

# Romanoff RCS 5kw Automatic Centrifugal Casting Machine *Operation Manual*



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TECHNICAL PRODUCT SPECIFICATION		
Product Models:		
Romanoff RCS 5kW	79-700	Centrifugal Casting System, 5kW, 1-ph, 230VAC
TECHNICAL DATA		
SPECIFICATION	DESCRIPTION	CONDITION
Max Absorbed Power	5.4 kW	
INPUT		
Supply voltage	230V $\pm$ 10%	
Line Phases	1	
Line Frequency	50 / 60 Hz	
Maximum current	37 A	
Minimum cross-sectional area of power conductors	4 mm <sup>2</sup>	
OUTPUT		
Transformer Ratio range	8: 1	Factory Set
Output power (rated)	5kW	Power regulation 10-100%
Output Frequency range	85-105 kHz	@ 100% output power
MISCELLANEOUS		
Auto-Cast Program	Yes	
Temperature Ranges	41°F (5°C) to + 104°F (40°C)	Operating
Humidity range	30-90%	avoid condensation
PHYSICAL		
Cooling System	Water-Internal	
Max Melting, T°	2000 C°	
Flask Size, mm (max)	D=90 x H=90	
Module Dimensions W x D x H inch (cm)	26.8x24.8x44.1 (68x63x114)	Overall dimensions without handles
Weigh	175kg	Net weight
Packaged weigh	407 lb (185 kg)	Gross Weight
Package Dimensions W x D x H inch (cm)	31.9"x31.5"x50.4" (81x80x128)	
Crucible capacity	Pt = 200g; Au = 150 g; Ag = 80 g; Ti=80g	
* Minimum operating material	50g Pt; 10g Ti - ingot	* due to non-susceptor heating

Dear Customer,

Congratulations for choosing a Romanoff RCS 5kW Automatic 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.

Romanoff RCS is compact, multi-purpose machine that allow you to cast in atmosphere, vacuum or argon, by setting the various parameters.

These multiple functions require an accurate and detailed reading of this operator's manual. Only by doing so will you be able to draw the maximum potential from your machine and to achieve high quality casting.

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

Romanoff technologies are always at your disposal for any request you may have.

## 1 GETTING STARTED GUIDE

### 1.1 SAFETY INSTRUCTION

#### 1.1.1 IMPORTANT NOTES

1. This operator's manual is addressed to the owner, for a 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 project hypotheses and technical features, to supply instructions for the installation, assembly, regulation and use, personnel training, to direct the maintenance intervention and to supply information on residual risks.
3. It also supplies complete information for the Romanoff RCS 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, its consultation should be allowed near the machine and it should be kept with due care (protected, in a dry place, away from sun rays or atmospheric agents, etc.). In case of loss or damage, you can request a new copy from directly from Romanoff.
6. The information provided by this manual is based on the original production of the machine.
7. Changes from later revisions may not be present in this manual. In this document period "." will be used as a decimal point delimiter.
8. The manufacturer reserves himself the right to amend or update his own production and relative manuals, without being obliged to update previous productions, unless in exceptional cases.
9. You can request further details or updates to this manual from our directly from Romanoff.
10. Any suggestion to improve the machine can be sent in writing to our office. We will be pleased to read and send your comments to appropriate team for review.

### 1.1.2 SAFETY WARNINGS

To guarantee the utmost operating reliability, Romanoff has carried out an accurate selection of materials and components to be used in the machine manufacture. 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 and made with such a safety level that they can 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, faulty operation.

In any event, respect the following measures:

**NEVER USE THE MACHINE OR CARRY OUT ANY INTERVENTION ON THE MACHINE IF YOU HAVE NOT CAREFULLY READ AND WHOLLY UNDERSTOOD THIS MANUAL IN ALL ITS PARTS.**

**IN PARTICULAR, TAKE ALL THE NECESSARY MEASURES LISTED IN SECTION 1 - SAFETY INSTRUCTIONS AND INFORMATION.**

**DO NOT USE THE MACHINE IN CONDITIONS OR FOR A USE OTHER THAN THAT STATED IN THE MANUAL. ROMANOFF SHALL NOT BE DEEMED RESPONSIBLE FOR ANY FAILURE, FAULT OR ACCIDENT DUE TO THE NON OBSERVANCE OF THIS USER MANUAL.**

This manual is made up 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 MAINTENANCE INTERVENTIONS.

**NOTE: DO NOT TAMPER WITH, ALTER OR CHANGE, EVEN PARTIALLY, THE MACHINE OR EQUIPMENT REFERRED TO IN THIS OPERATOR'S MANUAL, AND IN PARTICULAR THE GUARDS FITTED FOR THE PERSONS' SAFETY.**

**DO NOT OPERATE IN A WAY OTHER THAN THE SPECIFIED WAY, OR TO NEGLECT SAFETY RELATED OPERATIONS.**

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 the tampering with the equipment parts can lead to injuries to people, will be indicated in the manual by this sign.



During the machine operation, the operator is protected by the centrifugation chamber closed lid. The working cycle is only possible after the lid has been closed and locked. The protection remains locked in 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 2.2 ACCIDENT PREVENTION PROTECTIONS.



**EMERGENCY LID UNLOCK SHOULD BE USED ONLY IN CASE OF POWER SUPPLY FAILURE, DURING THE CASTING OPERATION. WHEN THE LID IS UNLOCK MANUALLY THE ARM ROTATION IS NOT ALLOW.**

### 1.1.3 GROUNDING

This product is a Class 1 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.

### 1.1.4 MAGNETIC FIELD



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

## 1.2 GENERAL INFORMATION

### 1.2.1 RECOMMENDED USE

**Romanoff RCS 5kW** is a centrifugal casting unit with medium frequency inductive heating, designed to melt wide range of metal alloys.

The safety devices fitted on the machine make it safe and reliable in time.



## 1.2.2 SUPPLIED ACCESSORIES

**Table 1.1 Romanoff RCS 5kW Accessories**

No	Description	Qty	Picture
1	Tongs for cylinder and crucible	1	
2	Graphite crucible 100g	1	
3	Crucible for titan 80g	1	
4	Ceramic crucible for Pt 200g		
5	Filter glass blue	1	
6	1 Screwdriver system "ZERO"	1	
7	4 Adjustable fee	4	
8	KIT of: Spacer for saddle Spacer for saddle L=70 Spacer for saddle L=75 Spacer for saddle L=80 Spacer for saddle L=85	1	
9	KIT of the saddle in mm: Flask saddle 30mm Flask saddle 48mm Flask saddle 63mm Flask saddle 80mm  or KIT of the saddle in inch: Flask saddle 2in Flask saddle 2 3/8in Flask saddle 3in Flask saddle 2.5in	1	

### 1.2.3 UNAUTHORIZED USE

The metal cannot undergo centrifugation melting if the top lid is opened.

### 1.2.4 PERSONNEL TRAINING

The Romanoff RCS 5kW melting unit have been designed and built to be used by qualified personnel; these persons are supposed to be perfectly acquainted with the work execution procedures and with the characteristics of the materials to be used.

An accurate reading of this manual and a short training under the supervision of a qualified operator is recommended.

### 1.2.5 SAFETY DEVICES

The machine is equipped with devices designed to guarantee the safety of the operator:


1. Top lid locking during rotation.
2. No melting start in case of insufficient water flow.
3. No melting start if the water temperature is above 50°C.
4. Red mushroom emergency stop on yellow background. It should be used:
  - 4.1. To avoid, as soon as they arise, dangers to people;
  - 4.2. To reduce, when they arise, damages to the machine or the on-going operation. USE MODERATELY.

### 1.2.6 NOISE LEVEL

The measure has been taken with the machine in the centrifugation phase, as this is the operation with the highest 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.  $L_{Aeq1T_p} = 68.7$

### 1.2.7 RESIDUAL DANGER AND EMERGENCY SITUATION

	<ol style="list-style-type: none"> <li>1. Avoid direct contacts with the melting coil during the heating phase (ELECTRIC HAZARD).</li> <li>2. Avoid introducing metal objects inside the melting coil without the appropriate crucible (ELECTRIC AND THERMAL HAZARD).</li> <li>3. Avoid direct contacts with the mechanical parts situated near the crucible; use supplied prongs and wear suitable gloves to manipulate crucibles and cylinders (THERMAL HAZARD).</li> <li>4. Avoid any type of intervention on the machine before the machine has been disconnected from the electric supply.</li> </ol>
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**Note:** The residual dangers are indicated on the machine by specific labels.

## 2 INFORMATION ON THE MACHINE OPERATION

### 2.1 TECHNICAL DESCRIPTION OF THE MACHINE

Casting unit consists of a steel framework supporting the centrifugation chamber, and a steel plate panelling closing the machine. On top of the machine, a lid opens in a compasses movement to give access to the working compartment. This lid is fitted with a safety lock.

