



Original User Manual Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

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Declaration of conformity

EC Declaration of Conformity according to:

- Appendix II B. of the Low-Voltage Directive 2006/95/EG
- Appendix IV B. of the EMC Directive 2004/108/EG
- Appendix II of the RoHS Directive 2011/65/EU

We,

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hereby declare that the following product:

Servo Control System

Type: SKS-3.1 / SKS-3.2 / SKS-3.3

In the by us provided designs meets the requirements of the following directives

- Low-Voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- RoHS Directive 2011/65/EU

The following harmonized standards we used:

EN 60204-1:2006 + A1:2009

EN ISO 13850:2008

EN 61000-6-1:2007

EN 61000-6:3:2007

EN 50581:2011

The last two digits of the year in which the CE marking was attached: 11



Michelstadt, 09.12.2011

City and date of the declaration

Managing Director, Thomas Meister

Information of the authorized person, signature)

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Chapter

1

1 Introduction

With the Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 you purchased a complete control unit, which we have developed according to the latest state of the art.

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 offers universal application to control of servo drives and convinces with the following benefits:

- Rotary and linear movements with superb repeatability
- Precise, individual control of torque and rotary speed
- Ability to combine complex rotary and linear movements
- Controls can be configured and programmed individually
- Controls with in-built torque threshold monitoring
- User-friendly touch screen controls
- Dependable and safe, since control with integrated safety technology (Emergency STOP and safety door)
- Meets protection class IP32
- Independent and flexible since universally applicable to almost all injection moulding machines (MM).
- LED lights for indicating operation states/conditions

1.1 General information

This manual describes the installation and commissioning of the Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3. The manual includes technical data as well as information intended for programming, use and maintenance.

Please read this instruction manual carefully before using the Servo Control System .

Keep the instructions in a safe place for use at a later date.

In the case of relocation of Servo Control System this instruction manual, along with the Servo Control System must be handed over to the new operator.

For a change of location of the Servo Control System to a non-European region, the respective national safety regulations of the destination country must be observed!

Please contact the manufacturer if cases of a relocation to a non-European region Servomold GmbH & Co. KG .

The knowledge and technically sound implementation of the information included here are crucial for the correct preparation and safety during handling, maintenance, and the repair of Servo Control System.

Only use the Servo Control System when all of the safety rules and handling of the Servo Control System have been fully understood. If you would like any further information, then please contact Servomold GmbH & Co. KG, or the manufacturer. Servomold GmbH & Co. KG.

In the instruction manual, the following various coloured instructions are used for explaining facilities and features as well as for prompting an action:

This notice provides explanations about equipment and functions of the servo complete controller as well for displays on the touchscreen.

This notice prompts you to hit a button in the control field or on the touchscreen or to enter a value

1.2 Liability exclusion

The compliance with the operating instructions is a prerequisite for the safe operation of the Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 and for achieving the specified product and performance characteristics Servomold GmbH & Co. KG is not liable for person injury, property damages or financial loss that arise from non-compliance with the operating instructions. The warranties for defects is in such cases excluded.

Chapter

2

2 Safety

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has been designed and built safely by us and also left the plant in a safe and proper condition. It has protection class IP32 and meets the requirements of the Low-voltage directive 2006/95/EG as well as the 2004/108/EG directive dated 12/15/2004 (EMV guideline)

To maintain this condition and to ensure safe operation, the user must follow the instructions and warnings contained in this manual and in the safety instructions.

Since the observance of safety is outside our sphere of influence, we can not be held liable for damages resulting from failure to comply with one or more of these rules.

The list of safety regulations can not be complete (mechanical and foreign regulations). Not-mentioning or listing these rules does not mean that they have no validity.

Commissioning, maintenance and repair work may only be performed by persons which are recognized as professionals, within the meaning of the provisions - VDE regulations, equipment safety law, accident prevention regulations of the trade associations, etc..

2.1 Step-by-step safety instructions

In these operating instructions the warnings and notices are characterized by a symbol with SIGNAL WORD!

The warnings and instructions are in bold and highlighted by a border.

The warnings are graded hierarchically and are designed according to the SAFE method. The acronym **SAFE** stands for four principles:


- **S** severity of the hazard (SIGNAL WORD!)
- **A** type and source of hazard
- **F** consequences when disregarding the hazard
- **E** Advert (Measures to avoid hazard)

	DANGER!	The key word DANGER is used on warnings of an imminent danger . The immediate consequences are death or severe injuries (personal injury).
• Note the warnings and safety instructions!		

	WARNING!	The key word WARNING is used on warnings of a possible danger . The immediate consequences can be death or severe injuries (personal injury).
• Note the warnings and safety instructions!		

	CAUTION!	The key word CAUTION is used on warnings of a possible danger . The consequences can be minor or slight injuries (personal injury).
• Note the warnings and safety instructions!		

	NOTICE!	The key word NOTICE is used on warnings of property damages . The possible consequences of failure to comply can be damages e.g. on the machine or material or environmental damage (damage to property).
• Note the warnings and safety instructions!		

	INFO	<p>The key word INFO refers to information about the operation, programming and operation of the equipment</p> <p>This information helps to avoid errors and provides tips on using the device.</p>
<ul style="list-style-type: none"> • Heed the information notices for operation, programming and handling of the device. 		

2.2 Intended use


The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has been designed and built to control servo drives from the manufacturer Servomold GmbH & Co. KG. Should drives from third party companies be used, then priorly contact Servomold GmbH & Co. KG.

Apart from the functional test during assembly or reassembly (special operating mode process monitoring), the servo drives controlled by Servo Control System may only used within the protection zone of a machine.


If the special operating mode "process monitoring" is set by the commissioning personnel, then the special safety instructions apply. Please note the safety instructions in chapter [Safety / authorized operator / commissioning personnel.](#)²¹

Improper use:


- The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 may not be used in explosion hazardous areas.
- The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 may not be used outside the machines protective zone, except for function testing during installation or re-installation (special operating mode process monitoring)!

	WARNING!	<p>Danger from misuse of the Device (Servo Control System)</p> <p>Consequences of improper use may include severe injury, property or environmental damage.</p>
<ul style="list-style-type: none"> • Only use the Device (Servo Control System) for the indicated proper use, in particular within the specified limits! • Observe the maintenance instructions and use only original spare parts from Servomold GmbH & Co. KG! • The operator is exclusively liable for damages to the Device (Servo Control System) if they occurred due to improper use! 		

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has been designed and built by us safely.

	NOTE!	<p>Danger arising from modifications or retrofitting</p> <p>The possible consequences can be property damages or environmental damages.</p>
<ul style="list-style-type: none"> • Do not perform any unauthorised modifications or retrofits on the Device (Servo Control System) ! • Do not retrofit with unauthorised parts or operating materials from other manufacturers without prior consultation with Servomold GmbH & Co. KG! • Modifications or retrofitting without prior written consent from Servomold GmbH & Co. KG will lead to loss of any warranty! 		

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 requires little maintenance, but is not maintenance free.


	NOTICE!	<p>Maintenance</p> <p>The consequences of irregular maintenance can cause property damages to the machine and loss of production.</p>
<ul style="list-style-type: none"> • Follow the maintenance instructions! 		


2.3 General description of the device

This chapter contains information about the safety devices of the Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3.

2.3.1 Residual risks

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has been designed and built according to the basic safety requirements of the EC Machinery Directive.

	WARNING!	<p>There are residual risks</p> <p>Consequences of misuse or faulty operation can be severe injuries as well as property and environmental damages.</p>
<ul style="list-style-type: none"> • Read and adhere to these operating instructions! • Only sufficiently qualified, knowledgeable persons might work on or with the Device (Servo Control System)! • Note the warnings and safety instructions! 		

	WARNING!	<p>Danger from misuse of the Device (Servo Control System)</p> <p>Consequences of improper use may include severe injury, property or environmental damage.</p>
<ul style="list-style-type: none"> • Only use the Device (Servo Control System) for the indicated proper use, in particular within the specified limits! • Observe the maintenance instructions and use only original spare parts from Servomold GmbH & Co. KG! • The operator is exclusively liable for damages to the Device (Servo Control System) if they occurred due to improper use! 		

2.3.2 Safety devices

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 is equipped with safety devices that allow the safe set-up, operation and maintenance of the device. This includes:

- A power disconnect device (power switch)
- Housing
- An emergency stop device (safety relay)
- Warning signs

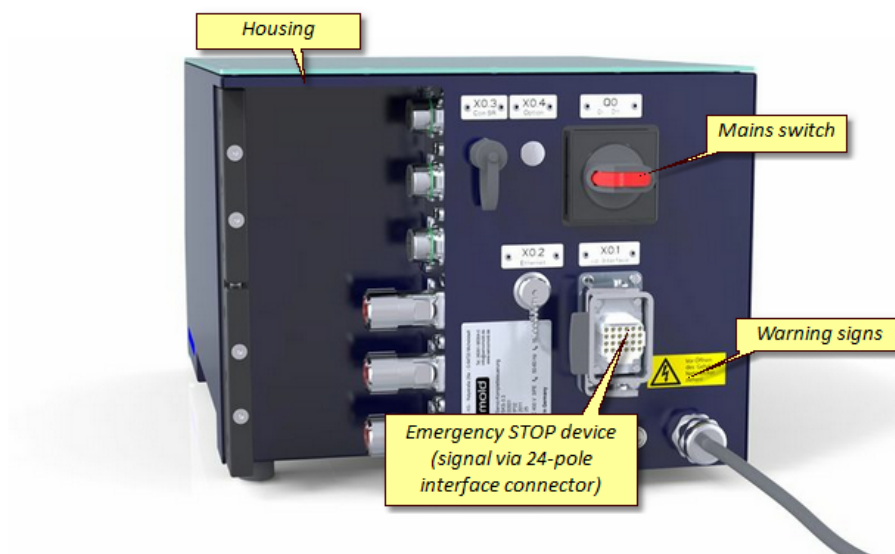


Fig. 1 Safety devices on the Device (Servo Control System)

	WARNING!	<p>Electrical and mechanical hazards Electric current or mechanical movements can kill or seriously injure.</p>
<ul style="list-style-type: none"> The Device (Servo Control System) may only be operated with the housing closed! 		

2.3.2.1 Mains disconnect device

The Servo Control System has a lockable mains disconnect device.

The black labeled mains disconnect device (mains switch) is located at the rear side of the device.



Fig. 2 Mains disconnect device (mains switch) on the Device (Servo Control System)

2.3.2.2 Housing

The Servo Control System is equipped with a housing of protection class IP32.
The housing prevents access to live parts.

2.3.2.3 Emergency stop devices

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has an Emergency stop device (2-channel, Save-Torque-Off, STO)

The machine's safety devices (2-channel) and the emergency stop devices (2-channel) - that are within their protective zones - are powered by the servo-drives controlled by Servo Control System and are evaluated using two safety relay components (each 2-channel) to ensure a secure fit.

2.3.2.4 Warning signs

Warning signs on the Device (Servo Control System) indicate residual risks:




Warning signs	Meaning	Who?
	Warning from dangerous electrical voltage	Control
	Warning of hot surface	Motor housing Gearbox housing

Table 1 Warning signs on the Device (Servo Control System)

2.3.3 Work stations

	CAUTION!	<p>Misused or unkempt workstations Possible consequences may include minor injury (personal injury), property or environmental damage.</p> <ul style="list-style-type: none"> • Clean your workstation regularly! • Keep the workstations free of items that are not or no longer needed on the workstations!
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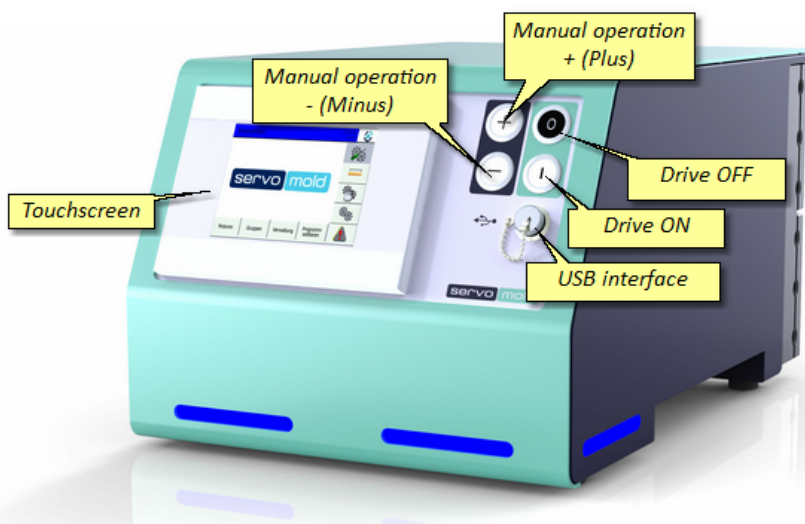
The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 has a work station.

Work station	Work station area	Work station description	Tasks
1	Control, rear-side	Line disconnecter	Sw itching the control off/on
	Front side of control	Control panel	Sw itching the drives on/off (one-zero button) if required move manually (plus-minus button) Operate and configure control (touchscreen) and also: - start homing - select automatic operating mode - start automatic operating mode

Table 2 Work station on Device (Servo Control System)



Fig. 3 Work station mains switch on the Device (Servo Control System)



2.4 Authorized operating personnel

Work on and with the Device Servo Control System may only be performed by sufficiently qualified and trained persons.


	<p>CAUTION!</p>	<p>Dangers arise from staff not being sufficiently qualified Not sufficiently qualified staff is endangered or poses danger to third parties. The possible consequences can be minor injuries, property damages or environmental damages.</p>
<ul style="list-style-type: none"> • Only sufficiently qualified persons might work on or with the Device (Servo Control System)! • Restrict unauthorized access! • Changing and managing the application software may only be done by specially authorized and trained persons (commissioning personnel or main fitter)! • Only qualified personnel should perform maintenance and repair work! • Repairs and fault remedy must be performed only by the manufacturer or qualified persons! 		


To ensure that only authorized personnel can gain access to relevant functions and user levels, the user levels are password protected.

The following user levels (levels) can be distinguished:

Level	User	Explanation
0	Manufacturer	Locked for customers / Basic settings of the manufacturer
1	Manufacturer	Locked for customers / Basic settings of the manufacturer
2	Commissioning personnel	Special operating mode (process monitoring mode): <ul style="list-style-type: none"> • All settings are possible • Operation without active safety devices is possible! Note the warnings!
3	Main setter	Advanced set-up mode: <ul style="list-style-type: none"> • Full access to setting, homing, manual operation and automatic operation • Can create and edit, read and save programs • Individual axes can be moved using the jog operation.
4	Setter	Setting mode <ul style="list-style-type: none"> • Full access to homing and automatic operation • Limited access to setting and manual operation • Can read programs, no possibilities to change the program sequence • Can reset faults
5	User	User mode 1: <ul style="list-style-type: none"> • Full access to automatic operation • Limited access to setting and manual operation • No access to the homing operation • No possibilities for changing the programs sequence, since no reading of programs
6	User	User mode 2: <ul style="list-style-type: none"> • Limited access to setting and automatic operation • No access to homing and manual operation • No possibilities for changing the programs sequence, no confirming of faults, no reading of programs

When starting the controller, the last used user level is set.

	<p>WARNING!</p>	<p>Moving machine parts Loose clothing, long hair, jewellery chains or similar could get stuck during troubleshooting, repairs, or functional testing and can lead to severe injuries.</p>
<ul style="list-style-type: none"> • Work only with tight fitting clothes! • Secure long hair under a hat! • Do not wear jewellery (such as necklaces, rings, etc.)! 		

	CAUTION!	Danger can arise from modifications, external influences, modifications Consequences can be minor injuries, property damages or environmental damages.
<ul style="list-style-type: none">• Check the Device (Servo Control System) for safety prior to each operating cycle and only operate in good order and condition!• Have any safety defect immediately remedied by an expert!• Only operate the Device (Servo Control System) with closed housing!• Prior to switching on ensure that no persons are endangered by the starting Device (Servo Control System)!• After triggering a movement or during automatic operation never grab or access into the Device (Servo Control System)!		

2.4.1 User

The operator is a trained and sufficiently qualified person.

The operator

- operates the Servo Control System
- switches, if required, the mains power switch on and off.
- switches the drives on and off
- selects the automatic operating mode
- starts the automatic operation
- check the work sequence
- moves the drive in limited manual operation according to the indicated program (retract, extend) (operator 1)
- remedies faults during the daily work sequence
- performs outside cleaning work on the switched off Servo Control System.

If desired, the operator can set the user levels 5 (Level 5) by entering a password

. In user level 5 there is complete access to the functions of the automatic operation (start and stop of automatic) as well as limit access to manual operation.

2.4.2 Setter

The setter is a specially authorized and trained person.

The setter

- operates the Servo Control System
- switches the mains power switch on and off, if required.
- Enters the password for user level 4 (Level 4)
- Loads the program from the internal program memory
- Selects the operating mode
 - Homing
 - Semi-automatic
 - Administration
- Switches the drives on and off
- Start the homing
- Moves the drives in the limited manual mode according to the program (retract, extend) or the program can proceed step by step in the advanced manual mode
- Selects the automatic operating mode
- Starts the automatic operation
- Check the work sequence
- Remedies faults during the daily work sequence
- Resets faults
- performs exterior cleaning work on the switched off Servo Control System.

2.4.3 Main setter

The main setter is a trained and specially authorized person.

The main setter

- Enters the password for user level 3 (Level 3)
- Creates programs (program sequences)
- Administers programs internal or via USB stick
- Programs the process parameter (e.g. rotation speed, acceleration, delay)
- Parametrizes the Servo Control System

In addition to the listed tasks, the main setter has access to all areas to which the setter has access.

2.4.4 Commissioning personnel

The commissioning personnel is a person that is qualified, has expert knowledge and is specially authorized.

The commissioning person

- commissions the Servo Control System into operation.
- switches the mains power switch on and off, if required.
- Enters the password for user level 2 (Level 2) (process monitoring)
- Selects the operating mode
 - Homing
 - Semi-automatic
 - Administration
- Switches the drives on and off
- Moves the servo-drives during manual operation
- Check the proper operation of the drives
- If required, performs correction on the program sequence
- Prepares a commissioning record and releases the device for operation.



DANGER!

Mechanical hazard

During the commissioning of the Devices (Servo Control System) all safety equipment might not be active yet!

Failure to observe can kill or seriously injure a person.


- Commissioning may only be carried out by a qualified and competent person!
- Make sure that there are no people in the immediate area of the servo drives.
- Make sure that there are no objects or tools in the immediate area of the servo drives.
- Prior to commissioning check the operating parameters (speed, torque, acceleration, deceleration, etc.) that are set on the control
- Perform all program steps with more than 10% of the maximum torque.
- Wear appropriate personal protective equipment (safety glasses, safety shoes, hard hat, protective clothing)


2.4.5 Maintenance and installation personnel


The maintenance and installation personnel consist of qualified, knowledgeable experts, licensed electricians and mechanics.

Maintenance and installation personnel

- Perform the installation of mechanical and electrical components of the Servo Control System.
- Service the mechanical and electrical components of the Servo Control System.
- Perform service work and repair work.
- Perform troubleshooting and fault remedy.
- Clean the Servo Control System.
- Perform the interior cleaning of the Servo Control System.

	WARNING!	<p>Maintenance and service tasks</p> <p>Consequences of improper installation and / or repair may be death, severe or minor injury, property damages or environmental damages.</p>
<ul style="list-style-type: none"> • The installation and repair work may only be performed by qualified, knowledgeable professionals! • Switch off the Device (Servo Control System) at the line disconnecter (main switch) and protect against unintentional activation! • Immediately after completing the assembly and service work, reinstall all protective cladding and safety devices and check their functioning. 		


	WARNING!	<p>Fault finding and fault fixing</p> <p>Consequences of improperly performed fault finding and fault fixing may be death, severe or minor injury, property damages or environmental damages.</p>
<ul style="list-style-type: none"> • Fault finding and fault fixing may only be performed by qualified, knowledgeable professionals! 		

	NOTICE!	<p>Spare parts</p> <p>Consequences of the use of inappropriate spare parts could be property damage.</p>
<ul style="list-style-type: none"> • Spare parts must meet the technical requirements of the machine manufacturer! • Use only original spare parts from the manufacturer! 		

2.5 Handling

The following chapter provides information about transport, acceptance and storage of the Device Servo Control System.

2.5.1 Transportation

	WARNING!	<p>Transportation</p> <p>Falling parts can kill or seriously injure</p>
<ul style="list-style-type: none"> • Watch the weight! 		

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 is delivered completely assembled in a transport box. The accessories (motor cable, signal cable, interface cable, commissioning box) are enclosed in the transport box. The design of the transport packaging is based on the contractual arrangements and the destination.

Components	Weight, about/kg
Servo Control System SKS-3.1	21
Accessories	7

Table 3 Weight/dimensions table SKS-3.1


Components	Weight, about/kg
Servo Control System SKS-3.2	22.5
Accessories	9.5

Table 4 Weight/dimensions table SKS-3.2

Components	Weight, about/kg
Servo Control System SKS-3.3	25
Accessories	12

Table 5 Weight/dimensions table SKS-3.3

2.5.2 Acceptance

	NOTICE!	<p>Transport damages and completeness The Device (Servo Control System) could have been damaged during transport.</p>
<ul style="list-style-type: none"> • Check the Device (Servo Control System) for transport damages and completeness! • Immediately notify the shipper when detecting transport damages and Servomold GmbH & Co. KG 		


2.5.3 Storage

Should the Servo Control System not be put in operation immediately after delivery, then it must be carefully stored at a protected location.

The minimum and maximum storage temperature is:

- " min.: -20 °C
- " max.: 55 °C

Bare machine parts have been covered by the manufacturer with corrosion protection. This protection lasts for about two months.

	NOTICE!	<p>Corrosion protection Corrosion can lead to property damages.</p>
<ul style="list-style-type: none"> • Check the Corrosion protection when storing on a monthly basis and replace if required. 		

2.6 Assembly or set-up or installation and connection

	WARNING!	<p>Assembly or set-up or installation and connection</p> <p>The consequences of not properly performed assembly or set-up or installation and connection could be serious or minor injuries, machine or workpiece damage and environmental damage.</p>
<ul style="list-style-type: none"> • The assembly or set-up or installation and connection must be performed by qualified, knowledgeable professionals! 		

The assembly or set-up or installation and connection consists of:

- Setting up the Servo Control System at a suitable location, done by experts.
- Electrical wiring of the Servo Control System to the servo-drives should be done by licensed electricians.
- Electrical wiring of the Servo Control System to the mains power as well as the connection of additional earth conductor should be done by licensed electricians.
- Electrical wiring of the Servo Control System control lines to the machine interface should be done by licensed electrician.
- where necessary, electrical wiring of the connection cable of the control panel (SUS-Panel) with the panel interface of the control unit.
- where necessary, electrical wiring of the connection cable of the Master-control-unit (SUS-Con) with the Slave-control unit (SUS-Con).
- Function test and trial of the Servo Control System should be done by experts.

During the set-up of the Servo Control System ensure that the Device stands stable and the lines can not be pulled down by the operating personnel or otherwise damaged.

Also be ensure that the ventilation slots located at the housing bottom of the Servo Control System are not covered and permanent air circulation can take place.

2.6.1 Electrical connection

The Servo Control System must be connected to the electrical power supply.

	WARNING!	<p>Electrical Voltage</p> <p>Electric shock currents can kill or seriously injure</p>
<ul style="list-style-type: none"> • The connection must be made by a qualified electrician. • The rated voltage must be stated on the type plate and correspond with the power source! • On the supply side a corresponding electrical protection must exist! 		

Servo Control System	SKS-3.1 / SKS-3.2 / SKS-3.3
Mains supply voltage	3/N/PE AC 400/230V
Mains frequency	50/60 Hz
Rated current	16A
Recommended fuses mains side	16A
Recommended cross section of the mains connection line	min. 2.5mm ²
Voltage equalising cable	10mm ²

Table 6 Electrical connection Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3


2.6.2 Motor connection

The Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 is configured especially for the use of motors supplied by Servomold GmbH & Co. KG.


Please note that the use of a 230V controller compared to 400V controller can result in a change in the performance characteristics. (Maximum achievable torque/rotation speed)

The use of motors from other manufacturers' depends on the motor type and requires in any case, an adjustment of the Servo Control System.

In this case, please contact us.

	NOTICE!	<p>Motors of other manufacturers Using motors from other manufacturers can lead to property damages.</p>
<ul style="list-style-type: none"> • Motors must meet the technical requirements of the Servomold GmbH & Co. KG! • Only use original motors from Servomold GmbH & Co. KG! • Prior to using motors of other manufacturers please contact Servomold GmbH & Co. KG. 		

The Servo Control System should be connected to the servo-drives using the motor and signal line.

	NOTICE!	<p>Motor and signal lines Consequences of using unsuitable motor and signal lines could be property damage.</p>
<ul style="list-style-type: none"> • Motor and signal lines must meet the technical requirements of the machine manufacturer! • Only use original motor and signal lines from Servomold GmbH & Co. KG! • Only use the motor and signal lines, fitting to the Position Encoder of the motor! 		

Depending on the design of the Servo Control System different amounts of motor and signal lines are used.

All servo-drives and controllers supplied by Servomold GmbH & Co. KG are powered with the same type of motor and signal lines.

