MOVACOLOR

LEADERS IN DOSING TECHNOLOGY

MCTC manual

MCBalance

MANUAL

Software version : 2.11.x
Manual revision : rev.00
Language : ENG
Date : February 2021

Index

1 Introduction

Thank you for purchasing a Movacolor metering device. This manual is addressed to operators and qualified technicians taking care of the metering of dry additives to ensure correct use of the Movacolor dosing unit.
ⓘ This manual must be read before installing the dosing unit. Keep this manual in a place accessible for all operators.

1.1 **Symbols**

ⓘ Important note.

 Attention; safety regulations for the operator.

1.2 **Terms**

Operator:	A person charged to operate, adjust, maintain and clean the machine.
Qualified Technician:	A specialized, suitable trained person authorized to execute the installation, non-routine maintenance, or repairs requiring special knowledge of the machine and how it operates.
Multi component:	Two or more dosing systems on one machine.

1.3 **Transport**

To protect the Movacolor unit against damage during transport, the unit is packed in a cardboard box filled with polyurethane foam. Delivery terms are Ex-Works Sneek, The Netherlands. Buyer is responsible for the transport. Movacolor cannot be held liable for any damage during transport.

1.4 **Receipt**

Check the unit thoroughly upon receipt for damages or missing parts. Pass any remarks to the local agent or Movacolor within 8 days upon receipt of goods.

1.5 **Disclaimer**

Movacolor does not warrant that the hardware or software will work properly in all environments and applications, and makes no warranty and representation, either implied or expressed, with respect to the quality, performance, merchantability or fitness for a particular purpose.

Movacolor has made every effort to ensure that this user's manual is accurate; Movacolor disclaims liability for any inaccuracies or omissions that may have occurred.

Information in this user's manual is subject to change without notice and does not represent a commitment on the part of Movacolor. Movacolor assumes no responsibility for any inaccuracies that may be contained in this user's manual. Movacolor makes no commitment to update or keep the current information in this user's manual, and reserves the right to make improvements to this user's manual and/or to the products described in this user's manual, at any time without notice.

If you find information in this manual that is incorrect, misleading or incomplete, we would appreciate your comments and suggestions.

2 General information

2.1 **Safety**

The equipment is only designed and may only be used for the dosing of dry additives.
Any use that is not in conformity with the instructions is considered improper and as such frees the manufacturer from any liability regarding damage to things and/or persons.

Before switching on the unit for the first time, ensure that the mains power voltage applied is between 95 and 250VAC.

Ensure that all parts are securely fixed to the extruder, injection molding machine or machine support.

Always switch off the Movacolor control cabinet and disconnect the mains power plug from electrical power before performing maintenance.

Dangerous voltages are present inside the control cabinet for up to 2 minutes after it has been switched off.

Always disconnect the main compressed air connection before performing maintenance.

2.2 **Certification**

The Movacolor dosing unit is designed and produced in conformity with the following European regulations:

1. CE standards for machinery (health, safety, environment).
2. EMC (electromagnetic compatibility).
3. 2006/42/EG.
4. RoHS.

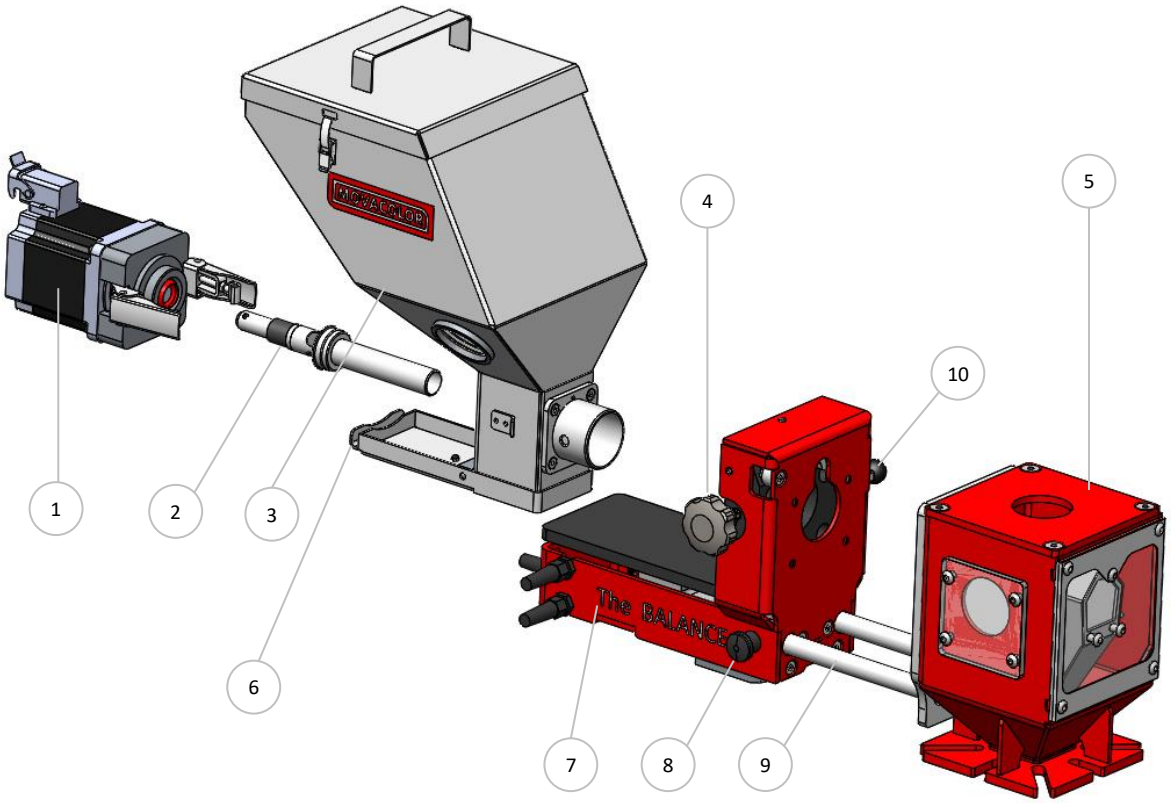
2.3 **Operating environmental conditions**

1. The unit must be protected against weather conditions.
2. Operating temperature -20 to +70 degrees Celsius.
3. Protection class: IP-50.

3 MCBalance

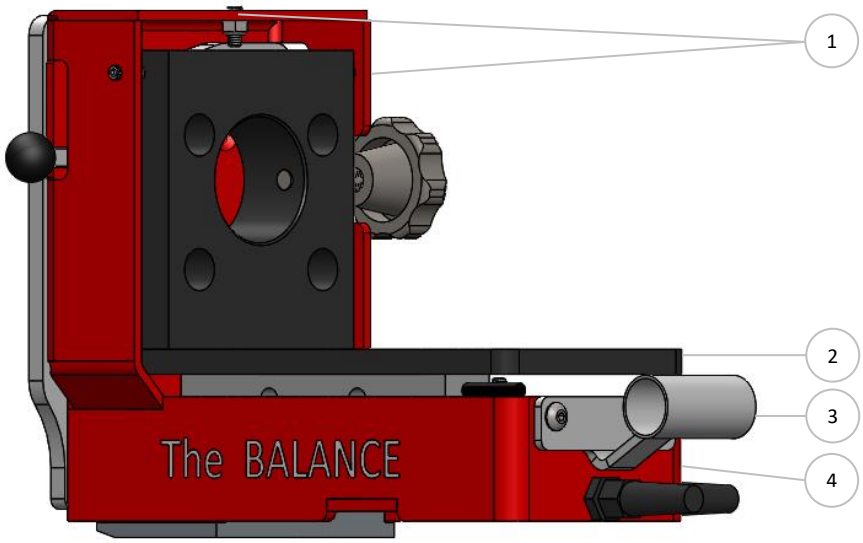
3.1 **Introduction**

3.1.1 MCBalance component overview



1.	Stepper motor
2.	Dosing system (Dosing cylinder)
3.	Hopper
4.	Curled knob
5.	Neckpiece
6.	Material discharge slide (in closed position)
7.	MC-Balance Load frame
8.	OPTIONAL Slide locking bolt (locking the slide-out position) Only supplied together with the optional slide mechanism
9.	OPTIONAL Slide frame
10.	OPTIONAL Slide locking bar (locking the slide-in position) Only supplied together with the optional slide mechanism

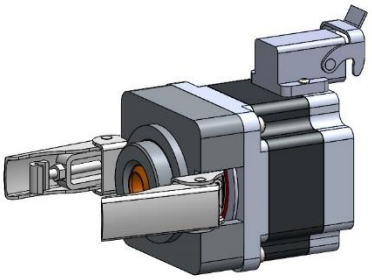
3.1.2 Weighing frame



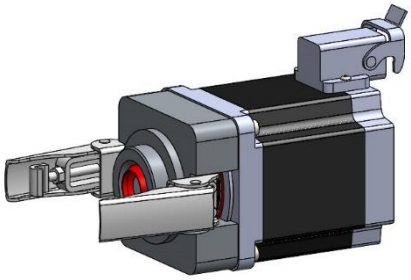
1.	Safety bolts (total of 5)
2.	Weighing frame
3.	Hopper loader tube support
4.	MCBalance frame

ⓘ Do not touch this weighing frame (and dosing unit) while dosing. This will influence the dosing accuracy.
ⓘ Do not adjust the safety bolts under the weighing platform. These are for overload protection.

3.1.3 MCBalance motor



Stepper motor 2A (LT)



Stepper motor 4,5A (HT)

ⓘ The MCBalance dosing units are standard equipped with the stepper motor 2A (LT), in case of using the feed screw A30 the stepper motor 4,5A (HT) will be supplied. Also a screw A20 can be connected to the HT motor.

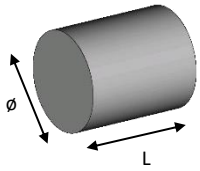
ⓘ During configuration of the software, do not select the HT motor if LT motor is connected. This will damage the motor. If LT motor is selected and HT motor is connected there will be less motor torque and this can influence the dosing.

The motor type (LT/HT) and serial number of the motor can be found on the backside of the motor.

3.2 **Material types**

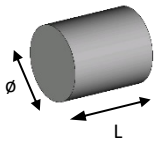
The controller of the dosing unit makes a distinction between two groups of materials, normal granules and micro granules. To determine the kind of material in your application use the description below.

Normal Granules (NG):



Ø 2,5 < 4 mm L < 4 mm

Micro / Mini Granules (MG):



ø < ø2,5 mm L < 3 mm

The term Micro/Mini Granules also includes free flowing powder.

The actual capacity of the dosing system depends on:

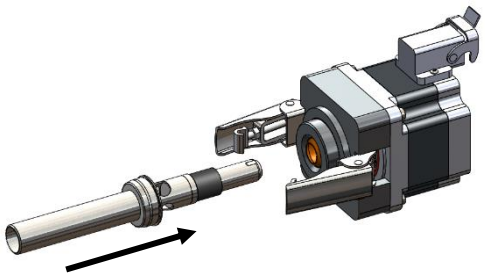
- The volume weight of the material (bulk density);
- The specific weight of the material (specific density);
- The granular shape of the material;
- The granule size;
- The surface structure of the material.

The granular material and powder material has to be free flowing, non-static and not sticky. Movacolor offers mainly two dosing systems, the dosing cylinder and the feed screw.
(for more information see chapter MCBalance dosing system / capacities).

3.3 **Dosing system**

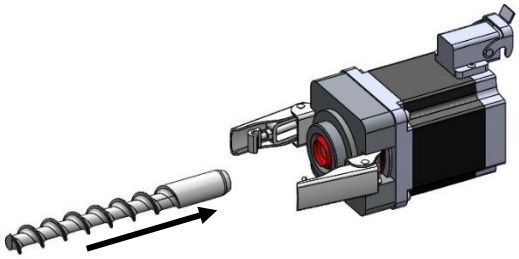
3.3.1 Mounting the dosing cylinder:

The motor shaft is equipped with one flat side which fits exact in shaft of the dosing cylinder.
To connect the dosing cylinder just put it on the motor axle while turning it to find the flat side, than press the dosing cylinder completely backwards.



3.3.2 Mounting the dosing auger:

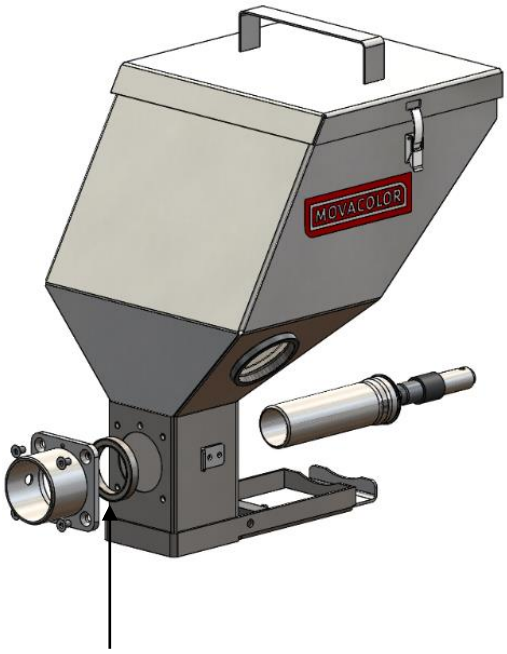
To connect the dosing auger just put it on the motor axle. The motor shaft is equipped with one flat side. A hexagonal socket head screw has to be mounted in the auger when it is slid on the motor axle. The screw has to be placed on the flat side of the motor axle.



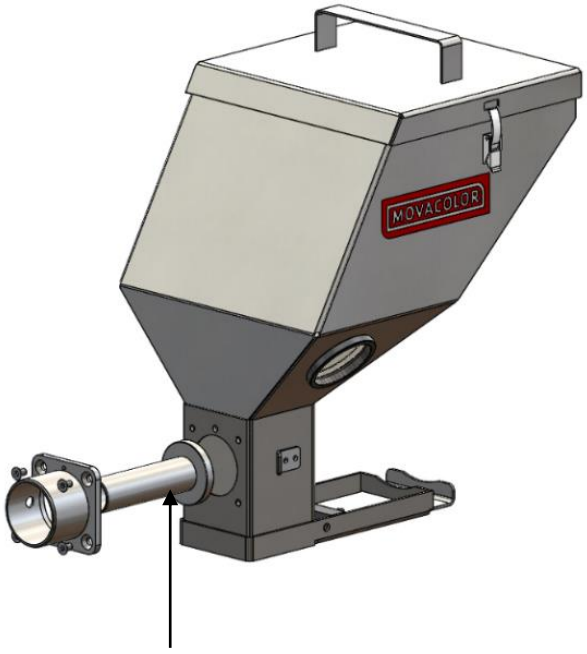
3.3.3 Changing from cylinder to auger and vice versa

In order to change from a dosing cylinder to a dosing auger, some changes have to be made on the hopper. This means that the ball-bearing used for the supporting of the cylinder has to be removed.
To do this, please follow the below sequence:

- Remove the hopper from the load frame;
- remove connection flange from the hopper by removing the four screws;
- remove the bearing from the connection flange;
- place the tube of the dosing auger in the place of the bearing (between the connection flange and the hopper;
- mount the connection flange on the hopper by placing the four screws.