The melting circuit based on the current oscillation about 90 kHz in such a way as to create a alternate magnetic field, uses the new generation IGBT transistors technology, which guarantees a better yield of the power circuit, lower consumption and excellent reliability in time.

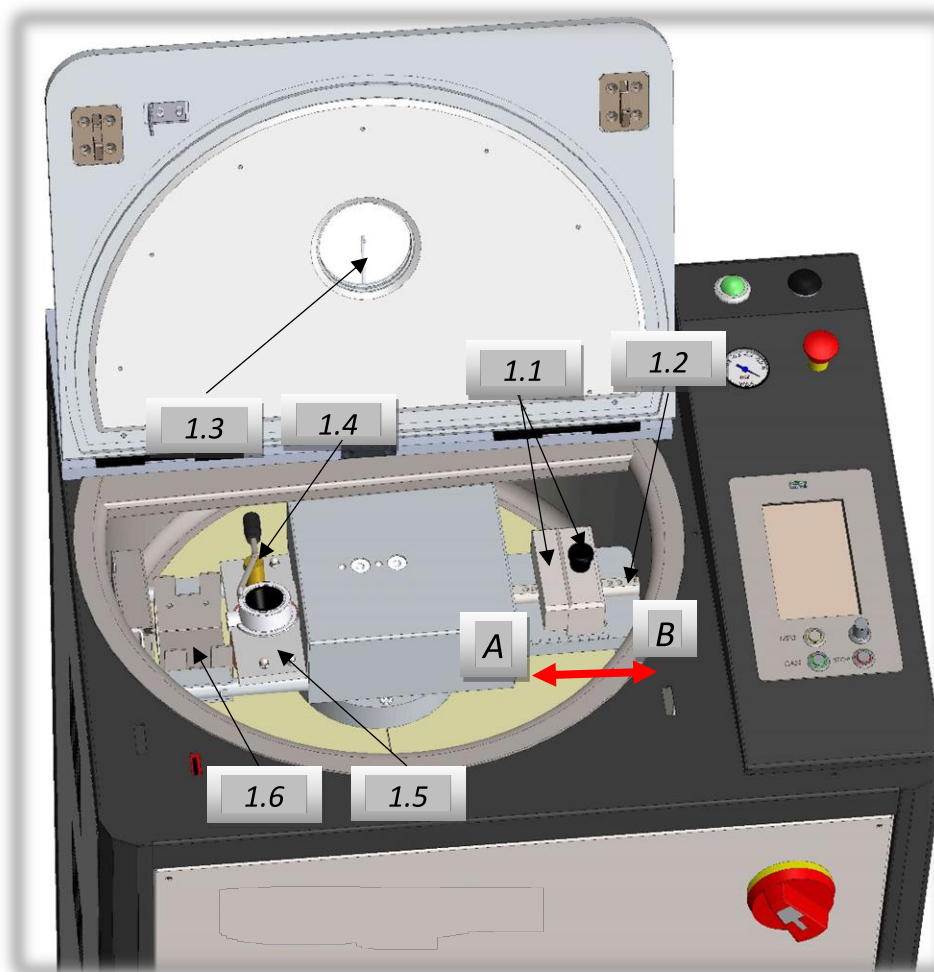
This type of circuit offers two essential advantages:

1. Low current consumption.
2. In the melting point the metal begins to rise slightly and form a dome, thus giving clear evidence of the melting.

Lastly, the machine is fitted with some automatic functions, for an easier work, such as:

1. Adjustable centrifugation time out.
2. Adjustable speed and acceleration for centrifugation.
3. Maintain set temperature for certain adjustable time.

#### 2.1.1 IDENTIFICATION OF THE CENTRIFUGATION TANK COMPONENTS



**Fig. 2.1**      **RCS 5kW Centrifugal tank components**

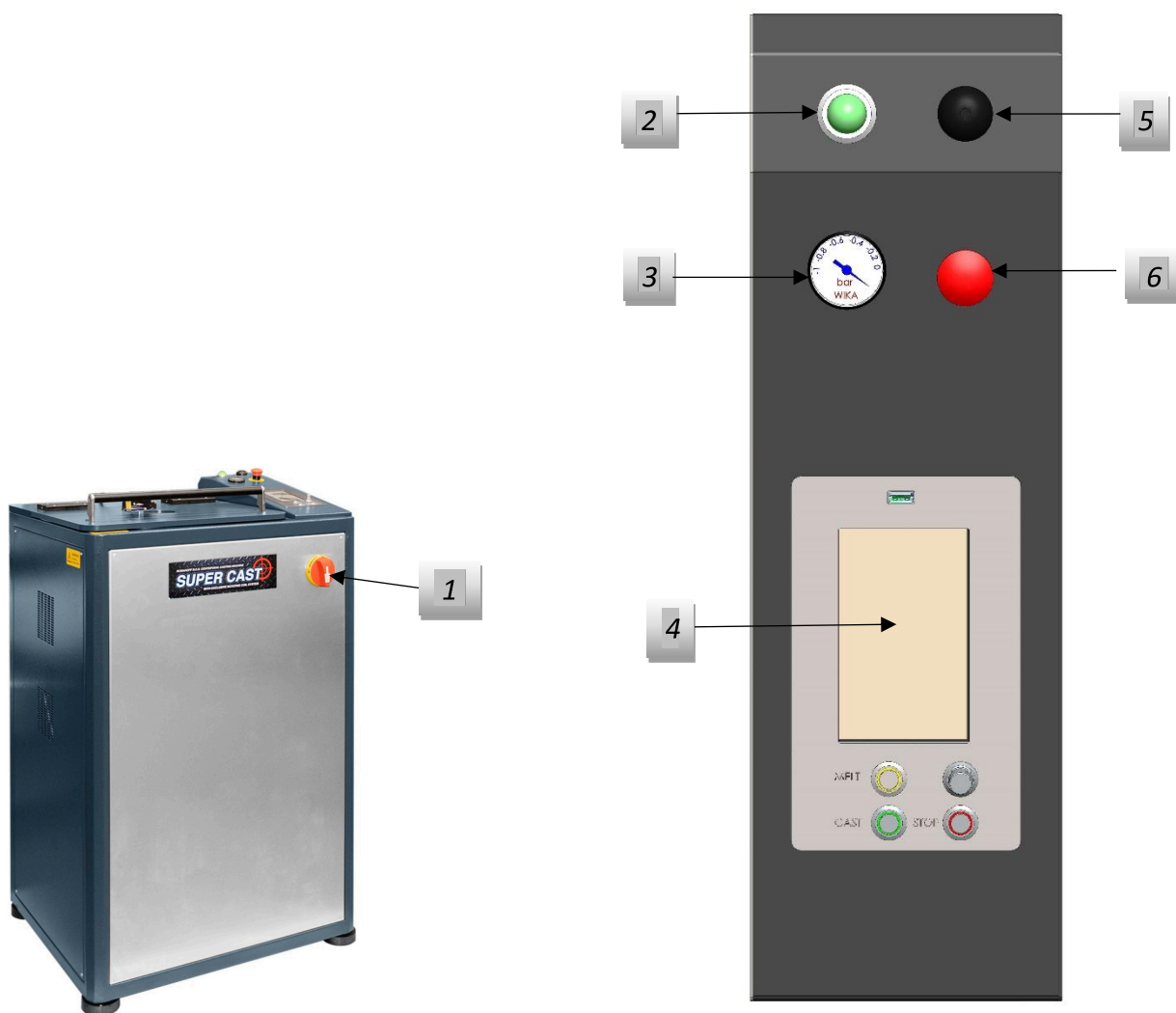
1.1	Counterweight	1.4	Crucible locking lever
1.2	Counterweight retainer	1.5	Crucible support
1.3	Viewing window	1.6	Saddle

\*Pull the knob **1.2-Fig.2.1** to move counterweight.

\*To balance the arm, adjust the counterweight position by moving it in A or B direction.

## 2.2 CONTROLS AND OPERATION

### 2.2.1 FRONT PANEL OVERVIEW



**Fig. 2.2 Front Panel Romanoff RCS 5kW**

\*The above drawing represents the control section of Romanoff RCS 5kW.

