SINCE 1949
ROMANOFF®
INTERNATIONAL SUPPLY CORPORATION

PRODUCT MANUAL

SKU: 79-500-D1, 79-500-D2

Romanoff CCM Centrifugal Casting Machine

Operation Manual



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Product Models		
CS1-J	0UPT 017-110-00	Jewelry Casting Machine, 3P/380 VAC
CS1-JT	0UPT 017-110-05	Jewelry Casting Machine, 3P/230 VAC with Transformer

SPECIFICATION			
	CS1-J	CS1-JT	
Absorbed Power (kW, max)	8.3 kW		Power regulation 10÷100%
Power regulation	10÷100%		
Medium frequency melt circuit	50-90 kHz		
Timer Resolution	1 min/step		1 – 30 min.

INPUT		
Line Phases	3	
Line Frequency	50 / 60 Hz	
AC Line Voltage/ Ph. Current(max)	380V/ 15A	230V/24A
Minimum cross-sectional area of power conductors	2.5 mm2	4.0 mm2

Output	CS1-J	CS1-JT	
Output power (rated)	7.5 KVA		Power regulation 10 ÷ 100%
Power regulation	10÷100%		
Medium frequency melt circuit	50-90 kHz		
Timer Resolution	1 min/step		1 – 30 min.

PROTECTION		
Over-current	53 A (RMS)	Output current - inverter
Over-temperature heat sink	Thermoswitch @ 50°C	Reset by depressing STOP

MISCELLANEOUS		
Environment temperature	41˚F (+5°C) to + 104˚F (+40°C)	Operating
Relative humidity	30 to 90%	avoid condensation

PHYSICAL		
Cooling System	Water	
Minimum water flow rate	2 lt/m (0.53 gal/m)	Minimum differential pressure of the cooling water 4Bar (60PSI), maximum input pressure 8 Bar (120 PSI)
Minimum inlet temperature	15 °C	avoid condensation
Maximum inlet temperature	35 °C	
Input air pressure	6 ÷ 10bar	
Module Dimensions W x D x H inch (mm)	30.3x27.0x43.5 (770x685x1105)	
Weight	250 kg	
Packaged weigh	639.3 lb (290 kg)	
Package Dimensions W x D x H inch (cm)	34x31x47 (870x785x1205)	
Crucible Capacity	350g Pt, 300g Au	
*Minimum operating material	90g Pt	
Flask Size mm (max)	D=100x H=120	
Max Melting T°	2000 C°	
due to non-susceptor heating		

Dear Customer,

Congratulations on choosing an ***CSx Digital*** centrifugal casting machine. We wish to remind you that this machine is a very advanced product with regard to the casting system, the temperature reading device, the automatic controls, and the safety devices.

The ***CSx Digital*** is our top of the line, large universal centrifugal casting system. This system is perfect for jewellery manufacturers with a high demand.

The ***CSx Digital*** casting machines can cast all metals and alloys commonly used in the jewellery manufacturing – gold, silver, steel, platinum, palladium, and many more.

This powerful induction heating generator provides fast and efficient melting and mixing of precious and non-precious metals and alloys.

We thank you for choosing our machine, and we wish you fruitful work.

Romanoff International is always at your disposal for any request you may have.

1. GETTING STARTED GUIDE

1.1 SAFETY INSTRUCTIONS

1.1.1 IMPORTANT NOTES

1. This operator's manual is addressed to the owner, for correct installation, use, and maintenance of the machine.
2. The operator's manual contains useful information to specify the recommended use of the machine according to the application requirements and technical features, to supply instructions for installation, assembly, regulation, and use, personnel training, to direct maintenance, and to supply information on residual risks.
3. It also provides complete information on all models and all additional modules of the CS series casting units. You are therefore advised to refer to all the paragraphs concerning the model(s) in your possession.
4. For a professional use of the machine, this manual can never replace the operator's specific experience. However, it supplies all the information required for a correct installation and is a useful reminder of the main basic operations.
5. This manual is an integral part of the machine and should be kept for future reference until the final disassembly of the machine. Therefore, this manual should be kept near the machine and it should be treated with excellent care (protected, in a dry place, away from sun or other atmospheric agents, etc). In case of loss or damage, you can request a new copy from our dealers, technical service centers, or directly from Romanoff Inernational. This manual reflects the state-of-the-art at the moment of the machine commercialization, and cannot be considered inappropriate due to subsequent amendent on the basis of new experience.
6. The information provided by this manual is based on the original production of the machine. Changes from later revisions may not be present in this manual.
7. In this document, a period "." will be used as the decimal point delimiter.
8. The manufacturer reserves the right to amend or update production manuals, without being obligated to update previous versions, aside from exceptional circumstances.

9. You can request further details or updates to this manual from our dealers, technical service centres, or directly from Romanoff International.
10. Any criticism or suggestion aimed at improving the machine can be sent in writing to our office. We will be pleased to read them and send our comments to the persons concerned.

1.1.2 SAFETY WARNINGS

To guarantee the utmost operating reliability, Romanoff International has carried out an accurate selection of materials and components to be used in the manufacturing of the machine. The machine has undergone regular checks before being delivered. The machine's productivity over the years also depends on its correct use and an appropriate preventive maintenance according to the instructions contained in this manual.

All manufacturing elements, connecting components, and controls have been designed to resist abnormal strains or strains higher than those specified in this manual. The materials are of the best quality and their acceptance, storage, and use in the workshop are continuously controlled in order to guarantee the absence of damage, wear and tear, and faulty operation.

In any event, the following precautions must always be taken:

1. NEVER USE THE MACHINE OR CARRY OUT ANY MAINTENANCE ON THE MACHINE IF YOU HAVE NOT CAREFULLY READ AND WHOLLY UNDERSTOOD THIS MANUAL IN ALL ITS PARTS.
2. IN PARTICULAR, TAKE ALL THE NECESSARY MEASURES LISTED IN **SECTION 1** - GETTING STARTED GUIDE.
3. IT IS FORBIDDEN TO USE THE MACHINE IN CONDITIONS OR FOR A USE OTHER THAN THOSE STATED IN THE MANUAL. ROMANOFF INTERNATIONAL SHALL NOT BE DEEMED RESPONSIBLE FOR ANY FAILURE, FAULT, OR ACCIDENT DUE TO THE NON-OBSERVANCE OF THIS PROHIBITION.

This manual consists of three parts:

SECTION 1: deals with the SAFETY INSTRUCTIONS AND INFORMATION
SECTION 2: illustrates the MACHINE CHARACTERISTICS - OPERATION - TRANSPORT - AUXILIARY EQUIPMENT ASSEMBLY – EQUIPMENT - SHUTDOWN - CIRCUIT DIAGRAMS.
SECTION 3: deals with the INFORMATION ON MAINTENANCE AND REPAIR.

NOTE: IT IS FORBIDDEN TO TAMPER WITH, ALTER, OR EVEN PARTIALLY CHANGE THE MACHINE OR EQUIPMENT REFERRED TO IN THIS OPERATOR'S MANUAL, AND IN PARTICULAR THE GUARDS FITTED FOR THE PERSONNEL'S SAFETY.

IT IS FORBIDDEN TO OPPERATE THIS MACHINE IN A MANOR NOT SPECIFIED IN THE MANUAL, OR TO NEGLECT THE RELATED SAFETY PRECAUTIONS.

Operations, for which the non-observance of the instructions can lead to damages to the machine or other parts related to the machine or to the surrounding environment, will be indicated in the manual by this sign.



Operations, for which the non-observance of the instructions or tampering with the equipment or parts can lead to personal injuries will be indicated in the manual by this sign.



During the machine operation, the operator is protected by the closed centrifugation chamber lid. The working cycle can only begin after the lid has been closed and locked. The protection remains locked in the closed position until the cycle is over.

	**DURING THE WORKING CYCLE, THE PROTECTION LID SHOULD NOT BE FORCED OPEN. IF, AT THE END OF THE CYCLE, THE LID REMAINS LOCKED, DO NOT FORCE THE OPENING AND CONTACT OUR SERVICE DEPARTMENT.**

The compartment underneath the centrifugation chamber houses the control and power electric circuits and the arm rotation motor. This compartment is isolated from the operator by fixed bulkheads. The bulkheads are kept in position with screws that can only be removed with special wrenches supplied with the machine.

EMERGENCY LID OPENING: In case of a black out, to unlock the cover, **see chapter 3.2 ACCIDENT PREVENTION PROTECTIONS**.

	**EMERGENCY LID UNLOCK SHOULD BE USED ONLY IN CASE OF POWER SUPPLY FAILURE DURING THE CASTING OPERATION.**

1.1.3 Magnetic Field

	***WARNING: MAGNETIC FIELD!*** **CAN BE HARMFUL TO PACEMAKER WEARERS AND PEOPLE WITH METALLIC IMPLANTS!** **PACEMAKER AND METALLIC IMPLANTS WEARERS STAY BACK 30 cm (12in)!**

1.1.4 GROUNDING

This product is a device which utilizes protective grounding to earth to ensure operator ‘s safety.

	**PROTECTIVE EARTHING CONDUCTOR TERMINAL** -This symbol indicates the point on the product to which the protective grounding conductor must be attached.
	**EARTH (GROUND) TERMINAL** -This symbol is used to indicate a point which is connected to the PROTECTIVE EARTHING TERMINAL. The component installer/assembler must ensure that this point is connected to the PROTECTIVE EARTHING TERMINAL.
	**CHASSIS TERMINAL** -This symbol indicates frame (chassis) connection, which is supplied as a point of convenience for performance purposes. This is not to be confused with the protective grounding point and may not be used in place of it.

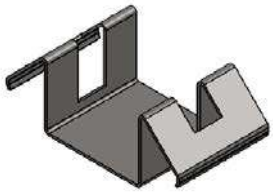
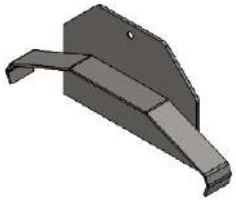
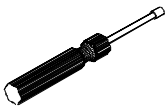
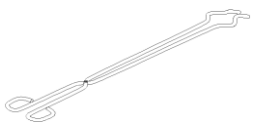
1.2 GENERAL INFORMATION

1.2.1 RECOMMENDED USE

The ***CSx Digital*** range of casting machines can cast all metals and alloys commonly used in the jewellery manufacturing – gold, silver, steel, platinum, palladium, and many more.
The safety devices fitted on the machine make it safe and reliable.

