USD 3184

PALL Life Sciences

LevMixer®

Single-Use Mixing System

OPERATOR MANUAL

Models DB-300, DB-300C

PALL Life Sciences

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A. SAFEGUARDS & PRECAUTIONS

1. Read and follow all instructions in this manual carefully, and retain this manual for future reference

2. Do not use this instrument in any manner inconsistent with these operating instructions or under any conditions that exceed the environmental specifications stated.

3. Be sure the power supplied to this instrument matches the specifications indicated on the control box and described on the Copy of Equipment Nameplate page.

4. If the drive unit is transported or stored in temperatures colder than the operating environment it is necessary to wait 1-2 hours to equalize the internal temperatures of the drive unit before powering on.

5. Be sure all power is disconnected before opening, assembling or disassembling the superconductive drive unit or its control box.

6. For full compliance with CE specifications, be sure the appropriate ground connection is made.

7. For technical assistance contact the sales organization from which you purchased the product or Pall Life Sciences directly

8. Each LevMixer® mixing bag contains a magnetic impeller, which is a source of strong magnetic field within close proximity (12 inches) of the impeller. PEOPLE USING ANY ELECTRONIC MEDICAL DEVISES, SUCH AS PACEMAKERS, SHOULD NOT BE INVLOVED IN THE CLOSE HANDLING OF LEVMIXER MIXING BAGS, MAGNETIC CHARGERS, IMPELLERS OR TEST IMPELLERS.

9. Keep the supplied magnetic shields on bags, magnetic chargers, and impellers when not in use.

DO NOT open the machine or control box while the Drive Unit is plugged in.

DO NOT submerge the drive in water. The unit outer surfaces may be cleaned and sanitized by wiping with a mild detergent solution.

DO NOT cut the ground plug.

B. TABLE OF CONTENTS

C. SPECIFICATIONS

Table1. Specifications sheet

Footprint (in. & mm) WxLxH:	16" x 44" x 36" (compact configuration) 16" x 51.6" x 36" (expanded)
Control box, cart, & mixer enclosure material:	304L Stainless Steel
Control box, cart, & mixer enclosure surface finish	At least 35 µin. Ra / 0.89 µm Ra
Control box ingress rating:	IP 65
Enclosure ingress rating:	IP 23
Voltage:	100-230VAC,50/60Hz
Input Wattage:	Less than 350W
Amperage:	100V 2.8A; 110V 2.5A ; 230V 1.5A
Voltage fluctuation:	+/- 10%
Altitude rating:	1000m
Max humidity:	85%, avoid condensation
Ambient temperature:	4-40°C
Motor horsepower:	1/8hp
Power cord length:	20 ft (600 cm)
Power cord plug options:	US, Continental Europe, Swiss, Australia, Japan, UK
E-stop (present, yes/no, location):	Yes, face of control box
Min and Max speed:	20 to 210 RPM
Connections for remote output/control:	TURCK RSFPV61, RSFPV579
Functions available from remote control panel:	Motor - start, stop. Speed – adjustment, indication. Alarm – indication. Mode of control (remote/local) – indication
Signal type(s) for remote output/control:	Impeller speed out 4-20mA, motor control in 0-10 VDC, discrete I/O signals relay contact type
Alarms generated:	Motor failure, impeller coupling failure, speed off-range failure, cryocooler failure, E-stop activation
Mixer charge time:	35 minutes
Operator interface type:	Touchscreen PLC
Method for RPM measurement:	Direct measurement of impeller speed via non-contact magnetic sensor
Noise level at operator position:	67dB
Casters:	2X swivel (front), 2X stationary (rear)
Wheel material:	Polyurethane
Recipe storage:	Yes. Up to 10 can be stored. Up to ten instructions in each recipe are executed sequentially. Each instruction contains individual programmable parameters: mixing time, pause time, and speed.
Password protection:	Operator level: access to protected function - start recipe run. Supervisor level: access to protected functions - Recipe Editor, Pause or Abort Recipe run, Switch of Control between Local to Remote, adjustment of set up for reduced set of parameters. Maintenance level: access to protected functions – Program Setup parameters, System parameters and includes Supervisor level of access.

D. OVERVIEW

The LevMixer® utilizes a levitating impeller in a sterile closed bag, driven and levitated by a superconducting drive. The LevMixer® is able to mix within sterile disposable hermetically sealed standard or custom bags with volumes up to 2000L.

The mixing system hardware has three major components:

1. Superconducting drive unit
2. Elevated Retaining Tank (either on dolly or with integrated legs)
3. Drive Port that couples drive unit with bag

The mixing system can accommodate a variety of standard and custom-designed single-use mix bags available from PALL LifeSciences.

E. PRINCIPLE OF OPERATION

The LevMixer®'s mixing technology is based on non-contact magnetic coupling between conventional permanent magnets in the impeller and superconducting material in the drive. Superconducting material has the ability to trap the magnetic field generated by the permanent magnets and "lock the magnetic field in memory" in an equilibrium position.

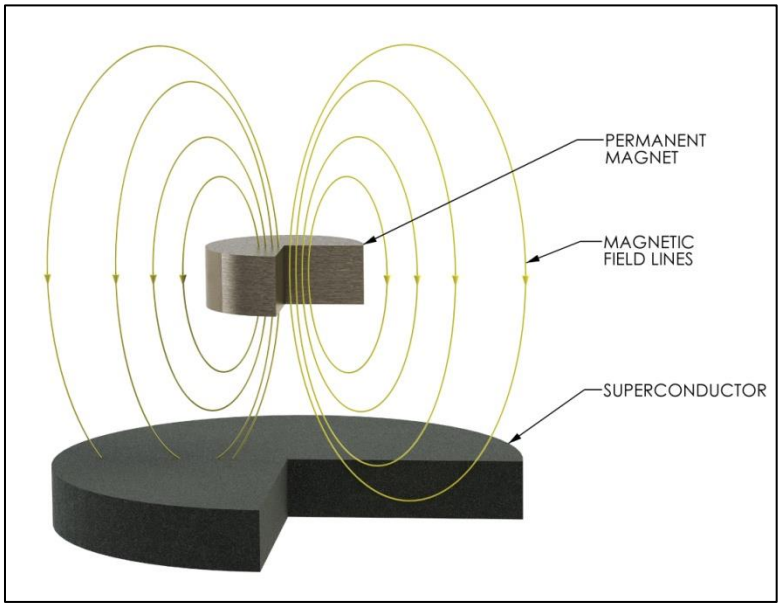


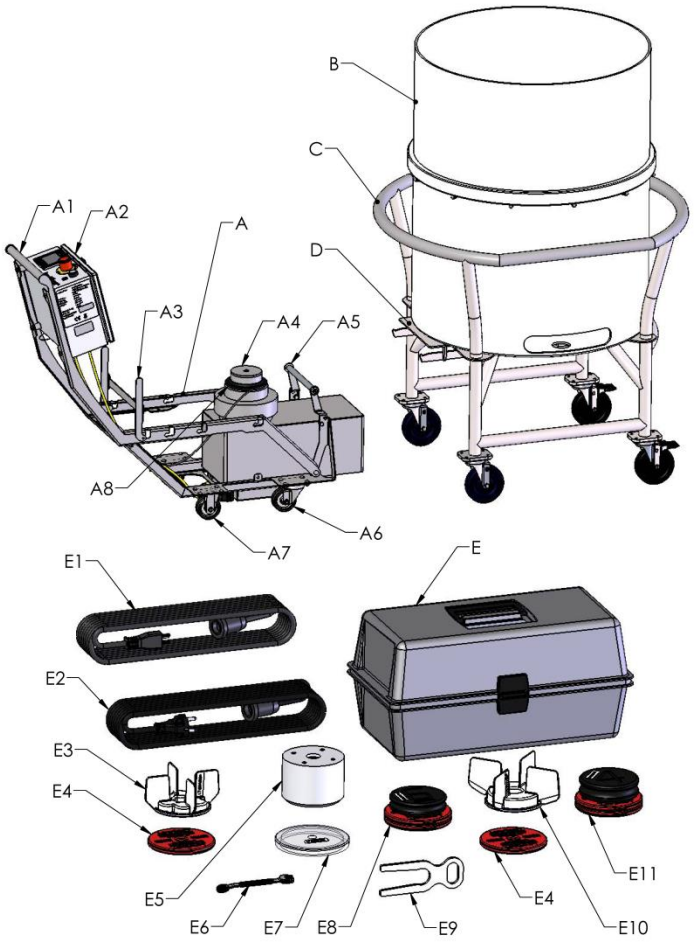
Figure 1: Noncontact magnetic coupling between the permanent magnet and superconductors. The superconducting material traps the magnetic field from the magnet, resulting in stable mechanical coupling without physical contact.

The trapped magnetic field behaves like mechanical springs; if the magnet is moved up, down or sideways by outside forces (e.g., gravity or angular torque), it will tend to be pulled back to an equilibrium position. The peculiar nature of magnet-

superconductor interaction ties the two bodies together resulting in a very stable mechanical coupling with finite equilibrium separation. This peculiar stability cannot be attained in conventional mixer designs that employ two permanent magnets.

The Cryogenic temperatures (approx. –200^{O} C) required for the superconducting material are achieved by an internal cryocooler (Sterling cycle refrigerator).

F. MIXING SYSTEM COMPONENTS AND ACCESSORIES



ITEM	DESCRIPTION
A	SUPERCONDUCTIVE DRIVE UNIT
A1	DRIVE UNIT HANDLE
A2	DRIVE UNIT CONTROL BOX
A3	LATCH
A4	LEVITATION HEAD
A5	GUIDE BEARINGS
A6	FRONT WHEELS
A7	REAR WHEELS
A8	SENSOR RING
B	PLASTIC RETAINING TANK
C	DOLLY
D	DRIVE RAIL PORT
E	ACCESSORY TOOL BOX
E1	US POWER CORD
E2	EU POWER CORD
E3	6-MAGNET TEST IMPELLER
E4	MAGNETIC SHIELD
E5	MAGNETIC CLAMP
E6	COMBINATION WRENCH
E7	CENTERING ALIGNER
E8	6-MAGNET CHARGER
E9	CLIP FOR 1" DRAIN VALVE
E10	4-MAGNET TEST IMPELLER
E11	4-MAGNET CHARGER

Figure 2: Main components of LevMixer system.

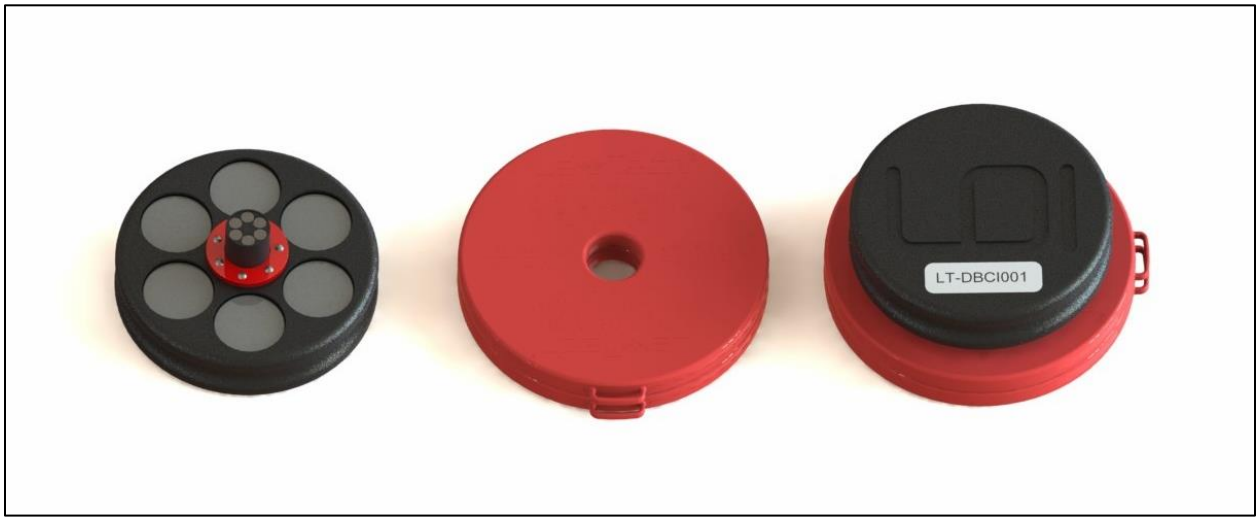


Figure 3: From left to right, Magnetic Charger (DBCI001), Shield for Magnetic Charger, (DBAK011) and Magnetic Charger (DBCI001) coupled with Shield. During the charging procedure, the ball bearing (red in far left picture) should rest on the surface of the levitation head of the drive unit.

Figure 4: From left to right, Magnetic Charger (DBCI005), Shield for Magnetic Charger, (DBAK011) and Magnetic Charger (DBCI005) coupled with Shield. During the charging procedure, the ball bearing (red in far left picture) should rest on the surface of the levitation head of the drive unit.

Magnetic Charger & Test Impeller Chart:

Magnetic Charger	Corresponding Test Impeller	Magnet Configuration
DBCI001	DBAK004	6-magnet charger & impeller
DBCI005	DBAK007	4-magnet charger & impeller

*Note: the appropriate magnetic charger must be used to set the drive machine for use with the corresponding impeller. The machine will not properly drive an impeller which does not have the corresponding magnet configuration.

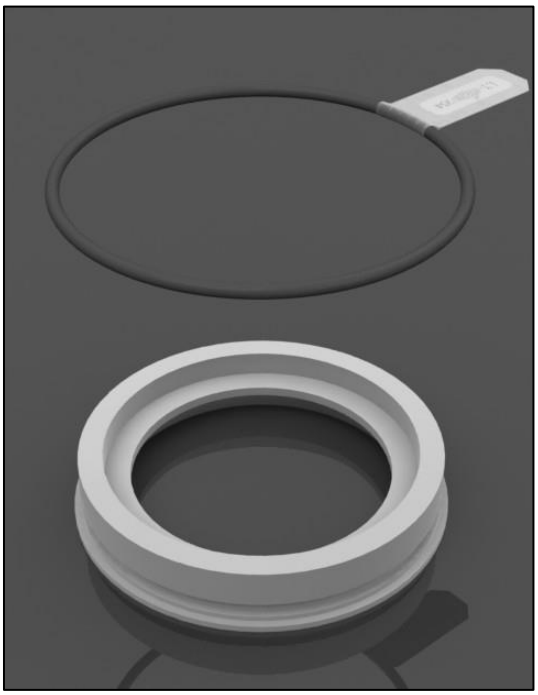


Figure 5: (Top) Drive-bag interface. (Bottom) Interface is installed in the railed port of the dolly (held in place by the O-ring).

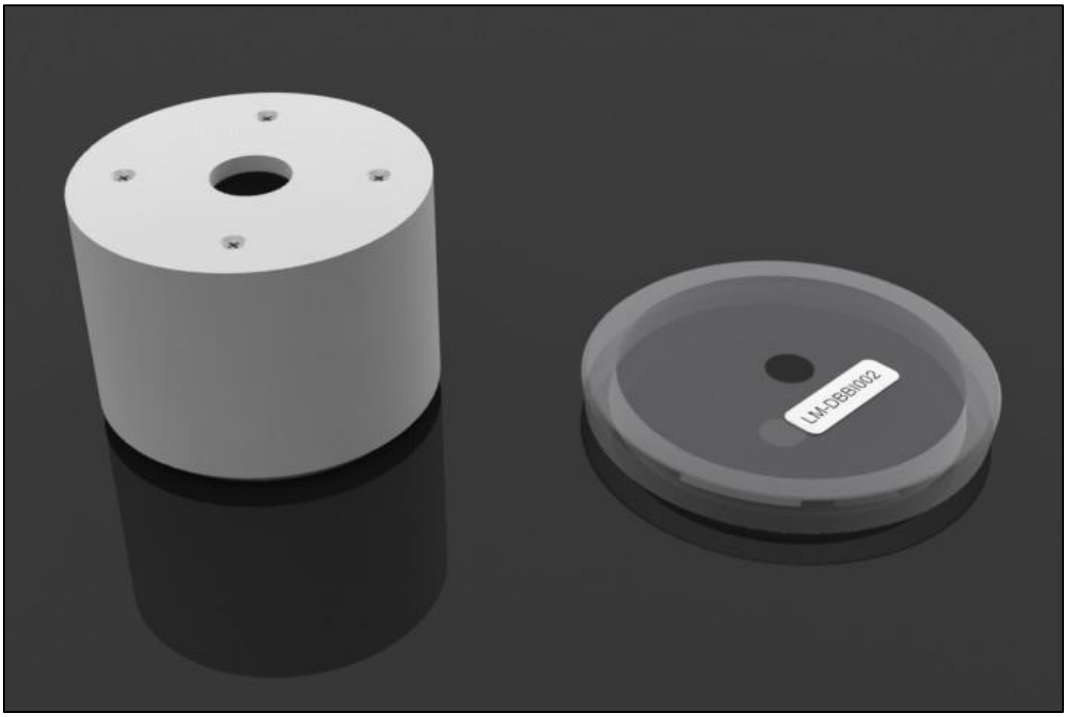


Figure 6: Magnetic clamp (left) and centering aligner (right).