Servo Control System	SKS-3.1
Amount of max. connectable motors	1
Amount of motor lines/signal lines provided with the control	1 / 1
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 7 motor and signal lines connection Servo Control System SKS-3.1

Servo Control System	SKS-3.2
Amount of max. connectable motors	2
Amount of motor lines/signal lines provided with the control	2 / 2
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 8 motor and signal lines connection Servo Control System SKS-3.2

Servo Control System	SKS-3.3
Amount of max. connectable motors	3
Amount of motor lines/signal lines provided with the control	3 / 3
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 9 motor and signal lines connection Servo Control System SKS-3.3

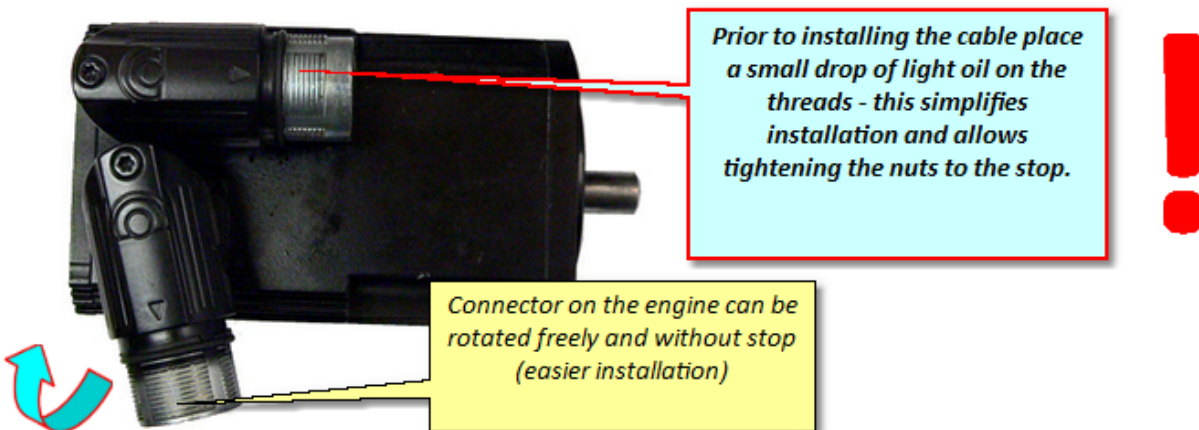


Fig. 4 Motor connector plug

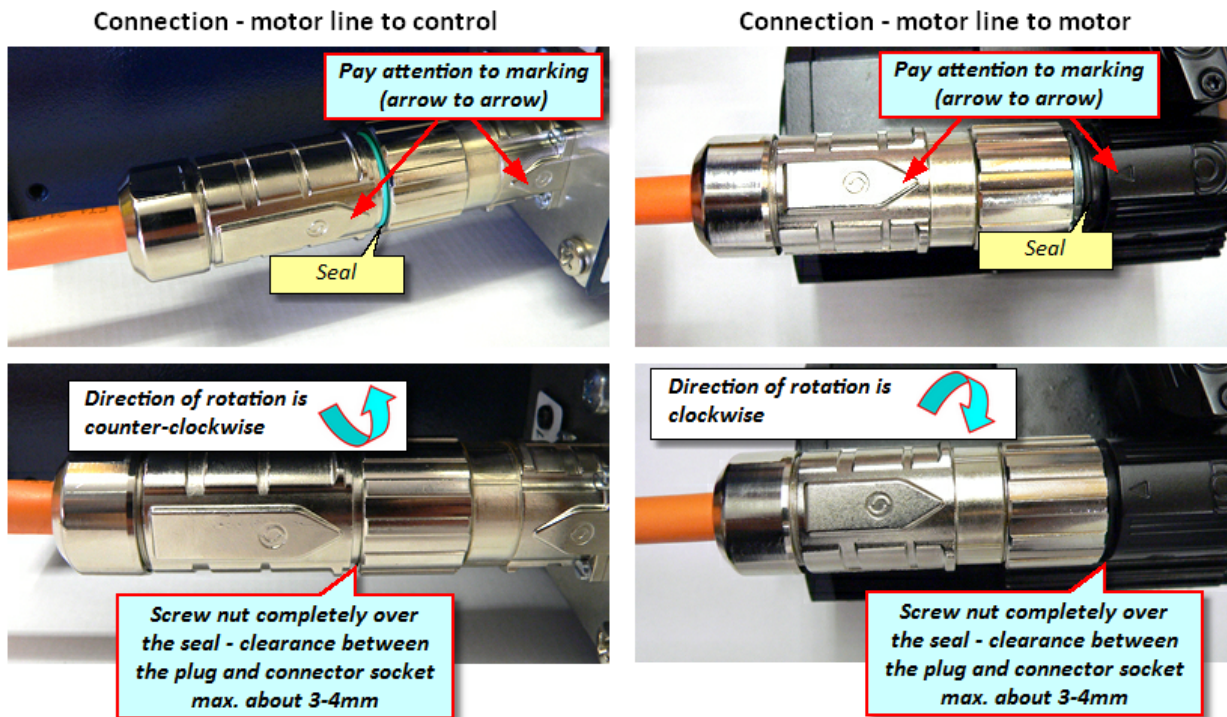


Fig. 5 Connecting the motor line

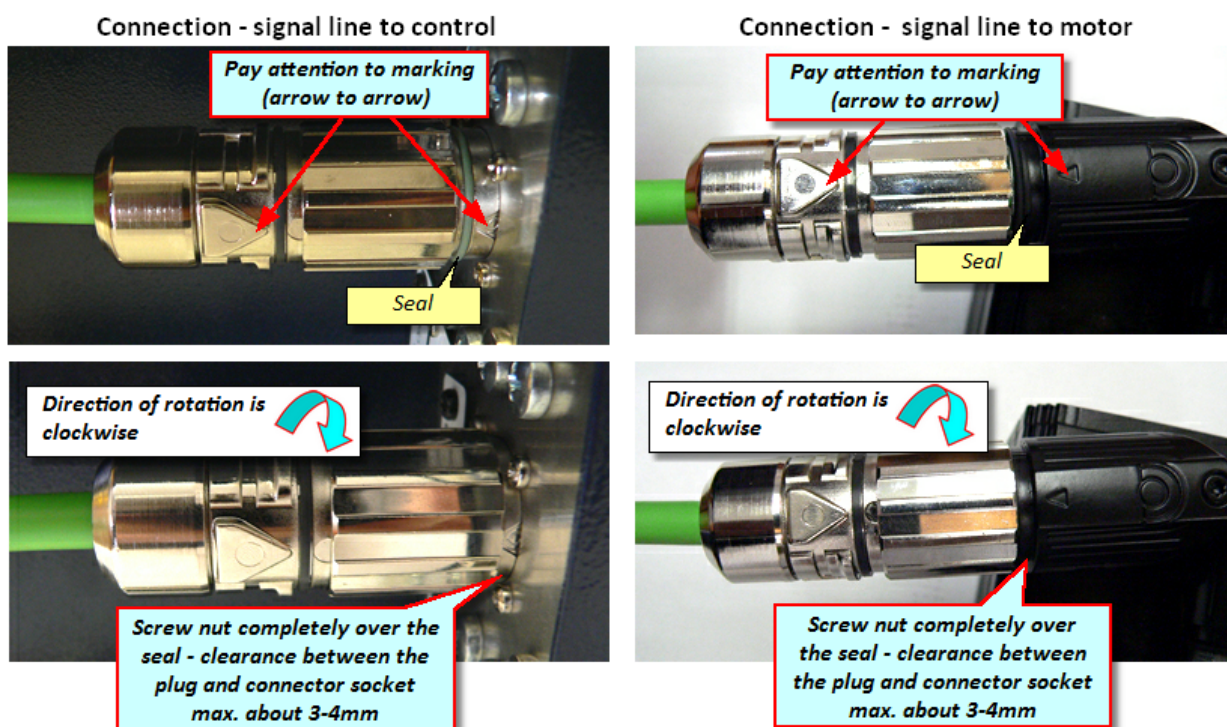



Fig. 6 Connecting the signal line

	WARNING!	<p>Work tasks on motor and signal lines</p> <p>Consequences of improper performed work on the motor and signal lines can be death, severe or minor injury, property damages or environmental damages.</p>
<ul style="list-style-type: none"> • During work on the motor and signal lines switch off the Device (Servo Control System) at the line disconnecter (main switch) and protect against unintentional activation ! • Work on the motor and signal lines must be performed by electricians! • When connecting the signal and cable lines, heed the identification of the lines and connect the lines to the connectors of the Servo Control System with the corresponding connector sockets of the battery. • Never pull the plug of the motor and signal lines while under voltage! • Tighten the nut of the connector firmly! - Prior to commissioning of the Servo Control System check all socket connection for tight fit. 		

2.6.3 Interface connection


The Servo Control System should be connected to a suitable interface of the machine via an interface cable. Detailed information can be found in the chapter Device description / [Interfaces](#) ³².

2.6.4 dimensions

Servo Control System	SKS-3.1 / SKS-3.2 / SKS-3.3
LxWxH	570x350x300
Required space LxWxH	700x450x350

Table 10 Dimensions Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

2.7 Disposal

	NOTICE!	<p>Improper disposal</p> <p>Improper disposal can damage the environment.</p>
<ul style="list-style-type: none"> • Ensure that the Device (Servo Control System) is proper or contract a specialist! 		

2.8 Emergency, extinguishing agent

During emergencies switch-off the Servo Control System by disconnecting the mains switch!

If the Servo Control System is on fire, use ABC powder or carbon dioxide.

When extinguishing using water, watch for required minimum clearance!

The minimum clearance depends, among other things, from the nozzle diameter, sprayjet or full jet.

When using a C-tube with nozzle (12 mm) and sprayjet, then the minimum clearance is one meter.

On a full jet the minimum clearance is five meter.

Chapter

3

3 Device description

In the following you find the principle description of the Servo Control System

The Servo Control System can be easily operated via the touch screen. Whenever possible operate the touch screen using a touch pen (stylus) to prevent damage to the surface of the touchscreen.

Depending on design, deviating from the illustrations, not the complete amount of sockets are shown. The connectors shown as optional can also be different.

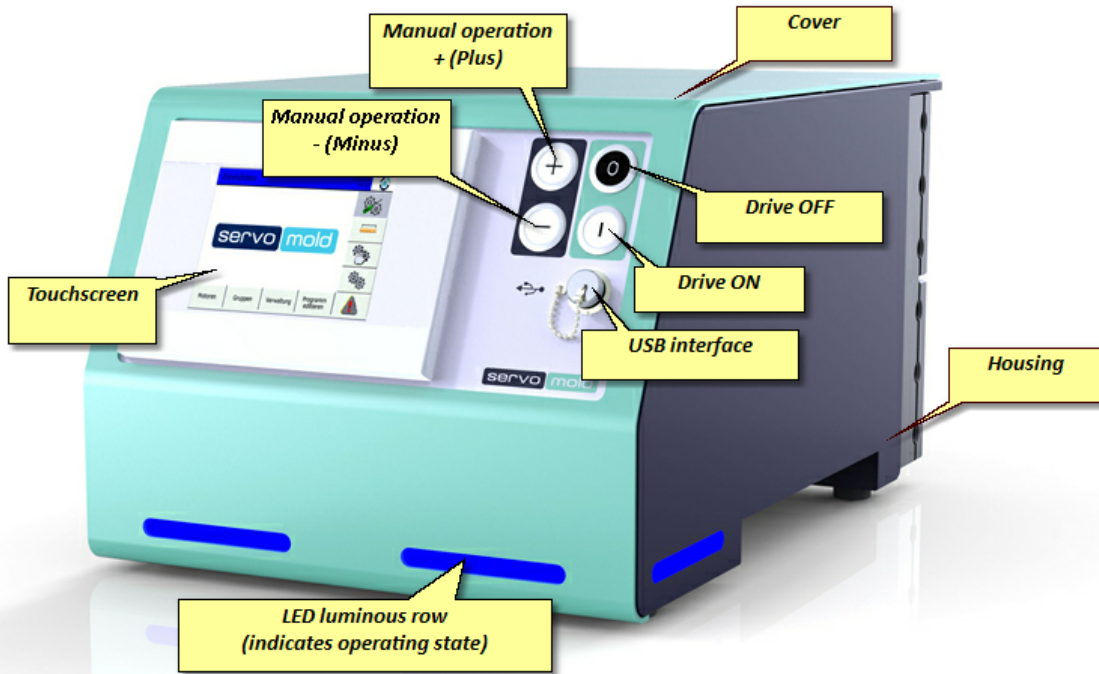


Fig. 7 Front view Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

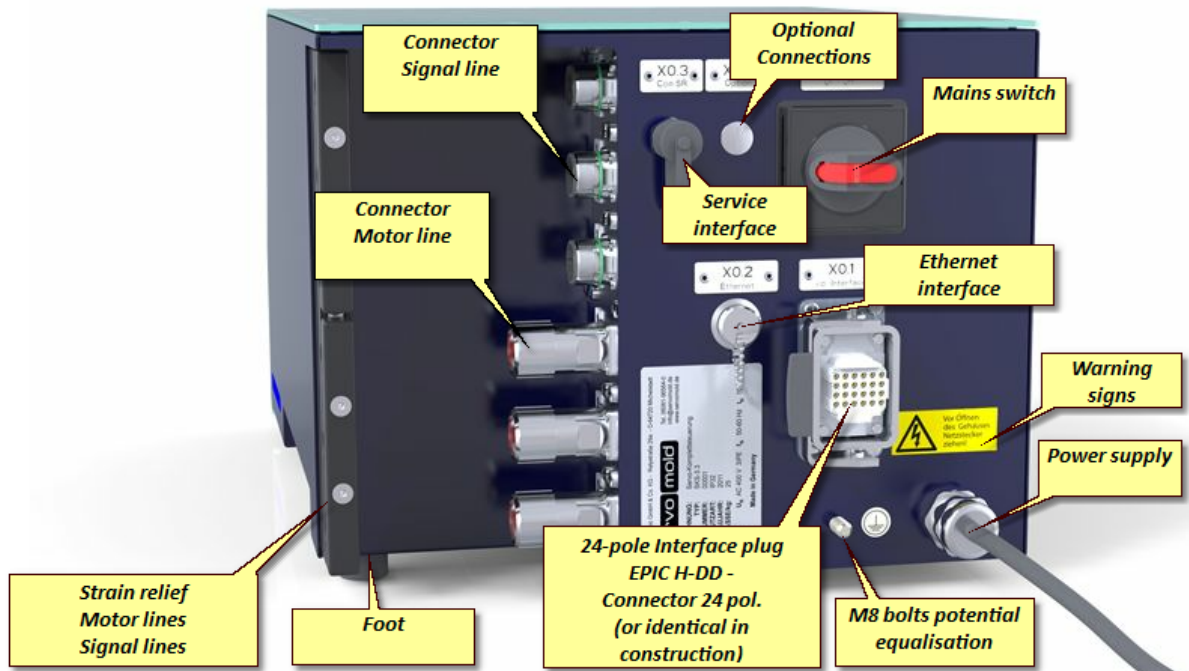


Fig. 8 Rear view Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

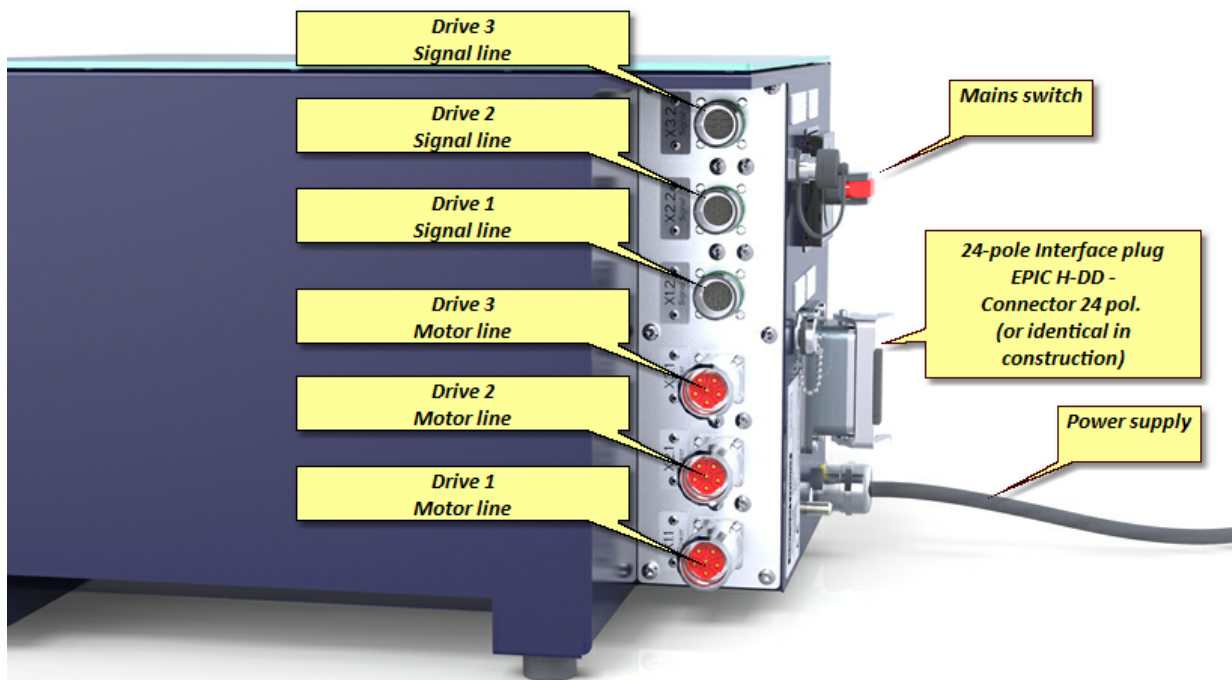


Fig. 9 Connector Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

3.1 Function

The Servo Control System has exclusively been designed and built to control

- servo unscrewing units "Single" (SAE), "Double" (SAD) and "Quadruple" (SAV)
- Servo-multi drives (SMA) to operate the servo-unscrewing unit "Multi" (SAM)
- Servo drive unit "Toothed wheel" (SAZ) and servo-drive unit "Shaft" (SAW)
- Servo-angle drive "Toothed wheel" (SWZ) and Servo-angle drive "Shaft" (SWW)
- Servo-linear drives "Screw drive" (SLG)
- Servo-screw drive "Single" (SSE) and "Double" (SSD)
- Servo-drives from Servomold GmbH & Co. KG on tools for injection moulding machine
- Servo-drives from Servomold GmbH & Co. KG within the protective zone of the machine.
- by Servomold GmbH & Co. KG released servo-drives on tools for injection moulding machine or within the protective zone of a machine

General advantages:

- Rotary and linear movements with superb repeatability
- Precise, individual control of torque and rotary speed
- Ability to combine complex rotary and linear movements
- Controls can be configured and programmed individually
- Controls with in-built torque threshold monitoring
- User-friendly touch screen controls
- Dependable and safe, since control with integrated safety technology (Emergency STOP and safety door)
- Meets protection class IP32
- Independent and flexible since universally applicable to almost all injection moulding machines.
- LED lights for indicating operation states/conditions
- Remote maintenance via Ethernet interface

3.2 Connections

The connection of the Servo Control System is done in three steps:

- **Electrical connection** (Connection of Servo Control System to the electrical power supply)
- **Motor connection** (Connection of Servo Control System to the servo drives via motor and signal lines)
- **Interface connection** (connection of the control line of the Servo Control System to the interfaces of the machine)
- where necessary, electrical wiring of the connection cable of the control panel (SUS-Panel) with the panel interface of the control unit.
- where necessary, electrical wiring of the connection cable of the Master-control-unit (SUS-Con) with the Slave-control unit (SUS-Con).

Since both the electrical connection and the motor connection may only be performed by qualified electricians, the safety information in Safety - Assembly, installation and connection [Chapter Safety - Assembly, installation and connection](#) ²⁴ must be noted.

It also provides detailed descriptions of how to properly use the motor and signal connectors.

Information on connecting to the interface of the injection moulding can be found in the chapter [Interfaces](#) ³².

3.3 Interfaces

The interfaces on the Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 are located at the front and rear side of the device.



Fig. 10 Interfaces Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

3.3.1 Signal interface

The most important interface for the communication with the injection moulding machine or other machines is the signal interface:

Servo Control System	SKS-3.1
Amount of digital inputs/outputs	3 / 3
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 11 Interface line connection Servo Control System SKS-3.1

Servo Control System	SKS-3.2
Amount of digital inputs/outputs	8 / 4
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 12 Interface line connection Servo Control System SKS-3.2

Servo Control System	SKS-3.3
Amount of digital inputs/outputs	8 / 4
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 13 Interface line connection Servo Control System SKS-3.3

This is connected via an interface cable to a suitable interface or to a special signal connector of the injection moulding machine.

The following options are available on most injection moulding machines:

- Core-pull signals
- Euomap 67 interface (older version Euomap 12) (Commonly known as an interface for robot or handling equipment)
- Euomap 74 interface (newer interface to control electrical core pulls)
- Robot interface (some robots or handling systems have their own interface - e.g. Arburg)
- Freely programmable inputs and outputs

The connection to this machine interface allows the following function:

- Receive of digital signals from the injection moulding machine to start program sequences (move axis A,B,C)
- Sending digital signal to the injection moulding machine to display different operational modes (axis A,B,C has reached a certain position)
- Connection of the Emergency Stop interface and the protective door interface of the injection moulding machine to the safety components of the Servo Control System

The integration of the Servo Control System in the Emergency Stop circuit and protective door circuit of the injection moulding machine is required! Without the respective release signal from the injection moulding machine the Servo Control System can not be operated.

Since some interfaces also only provide limited possibilities to integrate the Servo Control System in the program sequence of the injection moulding machine an interface is required to connect the Servo Control System

Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3 as core pull

A proven method is the use of electrical **core pulling signals** of the injection moulding machine. For this, the electrical signals of a core puller (core retract, core forward, core retracted, core is forwarded) are accessed in the cabinet of the injection moulding machine and placed on a 24-pin connector (HAN 24B or identical), which is attached to the control cabinet of the injection moulding machine. Furthermore, additional safety relays are used that allow the release of the Servo Control System when the safety circuit is closed.

In the following the assignment of the interface cable, and the wiring of the signal interface is described.

Fig. 11 Interface cable

3.3.2 USB interface

The use of the USB interface to manage programs is described in chapter [Commissioning / Manage programs](#) ⁶⁶.

3.3.3 Ethernet interface

The Ethernet interface can be used for the remote access to the Servo Control System. Here the connection is established either to the company network via a LAN cable or to a mobile router.

Using the special software (remote access software) allows the transfer e.g. content of the touch panel screen to another PC and thus operation of the touch panel from a different PC.

3.3.4 Service interface

This interface is intended for the direct access to the servo-controller. A special data cable is required which is only available to employees of Servomold GmbH & Co. KG as well as by Servomold GmbH & Co. KG authorized persons.

To prevent damages to the servo-controller, the protective cap on this plug may not be removed.

3.3.5 Optional interface

Here, the connection of a hand button that moves the drives in manual operating mode is possible. When required, please contact Servomold GmbH & Co. KG

3.4 Emission sound pressure level

The evaluated equivalent emission sound pressure level during automatic operation is at all workstations <70 dB(A).

3.5 Limit values of the ambient condition

Limit values of the ambient condition	min.	max.
Ambient temperature of air	5°C	40°C
Relative humidity of ambiance	10%	90%, operation only in not dew y/condensate and not icy condition
Altitude	--	2,000 m above sea level
Set-up location (contamination)	Weather protected locations, e.g. not fully-air-conditioned operation rooms (contamination degree 3)	
Transport and storage	-20°C	55°C

Table 14 Limit values of the ambient condition of the Servo Control System

3.6 Technical data

Servo Control System	SKS-3.1 / SKS-3.2 / SKS-3.3
Mains supply voltage	3/N/PE AC 400/230V
Mains frequency	50/60 Hz
Rated current	16A
Recommended fuses mains side	16A
Recommended cross section of the mains connection line	min. 2.5mm ²
Voltage equalising cable	10mm ²

Table 15 Electrical connection Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

Servo Control System	SKS-3.1
Amount of max. connectable motors	1
Amount of motor lines/signal lines provided with the control	1 / 1
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 16 motor and signal lines connection Servo Control System SKS-3.1

Servo Control System	SKS-3.2
Amount of max. connectable motors	2
Amount of motor lines/signal lines provided with the control	2 / 2
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 17 motor and signal lines connection Servo Control System SKS-3.2

Servo Control System	SKS-3.3
Amount of max. connectable motors	3
Amount of motor lines/signal lines provided with the control	3 / 3
Motor line (Orange) - Ø 10.6mm - min. bending radius static / dynamic	43mm / 80mm
Signal line (Green) - Ø 8.9mm - min. bending radius static / dynamic	36mm / 72mm
Temperature range for motor and signal lines	-30°C ... +80°C
Abrasion-proof, cut-proof, free of halogen, oil resistant/flame resistant acc. to IEC 60332-1-2 & CSA FT1	

Table 18 motor and signal lines connection Servo Control System SKS-3.3

Servo Control System	SKS-3.1
Amount of digital inputs/outputs	3 / 3
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 19 Interface line connection Servo Control System SKS-3.1

Servo Control System	SKS-3.2
Amount of digital inputs/outputs	8 / 4
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 20 Interface line connection Servo Control System SKS-3.2

Servo Control System	SKS-3.3
Amount of digital inputs/outputs	8 / 4
Signal plug on device side	EPIC H-DD - Connector 24 pol. (or identical in construction)
Control line (transparent) - Ø 15,3mm - min. bending radius (line is sometimes moved)	300mm
Plug on machine side (recommended)	HAN 24B (or identical in construction)
Temperature range for motor and signal lines	-40°C ... +80°C

Table 21 Interface line connection Servo Control System SKS-3.3

Servo Control System	SKS-3.1 / SKS-3.2 / SKS-3.3
LxWxH	570x350x300
Required space LxWxH	700x450x350

Table 22 Dimensions Servo Control System SKS-3.1 / SKS-3.2 / SKS-3.3

3.7 Signal box

The signal box is required for commissioning the Servo Control System in the special operating mode "Process monitoring" in a workshop. It consists of a housing and an attached interface cable with a 24-pole (42-pole) plug.

Furthermore, the signal box consists of a switch that is suitable for the simulation of digital outputs as well as an Emergency Stop Button to stop the drives during commissioning.

As soon as the signal box is connected, the control detects it automatically and allows then the operation of the control unit, only on setting for user level 2, by the commissioning personnel. Operation is not possible in all other user levels!

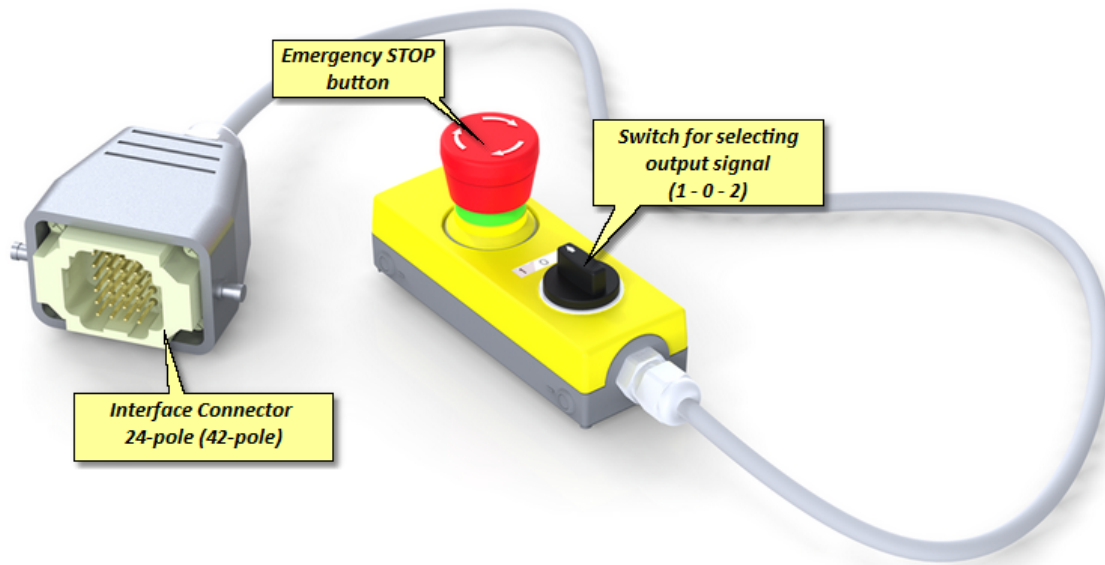


Fig.12 Signal box

Chapter

4

4 Software

After starting the Servo Control System the main display will show the "Setting" operating mode.

