The platform for formulation development

User's Manual

Xplore Micro Compounder

MC 15 HT

Serial: 15HT#0101 and higher.

Xplore Instruments B.V.
Sittard, The Netherlands

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Foreword

Xplore is a brand name of Xplore Instruments BV and the brand name Xplore is used in this manual.

This manual describes the Xplore MC 15 HT Micro Compounder as delivered from mid-2018.
The information in this manual is important for a proper and safe functioning of the instrument, so you should carefully read this user manual from beginning to end. Xplore also recommends that all new users (operators, installers, maintenance people and if necessary, cleaners) receive training, for which this manual can serve as the basis.

Xplore recommends keeping the original of this user manual, including appendices, in a safe central location; another original or copy of this user manual should be kept close to the instrument at the work site.

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1. Something about this manual

This manual will help you to acquaint yourself with the Xplore Micro Compounder. Moreover, you can use this manual as a kind of quick reference work or "dictionary".
To those who work for the first time with this machine, it is recommended to try out all functions which are described in this manual to get to know and to understand this machine. Only this will ensure a safe and perfect operating of the Xplore Micro Compounder.

Agreements
This operator's manual has to be placed near the machine. It has to be read and applied by every person in charge of the following works with/at the machine, e.g.:

- **Operate** including set up, fault clearance in the workflow, support, disposal of operating supplies;
- **Maintain** (maintenance, inspection, service) and/or;
- **Transport**.

In addition of the user documentation and the prevailing mandatory provisions of accident prevention at the usage site you have to follow the approved expert rules of safe and professional working.

To mark certain passages in the text we have used different icons in this manual. Each symbol has a special function:

	**TIP** Gives you suggestions and advice on how to perform certain tasks more easily or speedily.
	**ATTENTION** Calls attention to additional information; points out possible problems.
	**CAUTION** The instrument may be damaged if you do not perform the procedures carefully.
	**WARNING OF DANGER** You can injure yourself (seriously) if you do not perform the procedures carefully.
✓	Precondition to an operation
➔	Single step operation requirement
1. … 2. …	Multi-step operation requirement ➔ Comply with the sequence

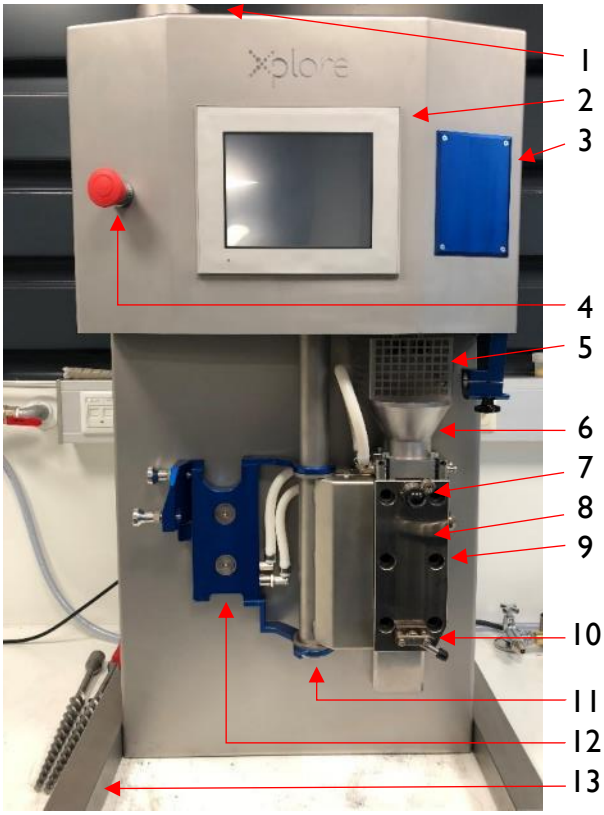
2. Warranty

The applicable terms of warranty, including liability, are set forth in the purchase documents.

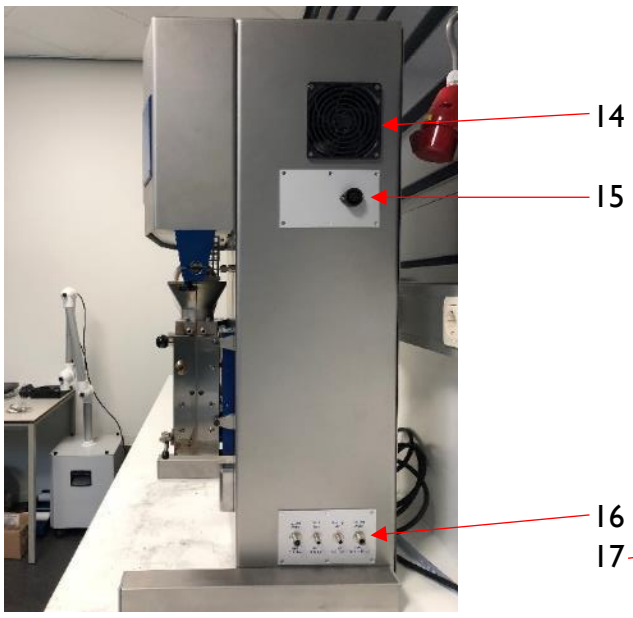
- The warranty lapses if the instrument is used for improper purposes or for applications not mentioned in the manual.
- The warranty lapses if the instrument is used wrongly or contrary to the instructions.
- The warranty lapses if the instrument is altered without consent of the supplier.
- The warranty lapses if the co/counter option is wrongly used.
- Altering or disabling the safety features is strictly forbidden.
- The buyer has no right to compensation for the time during which the instrument cannot be used.

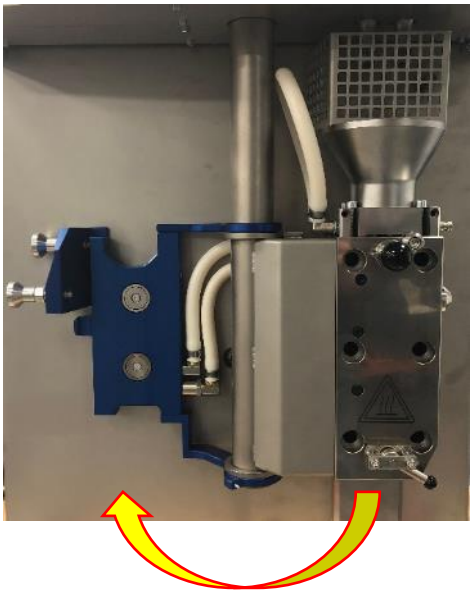
3. Machine specifications

3.1 Overview of the Micro Compounder

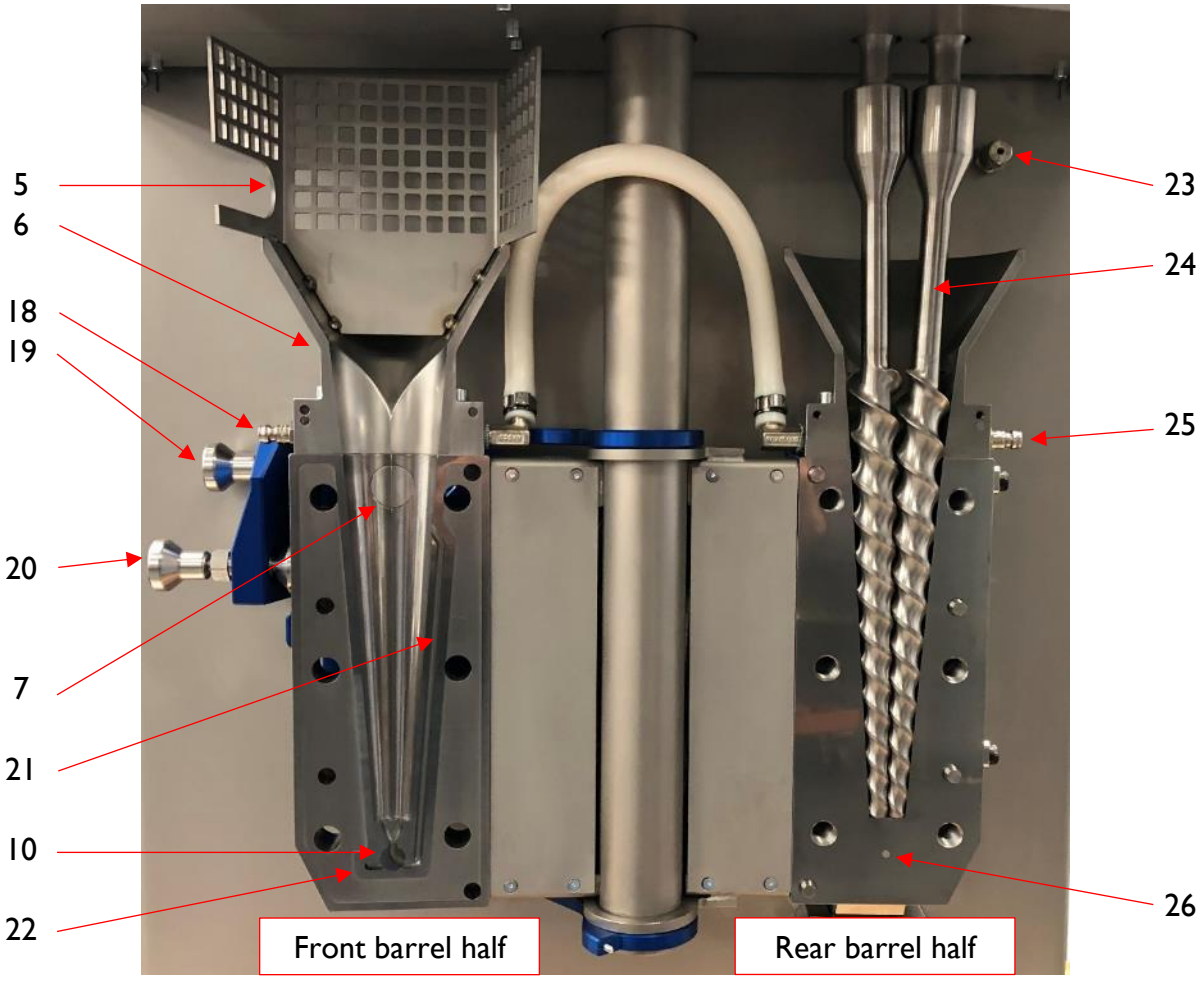


No.	Description
1	Fume extraction connection
2	Touch screen
3	Safety cover for co-counter switch
4	Emergency stop button
5	Safety guard for barrel
6	Water cooled top hopper
7	Barrel filling plug
8	Barrel housing
9	Barrel retaining bolts
10	Valve for melt flow control
11	Barrel hinge
12	Water cooling plate
13	Supporting leg
14	Cooling fan
15	Accessory connection plate (optional)
16	Water and gas connections
17	Main switch and USB data connection

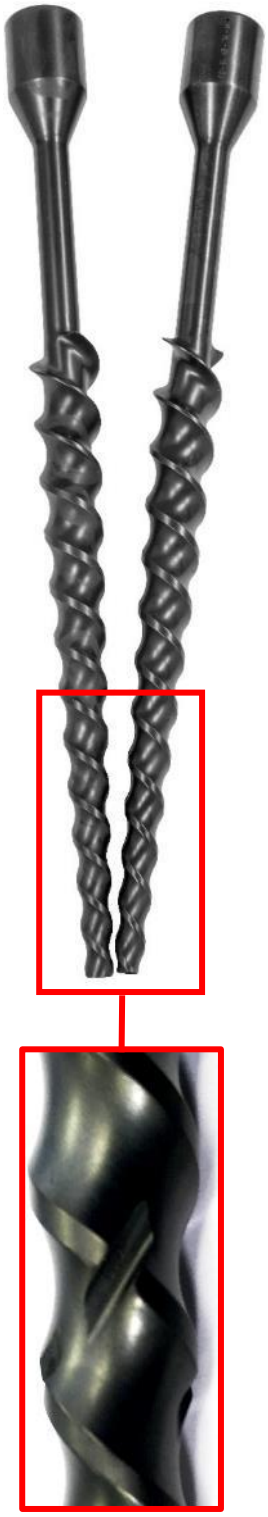




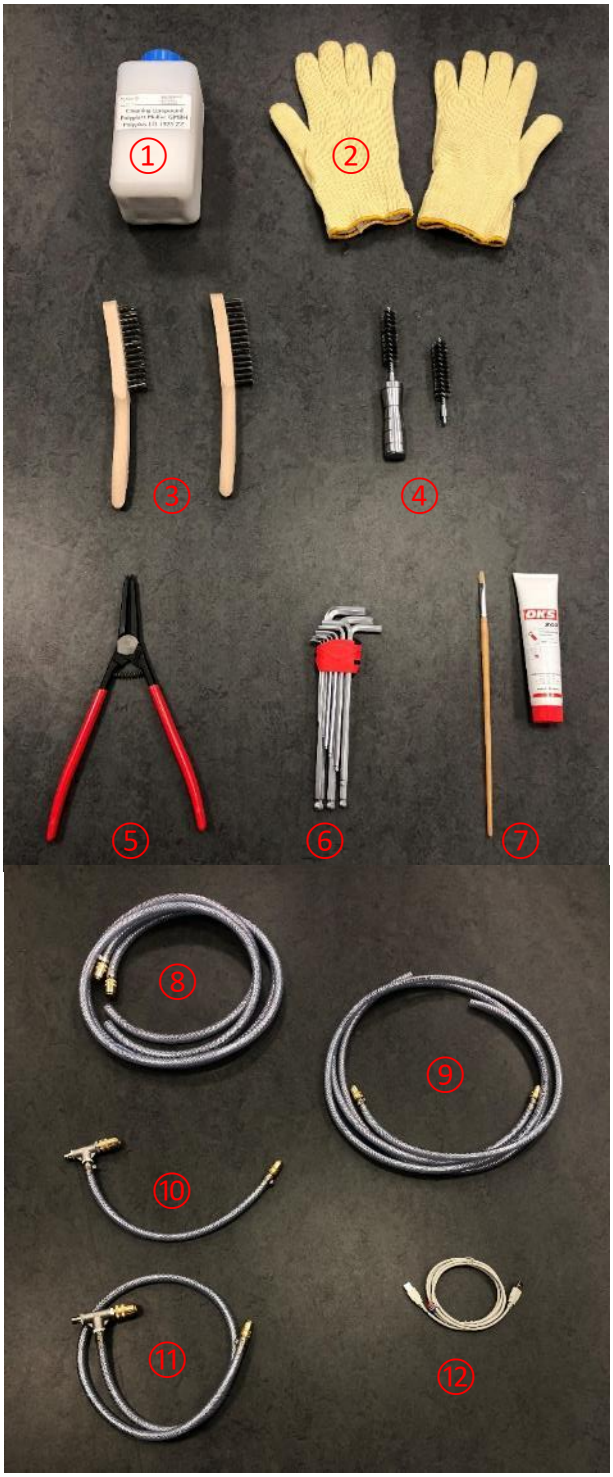
No.	Description
5	Safety guard for barrel
6	Water cooled top hopper
7	Barrel filling plug
10	Valve for melt flow control
18	Hopper water outlet
19	Retaining pin for water cooling plate
20	Retaining pin for front barrel half
21	Recirculation channel
22	Extrusion channel
23	Inertisation gas connection
24	Mixing screw
25	Hopper water inlet
26	Melt temperature sensor



3.2 Mixing screws

Standard	Option	Option
CO rotating Easy filling screws	**CO** rotating flight slotted Easy filling screws	**COUNTER** rotating Easy filling screws
		

3.3 Standard tool set



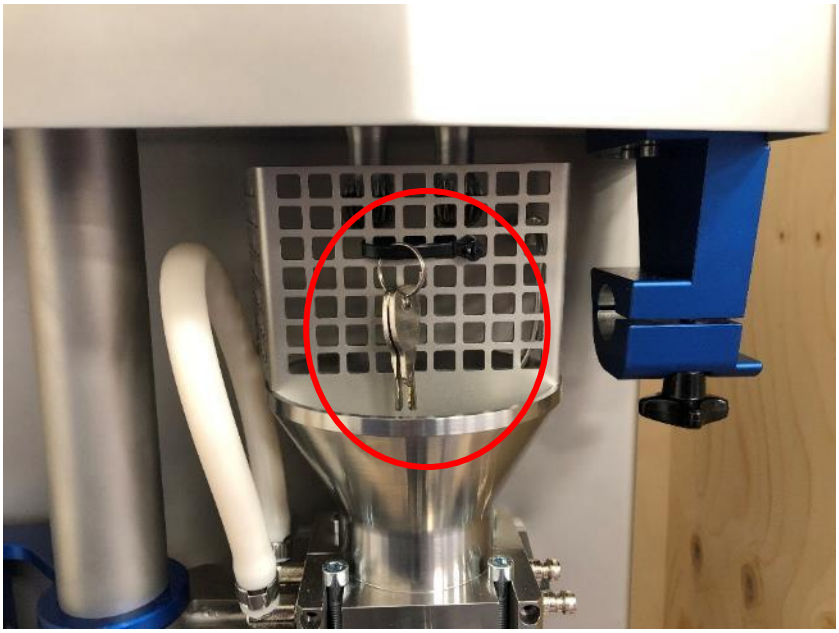
No.	Description
1	1 kg standard cleaning compound
2	1 Pair of heat resistant gloves
3	2 Stainless-steel brushes
4	1 Stainless-steel flame pipe brush with holder 1 Spare stainless-steel brush
5	Pliers for recirculation valve disassembly
6	Allen key set
7	Anti-seizing grease with applying brush
8	Water hoses
9	Gas hoses
10	Hopper water inlet connection hose
11	Hopper water outlet connection hose
12	USB data cable

3.4 Gearbox key lock

The gearbox is protected by a key to prevent unintended switching between CO and COUNTER rotating. Refer to section 10 Changeover Co / Counter rotating on page 75.

This key is attached to the safety fence of the barrel.

After arrival of the machine, take off the key and store it in a safe place.

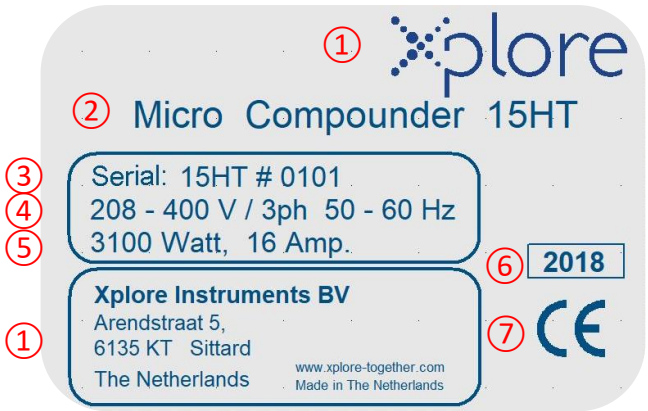


3.5 Nameplate

The nameplate of the micro compounder is on the instrument, just above the main switch.

The following information is reported on the plate:

No.	Explanation
①	Manufacturer
②	Machine type
③	Serial No.
④	Operation voltage, phases and frequency
⑤	Power consumption, watt / amps
⑥	Year of manufacturing
⑦	CE-Mark



3.6 Technical specifications

Type **MC 15 HT**

Dimensions	Compounder dimensions:	Width Depth: Height:	60 cm 45 cm 95 cm
	Barrel dimensions:	Width: Depth: Height:	90 mm 80 mm 215 mm
	Mixing volume: Total volume:	15.0 ml 16.5 ml	
	Screw length: 336 mm, mixing length 172 mm, diameter: 22 - 9 mm		
Weight	145 kg		
Lifetime	(In normal use) unlimited		

Electrical system	Power supply connection	1ph 208-240 Vac 50/60 Hz	3ph 208-400Vac 50/60 Hz
	Control voltage	24 Vdc	24 Vdc
	Power consumption	3.5 kW	4.2 kW
	Secure wall outlet for	16 A	16 A
	Maximum peak current	16 A	16 A
Main drive	Drive motor power	1.35 kW	1.35 kW
	Total output torque	40.0 Nm	40.0 Nm
	Screw torque	20.0 Nm	20.0 Nm
	Screw speed	1 – 250 rpm	1 – 500 rpm

Frequency controlled servo drive.
The maximum mixing screw torque is available over the entire rpm range.

Heating system: 2 x 3 separately controlled heating zones (8 heating cartridges, 6 thermocouples), each with an adjustable temperature range (temperature gradient possible within the barrel).

Maximum operating temperature is 450°C (standard) or 500°C (option combined with MC.15.2.80), which is protected by 2 extra thermocouples (safety).

Heating time from 20°C to 240°C is less than 20 min.

A melt temperature measurement is included.

Cooling: The cooling system consists out of an air-cooled part, and a water-cooled part.

The air cooling is used for precise temperature control, and for cooling down from high temperatures.

The water-cooling unit allows rapid cooling below 300°C, which decreases time between experiments.

With water cooling it takes less than 10 minutes to cool from 240°C to 80°C* (less than 35 minutes with air cooling).

** Cooling water source: min. 5 l/min at max. 20°C inlet temperature*

Hopper: Water cooled top hopper

Controls: A colour touch screen control panel is integrated in the instrument housing

Standard accessories:

- One set of co-rotating mixing screws
- Operating tools
- User manual

Air supply	Pressurized air supply of 0 – 6 bars, minimum flow 50 l/min
Water supply	Cooling water supply, 0 – 6 bars, minimum flow 5 l/min Water recirculation connection for closed loop system or sink for open connection necessary.
Inert gas supply	(Only if inertisation gas will be used) Nitrogen (N2) or Argon (Ar), supply 0 - 6 bars
Lubrication	The gearbox is lubricated with long-life grease for its entire lifetime. The ball joints connecting the mixing screws should be lubricated with cupper grease once every week.
Noise Level	The noise level is measured according to the requirements of the Instrument Guideline. The A-weighted sonic pressure was measured at the work station during normal working conditions. The measurement was taken at a distance of 1 meter from the instrument surface and at a height of 1.60 meters above the floor. The level of the A-weighted equivalent continuous sound pressure (LAeq) is under 70 dB(A).
Environment and storage	The instrument must be placed and used in a noncorrosive environment (use the instrument indoors). The micro compounder must be placed and used in an environment preferably having: • a flat and sturdy base; • not directly exposed to sunlight or other source of heat; • a reasonably constant temperature between 0 and 45 °C; • a relative humidity of no more than 75%; • reasonably free of dust, corrosive gases, and high concentrations of organic fumes; • not near a source of vibration.
Transport	The Xplore MC 15 HT will be delivered on a pallet frame as part of the transport crate. The design is such that fork-lift blades or hoisting gear can be easily shoved under the frame. The package was designed to allow for stability during transport. However, abrupt movements involving tilting should be avoided as much as possible whenever the transport crate is off the ground. It is advisable to keep this crate for future moves.
Options and configurations	• Vari-batch® barrel for flexible barrel content of 3, 7 or 15 ml • Different type of mixing screws • Continuous dosing unit • Data acquisition and rheological software • Injection moulder • Film devices • Fiber lines
Certification	• According to CE. The directives and standards are summarized in the EU Statement of Conformity. Refer to section: 23.1 Appendix 1; EC-Declaration of conformity for instrumentry on page 149 • UL-compliant.

4. Safety

4.1 Intended use

The MC 15 HT is intended for fast and efficient compounding/mixing of small quantities of viscous materials and additives. The instrument is designed to speed up the development of new materials and new formulations.

The mixed material can be extruded out and collected as a sample or can be processed further onto one of Xplore's shaping instruments.
Also it is possible to extract data from the micro compounder with data acquisition or rheological software.

The parts of the micro compounder are especially selected to cope aggressive chemicals, and abrasive materials at high temperatures, (pH 0 – 14 up to 500ºC). The barrel and mixing screws lifetime are depending up on the aggressiveness and abrasiveness of the materials used.

The barrel and mixing screws are not able to resist chemical interference with unbound Fluor (F).

Every further use as for example the compounding/mixing of different materials as specified above is not according to the intended use. The manufacturer is not liable for possibly resulting damages. It is at the user's own risk.

The use according to the intended use also includes the observance of the operating, maintenance and service conditions as well as the safety regulations prescribed by the manufacturer.
Unauthorized alterations at the machine exclude the liability of the manufacturer for resulting damages.

4.2 Target group

The target group to which this user manual applies is authorized persons and technically competent persons.

Authorized persons are those who:

- have acquired a certain level of knowledge by schooling/training (internal course specific to the Xplore micro compounder and,
- have certain skills to operate the instrument.

Technically competent persons are those who:

- are authorized and
- have acquired a certain level of technical knowledge by schooling/training and
- are acquainted with the engineering of the instrument and aware of the possible dangers and risks (personnel trained by Xplore is recommended).

WARNING OF DANGER
Installation, periodic maintenance and performance of repairs may only be done by persons who are technically competent, unless otherwise indicated.

At the start of each chapter with instructions, there is a statement as to whether the information is intended for authorized or for technically competent persons.

By operation we mean:

- the setting up of the instrument;
- working with the instrument;
- cleaning of the instrument;
- performance of simple maintenance operations.

4.3 Before getting started

	**WARNING OF DANGER** The instrument should only be operated with original parts.
	**WARNING OF DANGER** Carefully read this user manual before performing operations involving the MC 15 HT. Xplore is not liable for injuries, damage and/or excessive wear caused by improperly performed maintenance, improper use of or modifications to the instrument.
	**WARNING OF DANGER** Plant management must make sure that all inspection, maintenance and assembly activities are performed by authorized and qualified personnel, who are well informed as to the instrument/installation after reading the user manual.
	**WARNING OF DANGER** If issues, questions or problems arise which are not discussed in this manual, inform your supervisor or e-mail info@xplore.com or call: 0031 46 2089770
	**WARNING OF DANGER** It is forbidden to place this instrument in a room where a danger of explosion is present.
	**WARNING OF DANGER** ➔ Do not wear loose clothing (for example necktie, open jacket, etc.) ➔ Tie up long hair
	**WARNING OF DANGER** Do not smoke, eat or drink in proximity to the Xplore Micro Compounders
	**ATTENTION** If the instrument is used by a third party, you as the owner/user are yourself liable, unless otherwise stipulated.
	**Tip** Provide sufficient lighting at the workplace (at least 200 lux during production and 500 lux during repair or maintenance activities);
	**Tip** Make sure the workplace is clean and safe (ARBO = Occupational Health and Safety) and do not leave tools lying around

4.4 Handling of technical safety measures

	WARNING OF DANGER Anyone who works with this instrument must be familiar with the emergency stop locations refer to sections: 4.7.1 Emergency stop on page 29 7.3 Emergency stop procedure on page 63 Emphasize this during the training that must be given after installation.
	WARNING OF DANGER When working with the MC 15 HT, you must keep in mind: • There is a risk of burning due to the high temperature of the compounder barrel and the subassemblies. • Risks when working with hot viscous (chemical) (hazardous) materials. • Moving parts.
	WARNING OF DANGER It is forbidden to remove covers or safety features. It is forbidden to bypass and/or work around safety features. The safety switches monitoring the barrel position (open/closed) are intended as an extra safety feature; simply opening the barrel is not enough for safe access.
	WARNING OF DANGER The micro compounder and the safety features described in this manual cannot be expanded, adapted, or altered without prior written permission from Xplore.
	WARNING OF DANGER Repairs or maintenance to mechanical parts, the electrical circuit or subassemblies: ➔ First shut off the main power supply of the instrument. ➔ Repairs or maintenance to mechanical parts, the electrical circuit or subassemblies should only be carried out by a technically competent and trained person. (see section 4.2 Target group on page 22)
	CAUTION The micro compounder has several parts that are brittle and / or sensitive if dropped on the floor. ➔ It is advisable to place a rubber mat on the floor in front of the compounder, to reduce the risk of breaking parts when accidentally falling.

4.5 The employer's responsibilities

To avoid injuries to his employees it is the employer's responsibility:

- ✓ to ensure that the equipment is properly installed by a technically competent person;
- ✓ to provide a clear and well-lighted work area around the equipment, to permit a safe operation and a routine maintenance;
- ✓ to ensure that all personnel (service personnel, maintenance personnel etc.) are trained and instructed how to operate and maintain the machine;
- ✓ to ensure that the equipment is never operated without all guards and warnings in place;
- ✓ to ensure that the personnel wear proper personal protection equipment while operating the equipment;
- ✓ to instruct all personnel that this machine contains hot parts and moving parts that can cause severe bodily injuries;
- ✓ to ensure that adjustments are made only by a trained operator and that alignments and maintenance are performed by technically competent persons;
- ✓ to ensure that the equipment is periodically inspected for proper operation;
- ✓ to ensure that the machines are equipped with a sufficient surge protection.

National Regulations (e.g. OSHA, British Factory Acts and others) require the employer to properly guard all equipment. Due to the specific environment and purposes for which this machine is used, the employers may need to use additional safety measures.

The sound emission value for operator's position at the working places of the operating personnel does not exceed 85 dBA.

4.6 The most important risks

Figure 1 Warning symbols for hot and rotating parts

WARNING OF DANGER BY BURNING WHEN TOUCHING HOT PARTS AND/OR HOT VISCOUS MATERIALS.

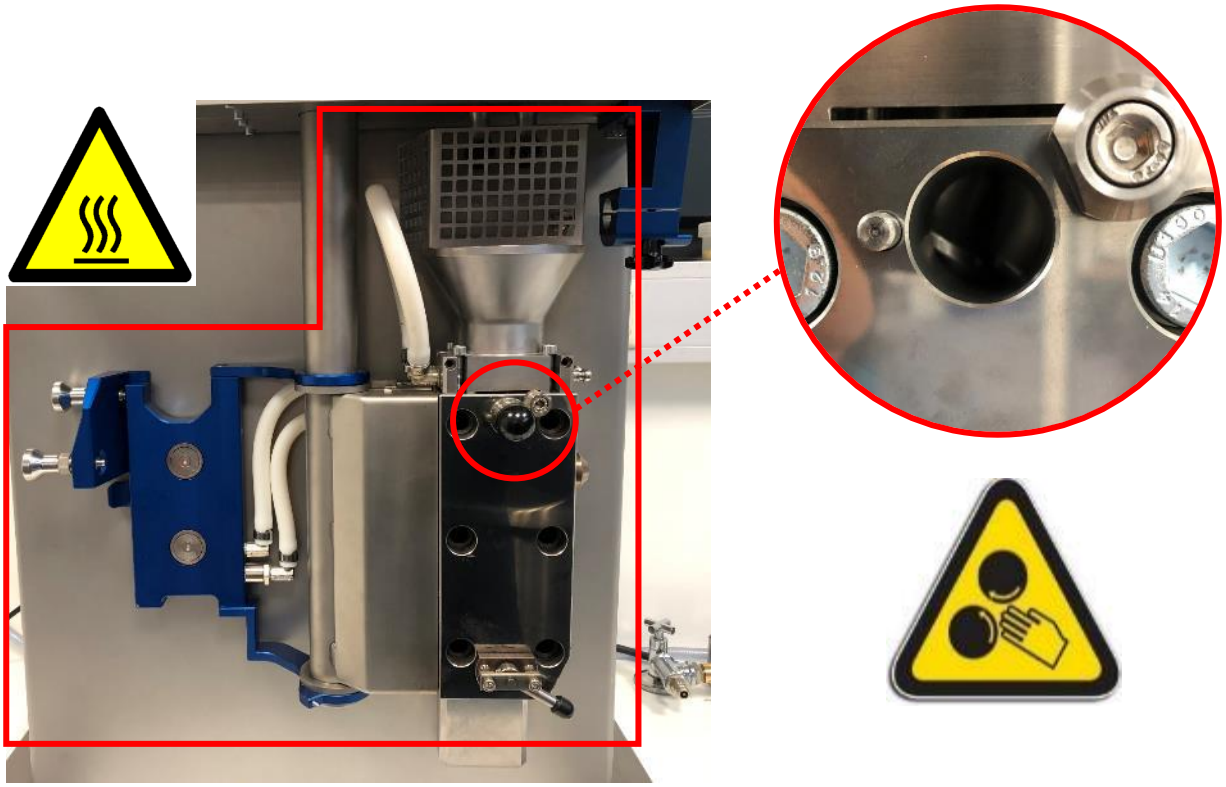
SPECIFICS:

- Due to the high temperature of the compounder barrel and the subassemblies, there is a risk of burning.
- Risks when working with hot viscous materials.

WARNING OF DANGER BY ENTRAPMENT OF ROTATING PARTS.

SPECIFICS:

- When the sealing plug is removed for filling and the front hopper is not connected, there is a risk of entrapment in between the mixing screws.



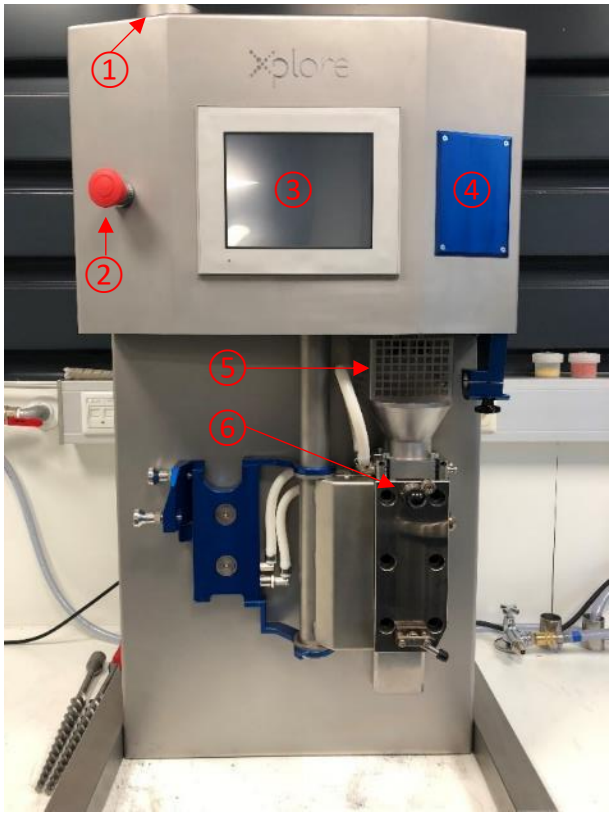
4.7 Safety measures

The following drawing gives an overview of the safety installations and warning labels at the machine.

	**ATTENTION** Regularly check if all pictograms are in the proper place on the instrument; if not, replace them.

Pictogram	Description	Position on the Instrument
	Warning: Danger at or near parts under tension. Access only by technically competent personnel.	On the outside of the door providing access to the electrical compartment.
	Warning: Danger. Do not open. Risk of electric shock. Disconnect all sources of supply prior to servicing.	On the outside of the door providing access to the electrical compartment.
	Warning: Danger of burns if hot parts are touched.	On the barrel and in the display when the heating is switched on. On the front side of the machine, just below the emergency push button.
	CE Marking: Indicates compliance with the European directives.	On the nameplate at the left side of the instrument.

