OPERATING GUIDE

2-AXIS CONTROLLER ED2

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 1/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

0 Contents

Wandfluh AG
Postfach
CH-3714 Frutigen

Tel. +41 33 672 72 72
Fax +41 33 672 72 12

E-mail: sales@wandfluh.com
Internet: www.wandfluh.com

Page 2/80
Edition 07 01
ED23xBAE.doc

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 3/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Operating Instructions for 2 Axis Controller ED2

1 General Information

The Operating Instructions (OI) have the objective of enabling the axis controller ED2 of Wandfluh to be utilised in accordance with its intended purpose, properly, effectively and safely. The Operation Instructions comprise instructions on conduct, which Wandfluh as the manufacturer or its re-selling organisations (Wandfluh sister companies or Wandfluh representatives) provide for the user within the framework of their obligation to instruct.

The Operating Instructions to this intent and purpose mainly contain:
- Information about the utilisation in accordance with the intended purpose, installation and commissioning of the amplifier card.
- Information about safety when handling the controller.

The OI relate to those versions listed in 2.5 "Type Code", with the exception of the options "Profibus DP" and "CAN-Bus", for which in addition product-specific instructions will be provided.
For the 1 Axis controller ED3 please refer to the "Operating Instructions for 1 Axis controller ED3".
Both operating instructions can be downloaded from the Wandfluh Website http://www.wandfluh.com under "Downloads"

2 Product Description

2.1 General

The axis controller is implemented as a 19" plug-in card with two DIN41612, type F48 plugs.

2.2 Field of Application

As an Eurocard, the field of application of the axis controller is situated above all in the industrial field.

2.3 Conformity

The axis controller ED2 has been developed and tested in accordance with latest technical standards. Applied in particular was the EU Guideline 89/336/EEC (EMC Guideline).

2.4 Labelling of the Product

The multipoint plug of the axis controller card is provided with the following adhesive labels:
- with an adhesive type label
- with an adhesive serial number label (with the initials of the tester).

With the parameterisation software PASO, under the menu point "Help_Axis Controller Identification", the following information can be directly read-off the axis controller card:

- Type of card
- Software version of the ED2
- Firmware version of the ED2
- Hardware configuration of the ED2

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 4/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

2.5 Type Code

```
                                     E  D2  3 □  4 D2  0  0  □ □  # □
```

Eurocard

Digital

Parameters to be set with:
PC-Software

Basic card	0
additionally 4 analogue inputs 16-Bit	1

4-solenoid version

24 VDC supply voltage

Preset value input selection

Feedback value input selection

Position controller	-
Position controller Slave for network	S
Position controller Master for network	M

Controlling
analog (option 16-Bit) and digital	A	
by Profibus DP	B	(on request)
by CAN-Bus	C	(on request)

Design-Index (Subject to change)

2.6 Technical Data

2.6.1 General Characteristic Values

Execution	Double Eurocard (double-deck print)	
Dimensions	Front plate : Printed circuit board :	60.6 x 128.4 mm, 12TE / 3 HE 160.0 x 100.0 mm
Weight		220g
Connections	2 connectors	in accordance with DIN 41612, type F48
Operating temperature		-20...+60 °C

2.6.2 Electrical Characteristic Values

Power supply voltage		24 VDC
Voltage tolerance		21...30 VDC
Ripple on supply voltage		±10 %
Fuse protection		The card has to be protected with a slow-blow fuse by the user (Amp-value = no-load power demand plus maximum solenoid power).
Temperature drift		< 1% with $\Delta T = 40$ °C
No-load power demand		8 W
Analogue inputs	2 Differential inputs 10Bit	±10 V
	2 Differential inputs 10Bit	0/4...20 mA
	Option:	
	4 Differential inputs 16Bit	±10 V or 0/4...20 mA
Input resistance analogue inputs	Voltage differential input	> 80 kOhm
	Load for current inputs	= 200 Ohm

Wandfluh AG
Postfach
CH-3714 Frutigen

Tel. +41 33 672 72 72
Fax +41 33 672 72 12

E-mail: sales @wandfluh.com
Internet: www.wandfluh.com

Page 5/80
Edition 07 01
ED23xBAE.doc

Digital inputs	18 Inputs active-high, opto-decoupled	
	Switching threshold high	12...34 VDC
	Switching threshold low	0...4 VDC
	Internal pull down resistances (10 kOhm)	
Input resistance digital inputs	with 24 VDC	2.8 kOhm
Measuring system inputs	Max. 2 inputs selectable:	
	Incremental: Interface:	TTL (RS422) < 1 MHz
	Signal extern:	< 1 MHz
	Signal intern:	quadruple (< 4 MHz)
	Process range:	2^{23} x resolution
	Absolute: Interface:	SSI / SSD
	Data format:	24-Bit
	Code format:	gray or binary
	Clock rate:	312 kHz
	Analogue: refer to 5.5 "Analogue Inputs"	
Serial interface	1 Interface D-SUB-plug connector 9-pole female on front plate in accordance with RS232 C standard	
	Baudrate 4800 or 9600, depending on ED2 version	
	8 bits, 1 stopbit	
CAN interface (Versions "MA", "SA", "-C", refer to 2.5 "Type Code")	CAN-Spec. 2.0A, optionally with electrical isolation	
Stabilised output voltages	1 output +15 VDC, maximum load	50 mA
	1 output -15 VDC, maximum load	30 mA
	1 output +10 VDC, maximum load	10 mA
	1 output -10 VDC, maximum load	10 mA
	1 output 5 VDC, maximum load	500 mA
Solenoid outputs	The solenoid outputs are short-circuit-proof and protected against negative voltage peaks with a recovery diode. 4 proportional solenoids (nominal voltage 24 V) can be connected.	
Solenoid current	Minimum current Imin adjustable	0...900 mA
	Works setting	150 mA
	Maximum current Imax adjustable	Imin...1800 mA
	Works setting	700 mA
Dither **(only proportional solenoids)**	Frequency adjustable	20...250 Hz
	Works setting	100 Hz
	Level adjustable	0...200 mA
	Works setting	100 mA
Digital outputs	6 outputs opto-decoupled; High-side switch, short-circuit proof	
	Max output current with high signal	0.7 A
	Max total current of all outputs	3 A
	Power supply	10...34 VDC
Analogue outputs	2 analogue outputs	
	Output voltage	±10 VDC
	Max output current	±5 mA
	Resolution	12 bit
Free connections	With the 6 connections AUX1 - AUX6, customer-specific options can be implemented on the module plug-in slot.	

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 6/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

Status indications by LED	(Detailed description under 5.11"Light Emitting Diodes LED Green / Yellow / Red" on page 30)
LED green	
LED yellow	Power supply voltage
LED red	Function
	Error
EMC	
Immunity against interference	EN 50082-2
Interference emission	EN 55022 class B

2.7   Environment

Storage	Packaging:	The card has to be stored in its original packaging
	Temperature range:	-25...+85 °C
	Resistance against caustic solutions / acids:	The card has to be protected against caustic solutions and acids.
In operation	Temperature range:	-20...+60 °C
	Resistance against caustic solutions / acids:	The card has to be protected against caustic solutions and acids.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 7/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

WANDFLUH
Hydraulics + Electronics

2.8 Block Diagram

Earth — X3-1 — X1-32z

+ X3-2/26 — X1-4dbz

Supply voltage 24VDC

- X3-3/27 — X1-2dbz

Digital ground — X3-28 — X1-6z

24V output — X3-4 — X1-6d

ED2 — Z05-B

Output voltage

X1-32d — X3-47 — +5VDC
X1-30d — X3-23 — +15VDC
X2-32d — X4-29 — +10VDC
X2-32b — X4-30 — -10VDC
X1-30b — X3-48 — -15VDC

+5V — LED green

Analogue input	Terminals
Analogue input 1	X4-20 / X2-30d ; X4-10 / X2-30b
Analogue input 2	X4-19 / X2-30z ; X4-9 / X2-28z
Analogue input 3	X4-18 / X2-28d ; X4-8 / X2-28b
Analogue input 4	X4-17 / X2-26d ; X4-7 / X2-26b

Option — A / D

Provision for plug in modules

X2-16d — X4-1 — Aux 1
X2-16b — X4-2 — Aux 2
X2-16z — X4-11 — Aux 3
X2-14z — X4-12 — Aux 4
X2-14d — X4-21 — Aux 5
X2-14b — X4-22 — Aux 6

A1 — A2

+5V

Analogue input	Terminals	A/D
Analogue input 5	X4-16 / X2-24d ; X4-6 / X2-24b	A/D
Analogue input 6	X4-15 / X2-22d ; X4-5 / X2-22b	A/D
Analogue input 7	X4-14 / X2-22z ; X4-4 / X2-20z	A/D
Analogue input 8	X4-13 / X2-20d ; X4-3 / X2-20b	A/D

LED yellow
LED red

Analogue ground X4-25..28 — X2-26z/24z

Digital input	Terminals
Digital input 1	X3-37 / X1-18d
Digital input 2	X3-13 / X1-18b
Digital input 3	X3-38 / X1-18z
Digital input 4	X3-14 / X1-20d
Digital input 5	X3-39 / X1-20b
Digital input 6	X3-15 / X1-20z
Digital input 7	X3-40 / X1-22d
Digital input 8	X3-16 / X1-22b
Digital input 9	X3-41 / X1-22z
Digital input 10	X3-17 / X1-24d
Digital input 11	X3-42 / X1-24b
Digital input 12	X3-18 / X1-24z
Digital input 13	X3-43 / X1-26d
Digital input 14	X3-19 / X1-26b
Digital input 15	X3-44 / X1-26z
Digital input 16	X3-20 / X1-28d
Digital input 17	X3-45 / X1-28b
Digital input 18	X3-21 / X1-28z
Digital-Common	X3-22/46 / X1-30z

PWM — X1-12d — X3-33 — Solenoid A
X1-12b — X3-9
Axis 1
PWM — X1-14d — X3-34 — Solenoid B
X1-14b — X3-10
PWM — X1-14z — X3-35 — Solenoid A
X1-16z — X3-11
Axis 2
PWM — X1-16d — X3-36 — Solenoid B
X1-16b — X3-12

Micro-controller

Input/output position sensors system 1
X5-1 ; X5-2 / X2-4d ; X5-3 / X2-4b ; X5-4 / X2-4z ; X5-5 / X2-6z ; X2-6d
+5VDC — X5-6
Digital ground — X5-7 / X2-6b
+24V output — X5-8 ; X5-9

Input/output position sensors system 2
X6-1 ; X6-2 / X2-8d ; X6-3 / X2-8b ; X6-4 / X2-8z ; X6-5 / X2-10z ; X2-10d
+5VDC — X6-6
Digital ground — X6-7 / X2-10b
+24V output — X6-8 ; X6-9

Logic Device

X1-6b - — X3-29 — - Digital output / - supply
X1-8d + — X3-5 — + supply
X1-8b — X3-30 — Digital output 1
X1-8z — X3-6 — Digital output 2
X1-10d — X3-31 — Digital output 3
X1-10b — X3-7 — Digital output 4
X1-10z — X3-32 — Digital output 5
X1-12z — X3-8 — Digital output 6

X7/X8-9 — +24VDC
X7/X8-6 — 0VDC
X2-2d — X7/X8-7 — CAN-H
X2-2b — X7/X8-2 — CAN-L
X2-2z — X7/X8-3 — CAN Gnd
(opt.)

EPROM
RAM
EEPROM

A1 A2
D / A

X2-18d — X4-23 — Analogue output 1
X2-18b — X4-24 — Analogue output 2

RS 232 C
X3-49 ; X3-24 / X2-12b ; X2-12d ; +15VDC
J2-9 ; J2-2 ; J2-3 ; J2-5
X3-25 / X2-12z

Wandfluh AG   Tel. +41 33 672 72 72   E-mail: sales@wandfluh.com   *Page 8/80*
Postfach   Fax +41 33 672 72 12   Internet: www.wandfluh.com   *Edition 07 01*
CH-3714 Frutigen   ED23xBAE.doc

2.9 Dimensions

Standard:

3 Safety rules

3.1   Installation / Commissioning / Parameterisation

- These Operating Instructions have to be carefully studied beforehand and the instructions are to be complied with.
- The installation, the commissioning and the parameterisation must only be carried out by personnel with a corresponding training.
- Prior to the installation, all power supply voltages and any other energy sources have to be disconnected.
- During unpacking and when installing it, the card must only be gripped by the handle on the front plate. Any contact with soldering points, components and contact pins of the card should be avoided.
- Wrong manipulations by the personnel cannot be prevented by the controller card.
- Before the switching on of the supply voltage, the fuse protection, the correct wiring and the conformity of the power supply voltage with the permissible supply voltage range have to be verified.

- **The control monitors the working conditions within the electronic and within the installation. Uncontrolled movements caused by defective parts or other unpresumable errors cannot be prevented in every case.**

- **Danger for persons has to be avoided by installing an emergency stop device wich cuts off the power supply to the system and/or by other measures.**

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 9/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

4 Operating - and Indicating Elements

4.1 Introduction

The 2-axis controller is equipped with a front plate in its standard version.

The controller provides a 9-pole plug for an RS 232 interface on the front plate, through which the configuration and the parameterisation are carried out and through which also some diagnostic functions can be called up. After parameterisation the controller is to be operating stand-alone.

The front plate provides 3 LED indicators informing about the state of the controller (refer to section Light Emitting Diodes LED Green / Yellow / Red on page 30).

4.2 View of Front Plate
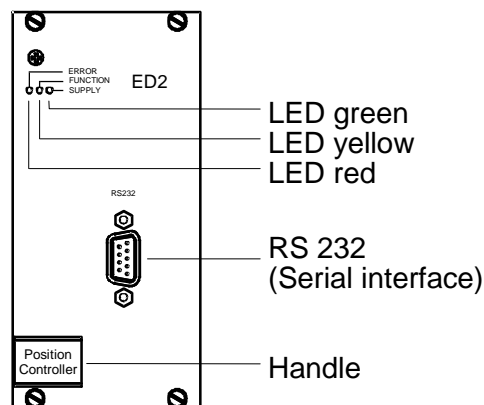
5 Axis controller Construction and Function

Refer to the section 2.8 "Block Diagram" on page 8.

5.1 Introduction

- The axis controller ED2 is constructed as a double-decker **Eurocard**.
- All inputs and outputs have to be made contact with through the **connectors**.
- The axis controller is available in its standard version with a front plate.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 10/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.2 Description of the Function

5.2.1 General

The control system is designed as a 2-axis controller for the positioning of two axes. By networking several axis controllers, up to 4 axes can be controlled in synchronism (more axes on request). For the networking, however, one requires at least one ED2-2-axis controller (version "MA") and one or more axis controllers ED2 or ED3 (version "SA", refer to 5.2.2 "Network Operation").
The 1-axis controller ED3 functions similar to the 2-axis controlller ED2 and is described in the "Operating Instructions for 1-Axis Controller ED3".

The set-point positions can either by predefined externally analogue (option 16-bit, refer to 2.5 "Type Code"), e.g. with a potentiometer, or through the optional external Profibus - or CAN-Bus - interface (options "–B" or "–C"), or internally by means of freely establishable running profiles. As actual value transmitter, apart from analogue measuring systems (V, mA) all standardised absolute and incremental measuring systems can be directly connected to the control system. Numerous digital inputs and outputs enable the connection to a superimposed machine control system. Through the optional CAN-Bus interface (option "–C"), the control system can communicate directly, e.g. with a SPS. With the positioning controllers Master (version "MA", only ED2) and Slave (version "SA") the CAN-Bus interface enables the networking of several axis controllers ED2/ED3 together with the objective of operating more than 2 axes in synchronism.

The supplied parameterisation software ("PASO for ED2/ED3"), running under Windows, enables the user to make various settings menu-guided through the RS232 interface. The control characteristics can be adapted to the corresponding control system with various parameters. It is also possible to switch off the control system completely for test - and adjustment purposes.

Changed parameters are stored in a non-volatile memory, so that they are available again after a renewed switching on of the control system.

5.2.2 Network Operation

Several axis controllers ED2 and ED3 can be networked, so that more than 2 axes can be simultaneously and synchronously controlled. In network operation all axis controllers ED2/ED3 are networked together by means of an internal WAG-CAN-Bus and communicate together in this manner. The set-point value setting as well as the parameterisation in this case takes place centrally through the so-called **Master-ED2 (**version "MA", only ED2**)**. The other participating axis controllers, the **Slave-ED2** and **Slave-ED3 (**version "SA", refer to 2.5 "Type Code"**)**, receive the commands and parameters through this **Master-ED2**. For more details refer to 9 "PASO in Network Operation".
Example: A 3-axis synchronous control system can be implemented with a Master-ED2 (2-axis controller, version "MA") and a Slave-ED3 (1-axis controller, version "SA").

Master-ED2, **Slave-ED2** and **Slave-ED3** are special, networkable ED2/ED3 axis controllers, which are parameterised with the help of the parameterisation software PASO. Every axis controller ED2 can actuate a maximum of 2 axes (ED3 1 axis). Some functions are not supported relative to the conventional axis controllers. A Master-ED2 can, with these limitations, in principle also be operated as a conventional ED2 axis controller for 2 axes. While a Slave-ED2 or a Slave-ED3 can be parameterised, they are, however, on their own not suitable for all control tasks without networking with a Master-ED2.
In the current axis controller software version it is possible to control up to 4 axes synchronously with a Master-ED2 and a Slave-ED2 (3 axes with a Master-ED2 and a Slave-ED3). More axes on request.

The designations "Master" and "Slave" refer to the organisation of the communication through the WAG-CAN Bus. The Master-ED2 manages the network, distributes the parameters and the running commands. The designations have no association with a possible synchronous control principle "Master-Slave".
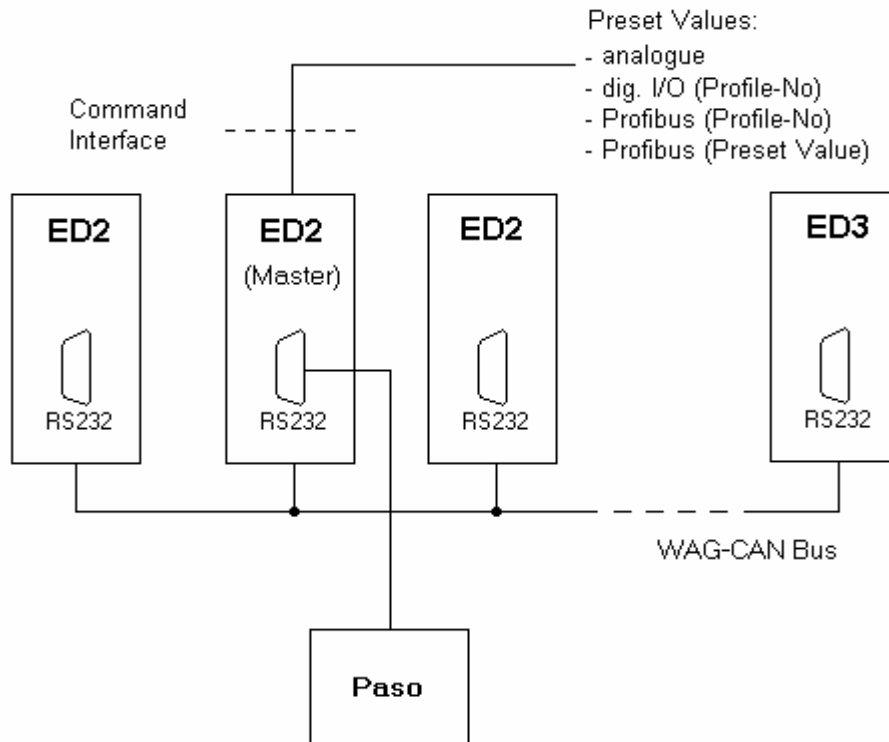
Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 11/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

Figure 5.2.2.1 Networking several ED2/ED3 controllers

5.2.3 Control Principle

The axis controller is a "speed controller", i.e., not only the end position, but also the movement to the end position (the momentary set-point speed), determined by the movement parameters acceleration, speed and deceleration, is controlled. For this purpose, the position set-point value generator calculates every 2 ms from the predefined end position, the last internal set-point position and the momentary set-point speed a new dynamic **internal** set-point position (with few exceptions on special cards, this is a position set-point value), and this, that the movement parameters are followed. The movement parameters are set in PASO.

The internal set-point position is calculated independently of the real axis position and the real axis movement and is subsequently transmitted to the PI-controller. However by starting the internal set-point value generator, the actual axis position value (in case of position controlling) or mean position value of the actual axes (in case of synchronism) is taken over and serves as first internal set-point position.
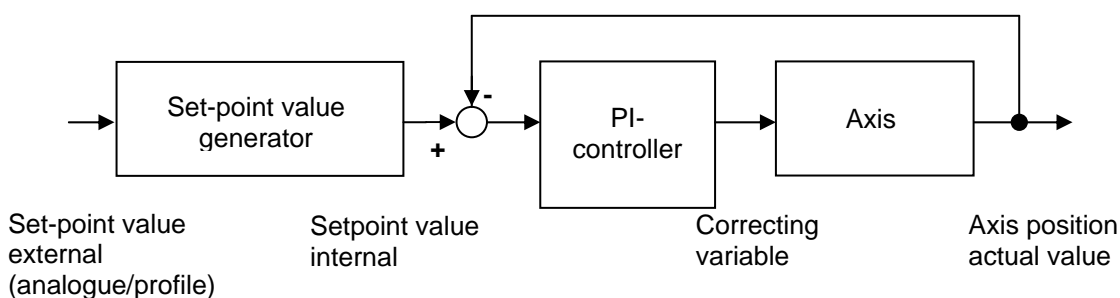
Figure 5.2.3.1 Control principle of the ED2-axis controller for one axis

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 12/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.2.4 Contouring Error

The difference between the position calculated by the set-point value generator (internal set-point value) and the actual position (actual value), or in the case of synchronism the difference between the axis positions, is designated as contouring error. **The contouring error definitions are different in single axis - or synchronous operation!**

The contouring error is continually monitored by the controller on the ED2-axis controller. As soon as the contouring error becomes too great, in positive or in negative sense, the axis and the set-point value generator are stopped until the axis once more is within the tolerance defined by PASO. The tolerance, the **contouring error limit value**, under PASO is set in the menu "Parameters_Drive_General" under "Monitoring control difference" or "Monitoring synchronism".

- **Single axis operation**
  In single axis operation the difference between the measured actual position of the axis and the internal one calculated by the set-point value generator is designated as contouring error.
- **2-axis synchronous operation (1 ED2-controller)**
  For 2-axis synchronous operation the difference between the actual positions of the 2 axes is defined as contouring error. In case of exceeding the limit value of the contouring error, both axes and the set-point value generator are stopped. For both axes in principle differing contouring error limit values can be set, although this usually does not make sense. The smaller value determines the error triggering. The difference between the set-point value and the actual value of the axes in synchronous operation is **not** monitored through the contouring error limit value as is the case with single axis operation.
  An exceeding of the contouring error limit value can have different reasons:
  – The position measuring systems of one or of both axes are faulty or deviate from one another too much.
  – The settings in PASO of the position measuring systems of both axes deviate from one another too much (PASO menu "Configuration_Set-point/actual values").
  – When starting the control system the positions of both axes for some reason are further apart than the contouring error limit value allows.
  – The control system or the hydraulics of one or of both axes is faulty.
  – The dynamics or hydraulics of the second axis cannot follow the movement of the first axis.
- **Multi-axis synchronism in ED2 - network operation (several ED2-controllers)**
  For multi-axis synchronism in ED2 - network operation, for every axis the deviation of the actual position relative to the average values of the actual positions of all axes in the network association is defined as contouring error. As soon as the contouring error of one of the axes exceeds the limit value defined for this axis, all axes in the network association and the set-point value generator are stopped. The difference between the set-point value and the actual value of the axes during this operation is **not** monitored through the contouring error limit value as is the case with single axis operation.