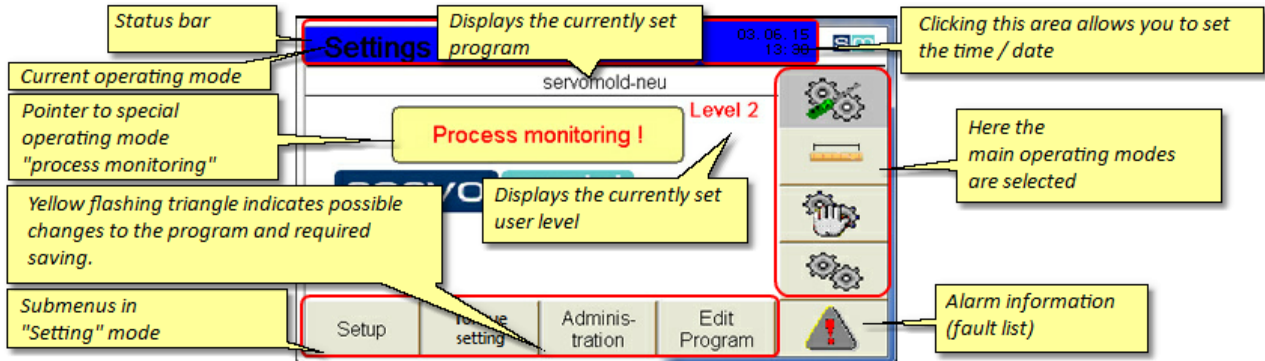


Fig. 13 Main display

4.1 Operating modes

The main operating modes can be set on the right-hand menu bar - Depending on state of the control and [User level](#) ⁴³ access to the operating modes is only limited possible - for example, on a not homed drive, the selection of the "Automatic" operating mode is not possible.

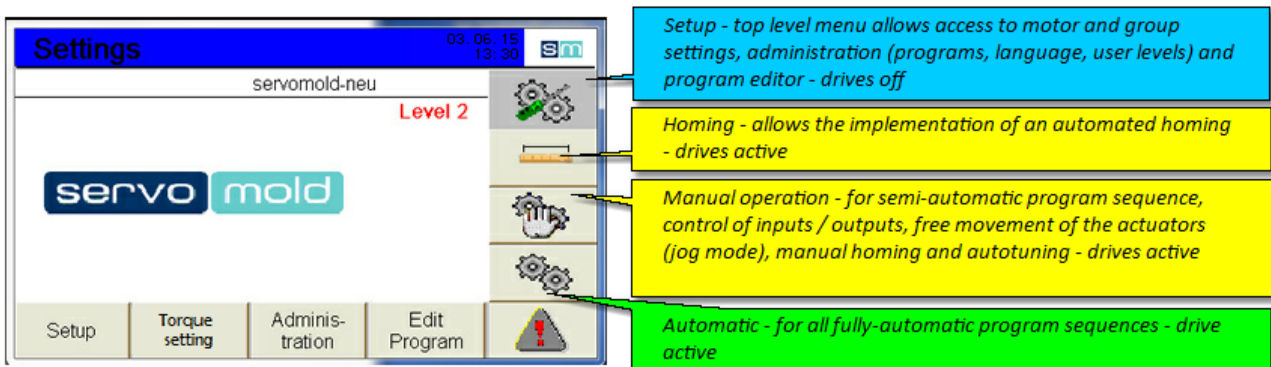


Fig. 14 Operating modes

The basic settings are performed in the sub-menus Setup, Quickset, Administration and in the Program Editor:

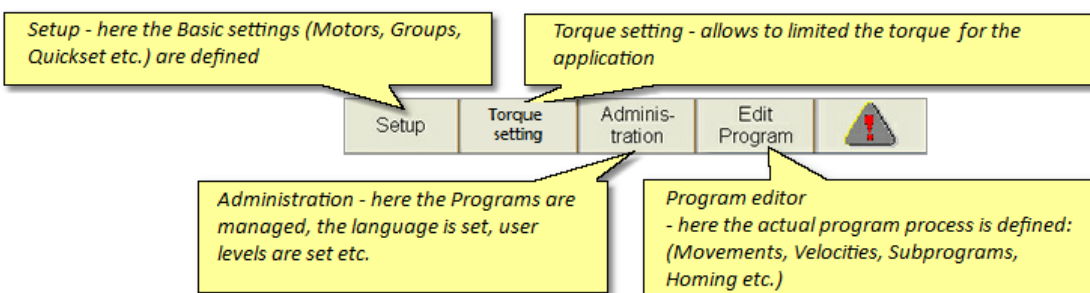


Fig. 15 Sub-menus

Depending on operating mode the operating conditions of the Servo Control System are shown by different colours and a static or flashing status bar or LED light strip:

Colour	Operating mode	Operating condition - LED flashing	Operating condition - LED static
Blue	Setting	Booting process of control	Relay active - normal state
Yellow	Homing / manual operation	Drive OFF (inactive) or notice for fault (during all operating modes)	Drive active - normal state
Green	Automatic	Automatic off	Drive active - normal state
Red	Fault	Drive inactive or notice for fault or error (in all operating modes)	none



Fig. 16 Operating mode - LED light strip

4.2 User levels

Depending on user level, different functions are released or locked in the respective operating mode. The matrix in the following provides an overview.

Userlevel Matrix								
		Servo-mold	Commissioning personnel	Main Setter	Setter	User 1	User 2	
	Functions	Level 1	Level 2	Level 3	Level 4	Level 6	Level 6	Menulevel
Settings	Homing	Yes	Yes	Yes	Yes	No	No	1
	Manual Mode	Yes	Yes	Yes	Yes	Yes	No	
	Automatic	Yes	Yes	Yes	Yes	Yes	Yes	
	Warnings	Yes	Yes	Yes	Yes	Yes	Yes	
	Program edit	Yes	Yes	Yes	No	No	No	
	Administration	Yes	Yes	Yes	Yes	Yes	Yes	
	Quickset	Yes	Yes	Yes	Yes	Yes	No	
	Setup	Yes	Yes	Yes	No	No	No	
	Home	Homing Start / Stop	Yes	Yes	Yes	Yes	No	
Manual mode		Move out / Move in	Yes	Yes	Yes	Yes	Yes	No
	Start (after Malfunction)	Yes	Yes	Yes	Yes	Yes	No	
	ext. Mode	Yes	Yes	Yes	Yes	No	No	
Auto	Start / Stop	Yes	Yes	Yes	Yes	Yes	No	
	Auto on/off	Yes	Yes	Yes	Yes	Yes	No	
	View	Yes	Yes	Yes	Yes	Yes	Yes	
Malfunction	Drive - reset malfunction	Yes	Yes	Yes	Yes	Yes	No	
	Malfunction list	Yes	Yes	Yes	Yes	Yes	Yes	
	Single reset malfunction	Yes	Yes	Yes	Yes	Yes	No	
	All reset malfunction	Yes	Yes	Yes	Yes	Yes	No	
Administration	System (EXIT)	Yes	No	No	No	No	No	
	Change password	Yes	Yes	Yes	No	No	No	
	User level	Yes	Yes	Yes	Yes	Yes	Yes	
	Language	Yes	Yes	Yes	Yes	No	No	
	Reset counter	Yes	Yes	Yes	Yes	No	No	
	Programs	Yes	Yes	Yes	Yes	No	No	
ext. Mode	Sub-programs	Yes	Yes	Yes	Yes	No	No	
	Step by Step mode	Yes	Yes	Yes	Yes	No	No	
	Single mode	Yes	Yes	Yes	No	No	No	
Programs	Edit name	Yes	Yes	Yes	No	No	No	
	Delete program	Yes	Yes	Yes	No	No	No	
	Load program	Yes	Yes	Yes	Yes	No	No	
	Save program	Yes	Yes	Yes	No	No	No	
	Show USB / internal	Yes	Yes	Yes	No	No	No	
	Backup	Yes	Yes	Yes	No	No	No	
	Mark program	Yes	Yes	Yes	No	No	No	
	Copy program	Yes	Yes	Yes	No	No	No	
Axis A,B,C	Jog-move (free movement)	Yes	Yes	Yes	No	No	No	4
	Autotuning	Yes	Yes	Yes	No	No	No	
	Homing	Yes	Yes	Yes	No	No	No	

Fig. 17 User level matrix

Chapter

5

5 Commissioning

This chapter provides information about:

1. [Providing connections](#) ⁴⁶,
2. Device [Switch-on](#) ⁴⁷,
3. [Basic settings](#) ⁴⁸ (checking), e.g. [Setting the motors](#) ⁴⁹, [Application settings](#) ⁵¹, [Position settings](#) ⁵², [Torque settings](#) ⁵³, [Manual operation setting](#) ⁵⁴, [Action settings](#) ⁵⁴,
4. [Interface settings](#) ⁵⁴,
5. [Drive settings](#) ⁵⁵ (Autotuning),
6. [Move axes](#) ⁵⁷
7. [Edit programs](#) ⁶¹ and
8. [Administer program](#) ⁶⁶,

For different setting you should select the respective [Operating mode](#) ⁴¹.

Initial start-up always takes place according to the same sequence - during the use of existing programs, make sure that all [Basic settings](#) ⁴⁸ are checked and if required adjusted. Step no. 5 ([Autotuning](#)) ⁵⁶ must be performed in any case during the change of drives or when using the controller on another tool.

In many cases initial commissioning takes place in the workshop to test the interaction of mechanical and electrical components, settings and to make corrections if necessary. In this case special conditions apply regarding the safety devices that may not yet be active!

To provide safety during commissioning in a workshop, the operation in special mode "Process monitoring" is possible.

For this the following steps are required:

- Connection of the signal box (see chapter [Signal box](#) ³⁹)
- Adjusting the user level 2 only performed by the commissioning personnel

Through the signal box, the commissioner has direct influence on the emergency shut-down of the drives and can bring these to an immediate stop. Commissioning of the Servo Control System may only be performed by [the commissioning personnel](#) ²¹!

5.1 Provide connections

The connection of the Servo Control System is done in three steps:


- **Electrical connection** (Connection of Servo Control System to the electrical power supply)
- **Motor connection** (Connection of Servo Control System to the servo drives via motor and signal lines)
- **Interface connection** (connection of the control line of the Servo Control System to the interfaces of the machine)
- where necessary, electrical wiring of the connection cable of the control panel (SUS-Panel) with the panel interface of the control unit.
- where necessary, electrical wiring of the connection cable of the Master-control-unit (SUS-Con) with the Slave-control unit (SUS-Con).

Since both the electrical connection and the motor connection may only be performed by qualified electricians, the safety information in Safety - Assembly, installation and connection [Chapter Safety - Assembly, installation and connection](#) ²⁴ must be noted.

It also provides detailed descriptions of how to properly use the motor and signal connectors.

Information on connecting to the interface of the injection moulding can be found in the chapter [Interfaces](#) ³².

If commissioning does not take place on the injection moulding machine but in a workshop, then the **interface connection** is subsequently the [Signalbox](#) ³⁹.

	<p>INFO</p>	<p>Signal box During commissioning in a shop, the signal box should be connected to the injection moulding machine instead to the interface cable.</p>
<ul style="list-style-type: none"> • The connection of the signal box allow s the operation of the Servo Control System in the tool shop. • Using the signal sw itch, all output signals of the injection moulding machine an be simulated and used to start the program sequence. • The Emergency OFF button allow s fast stopping of the drive. 		

During set-up in the workshop ensure that the lines are not being damaged!

Lay the cables so that they pose no danger to people (Risk of falling!)

To avoid interchanging the motor and signal line, label them clearly!
(Motor 1, Motor 2, Signal 1, Signal 2, etc.)

5.2 Switching on

After the connections have been properly provided and checked by a licensed electrician, you are able to switch on the Servo Control System at the mains power supply.

Here, only the power supply to the servo controllers is established - the servo controllers are not yet activated.

During the switch-on of the Servo Control System at the mains switch, the PLC control is started. The booting process takes about 1 minute - subsequently you find the following start screen

User level 4 is pre-set and allows only limited access to the control functions.

To be able to commission the Servo Control System you must first change to user level 2.

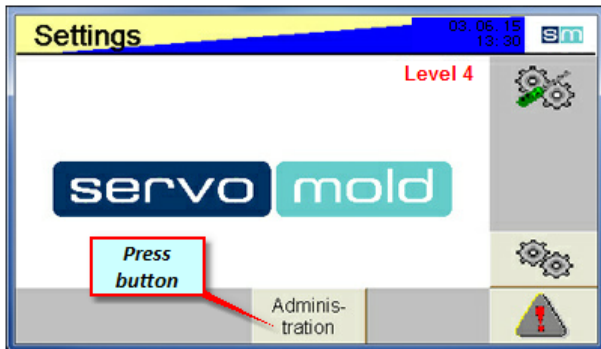


Fig. 18 Setting User level 6 - Drive inactive

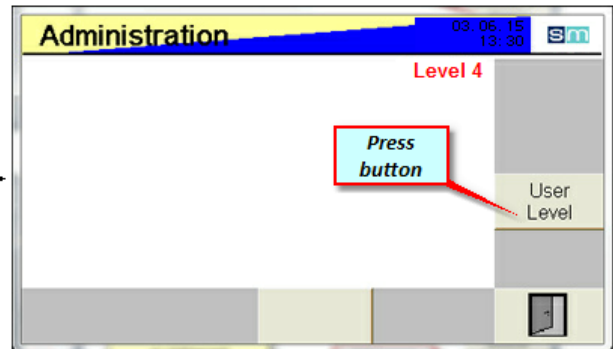


Fig. 19 Setting - Administration

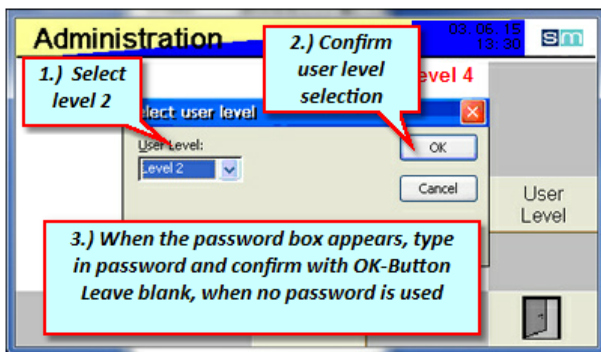


Fig. 20 Setting - Administration - Change user level

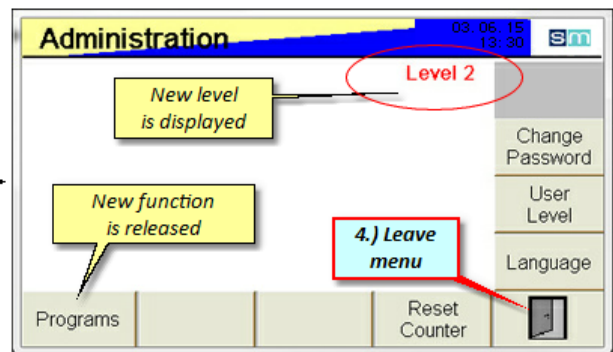


Fig. 21 Setting - Administration - User level 2

After leaving the administration menu you now have full access to the function for commissioning.

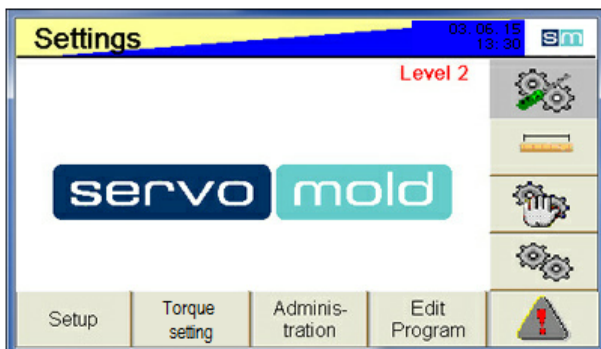
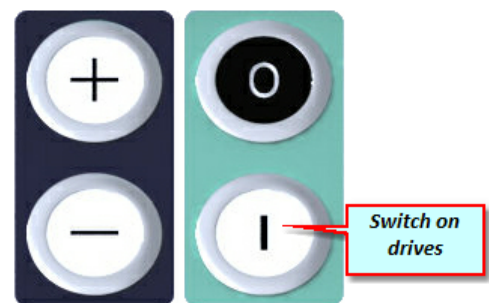


Fig. 22 Setting - User level 2 - Drive inactive



The yellow/blue flashing of the upper bar indicates that the drives are not active yet. Another indication of inactive drives is the flashing LED light strip at the front side of the device.

As soon as the drives are switched on (safety relay activated), the display changes to blue static.

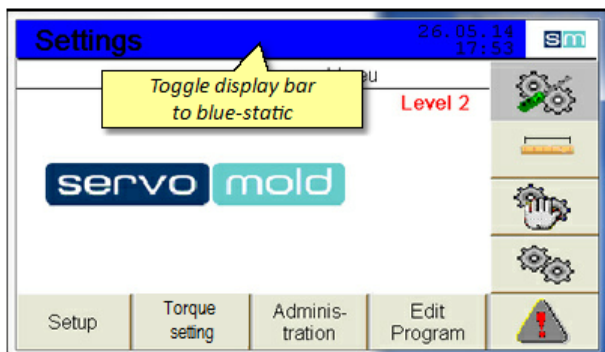


Fig. 23 Setting - User level 2 - Drive active

5.3 Basic settings

This chapter provides information on how to perform the basic settings for the Servo Control System, if no available program is loaded. In normal cases you will however access already existing programs and edit those. The basic settings must be carefully edited and checked even when using already existing programs!

In principle, the following settings are divided into the chapters [Motors](#) ⁴⁹, [Groups](#) ⁵⁰, and Quickset.

Whenever changes are made in the program sequence (e.g. the operator changes to the Setup / Motors or Groups menu), a yellow triangle appears on the settings button - this is the indication that, where appropriate, changes need to be saved. The software does not distinguish whether these changes were also carried out, and the short change in the group menu is seen as initiating a change and a yellow flashing triangle appears.

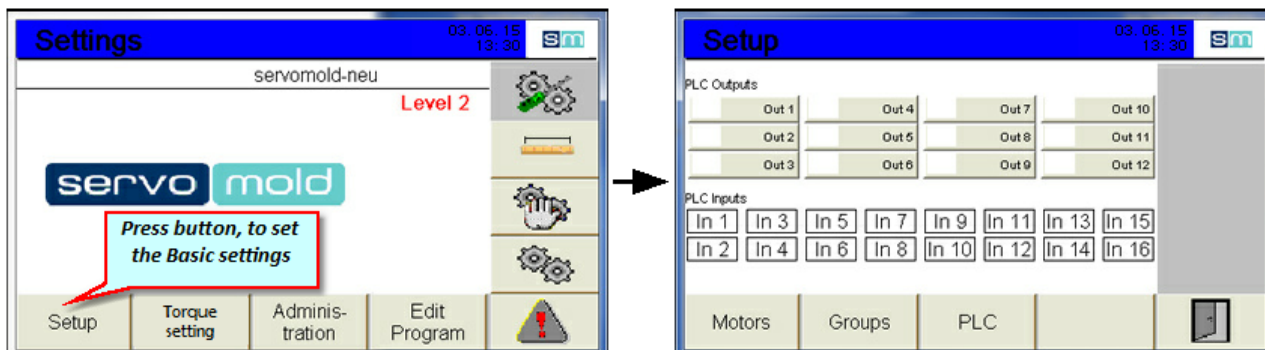


Fig. 24 Setting - Setup

5.3.1 Motor settings

This chapter provides information about the settings for the motors.

The motors connected to the connector sockets must be assigned to the respective program. If this assignment was performed once, it will be saved with the respective program and automatically performed during loading of the program.

Please check prior to starting the program if the assignment is still valid - if other motors are to be used, the selection of the motors must be re-entered.

By deactivating the axis (green checkmark is removed), a motor can be excluded from the movement of the group, for a particular purpose.

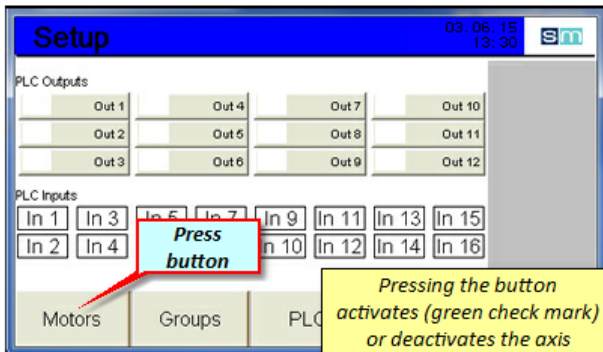


Fig. 25 Setting - Motors

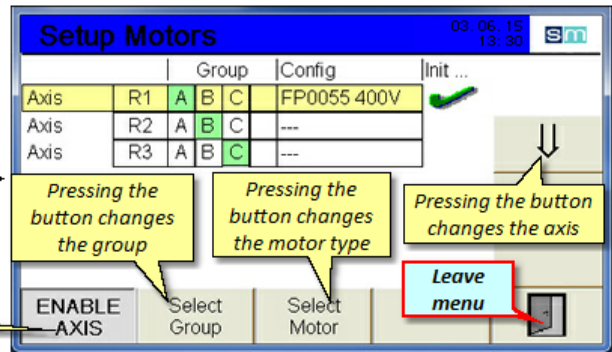


Fig 26 Set-up - Motors

5.3.2 Group settings

This chapter provides information about the settings for the groups.

A group is a collection of motors, if they are run synchronously. As soon as a motor is allocated to a group in the [Motor](#) menu, it "inherits" all parameters of this group.

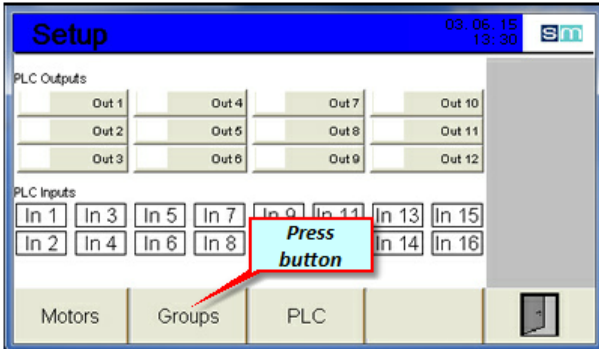


Fig. 27 Setting - Groups

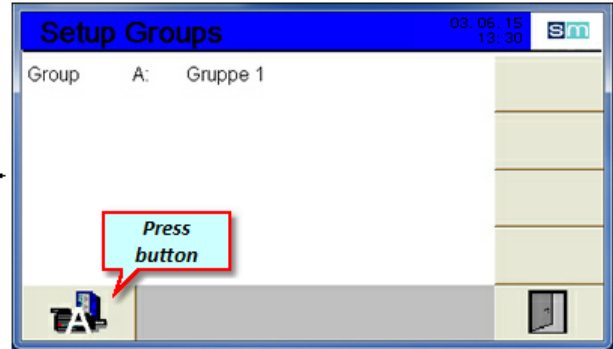


Fig. 28 Set-up - Groups

After switching to the respective group you are able to determine the valid settings and parameters for this group.

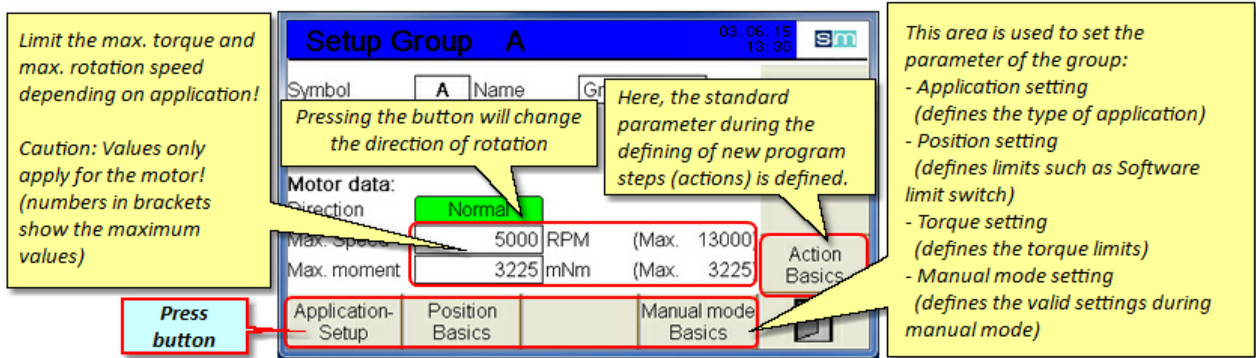


Fig. 29 Set-up - Group A

The direction of rotation is in principle pre-set to "Normal" - this means - when looking at the motor shaft, the positive direction of rotation is clock-wise.

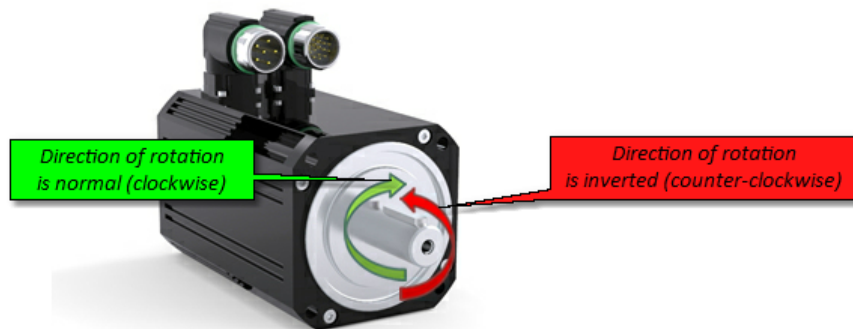


Fig. 30 Motor - Direction of rotation

Commissioning

5.3.2.1 Application settings

The application settings allow input of various parameters, to calculate the factor for the number of motor revolutions (resulting factor). Thus, it is possible for the later program, to operate with real values to approach the positions.