Bearing (only used for dosing cylinder)



Dosing auger tube (only used for dosing auger)

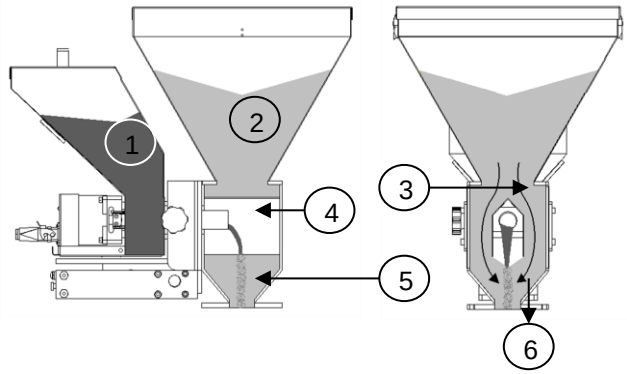
3.3.4 MCBalance metering principle

The Dosing Cylinder® of Movacolor combined with a stepper motor ensures that the additive output is accurate and regular. The neckpiece (a mixing chamber) is designed to blend the main material and the additive homogeneously. The most common mounting of the neckpiece is between the production machine and the main material hopper. In the figure below a cross section of the NST40 neckpiece can be seen.

Standard neckpiece

During operation, the virgin material runs from the machine hopper through the neckpiece into the machine. Inside the neckpiece the Virgin material flow is divided into two streams by the cover plate. In the space below the cover plate, the rotating cylinder is dosing additive.

Additive is added directly into the center of the virgin material flow, just before it enters the production machine. This is a great advantage over metering devices that use batch pre-mixing because pre-mixing can actually cause material separation. Separation of materials results in an irregular additive flow into the production machine.



1. Color 2. Virgin material 3. Neckpiece 4. Dosing cylinder

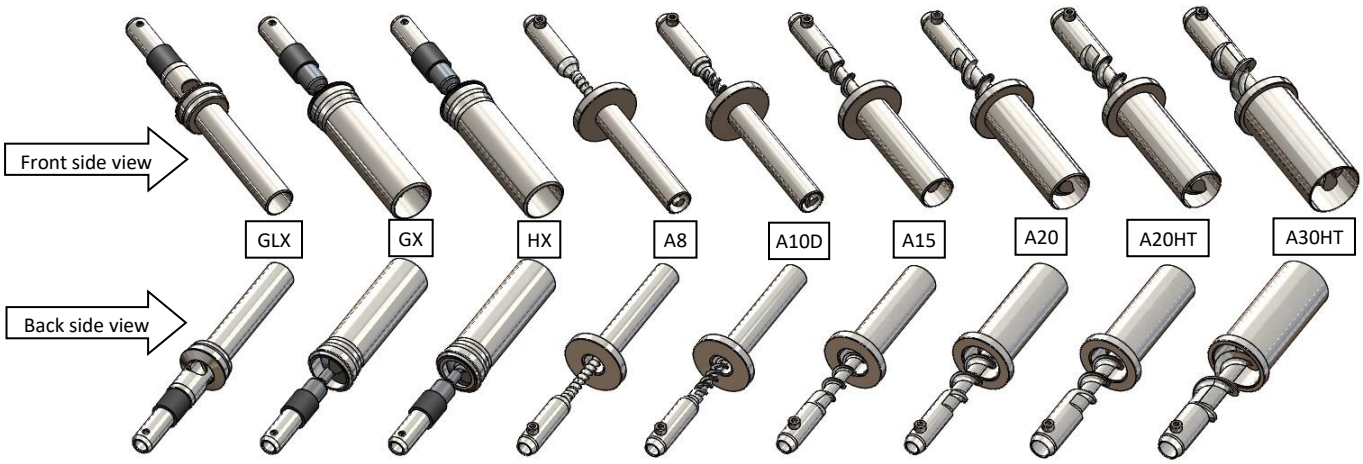
4. Cover plate 5. Mixing zone 6. To production machine

3.3.5 MCBalance dosing system / capacities

Depending on the application a different dosing system might be needed.
Use the following table to determine roughly the best system for the application. For more detailed information please contact your agent or Movacolor.

Dosing system	Granular materials	Accuracy	Dosing capacity Gram/sec.	Dosing capacity Kg/hour
GLX dosing cylinder	YES	++	0,02 to 1,6*	0,07 to 5,8*
GX dosing cylinder	YES	+	0,2 to 5,0*	0,72 to 18,0*
HX dosing cylinder	NO	++	0,01 to 1,6**	0,04 to 5,8**
A-8 Feed screw	YES	+	0,02 to 1,0*	0,07 to 3,6*
A-10D Feed screw	YES	+	0,05 to 3,3*	0,18 to 11,9*
A-15 Feed screw	YES	+/-	0,2 to 5,0*	0,72 to 18,0*
A-20 Feed screw	YES	+/-	0,5 to 20*	1,8 to 72*
A-30 Feed screw***	YES	+/-	2 to 50*	7,2 to 180*

Note * measured with normal granular masterbatch 0,8 kg/dm3.
Note ** measured with free flowing powder 0,65 kg/dm3.
Note *** only available with high torque (4,5 Amp) stepper motor.



The below table shows how to select the correct length of dosing tool for your application.

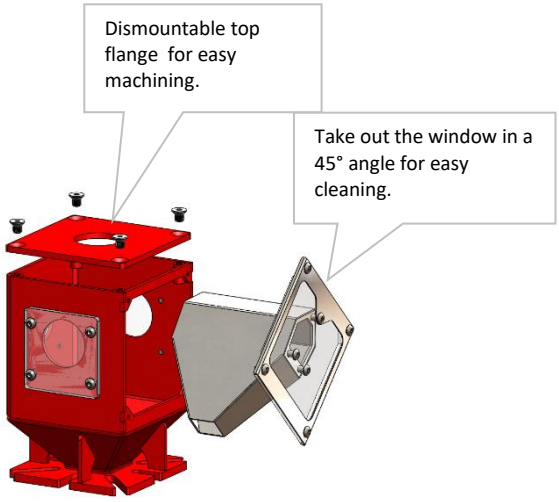
Type	Code for standard neckpiece	Code for water-cooled neckpiece **or** support frame	Code for water-cooled neckpiece **and** support frame
GLX	GLX	GLXC	GLXC/SF
GX	GX	GXC	GXC/SF
HX	HX	HXC	HXC/SF
A8	A8	A8C	A8C/SF
A10/D	A10/D	A10/DC	A10/DC/SF
A15	A15	A15C	A15C/SF
A20LT	A20	A20C	A20C/SF
A20HT	A20HT	A20HTC	A20HTC/SF
A30HT	A30HT	A30HTC	A30HTC/SF

3.4 **MCBalance mechanical installation**

Most mechanical parts are pre-assembled, making installation quick and simple.

1. When installing a foreign main material hopper on top of a neckpiece, the top flange of the neckpiece needs to be adapted. The lid of the neckpiece can be dismounted for easy machining.

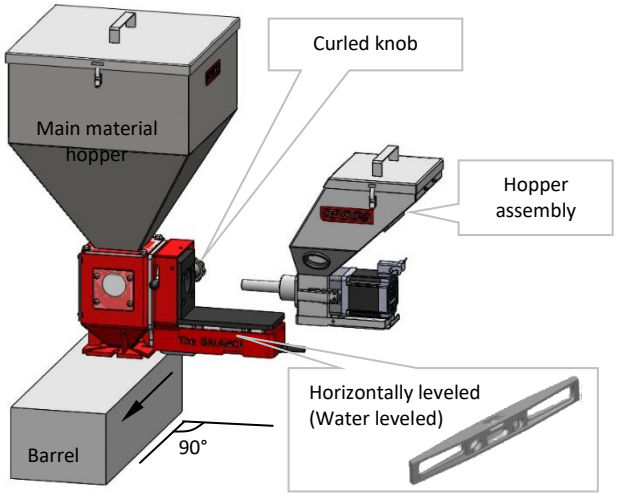
2.
   - Install the neckpiece directly on top of the entrance of the production machine;
   - Install the neckpiece in a **90-degree** angle to the machine barrel. This will optimize the dosing accuracy in relation to vibrations of the production machine;
   - Make sure that the complete unit is mounted;
   - **horizontally levelled** and fixed securely;
   - Assure proper grounding to control cabinet, neckpiece and dosing unit.



3. Connect the hopper assembly to the neckpiece
   by turning the curled knob clockwise.
   Make sure that the curled knob is tightened firmly.

4. Mount the controller vibration free and conform specified temperatures.

ⓘ Install the neckpiece in a 90-degree angle to the machine barrel, as shown in the picture.



3.5 **MCBalance electrical installation**

The MCTC or MCBC controller delivered together with the MCBalance is standard equipped with 2 or 3 connections:

- Mains power cable;
- Input cable (standard only MCTC);
- Motor cable.

ⓘ Before switching on the unit for the first time, ensure the mains power voltage being applied is between 95 and 250Vac 50/60Hz;
ⓘ In case of a multi component system, the controller can be equipped with an additional CAN bus cable to interconnect between the MCTC and other MCBC's;
ⓘ Be aware that the cables can be influenced by external circumstances as electromagnetic fields;
ⓘ Mount the controller on a place which is free of vibrations and within the specified temperature range.

The MCBalance is standard equipped with 2 connections:

- Load cell cable;
- Motor cable.

Connect the load cell connector to the MCTC or MCBC and tighten the locking screws gently. The motor connectors are equipped with a positioning notch and can be connected in one way only. Fixate the connector with the locking mechanism to prevent loosening of the connector due to vibrations.

To connect the input cable, please check **appendix Electrical diagram**.

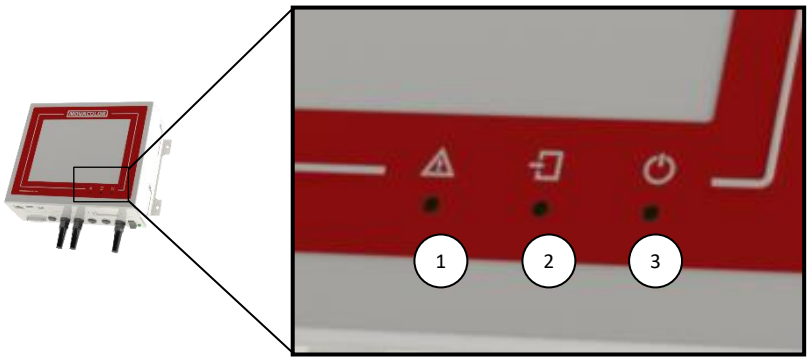
Optional are:

- Alarm flash light, complete with cable;
- Compressed air solenoid valve complete with cable (for automatic hopper loader).

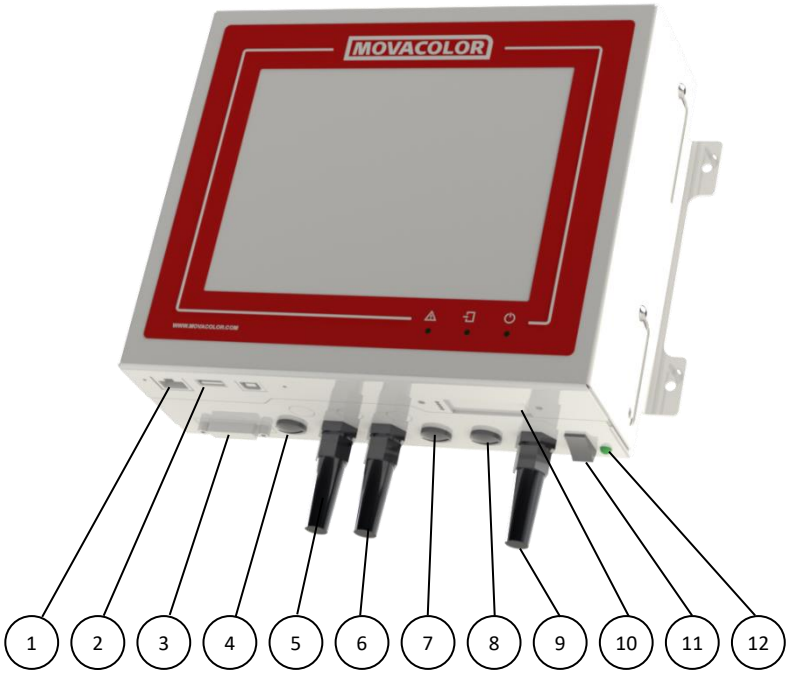
4 General operation

4.1 The Interface

4.1.1 MCTC Touchscreen



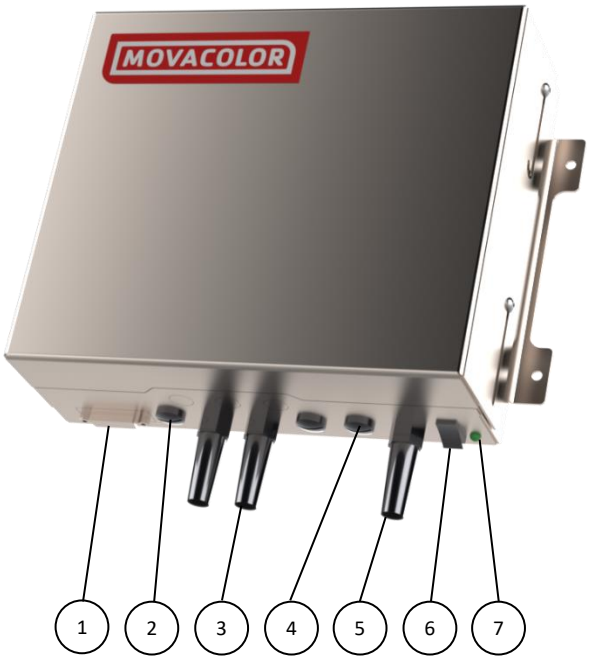
1.	Alarm LED
2.	Input signal LED
3.	Start LED (blinking = standby / waiting for start input, steady = motor running)



1.	External communication / network
2.	USB Port
3.	Load cell
4.	CAN bus cable
5.	Start input cable
6.	Motor cable
7.	Output for: Alarm, Warning, Running
8.	Valve output for hopper loader
9.	Mains power cable
10.	Optional communications
11.	Mains power switch
12.	Main power indicator

4.1.2 MC-BC Blind controller

The image below shows the MC-BC in a standard configuration. In multicomponent or remote setups, refer to chapter Multicomponent.