	**WARNING OF DANGER** Regularly check if all safety features are available and function accordingly.



No.	Safety feature
①	Fume extraction connection
②	Emergency stop button
③	Touch screen
④	Safety cover for gear lever Co/Counter system
⑤	Safety guard for barrel
⑥	Barrel filling plug
⑦	Main switch
⑧	Rear cover

4.7.1 Emergency stop

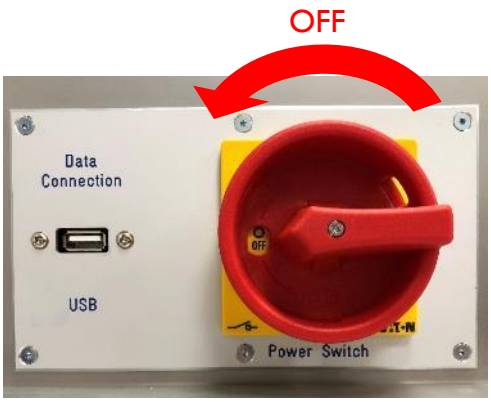
	**WARNING OF DANGER** If dangerous situations occur switch off the Micro Compounder by means of the emergency stop installations! There are 2 emergency stop installations: The emergency push button left to the touch screen. ➔ By pushing the push button. The main switch, on the left side of the compounder, which can also be used as an emergency stop switch. ➔ By turning the main switch to the "off" position.

	**WARNING OF DANGER** Operating on of the emergency stop installations does not disconnect the operating voltage.

Emergency stop operation by push button:
By operating the emergency stop button the motor and heating system are switched off.

- ➔ Push the push button to stop the machine in case of an emergency;
- ➔ After resolving the emergency situation, the machine can be unlocked from the emergency stop situation by turning the push button clockwise;
- ➔ The machine is immediately ready to use.

Emergency stop operation by main switch:
By operating the main switch, the power supply is directly shut off, not only the drive motor and the heating systems are switched off, but also the touch screen.



- ➔ Turn the main switch to the left to stop the machine in case of an emergency;
- ➔ After resolving the emergency situation, the machine can be unlocked from the emergency stop situation by turning the main switch to the "on" position, the machine will restart;
- ➔ Wait for the machine to be completely restarted before continuing operation.

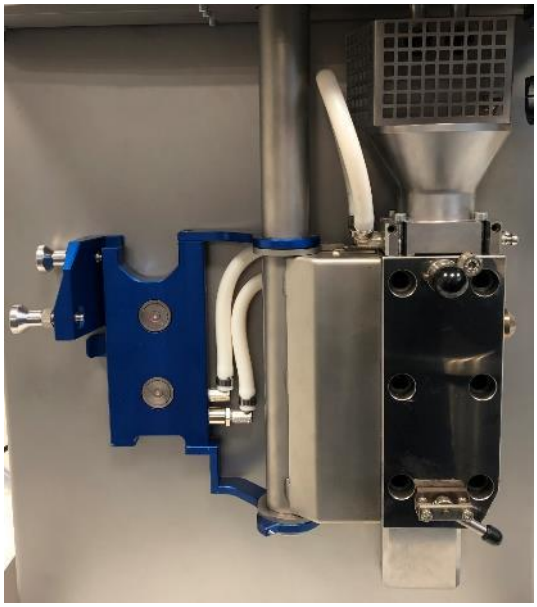
4.7.2 Protection against hot parts

	**WARNING OF DANGER** Always pay attention to the temperature of the compounder.

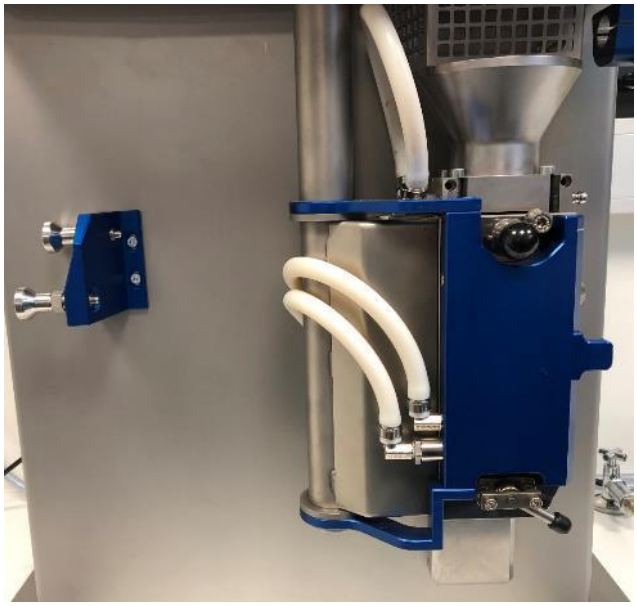
There is a danger of burns from touching the micro compounder. The temperature of the barrel can be as high as 500 °C. A peak temperature protection is present to prevent this temperature from being exceeded. The following warning pictogram is on the machine, near the hot parts.

The barrel temperature is regulated by a microprocessor on the PCB. The barrel of the compounder has cooling channels through which pressurized air flows downward and exits at the bottom of the barrel. The cooling air flowing through the barrel is controlled by electric valves.

It is also possible to speed up the cooling process of the barrel with water-cooling plates.



One cooling plate is positioned behind the rear barrel half.
The second cooling plate is located next to the barrel and can be hinged to the barrel.



The water-cooling plates for quick cool down are made of aluminium. Aluminium quickly absorbs the heat of the barrel; one should make sure that cooling water is present, or else the cooling plates and tubing may be damaged due to the high temperatures.
The temperature of the barrel is regulated by electric heating; if the set point is lower than the measured value, the control system will try to reach this value by means of the air cooling. If the user desires a faster cool down, the water cooling can be used. If the water-cooling is placed in operation, the heaters will be automatically switched off, while the air cooling is maintained at that time.

	WARNING OF DANGER Always make sure that cooling water is connected according to the specifications, before using the extra cooling elements, otherwise the hoses might melt due to the high temperature of the barrel. If the extra cooling elements are being used, the outflowing cooling water can also be hot.

	WARNING OF DANGER If the air cooling is being activated, the outflowing air at the bottom of the barrel can be hot.

	WARNING OF DANGER If the barrel becomes too hot, e.g. due to the friction created, automatic cooling is effected by pressurized air. Thus, always make sure that pressurized / cooling air is connected to the instrument.

	WARNING OF DANGER Always remember that not just the barrel is hot. The mixing screws, bolts, tools, steel objects and anything in contact with the compounder can be hot, even if making contact with the barrel for only a few minutes.

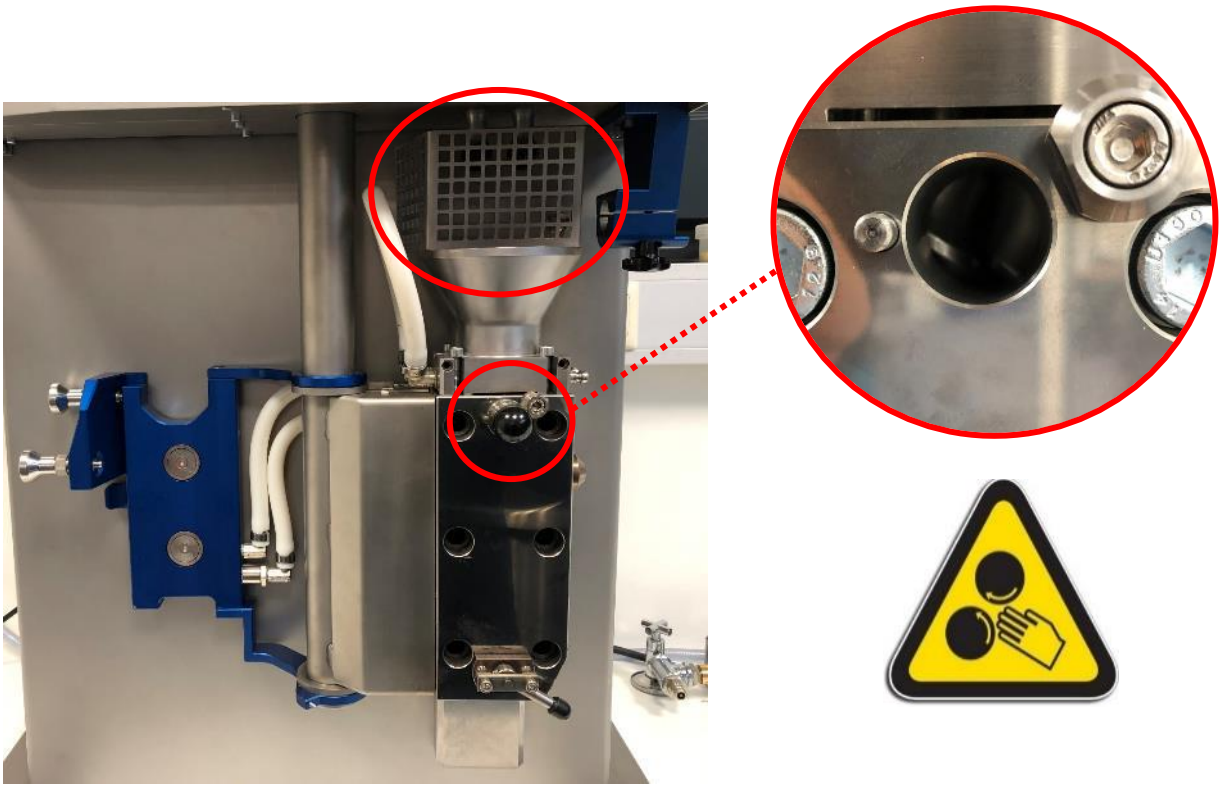
4.7.3 Protection against entrapment

	WARNING OF DANGER Never touch moving parts, this could cause entrapment and lead serious injuries.

To protect against entrapment between rotating mixing screws, especially when using the counter-rotating configuration the top hopper is equipped with a safety guard.

The barrel is equipped with a filling plug. If this filling plug is disassembled for example when using the front feeding hopper there is a risk of entrapment when the mixing screws are rotating.
Because there is no technical sufficient way of monitoring the filling plugs position and accessories which can be used in the filling plug hole there is no safety feature available.

For safety the feeding plug can only be taken out by using tools.



4.7.4 Safety measures for Co-Counter configuration

There are several safety features applied to avoid unintended use of the Co/Counter option.

WARNING OF DANGER
The change-over lever should only be operated by instructed persons who are aware of the possible dangers!
Refer to sections 10 Changeover Co / Counter rotating on page 75

For using the Micro Compounder in Co-rotating mode there are special Co-rotating mixing screws (standardly delivered).
For using the Micro Compounder in Counter-rotating mode the LEFT screw should be the special Counter-rotating screw, recognizable by the Counter-rotating symbol.
The change-over from Co to Counter or visa versa must only be done without any mixing screws being attached to the ball joints.

CAUTION
Change-over can only be done if the mixing screws have been removed!
If change-over is done with mixing screws mounted, the mixing screws as well as the barrel and gearbox may be seriously damaged!

There are 4 safety measurements taken to avoid unintended use of the Co/Counter gear lever:

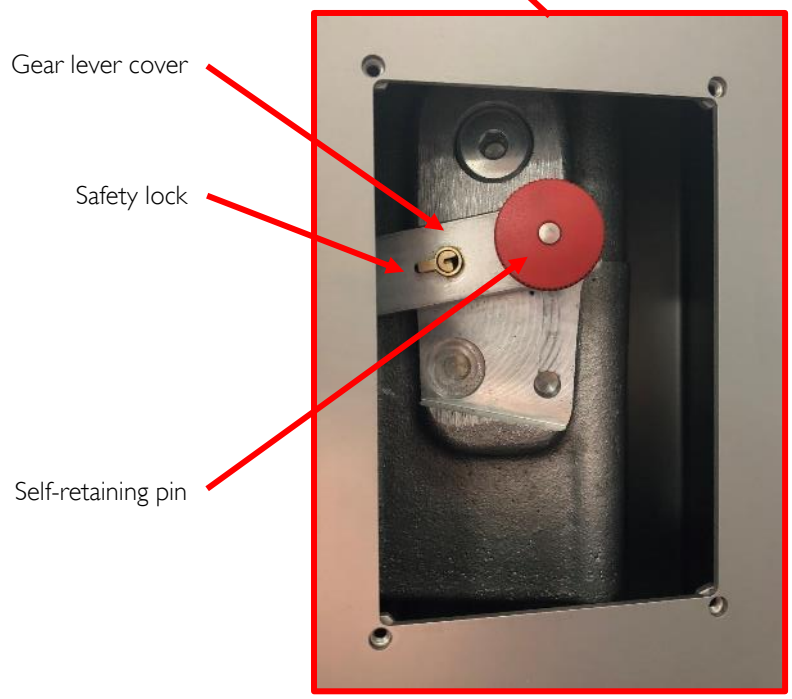
1. The gear selector lever is positioned behind a cover on the front of the machine. The cover can only be taken off by means of using tools;
2. The gear selector lever is locked with a lock to avoid unintended movement by non-trained persons. Store the key in a safe place!
3. The gear selector lever is latched in place by a self-retaining pin, the pin must be pulled outwards to operate the gear selector lever;
4. After change-over it is impossible to mount the wrong type of mixing screws.

CAUTION
Install the correct mixing screws after the change-over!
For Counter rotating, this is a special left screw, only use it on the LEFT ball joint!

CAUTION
After the change-over, install:
➔ Safety lock
➔ Cover on the front of the instrument

TIP
Keep the mixing screws not being used in a safe place so that they cannot be used unintentionally!

	**WARNING OF DANGER** Always install the safety features after change-over: ➔ Safety lock ➔ Cover on the front of the instrument



4.7.5 Intrinsic safety

Safety distances:

- The moving parts of the micro compounders are placed in such manner that they are unlikely to be touched (motor and gear box).
- The protective guard on the top hopper avoids entrapment by the mixing screws.

4.7.6 Torque in the compounder

The mixing screws exert a torque when mixing viscous materials in the barrel.
The compounder drive system is protected against overload.

4.7.7 Electrical safety features

WARNING OF DANGER
Electrical compartments, for example: motors and transformer, relay boxes, etc. must only be opened by technically competent persons.
(see section 4.2 Target group on page 22)

The following safety features have been included in the electrical installation:

- A printed circuit board (PCB) with the various regulators, also controlling a separate motor controller which controls the speed and/or torque of the motor;
  Including:
  - 2 Main fuses; 10A for the motor drive and 16A for the heating and PCB
- Functional interlocks (such as opening of barrel, barrel temperature protection and the temperature protection of the motor, both switch the motor off).

The compounder motor has a maximum torque limiter.

All function-interlocking covers of the MC 15 HT are provided with a double function interlock switch. The function interlock stops all moving parts located behind this cover if one or more of the covers are opened.

Access to the electrical compartments are shielded by means of covers.

4.7.8 Safety measures for working with dangerous substances

Exhaustion:
Connect an exhaust system to remove possibly toxic fumes (for specifications of the exhaust, refer to the utility specifications in section 5.4 Utility connections on page 43

Which combinations should not be used:
➔ Avoid using with easily flammable liquids/gases if the barrel is warm.

4.7.9 Steps for safe lifting and handling

The Xplore MC 15 HT is placed and secured on a pallet frame as part of the transport crate.
It is advisable to keep this crate for future moves. The design is such that fork-lift blades or hoisting gear can be easily shoved under the frame. The package was designed for stability during transport. However, abrupt movements involving tilting should be avoided as much as possible whenever the transport crate is off the ground.
Because of the weight, suitable lifting gear and/or specialized labour/firms must be used for horizontal and vertical transport.

4.7.10 Personal protection equipment

Use of personal protection equipment:
The following personal protection equipment is mandatory:
- ✓ protective clothing in connection with hot surfaces;
- ✓ mouth protection for hygiene;
- ✓ safety shoes;
- ✓ safety gloves (hot surfaces and danger of cutting);
- ✓ safety goggles.

4.7.11 Instructions

Instructions and/or briefing:
In view of the occupational health and safety obligations which the employer must satisfy, it is advisable to make a number of working instructions and organize briefing meetings.

4.7.12 Ergonomics

Proper consideration was given to ergonomic aspects during the design phase. Because the operator is constantly present at his workstation, maximum consideration was given to the human aspects in the design and installation of the operation panels. The design of the operation system is as clear and conspicuous as possible.

4.7.13 Safety during maintenance / repair / shutdown, etc.

Main switches:
The power supply of the electrical compartment can be disconnected by a main switch. If the power cable is removed from the power source, one can work safely on the instrument.

	WARNING OF DANGER Before performing maintenance activities. Make sure the device is disconnected from the electrical power source and it is protected from unintended switching on (Lock-Out, Tag-Out).

	WARNING OF DANGER Make sure the cooling water, pressurized air and pressurized inertisation gas are disconnected before performing maintenance activities.

	WARNING OF DANGER Make sure the barrel is cooled down to a safe temperature before performing maintenance activities.

5. Transportation, placing and installation

This section describes the procedure for transporting and installing the micro compounder and taking it in operation.

Before getting started with transportation, placing and installation obey the following precautions.

	WARNING OF DANGER The installation of the micro compounder must be done by technically competent personnel. (see section 4.2 Target group on page 22)
	WARNING OF DANGER The weight of the crate including the machine is specified in the technical specifications. Ensure proper transport devices to be used only.
	CAUTION Transport and handling of the micro compounder, or its parts (whether or not in original packaging), should be carried out carefully to avoid any damage.
	TIP • Place the instrument on a stable table on an ergonomic height (depending up on the user). • Use a table which has got a minimum load capacity of 2,5 times the instruments weight. This to ensure enough stability during working on the machine. (note the weight of the instrument). Refer to the technical specifications for the instruments weight data.
	TIP • Place the instrument level at the workstation. The design of the micro compounder takes into account a handling of the instrument to guarantee sufficient stability. • The space around the instrument must be large enough so that operation, maintenance, cleaning and shutdown can occur without problem or extra danger. Advice: there should be around 20 to 30 cm of free space left and right of the compounder.

5.1 Transport

The micro compounder is packaged and transported in a special designed crate. The crate can be lifted by means of a forklift truck or manually by pallet jack.

Be carefully when moving the crate around, the centre of gravity is in the top part. Always fix the crate secure when transporting.

Be aware, the centre of gravity is in the top half of the crate!

5.2 Unpackaging

TIP
The crate and the packaging material should be kept during the warranty period, so that the compounder can be sent back for possible servicing.

If the crate and the packaging material are not kept, and the compounder needs to be sent back during the warranty period, you will have to arrange for proper shipment packaging yourself. Damage occurring during transport due to improper packaging shall be at the expense of the owner.

It is also advisable to keep the crate and packaging material for future transport.

ATTENTION
Check the instrument for possible damage. If damage is found, this must be directly reported to the supplier, whether or not the warranty is invoked.

Preparations for unpackaging:

- ✓ Arrange a suitable lifting device for the crate, for example a pallet jack.
- ✓ Arrange tools for opening the crate and removing packaging:
  - Screwdriver head type PZ2 or an electric drill with a bit type PZ2, for opening of the crate;
  - Utility knife for removing packaging.

Utility knife

Screwdriver or electric drill containing PZ 2 bit type

Unpacking the instrument:

1. Move the instrument close to the desired location;
2. Remove the top lid;
3. Take out the transport filling material;
4. Check inside the crate whether it is safe to open the front cover of the crate.
   If parts have fallen down or rest against the front cover remove these first;
5. Remove the front cover;
6. Remove the boxes containing the standard tools or ordered accessories.
   Place them aside for further use later;
7. Remove the side and rear covers;

5.3 Placing

	**WARNING OF DANGER** Use a table which has got a minimum load capacity of 2,5 times the instruments weight. This to ensure enough stability during working on the machine. (note the weight of the instrument). Refer to the technical specifications for the instruments weight data.

Preparations for placing the instrument:

- ✓ Suitable location for the instrument
- ✓ Arrange tools for loosening the instrument from the crate and removing packaging:
  - Screwdriver head type PZ2 or an electric drill with a bit type PZ2, for loosening the screws which hold the machine to the crate;
  - Utility knife for removing packaging.

Utility knife

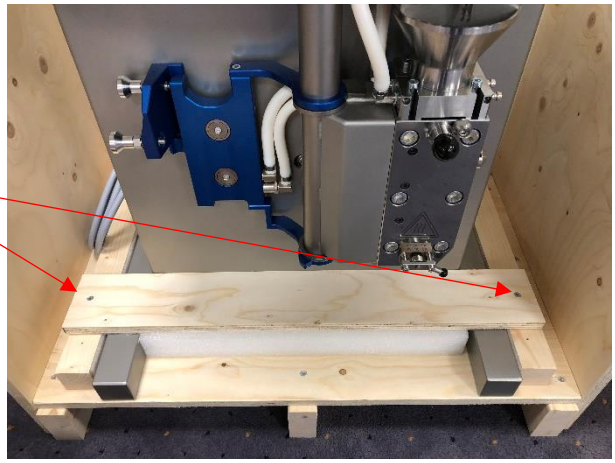
Screwdriver or electric drill containing PZ 2 bit type

Placing the instrument:

1. Move the instrument to the desired location;
2. Lift up the instrument by means of a suitable lifting device;
3. Level out the bottom of the instrument with the height of the table;
4. Loosen the screws which fix the device to the bottom plate of the crate;
5. Slide the instrument off the bottom plate onto the table by pushing.

Step 4

Loosen the screws which fix the device to the bottom plate of the crate.



5.4 Utility connections

WARNING OF DANGER
Only install the instrument if the correct utility connections are available.
Not obeying the correct utility connections could lead to safety risks or machine malfunction.

Preparations before installing the instrument:

- ✓ Prepare the utility connections according to the specifications on next pages;
- ✓ Understand below listed electrical connections

Carefully check your order conformation for the specified machine type.
Depending up on the execution of the machine it can either be powered by a single or multi-phase power source. Also, there are different kind of plugs available for wall socket connection.

Please refer to the order conformation to determine which execution of the machine you bought.

Mixing screw speed range
1 – 250 rpm ➔ single phase electrical connection
1 – 500 rpm ➔ multiple phase electrical connection

MC 15 HT Utility connections Electrics	
Machine type ↓	Electricity connections ↓
1 – 250 RPM	**Only for devices delivered in Europe** **Screw speed range: 1 – 250 rpm** • 3 meters of power cable attached to the device • Cable gauge for UL: 12 AWG or for CE 2,5 mm² • According to order conformation with plug or without plug • 1 phase + Neutral + PE, 208 – 240Vac, 50 / 60 Hz • Fused @ 16 A • Power consumption 3500 W @ 230 Vac, 50 Hz
1 – 500 RPM	**Only for devices delivered in Europe** **Screw speed range: 1 – 500 rpm** • 3 meters of power cable attached to the device • Cable gauge for UL: 12 AWG or for CE 2,5 mm² • According to order conformation with plug or without plug • 3 phases + Neutral + PE, 208 – 400Vac, 50 / 60 Hz • Fused @ 16 A • Power consumption 4200 W @ 380 Vac, 50 Hz

MC 15 HT Utility connections Gas, water and fume extraction	
Pressurized air	Necessary for operating the micro compounder. Pressurized air is used for the barrel temperature control system. • Supply pressure: 0 – 6 bars • Minimum flow 150 l/min @6 bars • Included hose: internal diameter 9 mm, length 2 meter
Cooling water	Necessary for operating the micro compounder with water cooled top hopper. Essential for the rapid barrel cooling system. Without water connection using the rapid barrel cooling function is not possible. Included hoses internal diameters: • Inlet: 13 mm • Outlet: 13 mm Length: 2 meter When using an open system (tap and sink): • Inlet pressure: 0 – 6 bars • Outlet: open sink connection • Minimum flow 5 l/min • Water inlet temperature advise: 20°C (higher inlet temperatures will lead to longer cooling time. When using a closed loop system (recirculating chiller): • Inlet: pump pressure >250 mbar • Outlet: open return connection • Pump capacity 10-20 l/min • Bath capacity: ≥15 liter • Cooling capacity: 0.5 – 1.0 kW • Temperature setting: 15 – 20 °C Note: during the cooling cycle the bath temperature may rise a few degrees.
Inertisation gas	Necessary for operating the micro compounders inertisation system. • Nitrogen (N2) or Argon (Ar) • Supply pressure: 0 - 6 bars • Included hose, internal diameter 9 mm, length 2 meter
Fume extraction	Used to extract fumes which arise during processing. • Exhaust pipe external diameter: 80 mm • Minimum extraction volume: 20 m³/h • Note: no hose included

5.5 Installation

	TIP Find a place for the manual within reach of the operator of the instrument.

	WARNING OF DANGER The instrument should only be operated if all parts have been correctly installed.

	WARNING OF DANGER Installation in another location: keep in mind the safety measures in this chapter. Consult your supplier.

	WARNING OF DANGER Electrical installations should only be connected by trained and qualified persons.

	WARNING OF DANGER Pressurized gas and water connections should only be connected by trained and qualified persons.

	WARNING OF DANGER When the installation of the instrument is ready, all persons involved in this instrument must be instructed with regard to supervision, operation, maintenance, safety measures and specifications based on this user manual.

Preparations for installing the instrument:

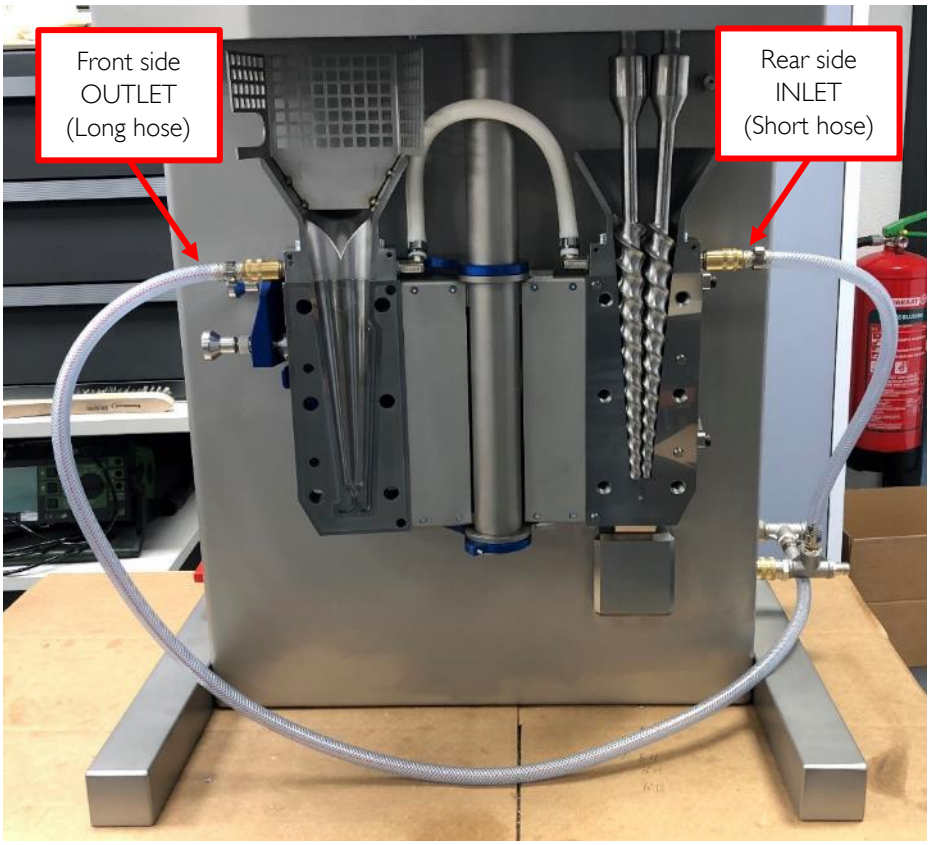
- ✓ Unpack the boxes containing the (optional) accessories and standard tools.
  Place them this way that you have provided a clear overview of the contents.

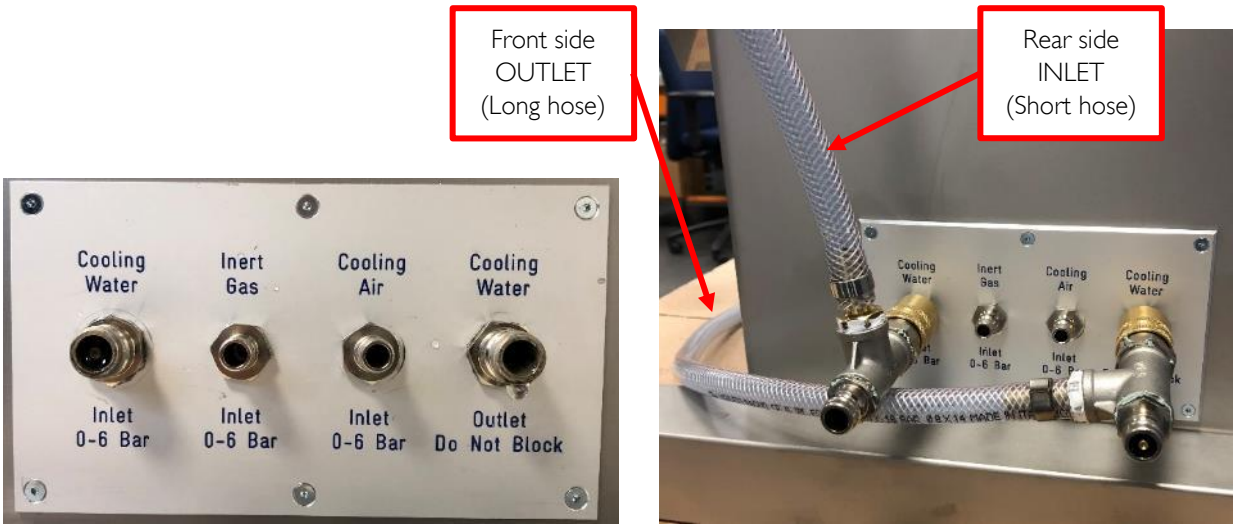
- ➔ If the included cable, is short, use an extension cord.
- ➔ If the included hoses are too short, use new hoses with correct length.
  Minimum burst pressure 20 bars.
  Internal diameters according to the utility specifications.
- ➔ Use new hose clamps for connection the pressurized hoses, never reuse hose clamps

Installation:

1. Connect the water cooled top hopper, by means of using the included connections hoses. Refer to chapter 3.3 Standard tool set on page 16, connection hoses No. ⑩ and ⑪

   Connect the **inlet hose** (short hose) to the **rear side of the top hopper** and to the **Cooling Water Inlet** of the compounder.
   Connect the **outlet hose** (long hose) to the **front side of the top hopper** and to the **Cooling Water Outlet** of the compounder.



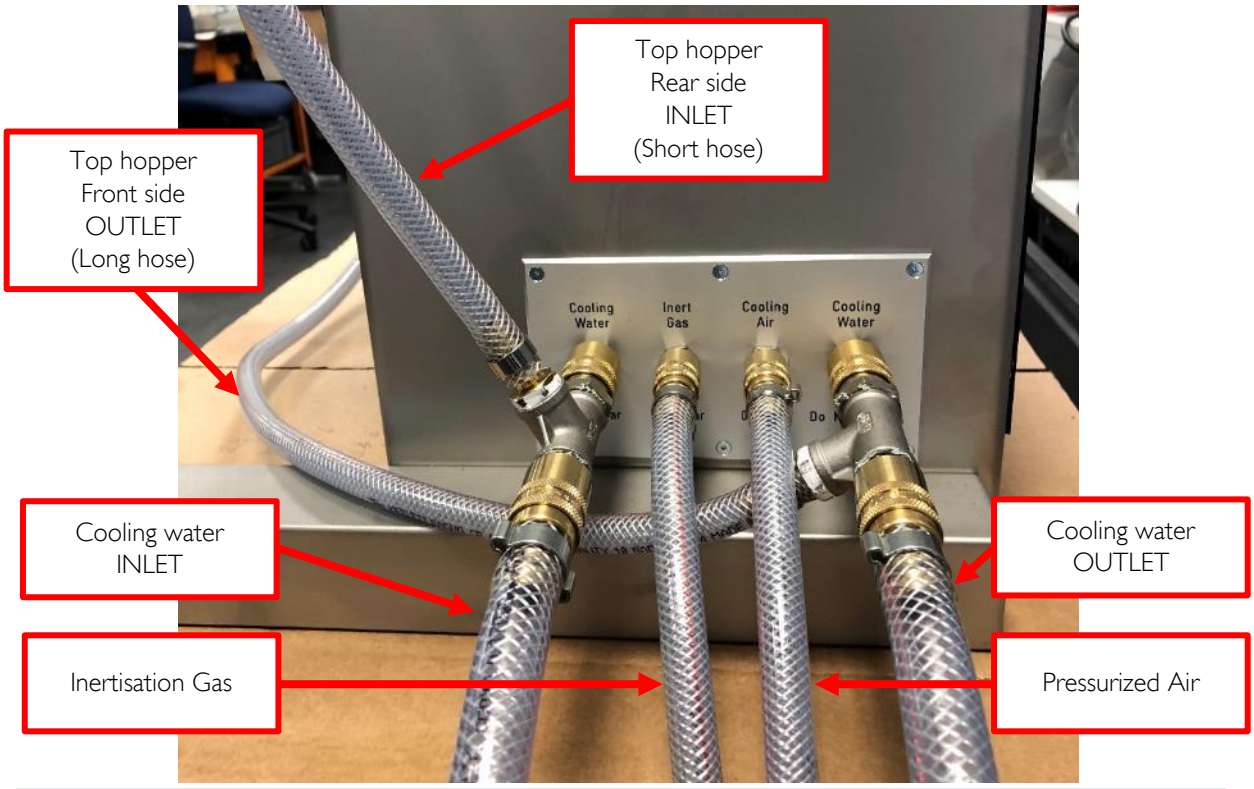


2. Connect the instrument electrically
3. Connect the pressurized air supply to the **Cooling Air** connection
   Use the included gas hose.
   Refer to chapter 3.3 Standard tool set on page 16, connection hose No. ⑨
4. Connect the instrument to the water supply and drain, or chiller

   When using a supply and drain system:
   Connect the supply to the **Inlet** of the compounder
   Connect the drain to the **Outlet** of the compounder, do not block the drain

   When using a recirculating chiller:
   Connect the outlet of the chiller to the **Inlet** of the compounder
   Connect the inlet of the chiller to the **Outlet** of the compounder

   Use the included water hoses.
   Refer to chapter 3.3 Standard tool set on page 16, connection hose No. ⑧
5. Connect the inertisation gas supply to the **Inert Gas** connection
6. Connect the instrument to the fume extraction system



6. General use

	WARNING OF DANGER To avoid burns, use heat resistant gloves when handling hot parts.

6.1 Opening the barrel

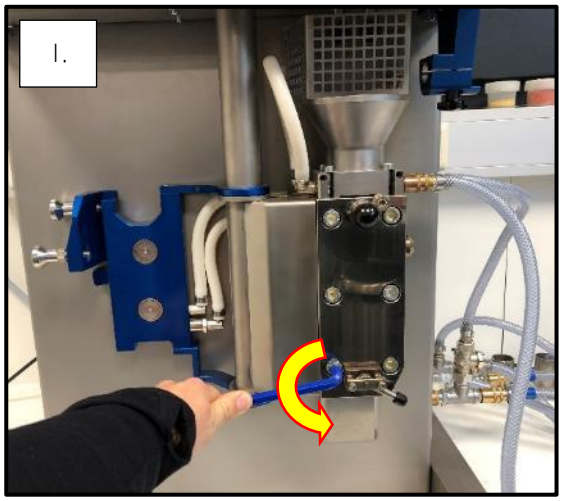
For opening a barrel which contains polymer (for example when the machine is jammed), first refer to section 14 Cleaning on page 91.
If the barrel is opened when polymer is inside extreme precaution must be taken to avoid burns.