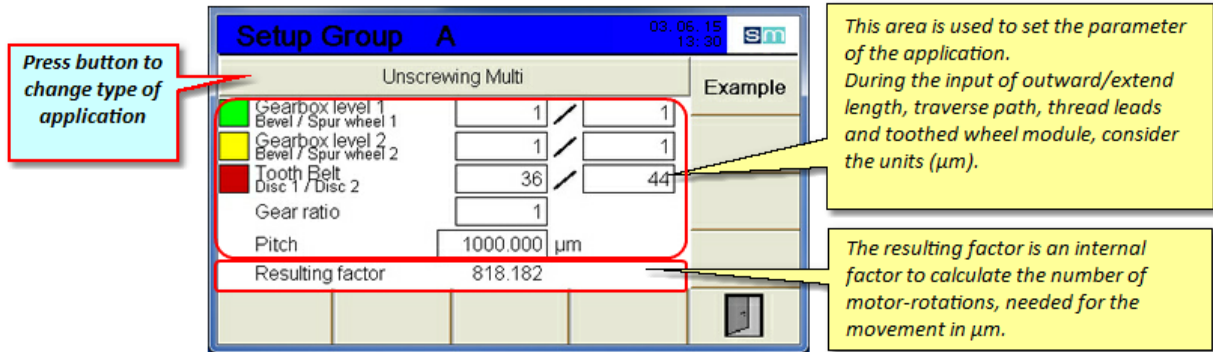


Fig. 31 Set-up - Group A - Multiple screwdriver

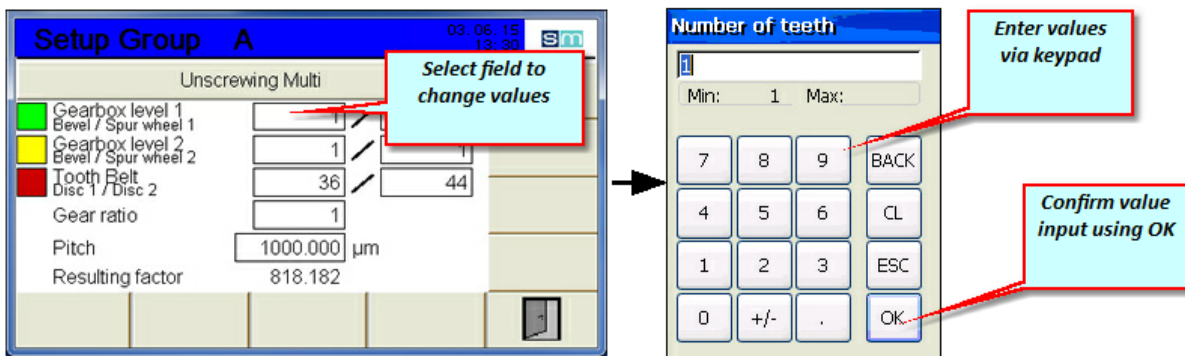


Fig. 32 Set-up - Group A - Unscrewing Multi - Value input

Depending on application, you can just enter the required parameter into the mask of the respective application type:

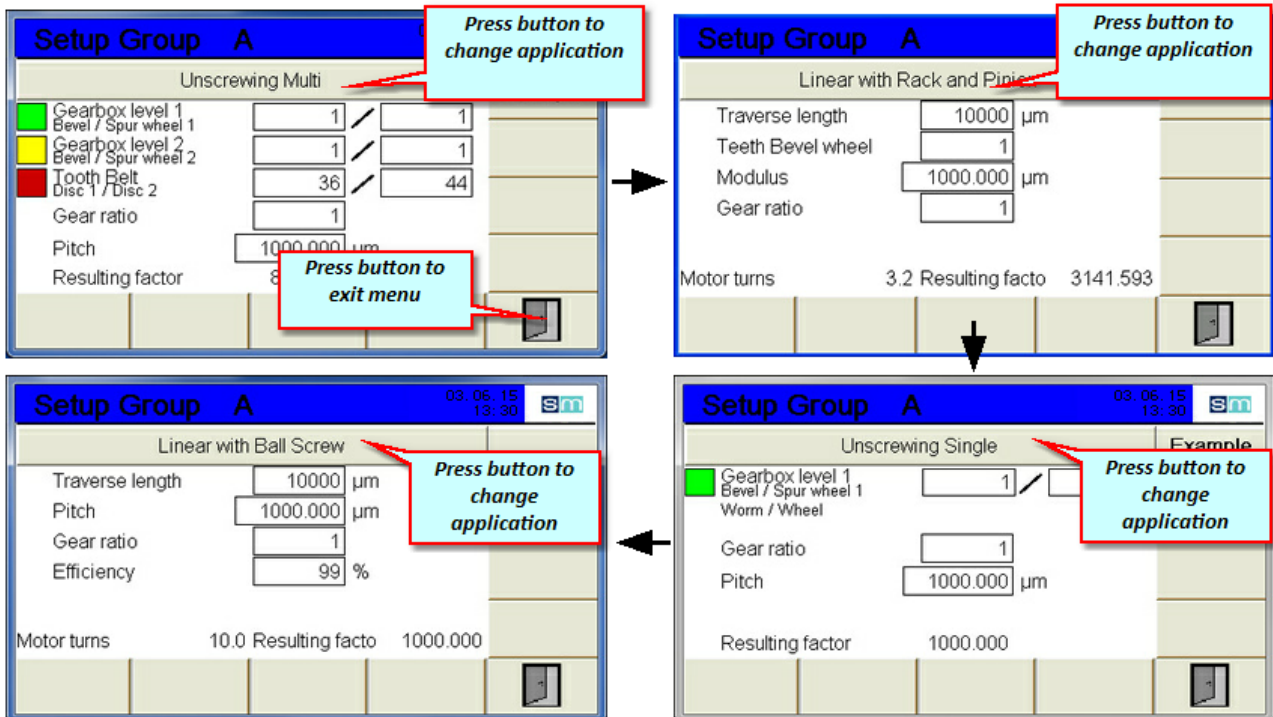


Fig. 33 Set-up - Group A - Change application

5.3.2.2 Position settings

Subsequently you can perform the position settings valid for the group. Via a value input on "Min. position limit" and "Max. position limit" the software limit switches can be defined. The drive will then not exceed these positions.

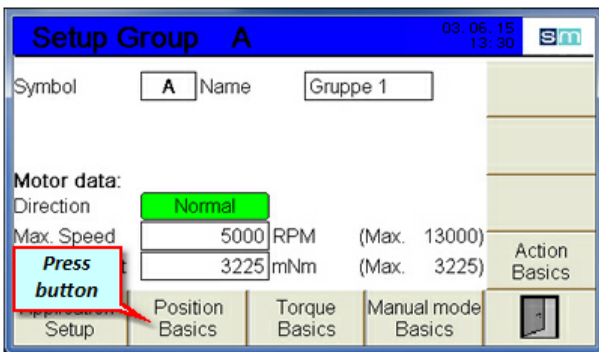


Fig. 34 Set-up - Group A - Change into position settings

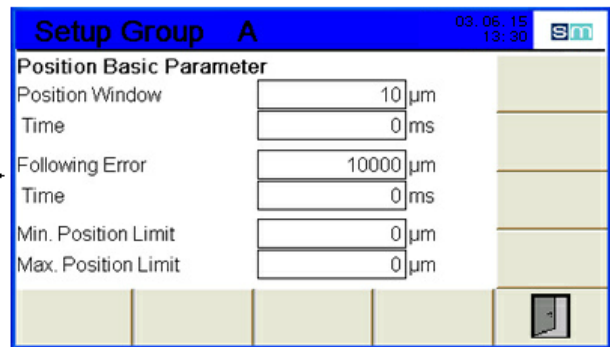


Fig. 35 Set-up - Group A - Position settings

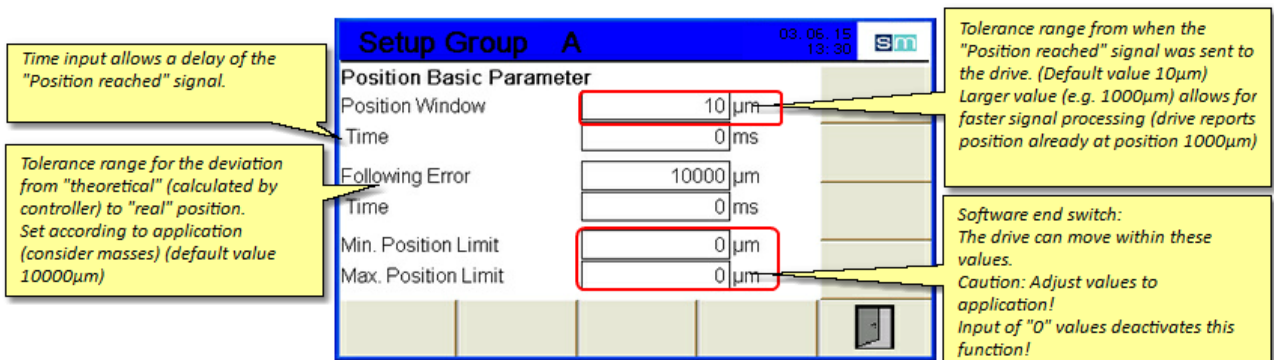


Fig. 36 Set-up - Group A - Perform position settings

5.3.2.3 Torque settings

The torque settings describe the limits of the torque and force monitoring.

Caution: These values are not intended to limit the torque or force, but only serve to monitor the actual applied torque (force), and to initiate appropriate actions when reaching these limits.

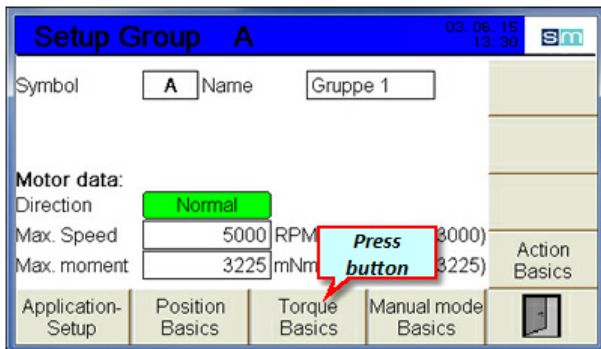


Fig. 37 Set-up - Group A - Torque settings

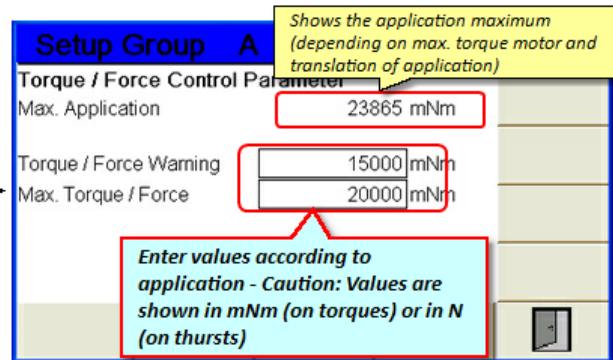


Fig. 38 Set-up - Group A - Torque monitoring

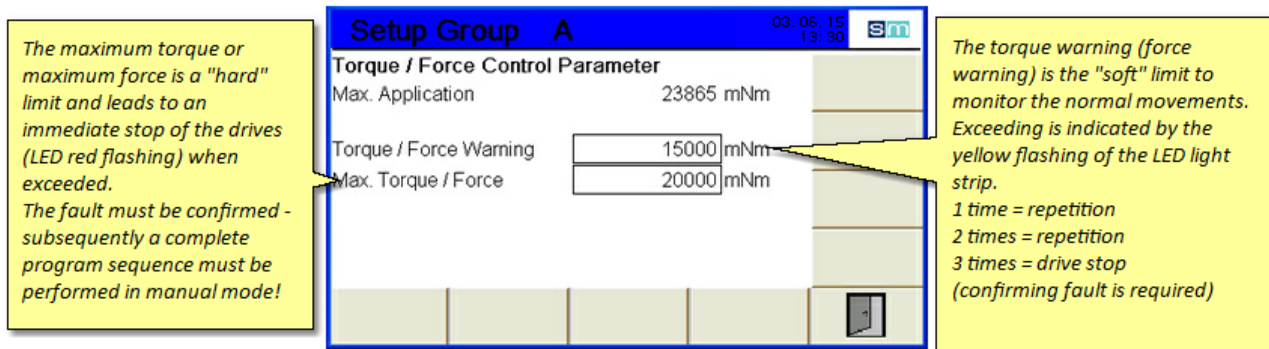


Fig. 39 Set-up - Group A - Perform torque settings

Exceeding the limits set by torque / force warning, still does not end the movement - an exceeding of the maximum torque (maximum force) stops the drive immediately.

Depending on the nature of the exceedance, an acknowledgment of the fault is necessary. This can only be carried out from user level 5 (operator 1) - thus, it is ensured that fault messages are not passed over without closer examination of the reason of the fault.

More information about confirming faults as well as a [List of possible faults](#) ⁹⁰ and their meaning can be found in the chapter [Faults](#) ⁸⁹.

5.3.2.4 Manual operation settings

The manual operation settings describe the valid parameters during manual operation. This applies primarily to the maximum allowed speed, acceleration and deceleration, and the maximum torque (in mNm) and the maximum force (in N) for the homing.

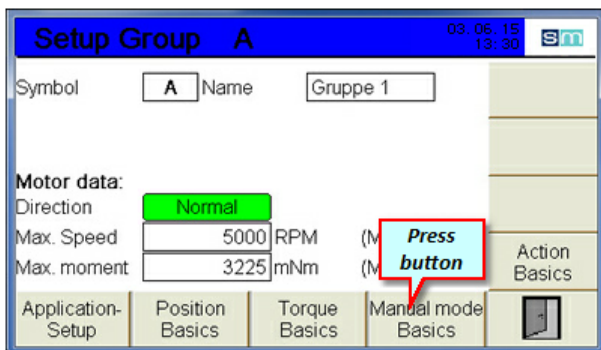


Fig. 40 Set-up - Group A - Switch to manual operation settings

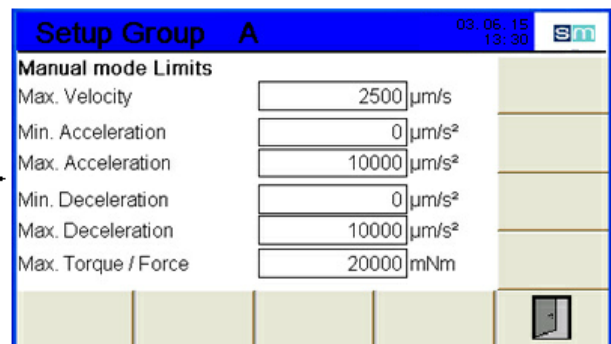


Fig. 41 Set-up - Group A - Manual operation settings

5.3.2.5 Action settings

The action settings are entered as default values when defining new program steps (actions) - this allows you to set "common" values (e.g. during acceleration and deceleration) so they do not always have to be entered again.

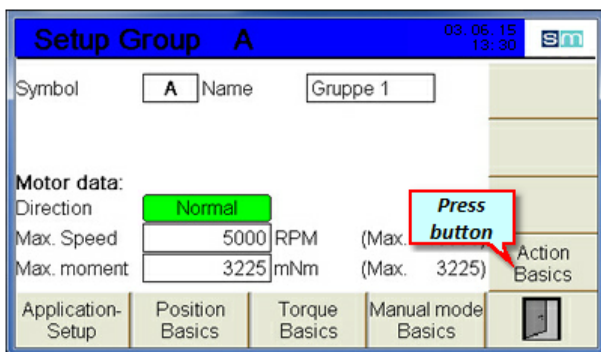


Fig. 42 Set-up - Group A - Change in action settings

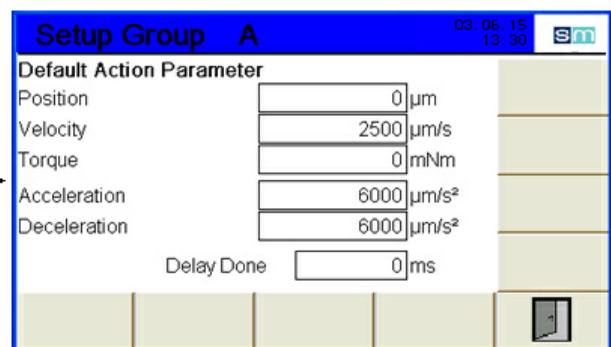


Fig. 43 Set-up - Group A - Action settings

5.4 Interface settings

Should a commissioning be performed on the injection moulding machine, then the interfaces of the injection moulding and the Servo Control System must be configured together.

The basic definition of the inputs and outputs takes already place during the configuration of the interface cable and the interface connector on the injection moulding machine. Now it must be checked, if the signals arrived, as required, at the Servo Control System as well as at the controller of the injection moulding machine.

For this, you have the possibility to check the inputs and outputs during setting mode / setup and set them manually to check the signal on the injection moulding machine.



Fig. 44 Setting- Setup

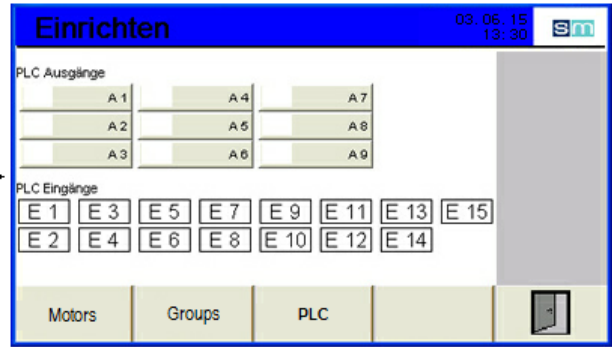


Fig 45 Set-up Input- Output signals

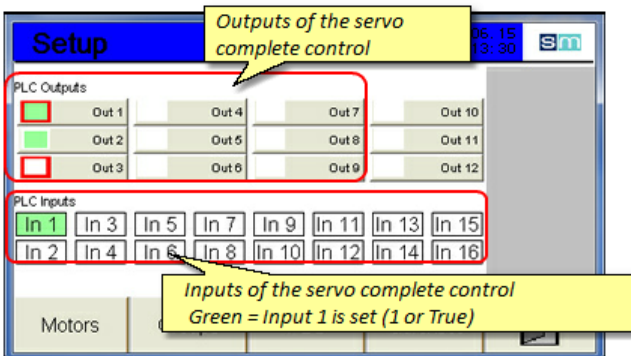


Fig. 46 Set-up Modify Input- Output signals

The outputs of the controller can be changed by pressing the respective output key.

- Green = output is set (1 or True)
- White = output is not set (0 or False)
- The standard state is shown without frame.
- The red frame indicates that the output was changed manually.

<input checked="" type="checkbox"/>	A 1	Output A1 was manually set to 1
<input type="checkbox"/>	A 2	Output A2 was set to 1 by the program
<input checked="" type="checkbox"/>	A 3	Output A3 was manually set to 0

5.5 Drive settings

Among the drive settings are the settings that control the behavior of the servo controller with respect to the mass inertia of the motor and load.

Whenever the control is operated by other motors or other tools, the response characteristics of the drives (servo controller) must be adapted to the changed situation by autotuning.

Since e.g. modified mass inertia exist (both from the motor, and on the load), the drive must e.g. provide more power to maintain the motor in position or to approach a position exactly.

Auto-tuning determined drive parameters are **written during the save of the program** to the permanent memory of the drive and are available from this point on, even long after a restart of the controller.

Only when another drive or a modified mechanism is used (other tool), the auto-tuning has to be performed again.

	NOTICE!	<p>Autotuning</p> <p>Wrong parameter values (application settings, max. Torque motor, etc.) distort the result of autotuning!</p>
<ul style="list-style-type: none"> • For autotuning use the settings (parameters) of your application! • Provide all mechanical conditions which are used later in your application. • Perform autotuning on completely assembled and operational ready drive. 		

You should also read the information in the installation and operating instructions for the individual drive units.

5.5.1 Autotuning

During the following situation autotuning should or must be performed:

- Should - **After** a complete **maintenance** of the tool, since the mechanical characteristics might change.
- Must - **Same drive** but **installed on other tools**.
- Must - Always when the **control is operated on another tool** (other drive).

The most used standard for the settings is as following:

- **Position type** - Overshoot (force the motor to stop exact on the desired position)
- **Filter type** - Max stiffness (helps to get a setting where the motor is a bit more "aggressive")
- **Bandwidth** - Low

If the result is not as desired (motor to aggressive - starts to drone) you can set **Filter type** to "Standard"

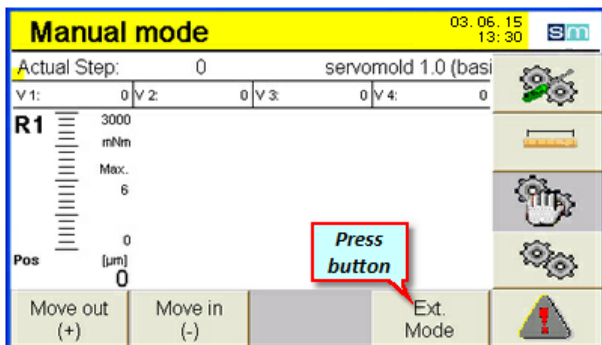


Fig. 47 Setting- manual operation

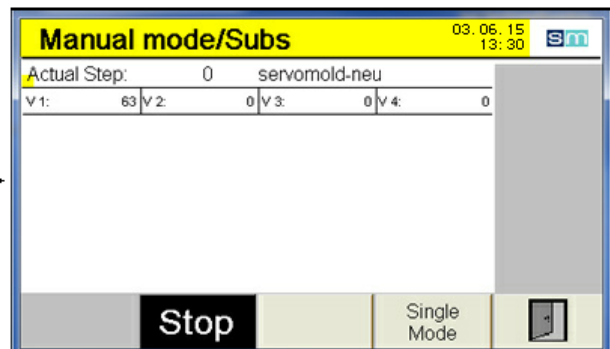


Fig 48 manual operation - ext. Mode

As soon as you switch to manual operation, the colour of the menu as well as the LED light strip changes to yellow - this is the indication that the drives are now under power

In order to auto-tune the drives, you can switch to the Ext. Mode, Single Mode and select the appropriate axis (A) by pushing the button. By pressing the auto-tuning button you reach the sub-menu auto-tuning.

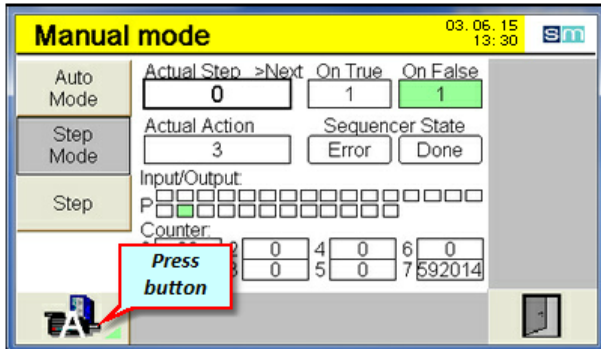


Fig. 49 Setting- Manual operation - Expanded mode

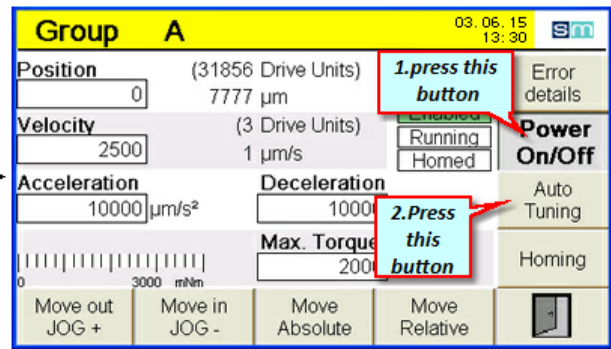


Fig. 50 Manual operation - Jog mode

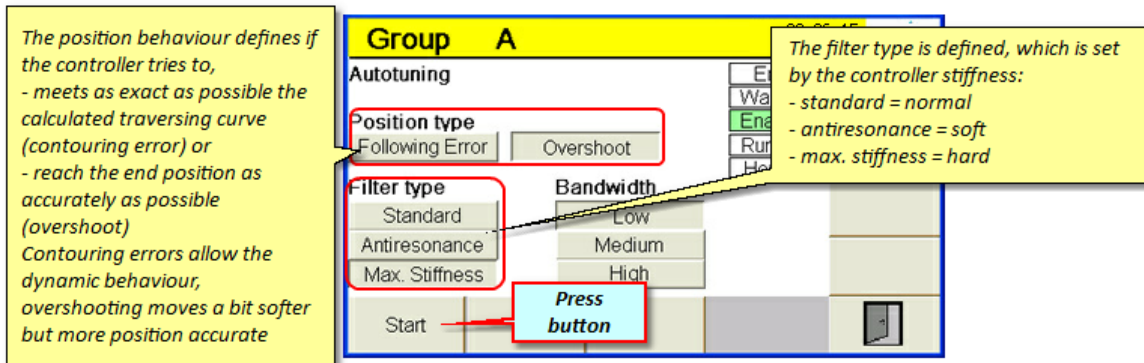


Fig. 51 Auto-tuning settings

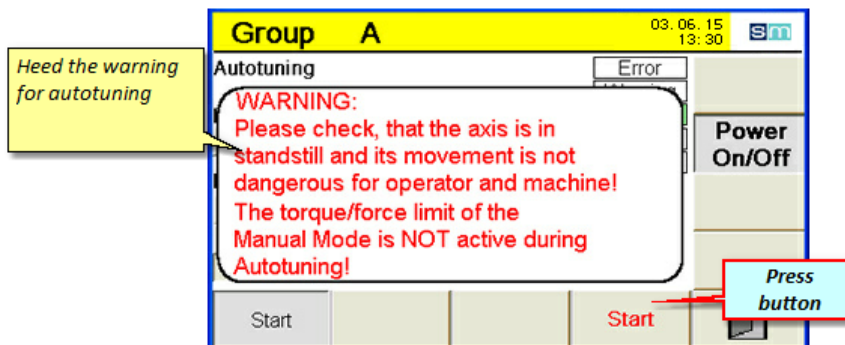



Fig. 52 Start auto-tuning

5.6 Move axes

After the basic settings have been completed, the drives can already be moved manually. Please ensure that with a non-homed system, the software limit switches are disconnected from power. Move only slowly and with little force. ATTENTION: Keep in mind, that on too low delay values an overtravel of the drives can happen!

	NOTICE!	<p>Not-homed</p> <p>Move the drives especially careful, if it is a not-homed system, to avoid property damages!</p>
<ul style="list-style-type: none"> • Wrong parameter values can damage your tool - check all values before you move the drives. • In a not-homed system the software limit switches are inactive - make sure that you do not exceed the mechanical limits! 		

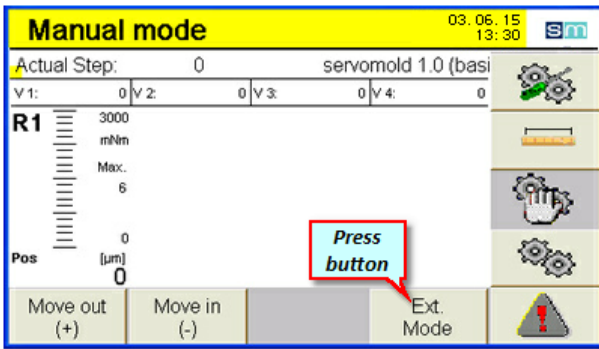


Fig. 53 Setting- manual operation

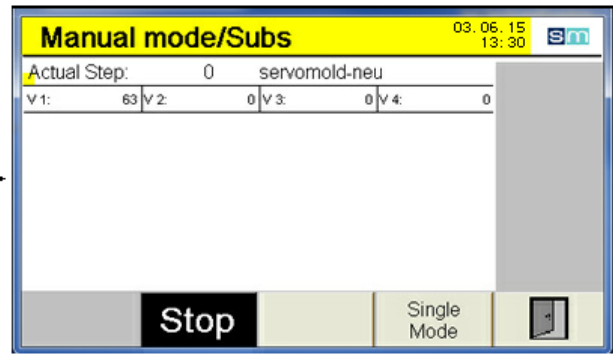


Fig 54 Manual operation - Extended Mode

As soon as you switch to manual operation, the colour of the menu as well as the LED light strip changes to yellow - this is the indication that the drives are now under power

In order to operate the drives in manual operation, you can switch to the Ext. Mode, Single Mode and select the appropriate axis (e.g. A) by pushing the button.

Prior to the movement check the set parameter again (especially speed, acceleration, delay and max. torque/force). During the first travel use only very low values for speed and for max. torque / force to prevent damage to the mechanism. The values should not be too low, for the acceleration and deceleration, in order to avoid overrun the position.

Pressing the JOG + and JOG button (or the + and - buttons on the front panel), you can now freely operate the drives.

