 5V, differential input 26LS32	**Pin 4**	**B**
Middle level: Pull up 2,7kΩ to 5V, pull down 2.2kΩ, differential input 26LS32	**Pin 5**	**B***
Middle level: Pull up 2,7kΩ to 5V, pull down 2.2kΩ, differential input 26LS32	**Pin 6**	**A***

6.2.8 PLC I/O

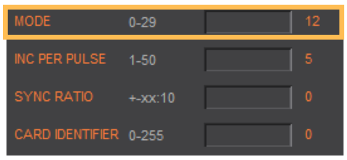
A pre-assembled shielded cable with free end according to this pin assignment is available from Jenny Science AG.

Signal Output	D-Sub	PLC Cable	PLC I/O
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 1	white	Output 1 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 2	brown	Output 2 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 3	green	Output 3 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 4	yellow	Output 4 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 5	grey	Output 5 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 6	pink	Output 6 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 7	blue	Output 7 (0/24V)
Source PNP: 24V/100mA, Sink NPN: open collect. 24V/400mA	Pin 8	red	Output 8 (0/24V)

Input			
24V Input, Ri 31kΩ	Pin 17	white-grey	Input 1
24V Input, Ri 31kΩ	Pin 18	grey-brown	Input 2
24V Input, Ri 31kΩ	Pin 19	white-pink	Input 3
24V Input, Ri 31kΩ	Pin 20	pink-brown	Input 4
24V Input, Ri 31kΩ	Pin 21	white-blue	Input 5
24V Input, Ri 31kΩ	Pin 22	brown-blue	Input 6
24V Input, Ri 31kΩ	Pin 23	white-red	Input 7
24V Input, Ri 31kΩ	Pin 24	brown-red	Input 8 (program Start)

24V Input, Ri 31kΩ / Bit 0 binary coded	Pin 13	white-green	Input 9
24V Input, Ri 31kΩ / Bit 1 binary coded	Pin 14	brown-green	Input 10
24V Input, Ri 31kΩ / Bit 2 binary coded	Pin 15	white-yellow	Input 11
24V Input, Ri 31kΩ / Bit 3 binary coded	Pin 16	yellow-Brown	Input 12

MODE >=10 Input 9-12, binary coded, for program number 1-15, input 8 fix dedicated for program start (edge triggered)

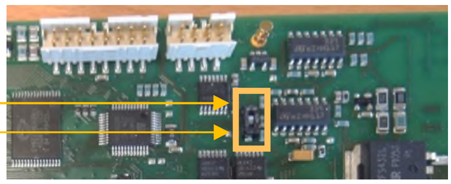


Enabling Power Stage

Activate the function with DIP-switch

ON

OFF



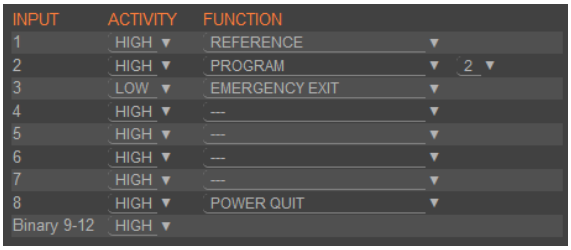
DIP switch OFF	HW power stage enabling with 24V on Pin 9 Input open or 0V = power stage blocked	Pin 9	black	Enable PWR / Input
DIP switch ON	Always enabling power stage, Pin 9 inactive (Standard configuration)			

2A	Pin 10	violet	GND
24V / 80mA	Pin 11	Grey pink	Pulse Output (not implemented)
24V / 200mA (total Pin 12+Pin 26)	Pin 12	Red-blue	24V Output

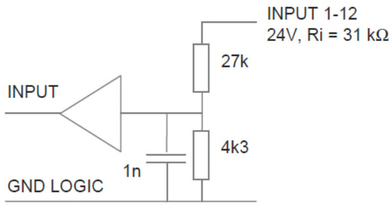
2A	Pin 25	White-black	GND
24V / 200mA (total Pin 12+Pin 26)	Pin 26	Brown-black	24V Output

6.3 Internal I/O Circuit

INPUT 1-12



INPUT	ACTIVITY	FUNCTION	
1	HIGH	REFERENCE	
2	HIGH	PROGRAM	2
3	LOW	EMERGENCY EXIT	
4	HIGH	---	
5	HIGH	---	
6	HIGH	---	
7	HIGH	---	
8	HIGH	POWER QUIT	
Binary 9-12	HIGH		



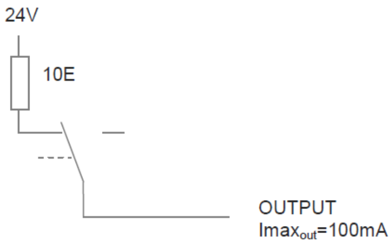
HIGH or LOW ACTIVITY programmable

OUTPUT 1-8

TYPE SOURCE

SOT Bit-value	TYPE	SOA Bit-value	ACTIVITY	Output ON	Output OFF
0,1	SOURCE	1	HIGH	**24V***	**open***
		0	LOW	open	24V

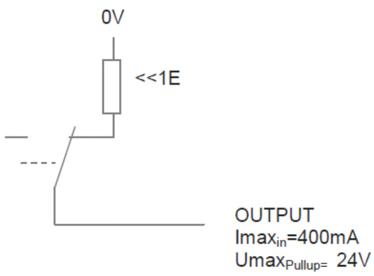
All Output SOURCE
SOT 21845
SOA 255 / 0



TYPE SINK

SOT Bit-value	TYPE	SOA Bit-value	ACTIVITY	Output ON	Output OFF
0,0	SINK	1	HIGH	open	0V
		0	LOW	0V	open

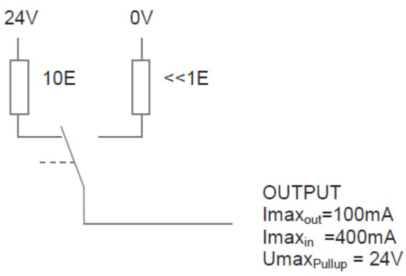
All Output SINK
SOT 0
SOA 255 / 0



TYPE SOURCE/SINK

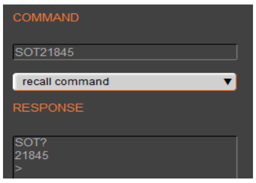
SOT Bit-value	TYPE	SOA Bit-value	ACTIVITY	Output ON	Output OFF
1,0	SINK / SOURCE	1	HIGH	24V	0V
		0	LOW	0V	24V

All Output SOURCE/SINK
SOT 43690
SOA 255 / 0



6.4 Output Configuration

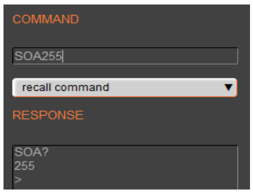
TYPE
SOT (Set Output Type) parameter 16 Bit
2 Bit-value per output



Output	8		7		6		5		4		3		2		1	
SOT Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit- value	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Decimal	*21845*															

*Default setting all output on SOURCE
>SOT 21845

ACTIVITY
SOA (Set Output Activity) parameter 8 Bit
1 Bit-value per output



Output	8	7	6	5	4	3	2	1
SOA Bit	7	6	5	4	3	2	1	0
Bit-value	1	1	1	1	1	1	1	1
Decimal	*255*							

*Default setting all output HIGH ACTIVE
>SOA 255

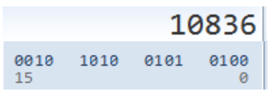
Parameter Values

Output	**SOT Bit**	**SOT Bit-value**	**TYPE**	**SOA Bit**	**SOA Bit-value**	**ACTIVITY**	**Output ON**	**Output OFF**
1	0,1	0,0	SINK	0	0	HIGH	0V	open
				0	1	LOW	open	0V
2	2,3	0,1	SOURCE	1	0	LOW	open	24V
				1	1	HIGH	**24V***	**open***
3	4,5	1,0	SINK/SOURCE	2	0	LOW	0V	24V
				2	1	HIGH	24V	0V

Examples

Output	**SOT Bit**	**SOT Bit-value**	**TYPE**	**SOA Bit**	**SOA Bit-value**	**ACTIVITY**	**Output ON**	**Output OFF**
1	0,1	0,0	SINK	0	0	HIGH	0V	open
2	2,3	0,1	SOURCE	1	1	HIGH	**24V***	**open***
3	4,5	0,1	SOURCE	2	1	HIGH	**24V***	**open***
4	6,7	0,1	SOURCE	3	1	HIGH	**24V***	**open***
5	8,9	1,0	SINK/SOURCE	4	0	LOW	0V	24V
6	10,11	1,0	SINK/SOURCE	5	0	LOW	0V	24V
7	12,13	1,0	SINK/SOURCE	6	1	HIGH	24V	0V
8	14,15	0,0	SINK	7	1	HIGH	0V	open

SOA	11001110_b	**206_d**
SOT	0010101001010100_b	**10836_d**



7 Configuration Motor Type Jenny Science / Motor customer specific

The XENAX® Servo Controller differentiates between Jenny Science Motors LINAX® Lx, ELAX® Ex or ROTAX® Rx, and motors from other manufacturers.
The XENAX® Servocontroller recognises if the connected motor is a Jenny Science motor (LINAX® Lx, ELAX® Ex or ROTAX® Rx) or a motor from another manufacturer (typically a rotative servo motor) and configures the required settings.
If this automatic detection is not desired, the settings can be fixed to either Jenny Science Motor (command: MM1) or third party motor (command: MM2). AutoDetection (MM0) is switched on by default.

8 USB/COM Socket

8.1 USB Operation

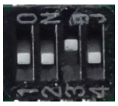
A serial communication can be established over the USB/COM socket. By default, the serial communication is implemented with USB. This means that a computer can be directly connected with a XENAX® over a USB cable. The XENAX® will register itself as "serial USB device" on the computer. A serial communication can be established with the following settings:

Baudrate	115'200 Baud
Data	8 Bit
Parity	kein
Stop	1 Bit

8.2 RS232 Operation

Optionally, the USB/COM socket can be used as a plain RS232 interface. Note that the XENAX® must be ordered with this option because hardware changes are required. With this option, the baud rate can be configured with a DIP switch.

Baud rate configuration for RS232 with 4-Bit DIP switch. The XENAX® must be opened to reach the DIP switch. The new settings is applied after a reboot.



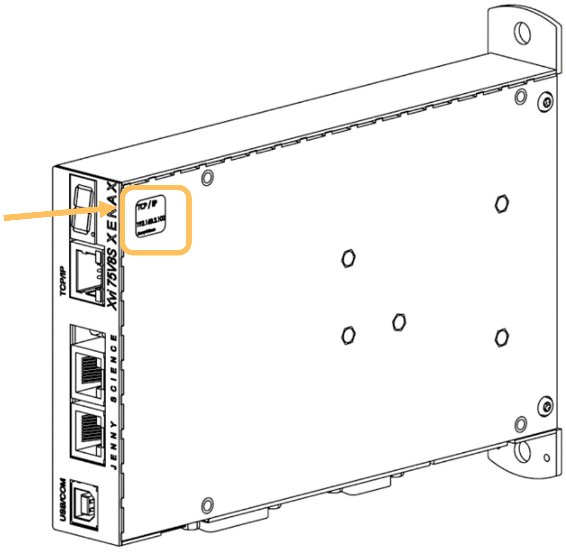
Baudrate	Bit 1	Bit 2	Bit 3	Bit 4
RS232 9600 Baud	x	OFF	OFF	x
RS232 115'200 Baud (Default)	x	OFF	ON	x
RS 232 57'600 Baud	x	ON	OFF	x
RS232 19'200 Baud	x	ON	ON	x

Data	8 Bit
Parity	kein
Stop	1 Bit

9 ETHERNET TCP/IP Interface

The TCP/IP interface has two essential functions. Firstly, HTML5-WebMotion can be accessed over the Ethernet TCP/IP interface. Secondly, the Ethernet TCP/IP interface is used to control the axis with all available ASCII commands. The port 10001 I used for ASCII commands.

IP-address of XENAX® is provided on the back side of the controller. If this has been changed or the label is not accessible, you can have the IP-address displayed on the 7-segmet display. To do this, switch on the logic supply and switch it off again while the dot in the 7-segment display lights up. The next time you switch it on, the IP-address is shown on the 7-segment display.



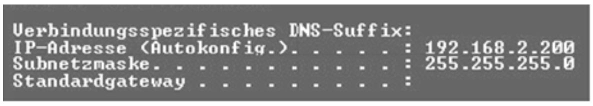
Connection of XENAX® to laptop/PC over a normal RJ45 network cable.

When connecting laptop/PC directly without a switch to XENAX®, it may need a crossed RJ45 cable. However, with newer network types a crossed RJ45 cable is not necessary anymore.

Ethernet connector

The green "Link Status" LED lights up as soon as the cable is connected and the initialization of the connection is complete.
Die orange «Activity» LED blinkt bei Kommunikation.

9.1 Test IP Connection with >IPCONFIG



IPCONFIG command in DOS window

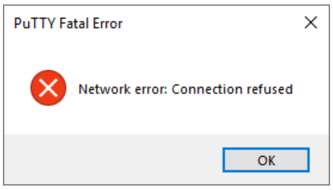
Test TCP/IP address range.
IP address has to be in range of 192.168.2.xxx
If necessary adjust IP address in computer „network environment“ to e.g. IP 192.168.2.200.
xxx = 001 – 255
≠ IP Address XENAX®

9.2 Test Connection with >PING

PING command in DOS window

IP address is provided on the back side of XENAX®.
If no response, check direct connection with crossed RJ45 cable.

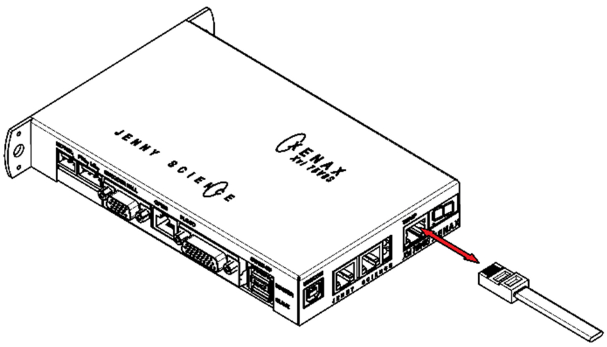
9.3 Close Port 10001



If the port 10001 is not closed correctly it can stay open. In this case, it is no longer possible to connect to this port with a new TCP/IP connection

There are 3 options for closing the port again.

Disconnect the Ethernet cable directly on the Xenax and the port will be closed automatically.



Open a second TCP/IP connection over the port 9999 and send a «ENPR» command. This will close the port 10001.
Note: Port 9999 can only be used for the "ENPR" command.

Set a timeout with the command „WD“ and specify the watch dog time in milliseconds. A <CR> must now be sent over port 10001 with the defined interval or the port will be closed automatically.

10 ASCII Protocol

Over Ethernet TCP/IP in the menu *move axis / by command line* in WebMotion®
or via the serial interface e.g. with hyper terminal.

The simple ASCII protocol works with the echo principle.
The sent characters come back as an echo and can be checked immediately.
Thus, if existing, you get a parameter value and finally the character prompt ">". If the command could not be
accepted then, it has a “?” character in the string.

Description	Command	[Parameter]	Echo command accepted
Write parameters:			
Power continues	PWC	<CR>	PWC <CR> <LF> >
Speed	SP	10-9’000’000 <CR>	SPxxxxxx<CR> <LF> >
Acceleration	AC	2'000-100'000’000 <CR>	ACxxxxxx<CR> <LF> >

Terminate a command with <CR> only, no additional <LF>.

Description	Command	[Parameter]	Echo command accepted
Read parameters:			
Tell Position	TP	<CR>	TP <CR> <LF> XXXXXXX<CR> <LF> >
Retrieve	e.g. AC?	<CR>	AC? <CR> <LF> XXX <CR> <LF> >
	SP?	<CR>	SP? <CR> <LF> XXX <CR> <LF> >

Echo command not recognized or cannot be completed in the current configuration
<command> <CR> <LF> ? <CR> <LF> >

Echo command cannot be accepted at this time
<command> <CR> <LF> #xx <CR> <LF> >

#-List

Nr.	Description
#01	Error in queue
#03	Drive is active
#05	Program is active
#13	EE1 in queue
#14	EE in queue
#15	Force Calibration active
#27	I Force Drift Compensation active
#34	Rotary reference active
#36	Gantry reference active
#38	Reference active
#40	Command at active bus module not allowed
#47	Fault reaction active (f.e. stop ramp)
#49	No JSC Motor detected
#65	Value of parameter not valid
#66	Command not completed correctly (>5s between ASCII-signs)

Note for sequential commands:
Terminate a command with <CR> only, no additional <LF>. Do not send a new command until you have received the prompt character „>“ before.

10.1 ASCII Protocol TCP/IP

In TCP/IP the cohesive ASCII sequences can be splitted into different telegram packages. This is why a separate receive buffer has to be considered.

Socket receive	Buffer	ASCII Answer
TP4500 CR LF > **TM**	**TM**	TP4500
C2300 CR LF >		**TM**C2300

10.2 Asynchronous Messages (Events)

To reduce response time, status or PLC input modifications of the PLC interface can be sent automatically (events). Therefore it is not necessary to poll the status or inputs permanently.

Enable Events

Events disabled, default	EVT0
Events enabled generally	EVT1

Status modifications / Reference Event

Will be sent in case of generally activated events.

Power OFF	@S0
Power ON / Halt	@S1
In motion	@S2
Error	@S9
Reference finished	@H

PLC Input

In addition to the status modifications, changes of the PLC inputs can also trigger events. Prerequisite for this is that Events is activated (EVT1) and ETI (Event Track Input) is selected.

Inputs are selectable with ETI (Event Track Input)

Enable event of input 1..12	ETI1..C
Enable all input events	ETI0

Disable event of PLC input with DTI (Disable Track Input).

Disable event for input 1..12	DTI1..C
Disable all input events	DTI0

Structure of input events @Ixyz
with xyz as half bytes in Hexadecimal notation and
shows the physical state of the inputs.

PLC I/O pin no.	16	15	14	13	24	23	22	21	20	19	18	17
INPUT no.	12	11	10	9	8	7	6	5	4	3	2	1
Example input bits after modification	1	0	1	1	0	0	1	0	1	1	0	1
Event general @I	x				y				z			
Example Event @I	"B"				"2"				"D"			

Default Settings after Power ON
After power on of XENAX® servo controller or application download, default settings are active again:

Events OFF
PLC Input Events OFF

11 WebMotion®

WebMotion® is an integrated graphic user interface (website), located in XENAX®.
It is loaded and activated over a web browser (Internet Explorer >= 8.0, Chrome, Firefox, Opera, …).

Note:
Please make sure that zoom-settings of the browser window are at 100% (original size). Otherwise the WebMotion® display is affected.

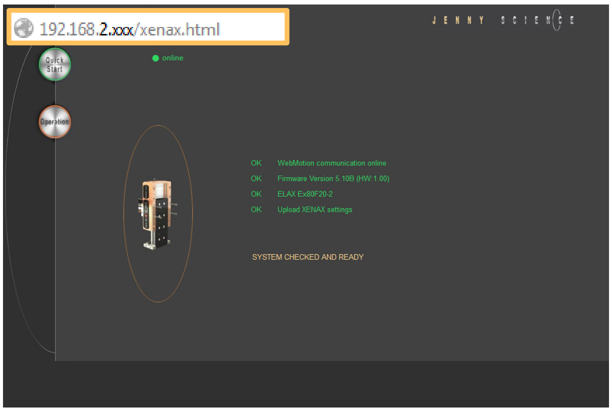
Consult also the TUTORIAL Video
Tutorial 1: Startup with web browser
On our website. Within 5 minutes you are able to start any of our linear motor or rotativ axis and control them simply by using your Webbrowser.

11.1 Start WebMotion®

Start your web browser with the IP address number of your XENAX® and add "/xenax.html" as a suffix.

IP address is provided on the back side of the XENAX®.

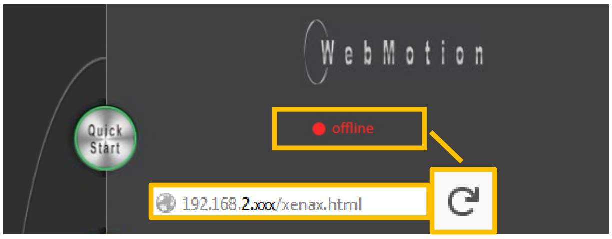
Example:
http://192.168.2.xxx/xenax.html



XENAX® is being started with an automatic system self-check including type designation and version information on firmware and hardware. Moreover, WebMotion® identifies the connected linear motor or rotary motor and uploads the current XENAX® settings (parameters, programs) in to the WebMotion®.

Interruption of TCP/IP Connection

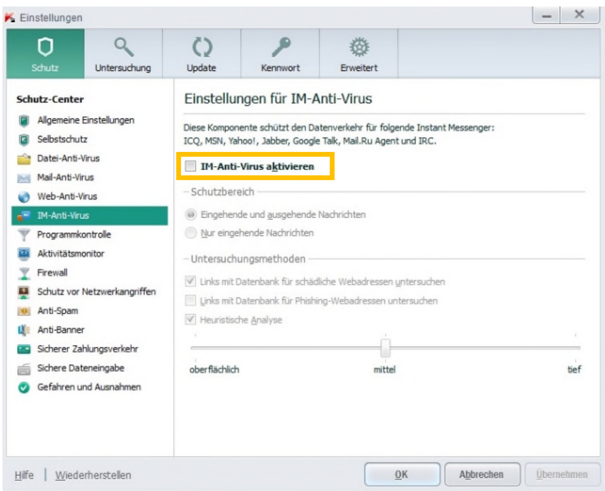
If the XENAX® logic supply is interrupted or if the Ethernet cable is disconnected, the TCP/IP interruption will be detected by WebMotion® and signaled with "offline". After removing the cause of the offline-mode, the TCP/IP connection has to be reloaded by updating the current web browser window.



If it is still blocked, it is recommended to first exit and then restarts the web browser.

11.1.1 Error „Upload XENAX® Settings"

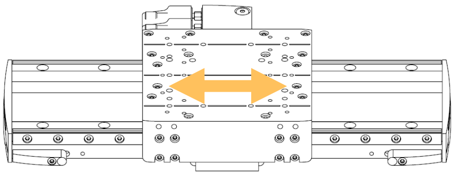
The settings in Kaspersky Internet Security might be responsible if the error code „Error Upload XENAX Settings" occurs with the automatic self-check of WebMotion®.
If you are using Kaspersky or similar internet security software, the security for Instant Messenger Services has to be deactivated.
(Refer example in Kaspersky *Pure 3.0)*



11.2 Quick Start (only with LINAX® and ELAX® linear motor axes)

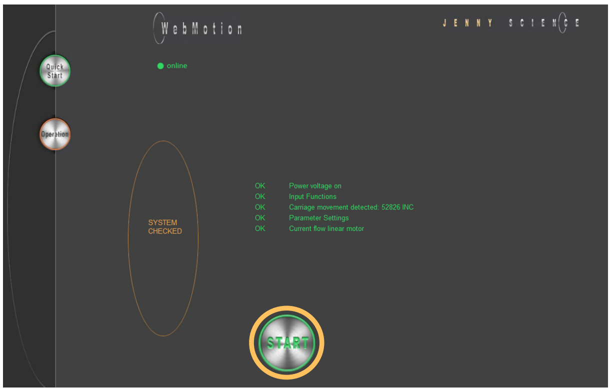
The Quick Start function allows the user to setup the LINAX® or ELAX® linear motor axis with the XENAX® controller simply immediately after receipt of the components.
It is completed per mouse click, without parameter settings and without an instruction manual.
By pressing the Quick Start button, a system check is automatically started including the following tests: Cable connections, power voltage, input functions, functionality of the measuring system, parameter settings and current flow of the linear motor.

In order to test the functionality of the measuring systems the system asks you to move the slider of the LINAX® linear motor axis of a distance of at least 20mm back and forth.

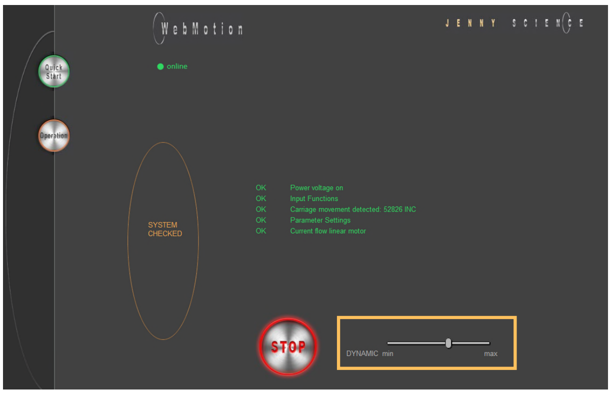


With the START the LINAX® or ELAX® linear motor will be referenced automatically and will then move the distance back and forth that was indicated manually by hand before.

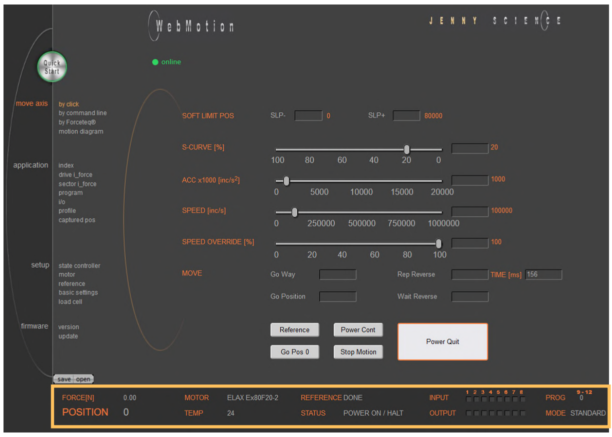
For the Quick Start Function it is recommended to operate the linear motor axis in horizontal orientation without a payload.



The dynamics can dynamics be adjusted with the slider “DYNAMIC”.



11.3 Operation, Status Line



The status line on the lower edge of WebMotion® gives an overview of the current condition of XENAX® and the connected motor at any time. These data cannot be changed and are for the user's information only.

FORCE[N]
Shows the current measured Force in [N] when a Signateq® is connected.

POSITION
After referencing, this indicates the absolute position of the motor in increments of the measuring system. Standard for LINAX®/ ELAX® linear motors is 1Increment = 1µm.

MOTOR
Automatic identification of the connected LINAX®/ ELAX® / ROTAX® motor axis. If a third-party rotary motor is connected, "ROTATIVE" is displayed.

TEMP
Shows the current temperature of the coils in the LINAX® / ELAX® / ROTAX® motors, which is detected by a sensor. This measuring function is not possible for rotary servo motors. The temperature observation for servo motors is done by an I^2T calculation. For LINAX®/ ELAX® / ROTAX® motors the I^2T observation is performed in addition to the motor temperature measurement.

REFERENCE
The reference is a condition to start the LINAX®/ELAX® linear motor axes. This is also how the precise current commutation is being calculated.
PENDING = Reference outstanding
DONE = Reference completed

STATUS
POWER OFF = off
POWER ON / HALT = On, Motor is not moving
IN MOTION = Motor is in motion
ERROR XX = error number, with a button that details the error and shows error history.

INPUT
Physical state of the input 1-8 directly and the input 9-12 binary coded.

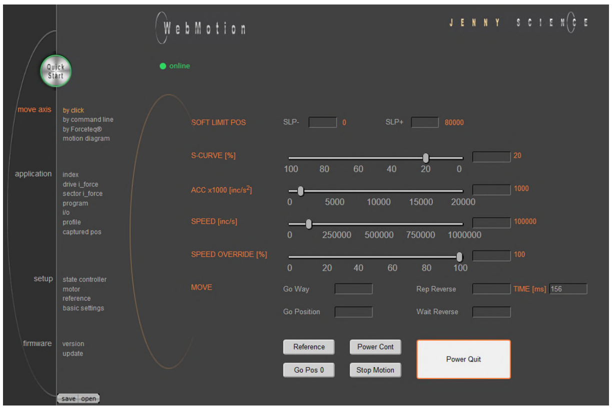
OUTPUT
Physical state of output 1-8
(Modification under menu *application / I/O*)

PROG
Program number, binary coded from inputs 9-12. For this binary coded program selection, the MODE has to be set on higher or equal 10, while input 8 is the trigger for program start.

MODE
Displays the operating mode:
0=Standard Servo
1 = El. Gera mechanism over second encoder
2 = Pulse/Dir, stepper emulation
10 = Coded Prog No Standard
12 = Coded Prog no for Stepper Controlled

11.4 Move Axis by Click

11.4.1 Move Axis by Click for LINAX®/ELAX® Linear Motors



Simple online control for setup and test of the linear motor axes.

The orange values behind the empty fields show the current registered values in XENAX®. New values can be entered in the empty fields and registered with <Enter>. These parameters will overwrite the existing values and will be registered directly in the XENAX® servo controller.

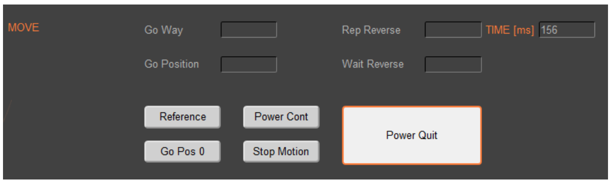
SOFT LIMIT POS
Software Limit Position, setting of an individual motion range in increments.
SLP- = position counter lower values
SLP+ = position counter upper values
Both values 0 = No limit (limit is the stroke of the connected linear motor)

S-CURVE %
Percentage S-curve rounding of the internal motion profile, e.g. in an INDEX, generally for all motion profiles. Automatic calculation of jerk (changing of acceleration per time unit inc/ s^3)

ACC *1'000
Acceleration in inc/s^2 multiplied with a factor of 1'000

SPEED
Speed in Inc/s

SP OVERRIDE %
Override of the set speed and acceleration of a motion profile, for example for process deceleration or set up mode.



Go Way (REL)
Input of the distance relative to the present position in increments. Sta rt with <Enter>.

Go Position (ABS)
Input of the position absolute to the zero point in increments. Start with <Enter>.

Rep Reverse
Endless automatic motion back and forth.
Input of the way relative to the present position in increments. Start with <Enter>.
While running, the motors parameters such as acceleration, speed, and wait time can be adjusted online.
Stop the back and forth movement with “Stop Motion”.

