

Operating manual
colorDoS®



HNP Mikrosysteme GmbH
Bleicherufer 25
D-19053 Schwerin
Telephone: +49 (0) 385/52190-300
Fax: +49 (0) 385/52190-333
e-mail: info@hnp-mikrosysteme.de
<http://www.hnp-mikrosysteme.de>

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HNP Mikrosysteme GmbH
Bleicherufer 25
D-19053 Schwerin

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This operating manual has been prepared with care. However, HNP Mikrosysteme shall not be liable for any errors in this operating manual and their consequences. Likewise, no liability shall be accepted for direct damage or consequential damage resulting from improper use of the equipment.

When using the colorDoS®, the relevant regulations regarding the specifications in this operating manual must be observed.

Subject to change without notice.

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1 General Information

This operating manual contains basic instructions that must be observed during installation, operation and maintenance. It is therefore essential to read this operating manual before installation and commissioning and it must always be available at the operating site of the colorDoS®.

1.1 Intended Use

The colorDoS® described in this operating manual is suitable for continuous and discrete dosing of liquid colors. Any liquid to be pumped will hereafter only be referred to as "medium".



If you intend to pump *aggressive, toxic, radioactive, etc. media*, you are required to comply with the *legal regulations in force for appropriate safety measures*.

The pumping of corrosive media must be clarified with the manufacturer in each individual case.



New liquid colors must be approved by HNP Mikrosysteme before use.



The colorDoS® is only intended for industrial use. Private use is not permitted.



HNP Mikrosysteme provides information about *media resistance* to the best of its knowledge. However, a *guarantee cannot be given* for this information due to varying parameters in different applications.



The information in this operating manual does not exempt the purchaser from carrying out his own checks for completeness, correctness and suitability for the intended purpose. The applicable technical standards and guidelines must be observed when using the products.

If you require further information beyond this operating manual, please contact HNP Mikrosysteme.

1.2 Product Information

This operating manual applies to the colorDoS® manufactured in 2020 and later by HNP Mikrosysteme GmbH, Bleicherufer 25, D-19053 Schwerin, Germany.

The cover sheet of this operating manual shows the release status.

1.3 Technical data of the colorDoS®

The technical data of the colorDoS® for use in plastic injection moulding can be seen in Table 1.

Shot weight	from 2 g (dependent on color addition and color density)
Color addition	from 0.1% (dependent on shot weight and color density)
Dosing volume	0.02 ... 100 g color/shot (depending on dosing time and viscosity)
Precision CV	1% (coefficient of variation CV)
Clearance volume	approx. 3 ml
Color change duration	from 120 s
Container change duration	from 10 s
Viscosity range	0.3 ... 10,000 mPas
Operating temperature range	-5 ... +60 °C
Adaption	4 x M6, 60 x 60 mm (standard Arburg flange pattern); other connection dimensions can be realised using adapter plates
Container sizes	1, 5, 10 and 20 litre Cubitainer; Colorcube (max. weight 30 kg)
Fluid connection	dripless, quick-release coupling
Interfaces	Start signal, error message on injection moulding machine (potential-free contact), Ethernet
Controller	intuitively operated display control with 7" touch display
Electrical connection	230 V AC
Dimensions (L x W x H)	256 x 487 x 362 mm (dimensions vary depending on Cubitainer holder)
Weight	approx. 18 kg (weight varies depending on Cubitainer holder)

Table 1 Design characteristics and performance parameters colorDoS®

Attention

The material characteristics of the medium (e.g. viscosity, lubricity, particle content, corrosivity) influence the hydraulic performance data as well as the service life of the pumps.

The performance data can therefore be both exceeded and undercut under suitable conditions.

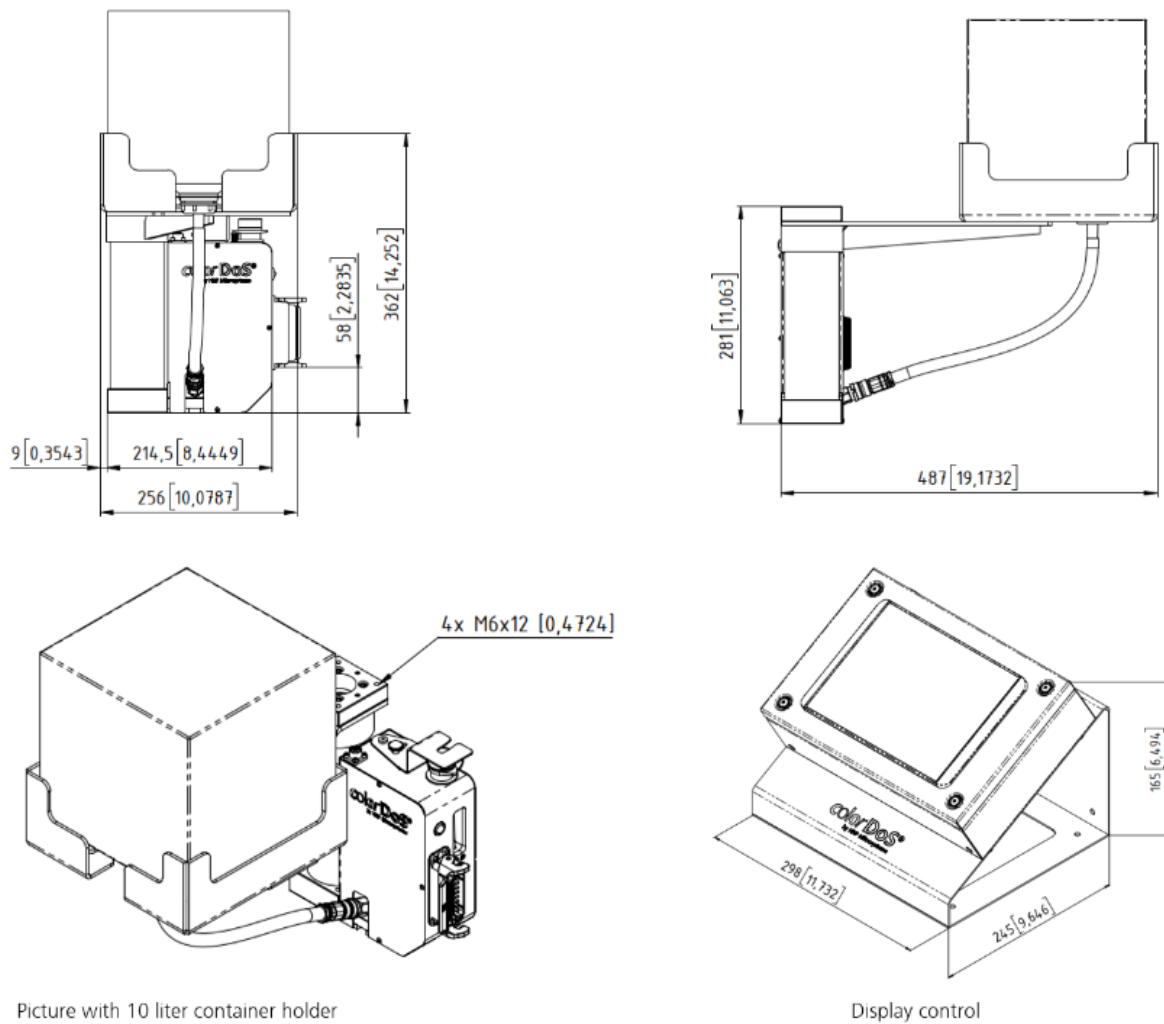
Attention

The storage temperature range of 5 ... 40 °C must be observed.

Attention

If one or more of the parameters described in the table is/are exceeded, ask the manufacturer whether these operating conditions can be authorised. Otherwise, the pump must be modified to suit the current application, otherwise the pump or the system in which the pump is integrated may be damaged or destroyed.

1.4 Dimensions



Picture with 10 liter container holder

Display control

Figure 1 Dimensions colorDoS® with 10 l container holder

2 Safety instructions

The general safety instructions stated in this main section "Safety instructions" as well as the special safety instructions given in the other sections must be observed.

2.1 Marking of notes in this operating manual

Disregard of the safety instructions in this operating manual that are specially marked with the following signs may result in hazards for *people*

the general danger symbol



safety symbol according to DIN 4844 – W9

warning about electrical voltage



safety symbol according to DIN 4844 – W8

In the case of safety instructions whose disregard may cause dangers for the *colorDoS®* and its function, the following word is inserted

Attention

Notices attached directly to the *colorDoS®*, such as fluid port labelling, must be observed and maintained in completely legible condition.

2.2 Personnel qualification and training

The personnel for operation, maintenance, inspection and installation must have the appropriate qualification for this work. The area of responsibility and supervision of the personnel must be clearly defined by the operating company. The personnel must be trained and instructed accordingly if they do not have the required knowledge. If required, such training can be carried out by the manufacturer / supplier by order of the operating company of the *colorDoS®*. The operating company must also ensure that the personnel have completely understood the contents of the operating manual.

2.3 Safety-conscious working

The safety instructions shown in this operating manual, the existing national accident prevention regulations and any internal working, operating and safety regulations of the operating company must be observed.

2.4 Safety instructions for the operating company

The colorDoS® must be protected against dust, condensing air humidity, moisture, splash water, aggressive gases and liquids.

The colorDoS® must not be used in potentially explosive atmospheres or in the presence of flammable gases and vapours.

Any leaks of hazardous media (e.g., from the shaft seal) must be removed so that no hazards arise for persons and the environment. The colorDoS® must be checked for leaks at regular intervals. All legal requirements must be complied with.

The contact protection for moving parts (e.g., coupling unit) must not be removed when the colorDoS® is in operation.

Hazards due to electrical energy must be ruled out (for details, see e.g., the regulations of the VDE and the local power supply companies).

Attention

Make sure that all liquid conveying parts such as tubes, pipes, couplings, etc. are absolutely free of dirt, dust or foreign particles. Impurities (e.g., metal swarf, plastic chips, broken glass, etc.) can impair the function of the colorDoS® or damage it and result in operational failure.

2.5 Safety instructions for maintenance, inspection and installation work

In principle, work on the colorDoS® must only be performed when it is at a standstill. The shutdown procedure described in the operating manual for the colorDoS® must be strictly observed (see chapter 6.7). Pumps which are used for conveying hazardous media must be decontaminated. All safety and protective devices must be reinstalled and / or made operative immediately after completion of the work.

The instructions in chapter 6 must be observed before starting operation.

Attention

Do not dismantle the colorDoS® in the event of a fault, but contact a service employee of HNP Mikrosysteme who will help you further.

2.6 Unauthorised modification and spare parts manufacture

Conversion or modifications of the colorDoS® are only permitted after consultation with the manufacturer. Safety is ensured by using original spare parts and accessories approved by the manufacturer. The use of other parts voids the liability of the manufacturer for any resulting consequences.

2.7 Improper operation

The operational safety of the supplied colorDoS® is only guaranteed if it is used as intended in accordance with chapter 1 of the operating manual. The limit values specified in the operating manual must never be exceeded.

3 Transport and intermediate storage

3.1 Shipment of the colorDoS® and protective measures

The colorDoS® are shipped from the factory so that they are protected against corrosion and against impacts and shocks. The inlet on the pump module and the nipple of the quick-release coupling on the tube kit are sealed with dust protection caps. This measure is necessary to prevent the entry of any impurities.

3.2 Transport

In order to avoid damage during transport, the transport packaging must be protected against shocks and impacts. We guarantee that the goods are in perfect condition at the time of shipment. The colorDoS® must be inspected for transport damage immediately after receipt of the goods. If damage is discovered, this must be reported to the responsible carrier, the authorised dealer or HNP Mikrosysteme as the manufacturer.

3.3 Intermediate storage

When storing the colorDoS®, the following points must be observed:

- Perform preservation (see also chapter 6.7.1).
- The dust protection caps must be attached.
- The colorDoS® must not be stored in wet or damp areas.
- Storage temperature according to chapter 1.3 of this operating manual.

4 Description of the colorDoS®

The individual components of the colorDoS® are explained in the following chapter.

4.1 Design

The colorDoS® consists of the following modules (see Figure 2).

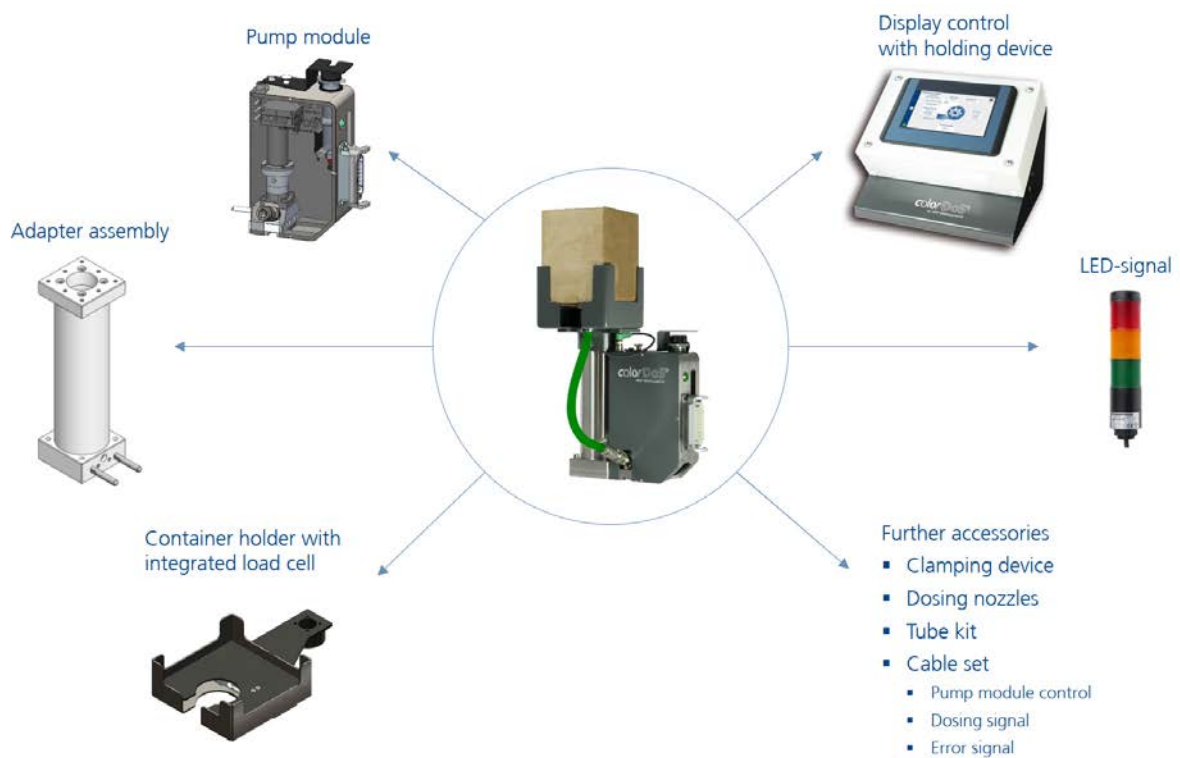


Figure 2

Design of colorDoS®

4.2 Pump module

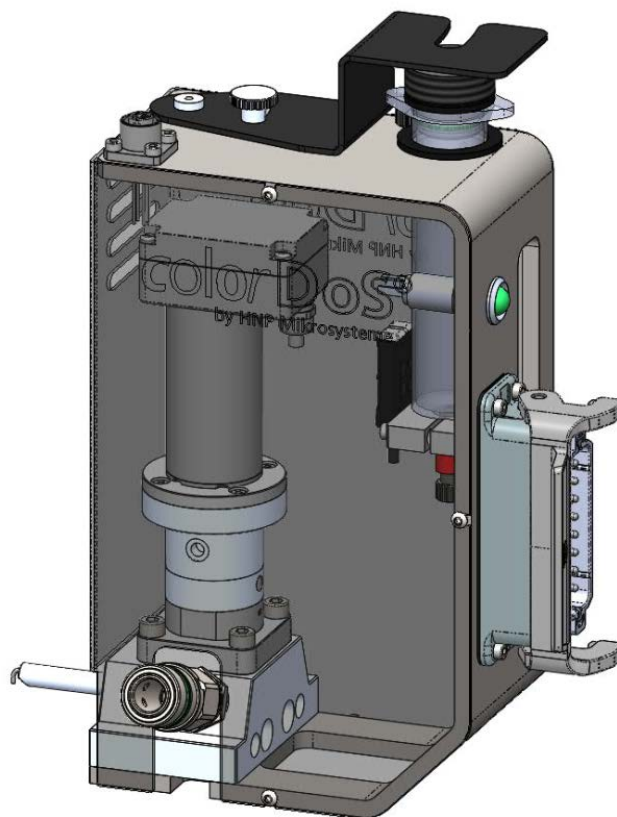


Figure 3 Pump module

The pump module is the heart of the colorDoS®. It contains the micro annular gear pump m zr-7245X2-ha-vb-M4 +S. The pump is equipped with a barrier seal as standard for the colorDoS® (see chapter 4.2.2).