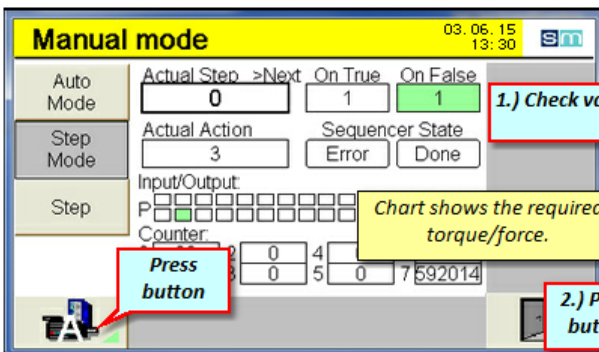


Fig. 55 Setting- Manual operation - Single Mode

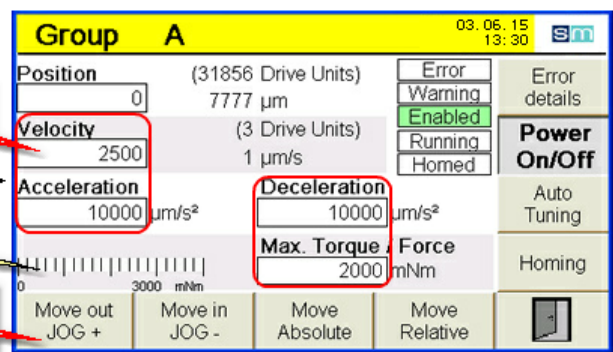
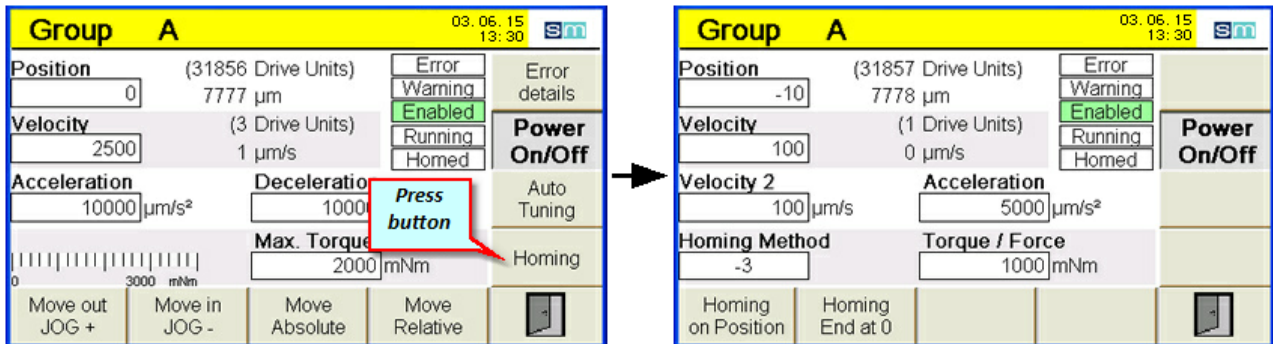


Fig. 56 Manual operation - Jog mode

To get an indicative value for subsequent homing, you should record the necessary torque / force, in which a travel of the drives in idle is possible. The torque or force for the homing should be above in order to ensure safe homing.

5.6.1 Homing the axis

Change in the respective menu for the homing:



All values relevant for the homing are set in this menu. Make sure when you enter the torque or force that the drive can build up enough strength to even reach the safe end position (stop position).

If torque or force is set too low, the system assumes that the stop point (mechanical stop) was already achieved - this can lead to, that home point and stop point are not matching.

Be careful when specifying the position value that, depending on homing method used, the correct sign is used!

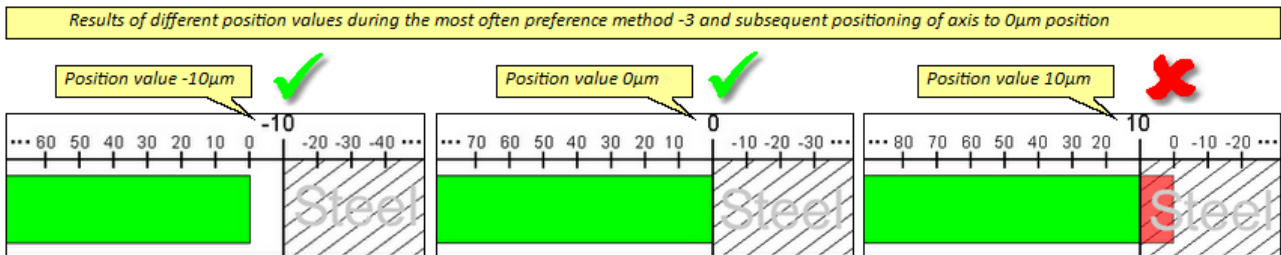


Fig. 57 Program example - Homing - Position values

	NOTICE!	<p>Homing values</p> <p>Prior to starting the homing, check the values for position, speed, acceleration and max. torque as well as homing method</p>
<ul style="list-style-type: none"> • Wrong parameter values can damage your tool - check the values prior to starting the homing. • Ensure that the correct position values are entered acc. to the homing method! <ul style="list-style-type: none"> - 3 (mechanical stop in negative direction) = 0 or negative value as position value - 4 (mechanical stop in positive direction) = 0 or positive value as position value 		

By entering a value in position, you tell the system which position value is present during mechanical stop. Example: -10 means that the home point in the homing method (-3) is around -10µm behind the reference surface. Since the drive in normal program sequence moves to position 0 it has thus 10µm clearance to the fixed stop.

Enter the values that apply for the homing process.

Common values:
 -3 = mechanical stop - negative motion(-)
 -4 = mechanical stop - positive movement (+)
 35 = home point at current position

Pressing the power On / Off button sets drive to "Ready" (green) or switches it off. (Also for stopping the homing)

Enter the method of homing and the torque or the force.

Pressing the button starts the homing - axis stays on the position value (e.g. -10)

Pressing the button starts the homing - axis moves subsequently to position 0.

Fig. 58 Set-up - Manual operation - Homing - Ready

The current position is shown here.

Axis is shown as "in operation" (green)

Fig. 59 Set-up - Manual operation - Homing

On a homing process started with the "Homing End at 0" button the displayed position is then 0 µm instead of -10 µm

The axis is shown as homed (green)

Fig. 60 Set-up - Manual operation - Homing axis

After homing the drives the [Software end switch](#) ⁵² can be used to limit the movement of the axis.

	INFO	<p>Software end switch</p> <p>Software limit switches allow you to limit the range of movement - it can avoid unwanted movements across limits.</p>
<ul style="list-style-type: none"> Limit the travel range of the drive by setting the limits in the menu: Set group / position setting / min. - max. position limit. The range of movement defined by the software end switch is always relative to your home point. Always home the axes first before you move it. 		

5.6.2 Move axis

Now you are able to move the axis within the limits of the software end switch and thereby check the mechanical sequences.

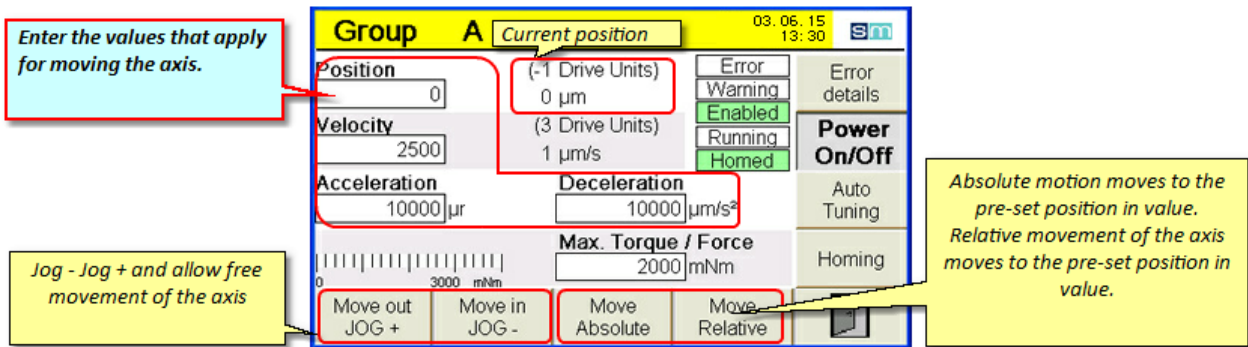


Fig. 61 Set-up - manual operation - Jog operation

In addition to the Jog button on the touch screen the Plus/Minus button on the control can also be used. The drive moves as long as the button is pressed - when you release the button, the drive stops (note the set acceleration and deceleration, and consider this with the manual method).

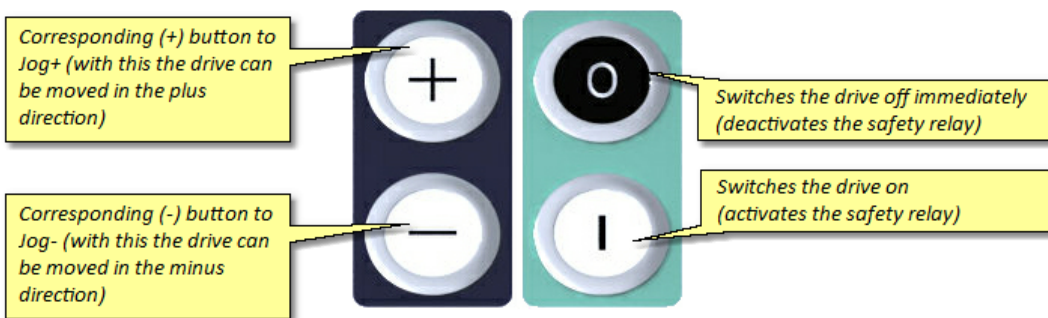


Fig. 62 Controller operating button

5.7 Edit programs

This chapter provides information for creating (editing) programs. The previously made basic settings form the basis for the following programs. Entirely new programs can be created and existing programs can be changed (the most common way to create a program).

Further information on the structure of the programs can be found in the chapter [Programs](#).⁸²

Ensure that the programs that have been changed or newly created are saved via the [Administration](#)⁶⁶ program, to ensure that the actual settings are not lost.

	NOTICE!	<p>Wrong machine parameter</p> <p>Wrongly set machine parameter can lead to property damages to the Device (Servo Control System) or on the injection moulding tool.</p>
<ul style="list-style-type: none"> • Setting the machine parameter and commissioning may only be done by experts! • Note the information about maximum rotation speed/max. torque of the drive/transmission combination used! • Only set the machine parameter using the manufacturer installation and operating instructions for the drive/gear combination! • Ensure that only the program for the respective injection moulding tool is loaded! 		

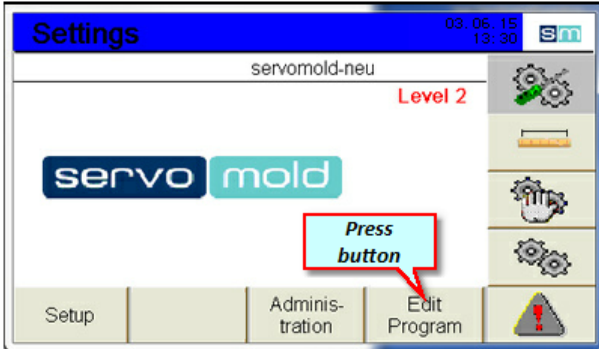


Fig. 63 Setting - Edit, change in program

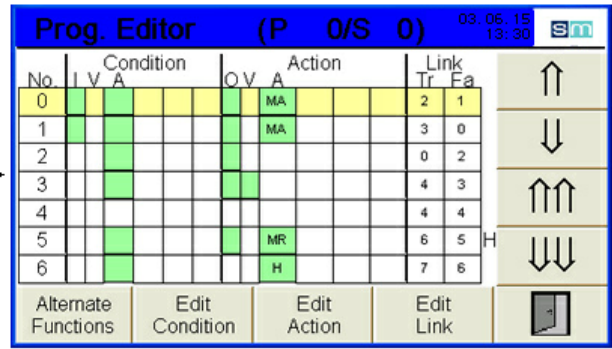


Fig. 64 Program editor - Overview window

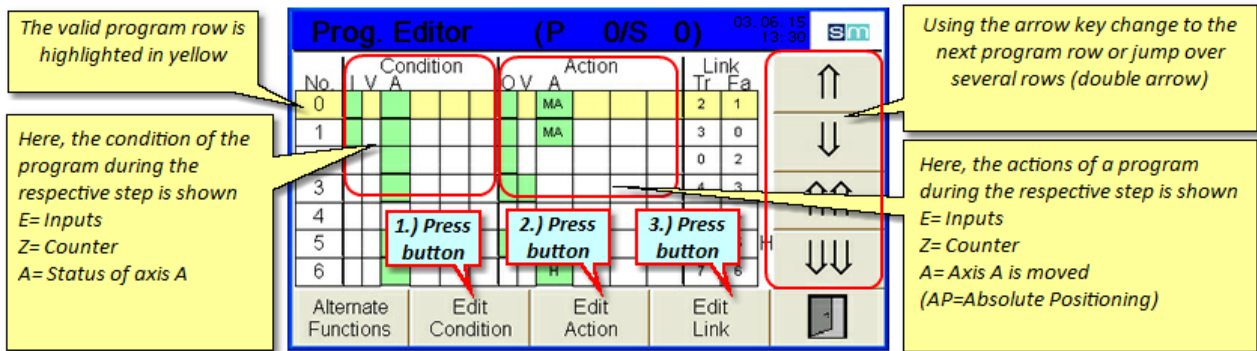


Fig. 65 Setting - Program editor

5.7.1 Conditions

The condition editor shows what conditions must be met to perform the settings in the action field.

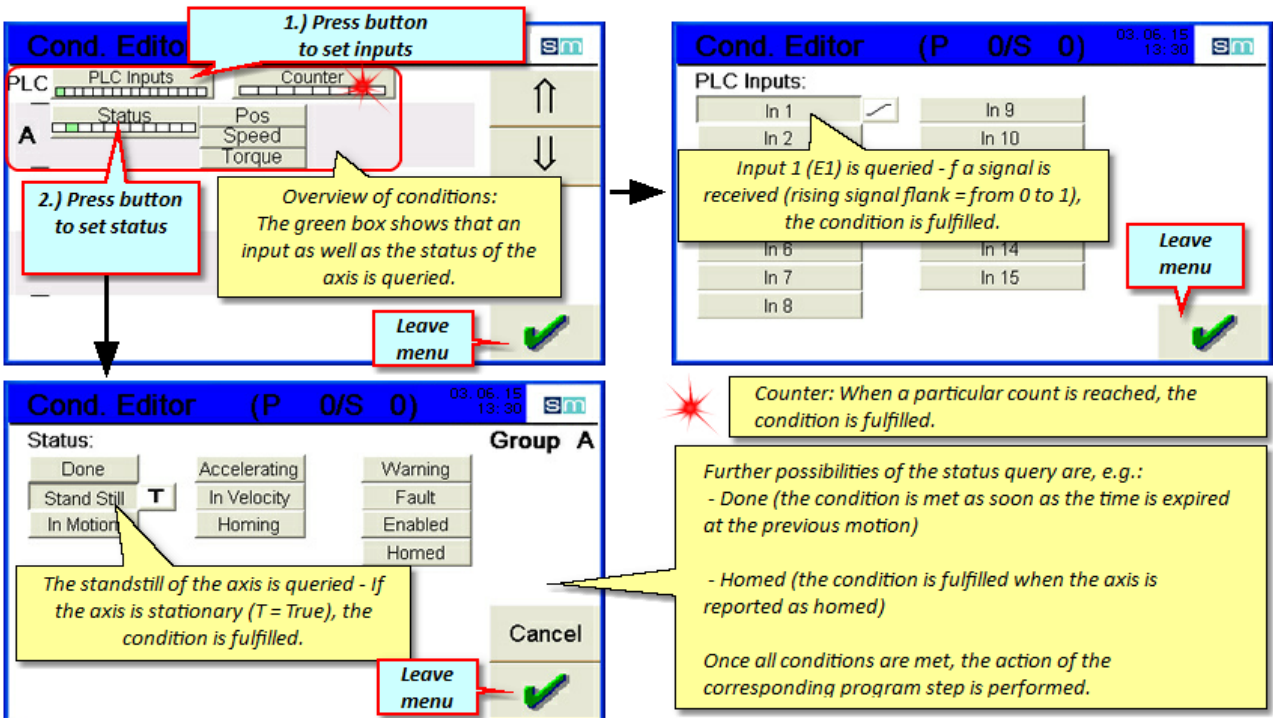


Fig. 66 Condition editor

5.7.2 Actions

The action editor allows you to set different actions - a prerequisite for starting the action is the fulfillment of the conditions in each program step.

An action can e.g. be the move to a certain position, but also the stopping of a drive or performing a homing.

Fig. 67 Action editor

CAUTION: The set delay interval "Done" is only effective when the next (following) condition in the axis status checks the "Done" signal.

Fig. 68 Condition editor - Status - Done

5.7.3 Links

Links refers to the objective of a condition, depending on whether this is reported as completed (T = True) or not completed (F = False). The target of the link here is the specified program line (No. 0,1,2, etc.)

No.	Condition			Action			Link	
	I	V	A	O	V	A	Tr	Fa
0							2	1
1						MA	3	0
2							0	2
3							4	3
4							4	4
5						MR	5	H
6						H	6	6

The links show which program step is performed when conditions are met (T=true) or not met (F- false). This means that if the condition in step no. 0 are not met, the program jump to step no. 1. If the condition at step no. 1 are not met, the program jump back to step no. 0 - and so on... As soon as the conditions in one step are fulfilled, the program jump to the link destination Tr (True). This condition is checked every 50ms - thus, further conditions can be checked during an action. (e.g. input 1=False, to stop the motors immediately during signal drop)

Fig. 69 Program editor - Links

Fig. 70 Program editor - change link target value

Fig. 71 Program editor - Link target - numerical

Using the links, the programs can be structured and divided into program blocks - thus it is possible to query in the first program lines conditions which can depending on status, jump to a certain program block. E.g. automatic homing (program checks whether the axis is reported as homed - if not, an action "homing" is performed, which begins in the main program as a sub-program in a corresponding program line. If the axis is reported as homed, the program skips this action and immediately begin the actual movements)

Thus programs of varying complexity can be created, which respond to diverse situations and thus lead to a safe running of the program.

5.7.4 Sub-programs

Using Sub-programs you can program special procedures and functions. This can, for example, be the start of a basic position or even a special homing.

The respective sub-program is started in the editor after an empty program line. It ends by an empty line. Using the "edit link" the subroutine is then named and assigned with a program number.

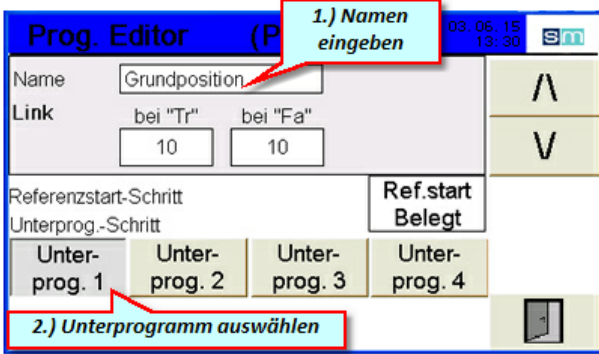


Fig. 72 Program editor - Define Sub program

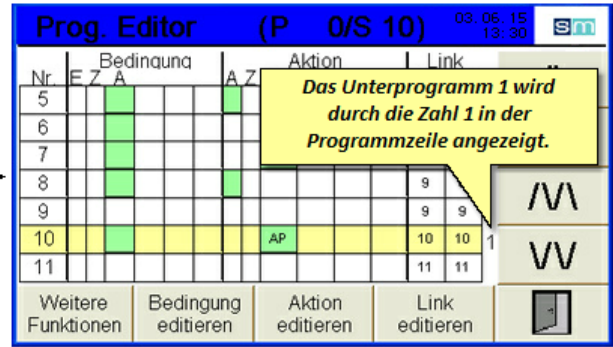


Fig. 73 Program editor - Sub program

The sub program is shown in the Manual Mode / Ext. Mode and can be chosen there.

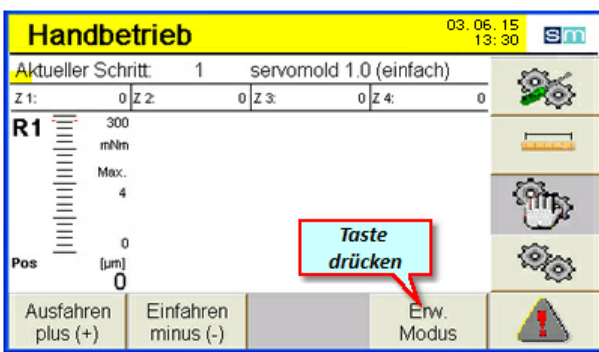


Fig. 74 Manual Mode - Ext. Mode

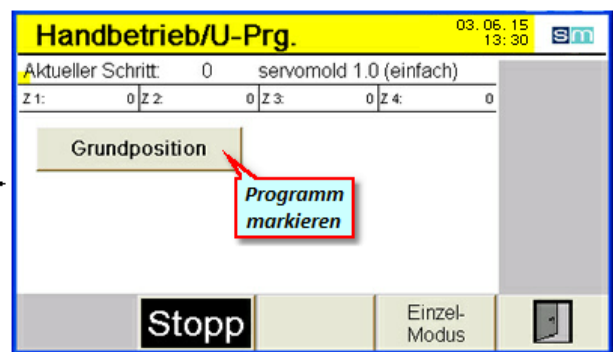


Fig. 75 Manual Mode - Choose sub program

The chosen program can then be started.



Fig. 76 Manual Mode - Start sub program

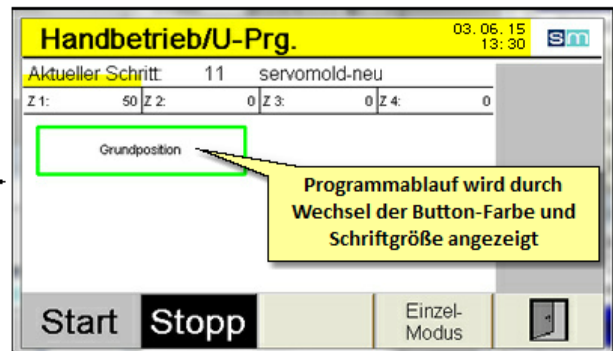


Fig. 77 Manual Mode - run sub program

5.7.5 Editor of further functions

Possibilities are provided under "More functions" to copy individual program rows (program steps), to insert them, newly create or also delete. There is furthermore an "Undo" function that can reverse and accidental action.

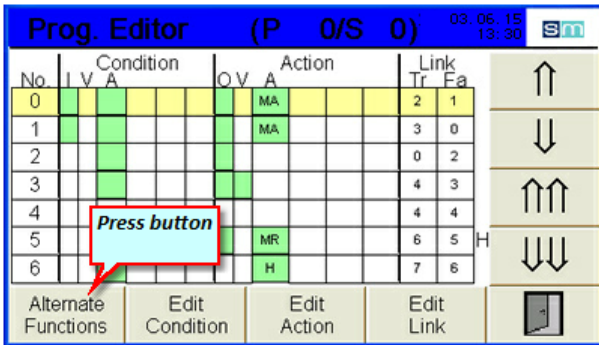


Fig. 78 Program Editor - Switch to more functions

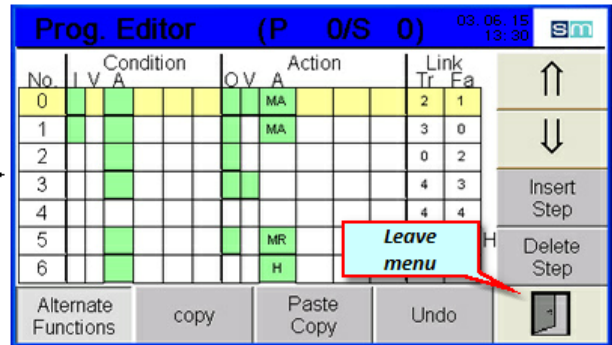


Fig. 79 Program Editor - More functions

	INFO	<p>Insert copy</p> <p>This command allows you to insert a previously copied step anywhere.</p> <ul style="list-style-type: none"> Before you insert a copy of another step, you need make space for this step at the desired location ("New Step"). Otherw ise, the program step w here you insert the step is overw ritten.
--	-------------	--

5.8 Administer programs

For the administration of programs both internal and external (USB) storage locations are available. The internal storage options currently include 10 memory locations- externally any number of programs can be stored on a USB stick.

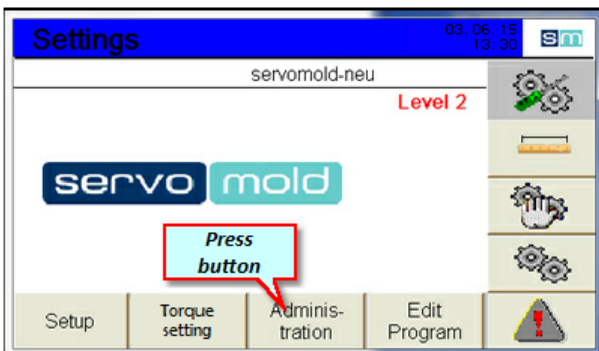


Fig. 80 Setting - Administration

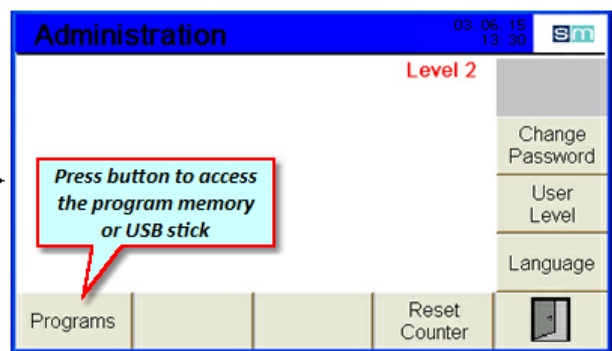


Fig. 81 Administration

5.8.1 Save programs

When new programs were created or existing programs were modified, these programs must be saved. If you do not save the program after the change of values or parameters, then those changes are lost when you turn off the controller.

To change the name of the program you simply select the program using the arrow keys (yellow) and press the button "Edit Name"

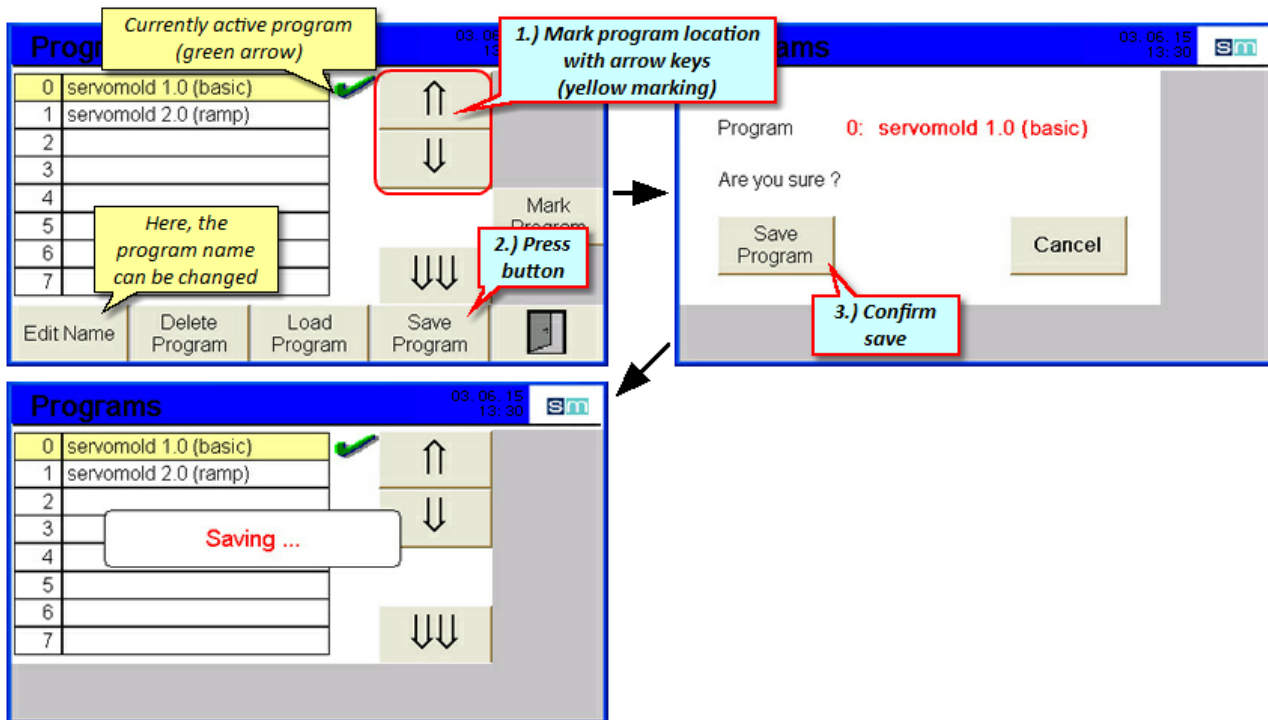


Fig. 82 Save programs

5.8.2 Create new program

To create a new program select the next empty memory space (yellow marking) and press the "Edit name" button. Subsequently you can save the current (located in the memory) program under a new name.