In synchronous - and in network operation the controller monitors the synchronism of the axes and notifies any exceeding of the contouring error limit value. The difference between the set-point value and the actual position of the axes is n o t monitored in these cases. As long as the axes are synchronous, the set-point value generator and the axes are not stopped, even if the axes do not follow the predefined internal set-point values (i.e., in case of a great difference between the set-point value and the actual value)! The monitoring of the synchronism has priority.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 13/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.2.5 Set-point Value Generator

On the axis controller a set-point value generator is assigned to every axis. The set-point value generator independent of the measured axis position generates the calculated dynamic set-point values, which are transmitted to the actual controller (refer to 5.2.3 "Control Principle"). It is the function of the controller and of the axis control system to implement the predefined set-point values. The set-point value generator is stopped (i.e. the set-point value generator stays at the last value) in the following cases:

- if the external set-point position has been reached (automatic operation)
- if one of the axes runs over the path limit, set in PASO, and the path limitation is active (refer to 10.3.3 „Parameters_Drive_Limits"):
  immediately stopping the set-point value generator
- if the digital input 5 is set to zero (Stop signal refer to 5.7 "Digital Inputs"):
  „smoothly" stopping with regard on the preset maximum deceleration

In the following cases the set-point value is reset to the actual value and stopped:

- if the controller notifies an exceeding of the contouring error limit (refer to 5.2.4 „Contouring Error", regulator and axes are immediately stopped)
- if the digital input DE1 is set to zero, (disabling the controller, controller and axes are immediately stopped, refer to 5.7 "Digital Inputs" on page 24)

In **synchronous operation** (two axes synchronous) only the set-point value generator of the first axis is active, in **synchronous network operation** (more as two axes networking), only the one of the master axis. The set-point value generators of the other axes are only active when running with independent axis movement (for testing - and commissioning purposes).

The axis controller ED2 in principle differentiates between automatic operation and manual operation (more details under 5.2.3 "Control Principle" and 5.3 "Operating Modes of the Axis Controller"):

- In automatic operation an **external** set-point value (end position at the analogue input or, in case of profiles: a set-point value, which is set through the keyboard and stored in the ED2-controller) is predefined. In case of an analogue external set-point value position the axis moves to the predefined external set-point value position with the limit values for speed and acceleration (menu "Parameters_Drive Limits") set in PASO. In case of a predefined profile set-point value, however, the speeds and accelerations defined in the profile generator (menu "Profiles") are maintained.
- In manual operation, **no external** set-point value is predefined and the internal set-point value is continually calculated by the set-point value generator in such a manner, that the manual operation speed and the manual operation acceleration (menu "Parameters_Drive Limits") defined in PASO is followed. The axis moves for as long as the manual running command is set at the digital input DE10 or DE11.

Set-point position external	Operation	Current movement parameters for this operation
Analogue	Automatic	Limits from the menu "Parameters_Drive Limits"
Profile	Automatic	Set-point position, speed, acceleration and deceleration of the profile sequences (menu "Profiles")
None	Manual operation	Manual operation speed / - acceleration from the menu "Parameters_Drive Limits"
None	Test moving	Set-point position, speed, acceleration and deceleration of the test run (menu "Parameters_Controller")

Table 5.2.5.1 Set-point position preset and movement parameters

Wandfluh AG   *Tel.* +41 33 672 72 72   *E-mail:* sales@wandfluh.com   *Page 14/80*
Postfach   *Fax* +41 33 672 72 12   *Internet:* www.wandfluh.com   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

The following three sketches illustrate the first three variants and will make clear the principle of the set-point value generator.
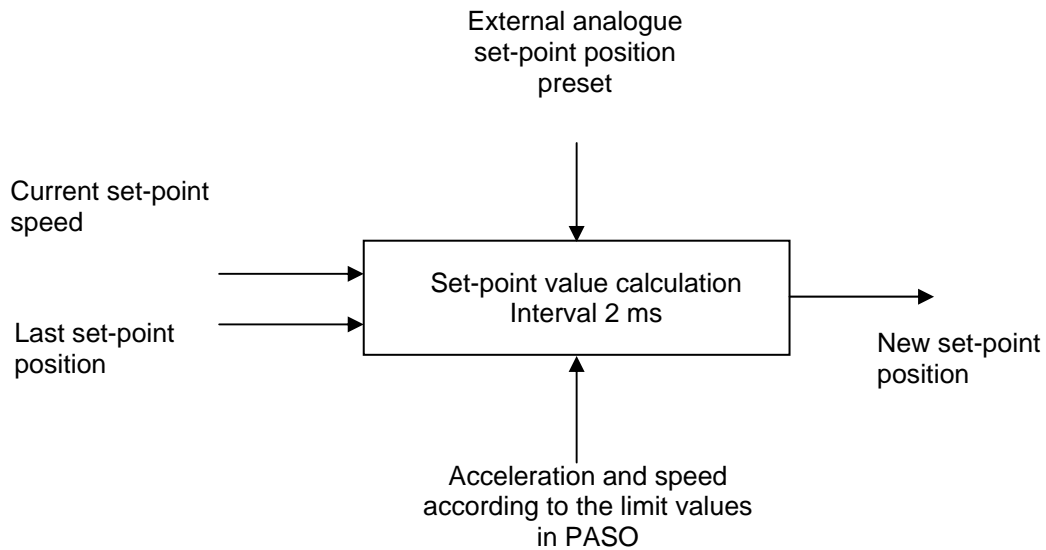
External analogue
set-point position
preset

Current set-point
speed

Last set-point
position

Set-point value calculation
Interval 2 ms

New set-point
position

Acceleration and speed
according to the limit values
in PASO

Figure 5.2.5.1 Set-point value generator, analogue set-point position preset (automatic operation)

Profile sequence end
position (PASO)

Current set-point
speed

Last set-point
position

Set-point value calculation
Interval 2 ms

New set-point
position

Acceleration and speed of
the current profile sequence
(PASO)
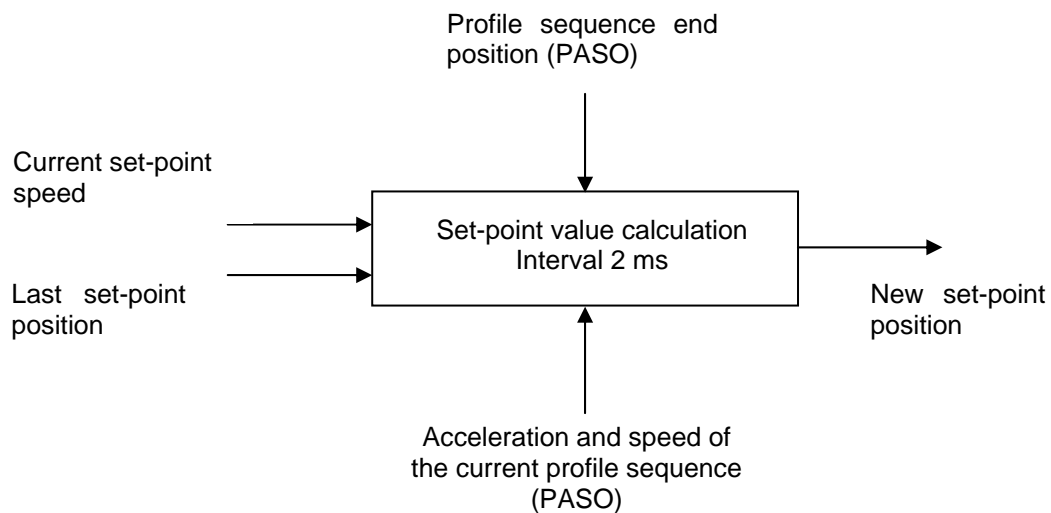
Figure 5.2.5.2 Set-point value generator, set-point value preset through profiles (automatic operation)

Wandfluh AG　　　　*Tel. +41 33 672 72 72*　　　*E-mail: sales@wandfluh.com*　　　*Page 15/80*
Postfach　　　　　　*Fax +41 33 672 72 12*　　　*Internet: www.wandfluh.com*　　*Edition 07 01*
CH-3714 Frutigen　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　*ED23xBAE.doc*

Current set-point
speed

Last set-point
position

```
┌─────────────────────────┐
│ Set-point value calculation │ ──────→  New   set-point
│      Interval 2 ms       │            position
└─────────────────────────┘
            ↑
```

Acceleration and
speed in manual
operation (PASO)
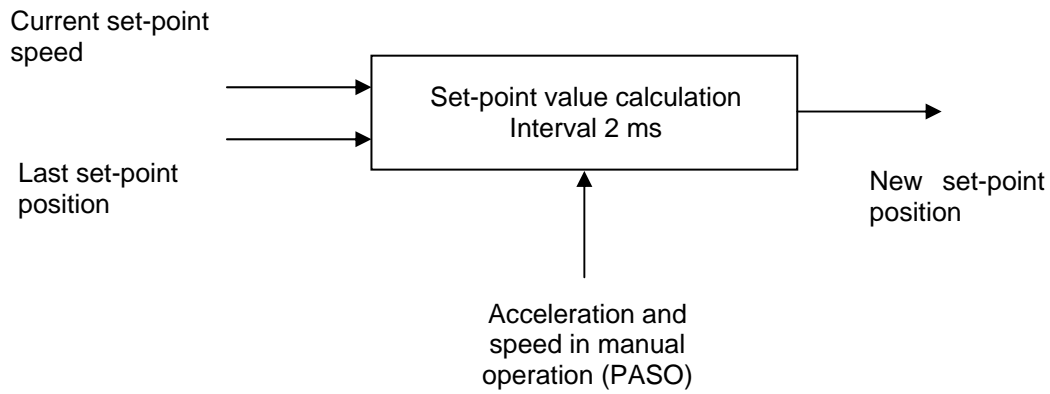
Figure 5.2.5.3 Set-point value generator in manual operation (no external set-point value preset)

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales @wandfluh.com*   *Page 16/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.2.6 Set-point value Preset in Network Operation

The external set-point value preset in network operation takes place exclusively through the Master-ED2, the external set-point value preset on the other Slave-ED2/ED3 is correspondingly deactivated. In synchronous manual operation or in synchronous test movement (menu "Parameters_Controller"), exclusively the movement parameters of the first Master axis are applicable. Only in operation with independent axis movement (for test - and installation purposes) the movement parameters of the respectively active axis are applicable. **In the ED2 software - version 1.6, only manual movement in synchronous operation is permitted through the digital inputs.**

5.2.7 Axis Control

The axis control is a PI - control and converts the dynamic set-point value calculated by the set-point value generator into an axis position. The control parameters for the axis control can be set for every axis with the help of the PASO software (menu "Parameters_Controller"). In addition, the influence of the I - proportion can be limited in this menu (I - limitation).
The actual position in general is present in the controller as a mm value. From the difference with the internal set-point value preset the control difference results. Through the control parameters set, the correcting variable is calculated (-10...+10 V) and converted into the corresponding solenoid current (solenoid A or B) of the valve. In case of synchronous - or network operation, the correcting variable is corrected with the deviation from the synchronous average value.

5.2.8 Position Control (1 Axis)

For the position control the following formula is applicable (refer to footnote for the names of the parameters):

$$Corr = K_s \left(K_p \, e + \Delta T / T \sum e \right)$$

The principle of the control operation is schematically illustrated in Figure 5.2.8.1. The influence of the I - control is additionally limited. The control parameters can be set under PASO.
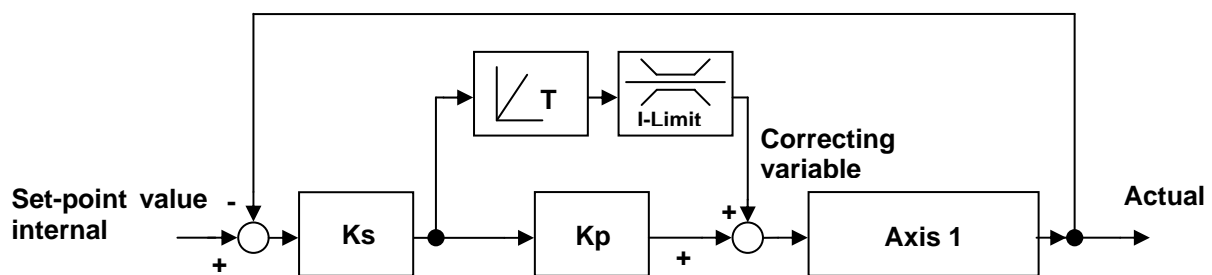
Figure 5.2.8.1 Position controller

---

e = set-point - actual: Control difference of the axis
Corr : Correcting variable
K_s : Proportional coefficient of the axis
K_p : P - proportion of the axis
T : Reset time [s] of the axis
ΔT : Sensing period [s]

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 17/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc

5.2.9 Synchronous Control in accordance with the Average Value Principle (2 Axes)

For the 2-axis synchronous control in accordance with the average value principle, as from the ED2 - axis controller version 1.6 the following formula is applicable (refer to footnote for the designations of the parameters):

$$Corr_1 = K_{p1} e_1 + \Delta T/T_1 \sum e_1 + K_{s1} (act_{average} - act_1)$$

$$Corr_2 = K_{p2} e_2 + \Delta T/T_2 \sum e_2 + K_{s2} (act_{average} - act_2)$$

The principle of the control is schematically illustrated in Figure 5.2.9.1. The influence of the I-control is additionally limited. The control parameters can be adjusted under PASO.
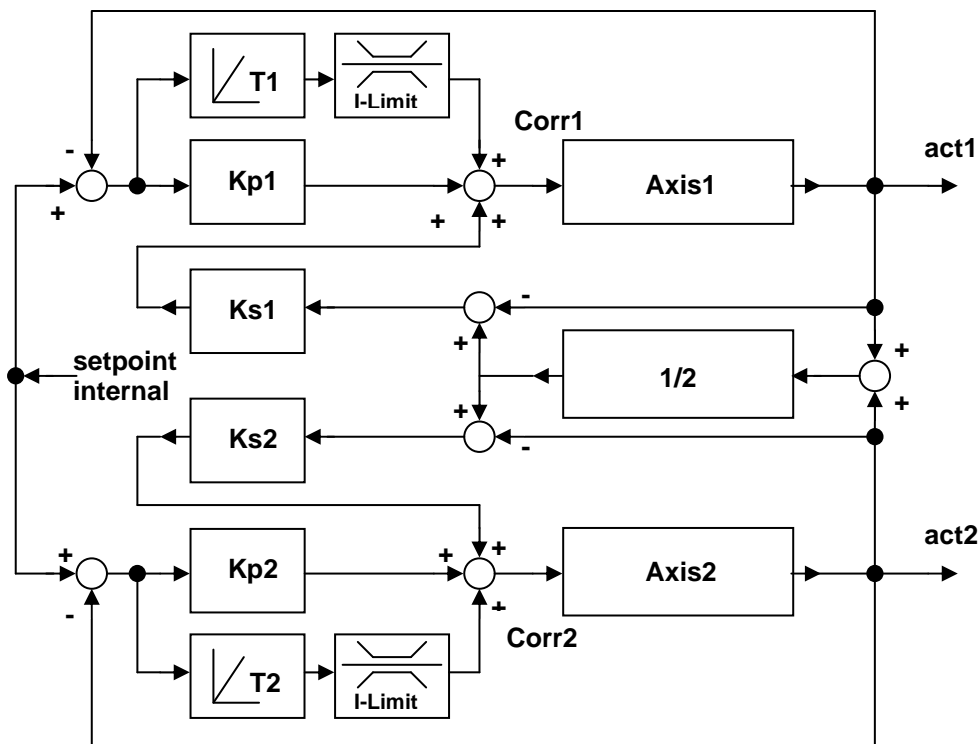
Figure 5.2.9.1 Two-axis synchronous control in accordance with the average value principle (as from version 1.6)

_____

e_1 = set - act_1	:	Control difference of the axis 1
e_2 = set - act_2	:	Control difference of the axis 2
$act_{average}$ = ½ ($act_1 + act_2$)	:	Average value in case of 2-axis operation

$Corr_1$: Correcting value of the axis 1
$Corr_2$: Correcting value of the axis 2
K_{p1} : P-proportion of the axis 1
K_{p2} : P-proportion of the axis 2
K_{s1} : Proportional coefficient of the axis 1
K_{s2} : Proportional coefficient of the axis 2
T_1 : Reset time [s] of the axis 1
T_2 : Reset time [s] of the axis 2
ΔT : Sampling period [s]

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 18/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc

Older versions of the ED2 - axis controller utilise a deviating control formula for the 2-axis synchronous control with average value forming. The schematic control sketch above (Figure 5.2.9.1) is therefore **not** applicable for the ED2 - axis controllers up to 1.5. The precise control results from the formulas below. A graphic illustration of these two variants is not provided here.

For the ED2 - axis controllers versions up to 0.4b the following formula is applicable (refer to footnote for the names of the parameters):

$$Corr_1 = e_1 + K_{s1} [K_{p1} (act_{average} - act_1) + \Delta T/T_1 \Sigma (act_{average} - act_1)]$$

$$Corr_2 = e_2 + K_{s2} [K_{p2} (act_{average} - act_2) + \Delta T/T_2 \Sigma (act_{average} - act_2)]$$

For the ED2 - axis controller versions up to 1.5 the following formula is applicable (refer to footnote for the names of the parameters):

$$Corr_1 = e_1 + K_{s1} [K_{p1} (act_{average} - act_1) + \Delta T/T_1 \Sigma e_1]$$

$$Corr_2 = e_2 + K_{s2} [K_{p2} (act_{average} - act_2) + \Delta T/T_2 \Sigma e_2]$$

5.2.10 Average Value Multi-Axis Synchronous Control (Network Operation)

In case of the multi-axis synchronous operation in accordance with the average value principle (network operation of several ED2 - axis controllers), the average value is formed out of the actual position values of the axes involved and serves as reference for the synchronism. Represented as a formula (refer to footnote for the names of the parameters):

$$Corr_1 = K_{p1} e_1 + \Delta T/T_1 \Sigma e_1 + K_{s1} (act_{average} - act_1)$$

$$Corr[i] = K_p[i] e[i] + \Delta T/T[i] \Sigma e[i] + K_s[i] (act_{average} - act[i])$$

The principle of the control is schematically illustrated in Figure 5.2.10.1. The influence of the I-control is additionally limited as in the case of the two-axes synchronous control (not illustrated in the sketch for space reasons). The control parameters can be adjusted under PASO.

$e_1 = set-point - act_1$:   Control difference of the axis 1
$e_2 = set-point - act_2$:   Control difference of the axis 2
$e[i] = set-point - act[i]$:   Control difference of the axis i
$act_{average} = \frac{1}{2} (act_1 + act_2)$: Average value in case of 2-axes operation
$act_{average} = 1/N \Sigma act[i]$:   Average value in case of 2-axes operation

N	:	Number of axes in the network
$Corr_1$	:	Correcting variable of the axis 1
$Corr_2$	:	Correcting variable of the axis 2
$Corr[i]$	:	Correcting variable of the axis i
K_{s1}	:	Proportional coefficient of the axis 1
K_{s2}	:	Proportional coefficient of the axis 2
$K_s[i]$	:	Proportional coefficient of the axis i
K_{p1}	:	P-proportion of the axis 1
K_{p2}	:	P-proportion of the axis 2
$K_p[i]$	:	P-proportion of the axis i
T_1	:	Reset time [s] of the axis 1
T_2	:	Reset time [s] of the axis 2
$T[i]$	:	Reset time [s] of the axis i
ΔT	:	Sampling period [s]

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 19/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*
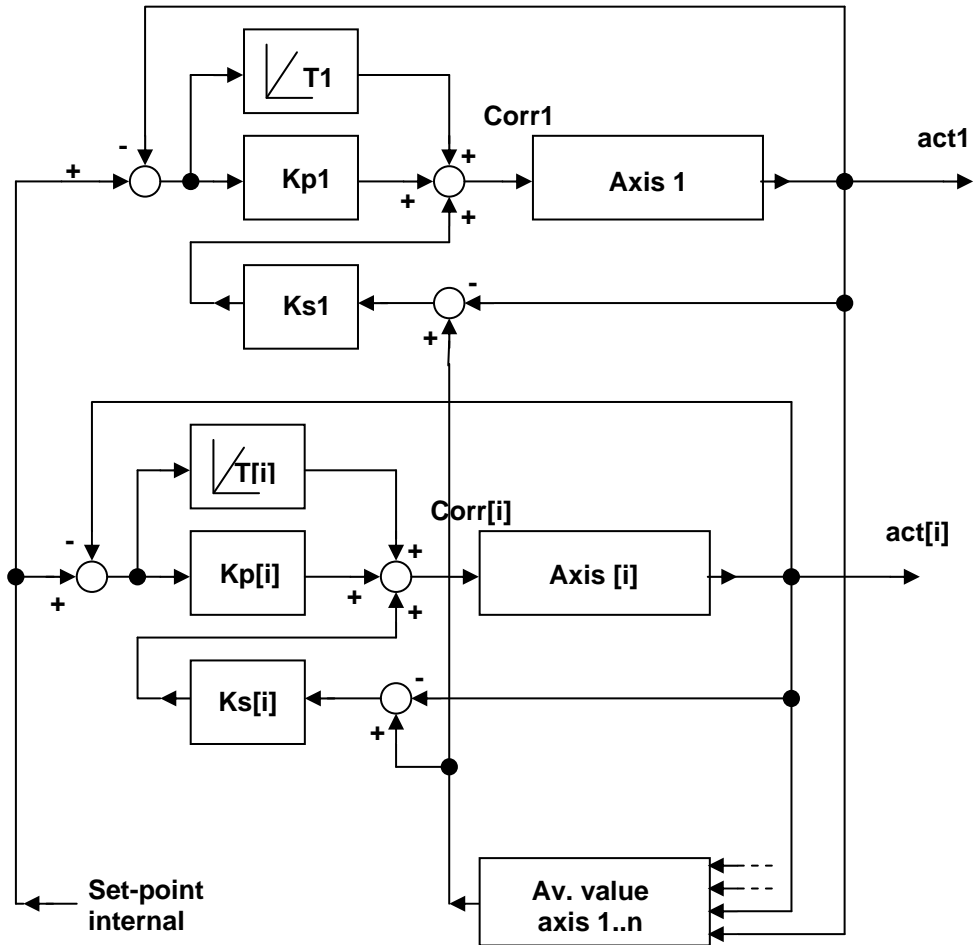
WANDFLUH
® Hydraulics + Electronics

Figure 5.2.10.1 Multi-axis synchronous control in accordance with the average value principle
(as from version 1.6)
The I-limitation is not illustrated for space reasons

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 20/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.3 Operating Modes of the Axis Controller

The axis controller ED2 operates in one of four possible operating modes (not to confuse with PASO Operating Modes, refer to 8.2 "PASO Operating Modes"). In each operating mode certain functions are available. A part of the functions is only accessible through the parameterisation software PASO (refer to 8 "Settings with the help of PASO"). In the table below the operating modes with the functions belonging to them are listed.