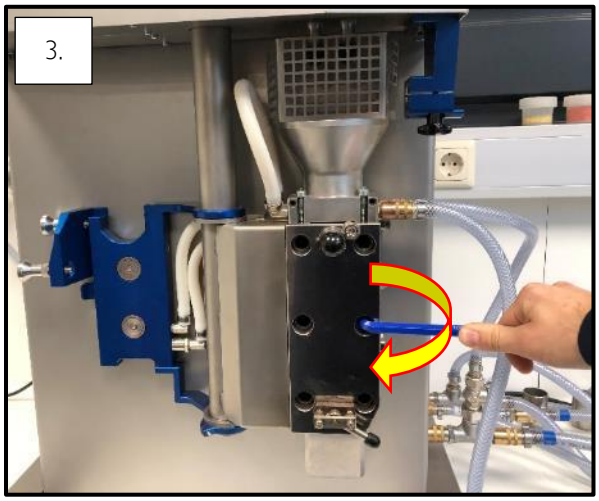
Opening the empty barrel:

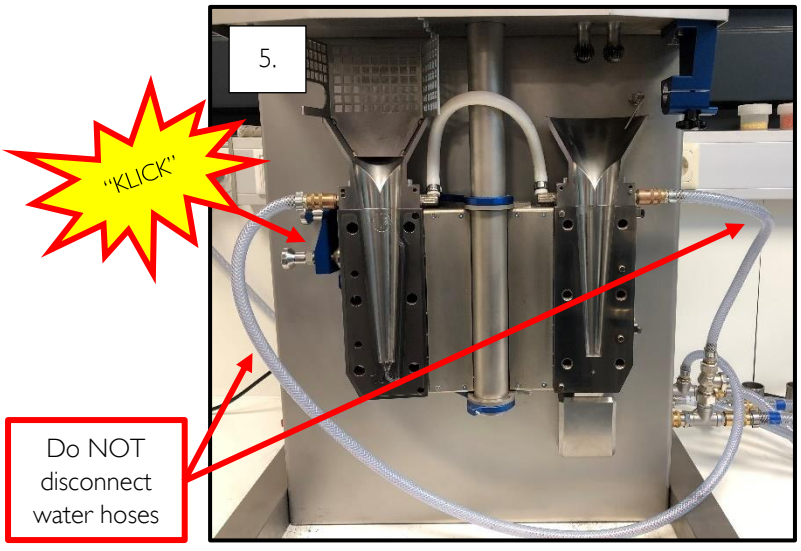
- ✓ To avoid burns, use heat resistant gloves for handling hot parts;
- ✓ Allen key No. 10 mm

- ➔ Do not disconnect the water-cooling hose on the top hopper, hot water could escape causing a risk of burns;
- ➔ The water-cooling hose on the front side of the top hopper is long enough to swivel open.

1. Unscrew the 6 bolts by using the allen key.
   To avoid injuries always push down on the allen key, never lift up the allen key;
   Be certain to put the allen key completely in the bolts head;
2. Take the bolts out of the barrel;
3. Place the allen key in the middle right hole and swing open the barrel;
   Caution! Do not pull on the top hopper, this could cause damage to the top hopper!
4. Remove the allen key from the barrel;
5. Klick the barrel in the retaining pin to avoid uncontrolled closing of the barrel







6.2 Closing the barrel

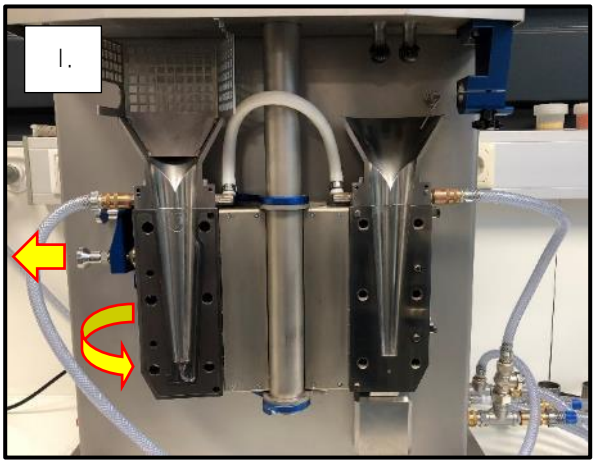
➔ Only close the barrel if the sealing surfaces are perfectly clean, refer to chapter 8 for cleaning instructions.

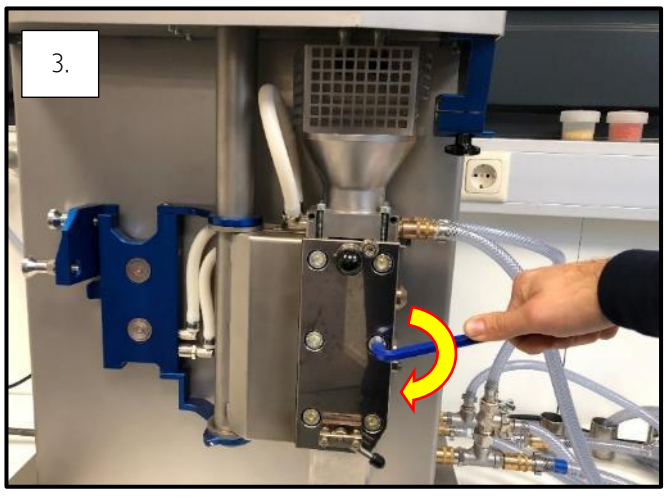
	**WARNING OF DANGER** If the barrel will be closed without proper cleaning of the sealing surface this could cause leakage of hot polymer.

✓ To avoid burns, use heat resistant gloves for handling hot parts;
✓ Allen key No. 10 mm

1. Pull the retaining pin and swing the barrel close;
   Caution! Do not pull on the top hopper, this could cause damage to the top hopper!
2. Ensure the retaining bolts are greased with anti-seizing grease. Only use a very small amount of anti-seizing grease!
3. Tighten the 6 bolts with the allen key hand tight only;
4. Heat up the barrel to the desired working temperature, now tighten the bolts;
   This is best done with a torque wrench.
   - 60 to 70 Nm for normal polymers
   - 85 to 90 Nm for high viscous polymers

Be certain to put the allen key completely in the bolts head to avoid slipping off.
Only push downward with the allen key, to minimize the risk of injuries in case of slipping off the bolts.

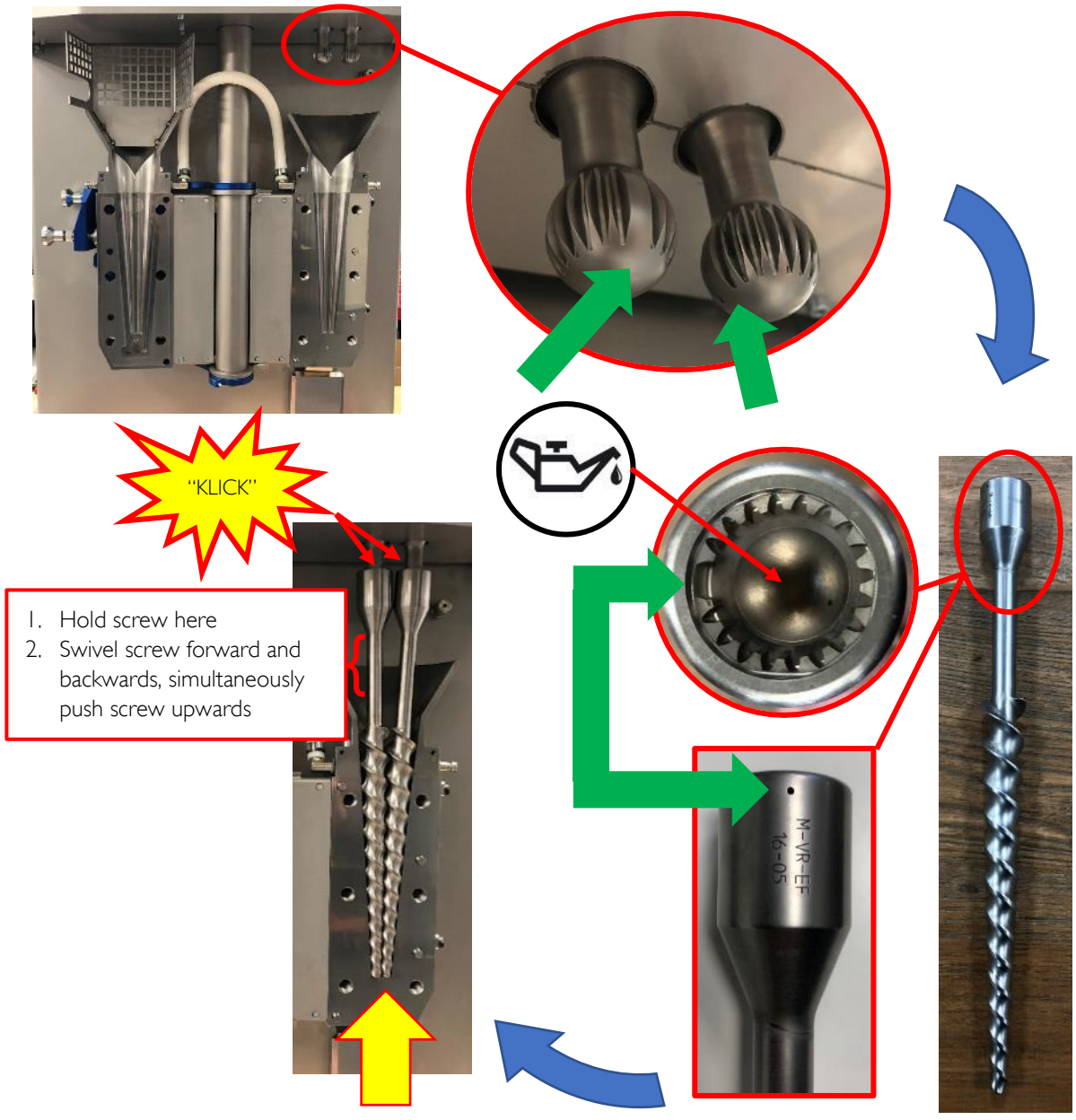




6.3 Mounting the Co-rotating mixing screws

- ✓ Make sure the compounders gearbox is in co-rotating mode.
  Refer to section 10 Changeover Co / Counter rotating on page 75.
- ✓ To avoid burns, and injuries when accidentally loosing grip on the mixing screws use heat resistant gloves;
- ✓ Open the barrel, refer to chapter Opening the barrel on page 50

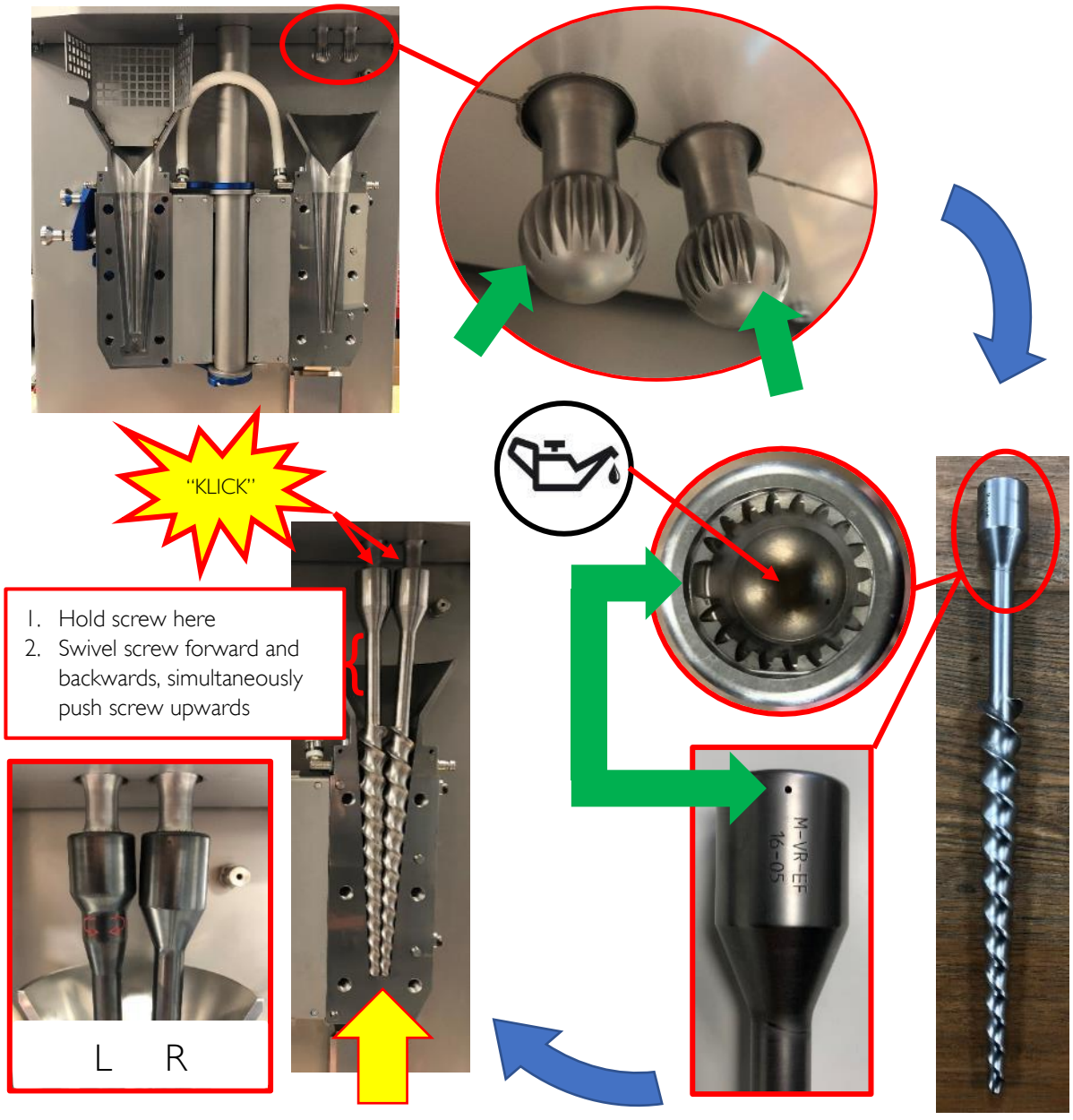
1. Check if the ball joint is lubricated sufficient;
   ➔ If not; lubricate the inside of the mixing screw ball joint with a small amount of anti-seizing grease.
2. Look where the big spline on the ball joint drive is;
3. Take one of the mixing screws, there is no difference in the left and right screw;
4. Hold the screw just below the ball joint;
5. Align the mixing screw big spline to the ball joint drive big spline;
6. Gently swivel the mixing screw forward and backwards and push simultaneously upwards until the mixing screw snaps into place;
7. Take the second mixing screw;
8. Repeat step 4 till 6 for the second mixing screw.



6.4 Mounting the Counter-rotating mixing screws

- ✓ Make sure the compounders gearbox is in counter-rotating mode.
  Refer to chapter 10 Changeover Co / Counter rotating on page 75.
- ✓ To avoid burns, and injuries when accidentally loosing grip on the mixing screws use heat resistant gloves;
- ✓ Open the barrel, refer to chapter Opening the barrel on page 50

1. Check if the ball joint is lubricated sufficient;
   ➔ If not; lubricate the inside of the mixing screw ball joint with a small amount of anti-seizing grease.
2. Look where the big spline on the ball joint drive is;
3. Take the left side mixing screw, this screw is marked with the symbol
4. Hold the screw just below the ball joint;
5. Align the mixing screw big spline to the ball joint drive big spline;
6. Gently swivel the mixing screw forward and backwards and push simultaneously upwards until the mixing screw snaps into place;
7. Take the right mixing screw, this is the standard screw without symbol;
8. Repeat step 4 till 6 for the right mixing screw.

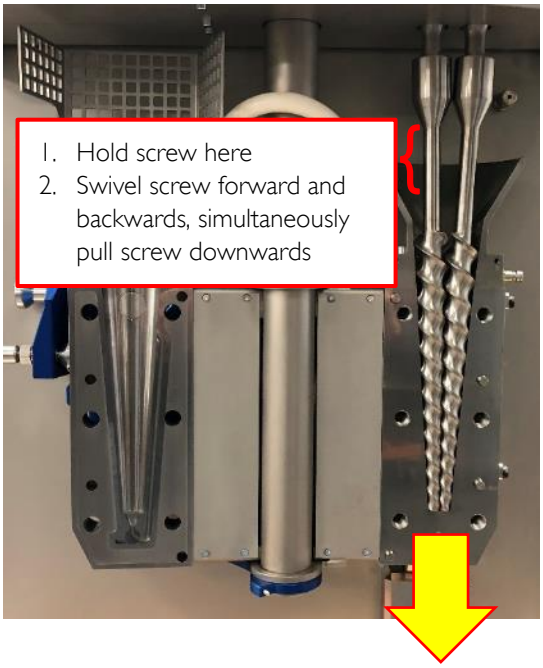


6.5 Removal of the mixing screws

	WARNING OF DANGER The mixing screws can be hot. It is possible to slip of the screw and risk cutting of your hands against the sharp parts of the barrel. For safety always wear heat resistant gloves when removing the mixing screws.

- ✓ To avoid burns, and injuries when accidentally loosing grip on the mixing screws use heat resistant gloves;
- ✓ Open the barrel, refer to chapter Opening the barrel on page 50

1. Pull the bottom of the mixing screw towards you;
2. Hold the mixing screw just below the ball joint;
3. Gently swivel the mixing screw back and forward and pull downward simultaneously until the mixing screw comes out;
4. Put the mixing screw aside safely without risk of causing fire or falling down on the floor



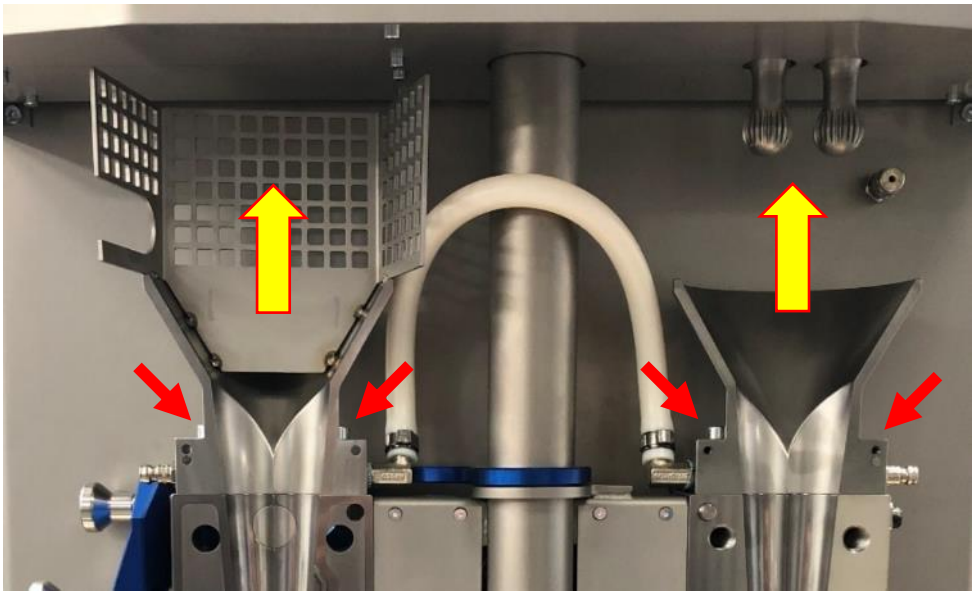
6.6 Mounting / removal of the water-cooled top hopper

⚠	**WARNING OF DANGER** The water-cooled top hopper can be hot. For safety always wear heat resistant gloves when removing the top hopper.

⚠	**WARNING OF DANGER** The water-cooling system can be pressurized. First stop and blead the water supply before starting work.

Removal

1. Stop and blead the water supply for the water-cooling;
2. Disconnect the water-cooling hoses;
3. Open the barrel, refer to chapter 6.1 Opening the barrel on page 50;
4. Remove the mixing screws, refer to chapter 6.5 Removal of the mixing screws on page 54;
5. Unscrew and take out the four bolts holding the top hopper;
6. First lift the top hopper upwards, then take out both of the hopper halves.



Preparations before mounting

➔ Lubricate the bolts with a small amount of anti-seizing grease to avoid seizing.

Mounting

1. Place the top hopper;
2. Place and tighten the four bolts holding the top hopper;
3. Connect the water-cooling hoses;
4. Pressurize the water-cooling system and check for leaks.

6.7 Removal and mounting of the filling plug

	WARNING OF DANGER Beware of hot parts, use heat resistant gloves!
	WARNING OF DANGER Beware of entrapment!
	WARNING OF DANGER If the barrel is overfilled, pressure build up could force the filling plug outwards when removing it. Always work with caution when handling the filling plug.
	CAUTION Do not put any other objects into the filling plug, they may damage the mixing screws.

Refer to the pictures on next page.

Removal

1. Hold the filling plug with your left hand to avoid it from being forced out of the barrel in case the barrel is overfilled;
2. Rotate the interlock using an allen key until the flat part lines up with the filling plug;
3. Pull outwards the filling plug.

If it is impossible to pull out the filling plug by hand, it is probably hold in place due to polymer which has been forced in between the barrel and filling plug.
To loosen the filling plug in this case, heat up the barrel above the melting point of the polymer. Disassemble when hot.

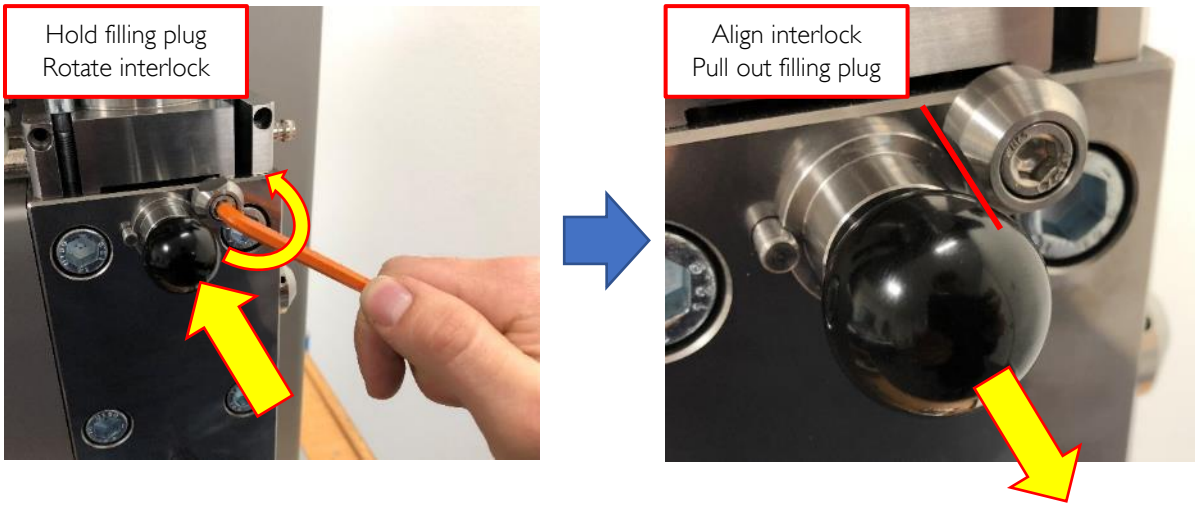
Before mounting

- ➔ Clean the filling plug so it does not jam when being mounted
- ➔ Clean the hole in the barrel so the filling plug does not jam when being mounted
- ➔ Lubricate the **interlocks thread** with a small amount of anti-seizing grease to avoid seizing. Take out the interlock completely to perform this action.

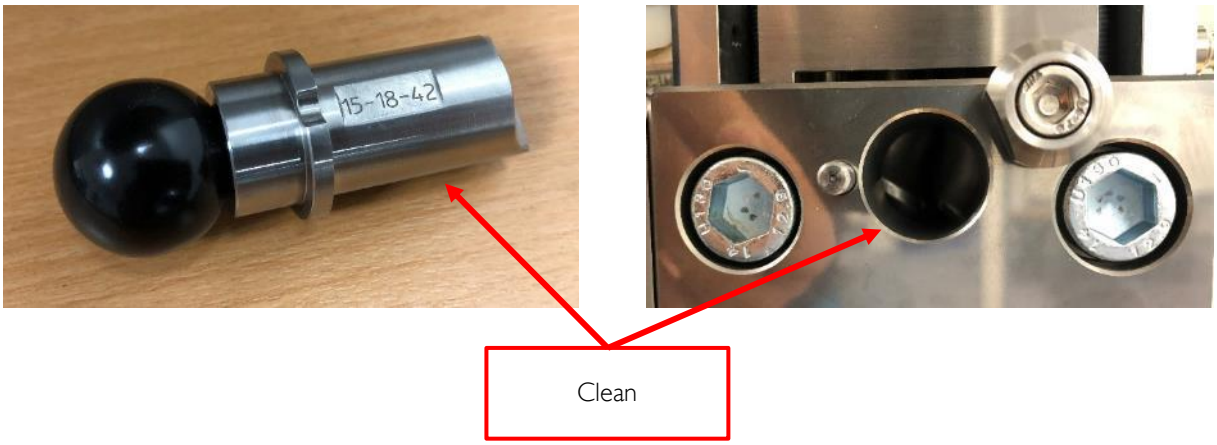
Mounting

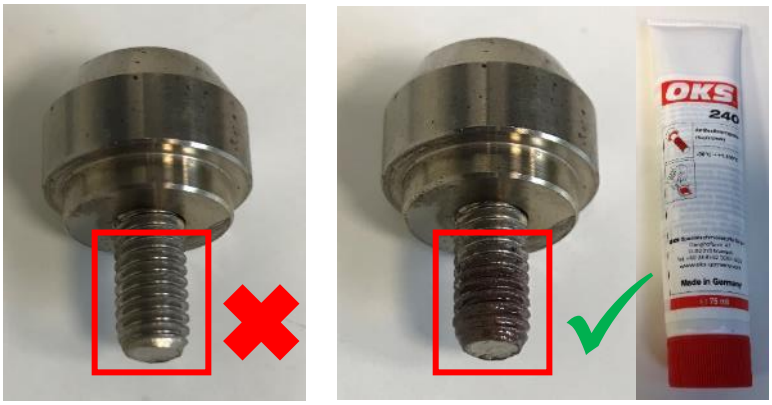
1. Rotate the interlock so the filling plug can be mounted;
2. Insert the filling plug completely into the barrel, line up the positioning pin with the slot in the filling plug;
3. Rotate the interlock using the allen key to lock the filling plug.
   Only hand tighten the interlock!

Removal

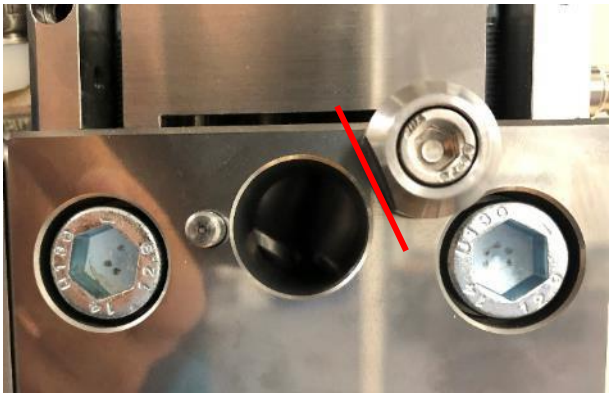


Before mounting





Mounting



1.
Align interlock.

2.
Insert filling plug.

3.
Lock filling plug.

6.8 Calibration of melt torque

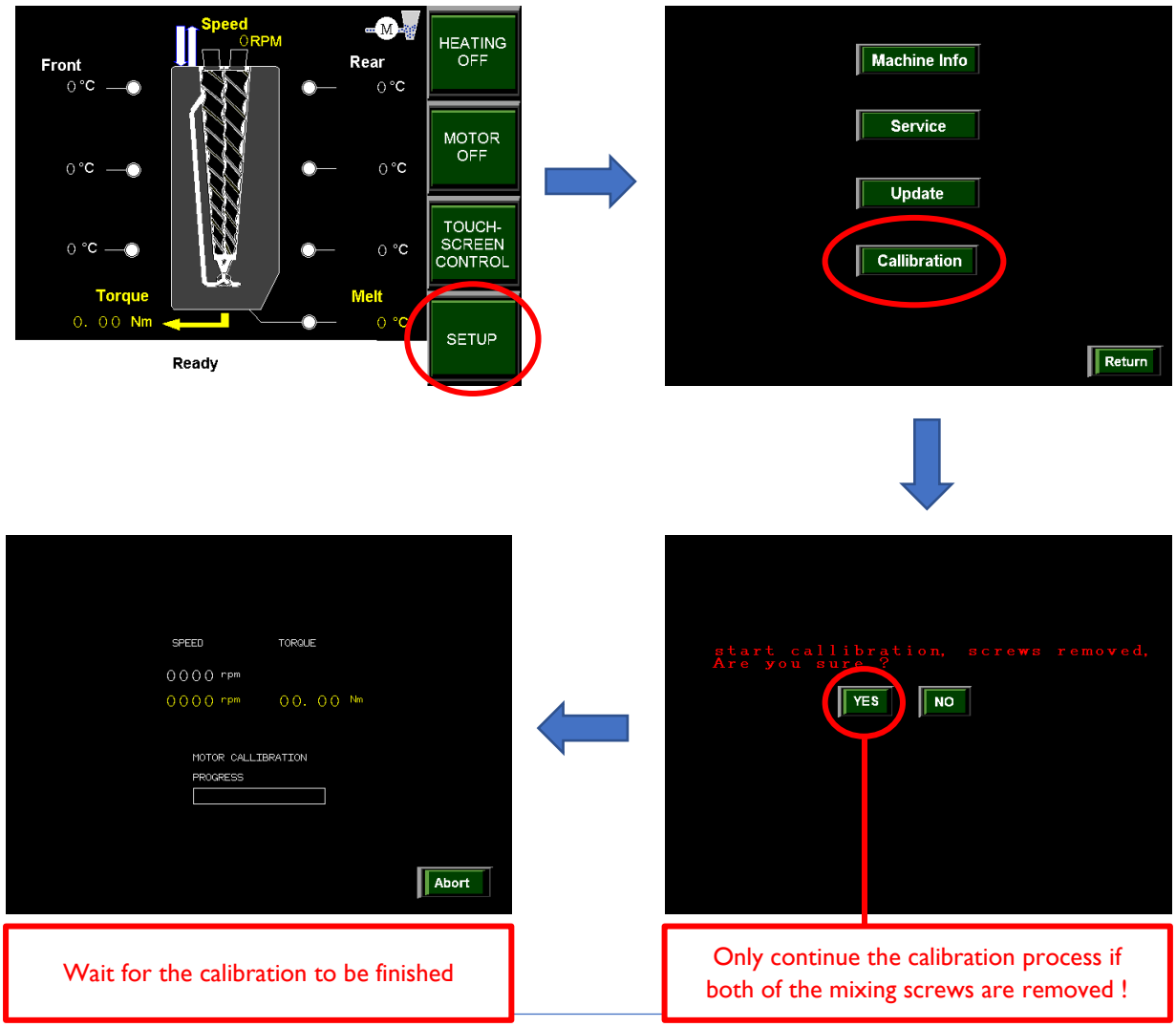
To ensure an accurate melt torque value the micro compounder is equipped with an automatic calibration program.

For gathering accurate data, it is advised to calibrate the machine after the first week of use and then each month.

Calibration:

- ✓ Switch on the machine and wait for the MAIN SCREEN to be shown;
- ✓ Remove both mixing screws, see section 6.5 Removal of the mixing screws on page 54
  If the mixing screws will not be removed this could cause damage to the mixing screws and barrel;
- ✓ Close the barrel, see section 6.2 Closing the barrel on page 51.

1. Click on the SETUP button in the MAIN SCREEN;
2. Click on the CALLIBRATION button;
3. Check if both of the mixing screws are removed from the barrel.
   Only if the mixing screws have been removed continue the calibration process by clicking on YES.
4. Wait for the calibration to be finished, this will take several minutes. The machine will start the motor automatically and slowly increase its speed.
   Progress will be shown in the time-line.
   The calibration can always be aborted by pressing the ABORT button;
5. After calibration the machine will restart automatically and is directly ready for use.



6.9 Placing the Micro compounder out of operation

1. Empty and clean the barrel and mixing screws, refer to section 14 Cleaning on page 91;
2. Close the barrel, refer to section 6.2 Closing the barrel on page 51;
3. Turn off the main switch;
4. Electrically disconnect the instrument.

6.10 Disconnecting the energy supply

Perform the following procedure before shutting off the energy supply.

1. Isolate (disconnect, cut out) the instrument from the power supply and other energy sources. Isolation from the mains must be visible. (the power cable must be removed);
2. Make sure no one else can connect the power supply line. (stow it safely away);
3. Check by a procedure whether all the above steps have been taken and the desired result achieved.

7. Operation

WARNING OF DANGER
Working with the MC 15 HT should only be done by authorized persons.
Shut down and fault analysis should only be done by technically competent persons
(see section 4.2 Target group on page 22)

7.1 Starting the micro compounder

To perform a particular action with the operating panels of the micro compounder, the following general starting conditions always need to be fulfilled.

General Starting Conditions

- ✓ Necessary safety precautions must be taken;
- ✓ Electrical power;
- ✓ Cooling-water and sink, when using a chiller switch on the chiller and check functionality;
- ✓ Pressurize air supply;
- ✓ When using inertisation gas, check if the supply is available;
- ✓ When using the fume extraction, switch on the fume extraction;
- ✓ The compounder parts must be clean (refer to section 14 Cleaning on page 91);
- ✓ Both mixing screws must be mounted.
  Check whether de correct mixing screws are mounted according to the gearbox setting
  (Co rotating: Section 6.3 Mounting the Co-rotating mixing screws on page 52)
  (Counter rotating: Section 6.4 Mounting the Counter-rotating mixing screws on page 53);
- ✓ The barrel must be closed, (see Section Closing the barrel6.2 Closing the barrel on page 51).

CAUTION
Whenever viscous material is still present in the barrel and the temperature of the barrel is below the melt temperature of the viscous material used, the mixing screws cannot be placed in motion!
This is certainly the case when working with the compounder when the barrel has not been cleaned.

Starting

- ✓ Make sure the correct mixing screws have been mounted (co or counter rotating);
  (Co rotating: Section 6.3 Mounting the Co-rotating mixing screws on page 52)
  (Counter rotating: Section 6.4 Mounting the Counter-rotating mixing screws on page 53);

1. Switch on the instrument by turning the main switch to the ON direction;
2. Wait until the main screen appears;
   Refer to section 8.1 Main screen on page 66
3. Respond to any faults and reset them.
   Refer to section 12 Warnings on page 87
4. Perform functional tests, check if the emergency stop feature works:
   Refer to section 7.3 Emergency stop procedure on page 63
5. Start the desired movements on the operating panel.
   Refer to section 8 Touch screen control on page 66

7.2 Stopping the micro compounder

Stopping

1. Clean the barrel and mixing screws,
   Refer to section 14 Cleaning on page 91;
2. Make sure the quick cooling plates are not in use and retained,
   Refer to section 7.4 Quick cooling system on page 64;
3. Stop the mixing screws,
   Refer to section 8.3 Adjusting the mixing screw setpoint on page 71;
4. Switch off the heating,
   Refer to section 8.2 Adjusting the barrel temperature setpoint on page 67;
5. Switch off the instrument by turning the main switch to the OFF direction.