1.	Load cell
2.	CAN bus cable
3.	Motor cable
4.	Valve output for hopper loader
5.	Mains power cable
6.	Mains power switch
7.	Mains power indicator

4.2 **Start-up & Login**

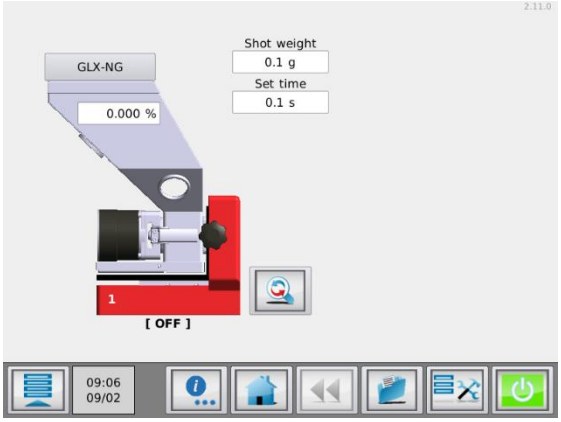
After switching on the mains power of the MCTC, the screen will remain black for about 15 seconds, followed by various loading screens. After about 90 seconds the home screen appears. When the unit is used for the first time, a Configuration Wizard appears.

4.2.1 Configuration wizard

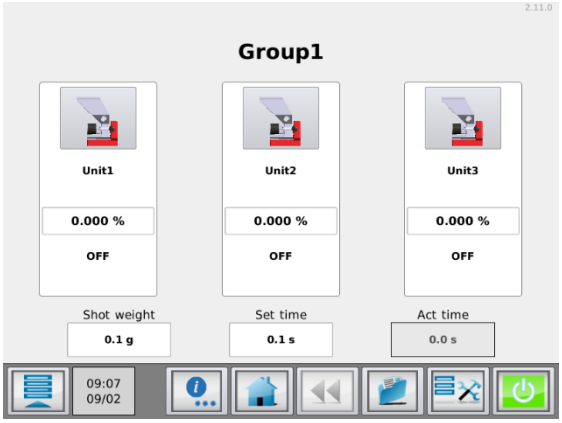
When the machine is powered up for the first time a configuration wizard will pop up. In this wizard, the date/time can be set and a weight tare can be done for each unit. For the weight tare, it is necessary to have the unit(s) installed as they will be during production, but not yet filled with material.

ⓘ Weight tare does not improve the dosing accuracy. If the dosing accuracy is a problem, please perform a loadcell calibration.

4.2.2 Home screen



Single component



Multi component

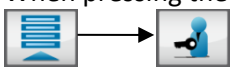
4.2.3 Help function

On most screens and popups a  button is available. By pressing this button a new window will open with context sensitive information.

4.2.4 User levels

The MCTC controller has three user levels, each level has other rights to access or change functions and/or options. The three user levels are: Operator, Tooling and Supervisor

For changing to another user level, press on the menu icon (left bottom corner) and the user button appears. When pressing the user button, the login menu is entered.



Press the LOGIN button and enter the password (4 numerals) and confirm. The passwords for the Tooling and Supervisor user levels can be defined by the supervisor in the “System Configuration” menu.

The accessible menus and settings per user level are shown in the table below. For some settings, the rights can be configured in the Login rights configuration menu.
For “Operator” and “Tooling” level, some functionality is limited. These limitations can be found in the corresponding chapter.

	User Level		
Menu access	**Operator**	**Tooling**	**Supervisor**
Login	✓	✓	✓
Component configuration	✗	✓	✓
Active alarms	✓	✓	✓
Consumption	✓	✓	✓
USB options	✓	✓	✓
Advanced settings			
System configuration	✗	✗	✓
Materials	✗	✓	✓
Configurable			
Select/Load recipes			
Production parameters			
Open tools form			
Disable filling systems			
Change dosing tool by recipe			
System start/stop			
Change/reset consumption			

Forgot your supervisor password? Contact Movacolor service to retrieve an overall supervisor password.
When entering a wrong password the user level will be set automatically to operator level.

Screen time out:
After 180 seconds (default setting) of inactivity the system will automatically logout to *Start login* level and the home-screen will be shown. The *Time out time* and *Start login* level can be set in the configuration menu.

4.2.5 Customer Support -NEW-

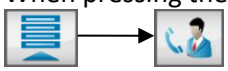
ⓘSupervisor login required

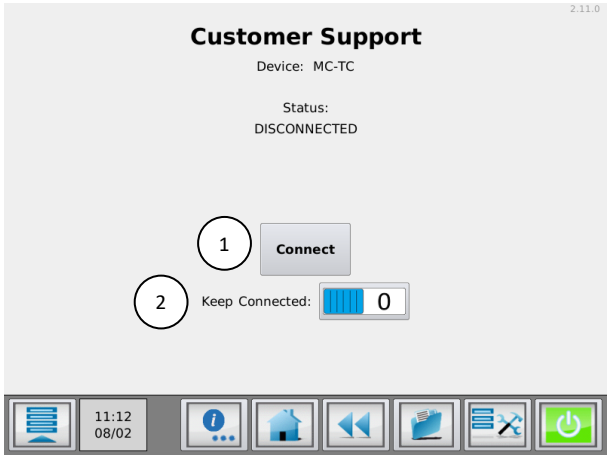
From software version 2.11.x onward Customer Support is available. This is an online service which makes it possible to get remote support from a support employee. To use this function, the MCTC needs to be connected to the internet via the ethernet port on the MCTC.

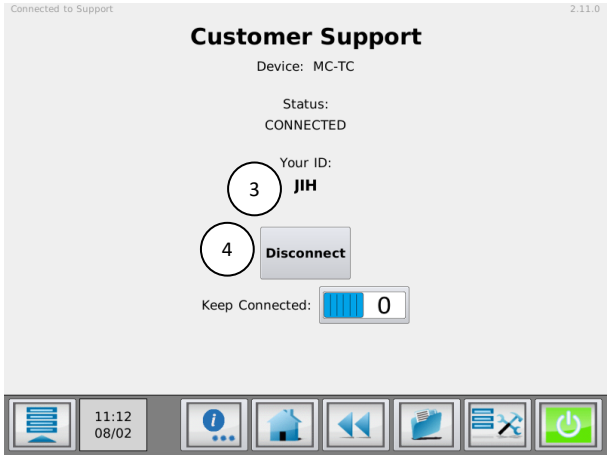
The connection between the MCTC and the remote server is entirely secured using several encryption and authentication techniques and thus can be used safely. No data will be saved to the remote support servers.

Once the MCTC is connected to the remote server, a 3-digit ID will be displayed on this screen. A support employee will ask for this ID as it's used to identify the MCTC.

When pressing the Customer Support button, a new window is opened.







Connect/Cancel (1)
Connects the MCTC to the remote server. Make sure the MCTC meets the usage requirements.
After pressing the connect button, but before the MCTC is connected, this button can be used to cancel the active connection attempt.

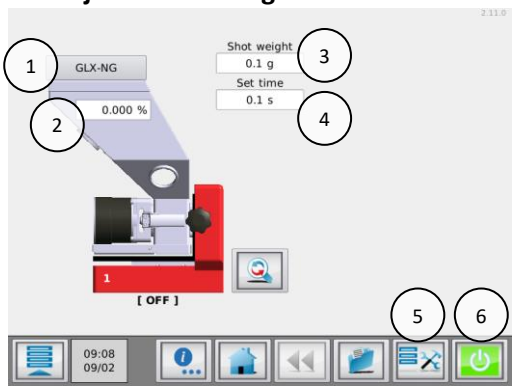
Keep Connected (2)
When this option is enabled, the MCTC will reconnect automatically when the connection is lost.

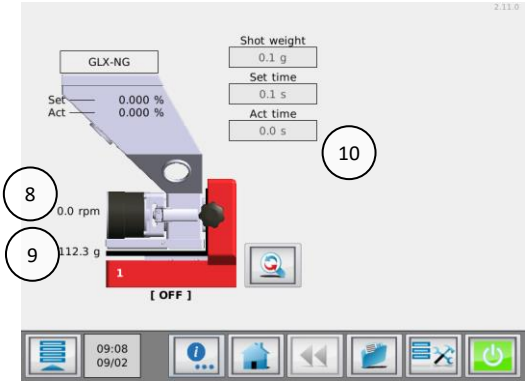
Code (3)
3-digit ID to be communicated to the support employee to establish a connection.

Disconnect (4)
Disconnects the MCTC from the remote server. The ethernet cable can be safely removed after this if it is undesirable to stay connected to the internet at all times.

4.3 **The MCTC production screen**

4.3.1 Injection Molding mode

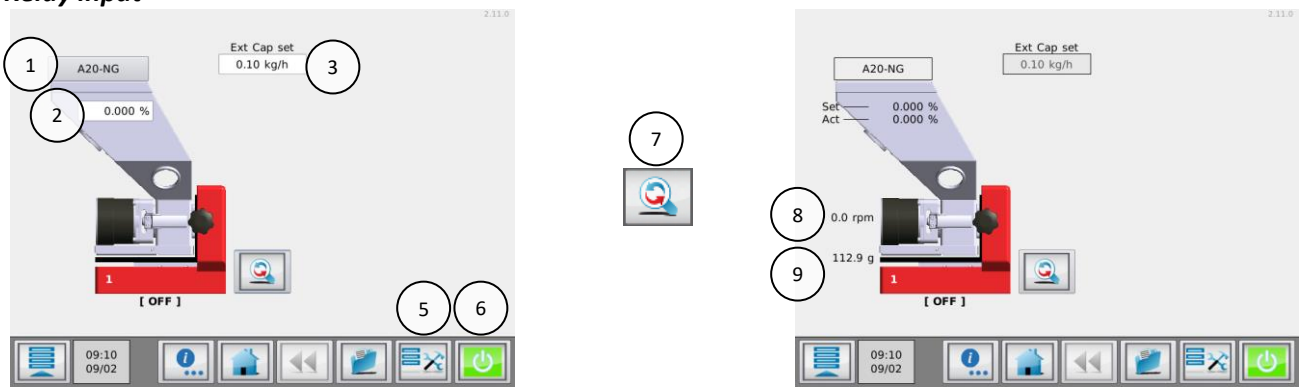




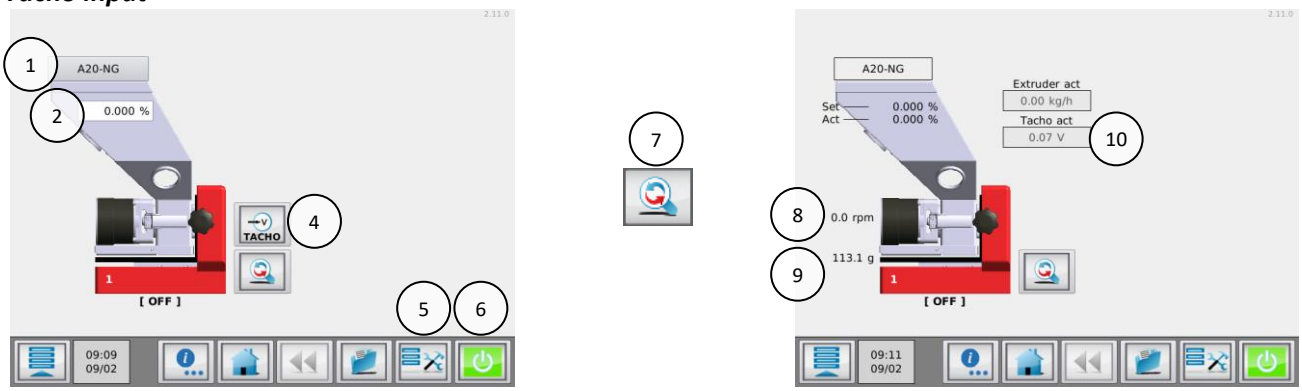
1.	Material selection button. Through this button the material can be stored during production.
2.	Percentage of additive to be dosed in relation to the entered shot weight.
3.	Shot weight of the injection molding machine. Used for calculating the additive to be dosed.
4.	Set dosing time (only visible in INJ – TIMER mode).
5.	Tools menu. In this menu different settings can be made to the system. Check the “MCTC_Manual_General” for more detailed information.
6.	Start/Stop button. When the button is colored green, the system is OFF (safe). In red condition the system is ON.
7.	Toggle button. With this button you can toggle between the normal and the detailed view.
8.	Actual RPM.
9.	Actual Hopper weight.
10.	Actual dosing time. Starting at the set time (4) and counting down to 0 seconds. Only visible in INJ - TIMER mode.

4.3.2 Extrusion mode

Relay input

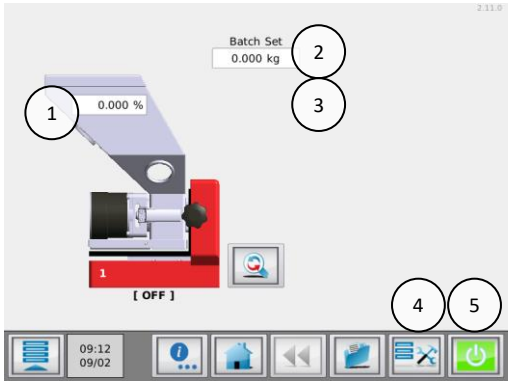


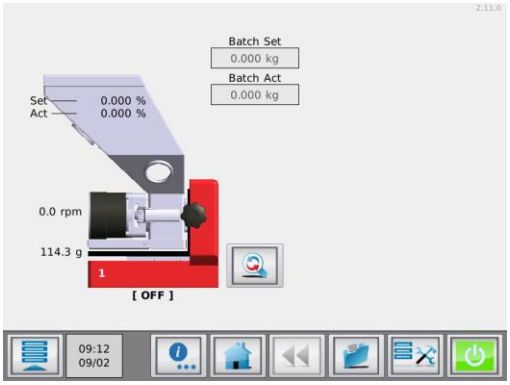
Tacho input



1.	Material selection button. Through this button the material can be stored during production.
2.	Percentage of additive to be dosed in relation to the set extruder capacity.
3.	Capacity of the extruder. Used for calculating the additive to be dosed. To be set by the user when the controller is in EXT – RELAY mode.
4.	Tacho ratio button. Here you can link the applied voltage to a extruder capacity (only in EXT – TACHO mode)
5.	Tools menu. In this menu different settings can be made to the system. Check the “MCTC_Manual_General” for more detailed information.
6.	Start/Stop button. When the button is colored green, the system is OFF (safe). In red condition the system is ON.
7.	Toggle button. With this button you can toggle between the normal and the detailed view.
8.	Actual RPM.
9.	Actual Hopper weight.
10.	Actual tacho voltage.

4.3.3 Batch mode



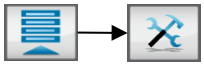


1.	Percentage of additive to be dosed in relation to the set batch weight.
2.	Batch weight
3.	Batch unloading time (only when unloading function is enabled)
4.	Tools menu. In this menu different settings can be made to the system. Check the “MCTC_Manual_General” for more detailed information.
5.	Start/Stop button. When the button is colored green, the system is OFF (safe). In red condition the system is ON.