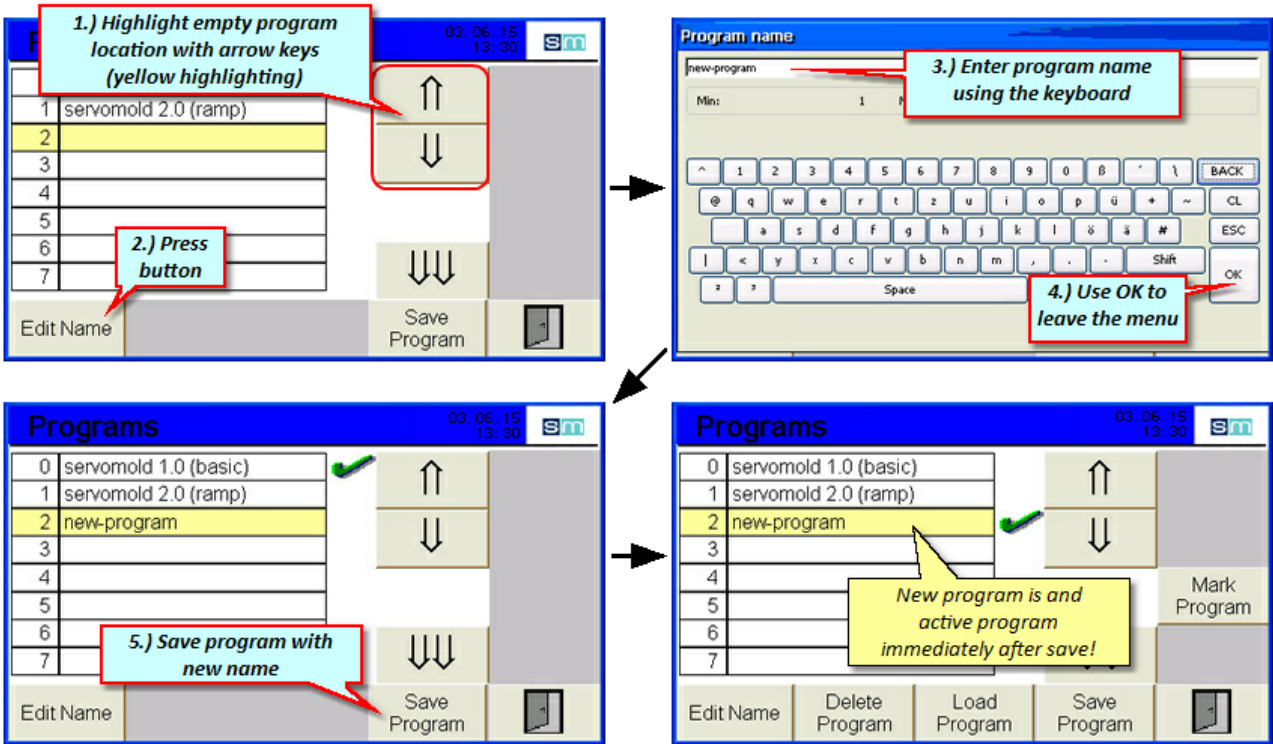


Fig. 83 Create new program

5.8.3 Load programs

When switching on the controller, the last valid program is always loaded - Should there have been changes performed on the program, then they are also loaded. If the changes had not been saved previously, then they are lost when loading the program.

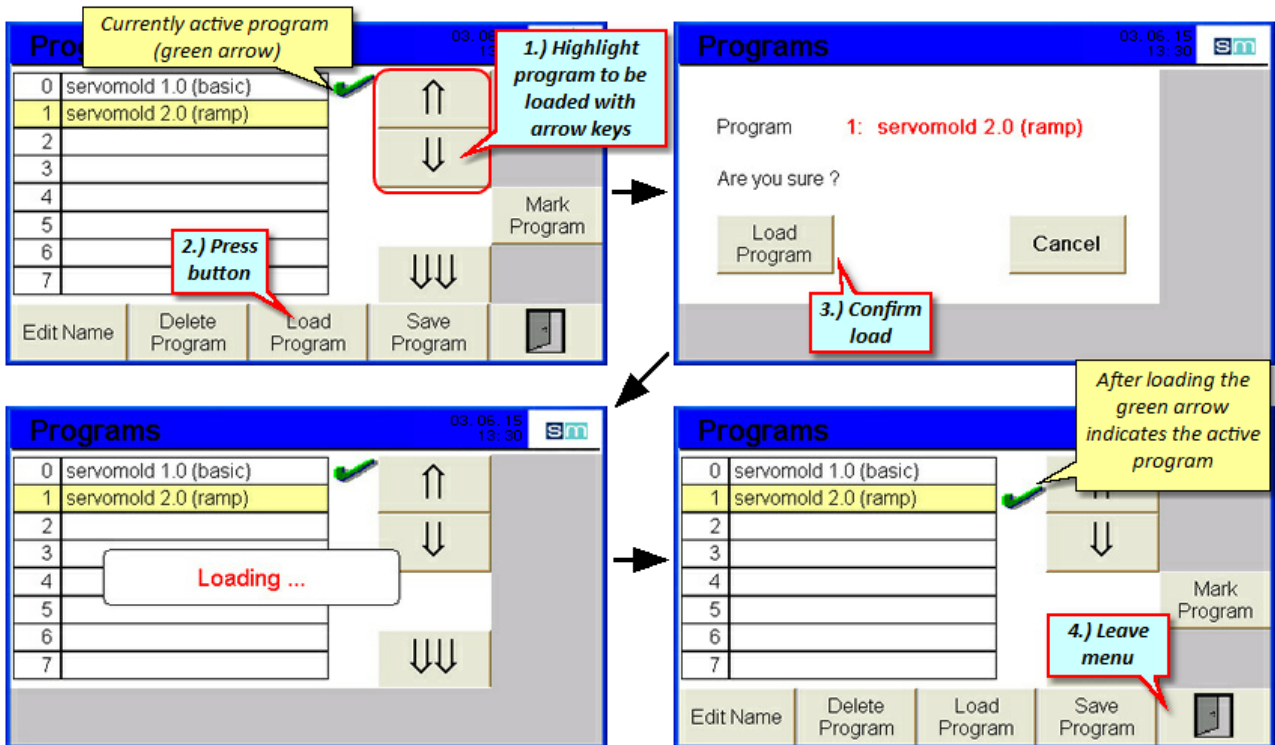


Fig. 84 Load programs

5.8.4 Delete programs

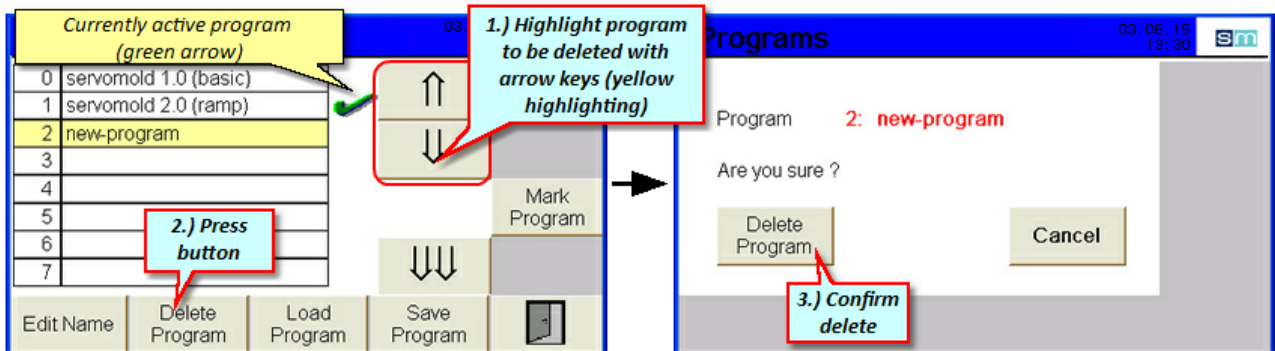


Fig. 85 Delete programs

5.8.5 Backup programs

To backup all programs in the internal memory, insert the USB stick in the USB connection at the front side of the device. Subsequently the "Backup" button appears in the menu at the top left.

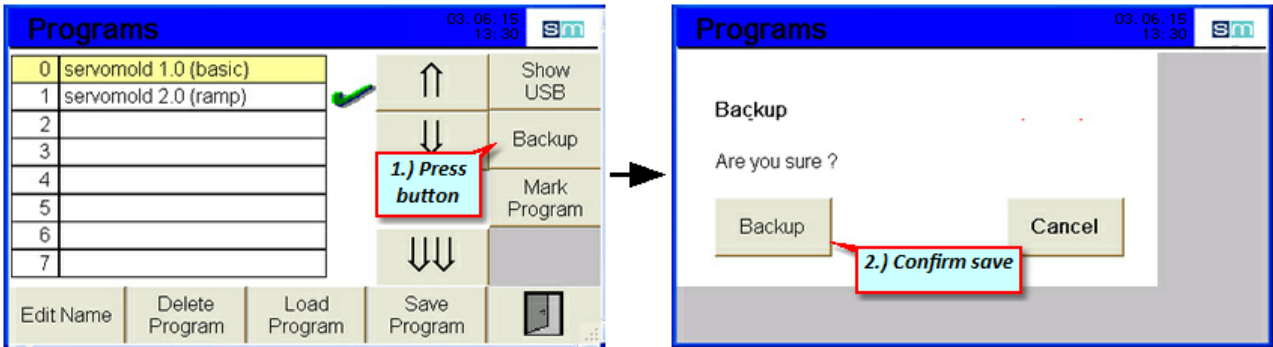


Fig. 86 Backup

5.8.6 Programs on USB

If an USB stick is connected an additional function appears in the program menu - With this you can display, rename or delete programs located on the USB.

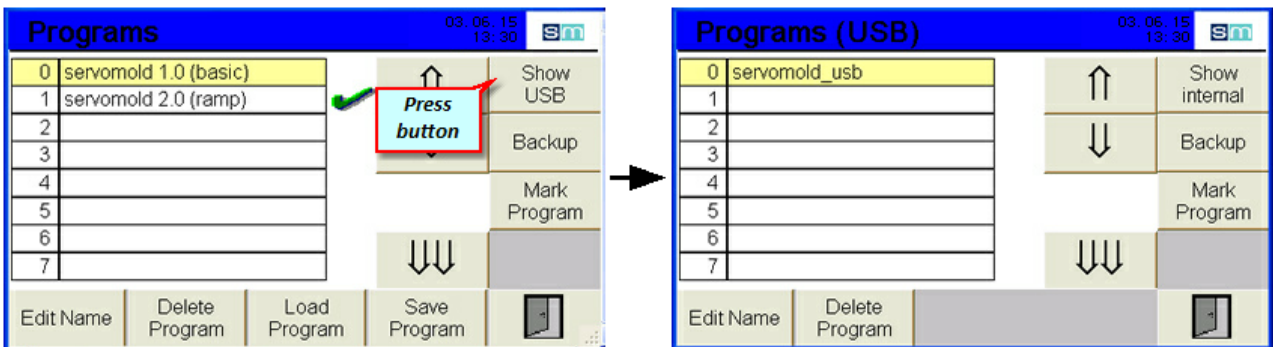


Fig. 87 Programs on the USB stick

5.8.7 Copy programs from USB

To copy a program from an USB stick to the internal program memory, mark the program first. Subsequently copy to an empty memory place.

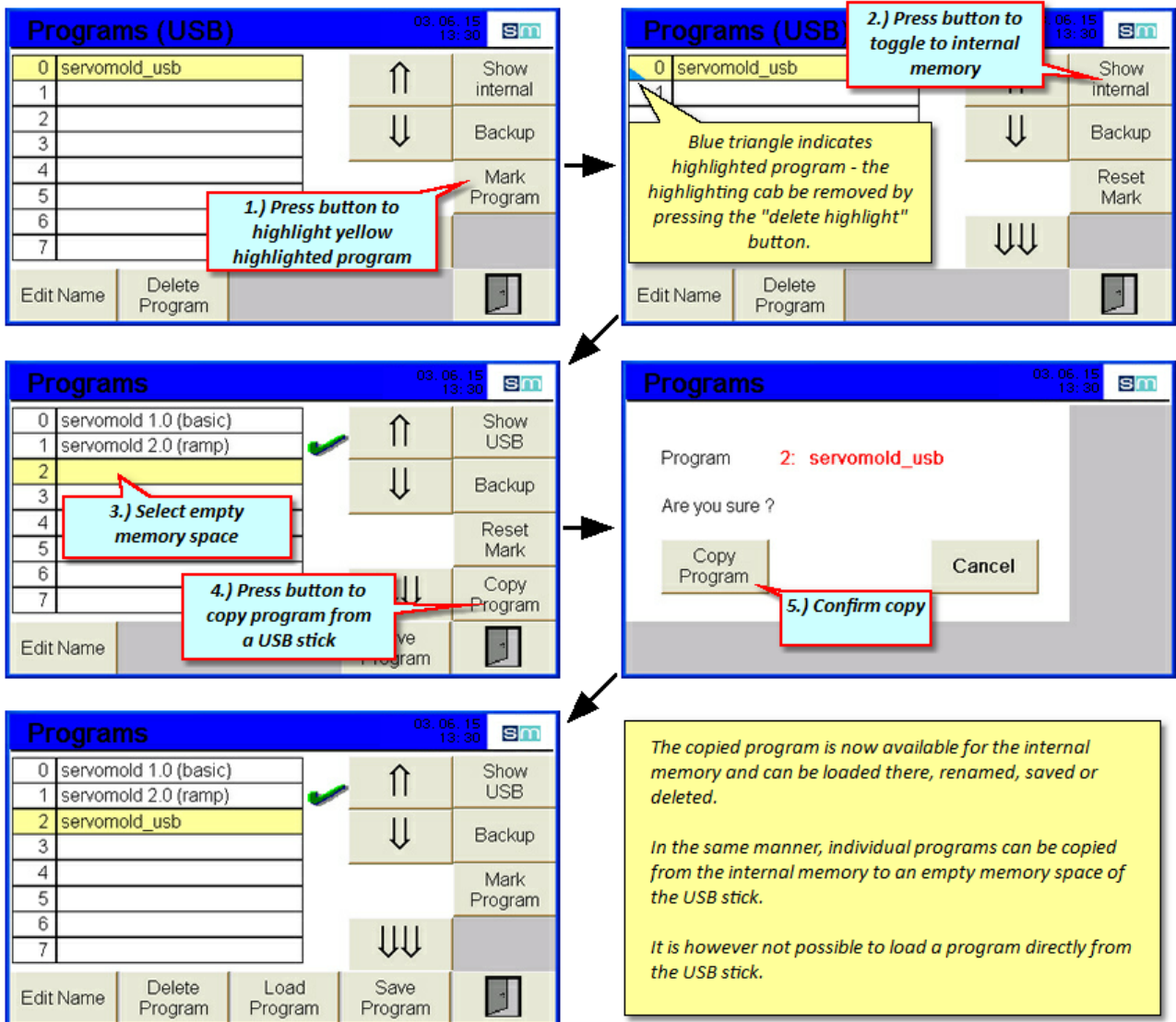


Fig. 88 Copy programs from USB stick

Chapter

6


6 Operation

This chapter provides information about the "normal" operation of the Servo Control System. The functions described here can be performed on user level 4,5 and 6.

All further functions such as traversing the drive in Jog mode or editing programs, require user level 2 or 3. Information about the functions can be found in chapter [Commissioning](#).⁴⁵

Heed the safety information provided in chapter [Safety](#)¹² as well as the notes about [Authorized operating personnel](#)¹⁷, about [Safety devices](#)¹⁴ and [Work stations](#)¹⁶.

Ensure during loading of programs, the program suitable for the particular tool is loaded!

	NOTICE!	<p>Wrong machine parameter Wrongly set machine parameter can lead to property damages to the Device (Servo Control System) or on the injection moulding tool.</p>
<ul style="list-style-type: none"> • Setting the machine parameter and commissioning may only be done by experts! • Note the information about maximum rotation speed/max. torque of the drive/transmission combination used! • Only set the machine parameter using the manufacturer installation and operating instructions for the drive/gear combination! • Ensure that only the program for the respective injection moulding tool is loaded! 		

6.1 Switching on

During the switch-on of the Servo Control System at the mains switch, the PLC control is started. The booting process takes about 1 minute - subsequently you find the following start screen

User level 4 is pre-set and allows only limited access to the control functions.

In case you are starting the control for the first time, please read the information found in chapter [Commissioning](#) ⁴⁵. If you have performed commissioning before, or you like to operate the control in normal mode, then you should first change to user level 4 (setter) to load the correct program.

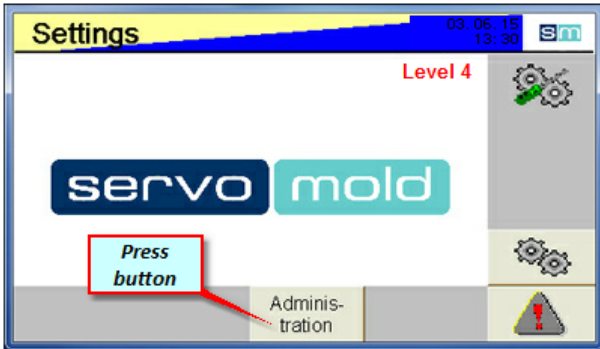


Fig. 89 Setting User level 4 - Drive inactive

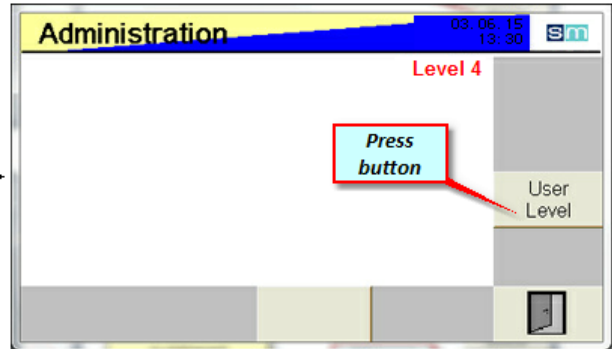


Fig. 90 Setting - Administration

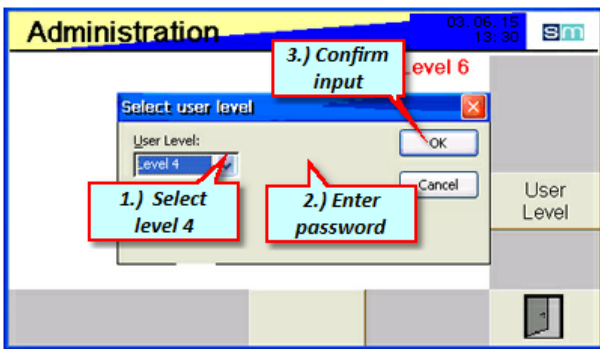


Fig. 91 Setting - Administration - Change user level

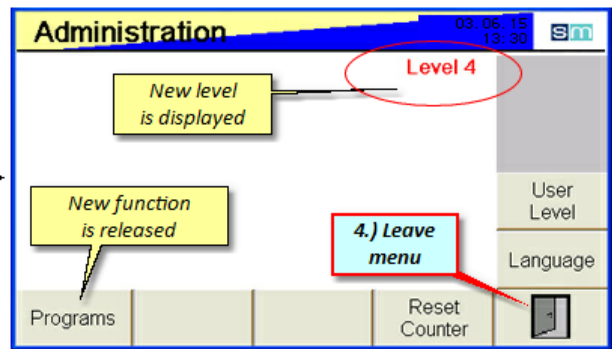


Fig. 92 Setting - Administration - User level 4

After leaving the administration menu you now have access to the function to operate the control.

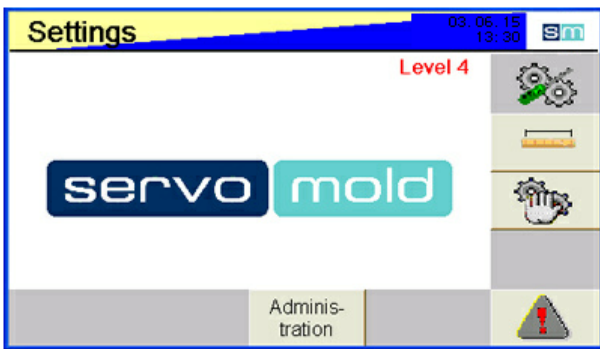
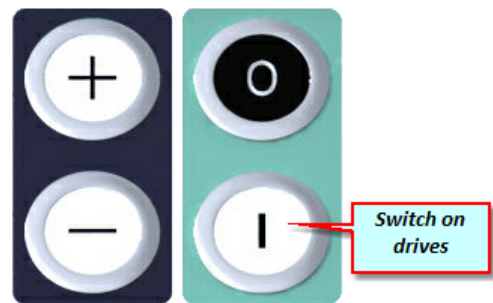


Fig. 93 Setting - User level 4 - Drive inactive



The yellow/blue flashing of the upper bar indicates that the drive is not active yet. Another indication of inactive drives is the flashing LED light strip at the front side of the device.

As soon as the drive is switched on (safety relay activated), the display changes to blue static.

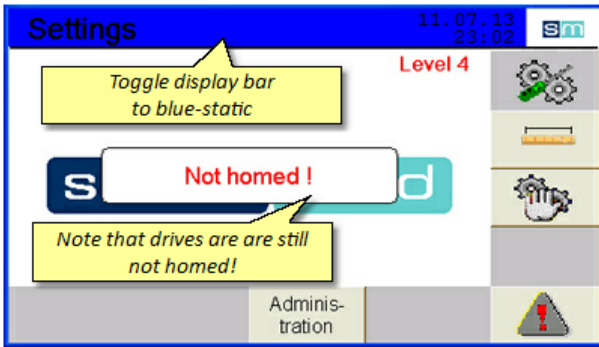


Fig. 94 Setting - User level 4 - Drive active

6.2 Load program

Now load the program associated to the injection moulding tool into the controller.

When switching-on the controller the most recent valid program is loaded - If changes were made to the program parameters, then these will be loaded too. If the changes had not been saved previously, then they are lost when loading the program.

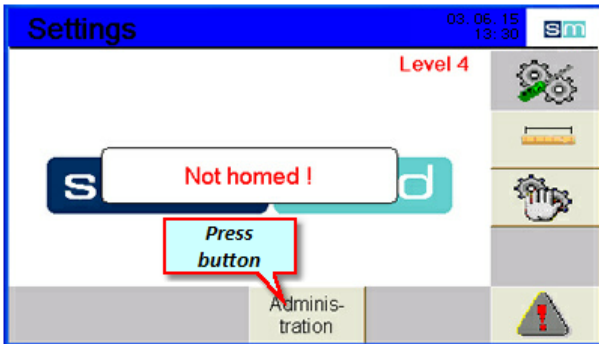


Fig. 95 Setting - Administration

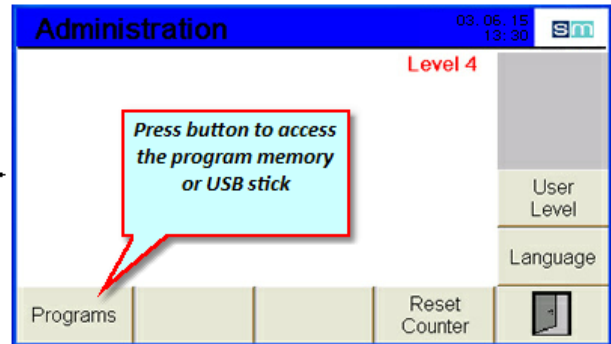


Fig. 96 Administration

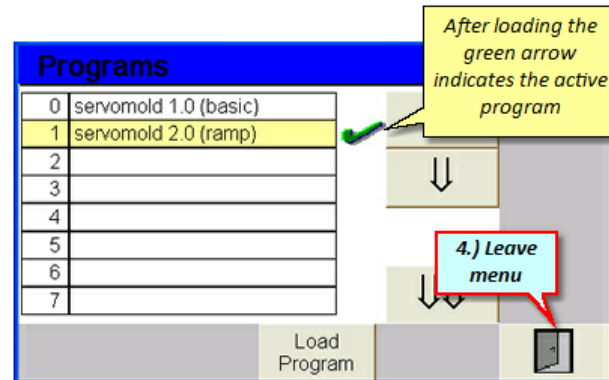
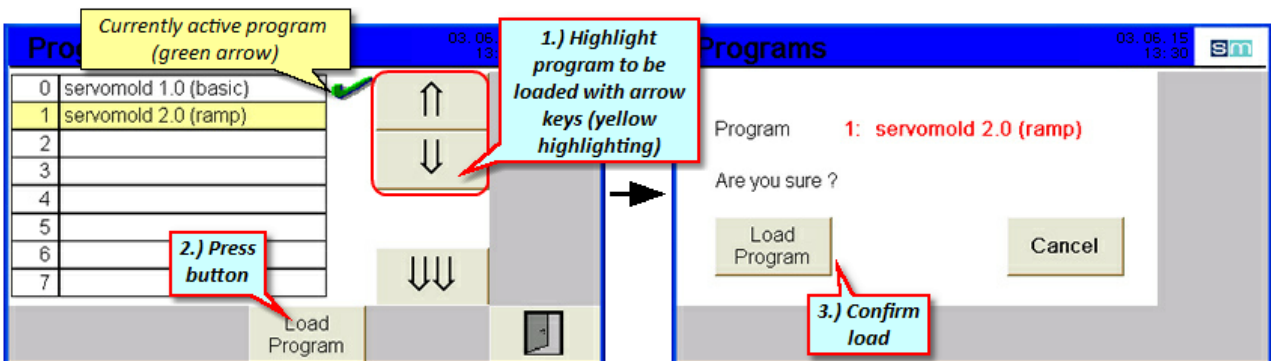


Fig. 97 Load program

6.3 Homing

In chapter [Commissioning / homing axis](#) ⁵⁹ we performed the homing for individual axes.

Since (depending on use of the drives) homing also might require a certain sequence, it is recommended to define the homing as a set program within the complete program sequence.

This has the advantage even during operation (e.g. after the injection moulding tool has heated up completely) an automatic homing can be performed. For example, the homing can be performed according to a certain amount of cycles.