After stopping the instrument

1. Close off the pressurized air supply
2. Close off the water supply, or in case of using a chiller, turn of the chiller
3. Close off the inertisation gas supply

7.3 Emergency stop procedure

	**WARNING OF DANGER** If dangerous situations occur switch off the Micro Compounder by means of the emergency stop installations! There are 2 emergency stop installations: The emergency push button left to the touch screen. ➔ By pushing the push button. The main switch, on the left side of the compounder, which can also be used as an emergency stop switch. ➔ By turning the main switch to the "off" position.

	**WARNING OF DANGER** Operating on of the emergency stop installations does not disconnect the operating voltage.

Making an emergency stop by using the push button:
By operating the emergency stop button the motor and heating system are switched off.

➔ Push the push button to stop the machine in case of an emergency;

After the emergency stop:
➔ After resolving the emergency situation, the machine can be unlocked from the emergency stop situation by turning the push button clockwise;
➔ The machine is immediately ready to use.

Making an emergency stop by using the main switch:
By operating the main switch, the power supply is directly shut off, not only the drive motor and the heating systems are switched off, but also the touch screen.

➔ Turn the main switch to the left to stop the machine in case of an emergency;

After the emergency stop:
➔ After resolving the emergency situation, the machine can be unlocked from the emergency stop situation by turning the main switch to the "on" position, the machine will restart;
➔ Wait for the machine to be completely restarted before continuing operation.

7.4 Quick cooling system

	**WARNING OF DANGER** Always turn on the water supply and check for open sink connection or check function of the refrigeration chiller. If there is no cooling-water circulation the water will boil inside the quick cooling system causing severe damage to the system as well as severe burns due to escaping steam and boiling water.

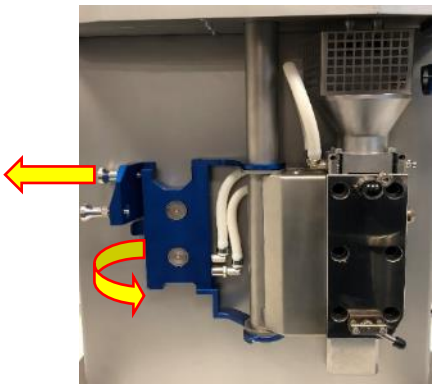
	**WARNING OF DANGER** Do not use the quick cooling system above 300 °C The risk of boiling the cooling-water is to big! For your safety the quick cooling system will not switch on above 300 °C

To cool down the barrel rapidly the quick cooling system can be activated.
The quick cooling system is based on water-cooling to conduct the heat away from the barrel fast.

Activate the quick cooling system:

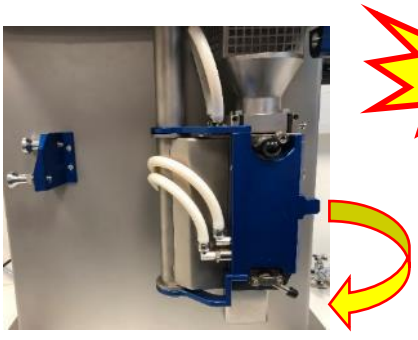
- ✓ Make sure the quick cooling plates are clean to achieve maximum heat conductivity.
- ✓ Make sure the water supply is open or the chiller is switched on, and according to the specifications in the installation manual.

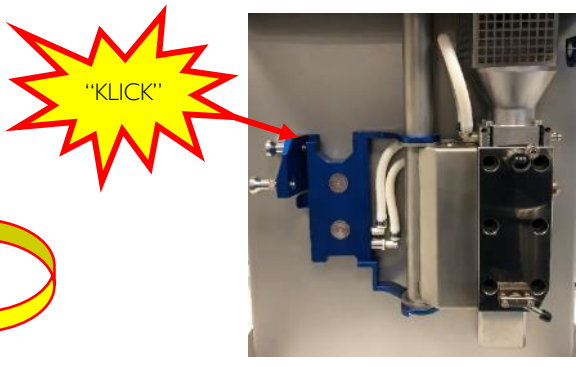
1. Unlock the cooling plate by pulling the retaining pin outwards
2. Swivel the cooling plate over to the barrel,
   The cooling plate will hold on to the barrel automatically, the rear cooling plate will be applied automatically;
3. Wait for the barrel to have been cooled down to the desired temperature
   Note: if the quick cooling is active, the heating will be switched off automatically.



Deactivation of the quick cooling system:

1. Swivel backwards the front cooling plate and lock it into the retaining pin
   The rear cooling plate will be deactivated automatically.

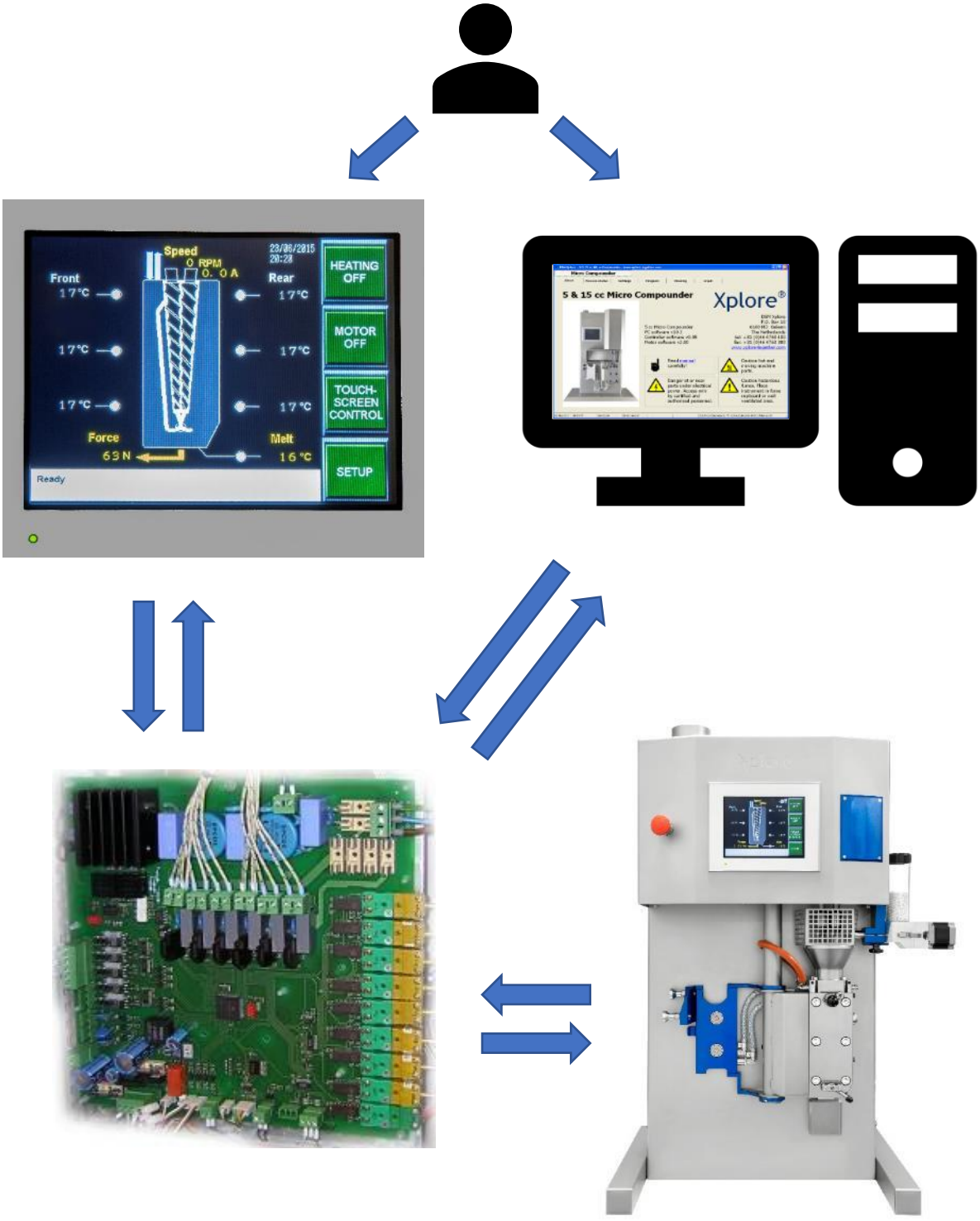




7.5 Operating systems

The Compounder is based on a multi loop microprocessor-controlled control system.
Operation is affected by a Touch Screen module, connected to the PCB by means of a communication cable. Or by the optional PC software which enables operation of the compounder via PC.

➔ Operating by means of the touch screen refer to section 8 Touch screen control on page 66;
➔ Operating by means of the optional PC control refer to section 9 PC control on page 74.

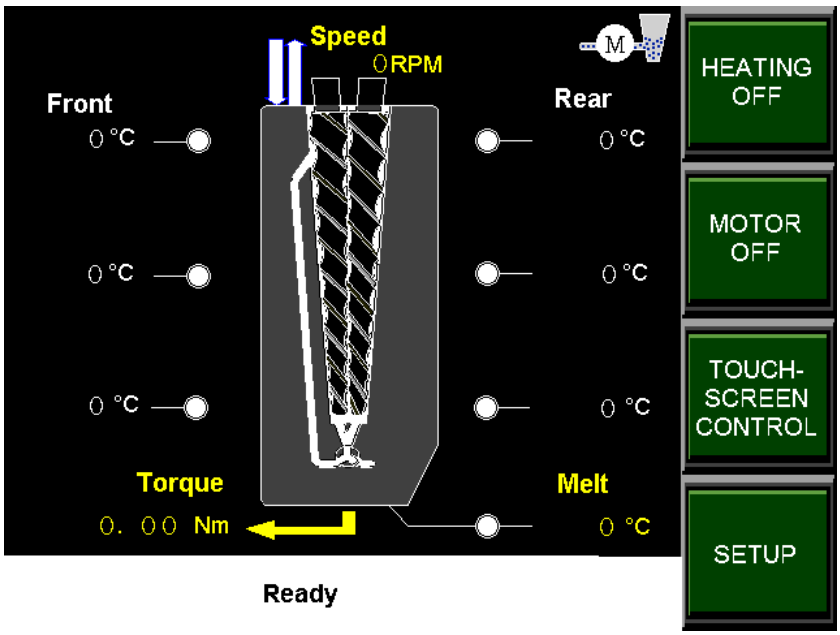


8. Touch screen control

This section describes the control of the device by using the built-in touch screen control.

8.1 Main screen

After switching on the main switch, the control system will first perform a diagnostic test. During this test the Xplore logo and software versions are visible.
Then the MAIN SCREEN appears.



8.2 Adjusting the barrel temperature setpoint

This section describes how to adjust the temperature set points.

The barrel is divided in 3 adjustable temperature zones:

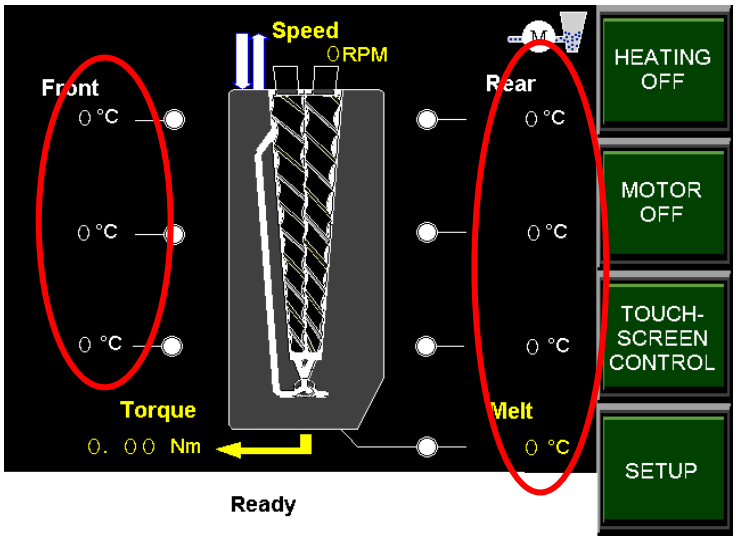
1. Top
2. Middle
3. Bottom

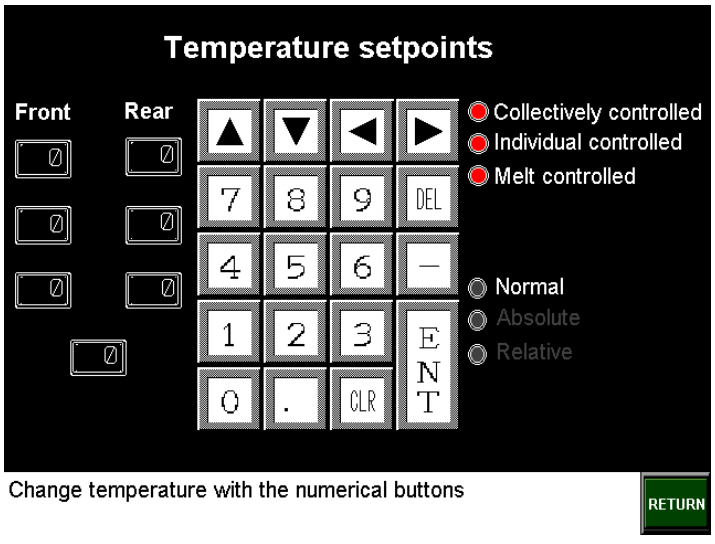
There are 7 temperature read-out points, they are updated continuously:

1. Top front zone
2. Middle front zone
3. Bottom front zone
4. Top rear zone
5. Middle rear zone
6. Bottom rear zone
7. Melt temperature

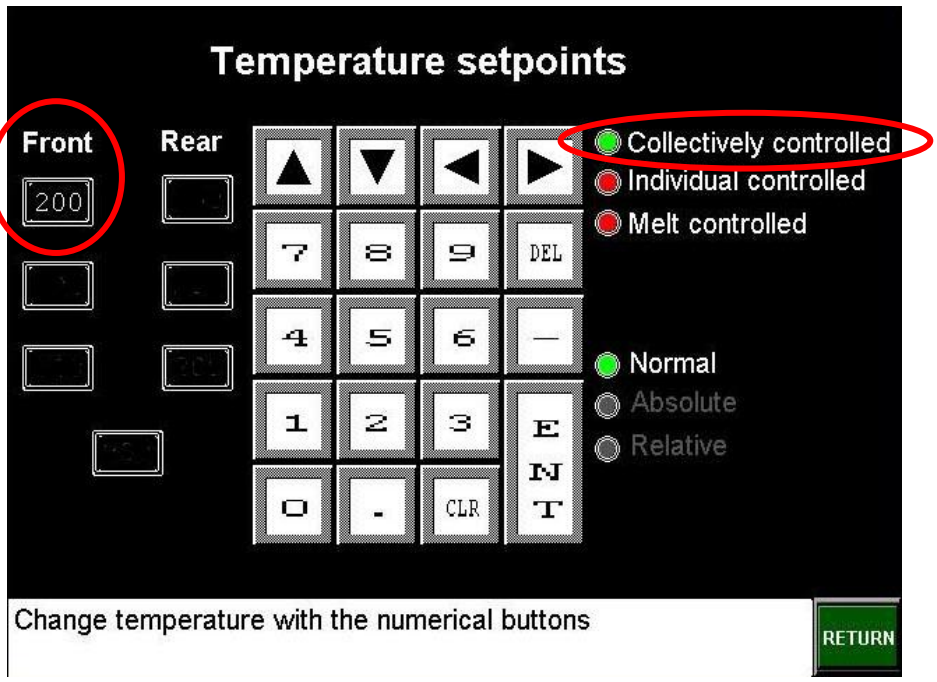
The heating can be switched **on** by pressing HEATING OFF.
The heating can be switched **off** by pressing HEATING ON.

To reach the TEMPERATURE SETPOINT screen, one must press one of the seven temperature indications in the MAIN SCREEN; the TEMPERATURE SETPOINT screen then appears.





Collectively controlled
There is one setpoint temperature for all heating zones of the barrel.



Changing temperature setpoint:

1. Click on the top left field
2. Use the numeric panel to enter the desired value
3. Confirm the setup by pressing ENTER,
   The barrel will heat up or cool down to the set value

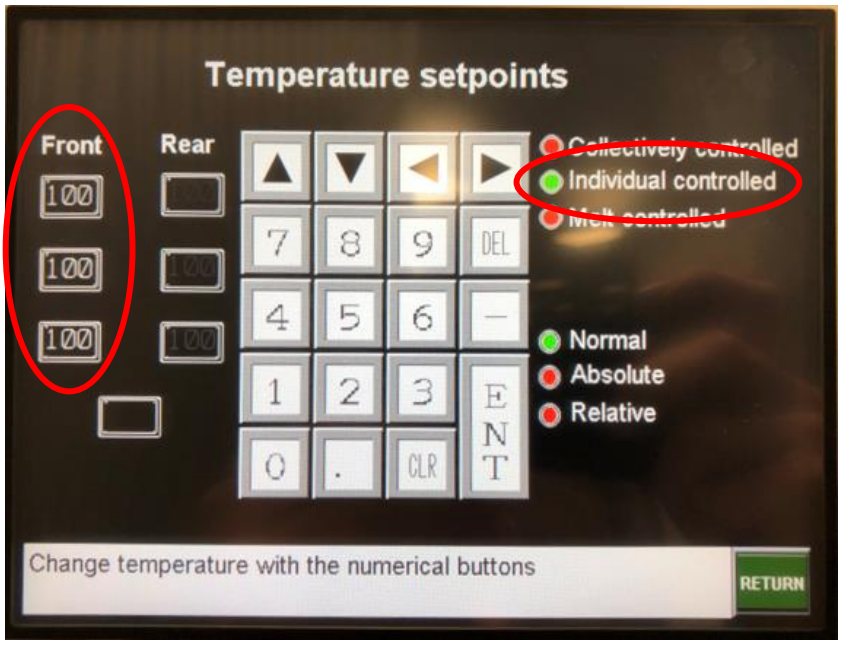
➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN
➔ To activate the heating, press the HEATING OFF button, so it lights up bright green and shows HEATING ON

Individual controlled
Each temperature zone can be controlled separately.
FRONT and REAR are always linked to each other and cannot be set differently.

	**TIP** When processing a polymer with low melting point at high temperature, increase the temperature of the top zone to make the feeding of the polymer easier.

There are 3 different temperature states:

- **Normal**
  Each zone can be set separately
- **Absolute**
  The temperature setting can only be changed with the Top temp control. In this case, the Mid and Bottom setting are adapted absolutely (with a fixed offset) with respect to the Top setting.
  The offset is determined by the setting before switching on "Gradient ΔT".
- **Relative**
  The temperature setting can only be changed with the Top temp control. In this case, the Mid and Bottom settings are adapted relatively with respect to this, based on the condition prior to switching on the "Gradient Δ%T".



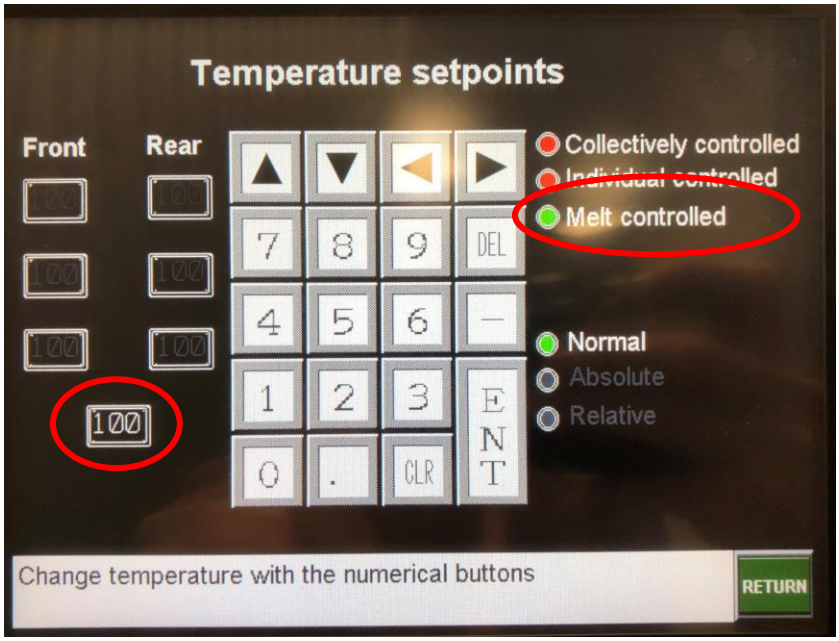
Changing temperature setpoint:

1. Click on the field you would like to change
2. Use the numeric panel to enter the desired value
3. Confirm the setup by pressing ENTER,
   The barrel will heat up or cool down to the set value
   (When using the Absolute or Relative function press at least once ENTER in each field).

➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN
➔ To activate the heating, press the HEATING OFF button, so it lights up bright green and shows HEATING ON

Melt controlled

The barrel temperature is automatically changed to achieve a desired melt temperature.



Changing temperature setpoint:

1. Click on the melt temperature field
2. Use the numeric panel to enter the desired value
3. Confirm the setup by pressing ENTER,
   The barrel will heat up or cool down to achieve the set melt value

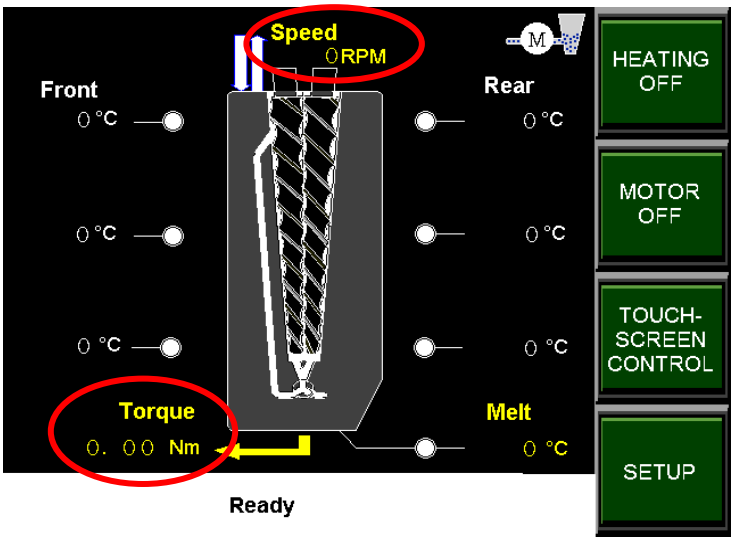
➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN
➔ To activate the heating, press the HEATING OFF button, so it lights up bright green and shows HEATING ON

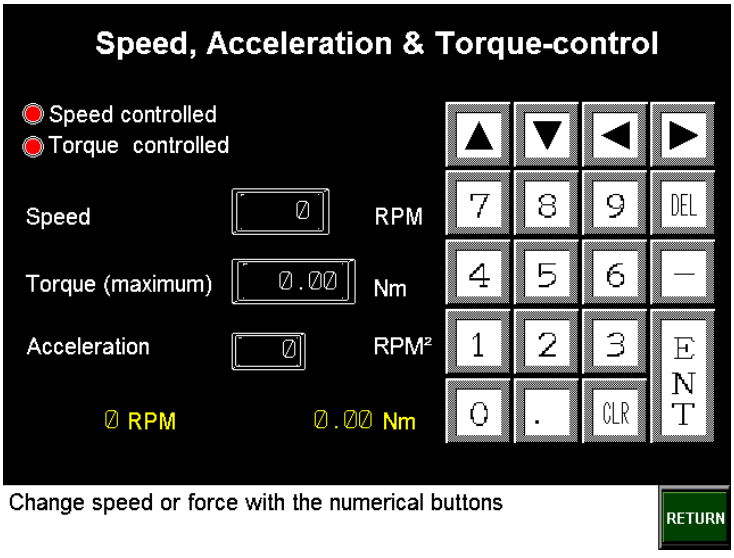
8.3 Adjusting the mixing screw setpoint

The speed and melt torque of the mixing screws can be set.

By pressing the "Speed" or the "Torque" read-out, one goes to the screen for adjusting the speed and torque control.

In this screen, the desired acceleration for the motor can also be chosen.





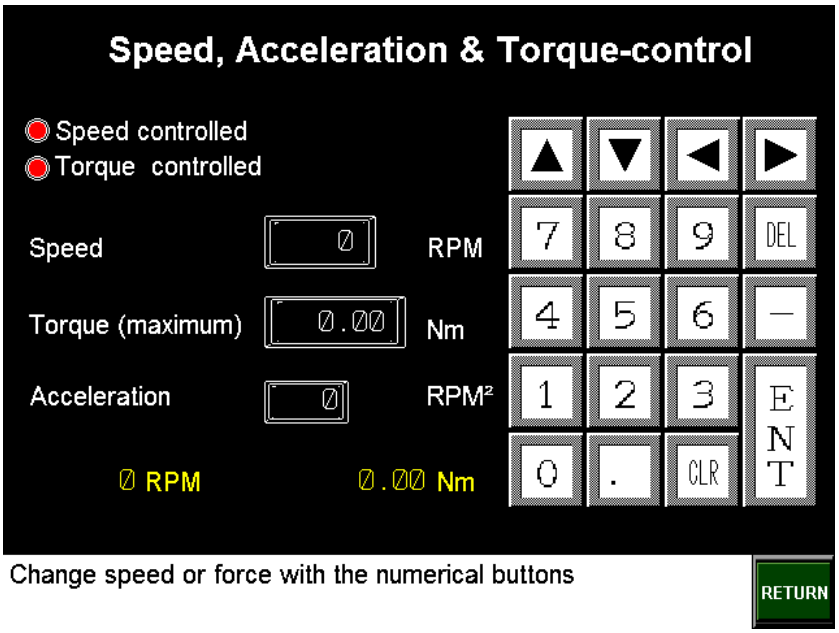
	ATTENTION If the compounder mixing screws are turning without polymer, the instrument will squeak because of the metal contact between the mixing screws and the barrel. Therefore, try to prevent turning the mixing screws without polymer.

Speed controlled
The entered mixing screw speed will be kept constant until the set maximum torque is reached.
If the maximum torque is reached the drive train will slow down the mixing screw speed.

Should the maximum torque be overridden the machine will stop automatically.
The machine will not be able to be switched back on, and a warning in the display will be shown:

Motor overload protection

By clicking on the warning, the protection will be deactivated, and the motor can be started.



Changing speed setpoint:
1. Click on the speed field;
2. Use the numeric panel to enter the desired value;
3. Confirm the setup by pressing ENTER,
   The mixing screw speed will immediately be changed to the set value.

Changing maximum melt torque setpoint:
1. Click on the torque field;
2. Use the numeric panel to enter the desired value;
3. Confirm the setup by pressing ENTER,
   The mixing screw melt torque will immediately be changed to the set value.

Changing acceleration setpoint:
1. Switch off the motor;
2. Go to the Speed, Acceleration & Torque-control menu;
3. Click on the acceleration field;
4. Use the numeric panel to enter the desired value;
5. Confirm the setup by pressing ENTER;
6. Press return to go back to the main menu;
7. When restarting the motor the entered acceleration will be taken into account.

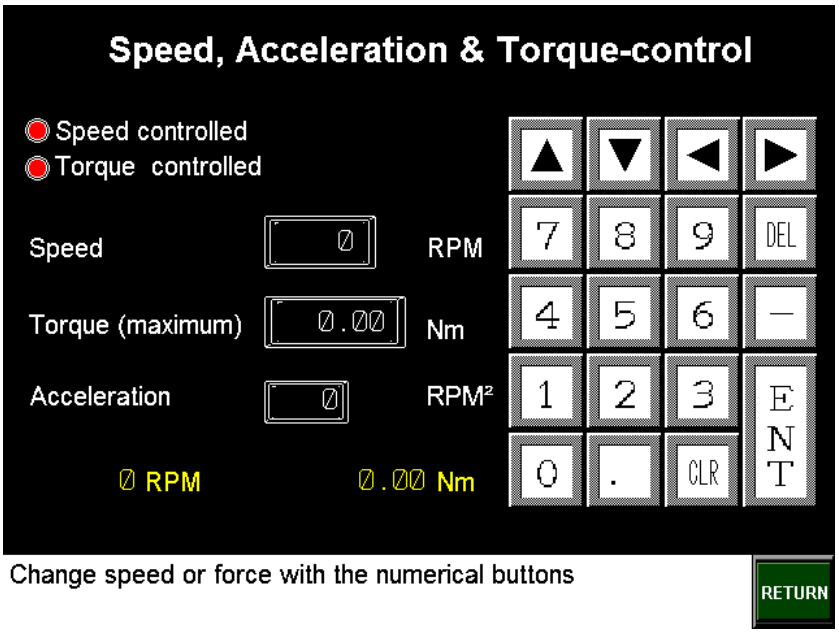
➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN
➔ To activate the motor, press the MOTOR OFF button, so it lights up bright green and shows MOTOR ON

Torque controlled
The entered melting torque will be kept constant by changing the mixing screw speed up to the maximum set value.

Should the maximum torque be overridden the machine will stop automatically.
The machine will not be able to be switched back on, and a warning in the display will be shown:

Motor overload protection

By clicking on the warning, the protection will be deactivated, and the motor can be started.



Changing maximum speed setpoint:
4. Click on the speed field;
5. Use the numeric panel to enter the desired value;
6. Confirm the setup by pressing ENTER,
   The mixing screw speed will immediately be changed to the set value.

Changing melt torque setpoint:
4. Click on the torque field;
5. Use the numeric panel to enter the desired value;
6. Confirm the setup by pressing ENTER,
   The mixing screw melt torque will immediately be changed to the set value.

Changing acceleration setpoint:
8. Switch off the motor;
9. Go to the Speed, Acceleration & Torque-control menu;
10. Click on the acceleration field;
11. Use the numeric panel to enter the desired value;
12. Confirm the setup by pressing ENTER;
13. Press return to go back to the main menu;
14. When restarting the motor the entered acceleration will be taken into account.

➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN
➔ To activate the motor, press the MOTOR OFF button, so it lights up bright green and shows MOTOR ON

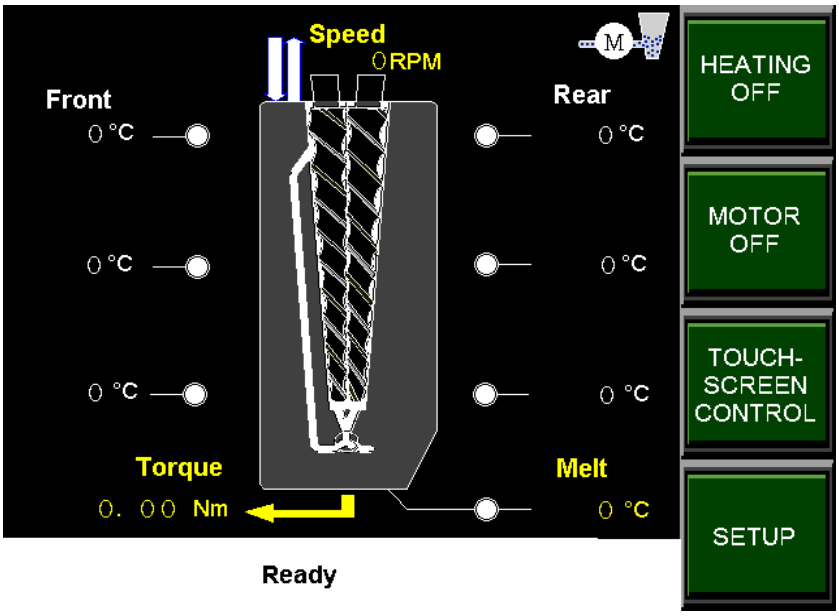
9. PC control

This section will explain the use switch over to PC Control.
Refer to chapter 16 to read more about operating the optional software.

In the TOUCH SCREEN CONTROL mode, all settings can only be changed by means of the Touch Screen.

With the TOUCH SCREEN CONTROL push button, the compounder can be switched to computer control, the button will light up bright green and show PC CONTROL.

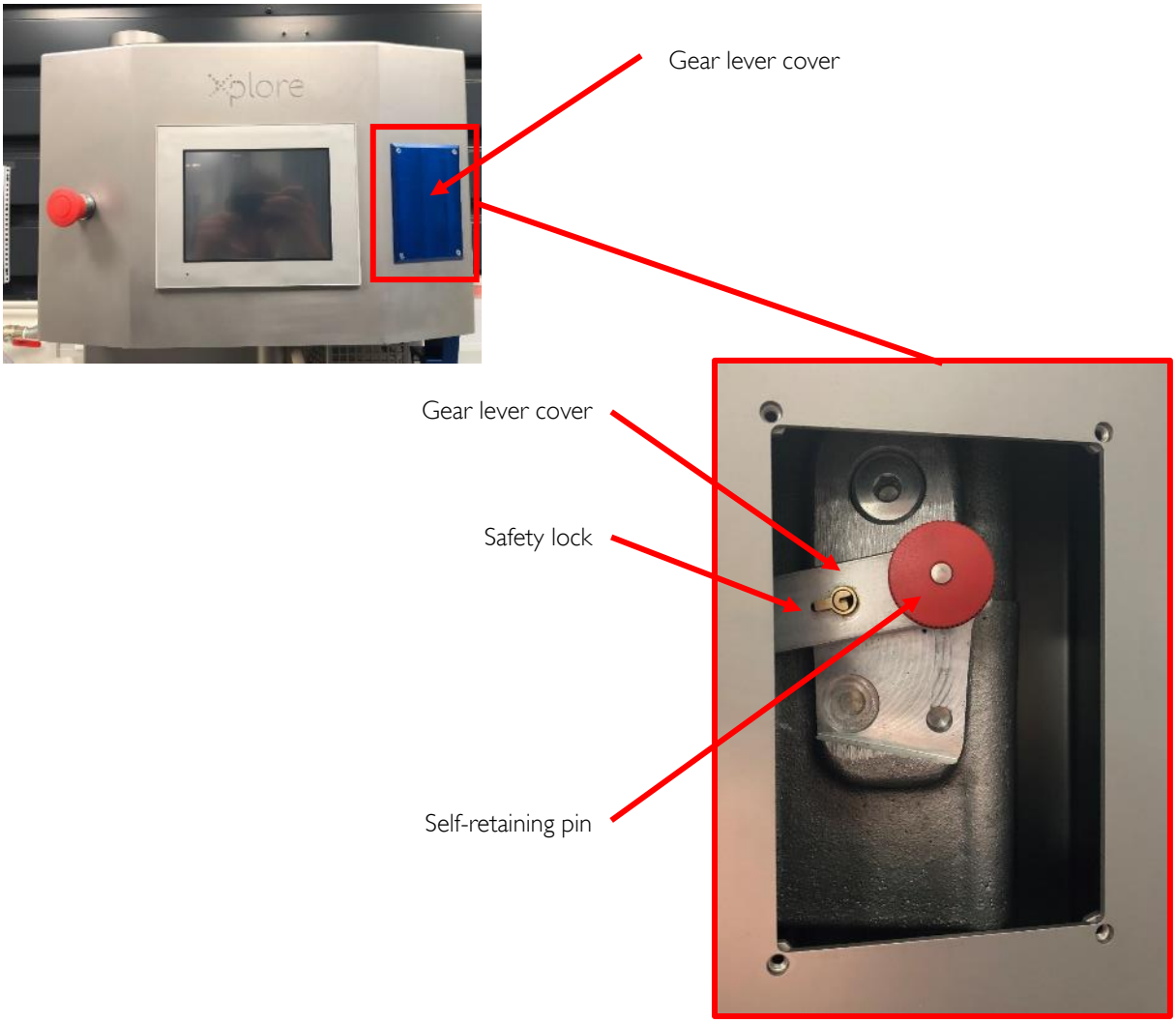
The data can now be entered only by the computer.
In the PC CONTROL mode, the setpoints have to be controlled from the computer. Now, no changes are possible with the Touch Screen.