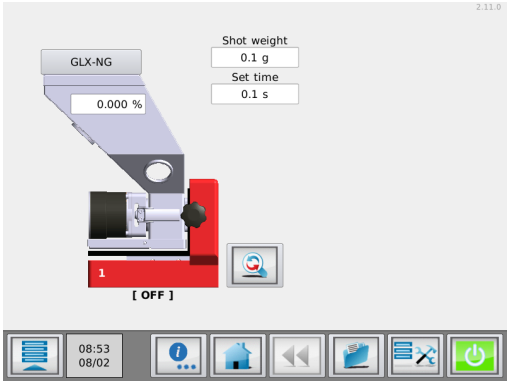
5 MCBalance operation

5.1 **MCBalance component configuration**

When the MCBalance is used for the first time, it needs to be configured. The unit is delivered pre-configured, but some settings need to be altered to the process needs.

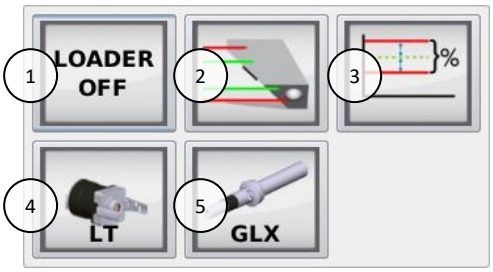


ⓘ In multicomponent setups it can be necessary to use the  button to select the unit which has to be configured.



MCBalance production screen

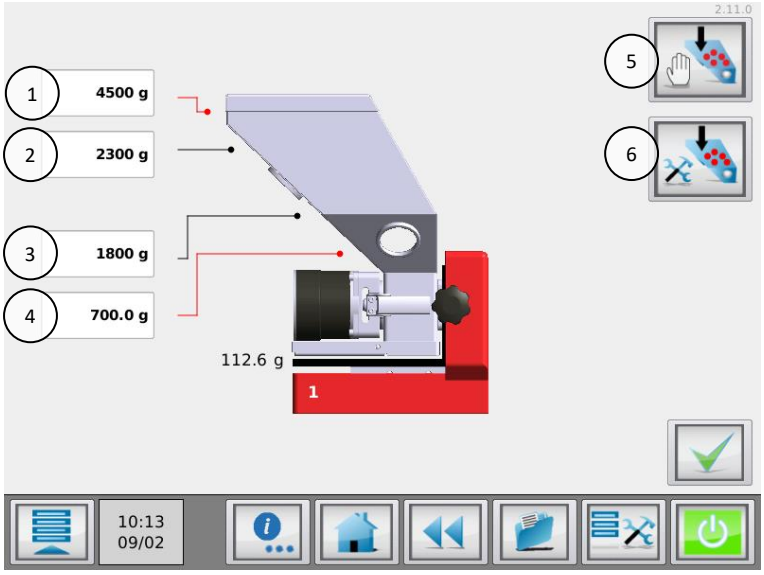
MCBalance settings:



1.	Loader type	LOADER OFF / ME / MV / EX / MFD / 3PH
2.	Hopper levels	See “Hopper level settings”
3.	Tolerance settings	Deviation alarm: 25% Calibration deviation: 5%
4.	Motor type	LT / HT
5.	Dosing tool	HX / GLX / GX / A8 / A15 / A20 / A30

ⓘ Do not select HT motor if LT motor is connected.
ⓘ Highlighted is default setting.

Hopper level settings:



1.	Max fill level (Hi alarm)
2.	Fill stop level
3.	Fill start level
4.	Hopper empty (Low alarm)
5.	Manual fill
6.	Advanced loader settings

To adjust the hopper levels, determine the Max fill level by manual filling the hopper to the maximum hopper level. Recommended settings for the other 3 levels is 75%, 25% and 10% respectively.
To manual fill the hopper, the manual fill button can be used. The EX knife gate valve will be open or the ME/MV system will be activated as long as the button is pressed.
For more detailed information about hopper loading, see chapter MCBalance Loaders.

Advanced loader settings:
When the system is unable to load material the decision can be made to stop the filling cycle after a certain time period and generate an Alarm.

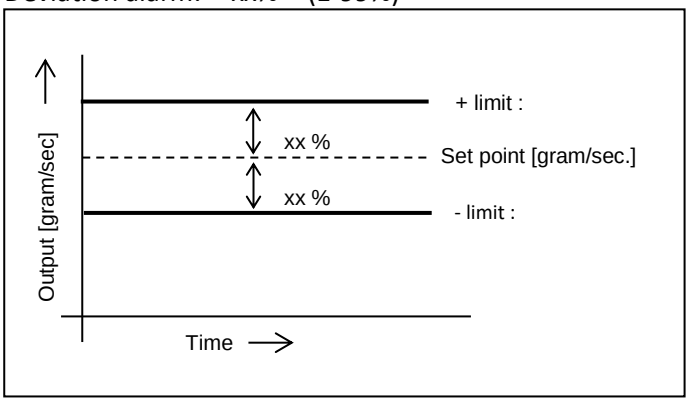
Fill time	Time that MV / MFD will transfer material to the receiver per cycle	20 seconds default, MV and MFD
Empty time	Time that MV / MFD needs for releasing material into the hopper	5 [10] seconds default, MV and MFD
Alarm time	Maximum fill time period	180s default
Fill alarm mode	Continue filling or stop filling	ON = continue fill, OFF = stop fill
Blow back time	Compressed air filter cleaning	3 seconds default, MFD only

Tolerance settings:
Deviation alarm: Threshold for the “Maximum deviation exceeded” message.

The MCBalance automatically adjusts his motor speed to dose at the desired set point. The controller is able to detect and alarm when the set point is not reached within a set percentage. If after the normal performed speed adjustments the set point is not reached, the controller will give an alarm signal and message in the display. This will also switch the warning output on the mainboard.

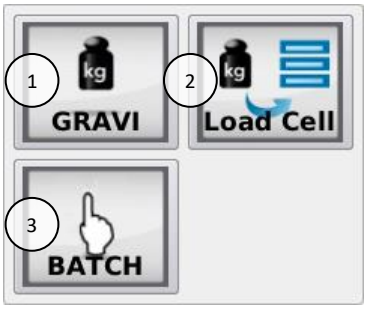
If the set point is not reached within the set percentage this might be caused by:
- Partial or complete blockage by sticky or hard flowing material;
- Inaccurate dosing because material is not uniform in size;
- Disturbance of the weight signal, for example by mechanical blocking of the MCBalance load frame.

Deviation alarm: xx% (1-99%)



Example:
- The Deviation alarm setting in the configuration menu is default set to: 25%;
- The set point is set to: 1,000 gr/sec;
- The maximum limit value will be: 1,250 gr/sec;
- The minimum limit value will be: 0,750 gr/sec.

Calibration deviation:
The maximum allowed deviation from the Calibration set point can be set with this Parameter. (For more information see chapter Material files)



1.	Control mode	GRAVI / VOLU
2.	Load cell menu	
3.	Batch mode settings	Only available when production mode is set to “BATCH

ⓘ highlight is default setting

Control mode (1)

The MCBalance is able to run in Gravimetric mode or in Volumetric mode. In gravimetric mode, the unit will control its motor speed to achieve an accurate/stable output in gr/sec. In Volumetric mode, the user can set the motor speed in the production settings, the motor speed will not automatically be adjusted to achieve an accurate/stable output.
In both Gravimetric and Volumetric mode the automatic filling system can be used.

Load cell menu (2)

In this menu, three options are available:

- Type of load cell (20kg or 50kg)
- Load cell calibration (see paragraph load cell calibration)
- Weight check

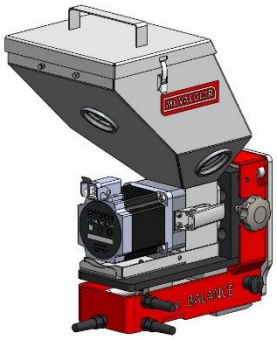
Batch mode menu (3)
ⓘ only available when production mode is set to batch

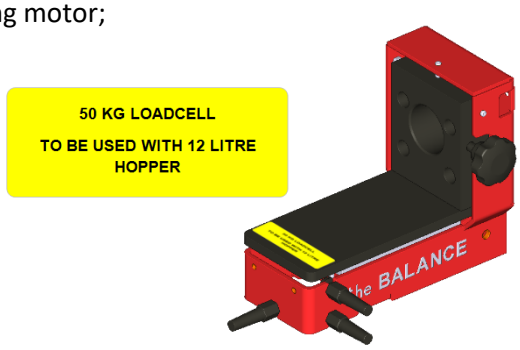
In this menu some settings can be made for the batch mode. For more detailed information about this mode, please check the “MCTC_Manual_General” manual.

5.2 **MCBalance load cell calibration**

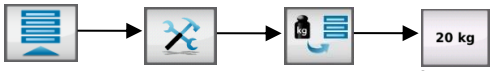
When using a MCBalance for the first time, perform an initial **load cell calibration** as follows:

- The unit must be mounted horizontally (water levelled);
- Avoid vibrations during the load cell calibration. This will influence the calibration;
- Do not touch the unit during load cell calibration;
- When using a slide the whole unit has to be slid in against the neckpiece and fixed;
- When a ME or MV hopper loader is used, be sure it is in place and the tubing is fixed to the tube support and not interfering by any surrounding object;
- The motor connection cable must be connected to the dosing motor;





- Be sure that the MCBalance load cell is connected to the controller;
- Be sure the right load cell type is configured (20 or 50 kg);

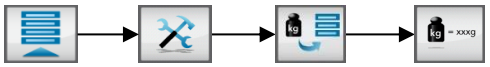


- Start calibrating the load cell of the MCBalance (500gr. calibration weight required);

- Follow the instructions on the screen and place the 500gr. reference weight when instructed;
- After approx. 1 minute the load cell calibration is ready, remove the reference weight when instructed;
- Press confirm to exit the load cell calibration menu screen.

To check if the load cell calibration was OK, the weight check menu will be shown. You can now check the calibration by placing and removing the 500 gr. calibration weight.

- Be sure the hopper is completely empty and the motor connector is connected to the stepper motor;
- To do to the weight check enter the “Component configuration” menu and press the load cell button followed by the weight check button;



- Place 500 gr. calibration weight on the Hopper and check the displayed weight.

ⓘ If the actual weight is not corresponding with the placed weight, perform a new load cell calibration.

5.3 **Material files**

Each material has its own flowing characteristic. This results in a material curve which is used for accurate dosing. During system start, when there is not enough measurement info available, the dosing system uses this curve. The speed of the dosing tool is then adjusted according to the learned curve. Using a pre-calibration results in a faster system start, the system will operate faster within the set specification.

Two different options are available to create material files:

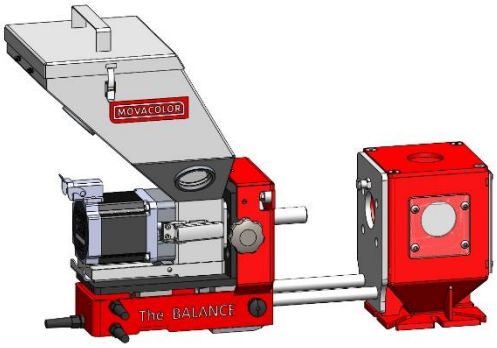
1. *Bulk density input -NEW-*
   Fast, but less accurate than the Offline Material curve learn function.
2. *Offline Material curve learn function*
   Relatively slow, especially with low shot weights, but very accurate.

5.3.1 Bulk density defined material -NEW-

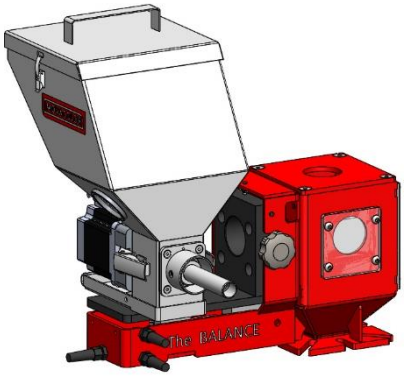
For fast set-up of a new material, it is possible to enter the bulk density for this material. The unit will use this in combination with a default curve to calculate the required speed of the dosing tool. During production, the MCTC will check/adjust the curve so it matches the setpoint. The next time the machine is started it will use the adjusted curve.

5.3.2 Offline Material curve learn function

For a more accurate material file, a material curve learn function is available. To avoid the waste of material, this function can be performed offline.
The pre-calibration can be done in two ways (see below).



1) Unit with option slide frame:
Slide the frame with unit backwards until it “clicks”.



2) Unit without optional slide mechanism:
Take out the dosing unit and put it on the frame like shown.

ⓘ In case of a MCHigh Output, the dosing tube drain can be opened to avoid material waste.

Before starting the material curve learn function, be sure that:

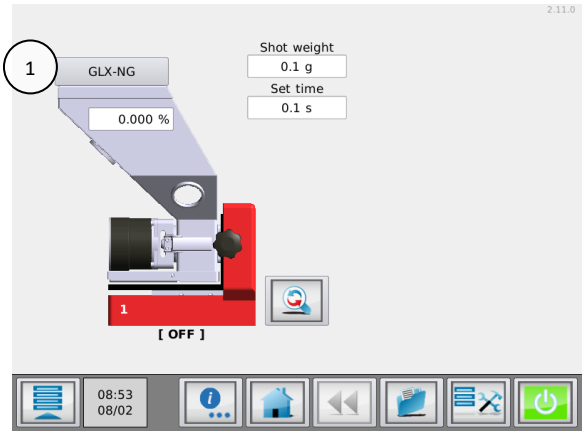
- during calibration the dosing unit is horizontally fixed and also free of vibrations;
- the correct dosing tool is mounted;
- the hopper is filled with sufficient material;
- the load cell cable is connected to the controller;
- the load cell is calibrated;
- the system is in “OFF” mode (green start button);
- user login level is TOOLING or higher.

The following parameters will be stored with a Material calibration, depending on the configuration:

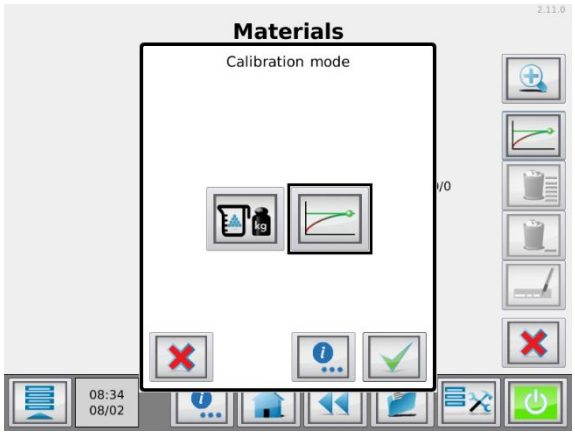
• Configuration parameters:	Cylinder type:	Type of dosing cylinder or feed screw.
	Material Type:	Normal or micro-granules.
• Calibration parameters:	Material name:	Name of calibrated material.
	Calibration results:	Results of the material calibration procedure.