The pump module is equipped with a mounting block to which the m zr pump, the dosing nozzle and the coupling side of the quick-release coupling are attached.

The barrier seal reservoir is integrated in the pump module. This must be filled before using the colorDoS®. The fill level of the reservoir is monitored with an appropriate sensor. If the fill level is too low, a warning is output via the control software.

A 16-pin connector on the back of the pump module is used to establish the connection to the controller. An LED also indicates the status of the colorDoS®.

The media resistance must be checked by the operating company in each individual case. When pumping non-lubricating media, the service life of the integrated micro annular gear pumps is reduced.

4.2.1 Principle of the micro annular gear pump

Micro annular gear pumps are positive displacement pumps and have an externally toothed inner rotor and an internally toothed outer rotor which are mounted eccentrically to each other (see Figure 4). Both rotors are intermeshed with their cycloidal gearing and form a system of multiple sealed pumping chambers at all times during rotation. During rotation of the rotors around their offset axes, the pumping chambers simultaneously increase on the induction side and decrease on the delivery side of the pump (see Figure 5). A homogeneous flow rate is generated between the kidney-shaped inlet and outlet.

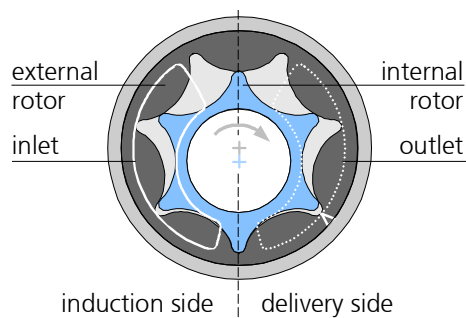


Figure 4

Design of the micro annular gear pump

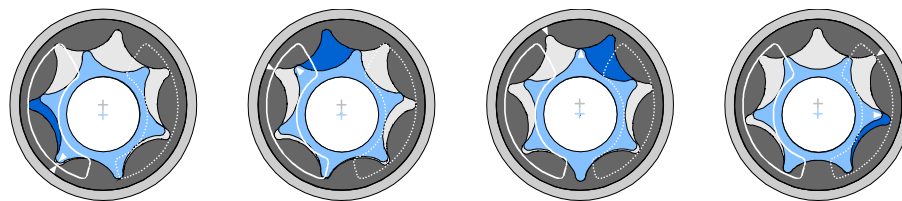


Figure 5

Functional principle of the micro annular gear pump

For positive displacement pumps, there is a direct correlation between the pumped volume via the displacement volume V_g of the pump and its drive speed n . The displacement volume is the volume that is theoretically pumped during one revolution. The formula for the correlation for the flow rate Q of the pump is:

$$Q = \eta_{Vol} \cdot V_g \cdot n$$

The volumetric efficiency η_{Vol} describes the deviation of the actually pumped volume from the theoretically resulting value. The deviations from the theoretical value occur due to internal leakage losses during the pumping.

Example: The mzs-7240 pump, with its displacement volume of 48 µl at 3000 rpm and a volumetric efficiency of 100%, delivers a volume flow of 144 ml/min according to the above formula. Table 2 shows the resulting theoretical volume flow as a function of the speed in the units ml/min and ml/h.

mzs-7240		
Speed [rpm]	Q [ml/min]	Q [ml/h]
500	24	1440
1000	48	2880
2000	96	5760
3000	144	8640
4000	192	11520
5000	240	14400
6000	288	17280

Table 2

Theoretical volume flow of the micro annular gear pumps

The pressure that the pump must produce is determined by the design of the fluid system and results together from the hydrostatic pressure and the hydraulic resistances (given by pipes, constrictions, etc.). The volumetric efficiency of the pump decreases with increasing back pressure.

The viscosity of the medium to be pumped has a decisive influence on the volumetric efficiency. Thus, the volumetric efficiency increases with increasing viscosity due to the lower losses in the columns of the pump.

Cavitation is an effect that can reduce volumetric efficiency above a certain limit speed. This limit speed is lower for high viscosities. The cause is the media-specific undercutting of the vapour pressure in the suction channel of the pump, which results in the formation of gases in the pump.

The special feature of the mzs pumps is their high-precision design, which ensures both the high operating pressure and the high accuracy during pumping and dosing. Thus, the tooth and face gaps of the rotors as well as the gaps to the adjacent housing parts are in the range of a few micrometres. Precision is also a criterion for achieving volumetric efficiency in a range approaching 100%.

4.2.2 Barrier seal

The micro annular gear pump integrated in the colorDoS® has a barrier seal module as standard. The following section explains the function and operation with a barrier seal.

During the pumping process, the barrier seal module has the task of preventing the penetration of air humidity and oxygen from the atmospheric environment into the pump in order to prevent unwanted reactions of the medium to be pumped with these media (such as crystallisation or chemical reactions). The discharge of medium from the pump is also limited.

Function

The shaft seal, as used in the micro annular gear pumps of the modular series, has a liquid boundary layer due to its design, where the pumped medium comes into contact with the ambient atmosphere. This causes small amounts of humidity and oxygen from the atmospheric environment to enter the pump interior via the liquid boundary layer of the sealing lip. To ensure that this inflow can take place with a defined medium that is unproblematic for the pumped medium, the (liquid) barrier seal is available as an optional module. A reverse discharge of substances from the pump into the environment cannot be ruled out without a barrier seal.

With the barrier seal, the actual shaft seal is supplemented by a second seal. There is a cylindrical chamber between these seals with two connections, each offset by 180°. If this chamber is filled with a suitable barrier medium, the pumped medium will not be diluted with humidity and oxygen during the pumping process, but with the barrier medium in a very small proportion. The dilution ratio depends on the pressure conditions and decreases with increasing viscosity.

Operation with barrier seal

Only those media should be selected as barrier media with which the medium to be pumped can be diluted without any problems, i.e. no media that enter into a chemical reaction with the medium to be pumped.

Before mounting the pump module on the injection moulding machine, the barrier seal reservoir must be filled with the appropriate barrier medium (included in the scope of delivery).

Filling of the barrier seal

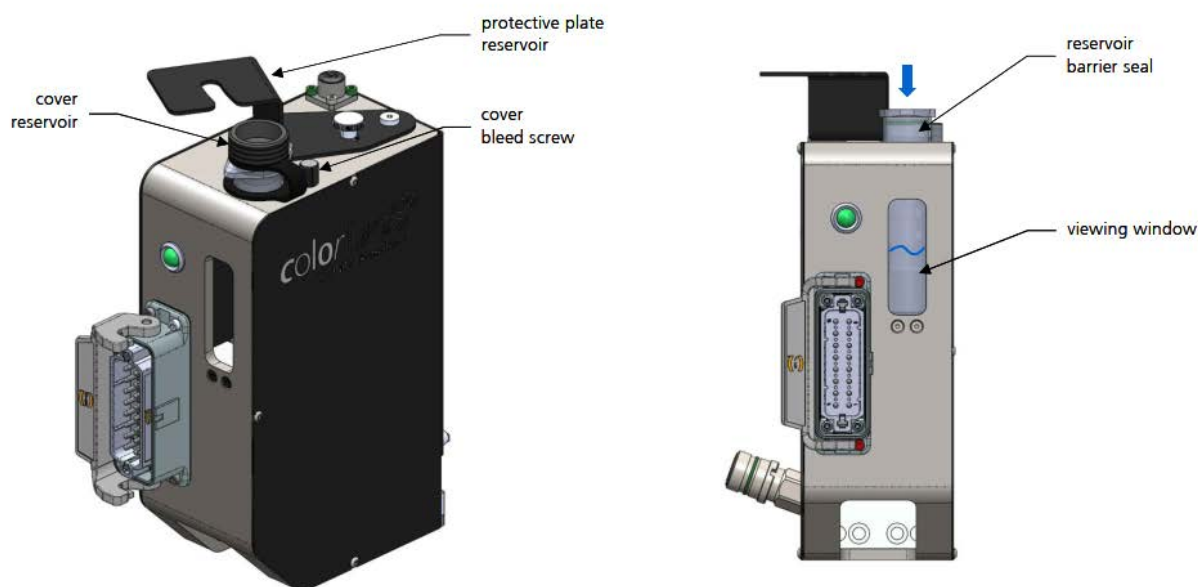


Figure 6

Filling barrier seal reservoir

First, the protective plate must be swivelled to the side and the cover of the bleed screw and the barrier seal reservoir must be removed.

Then the supplied barrier medium can be filled into the reservoir. The level can be observed via the viewing window on the back of the pump module (fill up to approximately the marking in Figure 6).

Then wait for about 5 minutes so that the medium can run completely through the barrier seal module of the m2r pump.

Then replace the covers of the bleed screw as well as the barrier seal reservoir and swivel back the protective plate.

The fill level is now automatically monitored using a sensor. If the fill level is too low, a warning is output via the controller.

The barrier seal can be supplemented with a compressed air connection. This can improve the seal under difficult operating conditions.



If the barrier seal module is empty, shut down the pump immediately to prevent the shaft seal from running dry and to avoid operational failure.

4.3 Adapter assembly

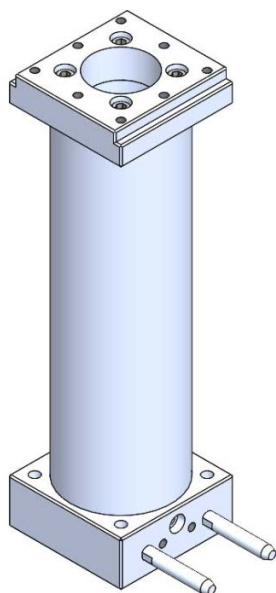


Figure 7

Adapter assembly

The adapter assembly is used as a placeholder or mounting for the pump module and the container holder. It is mounted directly in the feed area of the injection moulding machine. The dimensions for the machine flange are 60x60 mm 4xM6 (standard for Arburg injection moulding machine). Other injection moulding machines may require appropriate adapter plates.

4.4 Container holder

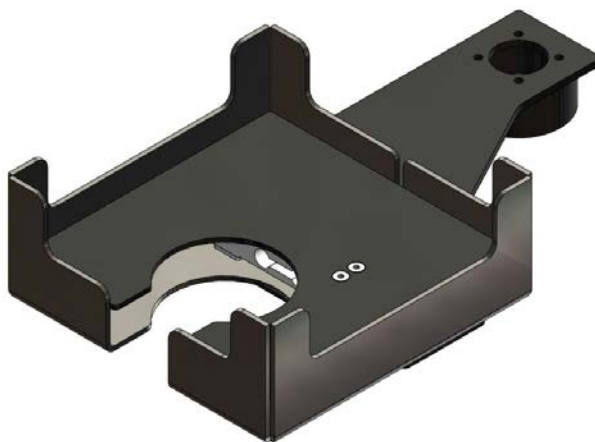


Figure 8

Container holder up to 10 litres Politainer

The container holder can be supplied in 3 different variants:

- up to 10 litres container
- up to 20 litres container
- ROWASOL COLOR CUBE

The holder also has an integrated load cell that monitors the container fill level. The maximum container weight is 30 kg.

4.5 Display control



Figure 9

Display control colorDoS®

The controller is set up separately on the machine and has a wide range of functions (different operator levels, color code management, remaining time display, cleaning mode, alarm manager, etc...). The software and the operation of the display control are explained in more detail in chapter 7.

4.6 Clamping device (accessories)

To simplify purging of the pump module and thus improve handling, it is possible to fasten the pump module via a clamping device. The device consists of two long guide pins, a stop block and a undetachable clamping screw. As soon as the clamping screw is loosened, the pump module can be pulled back on the guide pins until the dosing point is freely accessible. This makes it possible to place a reservoir under the outlet of the dosing nozzle and to purge the pump. The following figure shows the device in the installation position.

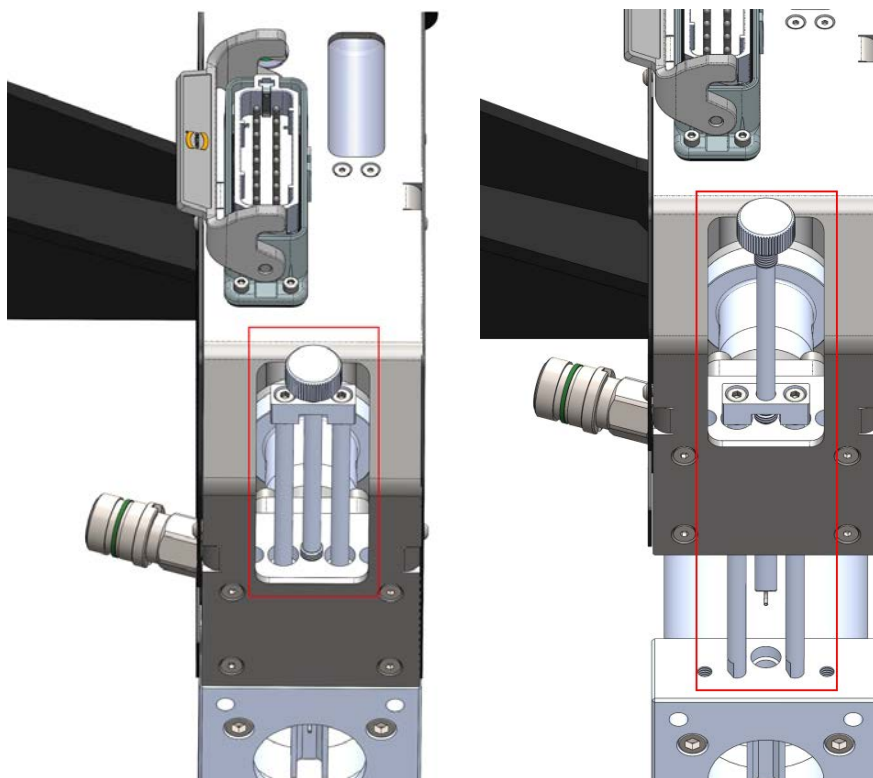


Figure 10

Left: Clamping device closed / Right: Clamping device open

The long guide pins are screwed into the M6 threaded holes, which are normally provided for the M6x55 fixing screws. The two short positioning pins, which are installed as standard, can be removed. The stop block is fixed with the two M4x10 screws at the end of the guide pins. The clamping screw is then screwed through the M8 thread provided for this purpose in the stop block.