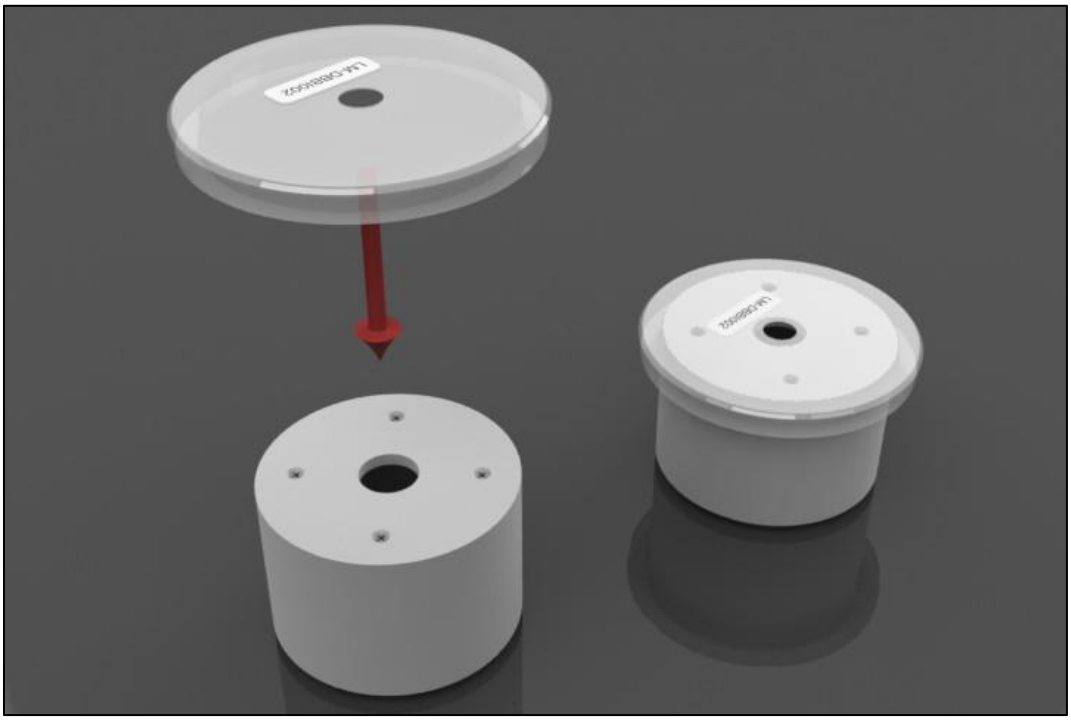


Figure 7: Magnetic clamp is assembled with centering aligner prior to attachment to the bag.

G. SUPERCONDUCTING DRIVE UNIT CONTROL

Note: the Superconducting drive unit is sealed for water/spray resistance and has a splash resistant control box.

General Overview

Direct reading of impeller speed of rotation is provided by a sensor ring on the levitation head. Speed of rotation is calculated based on direct reading of the impeller magnets.

IMPORTANT! Correct reading of RPM is available only when the sensor ring is correctly installed on the levitation head, the unit properly charged AND the correct impeller is coupled above the levitation head. Incorrect readings may result in an alarm after rotation is started.

External electrical connections are done with cables running along the frame.

The controls are located on the face panel of the control box (Figure 8). They are: Touchscreen Controller, Quick adjustment keys, Power Switch, and Emergency Stop push button. In addition, other connections including one for remote control are available on the back panel of the control box as shown in Figure 9.

Most control functionality is provided to the user through the touchscreen interface including activation of functions, display of system information, and alarm status. The LevMixer can be operated in one of three modes selected by the operator from the Main Menu: Manual mode, Automatic mode, and Remote mode. Each mode includes a specific set of functions to support processing requirements.

Two auxiliary modes of operation can be activated by the system: Power Up mode used to monitor the unit is properly charged, and Failure mode used to notify the operator of detected malfunctions. Both auxiliary modes require operator interaction. Note: mixing functionality is not available in either auxiliary mode.

When the drive unit is powered on it automatically begins in Power Up mode. At this stage the system will determine the current levitation condition and provide directions to the operator. Charging may be required as part of the power up procedure. Operator access to the mixing functions via the Main Menu is only available after the power up process is successfully completed.

Turning power off while the mixer is in charged condition should only be done through the shutdown procedure. Otherwise it will be detected as an unscheduled power outage and an alarm notification will be displayed upon next power on.

IMPORTANT! In case of emergency the operator can stop rotation of the motor by pressing the E-Stop button on the face panel. This can be done during any mode of operation. Doing so halts motor rotation and activates the system Failure mode while

leaving other functions of the drive unit in operation. To reset the unit release the E-stop button by pulling it up until it clicks, then acknowledge the alarm on the touch screen.

IMPORTANT! If the drive unit charging phase has not been completed it is possible the Levmixer will not levitate correctly. In order to ensure proper levitation in those cases, turn the unit off, wait for at least 25 minutes, and then charge it following the standard procedure as described in section H.

For details of operation see Section P *Operator Control Interface Guide*

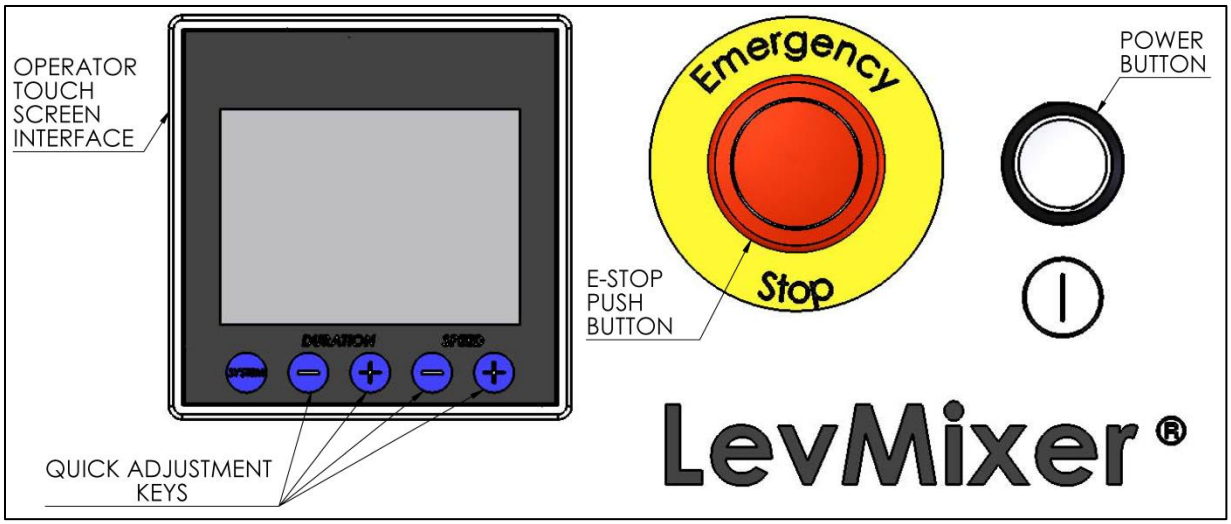


Figure 8: Face panel of control box

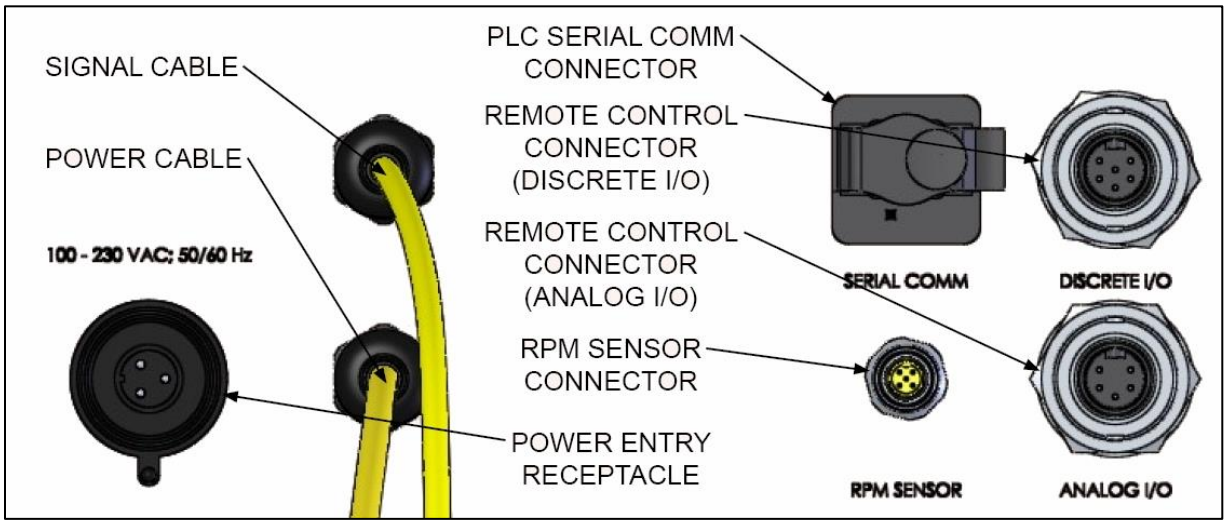


Figure 9: Rear panel of control box.

H. CHARGING THE SUPERCONDUCTORS

NOTES:

1. To maintain levitation the superconductors in the levitation head of the LevMixer should be properly charged. Charging is part of the Power Up mode sequence and is monitored on the power up window on the touch screen.
2. Charging can only be completed when initiated on a drive unit that has remained in power off mode for at least 25 min.
3. The system will monitor charging automatically and prevent operators from bypassing the sequence.
4. The type of impeller (4-magnet or 6-magnet) must be selected prior to charging. It is imperative that the charging sequence be set for the impeller type installed within the single-use mixing bag the drive unit will operate. Pall single-use mixing bags employ the 4-magnet set-up as a standard, although the 6-magnet format is available for select applications.
5. If the LevMixer is transported or stored in temperatures colder than the operating environment it is necessary to wait 2 hours to equalize the internal temperature of the drive unit prior to initiating the Power Up mode.

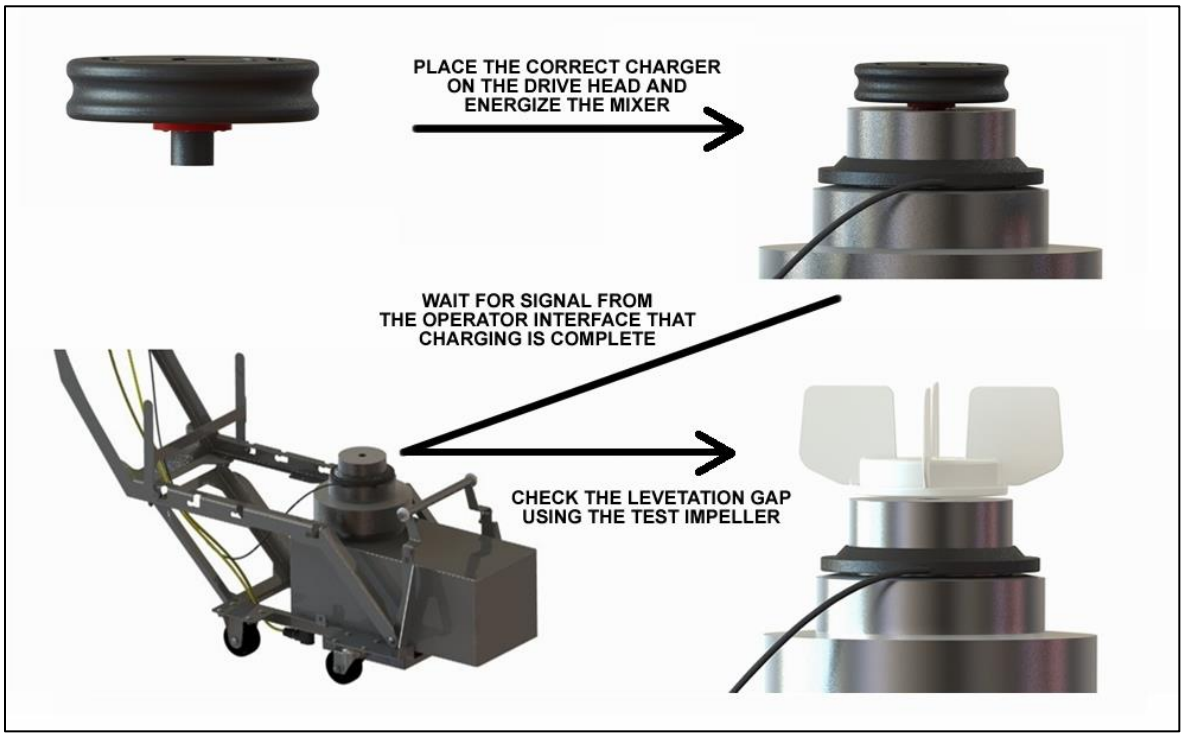


Figure 10: Superconductor charging sequence

CHARGING PROCEDURE:

1. Connect the superconducting drive unit to the appropriate power source (100-230 VAC 50/60Hz).
2. Select the correct charger, matching the impeller type within the mix bag to be used.
3. Remove the protective shield from the magnetic charger and place the charger, bearing end down, on the levitation head as shown in Figure 10.

4. Press the main power button on the control box; the button will illuminate when activated. The cryocooler and touch screen will activate. A PLACE CHARGER IMMEDIATELY notification will be displayed on the touch screen to remind the user to complete step 3.
5. Use the touch screen to acknowledge that the charger is in place to proceed to the power up screen.
6. The charging procedure will start automatically. A blinking CHARGE IN PROGRESS will display on the power up window status bar. Certain initial conditions may prevented the system from initiating charging after power on. A notice will display on the screen if an issue exists. See details of power up logic in Section P.3.
7. Press the blinking NONE button on the Power up screen. When the entry screen opens, select the type of impeller: use up and down arrows to set four-magnet impeller or six-magnet impeller type according to matching the impeller type within the mix bag to be used. Press ENTER. The selected impeller type will now be shown on the power up screen and a charging timer will indicate the elapsed charging time in the charging status area (bottom row of power up screen).
8. Superconductor charging will take approximately 35 minutes. After charging is complete a blinking READY button will appear on the screen and the CHARGED notice will be displayed instead of charging time. Charging is complete assuming the charger was placed on the levitation head prior to powering on the unit.
9. Proceed to Main Menu window by pressing the Main Menu button.
10. Remove the magnetic charger and replace the protective shield on the charger. IT IS CRITICAL THAT THE CHARGER BE PLACED ON THE LEVITATION HEAD FOR THE ENTIRE 35 MINUTE CHARGING PERIOD.

 Always put the protective shield back on the magnetic charger when charging procedure is complete.

MAKE SURE charger can rotate free being installed in recess of levitated head. It should sit loose enough to get right orientation.
DO NOT use alternative spacing/separating devices when charging the drive.
DO NOT disturb or remove the charger from levitation head until charging is completed.
Use only the magnetic charger provided in the kit.
Power off for more than 25 minutes is required to reset the superconductors.

While drive unit is charging, you can continue with Dolly – Tank Assembly

Figure 11: Test impeller levitates above the head of the super-conductive drive unit during a levitation test.

11. Remove the protective shield from the test impeller and place the test impeller on the levitation head. The impeller should levitate a few millimeters above the surface of the levitation head. This will indicate that the machine is ready for operation.*
12. Select Manual Mode from Main Menu. In the Manual Mode window select the Edit button. A Manual Setup window will appear. In the Manual Setup window press the Set point button. When the entry window opens set the speed to 50 RPM and press ENTER. The screen will return to Manual Setup window. Press button in the top right corner to return to Manual mode window.
13. In the Manual mode window check that the run is set as a Permanent run with a speed setting of 50 RPM. Press and hold START button until top bar of the window is filled (2-3 sec).
14. The levitated impeller will spin. The levitation gap should remain uniform with no significant wobbling of the impeller*.
15. In the Manual Mode window press and hold STOP button until top bar of the window is filled (2-3 sec).
16. When impeller stops rotating remove it from above the levitation head. Do not try to remove the test impeller while it is spinning. Replace the protective shield on the test impeller. The unit is now ready to be placed under the mixing tank.

 Always put the protective shield back on test impeller when testing procedure is complete.

 If at any time the drive unit is turned off or unplugged, or if there is a power outage for more than 15 minutes, or if an outage occurs at any period during charging the drive unit must be recharged before use – review section H above and repeat the charging procedure steps 1-14.

*If the test impeller does not levitate or substantial wobbling occurs (more than 1.2 mm change in the gap) the system must be reset. Turn the system off for at least 25 minutes and repeat the set up procedure. If the problem continues, contact a technical representative from your distributor or Pall Life Sciences directly.

I. DOLLY – TANK ASSEMBLY

For compact drive unit model see Section S.

1. The Dolly/Tank has a pre-cut hole over the drive port. Insert the drive/bag Interface into this hole from below and apply the O-ring to secure as shown in Figure 5. It is not necessary to remove or replace the Interface after installation (i.e. after mixing or between batches).

2. Position the plastic tank on the dolly. The bottom of the tank has two pre-cut holes: a small hole for the bag drain and a larger hole for the drive head. Line up the larger hole with the drive port on the dolly. The tank hole should fit loosely around the Interface.

3. When using PALL standard containers and dollies, tanks up to and including 350L use a centrally located impeller and therefore use the central port dolly configuration. PALL standard 500L bags use off-center impeller and therefore use the off-center port dolly configuration. *See procedure below for changing the dolly port configuration.*

CHANGING DOLLY CONFIGURATION BETWEEN CENTER AND OFF-CENTER IMPELLER PORT

1. Determine which port configuration is required: central 15" port or off-center 8" port. Each rail of the dual port has an adjuster attached to the rail with two screws. The right adjuster is marked with two dots and the left adjuster is marked with one dot. The right and left rails of the port are also marked with two and one dot respectively, *see images below*. Right adjuster should always be used with the right rail and the left adjuster with the left rail.