Wait Reverse
Wait time at reversal point of rep reverse in units of 1 milliseconds. Start with <Enter>.

TIME (ms)
Time of the last profile drive in milliseconds.

Reference
Reference-drive (>REF)
Executes the reference-drive to calculate the absolute position.
Run this function once after switching on the power.

Go Pos 0
(>G0) Go to position 0.

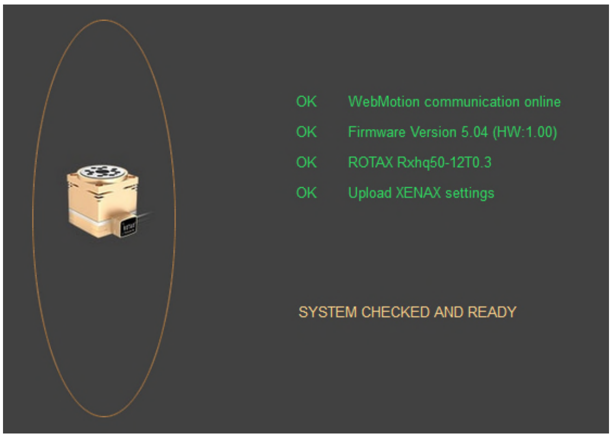
Power Cont
Power continues (>PWC)
Turning on the power stage with taking over the most recent absolute position and **without the need of referencing the linear motor, e.g. after error 50 or after “Power Quit”.** This is only possible as long as the logic supply has not been interrupted after the linear motor was referenced.

Stop Motion
Stops the motion under control of deceleration ramp.

Power Quit
Power stage without power, the linear motor is movable by hand. Acknowledge error.

11.4.2 Move Axis by Click for ROTAX® Rotary Motor or Third Party Motors

The XENAX® Servo Controller automatically recognizes the ROTAX® rotay motor.

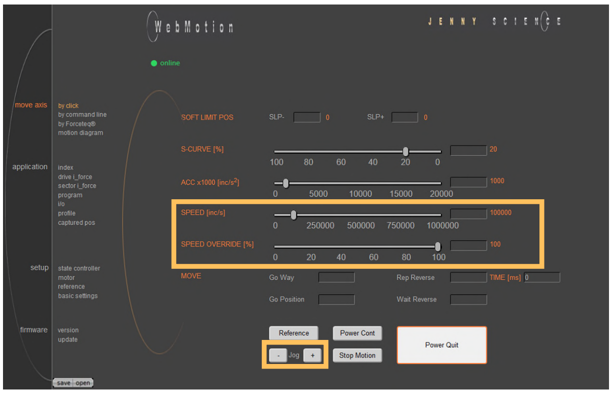


If the XENAX® servo controller does not recognize a LINAX® or ELAX® linear motor axis or a ROTAX® rotary axis, XENAX® assumes a connection with third party motor. Instead of “Go Pos 0“ WebMotion® offers Jog + und Jog – functions.

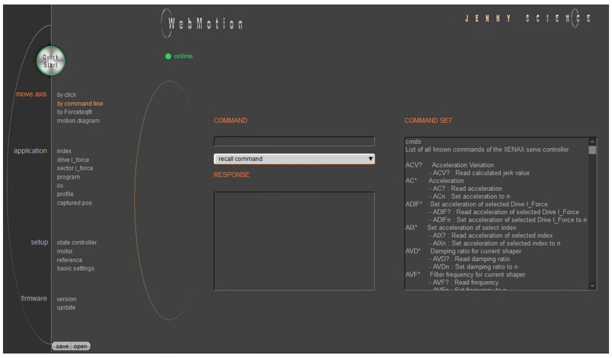
Jog -
Runs the motor in negative direction until the command “Stop Motion” stops the motor.

Jog +
Runs the motor in positive direction until the command “Stop Motion” stops the motor.

While the motor is running with Jog, the dynamics SP OVERRIDE or SPEED can be adjusted online.



11.5 Move Axis by Command Line



The XENAX® can directly be controlled by a ASCII command set.

COMMAND
Transmits an ASCII command with <Enter>. Under “Recall commands“ the activated commands are saved and can be reactivated by mouse click

RESPONSE
shows received characters by WebMotion®.

COMMAND SET
Lists all ASCII commands, recognized by XENAX®.

11.6 ASCII Command Set for XENAX®

Using the simple ASCII command [+PARAMETER] set, all XENAX® Servo controller functions can be activated with an extremely short reaction time.

Information about the tables:
[1]) *Diagnosis and test functions*
? Query of the programmed value

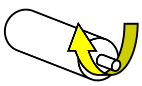
11.6.1 Power / Reset

DESCRIPTION	Short	CMD	PARAMETER
Power ON incl. reset encoder counter	Power	**PW**	
Power ON continue, keep encoder counter	Power continue	**PWC**	
Power OFF servo amplifier	Power quit	**PQ**	
Reset setup parameters to default values	Reset	**RES**	
Reset motor parameters to default values for the currently connected motor (other parameters remain unchanged)	Reset Motor	**RESM**	
Clear actual position counter, (not possible with LINAX®/ ELAX®, with ROTAX® only possible if it is not referenced)	Clear position to 0	**CLPO**	
Deactivate blocking by unconfigured SMU (until next power-cycle)	Disable Motion blocked by unconfigured SMU	**DMBUS**	

11.6.2 Basic Settings

DESCRIPTION	Short	CMD	PARAMETER
Set up of MODE (Operating) Important! In case of changing this value, the servo amplifier must be in state POWER OFF (>PQ)..	Mode	**MD**	0, 1, 2, 10, 12 / ?
Inc. per pulse, pulse/direction control	Inc per Pulse	**ICP**	0-50
Synchronous ratio for electronic gear	Synchronous Ratio	**SR**	± 1-1'000 : 10
Set CI (query), CANopen Node ID, Powerlink Node ID, Remote ID in Master/Slave Configuration	Card Identifier	**CI**	0-255 / ?
Card Identifier of Gantry Slave	Gantry Slave Identifier	**GSID**	1 - 3
Identification string max 32 characters free for user	Servo controller ident.	**SID**	string / ?
Automatic detection of motor manufacturer (Jenny Science or Third Party Motor) or set motor manufacturer MM0 = AutoDetection (Default setting) MM1 = Jenny Science Motor MM2 = Third Party Motor	Motor Manufacturer	**MM**	0 – 2 / ?

11.6.3 Motor Settings

DESCRIPTION	Short	CMD	PARAMETER
Max. motor current nominal [x10mA]	I stop	**IS**	10-2’000 / ?
Max. motor current peak [x10mA]	I run	**IR**	10-2’000 / ?
Pole-pair number of motor	Pole pair	**POL**	0-100 / ?
Number of encoder increments per revolution	Encoder	**ENC**	10-10'000'000 / ?
Direction of phase control (u,v,w or v,u,w)	Phase Direction	**PHD**	0,1 / ?
Detection of phase control sequence. By rotating the motor clockwise, 0 or 1 appears. Parameter can be used to enter the phase control (PHD).  If “?” appears, the Dip-switch is set to linear in the XENAX® servo controller or the hall wiring is wrong.	Phase Direction Detection	**PHDD**	?
Correction of the electrical angle at new adjustment of coils to magnets.	Phase Offset	**PHO**	0-359 / ?
Force constant of the motor for LINAX®/ELAX® in [mN/A], torque constant for rotary motors in [µNm/A]	Force Constant Motor	**FCM**	0-100‘000‘000 / ?
Resistance phase to phase of the motor in [mΩ]	Phase to Phase Resistance	**RPH**	0-100‘000 / ?
Inductance phase to phase of the motor in [µH]	Phase to Phase Inductance	**LPH**	0-100‘000 / ?
Gear ration of rotary Jenny Science motors (ROTAX)	Gear Ratio	**GR**	?

11.6.4 Controller Settings

DESCRIPTION	Short	CMD	PARAMETER
Payload “PAYLOAD” [g] or moment of inertia „INERTIA“ [x10^{-9} kgm^2]	Mass Load	**ML**	0-100’000’000 / ?
Bandwidth position controller “GAIN POS”	Bandwidth Position	**BWP**	1-5’000 / ?
Bandwidth current controller “GAIN CUR”	Bandwidth Current	**BWC**	5-5’000 / ?

Notch-Current filter frequency “Avoid Vibration FREQ NOTCH”	Filter Frequency Current	**FFC**	0-, 160-2’000 / ?
Notch-Current filter quality factor	Filter Quality Current	**FQC**	500–100’000 / ?
Active-Current filter frequency “Avoid Vibration FREQ ACTIVE”	Avoid Vibration Frequency	**AVF**	0-, 200-2'000 / ?
Damping coefficient settings in % of Active-Current filter	Avoid Vibration Damping	**AVD**	1-50 / ?
Max. position deviation in increments “Deviation POS ACT”	Deviation Position	**DP**	1-1’000’000 / ?
Permissible target point deviation “Deviation TARGET”	Deviation Target Pos.	**DTP**	1-10‘000 / ?
Dwell time [ms] in the "Deviation Target Pos" window for the PSR Bit "IN POSITION" and statusword Bit "Target Position Reached".	Position Window Time	**PWT**	0-1000 / ?
Speed filter frequency	Filter Frequency Speed	**FFS**	0-, 160-2’000 / ?
Speed filter quality factor	Filter Quality Speed	**FQS**	500–100’000 / ?
Restore controller settings to behaviour smaller or equal to firmware V4.04D	Enhanced Bandwidth Mode Disable	**EBMD**	0–1 / ?
Controller Stability Settings “STAB – DYN”	Pole Placement Stability Dynamic	**PPSD**	± 50 / ?
Damping coefficient settings in % for swing out time reduction	Swing Out Reduction Damping	**SORD**	0-50 / ?
Frequency settings in 0.1Hz (21 => 2.1Hz) for swing out time reduction	Swing Out Reduction Frequency	**SORF**	0-, 20-1000 / ?

11.6.5 Motion Settings

DESCRIPTION	Short	CMD	PARAMETER
Position rated absolute, Inc	Position	**PO**	± 2'000'000'000 / ?
Position soll (absolute) increment, initial value after powerup	Position Initial Value	**POI**	± 2'000'000'000 / ?
Way relative, encoder increment	Way	**WA**	± 2'000'000'000 / ?
Way (relative) encoder Inkrement, initial value after powerup	Way Initial Value	**WAI**	± 2'000'000'000 / ?
Speed Inc/s (encoder counter)	Speed	**SP**	10-9’000’000 / ?
Speed Inc/s (encoder counter) , initial value after powerup	Speed Initial Value	**SPI**	10-9’000'000 / ?
Acceleration Inc/s² (encoder counter)	Acceleration	**AC**	2'000-1‘000'000'000 / ?
Acceleration Inc/s² (encoder counter) , initial value after powerup	Acceleration Initial Value	**ACI**	2'000-1‘000'000'000 / ?
Emergency Deceleration Inc/ s² (e.g. for input function EE/EE, for errors, if driving in limit switch or soft limit etc.) If necessary, the emergency deceleration can be adjusted during operation if there is an emergency deceleration of >1s ➔ In case of emergency the deceleration is always <1s	Emergency Deceleration	**ED**	10’000-1‘000'000'000 / ?
Override, scaling from the Acceleration and Speed	Override	**OVRD**	1-100 / ?
Override, scaling from the Acceleration and Speed, initial value after powerup	Override Initial Value	**OVRDI**	1-100 / ?
Percentage S-Curve rounding. Calculation of jerk parameter automatically.	S-Curve	**SCRV**	1-100 / ?
Percentage S-Curve rounding. Calculation of jerk parameter automatically, initial value after powerup.	S-Curve Initial Value	**SCRVI**	1-100 / ?
Jerk of trajectory [x1000Inc/s³] of the completed drive	Acceleration Variation (Jerk), Read only	**ACV**	?
Movement range limitation within soft limit negative	Soft Limit Position Negative	**SLPN** (Old: LL)	Linear: 0 - <stroke> / ? Rotativ: 2^{-31} - 2^{31} / ?
Movement range limitation within soft limit positive	Soft Limit Position Positive	**SLPP** (old: LR)	Linear: 0 - <stroke> / ? Rotativ: 2^{-31} - 2^{31} / ?

11.6.6 Reference LINAX® / ELAX®

DESCRIPTION	Short	CMD	PARAMETER
Home linear motor axis encoder	Reference	**REF**	
Start direction REF function 0 = positive, 1 = negative 2 = Gantry REF positive, motors same direction 3 = Gantry REF negative, motors same direction 4 = Gantry REF positive, motors reverse direction 5 = Gantry REF negative, motors reverse direction	Direction REF	**DRHR**	0-5 / ?

11.6.7 Reference Gantry

DESCRIPTION	Short	CMD	PARAMETER
Card Identifier of Gantry Slave set in the Master Control	Gantry Slave Identifier	**GSID**	1-3 / ?
Set CI (query), CANopen Node ID, Powerlink Node ID, Remote ID in Master/Slave Configuration	Card Identifier	**CI**	0-255 / ?
Home linear motor axis encoder	Reference	**REF**	
Start direction REF function 0 = positive, 1 = negative 2 = Gantry REF positive, motors same direction 3 = Gantry REF negative, motors same direction 4 = Gantry REF positive, motors reverse direction 5 = Gantry REF negative, motors reverse direction	Direction REF	**DRHR**	0-5 / ?
Gantry Master Slave offset selection 0 = Use automatically determined value (DGMSO) 1 = User defined value (PGMSO)	Enable Gantry Master/Slave Offset	**EGMSO**	0-1 / ?
Responds the automatically detected Gantry Master Salve Offset. This value is used when EGMSO = 0	Detected Gantry Master Slave Offset	**DGMSO**	?
Value of the gantry master slave offset if EGMSO = 1. This value can be used to correct the rectangularity of the gantry setup. Changes are corrected directly in the slave and the rectangularity can thus be checked with a dial gauge.	Preset Gantry Master Slave Offset	**PGMSO**	± 2'000'000'000 / ?

11.6.8 Reference Rotary Motors

DESCRIPTION	Short	CMD	PARAMETER
Home function according to program	Reference	**REF**	
Direction of motor rotation to seek external coarse sensor, 1 = CW, 2 = CCW	Dir Home	**DRH**	1-2 / ?
Speed for seeking external sensor in [inc/s] If there is no external sensor, then set SPH = 0	Speed Home	**SPH**	0-250'000 / ?
Input number for external Home Sensor 0 = None, 1-8 = Input Number	Input Home	**INH**	0-8 / ?
Rotary direction of motor for seeking z-mark on encoder, 1 = CW, 2 = CCW 3 = shortest way (for ROTAX® Rxvp only)	Dir Z-Mark	**DRZ**	1-3 / ?

Speed for seeking z-mark in [inc/s] If there is no z-mark on the encoder, set SPZ = 0 (ROTAX® Rxvp 10-100'000))	Speed Z-Mark	**SPZ**	0-100'000 / ?
Position of Z-mark in reference to internal home sensor of ROTAX® Rxvp. Will be saved after first reference and remains from then on unchanged. With RXZP0 this value can be deleted and ROTAX® Rxvp will be set to default at time of delivery.	Rotax Z-Mark Position	**RXZP**	0 / ?
Kind of position determination when referencing with absolute measuring systems. The position is always reset to the single-turn position by the referencing. 0 = Calculated determination (default) 1 = Position is read out by the measuring system Reading from the measuring system (setting 1) can lead to the Safety Limited Speed being exceeded if SLS is active.	Enable Absolute Reference	**ENAR**	0-1 / ?
Retains the multiturn position after a reboot. If the position change exceeds the set tolerance, error 53 is displayed. 0 = Deactivated (default) > 0 = Activated with tolerance	Virtual Multiturn Absolute Encoder	**VMTAE**	0 - <Inc per Rev / 2>

11.6.9 Move Commands

DESCRIPTION	Short	CMD	PARAMETER
Go direct to rated position absolute, Inc	Go direct Position	**G**	± 2'000'000'000
Go to position absolute	Go Position	**GP**	(Position = PO value)
Go way relative	Go Way	**GW**	(Way = WA value)
Go to zero-mark on encoder disk	Go Z-Mark	**GZ**	
Jog (run) positive, v = constant	Jog Positive	**JP**	(Speed = SP value)
Jog (run) negative, v = constant	Jog Negative	**JN**	(Speed = SP value)
Repeat way (command WA) positive <-> negative xx times	*Repeat Reverse*	***RR[1])***	*1-100'000 (Way = WA value)*
Repeat way (command WA) in same direction xx times	*Repeat Way*	***RW[1])***	*1-100'000 (Way = WA value)*
Waiting [ms] time on command RR and RW	*Wait Repeat*	***WT[1])***	*1-10'000*
Waiting [ms] time for command RR and RW, initial value after powerup	*Wait Repeat Initial Value*	***WTI[1])***	*1-10'000*
Run index number	Index	**IX**	1-50
Run profile	Profile	**PRF**	1-5
Move DRIVE I_FORCE No. xx	Drive I Force	**DIF**	xx
Move DRIVE Force No. xx (available with Forceteq® pro)	Drive Force	**DF**	xx
Stop program and motion with deceleration	Stop Motion	**SM**	

11.6.10 Index (programmed movements)

DESCRIPTION	Short	CMD	PARAMETER
Run index number	Index	**IX**	1-50
Number of index pre-load for changing index parameters by remote control	Number Index	**NIX**	1-50
Acceleration write in Index at the NIX preloaded number (stored in non-volatile memory, still effective after power cycle)	Accel. Index	**AIX**	2-1‘000'000 (x1000) Inc/s²
Acceleration write in Index at the NIX preloaded number (not stored in non-volatile memory, only effective until the next power cycle)	Accel. Index Dynamic	**AIXD**	2-1‘000'000 (x1000) Inc/s²
Speed write in Index at the NIX preloaded number (stored in non-volatile memory, still effective after power cycle)	Speed Index	**SIX**	10-10'000'000 Inc/s
Speed write in Index at the NIX preloaded number (not stored in non-volatile memory, only effective until the next power cycle)	Speed Index Dynamic	**SIXD**	10-10'000'000 Inc/s
Distance write in Index at the NIX preloaded number (stored in non-volatile memory, still effective after power cycle)	Distance Index	**DIX**	± 2'000'000'000 Increment
Distance write in Index at the NIX preloaded number (not stored in non-volatile memory, only effective until the next power cycle)	Distance Index Dynamic	**DIXD**	± 2'000'000'000 Increment
Save index type in index for the preselected number with NIX (1 = absolute, 2 = relative) (stored in non-volatile memory, still effective after power cycle)	Type of Index	**TYIX**	1,2 / ?
Save index type in index for the preselected number with NIX (1 = absolute, 2 = relative) (not stored in non-volatile memory, only effective until the next power cycle)	Type of Index Dynamic	**TYIXD**	1,2 / ?

11.6.11 Program / Application

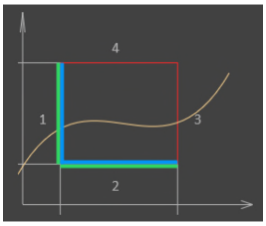
DESCRIPTION	Short	CMD	PARAMETER
Run program number	Program	**PG**	1-63
0 = Program 1..15 max. 50 program lines, Program 16..63 max. 10 program lines 1 = Program 1..5 max. 130 program lines, Program 6..63 max 10 program lines **Important:** Changes of PMAP parameter clears entire program memory	Program Mapping	**PMAP**	0,1 / ?
Save Application (incl. parameters) to Start-up Key	Save to Start-up Key	**SVST**	

11.6.12 Force Control Forceteq® basic

DESCRIPTION	Short	CMD	PARAMETER
Force Calibration is started with distance parameter. Value from 1 to 10'000'000 = Distance in Inc. of the scan run. ? = Returns whether scanned values are available 0 = Force Calibration delete scanned values The Force Calibration works iteratively and improves itself in repeated execution. If the motor oscillates during the Force Calibration, then wrong values are stored and the oscillation increases. In this case, the scanned values must be deleted with FC0 before starting a new Force Calibration. In the libraries for the operation with bus module, there exists an input "Iterative FC disable" in the function block JS_MC_ForceCalibration for this case. **Important:** **Force Calibration scan drive will begin at current position**	Force Calibration	**FC**	0-< stroke LINAX®/ELAX® or way ROTAX® / ?
Test function to check Force Calibration effect through manual movement of the carriage slider. 2 = Test Force Calibration On (without active compensation) 1 = Test Force Calibration (with active compensation) 0 = Test Force Calibration off (Servo holds position)	Force Calibration Test	**FCT**	0,1,2 /?
Request Status of Force Calibration: 0 = No Force Calibration scan values available 1 = Force Calibration scan values available	Force Calibration Valid	**FCV**	xx / ?
Automatic I_Force Drift Compensation Drive in positive direction	I_Force Drift Compensation Positive	**IFDCP**	
Automatic I_Force Drift Compensation Drive in negative direction	I_Force Drift Compensation Negative	**IFDCN**	
I_Force Drift Compensation Settings, bitwise coded: Bit0: Continuous compensation at disabled power stage Bit1: Automatic compensation before force calibration Bit2: Continuous compensation at enabled power stage at applicable position (see command PIFDC)	I_Force Drift Compensation Settings	**IFDCS**	0-7 / ?
Position for I_Force Drift Compensation at enabled power stage, depending on the motor type	Position I_Force Drift Compensation	**PIFDC**	?
Maximal approved force-proportional current [x10mA] 0 = Deactivated → As soon as the max. approved current has been hit, info „30“ is being activated and can be retrieved over Process Status registry **Bit 15 „I_FORCE_ LIMIT_REACHED“ with command TPSR** (Refer to chapter 11.6.19 System Information)	Limit I_Force	**LIF**	0 – value of “I run” / ?
Change Limit DR_I_FORCE to xx x 10mA value xx will overwrite the current parameter DR_I_Force, until DRIVE I_FORCE END	Change Limit I Force	**CLIF**	xx
Driving with limited force until reaching an object or the end position if there is no object. xx= [1-10] No. of the selected Drive I_Force parameter set	Drive I_Force	**DIF**	xx
Force-proportional, actual current-value filtered [mA]	I Force Actual	**IFA**	
Actual motor current [mA]	Tell motor current	**TMC**	

Select sectors which should be active. E.g. xx = 100110-> active are the sectors 2,3,6 Binary from right side LSB (binary notation, LSB = sector 1)	Select Sectors	**SSEC**	xx / ?
Reads I_FORCE peak value [x1mA] xx=not defined-> Max peak value over all sectors xx=n-> peak value of sector n	I Force Peak	**IFPK**	xx
shows the active sectors which force curve did not correctly pass through E.g. xx = 1001->Error in sector 1 and 4. (binary notation, LSB = sector 1)	Sector I_Force Curve Failed	**SIFF**	xx / ?
Is taking current actual position as an offset for all sectors with restart of monitoring. Furthermore the positions „Wait for distance greater/less“ and „Jump if distance greater/less“ are adjusted by this offset.	Take Position as Sector Offset	**TPSO**	
Provide offset for all sectors with restart of monitoring. xx = [Inc] offset Furthermore the positions „Wait for distance greater/less“ and „Jump if distance greater/less“ are adjusted by this offset xx. E.g. xx = 0, sets offset to 0	Set Sector Offset	**SSO**	xx / ?
Selecting sector number for which parameters shall be changed. xx = [1-10] Sector number, NSEC? = Retrieving the selected sector number.	Number of Sector for change parameter	**NSEC**	xx / ?
Sector start distance. xx = [Inc] starting distance (current position – sector offset)	Sector I Force Start	**SIFS**	xx / ?
Sector end distance. xx = [Inc] ending distance (current position – sector offset)	Sector I Force End	**SIFE**	xx / ?
Lowest value I_Force in pre-selected sector. xx [x10mA]	I Force High	**IFH**	xx / ?
Highest value I_Force in pre-selected sector. xx [x10mA]	I Force Low	**IFL**	xx / ?
Definition of transitions **Entry** and **Exit** in sector xx = activated transition 1,2,3,4 Entry/Exit	Sector Transition Configuration Decimal	**STC**	xx / ?
	Sector Transition Configuration Hexadecimal	**STCX**	xx / ?

Bit 15..12	11..8	7..4	3..0	xx
Entry	not used	**Exit**	not used	
4 3 2 **1**	0	4 3 **2** 1	0	Transition.
0 0 0 **1**	0 0 0 0	**0 0 1 0**	0 0 0 0	bin
1	0	2	0	hex
4128				dec



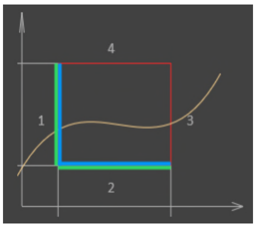
Selecting Drive I_Force number in which parameters shall be changed. xx= Drive I_Force number 1-10. NDIF? = Retrieving selected sector number	Number of Drive I_Force to change parameter	**NDIF**	xx / ?
Acceleration for Drive I_Force xx [x1‘000 inc/s²]	Acceleration of selected Drive I_Force	**ADIF**	xx / ?
Speed for Drive I_Force in [inc/s]	Speed of selected Drive I_Force	**SDIF**	10-10'000'000 / ?
Limitation of I-Force current while Drive I_Force [x10mA]	I_Force Limit of selected Drive I_Force	**IDIF**	0-2000 / ?
Direction Drive I_Force xx = 0 ->positive, xx =1 -> negative	Direction of selected Drive I_Force	**DDIF**	xx / ?

11.6.13 Force Control Forceteq® pro

DESCRIPTION	Short	CMD	PARAMETER
Tare function Signateq® measuring amplifier 0 = Clears tare value, force is displayed with offset 1 = Sets the currently measured force at the Signateq® to 0 ? = Returns the offset value (tare)	Clear Force Offset	**CLFO**	0,1 / ?
Set up of Forceteq® Mode 0 = Motor current (Forceteq® basic) 1 = Force sensor Standard-Mode (Forceteq® pro) 2 = Force sensor Elastic-Mode (Forceteq® pro)	Forceteq Mode	**FTM**	0-2 / ?
Bandwidth Force controller	Bandwidth Forceteq pro	**BWFP**	1-1000 / ?
Spring constant from the workpiece (often string or tape) for the Forceteq-Mode 2	Forceteq Pro Elastic Spring Constant	**FTPES**	1-10'000'000 / ?
Force Calibration is started with distance parameter. Value from 1 to 10'000'000 = Distance in Inc. of the scan run. ? = Returns whether scanned values are available 0 = Force Calibration delete scanned values The Force Calibration works iteratively and improves itself in repeated execution. If the motor oscillates during the Force Calibration, then wrong values are stored and the oscillation increases. In this case, the scanned values must be deleted with FC0 before starting a new Force Calibration. In the libraries for the operation with bus module, there exists an input "Iterative FC disable" in the function block JS_MC_ForceCalibration for this case. **Important:** **Force Calibration scan drive will begin at current position**	Force Calibration	**FC**	0-< stroke LINAX®/ELAX® or way ROTAX® / ?
Test function to check Force Calibration effect through manual movement of the carriage slider. 2 = Test Force Calibration On (without active compensation) 1 = Test Force Calibration (with active compensation) 0 = Test Force Calibration off (Servo holds position)	Force Calibration Test	**FCT**	0,1,2 / ?
Request Status of Force Calibration: 0 = No Force Calibration scan values available 1 = Force Calibration scan values available	Force Calibration Valid	**FCV**	xx / ?
Maximal approved force [mN] 0 = Deactivated → As soon as the max. approved current has been hit, info „31“ is being activated and can be retrieved over Process Status registry **Bit 27 „FORCE_ LIMIT_REACHED“ with command TPSR** (Refer to chapter 11.6.19 System Information)	Limit Force	**LF**	0 – 200'000 / ?
Change Limit DR_FORCE to xx [mN] value xx will overwrite the current parameter DR_Force, until DRIVE FORCE END	Change Limit Force	**CLF**	xx
Driving with limited force until reaching an object or the end position if there is no object. xx= [1-10] No. of the selected Drive Force parameter set	Drive Force	**DF**	xx
Returns the current force applied to the load cell [mN]	Tell Force	**TF**	

Select sectors which should be active. E.g. xx = 100110-> active are the sectors 2,3,6 Binary from right side LSB (binary notation, LSB = sector 1)	Select Sectors	**SSEC**	xx / ?
Reads FORCE peak value [mN] xx=not defined-> Max peak value over all sectors xx=n-> peak value of sector n	Force Peak	**FPK**	xx
Shows the active sectors which force curve did not correctly pass through E.g. xx = 1001->Error in sector 1 and 4. (binary notation, LSB = sector 1)	Sector Force Curve Failed	**SFF**	xx / ?
Is taking current actual position as an offset for all sectors with restart of monitoring. Furthermore the positions „Wait for distance greater/less“ and „Jump if distance greater/less“ are adjusted by this offset.	Take Position as Sector Offset	**TPSO**	
Provide offset for all sectors with restart of monitoring. xx = [Inc] offset Furthermore the positions „Wait for distance greater/less“ and „Jump if distance greater/less“ are adjusted by this offset xx. E.g. xx = 0, sets offset to 0	Set Sector Offset	**SSO**	xx / ?
Selecting sector number for which parameters shall be changed. xx = [1-10] Sector number, NSEC? = Retrieving the selected sector number.	Number of Sector for change parameter	**NSEC**	xx / ?
Sector start distance. xx = [Inc] starting distance (current position – sector offset)	Sector Force Start	**SFS**	xx / ?
Sector end distance. xx = [Inc] ending distance (current position – sector offset)	Sector Force End	**SFE**	xx / ?
Lowest value Force in pre-selected sector. xx [mN]	Force High	**FH**	xx / ?
Highest value Force in pre-selected sector. xx [mN]	Force Low	**FL**	xx / ?
Definition of transitions **Entry** and **Exit** in sector xx = activated transition 1,2,3,4 Entry/Exit	Sector Transition Configuration Decimal	**STC**	xx / ?
	Sector Transition Configuration Hexadecimal	**STCX**	xx / ?