1.2.2 SUPPLIED ACCESSORIES

Table: 1.1 Accessories CSx models

№	Accessory overview	Accessory Type	Qty
1		*2DET-017-000-KD Crucible Pt 350 g (CS 1)* *2DET-016-000-KM Crucible 750g Pt (CS 2)* *2DET-017-000-KF Crucible 1kg SS (CS 3)*	1
2		*2DET-017-000-KJ Crucible D50 with graphite (CS 1)* *2DET-017-000-KI Graphite crucible for Gold (CS 2)* *2DET-017-000-KK Graphite crucible Gold (CS 3)*	1
3		*2DET-017-100-LF Balance Key*	1
4		*2DET-017-100-NG Flask saddle 80mm (CS 1)* *2DET-017-200-AA Flask saddle 80mm (CS 2)* *2MAS-017-250-AZ Flask saddle o103/200mm (CS 3)*	1
5		*2DET-017-100-NI Flask saddle 90mm (CS 1)* *2DET-017-200-AB Flask saddle 90mm (CS 2)* *2MAS-017-250-DZ Flask saddle 103-155mm (CS 3)*	1
6		*2DET-017-100-NJ Flask saddle 100mm (CS 1)* *2DET-017-200-AC Flask saddle 100mm (CS 2)*	1
7		*2MAS-017-100-AV Spacer for saddle 19mm (CS 1)* *2MAS-017-200-HB Spacer for saddle 34mm (CS 2)* *2MAS-017-250-DB Spacer for saddle 155mm (CS 3)*	1
8		*2MAS-017-100-AW Spacer for saddle 34mm (CS 1)*	1
9		*4EAC-000-017-00 Feet, Adjustable*	4
10		*4HVM-000-100-00 Screw driver*	1
12		*4HVM-000-101-00 Crucible tongs*	1

The type and numbers of accessories depends of the customer specification

1.2.3 UNAUTHORIZED USE

The crucibles from materials others than ceramics or graphite have not been tested for use. The metal cannot undergo centrifugation casting if the top lid is opened.

1.2.4 PERSONNEL TRAINING

The ***CSx Digital*** machine models have been designed and built to be used by qualified personnel; these persons should be perfectly acquainted with the work execution procedures and the characteristics of the materials to be used.
The operator will be responsible for reading this manual to completion and completing all necessary training under the supervision of a qualified operator.

1.2.5 SAFETY DEVICES

This machine is equipped with the following devices to guarantee the safety of the operator:

1. ***Top lid locking during rotation.***
2. ***Melting will not start if insufficient water flow.***
3. ***Melting will not start if the water temperature is too high.***
4. ***Melting will not start if the coil does not rise.***
5. ***Coil will not rise in case of low air pressure.***
6. ***Coil will not rise if the position of the arm is not aligned with the crucible.***
7. ***Red mushroom emergency stop on yellow background. It should be used in the following circumstances:***
   - ***7.1. To quickly prevent personal injury during operation;***
   - ***7.2. To quickly prevent damage to the machine or the application. USE MODERATELY.***

1.2.6 NOISE LEVEL

Noise measurements have been made with the machine in the centrifugation phase, as this is the operation with the highest level of noise emission.

1. Phonometric measurement in compliance with UNI 9432.
2. Noise meter: Bruel & Kjaer 2218, with wad filter 1613 № 895445.
3. Weighting filter: Curve A.
4. Measuring system: The exposures are calculated starting from noise pressure measures and integrating for the time of exposure.
5. Estimated equivalent continuous noise level A in the working station.
6. $L_{Aeq1}T_p = 68.7$

1.2.7 RESIDUAL DANGER AND EMERGENCY SITUATION



1. **Avoid direct contact with the melting coil during the heating phase (ELECTRIC HAZARD).**
2. **Avoid introducing metal objects inside the melting coil without the appropriate crucible (ELECTRIC AND THERMAL HAZARD).**
3. **Avoid direct contact with the mechanical parts situated near the crucible. Use supplied CRUCIBLE TONGS and wear suitable gloves to manipulate CRUCIBLES and FLASKS (THERMAL HAZARD).**
4. **Avoid any type of intervention on the machine before the machine has been disconnected from the electric supply.**

Note: The residual dangers are indicated on the machine by specific labels.

2. INFORMATION ON THE MACHINE OPERATION

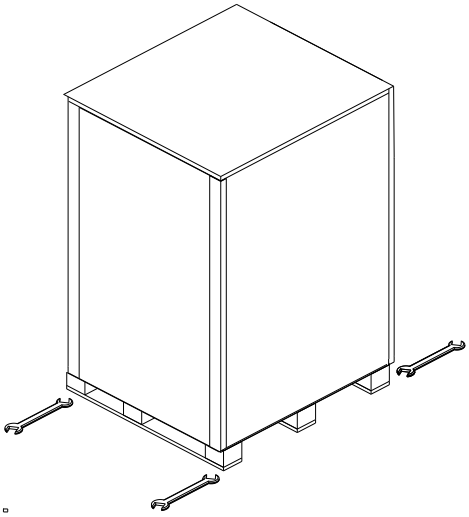
2.1 INSTALLATION AND SET-UP

2.1.1 UNPACKING THE MACHINE

The machine is fixed with bolts to a wooden pallet to guaranty a safe transport. Use a wrench n. 17 to unscrew the bolts and free the machine from the Pallet before the installation.

***ATTENTION:* be careful and keep the machine in vertical position.**

Ensure that the machine has not been damaged during transport. In the event of damage, immediately inform the shipping agent and relay this information to the manufacturer and reseller. Take four feet from Accessories and fit them instead of the transport feet.

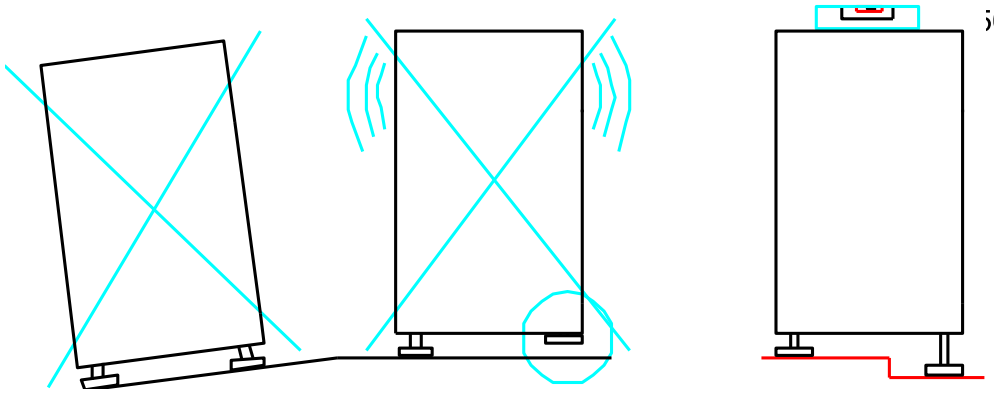


2.1.2 POSITIONING IN THE ROOM

The machine must be installed in a properly ventilated room to collect the fumes and steams that build up during the melting process. In order to reduce possible risks while handling hot materials, it is recommended to install the machine near the heating furnace and the service sink.

- ✓ PLACE THE MACHINE ON A PERFECTLY FLAT SURFACE.
- ✓ When the machine is installed, check THAT IT IS PERFECTLY LEVEL AND HORIZONTAL. Total stability is absolutely essential during the centrifugation arm rotation. If necessary, adjust the machine position with the feet fitted on the place instead of transport feeds, to adapt it to the floor.

DO NOT INSERT ANY SHIM BETWEEN THE FEET AND THE FLOOR. *With a level gauge, check that the upper surface is perfectly flat.*



2.1.3 MAINS CONNECTIONS

Check that the main voltage supply corresponds to the one written on the identification plate set on the back panel of the casting machine. Check that the installed power is sufficient.

ATTENTION: ***Always remember that grounding is MANDATORY. Check that the power supply and ground connection are made properly.***

№	*CABLE COLOUR*	*3-PHASE CONNECTION*
1	Brown	Line 1
2	Black	Line 2
3	Grey	Line 3
4	Blue	Neutral
5	Yellow-Green	Protective Ground

2.1.4 SERVICE CONNECTION

1. Check that the main voltage supply corresponds to the one written on the identification plate set on the back panel of the casting machine. Check that the installed power is sufficient. It is not possible to change the power supply voltage of the machine. If the voltage of the power supply network does not correspond to the value indicated on the data plate of the machine call the seller.

2. The plug and the socket for the connection of the power supply cable with the electrical network have to satisfy the applicable standards.

ATTENTION: ***Always remember that grounding is compulsory. Check that the power supply and ground connection are made properly.***

3. Check that the environment conditions correspond to the requirements reported on paragraph 1.

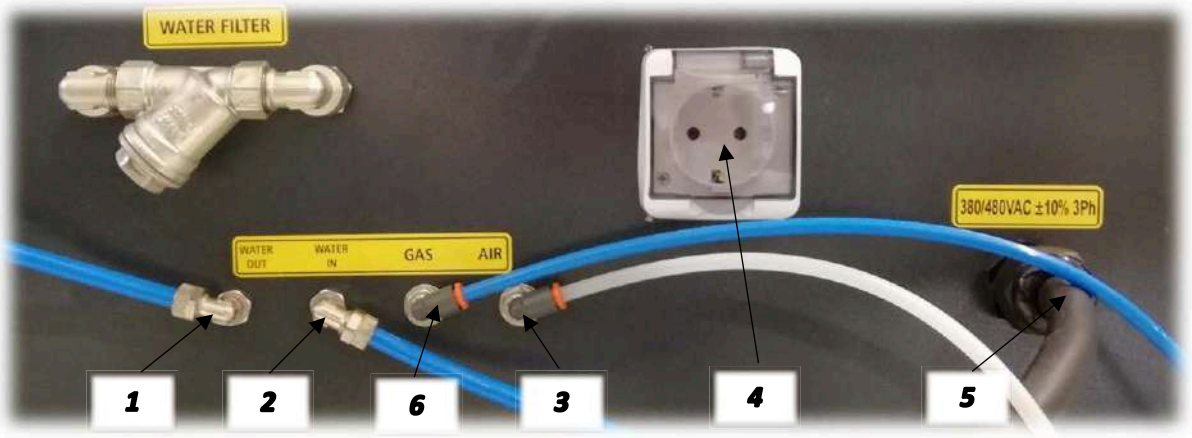
4. Do not obstruct the suction and ejection intakes of the cabinet cooling air.

5. Connect the cooling hydraulic circuit of the machine to the forced circulation cooling circuit, following the direction of delivery and discharge sense indicated near the respective connections on the rear panel of the machine indicated as 1 and 2 in fig 2.3.

6. Start the cooling water circulation and check that there is no loss on the connection points.

7. Connect the compressed air circuit through the appropriate connection 3 of fig.2.3. For a good operation the air pressure must be between 6 and 10 bar. In case the air pressure is lower than indicated the machine functions are stopped.

8. In case the machine is pre-set for the Argon, connect the gas bottle to a hose 4x6 to the connection (6 of fig.2.3). (Maximum 5 bar). We suggest the use of Argon Gas Air Liquide type N56.



1. ***Cooling water output***
2. ***Cooling water input***
3. ***Compressed air connection***
4. ***External Water Cooling system connection plug***
5. ***Power supply cable***
6. ***Inert Gas connection***

Fig. 2.3 Back panel

Romanoff International is not responsible for damages due to wrong installation procedures!

9. PRELIMINARY CONTROLS

1. Check that the inert gas circuit has been connected (there must be no leaks) and the power supply is on.

2. Check that the centrifugation chamber is free from any accessories.

3. Check that the emergency push-button is not pushed down; to unlock the emergency, rotate the push-button in the direction of the arrow.

4. IN CASE OF FAILURE.

If a malfunction is observed during the operation, immediately disconnect the machine and check troubleshooting section.