Operating mode	Functions	Operation
1. Automatic	Controlled movement	Digital input 2 on automatic, or through PASO
2. Manual	Synchronous manual operation	Digital input 2 on manual, digital input 14 on synchronism, or through PASO Movement through the digital inputs 10...14 or through PASO
3. Setting-up	Single axis manual operation	Digital input 2 on manual operation, digital input 14 on single axis or through PASO Movement through the digital inputs 10...14 or through PASO
	Test movement single axis	Only through PASO
	Test movement synchronism	Only through PASO
4. Open loop	Direct valve actuation	Only through PASO

Table 5.3.1 Operating modes

Through PASO all functions can be selected, through the digital inputs only the functions "Controlled movement" (Operating mode "Automatic"), "Synchronous manual operation" (Operating mode "Manual") or "Single axis manual operation" (Operating mode "Setting-up").

The changeover to another operating mode is only possible when the enabling is removed (digital input 1 on "not active"). Before changing over to another operating mode, therefore the axis controller should, if not already so, be de-activated, i.e., the enabling removed (digital input 1 on "not active"). After changing the operating mode, the enabling is once again reset to the old value. If the changeover takes place through PASO, then the enabling through PASO is automatically removed and reset to the old value again after the operating mode change.

If functions are not selected through PASO but externally through the digital inputs, then it has to be monitored whether an operating mode change is required (refer to table 5.3.1 "Operating modes"). If this is the case, the following sequence should be observed:
1. Remove enabling (digital input 1 on "not active", if not already the case)
2. Set the applicable digital inputs belonging to the function
3. Reset enabling (set digital input 1 to the old value again)

In older ED2 - axis controller versions (up to version 1.5) the operating mode change through the enabling is not imperatively necessary.

On a Slave-ED2 (Version "SA", refer to 2.5 "Type Code") the change of operating mode and the manual operation are only possible in network operating through the Master-ED2.

Wandfluh AG
Postfach
CH-3714 Frutigen

Tel.   +41 33 672 72 72
Fax   +41 33 672 72 12

E-mail: sales@wandfluh.com
Internet: www.wandfluh.com

Page 21/80
Edition 07 01
ED23xBAE.doc

5.4 Axis controller operating modes in Network operation mode

In network operation, i.e. one Master-ED2 with one or more Slave-ED2/ED3 in a network regulation association (refer to 5.2.2 "Network Operation"), the operating mode change always has to be done on the master (either through the digital inputs or in PASO, connected to the Master-ED2). The functions "Single axis manual operation", "Test movement single axis" (only PASO) and "Direct valve actuation" (only PASO) are subsequently set on the corresponding network ED2/ED3 (master or slave), the other functions on the Master-ED2.

The selected master operating mode is valid for the whole network association. Manual control of the interconnected axes through digital inputs takes place by actuating the masters digital inputs. Only in case of **single** axis manual control through the digital inputs, the inputs of the corresponding Slave-ED2 have to be used.

Operating mode	Functions	Operation
1. Automatic	Controlled movement	Digital input 2 on automatic, or through PASO
2. Manual	Synchronous manual operation	**Master:** Digital input 2 on manual, digital input 14 on synchronism, or through PASO Movement through the digital inputs 10...14 or through PASO
3. Setting-up	Single axis manual operation	**Master:** Digital input 2 on manual operation, digital input 14 on single axis or through PASO Movement through the digital inputs 10...14 or through PASO Axis selection of master axis through digital input 9 or through PASO **Slave:** Movement of a slave axis through the digital inputs 10...14 **at the slave** or through PASO connected to the Master-ED2 In case of a Slave-ED2 (2-axis Slave): selection of the slave axis through the digital input 9 **at the slave** or through PASO connected to the Master-ED2
	Test movement single axis	Only through PASO
	Test movement synchronism	Only through PASO
4. Open loop	Direct valve actuation	Only through PASO

Table 5.4.1 Operating modes in networking

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 22/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

5.5 Analogue Inputs

The analogue signal applied is digitalised by means of A/D converters with the following resolution:
10 bit for the analogue inputs 5 – 8 (concerns customer specific applications, not described in this guide),
16 bit for the analogue inputs 1 – 4 (option 16 bit, refer to 2.5 "Type Code").

- **Differential inputs**
  Differential inputs have to be used if the potential of the mass of the external preset value transmitters does not correspond to the analogue mass on the controller card. If the differential input is to be utilised like an analogue input against the analogue mass, then the – (minus) connection of the differential input has to be connected with the analogue mass.
- **The analogue inputs 1 – 4 are used for the preset or actual values**
  Analogue input 1 + 3 (for differential voltage signals)
  Input voltage range selectable: ±5 V ... ±10 V
  Analogue input 2 + 4 (for differential current signals)
  Input current range selectable: 0...+20 mA / 4...+20 mA
- **The analogue inputs 5 – 8 are used for additional signals from the system**
  and concern special versions, which are not described in this operating guide
  Analogue input 5 + 6 (for differential voltage signals)
  Input voltage range selectable: ±5 V / ±10 V / 0...5 V / 0...10 V
  Analogue input 7 + 8 (for differential current signals)
  Input current range selectable: 0...+20 mA / 4...+20 mA

5.6 Analogue Inputs in Network Operation

Analogue inputs on networkable ED2 controllers (Master-ED2 or Slave-ED2/ED3, refer to 2.5 "Type Code") can only be utilised on the master ED2 for the set-point value presetting.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 23/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

5.7   Digital Inputs

Attention: For ED2 controllers with Profibus (refer to 2.5 "Type Code") in part other assignments are applicable, which are described in the corresponding operating instructions.

- **Enabling control (digital input DE1)**
  Enables the axis controller in general. Without this enabling no movements can be made. If this input is not active, the solenoid current is set to zero and a possibly active positioning process is reset.
  0 = Axis controller blocked
  1 = Axis controller enabled

- **Automatic / *Manual operation (digital input DE2)**
  Changeover between automatic and manual operation. When changing over, the axes remain stopped in their respective positions and await further commands.
  Prior to the changeover the enabling (digital input 1) should be removed. For a subsequent movement the controller should be enabled once more (digital input 1 to One).
  0 = Manual operation
  1 = Automatic

- **Profile / *Sequence (digital input DE3)**
  Changeover between "Run through complete profile" and "Run through individual sequence". With the function "Start" (DE4), the required function is then started.
  0 = By actuating DE4 an individual sequence is run through
  1 = By actuating DE4 the complete profile is run through

- **Start (digital input DE4)**
  This input is only active when the control system is on "Automatic".
  Depending on digital input 3 (complete profile / sequence) the running through of the complete profile or of the next sequence only is started
  0 = No function
  1 = Start pulse (minimum 100 ms)

- ***Stop (digital input DE5)**
  Zero active input. If this input is not active, the current positioning is interrupted, i.e. the set-point value is stopped (set-point value = actual value).
  0 = Stop = stop axis
  1 = No function, resp. axis can move
  Attention: An axis possibly moving in manual operation is stopped with the acceleration / deceleration, which has been entered in the PASO menu "Drive limit values" under "Max. acceleration", i.e., in general significantly more abruptly than through the manual operating switches digital inputs 10 and 11.
  Remark: If the digital input 5 is open (not wired), then it stays fixed at "0" and the axes cannot be moved. This problem can be solved, if the digital input 5 through PASO is set fixed to "1" by software (menu "Configuration_Digital I/Os").

- **Profile selection (digital input DE6 - 9)**
  Selection of the required movement profile. Maximum selectable movement profiles = 16 (binary coded).
  In order to be able to select the movement profiles 9 - 16, in addition the digital input DE9 is required.
  The following inputs have to be set, so that the corresponding movement profile is activated:

Profile selection 8 (DE9)	Profile selection 4 (DE8)	Profile selection 2 (DE7)	Profile selection 1 (DE6)	Movement profile
0	0	0	0	1
0	0	0	1	2
≈	≈	≈	≈	≈
1	1	1	0	15
1	1	1	1	16

---

* = Action is active when input is Low (refer to 2.6.2 "Electrical Characteristic Values")
0 = Input Low
1 = Input High

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales @wandfluh.com*   *Page 24/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

- **Manual cylinder1 / *cylinder2 (digital input DE9, alternate function)**
  The Input has two operating modes depending on the Input "Automatic - / *Manual operation" (DE2).

DE2 = Manual operation:	DE9 determines which cylinder is effected by the manual forward or reverse movement.
	0 = cylinder 1 active
	1 = cylinder 2 active
DE2 = Automatic operation:	DE9 is the binary profile selection 8 for the profile selection (see profile selection DE6 - 9).

- **Manual forward (digital input DE10)**
  This input is only effective, when the controller is set to "Manual operation".
  Moves the axis in forward direction as long as the input is active. The axis speed depends on the Input "manual rapid / creep speed" (DE12).
  0 = no movement   (Acceleration equal to deceleration, set
  1 = axis moves forward   in the menu "Parameters_Drive_General")

- **Manual reverse (digital input DE11)**
  This input is only effective, when the controller is set to "Manual operation".
  Moves the axis in reverse direction as long as the input is active. The axis speed depends on the Input "manual rapid / creep speed" (DE12).
  0 = no movement   (Acceleration equal to deceleration, set
  1 = axis moves reverse   in the menu "Parameters_Drive_General")

- **Manual Rapid speed / *Creep speed (digital input DE12)**
  This input is only effective, when the control system is set to "Manual operation".
  Changeover between creep speed and rapid speed. With the function Manual forward (DE10), resp. Manual reverse (DE11) the required function is then started.
  0 = By the actuation of DE10, resp. DE11 the axis moves in the required direction at creep speed
  1 = By the actuation of DE10, resp. DE11 the axis moves in the required direction at rapid speed

- **Contouring error limit value Coarse / *Fine (digital input DE13)**
  This function is active as from version 1.6.
  Selection of the contouring error limit value, defined in PASO in the menu "Parameters_Drive general"
  0 = Contouring error limit value fine, meant for the normal control operation
  1 = Contouring error limit value coarse, meant for the starting until a controlled position has been reached.
  If the limit value is exceeded, the axis is (the axes are) stopped.

- **Manual Individual / *Synchronism (digital input DE14)**
  This input is only effective, when the control system is in "Manual operation".
  Here it can be selected, whether the functions Manual Forward and Manual Reverse are simultaneously effective for both cylinders or only for the cylinder selected with DE9.
  Attention: In individual movement the axes move individually and not in synchronism!
  0 = The manual functions act on both cylinders
  1 = The manual functions only act on the cylinder selected with DE9

- **Search for reference (digital input DE15)**
  A reference point in a defined direction is searched for. This function is utilised in connection with incremental measuring systems (only positioning controllers).
  0 = No function
  1 = Start search

---

* = Action is active when input is Low (refer to 2.6.2 "Electrical Characteristic Values")
0 = Input Low
1 = Input High

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 25/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

- ***Limit switch (digital input DE16)**
  Here the sensor can be connected, which monitors the maximum admissible stroke in the positive (+)
  direction. Zero active input. If this input is not active, the axes are stopped immediately.
  0 = axis stops immediately
  1 = axis is enabled to move
- ***Limit switch (digital input DE17)**
  Here the sensor can be connected, which monitors the maximum admissible stroke in the negative (-)
  direction. Zero active input. If this input is not active, the axes are stopped immediately.
  0 = axis stops immediately
  1 = axis is enabled to move
- **Reference switch (digital input DE18)**
  If this input is active, then the next reference pulse of the measuring system is set as the reference point
  of the system (zero point).
  0 = no function
  1 = next reference signal is the zero reference

5.8 Digital Inputs on a Network Controller or in Network Operation

5.8.1 Slave-ED2

On a Slave-ED2 (version "SA"), all digital inputs are not active, with the following exceptions:

- **Enable control system (digital input DE1)**
  Enables the individual axis controllers under the condition, that in network operation the Master-ED2 has
  transmitted the general enabling. The axes of a Slave-ED2 cannot be moved without network operation.
  For the network synchronous operation, all individual axis controllers have to have been enabled.
- ***Limit switch pos (digital input DE16)**
  Here a sensor for the monitoring of the maximum permissible stroke of the Slave axes in positive (+) -
  direction can be connected. Zero active input. If this input is not active, then all axes in the network
  association are stopped immediately.
  0 = Axis is stopped
  1 = Axis can move
- ***Limit switch neg (digital input DE17)**
  Here a sensor for the monitoring of the maximum permissible stroke of the Slave axes in negative (-) -
  direction can be connected. If this input is not active, then all axes in the network association are stopped
  immediately.
  0 = Axis is stopped
  1 = Axis can move

In the mode "Manual operation single axis", selectable through the Master (refer to 5.8.3 "Manual Operation
in the Network association"), additionally the following inputs are active on the Slave-ED2:

- **Manual *Cyl1 / Cyl2 (digital input DE9)**   first or second axis of the Slave-ED2
- **Manual Forward (digital input DE10)**   (in case of "Manual operation single
- **Manual Reverse (digital input DE11)**   axis", the axes on the Slave move
- **Manual Rapid Speed / *Creep Speed (digital input DE12)**   individually and not in synchronism)
Attention: In this mode, the network axes move individually and not in synchronism !

_____
* = Action is active when input is Low (refer to 2.6.2 "Electrical Characteristic Values")
0 = Input Low
1 = Input High

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 26/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc

5.8.2 Master-ED2

On a Master-ED2 (version "MA"), all digital inputs are active, as in the case of a non-network controller (refer to 5.7 "Digital Inputs"). Exceptions to this are the digital inputs DE15 (search for reference) and DE18 (reference switch), which relate to the incremental measuring system, which are not supported in network controllers (Master- or Slave-ED2/ED3).

The digital inputs for the profile movement of the Master-ED2 act on the complete network association. In network operation in addition the following digital inputs have an effect on the complete network association:

- **Enabling the control system (digital input DE1)**
  Enables the complete network association of axis controllers in general. Without this enabling no movements can be made in the network. If this input is not active, the solenoid current is set to zero and a possibly active positioning process is reset.
  0 = Network association blocked
  1 = Network association enabled, all Slave-ED2/ED3, however, also have to be enabled.
- **Automatic / *Manual operation (digital input DE2)**
  Sets the complete network association to manual operation or automatic operation.
  Prior to the changeover, the enabling (digital input DE1) should be removed. For a subsequent movement the controller should be enabled again (digital input DE1 to "1").
  0 = Manual operation
  1 = Automatic
  The digital input DE14 in addition defines whether the manual operation takes place in synchronism or in single axis movements.
- **Contouring error limit value (digital input DE13)**
  Selection of the contouring error limit value, defined in PASO in the menu "Parameters_Drive_General".
  0 = Contouring error limit value fine, meant for the normal control operation
  1 = Contouring error limit value coarse, meant for the starting until a controlled position has been reached
  If the limit value is exceeded, the axis is (the axes are) stopped.
  By switching the digital input DE13 on the Master, all Slave-ED2/ED3 in the network association are switched to "Contouring error limit value coarse" or "Contouring error limit value fine".
- **Manual individual / *Synchronism (digital input DE14)**
  This input is only active if the control system on the Master is set to "Manual operation" (digital input DE2).
  Here it can be selected, whether the functions Manual forward and Manual reverse are simultaneously effective for all axes in the network association or only for the cylinder (selected with DE9) on the corresponding axis controller.
  Attention: In individual movement the axes move individually and not in synchronism !
  0 = The manual functions act on all cylinders in the network association (controlling only at the master)
  1 = The manual functions only act on the cylinder of the corresponding axis controller.
        For a Slave-ED2 (2-axes controller), the local axis is selected through the digital input DE9 at the slave.
  By changing over the digital input DE14 on the Master, in manual operation all Slave-ED2/ED3 in the network association are switched to synchronism or single axis operation.
  Prior to changing over, the enabling (digital input 1) should be removed. For a subsequent movement the controller should be enabled again (digital input 1 to "One").

---

* = Action is active, when the input is Low (refer to 2.6.2 "Electrical Characteristic Values")
0 = Input Low
1 = Input High

Wandfluh AG	*Tel.* +41 33 672 72 72	*E-mail:* sales@wandfluh.com	*Page 27/80*
Postfach	*Fax* +41 33 672 72 12	*Internet:* www.wandfluh.com	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

5.8.3 Manual Operation in the Network association

Attention: When changing over to manual operation pay attention to any possible already active movement commands (digital inputs DE10 or DE11) on the network controllers, which could result in an immediate movement of the axes.

The modes "Manual operation synchronised" or "Manual operation single axis" can be set through the Master-ED2 by the following steps:

- The network control system should be working impeccably
- Remove the enabling on the Master (digital input DE1 to inactive)
- On the Master select manual operation (digital input DE2 to inactive)
- On the master set the manual operation to single axis if you want to select the mode "Manual operation single axis" (digital input DE14 to active. **Attention: All axes in the network association move independently !**), otherwise set the digital input DE 14 to inactive.
- On the Master enable the enabling again (digital input DE1 to active).
- All Slaves in the network association are now set to "Manual operation in synchronism" or "Manual operation single axis".

Back to the "Automatic mode" also through the Master-ED2 by the following steps:

- The network control system should be working impeccably
- Remove the enabling on the Master (digital input DE1 to inactive)
- On the Master select the automatic mode (digital input DE2 to active)
- On the Master set the manual operation to synchronism (digital input DE14 to inactive)
- On the Master enable the enabling again (digital input DE1 to active)
- All Slaves in the network association are now set to "Automatic" .

5.8.4 Profiles in the Network association

In case of network controllers in the network association only the profiles of the Master-ED2 are active. The profile movement takes place through the digital inputs as usual:

- Profile / *Sequence   (digital input DE3)
- Start   (digital input DE4)
- *Stop   (digital input DE5)
- Profile selection   (digital input DE6 - 9)

The profiles act on the complete regulated network association.

5.9 Analogue Outputs

- **Proportional solenoid outputs 1 and 2 for axis 1, resp. 3 and 4 for axis 2**
  The 4 solenoid outputs have a **P**ulse-**W**idth-**M**odulated current output modulated with 1000 Hz with superimposed dither. The polarity of the connected solenoids does not matter. The outputs are short-circuit protected and may be loaded with maximum 1.8 A.
- **Analogue output 1, resp. 2 correcting variable axis 1, resp., axis 2)**
  The analogue output 1, resp. 2 corresponds to the correcting variable (refer to 5.2.7 "Axis Control") for the axis 1, resp. axis 2.

---

* = Action is active, when the input is Low (refer to 2.6.2 "Electrical Characteristic Values")

0 = Input Low

1 = Input High

Wandfluh AG | *Tel.   +41 33 672 72 72* | *E-mail: sales@wandfluh.com* | *Page 28/80*
Postfach | *Fax   +41 33 672 72 12* | *Internet: www.wandfluh.com* | *Edition 07 01*
CH-3714 Frutigen | | | *ED23xBAE.doc*

5.10 Digital Outputs

Attention: For ED2-controllers with Profibus (refer to 2.5 "Type Code") in part other assignments are applicable, which are described in the corresponding operating instructions.

- **Digital output 1 (contouring error limit value exceeded)**
  This output becomes active in case the contouring error limit value of one of the two axes of the ED2 controller is exceeded (refer to 5.2.4 "Contouring Error"). Simultaneously the digital output 6 is set to 0 V. For this controller either the coarse or the fine limit values are applicable, selected by digital input DE13. In network operation, the Master (digital input 13) defines for the complete network whether the coarse or fine limit value is valid.

- **Digital output 2 (Sequence end position reached / Analogue set-point position reached)**
  1. *Profile movement (set-point value preset by profile)*
  The output becomes active, when the sequence end position has been reached, i.e., as soon as the set-point value (not the actual value!) has reached the sequence end. Condition is, that the parameter "Output in position" in the menu "Profiles" has been activated.
  The output remains active during the predefined holding time at the end of a sequence.
  2. *Analogue set-point value*
  Becomes active as soon as the difference between set-point value and actual value of one of the two axes of the ED2 controller lies within the position window defined in PASO (menu "Parameters_Drive General").

- **Digital output 3 (Profile end / In position)**
  1. *Profile movement (set-point value preset through profiles)*
  In profile movement the reaching of the profile end is indicated (output active), i.e.:
  - the profile set-point value (not the actual value!) has reached the end of the last sequence
  - a possible holding time has expired
  - the axis is (axes are) in position, i.e. the difference between set-point value and actual value of one of the axes of the ED2 controller lies within the position window defined through PASO.
  2. *Manual operation (menu "Commands_Manual operation")*
  During the movement the output is set to 0V. When stopping, the output is set to active, if the difference between the internal set-point value value and actual value lies within the position window.
  3. *Test movement (menu "Parameters_Controller")*
  The output becomes active as soon as one of the two axes of the ED2 controller has reached the predefined position 1 or position 2, i.e., the difference between the set-point value and the actual value of one of the two axes lies within the position window.

- **Digital output 4**
  Is not used.

- **Digital output 5**
  Is not used.

- **Digital output 6 (Ready / *Error)**
  The output is active when the axis controller is operating without any errors. If any error occurs, also, e.g. an exceeding of the contouring error limit value, or in network operation a network error, then the output is set to 0V.

In **Network operation** (networking of several axis controllers), the digital outputs per ED2/ED3 -controller indicate the status of the corresponding axis controller in the network. **Exception**: The digital output 6 of the Master-ED2 only indicates "Readiness", when all axis controllers in the network have been set to "Ready".

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 29/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc

5.11   Light Emitting Diodes LED Green / Yellow / Red

Light emitting diodes LED green / yellow / red

LED green: The supply voltage is present

LED yellow: The current actual value is in position:
    The difference between the current internal set-point value of the set-point value
    generator (refer to 5.2.3 "Control Principle") and the current actual value of one of
    the two axes of the ED2 controller lies within the position window defined in the
    menu "Parameters_Drive_General".
    Is also indicated during movement, both in manual as well as in automatic operation.

LED red: Indicates the inverted value of the digital output 6.
    Blinking: Start-=up phase of the ED2 axis controller.
    Constant lit: An error has occurred, the control system has been stopped.
    In network operation the red LED of the Master-ED2 is also lit, when an error
    has occurred on one of the Slave-ED2/ED3 (network error).

5.12   Inputs for the digital position measuring systems

The input/output interface provides the possibility of connecting different measuring systems to the axis controller.

- **Absolute measuring systems**
  Temposonic systems with **S**ynchron **S**eriell **I**nterface (SSI):
  Gray 13, 24, 25 bit increasing
  Binary 13, 24, 25 bit increasing

- **Relative measuring systems**
  Encoder systems with A+B track and reference impulse track
  Incremental (not in case of 2-axis synchronous mode, referencing necessary)

In **network operation** (networking of several axis controllers) only absolute digital measuring systems or analogue measuring systems can be used. Relative (incremental) measuring systems are not supported.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 30/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

6 Commissioning

Please refer to the section 3 "Safety rules".

6.1 Installation / Connection

The 2-axis controller should preferably be installed in a 19" rack or in a closed housing.