5.3.3 How to start the material curve learn function:

1. Press the material selection button on top of the hopper image (1)



2. Press the material learn button: 
3. Select the desired mode:



 Bulk density mode, follow the steps on screen

 Material curve mode, follow the steps below:

ⓘ Steps below are only for Material curve mode

4. Press the material “name” button and enter a material name.
5. Enter the production settings, recommended is to use the same settings as will be used in the final production.

   For injection molding:
   - the shot weight;
   - the dosing time;
   - dosing percentage.

   For extrusion:
   - extruder capacity (production rate);
   - dosing percentage.

ⓘ The ideal situation is to choose the same settings as used during actual production, however when the output is too high and the learn function cannot be completed within one hopper filling, choose a lower capacity.

6. Press the start button
7. You will be asked to check:
   - if the motor is connected;
   - the hopper is filled ;
   - if you want to prime the dosing tool, confirm the question.
8. The learning will take minimal about 3 minutes but can take more time depending on the used material and production parameters.
   It is possible to stop during the learning (for example to refill the hopper). When “Stop & Save” is selected the learning will pause. There are 3 options:

    = Stop learning and save the collected data.

    = Stop learning without saving.

    = Continue with learning.

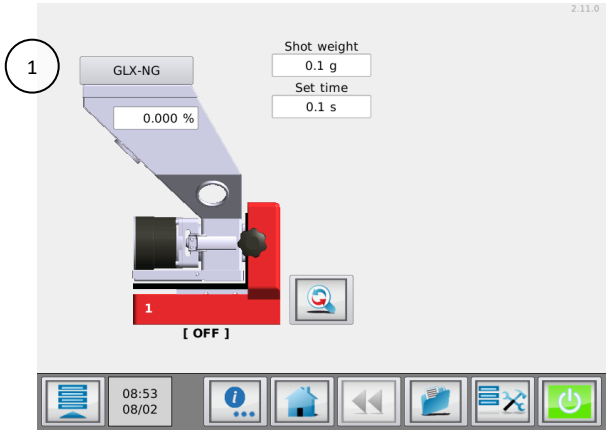
9. The unit will execute the calibration procedure, the procedure will stop when the dosing is within the calibration deviation range (default 5%). The material curve will be stored and is automatically selected for the current component.

During the calibration the unit is regulating to its set point. When this point is reached the calibration will be saved automatically. On the basis of this point a complete curve is made on bases of default pre-programmed curves.

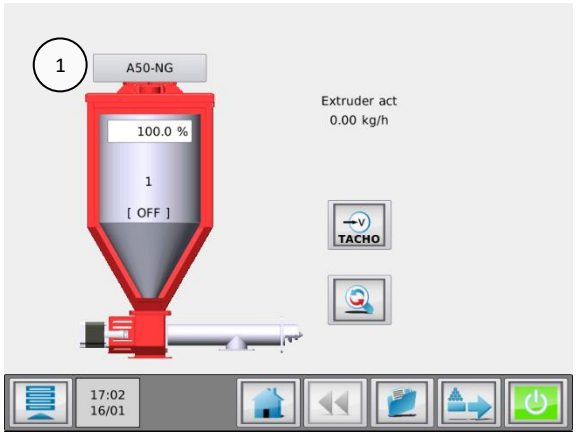
5.3.4 Selecting a learned material curve

When more material curve calibrations have been made, a curve can be loaded to the device. To do this:

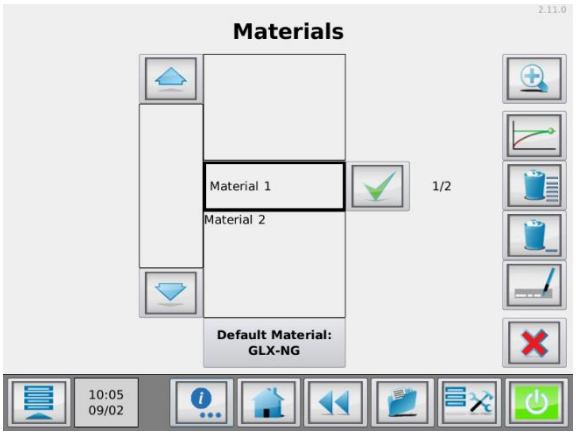
- In a multi component setup, select from the home screen the component to load the material on;
- Press the material selection button;
- Select with the up and down buttons the required material name and confirm, you will be prompted when the wrong dosing tool is configured.



1. MCBalance material selection button.



1. MCHigh Output material selection button.



When there is a long list of stored materials, it can be time consuming to find the material. It is possible to search in the list of materials by using the search button. You can enter part of the material name you need to search for. Example; you need to load the material named “pp-color-145”. When you enter “pp” in the search field, al material names containing “pp” will be displayed in the list.

Deleting materials can be done by selecting it from the material list followed by the delete selected button.

Delete all materials can be done by pressing the delete all button.

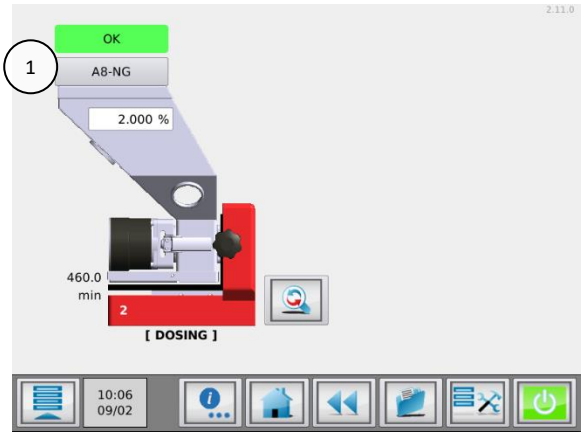
Renaming materials can be done by selecting it from the material list followed by the rename selected button.

To go back to the production menu without selecting a material from the list press the cancel button.

The standard Movacolor curve can be selected by pressing the **“default material”** button located below the material list.

5.3.5 Save data function

This function allows to store the actual data during production. A material description needs to be entered to save this data. A material file on basis of the actual data will be saved in the memory of the controller under the entered name.



Press on the curve description (1) when the unit is activated. The “SAVE MATERIAL” popup appears.

Enter a material description (max. 10 positions) and press  to store the actual material curve.

5.3.6 LEARN / OK indicator

During operation the indicator above the material hopper will display LEARN or OK. During startup of production without using a pre-learned curve (see previous paragraphs) the indicator will show LEARN. This means the set motor RPM is calculated according to the default Movacolor material curves, which might not correspond to the used material bulk density.
When starting production with a pre-learned curve, the motor RPM is calculated with this user defined material curve, which should correspond with the used material bulk density. The indicator will show OK immediately.

5.4 **MCBalance maintenance**

To keep the MCBalance functioning correctly, it is advised to perform regular maintenance.

Always switch off the control cabinet and disconnect the mains power plug from electrical power before performing maintenance.

Always disconnect the main compressed air connection before performing maintenance.

Weekly

- Clean the dosing tool (cylinder or auger) for proper operation;
- Check dosing tool (cylinder or auger) for wear out. The rubber coupling of a dosing cylinder is a typical wear out part;
- Check the dosing cylinder bearing for smooth rotating;
- Clean the dust filter of the ME/MV loader system. This can be done by taking out the filter and clean it with compressed air.

Monthly

- Perform a weight check as described in the load cell calibration chapter;
- Check the motor seal for abnormal wear out;
- Replace the filter of the ME system.

Yearly

- Perform a load cell calibration as described in the load cell calibration chapter.

6 Loaders

6.1 **ME Loader**

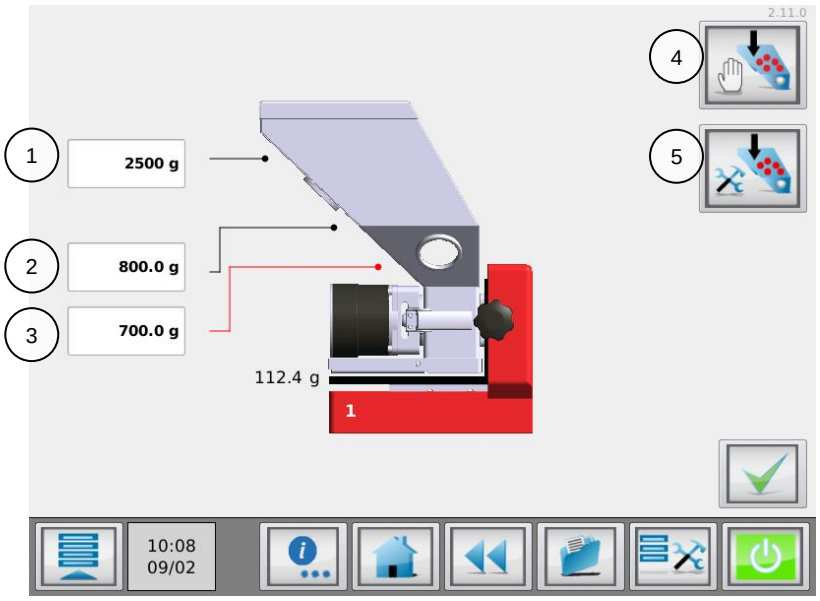
6.1.1 Introduction

The ME system blows the material from the bag, drum or container into the hopper of the dosing unit. The hopper lid of the housing has a simple and easy-to-clean dust filter to keep any dust particles in the hopper.

In gravimetric systems, the loader is triggered by the hopper loader start level weight. The low level weight parameter generates a low-level alarm if the hopper is empty.

6.1.2 ME hopper loader settings

On the MCTC the loader settings can be changed in the Loader Settings menu.



High Level (1)
Filling stops when the hopper weight reaches this level.

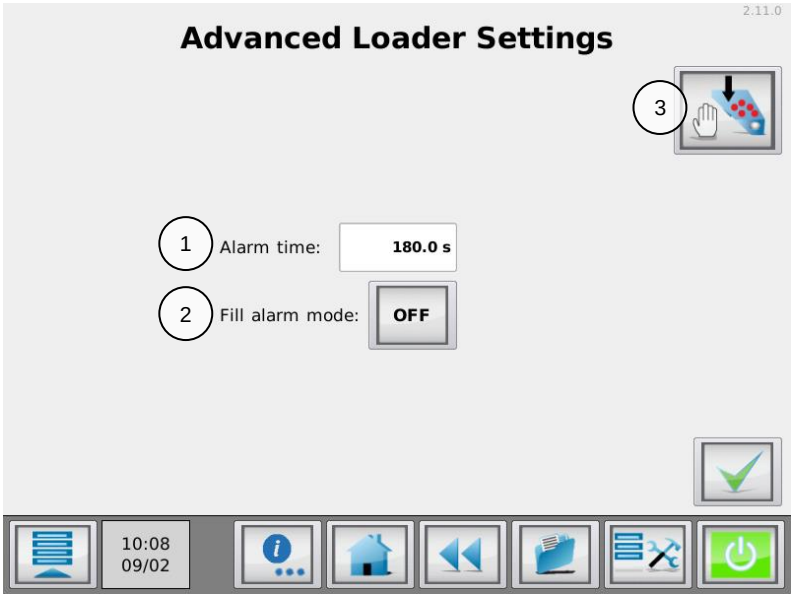
Hopper loader start level (2)
Filling starts when the hopper weight gets below this level.

Empty level (3)
When the hopper weight drops below this level, an empty level event is generated.

Manual fill (4)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ *Manual fill is only enabled when the MCTC is not running.*

Advanced loader settings (5)
This button opens the advanced loader level menu.

6.1.3 Advanced loader settings



Alarm time (1)
If the hopper weight is not above the High level within this time, the alarm starts. The alarm time cannot be set lower than the fill time.

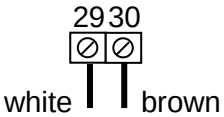
Alarm mode (2)
The 'Fill alarm mode' is used to set the loader 'ON' or 'OFF' if a fill alarm occurs. When this mode is set to 'OFF', the loader will turn off when an alarm occurs.

Manual fill (3)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

Recommended settings for ME hopper loader:
- Use for the filling start weight a level like shown in the filling start figure above, when using a to high weight level the amount of filling cycles will increase;
- Use a fill stop weight so that the material covers at least the sight glass in the back of the hopper;
- Overfilling of the hopper should be avoided.

6.1.4 ME Loader electrical connection

The ME uses the valve output of the MCTC/BC



6.1.5 Compressed air requirements
The ME loader system is driven by low-pressure compressed air and mounted directly on top of the hopper lid of the Movacolor dosing unit. The MCTC controls the operation of the ME loading system.

Air pressure:	4 – 8 Bar
Air consumption:	0,25 – 0,68 m^3/min
Remarks:	Clean dry air, non-lubricated

6.1.6 Maintenance
All parts are aluminum or stainless steel and are virtually maintenance-free. Only the filter needs to be cleaned periodically. To increase reliability and safety, there are no moving parts.

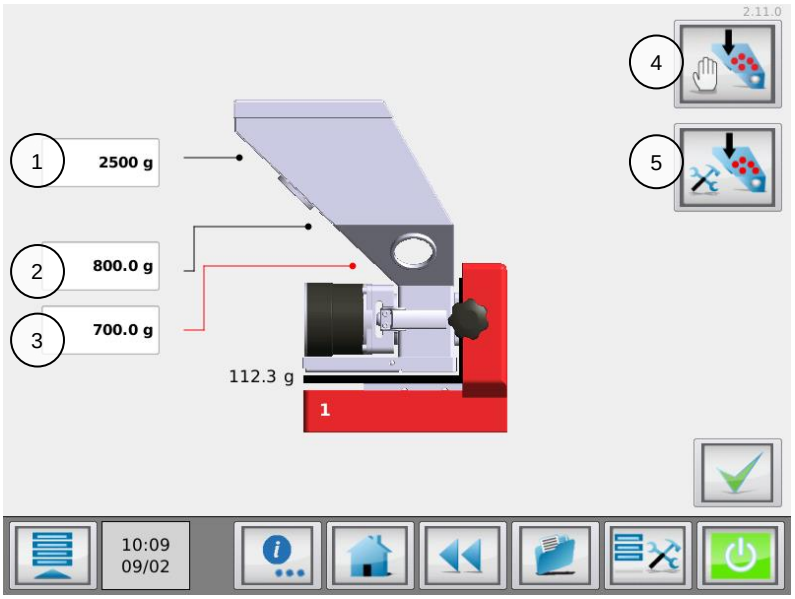
6.2 **MV Loader**

6.2.1 Introduction

The MV system uses a 3-stage vacuum generator driven by compressed air to create a vacuum that draws material into a chamber that closes. Once the chamber is filled with material, the cone that closes the chamber will open and the material will be discharged into the hopper.
The system is equipped with a superior filter to ensure that the finest particles (> 5micron) stay in the system and are not released into the atmosphere. This makes the MV system the most practical and user-friendly system for both powders and granules.