5. EMERGENCY STOP CONTROL.

6. This mushroom type push-button is red on yellow background. It should be used:

- ➢ to avoid, as soon as possible, danger to persons;
- ➢ to reduce, as soon as possible, damages to the machine or to on-going operations.

USE WITH MODERATION!

2.2 TECHNICAL DESCRIPTION OF THE MACHINE

The ***CSx Digital*** machine is a centrifugal casting machine with induction heating which has been projected to satisfy the demands of the jewellery laboratories, where there is the need to do lost wax casting of different shapes.

The machine is composed of a steel support which holds up the centrifugal tank and of the closing steel sheet panels. On the top panel of the machine there is an opening lid equipped with safety locking to reach the working area.

A heavy-duty DC motor delivers high speed and high acceleration centrifugal casting, resulting in excellent compacting of the metal and perfect filling of the finest details.

Integrated Infrared temperature control ensures perfect casting quality and repeatability. An advanced Dual-Colour IR pyrometer is available as an option.

The modern LCD Touch control panel features an easy to use interface and intuitive visual feedback. It displays the measured process parameters, receives user input, sets various parameters and saves multiple programs. It also displays diagnostic and warning messages.

The ***CSx Digital*** benefits:

- Centrifugal injection with pneumatic movement for fast coil descent
- Accurate temperature controller (up to 2000C)
- Centrifugal arm balancing with adjustable counterweights
- Advanced 5” full-colour LCD touch panel with remote diagnostics capabilities
- Melting power regulation from 10% to 100%
- Powerful DC motor with reduction gear and adjustable acceleration
- Max rotating speed – 500 rpm. Rotation timeout pre-set at 40 sec.
- Auto locking of the chamber lid during centrifugal phase for maximum safety
- Integral powerful vacuum pump
- Inert (Argon or Nitrogen) gas circuit included

2.2.1 CONTROLS OVERVIEW

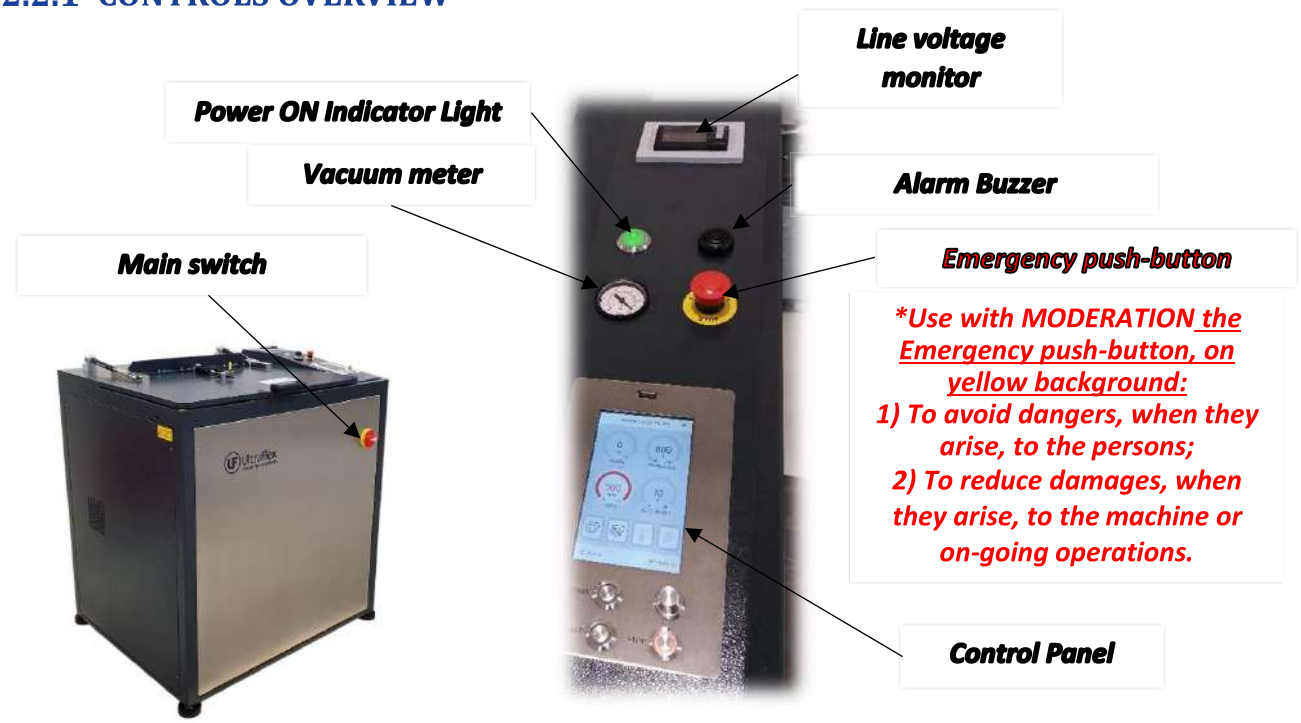


Fig. 2.4 Controls location

2.2.2 IDENTIFICATION OF THE CENTRIFUGATION COMPONENTS

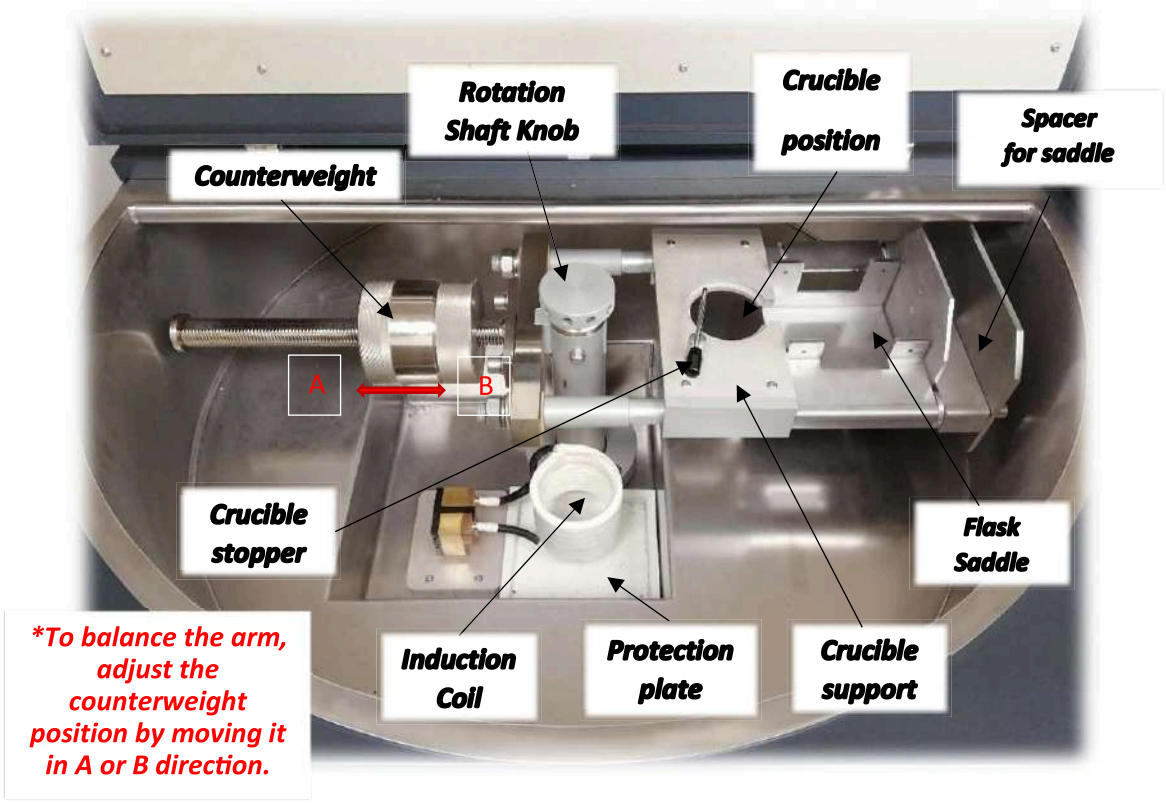


Fig. 2.5 Centrifugation components

2.2.3 CENTRIFUGAL ARM BALANCING

➢ Prepare the metal to melt inside the crucible.
➢ Insert the crucible into its seat of fig.2.5 and position it towards the outside of the well.
➢ Position the flask, which must not be hot, on its special cylinder saddle of fig.2.5 choosing the appropriate measure among the supplied sizes.
➢ Balance the counterweights: first of all, it is necessary to loosen the knob placed on the rotation shaft to balance the centrifugal arm: for this operation use the supplied balancing key inserting it into one of the special seat of the knob as it is shown of pic.2.6 and push it towards one own right. Subsequently position the counterweights until the balance point has been reached. Tighten with the knob of fig.2.5 the rotating arm of the centrifuge using the key and pushing it towards left.

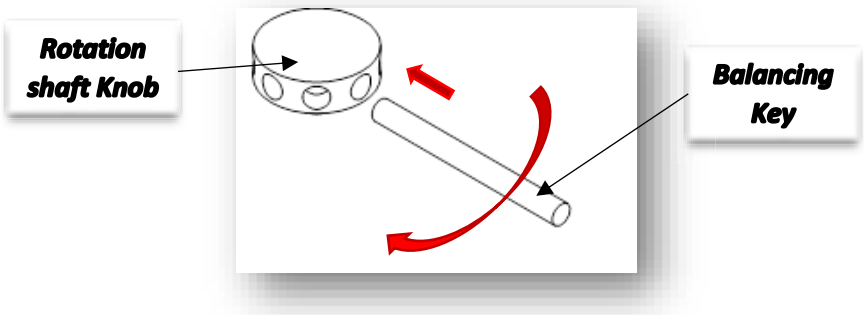


Fig. 2.6 Loosen the Rotation Shaft Knob

2.3 CONTROLS AND OPERATION

2.3.1 OVERVIEW

The unit is digitally controlled through a control panel located on the front of the unit. The control panel is designed to display the measured process parameters, to receive user input to set parameters and save programs, and to show error and warning messages. The Touch screen LCD display provides intuitive and informative visual feedback. The user can navigate through easy-to-use settings, diagnostics and service menus.

2.3.2 CONTROL

The user can navigate the user interface by directly pressing the corresponding buttons on the touch screen.