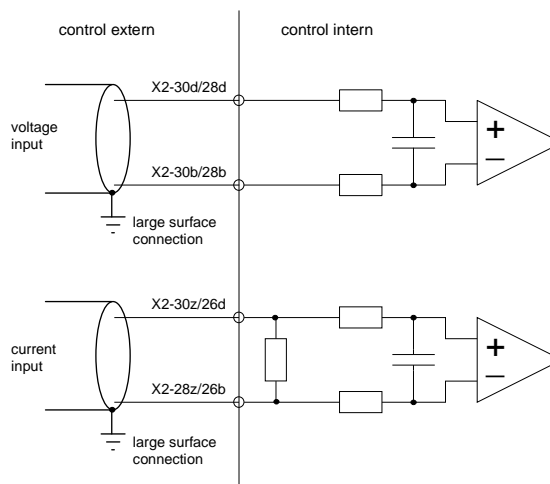For an **installation / connection appropriate for EMC** the following points absolutely have to be observed:

- The surface (at least the surface on which the front plate of the amplifier rests) of the rack / housing has to be electrically conductive (not anodised)!
- The rack / housing has to be grounded on an electrically conducting sub-surface using a conductor strand with a large cross section.
- On the rack - / housing side, two female multipoint connector in accordance with DIN 41612, type F48, have to be foreseen as the plug-in connector.
- The shielding connection (X1-32z) on the multipoint connector has to be connected with the rack, resp., housing with an as short as possible conductor with a strand cross section >= 1,5 mm^2·
- Basically screened cables have to be used (refer to chapter 6.2 "Connection Instructions").
- The screening of the cable on the rack - / housing side must only be connected with the rack / housing using a large surface area and low-ohm connection (best by means of a clamp shackle).
- Solenoid- and signal cables must not be laid parallel to high voltage cables.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 31/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

6.2 Connection Instructions

6.2.1 Power supply voltage

- For the dimensioning of the 24 V power supply, the maximum power demand of the solenoids has to be calculated (in the case of directional control valves, only the maximum power demand of one solenoid has to be considered). This power then has to be increased by the stand-by power demand of the axis controller card (refer to 2.6 "Technical Data").
- The limit values of the supply voltage and its residual ripple indispensably have to be complied with (refer to 2.6 "Technical Data").
- The axis controller card has to be protected with a slow-acting fuse. The rating of this fuse should correspond to approx. 1.5 times the current calculated above.

6.2.2 Solenoid outputs

For the solenoid outputs, the polarity, with which the solenoids are connected, does not matter.
The following, however, has to be observed:

- The conductor strand cross section has to be adapted to the solenoid current.
- Screened cables have to be used; the screen must be grounded only on the rack -, resp., housing side.

6.2.3 Digital inputs and outputs

- In order to exploit the electrical isolation (e.g., in the case of differing mass potentials), the connection "Common opto-coupler mass" (X1-30z) has to be connected to the mass of the external digital signal transmitter.
  If no electrical isolation is necessary, then the "Common opto-coupler mass" (X1-30z) can be connected with the minus of the 24 VDC power supply.

- The digital inputs are "active high" and are connected to +24 VDC for activation.

Wandfluh AG   *Tel.*   *+41 33 672 72 72*   *E-mail:*   *sales@wandfluh.com*   *Page 32/80*
Postfach   *Fax*   *+41 33 672 72 12*   *Internet:*   *www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

- The digital outputs are "active high" . They have to be supplied with an external supply voltage.

6.2.4   Analogue inputs

- Two current - and two voltage differential inputs are available (optional).

6.2.5   Analogue outputs

- Per axis, one analogue output (± 10 VDC) is available. The signal value corresponds to the correcting variable value for the corresponding valve. Instead of a proportional valve on the solenoid outputs, another valve, which has a ± 10 VDC preset value interface, can be connected here.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 33/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*
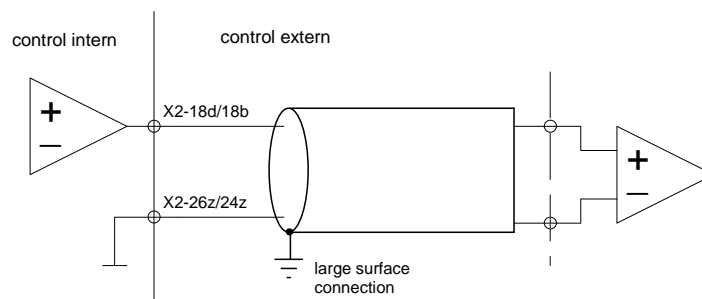
6.2.6 Position measuring inputs

- Temposonic Measuring unit with SSI-Interface
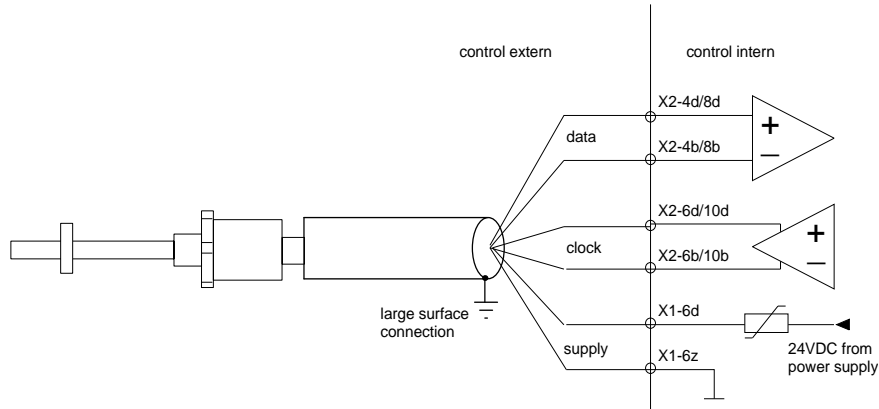
- Measuring unit with incremental-(Encoder)-Interface with 3 signals

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 34/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc
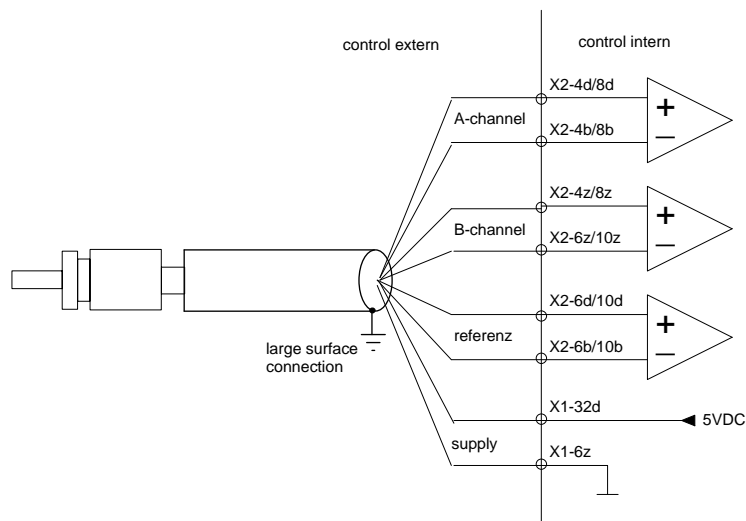
6.3 Connection Instructions for Network Operation

6.3.1 General

Also in the case of networking several axes, the axis controllers can be connected in principle as described above. Also refer to the connection examples under 6.4 "Connection Examples". A Master-ED2 and one or more ED2/ED3 are additionally connected to form a network.

Limitations are applicable in case of the analogue - and digital inputs (refer to 5.6 "Analogue Inputs in Network Operation" and 5.8 "Digital Inputs on a Network Controller or in Network Operation").

In addition, the axis controllers have to be networked through the internal WAG-CAN-Bus.

For the networking, the following connections of all ED2/ED3 have to be connected:

- CAN-H   ED2/ED3: X2-2d Z05: X7/X8-7
- CAN-L   ED2/ED3: X2-2b Z05: X7/X8-2
- CAN-Gnd   ED2/ED3: X2-2z Z05: X7/X8-3

Important: The two ends of the CAN-H and CAN-L lines each respectively have to be connected together with a 120 Ohm terminating resistor.

When utilising our plug-in card holder Z05, the CAN - signals can simply be connected through a 9-pole D-Sub - plug and cable. The termination with the terminating resistors is solved in a simple manner on the Z05 with jumpers (bridging plugs).

6.3.2 Block Circuit Diagram of a Network

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 35/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc
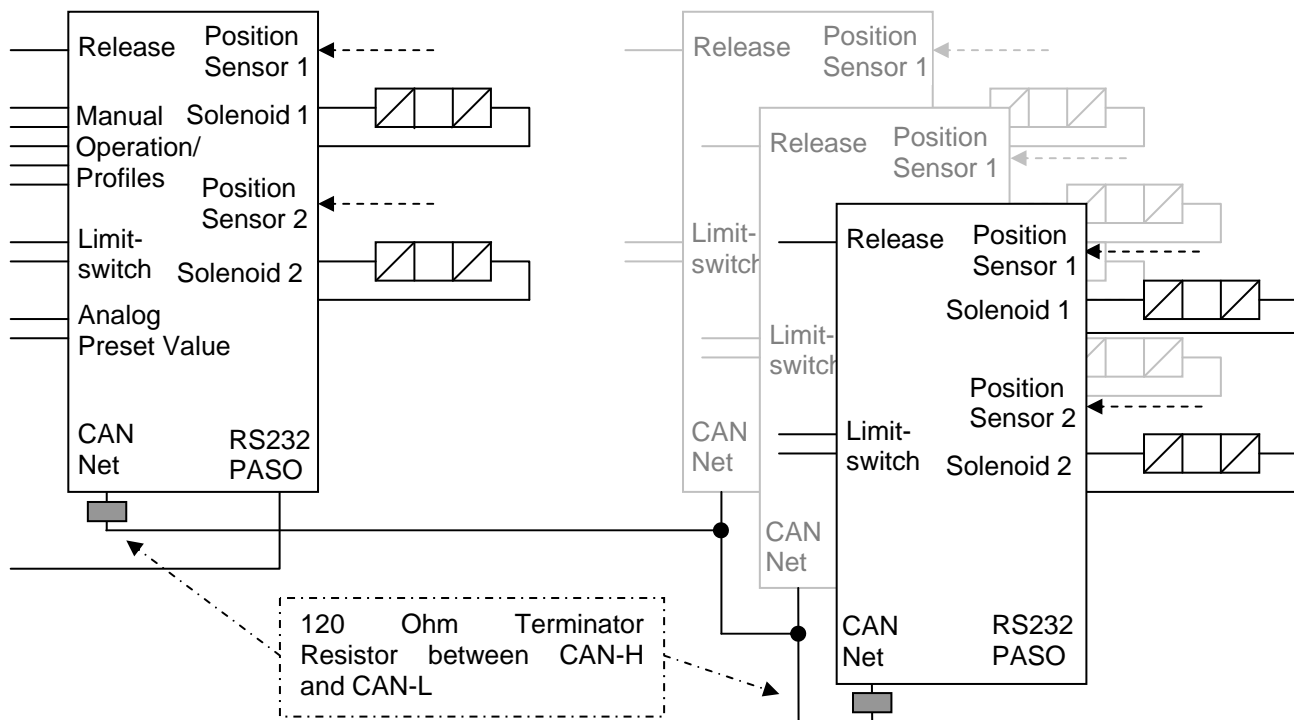
6.4 Connection Examples

6.4.1 1-axis position controller application

- The preset position is preset by the freely adjustable travel profiles. The selection of the travel profiles is made through the digital inputs "profile selection 1 - 8". With the digital inputs "start" and "stop", the run of the profile will be started or stopped.
- The used position measuring system is a absolute measuring system, therefore no reference signals and switches are used.
- The axis can be set externally in the manual operation. Then, the axis can be moved manual in forward or reverse direction.

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 36/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*
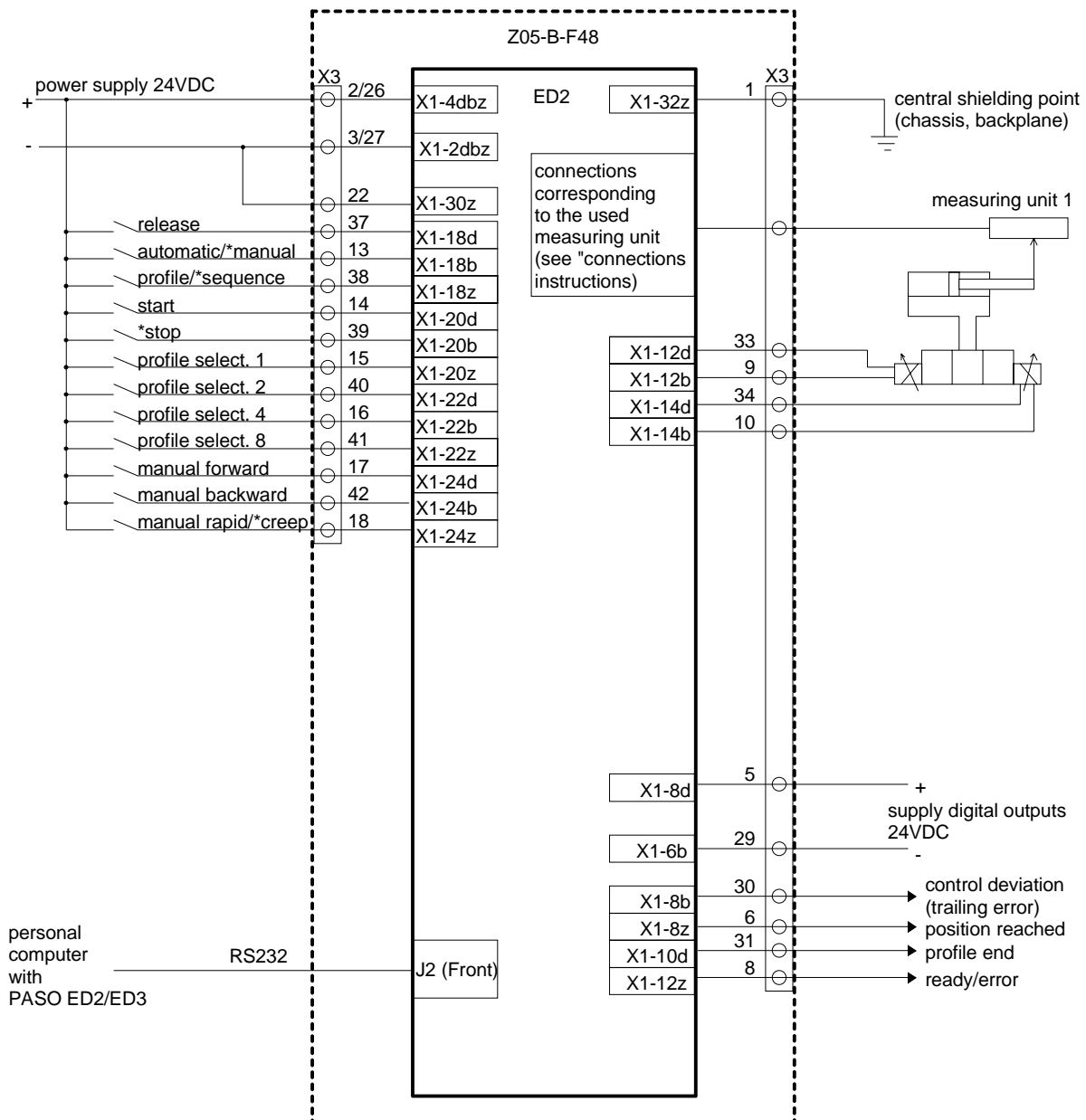
6.4.2 2-axis synchronism controller application

- The preset position is preset by the freely adjustable travel profiles. The selection of the travel profiles is made through the digital inputs "profile selection 1 - 8". With the digital inputs "start" and "stop", the run of the profile will be started or stopped. Both axis will be moved synchronous together.
- The used position measuring system is a relative measuring system, therefore the reference signals and switches are used.
- The axis can be set externally in the manual operation. Then, both axis can be moved manual in forward or reverse direction, in either single moving or synchronous mode.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 37/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

WANDFLUH
Hydraulics + Electronics
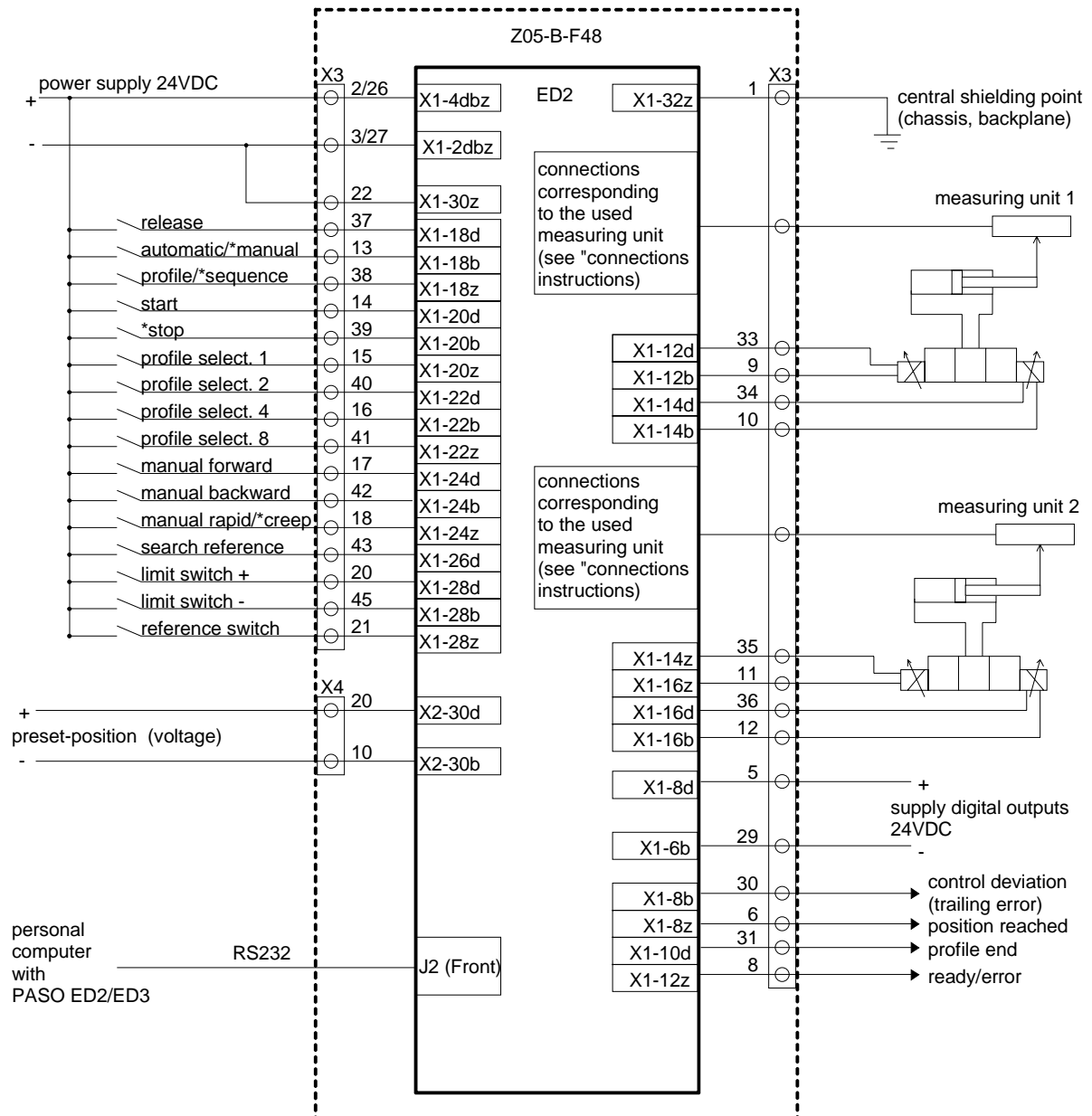
7 PASO Installation and Operation

The parameterisation software "PASO ED2/ED3" serves for the parameterising and diagnosing of digital control cards of the WANDFLUH AG company. The software provides a user interface, through which by means of a keyboard or a mouse all adjustments and settings can easily be carried out. The communication with the digital control card takes place through a serial RS 232 interface.

The parameterisation software "PASO ED2/ED3" can only be utilised in connection with a digital control card ED2 or ED3 of the WANDFLUH AG company. It is necessary to carefully study the operating instructions of the connected digital control card beforehand.

WARNING Virus !
At the actual state of technology it is not possible to 100% guarantee the PASO software being free of viruses.
In spite of carefully checking the occurence of viruses by means of the newest anti-virus software, we are not liable for damages caused by viruses.

7.1 System Requirements

In order to be able to correctly utilise the parameterisation software "PASO ED2/ED3", an IBM-compatible PC with the following requirements has to be available:

- Processor 486 or higher, min. 33MHz, min. 8MB RAM
  Recommended: 80586 66MHz or higher, 16 MB RAM or more
- Free harddisk storage space of minimum 4MB, plus storage space for program files
- Operating system MS-WINDOWS 95/98, NT 4.0 or higher
- Standard VGA or higher graphics card, recommended resolution 800x600
- At least one serial RS232 interface
  Notebooks without a RS232 interface, need an additional hardware like a PCMCIA-card → RS232 converter or a USB → RS232 converter to get the proper RS232 interface.
  Note: Not all USB → RS232 converters work properly, if necessary we assist you with the choice of the right one.
- Serial RS232 cable 1:1 (RxD and TxD not crossed)

Under PASO the serial interfaces COM1 to COM8 can be selected (Menu "Configuration_Interface").

7.2 Installation

The PASO software can be downloaded from the Wandfuh Internet website (http://www.wandfluh.com) under "Downloads". On request the software is available on CD-ROM.
Please check that you download the right PASO, i.e. "PASO ED2/ED3" for the digital controller cards ED2 and ED3.

The installation of the parameterisation software PASO is carried out by executing the program "setup.exe". An installation program takes over the complete installation of PASO. Simultaneously, a new program group for PASO and an uninstallation program are also installed.

7.3 Connection to ED2

The connection between the PC, on which the parameterisation software "PASO ED2/ED3" is installed and the axis controller takes place through the serial RS 232 interface. To do this, a 1:1 cable (RxD and TxD not crossed) has to be connected with the desired output port on the PC and with the RS 232 socket on the ED2-Electronics.

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 38/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

8 Settings with the help of PASO

Please refer to the section 3 "Safety rules".

8.1 Introduction

8.1.1 General

- In order to fulfil its application-specific tasks, the axis controller ED2 has to be parameterised. The necessary system - and parameter settings of the axis controller can be carried out with the help of the parameterisation software ED2/ED3 through the serial interface.
- If you have not installed PASO on your computer yet or if you have questions regarding handling, we refer you to section 7 "PASO Installation and Operation".
- Depending on the software version and the connected ED2 axis controller, certain parameter settings may be blocked.
- In the case of several axis controllers ED2/ED3 in **network operation** (networking of several axis controllers), the settings described have to be individually made for every axis controller. With few exceptions (basic settings of the network operation) these settings can be made through the Master-ED2 and the network connection. PASO is connected with the Master-ED2. The networked ED2/ED3 are selected through the corresponding axis selection.

8.1.2 Utilisation of PASO

Once the axis controller ED2 has been parameterised, it operates autonomously and the connection to the PASO computer is only required for possible changes or for a function analysis.