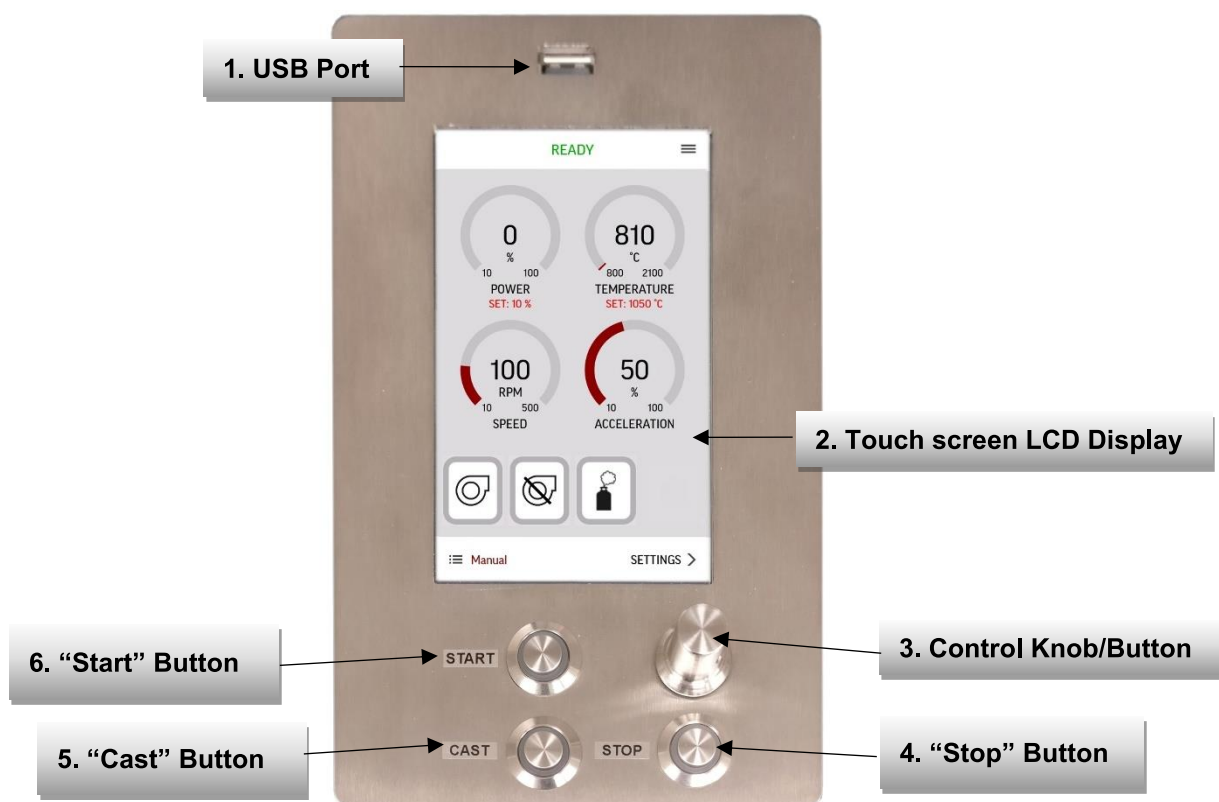
**Table 2.1 Romanoff RCS 5kW Front panel**

No	Description
1	Power On Switch
2	Green Lamp – Power On Light (electric supply)
3	Vacuum meter
4	Control Panel
5	Alarm Buzzer
6	Red mushroom emergency push-button, on yellow background USE WITH MODERATION to: 1) avoid dangers, when they arise, to the persons; 2) reduce damages, when they arise, to the machine or on-going operations.

## 2.2.2 CONTROL PANEL 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.

## 2.2.3 CONTROLS AND INDICATORS



**Fig. 2.3 Control Panel Layout and Controls**

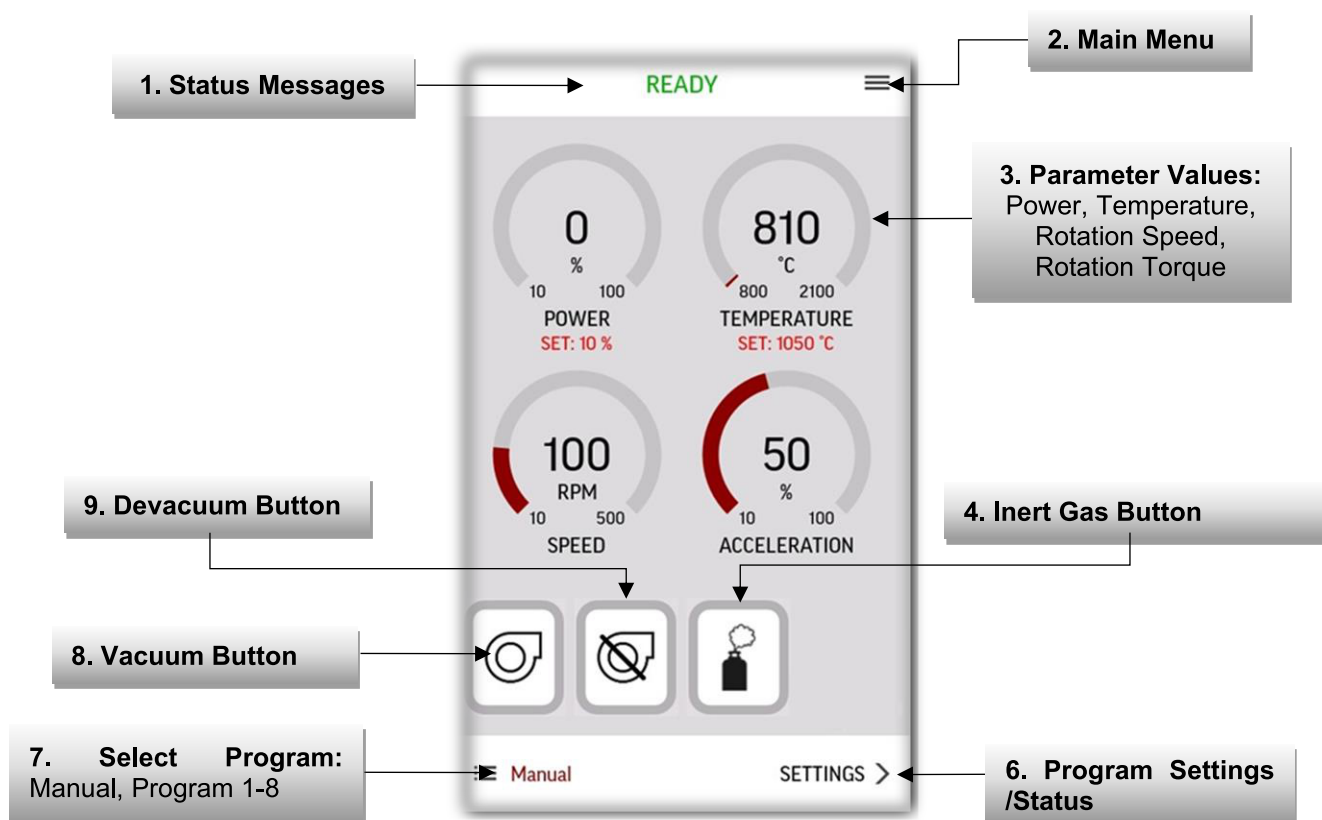


**Table 2.2 Description of Control Panel Controls**

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

## 2.2.4 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. 2.4 The Home Screen**

**Table 2.3 Home screen messages and buttons.**

No	NAME	DESCRIPTION
1	Status Messages	Shows the current status of the system when in operation. See Section <b>STATUS MESSAGES</b> for a description of possible status messages.
2	Main Menu	Allows users to configure custom <b>user settings</b> , access <b>tests &amp; diagnostic</b> protocols, implement <b>software updates</b> , and view <b>product information</b> .
3	Parameter Values	Displays and allows the user to adjust the set points of <b>Power</b> , <b>Temperature</b> , <b>Rotation Speed</b> and <b>Rotation Torque</b> . During operation, it displays the measured values as well as the set points. See Section <b>PROGRAM HEATING</b> for more details.
4	Inert Gas Button	The chamber starts to fill with inert gas after pressing of the button (if applicable).
5	Program Settings	Allows the user to view and customize all process parameters.
6	Select Program	Enables the user to choose between <b>Manual</b> mode or one of eight customizable pre-defined <b>Programs</b> . See Section <b>PROGRAM HEATING</b> for instructions on selecting and customizing user programs.
7	Vacuum Button	The Vacuum Pump starts working after the button is pressed and creates vacuum inside the casting chamber (up to -0.8 bar). <b>Time Out</b> - depending on the Machine type. For <b>Romanoff RCS'</b> it is <b>40 sec</b> .
8	Devacuum Button	After the button is pressed, devacuum valve opens and the vacuum is released from the casting chamber. <b>Time Out</b> - depending on the Machine type. For <b>Romanoff RCS'</b> it is <b>10 sec</b> .