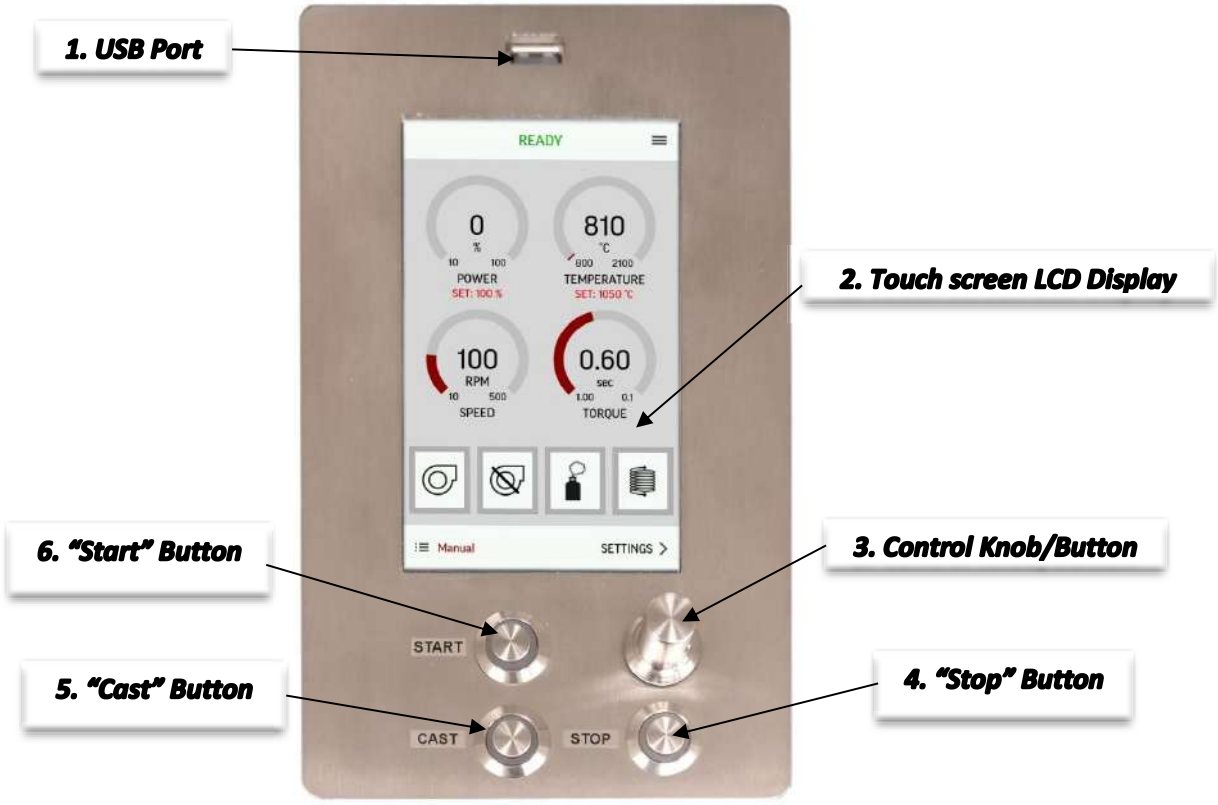


Fig. 2.7 Control Panel Layout and Controls.

Table: 2.1 Description of Control Panel Controls

№	NAME/FUNCTION	DESCRIPTION
1	**USB Port**	Access for easy software installation and updates.
2	**Touch screen LCD Display**	Allows the user to set casting process parameters, view measured parameters, save programs, and shows all errors and warnings.
3	**Control Knob/Button**	Rotary encoder with push button for changing parameters and scrolling through menus.
4	**"Stop" Button**	Stops the melting or casting process when pressed. Resets any errors or warnings.
5	**"Cast" Button**	Activates the casting process. Illuminates in yellow when pressed and the casting process begins.
6	**"Start" Button**	Activates the vacuum and melting process. Illuminates in green when pressed and the process begins.

2.3.3 HOME SCREEN

The following diagram illustrates a typical LCD display screen. The locations of status messages measured process parameters and user menus on the screen are indicated.

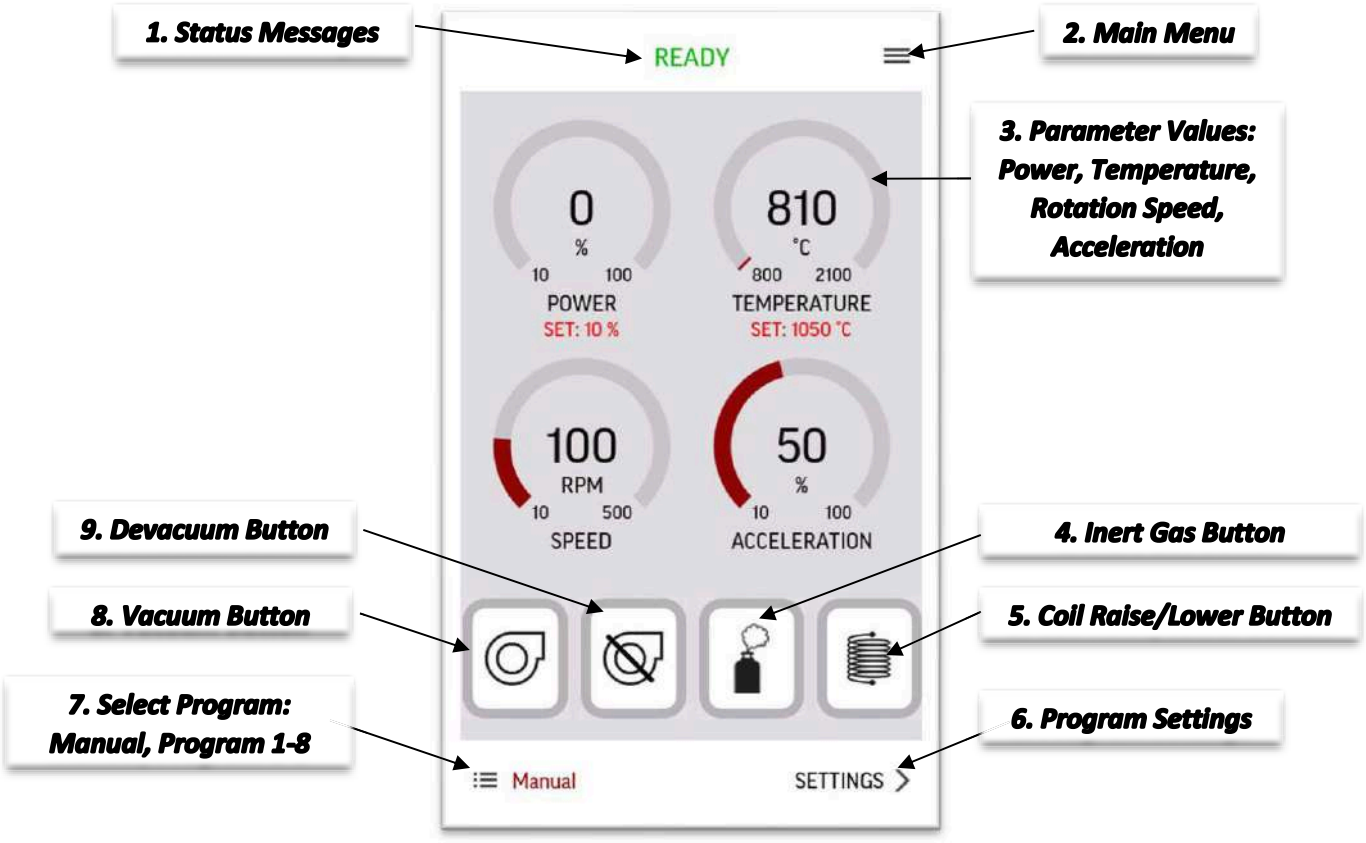


Fig. 2.8 The Home Screen

Table: 2.2 Home screen messages and buttons.

№	NAME	DESCRIPTION
1	**Status Messages**	Shows the current status of the system when in operation. See Section **STATUS MESSAGES** for a description of possible status messages.
2	**Main Menu**	Allows users to configure custom user settings, access tests & diagnostic protocols, implement software updates, and view product information.
3	**Parameter Values**	Displays and allows the user to adjust the set points of Power, Temperature, Rotation Speed, Acceleration. During operation, it displays the measured values as well as the set points. See Section **PROGRAM HEATING** for more details.
4	**Inert Gas Button**	The chamber starts to fill with inert gas after pressing of the button (if applicable).
5	**Coil Raise/Lower Button**	Allows the movement of the coil. Moves the coil either **UP** or **DOWN**.
6	**Program Settings**	Allows the user to view and customize all process parameters.
7	**Select Program**	Enables the user to choose between **Manual** mode or one of eight customizable pre-defined **Programs**. See Section **PROGRAM HEATING** for instructions on selecting and customizing user programs.
8	**Vacuum Button**	The Vacuum Pump starts working after the button is pressed and creates vacuum inside the casting chamber (up to -0.8 bar). **Time Out** - depending on the Machine type. For **CS3** it is **200 sec**.
9	**Devacuum Button**	After the button is pressed, devacuum valve opens and the vacuum is released from the casting chamber. **Time Out** - depending on the Machine type. For **CS3** it is **40 sec**.

2.3.4 STATUS MESSAGES

The status bar at the top of the home screen displays the machine status. The possible statuses and their meanings are summarized in the following table.

Table: 2.3 Status messages description.

READY	Indicates that the machine is ready to begin the melting and casting process.
SYSTEM TEST	Inverter test is in the process.
PREHEAT	The unit is in preheat condition.
PURGING <numb> CYCLE	Shows the number of washing cycle that is currently performed.
VACUUM	Points that the vacuum pump is operating, and vacuum is building inside the casting chamber.
MELTING	Indicates that the machine is heating and melting the load.
CASTING	Indicates that the machine is in the process of casting.
CHAMBER LOCKED	The top lid of the machine is locked, preventing access to the casting chamber.
CHAMBER RELEASE	The chamber is being freed from either vacuum or argon gas.
CHAMBER IS OPEN	The top lid of the machine is unlocked, granting access to the casting chamber.
ARM NOT ON POSITION	The coil is not in the correct position. If the rotating arm is not placed correctly, the coil cannot raise.
NOT READY	Indicates that the machine is not ready to begin the melting and casting process. An error or warning message will display the issue.

2.3.5 BEFORE OPERATION

From the Home screen, when the machine is in the **READY** state, the set points of Power, Temperature, Rotation Speed, Acceleration can be adjusted. To do so:

1. Press the parameter circle in the **Parameter Values** field of the home screen.
2. Turn the Control knob to adjust the parameter set point to the desired value.
3. Pushing the Control knob saves the parameter value. The new parameter value should now be displayed in the circle on the home screen.

To view and customize all process parameters, from the home screen press the bottom-right **SETTINGS>** button to bring up the **Program Settings** screen. There are two pages of parameters, which can be reached with the **NEXT>** and **<BACK** buttons on the bottom of the screen. To adjust the value of a parameter:

1. Press a setting on screen to toggle between ON and OFF. To edit the continuous parameters, select the parameter to open the editing screen. An example is shown below:

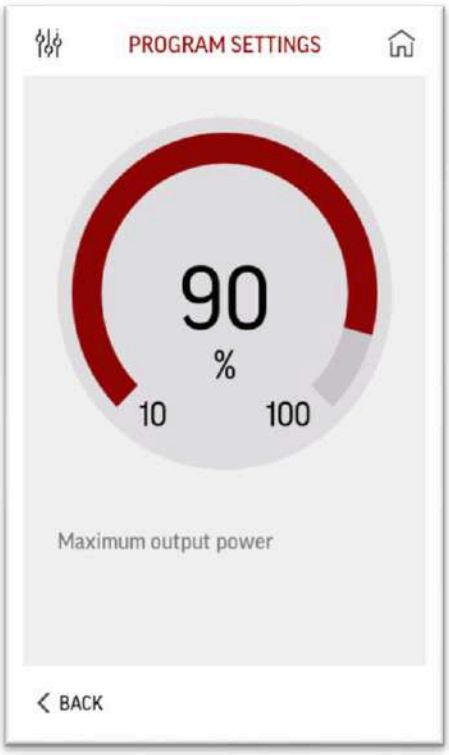


Fig. 2.9 How to regulate Maximum output power.