This device is an accessory and therefore not included in the standard scope of delivery. If required, it must be ordered separately.

5 Installation

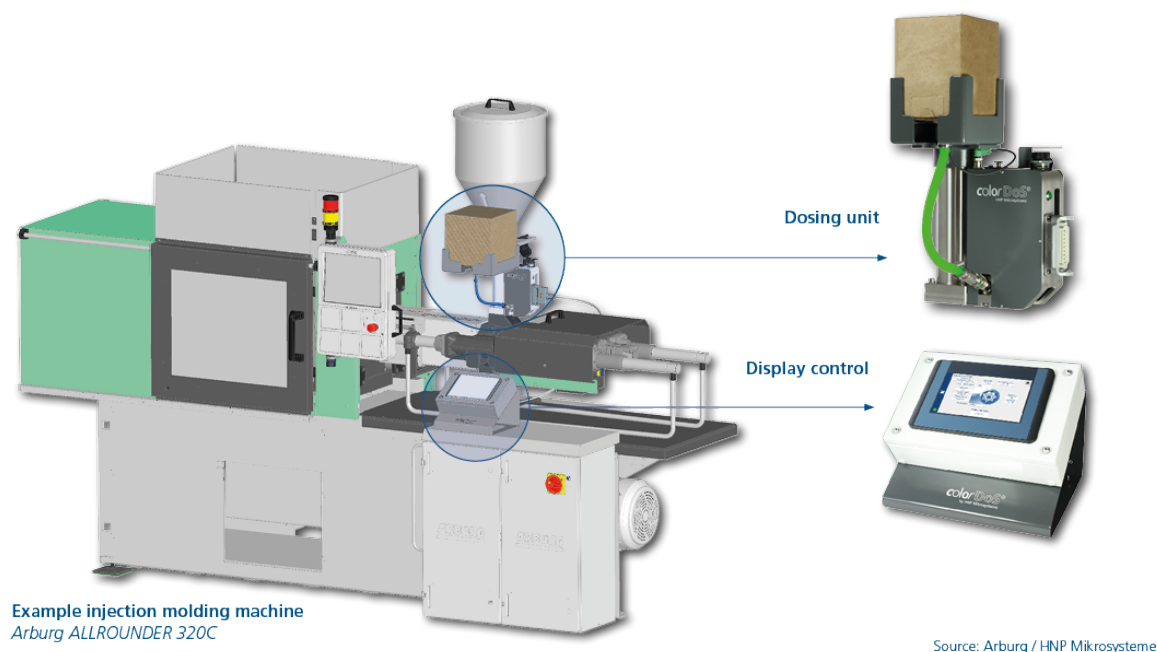


Figure 11 Installation situation colorDoS® on injection moulding machine

5.1 Check before initial set-up

First perform a visual inspection of the delivered colorDoS® for transport damage (see chapter 3.2).



If differences are found between the colorDoS version required in your system and the one supplied by us, please contact us. In this case, do not operate the colorDoS® without consulting us.

5.2 Mounting the colorDoS®

The dosing unit of the colorDoS® is mounted directly in the feed area of the injection moulding machine between the machine flange and the pellet feed. Depending on the injection moulding machine type (manufacturer and/or version), appropriate adapter plates may be required. The connection of the colorDoS® to the injection moulding machine must be clarified in advance with HNPM.

The following instructions show how to install the colorDoS® on an Arburg Allrounder 320 C injection moulding machine.



Take precautions in case of leakage of the pump module to avoid damage to adjacent equipment and the environment.



Only install the colorDoS® at locations with environmental conditions within the permissible parameters.

5.2.1 Mounting adapter assembly

The colorDoS® is attached via the adapter assembly with 4 M6x40 Allen screws. The preferred position for mounting the pump module is in the direction of the injection moulding machine drive. Therefore, care should be taken that the positioning pins of the adapter assembly point in this direction (see following illustration). If the preferred location cannot be made possible for space reasons, please consult HNPM.

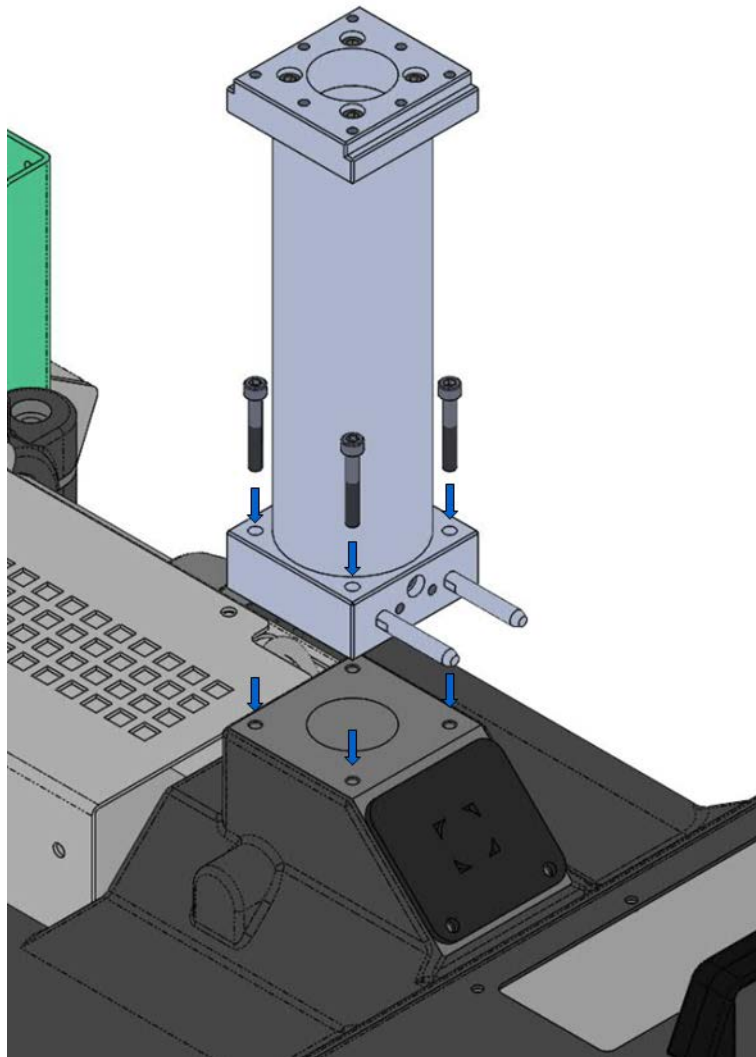


Figure 12

Mounting adapter assembly

5.2.2 Mounting of the container holder

The container holder can basically be installed in 4 different positions. The orientation of the container holder should be selected so that the storage containers are exposed to as little heat as possible. The following illustration shows the preferred position of the container holder and its mounting.

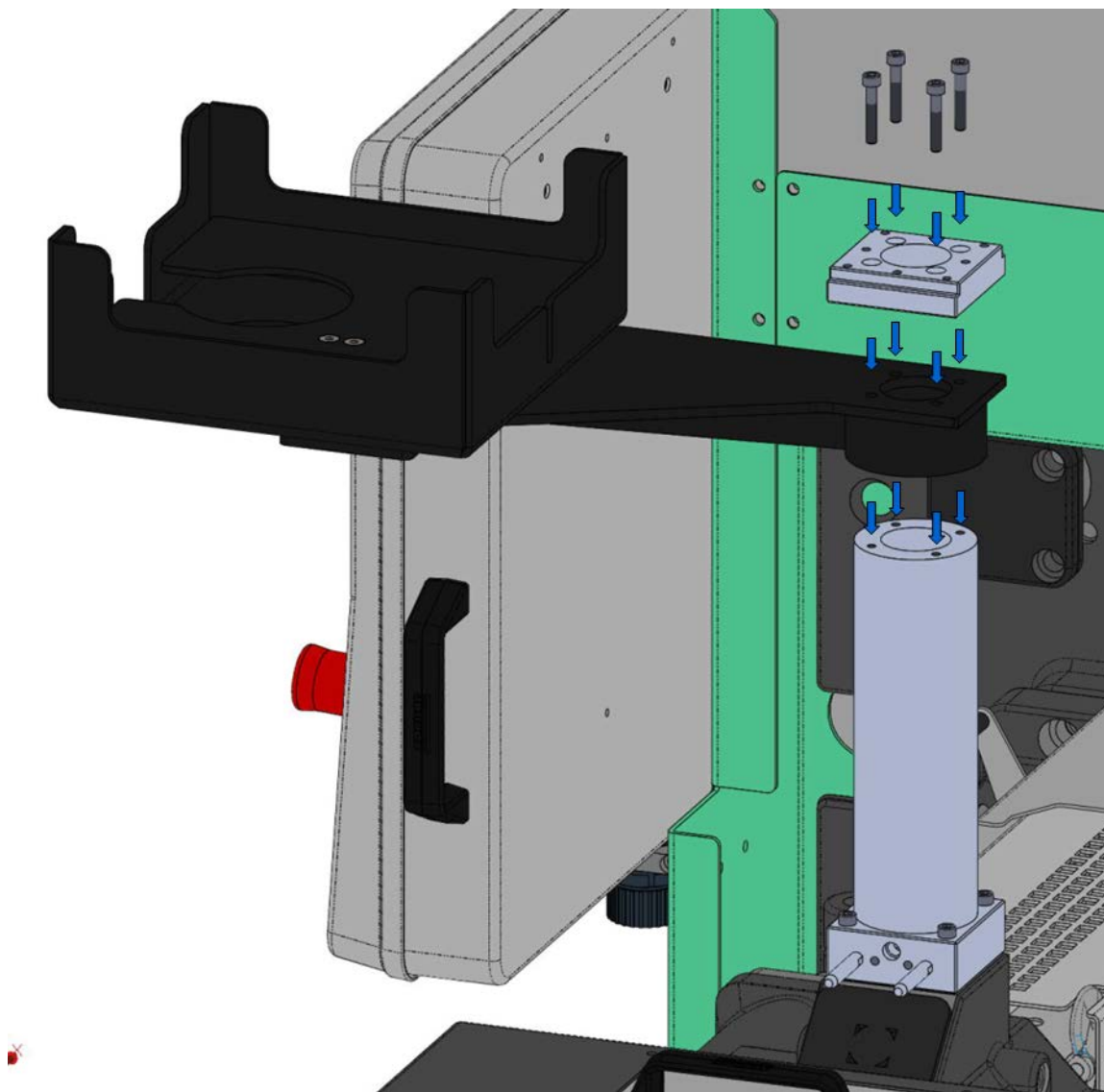


Figure 13

Mounting container holder

First loosen the upper flange of the adapter assembly and then put the container holder with the short pipe piece over the adapter pipe. Now fix the upper flange of the adapter assembly with four M6x35 mm screws. The container holder is clamped between the upper flange and the adapter pipe.

5.2.3 Mounting pump module

The pump module is fixed to the adapter assembly with 2 M6x55 Allen screws.

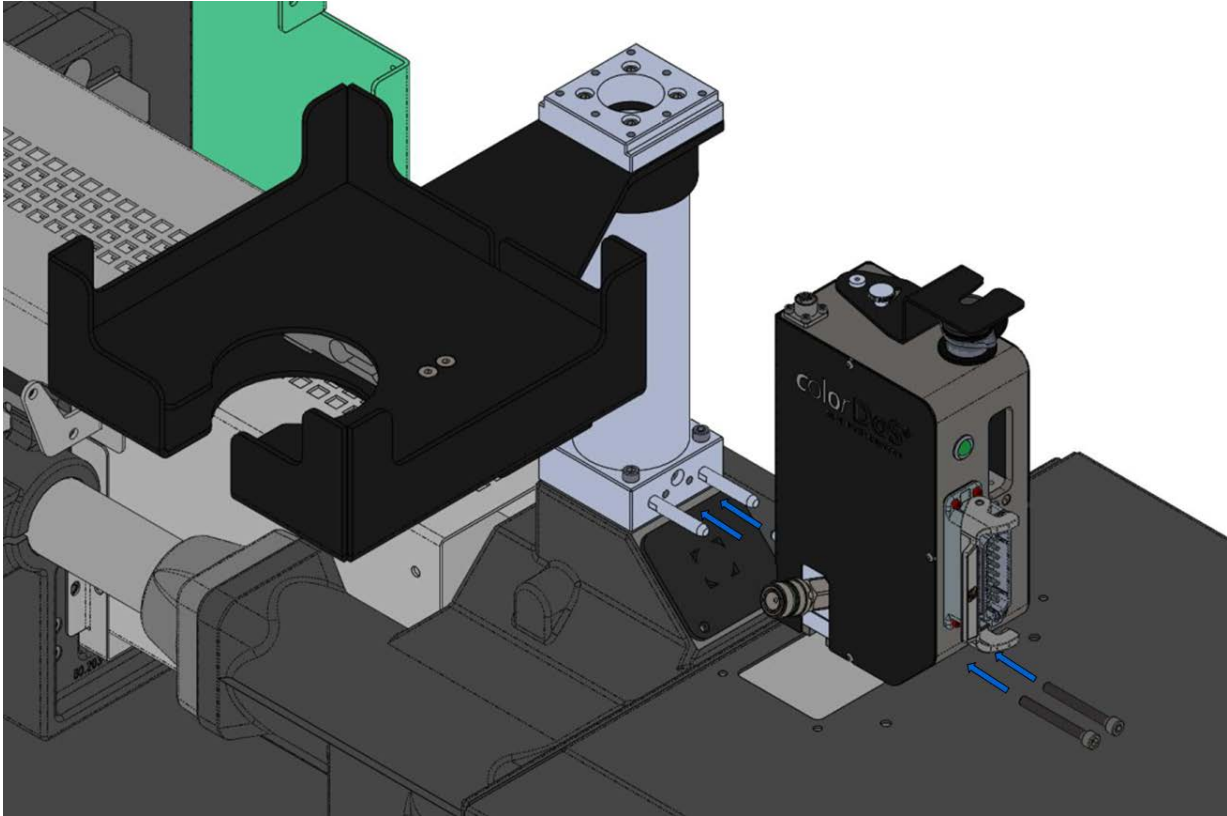


Figure 14

Mounting pump module

- Carefully slide the pump module over the positioning pins of the adapter assembly. Be careful not to damage the dosing nozzle when inserting it into the lower flange of the adapter assembly.
- Fix the pump module with both M6x55 screws.
- If a clamping device is used, please follow the instructions in chapter 4.6.
- Now connect the cable for the load cell. Use the connector socket on top of the pump module for this.

5.2.4 Connect controller

Now set up the controller. Make sure that the controller is securely and firmly positioned.