## 2.2.5 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 2.4 Status messages description.**

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

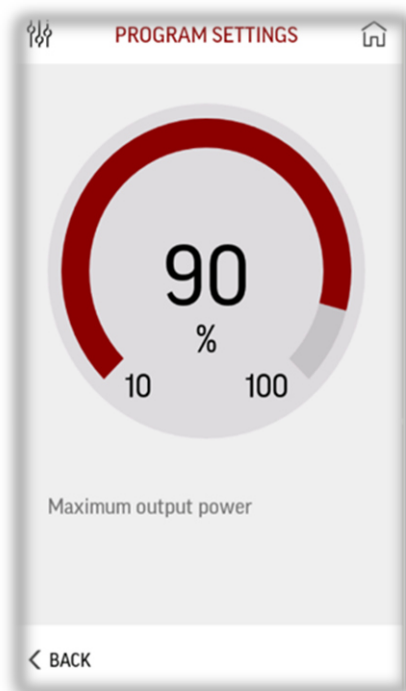
## 2.2.6 BEFORE OPERATION

From the Home screen, when the machine is in the **READY** state, the set points of Power, Temperature, Rotation Speed, Rotation Torque 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:

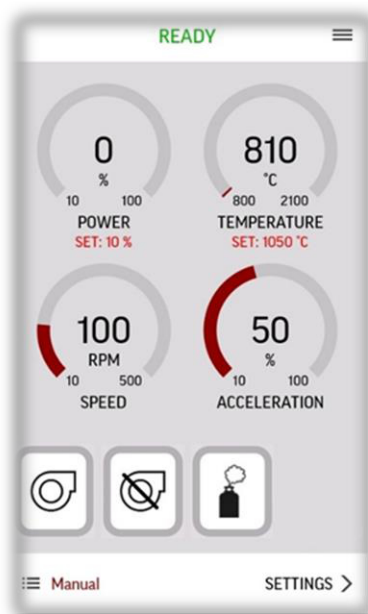
1. Press a setting on screen to toggle between ON and OFF. To edit the continuous parameters, select the parameter to open the editing screen. An example is shown below:



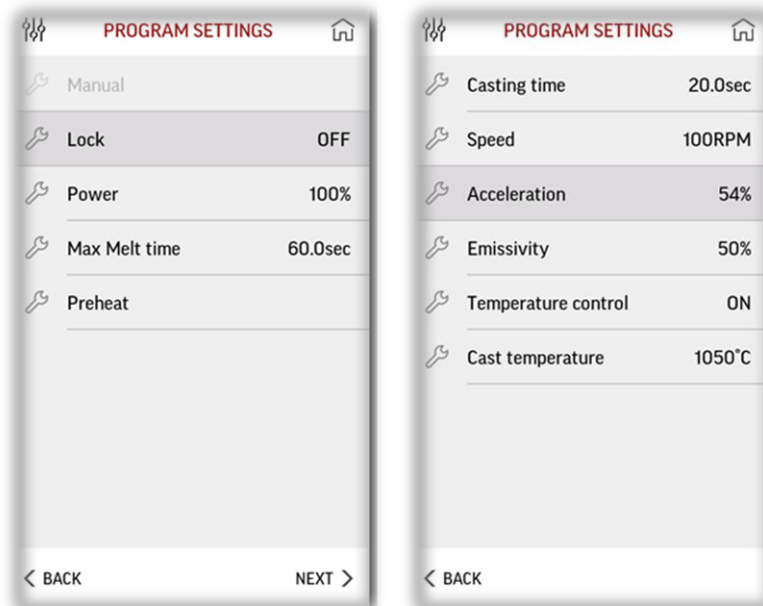
**Fig. 2.5** *How to regulate Maximum output power*

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.

## 2.2.7 MANUAL HEATING



**Fig. 2.6 Manual Heating Home Screen**



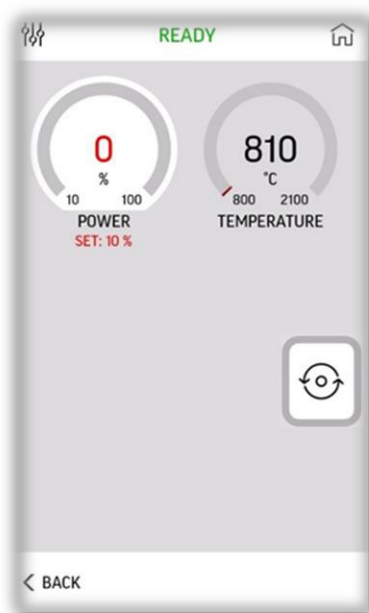
**Fig. 2.7 Manual Heating available settings**

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

**Table 2.5 Manual Heating process parameters.**

NAME	DESCRIPTION
<b>CASTING TIME</b>	The amount of time that the rotating arm is in motion. The value can be from <b>2 s</b> to <b>180 s</b> with <b>1 s</b> step.
<b>SPEED</b>	The Centrifugal Speed can be adjusted by rotating the Control Knob. Speed range – The Speed value can be adjusted from <b>10</b> to <b>500 RPM</b> in steps of <b>10 RPM</b> .
<b>ACCELERATION</b>	The time needed to reach the pre-set centrifugal speed. The range is between <b>10 %</b> and <b>100 %</b> in steps of <b>1 %</b>
<b>EMISSIONITY</b>	This is a setting specific to the IR temperature sensor. It is factory set at <b>50%</b> and should only be adjusted while testing to provide a more accurate temperature reading for specific alloys.
<b>TEMPERATURE CONTROL</b>	When this option is <b>ON</b> , the machine will try to regulate the power in regard to the pre-set temperature set point. When the option is <b>OFF</b> , 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 <b>OFF</b> in order to obtain a good idea of what the IR sensor is reading when the metal turns completely liquid.
<b>CAST TEMPERATURE</b>	Temperature set point to cast the material. From <b>900 °C</b> to <b>2000 °C</b> in step of <b>1 °C</b> .
<b>LOCK</b>	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: <b>0000</b> .
<b>POWER</b>	The maximum power level of the induction generator that will be reached during melting process. It is recommended for materials that melt below <b>1093 °C (2000 °F)</b> to set this at <b>80 %</b> . Above <b>80 %</b> 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.
<b>MAX MELT TIME</b>	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 <b>0</b> and <b>600 s</b> in <b>1 s</b> 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.
<b>PREHEAT</b>	Allows the user to preheat the material prior to the casting process. <b>POWER</b> – the power can be adjusted from <b>10 to 100 %</b> in step of <b>1 %</b> <b>TEMPERATURE</b> – this is indicator of the temperature of the material in the load (if applicable). <b>STIRRING BUTTON</b> – 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.

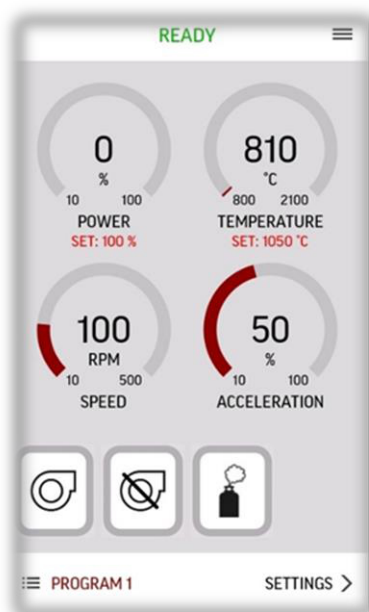




**Fig. 2.8 Preheating Screen**


## 2.2.8 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.

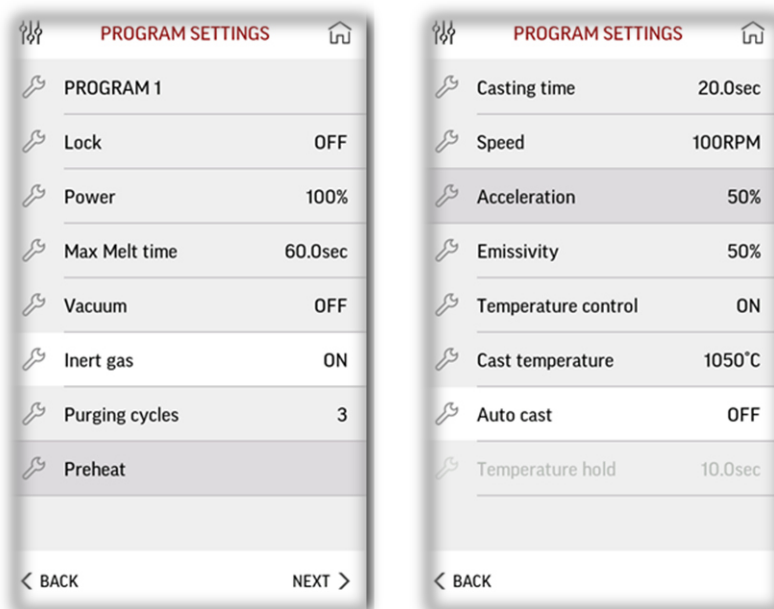


**Fig. 2.9 Program Heating Main Screen**

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.

- 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. 2.10 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)

- 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.
- Select "Lock" to lock the parameter values for the program. A user-set password is required for unlocking.
- 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. 2.11 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.