10. Changeover Co / Counter rotating

	WARNING OF DANGER The change-over lever should only be operated by instructed persons who are aware of the possible dangers!
	CAUTION Change-over can only be done if the mixing screws have been removed! If change-over is done with mixing screws mounted, the mixing screws as well as the barrel and gearbox may be seriously damaged!
	CAUTION Install the correct mixing screws after the change-over! For Counter rotating, this is a special left screw, only use it on the LEFT ball joint!
	CAUTION After the change-over, install: ➔ Safety lock ➔ Cover on the front of the instrument
	TIP Keep the mixing screws not being used in a safe place so that they cannot be used unintentionally!
	WARNING OF DANGER Always install the safety features after change-over: ➔ Safety lock ➔ Cover on the front of the instrument

10.1 Co / Counter parts

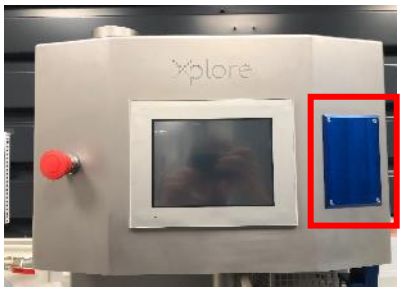


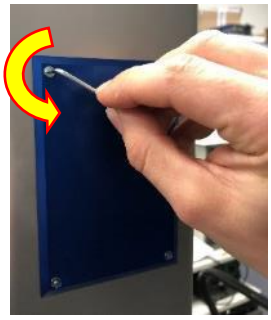
CO Rotating

COUNTER Rotating

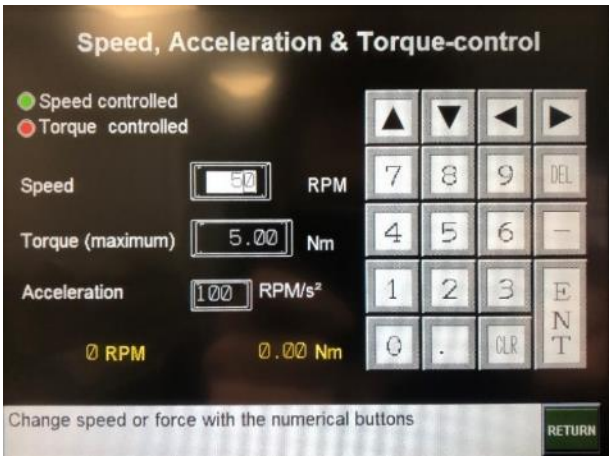
10.2 Changeover from Co to Counter rotating

- ✓ Switch on the machine and wait for the MAIN SCREEN to be shown;
- ✓ Remove both mixing screws, see section 6.5 Removal of the mixing screws on page 54
  If the mixing screws will not be removed this could cause serious damage to the gearbox, mixing screws and barrel;
- ✓ Close the barrel, see section 6.2 Closing the barrel on page 51.





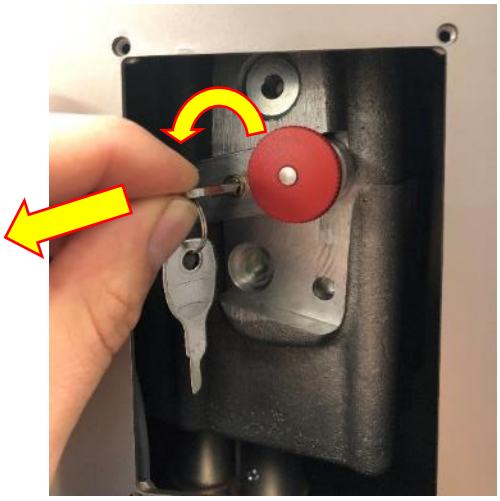
1. Take off the gear lever cover by unscrewing the 4 bolts;



2. Set the mixing screw setup at:
   - ➔ Speed controlled
   - ➔ 50 RPM
   - ➔ 5 Nm
   - ➔ 100 RPM/S²

   Refer to section 8.3 Adjusting the mixing screw setpoint on page 71;

3. Start the motor;



4. Take out the safety lock by using the delivered key,

   Insert the key and rotate it for ¼ turn, pull the safety lock out;

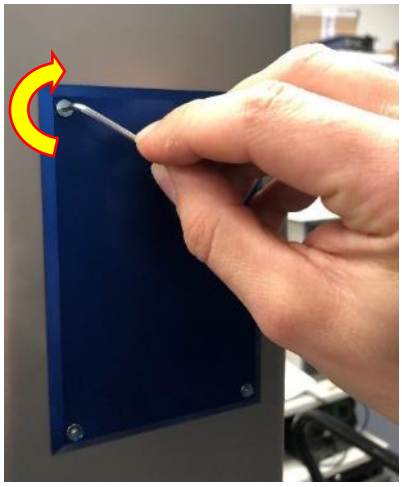
5. With **running motor** pull the red self-retaining pin and move the gear leaver from the top position to the bottom position.

   Assure yourselves that the retaining pin engages completely.

   If during the movement of the lever jams, slightly move it up, and down again;

6. Lock the gear lever with the safety lock and take out the key,
   Store the key in a safe place;

7. Switch off the motor;

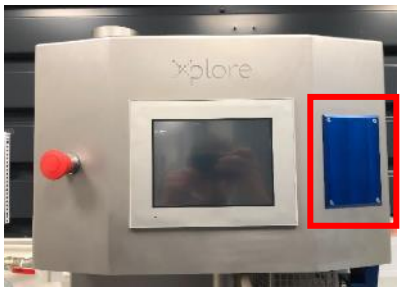


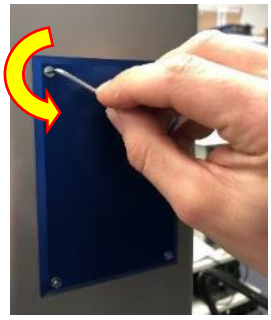
8. Mount the gear lever cover with the 4 bolts.

9. From now on only use the COUNTER rotating mixing screws.

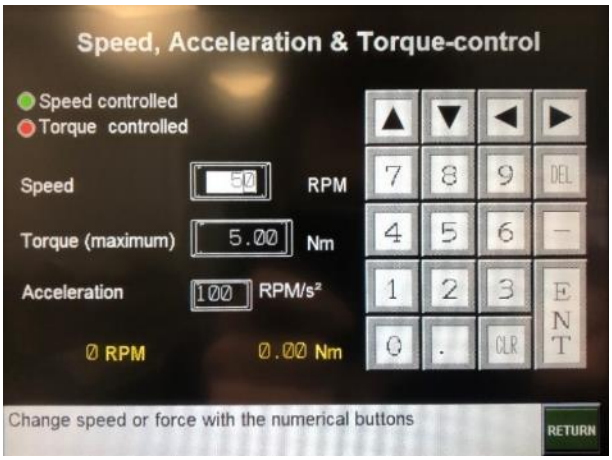
10.3 Changeover from Counter to Co rotating

- ✓ Switch on the machine and wait for the MAIN SCREEN to be shown;
- ✓ Remove both mixing screws, see section 6.5 Removal of the mixing screws on page 54
  If the mixing screws will not be removed this could cause serious damage to the gearbox, mixing screws and barrel;
- ✓ Close the barrel, see section 6.2 Closing the barrel on page 51.





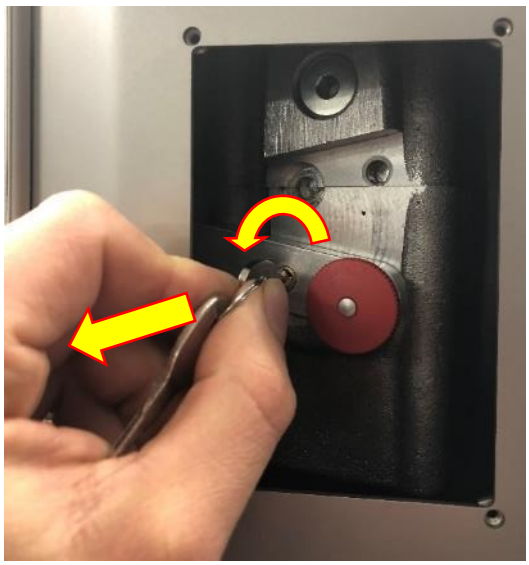
1. Take off the gear lever cover by unscrewing the 4 bolts;



2. Set the mixing screw setup at:
   - ➔ Speed controlled
   - ➔ 50 RPM
   - ➔ 5 Nm
   - ➔ 100 RPM/S²

   Refer to section 8.3 Adjusting the mixing screw setpoint on page 71;

3. Start the motor;



4. Take out the safety lock by using the delivered key,

   Insert the key and rotate it for ¼ turn, pull the safety lock out;

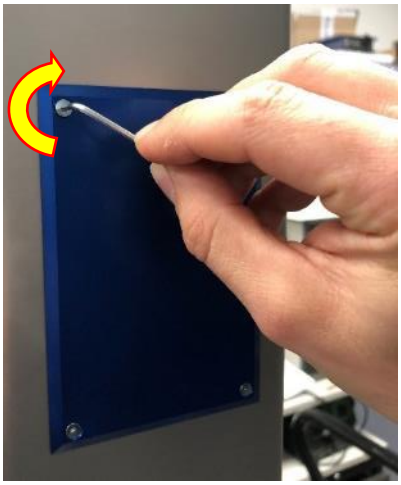
5. With **running motor** pull the red self-retaining pin and move the gear leaver from the top position to the bottom position.

   Assure yourselves that the retaining pin engages completely.

   If during the movement of the lever jams, slightly move it up, and down again;

6. Lock the gear lever with the safety lock and take out the key,
   Store the key in a safe place;

7. Switch off the motor;



8. Mount the gear lever cover with the 4 bolts.

9. **From now on only use the CO rotating mixing screws.**

11. Compounding

Because of the build in recirculation valve the micro compounder can be used for compounding and extruding. The vertical orientation of the barrel ensures automatically degassing, because the barrel is liquid tight the usage of liquid additives is also possible.

The barrel and mixing screws are extremely chemical and abrasion resistant, therefore it is also possible to mix in solids. However, one should always take into account that the compounder only can mix and extrude polymers as long as there is a sufficient amount of high viscous pumpable polymer inside of the barrel. Therefore, it is important to first add polymer which is melt able and creates a sufficient flow before adding a solid additive.

By opening or closing the recirculation valve it is possible to direct the flow of molten polymer.
The valve allows easy and accurate control over the residence time.

Also, it is possible to work in continuous mode, the position of the valve should be set to extrusion.
Residence time can now only be controlled by:

- Feeding rate
  Starve feeding resulting in lower pressure build up, thus leading to longer residence time;
- Mixing screw speed
  Higher speed resulting in higher flow, thus shorter residence time;

In continuous mode filling can be achieved by hand via the top hopper, or by the optional continuous feeder (refer to section 16 Continuous feeder (option) on page 113)
Remember that the dimensional stability of the extruded product is affected by the continuity of the pressure build up in the barrel. Because the compounder is a high viscous pump it will react immediately to the filling with additional unmolten material. Thus, leading to a pressure variation and a change of dimensional stability of the product.

The temperature of the barrel must agree with the melt temperature range of the viscous material to be used. If the temperature is too low, the pressure which the mixing screws need to exert on the viscous material will be too high. This is because the viscosity of viscous material is still quite high at this temperature. The speed of the mixing screws along with the temperature determines the speed at which the polymer flows out from the barrel.

During the filling and compounding, air can get into the molten viscous material. Due to the high temperature, the viscous material may be oxidized. To prevent this, a nitrogen purge can be connected to the compounder. For the micro compounders, the inertisation gas will enter the barrel via a pipe in the upper right corner of the barrel. This purge must always be on while heating the barrel, to drive out the air inside. Leave the purge on so that the purge channel does not get blocked.

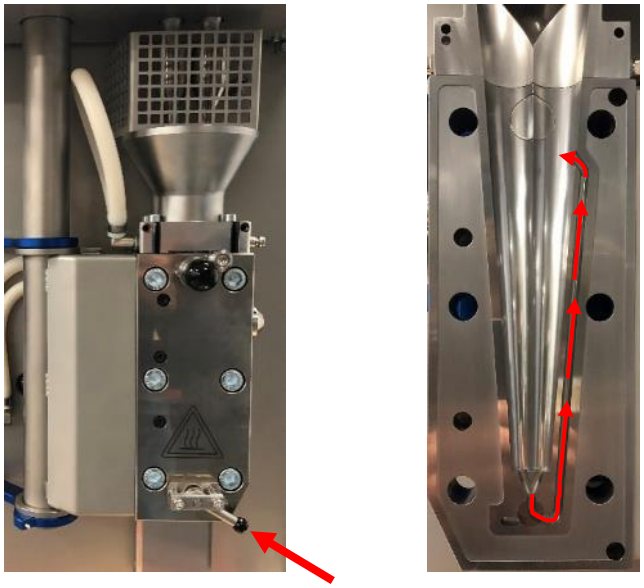
Remember that the content of the barrel is maximum 15 ml. For many materials this means that one should take in account the free volume of the material thus the melt density.
If you would like to compare several different mixing parameters always use the same amount of material.

Should the melt temperature be significantly less than the barrel temperature (20 – 30 °C) this could mean that there is a plug created inside the recirculation channel. This often happens if to many solid additives or materials with higher melting points are mixed in.
Check melting point temperature of the material or try to feed more melt able material before adding solid additives.

11.1 Recirculation valve

The recirculation valve controls the flow of molten material. By turning the valve it is possible to choose between recirculation and extrusion of the molten material.
There are several points to notice.

- ➔ Operate the valve in a smooth but quick movement
- ➔ The valve is made out of an extremely hard metal to create an extremely long lifetime.
  The hard metal however is also very brittle, if the valve will be operated on a rude way it could cause the sealing part to break of.
- ➔ Polymer will get in between the sealing surfaces of the valve.
  This will cause the valve to seize after the polymer solidifies when cooled down.
  Therefore it is only possible to adjust the position of the valve when the barrel is heated up sufficient.
- ➔ Trying to adjust the valves position when the polymer in between is solidified could cause damage to the valve.
- ➔ If the valve does not operate smooth any more it should be cleaned.
  Advised is to clean the valve at least once every month.
  The cleaning of the valve is described in section 14.6 Cleaning of the valve on page 98.



Recirculation (compounding)

Extrusion (extruding)

11.2 Filling with the top hopper

CAUTION
To enlarge the lifetime of barrel and mixing screws.
Fill the barrel slowly and avoid running the machine without molten polymer inside.

CAUTION
If material gets stuck in the top hopper, use a plastic brush to carefully swipe the material downwards.
Using metal objects is strictly forbidden, the metal object could jam the mixing screws and possibly damaging the mixing screws, barrel and drive train of the machine.

CAUTION
Only fill up the machine at maximum 50 RPM.
If higher rpms are being used the lifetime of the mixing screws and barrel will be affected negatively.

TIP
The viscous material can easily be oxidized at high temperature. Use the nitrogen purge if necessary.

- ✓ Mount mixing screws.
  Refer to section: 6.3 Mounting the Co-rotating mixing screws on page 52;
- ✓ Close barrel.
  Refer to section: 6.2 Closing the barrel on page 51;
- ✓ Switch on the cooling-water supply to cool the top hopper;
- ✓ Heat up the barrel to processing temperature.
  Refer to section: 8.2 Adjusting the barrel temperature setpoint on page 67;
- ✓ Retighten the barrel bolts when hot;
- ✓ When hot, check if the recirculation valve functions properly, otherwise clean the valve first
  Refer to section: 14.6 Cleaning of the valve on page 98.

1. Set the motor parameters:
   Refer to section:
   - **a.** Mixing screw speed: **Maximum of 50 RPM**
   - b. Mixing screw torque: As desired (advised is 40 Nm to prevent jamming of the mixing screws during filling)
   - c. Mixing screw acceleration: As desired;
2. Set the recirculation valve to the RECIRCULATION position;
   Refer to section:
3. Start the motor and wait for the mixing screws to rotate at 50 RPM
   Refer to section:
4. Start filling the material in the top of the hopper by using a spoon or other device.
   Fill the material **slowly** and **wait** for the compounder to have pulled in the previous load of material before adding a new load.

11.3 Extruding

After compounding it is possible to extrude the material.

✓ Assure the material is molten sufficiently.

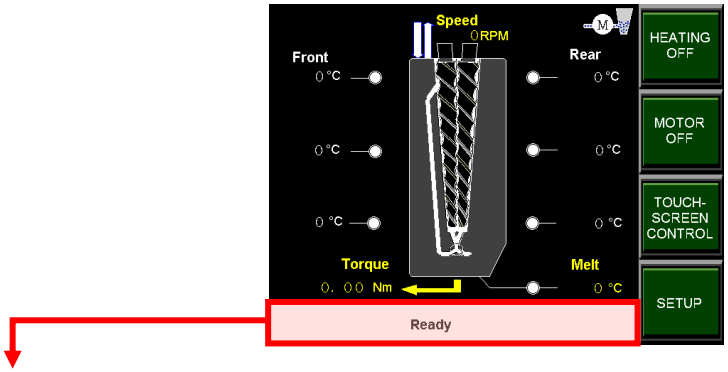
➔ If the melt torque stabilizes this is a sign all material is in the same state, this does not mean that all material is molten. Always check processing conditions!

1. Adjust the mixing screw speed to a maximum of 100 RPM;
2. Move the recirculation valve in a smooth jet quick movement from COMPOUNDING to EXTRUDING;
3. Wait for the barrel to be emptied;
4. After the flow of material has stopped shut off the motor.

CAUTION
To enlarge the lifetime of barrel and mixing screws.
Avoid dry running of the mixing screws, always shut off the motor after the extruding is completed.

12. Warnings

The MAIN SCREEN can show various warnings.
By clicking on the message, it can be reset however, only if the reason why the message is shown will be remedied.



Message	Reason	Effect	Remedy
Ready	The system is ready for operation.	Every operation is allowed	-
Barrel open	The barrel is open.	The motor will stop if it was running. The motor cannot be started.	Close the barrel to start the motor. Refer to section *6.2 Closing the barrel on page 51*
Safety switch	The emergency pushbutton is active.	The motor will be stopped and the heating shut off. No function can be started or switched on.	Clear the emergency situation. Reset the emergency stop and proceed work. Refer to section *7.3 Emergency stop procedure on page 63*
Barrel too hot	Exeding of the maximum barrel temperature.	The motor will be stopped and the heating shut off. No function can be started or switched on.	Let the barrel cool down and try again. If the message still appears contact Xplore Instrument Service.
Motor protection overload	The maximum melt torque has been exceeded.	The motor will be stopped or cannot be started.	Ensure correct processing parameters. Check for blocking of the mixing screws. Reset the message and try to start the motor again.
Motor error	Fault in the motor drive.	The motor will be stopped or cannot be started.	Reset the message and try againg. If not successful switch off the complete micro compounder and wait for 30 seconds before restarting. If the message still appears contact Xplore Instrument Service.
Motor calibration	The drive train should be calibrated. (For example after certain software updates).	The motor can be started however the melt torque readout will be inaccurate.	Start the calibration sequence. Refer to section *6.8 Calibration of melt torque on page 59*

13. Break in marks

After the first hours of working with the micro compounder it is normal see to break in marks occurring on the barrel and mixing screws.

Both the barrel and the mixing screws contain a special coating. This coating is designed to be extremely abrasive resistant. During the first working hours both coatings will polish themselves to create an absolute perfect matching surface.
During this polishing very, small particles of the coatings could break out, this is normal.
The hardness of the mixing screws is slightly lower as the hardness from the barrel, this results that the small coating particles will be pressed into the structure of the mixing screws. Therefore, locally changing the optical properties of the barrel and mixing screws.
The break in marks will not affect the mixing results and will not lead to a compromise in lifetime of the device.

The water-cooled top hopper is designed with another type of material than the barrel. The hopper does not need to cope with the same intense mechanical stresses as the barrel does.
Therefore, it is completely normal to have deeper marks on the top hopper than on the barrel.

Because of the mixing screws both are fully intermeshing there will appear small "touching" marks on the mixing screws over time. These touching marks are again the optical change of the surface coating. The small coating partials are over time polishing each other resulting in a bright and shiny line along the mixing screw flanks.

The pictures below give examples of normal break in marks.

The pictures below give examples of normal marks occurred due to break in marks and the fully intermeshing parts of the mixing screws.

Optical change because of fully intermeshing mixing screw flanks

Normal break in marks

14. Cleaning

When cleaning the outside of the instrument, the following safety requirements must be observed. Disinfect instrument parts using disinfectant products.

CAUTION
Before cleaning the instrument, first remove the plug from the socket.

CAUTION
Do not use a water hose, a high-pressure sprayer or steam cleaner.

WARNING OF DANGER
Always first switch off the power supply of the instrument and remove the plug from the socket

ATTENTION
1. Thoroughly rinse away soap residue and / or disinfectant residue.
2. Cleaning products should not contain silicone or attack stainless steel.
3. The cleaning products should not produce any chemical reaction when mixed.
4. Use the cleaning products according to the manufacturer's described procedures and instructions.

14.1 Cleaning of the barrel

Clean the compounder thoroughly after use. The barrel needs to be opened for this. Heat the barrel to above the melt temperature of the viscous material without placing the mixing screws in motion. When the viscous material is completely melted, the barrel can be opened.
If the instrument has cooled down closed with viscous material present in the barrel, the mixing screws are fixed in the barrel. A better way of cleaning the barrel is to perform a cleaning cycle with the help of cleaning compound, this ensures a better and faster cleaning than described above (see the following sections).

	**WARNING OF DANGER** Wear work gloves when taking out the mixing screws, due to sharp edges at the inside of the screw barrel.

	**WARNING OF DANGER** Wear work gloves and safety goggles when cleaning the barrel with a stainless-steel brush.

	**WARNING OF DANGER** Consult the directions for use when using cleaning compound.

There are two ways of cleaning the instrument:

1. Cleaning without cleaning compound.
   Refer to section 14.2 Cleaning without cleaning compound on page 93;
2. Cleaning with cleaning compound.
   Refer to section 14.3 Cleaning with cleaning compound on page 94.

If the barrel is open, the mixing screws cannot be placed in operation!

Do not turn off the main switch when cleaning. The temperatures can only be read on the Touch Screen when the power is on.

14.2 Cleaning without cleaning compound

Before cleaning of the compounder, the compounder barrel should be opened. The following conditions apply to this:

- ➔ Open the barrel only if the temperature of the barrel is above the melting temperature of the viscous material used, if viscous material is still present in the barrel,
- ➔ Use protective clothing and gloves when working with hot parts.

Proceed as follows when cleaning the micro compounder without making use of cleaning compound:

1. Unscrew the six compounder barrel bolts with the socket wrench.
2. Open the barrel with the allen key by placing it in middle right barrel hole.
3. Let the barrel cool down by turning off the heating or set a low barrel temperature and leave the heating switched on. The barrel will cool quicker because the cooling air will be activated.
4. Peel the viscous material from the mixing screws and clean them with chromium nickel or brass brushes (not standard steel brushes!!) and a flannel rag.
5. Clean the heated inside of the barrel using chromium nickel or brass brushes.
6. Scrape the heated barrel empty with a suitable tool.
7. Remove the last remainders, possibly with chromium nickel or brass brushes on a drill.
8. Use a flannel rag to make sure the barrel is completely clean (do not forget the seal surfaces and the recycle channel!!)
9. Clean the drain channel with an exactly fitting drill and strips of flannel rag.
10. Clean the hopper and seal plug. If the hopper is stuck, use protective means to avoid damaging the hopper.

	**CAUTION** Avoid damaging the barrel, it is very hard, but also very brittle.
	**CAUTION** Avoid damaging the melt thermocouple.
	**CAUTION** The mixing screws and the barrel are hardened. Stainless steel brushes can be used, because this material is softer.
	**CAUTION** Do not let the mixing screws fall or knock together. This could cause damage.
	**ATTENTION** Do not use brass brushes, tiny brass particles remain behind on the mixing screws and in the barrel. This may adversely influence test results.

14.3 Cleaning with cleaning compound

Cleaning procedure for operating temperatures up to 250 °C

Proceed as follows when cleaning the micro compounder with the use of cleaning compound (such as BP Novex):

1. Set the temperature control so that the remaining material melts.
2. Set the speed at 100 rpm, and the maximum possible "torque" limit.
3. Flush the compounder several times with a suitable cleaning compound.
4. Fill the compounder completely with the cleaning compound.
5. Remove the hopper and then cool the barrel quickly using the water cooling.
6. Now let the compounder cool down while running, the barrel becomes well cleaned in this way.
7. At a certain moment, the compounder motor will be switched by the "torque" limit.
8. Unscrew the six compounder barrel bolts with the socket wrench.
9. Open the barrel with the allen key by placing it in middle right barrel hole.
10. Remove the mixing screws.
11. Peel the cleaning compound from the mixing screws and clean them with chromium nickel or brass brushes (not standard steel brushes!!) and a flannel rag.
12. Scrape the heated barrel empty with a suitable tool. Remove the last remainders, possibly with chromium nickel or brass brushes on a drill.
13. Use a flannel rag to make sure the barrel is completely clean (do not forget the seal surfaces and the recycle channel!!).
14. Clean the drain channel with an exactly fitting drill and strips of flannel rag.
15. Clean the hopper and seal plug. If the hopper is stuck, use protective means to avoid damaging the hopper.

CAUTION
Avoid damaging the barrel, it is very hard, but also very brittle.

CAUTION
Avoid damaging the melt thermocouple.

CAUTION
The mixing screws and the barrel are hardened. Stainless steel brushes can be used, because this material is softer.

CAUTION
Do not let the mixing screws fall or knock together. This could cause damage.

ATTENTION
Do not use brass brushes, tiny brass particles remain behind on the mixing screws and in the barrel. This may adversely influence test results.

Cleaning procedure for operating temperatures between 250 and 350 ^{0}C

Proceed as follows when cleaning the micro compounder with the use of 2 cleaning compounds (such as ASA clean (high temp) and BP Novex (up to 250°C)):

1. Set the temperature control so that the remaining material melts.
2. Set the speed at 100 rpm.
3. Flush the compounder several times with a suitable cleaning compound.
4. Fill the compounder completely with the cleaning compound.
5. Remove the hopper and then cool the compounder by setting the heating back to 220 degrees Celsius.
6. Set a speed of 100 rpm and the maximum possible "Torque" limit.
7. Now let the compounder cool down while running to 220 degrees, the barrel becomes well cleaned in this way.
8. Flush the compounder several times with the low temperature cleaning compound, such as BP Novex.
9. Fill the compounder completely with the low temperature cleaning compound.
10. Remove the hopper and then cool the barrel quickly using the water cooling.
11. At a given moment, the compounder motor will be switched by the "torque" limit.
12. Unscrew the six compounder barrel bolts with the socket wrench.
13. Open the barrel with the allen key by placing it in middle right barrel hole.
14. Remove the mixing screws.
15. Peel the cleaning compound from the mixing screws and clean them with chromium nickel or brass brushes (not standard steel brushes!!) and a flannel rag.
16. Scrape the heated barrel empty with a suitable tool. Remove the last remainders, possibly with chromium nickel or brass brushes on a drill.
17. Use a flannel rag to make sure the barrel is completely clean (do not forget the seal surfaces and the recycle channel!!).
18. Clean the drain channel with an exactly fitting drill and strips of flannel rag.
19. Clean the hopper and seal plug. If the hopper is stuck, use protective means to avoid damaging the hopper.

Cleaning procedure for operating temperatures between 350 and 420 °C

Proceed as follows when cleaning the micro compounder with the use of 3 cleaning compounds (such as ASA clean PX 2(high temp) ASA clean UP (medium temp) and BP Novex (up to 250°C)):

1. Set the temperature control so that the remaining material melts.
2. Set the speed at 100 rpm
3. Flush the compounder several times with a suitable cleaning compound like ASA clean type PX 2.
4. Fill the compounder completely with this cleaning compound.
5. Remove the hopper and then cool the compounder by setting the heating back to app. 300 degrees Celsius.
6. Set a speed of 100 rpm and the maximum possible "Torque" limit.
7. Now let the compounder cool down while running to 300 degrees, the barrel becomes well cleaned in this way.
8. Flush the compounder several times with the medium temperature cleaning compound, such as Asa clean UP
9. Fill the compounder completely with this cleaning compound.
10. Remove the hopper and then cool the compounder by setting the heating back to 220 degrees Celsius.
11. Now let the compounder cool down while running to 220 degrees.
12. Fill the compounder completely with the low temperature cleaning compound.
13. Remove the hopper and then cool the barrel quickly using the water cooling.
14. At a given moment, the compounder motor will be switched by the "torque" limit.
15. Unscrew the six compounder barrel bolts with the socket wrench.
16. Open the barrel with the allen key by placing it in middle right barrel hole.
17. Remove the mixing screws.
18. Peel the cleaning compound from the mixing screws and clean them with chromium nickel or brass brushes (not standard steel brushes!!) and a flannel rag.
19. Scrape the heated barrel empty with a suitable tool. Remove the last remainders, possibly with chromium nickel or brass brushes on a drill.
20. Use a flannel rag to make sure the barrel is completely clean (do not forget the seal surfaces and the recycle channel!!).
21. Clean the drain channel with an exactly fitting drill and strips of flannel rag.
22. Clean the hopper and seal plug. If the hopper is stuck, use protective means to avoid damaging the hopper.

14.4 Cleaning of the compounder

For safety considerations, leave the power switched on during the cool down. The temperatures can only be read on the Touch Screen when the power is on.
If the barrel is open, the mixing screws cannot be started!

14.5 Cleaning of the barrel

The inside of the Barrel and the mixing screws can be cleaned with the help of chromium nickel or brass brushes. The mixing screws and the barrel are hardened.

Remove the last remainders, possibly with chromium nickel or brass brushes on a drill.

When using Brass brushes, tiny Brass particles remain behind on the mixing screws and in the Barrel, which can adversely influence test results.

When cleaning the Barrel, wear protective gloves to prevent any injury from sharp parts.

For an extensive description of the cleaning, see Section.

14.6 Cleaning of the valve

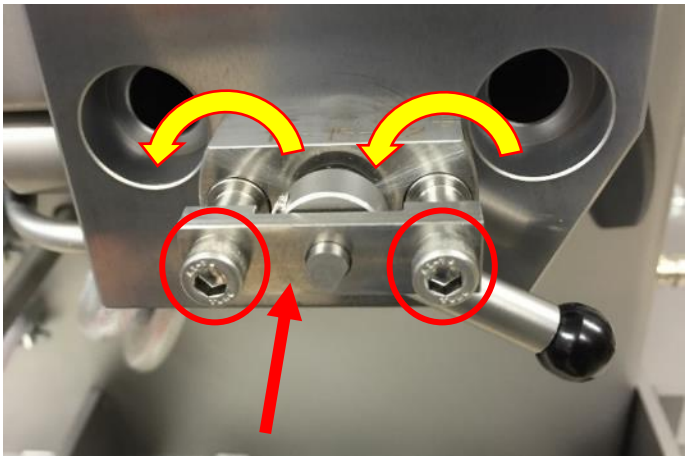
	**CAUTION** The valve is very brittle, be extra carefully in handling this part. This part is machined for each barrel separately, in case of replacement of this part it can take up to four weeks before a new one is ready.

	**CAUTION** The micro compounder has several parts that are brittle and / or sensitive if dropped on the floor. It is advisable to place a rubber mat on the floor in front of the compounder, to reduce the risk of breaking parts when accidentally falling.

	**WARNING OF DANGER** The micro compounder can be very hot, wear the correct precaution means.

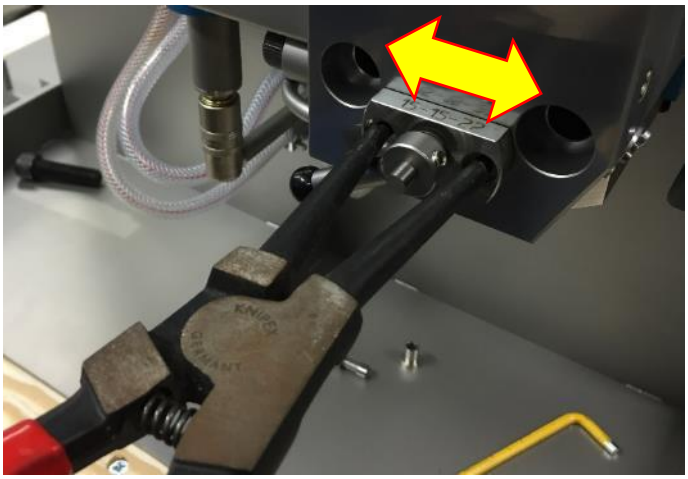
If the Valve is not moving smoothly it must be cleaned. Should work be continued at this point it is possible to jam the valve leading to breaking the valve. Each valve is especially made for each machine and marked with a unique number, it can be ordered at Xplore Instruments Service, but delivery time can be up to 4 weeks.

Recirculation valve disassembly, cleaning and reassembly



1.
Take the bolts out with an Allen key and remove the cover plate.

2.
After removing the bolts and the positioning pins the valve is ready to be taken out of the Barrel.



3.
By means of the delivered pliers, it is possible to remove the valve in a simple way from the barrel.

First heat up the barrel, if possible, to a temperature at which the valve is able to (slightly) move.

Use the pliers first to grip the valve body.

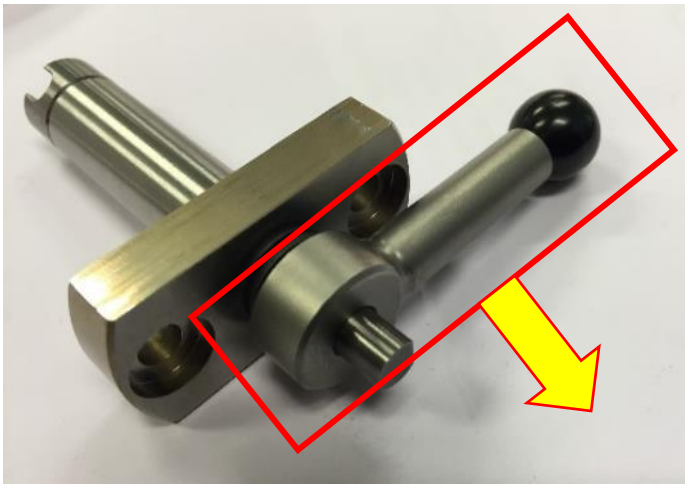
4.
Then try to rotate the complete valve body slightly left and right and simultaneously pull the valve outwards.