Connect the controller to the pump module. Use the cable with the two 16-pin connectors. The angled connector is attached to the controller and the straight connector to the pump module.

Connect the cables for the dosing and error signal. HNPM supplies these cables with open ends on the machine side. The customer provides the respective plug connection for the corresponding injection moulding machine type and ensures professional installation by a company electrician (specialist). HNPM provides a wiring diagram (see chapter 8).

Finally, connect the mains plug.

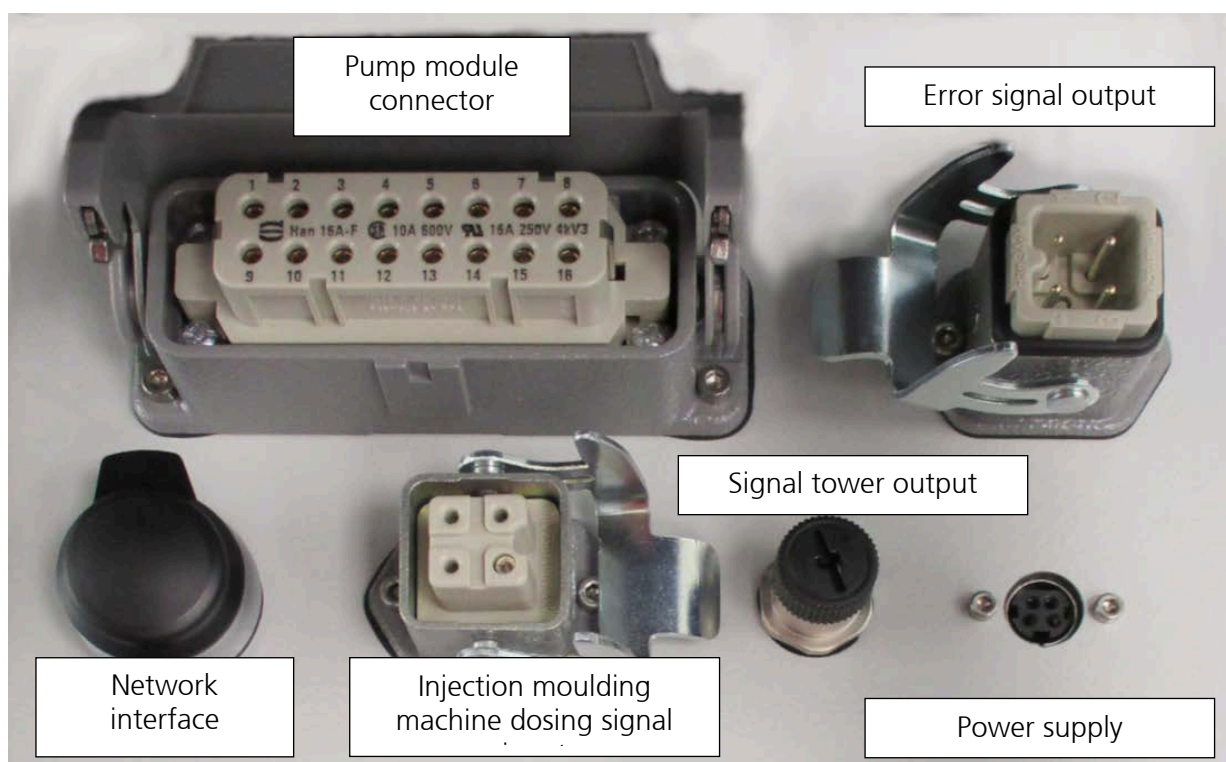


Figure 15

Interfaces of the controller

Figure 15 shows the rear side of the controller with the respective connectors.

6 Start-up / shutdown

6.1 Color container preparation

The color manufacturer usually supplies the color in disposable (Politainers) or reusable (e.g., Color Cube) containers. As the colors have a more or less strong settling behaviour, it is **imperative** that the colors are shaken up before they are used on the machine. The use of tumble mixers or drum mixers is recommended.



How long the color remains stable and how long the corresponding color must be shaken up must be clarified with the respective color manufacturer.

If this is not observed, deviating coloring in the injection moulded part or blockages or damage in the integrated mzs pump may occur.

Now install the supplied tube kit. Work cleanly and try to avoid contact with the liquid color!

The tube should be completely filled with medium before the start-up of the colorDoS®. For viscous colors, the filling process can be accelerated by flexing the tube. The tube then always remains on the container and can be used again when the container is changed.

6.2 General instructions for mounting the fluid ports and tubes

A tube kit is included in the scope of delivery of the colorDoS®. Additional tube kits can be obtained from HNP Mikrosysteme. If tube kits are made by the customer, then the following instructions must be observed.



Always cut the tubes at right angles. A tube cutter should preferably be used for this. If metal pipes are used, the pipes must be carefully cleaned of all adhering dirt and thoroughly rinsed after machining. The smallest chip in the fluid circuit can result in failure of the colorDoS®.



The suction line should be kept as short as possible and have as large an internal diameter as possible to ensure reliable suction of the medium.

6.3 Preparing for operation

After the complete set-up, the operational status of the colorDoS® and the peripherals must be checked again using the following questions.

- Is the pump module mounted correctly?
- Is the installation clean, i.e., free of foreign particles, impurities or chips?

- Are the electrical connections completely connected?
- Is the quick-release coupling of the colorDoS® correctly engaged?
- Is the tube completely filled and thus the supply of sufficient and the correct color guaranteed?
- Is prolonged dry running of the colorDoS® prevented?
- Have the peripherals been checked for leaks?
- Can the pump be switched off in an emergency if a malfunction occurs at the first start-up that was not foreseeable?

6.4 Start-up of the colorDoS®

Switch on the display control. The switch is located on the upper edge of the control housing on the left side.

6.4.1 Tare load cell

An error message (container empty) will now be displayed. The alarm bell at the top right now lights red. The load cell in the container holder must be tared first. Perform the following steps for this:

Log in as Administrator: Open the selection menu on the left and select the **Users** menu item. Select the **Administrator** entry from the drop-down menu. Password input: "admin".

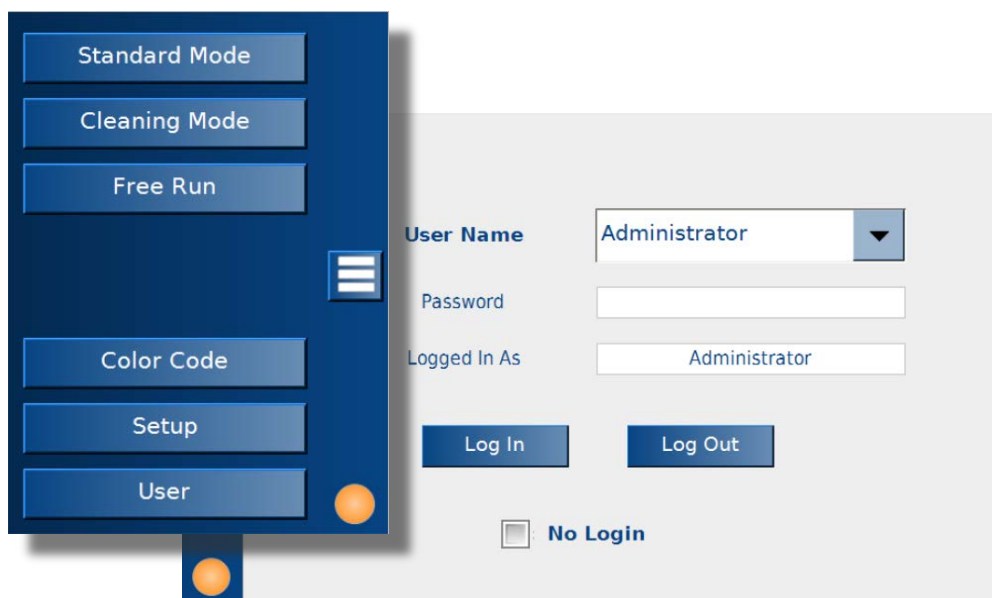


Figure 16

User login

Tap **Setup > Functions > "Tare"**. The prepared container can then be placed in the holder. **Then switch back to standard mode > select bell at top right > tap "confirm all"**.

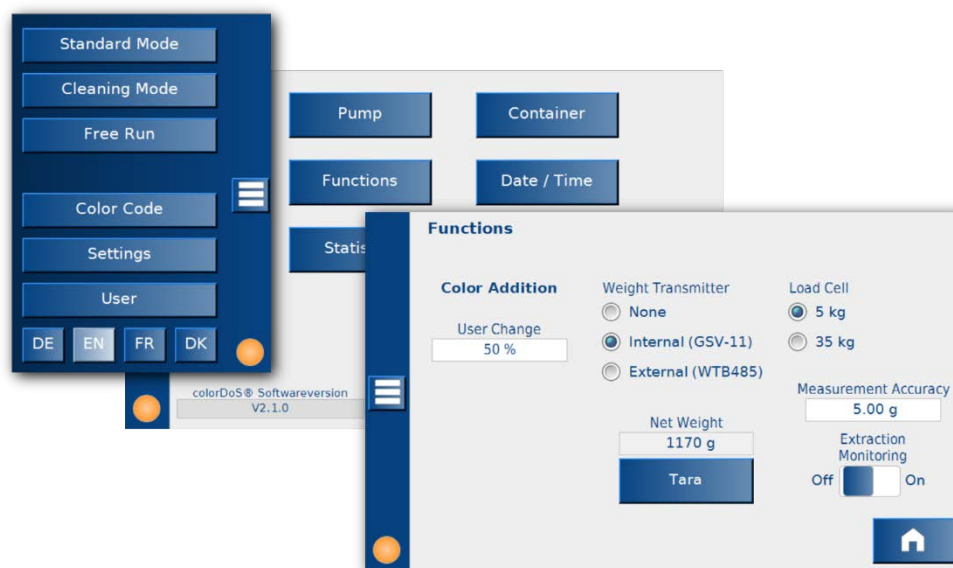


Figure 17

Tare

The tube kit can now be connected to the pump module. To do this, first remove the dust protection caps of the quick-release coupling and insert the nipple of the quick-release coupling on the tube kit into the corresponding counterpart on the pump module. The coupling snaps shut as soon as the nipple is correctly inserted. To prevent dirt from entering at a later time, always insert the dust caps of the nipple and coupling upside down into each other.

6.4.2 Configure container

To ensure that the optical display of the fill level is shown correctly, it is necessary to configure the container size used. You can also enter the time here at which you would like to be warned about an upcoming container change. To do this, go to **Menu > Setup > Container** (see chapter 7.3.2).

6.4.3 Create color code

The color code must be created in the next step. The following steps must be performed here.

Select **Menu > "Color code"**.

Up to 30 different color codes can be managed or stored in the colorDoS®.

Select an empty field in the list (on the left). Then enter the **color code name** and the injection moulding parameters (**shot weight, dosing time, color density and percentage color addition**) in the corresponding fields (on the right).

Refer to the color manufacturer's specifications for color density and color addition (usually indicated on the container).

Then **save** the specified color code using the corresponding icon (top left).

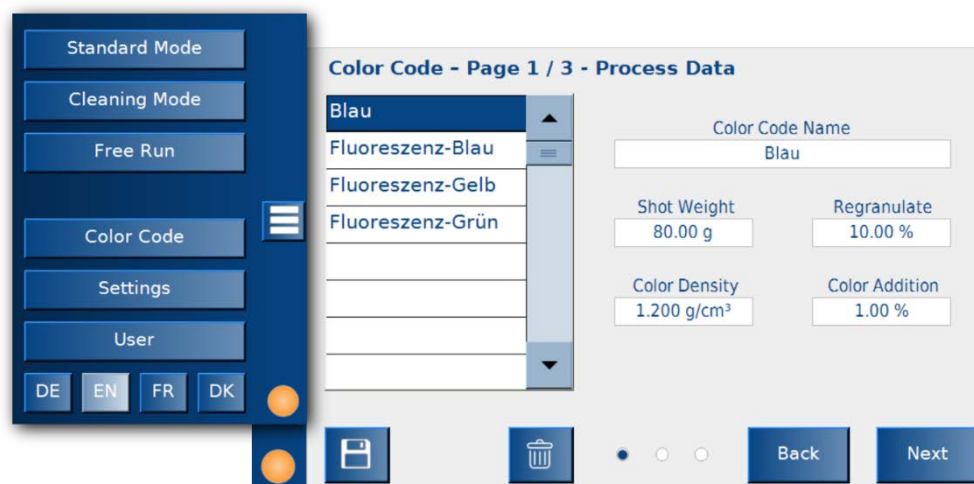


Figure 18

Color code

6.4.4 Start dosing

The colorDoS® is now ready for the dosing.

The colorDoS® has an internal clearance volume from the inlet of the quick-release coupling to the outlet at the dosing nozzle of approx. 3 ml. In addition, there is the complete material volume in the feed area and in the cylinder of the screw conveyor of the injection moulding machine. Depending on the shot weight and color addition, it may take some time until the produced parts are completely and homogeneously colored.

Therefore, there are now two ways to start the process:

1. Start dosing via standard mode

The dosing can be started via the standard mode if the correct color code has been created and selected. To do this, the "play button" in the rotor animation must be tapped. The device is now in a type of waiting mode. As soon as the dosing of the injection moulding machine starts, the potential-free contact switches and the color dosing also starts. With small shot weights and low color additions, it takes a relatively long time for the color to arrive in the injection moulding machine mould. During this time, defective parts may be produced.

2. Start dosing via cleaning mode

The dosing can also be started via the cleaning mode if the correct color code has been created and selected. This produces a spray cake behind the screw conveyor. If the cleaning mode is activated, the system waits for a signal from the injection moulding machine. As soon as the operator starts the manual dosing of the material, the liquid color is continuously fed through the colorDoS® in the ratio matching the selected color code. The spray cake is also a good indicator of when the material is completely colored through. The colorDoS® continues pumping as long as the signal from the injection moulding machine is present.

If the material appears to be completely colored, the cleaning mode can be ended and the standard mode can be switched to. The production of the parts can be started if the standard mode is activated. The time required for this variant is usually considerably less and you have optimally colored components after only a few cycles.

Attention

Any *dry running* of the integrated *micro annular gear pump* can particularly damage the bearing and the seal. A short dry-running phase during start-up of the pump is harmless.

6.5 Color change

Due to the low clearance volume in the pump module of the colorDoS®, a color change can be realised very quickly and easily.

The following work steps must be observed:

3. Prepare new color container (see chapter 6.1).
4. Stop dosing of the injection moulding machine and of the colorDoS®. Tap the "Stop button" in the rotor animation for this.
5. Disconnect the tube kit from the pump module via the quick-release coupling and remove the old container including the tube kit from the container holder. Refit the dust protection caps!
6. Place the new prepared container in the holder and connect the tube kit to the quick-release coupling on the pump module.

Attention

If the type or size of the container changes when the color is changed, it must first be reconfigured (see chapter 6.4.2).

7. An error message (container empty) can now be displayed. This must be confirmed using the Alarm Manager (see chapter 7.5)!
8. Create new color code or select existing color code (see chapter 6.4.3).
9. Start dosing (see chapter 6.4.4).

6.6 Rinsing procedure after use

If the colorDoS® is taken out of operation for a prolonged period (> 10 days), a rinsing process is strictly necessary.