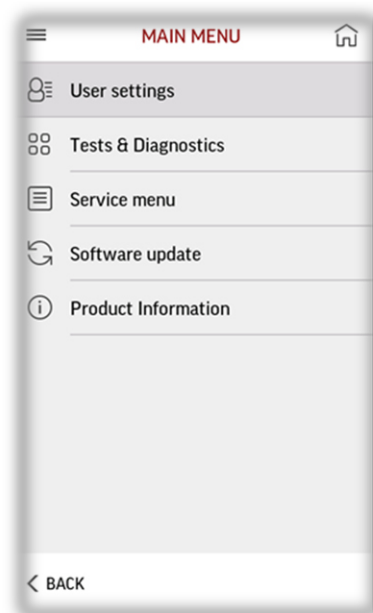
**Table 2.6 Program Heating parameters.**

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: <b>0000</b> .
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 <b>0 s</b> and <b>600 s</b> in <b>1 s</b> 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 <b>-0.8 bar</b> then filling it back with inert gas up to <b>-0.2 bar</b> .
PREHEAT	Enables or disables the preheat function. For more information see <b>Table - Manual Heating process parameters</b>
CASTING TIME	The amount of time that the rotating arm is in motion. The value can be from <b>2 s</b> to <b>180 s</b> with <b>1 s</b> step.
SPEED	The Centrifugal Speed can be adjusted by rotating the Control Knob. <b>Speed range</b> – The Speed value can be adjusted from <b>10</b> to <b>500 RPM</b> in steps of <b>10 RPM</b> .
ACCELERATION	The time needed to reach the pre-set centrifugal speed. The range is between <b>10 %</b> and <b>100 %</b> in steps of <b>1 %</b>

<b>EMISSIONITY</b>	This is a setting specific to the IR temperature sensor. It is factory set at <b>50 %</b> and should only be adjusted while testing to provide a more accurate temperature reading for specific alloys.
<b>TEMPERATURE CONTROL</b>	When this option is <b>ON</b> , the machine will try to regulate the power in regard to the pre-set temperature set point. When the option is <b>OFF</b> , 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 <b>OFF</b> in order to obtain a good idea of what the IR sensor is reading when the metal turns completely liquid.
<b>CAST TEMPERATURE</b>	Temperature set point to cast the material. From <b>900 °C</b> to <b>2000 °C</b> in step of <b>1 °C</b> .
<b>AUTO CAST</b>	If this function is <b>Enabled</b> , the casting process will start automatically after the temperature of the load reaches the pre-set set point.
<b>TEMPERATURE HOLD</b>	Only available when <b>Auto Cast</b> mode is <b>Enabled</b> . Define time delay to be used before the centrifuging rotation starts and after the temperature set point has been reached.

## 2.2.9 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. 2.12 Main Menu Home screen**

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

## 2.2.9.1 USER SETTINGS

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



*Fig. 2.13 User Settings Home screen*

**Table 2.7 Customizable settings in the User Settings menu.**

	NAME	DESCRIPTION
<b>1</b>	<b>THERMOREGULATOR</b>	Allows the user to set the parameters of the PID Thermoregulator, such as the Integral and Differential factors.
<b>1.1</b>	<b>MINIMUM POWER</b>	Minimum permissible power that can be fed to the output when the PID regulator is regulating. <b>Default Value – 10%</b>
<b>1.2</b>	<b>ZONE</b>	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. <b>Default Value – 100 °C</b>
<b>1.3</b>	<b>INTEGRAL FACTOR</b>	Integral gain of PID control law. Advanced parameter, editing this could lead to improper or not true control of the thermoregulator. <b>Default Value - 0</b>
<b>1.4</b>	<b>DIFFERENTIAL FACTOR</b>	Differential gain of PID control law. Advanced parameter, editing this could lead to improper or not true control of the thermoregulator. <b>Default Values - 0</b>
<b>2</b>	<b>MEASUREMENT UNITS</b>	Allows the user to set the displayed measurement units for temperature and water flow rate.
<b>2.1</b>	<b>TEMPERATURE UNITS</b>	Gives the choice of the default measuring unit for the temperature. The available options are in ° Kelvin, ° Celsius and ° Fahrenheit.
<b>2.2</b>	<b>WATER FLOW UNITS</b>	Gives the choice of the default measuring unit for the water flow. The available options are in <b>Litre per minute (l/min)</b> and <b>Gallon per minute (gpm)</b>
<b>3</b>	<b>CLEAR BATCH COUNTER</b>	Resets the batch counter, which counts the number of operation cycles.



4	<b>RESET TO DEFAULT</b>	Resets the equipment to the default settings.
5	<b>LANGUAGES</b>	Allows the user to select the displayed language. The available options are <b>Bulgarian</b> and <b>English</b> .
6	<b>DATE &amp; TIME</b>	Allows the user to set the date in <b>DD-MM-YYYY</b> format and the time in <b>HH:MM:SS</b> format.
7	<b>SET PASSWORD</b>	Allows the user to set a password for locking and unlocking the program settings. The default user password is <b>0000</b> . Inputting a password of <b>1234</b> when unlocking a program will reset the password to <b>0000</b> .



**Fig. 2.14** Enter new password screen

## 2.2.9.2 TESTS & DIAGNOSTICS

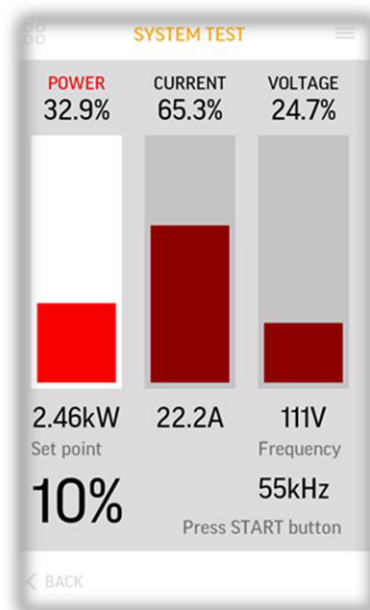
The **Tests & Diagnostics** menu gives the user a number of automated diagnostic tests for the equipment as well as information about the cooling status. The user is also able to input a custom value for the atmospheric pressure. The tests and statuses available in the **Tests & Diagnostics** menu are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



**Fig. 2.15** Test and Diagnostics Home screen

**Table 2.8** The diagnostic tests and measured data available in the Tests & Diagnostics menu.

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



**Fig. 2.16** Inverter test screen

### 2.2.9.3 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.

## 2.2.10 TUNING AND TROUBLESHOOTING

### 2.2.10.1 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.

### 2.2.10.2 ERROR, FAULTS AND WARNINGS

**Table 2.9 Error, Warnings (W) and Fault (F) Messages**

Nº	Screen Message	W/F	Condition	Cause	Advice
<b>N1</b>	Tuning Fault	F	Primary U & I out of phase	Resonant frequency is lost (Can't find resonant frequency)	<ul style="list-style-type: none"> <li>* Check resonant loop connections.</li> <li>* Check coil for shorted turns.</li> <li>* Check the condition and the mounting of the tank capacitors.</li> </ul>
<b>N2</b>	Inverter overcurrent	F	I primary > I Max	The primary current exceeds the maximum allowed safety current value	<ul style="list-style-type: none"> <li>* Possible very low load of the generator.</li> <li>* Inspect the condition of the outgoing cables from the Inverter board (1MOD-754-330-00).</li> <li>* Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</li> <li>* Possible FET/IGBT failure in the Power supply. Contact our Service department.</li> </ul>
<b>N3</b>	Inverter frequency out of range	F	$F > F_{max}$ or $F < F_{min}$ SC- J5/J5-T & SC - A5/A5-T - 85-105 kHz SC - AP5/AP5-T- 350-400 kHz	During Heat on sequence the operating frequency goes out of the pre-set range.	<ul style="list-style-type: none"> <li>* Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</li> <li>* Check the Coil for shorted turns and/or burn marks.</li> <li>* Check the condition and the mounting of the tank capacitors.</li> </ul>
<b>N5</b>	Auto tune fault	F	Can't find resonance frequency	The unit could not find resonant frequency during auto sweep	<ul style="list-style-type: none"> <li>*Possible very low load of the generator.</li> <li>*Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</li> <li>* Check the Coil for shorted turns and/or burn marks.</li> <li>* Check the condition and the mounting of the tank capacitors.</li> </ul>

Nº	Screen Message	W/F	Condition	Cause	Advice
N9	Communication lost control board	F	Communication Error Between Panel and Control Board	No acknowledgment is received after the last command	<p>* Communication time out has ended.</p> <p>* Are the RS and Power cables correctly and firm connected between</p> <ul style="list-style-type: none"> <li>- Control board (1MOD-754-100-00) and Interface board (1MOD-769-102-00)</li> <li>- Interface board (1MOD-769-102-00) and RS communication board (1MOD-017-300-00)</li> <li>- RS communication board (1MOD-017-300-00) and the Control panel (Main board- 1MOD-032-200-00).</li> </ul>
N21	Inverter frequency too high	F	$F > F_{max}$ <i>SC-J5-T, SC-A5-T - 200kHz</i> <i>SC-AP5-T - 550kHz</i>	During Heat ON mode, the working frequency goes above the pre-set range.	<p>* Check the Working frequency value from Home Screen use the TECHNICAL PRODUCT SPECIFICATION table for reference.</p> <p>* Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</p> <p>* Check the Coil for shorted turns and/or burn marks.</p> <p>* Check the condition and the mounting of the tank capacitors.</p>
N22	Inverter frequency too low	F	$F < F_{min}$ <i>SC-J5-T, SC-A5-T,</i> <i>SC-AP5-T - 50kHz</i>	During Heat ON mode, the working frequency goes below the pre-set range.	<p>* Check the Working frequency value from Home Screen use the TECHNICAL PRODUCT SPECIFICATION table for reference.</p> <p>* Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</p> <p>* Check the Coil for shorted turns and/or burn marks.</p> <p>* Check the condition and the mounting of the tank capacitors.</p>
N23	DC over current Fault	F	Failure related to 1MOD-754-200-00	The DC current exceeds the maximum allowed safety current value	<p>* Possible short circuit of the board's output</p> <p>* Inspect the condition of the outgoing cable from the DC DC Power Board 1MOD-754-200-00.</p> <p>* Check all cables and connection related to the board.</p>