6.2.2 MV hopper loader settings

On the MCTC the loader settings can be changed in the Loader Settings menu.



High level (1)
Filling stops when the hopper weight reaches this level.

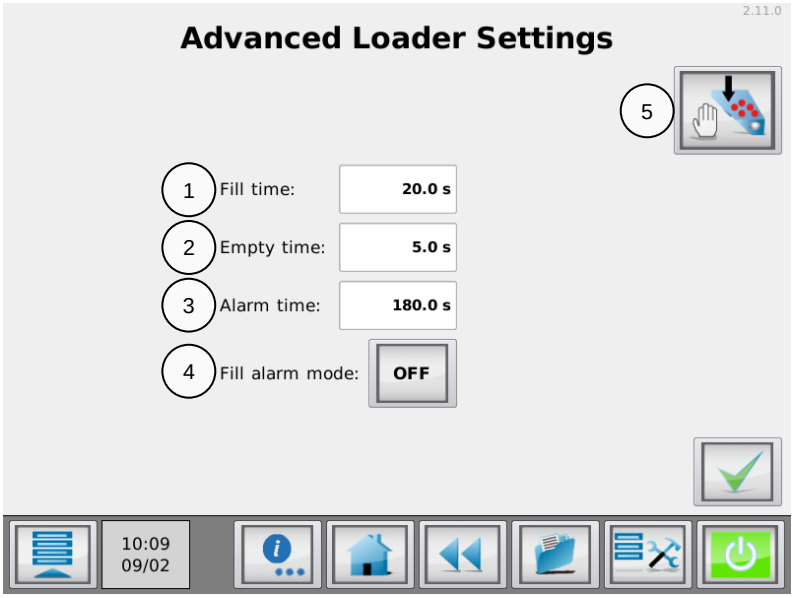
Hopper loader start level (2)
Filling starts when the hopper weight gets below this level.

Empty level (3)
When the hopper weight drops below this level, an empty level event is generated.

Manual fill (4)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

Advanced loader settings (5)
This button opens the advanced loader level menu.

6.2.3 Advanced loader settings



Fill time (1)
During this time the MV system sucks material into the vacuum chamber.

Empty time (2)
during this time the cone that closes the chamber will open and material falls down into the hopper of the dosing unit.

Alarm time (3)
if the hopper weight is not above the High level within this time, the alarm starts. The alarm time cannot be set lower than the fill time.

Alarm mode (4)
The 'Fill alarm mode' is used to set the loader 'ON' or 'OFF' if a fill alarm occurs. When this mode is set to 'OFF', the loader will turn off when an alarm occurs.

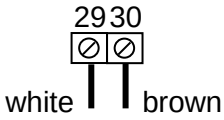
Manual fill (5)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

Recommended settings for MV hopper loader

- Use for the filling start weight a level like shown in the filling start figure above, when using a too high weight level the amount of fill cycles will increase;
- Use a fill-time so that the vacuum chamber of the MV-Loader is filled almost completely.
- Overfilling of the vacuum chamber should be avoided;
- Use for the empty time not a longer time than necessary. A empty time that is too short can cause decrease of the capacity of the MV-hopper loader;
- Use a fill stop weight so that the material covers at least the sight glass in the back of the hopper. Overfilling of the hopper should be avoided.

6.2.4 MV electrical connection

The MV uses the valve output of the MCTC/BC



6.2.5 Compressed air requirements

The MV loader system is driven by low-pressure compressed air and mounted directly on top of the hopper lid of the Movacolor dosing unit. The MCTC controls the operation of the MV loading system.

Air pressure:	4 – 8 Bar
Air consumption:	0,25 – 0,68 m^3/min
Remarks:	Clean dry air, non-lubricated

6.2.6 Maintenance

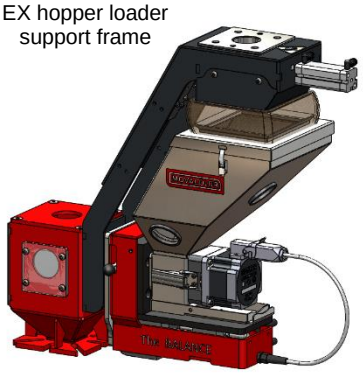
All parts are aluminum or stainless steel and are virtually maintenance-free. Only the filter needs to be cleaned periodically. To increase reliability and safety, there are no moving parts except for the pneumatic operated closing valve of the MV system.

6.3 **EX Loader (SFG)**

6.3.1 Introduction

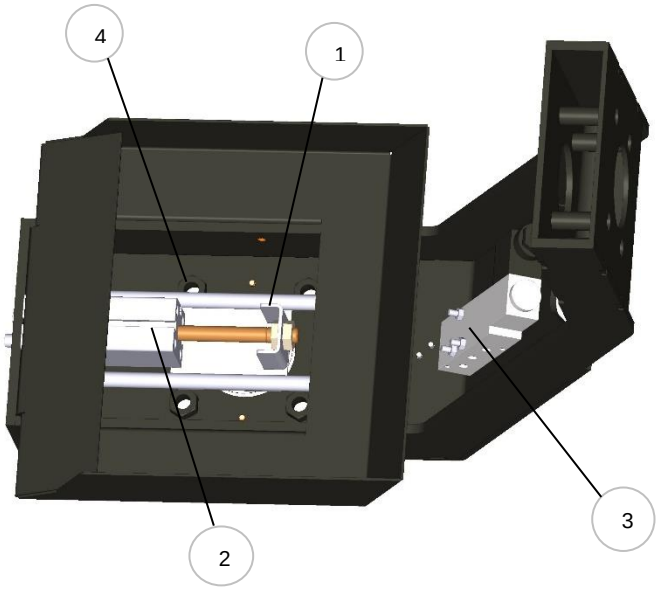
The function of the support frame is to use a foreign hopper loader in combination with the MC-Balance. The support frame is equipped with a knife gate valve for filling the hopper. The valve is normally closed. If the filling start level is reached (default 800gr.) the valve opens and the hopper is filled until the EX-H level (default 2500gr.). Then the valve will close automatically, so the support frame works independently from the hopper loader. If for some reason the weight reaches the EX-HH level a warning will be given. This can happen if for example the valve doesn't close.

EX hopper loader support frame



⚠ Do not take the dosing unit away before the compressed air of the valve is disconnected and press **STOP** on the controller to disable the valve because the knife gate valve can move!

ⓘ It could be necessary to use an customer specific intermediate plate between the hopper loader and the support frame to make a good fit.

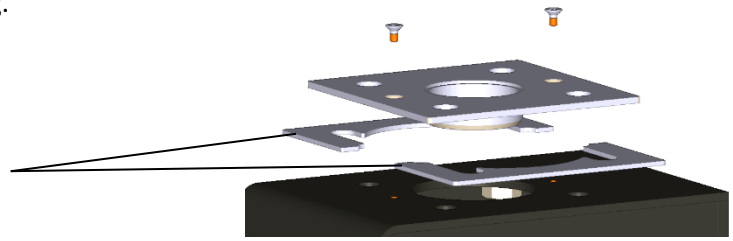


1	Knife gate valve
2	Cylinder for open/close the valve
3	Solenoid valve
4	Connection Nuts (M10) for hopper loader mounting

Material inlet distance ring

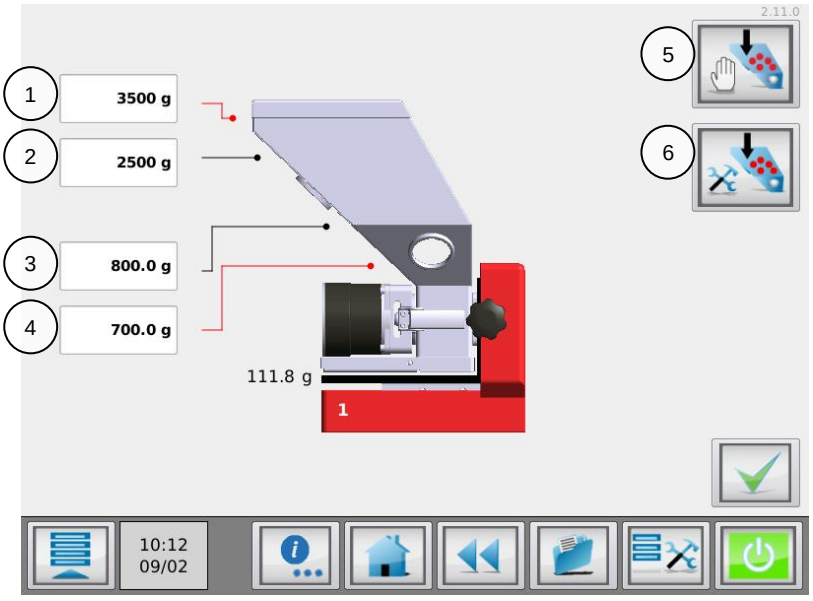
In case the EX frame is used for free flowing powder or micro granules (ø < 1mm) it is recommended to remove the material inlet ring.

Material inlet distance ring



6.3.2 EX hopper loader settings

On the MCTC the loader settings can be changed in the Loader Settings menu.



High High Level (1)

The Highest level. If this level is reached a “High High level” event appears.

High level (2)

The level where the knife gate valve will be closed after a filling cycle.

Hopper loader start level (3)

Filling starts when the hopper weight gets below this level.

Empty level (4)

When the hopper weight drops below this level, an empty level event is generated.

Manual fill (5)

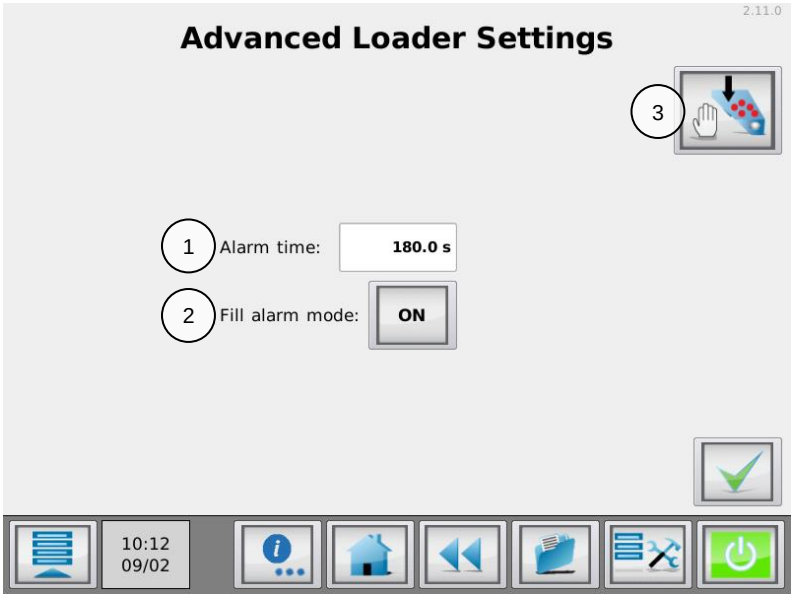
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.

ⓘ *Manual fill is only enabled when the MCTC is not running.*

Advanced loader settings (6)

This button opens the advanced loader level menu.

6.3.3 Advanced loader settings



Alarm time (1)
if the hopper weight is not above the High level within this time, the alarm starts. The alarm time cannot be set lower than the fill time.

Alarm mode (2)
The 'Fill alarm mode' is used to set the loader 'ON' or 'OFF' if a fill alarm occurs. When this mode is set to 'OFF', the loader will turn off when an alarm occurs.

Manual fill (3)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

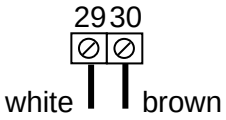
Recommended settings for EX hopper loader (support frame):

- The Volume of the hopper is 6 litres. To set the EX-H level (stop filling). It is recommended to take a safety margin to prevent the hopper of overfilling.
  EX-H (gr.) = 5 (litre) x bulk density (gr./litre).
  For example: If the bulk density = 700 gr./litre, the EX-H should be set to 700 x 5 = 3500 gr.;
- The EX-HH (gr.) should be set higher, recommended 700 x 6 = 4200 gr.;

Overfilling of the hopper should be avoided because it influences the measurement.

6.3.4 EX electrical connection

The EX uses the valve output of the MCTC/BC



6.3.5 Compressed air requirements

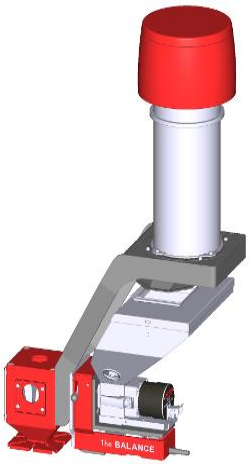
The EX loader system is driven by low-pressure compressed air. The MCTC controls the operation of the EX loading system.

Air pressure:	4 – 6 Bar
Air consumption:	n/a
Remarks:	Clean dry air, non-lubricated

6.3.6 Maintenance

All parts are aluminum or stainless steel and are virtually maintenance-free. Only the filter needs to be cleaned periodically. To increase reliability and safety, there are no moving parts except for the pneumatic operated knife gate of the EX system.

6.4 **MFD Loader (SFS)**

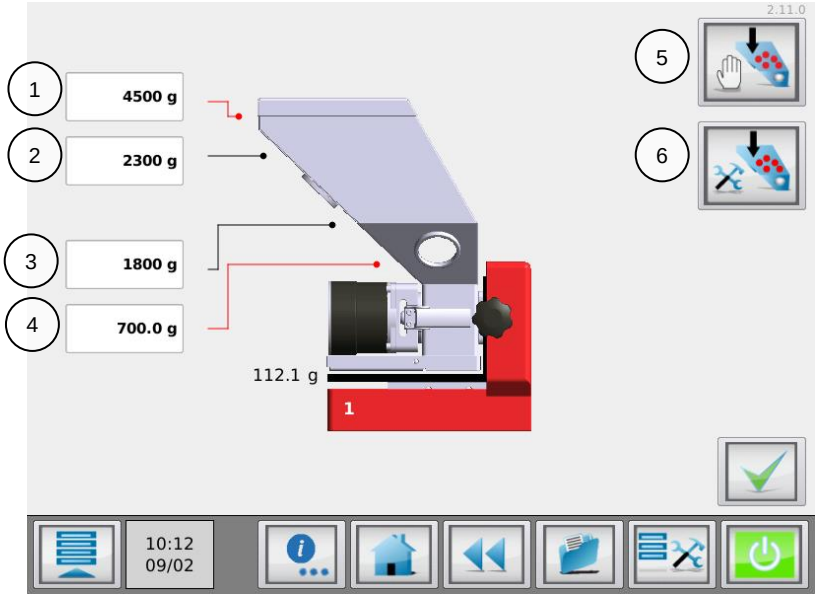


6.4.1 Introduction

The function of the MFD loader in combination with the MC-Balance. The MFD loader needs to be installed on a Simplified Support Frame (SFS). A SFS support frame is not equipped with a knife gate, the MFD loader dumps directly into the MCBalance hopper (12 liter). If the filling start level is reached (default 1800gr.) the motor is started to transfer material into the loader receiver. The motor will run for a period of time (default 20s). After dumping the material the compressed air filter cleaning option is activated. If the loader was not able to load sufficient material to reach the high level (default 2300gr.) the loader sequence will be repeated.