For this purpose, the colorDoS® should be carefully rinsed with a particle-free, filtered and non-corrosive rinsing liquid.

We recommend the following as a well suited rinsing medium for liquid colors:

ROWASOL HM 1067.01 ROWACLEAN

A liquid cleaning concentrate based on modified fatty acids. This rinsing medium can be used for preservation at the same time and accordingly remain in the pump after the rinsing process.

In case of doubt, ask the media supplier or HNP Mikrosysteme for a suitable rinsing liquid!

Attention

During the rinsing process, make sure that all components (colorDoS®, liquid color, rinsing medium, etc...) are handled cleanly!

The following procedure must be observed:

1. Remove pump module from adapter assembly and set down safely (If clamping device is used, pull back pump module on guide pins as far as it will go).
2. Place a suitable collection container under the outlet of the dosing nozzle
3. Connect rinsing liquid
4. Select the menu item **"Free Run"** in the software
5. Select the unit **rpm** in the selection field
6. Start the free run with **500 rpm**
7. The speed should be increased to **1000 rpm** as soon as a constant volume flow comes out of the nozzle.
8. When no more color can be detected in the volume flow, the rinsing process can be stopped.

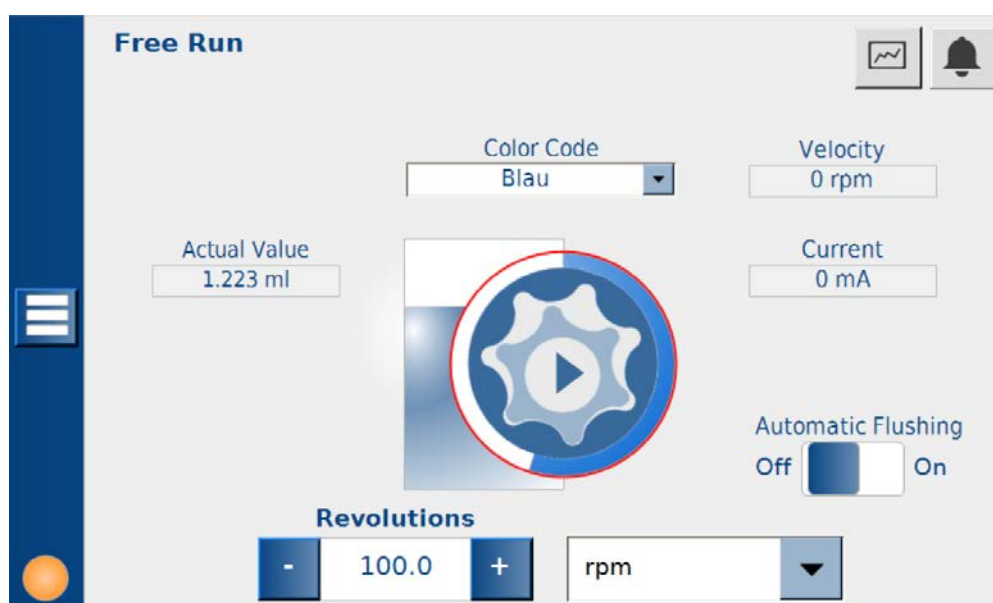


Figure 19

Free Run

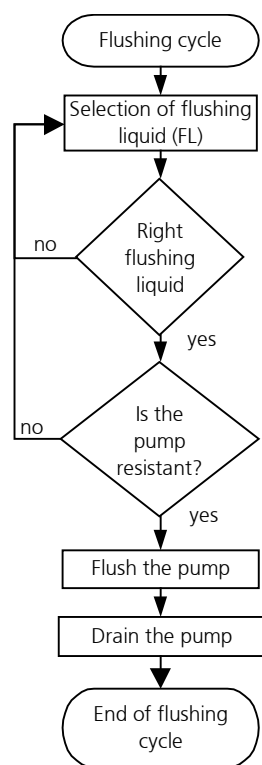


Figure 20

Rinsing process flow chart

Attention

Media residues remaining in the pump module of the colorDoS® can stick together or cause corrosion and thus impair the further function of the integrated micro annular gear pump.

The regulations for handling substances hazardous to health must be observed!

6.7 Shutdown

The following steps must be observed when shutting down the colorDoS®:

- Rinse the pump module with a particle-free, filtered rinsing liquid (see also chapter 6.6).
- Preserve the pump with a suitable preservative (see also chapter 6.7.1).
- Remove the colorDoS® from the injection moulding machine in reverse order to the installation (see also chapter 5.2).

Based on the flow chart (see Figure 21), you can take the colorDoS® out of operation for a prolonged time.

Attention

When storing the colorDoS®, always make sure that the dust protection caps are in place! This is the only way to prevent the ingress of dirt and ensure a reliable restart of the pump module.

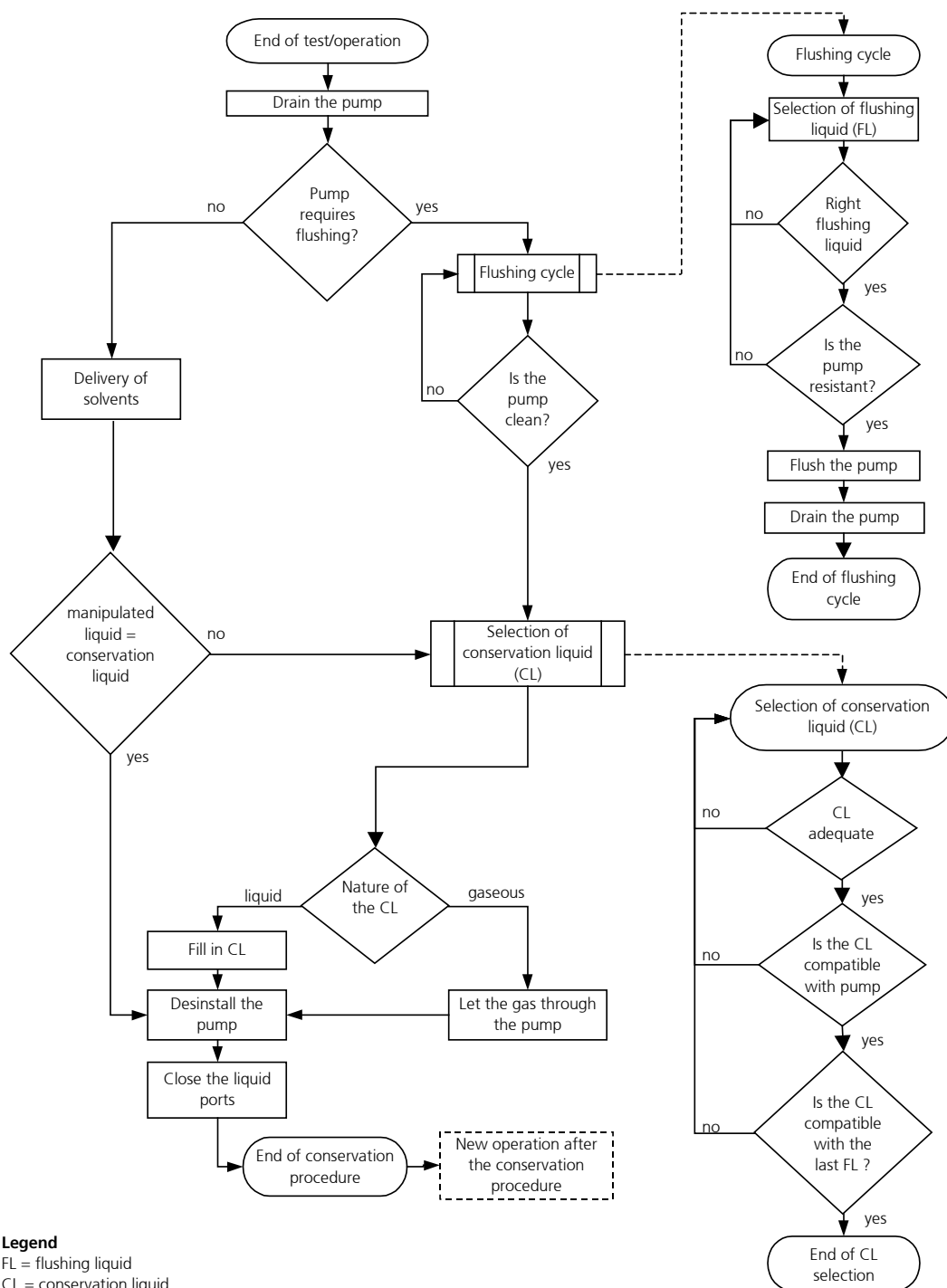


Figure 21

Shutdown flow chart

6.7.1 Preservation

If the colorDoS is operated at irregular intervals or taken out of operation for prolonged periods for other reasons, the pump module must be subjected to a preservative treatment with a suitable preservative medium after use and cleaning (see also chapter 6.6).

After cleaning the pump module, it must be filled with a suitable preservative. We recommend the following as a well suited preservation medium:

ROWASOL HM 1067.01 ROWACLEAN

A liquid cleaning concentrate based on modified fatty acids. This rinsing medium can be used for preservation at the same time and accordingly remain in the pump after the rinsing process.

In case of doubt, ask the media supplier or HNP Mikrosysteme for a suitable preservation medium!

Attention

Water or deionised water must not be used as a preservative. This germinates after only a few days and forms a biofilm that can block the pump.

6.8 Troubleshooting measures

If the colorDoS® stops or does not start, an error message "Pump stuck" is displayed. This error must first be confirmed (see chapter 7.5) Try to free the pump by:

- increasing the pump speed to 300-500 rpm, use the free run as described in chapter 6.6 for this
- rinsing with rinsing medium as described in chapter 6.6

If these measures are not sufficient, call the HNP Mikrosysteme Service (see chapter 14) and, if necessary, return the pump module to the manufacturer for examination / inspection.

Attention

Under no circumstances should you attempt to *dismantle* the pump yourself, as this may damage the pump components and invalidate all warranty claims.

6.9 Return of the colorDoS®

When shipping used colorDoS® and components, the following shipping instructions must be observed:

- Completely remove the medium from the pump
- Rinse the pump with appropriate cleaning medium
- Remove barrier medium from the barrier seal reservoir
- Put dust protection cap over the coupling on the pump module.
- Return in original packaging

The service personnel carrying out the repair must be informed about the condition of the used colorDoS® before starting work. The "Declaration about media contact of micro annular gear pump and components" (see chapter 17) is used for this purpose. The form can also be downloaded from the website www.hnp-mikrosysteme.de/service/download-center.



The "Declaration about media contact of micro annular gear pump and components" must be completed. The type of media contact of the micro annular gear pump and components must be identified. In the event of personal injury or damage to property, the sender shall be liable.

7 Operation "Display control"

The display control provides an easy way to operate the colorDoS® in conjunction with the injection moulding machine. The controller provides various menu items for this that can be activated by different users.

7.1 Menu

The menu is located in the left hand side and is normally collapsed. By tapping on the menu bar the menu unfolds. The menu collapses again, after selecting a menu entry or by tapping on an area outside the menu field. Depending on the operating mode and rights of the registered user some menu entries may be deactivated. The operating status display is located at the lower border. Those indicates the actual state of the display control. The operating status display is identical with the state of a connected signal light (optional).

7.1.1 Language Selection

Switching between languages is performed via the buttons on the lower area of the menu. (German (DE), English (EN), French (FR), Danish (DK)).

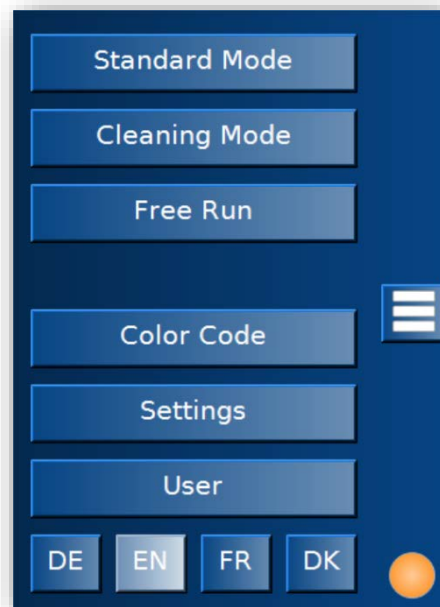


Bild 22

User interface language

7.2 User Management

The menu items "Standard mode"(Figure 23) and "Cleaning mode" are completely available to the standard user. Changes to the color code and the settings of the display control are not allowed.

All menu items are accessible to the "Setter" user. Changes can be made to the color codes. The behaviour of the display control is adjustable as well. Changes to the pump are not allowed.

There are no restrictions for the "Administrator" user. This user type is dedicated to extended use by HNPM.

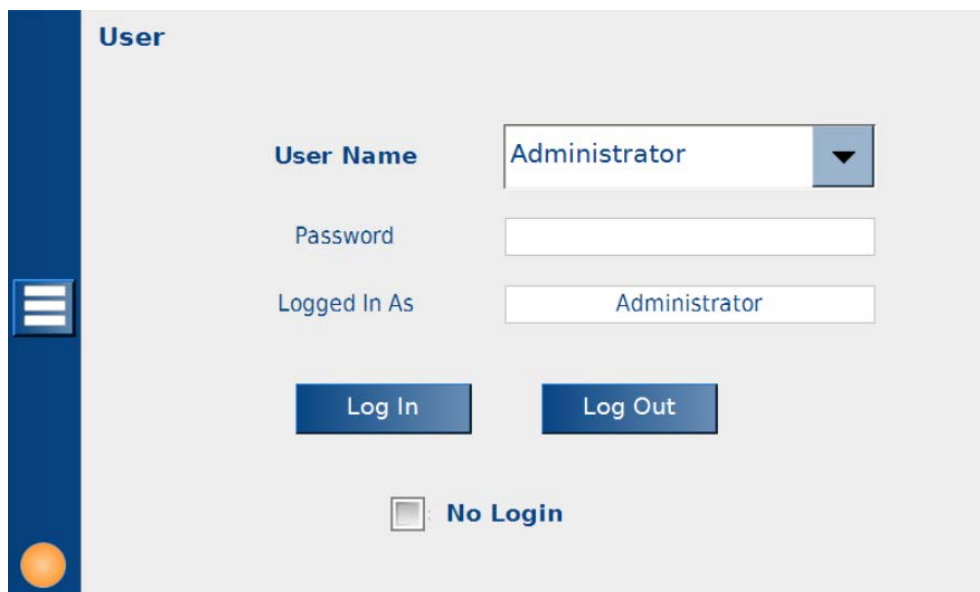
The image shows a web-based user interface for a system. On the left is a dark blue vertical sidebar with a white menu icon (three horizontal lines) and an orange circular button at the bottom. The main content area has a light gray background and is titled "User" in blue. It contains a login form with the following elements: a "User Name" label followed by a dropdown menu showing "Administrator"; a "Password" label followed by an empty text input field; a "Logged In As" label followed by a text input field showing "Administrator"; two blue buttons labeled "Log In" and "Log Out"; and a checkbox labeled "No Login".

Figure 23

User interface: User

User	Password
Setter	einrichter
Administrator	admin

Table 3

Passwords

7.3 Settings

The Setup menu item provides various options for adapting the controller to the existing conditions. The following chapter 7.3 explains the individual submenus in more detail.