The homing can also be started at any time by the operator or the setter, if he deems a new homing as required.

In the following the semi-automatic start of the homing is explained.

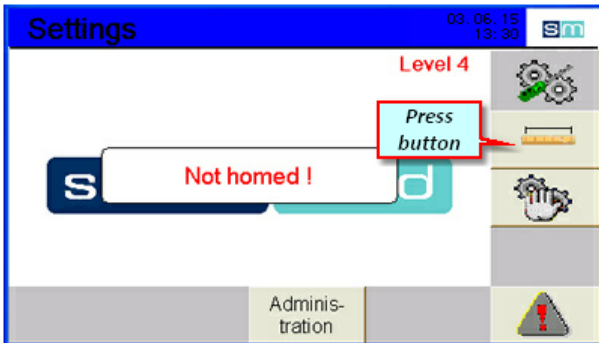


Fig. 98 Setting - Homing

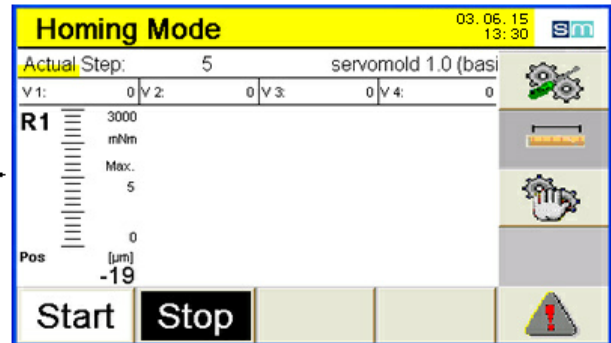


Fig. 99 Homing

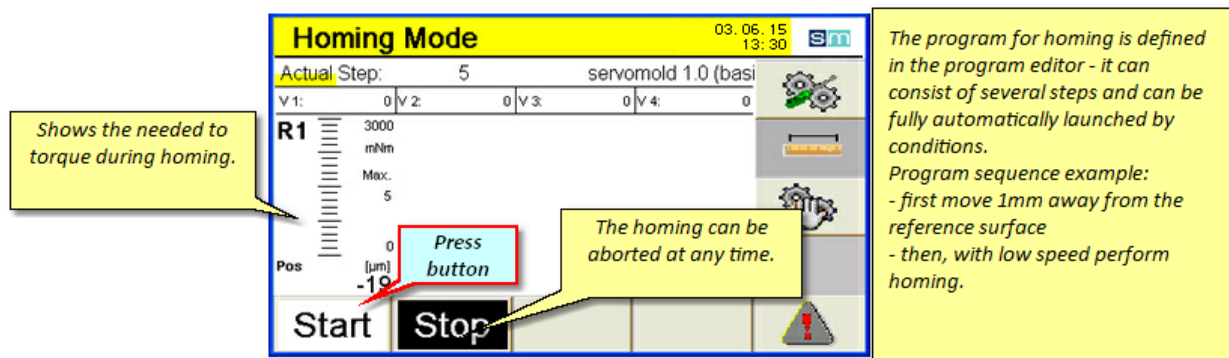


Fig. 100 Homing - semi-automatic

Also refer to the information about the homing program in chapter [Programs / Program example Homing](#). ⁸⁶

6.4 Manual operation

Manual operating mode allows the simple outward and inward rotation of the drives. Here the program is executed, which was predetermined in the program editor. Manual operation only simulates the input signals set by the injection moulding machine.

Another possibility is pressing the Plus/Minus button on the control.

Retract (Move out) = Plus (+)

Forward (Move in) = Minus (-)



Fig. 101 Setting- manual operation

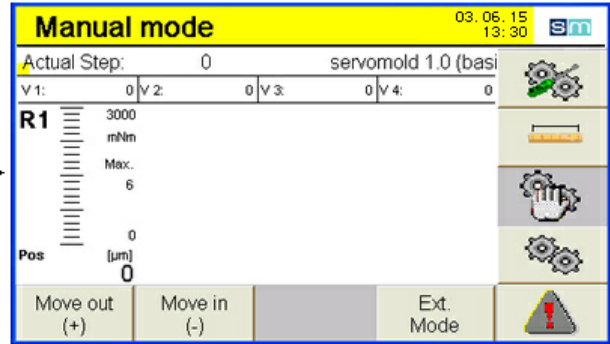


Fig 102 manual operation

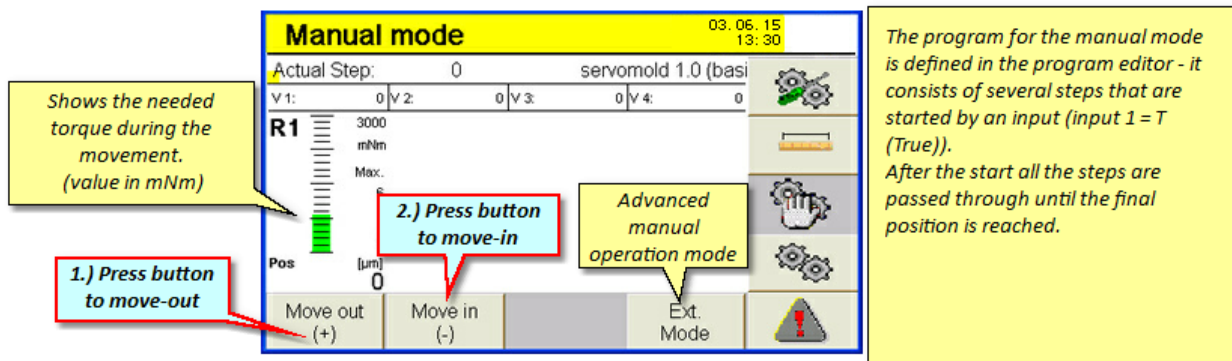


Fig. 103 Manual operation - move out / move in

The program for the manual mode is defined in the program editor - it consists of several steps that are started by an input (input 1 = T (True)). After the start all the steps are passed through until the final position is reached.

6.5 Automatic

During the change into automatic operation the control waits for the signals set in the program to start the program sequence.

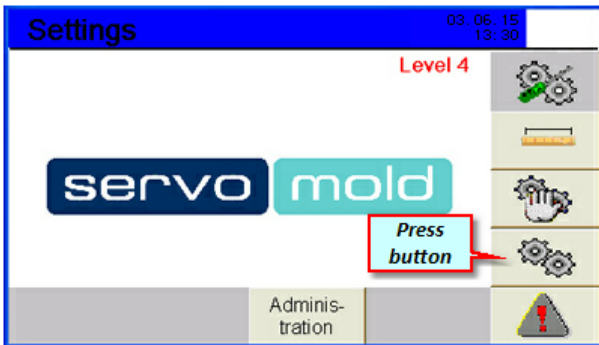


Fig. 104 Setting- automatic

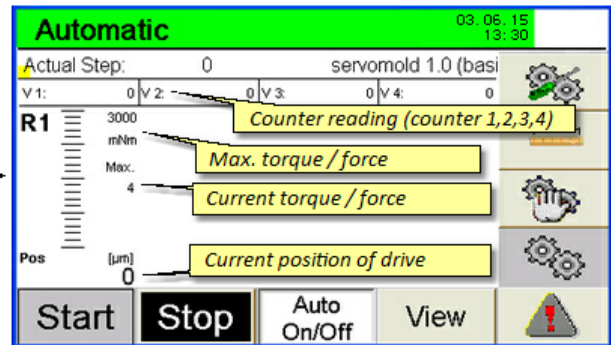


Fig 105 automatic

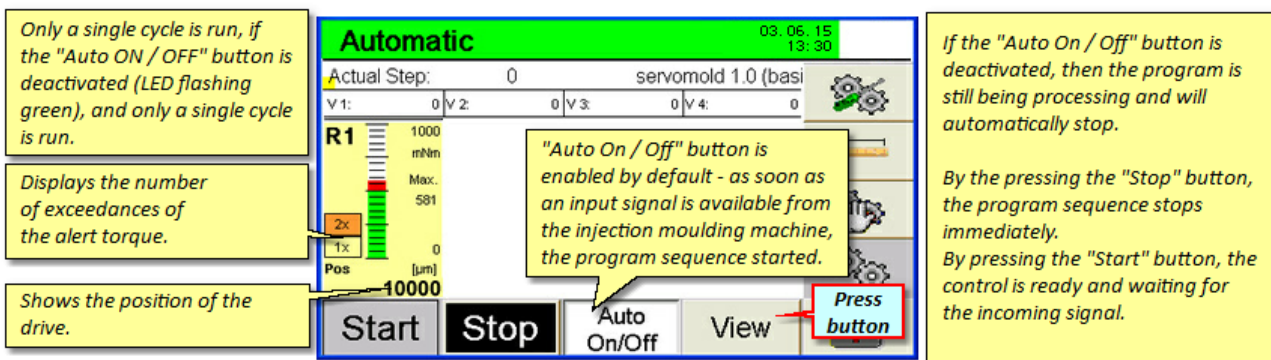


Fig. 106 Automatic Auto On/Off

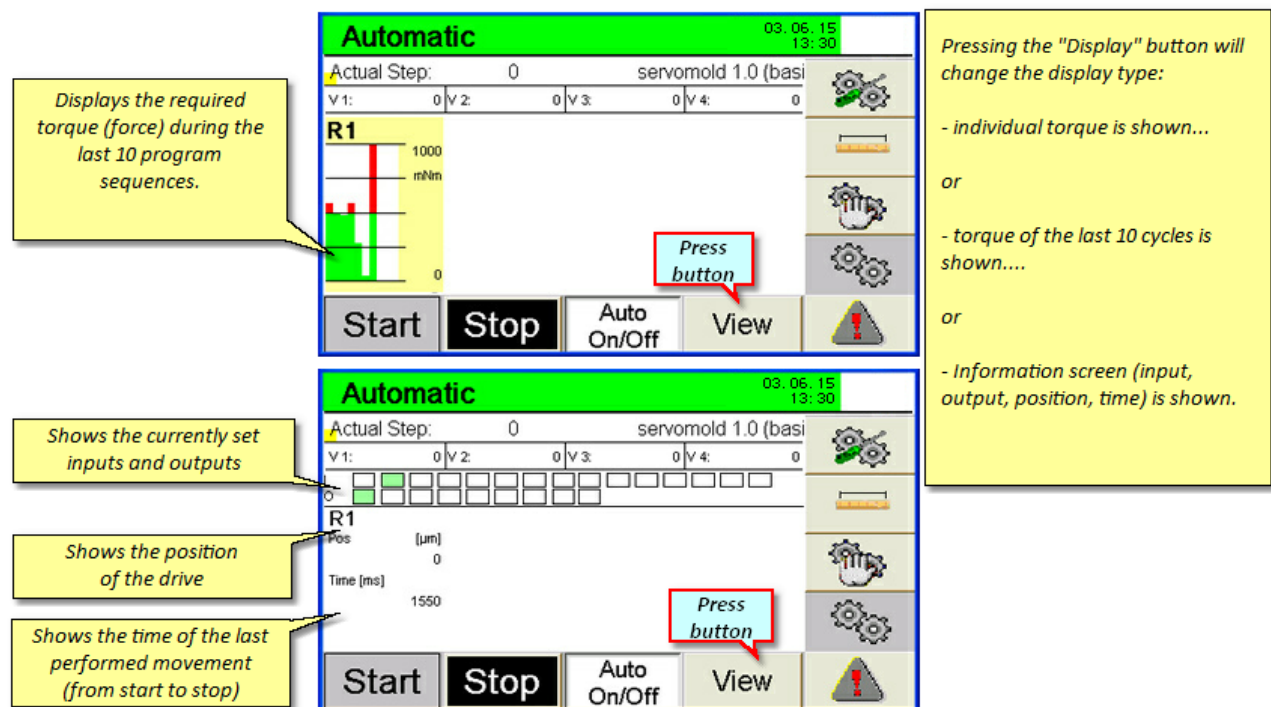


Fig 107 Automatic - display

6.6 Switching off

To switch off the control, wait until the actual cycle is finished by the molding machine or deactivate the "Auto ON/OFF" button and wait until the current cycle is ended. Change to Manual Mode and then to Setting Mode. After deactivating the servo drives you can switch to OFF the control unit.

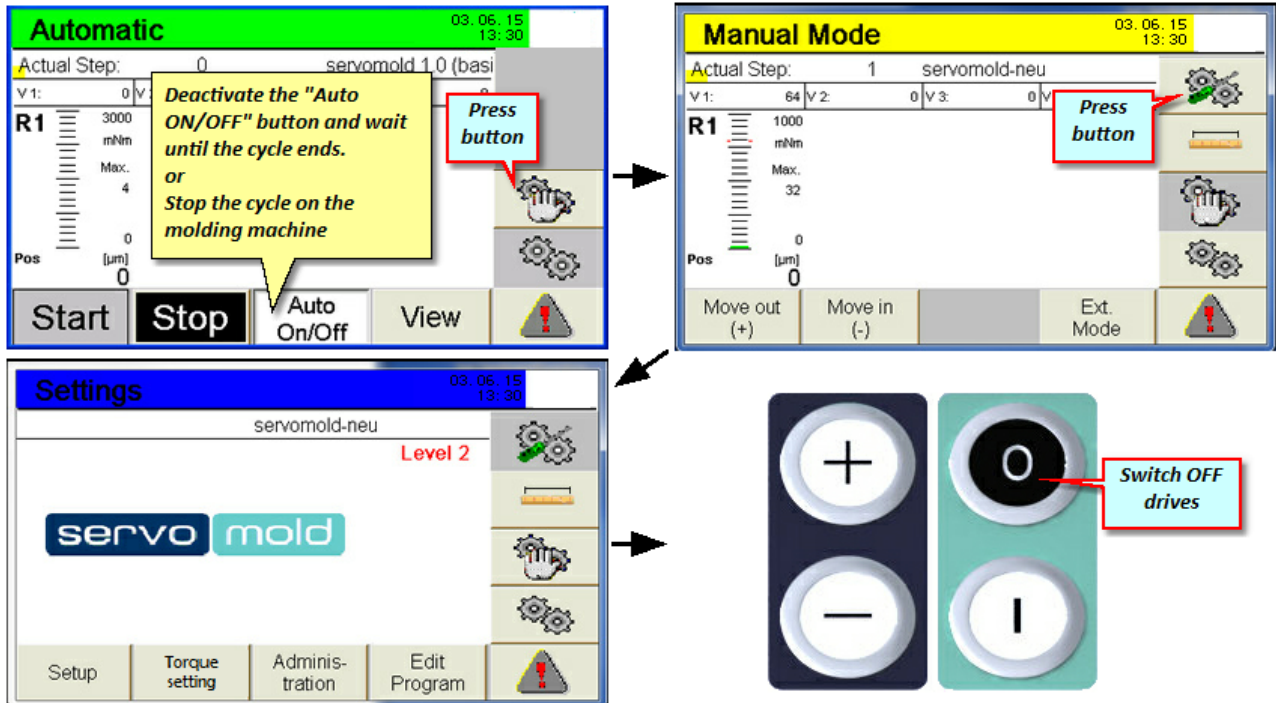


Fig. 108 Stop automatic

Chapter

7

7 Programs

This chapter provides information for creating programs as well as program examples. The program examples are for illustration purposes only - please check before adoption of program lines in your program, or if the program execution is possible in your case.

Programs can be saved or stored, both in the internal as well as in the external memory (USB). For information about this please refer to chapter [Commissioning / programs](#) ⁶⁶ administration or in the [Operation / load programs](#) ⁷⁶ chapter.

7.1 Program structure

The program sequence is defined in the program editor. Further information on editing programs can be found in the [Commissioning / edit program](#) ⁶¹ chapter.

Each program line defines a program step that comprises of the section "Condition", "Action", and "Link".

Once the condition is met (T=true) the action is started and the program step under "Link Tr" is accessed. If the condition is not met (F=false) no action is started and the program step under "Link Fa" is accessed.

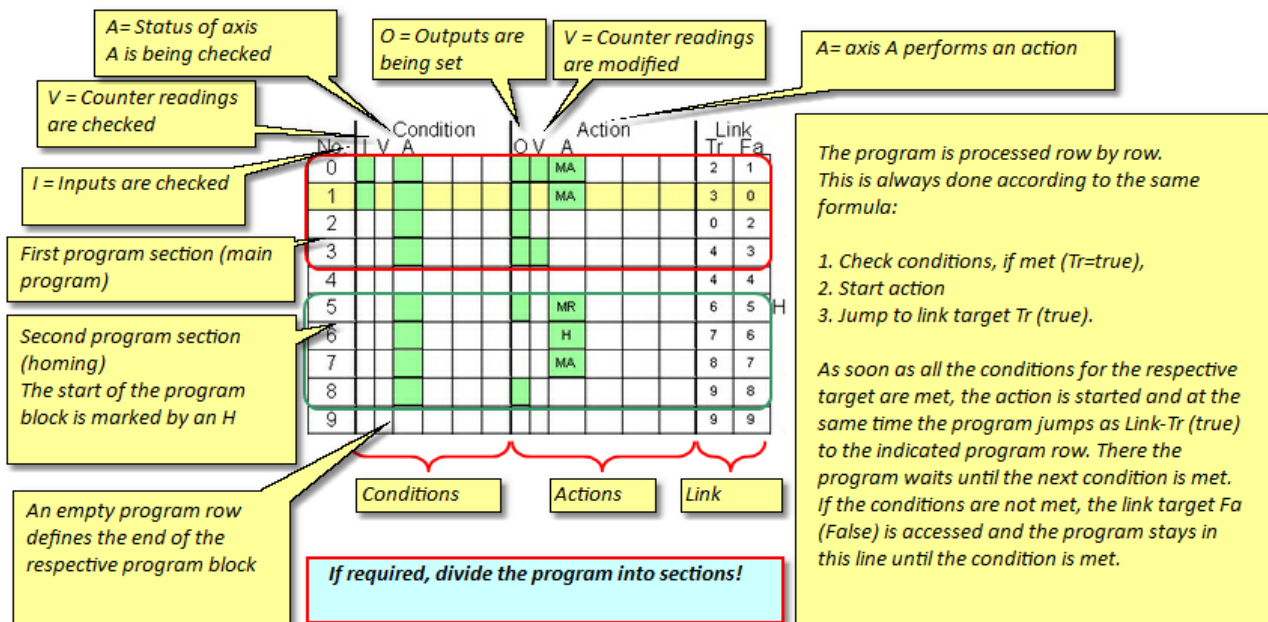


Fig. 109 Program structure

	INFO	<p>Program sequence Setting a schematic program sequence eases the subsequent implementation of the program in program editor.</p> <ul style="list-style-type: none"> Define the desired program sequence in a simplified diagram Keep a written record of all considerations to verify afterwards the function of the program easier. Divide the program into individual sections - this improves the manageability and facilitates changes to the program.
--	-------------	---

7.2 Program functions

Here you get an overview of the most important commands and functions to create programs.

These functions are divided in the areas:

- Conditions (status of the inputs status of axes, status of counters)

Programs

- Actions (setting outputs, change counter status, move or stop axes)
- Links (to access certain program lines, to structure the program)

7.2.1 Program function conditions

Conditions are required to query the status of an axis, **prior** to performing an action.

Conditions can be, e.g.:

- Status of the inputs
- Status of the axis
- Status of the counter
- Parameter of an axis

Status of the inputs:

PLC Inputs:	
In 1	T
In 2	F
In 3	/
In 4	\
In 5	X

All states are defined by a signal state.

T = True (signal present)
F = false (no signal)
Rising flank (signal from low to high = 0 to 1)
Falling flank (signal from high to low = from 1 to 0)
Any flank (not recommended!)

Fig. 110 Conditions - Inputs

Status of the axis:

Status:		
Done	T	Accelerating
Stand Still		In Velocity
In Motion		Homing
		Warning
		Fault
		Enabled
		Homed

The most common status inquiries on axes are

"Ready - True" (The end of the interval of a previous movement is considered as fulfilled condition)

"Standstill - True" (The previous motion was terminated - axis is stationary)

Fig. 111 Conditions - Axis status

Status of a counter:

Var 1	=	1
-------	---	---

Condition is met, if counter 1 has value 1.

Fig. 112 Conditions - Axis status

Parameter of an axis:

Pos	>	2000
Speed		
Torque		

The condition is met, if the position of the axis is larger (>) than 2000µm.
This condition can be used to change the speed starting at a certain position. (also possible for speed and torque)

The condition of the retrieved value can be queried with the shown ratio times.

Fig. 113 Conditions - Axis status

7.2.2 Program function action

Actions allow the mode change of an axis **if** (True) the condition defined in this program step is met.

Actions can be, e.g.:

- Changing the status of the outputs
- Changing the state of the axis through a movement

- Changing the status of the counter

Status of the outputs

PLC Outputs:	
Out 1	T
Out 2	F
Out 3	↗
Out 4	↘
Out 5	⊗

Here, the state of the outputs can be changed (for example, to indicate that a movement is completed (True) or that the movement takes place (False))

T = True (signal present)
 F = false (no signal)
 Rising flank (signal from low to high = 0 to 1)
 Falling flank (signal from high to low = from 1 to 0)
 Any flank (not recommended!)

Fig. 114 Program function actions - Change outputs

Changing the state of the axis:

Move Absolute	
Position	10000 μm
Velocity	10000 μm/s
Acceleration	30000 μm/s ²
Deceleration	30000 μm/s ²
Delay Done	0 ms

To a certain position

Move Relative	
Position	1000 μm
Velocity	10000 μm/s
Acceleration	30000 μm/s ²
Deceleration	30000 μm/s ²
Delay Done	0 ms

By a certain value

Homing	
Position	-10 μm
Velocity 1	100 μm/s
Velocity 2	100 μm/s
Homing Method	-3
Acceleration	5000 μm/s ²
Torque	2000 mNm
Delay Done	0 ms

Stop Drive	
Deceleration	30000 μm/s ²
Delay Done	0 ms

None	

These are the most commonly used actions for moving the drive (the axis):

- Absolute motion (to a certain position)
- Relative motion (by a certain value)
- Homing (to perform an automatic homing)
- Stop drives (stops the drive, if certain conditions occur)
- None (no action is performed - default position)

Homing example acc. to method -3:
 - defines the value that is used during the approach to a locating surface.

There is a clearance of 10μm to the locating surface, if the position during contact with the locating surface is defined as -10μm and the program will then approach position 0.

Fig. 115 Program function actions - Changing the state of the axis

Further information can be found in the chapter [Commissioning / Edit programs / Actions](#) 63

Changing the status of the counter:

Counter:		
Var 1	=	0
Var 2	+	1
Var 3	-	2

Counter reading is set on value 1.
 The counter reading can be increased (+) or decreased (-) by a certain value.

Fig. 116 Program function actions - Change counter

7.2.3 Program function links

Links allow you to structure the program as well as jump to certain program lines depending on a condition (true or false). The Links menu is furthermore used to define the program range that contains the homing.

Name	Grundposition		
Link	On True	On False	
	12	11	
Homing Start Step	Home-Start Used		
Subprog. Start Step	Sub 1	Sub 2	Sub 3
	Sub 1	Sub 2	Sub 4

Here, the respective link target can be indicated, depending on condition of this step.
 The homing start step indicates the step number at which range of the program the homing starts.
 This program step is jumped when selecting the "homing" and during the START of the homing

To choose the homing start, select the appropriate program line and press the "home start" button

Fig. 117 Program function Links

7.3 Program example basic

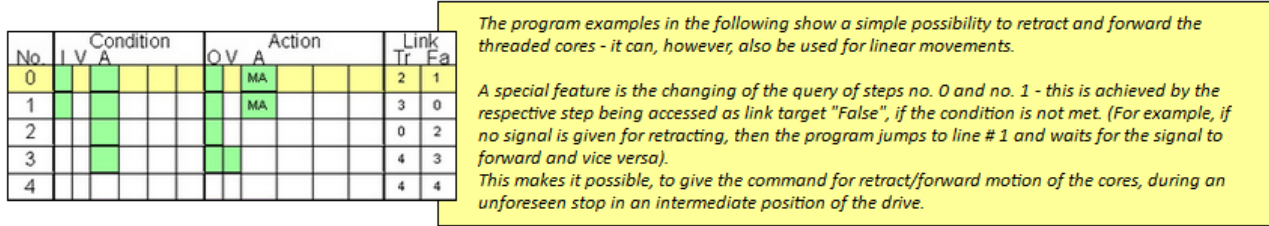


Fig. 118 Program example - basic - Program overview

Step no. 0 - During signal on input 1 the 10000µm position is approached (retract movement)

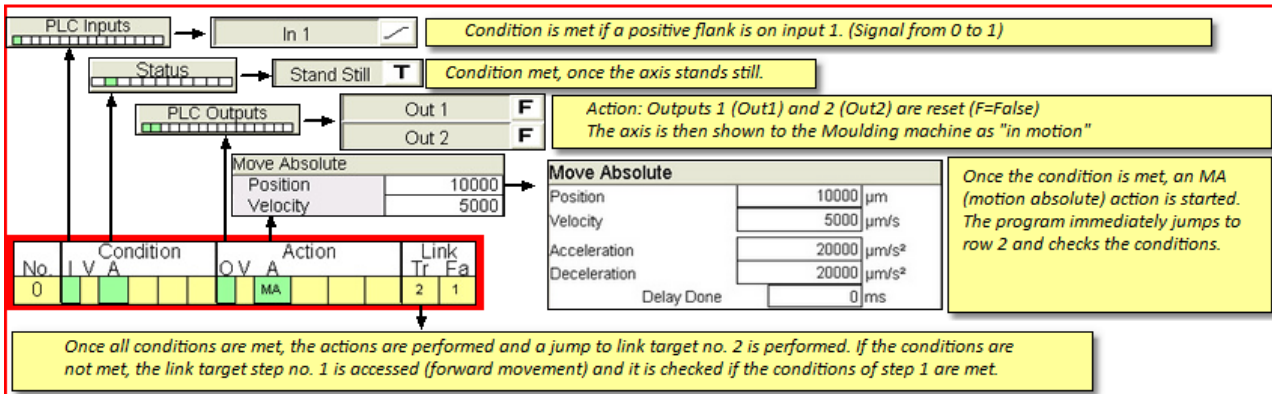


Fig. 119 Program example - basic - Step no. 0

Step no. 1 - During signal on input 2 the 0µm position is approached (forward movement)

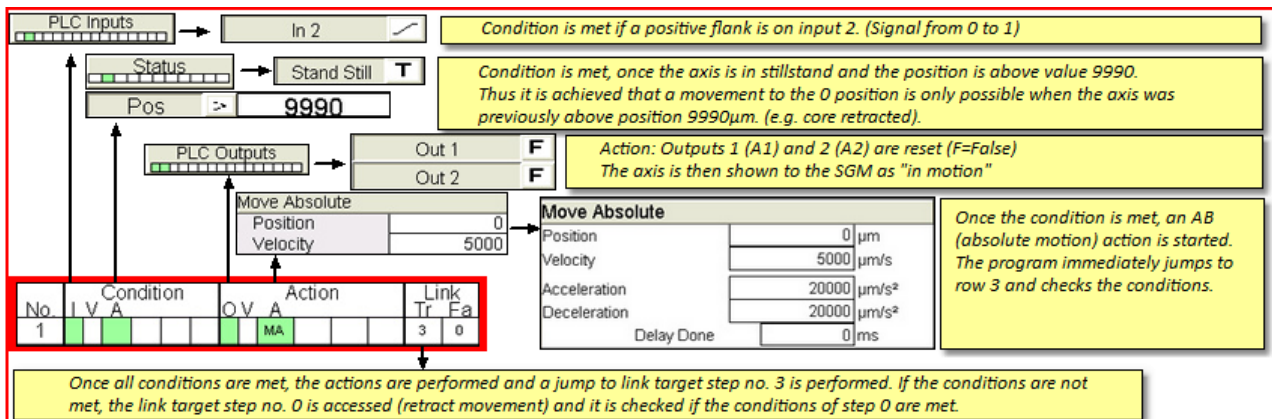


Fig. 120 Program example - basic - Step no. 1

Step no. 2 and no. 3 - If the movements of step no. 0 or step no. 1 are done the corresponding outputs are set (core retracted / core forwarded)

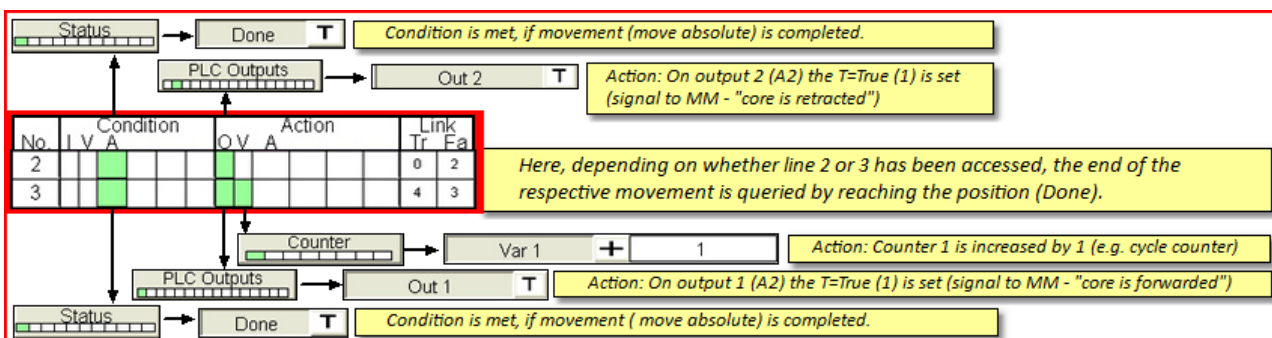


Fig. 121 Program example - basic - Step no. 2 and 3

Step no. 4 - Empty program lines define the program end - The program starts from the start.