Nº	Screen Message	W/F	Condition	Cause	Advice
N27	Inverter maximum temperature limit exceeded	F	T° heat sink >70°C	The heat sink of the inverter exceeds the max allowed T°	<ul style="list-style-type: none"> <li>* Wait until the heat sink cools down, the cooling water cools down or change the water of cooling system to help the process.</li> <li>* Check the temperature set point and what the machine measures - <i>Main Menu &gt; Test &amp; Diagnostics menu &gt; Water flow.</i></li> <li>* Check the cooling system for obstruction and temperature of the water.</li> </ul>
N28	Inverter water flow fault	F	Water Flow < 2 l/min (0.5GPM)	Restricted or no water flow	<ul style="list-style-type: none"> <li>* Check cooling water flow rate.</li> <li>* Check hoses and external water filter for blockages. Check flow switch.</li> <li>* Check the temperature set point and what the machine measures - <i>Main Menu &gt; Test &amp; Diagnostics menu &gt; Water flow.</i></li> </ul>
N32	Missing phase	F	No power supply to 1MOD-725-500-01 or moment dropping of line voltage	Missing or not proper voltage supplied to the machine.	<ul style="list-style-type: none"> <li>* Check the Power Supply coming to the machine.</li> <li>* Check Main Power Supply cable. It could have been damaged or missing.</li> <li>* This error is occurring after the power supply has been disconnected, until the capacitors in the machine get fully discharged.</li> <li>* Check if the AC wires inside the machine are disconnected or lose. Open the front panel - check the wiring. Make sure all wires are connected and are making good electrical contact.</li> <li>* Check the Fuse FU2.</li> <li>* Check circuit breaker FU5. Check for burn spots, measure input and output voltage.</li> </ul>
N34	DC under voltage fault	F	No DC Voltage to 1MOD-754-200-00	Contactor KM1 not working	<ul style="list-style-type: none"> <li>* Inspect the cables going from KM1 to J1 and J3 on the DC-DC Power Board 1MOD-754-200-00 and from KM1 to J3 and J4 on the Power Supply, 1ph.</li> <li>* Check, inspect and if necessary, change the faulty Contactor KM1.</li> </ul>

Nº	Screen Message	W/F	Condition	Cause	Advice
N36	Communication lost interface board	F	No connection with Interface Board	No acknowledgment is received after the last command	<ul style="list-style-type: none"> <li>* Communication time out has ended.</li> <li>* Are the RS and power cables correctly and firm connected between the Control board 1MOD-754-100-00, 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.</li> </ul>
N38	Inverter over frequency fault	F	Resonance frequency is close to high frequency limit $F > F_{max}$ <i>SC-J5-T, SC-A5-T - 200kHz</i> <i>SC-AP5-T - 550kHz</i>	During Heat on sequence the operating frequency goes above the maximal working frequency	<ul style="list-style-type: none"> <li>* Check everything in the Resonant loop- Load Coil, Tank Capacitors, Transformer.</li> <li>* Check the Coil for shorted turns and/or burn marks.</li> <li>* Check the condition and the mounting of the tank capacitors.</li> </ul>
N66	Local Emergency Stop	F	Local Emergency Stop is pressed	The inverter is not operating	<ul style="list-style-type: none"> <li>* Release the Local Emergency Stop by turning it to the left/ in the left direction.</li> </ul>
N71	Ambient over temperature Fault	F	$T_{INBOX} > T_{INBOX\ max}$ $T_{INBOX} > 65^{\circ}C$	The inbox temperature is too high for further operation	<ul style="list-style-type: none"> <li>* The value of the inbox temperature is above the safety operation threshold.</li> <li>* Check the Unit internal temperature value <i>Main menu &gt; Test and Diagnostics &gt; Box Temperature</i></li> <li>* Use the Power Supply TECHNICAL PRODUCT SPECIFICATION table for reference.</li> <li>* Default temperature: <b><math>T_{inb\ max} = 65^{\circ}C</math></b></li> </ul>
N82	Communication lost temperature board	F	No connection with Temperature Board	No acknowledgment is received after the last command	<ul style="list-style-type: none"> <li>* Check if the RS and power cables are correctly and firm connected between the RS Communication board 1MOD-017-300-00 and the Control Panel (Main board) 1MOD-782-100-00.</li> </ul>
N83	Centrifuge motor control fault	F	Motor Contactor is welded	Contactor KM3 and KM4 damage	<ul style="list-style-type: none"> <li>* Check if when the CAST button is pressed a clicking sound is present (the contactor is working as intended - the contacts are working).</li> <li>* Inspect FU4</li> <li>* Check, inspect and if necessary, change the faulty contactors (KM3 and/or KM4).</li> </ul>

No	Screen Message	W/F	Condition	Cause	Advice
N261	LCD initialization Fault	F	Control Panel fault	LCD failed	*Check if the "Ready" light (green LED) is On. If not Check the Power Supply coming to the machine. * Check Main Power supply cable *Check if the AC wires inside the machine are disconnected or lose. * Check the Fuses (FU2)
N262	I2C1 initialization Fault	F			
N263	I2C2 initialization Fault	F			
N264	SDRAM initialization Fault	F	Control Panel fault	SDRAM fault	
N272	Pizzato unlock Fault	F	Top Lid Opened	You tried to cast with open cover	* If casting was attempted while the top lid was opened, close the lid safely and try again. * If casting was attempted while the top lid was opened, close the lid safely and try again. * Check if the Safety Switch Pizzato is working properly - The top lid can be opened when the Machine is turned on and the preset time is out. * Remove the left cover to get access. If the Pizzato has been used to open the lid manually in a previous situation, check if afterwards the Pizzato has been returned to its default position.  (see 3.2 ACCIDENT PREVENTION PROTECTIONS paragraph for more information)
N275	Both vacuum and inert gas sensors are active	F	Problem with Vacuum switches		*Check the condition of the Vacuum switches positioned outside the melting chamber. * Check and inspect the cabling of the vacuum switches.
N276	Internal error	F	Control Panel fault	Analog signal measurement failed	*Check if the "Ready" light (green LED) is On. If not Check the Power Supply coming to the machine. * Check Main Power supply cable *Check if the AC wires inside the machine are disconnected or lose. * Check the Fuses (FU2)



No	Screen Message	W/F	Condition	Cause	Advice
<b>N277</b>	Current of the analog input 4-20mA is below 4 mA Fault	F	Control Panel fault	Current of the analog input 4-20mA is below 4 mA Fault	<ul style="list-style-type: none"> <li>* Inspect the External IO expander board 1MOD-032-101-00 and the Pyrometer connector P202.</li> <li>* Check if the "Ready" light (green LED) is On. If not Check the Power Supply coming to the machine.</li> <li>* Check Main Power supply cable</li> <li>* Check if the AC wires inside the machine are disconnected or lose.</li> <li>* Check the Fuses (FU2)</li> </ul>
<b>N523</b>	Invalid password	W	Wrong Password	You tried to log in with the wrong password	<ul style="list-style-type: none"> <li>* Wrong password entered. Check and enter again.</li> <li>* Inspect if you have made proper contact with the touch screen.</li> </ul>
<b>N524</b>	Passwords do not match	W	Password mismatch	You tried to confirm a password with the wrong password	<ul style="list-style-type: none"> <li>* Wrong password entered. Check and enter again.</li> <li>* The confirmation password is not matching. Check and enter again.</li> <li>* Inspect if you have made proper contact with the touch screen.</li> </ul>
<b>N525</b>	Please, close the chamber	W	Top Lid is Opened	The Casting chamber is not closed properly	<ul style="list-style-type: none"> <li>* Try to close the lid better.</li> <li>* If casting was attempted while the top lid was opened, close the lid safely and try again.</li> <li>* Check the Safety Switch Pizzato.</li> </ul>
<b>N526</b>	Max Melt time expired	W	The maximum allowed time to melt is reached	Expired time out for the Melt process	<ul style="list-style-type: none"> <li>* The time out of the Melting cycle has expired before the manual stop was used. The Melting cycle time-out is 10 min.</li> <li>* Possible very low load of the generator.</li> <li>* 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.</li> <li>* Use the Power Supply TECHNICAL PRODUCT SPECIFICATION table for reference.</li> </ul>