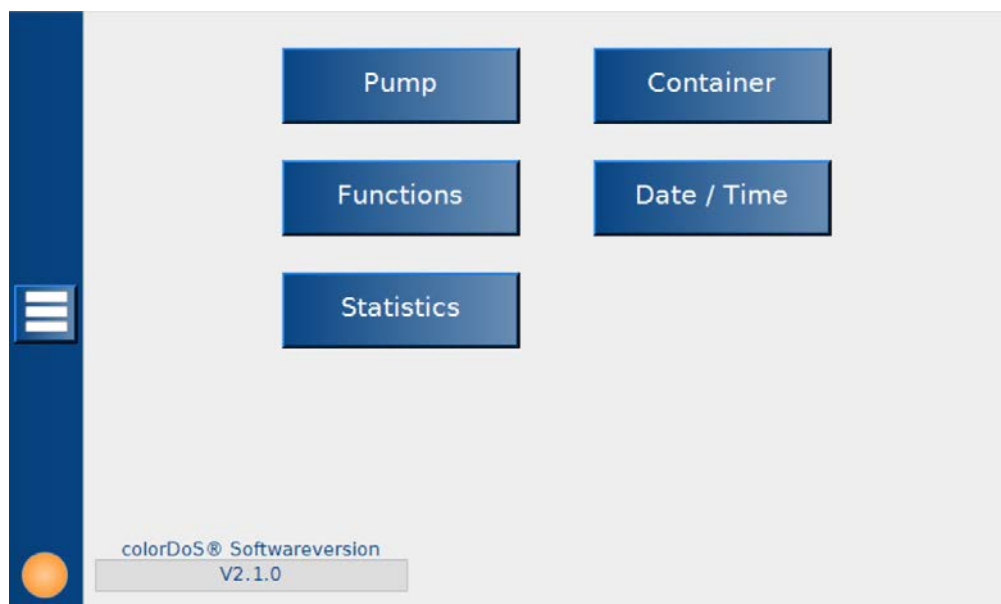


Figure 24

Settings

7.3.1 Pump

The "Pump" submenu allows basic parameter setting of the pump and setting of the range limits.

Attention

Changes to the parameter recipe should only be made in consultation with HNPM.

Figure 25

User interface pump parameters page 1

Figure 26

User interface pump parameters page 2

7.3.2 Container

The container sizes used must be configured in conjunction with the weighing unit. The configuration enables the display of the remaining quantity, the number of remaining doses and the remaining running time. The more accurately the configuration is performed, the less color remains in the container. The entries must be saved after the configuration.

Empty Container Weight names the complete container package (cardboard, plastic bag) up to the connecting socket but without the color included.

The hose weight refers to the mass of the empty hose including the connecting socket.

The pre-warning time triggers a warning if the remaining running time is less than the set pre-warning time.

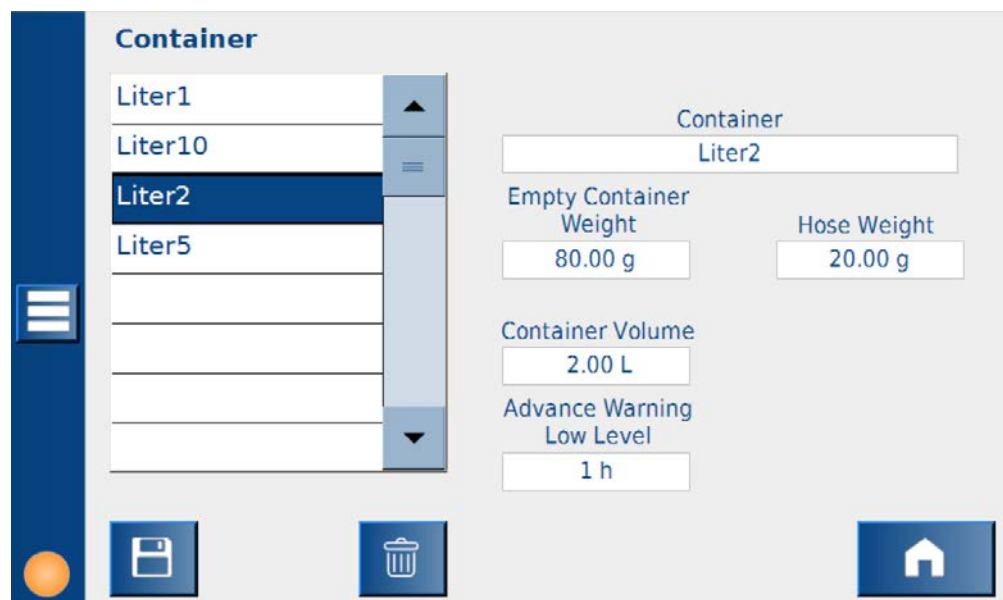


Figure 27

User interface Container

7.3.3 Functions

Use the "Color addition" parameter to specify how much influence a not logged in user (operator) may have on the color addition specified in the color code. This allows the operator to adjust the coloring of the parts without the need to change the color code permanently.

Example:

The color addition of the color code has been configured with 1%. The user change is 50%. The limitation has the range of 0.5% to 1.5%.

Shot weight: 80 g, color addition: 1%, color density: 1.0 g/cm³

This results in a dosing volume of 0.80 g. The possible setting range for not logged in users is 0.40 g (0.5%) to 1.2 g (1.5%).

If the colorDoS® is operated with an attached weight cell, the corresponding weight transmitter and the size of the weight cell has to be configured. The load cell can also be tared in this submenu. This must be done once during the initial commissioning of the colorDoS® (see chapter 6.4.1).

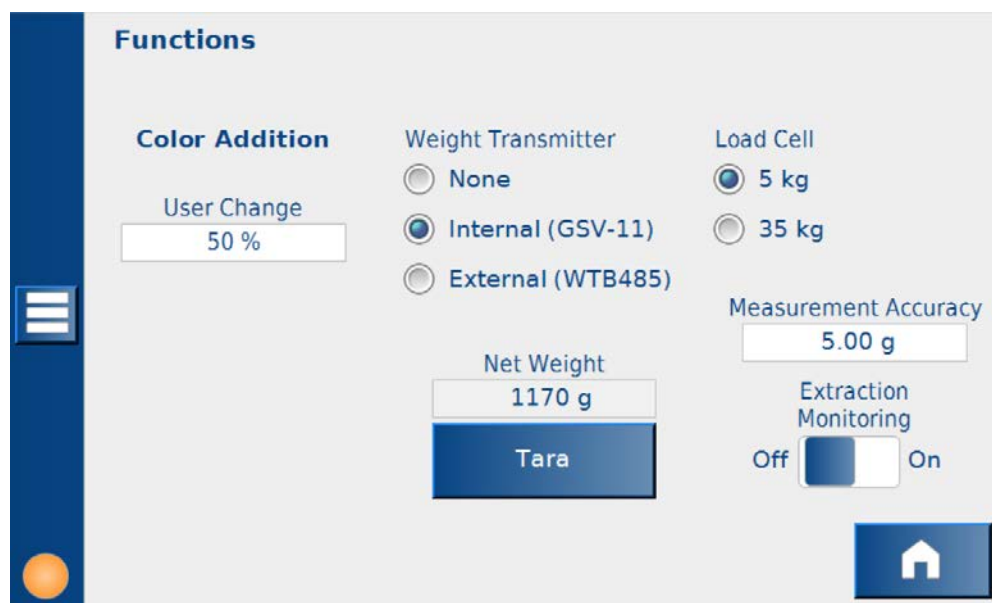


Figure 28

User interface Functions

7.3.4 Date and time

The internal clock of the controller is used to date errors and messages in the alarm manager.

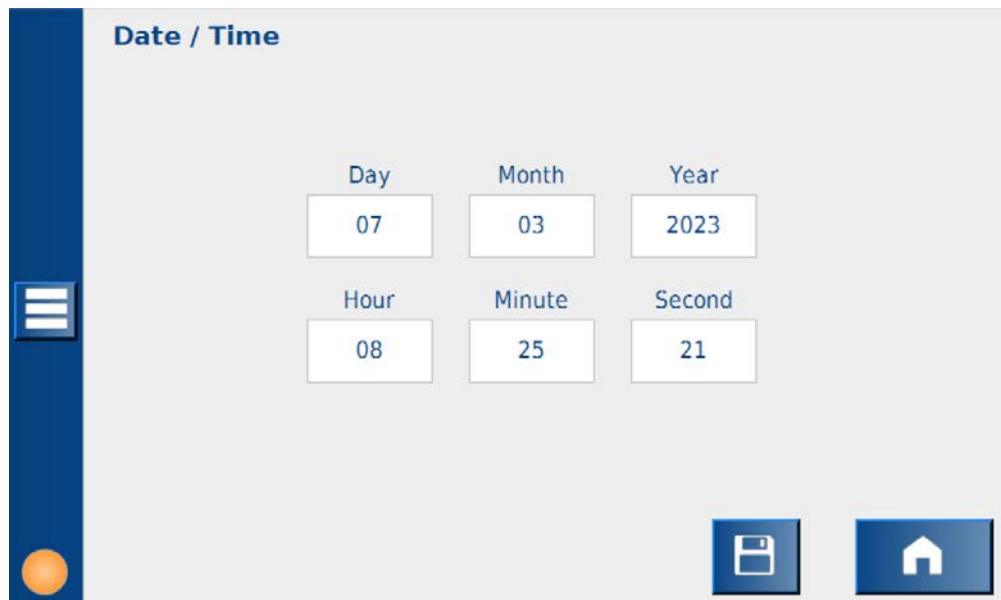


Figure 29

User interface Date and time

7.3.5 Statistics

The general operating statistics (Figure 30) are divided into two sections. The column on the left contains the operating hours of the entire system, the number of starts of the controller and the number of actually active hours, which are composed of dosing time and handling time. The column on the right contains the pure running time of the pump, the number of pump cycles and the number of restarts (attempts of the pump to free itself after a blockage). The "Reset" buttons optionally reset the counter of the pump cycles or the counter of the restarts.



Figure 30

User interface Statistics

7.4 Color code

The menu item "Color code" (Figure 31) enables the creation, selection and saving of different color code recipes. To do this, select the entry to be edited in the list. Only setters and administrators can change the recipes.

7.4.1 Page 1 - Process Data

Follow the input fields from top to bottom to create a new recipe. Tap on the input field under the heading "Color code name" and enter a unique name for the new recipe. The shot weight indicates the mass that is introduced into the injection mould per cycle. The use of the dosing time differs depending on the selection of the signal source.

Refer to the documentation of the color supplier for the color density. The color addition in percent refers to the shot weight and has a significant influence on the amount of delivered color, like the shot weight has. The value for

regranulate sets the amount of reused and already colored granulate. Save the recipe by tapping on the Save button

Color Code - Page 1 / 3 - Process Data

Color Code Name	Shot Weight	Regranulate	Color Density	Color Addition
Blau	80.00 g	10.00 %	1.200 g/cm³	1.00 %

Figure 31

User interface Color code - Process Data

7.4.2 Page 2 - Signal Data

The setting of the signal processing determines how the start signal of a connected injection-moulding machine is interpreted.

Machine Dosage Time: The default time of the injection-moulding machine is performed with a delay of one cycle. The signal time reflects the dosage time. The input field "Duration" refers to the initial reference value and will be overruled by the machine signal in the next cycle.

Machine Signal - Fixed Dosage Time: The injection-moulding machine specifies the start of the dosage with its start signal. The duration of the signal is not taken into account and is therefore set by the value "Dosage Time". Note that just the raising edge of the signal will be watched. The signal should be set low before the end of the dosage phase.

Fixed Dosage Time: This option is only available as Administrator. "Dosage Time" and "Idle Time" are fixed values. The signal of the injection-moulding machine is not monitored. The colorDoS is working asynchronously next to the injection-moulding machine.

Bild 32

User interface Color code - Signal Data

7.4.3 Seite 3 - Flush Data

The flush data will be used on "Automatic Flushing" in Free Running Mode only. The aim is, based on the last used color, dosing a certain quantity throughout the pump module to remove residues of the last used color out of the system. Conveying is intermittent due to the number of stops. The flushing volume shall reflect the volume of the pump module.

Bild 33

User interface Color code - Flush Data

7.5 Standard mode

Before starting, "Color code" and "Container weight" must be selected. The name of the current color code, the dosing time and the remaining time are displayed in the upper area. In standard mode (Figure 34), the reaction to the dosing signal (see "Color codes") can be activated or deactivated with the Start/Stop button. The progress of the dosing is indicated by the ring around the Start/Stop button.

The fill level indicator visualises the remaining content of the container. The number of "remaining doses" and the "net weight" of the container are derived from this. The number of doses completed so far is also displayed. This field is reset if a different color code is selected and started.

Without weighing cell the fill level indicator will be greyed out and shows no values. The fields for "Remaining Term" and "Remaining Dosages" will not be shown.

When using a weighing cell there will be an additional button next to the monitoring button. Switching between Velocity/Current and Net Weight can be done.



The Monitoring button calls up the monitoring window (Figure 35), in which two graphs are displayed. The upper graph shows "Current (current)", "Current (average)" and "Current (peak)". The lower graph represents the values for "Target pump speed" and "Actual pump speed". In addition, the values "Current (peak value)" and "Current (average value)" of the last seven doses are located above the graphs.



The Alarm Manager (Figure 36) shows the currently pending warnings and errors. When warnings are pending, the Alarm Manager icon (bell) is displayed in orange. In the case of errors, the icon is displayed in red.

Error routines are triggered automatically by the controller. In the event of an error, the status LED lights red and the dosing stops automatically. In addition, the error output is set.

If there is an error, it must first be confirmed in order to be able to continue working. The following steps must be performed for this:

Tap on the **bell** (lights "red" in the event of an error) > **Confirm all**

The error now disappears from the overview of the alarm manager. The dosing can be restarted.

The last 50 warnings or error messages can also be traced over time in the alarm manager via the **"History"** button.

If the enable has been given via the Start button, the controller waits for the dosing signal. If no warnings or errors are pending, the status LED at the bottom edge of the menu lights green. If the controller receives a dosing signal, the colorDoS® doses with the parameters specified under "Color code" and the corresponding selection.