7.4 Program example for Homing

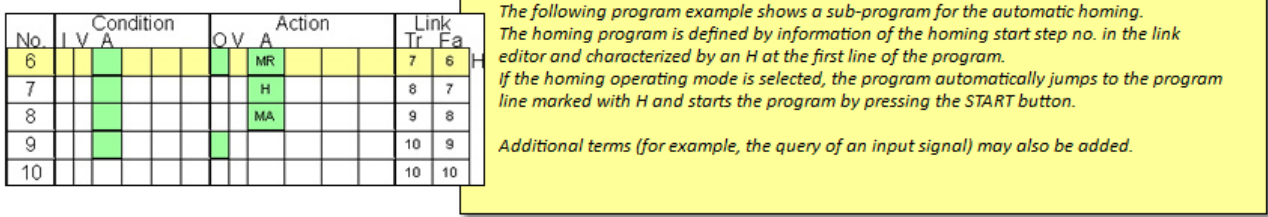


Fig. 122 Program example - Homing - Overview

Step no. 5 - By pressing the START button during the homing operating mode, the program is started at line no. 5.

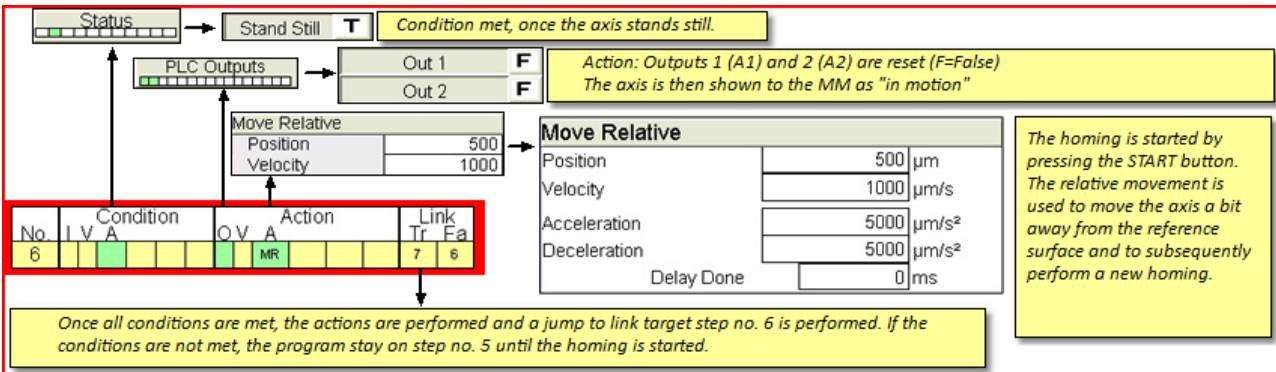


Fig. 123 Program example - Homing - Step no. 5

Step no. 6 - Here, the homing is defined.

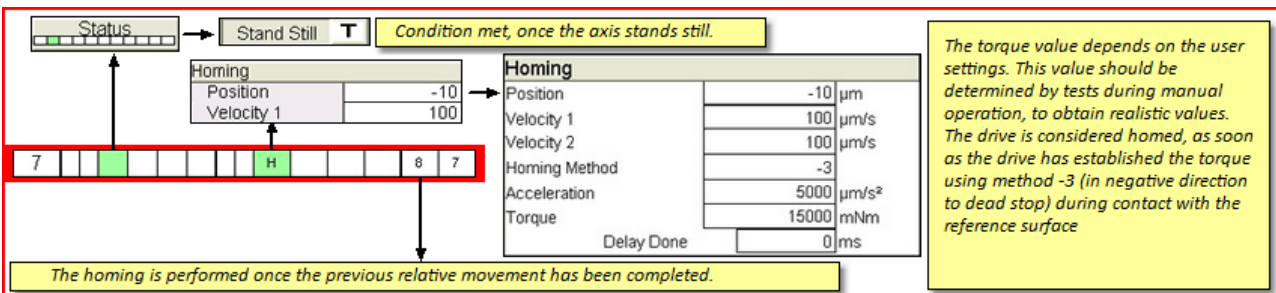


Fig. 124 Program example - Homing - Step no. 6

Be careful when specifying the position value that, depending on homing method used, the correct sign is used!

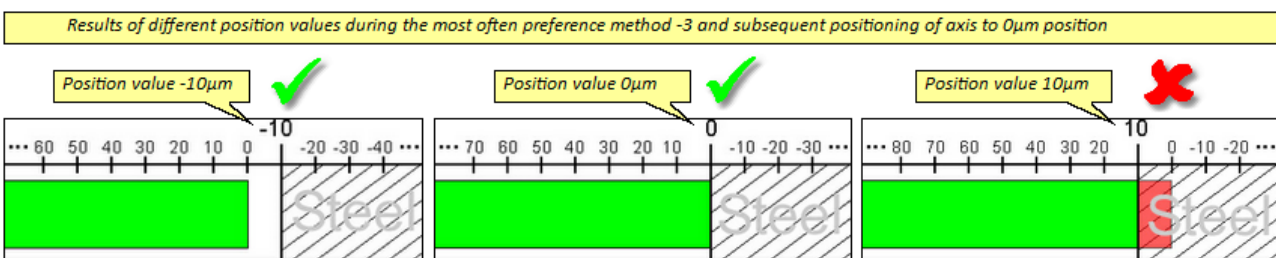


Fig. 125 Program example - Homing - Position values

	NOTICE!	<p>Homing values</p> <p>Prior to starting the homing, check the values for position, speed, acceleration and max. torque as well as homing method</p> <ul style="list-style-type: none"> • Wrong parameter values can damage your tool - check the values prior to starting the homing. • Ensure that the correct position values are entered acc. to the homing method! <ul style="list-style-type: none"> - 3 (mechanical stop in negative direction) = 0 or negative value as position value - 4 (mechanical stop in positive direction) = 0 or positive value as position value
--	---------	---

Programs

Step no. 7 moves the drive after the Homing to any position from which the main program can then be started.

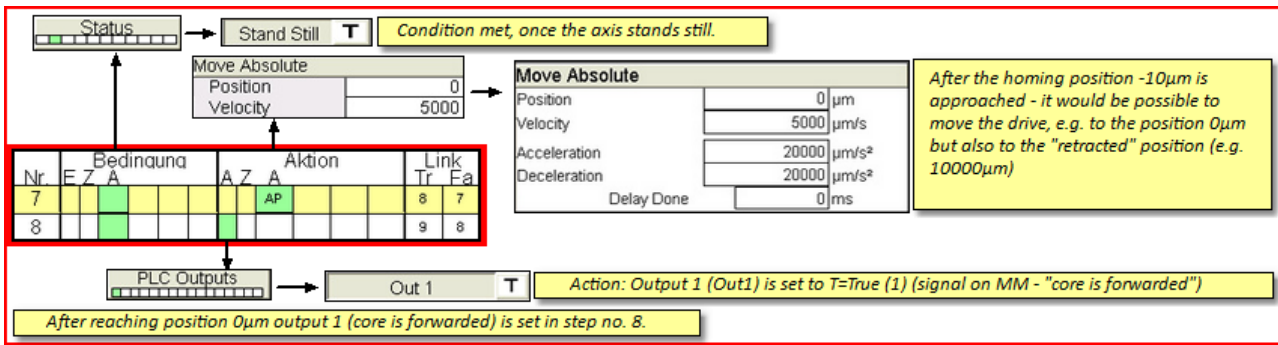


Fig. 126 Program example - Homing - Step no. 7 and 8


Step no. 9 - Empty program lines define the program end - The program starts from the start.

Chapter

8

8 Malfunctions

Malfunctions can occur during the daily operation. All work beyond the troubleshooting, such as maintenance and / or repair work may only be performed by qualified, trained personnel.

	WARNING!	<p>Not securely shut-off machine</p> <p>Operators can be severely injured due to a not securely shut-off Device (Servo Control System).</p>
<ul style="list-style-type: none"> • During repair work secure the Device (Servo Control System) by shutting off the drives! • Maintenance work may only be performed by qualified, knowledgeable professionals! • Repair and fault fixing may only be done by Servomold GmbH & Co. KG or by qualified professionals! • Note the warnings and safety instructions! 		

8.1 Fault types

Generally it is distinguished between **faults in the drive** (servo controller) and **faults in the software** (program)

These faults in the drive include for example:

- Leaving the position window $i^2 t$ (i-square-T) - nominal current is exceeded permanently
- $i^2 t$ (i-square-T) - the nominal current has been continuously exceeded
- Exceeding the contouring fault limit
- Undervoltage (the drive can not maintain the DC voltage in the intermediate circuit due to maximum load.)

Drive malfunctions (e.g. counting error) can (at the respective user level) be seen in the expanded manual operation under menu item - malfunction details - and be also reset there.

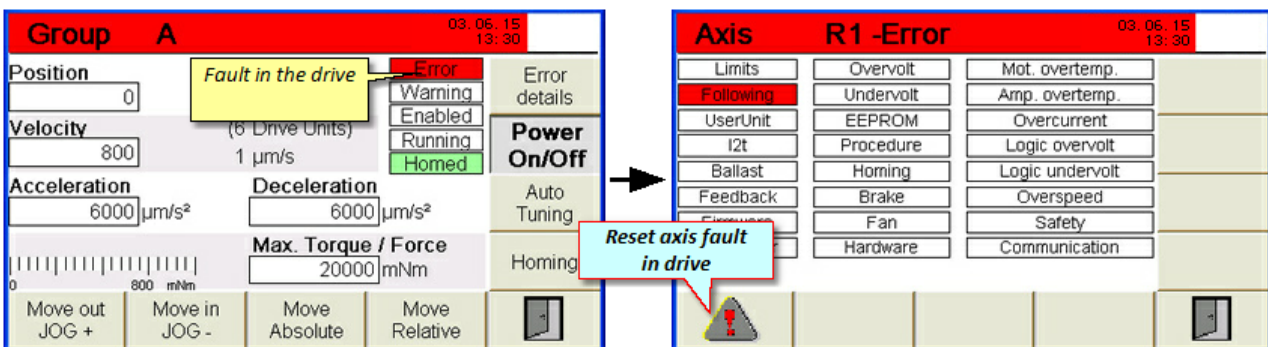



Fig. 127 Faults in the drive

Resetting the axis fault requires the subsequent confirming of the fault in the alarm menu.

	INFO	<p>Faults in the drive</p> <p>These faults include for example, contouring error, undervoltage, overvoltage, etc. - The fault in the drive must be reset in addition to acknowledging the error message!</p>
<ul style="list-style-type: none"> • The fault in the drive can either be reset in expanded manual operation under fault details or • Can be reset in the alarm menu using the error key. • The error message must subsequently be confirmed. 		

Other software errors are, e.g.:

- Exceeding the current limit (warning limit)
- Exceeding the limit torque

8.2 Reset fault

All faults/malfunctions occurring during the operation of the Servo Control System that are caused by the servo drives or software settings, are saved into a list. If these faults require an acknowledgment by a setter, you must perform this confirmation in the alarm menu.

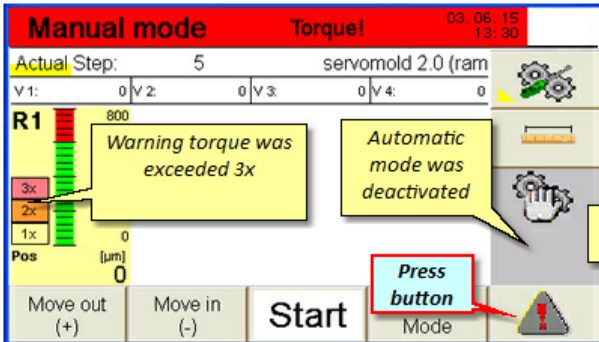


Fig. 128 Toggle to alarm menu

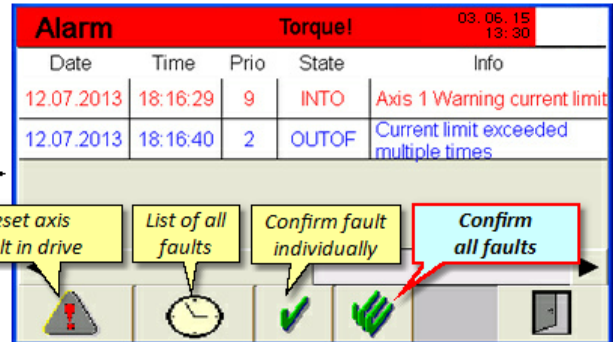
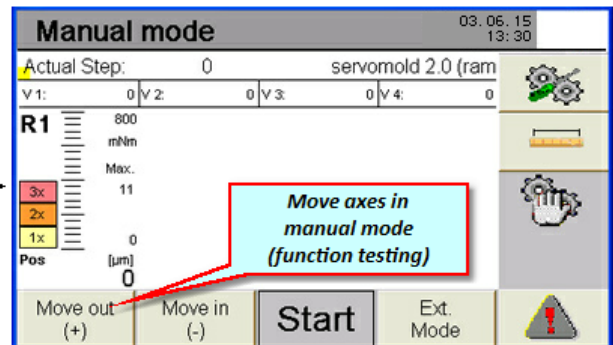
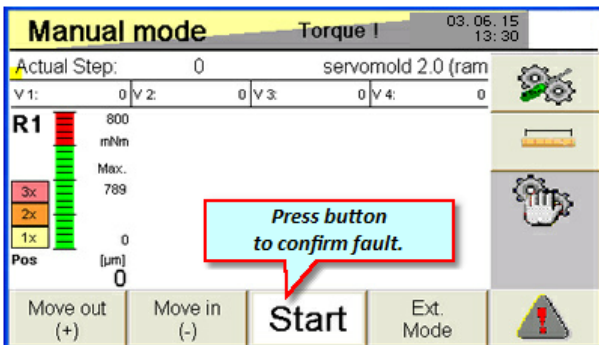


Fig. 129 Alarm menu - Fault/error list

The error list shows the exact time the fault occurred and also provides a description of the fault. Depending on priority and fault type, the faults with different priorities and different status messages is displayed.

After acknowledging the fault and the fault has been remedied, move the drive first in manual operation (extend/retract). In doing so the setter checks of the mechanics can operate fault-free, prior to operating the system in automatic mode again.



After the axis is moved, the automatic mode is enabled again, the warning counter is reset and the START button is hidden.

Then the control system can again be operated in the automatic mode.

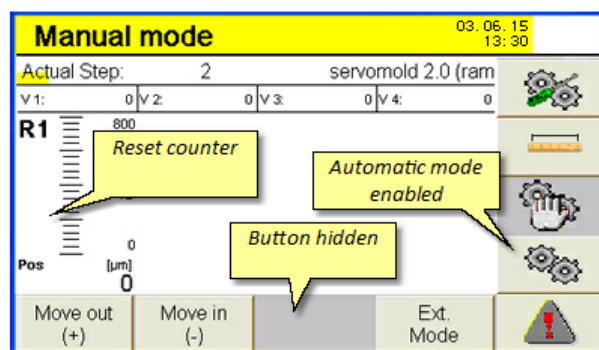


Fig. 130 Reset/remedy fault

8.3 Malfunction table

Here you find a list of possible malfunction/faults.

In many cases, problems are not due to a malfunction of the controller but due to incorrect settings of the operating parameters.

Malfunctions

An example of this is the error message "X axis error" which, for example, can mean a position error. The servo controller continuously calculates, during the motion, the necessary parameters in order to slow down the drive in time at the desired point. However, since in this case the accelerated mass (inertia) and the limit of the position window plays an important role, it can happen that the drive exceeds the desired position (and thus activates the software limit switch) or can not comply with the position window.

Example: Depending on gear ratio and size, only 5 motor revolutions are required to achieve 60mm path (60.000µm), when using linear drive rack application. One motor revolution here would mean 12.000µm path.

The built-in motor position sensor (resolver) allows the distribution of a complete revolution of the motor to 4096 increments. (1 increment would thereby be 3µm)

Should the position window be now limited with 10µm, then the servo controller should stop the drive exactly on 3 increments. Depending on the mass and speed this can however not be achieved.

In this case the position window must be enlarged.

Message	Fault description	Possible causes	Remedy/troubleshooting
Axis X error torque limit	Software error The limit torque set in the set-up has been exceeded.	<ul style="list-style-type: none"> • Maximum torque is set too low • Mechanics too sluggish • Damage to mechanics (cores have seized) 	<ul style="list-style-type: none"> • Increase torque • Check mechanics for damages and repair faults
Current limit was exceeded more than once	Software error The warning limit set in the set-up has been exceeded.	<ul style="list-style-type: none"> • Warning limit is set too low • Mechanics are sluggish or dirty 	<ul style="list-style-type: none"> • Set warning limit higher • Check mechanics for free movement • Clean mechanics
Axis X error	Drive error THE servo controller indicates a fault; e.g. sluggishness, position fault, undervoltage etc.	<ul style="list-style-type: none"> • The contour error limit is set too tight • The position window is set too tight • i^2t - the nominal current has been continuously exceeded 	<p>The limits possible in the lower position settings must be individually set for each project.</p> <ul style="list-style-type: none"> • It increases the value for the contouring error limit • It increases the value for the position window • Check the mechanism for easy running - a permanent exceeding of the nominal current limit indicates that the mechanism is either too sluggish, or the drive is dimensioned generally weak. If required contact Servomold GmbH & Co. KG.

Table 23 Malfunctions of the Servo Control System

In addition to the faults/malfunctions listed in the error table, there are situations that cause no error message, but that influence the function of the system adversely.

Thus, a too low set "maximum torque" during the homing, may stop the drives before reaching the actual home point and assume a false position as a home point. Here it is important to ensure already during commissioning that the torque limit for the homing is not set too low.

A peculiarity of the faults are the position limits represent (software limit switch). If the software limit switch has been set too tight. (e.g. minimum position limit-5µm) then it is possible that the drive exceeds the limit position, and thus brakes immediately and hard.

In this case, expand the position limits.

8.4 External faults


Considered an external fault occur are all faults occurring from the outside, either from the injection moulding machine, power supply, and other (including user-initiated) interruptions of the program run.

8.4.1 Power failure

The home point of the axis is lost during a power failure - this means, that after switching on the controller again, the homing must first be performed. The sequence of the homing is described in chapter [Operation - Homing](#) ⁷⁷.

Please note that to perform the homing the user level 4 (setter) must be set. Please also watch that before starting the homing the right program is loaded.

Since the position of the axes in this case (whenever the power failure occurred) can be quite far away from the reference surface, the homing therefore may take a little longer.

	NOTICE!	<p>Wrong machine parameter Wrongly set machine parameter can lead to property damages to the Device (Servo Control System) or on the injection moulding tool.</p>
<ul style="list-style-type: none"> • Setting the machine parameter and commissioning may only be done by experts! • Note the information about maximum rotation speed/max. torque of the drive/transmission combination used! • Only set the machine parameter using the manufacturer installation and operating instructions for the drive/gear combination! • Ensure that only the program for the respective injection moulding tool is loaded! 		

8.4.2 Open safety door

Opening the safety door causes different malfunctions on the injection moulding machine and on the Servo Control System:

- Interruption of the protective circuit at the injection moulding machine
 - Interruption of the protective circuit at the Servo Control System and therefore an immediate drop of the drives
- or
- Depending on the program structure - during drop of input signal an immediate stop of the drives

If the protection circuit of the Servo Control System was interrupted then the safety relay must be activated again (closed circuit protection) after the protective door was closed by pressing the (1) button.

Depending on in which mode the control is, the program will either continue or possibly trigger a failure.

Chapter

9

9 Maintenance

The Servo Control System should be thoroughly cleaned once a year by a licensed electrician.

Since dust can enter into the ventilation opening, clean the device once a year using compressed air.

	WARNING!	<p>Maintenance work Consequences of improper maintenance may be death, severe or minor injury, property damages or environmental damages.</p>
<ul style="list-style-type: none"> • Maintenance work may only be performed by qualified, knowledgeable professionals! • Switch off the Device (Servo Control System) at the line disconnecter (main switch) and protect against unintentional activation using a lock! • Immediately after completing the maintenance work, reinstall all protective cladding and safety devices and check their functioning! 		
	NOTICE!	<p>Spare parts Consequences of the use of inappropriate spare parts could be property damage.</p>
<ul style="list-style-type: none"> • Spare parts must meet the technical requirements of the machine manufacturer! • Use only original spare parts from the manufacturer! 		
	NOTICE!	<p>Improper cleaning Improper cleaning can affect the functions of the Device (Servo Control System).</p>
<ul style="list-style-type: none"> • Never clean with steam or water jet! • Do not use combustible, gasified or corrosive liquids to clean! 		
	NOTE!	<p>Faulty adjustment, worn or defective components Faulty adjustment, worn or defective components can affect the functioning of the Devices, as well as cause damages on the Device or the in-mould assembly.</p>
<ul style="list-style-type: none"> • Have regular service work performed by experts! 		

9.1 Maintenance schedule

When cleaning and servicing the Servo Control System a higher product life and process safety can be expected.

WHAT?	WHEN	HOW	WHO
Display (Touchscreen)	Weekly	<ul style="list-style-type: none"> • Switch off device • Clean screen and front of device using a suitable cleaning agent • Do not spray the cleaning agent directly on the screen or front of the device, but on the cleaning cloth. 	By person authorized by the operating company
Motor, signal and interface lines	Daily, prior to use	<ul style="list-style-type: none"> • Check lines for visual damages • Recognize unfavourable placing and remedy • Contact a licensed electrician when damages on the lines are found. 	User
Servo Control System	Annually	<ul style="list-style-type: none"> • Switch off device • Open housing and clean interior • Blow off device using compressed air • Close housing and replace seal, if required 	Licensed electrician

Table 24 Maintenance schedule of the Servo Control System

9.2 Error list

Repair, troubleshooting and rectification should be carried out by authorized and qualified personnel.

Fault	Fault description	Possible causes	Troubleshooting
Electrical fault (on-site)	On-site automatic fuse triggers	<ul style="list-style-type: none"> Damages lines (insulation defective) Cable break (line or cable are separated) Defective electrical components (e.g. defective plug) 	Have only licensed electricians: <ul style="list-style-type: none"> Remedy the cause Replace defective components
Electrical faults (device side)	Axis alert to error (undervoltage)	<ul style="list-style-type: none"> Motor fuse has been triggered 	Have only licensed electricians: <ul style="list-style-type: none"> Remedy the cause (overcurrent or fault of a phase) Switch on motor circuit breaker (in housing) again
Electrical faults (device side)	Safety relays are triggering - LED light strip signals a fault by yellow flashing	<ul style="list-style-type: none"> Automatic reset of fuse for control board has been triggered - cause can be e.g. a short circuit at the interface plug (e.g. 24V on mass) 	Have only licensed electricians: <ul style="list-style-type: none"> Remedy the cause (remove short circuit) Switch off power to device and wait 10 sec. Switch device back on at the main switch.
Mechanical fault	Housing is strongly damaged	<ul style="list-style-type: none"> Transport damages or damage during handling 	Have only licensed electricians: <ul style="list-style-type: none"> Check the damage and remedy, if required - in all cases contact Servomold GmbH & Co. KG.
Mechanical fault	General damages on the Servo Control System	<ul style="list-style-type: none"> Transport damages or damage during handling 	Have only licensed electricians: <ul style="list-style-type: none"> Check the damage, in all cases contact Servomold GmbH & Co. KG.
Display fault (touch screen)	Screen stays dark after start-up	<ul style="list-style-type: none"> No voltage supply 	Have only licensed electricians: <ul style="list-style-type: none"> Check the damage and remedy, if required - in all cases contact Servomold GmbH & Co. KG.
Display fault (touch screen)	date/Time is incorrect	<ul style="list-style-type: none"> Device was longer than 1 week without power 	By authorized persons: <ul style="list-style-type: none"> Set time anew on system level
Display fault (touch screen)	User software does not start. (screen stays blue)		<ul style="list-style-type: none"> Switch off power to device and wait 10 sec. Switch device back on at the main switch.

Table 25 Error list of the Servo Control System

Chapter

10

10 Spare parts

Article	Article number	Description	Manufacturer
Motor cable	SMK-05	Motor cable, 5m length, shielded, double-sided plug	Servomold GmbH & Co. KG
Signal cable	SGK-05	Signal cable, 5m length, shielded, double-sided plug	Servomold GmbH & Co. KG
Interface cable	SSK-05-dd24-oe	Interface cable, 5m length, plug DD24, shielded oil flex, open cable end	Servomold GmbH & Co. KG
Interface cable	SSK-05-dd24-24b	Interface cable, 5m length, plug DD24/24B, shielded oil flex	Servomold GmbH & Co. KG
Stylus pen	STP-01	Stylus pen, incl. holder	Servomold GmbH & Co. KG
Counter sunk screw	SENK-M4x8	Counter sunk screw with cross head, DIN 965	Servomold GmbH & Co. KG

Table 26 Spare parts list of the Servo Control System

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