5.
As soon as the valve can be taken out by hand pull out the complete valve.

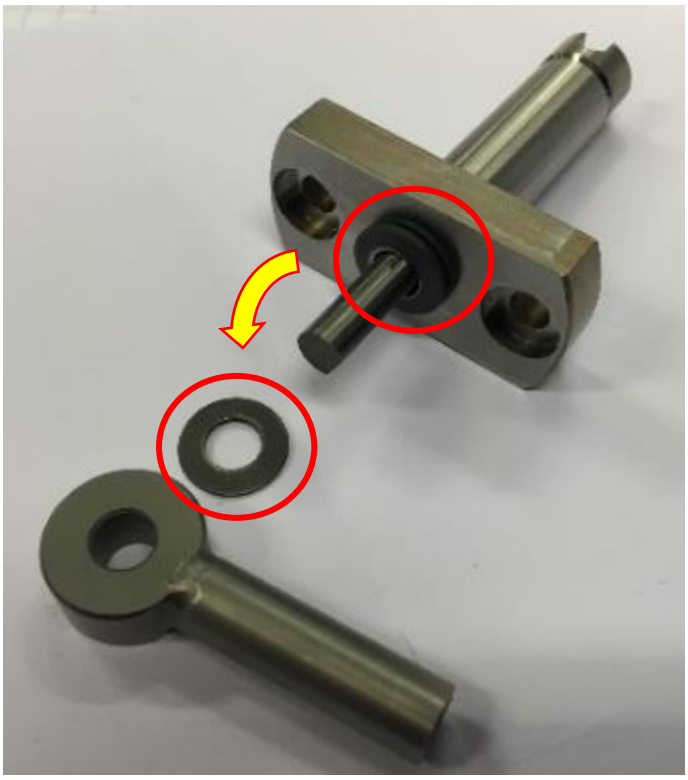
Warning the valve can be hot, wear protective heat resistant gloves!

6.
Take out the set screw after the valve is removed to disassemble the handle.

Be careful, behind the handle there are springs, also the valve can fall out of each other now.



7.
Take of the handle.



8.
Take of all the disc springs behind the handle.

9.
Pull out the solid carbide internal valve.

Clean the outside of the valve unit with the stainless-steel wire brush.

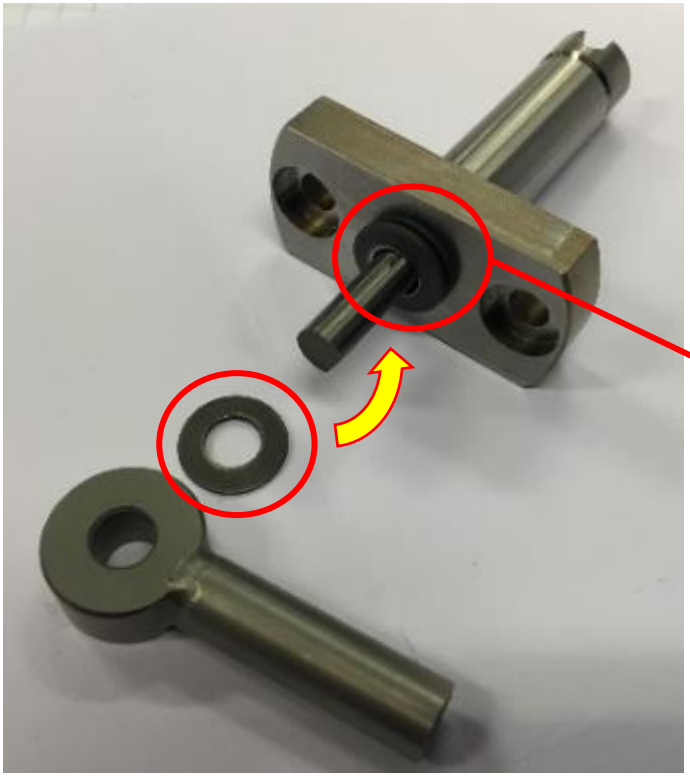
10.
Clean the solid carbide internal valve very carefully with the stainless-steel wire brush.

CAUTION
Be aware not to bend or drop the solid carbide internal part of the valve when handling it. This part is extremely hard but also very brittle, it will break very easy.

Reassembly of the recirculation valve

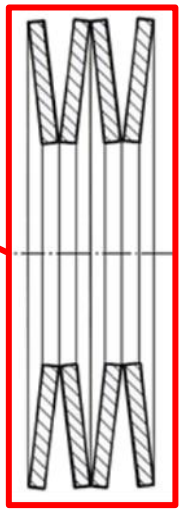
11.
Insert the solid carbide internal part of the valve.

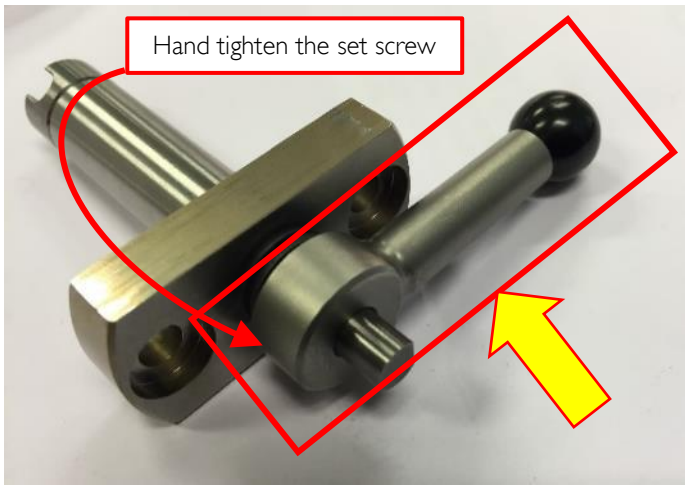
Check if the internal part can rotate smoothly inside the outer part.
If the internal part does not rotate smoothly this could mean that it is not perfectly cleaned.



12.
Stack the disc springs.

Only stack the disc springs like shown in the drawing below.



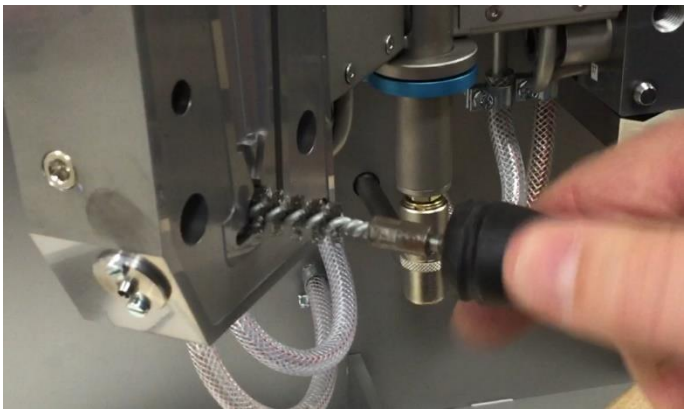


13.
Mount the handle.

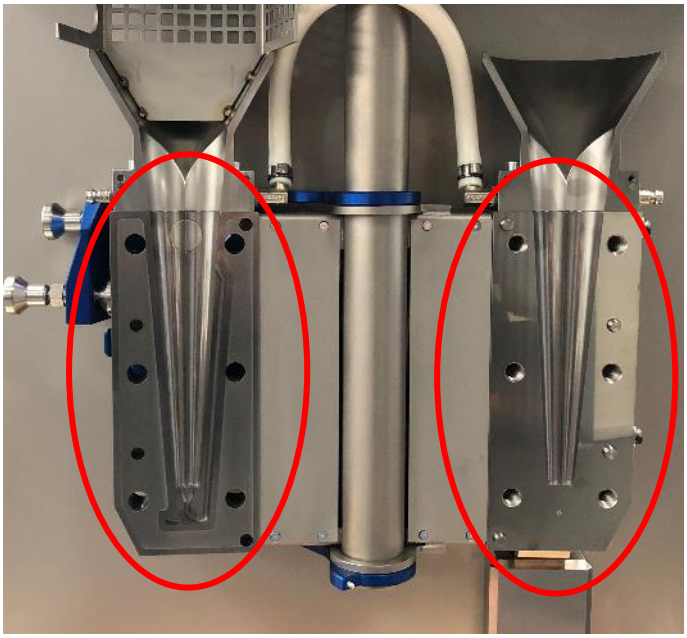
Apply a small amount of anti-seizing grease to the set screw locking the handle in place.

Hand tighten the set screw.

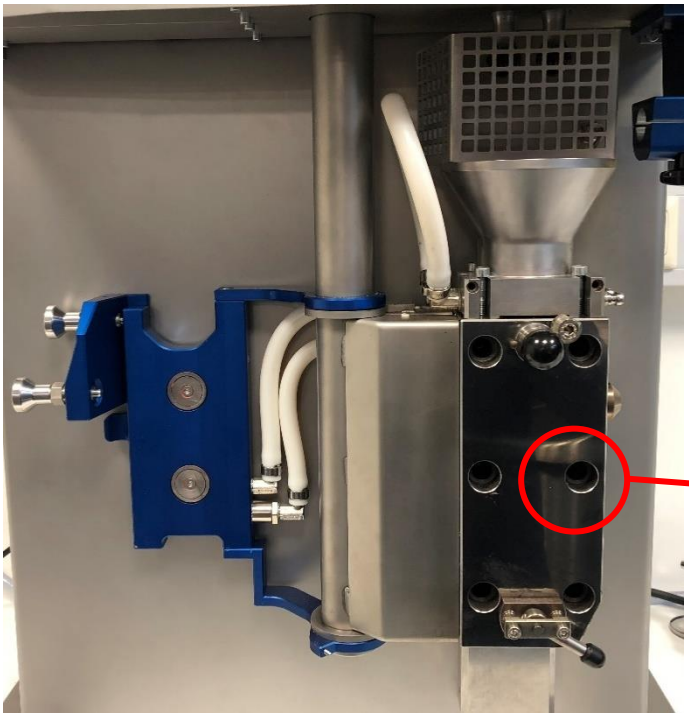
Put the valve away safely, first the barrel will be cleaned further to prepare the mounting of the complete valve unit.



14.
Open the barrel and clean the hole where the valve is mounted with the delivered wire brush.

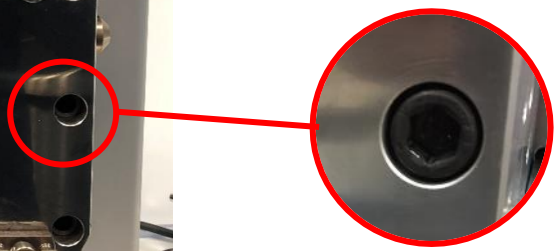


15.
Clean the inside of the barrel, especially the closing surfaces must be super clean. Also clean the outside of the barrel, where the valve will be mounted.

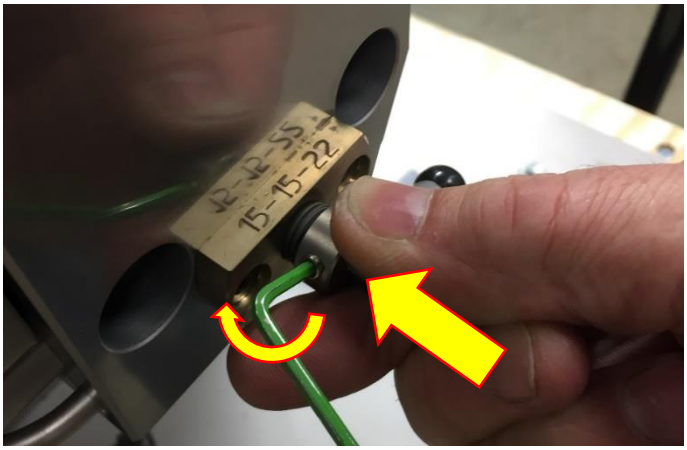


16.
The next steps will be to mount and adjust the valve unit, therefore it is of extreme importance to close the barrel completely.

In order to keep the barrel closed during this procedure it is necessary to mount at least one bolt.

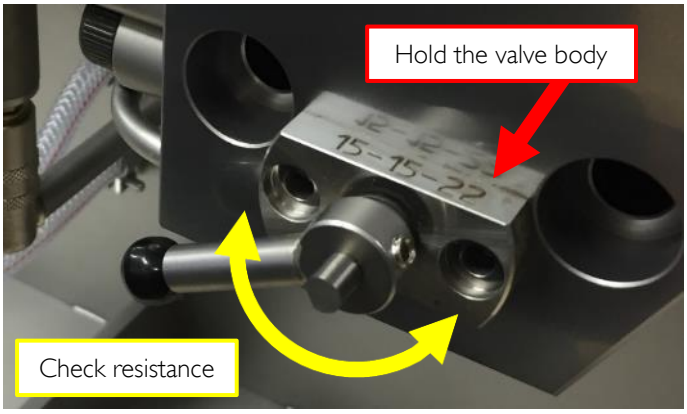


15.
Slide the valve into the barrel



16.
Loosen the hand tightened set screw of the handle slightly.

Press with thumb and pointing finger against the valves handle towards the barrel. This way the disc springs will be tensioned.
Simultaneously tighten the set screw.
The set screw only needs to be tightened a little, do not overtighten!

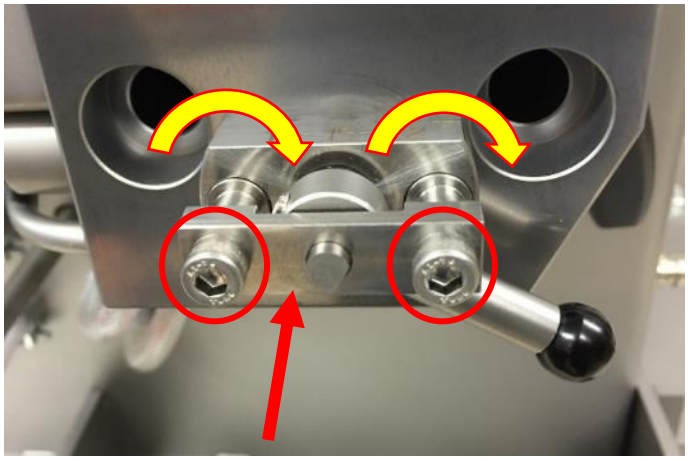


17.
Hold the valve body.
Try if the valve rotates smooth:

Optimum resistance:
If the valve moves smoothly by just applying pressure of one finger but does not move out of its own weight.

No resistance:
The disc springs are not tensioned sufficient, loosen the set screw and apply more pressure to the handle.

High resistance:
The disc springs are tensioned too much, loosen the set screw and apply less pressure to the handle.

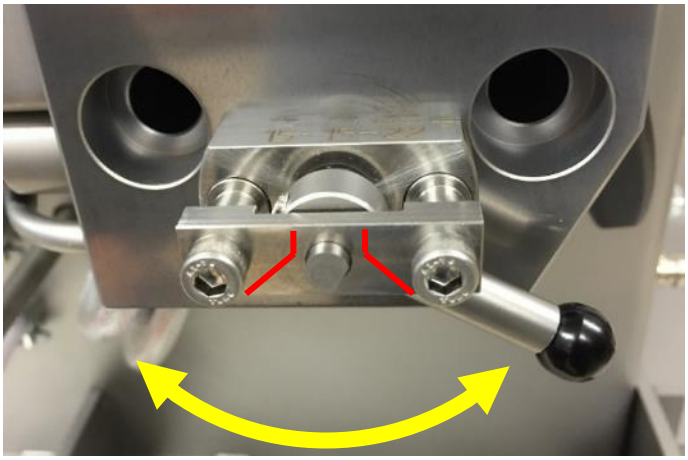


18.
Insert the positioning bushes.

Mount the cover plate, attention, the V-shape should be pointing downwards.

Apply a small amount of anti-seizing grease to the bolts.

Mount the bolts.



19.
Check if the valve works smoothly.

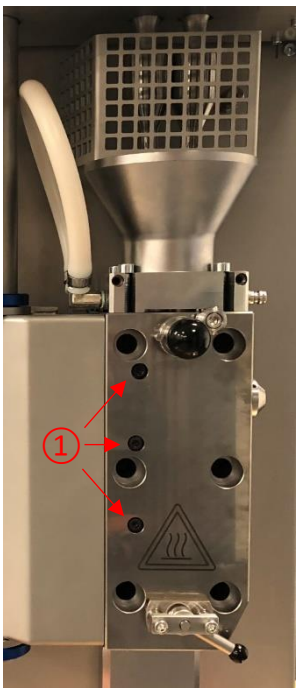
20.
Open the barrel and check on the inside if the valve aligns with the channels in the barrel.

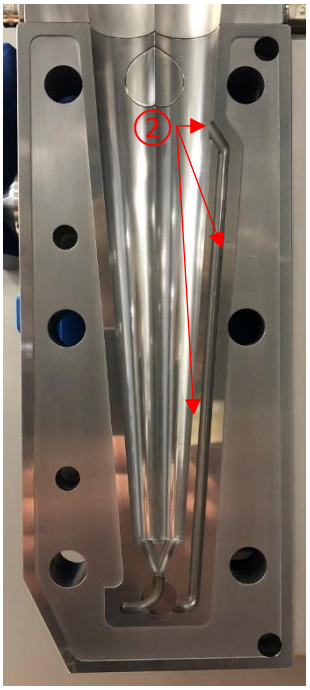
If everything runs smoothly and aligns properly the cleaning of the valve is completed and working with the micro compounder can be resumed. If not repeat the cleaning procedure.

15. Vari-batch® (option)

The MC 15 HT can be optionally configured as a Vari-Batch® compounder, the capacity of the compounder can be varied by means of inserts in the barrel. The batch volume can be chosen between 3 ml, 7 ml and 15 ml.
Thanks to this proprietary option, one can process very small quantities of material without acquiring another compounder for this (thus three instruments in one).

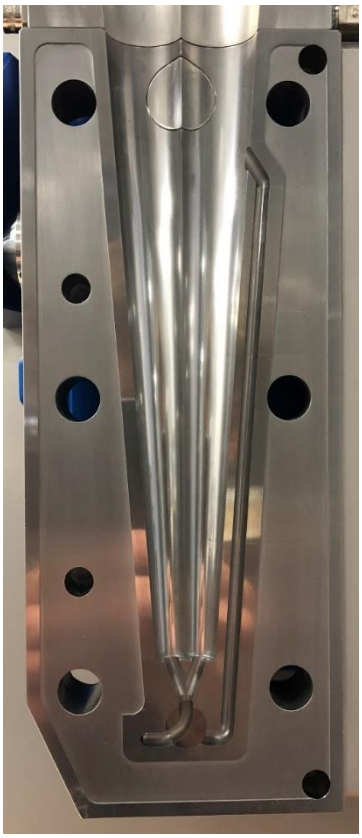
The Vari-Batch® barrel will be delivered from factory.
This chapter describes how to change the volume by swopping the inserts in the barrel.



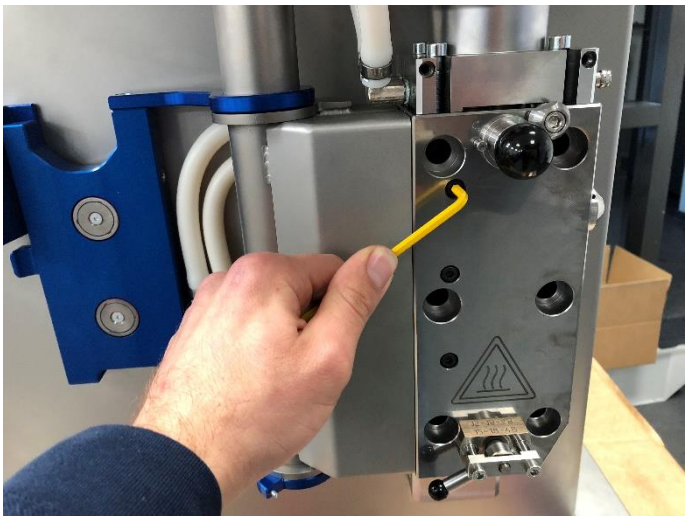


No.	Description
①	Insert retaining bolts
②	Inserts
③	Toolbox containing unique barrel number.
④	Insert replacement tool
⑤	Short retaining bolt
⑥	Long retaining bolt
⑦	Inserts

Only use the Vari-Batch® inserts in the below shown configurations.

15 ml setup	7 ml setup	3 ml setup
		
		

15.1 Changing of the Vari-Batch® insert line up



As example we will change the 15 ml setup to the 3 ml setup in this step-by-step manual.

1.
Close the barrel.

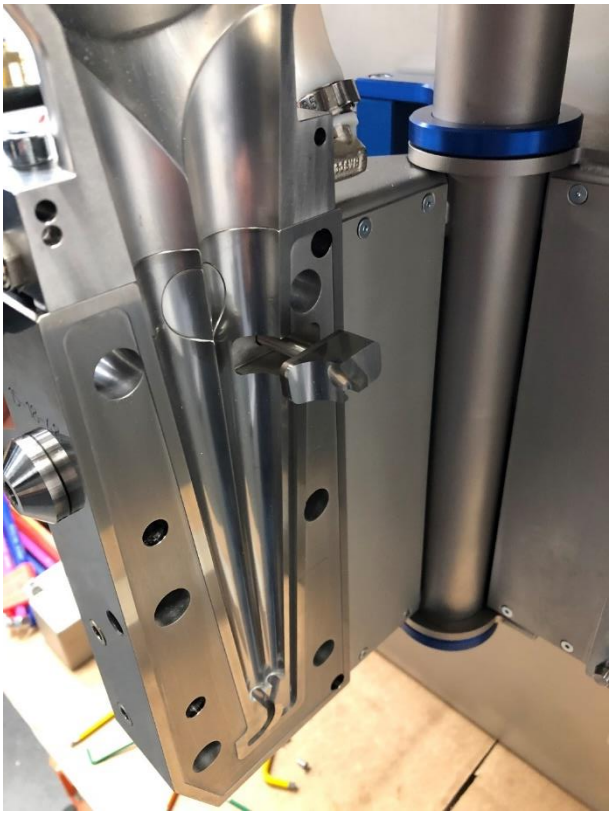
Loosen the retaining bolt of the insert you would like to change slightly.

Do not take the bolt out completely!
This is to avoid damaging of the insert when opening the barrel.

2.
Open the barrel.

Now take out the retaining bolt which is loosened completely.

3.
Turn the insert replacement tool inside the insert you would like to take out.



4.
Apply pressure to the tool until the insert comes out.

Hold the front barrel half open by using the heat resistant glove.
Use the heat resistant glove to prevent burns and cutting on the hot and sharp barrel edges.

If the insert does not come out, try to wiggle the insert-tool.

If there is no movement of the insert, heat up the barrel to max temperature.

5.
Clean the insert holes in the barrel thoroughly, use the stainless-steel wire brush and a small screwdriver to clean.

Make sure the whole insert holes is cleaned perfectly!
If material residue remains it is possible to damage the inserts and barrel.

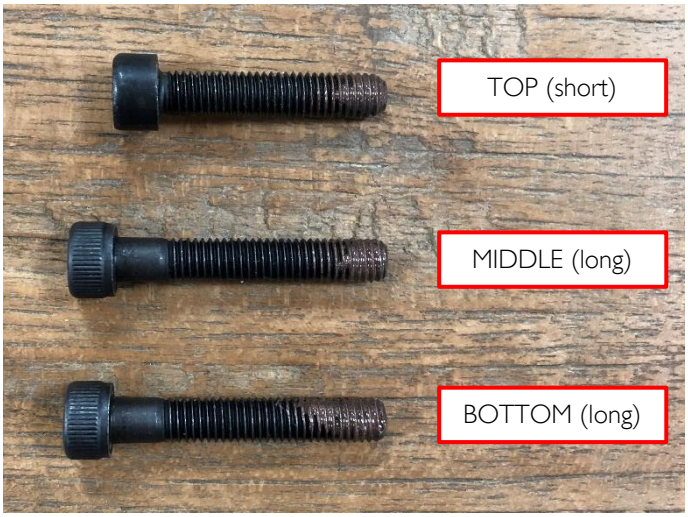
6.
Ensure that the insert you would like to use is absolutely clean. If not clean it with the stainless-steel wire brush.

Push in the desired insert.

If it is hard to push in the insert completely, use the insert replacement tool to gently wiggle the insert in.

Check whether the inserts are flush with the barrel wall.

If the inserts are not flush with the barrel this could mean that there is material between the barrel and the insert.
Check if there are no contaminations.

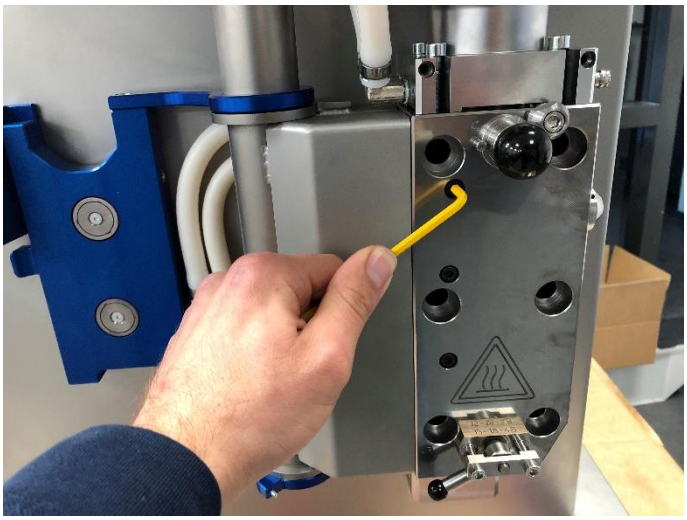


7.
Apply a small amount of anti-seizing grease to the bolts.

Note that in the top insert the short bolt is used.
In the two lower inserts the long bolts must be used.

Mount the retaining bolts, tighten the bolts sufficient.

Check again if the inserts are flush to the barrel.



Now the changing of the barrel volume is completed.
The compounder can be immediately used.

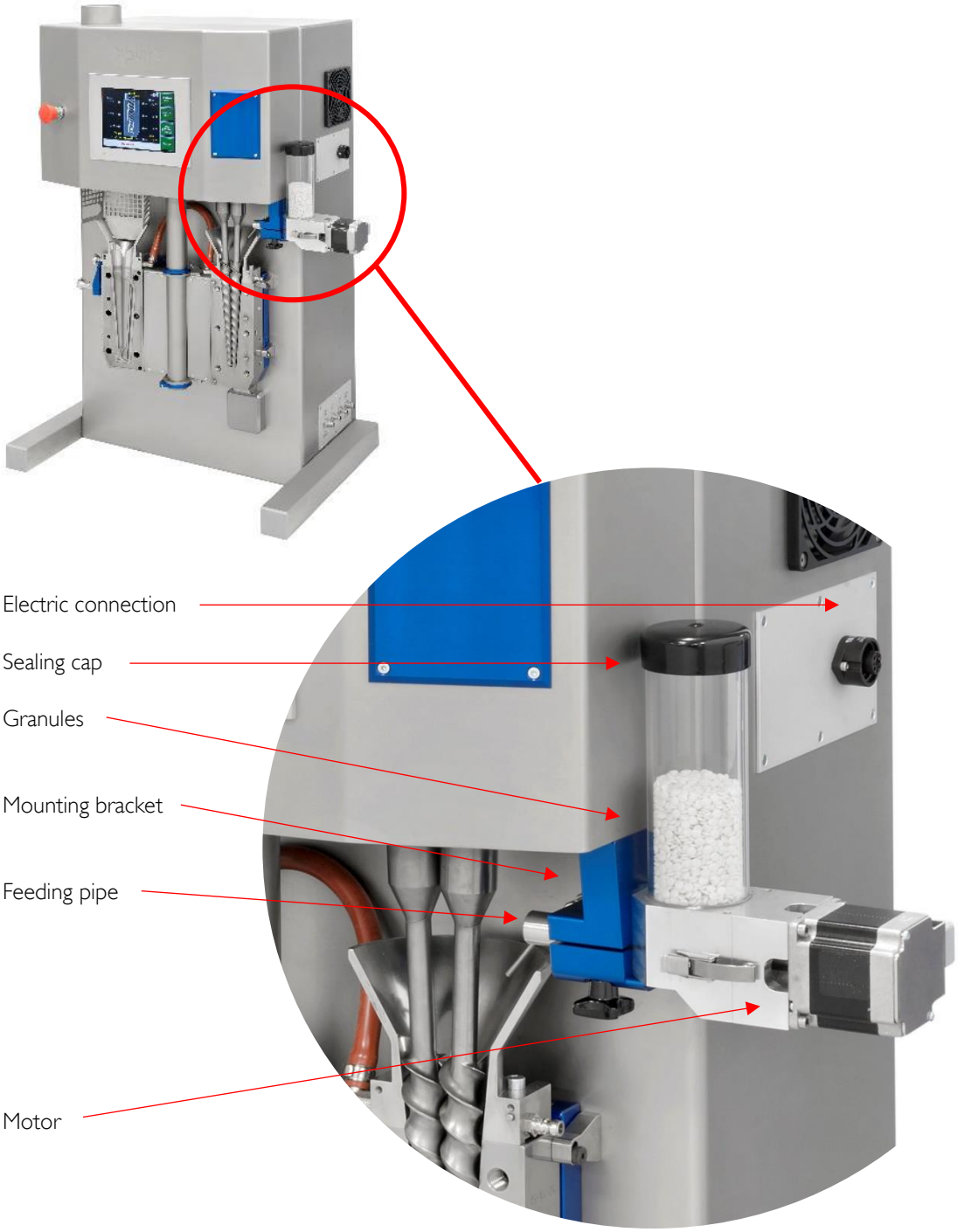
Note: the rheological software only applies for a barrel content of 15 ml.

16. Continuous feeder (option)

Optionally the MC15HT can be equipped with a continuous feeding system.
This feeder allows the feeding of granules in a continuous mode, for example ideal for gaining a consistent throughput during extruding.

The continuous feeder is operated from the build in touch screen. To make cleaning and filling or emptying the feeder easily it can be disassembled.
The transport screw inside the feeder is optimized for different granule shapes. On request there are separate transporting mixing screws available for powders.

Note, the continuous feeder can only be used in combination with the water-cooled top hopper and the easy filling screws.



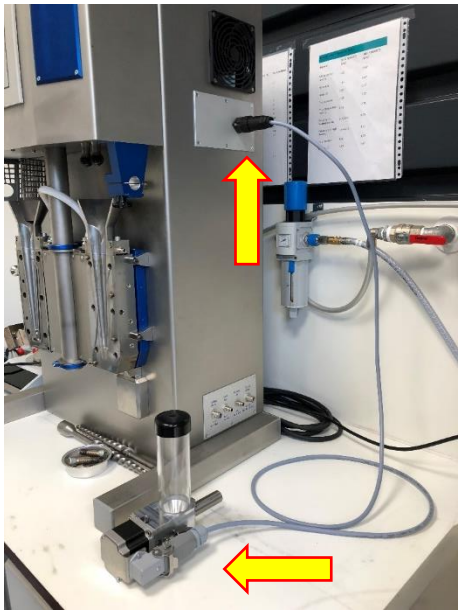
16.1 Mounting of the continuous feeder

1.
If the continuous feeder is not ordered together with the micro compounder the mounting bracket should be mounted first.

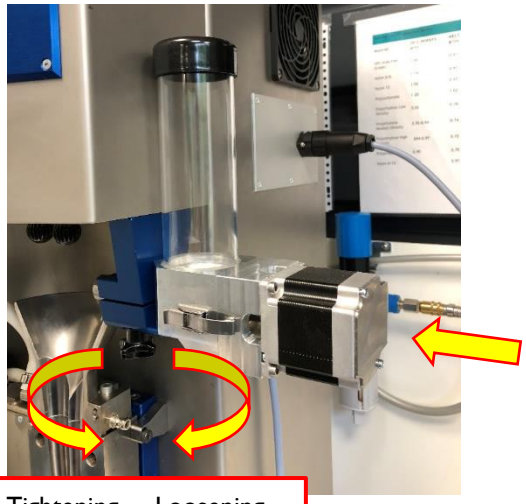
Loosen the two middle bolts of the cover and take them out.

Mount the bracket, with the delivered bolts.

Note: the new bolts for the bracket are longer than the bolts holding the cover.



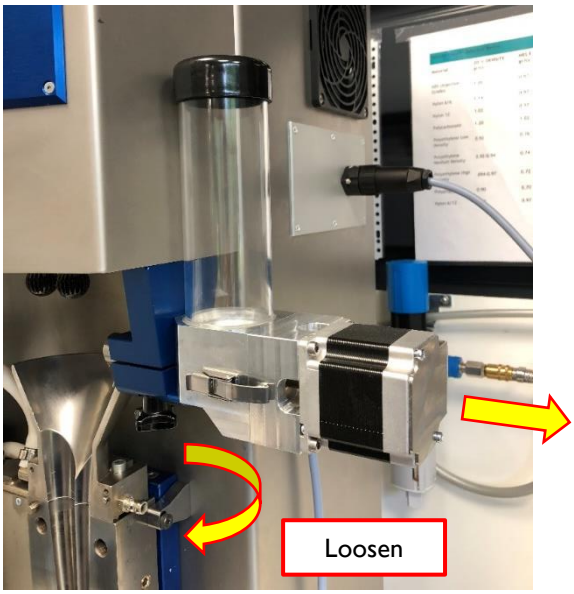
2.
Connect the power cable to the feeder and to the connection on the micro compounder.



3.
Insert the feeder in the bracket and tighten the black knob to hold the feeder secure in place.

Now the feeder is ready for use.

16.2 Cleaning of the continuous feeder

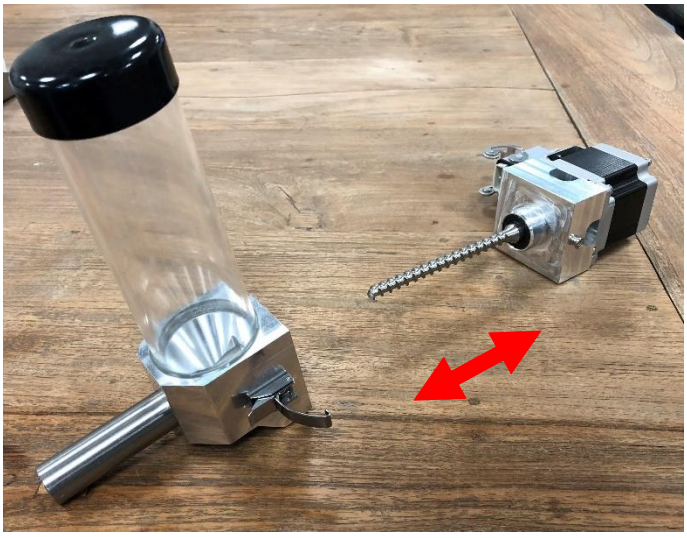


1.
Take the feeder out of the bracket.
Loosen the knob and pull out the feeder.

Take off the electric connector at the feeder.

2.
Put the feeder on a table so it will not fall out of each other when disassembling it.

Unclamp both clamps.