The PASO software is utilised for the following tasks:
- Transmitting a complete parameter set to the axis controller ED2
- Reading a complete parameter set from the axis controller ED2
- Changing or adapting individual parameters
- Storing or reading a complete parameter set (storage medium: Hard disk)
- Printer output of a complete parameter set
- Function analysis of the axis controller (signal recording, diagnostics, test movements, etc.)
- Updating the axis controller software (software download)

In order to be able to make the setting necessary for the first commissioning (refer to 11 "Tips for the First Commissioning"), first a parameter set belonging to the axis controller must be present for processing in the PASO, or else a new one has to be established. The following possibilities are available under PASO for this:
- Menu "File_New" (the parameters are reset to standard values)
- Menu "File_Load" (a parameter set established beforehand is loaded from the hard disk)
- Menu "File_On Line/Off Line" "Take over parameter set" (a complete parameter set is loaded from the axis controller)
- Start PASO with an active connection to the axis controller (in this case the parameters are loaded from the axis controller), or in the case of network operation establish a network connection (menu "File_Network") and take over the parameters (menu "File_On Line/Off Line").

Wandfluh AG *Tel. +41 33 672 72 72* *E-mail: sales@wandfluh.com* *Page 39/80*
Postfach *Fax +41 33 672 72 12* *Internet: www.wandfluh.com* *Edition 07 01*
CH-3714 Frutigen *ED23xBAE.doc*

8.2 PASO Operating Modes

The parameterisation software "PASO" runs in one of two modes:

- In the "Off Line" mode a processing of the parameter files is possible. The communication with the axis controller is not active. The axis controller is not needed in principle. The function analysis of the axis controller and manual operation are blocked.
- In the "On Line" mode there is active communication with the axis controller card. Every change immediately becomes effective in the axis controller. The parameter values in PASO and on the axis controller card are identical. In this mode the loading and processing of parameter files is not possible. Only the storing of the currently active parameters in a file is enabled. The function analysis and manual operation are enabled.

In the case of **network operation,** there are two further operating modes (refer to 8.3 "PASO Operating Modes in Network Operation").

When starting PASO with an active connection to the axis controller, automatically the parameter set of the axis controller is read and switching to the "On Line" mode takes place (exception: PASO network operation, refer to 8.3 "PASO Operating Modes in Network Operation"). If no axis controller is connected, or in the case of a communication - or parameter error, the parameters are set to standard values and PASO is in the "Off Line" mode.

The changeover between the two modes takes place through the menu point "File_On Line/Off Line". In case of a communication disruption, the controlling of the axis controller is not guaranteed anymore. An error message follows and the PASO software automatically changes to the "Off Line" mode.

8.3 PASO Operating Modes in Network Operation

In addition to the operating modes "On Line" and "Off Line" described above, in network operation three further modes are differentiated between (changeover with the help of the menu "File_Network"):
1. Individual operation (non-network operation)
   PASO works as usual
2. Network Off Line
   PASO is not imperatively connected to a Master-ED2 or a Slave-ED2/ED3. No communication takes place. Under PASO a network can be configured and parameterised. This, however, only makes sense, when at a later point in time a network with the same configuration can be connected.
3. Network On Line (network operation On, connected with the network)
   PASO is imperatively connected to a Master-ED2 and has read the relevant network parameters from the Master-ED2. By selecting an axis in an axis selection field, the network axis controller belonging to it (Master-ED2 or Slave-ED2/ED3) is respectively transparently connected with PASO, as though PASO were directly connected with the axis controller. PASO works with the currently selected network controller as in non-network applications and for every axis controller in the network also knows the operating modes "On Line" or "Off Line" (changeover between the two modes in the menu "File_On Line/Off Line").
   – On Line: The parameters in PASO and on the network controller are identical. Any change in PASO is immediately passed on.
   – Off Line: The parameters in PASO and on the controller are independent. After the processing in PASO the parameters can be transferred to the selected network controller as a complete set (menu "File_On Line/Off Line").

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 40/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

If PASO is connected to a Master-ED2 (refer to 2.5 "Type Code") and is started, then after successful communication switching to "Network On Line" takes place, otherwise to "Network Off Line". PASO, together with the Master-ED2 and the remaining network controllers, remains in the "Off Line" mode for the time being. The parameters of the Master, with the exception of the network parameters, are for the moment not read. If the communication is switched to "Network On Line", then, if necessary, through the menu "File_On Line/Off Line" with every axis controller ED2 or ED3 connected to the network, the "On Line - Operation" is started or aborted.

When PASO is not connected with a Master-ED2, but rather to a Slave-ED2/ED3 or to a non-network - ED2/ED3 (refer to 2.5 "Type Code"), and is started, then after successful communication as usual the complete parameter set is read by the axis controller. Following error-free communication and an error-free parameter test, PASO switches to the "On Line" mode, otherwise to the "Off Line" mode.

The changeover from "Off Line" into "On Line" mode or vice-versa for the respectively current network controller takes place as usual in the menu "File_On Line/Off Line".

Summary of the five PASO operating modes and the connection between PASO and the ED2 controller:

Network operation On/Off (menu "File_Network")	Connect with network (Y/N) (menu "File_Network")	Current controller On Line/Off Line (menu "File_On Line/Off Line")
Individual operation (non-network operation)	Not	1. Connected controller On Line (ED2 controller directly connected)
Individual operation (non-network operation)	Not	2. Connected controller Off Line (ED2 not imperatively connected)
Network operation	Network Off Line (not connected with network)	3. All network controllers Off Line
Network operation	Network On Line (Master-ED2 connected, refer to 2.5 "Type Code")	4. Current controller * On Line
Network operation	Network On Line (Master-ED2 connected)	5. Current controller * Off Line

_____

* the "Current controller" is the controller, of which one of the axes is selected in the axis selection field

Wandfluh AG   *Tel.*   *+41 33 672 72 72*   *E-mail:*   *sales@wandfluh.com*   *Page 41/80*
Postfach   *Fax*   *+41 33 672 72 12*   *Internet:*   *www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

8.4 Program Description

8.4.1 Description of the Keys

TAB	Transfer to the next input element
SHIFT-TAB	Transfer to the previous input element
ENTER	Execution of the active input element or conclusion of an input In many cases corresponds to the "OK" - key
ESC	Abort, undoing of an action

8.4.2 Input Elements

Key	A key executes the action, with which it is inscribed.
	Actuation of a key through the keyboard: • Push the key TAB, until the key becomes active. • Push the key ENTER. The action is now carried out. • Push the key ALT and the underlined letter of the key inscription: The action is carried out immediately. Actuation of a key with the mouse: • Click on the corresponding key. The action is now carried out.
Switch	By means of a switch, a selection between two possibilities is possible. A switch is either switched on or - off. Actuation of a switch through the keyboard: • Push the keys UP or HOME to switch on the switch. • Push the keys DOWN or END to switch off the switch. • Push the SPACE key for changing over (switching over). Actuation of a switch with the mouse: • Click on the switch for changing over (switching over).
Input field	The input fields enable the entering of numbers or text. All applicable keys of the keyboard are allowed, including the keys HOME, END, LEFT, RIGHT. In certain cases when taking it over, the input is checked and if necessary an error message is issued. Actuation of an input field through the keyboard: • Push the key ENTER or TAB to finish with the input field. • In the case of input fields with ARROW keys UP and DOWN: Actuation of the UP-/DOWN - keys for the step by step changing of the values. Actuation of an input field with the mouse: • Click within the input field, in order to position the cursor in it. • In the case of input fields with ARROW keys UP and DOWN: Click on the corresponding arrow for the step by step changing of the values.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 42/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

Selection field	The selection fields enable the selection from various possibilities. Actuation of a selection field through the keyboard: • Push the SPACE key to open all selection possibilities. With the help of the keys UP, DOWN, HOME, END, make the required selection. Subsequently push the ENTER key to confirm the required selection, or else the ESC key to undo the selection. • Push the key UP to cyclically select the previous selection. • Push the key DOWN to cyclically select the next selection. • Push the key HOME to select the first item of the selection list. • Push the key END to select the last item of the selection list. Actuation of a selection field with the mouse: • Click inside the selection field so that all selection possibilities are displayed and then click on the required selection.

8.4.3   Starting of PASO

Following the successful installation, the parameterisation software "PASO" can be started by double-clicking on the ED2/ED3 PASO icon. Certain settings of the PASO software, e.g., the selected interface port, are saved in a file "Konfig.kon". When PASO is started for the first time, this file is probably not yet present or else it is located in a different folder. A message follows, and the configuration values are set to standard values, which possibly are not applicable. During the course of running the program, these values can be corrected.

When starting the parameterisation software "PASO", it is checked, whether a communication with the axis controller is possible. If no communication can be established, the following error message appears: "Please check RS232 connection! Is the correct interface selected?" Upon acknowledgement the question appears: "Transmission error! Shall the process be repeated?". The reason for this message is either a not connected or not switched-on axis controller, or else, on the PASO side, not the same interface is selected as is used for the connection cable to the axis controller. In the latter case reply with "No" and after PASO has been started, change the interface in the menu "Configuration_interface".

If the response is "No", then the message appears "No communication with the axis controller is possible!". The communication is set to the "Off Line" mode. All menu points and keys, which contain an action in connection with the communication, are then blocked. All other functions of the parameterisation software "PASO", such as the processing of parameter files, can be utilised without any limitation.
If the response is "Yes", then another check is made to see whether a communication with the digital control card is possible.

If the interruption of the communication occurs during the operation of the parameterisation software PASO, then either the message "Please check axis controller!" or "Please check RS 232 connection, has the correct interface port been selected?" appears.
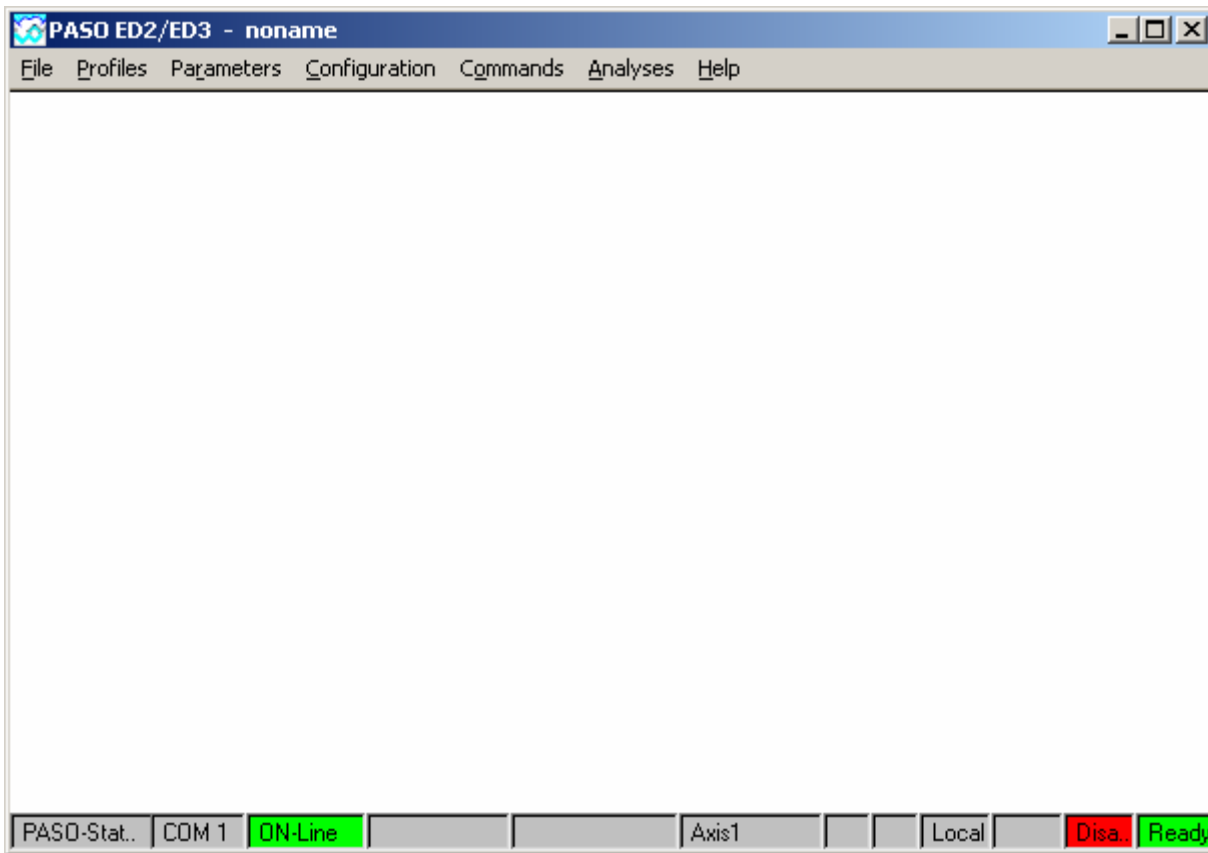The first message appears, when while communication was possible, wrong data, however, have been transmitted. The second message appears, when no communication was possible.
Following these messages, the communication is set to the "Off Line Mode". All menu points and keys, which involve an action in connection with the communication, are now blocked.
In order to re-establish a communication, the menu point "File_On Line/Off Line" has to be selected.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 43/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

8.4.4 PASO Base-Window

After the start-up, the PASO Base-Window appears:

If the communication works without any interference, and no Master-ED2 (see 2.5 "Type code" in the "Operating Guide 2-Axis Controller ED2") is connected, the parameters are loaded from the card and subsequently a verification of the axis controller values takes place. If one or several parameters are outside the corresponding tolerance, they are replaced with standard values and a message is issued. In this case the communication is set to the "Off Line Mode". The user now has the possibility to check the parameters and if necessary to correct them. The communication is resumed again through the menu point "File_On Line/Off Line". Subsequently one has to select the option "Re-program the axis controller", in order for the corrected values to be made active on the axis controller.

The menu points in the menu line can be selected in the following manner:
- by clicking on them with the mouse
- by actuating the ALT - key and the underlined letter of the required menu point
- if a menu point has been selected, then by means of the ←→ - keys one can change to the next menu point and with the ↑↓ - keys one can change to the next sub-menu-point within the menu selection field.

If a Master-ED2 is connected and the communication is free of errors, then PASO is only set to "Network On Line" Mode (refer to 8.3 "PASO Operating Modes in Network Operation").

In the header line of the window, the name of the current file is always displayed. If no existing file has been loaded or if the data have not been saved to a file, then this line reads "noname".

The description of the individual commands and parameters is contained in chapter 8 "Settings with the help of PASO".

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 44/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

The following (partially axis dependent) states will be displayed in the status line:

PASO-State:
- 1. Field: Selected RS232 interface ("COM1", "COM2", …)
- 2. Field: Current mode ("On Line" or "Off Line", refer to section
          "PASO Operating Modes" page 40)
- 3. Field: Netzwerk-Modus ("Network ON-Line" or "Network OFF-Line", refer to section
          "PASO Operating Modes in Network Operation" page 40)
- 4. Field: Parameter Inconsistency (only when operating with external bus, refer to the appropriate
          Operating Guide for the bus mode)

Device-State:
- 1. Field: Axis name of the current selected axis
- 4. Field: Operationsmodus ("Remote" oder "Local", only when operating with external bus,
          refer to the appropriate Operating Guide for the bus mode)
- 5. Field: Warning (only when operating with external bus, refer to the appropriate
          Operating Guide for the bus mode)
- 6. Field: Release
          - "Active" or "Disabled" (Digital input 1)
          - "Hold" or "Init" (only when operating with external bus, refer to the appropriate
            Operating Guide for the bus mode)
- 7. Field: Error state ("Ready" or "Error", refer to section "Analysis_Diagnostics" page 72)

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 45/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

9 PASO in Network Operation

PASO in network operation in principle behaves the same as PASO in single controller operation.
The differences and additions are described in the following sections.

9.1 Node Address and Network ID

Every network consists of a Master-ED2 and one or more Slave-ED2 or Slave-ED3. The designations "Master" and "Slave" do not refer to the type of control, but to the communication through the internal WAG-CAN Bus, which is managed by the Master-ED2. For the communication through the WAG-CAN Bus each Slave-ED2/ED3 has a differing CAN address (1...255), which can be set with the help of the PASO software. **The address of the Master-ED2 is fixed set to zero, and it cannot be changed.** In addition PASO addresses each ED2 and each ED3 through an own network identification (0...15), therefore each ED2/ED3 also has a differing network ID, which can also be set with the help of the PASO software supplied. The Master has a network ID equal to zero, the other network controllers the network IDs 1...15.

Network address and network ID can only be set through a direct communication with the axis controller and this in PASO single controller operation (not network operation, selectable through the menu "File_Network"). For this reason, the PASO software prior to the commissioning of the network has to be individually connected through the RS232 interface with each axis controller, and the CAN address as well as the network ID have to be checked or set through the menu "Help_Bus-Info internal". Please note, that the Master should have the address zero and the network ID zero, and that the other network controllers are assigned differing addresses and network IDs. If this is not the case, non-eliminatable network errors are produced. Address and network ID may have the same values on a network controller.

In the "On Line" mode, through the menu "Help_Bus-Info internal" the existing values for node address (CAN - address) and network ID No. are read from the axis controller and indicated. Any change is transmitted to the connected ED2.
In the "Off Line" mode, the values for the node address and the network ID can be freely edited. With the help of the key "Transmit", they are transmitted to a connected ED2, after the values have been read by the connected controller at least once.

9.2 Network Configuration

The network configuration contains the information as to which network controllers are defined in the network with which network ID and as to whether it is a Master-ED2 or Slave-ED2/ED3. The network configuration should be the same on all network controllers, and it has to be set on the Master-ED2 through PASO during the first commissioning, otherwise network errors are produced. Following every change in the network (change of the network ID or of the network controllers), the changed network configuration should be transmitted to the Master-ED2, which transmits the new network configuration to all network controllers present in the network. Subsequently the network should be switched off and then on again.

When the network is switched on, the Master-ED2 checks:
- Which Slave-ED2 or Slave-ED3 are active in the network
- Whether this corresponds with the network configuration of the Master-ED2
- Whether all Slave-ED2/ED3 in the network have the same network configuration.

If a network error is detected, then the Master sets the corresponding position of this ED2 or ED3 in the network configuration to "Error".

The network configuration can only be changed in the PASO mode "Network operation network Off Line" (selectable in the menu "File_Network"). In this mode select the menu "Configuration_Network" (refer to 10.4.1 "Configuration_Network").

By the selection of "Connect network" in the menu "File_Network", automatically the network configuration of the connected Master-ED2 is read and a possibly already existing network configuration is overwritten.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 46/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

9.3   Axis Selection during network operation

With the axis selection the different network controllers can be selected. By selecting an axis the network axis controller belonging to it (Master-ED2 or Slave-ED2/ED3) and the axis selected are respectively transparently connected with PASO, as though PASO were directly connected with the controller.
The axis selection field shows the axes of the different network axis controllers (ED2 or ED3). If no names have been assigned yet or read by the corresponding controller, then default values are listed, e.g. "Axis3.1" signifies the first axis of the controller with the network ID No. = 3.

Some menu windows do not have an axis selection field. This applies to menu windows, which show parameters, related to network controllers (not to single axes). The parameter of these menu windows in general refer to the current axis (the last axis selected in an axis selection field, resp. the selected network axis controller). In order to determine which axis, resp. network axis controller has been selected, you should temporarily change to a menu with an axis selection field, select a possibly new axis and leave this menu again with "Abort". The name of the selected axis is shown in the status line of the PASO Base-Window.

9.4   Representation of the Axis Names in the Axis Selection Field

PASO starts with default names for the axes until they are read from a file or from an axis controller, or until they have been changed in the menu "Configuration_Axis designation".
In network operation, in addition some characters are prefixed to the axis name in the axis selection field, which contain information about the "On Line" - or "Off Line" status of the corresponding controller and whether it is a Master or a Slave or a non-network controller. In this, it has to be noted: A Slave-ED3 only has one axis, an ED3 controller as Master is not possible.

Examples of default names in network operation:
`o/o [M] Axis0.1`	Axis controllerID 0, axis 1 in "Off Line" status (o/o)
	Concerns a Master [M] (only ED2 possible)
`o-o [N] Axis 12.2`	Axis controllerID 12, axis 2 (therefore not an ED3) in "On Line" status (o-o)
	Concerns a Slave ED2 (2-axis controller) in the network regulating association [N] controlled by the Master ED2
`o/o [ ] Axis 15.1`	Axis controllerID 15, axis 1 in "Off Line" Status (o/o)
	Concerns a network Slave controller [ ] (ED2 or ED3 possible) which is excluded from the network regulating association controlled by the Master ED2 (Network - ED2 or network ED3, which are not included in the regulating association, are not permitted in the current PASO version)

In the menu "Configuration_Axis designation", the axis names can be changed. In network operation, in this menu window the network ID of the ED2/ED3 axis controller belonging to it is prefixed to the axis name.

Examples of the axis selection list in this menu:
`#0 Axis0.1`	First axis, which belongs to the ED2/ED3 - axis controller with the ID number 0 (#0) This axis has the default name.
`#0 Axis0.2`	Second axis, which belongs to the axis controller with the ID number 0 (#0) (with two axes only an ED2 is possible). This axis has the default name
`#3 Slave_Axis1`	An axis, which belongs to the ED2/ED3 - axis controller with the ID number 3 (#3) This axis has at some point been renamed as Slave_Axis1.

9.5   Investigation of Possible Network Errors

In network operation On Line, during the transmission of parameters or measuring data the function of the CAN network is monitored. If a network error occurs, then PASO sends out a corresponding error message and switches to network operation Off Line. Any possible On Line connections through the Master with the network controllers are also switched to Off Line.
The network in such a case has to be switched off and then on again, and the network operation On Line has to be resumed (menu "File_Network").

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 47/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10 Description of PASO menu items

10.1 File Menu

Contained in the File menu are the menu points, which concern the file handling and the printing of the parameters. In the "On Line" mode", some of these menu points are blocked.

10.1.1 File_New

This menu point is only active in the "Off Line" mode. With this command all parameter values are set (reset) to standard values. The user is requested to select the corresponding card type (ED2 2-axis controller, or ED3 1-axis controller). The hardware configuration of a previous parameterisation can be maintained on request, otherwise the hardware configuration is set to the standard value (from the hardware configuration PASO derives the characteristics of the connected controller, e.g., the available inputs). In network operation of several axis controllers ED2/ED3 the parameters of the current controller are set to standard values, and this for all axes of this controller. The parameters of the not selected controllers are not changed. For this purpose, first an axis of these controllers has to be selected in an axis field (select a menu point, which contains an axis selection field).

10.1.2 File_Load...

This menu point is only active in the "Off Line" mode. With this command an existing file from a data carrier is opened and loaded. First the file selection window appears. In this window now the required file can be selected and opened with "OK". The parameter values can now be edited and changed if so required under the menu points "Configuration" or "Parameters", before they are saved again or else transferred to the controller. In network operation of several axis controllers ED2/ED3 the parameters of the current controller are loaded from the file, and this for all axes of this controller. The parameters of the not selected controllers are not changed. For this purpose, first an axis of these controllers has to be selected in an axis field (select a menu point, which contains an axis selection field).

10.1.3 File_Save

With this file the parameters are saved on a data carrier. All parameter values of the controller are saved under the current file name. If no file name has been defined, i.e., the file name is "noname", then first the file selection window appears (see under the menu "File_Save as..."). If an On Line connection with an axis controller exists, then the file name and the time and the date of saving are written to the axis controller. In network operation of several axis controllers ED2/ED3 the parameters of the current controller are saved on the data carrier, and this for all axes of this controller. The parameters of the not selected controllers are not saved by this command. For this purpose, first an axis of these controllers has to be selected in an axis field (select a menu point, which contains an axis selection field).

10.1.4 File_Save as...

With this parameter the parameters are saved on a data carrier. Alle parameter values of the controller are saved under the file name entered. First the file selection window appears. In this window the required file name can now be entered. If the file name is entered without an extension, then automatically the extension ".par" is assigned. After the actuation of the key "OK", the file information window appears (refer to the menu 10.1.6 "File_Info"). In this window now the required entries can be made. With the key "Save", thereupon the file is finally saved under the selected file name. If an On Line connection with an axis controller exists, then the date and the time of saving are written to the axis controller. With the key "Abort", however, one reverts back to the file window. In network operation of several axis controllers ED2/ED3 the parameters of the current controller are saved on the data carrier, and this for all axes of this controller (two axes in the case of an ED2-controller, one in the case of an ED3-controller). The parameters of the not selected controllers are not saved by this command. For this purpose, first an axis of these controllers has to be selected in an axis field (select a menu point, which contains an axis selection field).

Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	Page 48/80
Postfach	Fax +41 33 672 72 12	Internet: www.wandfluh.com	Edition 07 01
CH-3714 Frutigen			ED23xBAE.doc

10.1.5 File_Print...

With this command the current parameters are printed out in ASCII text format. The File_Print window is opened. In this window it is now possible to select whether the printing process is to be to a printer or to a file.

If the output is to be to a printer, then the Windows printer selection window is opened. **In this window please do not select "Print to file".** Otherwise possibly a new program start is necessary and you will lose any data, which have not been saved.

If the output is to be to a file, then the file selection window appears. In this window now the required file name can be entered. If the file name is entered without an extension, then automatically the extension ".txt" is assigned.
In network operation of several axis controllers ED2/ED3 the parameters of the current controller are printed, and this for all axes of this controller (two axes in the case of an ED2-controller, one in the case of an ED3-controller). The parameters of the not selected controllers are not printed by this command. For this purpose, first an axis of these controllers has to be selected in an axis field (select a menu point, which contains an axis selection field).

10.1.6 File_Info

This command is available after saving or loading a file. The file information of the current file is displayed. File information consists of the following parts:

Date, time:	Date, time of saving
File name:	The file name, under which the file has been saved
Card type:	The type of the connected digital control card at the moment of saving. If no card was connected yet, then this indication remains void. In the case of saving during "On Line operation", this indication is updated.
Operator:	The name of the operator
Remarks:	Possibility to enter remarks concerning the file.

When the File-Info-window appears during the execution of the command "File_Save", then the corresponding entries can be made in the different fields (with the exception of the fields "Date", "Time", "File name" and "Card type", which cannot be edited). When the File-Info-window appears during the execution of the command "File_File-Info", then the different fields cannot be edited.

10.1.7 File_On Line/Off Line

When PASO is in the On Line mode, then the connection with the axis controller is aborted. All menu points, which require a communication with the axis controller, are blocked. The PASO software now runs in the "Off Line" mode. There is no connection between the parameters in PASO and those of a possibly connected ED2. The loading, saving and the processing of parameter files is possible in this mode.

When PASO is in the Off Line mode, then with this command the connection with the axis controller is established. The user has the choice of taking over the parameters from the axis controller, or of transferring the parameters to the axis controller. After actuating the OK-key, the communication with the axis controller is briefly checked. If the connection works, then the parameters are subsequently transferred. During the transferring of the parameters, the user has the possibility of aborting.

Before parameters are transferred to the axis controller, it is checked whether the version of the axis controller supports the parameter values. If not, a message follows and the transfer to the controller is not possible.

In network operation of several axis controllers ED2/ED3 the corresponding axis controller is selected through the axis selection filed. Please select an axis, which belongs to the required controller.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 49/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

If the parameters have been taken over from the axis controller, then the parameters are briefly checked. If one or several parameters are outside the tolerance, then standard values are assigned and a message follows. If the transfer is successful and the possible checking manifests no errors, then the software subsequently runs in the "On Line" mode. The parameters in PASO and on the controller are identical. Any change is immediately transferred. The loading of parameter files is not possible in this mode.

10.1.8 File_Network

Under this menu point the network operation can be switched on or - off.
A network is present, when PASO is connected to a Master-ED2, and the Master-ED2 communicates with at least one Slave-ED2 or one Slave-ED3 through the internal WAG-CAN-Bus. Master and Slave-ED2/ED3 are special network capable ED2/ED3 axis controllers (refer to 8.3 "PASO Operating Modes in Network Operation").
While network operation can also be switched on when no ED2 or ED3, or solely a Master-ED2 is present and connected, this, however, only makes sense, when at a later point in time a network is to be connected. The user has the choice between network operation without a connection with the Master ("Network operation Off Line") or network operation with connection ("Network operation On Line"), or no network operation.

10.1.9 File_Axis Controller Data Record Info

This menu is only active in the "On Line" mode.
Under this menu the current data set information of the connected axis controller appears.
The axis controller data set consist of the following parts:

Axis controller type: The axis controller type is card-specific and cannot be changed.

File name: The filename shows, under which name the parameters of the axis controller were last saved to a file. The file name is written to the controller, when:
- a complete parameter set is written to the controller (menu "File_On Line/Off Line": reprogram the axis controller)
- in the "On Line" mode the current parameters are saved to a file
  The file name "no name" signifies, that the parameters have not yet been saved to a file.

Date, time: Date and time show the time of the last change of the axis controller data on the axis controller and are updated on the axis controller in the "On Line" mode in case of any change of the axis controller data.
In network operation, date and time indicate the time of the last change on one of he axis controllers in the network. In case of every change of the parameters on one of the network controllers, the date and time are updated on all axis controllers in the network.

10.1.10 File_SW-Download (Version 1.5 and higher)

If the axis controller is equipped with a flash EPROM, then by choosing this command a new axis controller software can be loaded into the axis controller. This menu item is mainly used for customer specific solutions and it is protected by password. The menu is only active in "Off Line Mode". The download file with axis controller software together with the password will be provided by Wandfuh AG. After password input the File Selection Window appears. The download file can be selected and downloaded on the axis controller. Please notify the Paso instructions.
ATTENTION: Any failed download will make the axis controller ineffective!

10.1.11 File_Exit

With this command, the parameterisation program PASO is terminated. If parameter data have been changed and have not yet been saved, then the question appears, as to whether these data should be saved.

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 50/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.2 Profile-Menu

The axis controller is in a position to save - and to run through complete travel profiles, which have been predefined by the operator beforehand. A travel profile is a sequence of individual profiles (sequences), which define a course of movement. In network operating mode in a regulating association only the profiles of the Master-ED2 are used. If a network controller (ED2 or ED3) of slave type is connected, the profile menu is not available.

10.2.1 Sequence (Single profile)

A sequence consists of the travel command data, among them the stop time (dwell time after reaching the target position) and a programmable "sequence achieved" function. If the "sequence achieved" function is active and a stop time greater than zero has been entered, then a predetermined output controller (Digital-Output DA2, see 5.10 "Digital Outputs" on page 29) is set, in order to inform a superordinate control system about the completed processing of a certain sequence of movements.

A sequence is defined by the operator with the help of the travel command data entered through the keyboard (menu "Profile_Generator").

The travel command data contain:
- Preset position (target - or end position of the sequence) **xtarget**
- Preset speed value (preset travelling speed of the process) **vpreset**
- Acceleration (acceleration or deceleration necessary for reaching the travelling speed, starting out from a sequence start speed) **as**
- Deceleration (deceleration or acceleration necessary for reaching the sequence end speed) **ds**
- Stop time (possible dwell time after reaching the end position) **ts**

The travel command data of the sequences are saved in the EEPROM of the axis controller.

From the travel command data, the theoretical course of the sequence is calculated. The calculated course of the sequence is jointly determined by the limit parameters (position and speed at the beginning and end of the sequence) **and it can significantly differ from the travel command data entered. Preset positions and possible stop times, however, are complied with in all cases.**
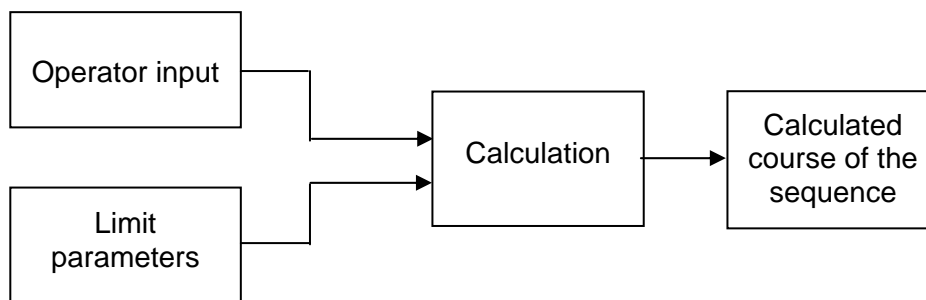
Calculation of a sequence course

The limit parameters are:
- **xstart** (preset position of the preceding sequence)
- **xtarget** (the preset position entered)
- **vstart** (the starting speed of the sequence = target speed of the preceding sequence)
- **vtarget** (target speed when the preset position is reached)

Wandfluh AG   *Tel.*   *+41 33 672 72 72*   *E-mail:*   *sales@wandfluh.com*   *Page 51/80*
Postfach   *Fax*   *+41 33 672 72 12*   *Internet:*   *www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

The target speed *vtarget* is determined by the operator input (travel command data) and the preset speed *vpreset* of the next sequence.

vtarget is equal to zero when:
- The end of the profile has been reached
- *vpreset* of the next sequence is equal to zero (artificial profile end)
- A change of direction takes place at the end of the sequence
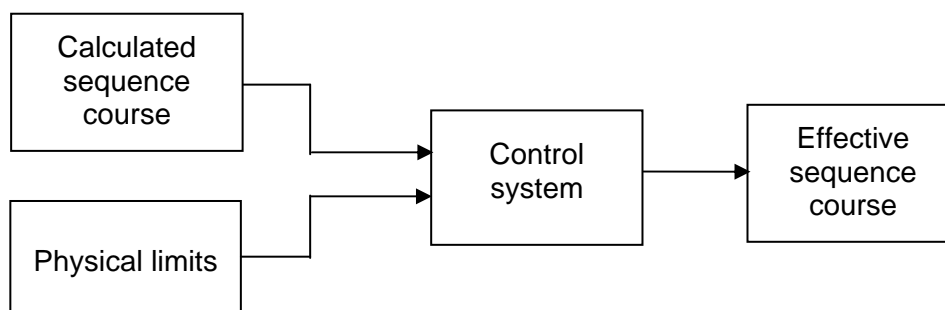- A stop time *ts* greater than zero has been entered

In the other cases, *vtarget* is determined as follows from the operator input of acceleration *as*, deceleration *ds* and preset speed *vpreset*:

Current sequence input value deceleration	Next sequence input value acceleration	*vtarget,* the target speed is equated to
ds not equal to zero	*as* not equal to zero	*vpreset* of the next sequence
ds equal to zero	*as* not equal to zero	*vpreset* of the current sequence
ds not equal to zero	*as* equal to zero	*vpreset* of the next sequence
ds equal to zero	*as* equal to zero	*vpreset* of the next sequence

Adaptation of the Acceleration or Deceleration to the Limit Parameters

In order for the target speed *vtarget* to be reached, the entered values for the acceleration *as* or deceleration *ds* are adapted if necessary (e.g. reverse digit sign, i.e. acceleration becomes deceleration or vice versa, or if so required change the value of the acceleration or deceleration). In conjunction with the other limit parameters, this results in the calculated course of the sequence. The adapted values in contrast to the entered ones are not saved in the EEPROM of the ED2. They are only expressed in the graphic representation of the profile.

As a consequence of the physical limits of the axis control system, the calculated sequence course is possibly not implementable. **This is not verified by the Paso software.** There is, however, the possibility to limit the input of the speed, acceleration and deceleration to realistic values (menu "Parameters_Limits"). As a result, the effective course of the sequence becomes identical to the calculated one. Values once entered are not automatically corrected, if the limit values are reduced. Therefore they have to be checked for every sequence and, if so required, newly entered.

Effective sequence course

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 52/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.2.2 Travel profile

A travel profile as a minimum consists of one sequence and, as a maximum, of the maximum programmable number of sequences. The sequences are consecutively numbered per travel profile (1..Maximum-Index). The sequence number 1 serves to run up to the profile starting position. Because the starting position of this sequence is not always known, this sequence is uniformly displayed in the graphic window (menu "Profile_Generator") with two blue arrows.

The travel profile ends either upon reaching the last sequence or else when reaching a sequence, which has been programmed with the speed 0 (artificial profile end). Thereafter the following sequences are not carried out. Per ED2 - card, a maximum of 100 sequences can be defined, which can be split-up in any manner required over the maximum 16 profiles.

A movement profile can either be run through completely or else step-by-step (sequence by sequence). The profile to be run through is selected through 4 digital inputs (= 16 profiles) (refer to 5.7 "Digital Inputs").
With the help of the digital input DE4, the profile movement is started.
For every execution of a positioning, a start signal has to be applied. If the operating mode "Run through individual sequence" has been selected (digital input DE3 on "Low"), each sequence has to be started individually. **If in doing so, a stop time = 0 has been programmed, the corresponding sequences are combined into one movement without any stopping time (sequence group).**

In the operating mode "Run through complete profile" (digital input DE3 to "High"), after the start signal the complete profile is run through.

If a profile end is detected, then with the next start signal the processing starts again with the sequence 1. The completion announcement of every completed travel profile is effected with the setting of the output signal "Profile end". The completion announcement of every completed positioning is effected with the output signal "In position" (refer to 5.10 "Digital Outputs"). Any and all positioning operations can be stopped, if the input "Stop" is activated (low active).

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 53/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

10.2.3 Example of a Profile in Speed - Stroke and in Stroke - Time Display
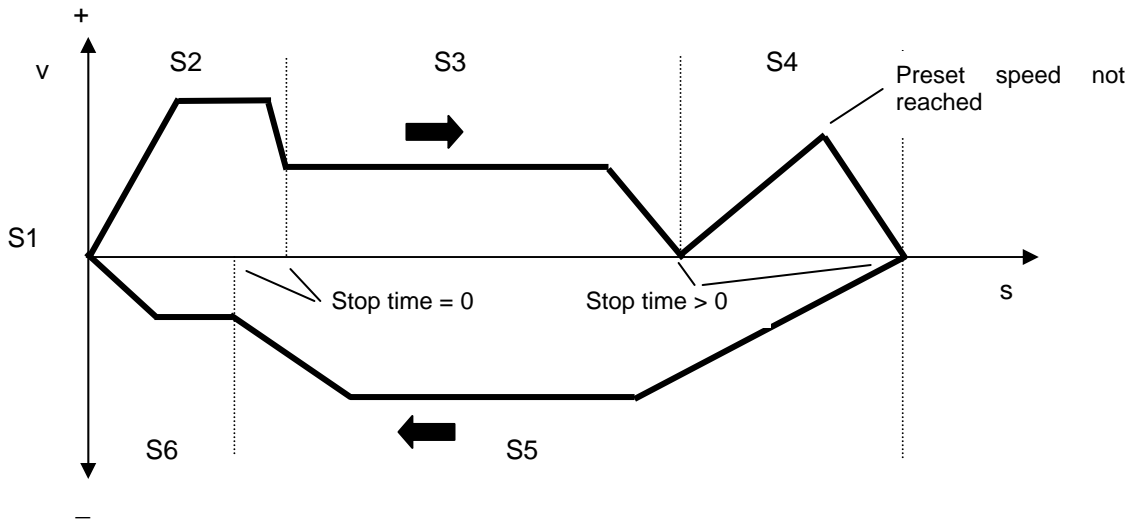
Figure 10.2.3.1 Speed - Stroke Diagram

Figure 10.2.3.2 Stroke - Time Diagram

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 54/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
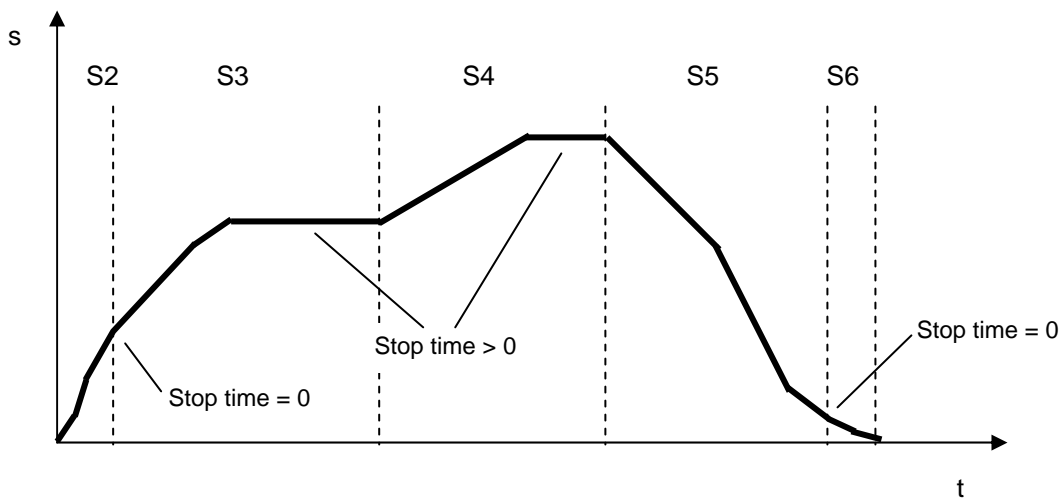*CH-3714 Frutigen*   *ED23xBAE.doc*

10.2.4 Profile Generator Window

In the profile generator window, the parameters described above can be predefined. During the input, the values are limited by the limit values, which have been entered in the menu "Parameters_Drive_Limits".

When running through the profiles, however, because of the predefined values (speed and position) of adjacent sequences it is possible, that the values entered into the fields acceleration and deceleration of the current sequence cannot be complied with. These values in this case are adapted during the calculation of the sequence. **In doing so, the limit values of the acceleration or deceleration from the menu "Parameters_Drive_Limits" can be exceeded**.

If the effective values (i.e. calculated values) of the acceleration or deceleration are greater than the input, then the operator is informed of this by a warning colour: an exceeding of the input values is indicated with a yellow field, an exceeding of the limit values from the menu "Parameters_Drive_Limits" is indicated with a red field.

In the remaining fields, any exceeding of the limit values by the values entered by the operator is also indicated in red.

 In the display of the travel profiles, the following has to be noted:
* The complete travel profile is indicated in black.
* The current sequence is indicated in blue (violet in the time diagram) and in boldface.
* The current sequence group is indicated in blue (violet).
* If at the end of the sequence a stop time has been defined, then this is indicated with a red cross.
* The 1st sequence is not indicated. It solely serves to predefine a defined starting position.

By clicking on a sequence in the graphic window with the left-hand mouse button, it automatically becomes the current sequence. The field "Sequence No." is adapted accordingly.

In the graphic window, the current travel profile is displayed as a speed - stroke - or stroke - time diagram. The changeover between the two types of diagram takes place by pushing the right-hand mouse button and selecting the required type of diagram, or else with the key combination CTRL+D.

Attention: When leaving the window with the key "Cancel", all data, which have not previously been saved by means of the key "OK", are lost!

Field	Parameter description	Range / Step size
Profile No.	Here the number of the required profile can be selected.	1 .. 16
Sequence No.	Here the number of the required sequence can be selected. At the profile end (empty sequence), the delete-key is deactivated. Browsing through the sequences is also possible by means of the key combination CTRL + ➡ or CTRL + ≫	1 .. 100
Insert / delete	With these two keys, a sequence can be inserted into the current profile or deleted from it.	
Take over	With this key, the current values are taken over into the current profile.	
Preset position	Predefinition of the end position.	
Speed	Predefinition of the preset speed.	0...max. speed
Travelling time	Travelling time of the current sequence excluding stop time, only display. (Only appears in the stroke - time diagram)	
Acceleration	Predefinition of the preset acceleration.	0...max. acceleration
Deceleration	Predefinition of the preset deceleration.	0...max. acceleration
Stop time	Predefinition of the stop time following a sequence end.	0...10sec

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 55/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Field	Parameter description	Range / Step size
Output "In position"	Predefinition, whether the sequence output is to be activated or not when the sequence end has been reached.	on / off
Sequence travelling		
Complete profile	If this input is activated, the commands "Home" and "Start" refer to the current profile, if not, to the current sequence.	
Home	The axis will move to the starting position of the current sequence (or of the current profile, if the input "Complete profile" is actuated).	
Start	The current sequence (or current profile, if the input "Complete profile" is activated) is run through. The "Start" key can only be activated, if the "Home" key has been actuated beforehand.	
Direct operation		
Go to preset position	The axis will move to the position entered in the field "Preset position".	
Touch operation "<", ">"	The current position can be changed with the step size selected in the field "Step". The axis will automatically move to the new position and the field "Preset position" will be updated accordingly. The "Touch operation" keys are only active, if the current preset position has been travelled to with the key "Go to preset position".	
Drive enable	If this key is pushed, the commands of "Sequence travelling" and "Direct operation" can be executed, otherwise they are disabled.	
Graphic window	• Changeover between the speed - stroke - and stroke - time diagram by pushing the right-hand mouse button and selection of the required type of diagram, or else with the key combination CTRL+D. • With the combination "CTRL+Left-hand mouse key", the graphic display is zoomed in, with the combination "CTRL+Right-hand mouse key", the graphic display is zoomed out. • With the combination "SHIFT+CTRL+Left-hand mouse key", the graphic display can be moved. • By clicking on a sequence in the graphic window with the left-hand mouse key, this sequence automatically becomes the current sequence. The field "Sequence No." is accordingly adapted.	

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 56/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.3   Parameters Menu

In the Parameters menu, all parameter values of the axis controller are set.

10.3.1   Parameters_Valves

In this window, all settings specific to the valves are made. Corresponding to the selection of the valve type (menu "Configuration_Valve type") the parameters can be set.

Field	Parameter description	Range / step
Axis	In this field, the active axis can be selected. (Axis, for which the settings are applicable).	
Position	In "On Line operation", in this field the current position of the active axis is displayed.	
Controller on / off	With this switch, the axis control can be switched on, resp., - off. If the solenoid current for the proportional valve is to be accurately set, then the controller has to be to "Off" for this. As standard, the controller is set to "On" when leaving this window with OK, otherwise the controller does not operate. If necessary, open the window again and leave it with OK. **If the controller is set to "On" again, the axes may carry out an unexpected movement.**	on / off
Proportional valve settings	If in the window "Configuration_Valve type" a proportional valve has been selected, then the adjustments can be made here. For every solenoid output the minimum and maximum solenoid current can be individually set, corresponding to 0, resp., 100 % of the preset current. In the "Off Line Mode", the theoretical Imin/Imax values are entered, without a valve, resp., a solenoid having to be connected to the controller. In the "On Line Mode", "Controller Off", with the entering of an Imin value, on the axis controller a preset current of 0 % is applied, with Imax a preset current of 100 %. In the operating mode "Controller On", internally <u>not</u> 0 %, resp., 100 % of the preset value is applied. As a result of the digitalisation, the numbers entered may be modified to less "rounded-off" numbers.	
Imin A	Adjust Imin in such a manner, that the axis moves slightly (Controller Off). .	0...500 mA 2mA
Imax A	Equalise Imax in such a manner, that the maximum required travelling speed is just reached ("Controller Off"). **ATTENTION: If "Controller Off" is set, the axis moves with the maximum speed !** Stop the axis with a brief change of Imin.	0...1800 mA 2mA
IminB / ImaxB	Adjust the min.- and max. current of solenoid B, the same as under min. - and max. current of solenoid A.	

Dither Settings		
Frequency	The dither frequency can be set in steps.	20, 40, 60, 70 80, 90, 100, 110, 125, 140 165, 200, 250 Hz
Level (Amplitude	Level of the alternating current superimposed on the solenoid.	0...199 mA 4mA

Wandfluh AG *Tel.   +41 33 672 72 72* *E-mail: sales @wandfluh.com* *Page 57/80*
Postfach *Fax +41 33 672 72 12* *Internet: www.wandfluh.com* *Edition 07 01*
CH-3714 Frutigen *ED23xBAE.doc*

10.3.2 Parameters_Controller

In this window, for every axis all controller-specific settings are made. Depending on the controller type selected (menu "Configuration_Controller type") the controller settings are active or inactive. For the definition of the different controller parameters, refer to the sections 5.2.8 to 5.2.10 under 5.2 "Description of the Function".

Field	Parameter description	Range / Step width
Axis	In this field the active axis can be selected. (Axis, for which the settings are applicable)	
Proportional coefficient	*Single axis control (positional control):* Amplification factor of the PI-controller. At 100% in case of a control difference of 10 mm the maximum correcting variable (10 V) of the controller is reached (without P-proportion), i.e., $K_s = 1$ V/mm. *Multi-axis control (synchronous control):* Amplification factor of the synchronism difference. At 100% in case of a synchronism difference of 10 mm the maximum correcting variable (10 V) of the controller is reached (without P-proportion), i.e., $K_s = 1$ V/mm	0...500 %
P – proportion	P-proportion of the PI-controller. At 100% in case of an input control difference of 10 mm the maximum correcting variable (10 V) of the controller is reached (without P-proportion), i.e., $K_s = 1$ V/mm	0...100 %
Reset time	Reset time of the I-controller. The time that the I-controller requires with the step response, in order to reach the input value (step value).	0.01...500 s
I – limitation	With this parameter the output of the I-element is limited to a maximum. A value of 100% corresponds to a limitation of the signal to maximum correcting variable (10 V). If 0% is selected, the I-control is ineffective.	0...100 %

The field "Test - movement" makes it possible to directly test the controller settings, in that the corresponding axis is moved. For this purpose, the moving parameters can be defined: two positions as well as the acceleration -, deceleration - and speed presets. These entries are limited by the values in the menu "Parameters_Drive_Limitations".
In synchronous two-axis movement the moving parameters of the first axis are applicable, and they can only be changed, when this axis is selected. In synchronous multi-axis operation (network operation) the moving parameters of the first Master axis are applicable.
If the switch "Axis individual" is activated, then the test movement for each axis individually is enabled, and the moving parameters can be individually set for each axis. **ATTENTION: The axes move independently**.

Field	Parameter description	Range / Step width
Position 1	Position 1 for test movement.	
Position 2	Position 2 for test movement.	
Acceleration	Acceleration for test movement.	0...max. accel.
Deceleration	Deceleration for test movement.	0...max. accel.
Speed	Speed for test movement.	0...max. speed
GoPos1	Axis moves to position 1 with defined parameters. The key remains active, until the output "Position reached" (digital output 3) is set, or another key is pushed.	
GoPos2	Axis moves to position 2 with defined parameters. Function otherwise as GoPos1.	
Axis individually	Enables the test movement for every axis individually	
Enabling	GoPos1 / GoPos2 are blocked / enabled	Blocked / enabled

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 58/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.3.3 Parameters_Drive_Limits

In this window all limiting setting for the drive are made. These limit data must not be exceeded, therefore, e.g. also not during test movements.
Corresponding to the selection of the controller type and of the drive, various settings may be inactive. The entries in the different menus are monitored for limit value exceeding. In case of exceeding a corresponding message is issued.

ATTENTION: Parameter exceeding will not be prevented by the axis controller. Only **analogue** preset values will be limited.

With analogue measuring system inputs (actual value), with respect to the calculations inside of the controller, the values of all parameters, which represent a velocity, acceleration or deceleration (profiles included), may not be greater as the entered actual-value resolution (menu "Configuration_Preset-/Actual value") multiplied by the number 1270.

Field	Parameter description	Range / Step
Axis	In this field, the active axis can be selected. (Axis, for which the settings apply).	
Rapid movement speed	Rapid movement speed in manual operation. Is limited by the settings under "Limitations".	
Creep speed	"Normal"-speed in manual operation. Is limited by the settings under "Limitations".	
Acceleration	Acceleration and deceleration in manual operation. Is limited by the settings under "Limitations".	
Max. acceleration	Maximum acceleration in automatic operation, which must not be exceeded.	
Max. speed	Maximum speed in automatic operation, which must not be exceeded.	
Negative path limitation	If the axis moves over the negative path limitation set, then the axis is blocked, when the path limitation control is active.	
Positive path limitation	If the axis moves over the positive path limitation set, then the axis is blocked, when the path limitation control is active.	
Path limitation	Check, as to whether the set path limitation is to be observed. When "On", the following functions are active: The values in the fields "Negative and positive path limitation" are active. The axis position values are monitored for limit value exceeding. If the set path limitation is overrun, then the axis is blocked.	
Reference search speed	Indicates the speed, with which the axis moves, in order to search for the reference mark.	
Reference switch speed	This parameter is only active, when an external reference switch is being used. If the reference switch input (digital input DE18) is active, the axis moves with the speed indicated here in the direction of the reference mark.	
Reference movement check	Check, as to whether after switching on the axis controller a reference movement has been made. Check active: If no reference mark has been found, then the axis is blocked.	

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 59/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.3.4 Parameters_Drive_General

In this window, all the general settings concerning the drive are made. Corresponding to the selection of the type of controller and of the drive, various settings can be inactive.

Field	Parameter description	Range / step
Axis	In this field the active axis can be selected. (Axis for which the settings are applicable)	
Signalling "In Position"		
Position window	Controls the output "Position reached". Indicates the range, within which the output "Position reached" is set (refer to 5.10 "Digital Outputs").	
Position window hysteresis	Lies on the edge of the position window. Prevent a rapid switching on/off of the output "Position reached" in transition.	
Monitoring control synchronism difference		
Contouring error limit value fine	*Position controller*: Defines the maximum permissible deviation between set-point value and actual value during movement. *Synchronous controller (2-axis synchronous operation)*: Defines the maximum permissible deviation between the actual value of the current axis and the actual value of the other axis. *Synchronous controller (multi-axis network operation)*: Defines the maximum permissible deviation between the actual value of the current axis and the average actual value of all axes. If the limit value is exceeded, then the corresponding axis of the position control (all axes of the synchronous system are) is blocked.	
Contouring error limit value coarse	As from axis controller version 1.6. For the definition refer to the description under "Contouring error limit value fine". Under certain circumstances, e.g., during starting, a greater contouring error limit value is desirable (changeover by means of digital input DE13, refer to 5.7 "Digital Inputs"). The greater limit value can be entered in this field.	
Error triggering after	As from axis controller version 1.6 Defines the time delay in blocking the axes after a contouring error limit value exceeding has been detected. If the contouring error within this time period is again below the limit value, then the axes are not blocked and automatic operation continues.	0.0...30.0 s
Measuring mode	Absolute measurement input / relative (incremental measurement)	absolute / relative
System control preceding sign	"Preceding sign" of the correcting variable	positive / negative
Referencing method	Method of the reference search process (only for actual signal type: Incremental)	1...10 Refer to table of the referencing modes below

Wandfluh AG
Postfach
CH-3714 Frutigen

Tel. +41 33 672 72 72
Fax +41 33 672 72 12

E-mail: sales@wandfluh.com
Internet: www.wandfluh.com

Page 60/80
Edition 07 01
ED23xBAE.doc

Table of the Referencing Methods

Referencing method	Reference switch	Zero pulse	Search direction
Selection0	None	yes	negative
Selection1	None	yes	positive
Selection2	Make contact	no	negative
Selection3	Make contact	no	positive
Selection4	Make contact	yes	negative
Selection5	Make contact	yes	positive
Selection6	Break contact	no	negative
Selection7	Break contact	no	positive
Selection8	Break contact	yes	negative
Selection9	Break contact	yes	positive

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 61/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.4 Configuration Menu

In the Configuration menu, all settings are carried out, which concern the function of the axis controller.

10.4.1 Configuration_Network

This menu can only be selected in network operation (networking of several axis controllers). Network operation is automatically switched on when PASO is started and is connected to a Master-ED2. Switching-on network operation is also possible through the menu "File_Network".
In the mode "Network Off Line", in this window a network can be configured (refer to 9.1 "Node Address and Network ID" and 9.2 "Network Configuration".
Belonging to the network configuration is also the selection of the method of network control (field "Multi-axis-synchronous", in the current version only "Network-synchronous-average value" is permitted).
When changing the network configuration, possible parameter sets in the Slaves can be lost, if they have not been saved to a file beforehand!

There are the following four possibilities (the first three in the mode "Network Off Line"):
- No network - ED2 (Master or Slave) is connected. The network configuration is processed without any connection with a network axis controller. The network configuration is not saved when leaving PASO, Therefore this processing only makes sense, if prior to terminating PASO a Master ED2 is connected and the menu "Configuration_Network" is selected once more (refer to the next point).
- A Master-ED2 is connected. With the help of the key "Read", if so required it is possible to read the current network configuration of the Master-ED2. If necessary the network configuration is changed and then transferred to the Master-ED2 again, which passes the configuration on to the Slave-ED2 through the WAG-CAN-Bus.
  When switching-on, the Master-ED2 makes contact with the Slave-ED2 listed in the network configuration. If the network configuration does not correspond to the response of the network ED2, e.g. because a Slave-ED2 has not been switched on simultaneously with the Master-ED2, then the Master sets the designation "Error" at the corresponding points.
- A Slave-ED2 is connected. With the help of the key "Read", the current network configuration of the Slave-ED2 can be read. The current network ID of the Slave-ED2 is marked. Changing or transferring the network configuration to the Slave-ED2 is now not possible anymore. By leaving the menu with "OK", however, the Slave network configuration read is taken over. If subsequently a Master-ED2 is connected and the menu "Configuration_Network" is selected again, or if it is still open, then this network configuration can be transferred to the Master-ED2.
- PASO in the mode "Network operation network On Line": A Master-ED2 is inevitably connected. The current network configuration is displayed, it cannot, however, be changed.

Field	Parameter description	Range / step
Multi-axis synchronism	Indicates the current method of network control. Changes only possible in the "Network operation network Off Line"	
Connection	In this field a network - ED2 can be defined with the corresponding ID - number. Permitted are: - Master (only with the ID - number = 0) - Slave (other ID - number)	
Read	With the key "Read", the network configuration of a connected network - ED2 is read.	
Transmit	With the key "Transmit", the network configuration is transferred to a connected network - ED2.	

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 62/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.4.2 Configuration_Controller Type

In this window, the type of controller is defined.

Field	Parameter description	Range / step
Multi-axis synchronism	This field is only visible in network operation. In this filed the type of multi-axis synchronous control selected under "Configuration_Network" is indicated. If at this point "No network control" is indicated, then under "Configuration_Network" no network has been defined.	
Axis	This field is only visible in network operation. In this field the active axis can be selected. (Axis, for which the settings are applicable)	
Controller type	From this ring menu the required type of controller can be selected.	Position controller / synchronous
Block diagram	In this window the selected type of controller is graphically depicted.	

10.4.3 Configuration_Valve Type

In this window, the valve type is determined.

Field	Parameter description	Range / Step
Axis	In this field, the active axis can be selected. (Axis, for which the settings apply).	
Valve type	From this ring menu the required type of valve can be selected.	Proportional valve Control valve
Block diagram	In this window, the selected type of valve is graphically displayed.	

10.4.4 Configuration_Command/Actual Value Signals

In this window, the signal types of preset value and actual value are set as well as the assignment of the preset - and actual value inputs to the axis controller hardware made. Through the setting of the resolution, the signal / stroke adjustment can be carried out. With the key "Scaling help", this will be done automatically.

If changing from a digital measuring system to an analogue system, or reverse, (Input control "Signal type") for technical reasons several parameters on the axis controller card will be rescaled. All parameters, that represent a position, speed, acceleration or deceleration (including profiles) will be influenced. By this rescaling, little rounding differences in promil range could occur, being visible only after the next reading of parameters.
To prevent these deviations, it is recommended to change measuring system digital to analogue or reverse, in OffLine mode, and subsequently send the parameters to the axis controller. ("File On Line Reprogram the axis controller")

With analogue measuring system inputs (actual values), with respect to the calculations inside of the controller, additionally some restrictions exist:
- the values of all parameters, which represent a velocity, acceleration or deceleration (profiles included), may not be greater as the entered actual-value resolution multiplied by the number 1270. This affects the parameter settings
  – in the menu „Profiles_Profil generator"
  – in Test moving in the Menü „Parameters_Controller"
  – in the menu „Parameters_Drive_Limits"
- with the other limits a corresponding message is shown

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 63/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Field	Parameter description	Range / Step
Axis	In this field, the active axis can be selected. (Axis, for which the settings apply).	
Indication of the travel distance unit in	In this ring menu, the travel distance unit can be selected. In all program windows the travel distance values will be indicated in accordance with this setting.	mm / degrees
Command value / Actual value	Selection of preset value or actual value. The following four settings refer to the preset value or actual value.	
Scaling help	Activate the Determination of the Resolution and the offset of the actual value automatic (see also 11.3 "Scaling" on page 77).	
Signal type	In this field, the required signal type (voltage, current, etc.) can be selected. Depending on the version of the card, various types are available for selection. ATTENTION: When selecting one of the signal types "Incremental" or "SSI", the connected measuring system should correspond to it. Otherwise there is the danger of damage to the card. If two axes are active, both with actual value signal types "Incremental" or "SSI", then the signals have to be of the same type (both "Incremental" or both "SSI").	
Utilised input	Hardware input for the corresponding signal type. Available are Volt -, mA - and digital inputs (digital measuring systems).	
Resolution	The resolution of the measuring system has to be entered. (For further details, refer to chapter 11.3 "Scaling").	
Offset measuring system	Indication of the zero point (actual value) for the control system.	

10.4.5 Configuration_Digital I/O

In this window, the digital inputs and - outputs of the connected axis controller or in network operation of the network controller selected through the axis selection are activated, deactivated or enabled (externally controllable). Any change to the settings is immediately transmitted to the connected axis controller. **The external inputs, depending on the setting, can be set to inactive (not enabled). At a later point in time the user is perhaps not aware of this and he might be confronted with an inexplicable behaviour of the axis controller.**

Field	Parameter description	Range / Step
Axis	Only visible in network operation. In this field, through the active axis the network controller can be selected (the network controller, for which the settings are applicable).	
Digital inputs	Set digital input with software. Reset digital input with software. Activate external digital input.	1 0 X
Digital outputs	Set digital input with software. Reset digital input with software. The digital output is driven by the running program.	1 0 X

Wandfluh AG
Postfach
CH-3714 Frutigen

Tel.   +41 33 672 72 72
Fax   +41 33 672 72 12

E-mail: sales@wandfluh.com
Internet: www.wandfluh.com

Page 64/80
Edition 07 01
ED23xBAE.doc

10.4.6 Configuration_Axis Name

Here the axis designation can be defined by the user himself. The axis selection is made from a list, the contents of which depend on the selected type of controller.

In network operation, the axis names are indicated with some prefixes (refer to 9.4 "Representation of the Axis Names in the Axis Selection Field").

Field	Parameter description	Range / Step
Axis name	List, from which the required axis can be selected.	
New axis name	In this field, the desired axis name can be entered.	max. 16 characters, no spaces
Take over	The name entered is taken over into the list of axes.	

10.4.7 Configuration_Interface

With this command, the serial output port for the communication with the connected control card can be selected. This setting is automatically saved in the file "Konfig.kon" and taken over with a new start.

- If the software is in the "On Line Mode", then the communication is broken off when the "OK" key is pushed.
- If the software is in the "Off Line Mode", then a confirmation window appears with the question, as to whether the communication with the axis controller is to be tested. If the communication works, a corresponding message is issued and a connection with the axis controller can be established through the menu point "File_On Line/Off Line".

If no communication can be established (transmission interference or no axis controller card connected), then an error message appears. All menu points and keys, which contain an action in connection with the communication, are then blocked.

Field	Parameter description	Range / Step
Output port	Here the serial port of the PC can be selected.	COM1 – COM8
Baud rate	Here the baud rate of the serial interface of the PC can be selected.	4800, 9600, 19200

10.4.8 Configuration_Language

In this window, the language can be selected, with which PASO is to operate. This setting is automatically saved in the file "Konfig.kon" and taken over with a new start.

Field	Parameter description	Range / Step
Language	Field, from which the desired language can be selected.	German English French

Wandfluh AG *Tel. +41 33 672 72 72* *E-mail: sales@wandfluh.com* *Page 65/80*
Postfach *Fax +41 33 672 72 12* *Internet: www.wandfluh.com* *Edition 07 01*
CH-3714 Frutigen *ED23xBAE.doc*

10.5 Commands Menu

In the Commands menu, direct control commands can be transmitted to the axis controller. These commands correspond to the functions of the digital inputs with the same name.

10.5.1 Commands_Hand control

This menu point is only active in the "On Line Mode".

Under this menu, the axis can be moved forwards and reverse in manual operation. Available options are speed in rapid - or creep motion. The axis moves in forward - or reverse direction, until the Close key or another key is pushed.

The key "Reference search start" (not in the actual Paso version), executes the search for a reference point in a defined direction (corresponds to digital input 15, refer to 5.7 "Digital Inputs"). This menu is only active in the case of incremental or SSI actual value signals.

ATTENTION: When leaving this menu, the controller is switched on again, which can lead to an unexpected movement of the axis.

10.5.2 Commands_Valve operation

This menu point is only active in the "On Line Mode".

In this window, depending on the controller - and valve type settings, one or two valves can be directly actuated. When the window is called up, the control becomes inactive, the valve or valves can now be actuated directly through the elements available in the window.

Field	Parameter description	Range / Step
Current	The solenoid current can be preset either with the slide control or in the numerical field.	0...100% (Imin...Imax)
Actuation	Through this key, the current set can be switched to the solenoid or else the solenoid can be switched to be without current.	Start / Stop
Solenoid	If as valve type a 4/3-way directional control valve has been selected, then with this switch one can changeover between solenoid A and - B.	A / B

ATTENTION: When leaving this menu, the controller is switched on again, which can lead to an unexpected movement of the axis.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 66/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

10.6   Analysis Menu

In the Analysis menu, measured values can be displayed on-line and various process signals can be recorded and correspondingly displayed.

10.6.1   Analysis_Axis Values

This menu point is only active in the "On Line Mode".
With this command, all relevant data of the connected axis controller are read-in and displayed. The values are continually updated (on-line).

Field	Description	Unit
Axis	In this field, the active axis can be selected. (Axis, for which the settings apply).	
Power supply voltage	Power supply voltage of the card.	V

Set-point position (internal)	Current internal set-point value (refer to 5.2.5 "Set-point Value Generator"). The internal set-point value is equalised to the axis actual position value or, in case of synchronism, to the average actual values of both axes, in case of
	– Removal of the enabling
	   (digital input DE1, refer to 5.7 "Digital Inputs") or
	– Contour value limit value exceeding
	   on one of both axes (refer to 5.2.4 "Contouring Error")
		mm Degrees

Actual position	Current actual value.	mm Degrees
Control difference	Momentary control difference (preset value - actual value).	mm Degrees
Analogue input	Additional analogue input (is used in case of special cards, otherwise idle)	V
Solenoid current A	Solenoid current to solenoid A of the current axis	mA
Solenoid current B	Solenoid current to solenoid B of the current axis	mA
Analogue output	Control signal ahead of the solenoid outputs (A/B) Axis1, for the controlling of a possible external solenoid. The signal corresponds to the correcting variable of the controller (refer to 5.9 "Analogue Outputs")	V
Digital inputs 1-18	Logical conditions of the digital inputs: When the inputs are set. When the inputs are not set.	1 0
Digital outputs 1-6	Logical conditions of the digital outputs: When the outputs are set. When the outputs are not set.	1 0

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 67/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.6.2 Analysis_Synchronisation

10.6.2.1 Analysis_Synchronisation Data in PASO - Single Operation (Non-network Operation)

If in the menu "Configuration_Controller" a synchronous control has been selected, then when selecting this menu the synchronisation data of both axes are indicated.
In the "Off Line" mode or in case of a 1-axis control, this menu point is not active.
In PASO network operation (refer to 8.3 "PASO Operating Modes in Network Operation"), the window has a lightly different appearance (refer to 10.6.2.2 "Analysis_Synchronisation Data in PASO - Network Operation")

Field	Description	Unit

Set-point position	Current internal set-point value (refer to 5.2.5 "Set-point Value Generator")
	The internal set-point value is equalised to the average actual values of both axes in case of
	– Removal of the enabling
	   (digital input DE1, refer to 5.7 "Digital Inputs") or
	– Contour value limit value exceeding
	   on one of both axes (refer to 5.2.4 "Contouring Error")
		mm
		degrees

Actual position axis 1	Current actual value axis 1	mm degrees
Actual position axis 2	Current actual value axis 2	mm degrees
Control difference	Current synchronous control difference (actual value axis1 – actual value axis2)	mm degrees
Analogue output axis 1	Control signal of the solenoid output axis 1, for the controlling of a possible external solenoid	V
Analogue output axis 2	Control signal of the solenoid output axis 2, for the controlling of a possible external solenoid	V

10.6.2.2 Analysis_Synchronisation Data in PASO - Network Operation

In network operation NetworkOnLine, the actual value of the Master as well as the actual values of the network axes and the difference to the average actual value of the network axes are indicated. If the Master-ED2 is OffLine, then temporarily an OnLine - connection with the Master is established, and the unit, actual signal type and resolution of the actual value of the first Master axis are read.

Field	Description	Unit
Set-point Master	Current internal set-point value of the Master-ED2 (refer to 5.2.5 "Set-point Value Generator") The set-point value is equalised to the average actual values of the network axes in case of – removal of the enabling (digEin1, refer to 5.7 "Digital Inputs") or – Contouring error limit value exceeding on one of the network controllers (refer to 5.2.4 "Contouring Error")	mm degrees
Average actual value	Current average network value of the actual values of all network axes	mm degrees

Wandfluh AG   *Tel.* *+41 33 672 72 72*   *E-mail:* *sales@wandfluh.com*   *Page 68/80*
Postfach   *Fax* *+41 33 672 72 12*   *Internet:* *www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Field	Description	Range
Actual position axis X	Current actual value of the network axis X Read-in is a raw value, which is scaled with the current actual value resolution of the network controller. If the actual value resolution is not known, because the corresponding Slave-ED2/ED3 is OffLine, then the unit and resolution of the first Master axis are utilised, which possibly may result in a wrong indication of the actual value.	mm Grad
Difference to the average actual value	Current control difference network axis X (network average actual value - actual value network axis X)	mm degrees

Wandfluh AG　　*Tel.　+41 33 672 72 72*　　*E-mail:　sales@wandfluh.com*　　*Page 69/80*
Postfach　　*Fax　+41 33 672 72 12*　　*Internet:　www.wandfluh.com*　　*Edition 07 01*
CH-3714 Frutigen　　　　　　*ED23xBAE.doc*

10.6.3 Analysis_Signal Recording

In the menu "Analysis_Signal Recording" different signals of the axis controller can be recorded and analysed. In network operating mode this menu is not available.