No	Screen Message	W/F	Condition	Cause	Advice
N535	The input air pressure is low	W	Attempted operation with insufficient air pressure.	The Air pressure is low	<ul style="list-style-type: none"> <li>* Check the Air flow system for leaks and damages.</li> <li>* Check the hoses and filters for blockages.</li> <li>* Ensure that all gas external valves are opened.</li> <li>* Check the Air/Gas diagram of the machine.</li> </ul>
N539	Chamber pressurization fault	W	The maximum allowed time to create vacuum is reached without success	The Vacuum timeout expired	<ul style="list-style-type: none"> <li>* Vacuum timeout expired. The time-out is <b>90 sec.</b></li> <li>* Check for audible or visible leaks or damages on the lid, gaskets, etc. If the Lid's gasket is still new, carefully press it a bit harder. Replace gasket if it is worn out.</li> <li>* Kinked or disconnected hoses should be inspected. Check all pressure/vacuum hoses.</li> <li>* Check the filter and pump for damages and leaks.</li> </ul>
N540	The inert gas pressure is low	W	The inert gas pressure time-out has ended	The Inert gas pressure is low	<ul style="list-style-type: none"> <li>* Problem with Inert Gas purging. Check the Inert gas flow system for leaks and damages.</li> <li>* Regulate the input Inert gas pressure per technical specification provided.</li> <li>* The inert gas pressure time-out has ended. The time-out is <b>30 sec.</b> Inspect if the value is set correct in the internal menus.</li> </ul>
N541	Please, close the chamber or disable temperature control	W	System indicates the Casting Chamber to be closed or the temperature control to be disabled	The operations are contradictory on the same time	<ul style="list-style-type: none"> <li>* The top lid is opened in manual control with temperature control enabled.</li> </ul>

## N.B.

If a different message from the table above appears or the system doesn't respond after clearing a fault contact the support- [support@romanoff.com](mailto:support@romanoff.com)

## 2.3 INSTALLATION AND SET-UP

### 2.3.1 UNPACKING THE MACHINE

The machine is fixed with bolts to a wooden pallet to garant 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.**

Control that the machine has not been damaged during transport. In case of damages, contest it to carrier and give immediate written communication to the manufacturer and reseller.

Take four feet from Accessories and fit them on place instead of transport feeds.

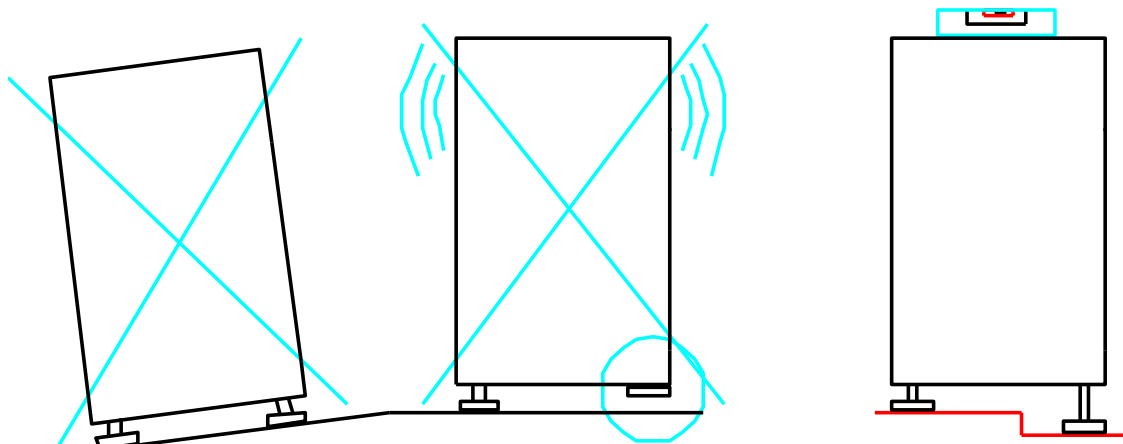
### 2.3.2 POSITIONING IN THE ROOM

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

#### 1. PLACE THE MACHINE ON A PERFECTLY FLAT SURFACE.

2. When the machine is installed, check **THAT IT IS PERFECTLY STABLE AND HORIZONTAL**. A 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.



### 2.3.3 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 compulsory. Check that the power supply and ground connection are made properly.*

### 2.3.4 BUILT-IN COOLING CIRCUIT

1. Connect cable (1 of Fig. 2.17) into an intake 220/230 VAC Single-Phase using type blue CE plugs with compulsory protection ground connection.
2. Open panel (6 of Fig. 2.17) unscrewing the two lateral knobs.
3. Fill the water tank by opening the plug with 25 Lt of distilled water. Use clean distilled water, if possible. The following are the recommended water quality specifications:

**Table 2.10 Recommended water quality specifications**

Specification	Recommended	Not to Exceed
<b>Total Hardness (CaCO<sub>3</sub>)</b>	15 ppm	100 ppm
<b>Total Dissolved Solids</b>	25 ppm	200 ppm
<b>Conductivity*</b>	20 - 50 $\mu$ S/cm	<20 $\mu$ S/cm; >50 $\mu$ S/cm
<b>Max Suspended Solids</b>	<10 ppm	>10 ppm
<b>PH**</b>	7.0 - 7.5	<7.0 >7.5

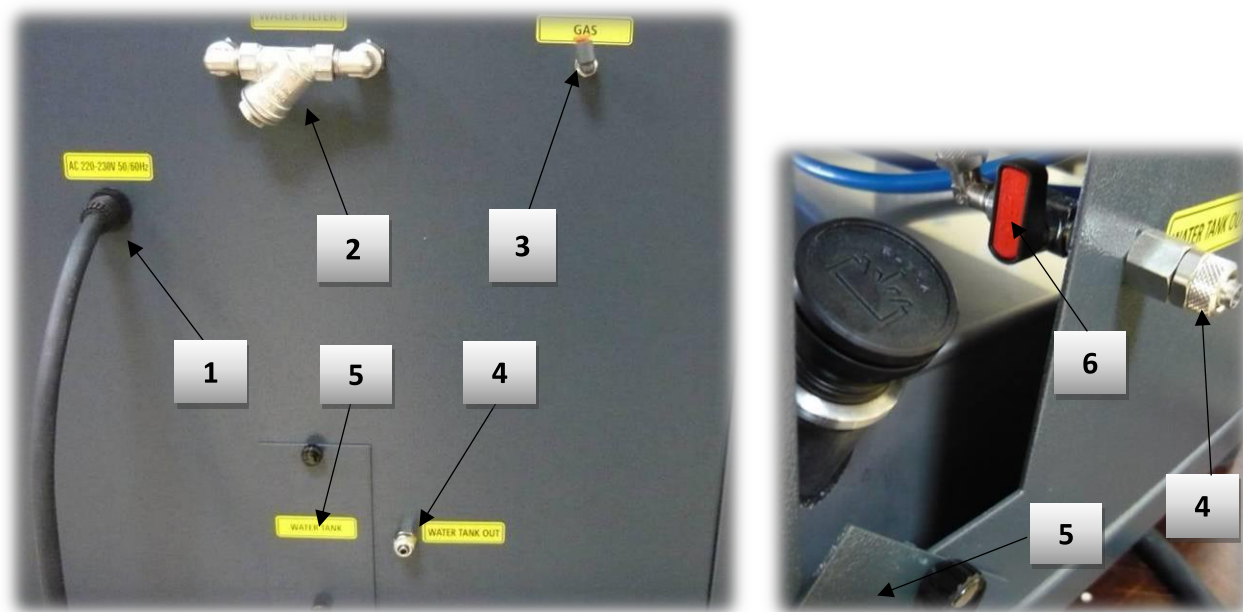
\* Water conductivity that is too low (e.g. De-ionized Water) is not recommended.

\*\* If the pH falls below 4.0 or rises above 9.0, the system should not be used and a system flush/fill should take place as soon as possible.

- a. Never use de-ionized (DI) water, as it will damage the aluminum, copper and bronze fittings.
- b. Glycol can help keep the water from becoming too aggressive. If used, a 30% ethylene glycol (nonconductive type) mixture is recommended with clean water as defined above. Phosphate based corrosion inhibitors are recommended to control the amounts of active ions help form protective oxide layers on metals.
- c. Phosphate based corrosion inhibitors are recommended to control the amounts of active ions and help form protective oxide layers on metals.

The machine is equipped with an internal closed cooling circuit which is connected with the above-mentioned tank. It is then not necessary to replace or add water because there is not consumption; fill up every 2 or 3 years according to the frequency of use of the machine.

4. In case the machine is pre-set for the Argon connect the gas bottle to a hose d 4x6 to the connection (3 of Fig. 2.17). We suggest the use of Argon Gas Air Liquid type N56.