3.
Separate the motor from the hopper.

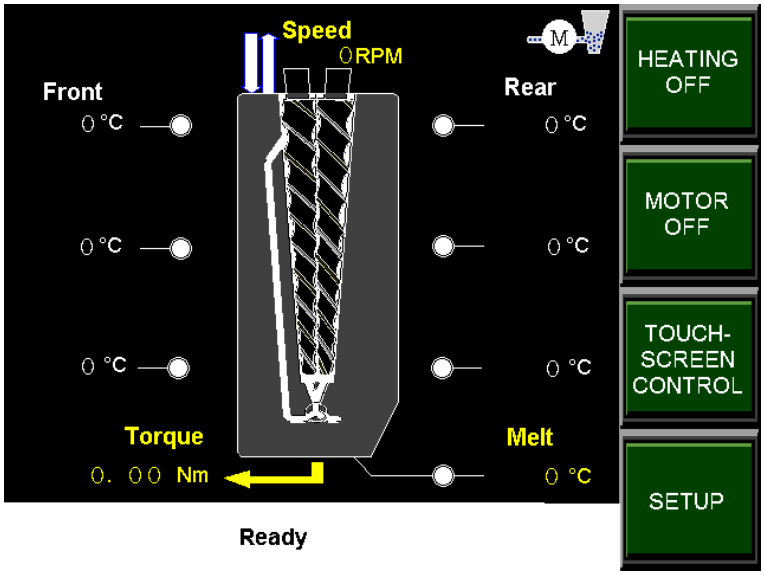
The transporting screws, hopper and feeding pipe can be easily cleaned now.

Be careful **not** to clean the motor with water or solvents!

Rebuild the feeder in reversed sequence.

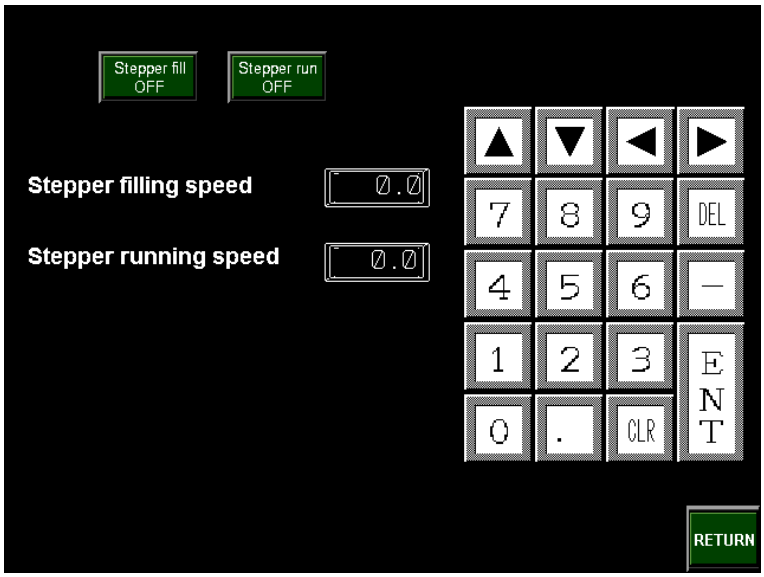
16.3 Operating the continuous feeder

The continuous feeder is operated from the build in touch screen.
Click on the feeder symbol to reach to the set-up menu.



It is possible to set the filling speed (speed at which the barrel will be filled)
And the processing or running speed (speed at which the process will be)

Press STEPPER FILL or STEPPER RUN to switch the stepper on and off, the button will light bright green if the feeder is running.



Changing the feeder parameters:

1. Click on the desired field (filling or running)
2. Use the numeric panel to enter the desired value
3. Confirm the setup by pressing ENTER,
   The feeder will immediately change to the new value.

➔ By pressing DEL or CLR the entered value can be erased
➔ By pressing the RETURN button, one returns to the MAIN SCREEN

17. Software (option)

17.1 Description

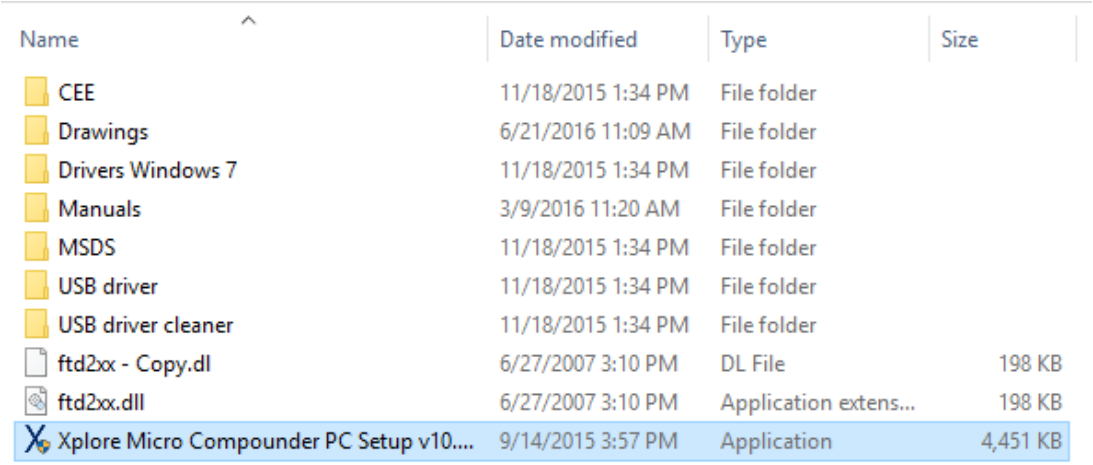
With the optional software, the Xplore Compounders can be connected to a PC via the standard USB port. This adds a number of functions to the system, such as data acquisition and automated cycles. Measurement data is plotted graphically and stored in files which can later be entered, for example, by a program such as Excel. With an automated process cycle, one can run through a complete cycle from filling to emptying with pre-set temperatures and speeds, and with a cleaning cycle the system can be cleaned in this way according to a pre-set procedure. Data is also saved during these cycles.

The minimum recommended system requirements for the used PC are:
Pentium PC or compatible, with 512 Mbyte RAM, 100 Mbyte free hard disk space, SVGA colour monitor and Windows 10, Windows 7, Windows Vista or Windows XP.

The Xplore Compounders can be connected with a standard USB cable to the USB port of the PC.

17.2 Installation of the software program

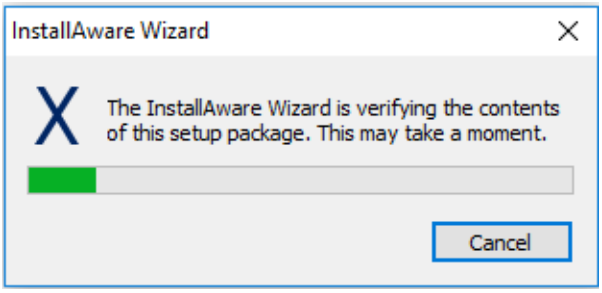
The newly designed Xplore program is installed from CD-ROM. The software should run automatically from the CD; if this is not happening the installation can be started with activating the install on the CD.



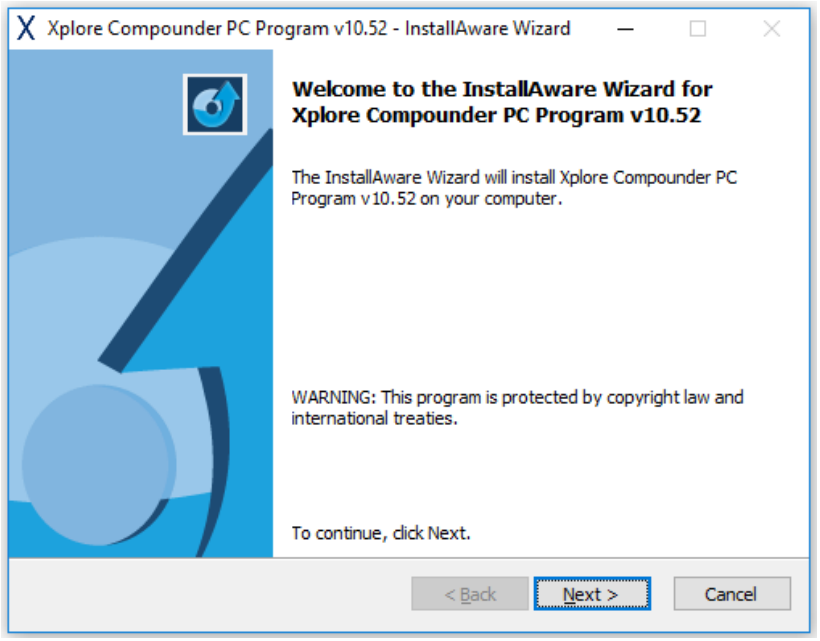
Name	Date modified	Type	Size
CEE	11/18/2015 1:34 PM	File folder	
Drawings	6/21/2016 11:09 AM	File folder	
Drivers Windows 7	11/18/2015 1:34 PM	File folder	
Manuals	3/9/2016 11:20 AM	File folder	
MSDS	11/18/2015 1:34 PM	File folder	
USB driver	11/18/2015 1:34 PM	File folder	
USB driver cleaner	11/18/2015 1:34 PM	File folder	
ftd2xx - Copy.dl	6/27/2007 3:10 PM	DL File	198 KB
ftd2xx.dll	6/27/2007 3:10 PM	Application extens...	198 KB
Xplore Micro Compounder PC Setup v10....	9/14/2015 3:57 PM	Application	4,451 KB

During the installation, the following steps occur, and use is made of an "InstallAware Wizzard", which ensures that the entire installation is flawless. It is possible to run the new version together with an older version of the Xplore Software on your PC, but it is recommended that you don't use the two software versions at the same time.

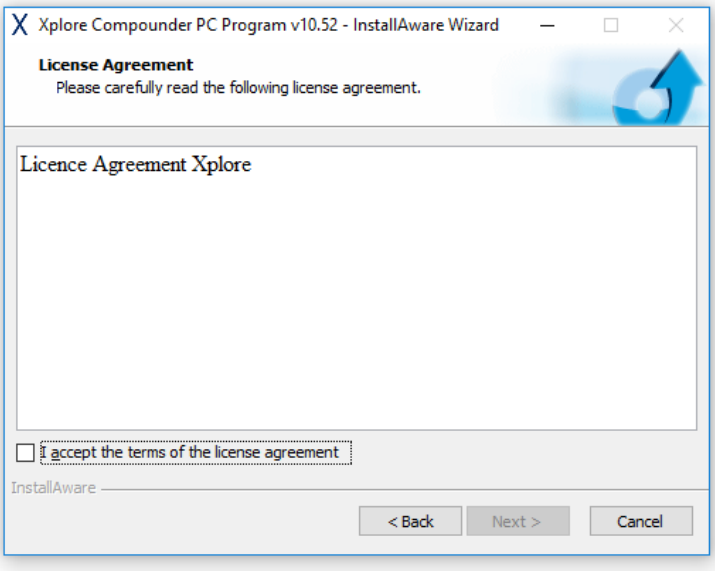
PC screens with installation information
In this manual we show screen prints of the version 10.x, which is the standard Software version from Xplore-Instruments. The same steps are needed to install the version 20.x software for the Xplore MC. This is the Rheological Software version from Xplore-Instruments. Below we show all consecutive screens.



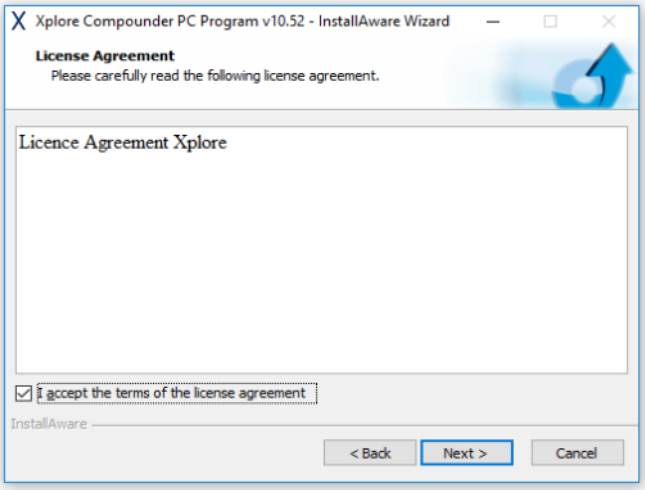
InstallAware Wizzard



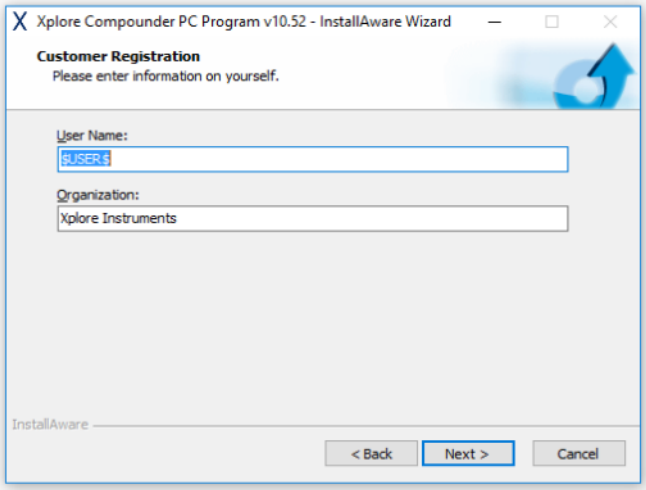
Welcome and Version
After choosing NEXT you will find the following screens:



Licence agreement, change to accept.

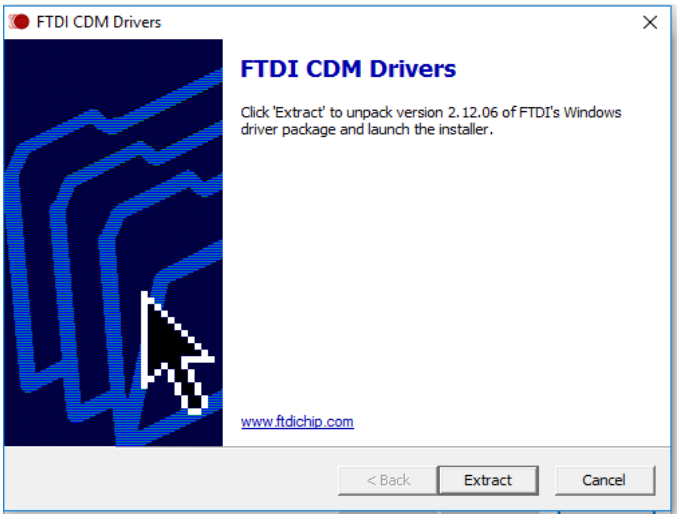


Accept License agreement

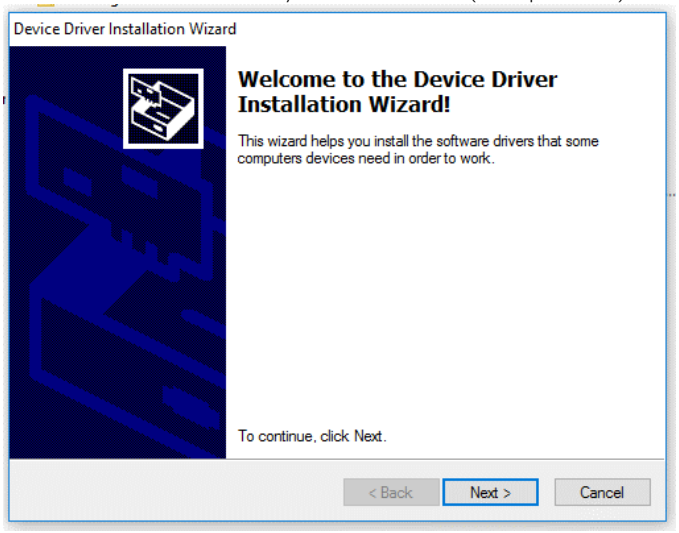


Customer information and preferences

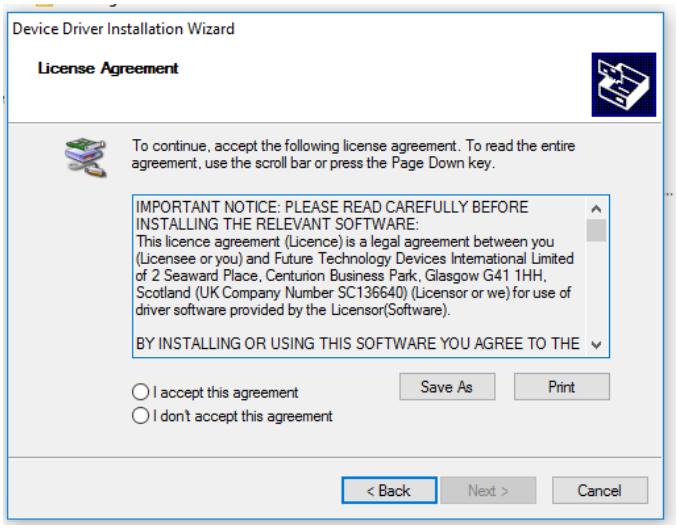
Change the user name to your requirements and change the organization to the correct one if needed.



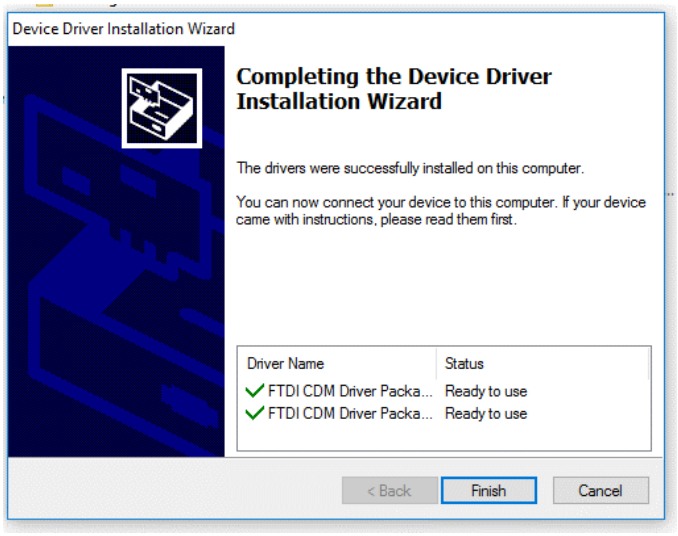
Extract the drivers for your new device (Compounder)



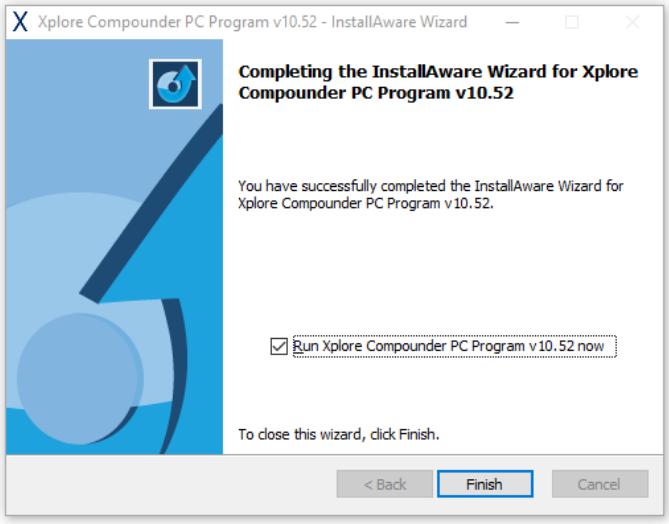
Driver installation Wizard



After clicking "I accept this agreement" the drivers will be installed.



The Wizard is now ready to install the software and you are asked if you want to change or review your installation settings, if not, click "install".



Final screen starting the software

The actual installed version is visual in this last screen, this version is depending on the ordered software.

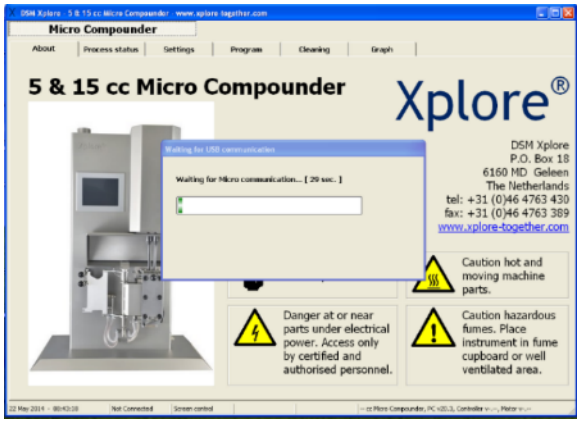
17.3 Xplore PC Software

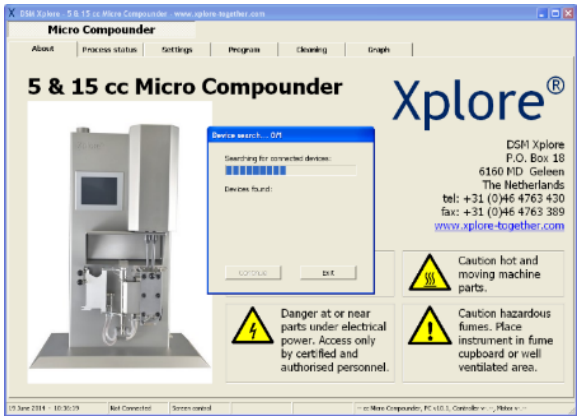
For the connection to the PC, the Xplore Micro Compounder has a USB port. In the touch screen, you can select whether to operate the Xplore Micro Compounder with "Touch Screen Control" or with "PC Control". The Xplore Micro Compounder can only be switched on in "PC Control" if a computer has been connected and the Xplore software has been started.

Program Starting / Closing
If the Xplore software is started, and the Xplore Micro Compounder is connected to the PC, the Xplore software automatically detects the Compounder. At this moment the PC software imports all the settings and readings from the Xplore Micro Compounder.

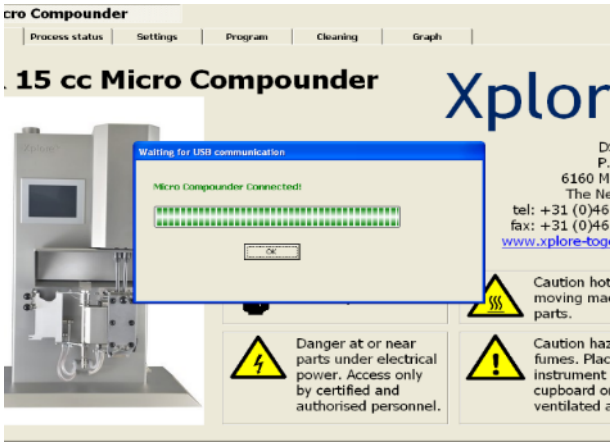
If no Xplore Micro Compounder is found, the software will indicate "No Micro communication". One can choose to run the PC software in "demo" mode. In the "demo" mode the program can be used for demo purposes without the Xplore Micro Compounder being connected.

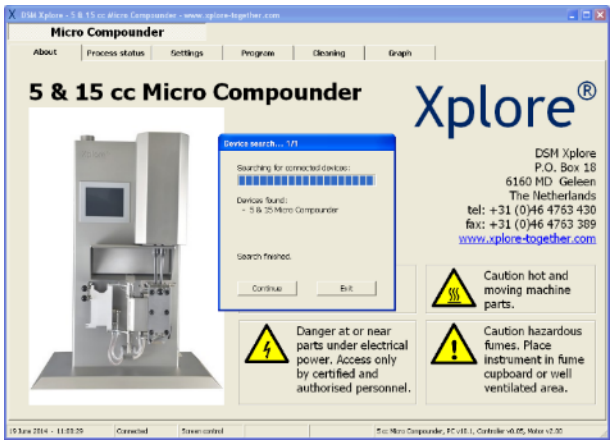
Upon starting, the "no communication" screen will appear, showing that there is no communication with the Xplore Micro Compounder.





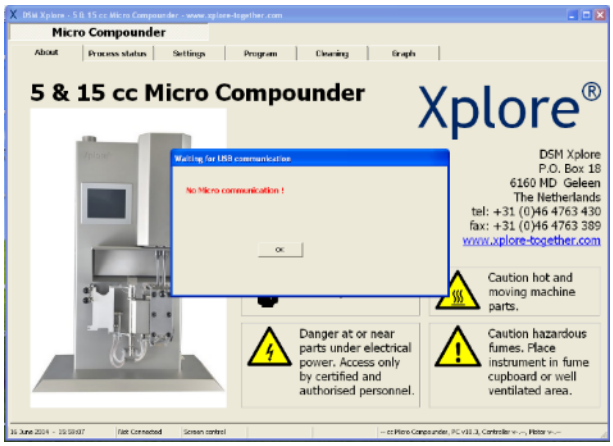
"Waiting for communication, screen"
Screen depending on software version installed.

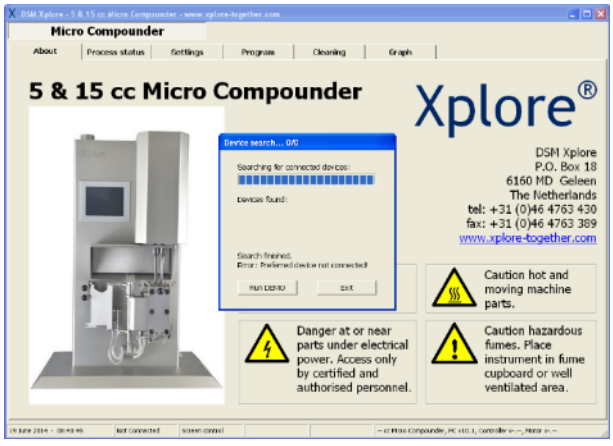




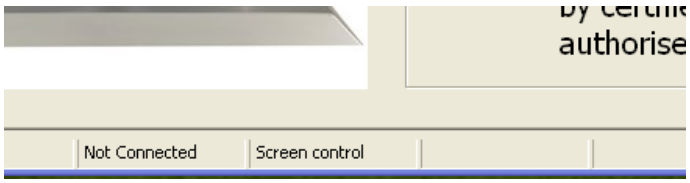
"Micro Compounder Connected, screen"
Screen depending on software version installed.

Upon starting, the following screen will appear, showing that there is no communication with the Xplore Micro Compounder.





"No Micro communication screen"
Screen depending on software version installed.



"Not Connected" indication at the bottom

"Micro Compounder Connected / start program, screen"
Screen depending on software version installed.

If the Xplore software program has detected an Xplore Micro Compounder, you are asked to continue the program by pushing the button "OK".

"Xplore About, starting screen"

From this window, the entire program can be run by means of the tabs at the top.
In the different windows the program can be closed by clicking on the "Exit" button, after which the program will stop.
Furthermore, various messages are presented in the screen and the current situation is indicated in the bottom section.

Making Selections
The various functions on the screen can be selected with the mouse or with the keyboard. With the mouse, this is done by clicking the left mouse button.
With the keyboard, by selecting the desired key or entry field with <TAB> or <shift TAB> (the dotted box around text indicates which is selected). If a key is selected, the desired value can be entered by means of the keyboard. If you have to give a number the indicator will be green if the value is valid, if the indicator is red the number you are trying to enter is not a valid value, so you have to change it.

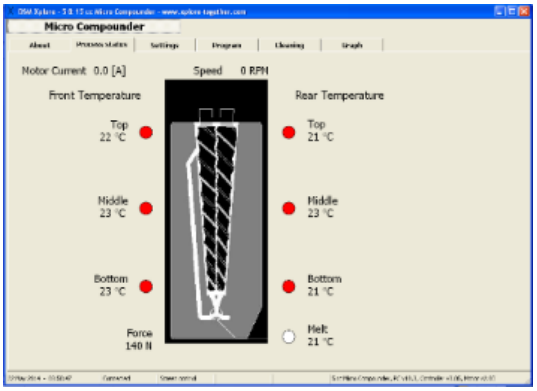
Entry Field

There is a distinction between text entry fields and numerical entry fields. The text entry field must be chosen from the different options in the list. The numerical entry fields have the units between "[...]" and the numbers must be filled out. The numerical entry fields are protected against text entry and are limited to a minimum and maximum value.

Screens

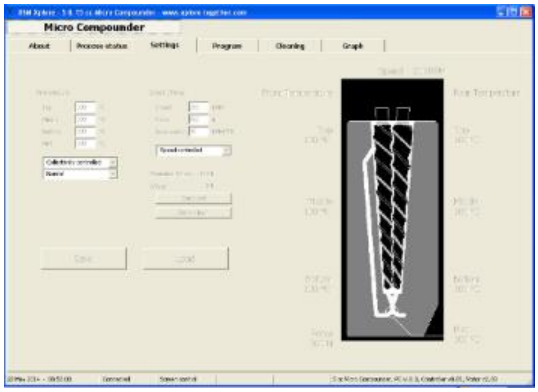
The software is constructed that you can move through all 6 screens by means of tabs.
These 6 tabs are shortly described below and more extensively further in the manual.

"About"

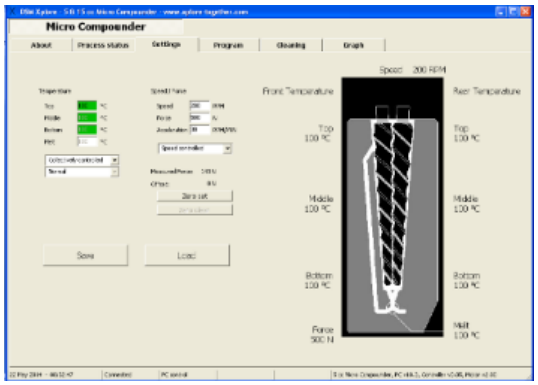


"Process status"

Screen	Description
About	In this screen you will find general information about the Compounder and Xplore
Process status	This screen shows the relevant processing data of the barrel and mixing mixing screws; it is almost a copy of the touch screen of the Xplore Micro compounder.

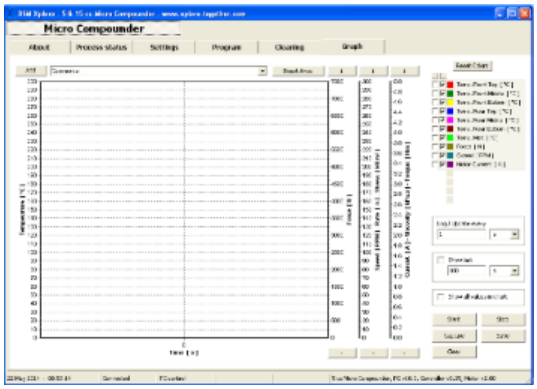


"Settings"

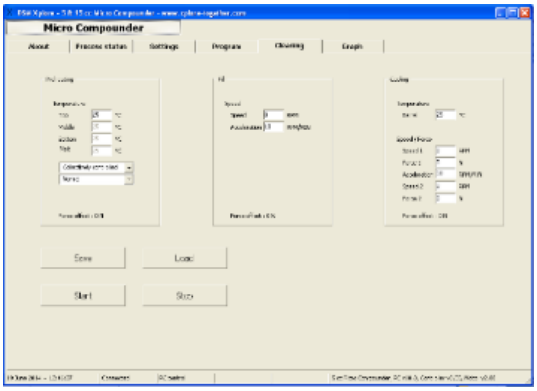


"Program"

Screen	Description
Settings	In this screen it is possible to control the Xplore Micro Compounder manually via the PC.
Program	This screen is used to create standard programs for several different polymer formulations, and store or load these programs.



"Chart"



"Cleaning"

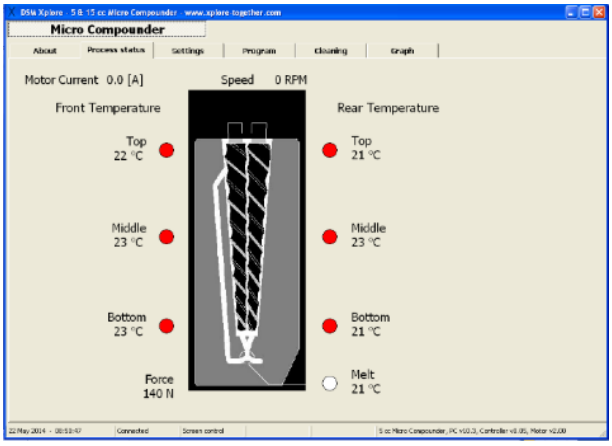
Screen	Description
Chart	This screen shows a chart of processing data selected and also gives you the option to start collect data to the PC.
Cleaning	The Cleaning screen gives you the possibility to create cleaning cycles and store them or reload these cycles.

In the "Settings" and "Program" and "Cleaning" screen, you can prepare and save processing settings for specific formulations and reload them, after which they can be started. This is to achieve maximum reproducibility. These screens are further described on the following pages.

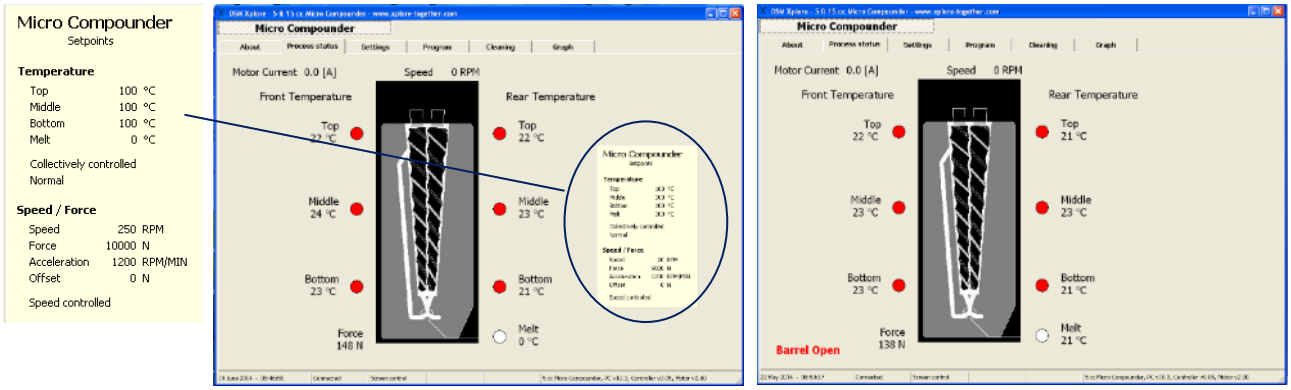
17.4 Process status Screen

In the "Status" screen, you can see all current processing values of the Xplore Micro Compounder, and also see the current setting values (click on right mouse button), if needed. This screen is nearly identical to the touch screen of the Xplore Micro Compounder, only the push buttons for operation of the "Heating," "Motor" and "PC Control" are absent here. This screen cannot be used to change setting values (see section 17.6 Settings Screen on page 129).

The heating and the motor can only be switched "on" or "off" with the touch screen of the Xplore Micro Compounder. If the Xplore Micro Compounder is being operated by means of the PC, the user must make sure that the heating and the motor are switched "on" or "off" at the required time: the PC does not indicate whether heating and/or motor are switched on or off, but only shows the actual process values.

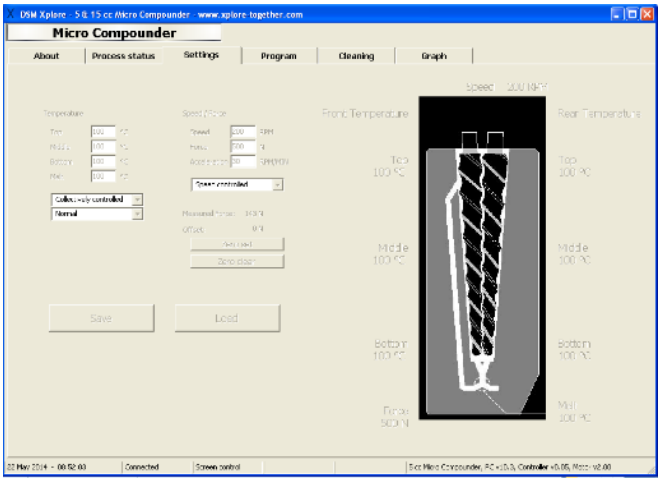


17.5 Status screen



"Status, screen / set values" "Status, screen/fault message (barrel open)"

17.6 Settings Screen



Settings

In the Settings screen it is possible to control the heating, the torque, and the speed of the Xplore Micro Compounder if the touch screen is set at PC mode. If the touch screen is set to PC control all settings made in this screen are directly send to the Compounder, and the Compounder is fully controlled via this screen.