ⓘ The compressed air filter cleaning is optional.

6.4.2 MFD Loader settings



High High Level (1)
The Highest level. If this level is reached a “High High level” event appears.

High level (2)
The level where the knife gate valve will be closed after a filling cycle.

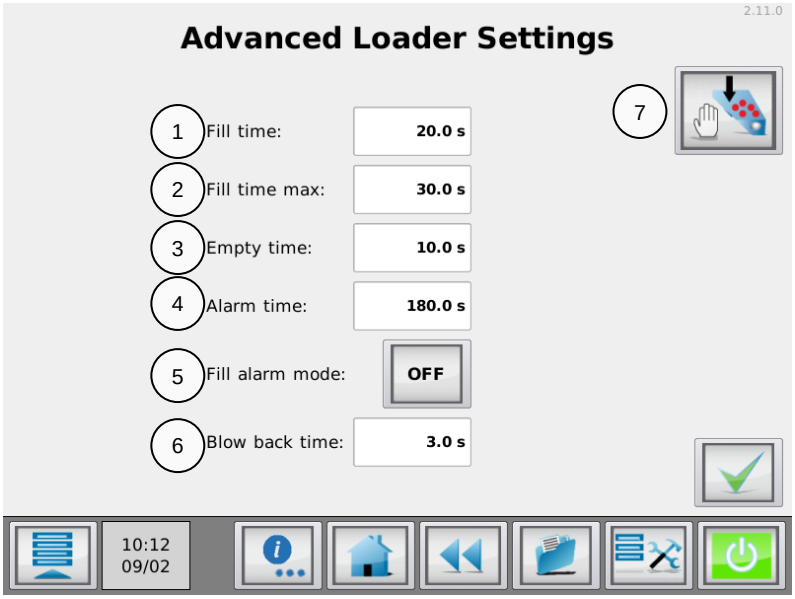
Hopper loader start level (3)
Filling starts when the hopper weight gets below this level.

Empty level (4)
When the hopper weight drops below this level, an empty level event is generated.

Manual fill (5)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

Advanced loader settings (6)
This button opens the advanced loader level menu.

6.4.3 Advanced loader settings



Fill time (1)
During this time the MV system sucks material into the vacuum chamber.

Fill time max (2)

Empty time (3)
The time the material has to fall from the loader into the hopper before another load cycle is started.

Alarm time (4)
if the hopper weight is not above the High level within this time, the alarm starts. The alarm time cannot be set lower than the fill time.

Fill alarm mode (5)
The 'Fill alarm mode' is used to set the loader 'ON' or 'OFF' if a fill alarm occurs. When this mode is set to 'OFF', the loader will turn off when an alarm occurs.

Blow back time (6)
After the last loading sequence the optional compressed air filter cleaning is activated for a period.

Manual fill (7)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

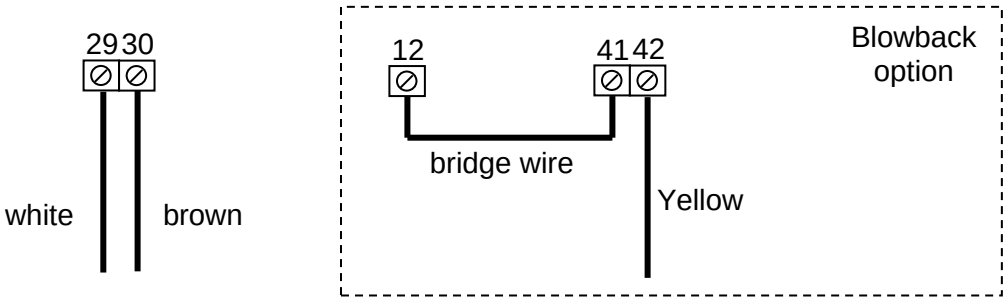
Recommended settings for MFD hopper loader:

- The Volume of the hopper is 12 litres. To set the MFD-H level (stop filling). It is recommended to take a safety margin to stop the loader preventing unnecessary additional loading sequences and to prevent the hopper of overfilling;
- MFD-H (gr.) = MFD-L + (7 (liter) x bulk density (gr./liter))/10;
- For example: If the bulk density = 700 gr./liter, the MFD-H should be set to 1800 + (7 x700)/10 = 2300gr;
- The MFD-HH (gr.) should be set higher, recommended 700 x 7 = ~4500 gr;
- Overfilling of the hopper should be avoided because it influences the measurement;
- Use fill-time so that the hopperloader receiver is almost completely filled.

⚠ The fill time should not be excessive long, this can damage the MFD motor

- For the empty time not a longer time than necessary to dump the material in the hopper;
- Use a blow-back time that is sufficient to clean out the internal filter.

6.4.4 MFD electrical connection



6.4.5 Maintenance

Maintenance of Filter
The filter placed between motor and hopper needs to be checked, and possibly cleaned by with compressed air - as a minimum once per 24 operation hours.

The filter must be replaced immediately if it is damaged.

The filter is cleaned/replaced by opening the snap lock above the control and tilt the motor frame into open position. The filter is hereby available.

⚠ Make sure no granules or dust can get into the motor of the MFD.

Maintenance of motor for blower
The motor carbon brushes should be examined after 500 hours of operation, and if necessary be replaced.

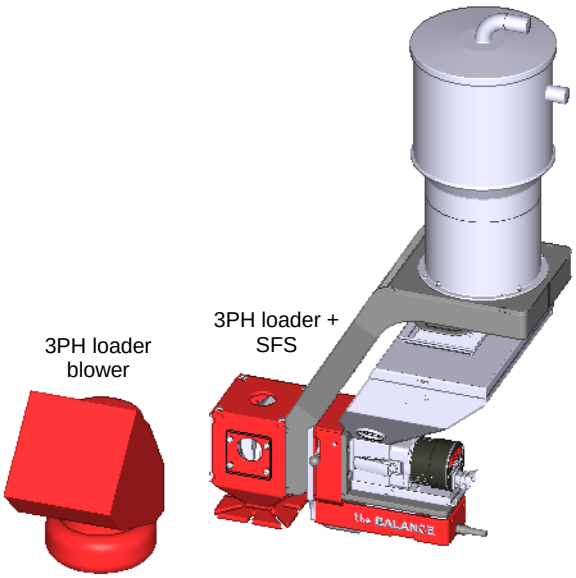
6.5 **3PH Loader (SFS)**

ⓘ A separate extended manual fort the 3PH loader is available.

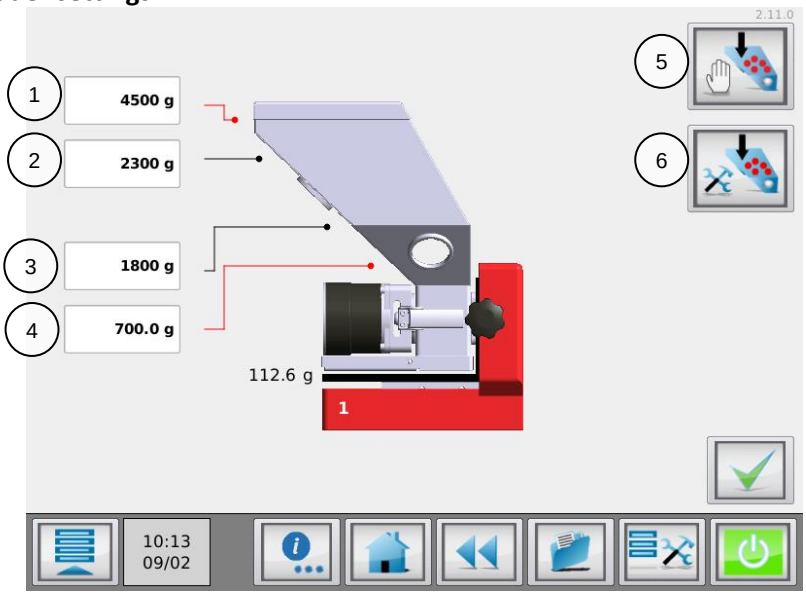
6.5.1 Introduction

The 3PH loader uses a separate blower motor and a separate receiver mounted on the simplified support frame (SFS).
A SFS support frame is not equipped with a knife gate, the 3PH loader dumps directly into the MCBalance hopper (12 liter)
If the filling start level is reached (default 1800gr.) the 3PH loading sequence is started to transfer material into the loader receiver. The motor will run for a period of time, to be set in the blower configuration using the blower control panel. When the loader was not able to load sufficient material to reach the high level (default 2300gr.) a new loading sequence will be initiated.

ⓘ When a third party loader is mounted on a simplified support frame, the options 3PH or MV can be used to configure/control the loader. The magnetic level sensor valve of the loader receiver needs to overruled by using OUT-3 potential free relay of the MCTC/BC



6.5.2 3PH hopper loader settings



High High Level (1)
The Highest level. If this level is reached a “High High level” event appears.

High level (2)
The level where filling cycle will stop.

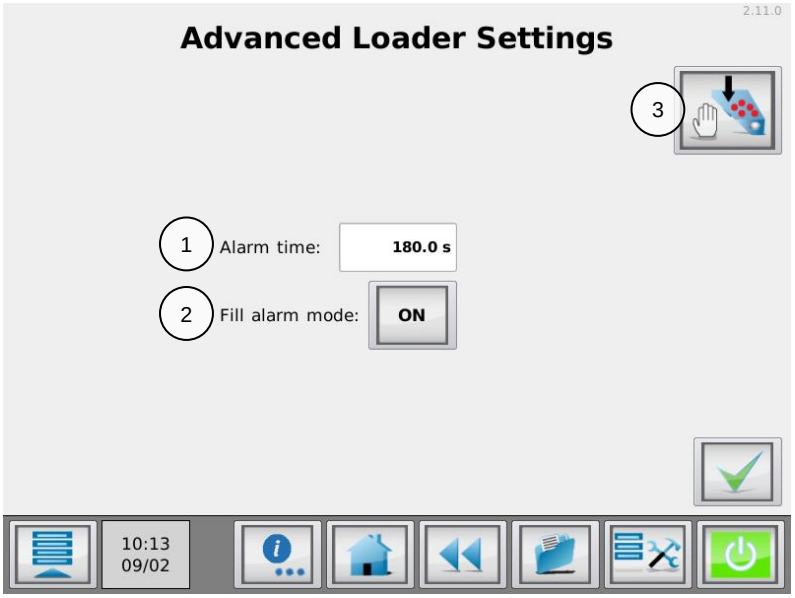
Hopper loader start level (3)
Filling starts when the hopper weight gets below this level.

Empty level (4)
When the hopper weight drops below this level, an empty level event is generated.

Manual fill (5)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

Advanced loader settings (6)
This button opens the advanced loader level menu.

6.5.3 Advanced loader settings



Alarm time (1)
if the hopper weight is not above the High level within this time, the alarm starts. The alarm time cannot be set lower than the fill time.

Alarm mode (2)
The 'Fill alarm mode' is used to set the loader 'ON' or 'OFF' if a fill alarm occurs. When this mode is set to 'OFF', the loader will turn off when an alarm occurs.

Manual fill (3)
This button can be used to fill the hopper manually. As long as the button is pressed, the loader will fill the hopper.
ⓘ*Manual fill is only enabled when the MCTC is not running.*

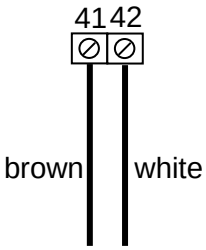
Recommended settings for 3PH hopper loader:

- The Volume of the hopper is 12 litres. To set the 3PH-H level (stop filling). It is recommended to take a safety margin to stop the loader preventing unnecessary additional loading sequences and to prevent the hopper of overfilling;
- 3PH-H (gr.) = 3PH-L + (7 (liter) x bulk density (gr./liter))/10 - safety margin;
- The 3PH-HH (gr.) should be set higher, recommended 700 x 7 = ~4500 gr;
- Overfilling of the hopper should be avoided because it influences the measurement.

6.5.4 3PH electrical connections

The 3PH loader comes with a separate valve cable. Prepare the right length of this cable (from MCTC/BC controller to the Hopper loader control box).

- Connect the brown and white wire to connection block 10-11 of the hopper loader control;
- Close the 3PH hopper loader control box;
- Connect the other side of the Movacolor valve cable to the valve output (OUT3) of the MCTC/BC.



6.5.5 Maintenance

Refer to the extended 3PH manual for maintenance routines.

7 Outputs

For the location of the output connections, see Electrical connections

Alarm / Warning Output
Connection **27** and **28**.

Warning event: this output is on (24V), the system continues running).
Alarm event: this output is on (24V), the system **stops** running.

Free programmable events can be programmed to an **Alarm** or **Warning**. See chapter: Events.

Valve Output
Connection **29** and **30**. This output is on (24V) to start the hopper loader or open the knife gate.

Alarm Output (OUT-1)
Normally open contact, connection **32** and **33.**
Normally closed contact, connection **32** and **34.**

Alarm event: this output is activated, the systems stops running.

Run Output (OUT-2)
Normally open contact, connection **35** and **36.**

The "RUN signal" can be used as a Start/Stop condition for the molding machine.
For example: Molding machine can only start in case dosing unit is also started.
Default the Run output 2 (OUT-2) is always on in production mode (status Dosing or Standby)

Production status = STANDBY or DOSING → output **35** and **36** is CLOSED.

Production status = OFF → output **35** and **36** is OPEN.

ⓘ In case of alarm, the alarm output (OUT-1) is switched and the system is stopped. This also switches output OUT-2.

AUX Output (OUT-3)
Normally open contact, connection **41** and **42**.

Function of OUT-3 depends on loader configuration.

Loader	Function	Action
ME	No action	No Action
MV	No action (can be used for 3rd party loader)	41 – 42 output CLOSED during fill time
EX	No action	No Action
3PH	Activation of blower loading sequence	41 – 42 output CLOSED during filling
MFD	Activation of compressed air filter cleaning	41 – 42 output CLOSED during blowback time

APPENDIX A: MCTC Technical Specifications

Controls:

Input:	Set and actual % setting for injection molding and extrusion
Extrusion control:	By relay or tacho
Injection molding control:	Automatic metering time synchronization or by manual timer
Manual speed and time setting	Speed: Manual setting from 0,1 to 200 RPM max, in increments of 0,1 RPM. Time: Manual settings from 0,1 to 999 sec in increments of 0,1 sec.
Security:	3 user levels with automatic logout
Loader system:	Integrated hopper loader controller
Recipes:	Up to 1000 materials and up to 1000 recipes can be stored.