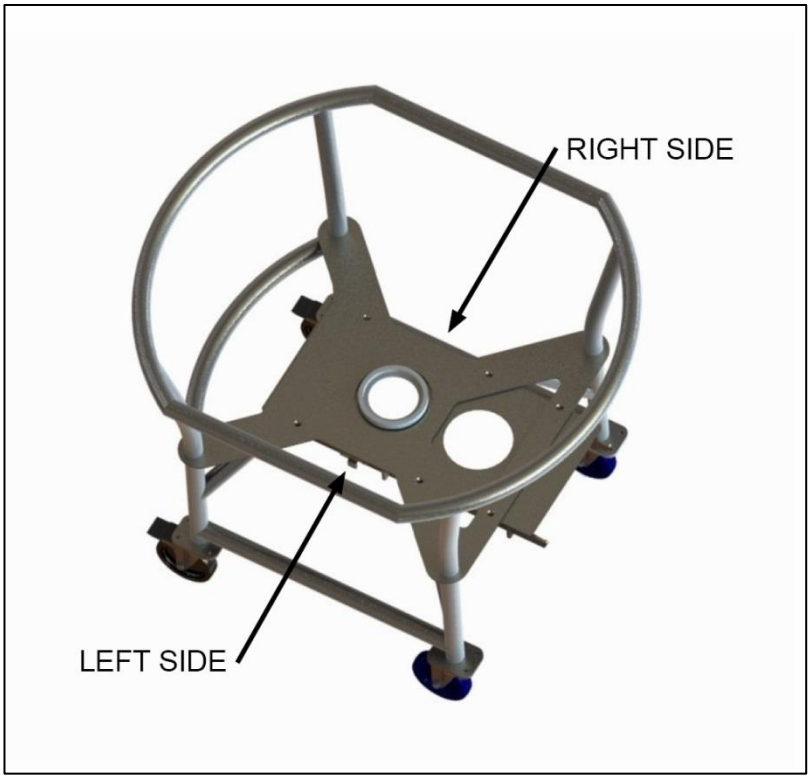


Figure 12: Rail port orientation – Showing left side vs. right

2. To set the rails for the central (15") port position set the right and left adjusters so that the side with word "CENTER" is visible on both. See figures 13 and 14. Ensure that the two dot marks on the right adjuster are located next to the two dot marks on the rail and single dot mark of the left adjuster is located next to the single dot mark on the left rail. Secure the adjusters with the screws provided.

3. To set the rails for the off center (8") port position set the right and left adjusters so that the side with words "OFF-CENTER" is visible on both. See figures 15 and 16. Ensure that the two dot marks on the right adjuster are located next to the two dot marks on the rail and single dot mark of the left adjuster is located next to the single dot mark on the left rail. Secure the adjusters with the screws provided.

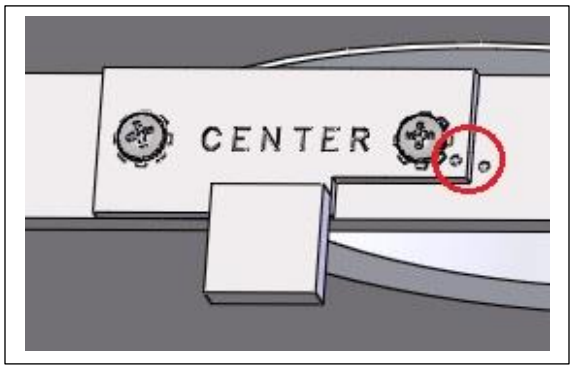


Figure 13: Left Rail - Center Installation

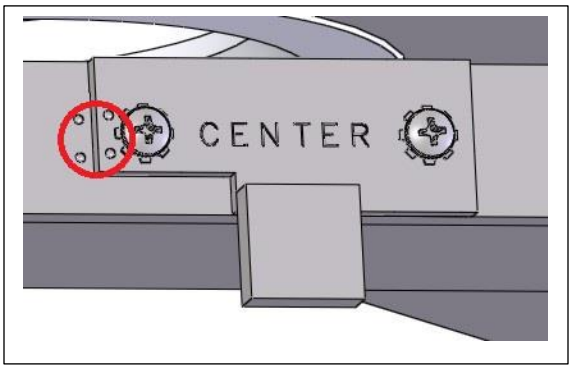


Figure 14: Right Rail – Center Installation

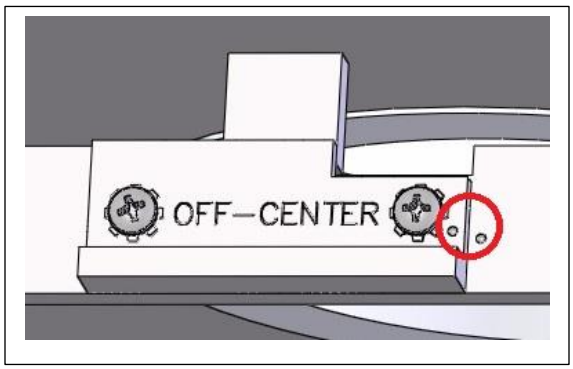


Figure 15: Left Rail – Off-Center Installation

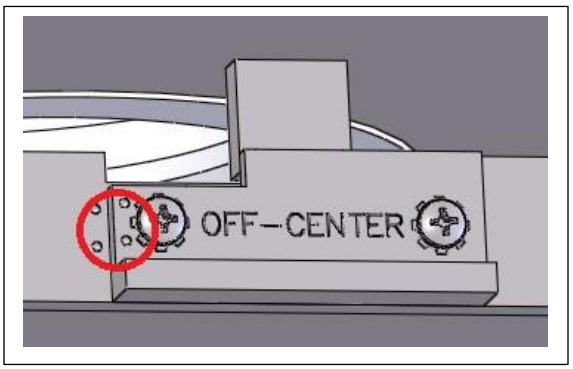


Figure 16: Right Rail – Off-Center Installation

J. BAG-INTERFACE ASSEMBLY

Figure 17: Assembly of dry bag with interface

Procedure:

1. Carefully open the EXTERNAL packaging of the mixing bag. A protective shield is magnetically attached to the outside of the bag over the Impeller seat. This shield must be removed from the bag before assembling the interface.

2. Assemble the centering aligner and magnetic clamp on the outside of the bag as shown in Figure 17.

K. INSERTING MIXING BAG INTO CONTAINER

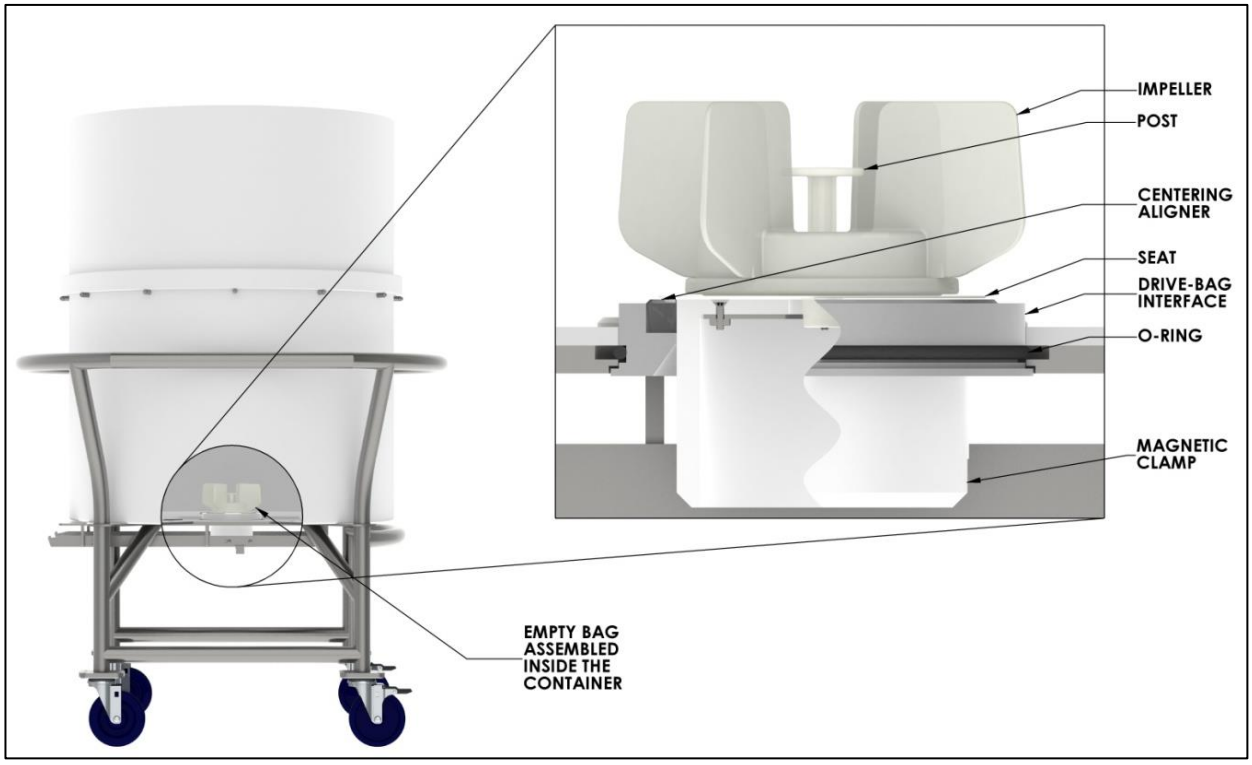


Figure 18: Bag-Tank Assembly

Procedure:

1. Place the mixing bag in the tank by aligning the magnetic clamp with the large pre-cut port on the bottom. Pull the bottom drain tube through the drain port opening.

2. Insert the magnetic clamp into the port.

3. Before filling the bag, ensure that the bottom drain tube is clamped. If the bag contains an EZ-Drain, ensure the drain is fully closed and clamp the drain in place using the provided plastic drain clip.

4. As bag starts to fill, gently pull the bottom surface of the bag to remove any wrinkles, especially near the impeller.

DO NOT exceed recommended bag capacity.
DO NOT alter the tube and/or impeller configuration.

L. COUPLING THE BAG WITH SUPERCONDUCTING DRIVE UNIT

For compact drive unit model see also Section S.

The unit can be used in one of two configurations: standard or expanded. The configurations can be switched following the procedure described in Section O. Each configuration allows connection of the unit to different rail ports using a universal latch (Figure 19). Marks on the frame at each latch slot proper positioning of the latch.

Adjust the universal latch by following the steps shown in figures 20 through 23.

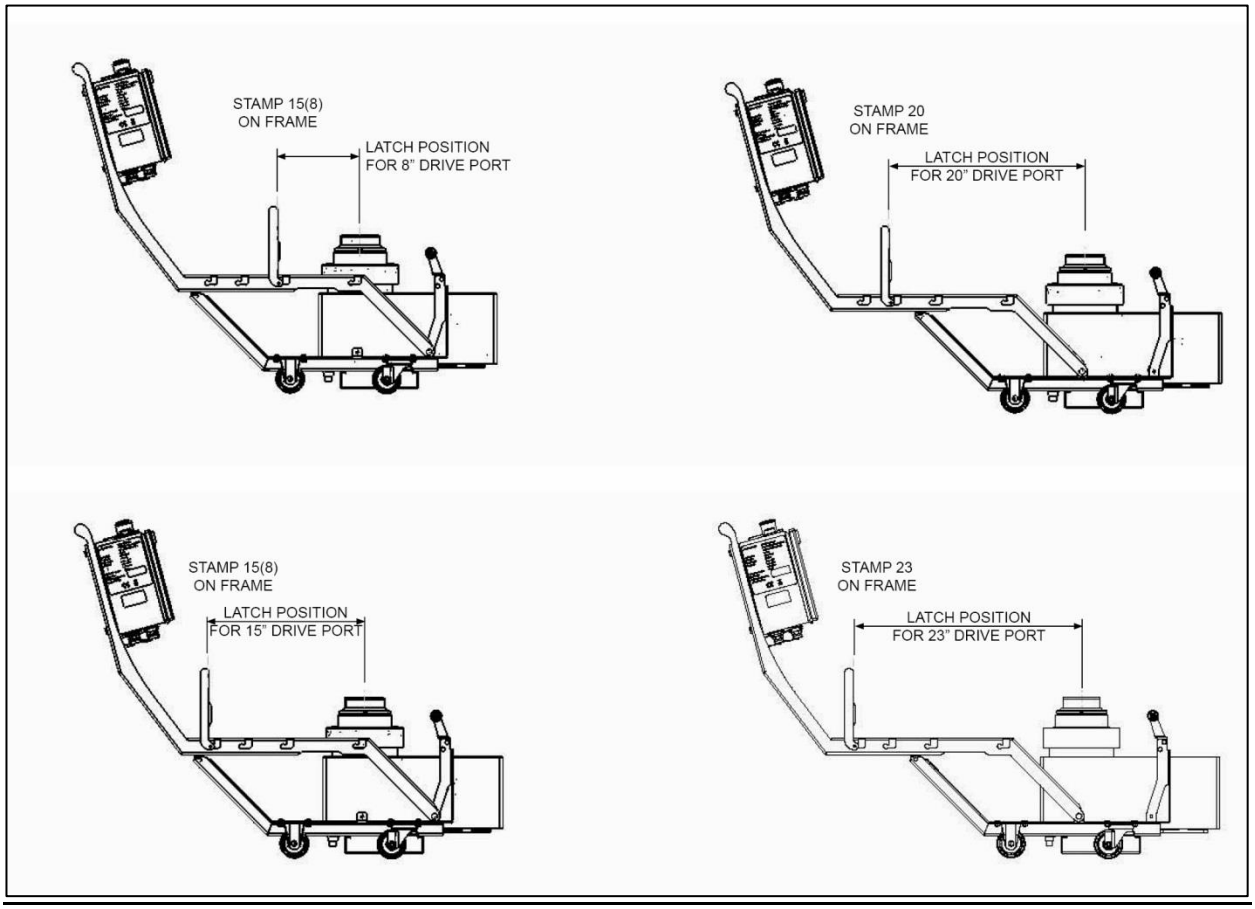


Figure 19: The LevMixer shown in standard (two left images) and expanded (two right images) configurations

Figure 20: Universal Latch Removal – Step 1
Initial latch position before removal is shown.

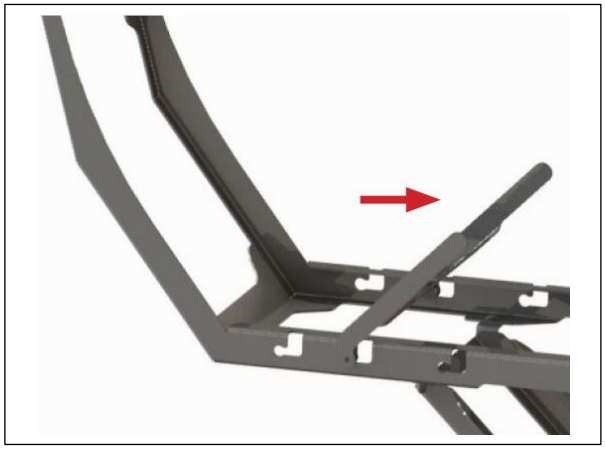


Figure 21: Universal Latch Removal – Step 2
Rotate the latch clockwise until the axle flats are aligned with the horizontal slots.

Figure 22: Universal Latch Removal – Step 3
Slide the latch toward the levitated head.

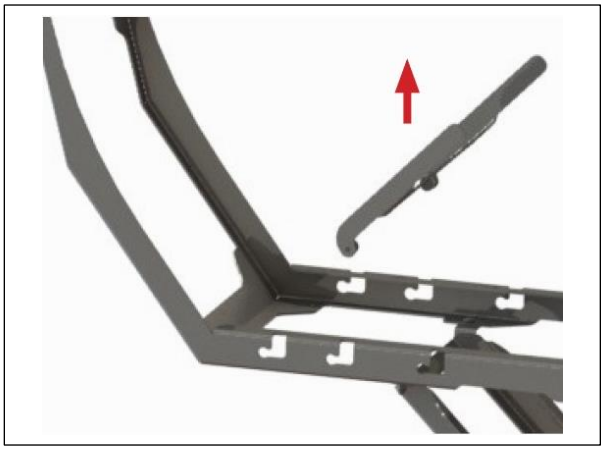


Figure 23: Universal Latch Removal – Step 4
Pull up to remove the latch.

DRIVE UNIT-BAG COUPLING PROCEDURES:
Note: Coupling of superconducting drive unit with the bag can be accomplished only when the bag is filled with fluid. No coupling should be attempted with an empty or dry bag. The impeller will damage the bag.

1. Remove the Magnetic Clamp from the bag-container assembly before coupling. To remove the magnetic clamp, reach underneath the drive port and carefully pull the magnetic clamp downwards until it is free from the bag-tank assembly. Return the magnetic clamp to the supplied Accessories Box for future use.

2. Make sure that *the universal latch is installed in the correct position to match the rail port intended for connection.* See Figure 19 for corresponding *latch and port positions*. Pull the latch back towards the handle as shown in Figure 20.
3. Carefully press down on the drive handle and raise the front wheels off the ground (as shown on the second step of the Figure 24)
4. Align the guide bearings on the drive port with the dolly guide rails.
5. Roll the superconductive drive unit along the rails all the way until the bearings rest in the well located at the end of the rails.
6. Using the drive unit handle, raise the superconductive drive unit to an upright position. While holding the drive unit in this position shift the latch toward the dolly/tank so that the cross bar rests on the grooves in the guide rails (as shown in the fourth step of Figure 24).

Figure 24: Coupling of superconducting drive unit

DO NOT attempt to move the Dolly by the Drive Unit Handle when assembled as it may damage the superconducting drive unit. Always use the **dolly/container handle** to move the Dolly or Dolly/Container-Drive Unit assembly.

DO NOT put fingers under the universal latch when locking the Drive Unit onto the Dolly or any container mounted rail port.

M. MIXING

1. On the touch screen choose the mode of operation and set parameters/recipe for the mixing run.
2. Start run
3. ***For additional instruction on using the operator interface, see section P***

 **DO NOT** attempt to mix in empty or dry bags. It may result in to damage of the film of the bag.

N. REMOVING SUPERCONDUCTING DRIVE UNIT FROM TANK

For compact drive unit model see also Section S.

1. When mixing is complete, press and hold the STOP button until top bar of the window filled (2-3 sec) unless the run finished and rotation stopped automatically. (Ensure that electrical power remains connected to the machine when mixing multiple bags consecutively.)
2. Firmly hold the drive unit handle and raise the drive unit slightly to release the locking lever. Release the latch by pulling it toward the control box.
3. Carefully lower the rear wheels of the drive unit to the floor. Roll the drive unit on its rear wheels away from the dolly.
4. Press down on the drive unit handle until the guide bearings are free from the guide rails.
5. Pull the drive unit away from the dolly until the guide bears are free from the rails. Carefully lower the front wheel to the ground.
6. The Superconducting Drive Unit can now be wheeled to another station for use.
7. When mixing is completed and the bag is completely drained, remove the bag by carefully pulling the impeller seat and the drain tube out of their respective ports.
8. Remove the centering aligner and return to the supplied Accessories Box for future use. The Interface should remain in its locked position for future use.

 Always put the protective shield back on the bag impeller before disposal.

9. Dispose of plastic bag.

O. MAINTENANCE & CARE OF SUPERCONDUCTING DRIVE UNIT

The LevMixer® Superconducting Drive is designed to operate with minimal maintenance. However, to minimize wear it is recommend that the drive be unplugged if it is not in use for more than 24 hours.

The LevMixer® drive unit can operate continuously for up to 45 days.

To recharge superconductors the machine must be powered off for at least 25 minutes.

When the unit is started with cold superconductors (short term power off), excessive noise and vibration are possible within first 15 min of operation. This is normal and is not considered a malfunction.

Recipes can be transferred between LevMixer units, including the whole recipe library, using external media (micro SD card).

IMPORTANT! Update/restore of software resets the runtime counters to zero.
IMPORTANT! Update/restore of software results in recipes content which is set to factory installed values (run time and pause time are zero, speed = 20 RPM).

If user defined library content needs to be transferred back in the unit after service is done it is recommended to save the recipe library on a micro SD card prior to conducting software service.

O.1 PREVENTIVE MAINTENANCE

Periodical maintenance is recommended to keep the drive unit in reliable working condition. Wearing of moving parts can be monitored through the elapsed run time counter in the PLC. Run time information is accessible for viewing on the touch screen through the setup menu.

Recommended preventive maintenance procedures are listed in Table 2.

Table2. Preventive maintenance procedures

Description	Frequency	Spare parts involved	Who performs
Filter inspection. Replace if deposits on the filter media are noticeable.	Every 1000 system run hours	Replacement Filter Tissue LT-SVSP327	User
Timing belt replacement	Every 9000 motor hours	Timing belt LT-SVSP003	Service
Battery replacement	6 years	Li battery CR2477	Service

O.2 TROUBLESHOOTING

Table 3 lists ways for resolving possible problems. Contact technical service if problems persist.

Table3. Troubleshooting

Problem Description	Possible Reason	Corrective Action
Unit does not start when power button is pressed.	Main power fuse is burned out	Contact service personnel
No white light when power is on while unit started	Power button LED is burned out	Contact service personnel
Excessive wobbling of levitated impeller during use	Unit improperly charged	Power off the unit. Wait for 25 min or more and charge the unit again.
	Misalignment of charger position during charging	Inspect the top surface of levitation head for levelness. Inspect the charger for mechanical damage.
	Charger magnet damaged	Recharge the unit with another charger and perform the levitation test.
	Cryomodule malfunction	Call for technical service.
Impeller doesn't levitate properly after charging completed.	Unit improperly charged	Power off the unit. Wait for 25 min or more and charge the unit again.
	Power cord is unplugged from the unit	Ensure the power cord is properly attached to unit.
	Cryomodule malfunction	Call for technical service.
	Cryocooler controller malfunction	Call for technical service.
Unsmooth rotation of Impeller with jerking movements, accompanied by knocking noise.	Coupling out of specification	Recharge the unit.
	Loose timing belt	Call for technical service
	Impeller is overloaded with torque	Inspect impeller load in application, reduce load if possible
Low battery notification	Battery low	Elevated risk of memory corruption and unreliable operation. Call for technical service.

Problem Description	Possible Reason	Corrective Action
Impeller Coupling Alarm	Sensor ring removed from levitated head	Install Sensor ring on levitated head
	Sensor ring cable is disconnected	Connect the sensor ring cord to connector on rear of control box (Figure 9).
	No impeller coupled to drive head	Use proper impeller.
	Improper impeller is coupled to drive head.	Recharge unit with proper charger.
	Type of charger chosen in power up screen doesn't correspond to actual charger used	Adjust charger type on the power up screen
	Malfunction of sensor ring	Replace sensor ring.
Motor failure Alarm	Overheating of the controller by frequent starting-stopping of the motor	Reset the motor controller alarm. Pause about 3 min before starting up motor. Avoid frequent starting-stopping of the motor.
Cannot read/write to micro SD card.	Micro card improperly formatted	Format micro SD card.
Power up screen indicates "Skipped" instead of "Charged" on charging status	Charging skipped during maintenance procedures	Turn unit off. Wait for at least 25 minutes then start unit and charge it.
E-stop ALARM persists after Reset	E-stop button is activated	Deactivate E-stop button by pulling it up until it clicks, then reset the alarm.

O.3 PROCEDURES

O.3.1 Change the frame configuration:

For compact drive unit model see Section S.

To change frame configuration follow steps below and Figures 25-27.

- Release cables from the two cable clips on the angled cross bar on the frame.
- At the four frame connection points loosen and remove the two nuts on the side connections and the two nuts on the top connections.

- Pull out the carriage screws at the four frame connection points and remove the two bushings installed in the side tabs. Hold the frame at the heavier control box side to prevent it from tipping.
- Move the frame to align it with the other set of connection points corresponding to the new frame configuration.
- Insert the four carriage screws into four frame connection points. The two side bolts should go through bushings as shown in Figure 27.
- Secure the frame with the four nuts at the connection points. Tighten the nuts. Make sure the square portion of screw heads are fitted into the square holes in frame.
- Adjust and clip the cables to the frame to fit the frame configuration as shown in Figures 25 and 26.

Figure 25: Extended configuration

Figure 26: Collapsed configuration

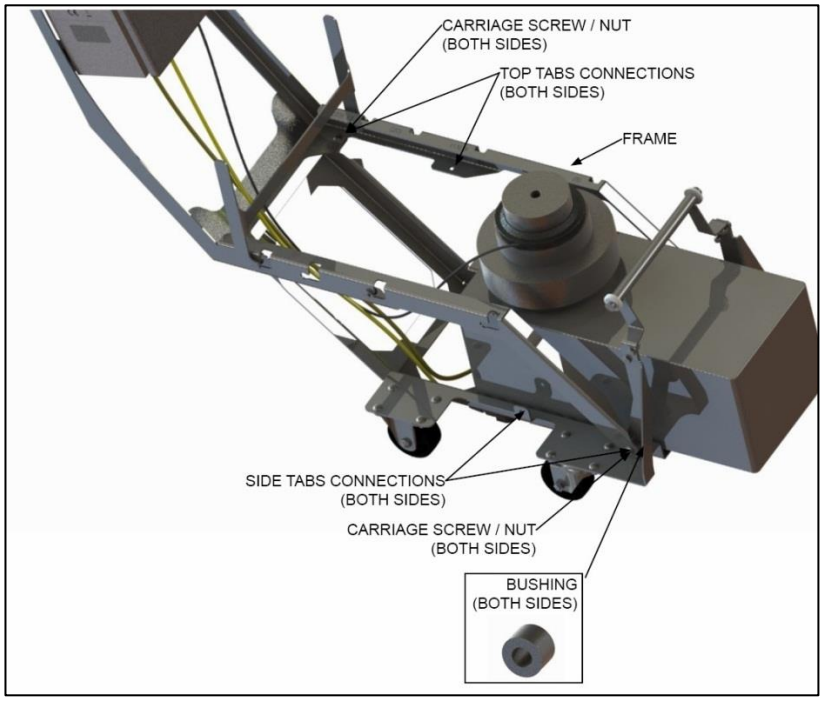


Figure 27: Frame adjustment elements

O.3.2 Sensor ring replacement:

If replacement of sensor ring is required perform the following steps:

- Unlock the cable clamps on the frame and release the sensor ring cable.
- Unscrew and unplug the sensor ring connector from the rear panel of the Control Box.
- Slip the sensor ring up and off of the levitator head.
- Put the replacement sensor ring over the levitator head.
- Connect the sensor ring connector to the rear panel of control box.
- Place the sensor cable in the cable clips on the frame and lock them.

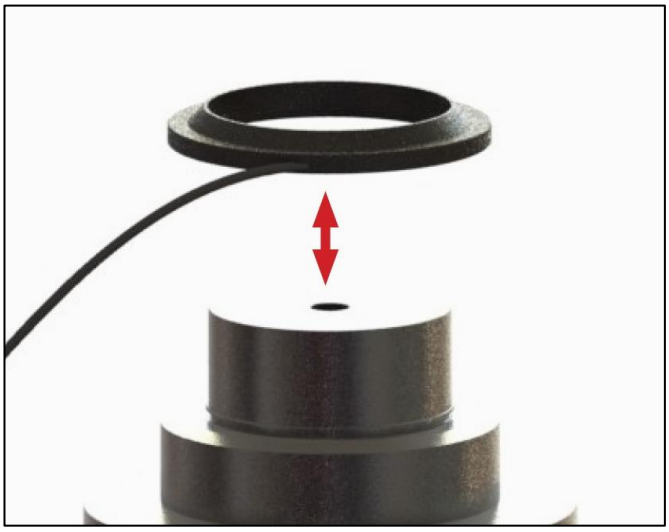


Figure 28: Sensor ring replacement

O.3.3 Power cord replacement:
Should you need to replace the power cord with an alternative one with a different type of plug follow the procedure as described below*. Changing the power cord is performed through a power entry connector on the back panel of the Control Box.

To replace the power cord follow these steps (see figure 29):

- Ensure the unit is turned off.
- Unplug the unit from the external power supply.
- Disconnect the power cord from the control box by rotating the power connector holding cap counterclockwise then, holding the connector plug, pull it out of the receptacle.
- Attach the replacement power cord connector plug to the power receptacle on the control box. Make sure the key on the receptacle and key hole in the plug are aligned and the connector plug is pushed all the way in.
- Secure the connector holding cap by rotating it clockwise. Tighten the cap firmly to seal the connection.

Use only power cords provided by PALL for replacement.

Figure 29: Power cord replacement

O.3.4 SD micro card replacement:
Micro SD cards with up to 2.0 GB of Flash memory are compatible with the Memory slot. The PLC uses a FAT 16 file system format. The Memory slot is equipped with a "push-in, push-out" connector for Micro SD cards insertion.

To change the SD card:

a) Switch the unit off and unplug it from the external power source.
b) Unlock control box by rotating the latch counterclockwise using a flat-head screwdriver.
c) Open the Control Box door and locate the memory slot on the upper side of the PLC (see Figure 30).

To insert the SD card

- Align the card so that the 8-pin gold edge connector is facing upwards on the SD card.
- Push the Micro SD card in all the way into the memory slot, ensuring that it clicks into place.

To remove the Micro SD card

- Push down on the top of the card gently to release the spring. The card will pop up for removal.

d) Close the Control Box door and lock it by rotating the latch 90º in a clockwise direction using a flat-head screwdriver.

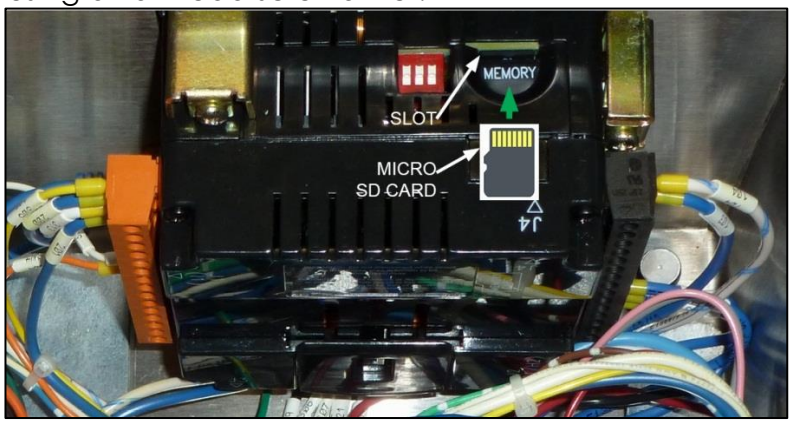


Figure 30: Micro SD Card installation

O.3.5 Fuse replacement:

To change the fuse (see figure 31):

- Switch the unit off and unplug it from the external power source.
- Unlock control box by rotating the latch counterclockwise using a flat-head screwdriver.
- Open the Control Box door and locate the Fuse holder.
- Grip the fuse holder, pull upwards and rotate it 90º.
- Unsnap and open the access door on the side of the fuse holder. The fuse will now be exposed.
- Remove and replace the fuse by pulling the old one out and snapping the new one into the slot on the access door surface.
- Close the access door and squeeze firmly to snap it back in place.
- Rotate the fuse holder back into its original position.
- Close the Control Box door and lock it by rotating the latch clockwise using a flat-head screwdriver.

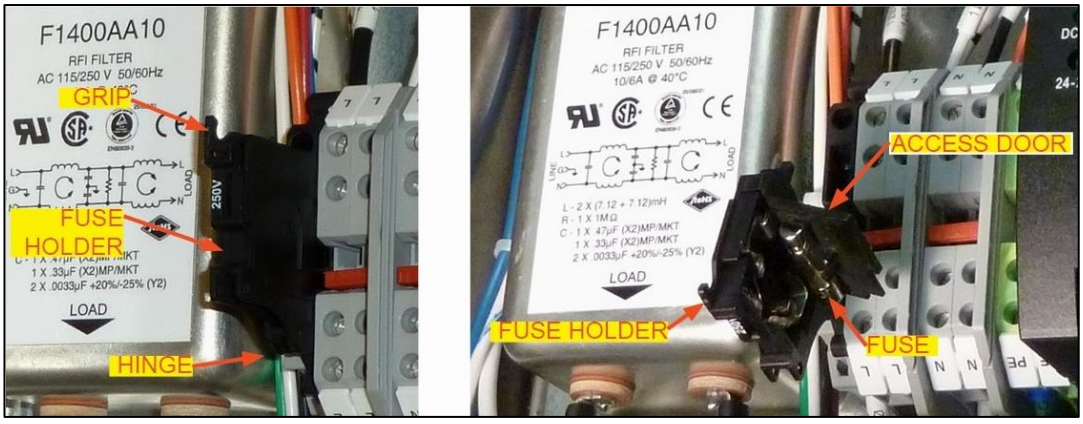


Figure 31: Fuse replacement

O.3.6 LED bulb replacement:

To change the LED bulb (see figures 32 and 33):

- Switch the unit off and unplug it from the external power source.
- Unlock control box by rotating the latch counterclockwise using a flat-head screwdriver.
- Open the Control Box door and locate the Contact block attached to the power button.
- Pull the Cap up from the lever (pry slightly with slotted blade screw driver).
- Turn the Lever to the left position.
- Pull the contact block off of the power button. The contact block will release and the LED will be exposed.
- Replace the LED by twisting and pulling it out of the contact block. Replace with a new LED.
- Place the contact block in its original position on the power button stem and lock it by turning the Lever all the way to right.
- Check to ensure the contact block is firmly seated on the power button and place Cap back on the lever all the way down.
- Close the Control Box door and lock it by rotating the latch clockwise using a flat-head screwdriver.

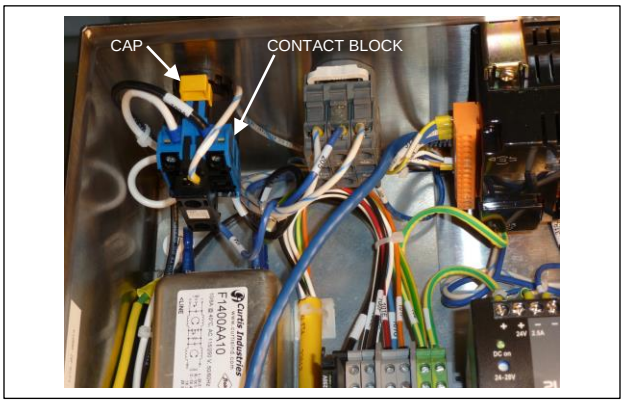


Figure 32: Contact Block release

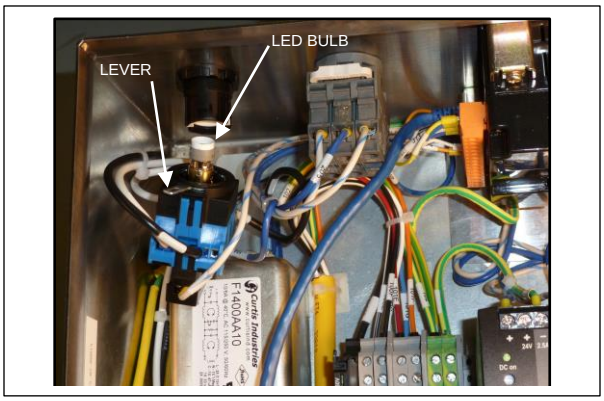


Figure 33: LED bulb replacement

O.3.7 Air Filter inspection:

To inspect air filter follow steps below:

- Switch the unit off and unplug it from the external power source.
- Lean the entire unit back to expose the bottom of the unit.
- Unsnap all four clips of the filter cover with a flat-head screwdriver and detach it from the filter body.
- Remove the cover by sliding it out. The filter tissue is located between the filter body and filter cover (see figures 34 and 35).
- Check the filter tissue for deposits on both sides. Replace filter tissue with a new one if noticeable deposits are found.
- Replace the filter tissue and snap the filter cover back onto the filter body.
- Check to ensure the cover is secured using all four clips.

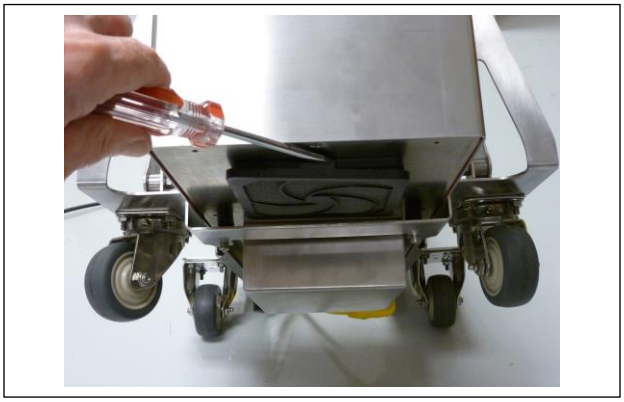


Figure 34: Removing filter cover

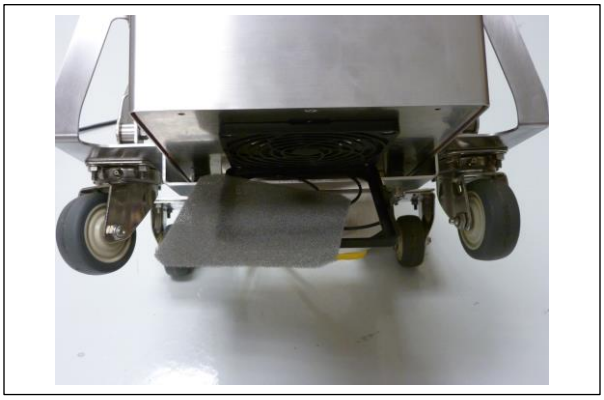


Figure 35: Replacing filter membrane

O.3.8 Speed Calibration Verification:

Equipment recommended:

Test Impeller: accessory item #LT-DBAK007T equipped with piece of reflective tape (tachometer accessory) on side surface.
Optical Tachometer: Omega HHT13 or equivalent

UNIT CONDITION: charged properly and have corresponding impeller coupled above the levitated head. Manual Mode of operation is set.

a. Set the permanent run speed of rotation to 20 RPM.
b. Press and hold the "Start" button, rotation started. Wait until the impeller accelerates to its nominal speed of rotation.
c. Reading from external tachometer write into the second column of Table 4.
d. Calculate and write down in the third column the difference between set point and measured in c) speed value.
e. Compare the reading recorded in column 2 with corresponding allowable range in the third column of the Table 4, then record the result in column 6.
f. RPM Reading from Panel screen record into the fourth column of Table 4.
g. Compare the reading recorded in column 4 with corresponding allowable range in the column 5 of the Table 4, then record the result in column 7.
h. Repeat steps c) to g) for each of the RPM set points in the first column of Table 4.
i. If unsuccessful, call service.

Table4. Rotational Speed Calibration Test Measurements

1	2	3	4	5	6	7
Set Point (RPM)	**External Tachometer Reading (RPM)**	**External Tachometer reading allowable range (RPM)**	**Panel Tachometer Reading (RPM)**	**Panel reading allowable range (RPM)**	**External Tachometer Max Deviation falls within allowable range (Y/N)**	**Panel Tachometer Max Deviation falls within allowable range (Y/N)**
20		19 - 21		19 - 21		
40		39 - 41		39 - 41		
60		59 - 61		59 - 61		
80		79 - 81		79 - 81		
100		99 - 101		98 - 102		
120		119 - 121		118 - 122		
140		139 - 141		137 - 143		
160		159 - 161		157 - 163		
180		179 - 181		176-184		
200		199 - 201		196 - 204		
210		209 - 211		206 - 214		

Calibration verification is successful if all the rows in columns 6 and 7 of Table 4 have result Y.

P. OPERATOR CONTROL INTERFACE GUIDE

P.1 Navigating the Levmixer control screen

Each screen in the LevMixer control software has a number of common elements.

1. The window bar shows the name and/or status of each screen.
2. To return to the previous screen, press the back button in the upper right corner of the screen.
3. Screen buttons corresponding to critical commands like START, STOP, PAUSE, etc… are protected from inadvertent activation by a delay function. To activate these commands the operator should press and hold the button until the indicating bar in the top of window completely fills (2-3 sec). A request to hold the command button is shown also indicated as text above the indicating bar.
4. Time is indicated on the operator interface in hh:mm format unless otherwise specified.
5. Each operation mode has its own interactive screen, which is either displayed automatically (failure, power up) or by operator choice from the Main Menu.

P.2 User Access Levels

Login function is available through the **PW** button in the left upper corner of each screen (except informational screens and entry screens). All passwords are group passwords, with a minimum of six uppercase, lower case or numeric characters. In total three group logins are available: Operator, Supervisor, and Maintenance. Maintenance login is only available while the system is in power up mode. The login time period is controlled via a program setup parameter. Access is automatically set to the default (common) level upon expiration of a prescribed time period since login.

Access to LevMixer control software functions is supported using the following levels:

Common (default) functions
- Use of Power up and Manual mode for full access (Sections P.3 and P.5).
- Use of Failure mode interactive screens for full access
- Use of Auto mode and Remote mode for view only access (Sections P.4 and P.6).
- No password protection

Operator: Includes all Common functions, plus…
- Use of Recipe start access (Section P.4).

Supervisor: Includes all Common and Operator functions, plus…
- Use of Auto mode and Remote mode for full access (Sections P.4 and P.6).
- Access to a limited set of parameters (Sections P.8).
- Ability to change the Password for the Supervisor and Operator groups.
- Ability to change the Automatic logout time.

Maintenance: Includes all Supervisor functions, plus…
- Full access to system and program parameters.
- The ability to skip power up logic.

Follow these steps to enter the passcode for different user access levels and log in using that level's privileges:

1. Press **PW** on the top left corner of the screen
2. Select the access level from the User Login screen (see Figure 36) then choose **Password** (see Figure 37) to open the password entry screen.
3. When the keypad entry screen appears, enter the passcode for the desired user access level and then press **Enter** (see Figure 38).
4. You will now return to the previous screen (see Figure 39). Press **Login.** You are now logged in under the selected user access level.

Figure 36: User Login screen

Figure 37: Supervisor User Password screen

Figure 38: Password entry screen

Figure 39: Supervisor Login screen

P.3 Power up

When the drive unit is turned on the cryocooler will start operating immediately. The system will display the Pall LevMixer screen (see Figure 40) with the software revision number shown. The unit will then automatically enter Power up mode. An interactive power up process begins when the power up screen opens.

When an uncharged unit is started the user is reminded to place the charger on the levitator head. The power up process screen prompts the user to input the type of charger in use (4-mag or 6-mag) and shows the date and time of last power off as well as the elapsed time of the current charging process. The selected charger is shown on the screen.

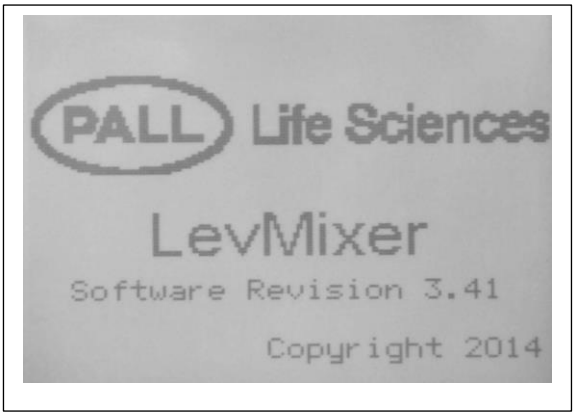


Figure 40: LevMixer screen

Figure 41: Place charger screen

Readiness of the unit for levitation is indicated by a blinking READY button on the screen after completion of the power up process. Selecting this button brings the system to the Main Menu screen where the user can choose the mode of operation to prepare for mixing.

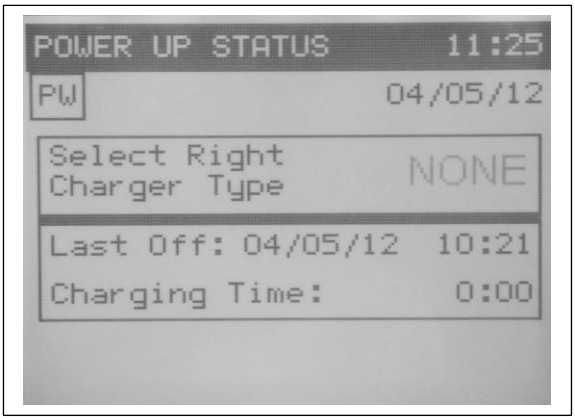


Figure 42: Power up screen

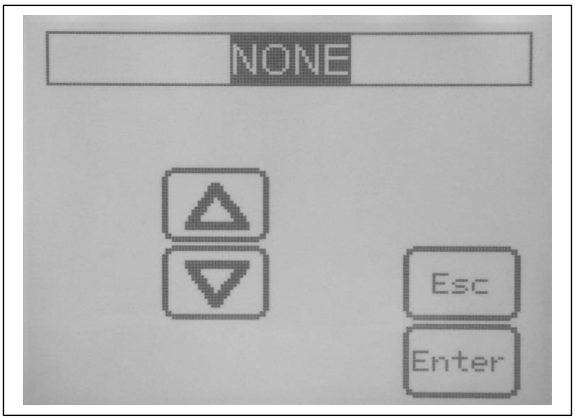


Figure 43: Charger selection screen

During the power up process the software will direct the operator to follow a prescribed process until the power up is completed so that the superconductors are properly charged.

One of three modes is possible when the unit is started:

1) Superconductors are not charged. Charging is required. This happens when the unit is powered off for 25 minutes or more. Operator must follow the Charging Procedure as described in Section H.

   Charging will start automatically after power is turned ON. The "PLACE CHARGER IMMEDIATELY" notice will display on the touch screen (see Figure 41). By acknowledging the user confirms that the charger is installed and the unit can proceed to the power up screen. A blinking "charge in progress" will be displayed in the window status bar and the elapsed charging time will be indicated in the charging status row along with Information on the last power off date and time (see Figure 42).

Screen controls require that he user select the type of charger needed for the impeller to be used for mixing (4-mag or 6-mag). This is a necessary step in the completion of power up. The Charger selection screen (see Figure 43) is accessible by pressing the button labeled "NONE". Choose the appropriate charger using the arrows and press enter. The selected charger is displayed on the power up screen (see Figure 44).

Upon completion of the prescribed charging time (35 min) the charging status will indicate "Charged". If the system already meets the second condition – a charger is selected different from "NONE" – a blinking READY button will appear on the screen (see Figure 45). By pressing the READY button the user arrives at the Main Menu screen with "common" access level (see Figure 46). At this point the unit is ready for mixing.

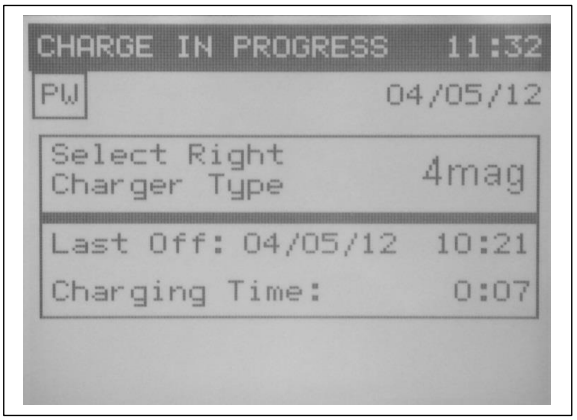


Figure 44: Power up charging status

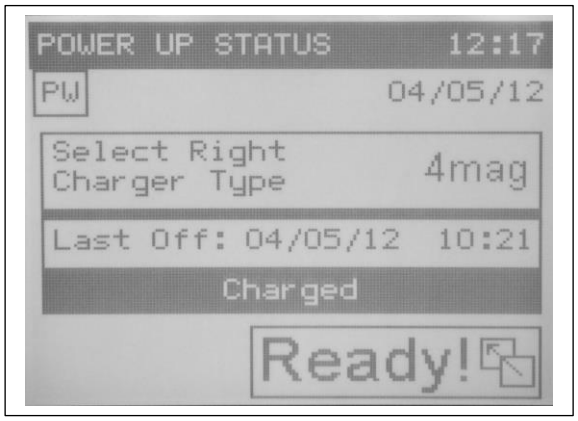


Figure 45: Power up ready status

2) Superconductors are partially charged. Power down is required. The on screen notification shows "COUPLING INSUFFICIENT!"
   The Operator must:
   a) Turn the unit off.
   b) Wait for at least 25 min.
   c) Follow the Charging Procedure as described in Section H.

   This mode can occur if the unit was powered off for 10 min to 25 min after charging OR if the unit was powered off during the charging process. At least 25 min of power-off time is required to reset the superconductors for charging.

IMPORTANT: Powering ON of the unit during the required power-off time will restart the 25 min power-off period resulting in an extension of the overall wait time.

3) Superconductors are completely charged. Once the READY button is shown on the power up screen and the correct magnet number is selected the Unit is ready for use. Press the READY button to proceed to the Main Menu.

   This mode can also occur if the unit is in fully charged condition and is powered off for less than 10 minutes.

If the mixer is powered-off without using the shutdown procedure the "Unscheduled Power Off" message with time stamp will appear during power-up. Read the screen directions carefully and select Acknowledge to continue.

For normal shutdowns follow the shutdown procedure available through the Main menu screen. To power off correctly:

- Press the **Shutdown** button on the Main Menu screen (see Figure 46).
- The screen will display confirmation of safe shutdown mode and a cancel button appears in the lower right corner.
- The unit can now be safely turned off by pressing the main power switch button on the face panel OR
- Shutdown can be cancelled and operator returned to Main Menu screen by selecting the cancel button on the screen.

OPERATING THE LEVMIXER

To select the mixer's operation mode, press one of the buttons on the Main Menu:

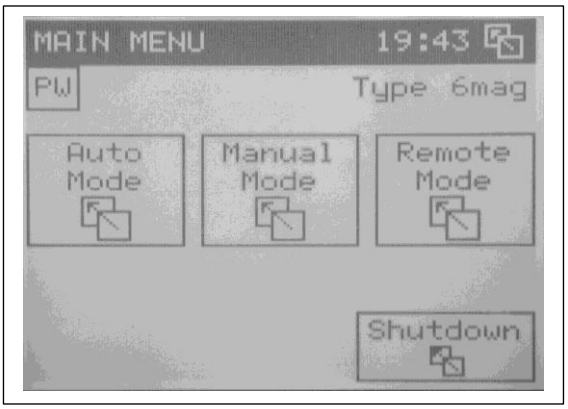


Figure 46: Main Menu screen

Select **Auto Mode** for the automatic operation mode.
Select **Manual Mode** for the manual operation mode.
Select **Remote Mode** to control the mixer remotely.

The three mode screens—the Automatic Mode screen, the Manual Mode screen, and the Remote Mode screen—are the locations for setting mixing parameters.

P.4 Automatic Mode

Automatic mode is used to run mixing according to recipes; lists of instructions composed by the user to run the mixing process at different speed settings and/or at certain time schedules. The Levmixer software includes a library of 10 recipes. Each recipe contains up to 10 instructions executed consecutively during a run. Each instruction consists of 3 user defined parameters: duration of mixing phase, duration of pause phase and speed of rotation. All the recipes have duration of mixing and pause factory pre-installed to values of zero, and speed of rotation set to 20 RPM. Any recipe with all mixing phase durations set to zero considered an "empty" recipe. If the operator tries to run such a recipe a notification is displayed on screen.

To simplify exchange of recipes between drive units a Migration function is available at the Supervisor level. The feature allows Import/Export of the entire library from/to a removable memory card (See O.3.4 and P.8 for details).

Operators can load, start recipe run and view a recipe's instructions. Supervisors and Maintenance can pause/resume or abort recipes as well as edit their contents or change the name under which the recipe is stored. To use the automatic mode to run the mixer according to a recipe, press Auto Mode on the Main Menu. The Automatic Mode screen opens and lists the currently loaded recipe. Status bar indicates "AUTOMATIC MODE" (Figure 47).

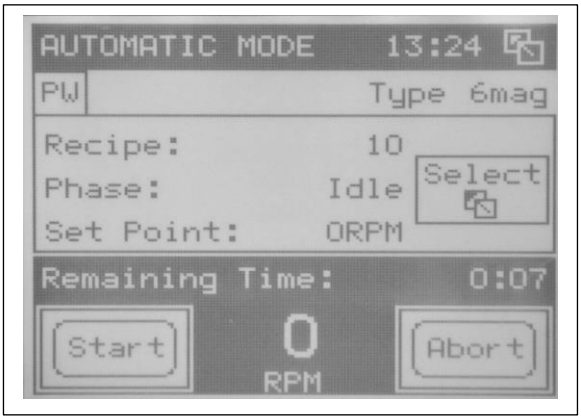


Figure 47: Automatic Mode screen

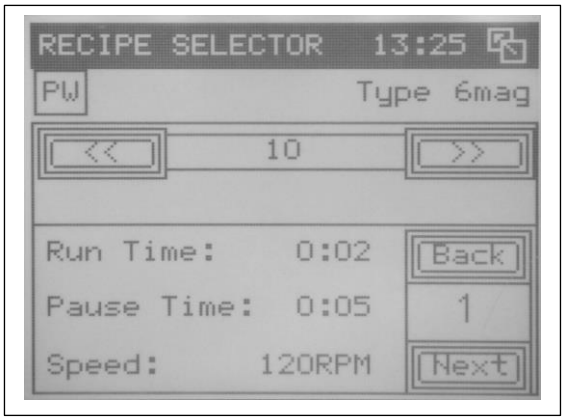


Figure 48: Recipe Selector screen

Loading a Recipe

To load a recipe, follow these steps:

- On the Automatic Mode scene, press Select. The Recipe Selector screen will open (Figure 48).
- Use the buttons on the Recipe Selector screen to load recipes and view their contents.
- At the top of the screen, press the arrow buttons to move through the list of recipes.
- In the lower right corner of the screen, press the **Back** and **Next** buttons to move through the individual instructions in the selected recipe.
- On the Recipe Selector screen, press the back button in the upper right corner of the screen to load the selected recipe and return to the Automatic Mode screen.

Running a Recipe

To run the recipe listed on the Automatic Mode screen, press and hold the **Start** button. The mixer will start according to the recipe's instructions and "Routine in Progress" will appear in the menu bar. The time remaining in the recipe is listed at the bottom of the screen. The window status bar will show a blinking "Routine in Progress".

Upon finishing the recipe run the screen will show "Successful Finish" with a time stamp, run duration and name of the recipe finished. To resume to the Auto Mode screen press the OK button.

When failure mode is activated during a recipe run the job is paused automatically and can be resumed upon failure reset. "Unscheduled Finish" is displayed with a time stamp, run duration and name of the recipe after finishing the recipe run. To resume to the Auto Mode screen press the OK button.

Aborting a Recipe
Supervisors and Maintenance user levels can abort running recipes. To abort a recipe that is currently running, press and hold the **Abort** button. When a routine is aborted the "Unscheduled Finish" screen with a time stamp, name of the recipe aborted and run duration will open. To resume to the Manual Mode screen press the OK button.

Pausing and Resuming a Recipe
Supervisors and Maintenance user levels can pause and resume recipes. To a recipe that is currently running, press and hold the **Pause** button. A blinking "Routine Paused" status is displayed in the status bar. To resume the recipe from where it was paused, press and hold the **Resume** button.

Editing a Recipe
Supervisors and maintenance user levels can edit a recipe's instructions. To edit a recipe, follow these steps:

1. Press **Select** on the Automatic Mode screen. The Recipe Selector screen opens.

   Use the arrow buttons at the top of the screen to scroll through the list of recipes until you open the one you want to edit.

   Press **Edit**. The Recipe Editor screen opens (Figure 49).

   If needed, press the **Back** and **Next** buttons on the right side of the screen to scroll through the list of instructions for that recipe.

   Each recipe can contain up to 10 instructions

   Set the parameters to use for a specific instruction.
   - Press **Pause** to set the length of time the LevMixer should pause for that instruction. When the keypad opens, type the length of time to pause and then press **Enter**.
   - Press **Run** to set the length of time the LevMixer should run for that instruction. When the keypad opens, type the length of time to run the mixer and then press **Enter**.
   - Press **Speed** to set the RPM set point at which the mixer should run for that instruction. When the keypad opens, type the RPM set point and then press **Enter**.
2. Press **Save** to save your changes to the recipe. To return to the Automatic Mode screen without saving your changes to the recipe, press **Cancel**.

Figure 49: Recipe Editor screen

To edit the name under which a recipe is stored, follow these steps:

1. Press **Select** on the Automatic Mode screen. The Recipe Selector screen opens.
2. Use the arrow buttons at the top of the screen to scroll through the list of recipes until you find the name you want to edit.
3. Press **Edit**. The Recipe Editor screen opens.
4. If needed, press the **Back** and **Next** buttons on the right side of the screen to scroll through the list of instructions for that recipe.
5. Press the button with the recipe name in it. An entry screen opens.
6. Use the onscreen keyboard and arrows to change the name of the recipe then press enter.
7. Press **Save** to save your changes. To return to the Automatic Mode screen without saving your changes to the recipe, press **Cancel**

P.5 Manual Mode

Use the manual mode to run the mixer either continuously or for a specific amount of time at a given RPM. The manual mode is ideal for mixing jobs that have no additional parameters. If the job requires mixing at different speeds use automatic mode instead.

To use the manual mode press **Manual Mode** on the Main Menu. The Manual Mode screen will open. The status bar will display "MANUAL MODE" (See Figures 50 and 51).

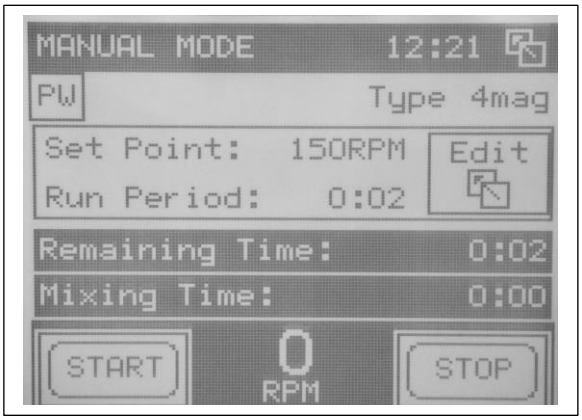


Figure 50: Manual Mode Parameters screen

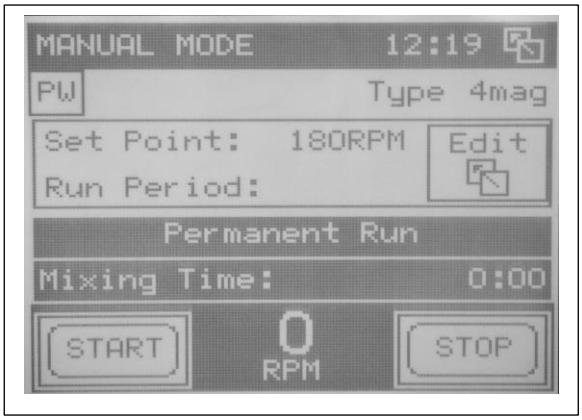


Figure 51: Manual Mode Permanent screen

Setting Up a Manual Job

Parameters available for a manual job are speed of rotation of impeller (RPM) and duration of run (hh:mm). Previous settings are remembered until they are changed manually. Quick adjustment of manual job parameters is possible from the PLC face panel with dedicated keys (Figure 8) regardless of run status.

To select the parameters to use for the manual job run, follow these steps:

- On the Manual Mode screen, press Edit. The Manual Setup screen opens (See Figures 52 and 53).
- Press the **Set Point** box to set the RPM set point.
- In the Entry screen enter the RPM set point and then press **Enter**.
- Set the time period for prospective run.
- The status PERMANENT indicated on a switch means it will run indefinitely until manually stopped.
- To have manual run stopped automatically, specify the length of run. Press the switch to toggle it to TIMED status to allow time period setting for run.
- To set the length of time the mixer should run, press the **Run Period** box. When the keypad opens, enter the amount of time and then press **Enter**.
- Return to the Manual Mode screen. All parameters are indicated in screen areas with white backgrounds (Figures 50 and 51).

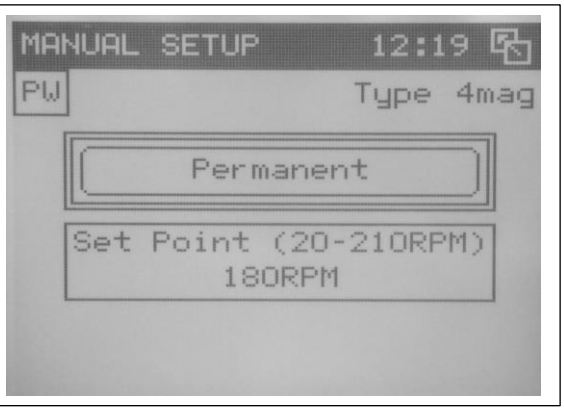


Figure 52: Manual Setup Permanent screen

Figure 53: Manual Setup Timed screen

Starting a Manual Job

To a manual job press and hold the **Start** button on the Manual Mode screen. The mixer will start and the current status will show in areas with dark backgrounds: the remaining time (for timed jobs) or the "Permanent Run" (for continuous runs) and net mixing time (Figures 50 and 51). The window status bar will have a blinking "Run in Progress".

Stopping a Manual Mode Job (Permanent Run)

To stop a manual job that is currently running, press and hold the **Stop** button. When a job is stopped the screen will display "Successful Finish" with a time stamp and run duration. To resume to the Manual Mode screen press the OK button.

When failure mode is activated during run the job is paused automatically and can be resumed upon failure reset. "Unscheduled Finish" is displayed with the time stamp and net mixing time after stopping the run. To resume to the Manual Mode screen press the OK button.

Stopping a Manual Mode Job (Timed Run)
Timed runs will automatically stop when the scheduled run time is complete. The screen will display "Successful Finish" with a time stamp and run duration. To resume to the Manual Mode screen press the OK button.

To stop a timed job that is currently running, press and hold the **Stop** button. When the job stops the screen will display "Unscheduled Finish" with a time stamp and run duration. To resume to the Manual Mode screen press the OK button.

When failure mode is activated during a run, the job is paused automatically and can be resumed upon failure reset. "Unscheduled Finish" is displayed with a time stamp and net mixing time after manually stopping or automatic finishing of the run. To resume to the Manual Mode screen press the OK button.

Pausing and Resuming a Manual Job
To pause the current job, press and hold the **Pause** button. To resume the job from where it was paused, press and hold the **Resume** button.

P.6 Remote Mode

The remote mode allows you to control the LevMixer from external equipment to which the mixer is connected. Supervisor and Maintenance user levels can switch the mixer between remote and local control.

Signal circuits for remote control pass through the control box via two connectors located on the back of the control box. With a remote control panel, the operator is able to:

- Start/Stop the motor
- Change the speed of rotation
- Read the speed of rotation
- Read alarms
- Read the unit mode status

While the LevMixer is in Remote mode the impeller rotation control is available only via the remote control unit. The LevMixer screen indicates speed of impeller for local monitoring only. When the control is switched back to local (LevMixer) the remote control unit can only monitor the speed of rotation and alarm status.

When in remote mode the mixer automatically switches to Manual Mode stop status when any alarms are activated.

To use the remote mode:

- Press **Remote Mode** on the Main Menu. The Remote Mode screen opens in "Local Control" status indicated in status bar (Figure 54).
- To switch control to any remote equipment connected to the mixer, first make sure that the equipment is correctly connected to the LevMixer and powered up. Then press and hold the **Switch Control to Remote** button on the Remote Mode screen.

When the control is switched to a remote panel the "Remote Control" status is indicated in the window status bar.

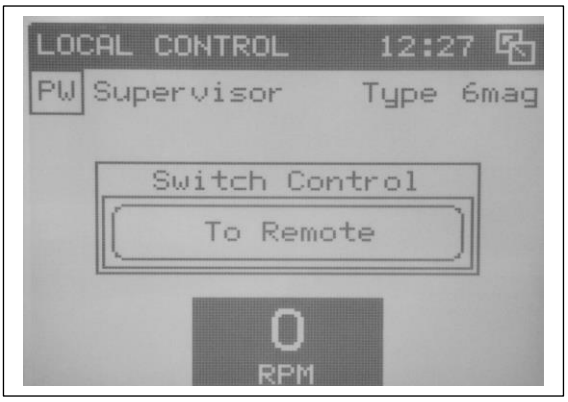


Figure 54: Remote mode screen

To switch control back to the LevMixer, press and hold the **Switch Control Back to Local** button on the Remote Mode screen. The system will switch to Manual Mode stop status.
For details of remote control I/O signals see electrical schematic in section S.

P.7 Alarms

Failure detected by the system will activate Failure mode while in any mode of operation. Failure mode causes the motor rotation to stop, displays an alarm notification to the operator (Figure 55) and generates and alarm output signal for remote control.
The equipment in the drive unit will stay powered up but cannot be operated until failure reset is complete. Failure resolution is available only from the LevMixer face panel. External control equipment will only receive an alarm signal with no ability to feedback control.
IMPORTANT: If failure happens while any of Editor screen is opened the alarm is generated but notification will not appear on screen until escape from Editor to any of Mode screens.
Reset of the failure mode is available from the failure detection screen (Figure 56) which is opened after pressing the **Alarm** button.

Figure 55: Alarm screen

Figure 56: Failure detection screen

Upon alarm reset the system will return to one of the following:

a) Manual Mode idle condition: if at the moment of alarm the mixer is in Remote mode or idled in Manual mode.
b) Manual Mode pause condition: if at the moment of alarm the mixer is in Manual mode.
c) Automatic mode idle condition: if at the moment of alarm the mixer is idled in automatic mode.
d) Recipe run pause condition: if at the moment of alarm the mixer is in Automatic mode.
e) Power up mode: if a Motor or Cryo Controller failure occurs as they require power cycling for reset.

Five types of failure can stop the current job:

1. **Manual E-Stop**: When an operator presses the E-Stop button on the LevMixer, the motor rotation immediately stops and the ALARM appears on the screen. To reset the unit follow the following steps:
   a) Release the E-stop button by pulling it until it clicks.
   b) Press the ALARM button. The failure detection screen will then open.
   c) On the failure detection screen identify the E-stop failure in the blinking bullet. Note: the date and time of the failure event is indicated on this screen.
   d) Press the RESET button to return the unit to operation.

2. **Coupling Off-Range**: If the measured RPM is outside the coupling range for longer than the specified Coupling time, the impeller may have decoupled from the mixer's drive. When this occurs, rotation is stopped and the ALARM appears on the screen. The operator should do the following steps:
   a) Press the ALARM button. The failure detection screen will then open.
   b) On the failure detection screen identify the Coupling Off-Range failure in the blinking bullet. Note: the date and time of the failure event is indicated on this screen.
   c) Press the RESET button to return the unit to operation.

3. **Speed Off-Range**: If the measured RPM deviates from speed set point outside the +/- 5 RPM limits for more than 60 sec, the speed control may be functioning improperly. When this occurs, rotation is stopped and the ALARM appears on the screen. The operator should do the following steps:
   a) Press the ALARM button. The failure detection screen will then open.
   b) On the failure detection screen identify the Speed Off-Range failure in the blinking bullet. Note: the date and time of the failure event is indicated on this screen.
   c) Press the RESET button to return the unit to operation.

IMPORTANT: The Speed Off-Range Alarm is not generated in remote mode of operation. In this case current speed and set point are controlled externally.

4. **Motor Failure**: If the mixer's drive motor experiences an error, it signals the PLC. The mixer then stops rotation and displays ALARM on the screen. The operator should do the following steps:
   a) Press the ALARM button. The failure detection screen will then open.

b) On the failure detection screen identify the Motor failure in the blinking bullet. Note: the date and time of the failure event is indicated on this screen.
c) Press the RESET button to return the unit to operation. The screen will open with a request to turn off power to reset the failure signal.
d) Turn the unit off then turn it back on.

5. **Cryo Controller**: If the mixer's cryocooler experiences an error, it signals the LevMixer. The mixer then stops rotation and displays the ALARM on the screen. The operator should do the following steps:
   a) Press the ALARM button. The failure detection screen will then open.
   b) On the failure detection screen identify the Cooler Controller failure in the blinking bullet. Note: the date and time of the failure event is indicated on this screen.
   c) Press the RESET button to return the unit to operation. The screen will open with a request to turn off power to reset the failure signal.
   d) Turn the unit off then turn it back on.

P.8 Auxiliary functions

System functionality is controlled with parameters accessible through the setup editor which is available through the Main menu screen. A Setup button will appear on the screen after a user has logged in at the Supervisor or Maintenance level (Figure 57). The selection of parameters available for adjustment depends on the level of access and is listed in the settings editor for the Supervisor level (Figure 58), which opens after pressing **Setup**.

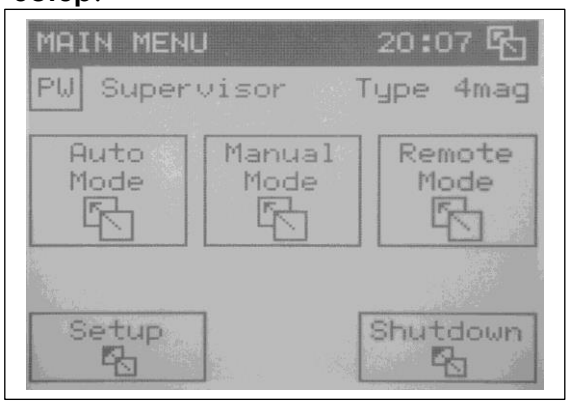


Figure 57: Supervisor Main Menu screen

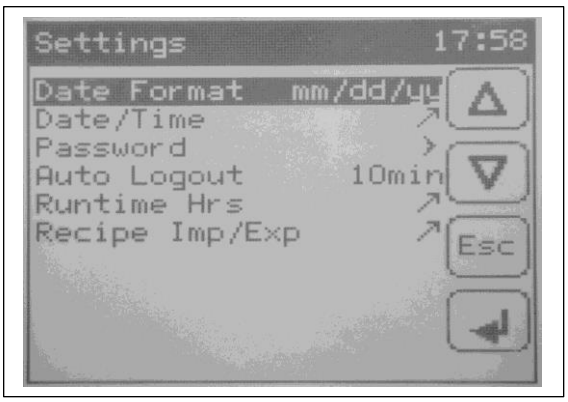


Figure 58: Supervisor settings screen

Supervisor settings editor allows:

1. Select the date format for indication on screens: mm:dd:yy or dd:mm:yy
   - Login to system as Supervisor
   - Press the setup button on the Main menu screen
   - Select the "Date Format" function using the up and down arrows
   - Press the curved arrow to go to the selection screen
   - Select the appropriate format using the arrows provided on screen and then press **Enter**

2. Adjust the Calendar date and Clock time
   - Login to system as Supervisor

- Press the setup button on the Main menu screen
- Select the "Date/Time" function using the up and down arrows
- Press the curved arrow to go to the next screen
- Press the button with the date, adjust the date to current, then press **Enter**
- Press button with the time, adjust time to current, then press **Enter**
- Press  to return to the Settings list

3. Change password for Supervisor and Operator levels
    - Login to the system as Supervisor
    - Press the setup button on the Main menu screen
    - Select the "Password" function using the up and down arrows
    - Choose the level of access to which the change of password is required
    - Press the curved arrow to go to the next screen
    - Press the curved arrow to go to the entry screen
    - Enter the new password twice as prompted and press **Change**
    - Press  to return to the Settings list

4. Adjust auto logout time
    - Login to the system as Supervisor
    - Press the setup button on the Main menu screen
    - Select the "Auto Logout" function using the up and down arrows
    - Press the curved arrow to go to the entry screen
    - Enter the time for auto logout then press **Enter**

5. View runtime counter indicators for System runtime and Motor runtime
    - Login to the system as Supervisor
    - Press the setup button on the Main menu screen
    - Select the "Runtime Hrs" function using the up and down arrows
    - Press the curved arrow to go to the view screen
    - The screen will indicate accumulated runtime separately for both system and motor rotation
    - Press  to return to the Settings list

6. Export of Recipe library to memory card
    - Insert a SD card into the Memory slot (See section O)
    - Login to the system as Supervisor
    - Press the setup button on the Main menu screen
    - Select the "Recipe Imp/Exp" function using the up and down arrows
    - Press the curved arrow to open the next screen (Figure 58)
    - Press the **File number** button to go to the entry screen
    - On the entry screen input the file number (0-9) you wish to export and press **Enter**
    - Press the **Export recipes** button and confirm when prompted (Figures 59 and 60).
    - The entire library will be exported to the Micro SD card under filename LIBRARYX.BAK, where X is the file number entered on the previous step.
    - A confirmation notice will appear after the file writing is finished (this may take several minutes)
    - Acknowledge the notice and press  to return to the Settings list

Figure 59: Import/Export screen

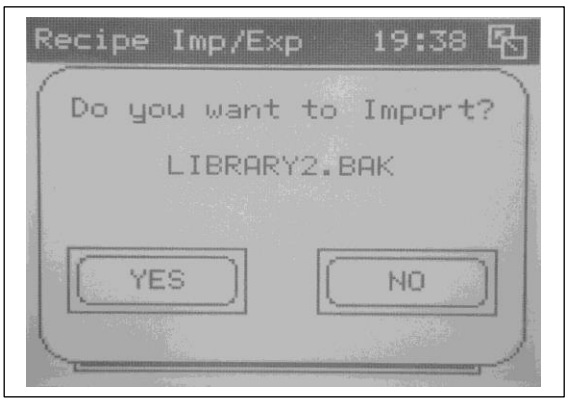


Figure 60: Confirmation screen

7. Import of Recipe library from memory card
    - Insert a SD card into the Memory slot (See section O)
    - Login to the system as Supervisor
    - Press the setup button on the Main menu screen
    - Select the "Recipe Imp/Exp" function using the up and down arrows
    - Press the curved arrow to open the next screen (Figure 58)
    - Press the **File number** button to go to the entry screen
    - On the entry screen input the file number (0-9) you wish to Import and press **Enter**
    - Press the **Import recipes** button and confirm when prompted (Figures 59 and 60).
    - The whole library will be imported from the file on the Micro SD card named LIBRARYX.BAK, where X is the file number entered on the previous step.
    - A confirmation notice will appear after the file writing is finished (this may take several minutes)
    - Acknowledge the notice and press  to return to the Settings list

P.9 Finishing Mixing Run

Each time upon finishing run the notification to operator is exposed on screen. Details of the notification depend on events during process. Possible scenarios are provided in the Table 5.

Table5. Finish notification details

PROCESS CONDITION		FINISH NOTICE CONTENT	
STARTED	DURING RUN	FINISH STATUS	DURATION SHOWN
Manual permanent or timed run.	Normal process	Successful	Neat mixing time (pause time is not included)
	Paused-resumed		
	Failure-Alarm	Unscheduled	
	Stopped (timed run only)		
Recipe Run	Normal process	Successful	Actual duration of recipe run time (includes pauses)
	Pause-resumed		
	Failure-Alarm	Unscheduled	
	Aborted		

P.10 Initial Settings

Default settings are the factory preinstalled parameters as listed in the Table6. The parameters can be adjusted through the corresponding editor screens.

Table6. Initial settings of user interface parameters

Description of parameter	Units	Factory setting
Manual mode speed of rotation	RPM	20
Manual mode run duration	Min	0
Recipe mixing phase time duration (in all instructions)	Min	0
Recipe pause phase time duration (in all instructions)	Min	0
Recipe speed of rotation (for all instructions in recipes)	RPM	20
Auto logout time	Min	10
Operator Password		123456
Supervisor Password		123456
Date format		MM:DD:YY
Calendar date		
Clock time		

Q. SPARE PARTS & STANDARD ACCESSORIES LISTS

Table7. Spare parts and accessories (See Figure 2, 61, 62 and 68)

Item	Description	Catalog number
	Accessories	
E1	US Power Cord	LT-SVSP365
E2	EU Power Cord	LT-SVSP366
E3	6-magnet Impeller	LT-SVSP311
E4	Soft magnetic shield	LT-SVSP313
E5	Magnetic Clamp Type 2	LT-SVSP309
E6	7/16” Combination wrench	LT-SVSP314
E7	Centering Aligner	LT-SVSP305
E8	6-magnet Charger	LT-SVSP307
E9	Clip for 1” Drain Valve	LT-SVSP312
E10	4-magnet Impeller	LT-SVSP310
E11	4-magnet Charger	LT-SVSP306
	Spare parts	
1	48 VDC Cryomodule, assembly	LT-SVSP300
2	Sensor Ring, assembly	LT-SVSP301
3	LevMixer Latch	LT-SVSP315
4	Roller	LT-SVSP320
5	Mount, vibration damping	LT-SVSP324
6	Replacement Filter Tissue	LT-SVSP327
7	Timing Belt	LT-SVSP330
8	Cryocooler Controller, 48 VDC Input	LT-SVSP338
9	Terminating plug	LT-SVSP341
10	White illuminated Pushbutton Switch	LT-SVSP414
11	Fuse, 250VAC x 5A	LT-SVSP354
12	Carriage screw ¼”-20, lg. 1”, 18-8 SS	LT-SVSP387
13	Carriage screw ¼”-20, lg. 1/2”, 18-8 SS	LT-SVSP386
14	Acorn nut ¼”-20, hex 7/16”	LT-SVSP388
15	Spacer 0.38 ID x 0.75 OD 7/8” lg, 18-8SS	LT-SVSP394
16	White LED Bulb	LT-SVSP415
17	Guide Roller for Magnetic mixer/Levmixer G2	LT-SVSP016
18	Guide Assembly	LT-SVSP449
19	Sensor Ring for Compact Drive	LT-SVSP472
20	Power Cord AU	LT-SVSP367
21	Power Cord SW	LT-SVSP368
22	Power Cord UK	LT-SVSP369

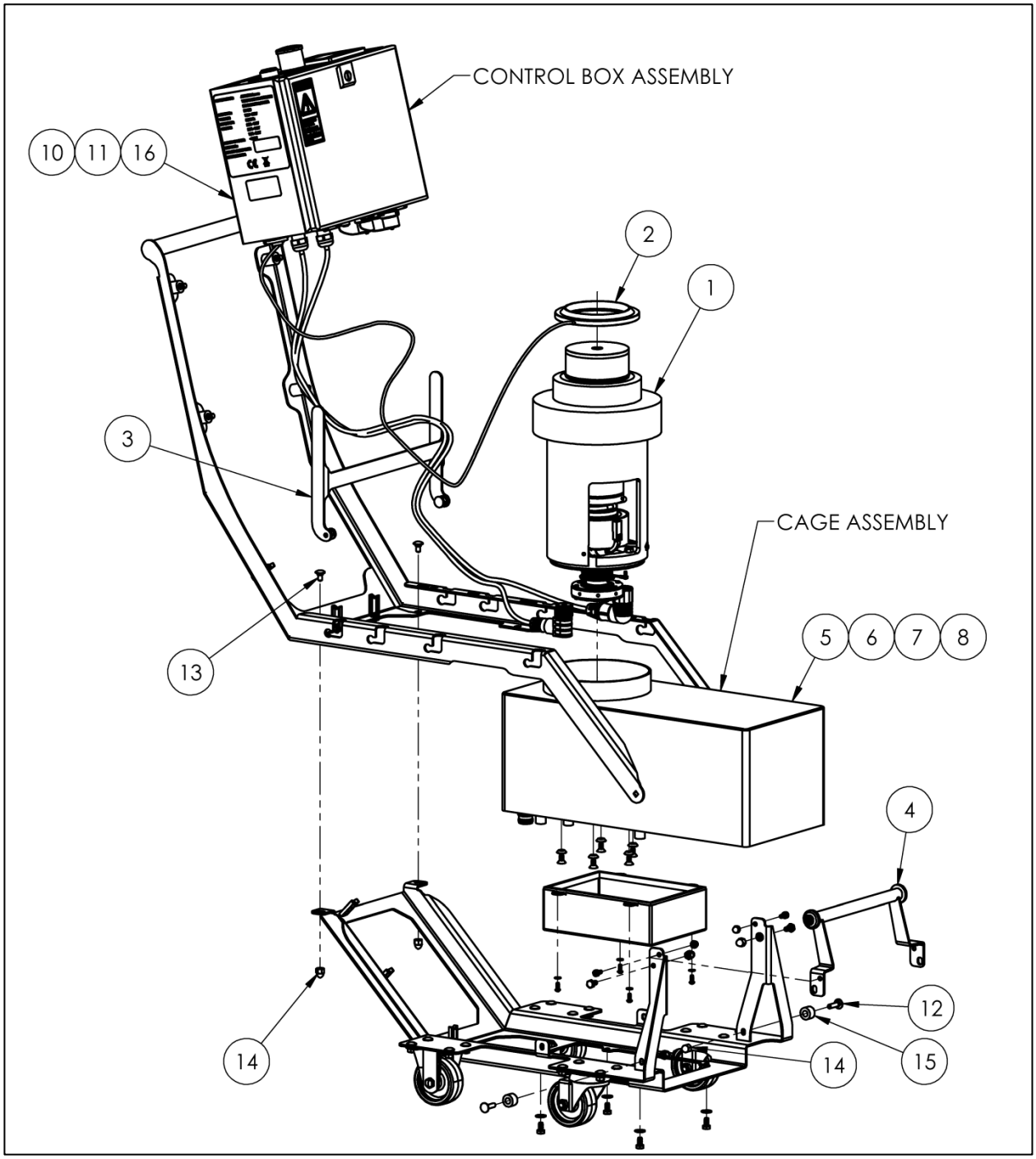


Figure 61: Levmixer components. **For compact drive unit model see Section S.**

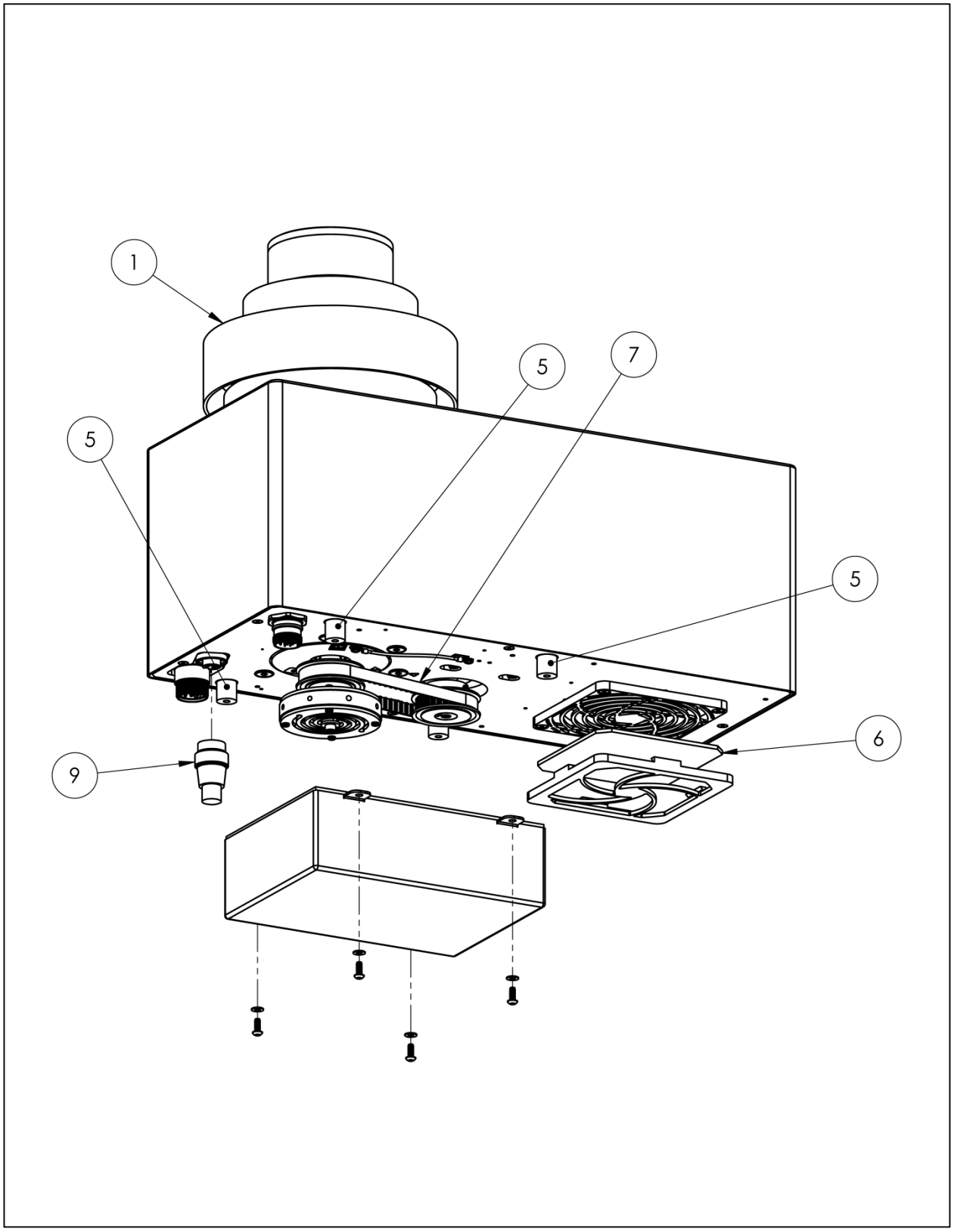


Figure 62: Levmixer components (bottom view)

R. ELECTRICAL SCHEMATIC

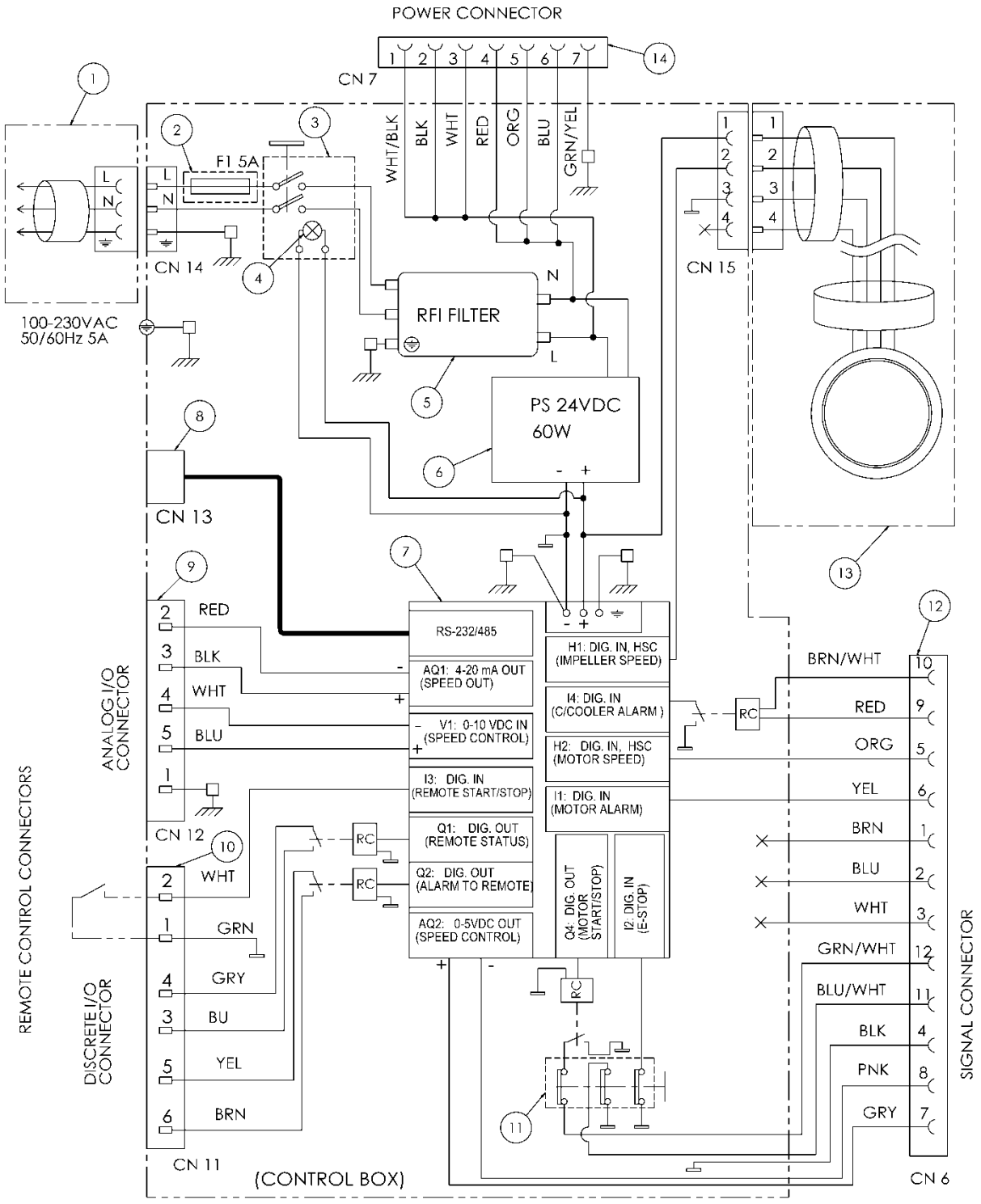


Figure 63: Electrical Schematic. Control Box
(See Table 8 for Remote Control I/O chart)

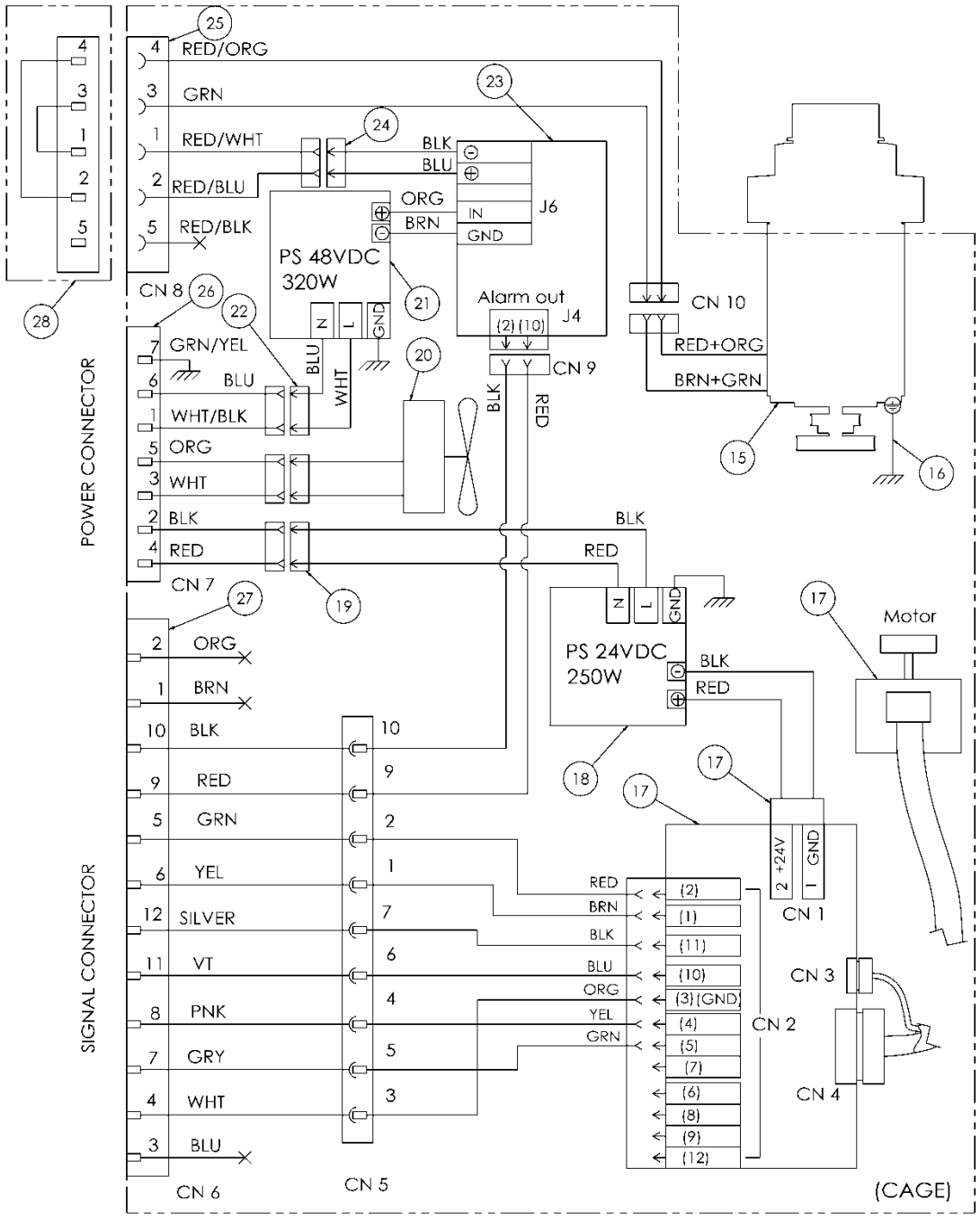


Figure 64: Electrical Schematic. Cage

Table8. Remote Control I/O Chart
(See schematic in Figures 63 and 64)

ANALOG I/O CONNECTOR CIRCUITS				
PIN#	CIRCUIT DESCRIPTION	RANGE	CALIBRATION	
2, 3	Speed output 4-20mA	0-210 RPM	4mA=0% of range	20mA=100% of range
4, 5	Speed set point input 0-10VDC	0-210 RPM	0V=0% of range	10V= 100% of range
DISCRETE I/O CONNECTOR CIRCUITS				
PIN#	CIRCUIT DESCRIPTION	SIGNAL TYPE	LOGIC	
1, 2	Motor Start/Stop input	Relay contact	Open=Stop	Closed=Run
3, 4	Remote status output	Relay contact	Open=Local Control	Closed=Remote Control
5, 6	Alarm output	Relay contact	Open=No Alarm	Closed=Alarm

The analog speed control input 0-10 V (pins 4 and 5 of analog input connector) has an impedance of 500 kOhm. The safe input voltage range is -0.5V to +15V

For the analog output 4-20 mA (pins 2 and 3 of analog I/O connector) the MAX load resistance should not exceed 500 Ohm.

For equipment safety and to avoid possible excess noise on the speed control input signal (pins 4, 5 of Analog I/O connector) it is recommended to include an Isolation Amplifier in the design of the 0-10 VDC remote control external circuitry.

Table9. List of Electrical Components
(See schematic on Figures 63 and 64)

Item	Description
1	Power cord assembly
2	5A fuse
3	Power button
4	LED light bulb
5	RFI filter
6	24 VDC 60W power supply
7	Touch screen PLC
8	RJ45 Socket
9	5-pin receptacle TURCK # RSFPV 579
10	6-pin receptacle TURCK # RSFPV 61
11	E-Stop button
12	12-pin cordset
13	Sensor ring assembly
14	7-pin cordset
15	Cryomodule assembly
16	Cryomodule Ground wire
17	Motor, motor controller & cables
18	24 VDC power supply
19	24V power supply input harness
20	Wired fan

21	48 VDC power supply
22	48V power supply input harness
23	Cryocooler controller
24	Cryocooler controller output harness
25	Cryocooler harness
26	Power harness
27	Signal harness
28	Terminating plug

S. COMPACT MODEL

All that described in sections A to T is applicable to compact model DB-300C except Sections I, O.3., Figure 61 and partially in Sections L, N.

Compact model was developed for applications that are critical in regard of space occupied by equipment in the room. This model is identical to basic one DB-300 except the frame. As it shown in Figure 65 the changed frame still carries the same standard subassemblies (Cage with Cryomodule and Control Box) but for connectivity with tank compact drive requires specific drive port configuration on the tank, designed to support compactness of the system. Compact model doesn't have the variety of port sizes for connectivity with tanks compare with basic model while mixing capacity and other functionality is identical to DB-300.

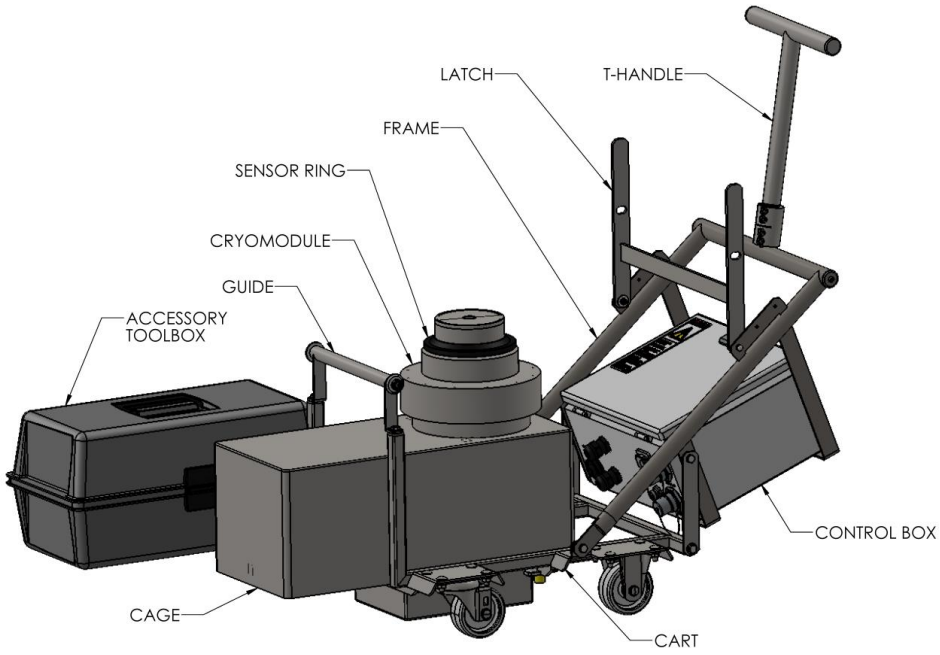


Figure 65: Compact Levitated Drive Unit

Generally compact unit has the same procedure for connection with tank as it described in Sections L, N for unit of basic model. Modified connection system has latching hooks separated from rails and positioned independently how it is present in Figure 66. Plungers mounted on the tank allow locking the connected drive for reliability on both sides of the latch.

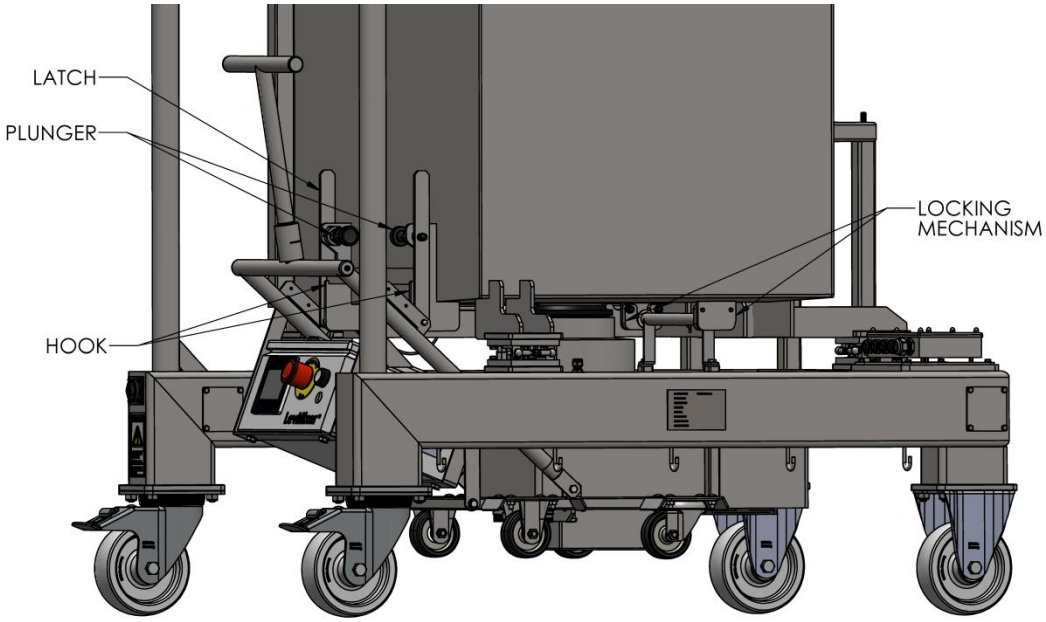


Figure 66: Compact Drive connected to tank

Version of the drive port for permanent connection instead of rails has locking mechanism mounted on the bottom of tank (see Figure 66). It holds the drive in place levelled correctly when it is positioned for mixing (closed position) while allow drive unit to be turned down to disconnect it from impeller and bag (open position, see Figure 67).

Figure 67: Open position of permanently connected drive unit

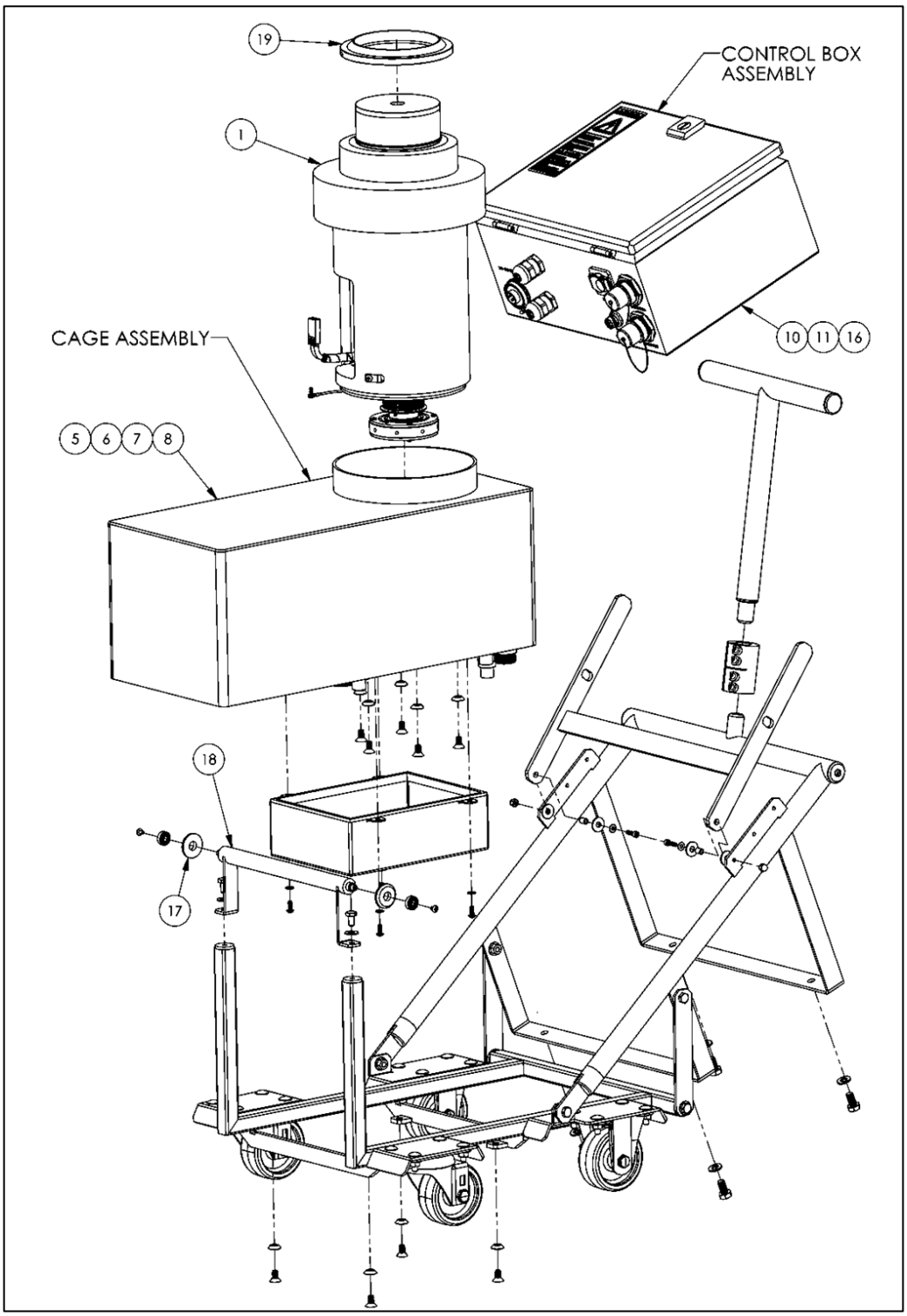


Figure 68: Components of Compact version of Levmixer .
For numbered spare parts see Table in Section Q

T. LEVMIXER - SERVICE

The Mixing system was developed exclusively for mixing fluids and solids in fluids in specially designed bags. The machine should only be used for this purpose to ensure a long service life.

Should your Magnetic Mixer require service, contact:

North America:
PALL Life Sciences
20 Walkup Drive
Westborough, MA 01581
E-mail: PASS_Support@pall.com

Europe:
PALL Life Sciences
Reugelstraat 2, B-3320 Hoegaarden, Belgium
Phone: +32 (0) 16.76.61.59
Fax: +32 (0) 16.76.76.25

LevMixer®

Patents:
Pall.com/patents

EC DECLARATION OF CONFORMITY IN ACCORDANCE WITH THE MACHINERY DIRECTIVE 2006/42/CE, Annex II., Sub. A

The manufacturer, Pall LifeSciences Belgium BVBA.

Reugelstraat 2
3320 Hoegaarden

Name and address of the person (established in the European Community/EEA) authorized to compile the technical file (to the authorities on request):

Steven Vanhamel, Director Research & Development, Pall Life Sciences Belgium BVBA.
Reugelstraat 2
3320 Hoegaarden, Belgium

Hereby declares that the machinery:

LevMixer® Single-Use Mixing System P/N LT-DBTL300, LT-DBTL300-C
Models DB-300, DB-300C

is in conformity with the relevant provisions of the Machinery Directive (2006/42/EC) and the regulations transporting it into national law.

is in conformity with the provisions of the following other EC-Directives

- Low voltage Directive 2006/95/EC
- EMC Directive 2004/108/EC
- Restriction on Hazardous Substances 2011/65/EU

And furthermore, we declare that:

the following (parts/clauses of) European harmonized standards have been used :

- EN 60204-1:2006 : Safety of machinery – electrical equipment of machines
- EN 61010-1:2010 : Safety requirements for electrical equipment
- EN 55011:2009 : Radio-frequency disturbance characteristics, Group 1, Class A
- EN 61000-6-2:2005 : Electromagnetic compatibility (EMC)

Done at Hoegaarden, Belgium, August 2015
Signature:

Date of Approval:
14/8/15

PALL Legal representative
Bob Foster, VP operations, PALL Life Sciences Belgium

AUTHORIZATION TO MARK

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

Applicant:	Pall Belgium Life Sciences BVBA	**Manufacturer:**	MultiSource Manufacturing LLC
Address:	Reugelstraat 2 3220 Hoegaarden	**Address:**	11545 12 Avenue South Burnsville, MN 55337
Country:	Belgium	**Country:**	USA
Contact:	Ms. Sandy Thielen	**Contact:**	Mr. Dan Larson
Phone:	(952)936-7052	**Phone:**	(952)882-6211
FAX:	NA	**FAX:**	(952)882-6232
Email:	sandy_thielen@pall.com	**Email:**	dlarson@multisourcemfg.com

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Oakdale, MN

Control Number: 4008753 **Authorized by:** _____

Paul Klemets for
Thomas J. Patterson, Certification Manager

C ETL LISTED US
Intertek

This document supersedes all previous Authorizations to Mark for the noted Report Number.

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights, IL 60005
Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

Standard(s):	UL 61010-1: Issued: 2004/07/12 Ed:2 Standard for Safety Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements CSA C22.2#61010-1:Issue:2004/07/12 Ed:2 (R2009) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements, with general instruction No. 1: 2008/10/28 - (R2009) IEC 61010-2-051: Issue:2003/06/01 Ed: 2 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 2-051: Particular Requirements for Laboratory Equipment for Mixing and Stirring-Edition 2
Product:	Mixing system
Models:	DB300