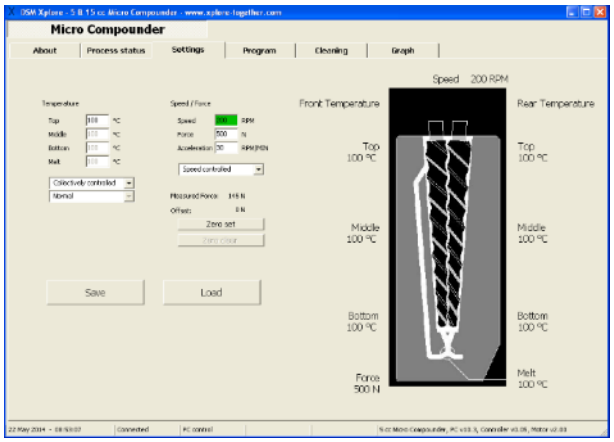
If the touch screen of the Compounder is not set at PC mode, no commands can be sent from this PC screen to the Xplore Micro Compounder. In that case it can only be controlled via the touch screen of the Xplore Micro Compounder.

The settings for the various control processes can be changed with the entry fields as explained below.

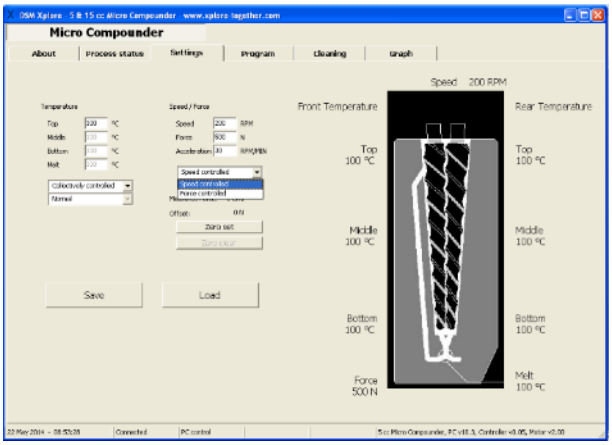
The acceleration setting is used to set the time needed for the motor to reach the set speed value (e.g. 100 RPM²).

The RPM of the motor is controlled with the speed setting.

If the Compounder is set to "Speed controlled", the maximum torque control can be used to set a maximum torque value that will not be exceeded. If this torque is reached the Xplore Micro Compounder will adapt the speed to avoid the torque to go over the set maximum torque value.



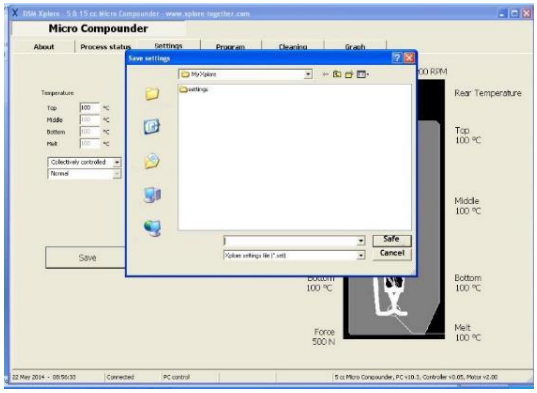
"speed value"



"speed controlled"

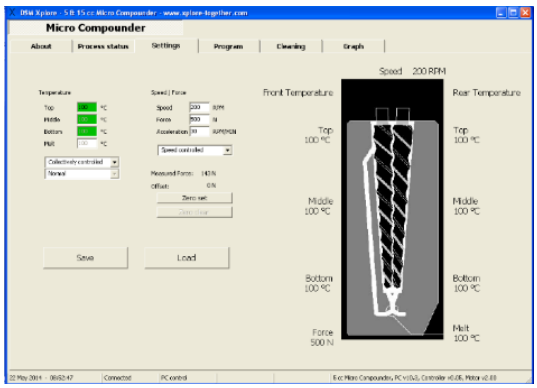
When "Torque controlled" is selected, it is possible to set a maximum motor speed (RPM) that will not be exceeded. When the motor is turned on the Xplore Micro Compounder will adjust the speed to a value for achieving the set torque on the Compounder, but the speed will not go higher than the set maximum speed.

With the "Save" and "Load" buttons it is possible to save or load settings made in this screen.

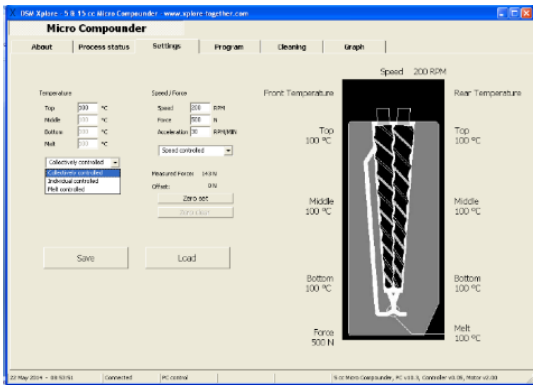


Save settings

The settings for barrel temperature are split up into three zones: Top, Centre and Bottom. The temperature settings are used to heat both the front and the rear half of the compounder barrel. It is possible to heat the three zones collectively, individually, or heat up the barrel with the option melt controlled (see below).



"Temperature value"



"Collectively controlled"

Collective

Using the Top control, all three zones are set at the same temperature.

Individual

This choice makes it possible to set each zone at a different temperature.
This does not apply to the "melt" temperature; only the Top, Center and Bottom can be controlled, the melt temperature follows.

Melt Controlled

Using the Melt control, all three zones are set to a temperature that will give the chosen value for the melt temperature.

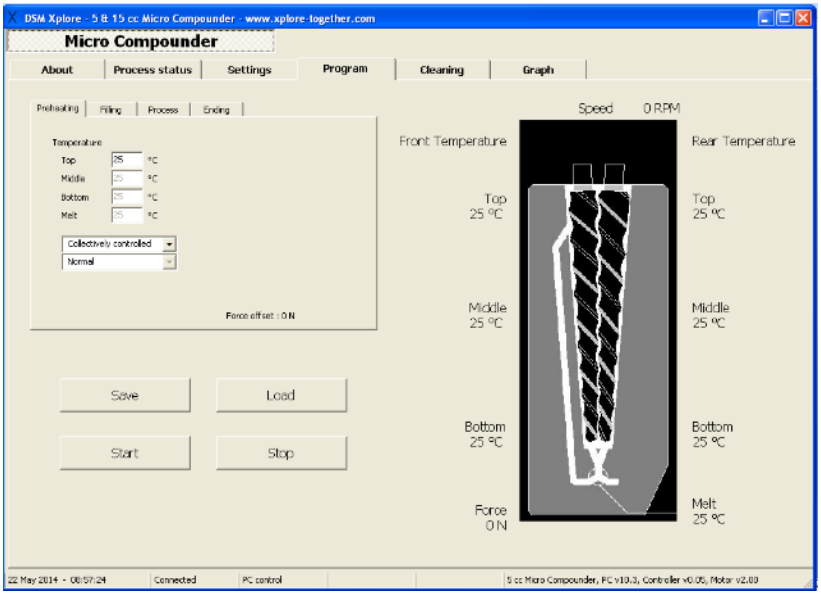
Relative ΔT

With this setting, the temperature setting can only be changed with the Top temp control. In this case, the Mid and Bottom settings are adapted relatively with respect to this, based on the condition prior to switching on the "Gradient Δ%T".

Absolute ΔT

Here, the temperature setting can only be changed with the Top temp control. In this case, the Mid and Bottom setting are adapted absolutely (with a fixed offset) with respect to the Top setting. The offset is determined by the setting before switching on "Gradient ΔT".

17.7 Program Screen



General

With this option a stored program cycle can be started, the manual settings control function is blocked and only the selected cycle is active. At any time this cycle can be terminated with the "Stop" button on the Program screen. The actions being performed are shown in a pop-up window, which also indicates whether the requested action has been performed.

The settings of a cycle can be saved under a name which you assign for re-use, by means of the "Save" button. With the "Load" button, previously saved cycles can be loaded again. The process cycles are saved with the extension *.Xplore; these files can be saved freely in the windows screen in any desired directory.

For collecting data you can start the "Chart" screen (see below).

Program functions

Under the "Program" tab, different kinds of process cycles can be implemented and recorded. Layout of the process cycle:

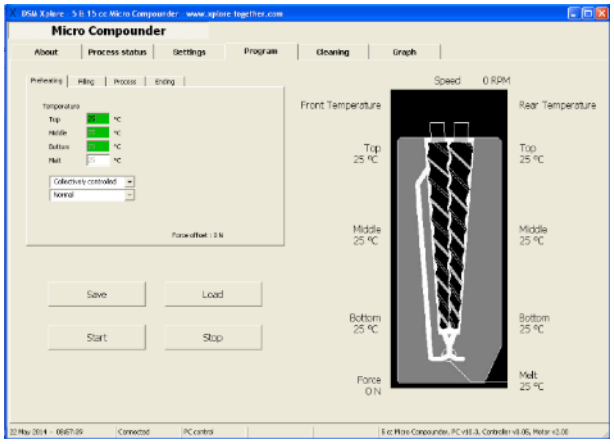
1. **Preheating**
   The process conditions for the preheating phase can be set here; they are:
   - The desired temperature
   - The type of temperature control: Collective, Individual, Melt – Normal, Absolute, Relative.

2. **Filling**
   The process conditions for the fill phase can be set here; these are:
   - The desired temperature
   - The type of temperature control: Collective, Individual, Melt – Normal, Absolute, Relative
   - The screw acceleration 0 – 100 RPM²
   - Speed controlled, or Torque controlled
   - The force or the maximum torque (depending on type of control)
   - The speed or maximum speed (depending on type of control).

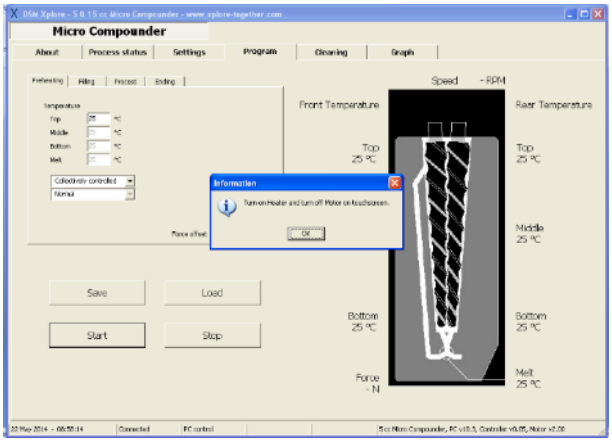
3. **Process**
   The process conditions for the processing phase can be set here; these are:
   - The desired temperature
   - The type of temperature control: Collective, Individual, Melt – Normal, Absolute, Relative
   - The screw acceleration 0 – 100 RPM²
   - Speed controlled, or Torque controlled
   - The force or the maximum torque (depending on type of control)
   - The speed or maximum speed (depending on type of control)
   - The processing time in minutes.

4. **Ending**
   The process conditions for the "End" phase can be set here; these are:
   - The desired temperature
   - The type of temperature control: Collective, Individual, Melt – Normal, Absolute, Relative
   - The screw acceleration 0 – 100 RPM²
   - Speed controlled, or Torque controlled
   - The force or the maximum torque (depending on type of control)
   - The speed or maximum speed (depending on type of control).

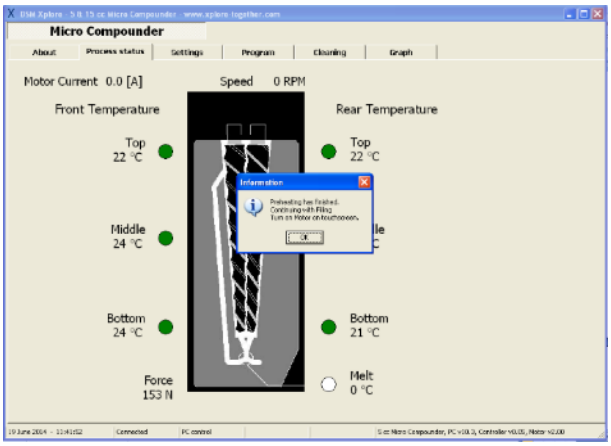
The following screens, generated by the software, illustrate the course of the process cycle.



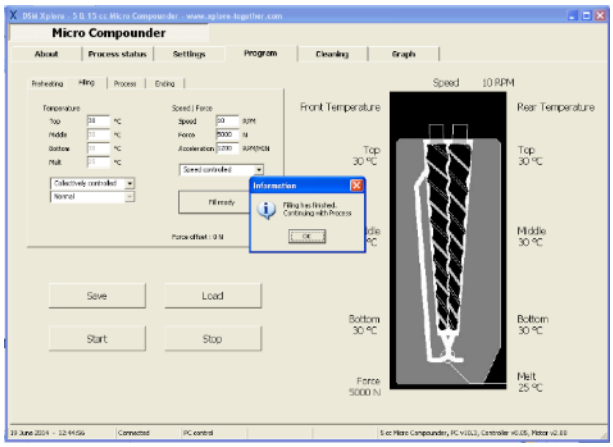
"Preheating"



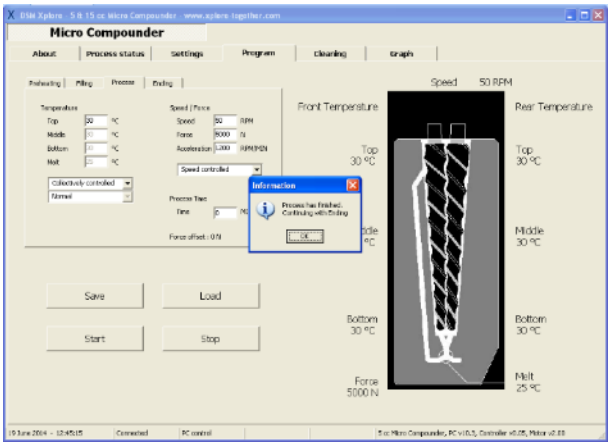
"Command turn heater on"



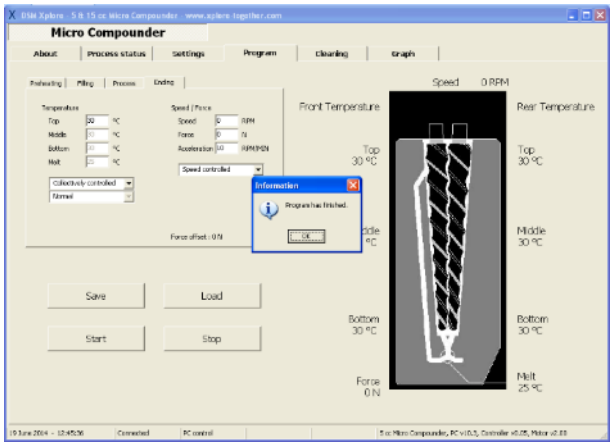
"Process preheating finished"



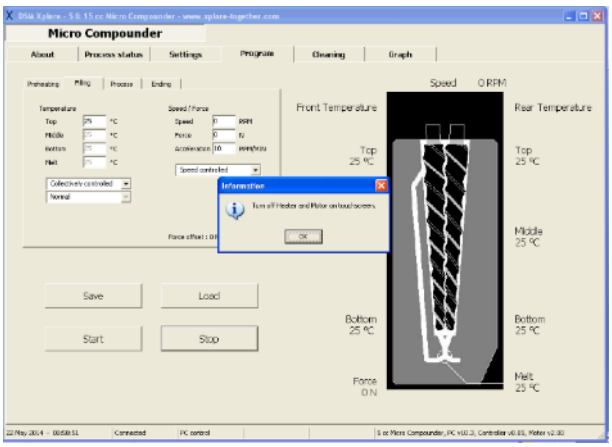
"Filing finished"



"Process has finished"

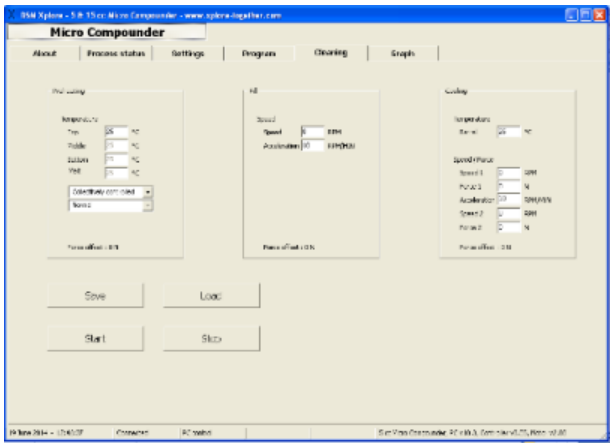


"Program has finished"



"Manually stopped"

17.8 Cleaning Screen



In the Cleaning screen it is possible to design, save and collect/load several cleaning cycles with a cleaning compound and the barrel closed and rotating mixing screws.
The "Save" "Load" "Start" and "Stop" buttons have the same functionality as in the "Program Screen".

General

If a cleaning cycle has been started, the manual control function is blocked, and only the selected cycle is active. At any time, the cycle can be terminated with the "Stop" button on the PC screen. The actions being performed are shown in a pop-up window, which also indicates whether the requested action has been performed.

The settings of a cycle can be saved under a name which you assign for reuse, by means of the "Save" button. With the "Load" button, previously saved cycles can be loaded again.

Cleaning Cycle

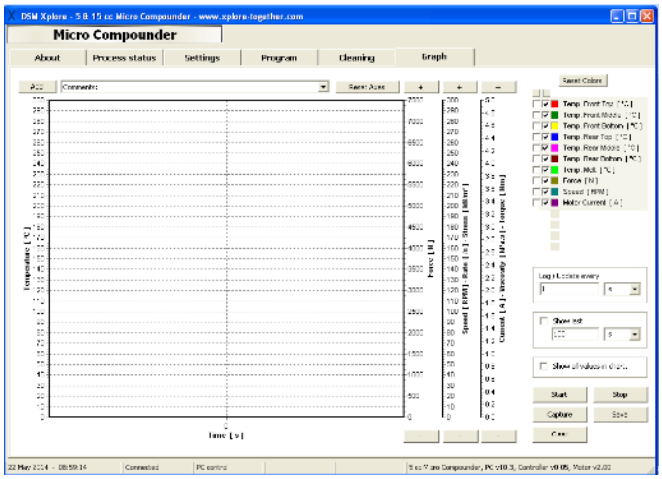
Various kinds of cleaning cycles can be implemented and recorded under the Cleaning tab. Layout of the cleaning cycle:

1. **Preheating**
   The conditions for the preheating phase can be set here; these are:
   - The desired temperature
   - The type of temperature control.
2. **Fill**
   The conditions for the Fill phase can be set here; these are:
   - The screw acceleration 0 – 100 RPM²
   - The speed (RPM)
3. **Cooling**
   The conditions for the Cooling phase can be set here; these are:
   - The desired barrel temperature
   - The Torque 1, until this torque is attained the speed is maintained at speed 1
   - The Speed 1, this value is maintained until the torque has reached the Torque value 1
   - The Screw acceleration 0 – 100 RPM²
   - The Torque 2, until this torque is attained the speed is maintained at speed 2, after which the cycle is expired
   - The Speed 2, this value is maintained until the torque has attained the Torque value 2.

Cleaning Cycle with water cooling

If the cleaning cycle with water cooling has been started, the heaters are switched off, the air cooling is switched on and the manual control function is blocked.
This option does not use the PC software but works independent.

17.9 Graph Screen



"Graph screen"

In the "Graph" screen, all or some process parameters can be represented in a graph versus processing time; the parameters to be shown can be selected by ticking "on" or "off" (the boxes right of the 3 y-axes).

The y-scales of the graph can be adapted by the select buttons "+" or "-" (buttons above and below the 3 y-axes) to fulfil the specific needs of the user. The time line can be set to show a specific time, by ticking the box show the last xxx s.

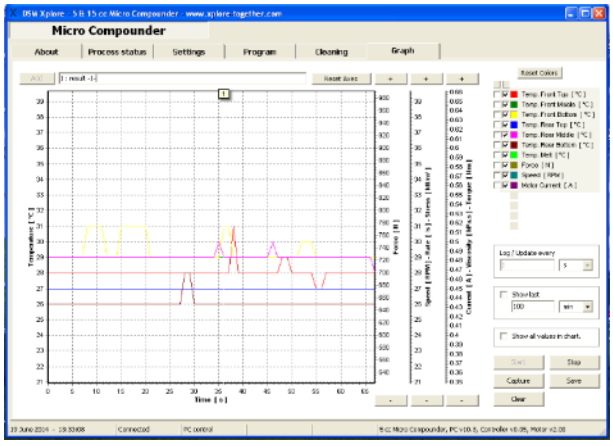
After finishing an experiment, this graph can be saved by means of the "Capture" button, it is saved as a Bitmap file, so that it can later be inserted in documents.

These files are saved under My Documents in the directory My Xplore and the name used for the file can be freely chosen.

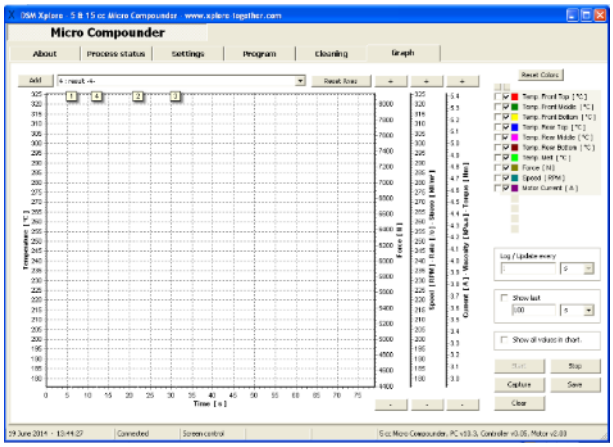
Within the graph Comments can be added (Add button above the graph in the screen), they can freely be placed within the graph, in the comment line you can give the comment.

The Chart is started by pushing the "start" button and stops by pushing the "stop" button in the PC screen. When the Chart is stopped the program will ask you where the collected data should be stored on your PC. The data is stored as an Excel file.

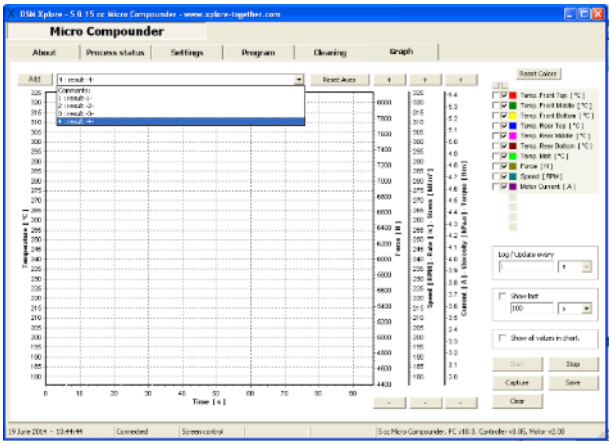
The following screens illustrate some options of the graph screen:



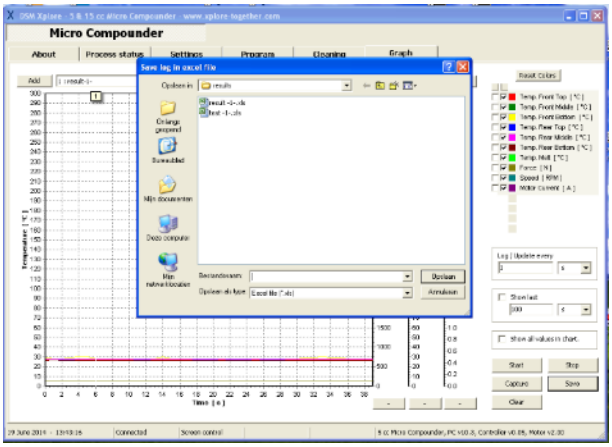
"Comment placing in the graph"



"Comments in graph 1 – 4 – 2 – 3"



"Comment lines"



"Saving XLS file"

18. Maintenance

WARNING OF DANGER
Do not replace parts yourself; bring in a technically competent person. (see Section 4.2 Target group on page 22)

To guarantee proper working of the compounder, good maintenance is essential.

It is important to regularly check all parts subject to wear and replace them in good time if they become worn.

Time period	Maintenance
Daily	No daily maintenance is required! It is wise to leave the compounder clean at the end of each working day!
Weekly	1. Regularly check the cooling hoses and the electric cables for damage. 2. Make sure the mixing screws are adequately lubricated; lubricate them if necessary. 3. Make sure the ball joints are adequately lubricated; lubricate them if necessary.
Monthly	1. Check the parts of the water cooling for lime build-up and remove this if necessary.

18.1 Maintenance of electrical installation

For good ventilation within the electrical switch box, it is necessary to regularly clean and/or replace the filters installed at the fans.

Carefully check:
- ➔ connections to ground;
- ➔ connection of the voltage terminals and auxiliary operating devices;
- ➔ proper working of the safety devices;
- ➔ adequacy of the protection system.

Maintenance Points for Electrical Installation	To be done After x work hours
Verify working of emergency stop buttons	200
Remove dust from (electrical) instrument parts	200
Remove dust from electrical compartment	500
Inspect motor	800
Inspect ground insulation of electrical installation	1300
Verify and inspect ground connections	1300

19. Replacement parts

When ordering spare parts, provide the following information:

1. Serial number, to be found on the devices name plate, refer to Section 3.5 Nameplate on page 18
2. Code number of the spare part (if known)

Replacement parts should be ordered from:

Xplore Instruments B.V.
Technical Support
Arendstraat 5
6135 KT Sittard
The Netherlands
info@xplore-together.com

20. Malfunction

20.1 Testing and inspection

ATTENTION
Perform this functional testing each day before you begin production (also after maintenance, repairs, etc.)
If you notice any fault, alter a technically competent person.
(see section 4.2 Target group on page 22)

1. Check the working of the stop button.
2. Check the working of the safety switch on the barrel.
3. Visually inspect the instrument. Pay special attention to the condition of covers and safety features.

20.2 Faults and repairs

The following tables describe various possible fault messages on the display of the electrical compartment and possible deviations. The cause(s) and solution(s) for each fault are given. There are faults which can be easily solved, and faults which require a certain technical skill level. A distinction is drawn between them.

WARNING OF DANGER
Do not replace parts yourself; bring in a technically competent person.
(see section 4.2 Target group on page 22)

20.3 General faults

WARNING OF DANGER
General faults can only be resolved by authorized person, unless otherwise stated.

WARNING OF DANGER
Technical faults can only be resolved by technically competent persons.
(see section 4.2 Target group on page 22)

If there is a "O" for operator under "Solutions", then the operator himself can resolve the fault.

If there is a "T" for technically competent person, then the service department has to be brought in.

If you cannot resolve the fault, contact Xplore.

Who	Fault	Cause	Solution
O	No voltage	Line cord not connected	Check/connect the line cord
T	No voltage	Defective fuse	Replace fuse
T	Touch Screen does not start	Defective fuse	Replace fuse
Xplore	Touch Screen does not start	There is a fault in the control section	Contact our Service Department
T	Touch Screen does not communicate with the print	Communication connection defective or loose	Restore it
Xplore	Touch Screen does not communicate with the print	There is a fault in the control section	Contact our Service Department
O	Barrel does not become warm	On/Off switch at touch screen is off	Turn on the heating
O	Barrel does not become warm	One of the safety features is "active"	Check the safety features and reset them
Xplore	Barrel does not become warm	There is a fault in the control section	Contact our Service Department
T	Barrel does not warm up evenly between front and back	Defective fuse	Replace the respective fuses
T	Barrel does not warm up evenly	One of the heating cartridges is defective	Replace them, if you know how! Otherwise, contact our Service Department
Xplore	Barrel does not warm up evenly	The control print is defective	Contact our Service Department

Who	Fault	Cause	Solution
O	Motor not running	On/Off switch at touch screen is off	Turn on the motor
O	Motor not running	One of the safety features is "active"	Check the safety features and reset them
O	Motor not running	The motor can become so hot that the excess temperature safety feature responds	Let the motor cool down so that the safety feature automatically resets!
O	Motor not running	The excess current safety feature responds	See whether the drive unit is jammed somehow, or make sure the temperature setting is not too low
Xplore	Motor not running.	There is a fault in the control section	Contact our Service Department!
O	Compounder becomes too warm	No air cooling present	Check for sufficient outside air supply! Check the air cooling!
O	Compounder does not work via the PC	Instrument still remains in "Touch screen control"	Place the instrument in "PC control"
O / T	Compounder does not work via the PC	No communication between the Compounder and the PC	Check the data cable between the two instruments Tighten RS 232 screws
Xplore	Compounder does not work via the PC	There is a fault in the control section	Contact our Service Department!
O	The water cooling does not work	Too little water pressure or too little Flow	Provide more supply and/or pressure
O	The water cooling does not work	No cooling water connected from the outside	Check the water supply and restore it!
O	The water cooling does not work	Cooling plates not placed (well) against the barrel	Place the cooling plates against the barrel!
T	The water cooling does not work	The electric valve or micro switch regulating cooling water supply are defective	Replace them, if you know how! Otherwise, contact our Service Department!
O / T	Recycle cock does not turn or turns too heavily	Cock fouled with viscous material	If you know how to clean the cock, clean it. Otherwise, contact our Service Department!
O	Software does not work or does not start	Software does not find any compounder	Let the software scan again

20.4 Technical faults

WARNING OF DANGER
Technical faults can only be resolved by technically competent persons.
(see section 4.2 Target group on page 22)

If faults occur in the Compounder that are not mentioned in the preceding section, or if you do not have sufficient instructions, these faults should be remedied by technically competent persons or contact the Service Department of Xplore:

Xplore Instruments B.V.
Technical Support
Arendstraat 5
6135 KT Sittard
The Netherlands
info@xplore-together.com

21. Taking the machine out of order

21.1 Demolishing

If the compounder is demolished, one must heed the waste processing rules in effect at the location and time of demolition. This also holds for worn parts and instrument parts which are replaced by a newer version. In either case, the customer/user is responsible for hauling away these parts.

21.2 Recycling

Most parts of the micro compounder are made of steel / aluminium. These parts can be scrapped as old metal.

22. Key word listing

Absolute temperature regulation	Temperature regulation via computer, difference between the zones is displaced in absolute value.
Adjustable speed	The speed of the extruder can be freely set between limit values.
Authorized person	Person appointed by the employer who can perform certain actions.
Barrel (liners)	The two barrel halves in which the mixing screws rotate.
Barrel retaining bolts	Bolts used to fasten together the two halves of the extruder barrel.
CE marking	European designation indicating compliance of the apparatus.
Coating	Top layer ensuring that the underlying material is protected against outside influences.
Computer Mode	Condition indicating that the Xplore Micro Compounder is operated via the computer.
Control valves	Electrically operated valves to regulate the supply of cooling air.
Corrosive plastic	Plastic which can cause corrosion of apparatus.
Crosslinking	Formation of a permanent, irreversible network in the plastic.
Current	Electrical current.
Danger zone	Room/location with an increased risk of injury to the Xplore Micro Compounder operator.
Data storage	The storing of various data generated by the Xplore Micro Compounder.
Degradation	Decline in properties of the polymer due to (too) long exposure to heat.
Demo Mode	Computer condition which is activated when no Xplore Micro Compounder is connected.
Drive ball bearing	Point of fastening for the mixing screws.
Emergency stop switch	Device on the Xplore Micro Compounder making it possible to make the entire Xplore Micro Compounder voltage-free in an emergency situation.
Ergonomics	Indicates that the Xplore Micro Compounder is designed so that the operator can work in a proper manner.
EU declaration	See CE declaration.
Exhaust	Externally located system to carry away fumes and gases.
Extruder	Apparatus for heating and blending various viscous materials.
Extrusion	Processing material in an Xplore Micro Compounder.
Feeder connection	Opening in the barrel where the feeder can be placed.
Function interlock	Blocking during unsafe situations.
Granulate	Polymer/excipient in the form of granulates
Health and safety requirements	Legally imposed obligations (Netherlands).
Heating elements	Parts allowing the extruder temperature to be increased.

Local Mode	Condition of the Xplore Micro Compounder making it possible to operate the Xplore Micro Compounder via the touch screen.
Locking screw	Special bolt to secure the feeder/sealing plug.
Main switch	Operating button which can separate the power supply from the Xplore Micro Compounder.
Manual front feeder	Tool for filling the extruder with granulate.
Mini injection moulding machine	Xplore instrument for making small test pieces using a mould.
Motor current measurement	Measurement of the current taken up by the motor.
Multiloop controller	Controller which can control various parameters.
Nozzle	Exit plate through which the molten polymer leaves the extruder.
Operation Menu	Main screen of the touch screen from which the Xplore Micro Compounder is operated.
Plastics	Thermoplastic products which can be processed with the Xplore Micro Compounder.
Plunger	Part of the front hopper injecting the granulate into the Barrel.
Polymer	Excipient, thermoplastic which can be processed in the Xplore Micro Compounder.
Polymer melt	Molten thermoplastic.
Positioning notch	Teeth at the drive ball enabling the screw to be mounted in the correct position.
Recirculation channel	Return channel from the bottom to the top of the barrel to lengthen the processing/mixing time of the polymer.
Relative temperature regulation	Temperature regulation via computer, difference between zones is displaced in relative value.
Run Mode	Condition in which the touch screen must be set in order to operate the Xplore Micro Compounder.
Safety distance	Distance such that no further risk exists.
Safety measures	Actions ensuring a safe handling and operation of the Xplore Micro Compounder.
Seal plug	Designed to close the front feed opening in the barrel.
Sealing plug	Part used to seal off the feeder connection after filling and removing the front feeder.
Sound pressure level	Value for the quantity of sound/noise.
Electrical compartment	Cabinet containing the electro technical components.
Technically qualified person	Person who had training to give her/him certain skills.
Temperature measurement	Registration of the prevailing temperature in the extruder.
Test bar	Test product which can be made with the injection molding machine.
Thermal safety feature	Excess temperature safety feature for the motor.
Touch Screen	Screen used to operate the Xplore Micro Compounder.
Toxic fumes	Fumes and gases having health risks.
Transport crate	Crate in which the Xplore Micro Compounder is delivered.
Vertical force	Vertical force by the mixing screws via the melt on the barrel; indicator for melt viscosity.

23. Appendix

23.1 Appendix 1; EC-Declaration of conformity for instrumentry

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CE

CONFORMITY AGREEMENT

Manufacturer: Xplore Instruments BV

Adress: Arendstraat 5,6135 KT Sittard, The Netherlands

Herewith declares that

The Xplore Micro Compounder MC15 with serial number 15#0409

Is in conformity with the provisions of the following directives:

- Machinery Directive (Directive 2006/42/EG)
- Low Voltage Directive (2014/35/EU (26-02-2014))
- Electro Magnetic Compatibility (2014/30/EU)

The following (parts/clauses of) national technical standards and specifications have been used:

- NEN 1010
- NEN 3140

Sittard, 01-10-2018

L.W.G. Rijks

23.2 Electrical drawings and scheme's

Please refer to the include CD-ROM for the drawings and scheme's.