Bit 15..12	11..8	7..4	3..0	xx
Entry	not used	**Exit**	not used	
4 3 2 **1**	0	4 3 **2** 1	0	Transition.
0 0 0 **1**	0 0 0 0	**0 0 1 0**	0 0 0 0	bin
1	0	2	0	hex
4128				dec



Selecting Drive Force number in which parameters shall be changed. xx = Drive Force number 1-10 NDF? = Retrieving selected sector number	Number of Drive Force to change parameter	**NDF**	xx / ?
Acceleration for Drive Force xx [x1‘000 inc/s²]	Acceleration of selected Drive Force	**ADF**	xx / ?
Speed for Drive Force xx [inc/s]	Speed of selected Drive Force	**SDF**	xx / ?
Force limitation for Drive Force xx [mN]	Force Limit of selected Drive Force	**FDF**	xx / ?
Direction for Drive Force xx = 0 -> positive, xx = 1 -> negative	Direction of selected Drive Force	**DDF**	xx / ?

11.6.14 Signateq®

DESCRIPTION	Short	CMD	PARAMETER
Tare function Signateq® measuring amplifier 0 = Clears tare value, force is displayed with correction 1 = Sets the currently measured force at the Signateq® to 0 ? = Returns the offset value (tare)	Clear Force Offset	**CLFO**	0,1 / ?
Version number of installed Signateq® firmware	Signateq Version	**SQVER**	
Nominal force [mN] of the sensor according to datasheet	Signateq Sensor Nominal Force	**SQSNF**	0-200'000 / ?
Measuring range [mN] of the sensor, definable by user Force direction Compression = 0N… +xxx Force direction Compression /Tension = -xxx… +xxx Force direction Tension = -xxx… 0N	Signateq Measurement Range	**SQMRP**	0-200'000 / ?
Sensitivity [nV/V] of the sensor according to datasheet	Signateq Sensor Sensitivity	**SQSS**	0-25'000'000 / ?
Force direction 0 = Compression/Tension 1 = Compression 2 = Tension	Signateq Sensor Force Type	**SQSFT**	0-2 / ?
Bandwidth Force controller	Bandwidth Forceteq pro	**BWFP**	1-1000 / ?
Filter bandwidth of the Signateq® measuring amplifier	Signateq Bandwidth	**SQBW**	100, 200, 300, 500, 1000, 2000, 3000, 5000 / ?
0 = Factory calibration 1 = Custom calibration 2 = Test Report	Signateq calibration mode	**SQCM**	0-2 / ?
Bit0: Internal use Bit1: Custom calibration Bit2: Factory calibration	Signateq available calibration	**SQAC**	?
Direction of force control. Depends on the mechanical construction. If 0 (default), detection is made during the first drive with limited force into the force sensor after a power-up. 0 = Automatic detection (default) 1 = Accordant (pos. encoder direction -> pos. force on sensor) 2 = Contrary accordant (pos. encoder direction -> neg. force on sensor)	Signateq Force Direction	**SQFD**	0-2 / ?
Maximum speed for motion as soon as the force is reached. Limitation prevents fast movements into a mechanical limit stop during force leaps, e.g. during setup or with decoupled systems (sensor not mounted on the motor). If no limitation is desired, this parameter can be set to max value. 0 = Speed of the current run 10-9'000'000 = max. speed [inc/s]	Limit Force Reached Maximum Speed	**LFRMS**	0, 10-9'000'000 / ?
Sensor Model Type max. 29 characters free for user	Signateq Sensor Model Type	**SQSMT**	String / ?
Sensor series number max. 29 characters	Signateq Sensor Serial Number	**SQSSN**	String / ?

11.6.15 Input / Output

DESCRIPTION	Short	CMD	PARAMETER
Set type of PLC outputs (Source, Sink, Source/Sink) -> refer chapter 6.4 Output Configuration	Set Output Type	**SOT**	0-65535
High / Low Activity of PLC outputs -> refer chapter 6.4 Output Configuration	Set Output Activity	**SOA**	0-255
Set PLC output to logic 1 (level according SOT, SOA)	Set Output	**SO**	1-8
Equivalent to SO, but set all outputs binary coded Bit 0 = Output 1, Bit 7 = Output 8	Set Output Hex	**SOX**	00-FF
Clear output (level according SOT, SOA)	Clear Output	**CO**	1-8
Status all Outputs, 0= logic 0, 1=logic 1	Tell Output	**TO**	
Status all Outputs in HEX format	Tell Output HEX	**TOX**	
Preload output number for output function assignment with command TYOF	Number Output Function	**NOF**	1-8
Assign type of output function to the with NOF preloaded output number (0 = no function, 1 = REFERENCE, 2 = IN MOTION, 3 = END OF PROGRAM, 4 = TRIGGER, 5 = ERROR, 6 = BRAKE, 7 = IN POSITION, 8 = I FORCE MAX LIMIT/FORCE MAX LIMIT, 9 = I FORCE IN SECTOR/FORCE IN SECTOR, 10 = IN SECTOR, 11 = IN FORCE, 12 = WARNING, 13 = INFORMATION, 14 = STO1, 15 = STO2, 16 = SS11, 17 = SS12, 18 = SS21, 19 = SS22, 20 = SLS1, 21 = SLS2)	Type Output Function	**TYOF**	0-21
Trigger upward counting, absolute, at output #x defined in Output-Function, pulse during 5ms	Trigger upward	**TGU**	± 2'000'000'000 Increment
Trigger downward counting, absolute, at output #x defined in Output-Function, pulse during 5ms	Trigger downward	**TGD**	± 2'000'000'000 Increment
0=all Input HIGH active, 1= all Input LOW active, 2= individual input activity selection according to ILAS (value 0 and 1 puts ILAS to 0x000 respectively 0xFFF)	Input Low active	**ILA**	0-2 / ?
individual input activity selection, 0=Input HIGH active, 1=Input LOW active 1. Hex for value binary inputs 9-12 only 0 or F, 2. And 3. Hex value for input 1-8 (values 0x000 and 0xFFF put ILA to 0 resp. 1. All other values are to 2 by ILA	Input Low Active Single	**ILAS**	0xx / Fxx / ?
Status all inputs, 0 = Low, 1 = High / ? incl. indication of input number	Tell Input	**TI**	1-12 / ?
Status single input, 0 = Low 1 = High	Tell Input	**TI**	1-12
Status all Inputs in HEX format	Tell Input HEX	**TIX**	
Preload input number for input function assignment with command TYIF	Number Input Function	**NIF**	1-8

Assign type of input function to the with NIF preloaded input number (0 = no function, 1 = REFERENCE, 2 = INDEX, 3 = PROGRAM, 4 = SET OUTPUT, 5 = CLEAR OUTPUT, 6 = JOG POSITIVE, 7 = JOG NEGATIVE, 8 = CAPTURE POSITION, 9 = INTERRUPT PROGRAM, 10 = STOP IMPULS, 11 = STOP IMPULS COUNTER, 12 = LIMIT SWITCH NEGATIVE, 13 = LIMIT SWITCH POSITIVE, 14 = EMERGENCY EXIT, 15 = EMERGEMCY EXIT POWER ON, 16 = POWER CONTINUE, 17 = PROFILE, 18 = REFERENCE LIMIT STOP, 19 = OVERRIDE, 20 = PROGRAM EXIT, 21 = DRIVE I_FORCE/DRIVE FORCE, 22 = POWER QUIT)	Type Input Function	**TYIF**	0-22
Parameter A of input function of with NIF preloaded input number (value depending on input function, according to value described in chapter 11.15.1 Selection of Input Functions)	Parameter A	**PAIF**	xx
Parameter B of input function of with NIF preloaded input number (value depending on input function, according to value described in chapter 11.15.1 Selection of Input Functions)	Parameter B	**PBIF**	yy
Parameter C of input function of with NIF preloaded input number (value depending on input function, according to value described in chapter 11.15.1 Selection of Input Functions)	Parameter C	**PCIF**	zz
Shows present position captured with input	Tell Capture Position	**TCP**	1-8
Shows the position captured with input 12	Tell Capture Pos. Buffer	**TCPB**	1-8
Set all 8 capture Position Register to 0	Clear Capture Position	**CLCP**	1-8 (all)
Activate capture position function over input 12	Capture Pos. Input 12	**CP12**	0,1
Break Delay in [ms] **Attention:** no works with the SMU module	Break Delay	**BRKD**	1-1000 (ms) / ?

11.6.16 Correction Table

DESCRIPTION	Short	CMD	PARAMETER
Status of correction table: 0= correction table deactivated 1= correction table activated 2= correction table initialized (physical values = Encoder value)	Correction Table State	**CTAB**	0-2 / ?
Starting position of the correction table in [inc]	Correction Table Position Start	**CTPS**	0-500‘000‘000 / ?
Distance between the entries in the correction table in [inc]	Correction Table Distance Points	**CTDP**	10-30‘000‘000 / ?
Preselect absolute encoder position in correction table in [inc]	Correction Table Preselect Position	**CTPO**	0-2‘000‘000‘000 / ?
Physical position deviation for preselected encoder position in correction table in [inc]	Correction Table Value	**CTVA**	-30‘000-30‘000 / ?

11.6.17 Event

DESCRIPTION	Short	CMD	PARAMETER
Event activation	Event Status or Input	**EVT**	0,1
0=All input events enabled 1..C= Event of input 1..12 enabled	Event Track Input	**ETI**	0-9, A-C
0= All input events disabled 1..C = Event of input 1..12 disabled	Disable Track Input	**DTI**	0-9, A-C

11.6.18 Limit Position ELAX®

DESCRIPTION	Short	CMD	PARAMETER
Start calibration of the **internal** mechanical limit stop positive. After the calibration the value can be read with *DMLPP*.	Mechanical Limit Calibration	**MLC**	
Position of the detected **internal** mechanical limit position positive ? = Returns the position of the detected internal mechanical limit stop positive. 0 = Deletes the position of the detected internal mechanical limit stop positive **Note:** - If DMLPP is deleted (DMLPP = 0), the value for the internal mechanical limit stop for the reference in positive direction is <stroke ELAX + 1mm> - If the value for the internal mechanical limit stop positive is known, this value can be set without calibration (without command MLC).	Detected Mechanical Limit Position Positive	**DMLPP**	0, <Stroke ELAX> - <Stroke ELAX + 3mm> / ?
Position of the detected **external** mechanical limit stop position negative. ? = Returns the position of the detected external mechanical limit stop negative. 0 = Deletes the position of the detected external mechanical limit stop negative **Note**: - MLPN always needs to be chosen smaller than MLPP - If MLPN is deleted (MLPN = 0), the value for the internal mechanical limit stop itself is used for the reference in negative direction, which is <-1mm> as per definition. - The position of an externally mounted mechanical limit has to be accurate. If the entered position of the externally mounted limit stop is wrong, the alignment of the coils to the magnets cannot be completed and the motor won't be capable to drive	Mechanical Limit Position Negative	**MLPN**	<-3mm> - <stroke ELAX + 3mm> / ?
Position of the detected **external** mechanical limit stop position positive. ? = Returns the position of the detected external mechanical limit stop negative. 0 = Deletes the position of the detected external mechanical limit stop negative. **Note**: - MLPP always needs to be chosen bigger than MLPN - If MLPN is deleted (MLPN = 0), the value for the internal mechanical limit stop itself is used for the reference in negative direction, which is <-1mm> as per definition. - The position of an externally mounted mechanical limit has to be accurate. If the entered position of the externally mounted limit stop is wrong, the alignment of the coils to the magnets cannot be completed and the motor won't be capable to drive	Mechanical Limit Position Positive	**MLPP**	<-3mm> - <stroke ELAX + 3mm> / ?

11.6.19 System Information

DESCRIPTION	Short	CMD	PARAMETER
Present position ± 2*10E9	Tell Position	**TP**	
Require actual motor velocity [inc/s]	Tell Velocity	**TV**	
Motor temperature in degree Celsius	Tell Temperature	**TT**	
Voltage at the power input in [mV]	Tell Voltage Power Supply Motor	**TVPSM**	
Status: 0 = Power OFF, 1 = Power ON, 2 = In motion, 9 = Error	Tell Status	**TS**	
Binary coded process status, size of return string 4 Bytes in HEX format ERROR = BIT 0 REFERENCE = BIT 1 IN_MOTION = BIT 2 IN_POSITION = BIT 3 END_OF_PROGRAM = BIT 4 IN_FORCE = BIT 5 IN_SECTOR = BIT 6 FORCE_IN_SECTOR = BIT 7 INVERTER_VOLTAGE = BIT 8 END_OF_GANTRY_INIT = BIT 9 NEGATIVE_LIMIT_SWITCH = BIT 10 POSITIVE_LIMIT_SWITCH = BIT 11 EMERGENCY_EXIT_1, REMAIN POWER ON = BIT 12 *(Function can only be used **without** bus module.* ***With** bus module, apply function "EMERGENCY_EXIT").* EMERGENCY_EXIT, POWER OFF = BIT 13 FORCE_CALIBRATION_ACTIVE = BIT 14 I_FORCE_LIMIT_REACHED = BIT 15 STO PRIMED/HIT = BIT 16 SS1 PRIMED/HIT = BIT 17 SS2 PRIMED = BIT 18 SS2 HIT = BIT 19 SLS PRIMED = BIT 20 SLS SPEED HIT = BIT 21 SLS POSITION HIT = BIT 22 WARNING = BIT 23 INFORMATION = BIT 24 PHASING DONE = BIT 25 I_FORCE_DRIFT_COMPENSATION_DRIVE_ACTIVE = BIT 26 FORCE_LIMIT_REACHED = BIT 27	Tell Process Status Register	**TPSR**	
Actual motor current [mA]	Tell motor current	**TMC**	
Motion time [milliseconds] of the last profile drive	Tell Motion Time	**TMT**	
Read process timer [m] refer also program functions TIMER_START, TIMER_STOP	Tell Process Time	**TPT**	
Version number of installed firmware	Version	**VER**	
Returns all the versions of Firmware, Bootloader, WebMotion®	Version All	**VERA**	
Version number of installed SMU firmware	Version SMU	**VERS**	
Versions number of the installed bus module firmware	Version Bus Module	**VERB**	
Versions queries of the boot loader (from version V4.00)	Version Boot Loader	**VERL**	
Version number of installed Signateq® firmware	Version Signateq	**VERSQ**	
Read the Ethernet MAC Adress	Ethernet MAC Adress	**EMAC**	?
MAC address query of PROFINET / Powerlink / EtherNet/IP bus module	MAC address Bus Module	**MACB**	

Temperature control, instantaneous value integration	I2T	**I2T¹)**	
Temperature control, maximum value integration painter	I2TM	**I2TM¹)**	
Calculate CRC over the current safety parameter	Safety Parameter CRC	**SPC**	
Calculate CRC over the current safety parameter and MAC Adress	Safety Param. & MAC CRC	**SPMAC**	
Returns the current DS402 ModeOfOperation	Tell ModeOfOperation	**TMO**	

11.6.20 Ethernet

BESCHREIBUNG	KÜRZEL	BEF	PARAMETER
Ethernet TCP/IP-Adresse Example: EIP192.168.2.100 (Default value)	Ethernet TCP/IP Adress	**EIP**	xxx.xxx.xxx.xxx / ?
Ethernet NetMask Example: ENM255.255.252.0 (Default value)	Ethernet Net Mask	**ENM**	xxx.xxx.xxx.xxx / ?
Ethernet Gateway Example: EGW192.168.2.1 (Default value)	Ethernet Gateway	**EGW**	xxx.xxx.xxx.xxx / ?
Ethernet Port Nummer Example: EPRT10001 (Default value)	Ethernet Port	**EPRT**	1 – 65535 / ?
Abfrage der Ethernet MAC Adresse	Ethernet MAC Adress	**EMAC**	?
Restore the factory settings for the Ethernet TCP/IP IP Adress to 192.168.2.100 NetMask to 255.255.252.0 Gateway to 192.168.2.1 Port Number to 10001	Reset Ethernet	**RESETH**	

11.6.21 Bus Module

DESCRIPTION	Short	CMD	PARAMETER
Baud rate of the optional CANopen interface	CAN Baud rate	**CAB**	1’000-1'000'000 / ?
Set cycle time [microseconds] in Cyclic Synchronous Position Mode (DS402). Used RMR for interpolation. Only multiple of 100 micro seconds possible	PDO Cycle Time	**PCT**	100-10‘000 / ?
Versions number of the installed bus module firmware	Version bus module	**VERB**	
IP address queries EtherNet/IP modules (from version V4.00)	IP Address bus module	**EIPB**	
Reset bus module	Reset bus module	**RESB**	
MAC address query of PROFINET / Powerlink / EtherNet/IP bus module	MAC address bus module	**MACB**	

11.6.22 DS402 Compatibility

DESCRIPTION	Short	CMD	PARAMETER
Re-adjust Bit „P402 Set Point Acknowledge“ to behavior. equal or smaller than firmware V3.68H	Set Point ACK disable	**SPAD**	0,1 / ?
Enable = 1 / Disable = 0 of the automatic reference drive when entering DS402 Mode of Operation 6	Automatic Reference	**AREF**	0,1 / ?

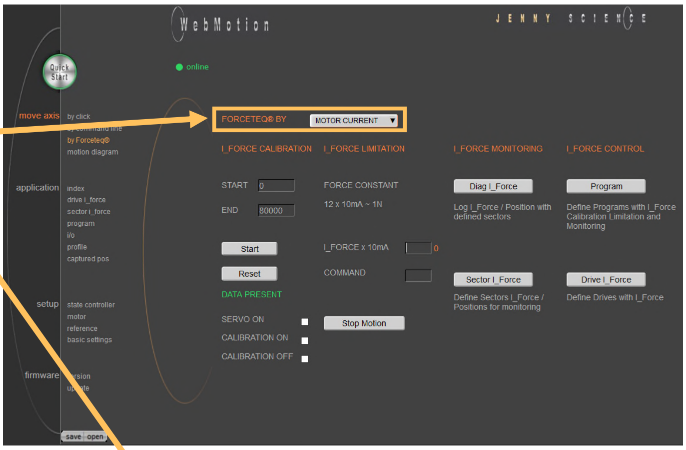
11.6.23 Error Handling

DESCRIPTION	Short	CMD	PARAMETER
Error number 01-99	Tell Error	**TE**	
Error number description string	Tell Error String	**TES**	
Retrieving error buffer (last 10 appearing info's, warnings or errors)	Tell Error Buffer	**TEB**	
Clears the error buffer (TEB)	Tell Error Buffer Clear	**TEBCRL**	
Description of the error state from the SMU (Only possible if SMU available)	Tell Error SMU	**TESM**	
Description of the error state of the SMU at the time of error 89 (Only possible if SMU available)	Tell Error SMU History	**TESMH**	

11.6.24 System Monitoring

DESCRIPTION	Short	CMD	PARAMETER
Switching off or turning on the encoder plausibility test: 0=Encoder plausibility test on 1= Encoder plausibility test off (for rotary motors only)	Encoder Plausibility Checking Disable	**ENCPD**	0-1 / ?
Watchdog for Serial/Ethernet interface 0 = deactivated 1-60'000 = Watchdog time in [ms]. If output stage is on and no ASCII command was received over the Serial or Ethernet for <WD> ms, output stage is turned off and error code 77 is shown.	Watchdog	**WD**	0-60'000 ms / ?
Echo for Serial/Ethernet interface (Default on) 0 = Off / 1 On	Echo	**ECH**	0-1 / ?

11.7 Move Axis by Forceteq®



The Forceteq® force measurement technology is available in two different modes:

Forceteq® basic: Current based with self calibrated motor -> FORCETEQ® BY MOTOR CURRENT

Forceteq® pro: Precise with Signateq® and external load cell -> FORCETEQ® BY FORCE SENSOR

The force processes of the XENAX® Xvi servo controller cover four functionalities:

- I_FORCE CALIBRATION: Calibration of the motor through detection of all idle running forces including the payload of the client specific installation on the slide. This creates the basis to precisely determine the external application forces.

- I_FORCE / FORCE LIMITATION: Driving with limited force to an object or an end position if there are no objects (e.g. inserting parts). Or driving with very little force in order to detect an "object's touching position".

- I_FORCE / FORCE MONITORING: Monitoring the force progression by defining sectors in a force/way diagram (e.g. inspecting switches). These sectors can automatically be adjusted towards the "object's touching position".

- I_FORCE / FORCE CONTROL: Integration of different FORCE functions into a program. This is how it becomes possible to use the force processes decentrally in the standalone operation mode. Of course, these FORCE functions can also be invoked by a superior PLC through Ethernet fieldbus.

More information about the force process can be found in the chapter
14 Forceteq® Force Measurement Technology

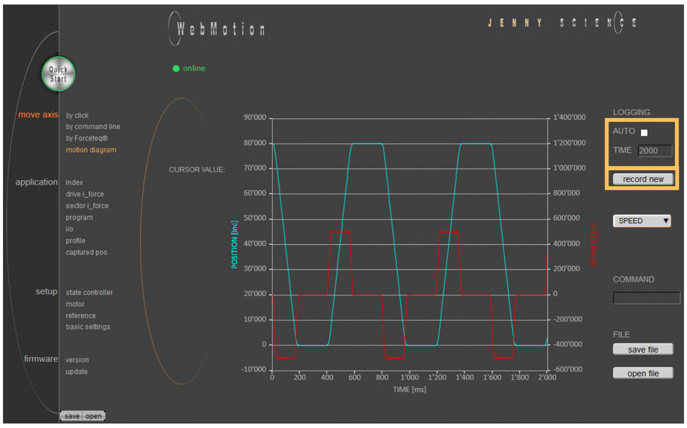
11.8 Move Axis Motion Diagram

Recording position, speed, IForce, position deviation and force

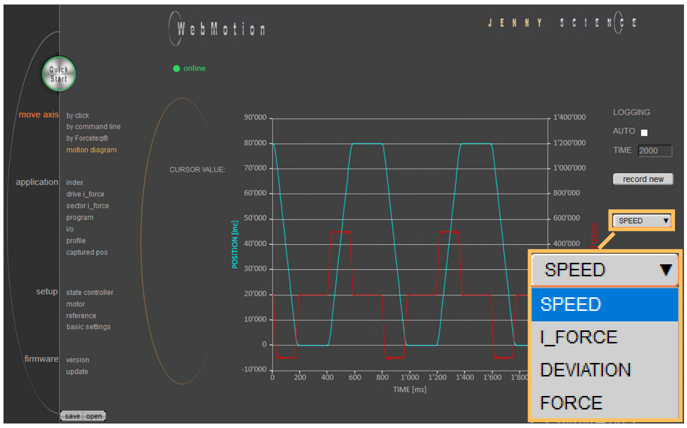
LOGGING AUTO
Recording starts, as soon as the drive has started. The record lasts until the drive and a possible program have ended.

LOGGING TIME
Recording starts, as soon as the drive has started. The record lasts as long as the time indicated (2-8000ms).

record new
Initialization for new recording sequence. Wait for message "ready for recording next motion". Start motion in command panel (*move axis / by click* or *by command line*) e.g. G44000.



SPEED
Records speed in increments in relation to the position.

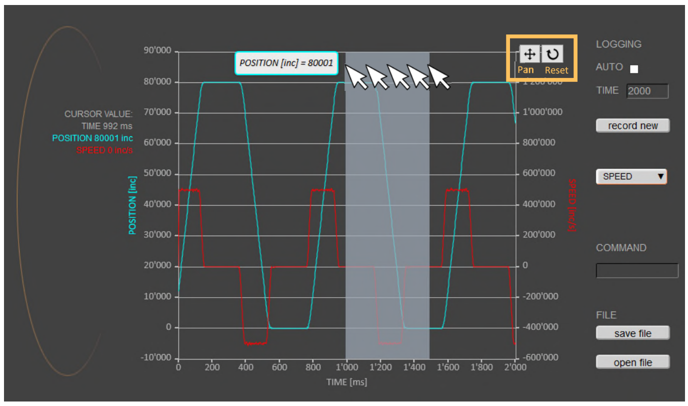


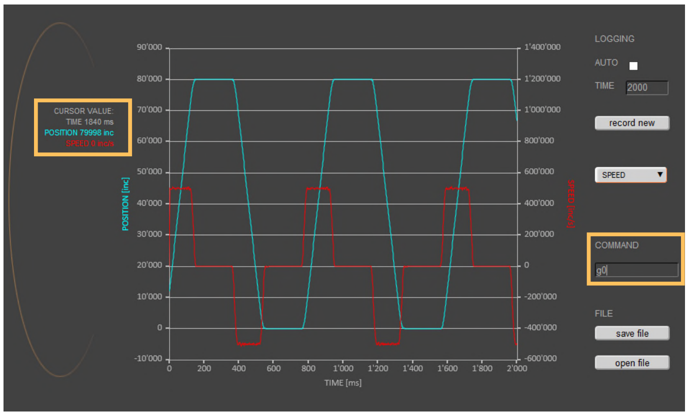
I_FORCE
Records current in milliampere in relation to the position.

DEVIATION
Records position deviation in increments.

FORCE
Records the Force in Newton in relation to the position (only with Forceteq@ pro possible).

Zoom
Zoom of curve section on time axis.
By dragging the mouse over a time section, this part can be zoomed.
The "Reset" button undoes the zoom action. With the "Pan" key the time axis can be moved with the mouse.



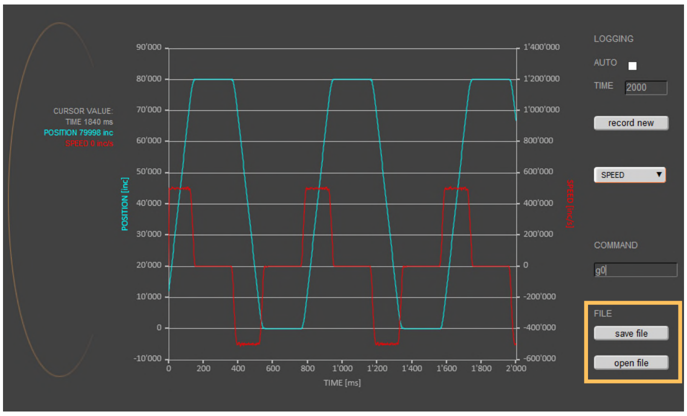


Command

Enter command e.g. starting position of the motor, REF, G0, drive on a position or repeat reverse (RR).

CURSOR VALUE

Shows the current values at the time of the cursor in the recording.



safe file

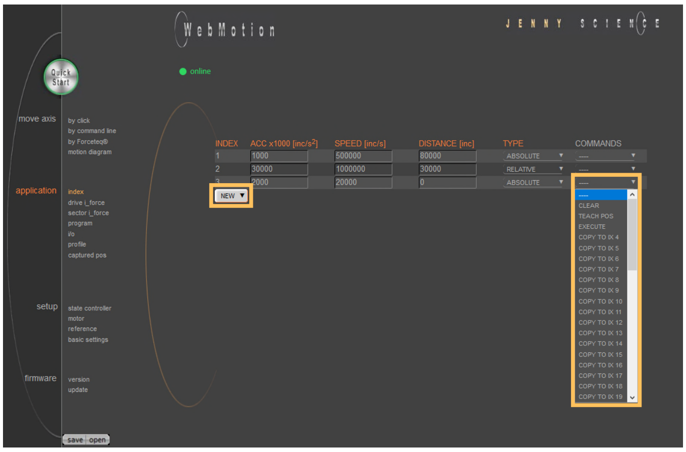
Saves the motion profile on the computer.

open file

Shows a motion profile which was saved on the computer. The upload has no influence on the parameters of the servo controller.

11.9 Index

An Index is a motion profile and contains acceleration (ACC), speed (SPEED), distance (DISTANCE) and TYPE of distance („ABSOLUTE“ with reference to the zero position or „RELATIVE“ with reference to the present position).
The values always refer to increments of the incremental encoder. The INDEXES simplify programming and reduce the communication time by serial control. Execute with IXxx<CR>.
A maximum of 50 INDEXES can be predefined.



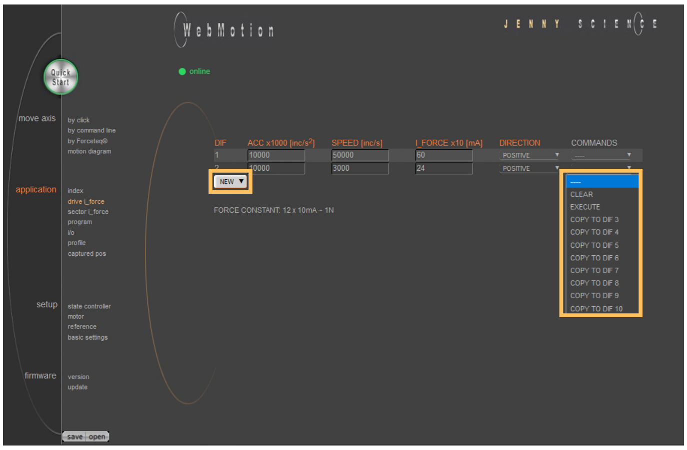
NEW
Create new index

Parameter of the Index

ACCx1000	Acceleration (2-1‘000'000'000 x 1’000 Inc/s^2)
SPEED	Speed (10-100’000’000 Inc/s)
DISTANCE	Distance in Inc
TYPE	ABSOLUTE (Position), RELATIVE (Way)

COMMNANDS
CLEAR = Clears the Index
TEACH POS = Current position is set in the field „DISTANCE”
EXECUTE = Index will be executed
COPY TO IXxx **=** Index will be copied into a new Index

11.10 Drive I_Force (Forceteq® basic)



A DRIVE I_FORCE is driving with force consisting of acceleration (ACC), speed (SPEED), current (I_FORCE) and driving direction (DIRECTION).

Up to 10 DRIVE I_FORCE can be stored.

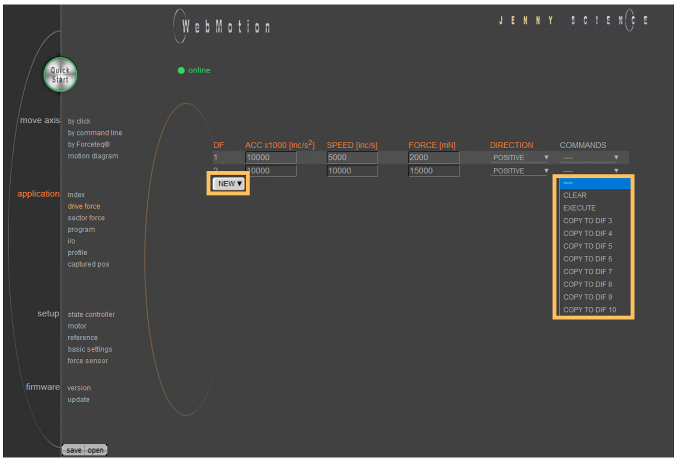
NEW
Create new Drive I_Force

Parameters of the Drive I_Force

ACCx1000	Acceleration (2-1‘000'000'000 x1000 Inc/s^2)
SPEED	Speed (10-100’000’000 Inc/s)
I_FORCEx10	Force Limitation (0-2‘000 x10 mA)
DIRECTION	POSITIVE = Positive direction, NEGATIVE = Negativ direction

COMMANDS
CLEAR = Clears the Drive I_Force
EXECUTE = Drive I_Force will be executed
COPY TO DIFxx = Drive I_Force will be copied into a new Drive I_Force

11.11 Drive Force (Forceteq® pro)



A DRIVE FORCE is driving with force consisting of acceleration (ACC), speed (SPEED), force (FORCE) and driving direction (DIRECTION).

Up to 10 DRIVE FORCE can be stored.

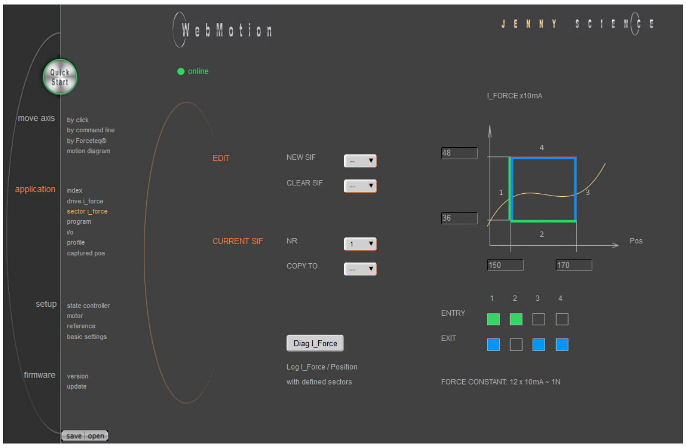
NEW
Create new Drive Force

Parameters of the Drive Force

ACCx1000	Acceleration (2-1‘000'000'000 x1000 Inc/s^2)
SPEED	Speed (10-100’000’000 Inc/s)
FORCE	Force Limitation (0-20’000mN)
DIRECTION	POSITIVE = Positive direction, NEGATIVE = Negative direction

COMMANDS
CLEAR = Clears the Drive Force
EXECUTE = Drive Force will be executed
COPY TO DFxx = Drive Force will be copied into a new Drive Force

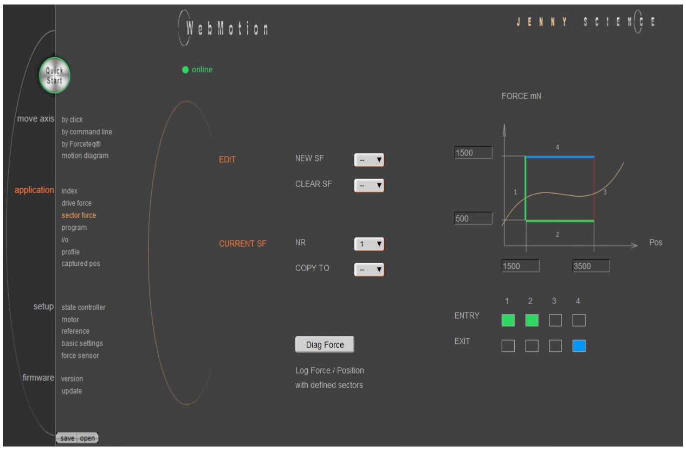
11.12 Sector I_Force (Forceteq® basic)



In the WebMotion® program menu „sector I-force“ up to 10 different force sectors can be defined.

Example:
Once an object is touched the force progression shall be examined in a sector of 150 to 170 Increments. When entering the force sector “ENTRY” the force should be between 3 and 4N. When exiting the sector “EXIT”, the force should have reached 4N. These force specifications are defined with the in the force sector incoming and exiting sector boundaries.

11.13 Sector Force (Forceteq® pro)



In the WebMotion® program menu „sector force“ up to 10 different force sectors can be defined.

Example:
Once an object is touched the force progression shall be examined in a sector of 1500 to 3500 Increments. When entering the force sector “ENTRY” the force should be between 0.5 and 1.5N. When exiting the sector “EXIT”, the force should have reached 1.5N. These force specifications are defined with the in the force sector incoming and exiting sector boundaries.

Refer more Information in chapter
14 Forceteq® Force Measurement Technology.

11.14 Program

Here you can define program sequences line by line.

PROGRAM
Select, create, copy or delete a program.

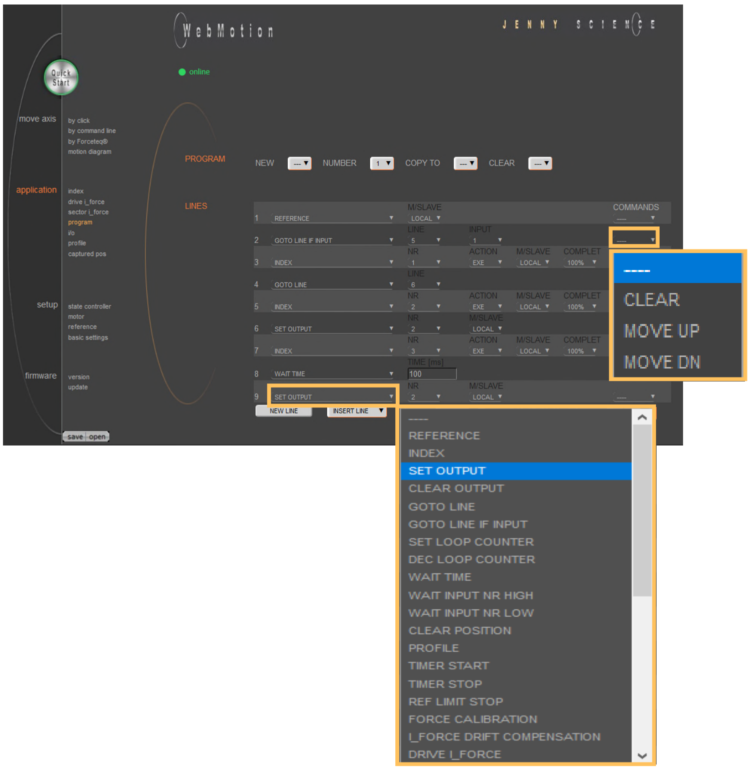
LINES
In this list all defined program lines of the present program will be shown.
Maximum number of lines depends on program mapping (PMAP, default = 0):

PMAP = 0	Prog 1-15: 50 lines	Prog 16-63: 10 lines
PMAP = 1	Prog 1-5: 130 lines	Prog 6-63: 10 lines

COMMANDS
CLEAR = Clears the Program-line
MOVE UP = Program-line will be moved up
MOVE DN = Program-line will be moved down

NEW LINE
A new program-line will be inserted in the last line

INSERT LINE
A new program-line will be inserted into any line. The following program lines are shifted by one line.



11.14.1 Program commands

Description	Command	Parameter	Master / Slave
Reference for LINAX®/ELAX® / ROTAX® and third party motors	REFERENCE		MS
Execute index number xx or change according operation yy with distance zz Operation „EXE“: Drive index No. xx and start a new index after COMPLETION zz% of the actual index command ACTION „=“: Set index distance to zz ACTION „+“: Increase Index distance by zz ACTION „-“: Reduce Index distance by zz ACTION „POS“: Set Index distance to the slider actual position.	INDEX	xx, yy, zz	MS
Set Output number xx	SET OUTPUT	xx	MS
Clear Output number xx	CLEAR OUTPUT	xx	MS
Go to Line number xx	GOTO LINE	xx	
Go to line number xx, if input number yy active	GOTO LINE IF INPUT	xx, yy	
Set Loop Counter # to xxxx (1-10000)	SET LOOP COUNTER (A-E)	xxxx	
Decrement Loop Counter #, if not zero, jump line xx. Loop counters can be interleaved with each other	DEC LOOP COUNT (A-E) JNZ LINE	xx	
Wait xx ms (in 10ms resolution)	WAIT TIME (ms)	xx	
Wait for logical High of Input number xx within timeout frame yy, otherwise jump to line zz „error handling“ (timeout can only be used locally, not for (remote)	WAIT INPUT NR HIGH	xx	MS
Wait to logical Low of Input number xx within timeout frame yy, otherwise jump to line zz „error handling“ (timeout can only be used locally, not for remote)	WAIT INPUT NR LOW	xx	MS
Set position counter to 0, (not possible with LINAX®/ ELAX®, with ROTAX® only possible if it is not referenced)	CLEAR POSITION		
Execute Profile number xx	PROFILE	xx	MS
Start process timer	TIMER START		
Stop process timer Command TPT (Tell Process Timer) returns measured time in milliseconds	TIMER STOP		
LINAX®/ELAX® drives to mechanical limited position, refer *setup / reference*.	REF LIMIT STOP		
Executing Force Calibration, Start Pos xx, End Pos yy	FORCE CALIBRATION	xx, yy	
Automatic I_Force Drift Compensation drive xx = POS => drive in positive direction xx = NEG => drive in negative direction	I_FORCE DRIFT COMPENSATION	xx	
Tare function Signateq® measuring amplifier. The displayed force at the sensor is set to 0 (Forceteq® pro)	CLEAR FORCE OFFSET		
Execute DRIVE I_FORCE No. xx (Forceteq® basic)	DRIVE I_FORCE	xx	
Execute DRIVE FORCE No. xx (Forceteq® pro)	DRIVE FORCE	xx	
Selection of active sectors with Bit mask. E.g. xx = 1010→ sectors 2 and 4 are active. LSB is on right.	SELECT SECTORS	xx	
Wait until Limit I_FORCE is reached according parameter DRIVE I_FORCE within timeout xx, otherwise jump to line yy „error handling“ (Forceteq®basic)	WAIT LIMIT I_FORCE	xx, yy	

Wait until Limit FORCE is reached according parameter DRIVE FORCE within timeout xx, otherwise jump to line yy „error handling“ (Forceteq® pro)	WAIT LIMIT FORCE	xx, yy
Wait for distance (absolute position – Sector Offset) to be greater than xx within timeout frame yy, otherwise jump to line zz „error handling“	WAIT FOR DISTANCE GREATER	xx, yy, zz
Wait for distance (absolute position – Sector Offset) to be smaller than xx within timeout frame yy, otherwise jump to line zz „error handling“	WAIT FOR DISTANCE LESS	xx, yy, zz
Wait for process status register Bit xx High within timeout frame yy, otherwise jump to line zz „error handling“	WAIT PROCESS STATUS BIT HIGH	xx, yy, zz
Wait for process status register Bit xx Low within timeout frame yy, otherwise jump to line zz „error handling“	WAIT PROCESS STATUS BIT LOW	xx, yy, zz
Is taking the actual position as offset value for all sectors followed by the restart of monitoring. Furthermore the positions “Wait for distance greater/less” and “Jump if distance greater/less” are being adjusted by the offset as well.	TAKE POS AS SECTOR OFFSET	
Setting offsets for all sectors followed by the restart of monitoring. xx = [Inc] Offset Furthermore the positions “Wait for distance greater/less” and “Jump if distance greater/less” are being adjusted by the offset xx as well. e.g. xx = 0, sets offset incl. TAKE POS AS SECTOR OFFSET to 0	SET SECTOR OFFSET	xx
Changing Limit DR_I_FORCE to xx x 10mA Value of I_FORCE will overwrite the current parameter I_Force in DRIVE I_FORCE until DRIVE I_FORCE END (Forceteq® basic)	CHANGE LIMIT I_FORCE	xx
Changing Limit DR_FORCE to xx mN Value of FORCE will overwrite the current parameter Force in DRIVE FORCE until DRIVE FORCE END (Forceteq® pro)	CHANGE LIMIT FORCE	xx
Jump to line zz if distance xx (absolute position – sector offset) greater than xx e.g. driving distance was too big after force was reached	JUMP IF DISTANCE GREATER	xx, zz
Jump to line zz if distance (absolute position – sector offset) smaller than xx e.g. driving distance was too small after force was reached	JUMP IF DISTANCE LESS	xx, zz
Jump to line xx “error handling” if one or more sectors are not passed correctly. Only active sectors are being tested. Caution: Before this analysis can be done, “DRIVE I_FORCE END” has to be completed. (Forceteq® basic)	JUMP IF I_FORCE SECTORS FAULT	xx
Jump to line xx “error handling” if one or more sectors are not passed correctly. Only active sectors are being tested. Caution: Before this analysis can be done, “DRIVE FORCE END” has to be completed. (Forceteq® pro)	JUMP IF FORCE SECTORS FAULT	xx

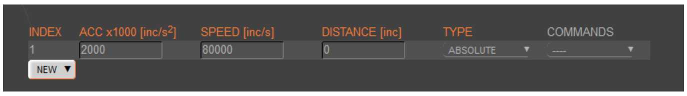
Stop Drive I_Force, current position = set point position, parameter LIMIT DR_I_FORCE inactive (Forceteq® basic)	DRIVE I_FORCE END	
Stop Drive Force, current position = set point position, parameter LIMIT DR_FORCE inactive (Forceteq® pro)	DRIVE FORCE END	
Power stage turned off, the linear motor can be moves by hand.	POWER QUIT	MS
Power continues (>PWC) Turning on the power stage while using the most recent absolute position and **without the need of referencing the linear motor, e.g. after error 50 or after "Power Quit".** This is only possible as long as the logic supply has not been interrupted after the linear motor was referenced.	POWER CONTINUE	MS
Program is being ended and does not proceed to last line. Beneficiary for „error handling"	PROGRAM END	

Important Note:
All entries in menu application / *program* must be "saved" in order to be activated

MS: Master/Slave function can be started on another controller.
LOC = Local, ID1…4 = Device with according Card Identifier (CI)

Example: Initialization LINAX®/ELAX®

This example shows the initialization of a LINAX®/ELAX® linear motor with the command REFERENCE which then drives to a defined starting position (INDEX 1).

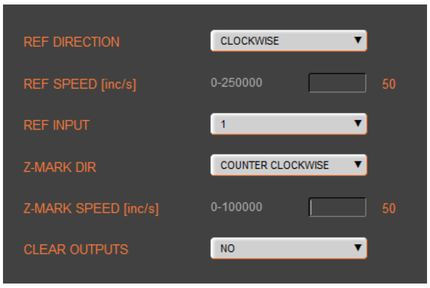


The start position is free to choose as long as it is within the stroke of the motor. In this example the axis drives to start position 0.

Important:
The command REFERENCE has to be completed once after powering on the servo controller.
Only after reference, other motion commands are possible.

Example: Initialization ROTAX® or third party motors
The reference function for rotary motors can be defined in the menu *setup / reference* (refer chapter 11.20.3 Reference ROTAX® und Third Party Motors).
With this function the motor drives first to a reference switch (approx. zero) and then to the encoder Z-mark.

If reference position differs from starting position, an index (INDEX 1) can be executed to move to start position.



The program starts with the ASCII command “PG1” in the menu *move axis / by command line* or by activating an input function “PG1”.

11.15 I/O Functions

OUTPUT FUNCTIONS
Assigning output functions to a physical output.
ON und OFF of the outputs by mouse click.

INPUT FUNCTIONS
Assigning input functions to a physical input.
Choice of high- or low-activity of all inputs.
Input 9-12 binary coded.

In the operations overview, the physical input and output conditions are displayed.

11.15.1 Selection of Input Functions

LINAX®: Reference for LINAX®, travels the distance of two coded reference marks and calculates the absolute position according LINAX® linear motor. **ELAX®:** Reference for ELAX®, the absolute potion is determined by driving to a mechanical limit. **ROTAX® and third party motors:** Complete Reference according to REFERENCE for ROTAX® and third party motors...	REFERENCE	
Execute index number xx or change according operation yy with distance zz	INDEX	xx, yy, zz
Execute Program xx	PROGRAM	xx
Set output xx	SET OUTPUT	xx
Clear output xx	CLEAR OUTPUT	xx
Drive (Jog) positive (const. speed xxxxx inc/sec) while input # is active	JOG POSITIVE	xxxxx
Drive (Jog) negative (const. speed xxxxxx inc/sec) while input # is active	JOG NEGATIVE	xxxxx
Capture Position, on triggered edge at input	CAPTURE POSITION	
Interrupt program, while Input active	INTERRUPT PROGRAM	
Stop Impulse, edge triggered*) If a LINAX® is connected, it behaves like "STOP IMPULS COUNTER"	STOP IMPULS	
Stop Impulse Counter, like "STOP IMPULS" but does not set position counter to 0*)	STOP IMPULS COUNTER	
Limit-switch negative*)	LIMIT SWITCH NEGATIVE	
Limit-switch positive*)	LIMIT SWITCH POSITIVE	
Emergency Exit with power off*)	EMERGENCY EXIT	
Emergency Exit with power on, Position stop *(Function can only be used **without** bus module. **With** bus module, apply function "EMERGENCY EXIT")*	EMERGENCY EXIT POWER ON	
Power ON continue, keep encoder counter	POWER CONTINUE	
Execute Profile No. xx	PROFILE	xx
Reference Limit Stop, also refer menu *setup / reference*	REFERENCE LIMIT STOP	
Speed and acceleration will be reduced by xx percent	OVERRIDE	xx
Stops and quits active program	PROGRAM EXIT	
Drive I_Force No. xx (Forceteq® basic)	DRIVE I_FORCE	xx
Drive Force No. xx (Forceteq® pro)	DRIVE FORCE	xx
Power stage turned off, the linear motor can be moved by hand.	POWER QUIT	

*) Stop with ED
(Emergency Deceleration) braking ramp

Notes to Input Functions:

Except “EMERGENCY EXIT“, “EMERGENCY EXIT POWER ON“ all input functions must only be parameterized in a Pick & Place Maser or Gantry Master.

For rapid deceleration in emergency shut down situations (“LIMIT SWITCH NEGATIVE“, “LIMIT SWITCH POSITIVE“, “EMERGENCY EXIT“, “EMERGENCY EXIT POWER ON“, “STOP IMPULS“, “STOP IMPULS COUNTER“) the special ED (Emergency Deceleration) can be given a value (COMMAND > ED xxxxx).

The Emergency Exit functions have the highest priority and are always activated immediately. As long as “EMERGENCY EXIT“ is active no other function can be executed.

For the other functions the following applies: If another function is already active it has to be finished before the next one is started. If several function calls are current at the same time, then the one with the lowest input number is executed first.

To run a program endlessly the assigned input can be simply left active.

With “INTERRUPT PROGRAM” the program being executed can be interrupted. If IP becomes inactive the interrupted program will be continued directly.

With “STOP IMPULS COUNTER” the running movement is stopped and aborted. A new travel command can then be executed even with unreleased stop impulse (“STOP IMPULS COUNTER” active).

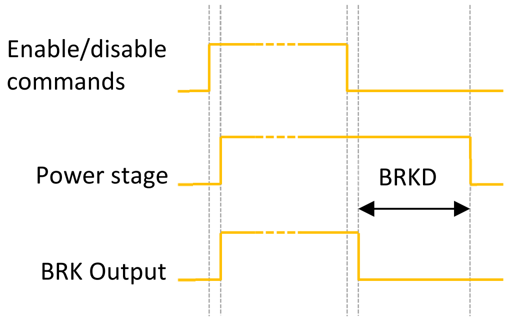
11.15.2 Selection Output Functions

REFERENCE has been completed	REFFERENCE
In motion, motor is running	IN MOTION
End of program	END OF PROGRAM
Trigger (5ms, defined by TGU, TGD commands)	TRIGGER
Error pending	ERROR
Release brake	BRAKE
In position, within deviation target position (DTP)	IN POSITION
Limit I_Force reached (command LIF) (Forceteq® basic)	I FORCE MAX LIMIT
Limit Force reached (command LF) (Forceteq® pro)	FORCE MAX LIMIT
I Force In Sector, when motion is completed (Forceteq® basic)	I FORCE IN SECTOR
Force In Sector, when motion is completed (Forceteq® pro)	FORCE IN SECTOR
In Sector (during and after motion is completed)	IN SECTOR
In Force (during and after motion is completed)	IN FORCE
Warning pending	WARNING
Information pending	INFORMATION
STO Feedback 1	STO1*
STO Feedback 2	STO2*
SS1 Feedback 1	SS11*
SS1 Feedback 2	SS12*
SS2 Feedback 1	SS21*
SS2 Feedback 2	SS22*
SLS Feedback 1	SLS1*
SLS Feedback 2	SLS2*

* Feedbacks are status information and not SMU safety functions. Only possible with optional SMU (Safety Motion Unit).

11.15.3 Operation with Additional Holding Brake

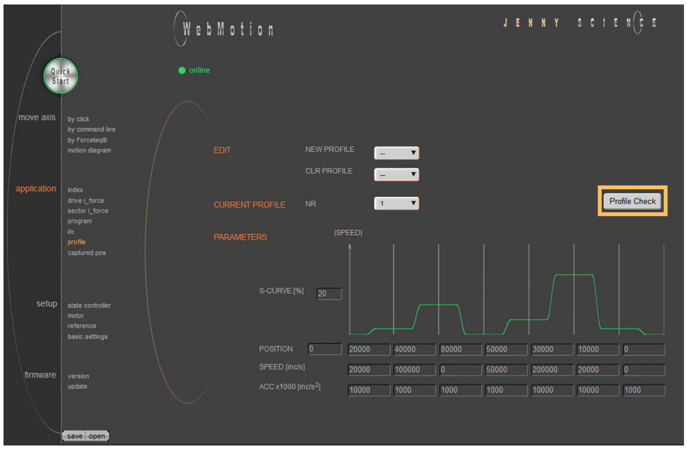
An additional holding brake for LINAX® Lxs and Lxu Motor types can be controlled with a XENAX® servo controller. The output function BRK (Brake) can be assigned to one of the controller outputs and used in combination with the BRKD (Brake delay) parameter.



This function allows the activation of a time delay by turning off the power stage. First the brake control signal output is set to low (brake is active) and after BRKD milliseconds (setting range from 1 to 1000ms) the power stage is turned off.

This feature allows an active braking with a switched-on power stage and after this a controlled power stage turn off, when the brake is safely on. The time delay is only effective by turning off the power stage.

11.16 Profile (Velocity)



Complex motion profiles can be linked with up to seven profile segments.

The XENAX® servo controller is able to store up to five profiles.

The profile definition includes a start position as well as absolute end-position, end-speed and acceleration of each profile segment. The result of these indications is the segment type (Speed up, Slow down, constant speed).
The “Profile Check” tests if the entered values can be realized with the connected linear motor.

Before profile curve starts, the linear motor has to be located at the predefined start position.

EDIT
NEW PROFILE = Enter new profile
CLR PROFILE = Clear profile

CURRENT PROFILE
This list contains all predefined profiles.

PARAMETERS
Set up of the parameters in „CURRENT PROFILE“

S-CURVE	Percentage S-curve rounding of the profile. Automatic calculation of jerk parameter for each profile segment.
POSITION	First panel: Input absolute start position
POSITION	End position of corresponding profile segment
SPEED	End speed of corresponding profile segment
ACCx1000	Acceleration within profile segment
PROFILE CHECK	The parameters will be checked on drivability (is distance long enough for demanded speed and acceleration ?) Correct profile segments are colored in green, wrong segments are red and untested segments are orange

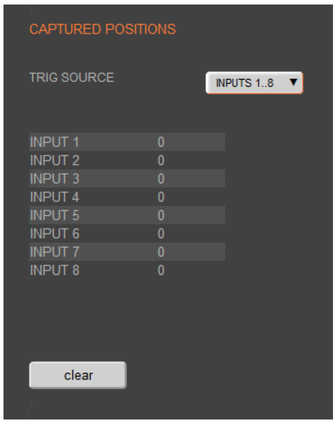
Defined and tested profiles have to be stored in the servo controller under *„save“*.

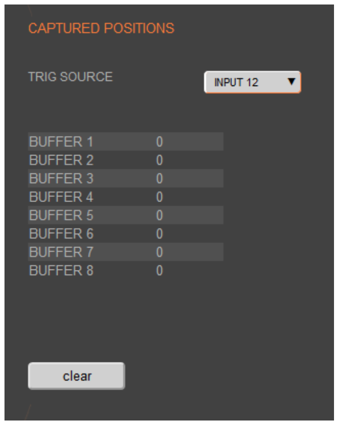
A profile can be started with the command PRFx. X represents the profile number.

Profiles can also be started as input function or in a program.

11.17 Captured Pos

The XENAX® servo controller has two special functions to read the current position of the motor.



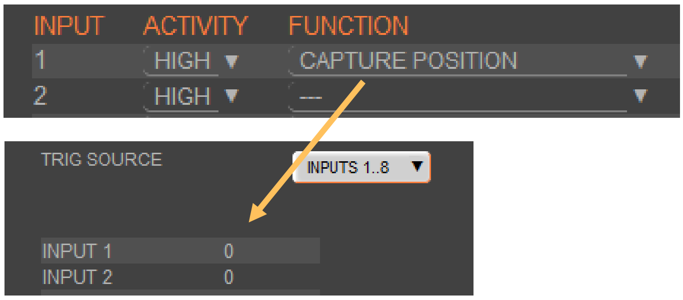


Record function of the actual position controlled by Input

In the WebMotion® menu I/O, you can select the record function CPOS for all digital inputs 1-8.

Reaction time > 4 ms.

(Input 1 = Pos Input 1 etc.
ASCII command: TCPn (n = register number)

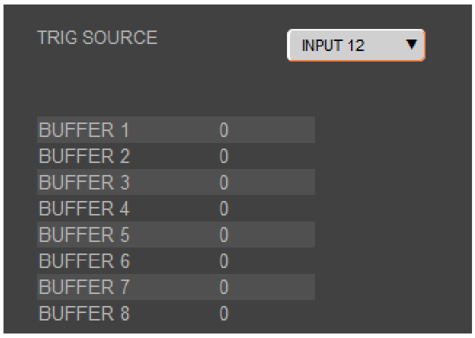


Record function of the actual position controlled by edge

With each increasing edge at input 12, the current position of the motor is written in a buffer register (Start is Captured Pos 1).

Reaction time ~ 4-6µs.
(First edge position = Captured Pos 1 etc.)
ASCII command: TCPn (n = register number)

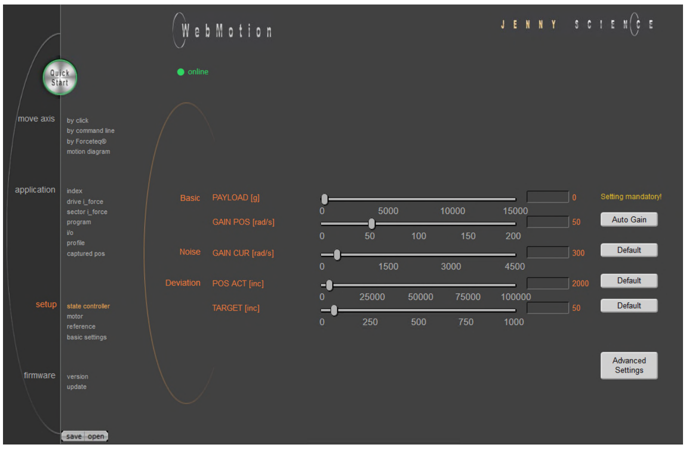
Function is available over Jenny Science bus module in asynchronous operation, too.



Object	Sub Idx		ASCII
5000h	0x5010	CLCP Clear all Captured Position	CLCP
	0x5015	Captured Position Mode Input 12	CP120
	0x5016	Captured Position Mode Input 1..8	CP121
5003h	0x37	Read Buffer Position (1..8)	TCPn (n=1..8)
	0x38	Return of value	

11.18 State Controller

Consult also the TUTORIAL Video
Tutorial 2: Initial XENAX® Xvi state controller setup
on our website. In this video you will see the basic settings of the XENAX® Xvi servo controller for Jenny Science linear motor slide.



The closed loop control system consists of a state controller with observer.

Basic Settings

These settings consent a very easy and clearly arranged controller configuration for most common applications.

Basic PAYLOAD

Additional payload on the linear motor in g. The weight of the motor carriage slider is automatically taken into consideration with the motor identification.

Or

Basic INERTIA (*only for ROTAX® and Third Party Motors)*

Adjustment of the external torque of inertia.
If a gear box is placed between the motor and the load, you must adjust the external torque of inertia according to the motor shaft. The gear transmission ration needs to be squared.
e.g. With a gear transmission ratio of 20:1, we need to reduce the external torque of inertia by a factor of 400.

For direct drive linear motors, it is important to set the parameter for the moment of inertia of the external payload (INERTIA), otherwise the linear motor oscillates. Because there is a factor of 10^{-9}, there can be very large values. If so, please enter the parameter in the corresponding field.
Calculation Example: The external payload is a homogenous disc of 1.1kg and Ø200mm.
Formula is as following:

$$J = \frac{1}{2} m \cdot r^2 = 5.5 \cdot 10^{-3}\ \mathrm{kgm}^2$$

scaling factor with 10^9 results in a parameter value of 5‘500‘000.

(Please refer to XENAX® Servocontroller/General files for XENAX® Xvi/PARAMETERIZATION OF ROTATIVE.*zip* on www.jennyscience.ch/en/download.)

Basic GAIN POS

Gain of position controller. This parameter must be reduced when payload is increased.
The “Auto Gain” function automatically proposes a value

Auto Gain
Sets the gain of position controller based on the entered payload value.
This is a theoretically calculated value. A small adjustment might be necessary and can be completed with "GAIN POS".

Noise GAIN CUR
Gain of current controller. The reduction of this gain consents a diminution of noise emissions in case of sound-sensitive environments.

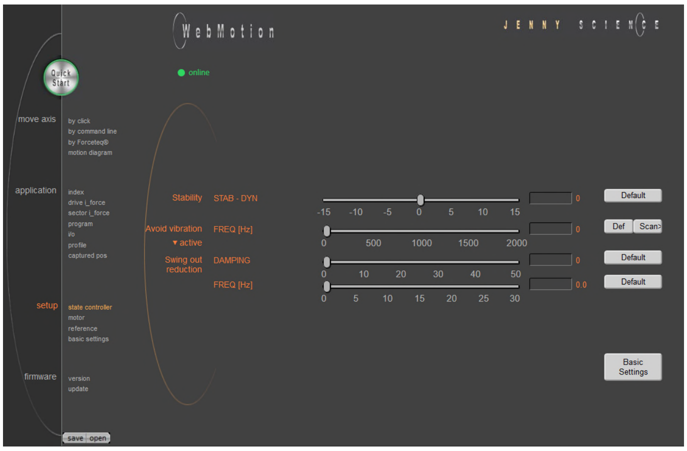
Deviation POS ACT
Maximum position deviation in encoder increments. If this value is exceeded, the error 50 occurs and flashes on the 7-segment display.

Deviation TARGET
Permissible position deviation in the target point until the status "in position" comes up.

Default
Standard setting of the different parameters. All parameters can be manually modified during the controller tuning and can be reset to default values with the „Default" button.

Advanced
Switch to advanced controller configuration parameters

Advanced Settings
These settings permit an advanced controller tuning for complexes constructions affected by mechanical vibrations.



Stability STAB – DYN
This parameter is set per default at 0 and consents to set the controller stability against external disturbances.
Settings in positive direction can improve the dynamic response of the system for basic mechanical construction with small payloads.
Settings in negative direction can reduce the sensitivity of the system to mechanical vibrations.

Avoid vibration FREQ
Current filter frequency. The filter is best suited for the reduction of vibrations with well pronounced frequencies Typical values are in between 300-500Hz. At a value of 0, the filter is not active. The frequency can be automatically detected with an internal scan function (refer to chapter 11.18.1 F Setting) or eventually with the help of a smartphone app. There are 2 types of filters available “active” and “notch” which can be active on different frequencies. The "active" is to be preferred, as it has little influence on the control loop performance. For resonance frequencies with a wide spectrum, a "notch" filter should be used.

Swing out reduction
This feature permits an automatic modification of the target trajectory, so that the settling time after a finished move can be reduced.
For this swing out reduction, two parameters have to be identified and set:
damping and frequency of the oscillation.
Setting one of the two parameters at 0 disables this feature.

Important Note:
The calculation of the target trajectory can not be abruptly changed in motion. After setting a new value for frequency or damping the axis should remain at standstill at least for 1000ms, before so that the new set of parameters will be inconsistent.
(refer to Info 27 in chapter 17 Error Handling).

Attention:
In the case of cyclic interpolated target position operation with a superordinate PLC, the internal controller desired trajectory is modified and the original target position will be reached with some time delay. The correct reaching of the target position must be ensured, tracking the actual position value, prior to start a new motion.

Swing out reduction DAMPING
This parameter consents to set the damping of the mechanical swing out oscillation in % and depends on the load.

Swing out reduction FREQ
This parameter permits to set the frequency of the mechanical swing out oscillation with a resolution of 0.1Hz. These oscillations exhibit low frequencies (usually below 30Hz).
The slowest possible frequency to be set is 2Hz.

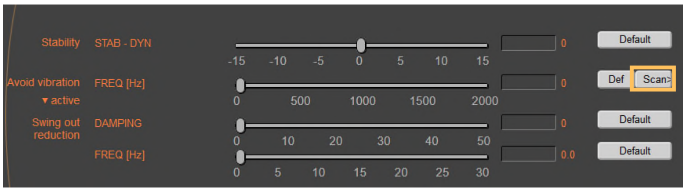
This frequency can be extracted for the “DEVIATION” curve in “Motion Diagram” if the ratio between load and slider load is sufficiently high.
If this is not the case, this frequency can be determined with the help of a highspeed camera, an acceleration sensor or a smartphone app for vibration measurements.

Basic Settings
Switch to the basic controller configuration parameters.

11.18.1 F Setting

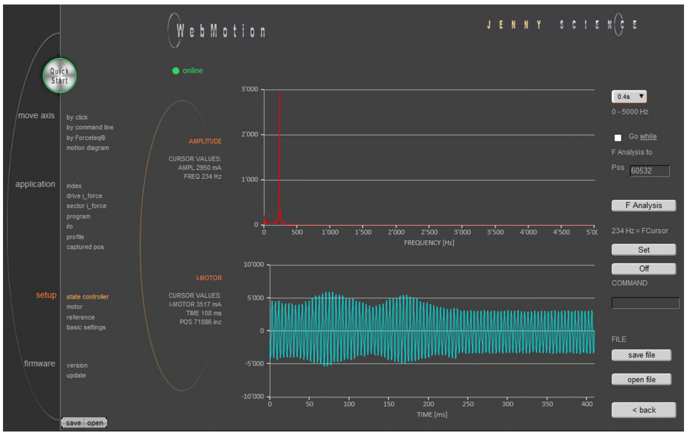
The band width of the position control (GAIN POS) should be set as high as the movements can be completed within the tolerable position deviation but before the motor begins to oscillate. In some applications, usually with high payloads, it sometimes happens that no setting can be found that meets both criteria. If the motor with a set band width begins to oscillate because of a resonance in the system, this oscillation can possibly be suppressed with a filter.

In the menu „state controller“ in WebMotion® the correct PAYLOAD and the required GAIN POS have to be set. If the motor oscillates, the resonance frequency can be found and suppressed with the frequency analysis function.



With the button „Scan>“, the frequency analysis pops up.

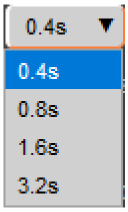
When operating, the frequency analysis can be started anytime. But because the current of the motor is being analyzed for the frequency analysis the, the output stage must be turned on. As soon as the analysis is completed, the measuring results are shown in WebMotion® and the frequency can be set.



Settings for the Frequency Analysis:

Recordable Time:

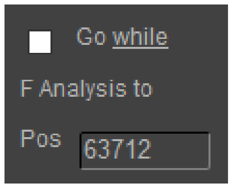
The longer the recording time is, the higher is the frequency resolution, but the smaller is the measurable frequency range. For each recordable time, the according measurable frequency range will be shown. Please begin with the minimal recording time of 0.4s (with the maximal frequency range). For low resonance frequencies, the analysis can be repeated with higher recording time and reduced frequency range.



0.4s -> 0 – 5000Hz
0.8s -> 0 – 2500Hz
1.6s -> 0 – 1250Hz
3.2s -> 0 – 625Hz

Go while F Analysis

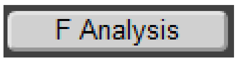
Turned off:
During the frequency analysis there is no movement of the axis. Please select this option, when the analysis should be completed in halt mode or when there is already a movement active (e.g. through a running program or through a superior PLC).



Turned on:
During the frequency analysis, the axis moves to the indicated position within the selected recording time.

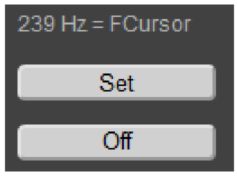
F Analysis

Starts the frequency analysis (and the movement if „Go while F Analysis“ is turned on).



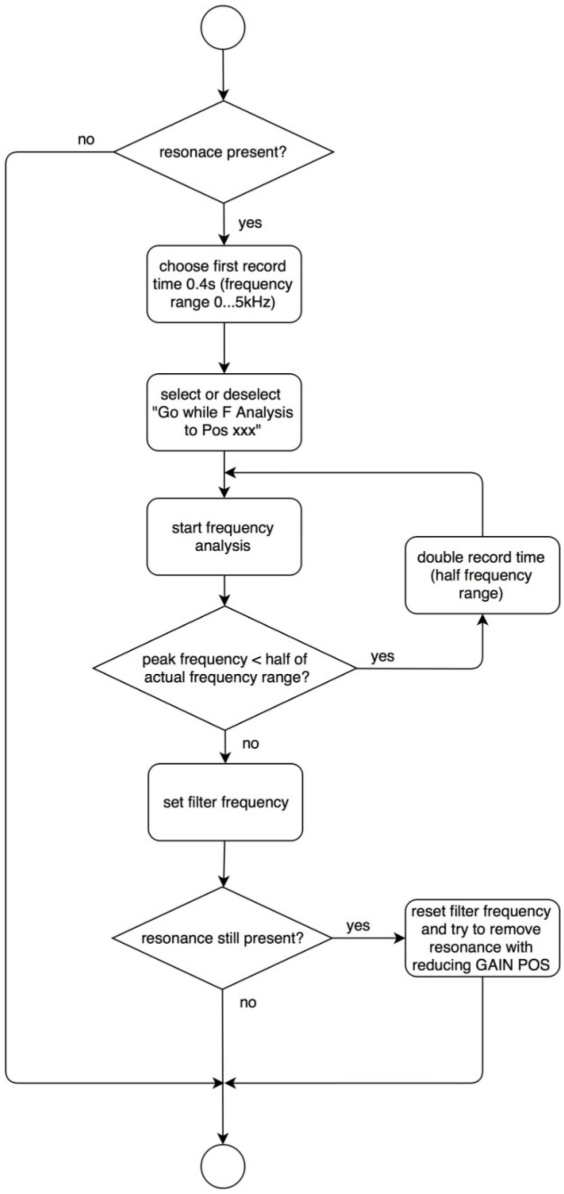
Set

If the cursor is located in the adjustable filter frequency range (Notch: 160…2000Hz, Active: 200…2000Hz), the filter frequency can be set according to the frequency the cursor shows by clicking the button „Set“. Directly after the frequency analysis, the cursor is automatically located on the frequency with the maximal amplitude within the adjustable filter frequency range. It is likely that this is where the resonance frequency is. However, the cursor can be moved anytime to set another filter frequency.
If the filter shall be turned off, then the button „Off“ can be pushed.



Process of a Frequency Analysis:

This process shows a typical process of a frequency analysis:



Notes to frequency analysis:

- The filter frequency might not always be able to clear the oscillation. Especially when the resonance frequency is low, the controller can possibly be affected too much by the filter frequency and the oscillation won't disappear. In this case, please reduce GAIN POS until the oscillation disappears.
- If there are multiple resonance frequencies, try to put the filter frequency in the approximate middle of the resonance frequency.
- On frequency 0, the mean current will be displayed during the frequency analysis. It corresponds to the DC-portion of the motor current, which is rarely 0.

Diagram Amplitude

In this diagram, the amplitudes of all existing frequencies in the motor current are shown. The amplitude and the frequency of the cursor position are displayed on the left side of the diagram.

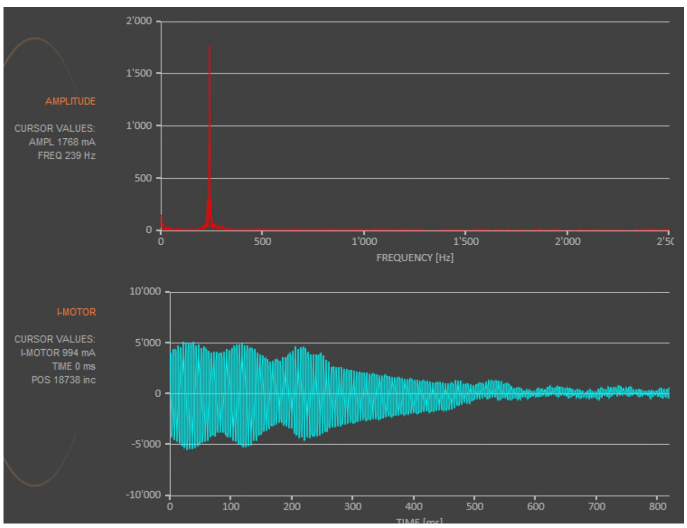


Diagram I-Motor

This diagram displays the motor current for the frequency analysis. The motor current and the recording time at the cursor position are displayed on the left side of the diagram. Furthermore, the same legend shows the position the linear motor slide was located, at the time of the recording.

11.19 Motor

11.19.1 Motors LINAX® and ELAX®

MOTOR TYPE
The connected motor type of LINAX® and ELAX® series will be recognized and shown automatically.

I STOP
Continuous current limitation in standstill.

I RUN
Continuous current limitation while moving.

NUMBER OF POLE PAIRS
LINAX® Lx and ELAX® Ex linear motor pole pairs = 1

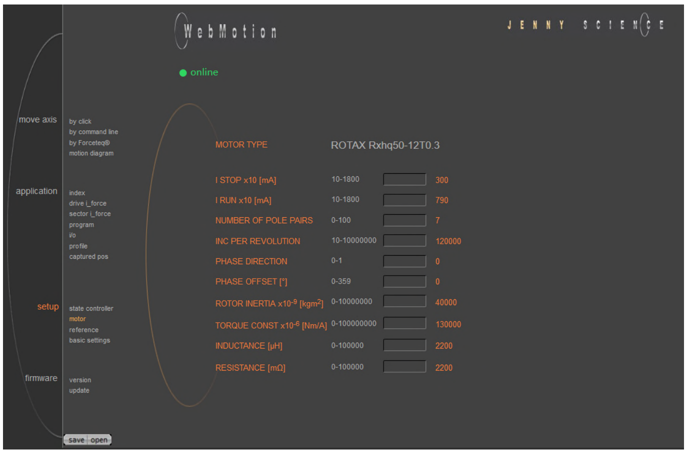
INC PER REVOLUTION
Number of encoder increments per revolution.

Linear motor axis:
Lxc 44F04, INC PER REVOL = 12'000
other LINAX® products Lxc, Lxe, Lxu, Lxs,
INC PER REVOL = 24'000
ELAX®, INC PER REVOL =14'171

PHASE DIRECTION
Direction of phase control
U, V, W or V, W, U, depending on motor type.
LINAX® / ELAX® linear motor, PHASE DIR = 0

PHASE OFFSET
Correction of electrical angle, in accordance with the orientation of the coil to the magnet. Value for all LINAX® and ELAX® products and the most of rotary motors PHASE OFFSET = 0

11.19.2 Motor ROTAX®



MOTOR TYPE
The connected motor type of ROTAX® series will be recognized and shown automatically.

I STOP
Continuous current limitation in standstill.

I RUN
Continuous current limitation while moving.

NUMBER OF POLE PAIRS
Number of pole pairs of AC / DC / EC brushless servo motors. For DC brush-type servo motors, set POLE PAIRS to 0.

INC PER REVOLUTION
Number of encoder increments per revolution by AC / DC / EC brushless servo motors. Not used for DC brush-type servo motors.

PHASE DIRECTION
Direction of phase control
U, V, W or V, W, U, depending on motor type. Can be detected with command PHDD.
With DC brush-type servo motors:
PHASE DIR = 0, if motor shaft turns clockwise with direct DC-supply voltage.
PHASE DIR = 1, if motor shaft turns counter clockwise with direct DC-supply voltage.

PHASE OFFSET
Correction of electrical angle, in accordance with the orientation of the coil to the magnet. Value for the most of rotary motors PHASE OFFSET = 0

ROTOR INERTIA
Rotor moment of inertia of the motor, with factor 10^9.

TORQUE CONST
Torque constant of the motor, with factor 10^6.

INDUCTANCE
Phase to phase inductance of the motor.

RESISTANCE
Phase to phase resistance of the motor.

11.19.3 Third Party Motors

THIRD PARTY MOTOR
Motors that are sold by Jenny Science, are available in the database and can be selected.

For parameterization of rotary servo motors, refer to the document XENAX® Servocontroller/General files for XENAX® Xvi/PARAMETERIZATION OF ROTATIVE.*zip* on www.jennyscience.ch/en/download.

I NOM (FOR I2T)
Acceptable thermic continuous current. Used for I^2T monitoring and current limitation in standstill.

I PEAK
Continuous current limitation while moving.

NUMBER OF POLE PAIRS
Number of pole pairs of AC / DC / EC brushless servo motors. For DC brush-type servo motors, set POLE PAIRS to 0.

INC PER REVOLOLUTION
Number of encoder increments per revolution by AC / DC / EC brushless servo motors. Not used for DC brush-type servo motors.

PHASE DIRECTION
Direction of phase control
U, V, W or V, W, U, depending on motor type. Can be detected with command PHDD.
With DC brush-type servo motors:
PHASE DIR = 0, if motor shaft turns clockwise with direct DC-supply voltage.
PHASE DIR = 1, if motor shaft turns counter clockwise with direct DC-supply voltage.

PHASE OFFSET
Correction of electrical angle, in accordance with the orientation of the coil to the magnet. Value for the most of rotary motors PHASE OFFSET = 0

ROTOR INERTIA
Rotor moment of inertia of the motor, with factor 10^9.

TORQUE CONST
Torque constant of the motor, with factor 10^6.

INDUCTANCE
Phase to phase inductance of the motor.

RESISTANCE
Phase to phase resistance of the motor.

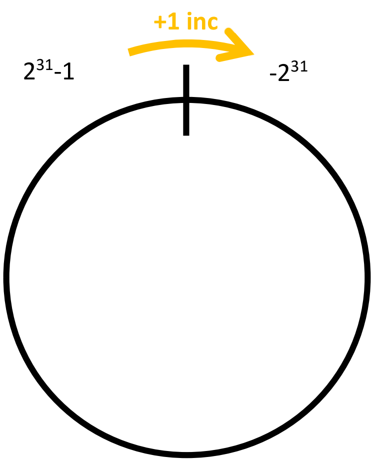
11.19.4 Position Overflow

For ROTAX® servo motor types and Third Party Rotative Motors, which are operated e. g. as rotary tables always in the same direction of rotation, it can occur that the encoder position reaches very high positive or negative values

In order to ensure that the position can be continuously incremented in positive or negative direction, a controlled overflow mechanism is integrated in XENAX® servo controller.

The maximum position values correspond to $2^{31}-1$ = 2’147’483’647 inc in positive direction and -2^{31}=-2’147’483’648 inc in negative direction. The overflow takes place between these two values.

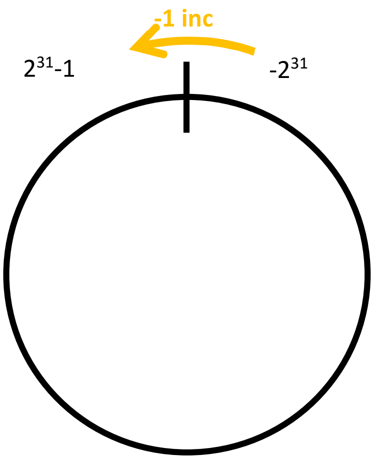
2’147’483’647 <> -2’147’483’648



Example: positive overflow

Actual Position: 2’147’483’646 inc
Relative Motion: 10 inc

Motion:
Start position: 2’147’483’646 inc
2’147’483’647 inc
-2’147’483’648 inc
-2’147’483’647 inc
...
Target position: -2’147’483’640 inc



Example: negative overflow

Actual Position: -2’147’483’648 inc
Relative Motion: -20 inc

Motion:
Start position: **-2’147’483’648 inc**
2’147’483’647 inc
2’147’483’646 inc
...
Target position: 2’147’483’628 inc

11.20 Reference

11.20.1 Reference LINAX®

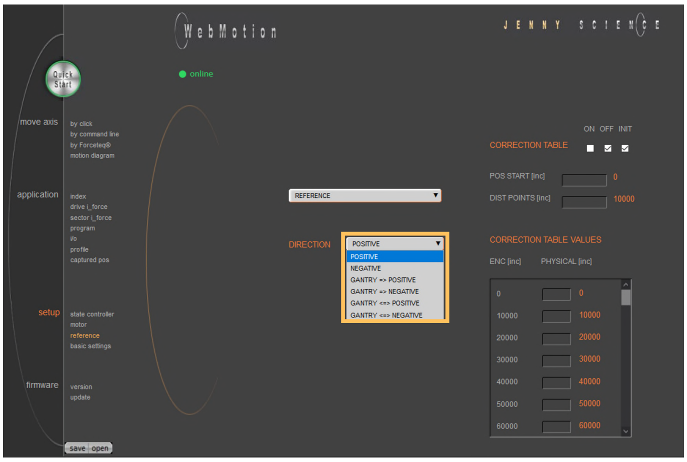
11.20.1.1 Reference Absolute, According Reference Marks

REFERENCE Selection

Default, reference over two reference marks on the measuring scale with calculation of the absolute position. This position refers to the mechanical zero point of the LINAX® linear motor axes.

DIRECTION

Enter start direction of the reference travel direction:



POSITIVE (DEFAULT) =	Reference direction up. Away, from absolute zero point, in positive direction.
NEGATIVE =	Reference direction down, direction towards absolute zero point.
GANTRY => POS =	Motors in same direction up, in positive direction (away from zero point).
GANTRY => NEG =	Motors in same direction, negative direction (towards zero point).
GANTRY<=>POS =	Motors in opposite direction up.
GANTRY<=>NEG =	Motors in opposite direction down.

11.20.2 Reference ELAX®

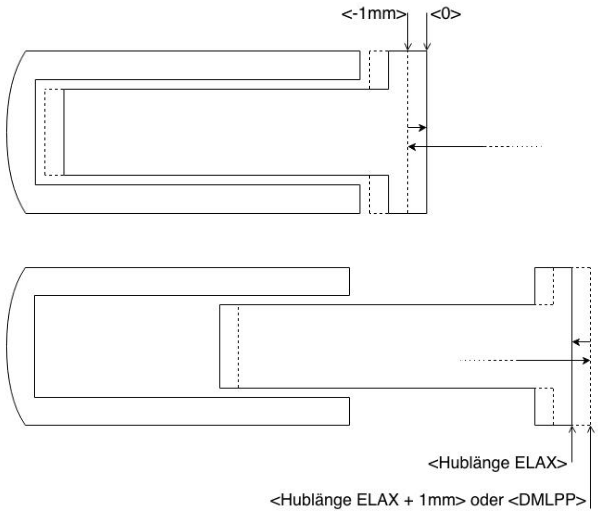
ELAX® does not possess Z-marks on the measuring scale. The absolute position is determined by driving on a mechanical limit. The direction of the reference can be positive or negative (refer to ASCII command “**DRHR**”)

11.20.2.1 Reference with Internal Limit

If there are no externally mounted limit stops (**„MLPN“** = 0 and **„MLPP“** = 0), the reference will be completed by the internal mechanical limits of ELAX® itself.
ASCII command „MLPN“= Mechanical Limit Position Negative
ASCII command „MLPP“= Mechanical Limit Position Positive

Negative Reference (DRHR = 1)
The slide drives in negative direction until the mechanical limit is recognized. This position will then be set to <-1mm> as per definition. In order to complete the reference, the slide moves then to the absolute position 0.
ASCII command „DRHR“= Direction REF

Positive Reference (DRHR = 0)
The slide drives in positive direction until the mechanical limit is recognized. If the calibration of the internal mechanical limit was completed (MLC, Mechanical Limit Calibration)positively, the current position is set to the value **“DMLPP**“. If no calibration of the internal mechanical limit was completed positively **(„DMLPP“ = 0)**,the current position is set to <stroke ELAX + 1mm> as per definition. In order to complete the reference, the slide moves then to the absolute position <stroke ELAX + 1mm>.



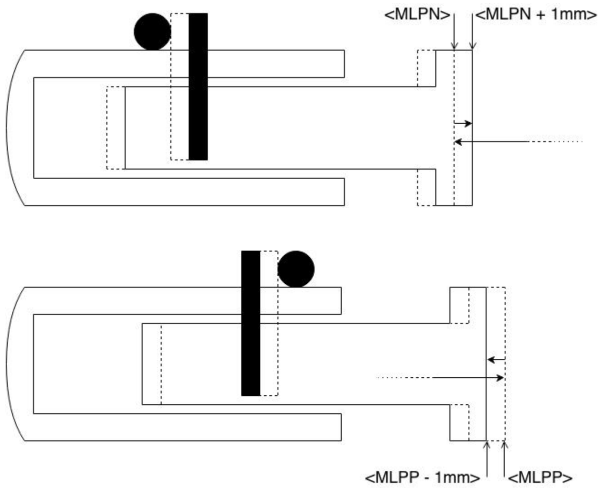
11.20.2.2 Reference with External Limit

If there are externally mounted limit stops (**MLPN** ≠ 0 **or MLPP** ≠ 0), the reference (REF) will be completed to one of the externally mounted limit stops.
ASCII command „MLPN“= Mechanical Limit Position Negative
ASCII command „MLPP“= Mechanical Limit Position Positive

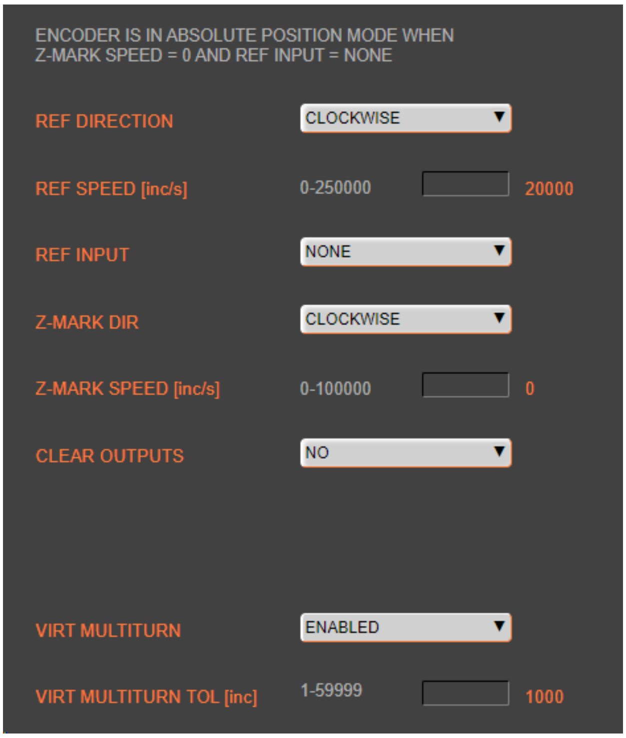
Negative Reference
The slide drives in negative direction until the mechanical limit is recognized. This position will then be set to the value of **„MLPN“**. In order to complete the reference, the slide drives to the absolute position <MLPN +1mm>.

Positive Reference
The slide drives in positive direction until the mechanical limit is recognized. This position will then be set to the value of **„MLPP“.** In order to complete the reference, the slide drives to the absolute position <MLPP - 1mm>.

Important Note:
The position of an externally mounted mechanical limit has to be accurate. If the entered position of the externally mounted limit stop is wrong, the alignment of the coils to the magnets cannot be completed and the motor won’t be capable to drive. If the ELAX® slide is driven to the internal negative limit position, the slide is positioned at <-1mm> as per definition. The position of an externally mounted limit stop has to be indicated in relation to <-1mm>



11.20.3 Reference ROTAX® und Third Party Motors



For ROTAX® and third party motors only, for LINAX® or ELAX® please use directly command „>REF“.

CLOCKWISE = clockwise
COUNTER CLOCKWISE = counter clockwise

REF DIR
Defines start direction for searching the external REF sensors 1 = CLOCKWISE, 2 = COUNTER CLOCKWISE

REF SPEED
Defines speed to search the external REF sensor.
If no home sensor exists, then set this value to 0.

REF INPUT
REF sensor external, input number (NONE or 1-8).

Z-MARK DIR
Defines start direction for searching the Z-mark on encoder 1 = CLOCKWISE, 2 = COUNTERCLOCKWISE. Or 3 = ON SHORTEST WAY (shortest way, only possible at ROTAX® Rxvp).

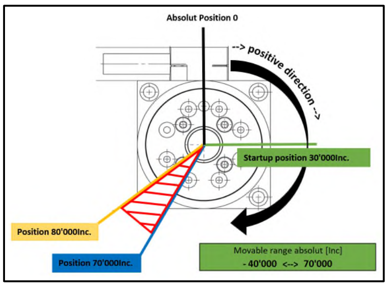
Z-MARK SPEED
Speed to search the Z-mark. If no Z mark (Reference mark) exists, then set this value to 0.

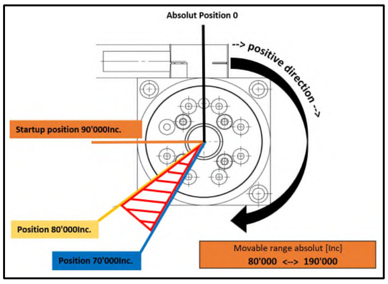
CLEAR OUPTPUTS
Set all outputs to OFF after reference.

VIRT MULTITURN (only available with ROTAX®)
By activating the Virtual Multiturn function, the position is retained by the servo controller after a reboot as long as the position has not changed beyond the set tolerance when the servo controller is switched off.

VIRT MULTITURN TOL
Tolerance window of the encoder position for the virtual multiturn. If the position of the axis changes more than this tolerance window when the virtual multiturn function is switched on, error 53 is displayed.

Note for ROTAX® Rxhq:
Due to the absolute position, the ROTAX® Rxhq is immediately ready for operation after power-on, no reference drive is necessary. If this is performed deliberately, the position changes back to the single-turn position.
For this purpose, the Z-MARK DIR must be set to 0 and the REF INPUT to NONE.
The position of the encoder immediately after starting up, always has a value in the first revolution (example with encoder resolution 120000Inc/revolution value between 0 and 119'999Inc.). E.g. in case of a mechanical stop the movable range of the encoder changes depending on the range (between 0 and mechanical stop in positive direction or between 0 and mechanical stop in negative direction) in which the motor is starting up.

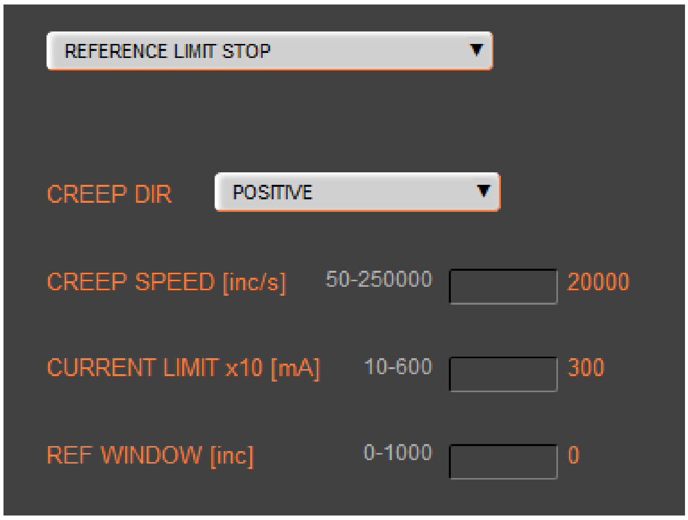




11.20.4 Reference to Mechanical Stop

Selection REFERENCE LIMIT STOP

After the ordinary reference of a LINAX® or ELAX®, it is possible drive to a mechanical stop.
Important: This function is optional and has no influence to the absolute positioning counter.



CREEP DIR
POSITIVE (Travel direction positive)
NEGATIVE (Travel direction negative)

CREEP SPEED
Speed to mechanical stop [Inc/s].

CURRENT LIMIT
Nominal motor current [x10mA] during reference
Power F = motor current x force constant

REF WINDOW
Maximal allowed variation compared to last REF position [Inc].

REF WINDOW = 0, testing off
Output Function REF = 1
REF WINDOW = 1, testing on
Variations within allowed tolerance (REF Window):
Output function REF = 1, current REF position will be new reference position.
Variations out of allowed tolerance:
Output function REF = 0,
The subsequent reference will be the new reference position.

11.20.5 Correction Table for LINAX® / ELAX®

Depending on the application's construction in which a LINAX® or ELAX® linear motor axis is used, it is possible that the encoder position does not correspond to the actual physical position of the linear motor slide (e.g. in cross table or for high cantilevered applications with leverage effect).

To a certain degree, the XENAX® servo controller offers the possibility to correlate the encoder position with the actual position. The correction table in WebMotion® offers 51 entries in which the physical position can be entered in fixed distances to the encoder position. The physical position can be measured with an interferometer.

The range for the way can be freely selected. Furthermore, the starting point and the distances between the entries of the table can be defined. If for example the range 0-100'000 increments shall be corrected, the starting position is 0inc and the distance for the 50 remaining table entries is 2'000 inc (100'000 / 50).

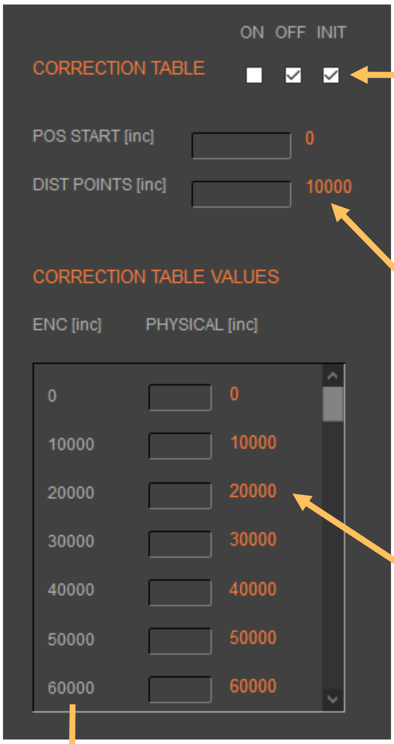
The correction values for the table are determined as follows: If the correction table is deactivated, all positions that were entered in the table are being driven to (example above: 0inc, 2'000inc, 4'000inc, …, 100'000inc). At each position, the actual physical position has to be measured and entered in the correction table. When activating the correction table, all driving commands refer to the actual physical position and no longer to the encoder position of the LINAX® or ELAX® linear motor axes.

Limitations

- Correction table is not supported in case of rotary motors
- Correction table is not supported with communication over Real time Bus module (for example EtherCAT)
- This correction table runs with following commands and functions only: >G, >GP, >GW, >IX, >PRF, >RR, >RW, >TP

Input the correction values with WebMotion®:

With the navigation **setup/reference** in case of LINAX® or ELAX®



Encoder Position (automatically generated from POS START and DIST POINTS)

INIT — Initialize correction table, physical position value = encoder value

OFF — Correction not active, moving commands refer to encoder position value

ON — Correction table active, moving commands refer to physical position value

POS START — Startposition of correction table.

DIST POINTS — Distance between data entries in correction table

Physical absolute Position, measured with laser interferometer.
If you enter a G8000 by command, and the laser interferometer reads the physical position 8011, you can put it in the table and press ENTER to take it over to the table.

Notes to correction table:

- For the positions outside of the correction table, the correction of the first respectively the last entry in the correction table holds valid. For example, the last entry is „ENC:100‘000 -> PHYSICAL 100‘017“, so for the encoder position of 110‘000 the physical value of 110‘017 is considered.
- The position values between the table entries are interpolated.
- The correction table is saved in the application data of the XENAX® servo controller.
- After a reset of the XENAX® servo controller (command “RES”), the correction table will be initialized and deactivated (physical position = encoder position).
- During the measurement of the physical position values, the correction table has to be deactivated.

ASCII Commands

>RES (Reset XENAX®) the correction table status is OFF, encoder values = physical values

>CTAB 0 (= OFF)
>CTAB 1 (= ON)
>CTAB 3 (= INIT)

>CTPS 0 (set correction table position start)
>CTDP 10000 (set correction table distance points)

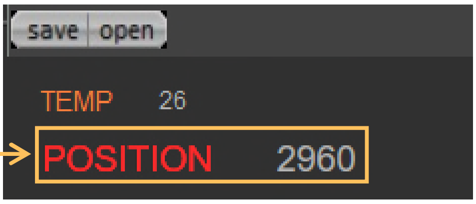
Setup individual correction table values
>CTPO 20000 (preselect absolute encoder position)
>CTVA 20003 (set correction table value with measured physical absolute position)

Important:
The reference point is also depending on the mechanical precision.
Hence this reference point must be always at the same position
We look for Reference REF 2 times.

Application example for Reference:

>REF	Absolute position is calculated anywhere on the linear motor stroke
>G0	Go to absolute position 0
>REF	Absolute position is calculated next to the 0 point This is repeatable at the same position.
>G0	Go to absolute position 0
➔	Now the Linear motor axis is ready

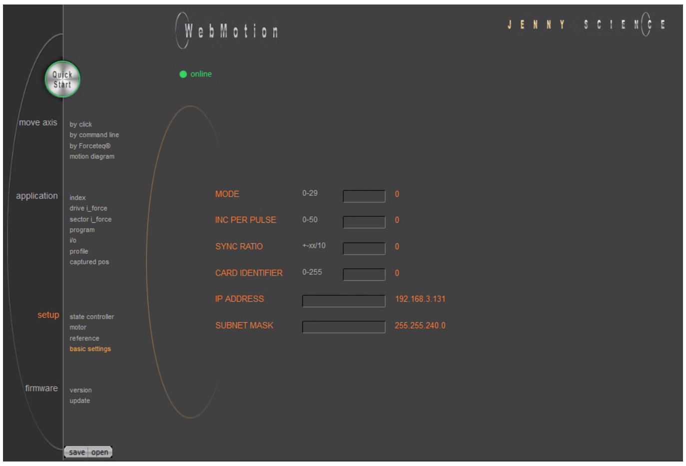
Remark: The position (WebMotion®/ TP „Tell Position") is the physical absolute position
The POSITION Value is blinking red/white when the correction table is in use.



Influence of Temperature on Measuring System
Besides the position deviation, which can be corrected with the correction table, the temperature influence on the measuring system has to be considered, too.
The deviation due to temperature can't be corrected in the correction table and is about 8.5µm per degree Celsius and meter for the optical measuring system. The optical measuring system
Please refer to data sheet of the according motor.

Examples:
1000mm optical glass scale: per 1° Celsius 8.5µm deviation
230mm optical class scale: Per 1° Celsius 2µm deviation

11.21 Basic Settings



General basic settings

MODE
Choose mode:

Standard	0
Electronic Gear	1
Stepper Control	2
Coded Prog No (standard)	10
Coded Prog No (stepper control)	12

INC PER PULSE
Inc. pro Pulse, MODE 2, Puls/Direction controlling.

SYNC RATIO
Ratio of electronic gear

CARD IDENTIFIER
Master/Slave, CANopen, Powerlink
Read form start-up key (2 x binary coded switch)
or set manual if there is no start-up key.

IP ADDRESS
Ethernet TCP/IP Adresse

SUBNET MASK
Ethernet TCP/IP Subnetmask

11.22 Load cell

The settings for the force sensor are only possible with a connected Signateq® measuring amplifier. The submenu is not visible without it.

11.22.1 Test Report

Setup with sensitivity and nominal force from the sensor data sheet as well as the desired measuring range.

SENSOR TYPE
Manufacturer specification of the connected sensor Type.

SERIAL NUMBER
Unique serial number of the connected sensor

SENSITIVITY [mV/V]
Output signal of the sensor according to manufacturer's specification

NOMINAL FORCE [N]
Nominal measuring range according to manufacturer’s specification

MEASURING RANGE [N]
Calibrated measuring range of the sensor

FORCE DIRECTION
COMPRESSION = 0N… +“MEAS. RANGE”
COMPR./TENSION = -“MEAS. RANGE”…+“MEAS. RANGE”
TENSION = -“MEAS. RANGE”…0N

Apply Sensor Data
Configuration is saved to the Signateq®. This deletes already existing calibration values.

BANDWIDTH SIGNATEQ
Bandwidth measurement filter of the Signateq® amplifier. Default setting by "Default" button. Select high enough to achieve the desired reaction time.
Note:
The setting must be smaller than the resonance frequency of the sensor.

FORCE OFFSET INITIAL
Initialization of the measuring range after all settings have been made and loaded "Apply Sensor Data".

11.22.2 Custom Calibration

Commissioning and calibration by entering the correction table.

Note:
Details about this calibration method can be found in the document "Calibration Load Cell_Forceteq® pro" at /www.jennyscience.ch/en/download.

11.22.3 Factory Calibration

Factory calibration is displayed if the sensor has already been calibrated with the Signateq® at Jenny Science AG.
In this case the settings will be displayed here.

11.23 Version

Overview of hardware and software versions of XENAX®, bus module and SMU module.

XENAX®
Overview of firmware, WebMotion®, hardware and MAC-address.

BUS-MODULE
Optional bus module with version indication and protocol type.
Mac-address issue with Profinet / Powerlink and EtherNet/IP
If the Mac-address is 0, the Card Identifier is missing.
IP address issue with EtherNet/IP

SMU-MODULE
Optional SMU module with version indication.

SIGNATEQ®
Optional Signateq® measuring amplifier with version indication.

11.24 Update Firmware

Loading new version of firmware and new WebMotion® to XENAX® or to bus module or SMU module.
The matching software components and hardware platforms can be found in the release notes.

XENAX FW Xvi75V8S
Update of firmware. After switching to the Update GUI, "FIRMWARE" can be selected in the dropdown menu. Then select the <*.mot> file by clicking on "from file" in the Explorer window. After installation and switching back to the WebMotion® interface ("Exit Update GUI") all functions are immediately available.

Recommended procedure of firmware download:
- Save application
- Disconnect PLC-connector and bus module cable if possible.
- We recommend using a point-to-point connection from PC to XENAX®, not via switch.
- After completion of firmware download reset servo controller with command “RES” (reset) in menu *move axis / by command line*
- Reload the application into WebMotion® and download it to servo controller.

XENAX WebMotion
Update from WebMotion®. After switching to the Update GUI, you can select "WEBMOTION" in the dropdown menu. Then select the <*.mot> file by clicking on "from file" in the Explorer window. After installation and switching back to the WebMotion® interface ("Exit Update GUI") all functions are immediately available.

BUS-MODULE Firmware
Update of Busmodul Firmware
(Only available if a bus module is present).
Select and load file (*.flash).
It is recommended to load the corresponding EDS (electronic data sheet) file into the PLC. This is contained in the folder of the firmware.

SMU-MODULE FW SMU
Update of SMU Firmware
(Only available if a SMU is present).
Select and download file Safety_Vx.xx.smu
We suggest checking and testing the safety settings after a safety firmware update.

SIGNATEQ FW Signateq
Update of Signateq® measuring amplifier Firmware (only available if a Signateq® is present). Select and download file FW_Signateq_Vx.xx.stq. After the update, restart the controller and then read out the force applied to the sensor using the "TF" (Tell Force) command to check that the value changes.

Note:
Alternatively, the JSC Ethernet Installer can be used to update each Firmware on several XENAX® Servo controllers simultaneously.

11.25 Save

Saves applications, which contain all from the client saved parameters, data and programs.

to XENAX

saves applications from WebMotion® to XENAX®.

to file

saves applications from WebMotion® to a file on PC/Laptop (Harddisk, Server).

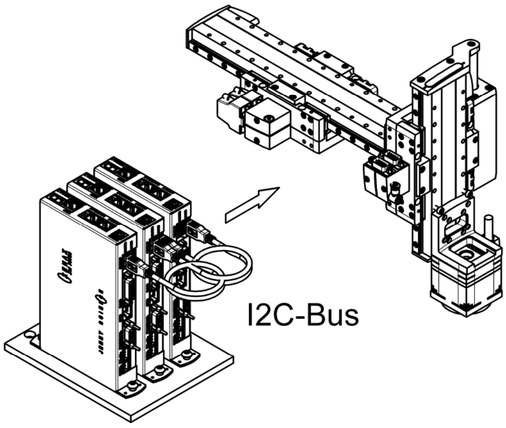
to start-up key
Saves applications in the start-up key to load faster on other XENAX®. If "with Ethernet settings" is checked, the Ethernet settings are also saved on the Start-up Key and thus copied to another servo controller when loading.

11.26 Open

Opens applications, which contain all from the client saved parameters, data and programs.

from file
loads an existing application from a file to WebMotion®. Data will be stored into XENAX®.

12 Master / Slave



With the master/slave configuration you can control up to 4 axes with one central program.

Typical applications are handlings modules (pick&place).

The master controls his slave's autonomously in stand-alone operation and can directly be controlled by a superior system over simple I/O signals.

12.1 Master/Slave Configuration

Master and slave devices are absolute identical standard XENAX® servo controllers.

The I^2C bus is interconnected via short standard USB patch cables. Both plugs (USB-A) are usable.

No difference between input and output.

The parameter CI (Card Identifier) must be set on the involved devices as follows:

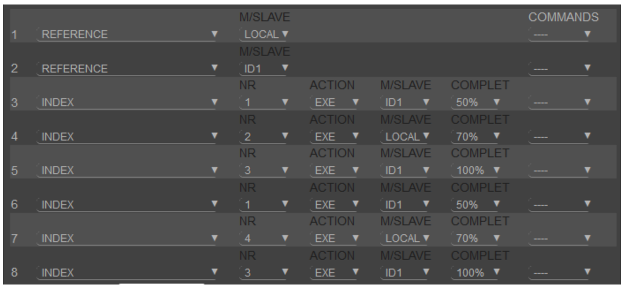
Device	CI	Remote ID	
Master	0	LOC (local)	programs
Slave 1	1	REM ID1	-
Slave 2	2	REM ID2	-
Slave 3	3	REM ID3	-

Important:
The program is running on the master servo controller.
On the slaves servo controller must be no programs loaded.

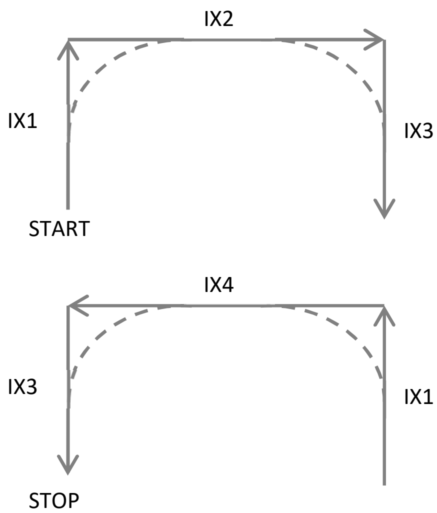
The start-up key functionality is disabled in master/slave configuration and must be disconnected.

12.2 Programming example Pick&Place

X-Axis Master (LOC)
Z-Axis Slave (REM ID1)



1	REFERENCE	M/SLAVE LOCAL				COMMANDS ----
2	REFERENCE	M/SLAVE ID1				----
3	INDEX	NR 1	ACTION EXE	M/SLAVE ID1	COMPLET 50%	----
4	INDEX	NR 2	ACTION EXE	M/SLAVE LOCAL	COMPLET 70%	----
5	INDEX	NR 3	ACTION EXE	M/SLAVE ID1	COMPLET 100%	----
6	INDEX	NR 1	ACTION EXE	M/SLAVE ID1	COMPLET 50%	----
7	INDEX	NR 4	ACTION EXE	M/SLAVE LOCAL	COMPLET 70%	----
8	INDEX	NR 3	ACTION EXE	M/SLAVE ID1	COMPLET 100%	----



Please note:
All indices and profiles have to be defined exclusively in the master device. After turning on the devices, indices and profiles will be automatically transferred to the slaves.

12.3 Timing Master / Slave

The program interpreter is triggered in 1ms intervals. The transmission of a command from the master to the slave takes an additional 0.45ms.

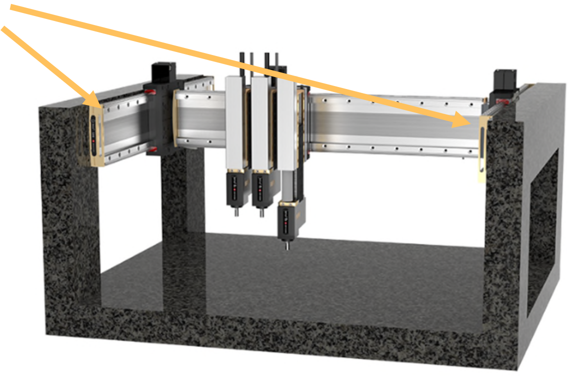
The measurement of time critical sequences is possible with the process timer functionality and the commands: “TIMER_START” und “TIMER_STOP”. The process time can be read with the command TPT (Tell Process Timer).

13 Gantry Synchronized Mode

In the gantry mode there are two linear motor axes mounted with the same driving direction. Those two axes have to move synchronously. In this example these are the y-axes marked with the arrows.

When switching on the system, these two Y-axes have to be aligned in order to move without mechanical tension.

The alignment is automatically completed with the function "REFERENCE". For "REFERENCE" function for gantry systems you will need the following information:



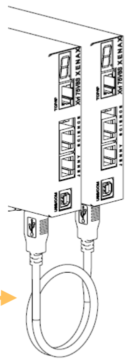
The arrangement of the two linear motor axes
Is driving direction from the mechanical absolute zero point the same for both axes or in opposite direction
In which direction should the reference be completed (parameter DRHR)

13.1 Activate Gantry Mode

The axis with which will be communicated by ASCII commands is the master. The slave has to be connected to the master via A-A cable.

The slave has to be assigned a CARD IDENTIFIER between 1 and 3. This can be done by WebMotion® under "*setup / basic / CARD IDENTIFIER*" or with ASCII command
CI x (where x = 1-3).
The card identifier (CI) can also be assigned with a start-up key and an address from 1 to 3. When turning on the logic supply the next time, this CI number of the start-up key is set.
The master has to be assigned to the number 0 or a different Card identifier (CI) than its slave.

Corresponds to CI

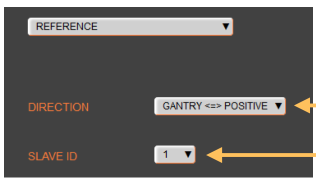


Master-Slave
USB A-A cable

XENAX®	Parameter	Description
SLAVE	CI	Card Identifier
MASTER	DRHR	Direction of reference drive and arrangement LINAX® / ELAX® linear motor axes.
MASTER	GSID	Gantry Slave ID corresponds to CI Slave

The gantry mode is activated with these settings.

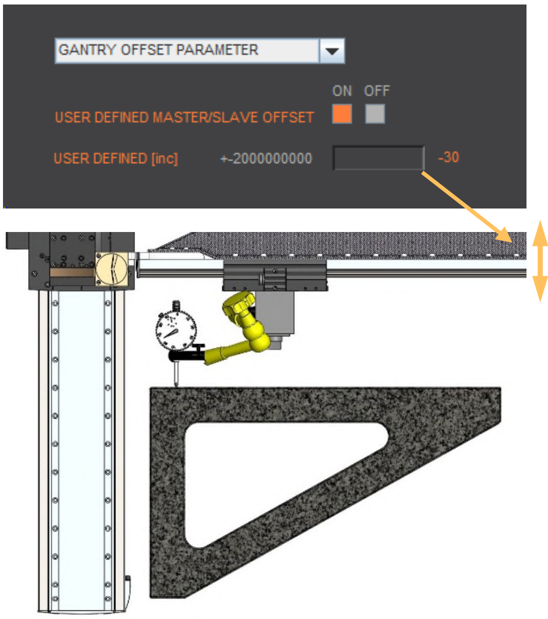
Settings WebMotion®
(settings only necessary on the XENAX® Master)



Corresponds to DRHR

Corresponds to GSID

By selecting the "Gantry Offset Parameter", you can specify whether the position offset between the master and slave should be set automatically or manually.
If you set the "User Defined Master/Slave Offset" option to OFF, the offset is determined during referencing and its value becomes visible.
If you select the "User Defined" setting, you can set the offset manually to correct the rectangularity of the gantry setup. This change is made directly in the slave and the rectangularity can then be checked using a dial gauge.



13.2 ASCII Commands for Gantry Synchronized Mode

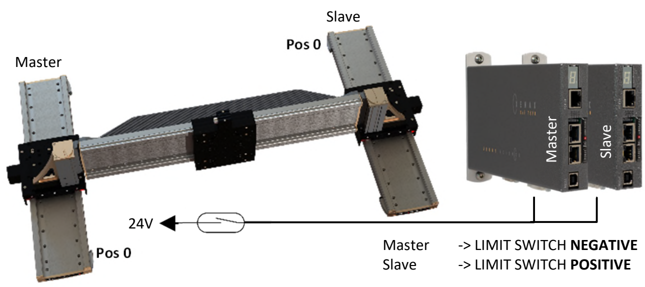
Command	Description
REF	Reference
GP / G	Go Position / Go direct Position
GW	Go Way
IX	Index
PRF	Start profile No. xx
PG	Program
EE*	Emergency Exit
EE1*	Emergency Exit 1
SM	Stop Motion

Can also be triggered as INPUT FUNCTION in the master.
Reference, profile and indices can also be invoked in a program.

** EE and EE1 must only be parameterized in a Gantry Master*

13.3 HW Limit-Switch in Gantry-Setup

If a limit switch is used in a gantry setup, it must be wired to both servo controllers (master and slave). Please note the different configuration with opposite zero position.



14 Forceteq® Force Measurement Technology

14.1 Forceteq® basic current based with self calibrated motor

The Forceteq® basic measurement technology is completely integrated in the XENAX® Xvi servo controller. This allows force-monitored control of all Jenny Science linear and rotary motor axes. The force is measured during the production process using the patented Forceteq® measurement technology, no external load cell is required. This allows you to acquire and record quality-relevant force-distance diagrams for all movements. Assembly operations can be monitored "in-process". Errors and discrepancies are detected immediately. This means better quality and higher throughput. Additional checking stations are no longer necessary.

- For Standalone Operation

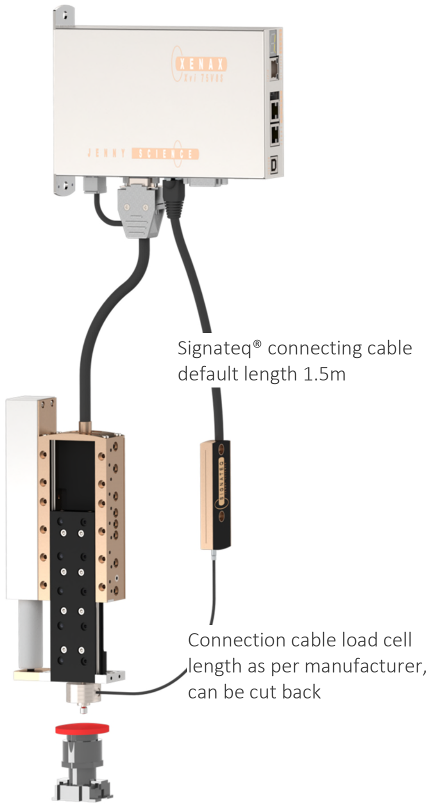
- Up to 10 force sectors programm able with WebMotion®

The individual axis types have different resolution and accuracy of the force and the measurable minimally measurable force.

Linear-Motor	Force Constant	Minimally Measurable Force	Resolution
LINAX® Lxc F08	1N ~ 32 * 10 mA	0.5 N	0.25 N
LINAX® Lxc F10	1N ~ 28 * 10 mA	0.5 N	0.25 N
ELAX® Ex F20	1N ~ 12 * 10 mA	0.5 N	0.25 N
LINAX® Lxc F40	1N ~ 11 * 10 mA	1.0 N	0.5 N
LINAX® Lxu / Lxs F60	1N ~ 10 * 10 mA	10.0 N	5.0 N

Rotativ-Motor	Torque Constant	Minimally Measurable Torque	Resolution
ROTAX® Rxhq 110-50T1.5	10mNm ~ 2.5 * 10 mA	60 mNm	30 mNm
ROTAX® Rxhq 50-12T0.3	10mNm ~ 8 * 10 mA	20 mNm	10 mNm
ROTAX® Rxvp 28-6T0.04	10mNm ~ 23 * 10mA	6 mNm	3 mNm

14.2 Forceteq® pro precise with Signateq® and external load cell



With the new developed Signateq® measuring amplifier, a standard strain gauge load cell can be connected directly to the XENAX® Xvi 75V8S servo controller. By using a load cell, the measurement and control adjustment of Forceteq® measurement technology becomes much more precise.
Due to the two-stage measuring amplifier, the signal noise is reduced and sensors with low sensitivity can be used with no problems.

Signateq® Measuring Amplifier

Length	78mm
Width	27.5mm
Height	12mm

Sampling rate of load cell	2µs
Transmission rate of average values	100µs
Bandwidth Signateq® (Amplifier)	100Hz up to 5kHz
Range of sensitivity *)	0.1mV/V up to 4.6mV/V
Calculate resolution of force	Max Force of Sensor / 3732

*) If the sensitivity is higher than 4.6 mV/V the measuring range is limited upwards.

Example: Load cell **type 8432 from Burster** with overload protection.

Specific linearity variation	0,15 %
Measuring range	0 ... 2,5 N to 0 ... 100 kN

Resolution of force

Art. No. Burster	Measuring range	Sensitivity	Resolution of force
8432-5005	0 - 5 N	0.75mV/V	1.3 mN / 0.13 gf
8432-5010	0 - 10 N	1.5mV/V	2.7 mN / 0.28 gf
8432-5020	0 - 20 N	2.0mV/V	5.4 mN / 0.55 gf
8432-5050	0 - 50 N	2.0mV/V	13.4 mN / 1.37 gf
8432-5100	0 - 100 N	2.0mV/V	26.8 mN / 2.73 gf
8432-5200	0 - 200 N	2.0mV/V	53.6 mN / 5.47 gf

[gf] = gram-force

Specifications of the available linear motor axes

Linear motor type Measuring system	Max. Force	Max. driving distance [mm]	Forceteq basic resolution	Forceteq pro resolution / range.
LINAX® Lxc F08, 1µm/100nm opt.	24N	44*	0.25 N	5.4mN, with max. 20N
LINAX® Lxc F10, 1µm/100nm opt.	30N	85*, 135, 230	0.25 N	5.4mN, with max. 20N
ELAX® Ex F20, 1µm magn.	60N	30*, 50*, 80*, 110*, 150	0.25 N	13.4mN, with max. 50N
LINAX® Lxc F40, 1µm/100nm opt.	112N	80*, 176*, 272	0.5 N	26.8 mN, with max. 100N
LINAX® Lxu F60, 1µm magn./100nm opt.	180N	40*, 80*, 160*, 240*, 320	5.0 N	53.6 mN, with max. 180N
LINAX® Lxs F60, 1µm magn./100nm opt.	180N	160 up to 1600	5.0 N	53.6 mN, with max. 180N

* Available with weight compensation for vertical installation, can reduce the force resolution of Forceteq® basic

14.3 Forceteq® basic via Realtime Bus

The force values are transmitted as process data objects (PDO) cyclically according to the bus cycle time

14.3.1 CANopen over Ethernet

Parameter	Objekt (PDO)	Description
Position Actual [Inc]	6064h	Position actual
I_Force Actual [mA]	2005h	Force-equivalent current actual
Limit I_Force [x10mA]	6073h	Limitation of force-equivalent current
Process Status Register	2006h Bit 15	Limitation of force-equivalent current reached

14.3.2 Ethernet/IP

Parameter	Class	Instanz	Id	Description
PositionActual [Inc]	0x66	0x1	0x24	Position actual
IForceActual [mA]	0x64	0x1	0x5	Force-equivalent current actual
LimitIForce [x10mA]	0x66	0x1	0x33	Limitation of force-equivalent current
ProcessStatusRegister	0x64	0x1	0x6 Bit15	Limitation of force-equivalent current reached

14.3.3 Profinet

Parameter	PROFIdrive Telegram 9	I/O Data Number	Description
XIST_A [Inc]	Standard	4&5	Position actual
I_Force Actual [mA]	Supplementary Data 4 Data 5	 2&3 1&2	Force-equivalent current actual
Limit I_Force [x10mA]	Supplementary Data 4 Data 5	 1 1	Limitation of force-equivalent current
Process Status Register	Supplementary Data 4 Data 5	 6&7 Bit 15 5&6 Bit 15	Limitation of force-equivalent current reached

14.4 Forceteq® basic via XENAX®

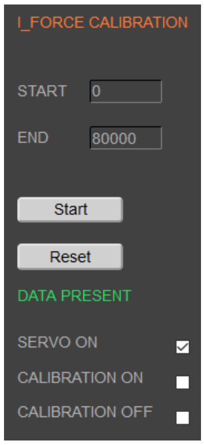
14.4.1 I_Force Calibration

With the patented function „force calibration“ of the XENAX® servo controller, the cogging-, load- and friction forces of the iron core LINAX® and ELAX® linear motor axes and the ROTAX® rotary axes from Jenny Science can be detected. This is how it becomes possible to limit, monitor and control forces in processes.

START: Determining the beginning position of calibration process in increments.

END: Determining the ending position of calibration process in increments.

In order to increase the accuracy of the detected forces at temperature variations, the temperature drift of the detection is continuously compensated at disabled power stage. The compensation also takes place before each start of a „force Calibration“.



Normal operation, calibration active
Test calibration active
Test without calibration

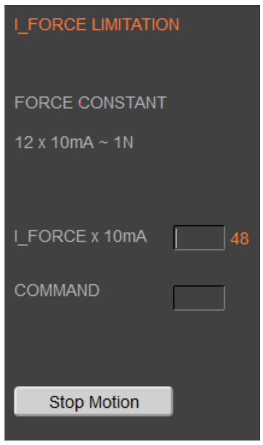
14.4.2 I_Force Limitation

The current value „I_Force“ is proportional to the force. Following graph shows corresponding relations for the different linear motor types.

LINAX® Linear Motor Axis	Force Constant	Minimal detectable force	Resolution
Lxc F04	50 * 10mA ~ 1N	0.5N	0.25N
Lxc F08	32 * 10mA ~ 1N	0.5N	0.25N
Lxc F10	28 * 10mA ~ 1N	0.5N	0.25N
Lxc F40	11 * 10mA ~ 1N	1N	0.5N
Lxe F40	11 * 10mA ~ 1N	10N	5N
Lxu / Lxs F60	10 * 10mA ~ 1N	10N	5N

ELAX® Linear Motor Slide	Force Constant	Minimal detectable force	Resolution
Ex F20	12 * 10mA ~ 1N	0.5N	0.25N

ROTAX® Rotary Motor Axis	Torque Constant	Messbares Min.moment	Resolution
Rxhq 110-50T1.5	2.5 * 10mA ~ 0.01Nm	0.06Nm	0.03Nm
Rxhq 50-12T0.3	8 * 10mA ~ 0.01Nm	0.02Nm	0.01Nm
Rxvp 28-6T0.04	23 * 10mA ~ 0.01Nm	0.006Nm	0.003Nm

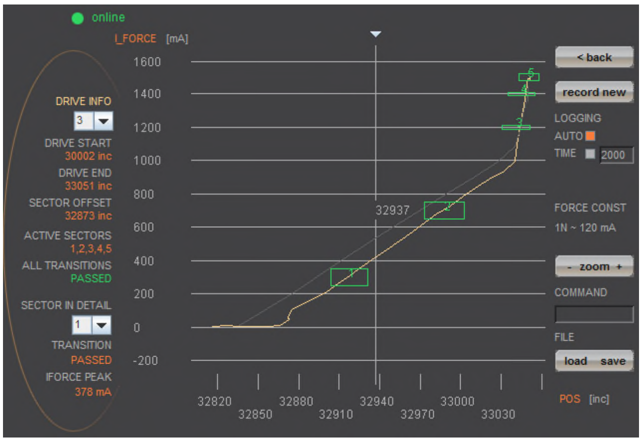


Example:
A compression die should apply no more than 4N force on an object.
Force Limitation with „LIMIT I-FORCE“
e.g.. ELAX® force constant: 12 x 10mA ~ 1 N
48 x 10mA ~ 4 N

14.4.3 I_Force Monitoring

14.4.3.1 Diagram I_Force

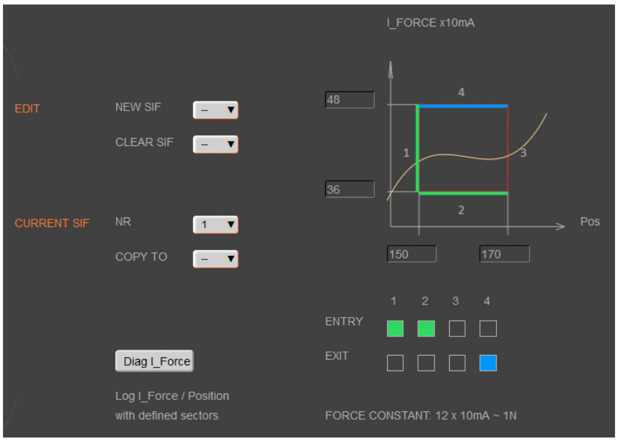
In the menu „Diag I_Force“ the way/force diagram can be recorded by which the force progression through the sectors can be verified.



14.4.3.2 Sector I_Force

In the WebMotion® program menu „sector i-force“ up to 10 different force sectors can be defined.

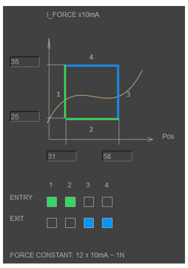
Example:
Once an object is touched the force progression shall be examined in a sector of 150 to 170 Increments. When entering the force sector (“ENTRY”) the force should be between 3 and 4N. When exiting the sector (“EXIT”), the force should have reached 4N. These force specifications are defined with the in the force sector incoming and exiting sector boundaries.

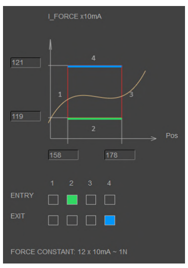


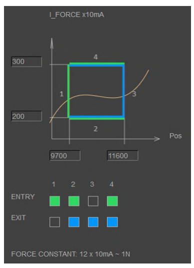
Force Specification Examples:
1) Force curve has to pass through sector from the left/bottom side to right/top side.

2) Force curve has to pass through sector from the bottom to the top side.

3) Force curve has to reach the sector and can pass through incoming and exiting force boundaries multiple times.


1


2

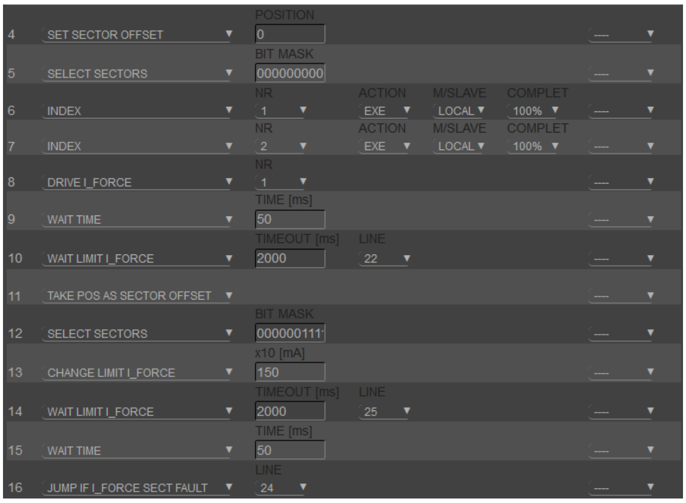

3

Note:
If there are defined incoming and exiting force boundaries, it is absolutely necessary that the force curve passes through them. If there are no incoming force boundaries defined, the force curve has to begin somewhere within the force sector. If there are no exiting force boundaries defined, the force curve has to end within the force sector.

14.4.4 I_Force Control

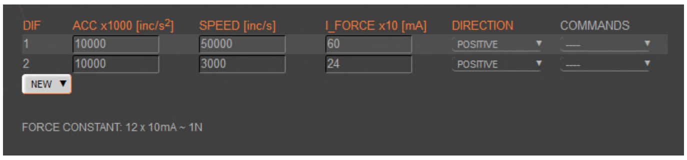
14.4.4.1 Program with I_Force Control Commands

In the WebMotion® menu „program“ the different force functions of I_FORCE CALIBRATION, I_FORCE LIMITATION and I_FORCE MONITORING can be combined and defined with the use of the according commands.
The command can be found in chapter 11.14.1 Program commands



14.4.4.2 Drive I_Force

DRIVE I_FORCE is driving with force consisting of acceleration (ACC), speed (SPEED), current (I_FORCE) and driving direction (DIRECTION).



After defining and saving the above mentioned parameters, DRIVE I_FORCE can be included in a program.

Up to 10 DRIVE I_FORCE can be defined.

14.4.5 Sector Offset for Touching Position

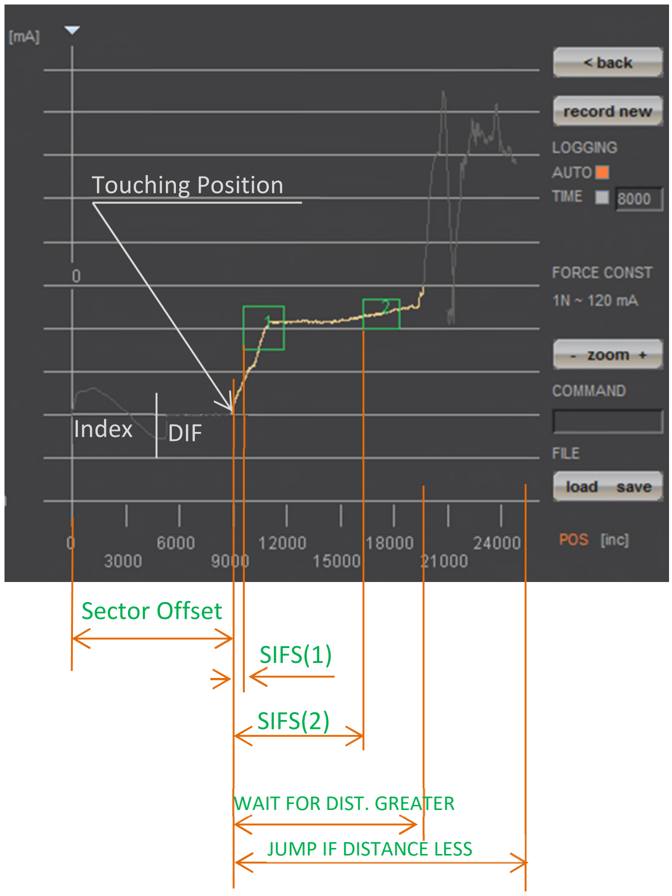
Typically an object is first touched. All following functions then relate to this touching position. Depending on the size tolerance of the objects, this touching position differs from object to object.

The touching position can very simply be detected with „Drive I_Force“ (by using little force). The command “TPSO” (Take IST-Position as Sector Offset) will take this touching position as sector offset for all functions that follow.

In order to determine the value „Sector I_Force Start“ and „Sector I_Force End“ it is simplest to record the force curve and to calculate the distance to touching position (absolute position – Sector Offset).

“Sector I_Force Start”, “Sector I_Force End”, “Wait for Distance greater/less” and “Jump if Distance greater/less” are distances relative to the touching position (sector offset).

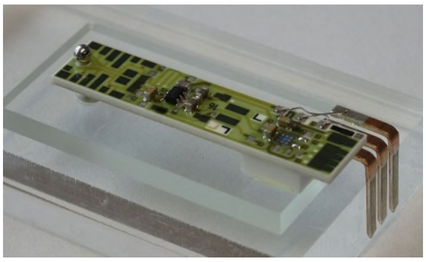
With „SSO“ Set Sector Offset = 0 the distances correspond to the absolute positions.



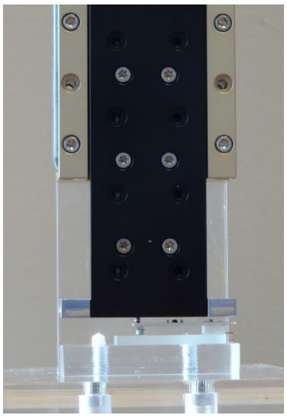
14.4.6 Application Example

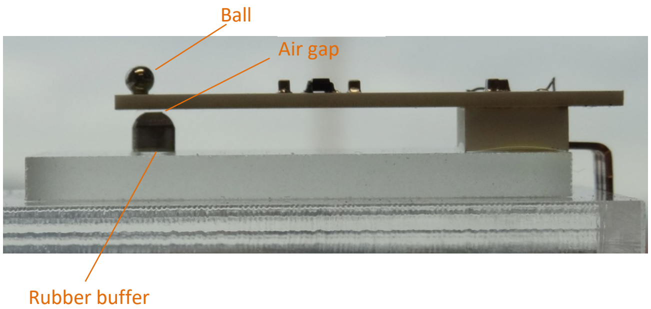
A force sensor consisting of a little mounting plate, ceramic and strain gauge elements glued on the top shall be tested upon its functionality.

The force sensor measures the external force applied to the small ball (upper left corner in picture).



With the ELAX® linear motor slide and the XENAX® servo controller the ball shall be touched and the touching position detected. The touching position is the offset of the actual force curve measurement. This offset compensates the height tolerances of the different measuring objects.





After touching position, the force curve of the ceramic plate shall be recorded.
After an air gap of only 200 µm, the ceramic plate hits the rubber buffer. At this position the force increases steeper as the rubber buffer acts against the ceramic plate. The maximal force is limited to approximately 12N ~150 x 10mA. Of interest is the increase in force while the plate is bending and the position where the force curve is making a kink upwards when hitting the rubber buffer. For this example, five different sectors are defined on the force-/way curve, which have to be passed correctly.

Hereinafter you can find the according program example 1) as stand-alone version programmed and stored in the XENAX® servo controller 2) as Ascii command set controlled via a superior controller.

14.4.6.1 Application as program in XENAX®

Input / Output Interface Definition

INPUT FUNCTIONS:

Input 1 = Program 1, Referencing and drive to position 0
Input 2 = Program 2, Force Calibration of ELAX® linear motor slide
Input 3 = Program 3, Entire test process including analysis

OUTPUT „STATUS":

Output 1 = No touching position found → No test object available
Output 2 = Error of test object
Output 5 = Test object OK

INDEX, DRIVE I_FORCE und SECTORS

Drive INDEX 1 to 0Inc. absolute (1Inc = 1µm)

******* Index 1******
Acc x1000 = 1000
Speed = 100000
Dist = 0
AbsRel = 1

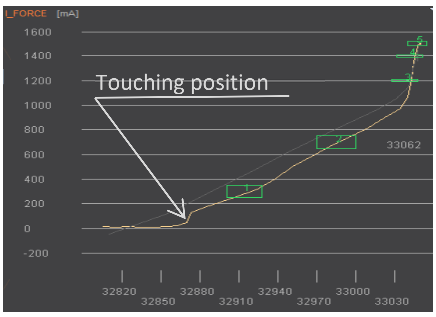
Drive INDEX 2 to 30'000Inc. absolut

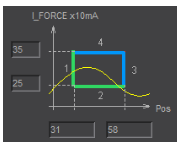
******* Index 2******
Acc x1000 = 1000
Speed = 100000
Dist = 30000
AbsRel = 1

Drive with Force, Force on 0.5N in order to recognize touching position. (1N = 12 x 10mA)

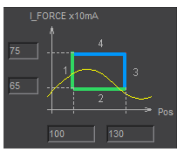
******* Drive I_Force 1 ***************
Acc x1000 = 100
Speed = 5000
IForce x10mA = 6
Direction = 0

In order to determine the following sector parameters, we recommend the following approach:
1. Drive towards test object (Drive I_Force) with little force (e.g. 0.5-1.0N) and remember the touching position (offset corresponds to the position at arrowhead)
2. Record Force/Way diagram of a correct test object. Then place the testing sectors according to the force curve and retrieve parameters. For Sector I_Force Start/End the offset has to be subtracted of the touching position.

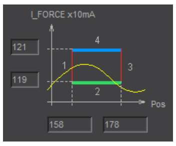




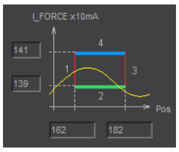
******* Sector I_Force 1 ***************
Sector IForce Start = 31
Sector IForce End = 58
IForce Low x10mA = 25
IForce High x10mA = 35
Sector Transit Config = 12480



******* Sector I_Force 2 ***************
Sector IForce Start = 100
Sector IForce End = 130
IForce Low x10mA = 65
IForce High x10mA = 75
Sector Transit Config = 12480

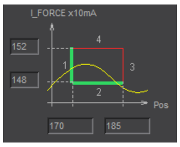


******* Sector I_Force 3 ***************
Sector IForce Start = 158
Sector IForce End = 178
IForce Low x10mA = 119
IForce High x10mA = 121
Sector Transit Config = 8320



******* Sector I_Force 4 ***************
Sector IForce Start = 162
Sector IForce End = 182
IForce Low x10mA = 139
IForce High x10mA = 141
Sector Transit Config = 8320

No „EXIT“
Ending position has to be in sector.



******* Sector I_Force 5 ***************
Sector IForce Start = 170
Sector IForce End = 185
IForce Low x10mA = 148
IForce High x10mA = 152
Sector Transit Config = 12288

******* Program 1 ******

Referencing and driving to position 0, INDEX 1

Line 1 REFERENCE
Line 2 INDEX 1, DEVICE = LOCAL COMPLETION = 100%

******* Program 2 ******

Calibration of linear motor slide by recording all forces (cogging, friction, weight etc.)

Line 1 FORCE CALIBRATION POSITION START = 0 POSITION END = 50000

******* Program 3 ******

Entire testing process with analysis of result

Reset output status display

Line 1 CLEAR OUTPUT 1 M/SLAVE DEVICE = LOCAL
Line 2 CLEAR OUTPUT 2 M/SLAVE DEVICE = LOCAL
Line 3 CLEAR OUTPUT 5 M/SLAVE DEVICE = LOCAL

Initializing sector offset to 0 (not mandatory)
Selected sectors 0 (not mandatory)

Line 4 SET SECTOR OFFSET POSITION = 0
Line 5 SELECT SECTORS 0

Drive to position 0, all the way to the top
Drive to position 30000, fast driving to pre-position
Drive to touching position with little force (0.5N)
Short wait time, in case the force has been exceeded while accelerating (when using little forces).

Line 6 INDEX 1 LOCAL COMPLETION = 100%
Line 7 INDEX 2 LOCAL COMPLETION = 100%
Line 8 DRIVE I_FORCE 1
Line 9 WAIT TIME TIME [ms] = 50

Wait until LIMIT I_FORCE is reached. If there is no touching position during timeout frame, jump to error “no object in place”, output 1 ON

Line 10 WAIT LIMIT I_FORCE TIMEOUT = 2000ms LINE = 23

Short wait time in order to stabilize touching position
Takes touching position as offset for the following tests
Selecting sectors 1-5

Line 11 WAIT TIME TIME [ms] = 20
Line 12 TAKE POS AS SECTOR OFFSET
Line 13 SELECT SECTORS 11111

Change I_FORCE forcurrent Drive I_Force from, 6 to 150 = 12.5N
Timeout in case that force is not reached, then no output no 5.
Short wait time after force reaches limit to “stabilize”.

Line 14 CHANGE LIMIT I_FORCE I_FORCE = 150
Line 15 WAIT LIMIT I_FORCE TIMEOUT = 2000ms LINE = 26
Line 16 WAIT TIME TIME [ms] = 20

Drive I_Force ends
Testing the selected sectors, in case of an error, jump to error
output 5 ON, meaning testing object OK

Line 17 DRIVE I_FORCE END
Line 18 JUMP IF I_FORCE SECT FAULT LINE = 25
Line 19 SET OUTPUT 5 M/SLAVE DEVICE = LOCAL
Line 20 SELECT SECTORS 0
Line 21 INDEX 1 LOCAL COMPLETION = 100%
Line 22 PROGRAM END

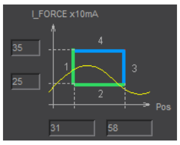
Line 23 SET OUTPUT 1 M/SLAVE DEVICE = LOCAL
Line 24 GOTO LINE 26

Line 25 SET OUTPUT 2 M/SLAVE DEVICE = LOCAL
Line 26 DRIVE I_FORCE END
Line 27 INDEX 1 = LOCAL COMPLETION = 100%

14.4.6.2 Force Process with ASCII Commands

Download the determined sector parameters into XENAX® servo controller.
There are 5 sectors all in all.

Below you find the description for sector 1. Sectors 2-5 are structured in the same way.

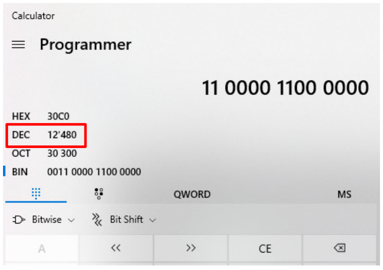


	Parameter Sector 1 laden
Pre-selection of sector number	>NSEC 1
Sector I_Force Start [Inc]	>SIFS 31
Sector I_Force End [Inc]	>SIFE 58
IFL I_Force Low [x10mA]	>IFL 25
IFL I_Force High [x10mA]	>IFH 35
Sector Transition Configuration	>STC 12480

In ordert o be able to see those parameters in the webbrowser under “sector i_force”, the site has to be re-loaded. This is how the values are transferred from the XENAX® to the Webbrowser.

Calculate STC parameter with Win Calc (view of programmer)
Decimal value can be negative if highest Bit, Entry 4 is set.

Bit 15..12	11..8	7..4	3..0
Entry	not used	**Exit**	not used
4 3 **2 1**	0	**4 3** 2 1	0
0 0 **1 1**	0 0 0 0	**1 1** 0 0	0 0 0 0



Program

Referencing Axis	>REF
Drive to position 0	>G 0
Delete old calibration values (optional)	>FC 0
Remove test objects, axis has to drive without obstacles. Execute Force Calibration from 0 until 50000 Inc (one-time)	>FC 50000
Force Calibration test, if slider is floating / in balance (optional)	>FCT1
Back to position control (optional)	>FCT0
Sector Offset is set to 0 (optional)	>SSO 0
Selection of active sectors of 0. Only to be activated before test drive, so the analysis SIFF is correct.	>SSEC 0
Drive to position 30‘000 Inc	>G 30000
Reduce Deviation Position, so the internal calculated desired position does not deviate too much from the actual position of Drive I_Force. Otherwise, the slide would jump in position when I_Force is increased. Only needed when there are long timeouts after Drive I_Force is reached.	>DP100
Drive I_Force 1 moves to touching position	>DIF 1
Take Position as Sector Offset (touching position)	>TPSO
Activate sectors 1-5	>SSEC11111
Change Limit I_FORCE to 150 x 10mA	>CLIF 150
Verify tell process status registery, Bit 5 „IN FORCE“	>TPSR
Stop Drive I_Force with Stop Motion	>SM
Shows faulting sectors. Response should be 0	>SIFF?
Reset Deviation Position to old value	>DP1000
Drive to position 0	>G 0

14.5 Forceteq® pro via Realtime Bus

The force values are transmitted as process data objects (PDO) cyclically according to the bus cycle time

14.5.1 CANopen over Ethernet

Parameter	Objekt (PDO)	Description
Position Actual [Inc]	6064h	Position actual
Force Actual [mN]	200Ah	Force actual
Limit Force [mN]	2009h	Limitation of force
Process Status Register	2006h Bit 27	Limitation of force reached

14.5.2 Ethernet/IP

Parameter	Class	Instanz	Id	Description
PositionActual [Inc]	0x66	0x1	0x24	Position actual
ForceActual [mN]	0x64	0x1	0xA	Force actual
LimitForce [mN]	0x64	0x1	0x9	Limitation of force
ProcessStatusRegister	0x64	0x1	0x6 Bit27	Limitation of force reached

14.5.3 Profinet

Parameter	PROFIdrive Telegram 9	I/O Data Number	Description
Position Actual [Inc]	Standard	4&5	Position actual
Force Actual [mN]	Supplementary Data 4 Data 5	 4&5 3&4	Force actual
Limit Force [mN]	Supplementary Data 4 Data 5	 2&3 2&3	Limitation of force
Process Status Register	Supplementary Data 4 Data 5	 6&7 Bit 27 5&6 Bit 27	Limitation of force reached

14.6 Forceteq® pro via XENAX®

14.6.1 I_Force Calibration

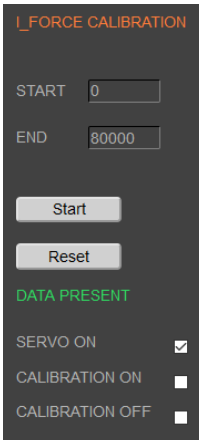
With the patented function „force calibration“ of the XENAX® servo controller, the cogging-, load- and friction forces of the iron core LINAX® and ELAX® linear motor axes and the ROTAX® rotary axes from Jenny Science can be detected.

This is how it becomes possible to limit, monitor and control forces in processes.

START: Determining the beginning position of calibration process in increments.

END: Determining the ending position of calibration process in increments.

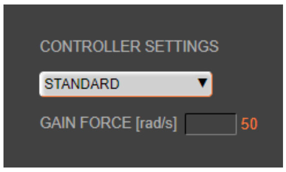
In order to increase the accuracy of the detected forces at temperature variations, the temperature drift of the detection is continuously compensated at disabled power stage. The compensation also takes place before each start of a „force Calibration“.



← Normal operation, calibration active
← Test calibration active
← Test without calibration

14.6.2 Controller Settings

The "GAIN FORCE" ensures a fast response when the target force is reached. A reduction can minimise vibrations when the limited force is reached. The ELASTIC-mode requires an additional adjustment of the spring constant of the workpiece.

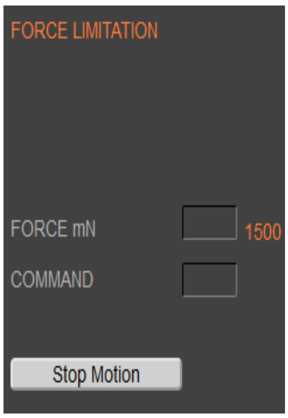


14.6.3 Force Limitation

Motion with limited force to an object or end position if no objects are present (e.g. insert parts). Or move with very little force to detect the "object touching position".

Example:
A compression die should apply no more than 1.5N force on an object.

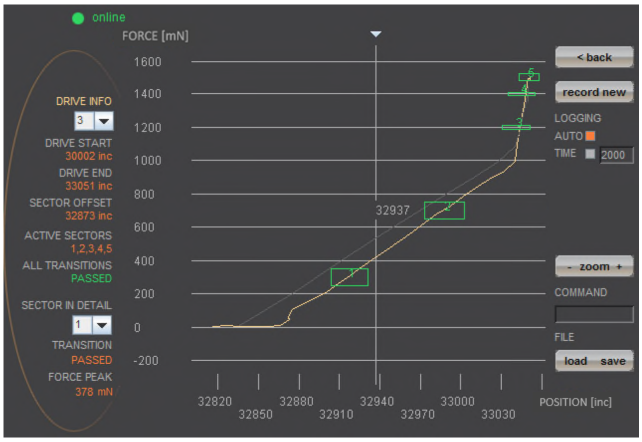
Force Limitation with „LIMIT FORCE“ 1500mN



14.6.4 Force Monitoring

14.6.4.1 Diagram Force

In the menu „Diag Force“ the way/force diagram can be recorded by which the force progression through the sectors can be verified.



14.6.4.2 Sector Force

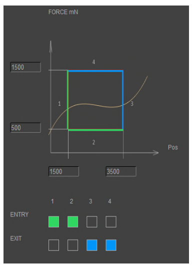
In the WebMotion® program menu „sector force“ up to 10 different force sectors can be defined.

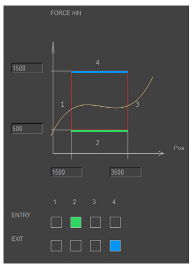
Example:
Once an object is touched the force progression shall be examined in a sector of 1500 to3500 Increments. When entering the force sector (“ENTRY”) the force should be between 0.5 and 1.5N. When exiting the sector (“EXIT”), the force should have reached 1.5N. These force specifications are defined with the in the force sector incoming and exiting sector boundaries.

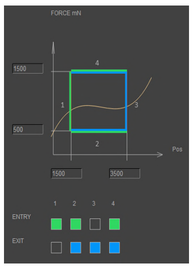
Force Specification Examples:
1) Force curve has to pass through sector from the left/bottom side to right/top side.

2) Force curve has to pass through sector from the bottom to the top side.

3) Force curve has to reach the sector and can pass through incoming and exiting force boundaries multiple times.


1


2

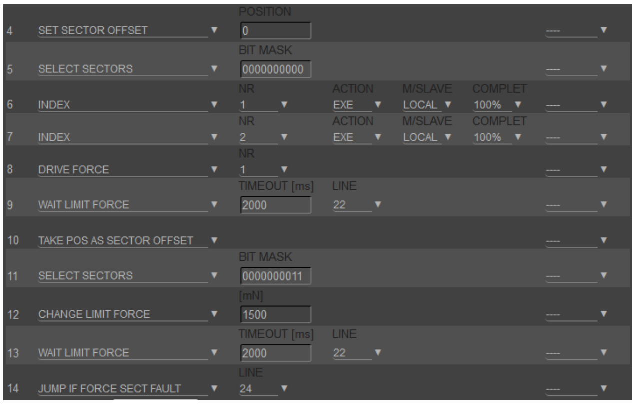

3

Note:
If there are defined incoming and exiting force boundaries, it is absolutely necessary that the force curve passes through them. If there are no incoming force boundaries defined, the force curve has to begin somewhere within the force sector. If there are no exiting force boundaries defined, the force curve has to end within the force sector.

14.6.5 Force Control

14.6.5.1 Program with Force Control Commands

In the WebMotion® menu „program“ the different force functions of I_FORCE CALIBRATION, FORCE LIMITATION and FORCE MONITORING can be combined and defined with the use of the according commands.
The command can be found in chapter 11.14.1 Program commands

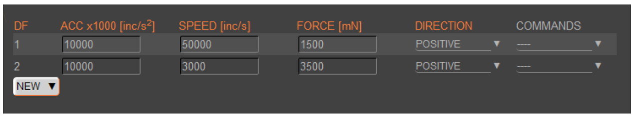


14.6.5.2 Drive Force

DRIVE FORCE is driving with force consisting of acceleration (ACC), speed (SPEED), force (FORCE) and driving direction (DIRECTION).

After defining and saving the above mentioned parameters, DRIVE FORCE can be included in a program.

Up to 10 DRIVE FORCE can be defined.



14.6.6 Sector Offset for Touching Position

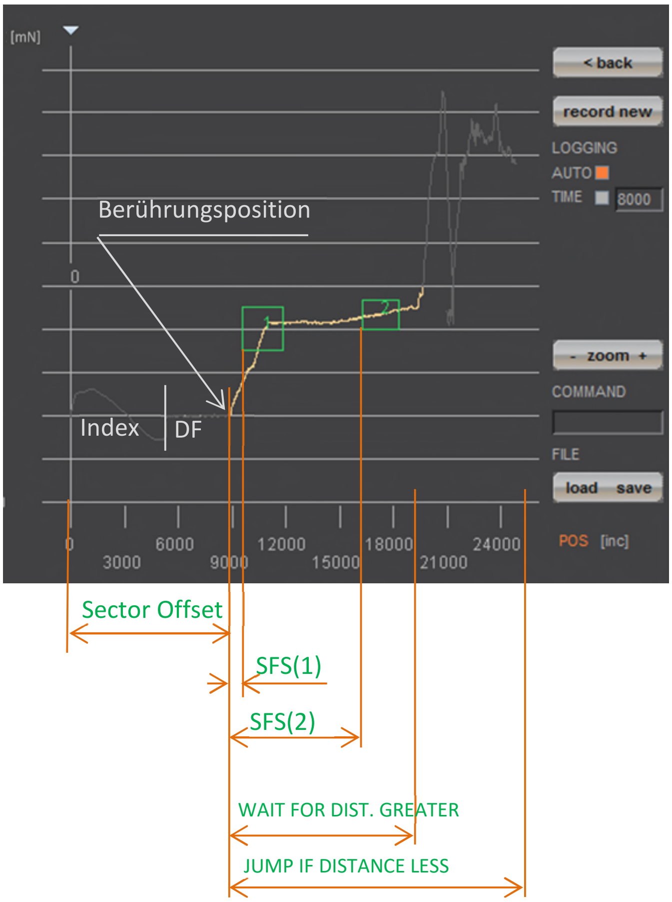
Typically, an object is first touched. All following functions then relate to this touching position. Depending on the size tolerance of the objects, this touching position differs from object to object.

The touching position can very simply be detected with „Drive Force“ (by using little force). The command “TPSO” (Take IST-Position as Sector Offset) will take this touching position as sector offset for all functions that follow.

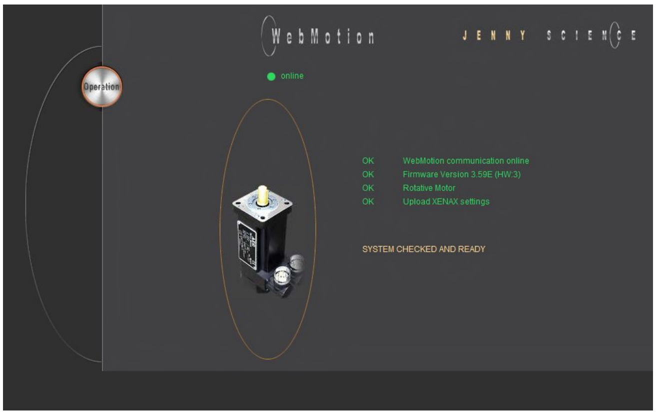
In order to determine the value „Sector Force Start“ and „Sector Force End“ it is simplest to record the force curve and to calculate the distance to touching position (absolute position – Sector Offset).

“Sector Force Start”, “Sector Force End”, “Wait for Distance greater/less” and “Jump if Distance greater/less” are distances relative to the touching position (sector offset).

With „SSO“ Set Sector Offset = 0 the distances correspond to the absolute positions.



15 Parameterization rotative third-party motor



The servo controller XENAX® Xvi75V8 allows motion control for rotative AC / DC / EC servomotors. With brush-type DC servomotors an incremental encoder is necessary. With brushless AC / EC servomotors 3 phase commutation signals (hall) and an incremental encoder are necessary.

The motor configuration must be set to "Third-party" via DIP switch. (For details, see chapter "**Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden.**")

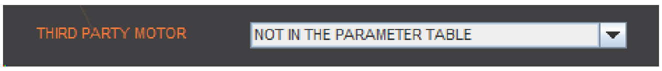
As the customer, you can do the commissioning yourself with the help of this guide. Alternatively, Jenny Science AG offers this as a service. You will receive a compatible cable for your motor and the necessary parameterization. To take advantage of this service, please send us the motor.

Necessary parameters from datasheet

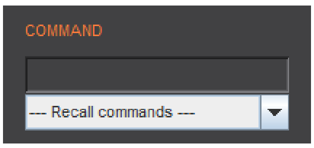
Motor parameters	Unit	Scale	Command
Nominal current (for calc. I^2T only)	[A]	$*10^2$	IN
Torque current	[A]	$*10^2$	IP
Number of pole pairs	[1]	-	POL
Encoder resolution (Edge = *4)	[1]	-	ENC
Phase direction	[1]	-	PHD
Phase offset	[°]	-	PHO
Rotor moment of inertia	[$Kg*m^2$]	$*10^9$	MAMO
Torque constant	[Nm/A]	$*10^6$	FCM
Phase - phase inductance	[µH]	-	LPH
Phase - phase resistance	[mΩ]	-	RPH

15.1 Motorparameter with WebMotion

Set motor type in *setup / motor* to „NOT IN THE PARAMETER TABLE“ if it is not already in the list.



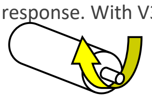
The motor parameterization can be done in menu *move axis / by command line* or *setup / motor*.



Parameter of friction (Default)
The default settings can be adopted unchanged.

Friction	Unit	Scale	Command	Default
Dynamical	[mN/m/s]	-	FFDY	10‘000
Static	[mN]	-	FFST	0

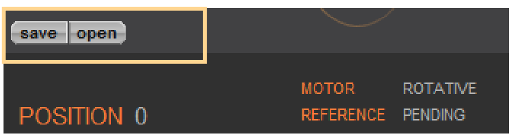
Example Faulhaber Motor 4490 H 024B

Motor parameter	Datasheet	XENAX® conversion	Command Terminal
Nominal current	8.62A Thermic acceptable continuous current	8.62A $*10^2$	IN862
Torque current	12A (selected) Depends on the application. Limit for acceleration and deceleration, temporary active.	12A$*10^2$	IP1200
Number of pole pairs	1 For brush-type DC motor, set value to 0	1	POL1
Encoder resolution (Edge = *4)	4000 INC/REV One revolution clockwise of motor shaft will increment position counter by 4000Inc positive.	4000	ENC4000
Phase direction	1 By enter PHDD in *by command line/terminal* and then turn the motor clockwise, it gets 0 or 1 as response. With V3.46 or higher.  If you receive «?» the DIP-Switch is still set to JSC-Motor or the Hall-Signals are not available.	1	PHD1
Phase offset	0 ° Fort the most products set 0 º Harmonic Drive: 330 º	0	PHO0
Rotor moment of inertia	130 gcm^2	0,000013 kgm^2$*10^9$ = 13‘000	MAMO13000
Torque constant	23,83 mNm/A	0,02383 Nm/A $*10^6$ = 23‘830	FCM23830
Phase - phase inductance	76 µH	76 µH	LPH76
Phase - phase resistance	0.237 Ω	237 mΩ	RPH237

After parameterization, the servo controller needs to be rebooted and the WebMotion® browser has to be refreshed.

Afterwards, the motor can be controlled under: Move axis.

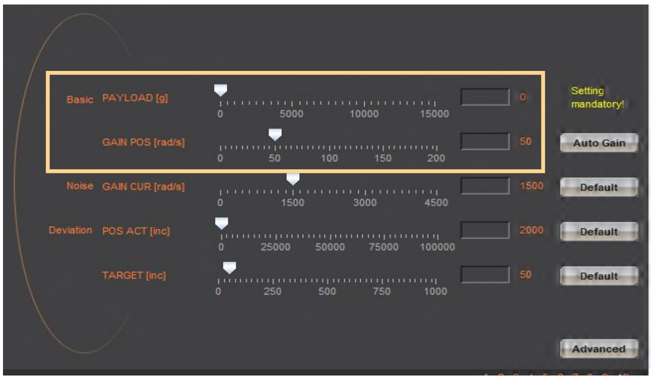
The motor parameters are an integral part of the application data and can be saved with the “save” button on the bottom of the WebMotion® interface.



15.2 External load for state controller

Moment of inertia	Unit	Scale	Command
Inertia	[Kg*m^2]	*10^9	ML

If a gearbox is placed between the motor and the load, the external moment of inertia must be must be converted to the motor shaft accordingly. The transmission ratio must be squared must be weighted. For example, gear ratio = 20:1. The external moment of inertia must be reduced by 400.



Oscillations and overshoot can be optimised in the setup / state controller menu during operation using the following parameters:

Bandwidth of position controller GAIN POS
Increasing: closed loop stronger, weightend on position.
Decreasing: closed loop smoother, weightend on velocity.

15.3 Template parametersset for documentation

Typ:

Motor parameter

Parameter	Value Datasheet	Unit	Scale	Command	Value to enter ***setup->motor***
Nominal current		[A]	*10^2	IN	
Torque current		[A]	*10^2	IP	
Number of pole pairs		[1]	-	POL	
Increments / Revolution		[1]	-	ENC	
Phase direction		[1]	-	PHD	
Phase offset		[°]	-	PHO	
Rotor moment of inertia scaled		[Kg*m^2]	*10^9	MAMO	
Torque constanta scaled		[Nm/A]	*10^6	FCM	
Phase – phase inductance		[µH]	-	LPH	
Phase – phase resistance		[mΩ]	-	RPH	

State controller parameter

Parameter	Unit	Command	Default	Value to enter
Moment of inertia load scaled (INERTIA)	[Kg*m^2]	ML	0	
Bandwidth of position controller (GAIN POS)	[Hz]	BWP	50	
Bandwidth of current controller (GAIN CUR)	[Hz]	BWC	300	
Dynamic friction	[mN/m/s]	FFDY	10‘000	
Static friction	[mN]	FFST	0	

16 Operating Status on 7-Segment Display

Description	Display
No firmware, operating system is active	F
Firmware active, servo controller OFF	0
Servo On, control loop closed	1
Error refer chapter 17 Error Handling)	xx flashing
No power supply logic or voltage on power supply logic >27VDC	none

17 Error Handling

Errors are displayed on the XENAX® servo controller's 7-segment display by flashing a two digit number. With the command „TE“ (Tell Error) they can be retrieved.

There are 3 different categories to differentiate:

Information	No 0-39	They do not change state of the servo controller. These are simple status indicators.
Warnings	No 40-49	They can trigger a stop of an active drive (e.g. driving in soft limit). However, the drive can then be continued without the need to switch off the output stage.
Errors	No 50-99	Always cause the output stage to switch off. The drive can only be continued after troubleshooting and error acknowledgement (Power Quit).

The first information/warning/error is always displayed first. A possible follow-up error won't be displayed. Each warning can overwrite information and each error can overwrite a warning or information. The error history can be retrieved with ASCII command „TEB“.

17.1 Error Codes

F-Number	Description	Note
		Information
01 to 12	Waiting for input xx (Low od. High)	Keeps driving, if status has been reached or restart with HO, REF, SM, or PQ, PWC.
20	Command not allowed	Command is not allowed, if an external PLC is controlling the axis. The command priority of the overriding PLC can be deactivated if the user set the CANopen Mode of operation to 0 (CANopen Object 0x6060)
22	Program start interrupted	Program start is interrupted through input function "INTERRUPT PROGRAM"
23	Starting position of motion profile is not valid	Motion profile (ASCII command "PRF") can only be started if linear motor slide is positioned at or behind the starting position of the motion profile.
24	Index Paramater not valid	One or more parameters of the most previous selected index are not valid. Please check Acceleration (ASCII-command „AIX“), Speed (ASCII-command „SIX“) and type (ASCII-command „TYIX“) of index.
25	Bus module supervision disabled	Bus module is only intended for development purposes. Change bus module by Jenny Science.
26	Third party motor not configurated or DIP-switch setting wrong	For Jenny Science Motors (LINAX/ELAX/ROTAX): For all Jenny Science motors the DIP-switch has to be set on „LINAX/ELAX/ROTAX“. For third party motors: Please make correct setting for the motor in WebMotion® under setup → motor.
27	Swing Out Reduction Parameter inconsistency	A new calculation of the target trajectory for swing out reduction feature can only be initialized after a motor standstill -> Motor has to be at standstill for at least 1000ms so that a new set of parameters can be used.
30	Limit I Force reached	Force proportional motor current reached "Limit I_Force Value" (LIF). Motor current is limited to "Limit I_Force Value". A possible detected error 50 (position deviation to large) is suppressed.

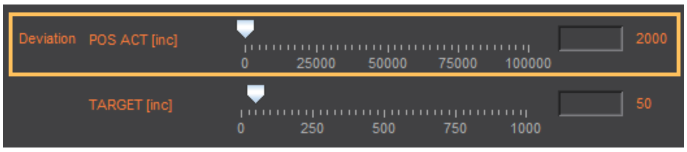
31	Limit Force reached	The force from the external force sensor on the Signateq® measuring amplifier has reached "Limit Force Value" (LF). Motor current is limited. A possible error "50" (position deviation too large) is suppressed.
32	I_Force Drift Compensation failed	Automatic I_Force Drift Compensation drive was blocked or the compensation position could not be held steady for 150ms (e.g., due to vibration)
34	Automatic detection of force direction not possible in standstill	Automatic detection of the direction of force (SQFD = 0) is only possible when the axis is moving. Start motion into the force sensor or switch off automatic detection (set SQFD to 1 or 2). Detection is performed during the first drive into the force sensor after a power-up.
35	Gantry Master Salve Offset	Difference between automatically measured Gantry Master Slave Offset and pre-set value through PGMSO greater than 0.5mm
		Warnings
40	Driveway limitation due to soft limit values	Soft limits can be adjusted in WebMotion® in menu *„move axis / by click"*.
41	HW-Limit switch positive/negative active	HW-Limit switches are defined as input function "LIMIT SWITCH NEGATIVE" / "LIMIT SWITCH POSITIVE"
42	Remote Controller Command rejected	One of the slave axes has an error or command for the slave could not be executed
43	Remote Controller not recognized	Master Slave configuration: Not all remote controllers defined in the master were recognized. The programs in the master have to be checked and the invalid remote controllers (Rem ID) have to be deleted.
44	Remote controller communication error	Check Master/Slave cable
45	AD Offset Error	The AD-Offset for measuring the current could not be retrieved correctly during the first drive. The linear motor has to be turned off while the output stage is turned on for at least 0.5s, so the AD-Offset can be retrieved correctly.
46	Cyclic data are not valid	Cyclic data specified via the bus modules are not valid. Check the Data S-Curve, Deviation position, Deviation Target position, I Force Max, Speed and Acceleration. Or PDO cycle time it not correct (only a multiple of 100us is valid).
47	Drive interrupted through SMU	The current drive was interrupted through the functional safety SS2 or SLS.
		Errors
50	Position deviation is too large.	The difference between the internal calculated position and the present motor position (encoder) is larger than the value defined as DP (deviation position) in Closed Loop setup. Refer to chapter 17.2 Notes for Error 50
52	The connected axis is not supported by this Servo Controller	The Servo Controller type you are using is not intended for the connected axis. Please use a compatible Servo Controller.
53	Virtual multiturn position deviation exceeded tolerance	Since the last time the logic supply was switched off, the ROTAX® has moved above the permissible tolerance of the Virtual Multiturn.
54	Excessive rise of temperature **or** weak signal of LINAX® read head **or** Measuring system error of ROTAX®	Temperature rise too high/fast or the signal in the detector head of the measuring system is too weak. Check your drive profile or clean glass scale on LINAX® linear motor. To ensure a correct start-up of the measuring system, the logic supply must be switched off for >10s when restarting.
55	Excessive rise of temperature	Temperature rise too high/fast. Check our drive profile.
58	Communication interruption Signateq®	No Signateq® measuring amplifier is connected and a force-limited (Limit_Force) drive is started or there is a connection failure to the Signateq® measuring amplifier.
59	JSC Motor does not fit application data	Connected JSC motor does not fit to the motor stored in application data (e.g. if a new JSC motor type is connected to the servo controller). Motor type reset (RESM) is required.

60	Over-temperature power stage	Above 85° detected by separate temperature sensor on power stage. Power stage will be switched off.
61	Overvoltage of power supply	Power supply voltage or retarding energy from motor too high. Error occurs only if power stage is turned off. If power stage is turned on, please refer to error code 62.
62	Ballast circuit too long active	The ballast circuit is still more than 5 sec continuously active: Retarding energy too high or the power supply voltage is too high, the power stage will be switched off.
63	Over-temperature LINAX®/ELAX®/ROTAX®	Coil temperature above 80° in LINAX® / ELAX® linear motor or ROTAX® rotative axis. Power stage will be switched off.
64	Under voltage of power supply	Motor power supply voltage is too low. The power supply probably is not able to temporary deliver the demanded current.
65	Field adjustment on the magnet poles	The adjustment on the magnet pole was not successful, travel-plate of LINAX® / ELAX® or rotor of the third party motor is blocked or encoder / motor cable is broken. If at multi-axis applications, all servo controllers show error 65, then the D-sub encoder connector is unplugged at one axis. Check the value payload (ML).
66	REF error	Push the travel-plate by hand to a “free range” and try “REF” again.
67	Z-Mark distance failure	The measured distance of coded reference marks is not plausible. Check the value payload (ML). Execute “REF” again.
68	Velocity too high during REF	Execute REF again. Could be consecutive fault of vector field adjustment on the magnet pole. Check the values I stop (IS) and I run (IR), maybe you have to increase these values.
69	Error HALL signal	Error in the consecutive order of HALL-signals, check Encoder cable.
70	Over-current power stage	Potential short circuit or accidental ground in motor cable / coils.
71	Power stage disabled	Release signal via PLC I/O Pin 9 not present (if activated) or power stage is disabled by Safe Motion Unit (SMU)
72	Speed is too high	The maximum speed is exceeded with the position setpoint. Possible cause: Target/actual-position adjustment forgotten after referencing. With 100nm measuring system = 9'000'000 inc/s = 0.9m/s
73	Over-temperature (I^2T)	I^2T calculation has detected over-temperature in the coil.
74	Electrical Angle Failure	The calculated electrical angle differs more than 50° from the estimated angle. Interrupt power and execute REF again. Cleaning the measuring scale might also be necessary. Check the values I stop (IS) and I run (IR), maybe you have to increase these values.
75	Reference pending	REF has to be executed before motor can move
76	Gantry Master Salve Offset	Difference between automatically measured Gantry Master Slave Offset and pre-set value through PGMSO greater than 0.5mm (Since firmware V5.08C Info 35)
77	communication error bus module/serial port	Depending on the operation mode, please check communication between servo controller and bus module or communication over serial interface (RS232/Ethernet). For communication over serial interface adjust Watchdog time if necessary (command „WD“)
78	MAC-address not valid	The XENAX® MAC-address is not valid, please contact the Jenny Science AG company
79	Wrong checksum of calibration data	Force calibration or position of mechanical limit wrong. Restart “Force calibration” (ASCII: fcxx) or “mechanical limit calibration (ASCII: mlc).
80	Over-current PLC Output	One or more outputs of the PLC interface are overloaded In source configuration is $Imax_{out}$=100mA per channel, in sink Configuration is $Imax_{out}$=400mA per channel. Error can potentially occur due to inductive load without free-wheeling diode. In this case please either insert free-wheeling diode or select Sink/Source configuration with $Imax_{out}$=100mA per channel.
82	Communication error I^2C bus to the motor	Check encoder and extension cables. Connect cable shields on servo controller and motor with GND. Check Master / Slave cables
83	Internal FRAM error	Permanent data storage not possible[1.] . Possible source of error like in error display “L”.

84	Start-up key error	Test with other key. Functionality in master-slave mode not supported.
85	I^2C switch error	Test without master-slave cables.
86	wrong checksum of application data	This error can appear after firmware download. Execute reset (RES)
87	Remote controller missing	Master Slave configuration: One or more remote controllers defined in master are missing. Check master programs for non-existent controllers (RemID) and delete them out of programs.
88	General I^2C error	Check the cable to the motor or the master-slave cable
89	SMU error	Critical error of the safety motion unit. Details to the cause and possible fix are given by WebMotion® as soon as error occurs. Please refer to chapter 17.3 Notes for Error 89
90	Functional Safety active	If safety function was active, the observation was triggered and the SMU (Safety Motion Unit) module has turned off the power stage. For SS2 or SLS, the ED (Emergency Deceleration) potentially was too small for Stop Timeout.
91	SMU Error	Error of Safety Motion Unit or motion blocked by unconfigured SMU. Details to the cause and possible fix are given by WebMotion® as soon as error occurs. Please refer to chapter 17.4 Notes for Error 91
92	3-Phase Output frequency > 599Hz	The output frequency of the 3-phase motor is over 599Hz. There are only movements allowed, which do not lead to an output frequency of >599Hz.
93	Encoder plausibility	The encoder signals are not plausible. Possible causes: interruption of strands in the encoder cable, or encoder signals are led asymmetrically only. When encoder signals are led asymmetrically by intention for rotary motors, the encoder plausibility check can be turned off (refer to command ENCPD).
94 („EE“)	Restart caused by exception	XENAX® restarted due to software exception. Contact Jenny Science for details.
96	Firmware Checksum Failure	Please try to reload the XENAX® firmware again. If the error persists, please contact Jenny Science.
97	Interlaced warnings	A new warning occurred before the state which led to the previous warning was cleared. Please make sure process is setup in a way where warnings cannot interlace (e.g. drive in soft limit and then drive in limit switch, before soft limit was left).
98	AD Interrupt Nesting	Fatal Error – Please restart the XENAX® servo controller.
99	Encoder cable unplugged/disconnected	Motor encoder cable was disconnected. Please connect encoder cable again and restart XENAX®.
„L“	Level I^2C Bus	The Level of the I^2C bus is not ok. Bus is blocked. Rotary motor connected to a XENAX® controller with linear axis setup (DIP Switch)? Or servo controller encoder connector defect. Test encoder: disconnect encoder; if XENAX® starts normally, connector is defect. If still not working, please contact Jenny Science for support.
„n“	Level I^2C Bus	I^2C bus response is „nak“ (not acknowledged) No communication on I^2C bus, XENAX® internal or LINAX®/ELAX®/ROTAX®, temperature check is not possible.

[1]) *Internal hardware failure of the device, please contact Jenny Science*

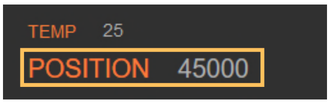
17.2 Notes for Error 50



Error 50 means that deviation from position target value to actual position value is higher than „DEVIATION POS ACT“ (→ *WebMotion®, setup, state controller*).
There are different possible causes which lead to this error. Please check the following:

Test POSITION Encoder counter

Status Display XENAX® WebMotion®



When the carriage slider of a linear motor axis or the rotary linear motor is being moved by hand, the position encoder counter has to adjust accordingly. If not check cable, signal encoder (check A/A* and B/B*).

If a shaft of a rotary motor is being turned clockwise (when looking at front shaft), the POSITION encoder counter has to count positive. When turned counter clockwise, the POSITION encoder counter has to count negative. Compare to chapter 6.2.6 Definition of Rotating Direction for Servo Motors.

Check parameters in setup

I STOP	sufficient?
I RUN	sufficient?
DEVIATION POS	2000 (Default)
DEVIATION TARGET POS	50 (Default)

Check power supply unit

Is there enough voltage and enough power supply?

For LINAX® rotating field adjustment
Lxc F04 at least 5,2A
Lxc F08 at least 6,1A
Lx F10 at least 5,5A
Lx F40 at least 6.0A
Lx F60 at least. 8.0A

For ELAX® rotating field adjustment
Ex F20 at least 5,5A

When using LINAX® linear motor axes and ELAX® electric slides, we suggest executing the Quick Start function with automatic system-check.

Test of brushless servo motors for hall signals encoder A/B and motor phase (wiring and colors).

There is no common standardization for servo motor connectors. Jenny Science is happy to support you during the setup process.

Test if motor is running at low velocity

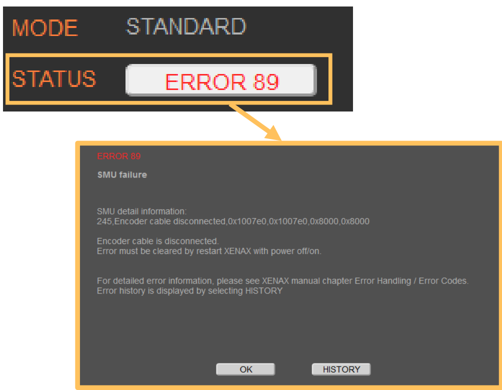
With WebMotion®
Menu Motion:
S-CURVE 20%
AC (x1'000) 100
SPEED 10'000
Power
Rep Reverse 10'000

Menu Terminal:
SCRV20
AC100000
SP10000
WA10000
PWC
RR100

17.3 Notes for Error 89

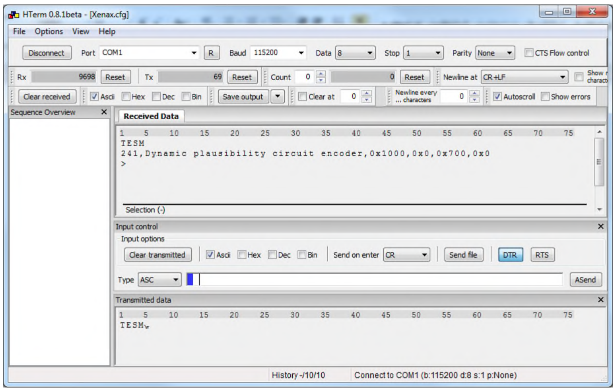
The error 89 shows a critical SMU error, which cannot be deleted by a command. The source of the error has first to be cleared and then the XENAX has to be restarted in order to delete the error. The description of the error is shown in WebMotion. If the error cannot be cleared or if the error occurs multiple times, please contact Jenny Science.

Click on the Button „ERROR 89" and the window would be open.



The Fault description without WebMotion®

Open a terminal program and give in the command „TESM“.



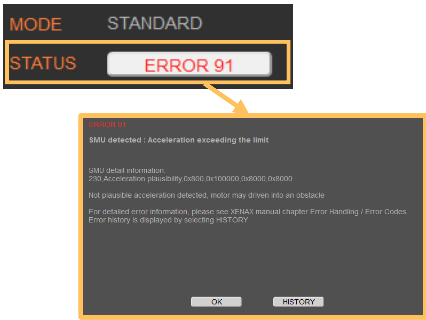
F-Number	Description	Note
210	host communication, external supervising, watchdog	Communication SMU to XENAX interrupted. Potentially, bad shielding of encoder cable
220	data consistency/checksum master/slave	Parameters were not uploaded correctly. Please try to download SMU parameters again.
232	firmware version not compatible	Firmware was not uploaded correctly. Please try to download SMU firmware again.
241	dynamic plausibility circuit encoder	Invalid state of one or more encoder signals. Check encoder cable, possible cable break. Restart XENAX®.
243	plausibility digital signal	Invalid voltage difference of one or more encoder signals. Check encoder cable, cable possibly broken
244	plausibility analogue signal	Unplugged encoder cable on XENAX®. Problems with the signal connecting. Cable possibly broken.
245	encoder cable disconnected	Encoder cable disconnected to XENAX®.
246	faulty input states	There is only one active Input from the safety. There must always be two Inputs activated for safety.
247	power active input test	Pin 9 is activated in XENAX®, this Input should not be used with the SMU
252	motor data failure	Motor data have not been forwarded to SMU. Potentially, there is bad shielding on the encoder cable

All other error codes are internal hardware failures. If error repeats multiple times, please contact Jenny Science.

17.4 Notes for Error 91

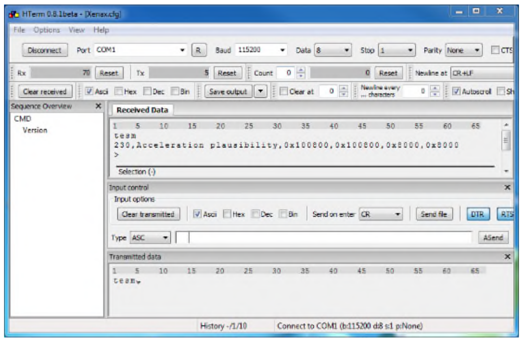
Error 91 shows not a critical SMU error. The source of the error, however, needs to be cleared. After that, the error can be normally deleted. The description of the error is shown in WebMotion.

Click on the Button „ERROR 91“ and the window would be open.



The Fault description without WebMotion®:

Open a terminal program and give in the command „TESM“.



F-Number	Description	Note
0	Motion blocked by unconfigured SMU	No safety function configured, motion blocked. As soon as a safety function is configured (see chapter 4.6 Functional Safety Parameterization in WebMotion®) the block is permanently removed. The blocking can also be temporarily removed until the next power cycle using the "DMBUS" command. CANopen direct command object 0x5000, value 0x5030
230	acceleration plausibility	Acceleration too high. Motion to hard mechanical limit
248	scale failure	For Jenny Science motors (LINAX/ELAX/ROTAX): Rise in temperature in the motor to fast or signal of measuring head too weak. Verify motion profile or for motors with glass measuring scale, please clean measuring scale. For motors of other manufacturers: Maybe DIP switch wrong. Dip Switch must be set to “No JSC motor” (refer to chapter 7 Configuration Motor Type Jenny Science / Motor customer specific).
249	overcurrent failure	Potential short circuit or ground fault in the motor cable / coils
250	overtemperature 3 phase power stage	Over 80°C measured by the temperature sensor in the output stage

17.5 Arbitrary Display on 7-Segment

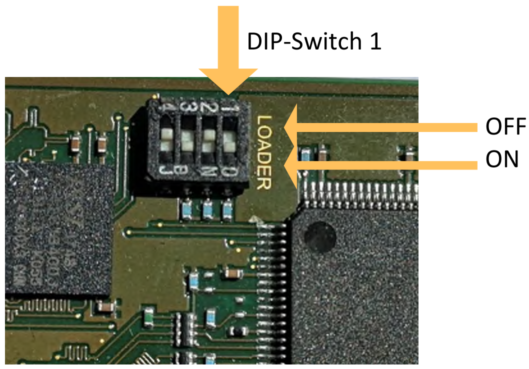
After turning on the logic supply (24V), typically a “0” appears on the display. The green LED of the RJ45 connector lights up green when using active Ethernet connection.

If there is an arbitrary sign e.g. “8.” or if the display is flickering, there are the following causes possible:

17.5.1 Defective adapter for logic supply

For the logic supply the adapter should deliver 24V DC and at least 300mA. Provides the adapter 24V DC for the logic as well as the power, 5A are required. **Measure logic supply (24VDC), change adapter if necessary.**

17.5.2 Defective Firmware



If a wrong or corrupt firmware data was loaded or another cause:

Delete XENAX® with DIP switch firmware recorder and start boot loader:

DIP switch 1 ON
Logic supply ON, firmware recorder is being deleted, wait until „F“ on display,
logic supply off,
DIP switch 1 OFF
Logic supply ON, display „F“→ boot loader active, Ethernet connection to PC/Laptop and load new firmware with WebMotion®.

MRL 2006/42/EC notes

- Surfaces may become hot, up to 85°C

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Jenny Science AG can neither guarantee nor be made responsible for any consequences resulting from incorrect information.

These manual is subject to change without notice.

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