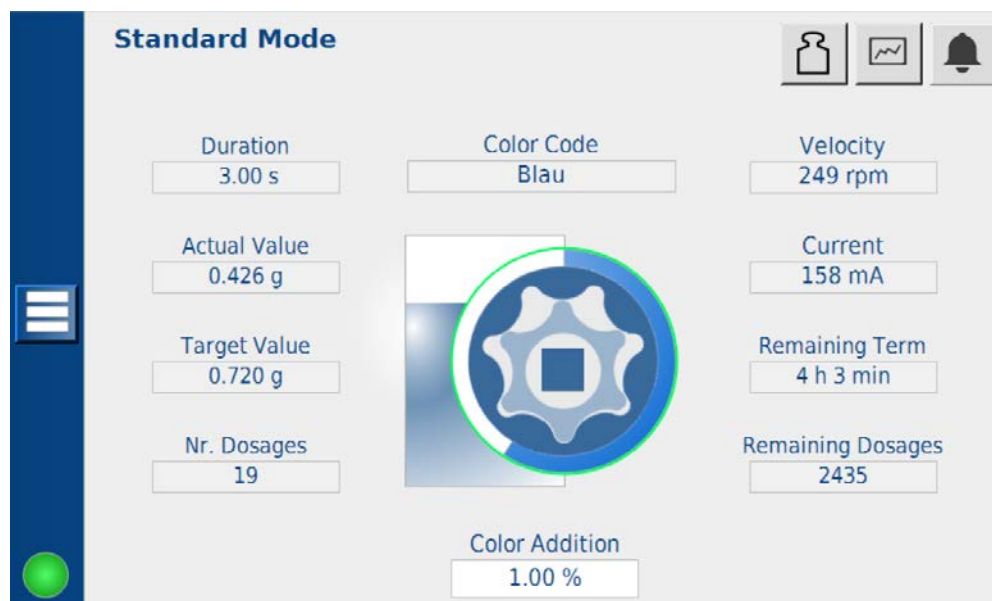




Figure 34 User interface Standard mode (user: Administrator)



Figure 35 User interface Monitoring window

22.02.2022 14:55:08		Standard active			
	Timestamp	Message	State		
0	16.02.2022 09:50:04	Container - Low Level	Normal		
1	15.02.2022 15:13:27	Container - Low Level	Waiting for confirm		
2	15.02.2022 15:12:53	Container - Low Level	Waiting for confirm		
3	15.02.2022 15:04:45	Container - Low Level	Normal		
4	15.02.2022 15:04:45	Container empty	Normal		
5	15.02.2022 15:04:45	Error Output set	Normal		
6	15.02.2022 15:00:50	Container - Low Level	Waiting for confirm		
7	15.02.2022 15:00:35	Container - Low Level	Waiting for confirm		
8	15.02.2022 14:40:58	Error Output set	Normal		
9	15.02.2022 14:40:58	Container - Low Level	Normal		

Acknowledge Selection
Acknowledge All
History
Freeze Scrolling

Figure 36 User interface Alarm manager

7.6 Cleaning mode

The "Cleaning mode" interface (Figure 37) provides for easy cleaning of the pump module. If the enable of the injection moulding machine is active, the user can start the cleaning by tapping the Start/Stop button. In cleaning mode, there is no adjustment of the dosing time and there is no handling time. Dosing is carried out continuously as long as the enable signal (dosing signal) is present. If the Stop button is tapped, the dosing is stopped immediately.

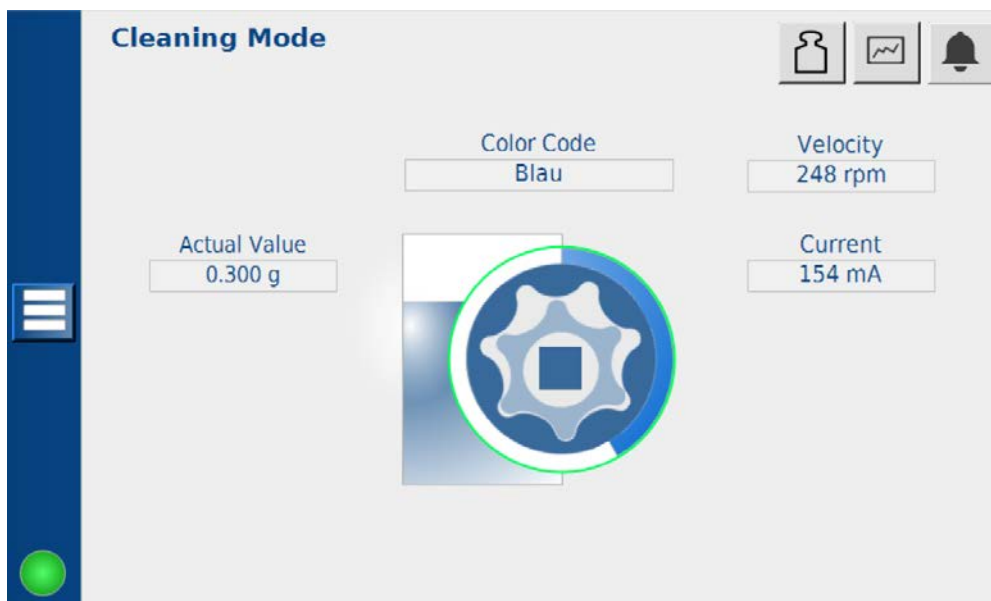


Figure 37 User interface Cleaning mode

7.7 Free Run mode

The "Free Run" mode (Figure 38) is available as a third operating mode. Continuous pumping takes place here. This can be started and stopped by tapping the Start/Stop button. The input can be made as pump speed (rpm), as well as volume flow (ml/min). No additional enable signal (e.g., injection moulding machine) is required for the Free Run mode.

Attention

The colorDoS® must never pump into the stopped injection moulding machine when free running. Therefore, always follow the procedure as described in chapter 6.6.

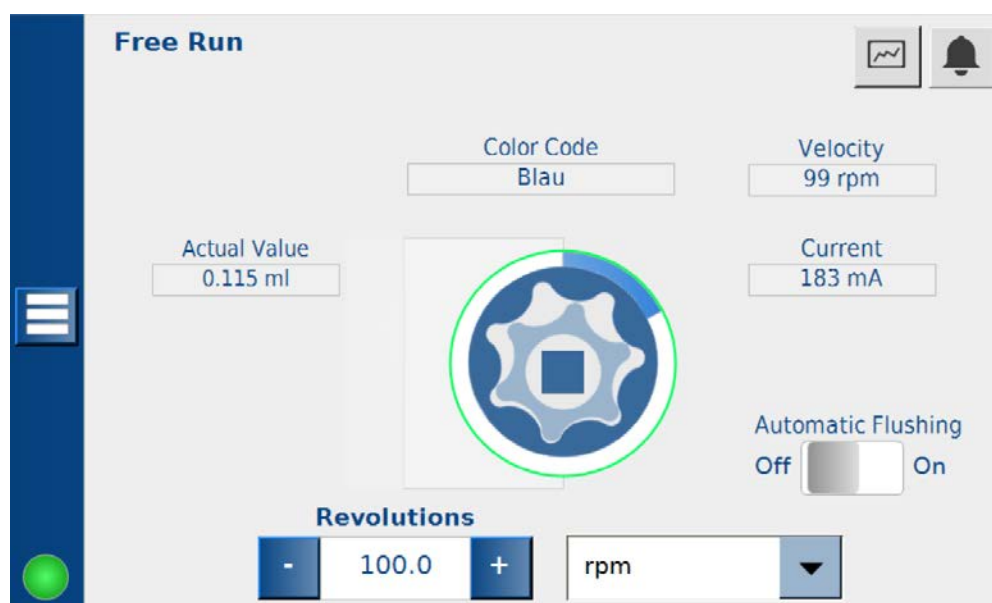


Figure 38

User interface Free Run

If automatic flushing is activated, the pump runs the flushing routine stored in the color code. The parameters for automatic flushing can be adjusted in the color code at any time.

8 Wiring diagram

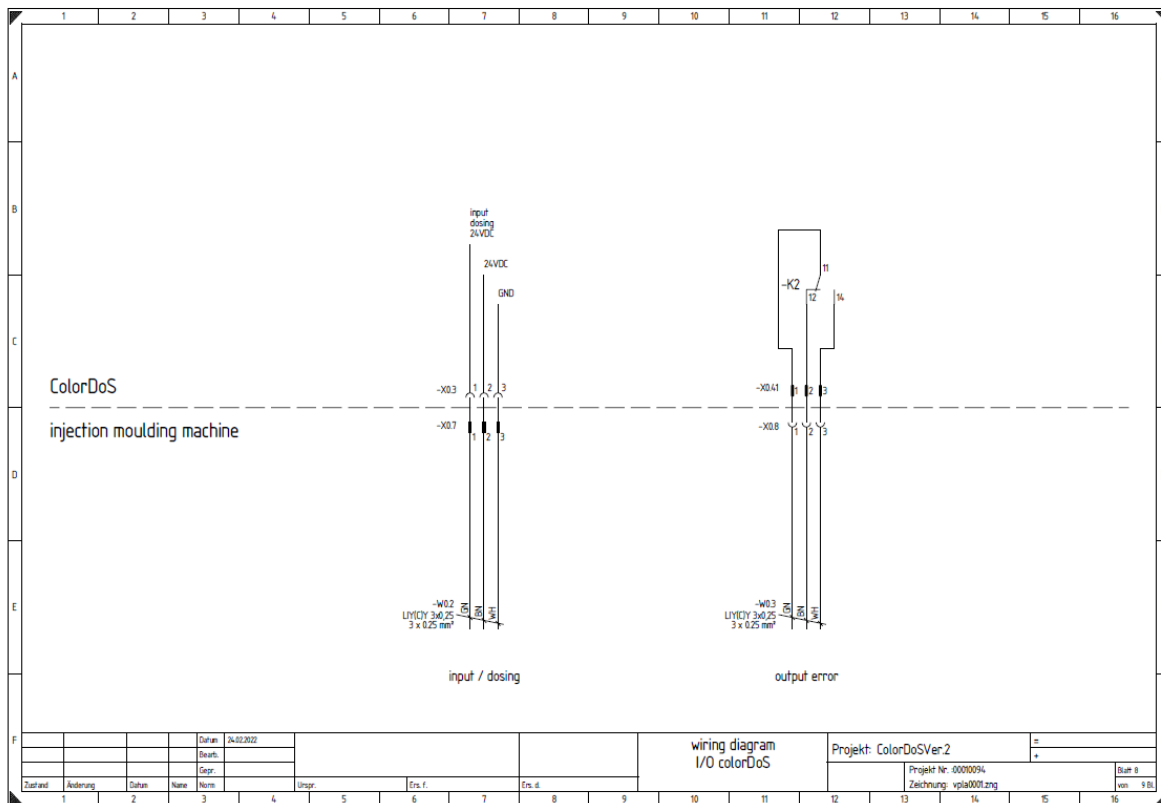


Figure 39 Wiring diagram for potential-free dosing contact and error output

9 Exclusion of liability

HNP Mikrosysteme GmbH shall not be liable for damage caused by failure to observe instructions in this operating manual.

The user shall be responsible for checking the completeness, correctness and suitability of the product for the intended use.

The user shall be responsible for compliance with all applicable laws, rules, regulations, etc. This is particularly applicable to the pumping of aggressive, toxic, corrosive etc. media.

10 EC Directives

A Directive or EC Directive is a legal act of the European Community which is addressed to the Member States and obliges them to achieve a certain objective. The following Directives may be relevant to the user of the colorDoS®:

Low Voltage Directive (2014/35/EU)

The Low Voltage Directive is not relevant for the colorDoS® described in this operating manual, as the supply voltage is limited to a maximum of 30 V DC and is thus below the scope of the Directive.

Machinery Directive (2006/42/EC)

A colorDoS® is a machine for the purposes of the Machinery Directive. The Directive is therefore applicable. The colorDoS® can also be a part of a machine or installation.

EMC Directive (2014/30/EU)

The Directive on Electromagnetic Compatibility (EMC) applies to all electronic and electrical devices, installations and systems, thus the motion controller of the colorDoS® is covered by the EMC Directive.

RoHS Directive (2011/65/EU)

To the best of our current knowledge, our products supplied to you do not contain any substances in concentrations or application whose placing on the market in products is prohibited in accordance with the applicable requirements of the Directive.

EC Directive on Waste Electrical and Electronic Equipment (2012/19/EU)



In Germany, the implementation of the WEEE Directive 2012/19/EU is regulated in the Electrical and Electronic Equipment Act (ElektroG). This law also holds the manufacturer responsible for the disposal of electrical and electronic equipment at the end of its life.

The symbol of the crossed-out wheeled bin on the electrical appliances indicates that they must not be disposed of with household waste, but require separate collection. Furthermore, we advise you to delete any existing personal data on the devices to be disposed of.

As a manufacturer, we offer our business customers (B2B) to take back and recycle all electrical equipment placed on the market according to certain ecological standards.

In order to avoid long logistics chains, we generally recommend giving old appliances to regionally based specialist disposal companies for disposal. Irrespective of this, HNP Mikrosysteme offers its business customers to send all devices of the brands m zr® that are in circulation in Germany to the following address at the end of their service life:

HNP Mikrosysteme GmbH | Brunnenstraße 38 | D-19053 Schwerin, Germany.
Please inform us in advance via the e-mail address service@hnp-mikrosysteme.de.

HNP Mikrosysteme GmbH will then ensure that they are disposed of in an environmentally friendly and legally compliant manner.

REACH Regulation (EC) No. 1907/2006

HNP Mikrosysteme is not a manufacturer or importer of chemical substances subject to mandatory registration, but a downstream user as defined by the Regulation. As a downstream user, we maintain the necessary communication with our upstream suppliers to ensure the continued supply of the components we need. We will inform you about relevant changes to our products caused by REACH, their availability and the quality of the parts/products supplied by us to you in the course of our business relationship and coordinate appropriate actions with you in individual cases. The audits carried out to date have not revealed any restrictions in the supply by our upstream suppliers.

10.1 Electromagnetic Compatibility (EMC)

EMC is defined as the ability of an electrical or electronic device to function satisfactorily/as intended in its intended environment without unacceptably influencing this environment due to self-generated electromagnetic interference.

10.1.1 EMC Directives and standards

Conformity has been demonstrated by proof of compliance with the following harmonised standards by the company Dr. Fritz Faulhaber and HNP Mikrosysteme GmbH.

EN 61000-6-4 (10/01): Generic standards – Emission standard for industrial environments

EN 61000-6-2 (10/01): Generic standards – Immunity standard for industrial environments

The above-mentioned generic standards prescribe certain standardised tests for emitted interference and immunity tests. The following tests are required due to the available connections on the controller:

Generic standard for emitted interference:	Description
EN 55011 (05/98)+A1(08/99)+A2(09/02):	Radio interference
Generic standard for interference immunity:	
EN 61000-4-2 (05/95)+A1(4/98)+A2(02/01):	Immunity to static electricity discharge
EN 61000-4-3 (04/02)+A1(10/02):	High-frequency electromagnetic fields
EN 61000-4-4 (09/04):	Fast transient electrical disturbances/burst
EN 61000-4-5 (03/95)+A1(02/01)	Surge voltage immunity test
EN 61000-4-6 (07/96)+A1(02/01):	Immunity to power disturbances induced by high-frequency fields:
EN 61000-4-8 (09/93)+A1(02/01):	Magnetic fields with power frequencies

Table 4

Overview of standards

All tests were performed successfully.

10.1.2 Information for the intended operation

The following must be observed for the colorDoS®:
The prerequisite for proper operation is operation in accordance with the technical data and this operating manual.

Restrictions

If the colorDoS should be used in a residential area, in a business or commercial area or in a small company, then suitable measures must be taken to ensure that the emitted interference is below the permissible limit values!

11 Declarations of conformity

The supplied colorDoS® is within the scope of the following EC-Directives:

- EC Machinery Directive (2006/42/EC)
- EMC Directive (2014/30/EU)

You can also request the declarations of conformity from us separately.

EC Declaration of Conformity (for the purposes of the Directive 2006/42/EC)

The manufacturer hereby declares that the product

colorDoS®

complies with all provisions of the following Directive in its respective applicable version:

– Machinery Directive 2006/42/EC

Furthermore, the manufacturer declares that the following international and national standards were applied:

DIN EN 809	DIN EN ISO 13857:2020-04
DIN EN ISO 12100	DIN EN 953
DIN EN 60204-1	Accident prevention regulations

This declaration is not a warranty of characteristics for the purposes of product liability. The safety instructions of the product documentation must be observed.

Authorised representative for the compilation of the technical documentation:

Mr. Lutz Nowotka
HNP Mikrosysteme GmbH
Bleicherufer 25
D-19053 Schwerin, Germany

Date: December 30, 2020

Manufacturer signature:

Dr. Thomas Weisener
Managing Director

EU Declaration of Conformity (for the purposes of the EMC Directive 2014/30/EC)

The manufacturer hereby declares that the product

colorDoS®

complies with all provisions of the following Directive in its respective applicable version:

- EMC Directive 2014/30/EU

Applied standards are, in particular

- | | |
|-----------------------|---|
| EN 61000-6-4 (10/01): | Generic standards - Emission standard for industrial environments |
| EN 61000-6-2 (10/01): | Generic standards - Immunity standard for industrial environments |

This declaration is not a warranty of characteristics for the purposes of product liability. The safety instructions of the product documentation must be observed.

Date: December 30, 2020

Manufacturer signature:

Dr. Thomas Weisener
Managing Director

12 Fault, causes and elimination

Fault	Cause	Elimination
1 colorDoS® does not function	No supply voltage	Check supply voltage
2 colorDoS® does not pump	No dosing medium in the storage container	Fill storage container
	Air or gas in the colorDoS®	colorDoS® cannot pump against the system pressure when dry. Fill the pump without pressure or at reduced system pressure.
	Malfunction in additional components (e.g. pressure line, dosing needle or external check valve)	Check and eliminate faults. Possibly clean the additional components
	Electrical installation defective	Check the electrical installation for correct cable assignment, loose connections, etc.
	No dosing signal from injection moulding machine Start conditions of the pump are not met or electrical start signals are not present.	Check start conditions, start signals (SPS, PLC, start input) and programming
3 colorDoS® cannot be put into operation (among others, initial commissioning)	Pump does not draw in	Suction line too long and/or internal diameter too small (NPSHA value too low)
		Suction line leaking or suction connection leaking, check suction connection, check installation
		Air bubbles in the fluid system (tubes, valves, ...)
		Check the pressure on the storage container
4 Motor turns, but colorDoS® does not pump	No medium in the pump module	Fill the pump module
	Air bubbles in the fluid system (tubes, valves, ...)	Fill the pump module and the fluid system
	Pressure line/dosing needle clogged	Cleaning, rinsing or replacement of the pressure line/dosing needle
	Coupling between motor and pump head has become loose	Return the pump to the manufacturer
	Pump shaft is broken	Return the pump to the manufacturer
5 colorDoS® does not pump, but is filled with medium		Check the motor error status with the Motion Manager software (GFS command). Try to get the pump free by running the pump backwards at -1000 rpm for approx. 1 s.
		Adjust the motor current of the controller. Contact the pump manufacturer for this.
		Check the motor error status with the Motion Manager software
		Try to get the pump free by running the pump backwards at -1000 rpm for approx. 1 s
	Particles in the dosing medium or pump is blocked	Rinse the pump with a sprayer
		Ask the manufacturer to clean the pump and use a filter, clean the system.
		Any check valve that may be present does not open.
		Rinse the check valve
6 Dosing volume does not match the set target values	Pressure line/dosing needle clogged	Cleaning, rinsing or replacement of the pressure line/dosing needle
		Air bubbles in the fluid system (tubes, valves, ...)
		Fill the pump and the fluid system
		Bleed fluid system and check for leaking fluid connections

Fault	Cause	Elimination
7 Pump speed cannot be adjusted	Pump cavitated	Suction line too long and/or too thin Shorten the suction line, change the mounting location of the pump.
	Filter dirty or too small	Replace filter with new or larger one
	Electrical installation defective	Check the electrical installation for correct cable assignment, loose connections, etc.
	Motor controller is defective	Return the motor controller to the manufacturer
8 Medium drips out of the dosing nozzle	Any check valve that may be present does not close	Rinse the check valve
	Pressure on the dosing medium storage container	Switch off the compressed air on the dosing medium storage container
	Storage medium container higher than the dosing nozzle	Ensure level compensation
9 Medium discharges from the barrier seal	Barrier seal connection set leaking	Check assembly, tighten screw connections
	Pressure on the barrier seal medium reservoir	Switch off the compressed air on the barrier seal medium reservoir, seal defective, return the pump to the manufacturer if necessary.
10 Dosing volume reduces over time	Filter dirty	Replace filter
	Deposits in the pump	Rinse the pump or return the pump to the manufacturer for dismantling and cleaning
	Wear of the pump during long periods of operation or with abrasive media	New determination of the calibration factor of the pump, is necessary due to shifting of the pump characteristic curve
11 Leakage of the colorDoS®	Seal in the pump is not OK	Return the colorDoS® to the manufacturer
12 Leaking from coupling assembly of the pump	Shaft seal defective	Return the colorDoS® to the manufacturer, arrange replacement of shaft seal
13 Leaking of the fluid connections	Clamping rings leaking	Replace or retighten fluid connection, replace screw-in fitting
14 Air bubbles on the pressure side	Loose fluid connections (particularly on the suction side)	Check fluid connection and tighten if necessary
	Shaft seal leaking/worn	Return the colorDoS® to the manufacturer
	Barrier seal empty	Fill barrier seal
15 Minimal leakage flow at standstill	No error, cause function-related	Use a check valve. Level compensation between suction and pressure side
16 Overtemperature	Pump surface becomes hot	Clean pump surface, rinse the pump
	Pump labours	Rinse the pump
	Particles in the dosing medium or deposits in the pump	Stop the pump immediately! Return the pump to the manufacturer for cleaning
	Grinding noises	Stop the pump immediately! Return the pump to the manufacturer for cleaning or repair
	Motor surface or motor interior too hot	Temperature fuse in the motor has tripped, return the pump to the manufacturer
17 Pump in the colorDoS® develops noises	Wear of the pump or defective parts	Pump must not continue to be operated. Send the pump to the manufacturer for servicing
18 No connection via RS-232 interface	No connection to the pump	Check the supply voltage 24 V DC Check the interface connection with the null modem cable, replace the cable if necessary.
	The motor controller has crashed	Briefly switch off the supply voltage for 10 s, switch on the supply voltage, automatic restart of the integrated motor controller
19 Overcurrent of the pump	Particles in the medium	Rinse the pump
	Pump labours	Dosing nozzle is damaged, clean, rinse or replace the dosing needle. Pressure line or dosing needle is clogged, clean, rinse or replace the component.

Fault	Cause	Elimination
	Deposits in the pump	Rinse the pump, return the pump to the manufacturer
20 Undervoltage of the colorDoS®	Supply voltage < 24 V DC	Check the supply voltage 24 V DC
21 Overvoltage of the colorDoS®	Supply voltage > 28 V DC	Check the supply voltage 24 V DC, controller possibly damaged, return the pump to the manufacturer

Table 5 Faults, causes and elimination

Fault	Cause	Elimination
1 Barrier seal - low fill level	The capacitive proximity sensor has detected a limit value underrun	Fill barrier seal medium reservoir
2 Pump restart	The pump could not completely perform the current (last) run command and has performed the restart routine	Regular cleaning of the colorDoS®
3 Container - low fill level	Based on the set color code and the container settings, the prewarning time has not reached the set value.	No elimination necessary A new container should be provided
4 Error output set	The colorDoS® signals a critical error	The error is in most cases accompanied by one of the following errors
5 Communication error	The communication with the pump has been interrupted.	Make sure that all connectors are correctly connected
6 No removal (container → pump)	Based on the set color code, the minimum removal quantity has not been reached.	Clean the colorDoS® Check for gas/air in the system
7 Container empty	The weighing of the container was/is 0.	Insert new container
8 Pump stuck	The pump could not completely perform the current (last) move command. The restart routine could not get the pump free.	Rinse the pump module, return the pump to the manufacturer

Table 6 Display control messages - faults, causes and elimination



If unnamed errors occur or if this results in uncertainty in dealing with the colorDoS®, the first thing to do is to shut down the colorDoS® immediately. Please call the HNP Mikrosysteme service department (see chapter 14) and return the colorDoS® to us for review if necessary.

13 Maintenance

13.1 General notes



For maintenance, make sure that the pump head has been rinsed with harmless media. If the pump head has been operated with media that are hazardous to health, maintenance must be carried out with the appropriate protective measures.



The "Declaration about media contact of micro annular gear pump and components" must be completed. The type of media contact of the micro annular gear pump and components must be identified. If the "Declaration about media contact of micro annular gear pump and components" is not or not completely or improperly filled in, maintenance cannot be performed. The user of the colorDoS® shall be liable for any personal injury or damage to property.



Send your colorDoS® to HNP Mikrosysteme for maintenance. The address can be found on the cover page of the operating manual.

13.2 Inspection and maintenance

Maintenance of the integrated micro annular gear pump should be carried out depending on the pumped medium for:

- *lubricating media* after 4000 h operating hours in depressurised operation, at the latest after 15 months,

- *non-lubricating, particulate or crystallising media*

after 3000 h operating hours in depressurised operation, at the latest after 12 months. If no significant wear of the integrated micro annular gear pump is detected during this initial inspection, the further inspection intervals can be carried out after 4000 h each, at the latest after 15 months, provided that the operating parameters remain the same.

If there is increased wear during the initial inspection, the maintenance intervals must be adjusted to the changed operating parameters.

In order to counteract increased wear, the colorDoS® should be properly shut down after each use (see also chapter 6.7). Additional rinsing processes with a neutral rinsing liquid (see also chapter 6.6) also improve the wear behaviour.



Rotors and bearings are wear parts and are replaced by HNP Mikrosysteme GmbH during maintenance depending on their degree of wear.



If the pump head is dismantled for maintenance work, all seals and O-rings must be replaced when it is reassembled, as otherwise absolute leak tightness cannot be guaranteed.



As rotary positive displacement pumps, mzp-pumps are subject to load-dependent wear. The selection of the hardest and most corrosion-resistant materials (carbide, ceramic) for the functional components of the integrated micro annular gear pump minimises the wear rate and ensures a long service life. Parts that are subject to increased wear are the rotors, bearings, pump shaft and shaft seal. Pumps that are operated at high loads naturally have a higher wear rate. The following are considered to be high loads:

- use of media containing particles
- corrosive media
- low-viscosity media with low lubricating characteristics such as water and solvents
- high speeds
- high differential pressure

The operation of pumps in such load ranges requires increased attention from the operating company and a shortening of the inspection intervals.

13.3 Maintenance/Repair

If the pump head is dismantled for repair work, all seals and O-rings must be replaced when it is reassembled, as otherwise absolute leak tightness cannot be guaranteed.

14 Contact persons

Application development, advice, service and accessories

Mr. Olaf Lang
Telephone +49| (0) 385|52190-362

Mr. Guido Zuther
Telephone +49| (0) 385|52190-332

Maintenance and servicing

Mr. Guido Zuther
Telephone +49| (0) 385|52190-332

Drive technology and control

Mr. Mathias Wakenhut
Telephone +49| (0) 385|52190-359

15 Legal information

Trademarks

mzr® is a registered German trademark of HNP Mikrosysteme GmbH.

MoDoS® is a registered German trademark of HNP Mikrosysteme GmbH.

colorDoS® is a registered German trademark of HNP Mikrosysteme GmbH.

µ-Clamp® is a registered German trademark of HNP Mikrosysteme GmbH.

HNPM® is a registered German trademark of HNP Mikrosysteme GmbH.

Teflon® is a registered trademark of DuPont.

Viton® is a registered trademark of DuPont Dow Elastomers.

Kalrez® Spectrum™ is a registered trademark of DuPont.

HASTELLOY® is a registered trademark of Haynes International, Inc.

PEEK™ is a registered trademark of Victrex plc.

Aflas® is a registered brand name of ASAHI Glass Ltd.

Microsoft®, Windows® are registered trademark or brand names of Microsoft Corporation in the USA and/or other countries.

Cavro® is a registered trademark of Tecan Systems, Inc.

Other names or product designations not listed here may be registered trademarks or brands of the relevant companies.

Patents

Micro annular gear pumps (and housings) are protected by granted patents: EP 1115979 B1, US 6,520,757 B1, EP 852674 B1, US 6,179,596 B1, EP 1354135, US 7,698,818 B2. Patents pending: DE 10 2011 001 041.6, PCT/IB2011/055108, EP 11 81 3388.3, US 13/884,088, CN 2011 8006 5051.7, HK 13 11 2934.9, DE 10 2011 051 486.4, PCT/EP2012/061514, EP 12 72 8264.8, US 9,404,492 B2, CN 2012 8003 8326.2. Further applications are pending in the USA, Europe and China (patent pending).

16 Safety information for the return of used colorDoS® and fluid components

16.1 General Information

The employer (operating company) is responsible for the health and safety of his workers. This also applies to external personnel who come into contact with the colorDoS® and components during repair and/or maintenance. The type of media contact of the integrated micro annular gear pump and components must be identified and the corresponding declaration must be completed.

16.2 Declaration about the type of media contact

The personnel carrying out the repair and/or maintenance must be informed about the condition of the used colorDoS® and components before starting work. The "Declaration about media contact of micro annular gear pump and components" is used for this purpose.

This declaration must be sent directly to the supplier or the company appointed by the supplier. A second copy of this declaration must be attached to the documents accompanying the consignment.

16.3 Shipping

When shipping used colorDoS® and components, the shipping instructions must be observed:

- drain the medium
- rinse the pump with appropriate solvent
- remove the filter inserts from attached or loose supplied filters
- seal all openings airtight
- return in original packaging

17 Declaration about media contact of micro annular gear pump and components

Type of equipment

Pump type/serial no./article: _____

Operating hours/running time: _____

Number of delivery note or delivery date: _____

Reason for sending: _____

Contact with media

The micro annular gear pump was in contact with the media: _____

and has been cleaned with: _____

Product/safety data sheet available: ☐ Yes* ☐ No

* Please add as enclosure

or available on the World Wide Web at: www. _____

If it is not possible for you to carry out proper cleaning before sending in the pump, we reserve the right to entrust the cleaning of a pump that has been in contact with substances hazardous to health to a specialist company. It is advisable to return the product in its original packaging. These precautions are necessary for the protection of the employees of the supplier.

Type of media contact:

☐ explosive☐ oxidising☐ sensitive to moisture☐ toxic (toxic byproducts)☐ radioactive

pH value: _____ approx. _____ to

☐ carcinogenic☐ microbiological

Other: _____

☐ irritant / caustic☐ corrosive

Hazard statements: _____

Precautionary statements: _____

Declaration

I/we hereby affirm that the provided information is complete and correct. The used micro annular gear pump and fluidic components are shipped in accordance with the legal requirements.

Company: _____

Salutation: ☐ Miss/Mrs./Ms. ☐ Mr. Title: _____

Department: _____

Name: _____

Street/no.: _____

Telephone: _____

Postal code/town: _____

e-mail: _____

Country: _____

Place, date: _____

Legally binding signature /
company stamp: _____