**Fig. 2.17 Rear panel**

1	Power supply cable	4	Water inlet
2	Water filter	5	Panel of the water cooling tank
3	Inert GAS inlet	6	Faucet

5. If it is necessary to drain out the cooling water, proceed as follows:
- Open the back panel (5);
  - Connect a hose d 8x6 to the connection (4);
  - Locate the cock in correspondence with the connection;
  - Open the valve (6);
  - Start the machine. The water pump will start working allowing the draining of the tank. To totally drain the tank, lay the machine to the front part and to the back;
  - Switch off the machine when air comes out from the tube. Turn off the faucet and close the back panel.

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



**ATTENTION!**  
**DO NOT FILL THE WATER TANK UNDER WATER PRESSURE!**



**A completely full tank allows carrying out about 15 consecutive melting operations (depends on ambient temperature and time for melting). If the laboratory needs to carry out more melting operations can be built in internal HEAT EXCHANGER.**

### **2.3.5 PRELIMINARY CONTROLS**

1. Check that the inert gas circuit have been connected (there must be no leaks, bleeds, etc.) and the power supply is on.
2. Check that the centrifugation chamber is free from any accessory.
3. Check that the emergency push-button (*Fig.2.2-6*) 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!**

## 2.4 OPERATING INSTRUCTIONS

### 2.4.1 ALLOY COMPOSITION 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 **SC-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.

### 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:

- Set on the casting machine the base value of the alloy, for example for a Platinum set 25%
- Set on the temperature function the melting point indicated by the alloy manufacturer. Please use the end of the melting interval.
- Start the casting process.
- If the alloy is melting before reaching the set point, decrease the emissivity value by choosing Emissivity control using rotating knob (*Fig. 2.3*).
- If the alloy is not melting even after reaching the set point increase the emissivity value by choosing Emissivity control using rotating knob (*Fig. 2.3*).

**Example:**

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

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

**Table 2.11 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 2.12 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 2.13 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 2.14 Acceleration value**

Type of alloy	Percentage
Yellow Gold	60%
White Gold-Silver Alloys	70%
Platinum	80%

## 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 2.15 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 favor the melting of some metals among which is Palladium. Change according to the following table:

**Table 2.16 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 2.17 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 Rotation arm is in the zero position (*see paragraph 2.4.10 CENTRIFUGAL ARM AND CRUCIBLE SETUP*). Press the Start-button. The button ring indication will be lit in green and, after 1 or 2 seconds, the Power indicator bar 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 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. To continue with the melting, you need to press the start button again. To stop the process, press the Stop Button. 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 utmost 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

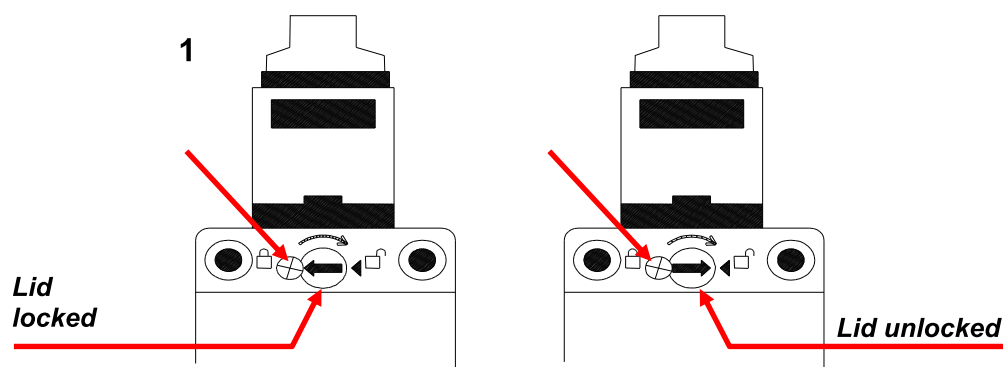
1. During the melting operations, the operator is protected by the centrifugation chamber closing lid. The arm rotation cycle is enabled only when the lid is locked. The lid remains locked in closed position until the centrifugation is completed.



**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 AUTHORIZED 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 (1 of Fig.18).
- Turn the screw 180° (2 of Fig.19) with an appropriate screwdriver so that the arrows match each other and unlock the lock.
- Open the lid
- Turn the screw 180° (2 of Fig.19) to bring back into use the safety device and then lock it again screwing the crossed screw.
- Re-assemble again the side panel.



**Fig. 2.18 Safety device to lock the lid**



**Fig. 2.19 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 your 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:***

***Americas***

Romanoff International Supply Corp  
9 Deforest Street, Amityville NY 11701  
tel: 1 631 842 2400

***Or e-mail Technical Service Department at: [support@romanoff.com](mailto:support@romanoff.com)***

***You can also send your request through our [www.romanoff.com](http://www.romanoff.com) via our live chat.  
Please note, your contact information so that you can be easily reached.***

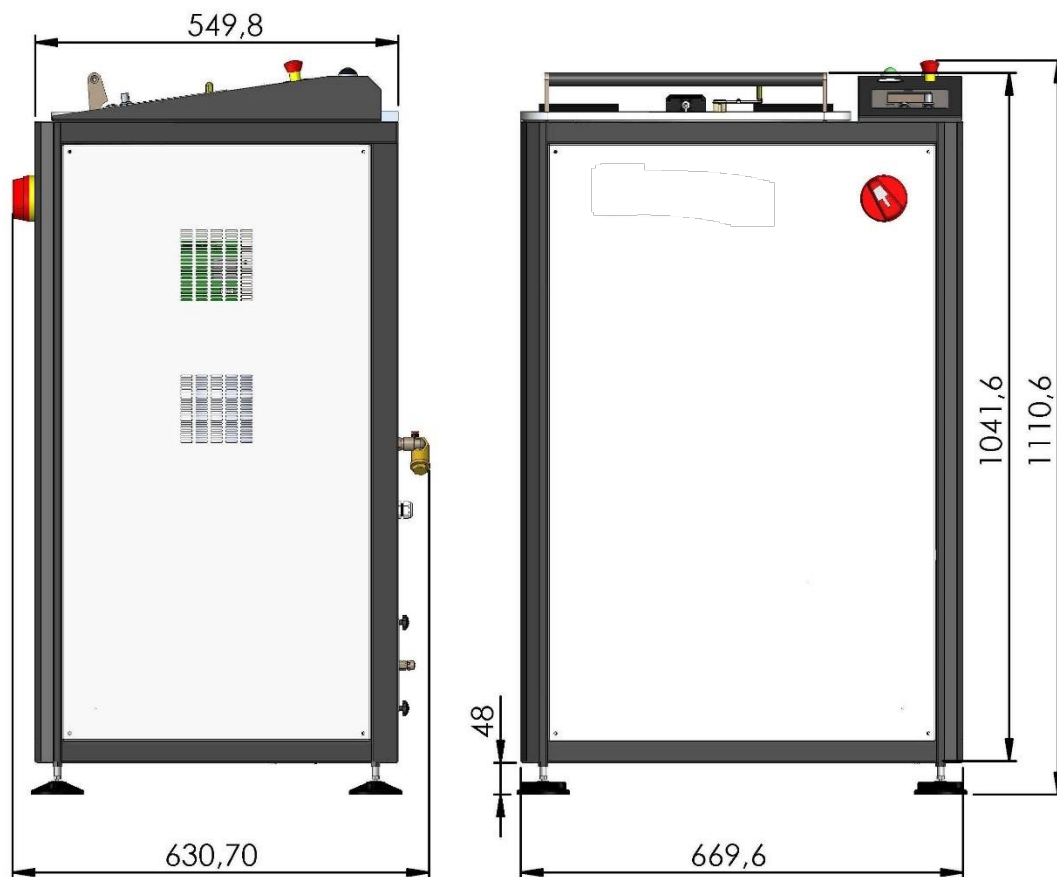
## Appendix A: RECOMMENDED SPARE PARTS KIT

*Table Appendix A: Recommended Spare Parts Kit Table*

No	Description	Part Number	Qty
1	Cogetherm F44	2DET-017-500-PS	1
2	Motor Board Assembly	2MAS-015-550-AB	1
3	Flow sensor	9VLO-000-054-00	1
4	Super Cast Inductor	1ASM-017-250-00	1
5	Relay Board	1MOD-017-851-00	1
6	Safety Switch Pizzato	3SBM-000-027-00	1
7	Rubber lid seal	6VCC-000-092-04	1
8	Inverter assembly, 8kW, HS with boards	1ASM-754-120-00	1
8.1	Inverter Control Board	1MOD-754-400-00	1
8.2	Inverter board	1MOD-754-330-00	1
8.3	DC-DC Regulator	1MOD-754-200-00	1



## Appendix B: MECHANICAL DIMENSIONS



**Fig. App.1 Romanoff RCS 5kW Dimensions (in mm)**

### Revision Table

Ver.	Date
1	1.12.2022