2. Turn the Control knob to adjust the parameter to the desired value, between the indicated minimum and maximum values. Pushing the Control knob saves the parameter value. The new parameter value should now be displayed in the **Program Settings** screen.
3. Select “Lock” to lock the parameter values for the program. A user-set password is required for unlocking.

2.3.6 MANUAL HEATING



Fig. 2.10 Manual Heating Home Screen

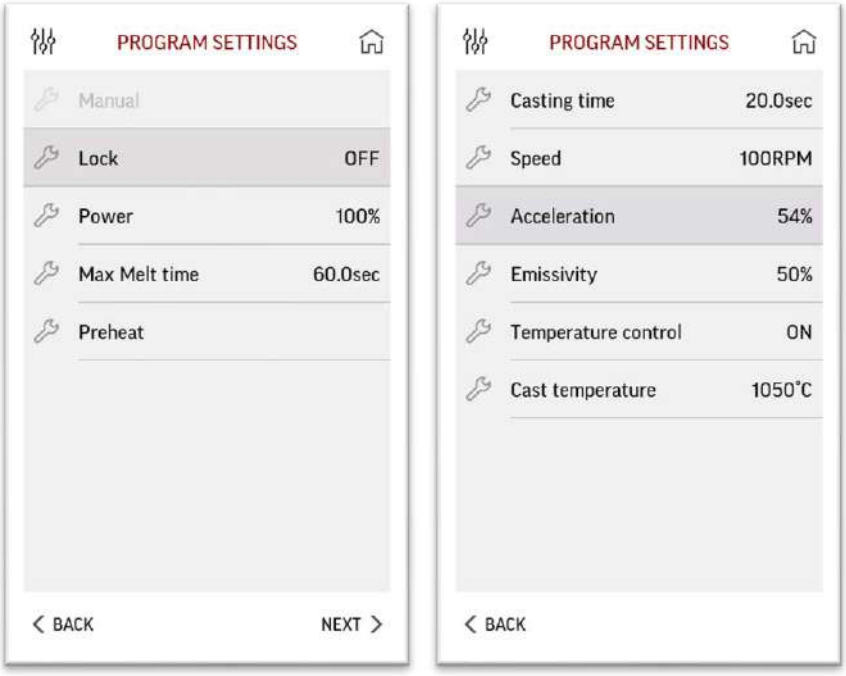


Fig. 2.11 Manual Heating available settings

A full list of process parameters with descriptions is shown in the following table.

Table: 2.4 Manual Heating process parameters.

NAME	*DESCRIPTION*
CASTING TIME	The amount of time that the rotating arm is in motion. The value can be from **2 s** to **180 s** with **1 s** step.
SPEED	The Centrifugal Speed can be adjusted by rotating the Control Knob. Speed range – The Speed value can be adjusted from **10** to **500 RPM** in steps of **10 RPM**.
ACCELERATION	The time needed to reach the pre-set centrifugal speed. The range is between **10 %** and **100 %** in steps of **1 %**
EMISSIVITY	This is a setting specific to the IR temperature sensor. It is factory set at **50%** and should only be adjusted while testing to provide a more accurate temperature reading for specific alloys.
TEMPERATURE CONTROL	When this option is **ON**, the machine will try to regulate the power in regard to the pre-set temperature set point. When the option is **OFF**, Max Power based on the Power setting will be applied until the user presses the Cast button or the Stop button. When using a new alloy and trying to find the appropriate casting temperature, the material should be cast with this option set to **OFF** in order to obtain a good idea of what the IR sensor is reading when the metal turns completely liquid.
CAST TEMPERATURE	Temperature set point to cast the material. From **900 °C** to **2000 °C** in step of **1 °C**.
LOCK	This allows the user to lock the setting for any particular program so that they cannot be changed from the home page. To change the settings, you will need a passcode: **0000**.
POWER	The maximum power level of the induction generator that will be reached during melting process. It is recommended for materials that melt below **1093 °C (2000 °F)** to set this at **80 %.** Above **80 %** power will cause the temperature to rise quickly and potentially unevenly. This may cause the unit to begin casting while part of the metal is still liquid while the rest is still solid.
MAX MELT TIME	The maximum time you are allowing the machine to heat the metal before erroring out if it has yet to reach the set temperature for casting. Between **0** and **600 s** in **1 s** step. If using the correct type of metal (beads and chunks) this should not take more than 120-150 seconds even for a large load of metal. It is recommended not to use high surface to low volume ratio pieces such as pillions or pins in this type of induction field as the energy transfer is inefficient.
PREHEAT	Allows the user to preheat the material prior to the casting process. **POWER** – the power can be adjusted from **10 to 100 %** in step of **1 %** **TEMPERATURE** – this is indicator of the temperature of the material in the load (if applicable). **STIRRING BUTTON** – When enabled by choosing this option the machine starts to stir the metal inside the crucible via controlling of the magnetic field. The stirring action of induction melting eliminates any need of external stirrer and allows better distribution of the components of the metal alloy. **COIL RAISE/LOWER BUTTON** - Allows the movement of the coil. Moves the coil either UP or DOWN.



Fig. 2.12 Preheating Screen

2.3.7 PROGRAM HEATING

In addition to **Manual** mode, **Programs** allow the user to save pre-defined process parameters. Up to 8 programs can be saved at once.



Fig. 2.13 Program Heating Main Screen

To set up a program:

1. Ensure that the machine is in the **READY** state. From the home screen, press the bottom-left ☰ button to bring up the **Program Select** screen. Ensure that **Manual** mode is **OFF** and select one of the eight programs to edit. The user will be returned to the home screen.

2. From the home screen, press the bottom-right **SETTINGS>** button to bring up the **Program Settings** screen. There are two pages of parameters, which can be reached with the **NEXT>** and **<BACK** buttons.

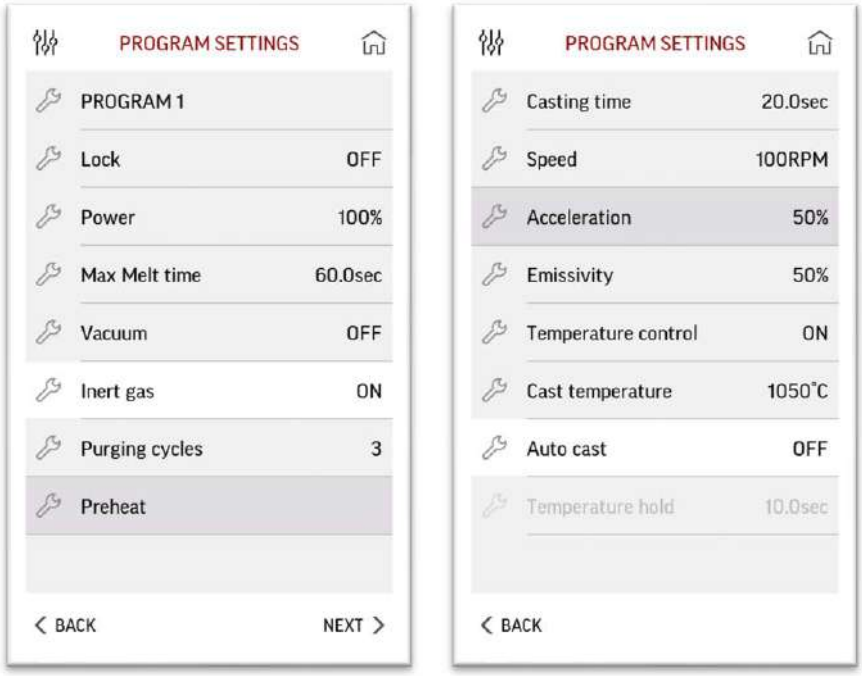


Fig. 2.14 Program Heating available settings

*80% if the casting temperature is expected below 1093 °C (2000 °F)
*100% if the casting temperature is expected to be above 1093 °C (2000 °F)

3. Select a setting on screen to toggle between **ON** and **OFF**. To edit the continuous parameters, select the parameter to open the editing screen. Turn the Control knob to adjust the parameter to the desired value. Pushing the Control knob saves the parameter value. The new parameter value should now be displayed in the **Program Settings** screen.

4. Select “Lock” to lock the parameter values for the program. A user-set password is required for unlocking.

5. The program name can be edited by selecting the top line of the first page of the **Program Settings** screen. A custom program name can be typed and saved.



Fig. 2.15 Edit Program name screen

6. When done editing the program, press the top-right button to return to the home screen. The name of the selected program should appear in the bottom-left area of the home screen.

Table: 2.5 Program Heating parameters.

NAME	*DESCRIPTION*
PROGRAM NAME	Edit or enter a new program name to be used.
LOCK	This allows the user to lock the setting for any particular program so that they cannot be changed from the home page. To change the settings, you will need a passcode: **0000**.
POWER	The maximum power level of the induction generator that will be reached during melting process.
MAX MELT TIME	The maximum time you are allowing the machine to heat the metal before erroring out if it has yet to reach the set temperature for casting. Between **0 s** and **600 s** in **1 s** step.
VACUUM	Enable or disable the use of vacuum in the casting chamber prior to the melting process.
INERT GAS	Enable or disable the use of inert gas in the casting process.
PURGING CYCLES	Defines the number of purging cycles to be performed. In program mode the inverter starts after the last purging cycle. Purging cycle is the process of making vacuum in the casting chamber up to **-0.8 bar** then filling it back with inert gas up to **-0.2 bar**.
PREHEAT	Enables or disables the preheat function. For more information see ***Table 4 -***
CASTING TIME	The amount of time that the rotating arm is in motion. The value can be from **2 s** to **180 s** with **1 s** step.

SPEED	The Centrifugal Speed can be adjusted by rotating the Control Knob. **Speed range** – The Speed value can be adjusted from **10** to **500 RPM** in steps of **10 RPM**.
ACCELERATION	The time needed to reach the pre-set centrifugal speed. The range is between **10 %** and **100 %** in steps of **1 %**
EMISSIVITY	This is a setting specific to the IR temperature sensor. It is factory set at **50 %** and should only be adjusted while testing to provide a more accurate temperature reading for specific alloys.
TEMPERATURE CONTROL	When this option is **ON**, the machine will try to regulate the power in regard to the pre-set temperature set point. When the option is **OFF**, Max Power based on the Power setting will be applied until the user presses the Cast button or the Stop button. When using a new alloy and trying to find the appropriate casting temperature, the material should be cast with this option set to **OFF** in order to obtain a good idea of what the IR sensor is reading when the metal turns completely liquid.
CAST TEMPERATURE	Temperature set point to cast the material. From **900 °C** to **2000 °C** in step of **1 °C**.
AUTO CAST	If this function is **Enabled**, the casting process will start automatically after the temperature of the load reaches the pre-set set point.
TEMPERATURE HOLD	Only available when **Auto Cast** mode is **Enabled**. Define time delay to be used before the centrifuging rotation starts and after the temperature set point has been reached.

2.3.8 MAIN MENU

The **Main Menu** allows users to configure custom user settings, access tests & diagnostic protocols for the equipment, reach the service menu, implement software updates, and view product information. From the home screen press the top-left ☰ button to bring up the **Main Menu**, shown below:

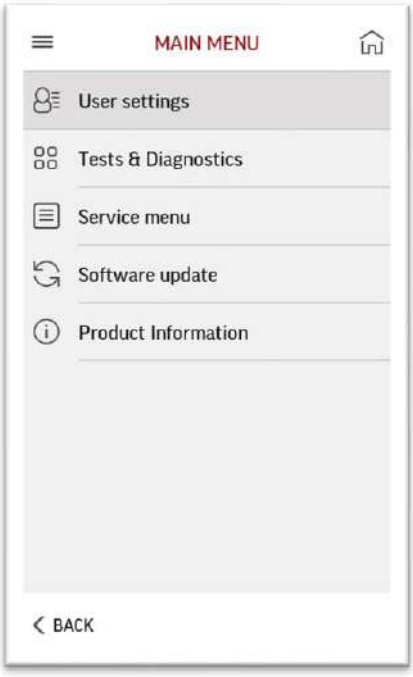


Fig. 2.16 Main Menu Home screen

Descriptions of the menus accessible from the **Main Menu** screen are given in the following sections.

2.3.8.1 USER SETTINGS

The **User Settings** screen allows the user to customize the settings described in the table below.



Fig. 2.17 User Settings Home screen

Table: 2.6 Customizable settings in the User Settings menu.

	NAME	*DESCRIPTION*
1	**THERMO-REGULATOR**	Allows the user to set the parameters of the PID Thermo-regulator, such as the Integral and Differential factors.
1.1	**MINIMUM POWER**	Minimum permissible power that can be fed to the output when the PID regulator is regulating. **Default Value – 10%**
1.2	**ZONE**	Zone for proportional law of the regulating. If the PV (process variable – measured temperature) is under "SP-Temp. Zone" the Output is maximum, if the "SP-Temp. Zone" < PV < SP, the output is proportional of the difference of the PV and SP. If the PV > SP the output is minimum. **Default Value – 100 °C**
1.3	**INTEGRAL FACTOR**	Integral gain of PID control law. Advanced parameter, editing this could lead to improper or not true control of the thermo-regulator. **Default Value - 0**
1.4	**DIFFERENTIAL FACTOR**	Differential gain of PID control law. Advanced parameter, editing this could lead to improper or not true control of the thermo-regulator. **Default Values - 0**
2	**MEASUREMENT UNITS**	Allows the user to set the displayed measurement units for temperature and water flow rate.
2.1	**TEMPERATURE UNITS**	Gives the choice of the default measuring unit for the temperature. The available options are in **° Kelvin**, **° Celsius** and **° Fahrenheit**.

2.2	**WATER FLOW UNITS**	Gives the choice of the default measuring unit for the water flow. The available options are in **Litre per minute (l/min)** and **Gallon per minute (gpm)**
3	**CLEAR BATCH COUNTER**	Resets the batch counter, which counts the number of operation cycles.
4	**RESET TO DEFAULT**	Resets the equipment to the default settings.
5	**LANGUAGES**	Allows the user to select the displayed language. The available options are **Bulgarian** and **English**.
6	**DATE & TIME**	Allows the user to set the date in **DD-MM-YYYY** format and the time in **HH:MM: SS** format.
7	**SET PASSWORD**	Allows the user to set a password for locking and unlocking the program settings. The default user password is **0000**. Inputting a password of **1234** when unlocking a program will reset the password to **0000**.



Fig. 2.18 Enter new password screen

2.3.8.2 TESTS & DIAGNOSTICS

The **Tests & Diagnostics** menu gives the user a number of automated diagnostic tests for the equipment as well as information about the cooling status. The user is also able to input a custom value for the atmospheric pressure. The tests and statuses available in the **Tests & Diagnostics** menu are described in the table below.

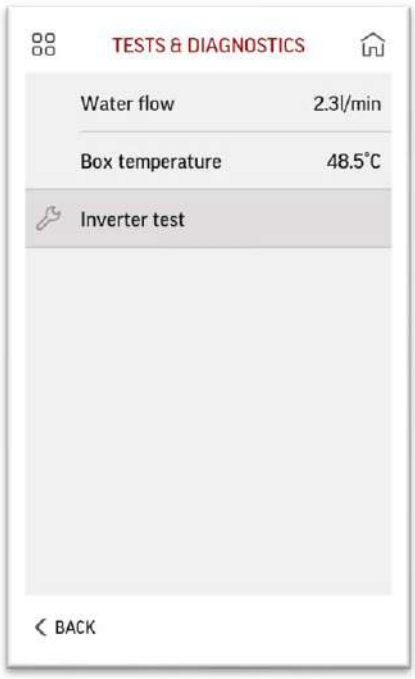


Fig. 2.19 Test and Diagnostics Home screen

Table: 2.7 The diagnostic tests and measured data available in the Tests & Diagnostics menu.

NAME	DESCRIPTION
WATER FLOW	Provides information form the water flow of the cooling water through the unit
BOX TEMPERATURE	Displays the temperature measured inside the unit.
INVERTER TEST	Performs a test of the power inverter module and reports the results. You will not need this unless diagnosing an issue.

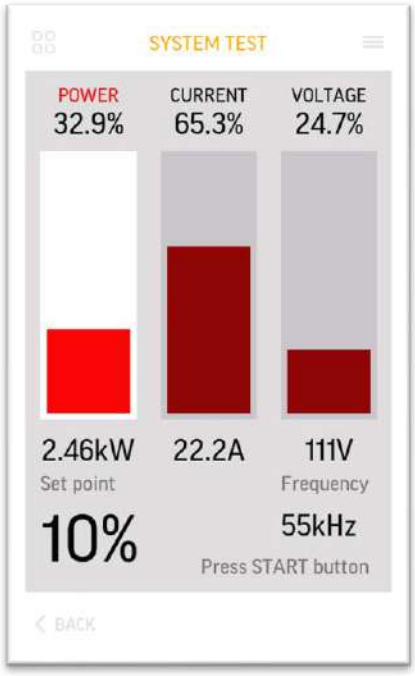


Fig. 2.20 Inverter test screen

2.3.8.3 SERVICE MENU, SOFTWARE UPDATE, AND PRODUCT INFORMATION

The **Service Menu** contains factory settings for the machine and can only be accessed with a service password. This menu should never need to be accessed by the user.

The **Software update** option allows the user to automatically update the equipment software when in possession of a USB drive with a software update. Selecting **Software update** will prompt the user to insert the USB drive into the USB port and press OK in order to proceed with the update.

The **Product Information** screen provides a full description of the equipment. It includes the product model, software revision numbers, a counter of the total number of operation cycles, and the batch counter. The batch counter counts the number of operation cycles from the last time it was cleared in the **User Settings** menu.

2.3.9 TUNING AND TROUBLESHOOTING

2.3.9.1 LOAD TUNING GUIDE

Since this is a fixed tank circuit and load (graphite crucible), the device is factory tuned and does not need additional load tuning.

2.3.9.2 FAULTS AND WARNINGS

Table: 2.8 Faults and Warnings

№	Fault Description	W / F	Condition	Cause	Advice
1	The arm not on position	W	Coil is not in the "Home" position.	While the arm was not positioned correctly, the coil tried to rise	* Position the Centrifugal Arm into its "Home" position and try again. *Check the Optic sensor. *Remove the left cover and by rotating the Centrifugal Arm check if the sensor's LED is ON, when the Centrifugal Arm passes through the zero position.
2	Please, close the chamber	W	Top Lid Opened	Casting was attempted with an open cover	*Close the Top lid and try again
3	Please, close the chamber or disable temperature control	W	Top Lid Opened	You tried to cast with open cover	* Close the Top lid or disable the temperature control and try again
4	The inductor is blocked	W	Coil is not moving as expected	The coil does not execute commands	*Repeat the commands and check if the error goes away. *Do you have the air supply correctly connected? Does the air supply meet the technical requirements? (see the Technical Product Specification table) *Check the Air flow system for leaks and damages. *Check the Optic sensors responsible for the Coil position. *Request the the Air/Gas diagram of the machine – SCHG and check the components and connections.

№	Fault Description	W / F	Condition	Cause	Advice
5	Max Melt time expired	W	The time out of the Melting cycle has expired before the manual stop was used.	The Melting cycle time-out is 10 min.	*The quantity of the metal used is not appropriate (too small or too much). *Check the TPS tables or Manual for the minimum and the maximum quantity. (see the Technical Product Specification table) *Check in what form is the metal to be melted. *Check the condition of the Crucible.
6	Chamber pressurization fault	W	The machine is not reaching or holding vacuum level	The Vacuum time-out is expired	* Check for any audible or visible leaks or damages on the Top lid, gaskets, etc. * If the gasket is still new, carefully press it a bit harder. Replace the gasket if it is worn out. * Kinked or disconnected hoses should be inspected. Check all of the pressure/vacuum hoses. * Check the Air filter for the Vacuum pump and Vacuum pump for damages.
7	The input air pressure is low	W	Attempted movement of the coil with insufficient air pressure	Insufficient air pressure	*Regulate the input air pressure per the provided TEHNICAL SPECIFICATIONS TABLE. *Do you have the air supply correctly connected? Does the air supply meet the technical requirements? *Check the Air flow system for any leaks and damages. *Request the Air/Gas diagram of the machine – SCHG and check the components and connections.
8	The inert gas pressure is low	W	Attempted washing cycle with insufficient inert gas pressure	Insufficient inert gas pressure	*Regulate the input inert gas pressure per the provided TEHNICAL SPECIFICATIONS TABLE *Do you have the inert gas supply correctly connected? Does the inert gas supply meet the technical requirements? *Check the inert gas system for leaks and damages.

					*Request the the Air/Gas diagram of the machine – SCHG and check the components and connections.
№	Fault Description	W / F	Condition	Cause	Advice
N1	Tuning fault	F	Primary U & I out of phase	Can't find resonant frequency	* Possible short in resonant circuit. *Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio.
N2	Inverter overcurrent	F	I primary > I Max	The primary current exceeds the maximum allowed safety current value.	* Possible short in resonant circuit. *Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio. * Check the minimum metal guidelines in the manual and make sure the amount of the metal you are trying to melt is above this minimum.
N3	Inverter frequency out of range	F	F < Fmin or F > Fmax	Frequency goes out of the pre-programmed range during Heat On	* Possible short in the Resonant circuit. *Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio. * Possible very low load of the generator. What is the load material shape, size, type and weight? * Possible Control or Driver board problem, Contact the Service Department for more details.

№	Fault Description	W / F	Condition	Cause	Advice
N5	Auto Tune Fault	F	Primary U & I out of phase	The resonant frequency cannot be found	* Possible short in resonant circuit. Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio. * Possible very low load of the generator. What is the load material shape, size, type and weight? * Possible Control or Driver board problem. Contact the Service Department for more details. * Possible short in resonant circuit.
N9	Communication lost control board	F	Communication error between Panel and Control Board	No acknowledgment is received after the last command	*Are the RS and power cables correctly and firmly connected between the Control board (1MOD-014-100-00), the Interface board (1MOD-769-102-00), the RS Communication board (1MOD-017-300-00) and the Control Panel (Main board) (1MOD-032-200-00)? *The shielding should be connected to the connector of the RS cable. *Is the small RS communication board (1MOD-017-300-00) on top of the temperature board (1MOD-017-710-00) connected correctly.
N21	Inverter frequency too high	F	F > Fmax	During Heat on sequence the operating frequency goes above the maximal working frequency.	* Possible short in resonant circuit. *Check the resonant loop parameters and adjust if needed. Load coil's inductance, Tank capacitors' values, Transformer Ratio. * Possible very low load of the generator. What is the load material shape, size, type and weight?

№	Fault Description	W / F	Condition	Cause	Advice
N22	Inverter frequency too low	F	F < Fmin	During Heat on sequence the operating frequency goes below the maximal working frequency.	*Check the resonant loop values. * Possible short in resonant circuit. *Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio. * Possible very low load of the generator. What is the load material shape, size, type and weight?
N23	DC over current fault	F	Failure related to 1MOD-014-200-00	The DC current exceeds the maximum allowed safety current value.	* Inspect the condition of the outgoing cable from the Chopper Board (1MOD-014-200-00) – connectors J3 and J4 * Is the outgoing cable from the Chopper making a short circuit? *Check everything in the Resonant Circuit.
N27	Inverter maximum temperature limit exceeded	F	T°heat sink >50°C	The temperature of the Inverter HeatSink is above safety operation range.	*Wait until the heat sink cools down, the cooling water cools down or change the water of cooling system to help the process. *Was the casting machine used extensively? More than 20 casting in a row? If so, let the machine cool off for 25-20 minutes and try again (leave the power on, so the internal fan and pump can circulate and cool the water). *What is the ambient temperature in the room? If more than 35C, this exceeds the normal operating conditions of the machine.

№	Fault Description	W / F	Condition	Cause	Advice
N28	Inverter water flow fault	F	Restricted or no water flow.	The water (coolant) flow supplied for the Inverter cooling is below the safety operation threshold	*Restricted or no water flow. Check the hoses and the external water filter for blockages. Check the Flow switch. *Check the waterflow SP and what the machine measures by navigating to - Main Menu >Test&Diagnostics menu > Water flow. *Check the cable going from the flow switch to the Interface board |(1MOD-769-102-00). The shielding of the flow switch cable should be from the Interface board's side.
N32	Missing phase	F	No Main power supply or moment dropping of line voltage	This error is occurring after the power supply has been disconnected, or when a problem with the Main Power Supply Voltage is present.	*Check the Main Power Supply cable. It could have been damaged or missing. *Check the Power Supply coming to the machine. * What voltage is the SOCOMEC device (3ISM-000-003-00) measuring for all of the 3 phases.
N34	DC under voltage fault	F	No DC Voltage to 1MOD-014-200-00	Missing supply voltage to Chopper Board	* Inspect the LEDs build in Inverter Gate Driver (1MOD-014-350-00) and Chopper board (1MOD-014-200-00), they must be illuminated in green if the boards are supplied properly with voltage. *Inspect the power supply cables coming to the board (1MOD-014-300-00) on the following connectors. - J4, J5, J6 - J7, J8, J9 - J1,U2P1 and X7
N36	Communication lost interface board	F	Communication error Between Panel and Interface Board	Communication time out has ended. No acknowledgment is received after the last command	*Are the RS and power cables correctly and firmly connected between the Control board (1MOD-014-100-00), the Interface board (1MOD-769-102-00), the RS Communication board (1MOD-017-300-00) and the Control Panel (Main board) (1MOD-032-200-00).

					*The shielding should be connected to the connector of the RS cable. *Is the small RS communication board (1MOD-017-300-00) on top of the Temperature board (1MOD-017-710-00) connected correctly.
N38	Inverter over frequency fault	F	Resonance frequency is close to high frequency limit	During the Heat ON sequence the operating frequency goes above the pre-set range	*During Heat on sequence the operating frequency goes above the maximal working frequency. *Check the resonant loop parameters for traces of damage and proper connection and contact: - Load coil's inductance; -Tank capacitors' values; -Transformer Ratio.
N82	Communication lost temperature board	F	Communication Error between Panel and Temperature Board	Communication time out has ended. No acknowledgment is received after the last command.	*Are the RS and power cables correctly and firm connected between the Temperature control board (1MOD-017-710-00) the Control Panel (Main board) (1MOD-032-200-00). *Is the small RS communication board (1MOD-017-300-00) on top of the Temperature board connected correctly. *Are the LEDs on the Temperature control board functioning properly?
N83	Centrifuge motor control fault	F	Motor Contactor is welded	There is problem with the control of the Motor board.	*Check, inspect and if necessary, change the faulty contactor - KM2 and/or KM3 (3FEM-000-010-01). *Check the contactors' terminals, clean the contactors if needed. *Check if when the CAST button is pressed you hear a clicking sound (the contactor is working as intended - the contacts are working).
N272	Pizzato unlock fault	F	Safety lock malfunction	Pizzato unlock Fault	* If casting was attempted while the Top lid was opened, close the lid safely and try again. *If the Sealing Head gasket is still new, carefully press it a bit

					harder. Replace the gasket if it is worn out. * Try to close the Top lid better. Has the cover previously been opened manually, forcefully or during an emergency? * Check the Pizzato safety switch (3SBM-000-027-00) *See paragraph 3.2 ACCIDENT PREVENTION PROTECTIONS
N274	Inductor position sensors fault	F	Coil is not moving as expected	When the coil does not execute commands	*The Coil does not respond appropriately to the commands. Repeat the commands and check if the error goes away. *Do you have the air supply correctly connected? Is the air supply confirming to the requirements? (see the TEHNICAL SPECIFICATIONS TABLE) *Check the Optic sensors (3SNM-000-005-00) responsible for the coil position. Open the front cover and carefully inspect the coil up/ down the sensors. The sensor must be lit when the Coil is in end (up or down) position.
N275	Both vacuum and inert gas sensors are active	F	Vacuum Switch malfunction	Possible problem with Vacuum switch connection	*Inspect the vacuum switches' cabling (3SNM-000-007-00). *Check if the Product information screen shows the correct machine in use. * Check if the valve for the upper position (vacuum switch for upper level) is set to 0.8bar. *Check if the valve for the lower position (vacuum switch for lower level) is set to 0.2bar.
N277	Current of the analog input 4-20mA is below 4 mA	F	Analog input device malfunction	The device providing the 4-20mA input is damaged.	*Check the wiring going from the external Dual Colour IR Pyrometer to the Control panel module. - X4 and P202 *Check the external Dual Colour IR Pyrometer.

2.4 OPERATING INSTRUCTIONS

2.4.1. ALLOY COMPOSITON AND TEMPERATURE TO BE SET

The composition of the alloy determines the temperature to set on the thermo-regulator to melt and as you can see from the previous table, it changes according to the presence of precious metals (Gold – Palladium – Platinum – Silver) or non-precious metal (Chrome – Cobalt – Nickel – Titanium).

Generally speaking, we can say that the casting temperature increase as a function of the decreasing of the presence of Gold and it highly increases with non-precious alloys.

The ***CSx-Digital*** machine has stirring option to help with improving the alloy composition. The stirring action of induction melting eliminates any need of external stirrer and allows better distribution of the components of the metal alloy(see Table.2.4).

2.4.2. EMISSIVITY

The regulation of the emissivity will let you to find the right melting point of your alloy. Every alloy typically has its emissivity value determinate by the composition. It is impossible for us to tell the exact emissivity value for every alloy unless is not pure metal. This value must be found by the operator with this simple operation:

a) Set on the casting machine the base value of the alloy, for example for a Platinum set 25%

b) Set on the temperature function the melting point indicated by the alloy manufacturer. Please use the end of the melting interval.

c) Start the casting process.

d) If the alloy is melting before reaching the set point, decrease the emissivity value by choosing Emissivity control using rotating knob (pic 3.).

e) If the alloy is not melting even after reaching the set point increase the emissivity value by choosing Emissivity control using rotating knob (pic 3.).

Example:

	Real Temperature (oC)	Emissivity Parameter (%)	Display Temperature(oC)
If	1300	50	1200
then	1300	40	1300

f) When you find the exact melting point of the metal perform a second trial. The emissivity value that you found with this operation must be memorized for the next casting cycle or used in program settings.

g) On the table below, you will find an indication of the emissivity which will be useful as a starting point.

Table: 2.9 Indication of the emissivity

Type of alloy	*Percentage*
Yellow Gold	35% - 45%
White Gold-Silver Alloys	30% - 40%
Platinum	25% - 35%
Titanium	25% - 40%

2.4.3. POWER

The supplied power determines the heating curves and consequently the melting time. The precious alloys with high percentage should be cast slowly, the non-precious do not have particular problems with fast melting times. We then suggest the following parameters:

Table: 2.10 Melting times

Type of alloy	*Percentage*
Yellow Gold	60%
White Gold-Silver Alloys	70%
Platinum	90%
Titanium	90%

2.4.4. ROTATION SPEED

The rotation speed determines the metal compaction and changes as a function of the specific weight of the alloy. Change according to the following table:

Table: 2.11 Rotation speed

Type of alloy	RPM
Yellow Gold	300
White Gold-Silver Alloys	350
Platinum	400
Titanium	400

2.4.5. ACCELERATION

The Acceleration value corresponds to the acceleration of the rotating arm and determines the injection speed of the metal and must be changed according to the specific weight of the alloy. It is therefore important to find the right acceleration degree because false ones could cause either a leak of the metal when the acceleration is too high or a lack in the casting when the acceleration is too low. Adjust according to the following table:

Table: 2.12 Acceleration value

Type of alloy	Seconds
Yellow Gold	60%
White Gold-Silver Alloys	70%
Platinum	80%
Titanium	100%

2.4.6. VACUUM

Vacuum consists of the total evacuation of the air inside the casting room through the pump. This creates an environment without oxidant agents present in the atmosphere. This is suggested for all alloys, especially for the non-precious ones. Change according to the following table:

Table: 2.13 Vacuum

Type of alloy	Function
Yellow Gold	Suggested
White Gold-Silver Alloys	Suggested
Platinum	Yes
Titanium	Mandatory

2.4.7. INERT GAS

The introduction of Inert Gas in the casting chamber is suggested after the vacuum. A neutral atmosphere will favour the melting of some metals among which is Palladium. Change according to the following table:

Table: 2.14 Inert Gas

Type of alloy	Function
Yellow Gold	Suggested
White Gold-Silver Alloys	Yes
Platinum	No
Titanium	Mandatory

2.4.8. CRUCIBLES

The crucible must be chosen according to the alloy melting point and its physical characteristics.

We suggest the following type of crucible:

Table: 2.15 Crucible types

Yellow Gold	Graphite
White Gold-Silver Alloys	Sintered graphite / ceramic
Platinum	Fuse Silica
Steel	Ceramic

Note: The introduction of pieces which, due to their shape and/or dimension can get stuck between the crucible walls may cause the crucible to break.

During the heating process, these pieces will expand and going to exert a strong pressure on the crucible walls which may cause them to crack.

2.4.9. MELTING AND CENTRIFUGATION SETUP

Before attempting to melt any type of alloy, refer to the technical data and processing data relevant to the metals used, supplied by the alloys manufacturers.

Choose the type of crucible to be used according to the alloys chemical characteristics.

Note: Always refer to the indications supplied by the alloy manufacturer.

	**Use a crucible in good working conditions. If necessary, replace the crucible with a new one to prevent it from breaking, which could damage the melting unit or produce bad melting.**

1. Insert the metal to be melted into the crucible;
2. Check that the metal reaches the bottom of the crucible and does not remain stuck at the top of the crucible;
3. Reuse of old alloy: Check with the alloy manufacturer if previously melted metal (in vacuum, argon or atmosphere) can be reused and if a percentage of new metal should be added. If this is possible, it is advised to eliminate all oxide traces (for example through sandblasting), and to cut it in appropriate portions to introduce it inside the crucible in such a way as to achieve the maximum contact between the various metal parts;
4. Place the crucible in its support and direct it toward the Flask.
5. Balance the weights: Adjust the position of the counterweights to find the balance point.
6. The arm balancing has some tolerance; this allows storing the counterweight position on the numbered arm for each type of Flask, notwithstanding the metal quantity.

	**The more accurate balance the lower is the machine vibrations.**

2.4.10. CENTRIFUGAL ARM AND CRUCIBLE SETUP



DURING THE MELTING OPERATION, HIGH TEMPERATURES ARE REACHED IN THE CRUCIBLE. HANDLE WITH CARE AND USE APPROPRIATE GLOVES AND TONGS.

1. Switch on the machine (and prepare it for work) turning the main switch ON.
2. Move the centrifuge arm in zero position. (Align the center of the crucible and center the protective glass of the lid).



If the arm position is not correct, the pyrometer will not work correct.

3. Place the crucible in to the holder.
4. Place the material to be melted into the crucible.
5. Lock the crucible with the lever on the crucible side.
6. Place the Flask in to the saddle so it remains stable.

2.4.11. MELTING

1. **Close the lid.**



During the melting process, a volatile gas is released from the metal mass. This can be dangerous only when the operator performs the melting process, willingly and consciously, with the lid open and directly breathes above the crucible.

2. **Manual Mode**

Before the melting starts make sure that the coil is in upper position (The Rotation arm should be in the zero position see paragraph 2.4.10 CENTRIFUGAL ARM AND CRUCIBLE SETUP). To rise the Coil either press the Coil Button or the Start Button.

Press the Start-button (Fig.2.7). The button ring indication will be lit in green and, after 1 or 2 seconds, the Power indicator bar (Fig.2.7) shows the power value in percentages; the power should be set according to the type and quantity of the metal by selecting the power indicator on the LCD screen and rotating of the Control Knob/Button (Fig.2.7) to the right to increase the melting power (and thus the melting speed).

Pressing the start button for a second time will stop the melting process, the coil will remain up. To continue with the melting, you need to press the start button again. To stop the process, press the Stop Button, this will also lower the Coil. The same logic is applied in Preheat mode and Inverter test mode.

The melting can be done with Opened Lid only if the thermo-regulator is disabled.

3. **Program Mode**

Select the program and push the start button to proceed.



For a direct view of the melting process, use the anti-UV screen on the lid. In case of lid open to be used appropriate safety glasses.

Once the metal is melted, the centrifugation process can be carried out (refer to section "CENTRIFUGATION").

2.4.12. VACUUM MELTING

1. Prepare the crucible in its support with the metal to be melted. Place the Flask in to the saddle, lock it and close the protection lid.
2. Press the push-button Vacuum to start the air suction process from the centrifugation chamber. Once a negative pressure of – 0.8 bars is reached, the pump can be switched off by pressing again the push-button.

2.4.13. INERT GAS INTRODUCTION



Check that the gas bottle is connected, the valve is open, and it is fitted with the appropriate pressure regulator.

When the protection lid is closed, press the Vacuum-button. As soon as the vacuum meter shows a negative pressure of - 0.8 bars press the argon-button to start the gas introduction process, checking the pressure inside the centrifugation chamber. When the vacuum meter shows a pressure close to -0.2 press argon-button again to interrupt the gas introduction. Press the melt-button to start the metal heating process.

2.4.14. CENTRIFUGATION

1. Make sure that the Flask is perfectly positioned, close the protection lid and wait until the metal is completely molten.
2. Press the Cast button to start the centrifugation process.
3. When the centrifugation is completed automatically, or if it is stopped with the push-button, wait until the safety locking system to unlock the lid. Open the lid and remove the Flask with the appropriate tongs.

3. INFORMATION ON MAINTENANCE AND REPAIR

3.1 MAINTENANCE

BEFORE PERFORMING ANY KIND OF MAINTENANCE INTERVENTION, SWITCH OFF THE MACHINE AND DISCONNECT THE POWER SUPPLY.

1. Carefully clean the inside of the centrifugation chamber, removing all coating fragments or metal residues. Clean with the upmost care the PTFE bushing where the coil slides, using the compressed air gun.

2. Every 6 months check the cooling water tank and top up the water evaporated during the melting operation, through the filler cap situated at the rear of the machine.

**More information can be found in our Annual maintenance list document.*

3.2 ACCIDENT PREVENTION PROTECTIONS

1. During the melting operations, the operator is protected by the centrifugation chamber closing lid. The arm rotation cycle is enabled only when the lid is locked. The lid remains locked in closed position until the centrifugation is completed.

DURING THE WORKING CYCLE, DO NOT FORCE THE PROTECTION LID OPEN.
IF THE LID REMAINS LOCKED AFTER THE CYCLE IS COMPLETED, DO NOT FORCE IT OPEN AND CONTACT THE AUTHORISED ASSISTANCE SERVICE.

2. The side cover, front cover and rear cover are fitted in position by screws that can be removed with a special screwdriver that is packaged with the machine (see ***Table 1.1***).

➢ To open the protection lid, perform the following operations:

- Remove the left side panel of the machine using the special key supplied with the machine
- Loosen the crossed screw (1of ***Fig.2.21***).
- Turn the screw 180° (2 of ***Fig.2.21***) with an appropriate screw driver so that the arrows match each other and unlock the lock.
- Open the lid
- Turn the screw 180° (2 of ***Fig.2.21***) to bring back into use the safety device and then lock it again screwing the crossed screw.
- Re-assemble again the side panel.

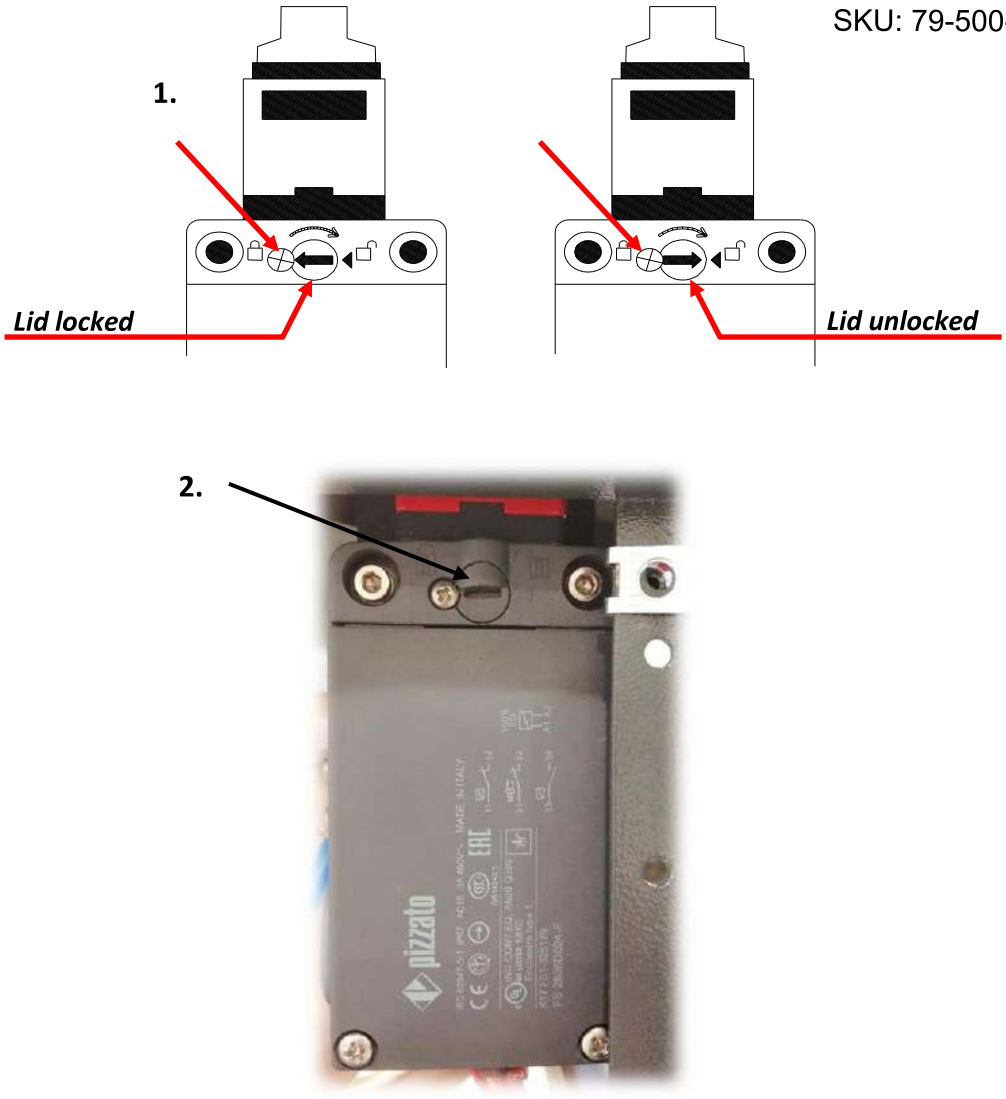


Fig. 2.21 Safety device to lock the lid

⚠	**THIS KEY SHOULD BE USED ONLY IN CASE OF ELECTRIC SUPPLY FAILURE.**

⚠	**TO PREVENT DAMAGES TO PERSONNEL, DUE TO HIGH TEMPERATURES AND ELECTRIC SHOCKS, AVOID DIRECT CONTACT WITH THE MELTING COIL DURING THE HEATING PROCESS.**

3.3 SERVICE

3.3.1 GENERAL

If for some reason the unit fails in the field it is recommended that the unit be serviced by the manufacturer or its authorized service representative. Should that happen, please contact us immediately (see contact information in Section 3.3.2).

Please have the following information about your unit available upon calling:

1. Unit Model and Revision (located on the label on the back of the unit).
2. Unit's Serial Number (located on the label on the back of the unit).
3. Line Voltage and frequency.
4. Detailed description of the problem encountered including – load and ambient temperature at the time of the failure.
5. Detailed description of the actions taken.
6. Approximate time in service.

If our technical staffs are unable to help you over the phone, then a repair authorization number (RA#) will be issued for you. With this number enclosed in you return package you can ship the unit back for repair. Additionally, you may request a service engineer to repair the unit on site.

3.3.2 SERVICE CONTACT INFORMATION

For technical service questions, please call:

USA: + 1 631 842 2400

Or e-mail us at: service@romanoff.com