Configuration and performance of the connected axis controller determine which signals can be recorded. The selection is made in the menu "Signal Assignment", which can be activated by clicking on the key "Signal Assignment" (see below).
In "Off Line" mode signal recording is not possible, however the recording parameters can still be set ("Signal Assignment").

For each measuring channel (maximum 6 channels) up to 1000 measuring values will be recorded. The sampling rate consequently is determining the maximum recording time: sampling rate times number of measuring values. Some axis controller types may have a different distribution of channels and total number of values. The minimal sample time is 2 ms. As first measuring value is sampled on time zero (start), the last measuring value is sampled one sample time before end of measuring span.

The Digital Input 1 (Axis controller release) figures in the list of possible recorded signals, however it cannot be recorded for older versions of axis controller. If this Digital Input 1 is set to "0", the controller is blocked, and recording will be stopped, resp. start of recording of any signal isn't possible.
Therefore, when recording is stopped, i.e. start button is reset immediately after pressing it, check the position of digital input 1 (Axis controller release). Also check the setting of this input in the menu "Configuration_Digital I/O" which may superpose the setting of input 1. If set to "0" the digital input DE1 and with it the axis controller are deactivated.
On later axis controller versions digital input DE1 doesn't influence recording.

The recording parameters, signal type, sampling rate, etc., are saved on the axis controller together with axis controller parameters, as well as on hard disk, when saving into file.
The recorded measuring values will **not** be saved with Axis controller parameters (e.g. menu "File_Save"), however there exists an export possibility (Key "Export").

The time cursors allows you to show the measurement values for each recording sample.

The recorded measuring values will be lost by changing "Off Line" / "On Line" mode, or by leaving PASO.

Field	Description	Range
Signal graph	Switching on the controls makes visible the recorded plots of the corresponding channels	
Time cursor	Positioning the time cursor using the input control Time [s] or by moving the slide control below the graphics	0 up to measuring span (see description in text)
Signal Assignment	Opens the menu "Signal Assignment" (see below)	
New	Possible recording data will be lost and the axis controller is standby for a new recording	

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 70/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Field	Description	Range
Start/Stop	**Start** A new recording will be started. On trigger event the signal recording is active (showing the field "Recording" blinking) and the measuring data are transmitted If there are already measuring data in memory, recording will continue from this point. If the maximum number of measuring values is recorded, eventually remaining data will be transmitted (plots will continue actualising). During transmission the plots can already been analysed ("Signal graph", "Auto Scaling"). **Stop** Stops the data transmission and signal recording. At this point recording can be continued by actuating the "Start" key. If the maximum number of measuring values is read, or in case of "OffLine" operation the "Start" key is dimmed.	Start / Stop
Export	By actuating this key recording data will be saved on hard disk. The used format ist text format with tabs as separators to enable an easy import into another program (e.g. Excel) The decimal sign is able to be chosen: point or comma.	
Autoscaling	By means of this key data plots in the signal graph will be showed in optimised presentation. Optimising is only executed on the visible plots. "Scaling" and "Offset" of the corresponding channels (see "Signal Assignment") will be modified automatically. Autoscaling is also possible during signal recording.	
Close	By actuating this key the signal recording menu will be left. Eventual signal recording data will be retrieved and can be made visible by opening the menu again.	

Submenu "Signal Assignment"
In this submenu, which can be opened by actuating the "Signal Assignment" key, you make a choice of the signals you want to record.
1. Up to 6 channels are provided, which can be made active for signal recording.
2. Under "Signal" you choose for each channel the signal type to be recorded.
3. Under "Supplementary" you can specify the desired signal, if necessary.
4. Under "Trigger" you can indicate the desired trigger channel, as well as trigger slope and level.
5. Under "Sample Time" you can select the recording sample time (range 0.002..10 s, as a multiple of 2 ms).
6. Signal plot representation is controlled by the inputs in "Scale/div" and "Offset".
7. Leaving the menu with "OK"
   If there has been modifications under 1-5, eventual recording data will be deleted (as well as the graph plots).
8. Leaving the menu with "Cancel"
   Eventual changes will be discarded.
The plot parameters "Scale/div" and "Offset" are saved on the axis controller together with the axis controller parameters.

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 71/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

10.6.4 Analysis_Diagnostics

With this command, possibly present errors / faults are indicated on the connected controller card. The error is read-continuously and indicated. If an error is present, the red LED on the ED2 will be on.

State / Mode	
State No	**State Text**
-11	Operation mode: Local automatic operation
-5	Operation mode: Comissioning
-4	Operation mode: Direct valve actuating (no control)
-3	Operation mode: WAG_INIT_MODE
-2	Operation mode: Manual operation
-1	Operation mode: local automatic operation
0	Operation mode: No operation mode selected
1	Operation mode: PROFILE_POSITION_MODE
2	Operation mode: VELOCITY_MODE
3	Operation mode: PROFILE_VELOCITY_MODE
4	Operation mode: TORQUE_PROFILE_MODE
5	Operation mode: RESERVED_5
6	Operation mode: Direct valve actuating (no control)
7	Operation mode: POSITION_CONTROL_AXIS
8	Operation mode: RESERVED_8_127
9	Operation mode: POSITION_CONTROL_AXIS
20	Device mode: No device mode activated
21	Device mode: command value by bus signal
22	Device mode: command value by local signal
31	Operation state: STATE_INIT
32	Operation state: STATE_ACTIVE
33	Operation state: STATE_DISABLED
34	Operation state: STATE_HOLD
35	Operation state: STATE_FAULT_REACTION
40	Axis operation: 2-axis synchronous control
41	Axis operation: 2-axis single control
295	Axis operation: No axis operation selected

Warning	
Warning No	**Warning Text**
50	Axis1 is out of positive software stroke limit
51	Axis2 is out of positive software stroke limit

System Error	
Error No	**Error Text**
101	Deviation preset-actual value Axis1, resp. actual value Axis1/Axis2 out of range
102	Deviation preset-actual value Axis2, resp. actual value Axis1/Axis2 out of range
104	Axis1 is out of positive stroke limitation
105	Axis2 is out of positive stroke limitation
106	Axis1 is out of negative stroke limitation
107	Axis2 is out of negative stroke limitation
108	Error measuring system axis 1
109	Error measuring system axis 2
110	Cable break coil A of axis 1 valve
111	Cable break coil A of axis 2 valve
112	Cable break coil B of axis 1 valve
113	Cable break coil B of axis 2 valve

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 72/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

114	Contouring Error 2: preset-actual value Axis1, resp. actual value Axis1/Axis2 out of range
115	Contouring Error 2: preset-actual value Axis2, resp. actual value Axis1/Axis2 out of range
120	Supply voltage out of range
130	Short circuit at Axis1 joystick entry
131	Short circuit at Axis2 joystick entry
132	Cable break at Axis1 joystick entry
133	Cable break at Axis2 joystick entry
134	Regulatortype "net synchronisation average value": more than 4 axes selected
135	Regulatortype "net synchronisation average value": more than 2 ED2/ED3-cards selected

Internal Error	
Error No	**Error Text**
198	FPT-Device profile initialising error
199	FPT-Device profile receiving error
200	FPT-Device profile transmitting error
201	Invalid Profile data cannot be saved
202	Profile data cannot be read from memory
203	Profile data cannot be updated after resolution change
204	Profile data cannot be updated after change of measurement system
205	Profile data cannot be saved while initialising
206	New profile data cannot be saved
207	Error in reading hardware configuration from memory. Configuration has been reset
208	Error in reading card type from memory. Card type has been reset
210	PLD Programming failed

Network Error	
Error No	**Error Text**
220	CAN-Slave Node 1 not responding
221	CAN-Slave Node 2 not responding
222	CAN-Slave Node 3 not responding
223	CAN-Slave Node 4 not responding
224	CAN-Slave Node 5 not responding
225	CAN-Slave Node 6 not responding
226	CAN-Slave Node 7 not responding
227	CAN-Slave Node 8 not responding
228	CAN-Slave Node 9 not responding
229	CAN-Slave Node 10 not responding
230	CAN-Slave Node 11 not responding
231	CAN-Slave Node 12 not responding
232	CAN-Slave Node 13 not responding
233	CAN-Slave Node 14 not responding
234	CAN-Slave Node 15 not responding
235	CAN-Master not responding
236	CAN-Master SDO-Error
237	Bus Node Adress of the internal WAG-CAN-Bus has been changed without restarting the ED2-cards
238	Automatic Net-Test failed
239	Net-Configuration faulty
240	Net ID Nr. has been changed without restarting the ED2-cards
241	Net-Configuration has been changed without restarting the ED2-cards
242	Error on a Slave-Axis

Wandfluh AG	*Tel.* *+41 33 672 72 72*	*E-mail:* *sales@wandfluh.com*	*Page 73/80*
Postfach	*Fax* *+41 33 672 72 12*	*Internet:* *www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

10.7   Help Menu

The Help Menu bases on the Operating Guide to the 2-axis controller ED2.

10.7.1   Help_General Info

General information about the 2-axis Controller ED2.

10.7.2   Help_Contents

This menu point gives you the contents of the Operating Guide to the 2-axis controller ED2.

10.7.3   Help_Index

An Index window is opened, in which all contents items are listed. In this list a subject can be clicked on to obtain the connected text.

10.7.4   Help_Axis Controller - Identification

This menu point is only active in the "On Line" mode.
Here the current axis controller versions of the hardware, firmware and of the software are read from the axis controller and indicated.
From the hardware configuration PASO derives the characteristics of the connected controller (e.g., the characteristics of the inputs present).

10.7.5   Help_Bus - Information Internal

With this menu point, the bus node address and the network ID number of a possible WAG-CAN connection on the ED2 - axis controller are indicated. The WAG-CAN connection is present on ED2/ED3 axis controllers, which are capable of being networked (position controller Slave or position controller Master for networking, refer to 2.5 "Type Code"). The bus node address of the position controller Slave can be set (1...255). The address of the position controller Master is fixed set to zero.
Also settable is the network ID number. The Master has a network ID equal to zero, the other network controllers the network IDs 1...15.
In non-network operation and in the "Off Line" mode, the address and the ID number of a connected axis controller can be read and transmitted again.
In non-network operation and in the "On Line" mode, the changes are directly transmitted to the axis controller.

10.7.6   Help_Bus - Information External

With this menu point, the type, status and address of a possible external bus node connection (Profibus DP or CAN-Bus) on the ED2 - axis controller are indicated. The bus node address is settable (1...255). An address value "0" makes the connection ineffective.
In the "Off Line" mode, the address is also settable, it only becomes effective, however, when the data are transmitted to the card (menu "File_On Line/Off Line") and if the axis controller has a bus node connection (refer to 2.5 "Type Code").
The external bus node address together with the other axis parameters is saved on the hard disk (menu "File_Save").

10.7.7   Help_Info

Information about PASO and its version.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 74/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

11 Tips for the First Commissioning

Please refer to the section 3 "Safety rules".

11.1   First Commissioning in Non-network Operation

1. Connect the power supply, but leave the axis controller switched-off
2. Switch-off the hydraulic drive (hydraulics switched-off)
3. Carefully check the connections.
   Switch on the power supply of the axis controller (not hydraulics)
4. Establish communication with PASO (connect PC and axis controller with RS232 - cable and start PASO). If the communication works, then PASO reads the parameters of the controller card and checks the parameters.
   If the communication does not work, then this may have various possible reasons (refer to chapter 12 "The System does Not Work").
   If the parameter test is positive, then PASO subsequently is in the "On Line" mode. If the parameter test is negative, or in case of any other errors, PASO subsequently switches to the "Off Line" mode.
   If PASO has switched to the "Off Line" mode because of communication errors, rectify these errors and start the commissioning once more, otherwise continue with point 5.
5. Configure the axis controller specifically to the installation. In doing so, the following sequence should be followed to:
   1. In the menu "Configuration_Controller" select the corresponding controller type
   2. In the menu "Configuration_Valve" select the corresponding valve type
   3. In the menu "Configuration_Set-point/Actual Value Signals" make the corresponding settings
   4. In the menu "Parameters_Valves" set the drive currents of the valves
   5. In the menu "Parameters_Drive_Limits" set the corresponding limit data
   6. In the menu "Parameters_Drive_General" make the corresponding settings
   7. In the menu "Parameters_Valve" make the corresponding settings
   8. In the menu "Parameters_Controller" make the corresponding settings
6. If PASO was in the "Off Line" mode as a result of a negative parameter test, then now re-establish the connection by transmitting the complete parameter set (menu "File_On Line/Off Line" select "Reprogramming"). PASO subsequently should be in the "On Line" mode, otherwise attempt the commissioning once more
7. Set the axis controller to manual operation in the menu "Commands"
8. Switch on the hydraulic. Upon actuation of the keys "Manual forward/reverse", the axis should move in the required direction, otherwise the connections of the solenoids 1 and 2 have to be inverted. If the axis moves to the mechanical stop only in one direction, then the system control sense is probably wrong (change it in the menu point "Parameters_Drive_General").
   In controlled operation, now the set-point value direction (e.g. potentiometer left/right) should correspond to the axis direction. Otherwise invert the set-point value direction or the actual value direction. If the actual value direction is inverted, then at the same time the connections of the solenoids 1 and 2 also have to be inverted.
   The system control sense is inverted by one of the following actions:
   1. Menu point "Parameters_Drive_General": Change the system control sense
   2. Invert solenoids 1 and 2 (this, however, has an effect on forward/reverse)
   3. Change of the actual signal direction (this has an effect on forward/reverse)
   Inverting twice re-establishes the original control sense

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales @wandfluh.com*	*Page 75/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

11.2 First Commissioning of a Network

1. Connect the power supply, leave all axis controllers still switched-off
2. Switch-off the hydraulic drive (hydraulics switched off)
3. Carefully check the connections
4. Start the PC with the PASO - software, start PASO and set PASO to the "Off Line" mode (i.e. without establishing the communication)
5. Connect the PC with the PASO - software with one of the network axis controllers through the RS232 cable. Switch on the power supply of the connected axis controller
6. Select the menu "Help_Bus-Information Internal". Read the CAN - address as well as the network ID of the axis controller, correct them if necessary and transmit them again.
7. Repeat the steps 5 and 6 for all network controllers
8. Connect the PC with the Master-ED2 by means of the RS232 cable
9. In the PASO menu "File_Network", activate network operation, but not "Connect with network" (PASO mode "Network Off Line")
10. Switch on the power supply of the network (all axis controllers approximately at the same time)
11. In the menu "Configuration_Network", transmit the respectively required functions of the network controllers (Master, Slave or non-network axis). Non-network axis is currently not permissible. Possibly read the network configuration of the Master-ED2 before. In case the communication does not work, start the network once more (switch off all controllers, subsequently switch them on again at the same time and wait for a few seconds). If the communication still doesn't work, refer to 12 "The System does Not Work".
12. Leave the menu with "OK" and start the network again (switch off, subsequently switch on again).
13. In the PASO menu "File_Network" switch on network operation and connect with the network (PASO mode "Network On Line")
14. Check the settings of the network configuration (menu "Configuration_Network")
15. Establish via the Master an "On Line" connectiion with the different network controllers and for every network controller proceed as described in "First Commissioning in Non-network Operation" on page 75

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 76/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

11.3 Scaling

11.3.1 Manual determination of the resolution of the actual value

The scaling of the actual value is dependent on the used measuring unit types. Connect PASO to the axis controller and start PASO. PASO should now be in "On Line" mode. If not, repeat the "First Commissioning in Non-network Operation" under 11.1.

With digital measuring units (incremental or SSI), the resolution (i.e., mm/Inc) is preselected by the measuring unit itself. In this case, please enter this resolution directly in the menu "Configuration_Command/Actual Value Signals" by the actual value.

With analogue measuring units, the resolution and the offset (refer to offset under 11.3.2) of the actual values can, if not known beforehand, be determined by moving the cylinder into 2 different positions. With the indicated position (menu "Parameters_Valves" or menu "Analysis_Axis Controller Data") and the real position, the existing resolution and offset can be corrected.

Example: for the experimental determination of the actual value resolution, proceed as follows:
1. Switch off the hydraulic system.
2. Menu "Parameters_Valves".
3. Switch off the controller in the menu.
4. Switch on the hydraulic system.
5. Select Imax A or Imax B (forward or reverse).
6. Apply a moderate current (e.g. 200 mA), if necessary increase or decrease.
7. Run up to Pos 1, e.g., the left-hand stop.
    The indicated - and the measured position must simultaneously either increase or decrease, if not, repeat the "First Commissioning in Non-network Operation" under 11.1.
8. Make a note of the measured and indicated position.
9. Run up to Pos 2, e.g., the right-hand stop.
10. Make a note of the measured and indicated position.
11. Calculate the measured range: **ΔPos = Pos 2 − Pos 1**

    Correction factor: K = ΔPos$_{measured}$ / ΔPos$_{indicated}$
12. Switch off the hydraulic system again.
13. Leave the menu "Parameters_Valves" by means of the key "Cancel", in order to re-establish the original values of Imax A and Imax B.
14. In the menu "Configuration_preset - / Actual value", select **"Actual value"** and **multiply the current resolution with K.** This produces the new, corrected resolution.
    The corrected resolution is subsequently entered in the field "Resolution".
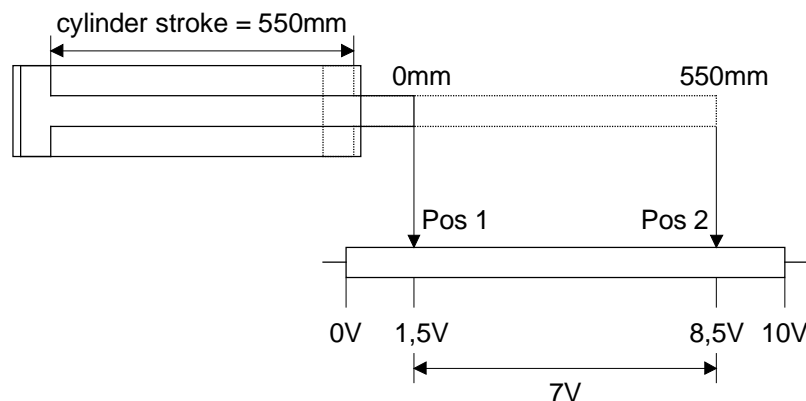
Figure 11.3.1.1 Example: *Preset signal type analogue: Resolution = 550/7 mm/V*
Offset (mm) = − 1.5 x Resolution
Analogue set-point value setting: Resolution 55 mm/V

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 77/80*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

Calculation example:

Actual resolution of the actual value = 100 mm/V (works setting value)

Pos 1 measured	0 mm	Pos 1 indicated	150 mm	(1.5 V x 100 mm/V)
Pos 2 measured	550 mm	Pos 2 indicated	850 mm	(8.5 V x 100 mm/V)
	-----------		-----------	
ΔPos measured	550 mm	ΔPos indicated	700 mm	(7.0 V x 100 mm/V)

Correction factor K = ΔPos measured / ΔPos indicated = 550 mm / 700 mm = 0.7857

New resolution = actual resolution x correction factor K = 100 mm/V x 0.7857 = **78.57 mm/V**
=========

Check: 7.0 V x 78.57 mm/V = 549.99 mm

11.3.2 Manual determination of the offset of the actual value

The offset is the number, which is added to the measured actual position.

1. Run up to a defined position, e.g., the zero position or the mechanical stop, and measure or determine for this axis the position to be displayed.
2. Detect the Actual Value Position, displayed by PASO, of the respective axis (Menu „Analysis_Axis Values")
3. Subsequently calculate the Offset correction:
   Offset correction = PASO Indication - Desired displayed position
4. Select the Menu „Configuration_Preset/Actual value signals", subsequently the respective axis and switch to Actual Values:
   Add the offset correction to the current offset of the measuring system and enter the new value into the control "Offset measuring system".

11.3.3 Determination of the resolution and the offset of the actual value automatically

If there are analogue measuring units and proportional valves connected, the above process will be done automatically by the PASO, by operating the switch "Scaling help" in the menu "Configuration_Command/Actual Value Signals". On 2 different positions, the measured position values can be inserted and PASO will calculate the resolution and offset of the actual value.

11.3.4 Determination of the resolution of the Set-point Value

In case of an **analogue** set-point value, enter the resolution of the set-point value in the menu "Configuration_Command - / Actual Values". A set-point value input of 0 V or 0 mA (4 mA in the range of 4...20 mA) corresponds to a set-point value of 0 mm. The axis controller attempts to regulate the difference between set-point value and actual value to zero. Depending on the scalings, which were effected for the actual values or on the physical limitations, certain actual value ranges possibly cannot be reached.

In the case of preset values by **profiles**, the resolution is set internally.

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 78/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*

12 The System does Not Work

In this chapter, the generally possible errors / faults and the procedures for eliminating them are listed and explained.

12.1 Procedure

Error	Possible causes
No communication between the ED2 card and the PC possible	• Check if the right interface (COM1...COM8) is selected in the menu "Configuration_Interface" • Check if the serial RS232 cable (1:1) is connected • Check whether a ED2 or ED3 card with the appropriate software is connected • Is the axis controller switched on? • If the ED2/ED3 card is switched on, switch off and on the card. • Check in your Windows system settings whether the used serial port has the right standard settings (refer to 7.1 "System Requirements")
The axis controller doesn't work properly	• Are some digital inputs deactivated (menu "Configuration_Digital I/O")?
The axis will not move	• Check if the solenoid cables are connected • Check if the ED2 card is disabled (digital input 1) • Check if the limit switch negative and positive are activated (digital inputs DE16 and DE17). • Check if the stop is activated (digital input DE5). • Check if the stroke limitation positive and negative are set to the right value (menu "Parameters_Drive_Limits"). • Check if the digital inputs are enabled (menu "Configuration_Digital I/O")
The axis will not stay in position	• Check if all adjustments are made in accordance with this user manual • Check if the digital inputs are enabled (menu "Configuration_Digital I/O")

Wandfluh AG   *Tel.   +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Page 79/80*
Postfach   *Fax   +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Edition 07 01*
CH-3714 Frutigen   *ED23xBAE.doc*

13 Disposal

- The electronics card has to be disposed of in accordance with the generally applicable regulations of that country, in which it is being used.
- Electronics cards are recycled by companies specialised in this field.

14 Additional Information

You can find additional information in the following Wandfluh documentations:

Wandfluh-Electronics General	Documentation A	Register	1.13
Accessories	Documentation A	Register	1.13
Proportional Directional Control Valves	Documentation A	Register	1.10
Proportional Pressure Control Valves	Documentation A	Register	2.3
Proportional Flow Control Valves	Documentation A	Register	2.6

Have a look at our Website: **http://www.wandfluh.com** !

Wandfluh AG	*Tel. +41 33 672 72 72*	*E-mail: sales@wandfluh.com*	*Page 80/80*
Postfach	*Fax +41 33 672 72 12*	*Internet: www.wandfluh.com*	*Edition 07 01*
CH-3714 Frutigen			*ED23xBAE.doc*