Monitoring/System Information/External communication

External Communication:	PC link using TCP/IP internet protocol Modbus TCP/IP Optional: Profibus DP slave, Profinet slave, Analog output
Alarm:	2 user alarm levels

Specifications/Standards & Directives/ Technical data:

Power supply:	Operating power from 95 VAC to 250 VAC, 50 and 60 Hz by integrated automatic voltage selector
Power consumption:	150 Watt maximum
Stepper motor:	(1,8degr/step) max 2A or 4A(high output) at 48 Volt.
Operating Temperature:	-20 to +70 degrees Celsius.
Load cell and electronics:	20 bits A/D resolution with a full digital filtering
Battery:	Used for date/time. Lifetime without mains power approx. 5 years. Type: CR2354

Input signal(s):

Injection molding:	Start/Stop trigger input, potential free or 24VDC*
Extrusion:	Start/Stop trigger input, potential free or 24VDC* Tacho input 0..30VDC
* Note potential contact	
Guaranteed OFF:	0-8VDC
Guaranteed ON:	18-30VDC

Output(s):

- -Stepper motor max. output 2A or 4A(high torque) at 48VDC
- -Solid state 24VDC/0.5 A output for valve hopper loader*
- -Solid state 24VDC/0.5 A output for external warning*
- -Relay for alarm level (max. 230Vac/30Vdc, 5A)
- -Relay for running contact (max. 230Vac/30Vdc, 5A)

* Maximum total output power: 12 Watt (Valve output + alarm output)

Standard Directives:
Protection class: IP-50
According to CE standards

Safety
In case of overload due to short-circuit or incorrect connection, the power supply automatically shuts down.
Opto-insulated start input for connection to production machine.

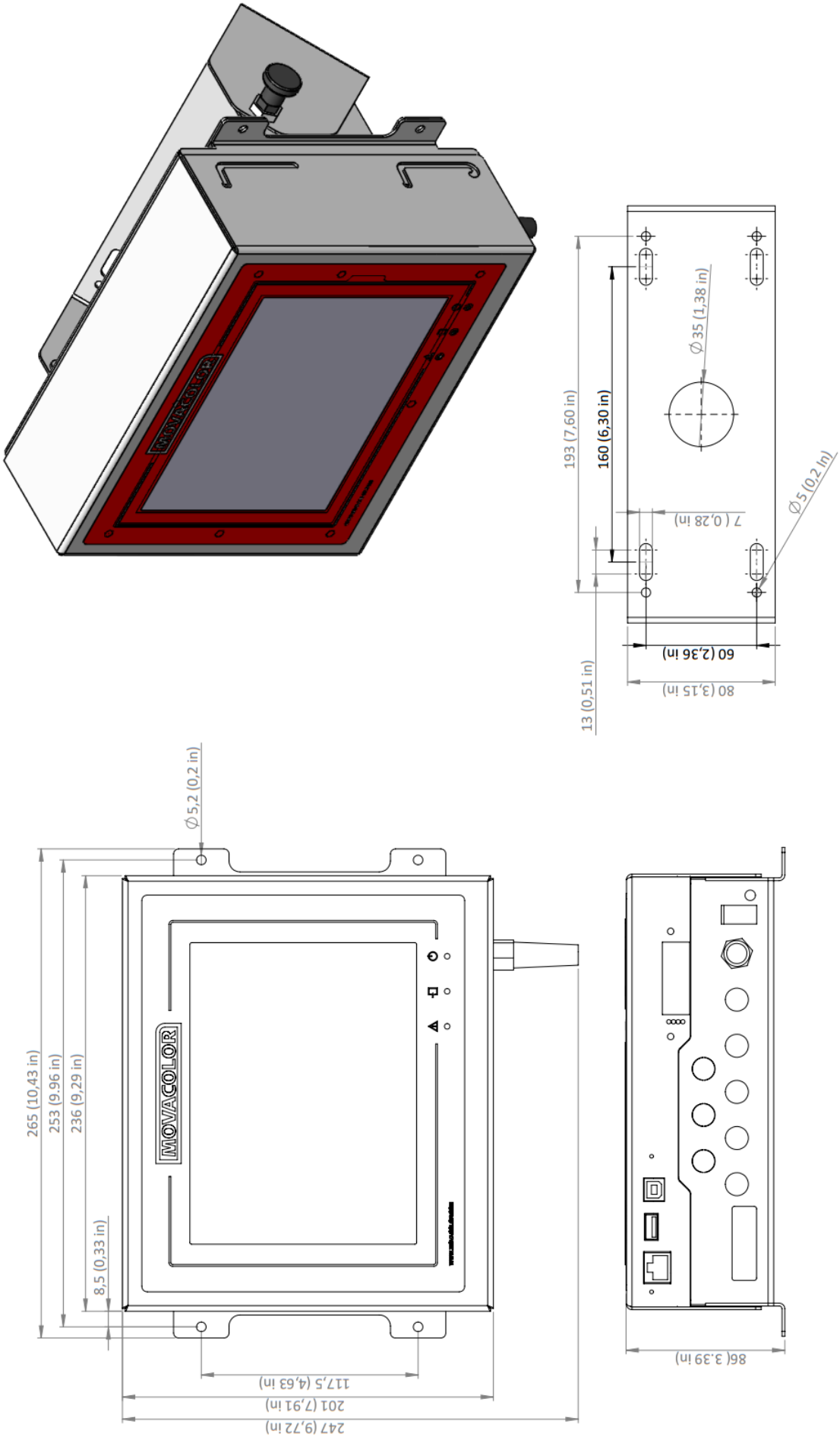
Optional parts
External Alarm Flash light.
External Alarm Siren.
Profibus DP slave module
Profinet module
Analog output module

MCBalance
Machine connection flange:
Standard flange NST40-neckpiece with cleaning opening.
Inlet/outlet ø50mm/ø40mm, steel epoxy coated RAL 3002

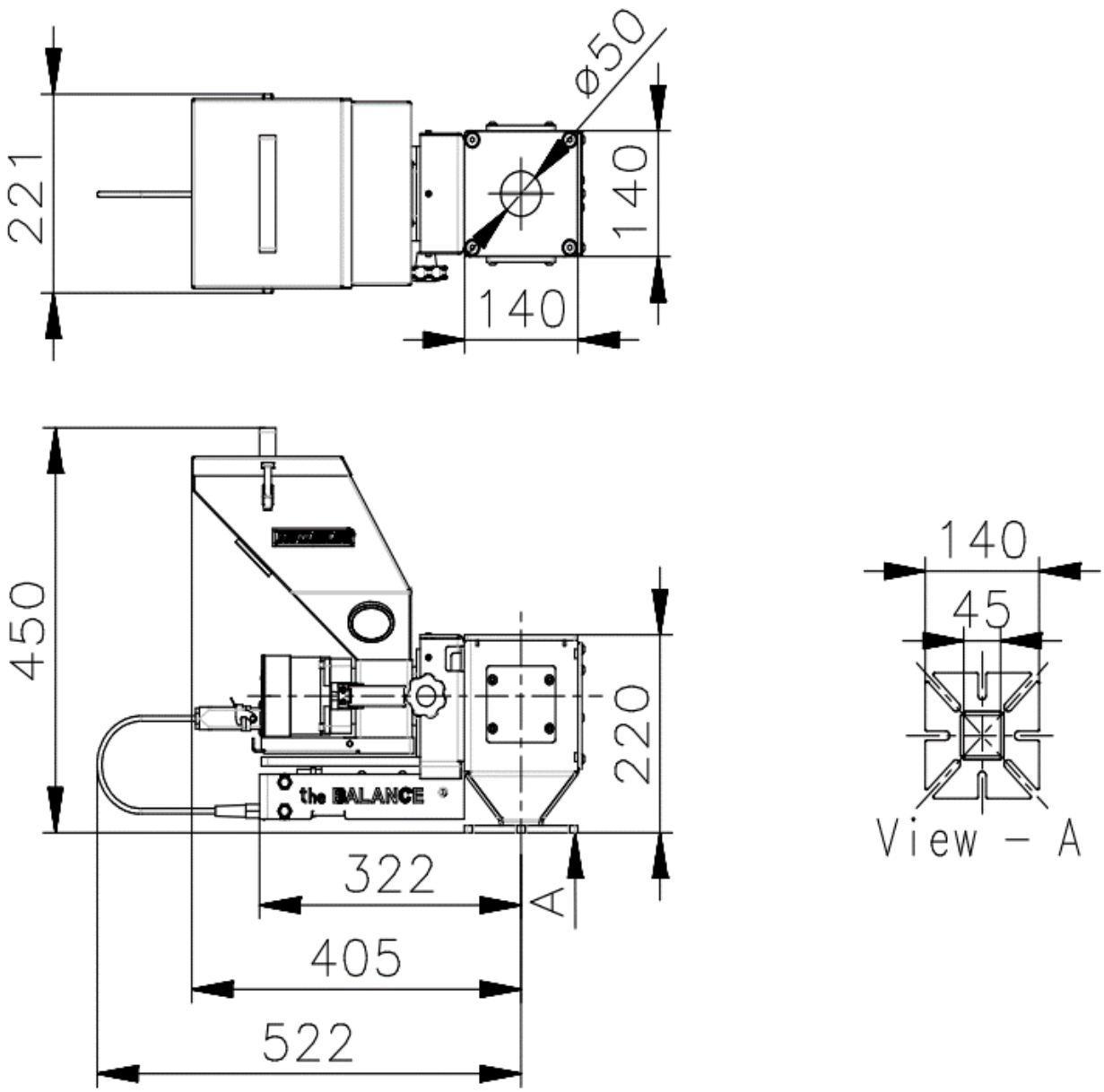
Load frame:

- - Balance frame: Steel, epoxy coated RAL 3002
- - Weighing frame: Aluminum, epoxy coated RAL 9005
- - Load cell: Nominal Load: 20 or 50 kg.
  Temp. compensated
  Temp. range: -20…+60 gr. Celsius
  Protection level: IP63 EN60529

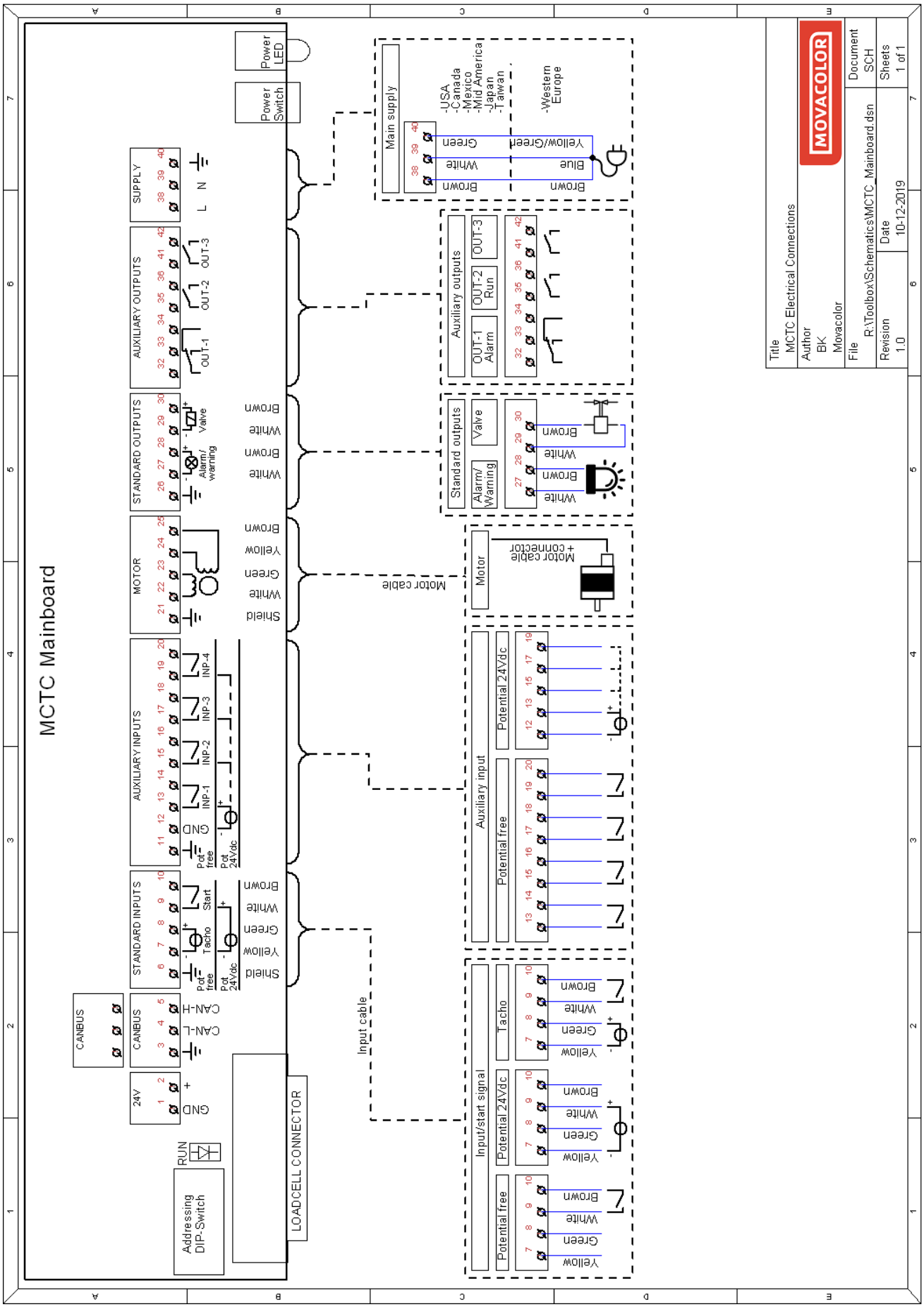
APPENDIX B: MCTC Dimensional drawing



APPENDIX C: MCBalance dimensional drawing



APPENDIX D: Electrical diagram



APPENDIX E: Declaration of conformity

DECLARATION OF CONFORMITY

(According to 2006/42/EC)

Manufacturer's name	:	MOVACOLOR BV
Address	:	P.O. Box 3016 8600 DA Sneek The Netherlands www.movacolor.com

Declare under our sole responsibility that the product:

Product description	:	Dosing equipment
Product designation	:	MCTC, MCBC
In combination with	:	MCBalance, MCHighOutput, MCWeight, MCLiquid, MCPowder, MCHybrid, MCNexus, MCNumera
Year	:	2021
Identification	:	From serial number 27500 onwards

- **The object of the declaration described above is in conformity with the relevant Union harmonization legislation;**

Machine Directive	2006/42/EC
EMC Directive	2014/30/EU
RoHS	2011/65/EU

- **The following harmonized standards and technical specifications have been applied:**

EN 60204-1	Safety of machinery - Electrical equipment of machines. Part 1: General requirements
EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements

Name: Gerhard Dersjant **Place:** Sneek the Netherlands

Position: Managing Director **Date:** February 2021

Signature: