

Renishaw 5/01 vario vacuum casting machine User manual



1 Publication information

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2 Summary

This guide will assist you in operating the 5/01 vacuum casting machine.

The equipment, which is controlled by a PLC, combines a vacuum pump with fast exhaust rate and a highly efficient mixing unit to ensure the production of premium quality castings in a variety of moulding materials.

The vacuum chamber itself is used for de-gassing both the silicone rubber mixture from which moulds are formed, and the two-component Renishaw resins used for the actual castings.

Please follow carefully the instructions for installation and use that are to be found in this Operating Manual, which also covers routine checks and adjustments.

A further Manual, vacuum casting technique (part number H-5800-0660), gives an overview of the system. A copy is supplied with every machine.

3 Definitions

ESC	Escape (or return to previous page)
PLC	Programmable logic controller
RPM	Revolutions per minute
CE	Conformity marking of the European community
PPE	Personal protective clothing
HMI	Human machine interface (control screen)
SV	Set value (target)
PV	Present value

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4 Safety

4.1 Health and safety

All units supplied on or after 1st January, 1995, bear the CE mark.

4.2 Electrical safety

Certain of the tasks described in this manual require access to the electrical control enclosure, and should therefore be carried out only by a suitably qualified person.

4.3 Materials safety data

Though no special hazard is likely when they are used in accordance with the suppliers' recommendations, each of the materials used in the process is the subject of a Safety Data Sheet, supplied at the time of first purchase and giving information in conformity with both European Directive 91/155/EEC and (in the United Kingdom) the Consumer Protection Act 1987.

4.4 Noise

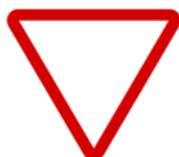
The equivalent continuous A-weighted sound-pressure level during working of this machines does not exceed 70 dB(A).

4.5 Safety warnings in this manual



PROCEED WITH EXTREME CARE

Indicates possibility of serious and irreparable personal harm or death and possibility of substantial property damage.



CAUTION

Indicates possibility of minor personal harm, damage to the Renishaw equipment and component quality issues.



WARNING

Danger by electrocution.



INDICATION

Indicates important information that requires your attention.

5 Machine layout

5.1 External

1. Mixing (upper) chamber
2. Mould (lower) chamber
3. Isolator
4. Electrical panel access door (side)
5. Vacuum pump access door (front)
6. HMI control panel
7. Emergency stop (E-stop)
8. Re-set button (blue)
9. Power supply (rear)
10. Vacuum pump exhaust (top)



Figure 8A - General front view

5.2 Internal view

1. Mixer motor assembly
2. Mixer paddle attachment
3. Cup A
4. Cup B
5. Funnel platform
6. Lower mould chamber



Figure 9A - General view with chamber open

6 Installation

6.1 Weight and dimensions

- Shipping weight, 234 kg gross (516 lb).
- Net weight 160 kg (353 lb).
- External dimensions: 1 195 mm high x 900 mm wide x 630 mm deep.
(47" high x 36" wide x 25" deep).

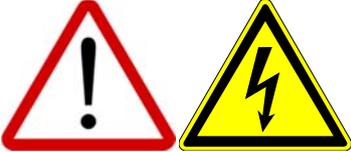
6.2 Power requirements

- The unit requires a single-phase, 230 volt supply.
- Normal current rating, 6.5 A.
- Maximum surge, 16 A.
- An earthing point and a circuit breaker must be provided.
- Units are not supplied with a plug, it will be necessary to have an appropriate plug fitted by a qualified person.

6.3 Locating the machine

- Do not site the unit in an area subject to excessive heat or high humidity.
- Choose a well-ventilated room. If possible, provide local exhaust ventilation to an outside vent.
- Avoid areas exposed to dust or vibration.
- Ensure that the unit stands on a level surface (adjustable feet are not provided).

6.4 Installation sequence

	<p>Before installing, read the instructions and ensure that you can identify each of the parts.</p> <p>Access to the main electrical panel is by the lockable side panel on the right-hand side of the cabinet.</p>
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Before installing, please read through the instructions and ensure that you can identify each of the parts.

Note that access to the main electrical panel is by the lockable side panel on the right-hand side of the cabinet.

- Open the vacuum pump access panel. Check the oil level and, if necessary, fill the vacuum pump to the level indicated by a mark on the sight glass using the oil supplied. Close the access panel
- Ensure that the main isolator is set to 'OFF' and that the Emergency Stop, shown, (Figure 11A) is pushed into the 'OFF' position.
- Open the side electrical access panel and ensure that the circuit breaker switch is in the 'up' position (i.e. switched on). Make and check the earth connection to the unit. Close the access panel.
- Connect to the power supply, using the cable and plug supplied. Switch on at the main isolator switch.
- Release the Emergency Stop knob by turning it clockwise.
- Press the 'reset' (blue) button (Figure 11A).
- Check that the chamber illumination light is now on. If it is not, turn off the machine at the isolator, open the side access panel and check the light bulb. Insert and adjust the mixing paddle (Figure 11B).



Figure 11A Turn isolator and E-stop off

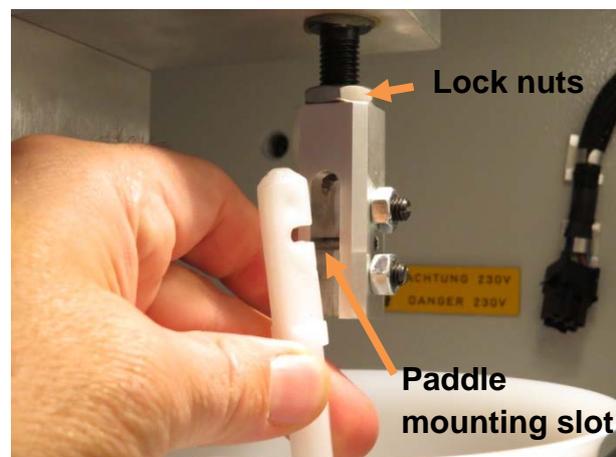


Figure 11B Turn isolator and E-stop off

Note that the paddle mounting has a slot into which the paddle fits. Pressure from a spring-loaded steel ball retains the paddle in position. The two grub screws can be adjusted and locked to provide the necessary preload so that it is possible to remove and replace the paddle by hand, without any tools, when correctly adjusted.

A cup and liner should be in position while height adjustment to the mixing paddle is made. To adjust the height slacken the two lock nuts on the spindle and rotate the paddle mounting to give a clearance of 1 mm to 2 mm (0.04" to 0.08") from the cup liner. Re-tighten the two locknuts against the paddle mounting.



WARNING - Do not operate the vacuum pump for longer than 30 seconds while the vacuum chamber is open. Failure to observe this precaution will result in excessive wear on the pump's components.

7 Preparing for operation

7.1 Preparation for casting

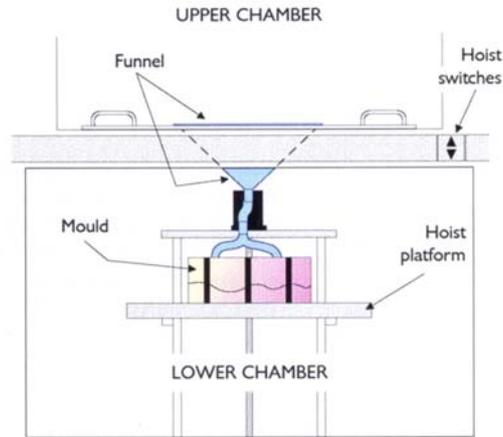


Figure 13A Arrangement of the mould, funnel, and accessories

	<p>The sequence of operations (explained in general terms in the companion manual “vacuum casting technique” requires the resin component cups, the whisk for mixing, a funnel and hoses all to be put correctly into place above the entrance gate(s) to the mould.</p>
--	---

7.2 Preparing the mould and flow-system

The standard accessory range includes several joints, which may be employed in conjunction with clear plastic hose to direct the mixed resin into the mould, with the flow being spilt through Y-joints if need be

Fit the funnel (Figure 13A) into the centre of the carriage in the upper part of the chamber, locating the front edge over the guard plate on the funnel position, and place the prepared mould (on a support platform in necessary) in the lower chamber. NB – do not use any form of support that might inflate under vacuum.

Decide on the pattern and sizes of hose and any connectors that may be needed, keeping the runs as short as conveniently possible.

Prepare the hose outlets, fixing to both funnel and mould. Ensure that you obtain a good fit, but one that is not too tight. Leave no end open.

7.3 Preparing the resin

Two- or three-component resins should be prepared in accordance with the supplier's instructions and placed in the appropriate cups.

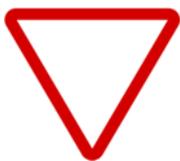
Although it is possible to cast without cup and funnel liners it is recommended that cup liners and funnel liners are always used (Refer to Appendix 1 for consumables).

For general guidance, refer to the manual Vacuum Casting Technique: a guide for new users supplied with the machine.

7.4 Fitting the cups and paddle

Fit the cups into their cradles, ensuring always that component 'A' is in cup 'A' (the upper right cup).

- Place cup A in its cradle, engaging the spout with the V-shaped cut-out. Ensure that the lip of the cup (and that of its liner, if used) is beneath the lip of the retaining clip.
- Remove the paddle from its clip (above cup B).
- Pull open the retainer assembly (with V-shaped cut-out) for cup B. Slide the cup B into the cradle, ensuring that the lip of the cup (and that of its liner, if used) is beneath the lip of the retaining clips at the side and rear of the cradle. Close up the retainer place, keeping the spout of the cup in the V-shaped cut-out, and lock it by turning anti-clockwise the knob at its left.
- Re-fit the paddle by sliding it into its holder, ensuring that it is fully engaged by the spring-loaded ball.

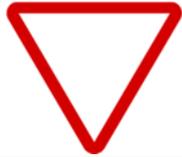


Before beginning a casting, always have the appropriate solvent ready to clean up residual resin.

8 Working procedures

8.1 To make the machine ready for use

- Switch on the machine at the isolator.
- Press the Blue re-set button (the inside of the chamber is now illuminated).



Always check that both resin components – and the mould – are in position before attempting to mix and cast.

8.2 Operating modes

The machine can be operated entirely in auto ([section 9.4](#)) or manual ([section 9.5](#)) mode.



Keep your hands out of the vacuum chamber while any of the mechanisms are operating.

8.3 Operating in manual mode

- Select the manual screen.
- Press 'Pump' to begin chamber evacuation.
- Press 'Speed' to select the mixing speed.
- Press 'Run' to start the mixing of part B.
- Once the vacuum time has been achieved, stop the mixer.
- Press 'A' cup down, allowed resin 'A' to drain into cup 'B'
- Press 'A' cup up.
- Re-start the mixer.

When the mixing is complete, stop the mixer and tilt cup 'B' by pressing its DOWN button. Allow it to drain before pressing the UP button to return cup 'B' to up position.

When the pouring is complete and the resin has settled, press the SLOW LEAK button. The slow leak will start to force the resin further into the mould. This should be continued for up to 30 seconds, after which pressing the FAST LEAK button will release the remaining vacuum fully, forcing the resin completely into the mould.

8.4 Using the automatic operation sequence

- With the mould, accessories and resin components all in place, close the chamber doors.
- Select required program
- Go to AUTO REPLAY
- Start the program.

8.5 Stopping in an emergency

To deal with unforeseen or unplanned steps in operation (for example, forgetting to load with a resin component, or an apparent malfunction as a result of faulty programming):

- Operate the red STOP button (it will lock into place)
- The machine is now completely shut down: nothing will operate.

8.6 Re-starting after emergency

- Rotate and release the red STOP button
- Press the blue re-set button
- Press 'Esc' to return to the main screen.

The machine can now be operated again. Gain access to the chamber after first operating the FAST LEAK control to release the vacuum. It will then be possible to correct any fault before continuing.

8.7 Shutting down

After casting: Drain excess resin from the mould fill tube and clean resin off mixing paddle using a suitable cleaning solution. Dispose of B-cup liner. The A-cup liner may be reused for the next casting, if using the same resin and colour pigment.

Complete shutdown: turn off the power supply at the isolator switch.



Remember after casting

Remove the cups and liners, the funnel and the pipes as soon as possible and clean them out with the recommended solvent, ready for re-use.

9 Control panel touch screen functions

9.1 Title screen

The Renishaw type 'PLC' vacuum casting machines are controlled by a touch-sensitive screen, which first appears in the form shown in (Figure 17A). Please note that a light touch is required: do not press the screen unnecessarily hard.

Touching the screen at any point of this display produces the menu screen of (Figure 17B).

9.2 Menu Screen (2 pages)

Note: The ESC button at the top left corner recalls the display last show, while the 'down' arrow at the top right calls up page 2. These buttons have the same functions on whichever screen they appear.

Any of seven function screens – briefly introduced below, and described fully on the pages indicated – can be called up by touching the appropriate button on the Menu screen. The next four are on a separate screen, reached by touching the arrow button.

Note: Vario-Vac is covered in the chapter titled [Vario-Vac](#)

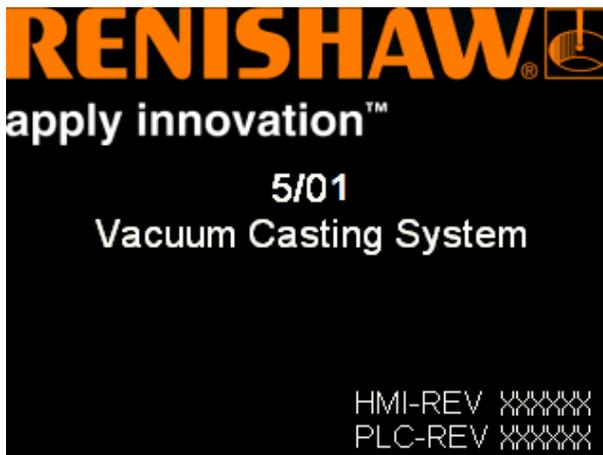


Figure 17A Title screen

ESC	MENU	▼
Program	Select Program and Modify Program Data	
Auto	Record / Replay Auto Programs	
Manual	Manual Control of Casting Machine	
Vario-Vac	Manual Control of Vario Casting	

Figure 17B Main menu

9.3 Program

Touching the Program button produces the Select program screen (Figure 18B), from which an existing program may be selected. The selected program may then be either operated or modified, as desired.

9.4 Auto

Touching Auto invokes the Auto replay screen (Figure 22A), with its two alternatives. The first monitors a running program, while the second allows a program to be recorded and stored.

9.5 Manual

The Manual button leads to the Manual control screen, (Figure 18A) from which the operator has step-by-step control. To toggle between the two Menu screens touch the arrow button in the top right corner.

9.6 System

The System data screen (see [system data](#)) displays information about running times of the machine and the mixing speeds (which can be altered at the screen) currently programmed.

9.7 Alarms

The Active alarms screen (see [alarms](#)) shows any current alarm operation. Records of previous alarm operations are also available from the screen.

9.8 Diagnostics

The Diagnostics screen shows the actual PLC input and output states. This is only used to assist with any system fault diagnosis. A battery health lamp warns of the PLC lithium battery condition. If the PLC detects that the internal backup battery has failed this lamp will clear.

9.9 The program selection screen

Touching Program on the Menu screen invokes the screen shown in (Figure 18B) from which one of five alternatives may be chosen (apart from Menu, which returns control to the menu screen)

No program can be run from this screen, or any of its subsidiaries: control must first be returned to the Menu Screen.

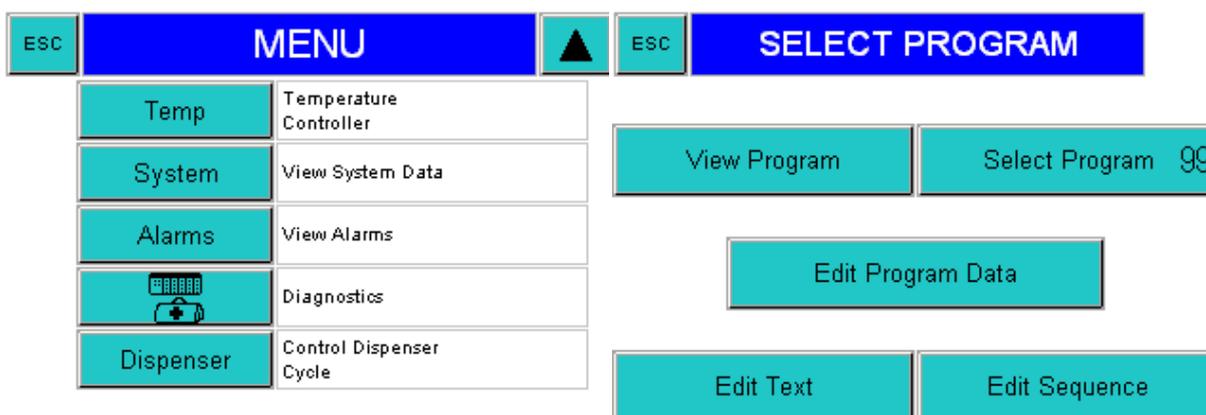


Figure 18A Manual control menu

Figure 18B Program selection screen

9.10 View program

The View program option displays the Program data screen (Figure 19A) which shows the currently selected program. The Select program screen can be regained by touching ESC.

9.11 Select program

The select program option (Figure 19B) displays the programs that are stored and currently available.

Touching the arrow button at the top right toggles between similar screens, each with ten stored programs.

Select by touching the appropriate button. After indicating your choice, touch ESC (once or twice, as required) to return to the Select program screen, and again to display the Menu screen.

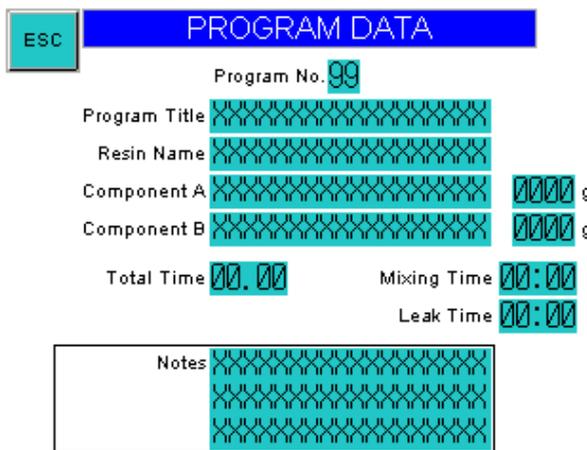


Figure 19A Program data

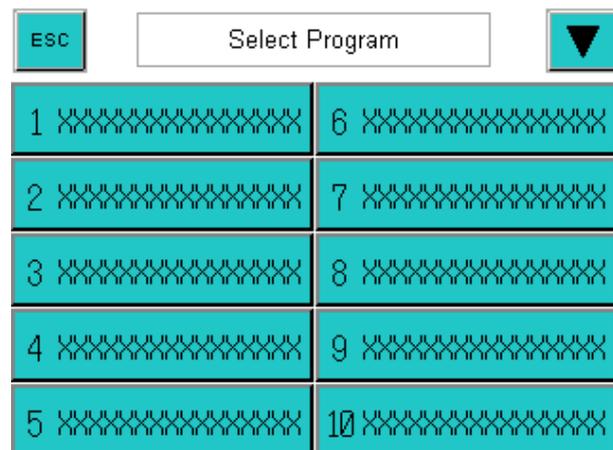


Figure 19B Select program

9.12 Edit program data

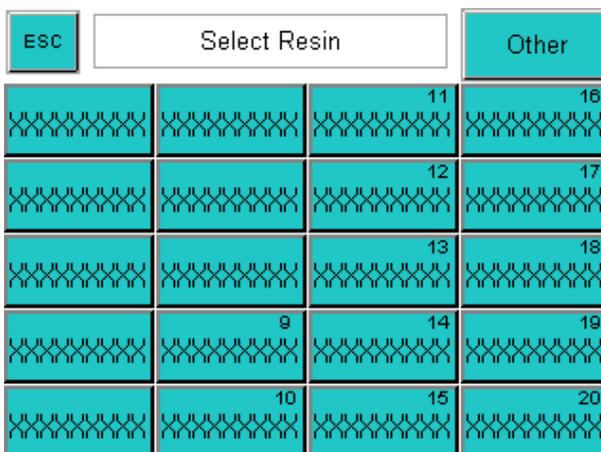


Figure 19C Program data

The third choice from the Select program screen – available only when a program has already been selected – is edit program data. The user is first asked to choose between UK and German resins.

Eight popular types of resin are shown on the screen (Figure 19C) any of which may be selected for substitution in the already-chosen program; in this case, a series of screens will appear to allow various modifications. When the resin to be used is not shown, the “other” button will allow an alternative type to be entered using one of the spare buttons.

9.13 STANDARD resin type

Selecting a standard resin type first produces the screen on which the intended weight of the resin casting is entered by touching the “Enter Required Weight” button to reveal the keypad (Figure 20A).

- Enter the required new weight.
- Confirm the change
- Press the Esc button at any time to abort the changes

9.14 ‘OTHER’ resin type

When a resin is to be used that does not appear on the standard list, touching the “Other” button produces the edit program data screen (Figure 20B). Here, the actual weights to be used of each separate component must be entered (remembering always to identify component ‘B’ with cup ‘B’ in the casting machine).

The enter button moves control to the Edit program screen, from where the procedure may be continued. After an initial screen on which the resin name must be entered, procedure is the same as for a standard resin type.

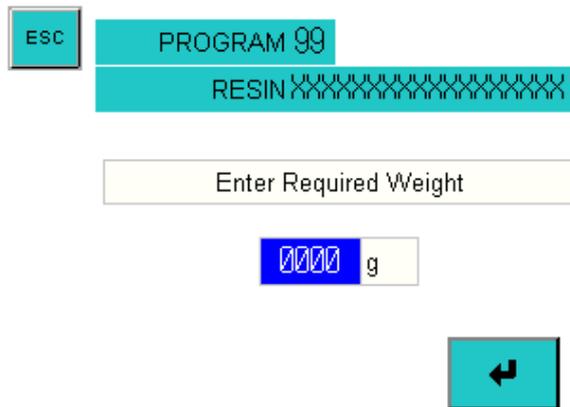


Figure 20A Enter weight standard resin

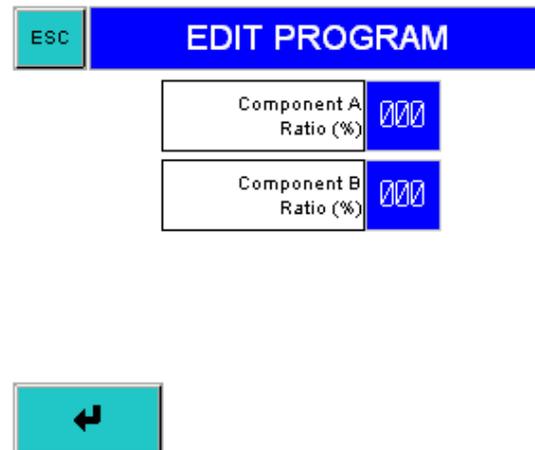


Figure 20B Edit custom resin

9.15 New program

The final choice from the Select program screen is New program, which is used to install functions with a resin already selected and for which the component weights are already specified.

Touching the number entry cells activates the keypad.

The program name and number should already have been selected. The first display to appear (Figure 21A) requires the length of the first period of mixing to be entered (the default is one minute).

When the time has been correctly entered, it may be registered by means of the enter button, which reveals the display of Figure 21B, on which the rotation speed of the mixer must be specified. The default speed for the mixer is 1 (low speed).

After selecting the preferred option (the button turning to solid colour), it may be confirmed by means of the enter button, which displays a screen similar to (Figure 21A), this requires the second mixing period to be entered. Again, the default is one minute: if a second period is not needed, the time should be set to zero.

After confirming the second mixing period by pressing the enter button, a fourth display, similar to that of Figure 21B, appears for entry to be made of the mixer speed.

When the second mix speed has been selected, the following screen asks for a Leak Time to be entered.

The enter button on this fifth display screen brings up the screen, where the changes are confirmed by the Yes button, or rejected by the No button. Either choice returns control to the Select program screen.

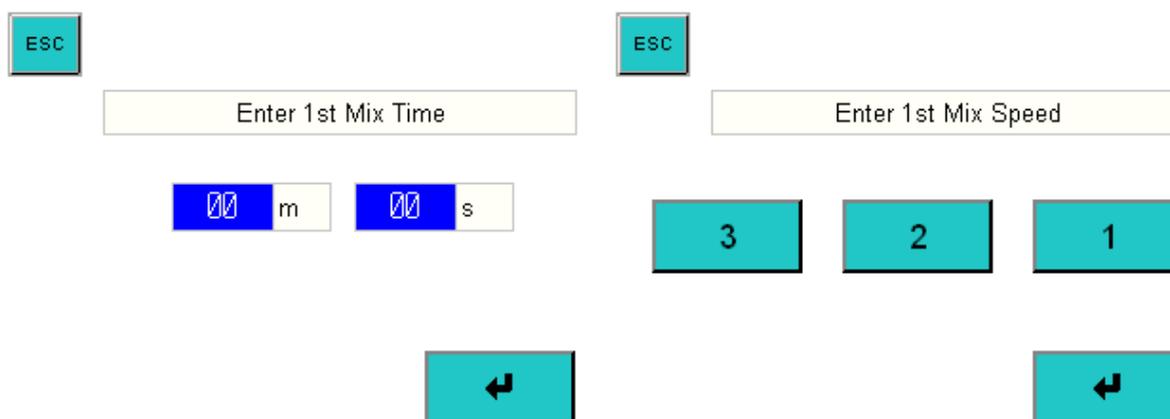


Figure 21A Mix time setting

Figure 21B Mix speed selection

9.16 Auto record and run

Auto record and run operates in 'teach' mode.

From the menu screen, select Auto, the screen shown in (Figure 22A) appears, displaying the name of the program already selected.

The program may be run as it stands, or it may be replaced by recording over it. The latter option is not a modification, but requires a complete new sequence to be entered. The Auto record button flashes when the screen is opened and erases the current program allowing a new one to be written.

Either Auto record or Play must be chosen before continuing.

9.17 Auto run

Three buttons control the automatic replaying of a selected program:

- The 'play' button begins the program immediately
- The 'pause' button stops the program temporarily
- The 'stop' button returns the program to the beginning

Touching the Monitor button (Figure 22A) enables progress of the program to be followed (Figure 22B).

The full bar beneath Pump indicates progress during initial evacuation of the chamber, completion being shown by the OK button.

A lamp indicates an operation in progress. The program time yet to elapse, mixer time and speed are displayed. Note: The counter runs forwards during recording, but counts-down during replay.

The end of the sequence (normally, when the vacuum has been completely released), is indicated by the "Auto Cycle Complete" screen. The ESC button returns to the "Auto replay" screen.

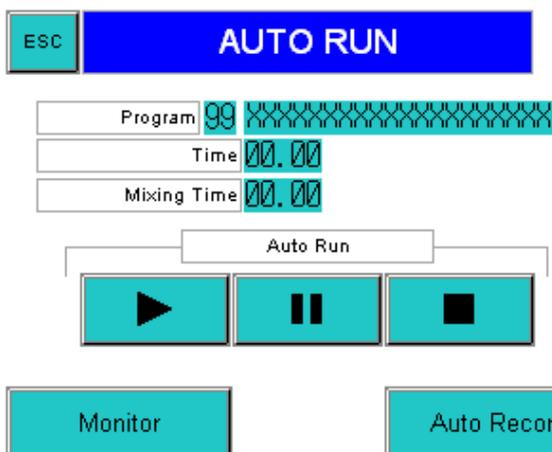


Figure 22A Auto run screen

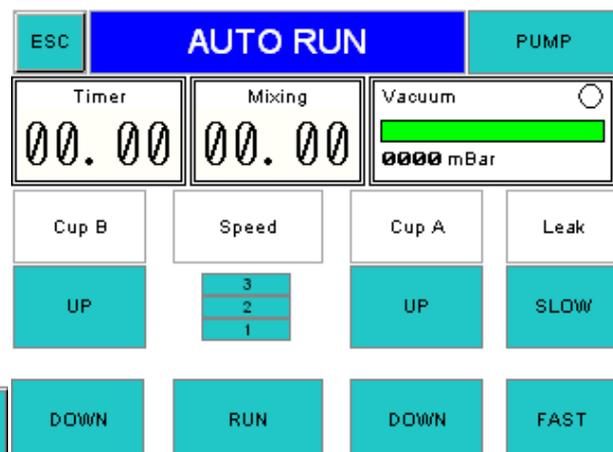


Figure 22B Auto run screen

9.18 Auto record

Selecting Auto record from the Auto replay screen brings the display of Figure 23A, where:

- The 'stop' button ends and deletes the recording
- The 'auto record' button starts program records
- The 'pause' button temporarily halts recording

Before auto recording the program already selected will need to be deleted by touching the Erase button, which produces the display of Figure 23B.

The No, like the ESC button, returns control to the previous screen.

The Yes button returns to the auto run screen, but the 'auto record' button now flashes, prompting the operator to initiate a recording sequence.

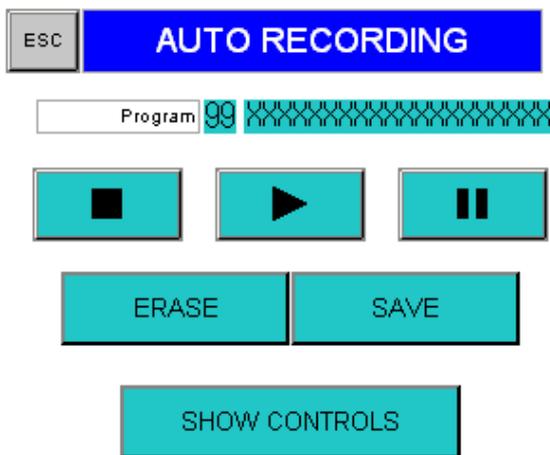


Figure 23A Auto record screen



Figure 23B Confirmation screen

After confirming the start of recording by touching the flashing button, Show controls (flashing) displays the Auto recording screen (Figure 23A). From this screen it is possible to record the new sequence of actions, but not to change the data on the resin (see [edit program data](#)).

Any button showing on this screen may be used; changing to black when active (the Up button for each cup opens in solid colour, indicating the starting position (Figure 24A).

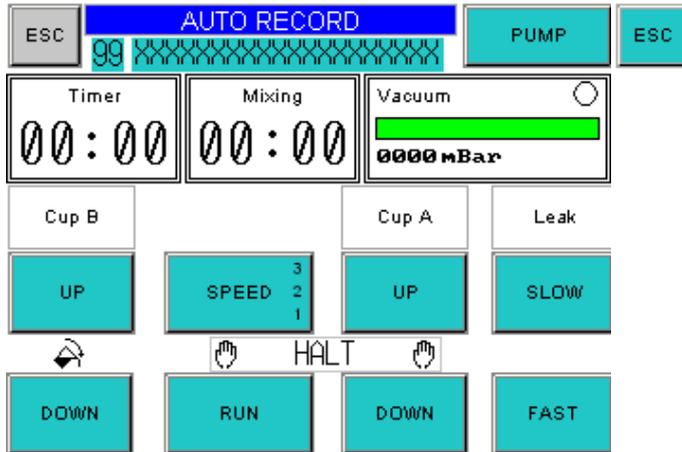


Figure 24A Auto record screen



Figure 24B Memory full

To record the program it is necessary only to operate the various controls at the appropriate moments. The actions taken are indicated by changes in the button colours, while times elapsed are all indicated automatically. The program steps have a resolution of one second: in other words, a one-second increase in program time must elapse before the next step begins (for example, a one-second delay must occur between changes of mixer speed).

A maximum of fifty program steps (00 to 49) is possible. At the last of these steps, the Memory Full warning display appears (Figure 24B). It is extremely unlikely that this condition will occur in normal practice.

The final steps of a sequence will be:

- Switch off the pump
- Slow leak on
- Fast leak on
- Slow leak off
- Fast leak off

After the last step has been entered, the ESC button is pressed to return control to the Auto record screen, on which the 'stop' button, seen to be flashing, must be touched to terminate the sequence. The program may now be deleted (e.g. if a mistake is believed to have been made) by touching Erase, when a new recording attempt may be carried out: or it may be accepted by selecting save.

The ESC button now returns control to the Auto replay screen, from which the program may be replayed. Alternatively, the Menu screen may be selected where, if necessary, the resin data may now be changed (see [edit program data](#)).

9.19 Manual control of machine

On touching the Manual button at the Menu screen, the Manual control display of Figure 25A appears.

With the mould mounted and the resin components already weighed out into the cups, a sequence may be run under complete manual control from this screen. The resin type and weight do not need to be entered before beginning.

The operations are exactly as already described for Auto record, and must include the same final steps of the sequence.

When casting is complete, ESC returns control to the Menu screen.

9.20 System data

Selecting the System data display from the Menu screen 2 (accessed by pressing the down arrow) reveals data relevant to maintaining the machine (Figure 25B).

The Run time shown is re-settable. It should be set to zero when the pump oil is changed, and is then useful in determining the proper time for the next change. If the Reset button is selected, the “Are you sure?” screen appears.

The Total Run Time approximates the total operating time of the machine, which is in fact the length of time for which the vacuum pump has been operated. Since the machine will seldom be operated to any significant extent unless the chamber is under vacuum, this provides a reasonably good estimate.

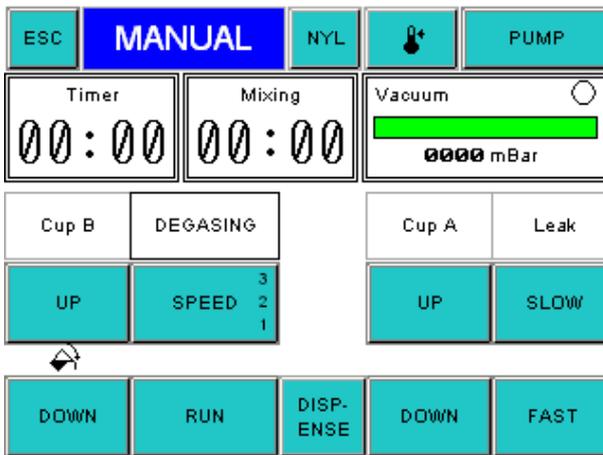


Figure 25A Manual control screen

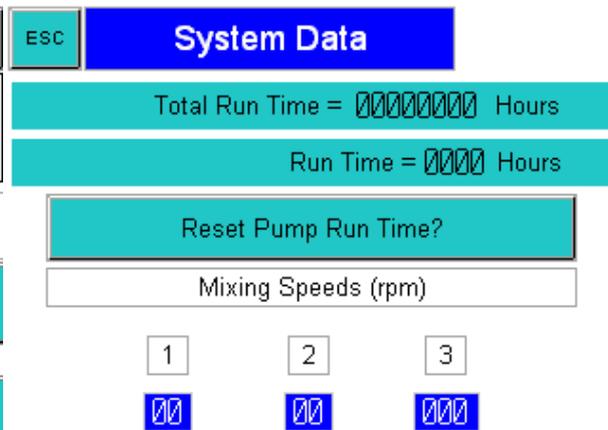


Figure 25B System data

9.21 Mixer speeds

The maximum values for the mixer speeds are the settings in place when the machine is delivered:

Setting	1	2	3
Speed RPM (Revolutions per minute)	49	99	160

The settings may be adjusted in the usual way to values appropriate to the task in hand, and when the Menu button is invoked the new current values will be recorded.

9.22 Alarms

Malfunctions and program faults cause an alarm condition, which can be investigated by examining the Active alarms display (Figure 26A). Note that, in certain conditions, this display may appear at start-up*.

9.23 Fault conditions

In the example shown, use of the emergency button has been automatically recorded. Other fault conditions, which may have occurred, are similarly recorded.

9.24 Vacuum pump

It is recommended that the oil in the vacuum pump should be changed every 500 hours and among the fault conditions is a warning that the time limit has expired. When the limit has been exceeded, an attempt to operate the machine will cause the Active alarms display to appear with the message 'Pump run 500 hours'. This does not prevent further use of the machine, but is a regular warning that the pump oil should now be changed which will recur until the Run Time has been re-set at the System data display.

9.25 History of faults

Touching the History button produces the display of Figure 26B, which lists the alarm conditions that have occurred, with the time and date (without the year) also indicated.

ESC Active Alarms		ESC History	
Alarm Message		28/08/13 09:25	Alarm Message ▲
Alarm Message		28/08/13 09:25	Alarm Message ▲
Alarm Message		28/08/13 09:25	Alarm Message
Alarm Message		28/08/13 09:25	Alarm Message
Alarm Message		28/08/13 09:25	Alarm Message
Alarm Message		28/08/13 09:25	Alarm Message
Alarm Message		28/08/13 09:25	Alarm Message
		28/08/13 09:25	Alarm Message
		28/08/13 09:25	Alarm Message ▼
		28/08/13 09:25	Alarm Message ▼

Figure 26A Active Alarms

Figure 26B Alarm history

10 Vario-vac

Vario-Vac (sometimes known as Vario-Pressure) is an optional system available on all PLC controlled vacuum casting machines from Renishaw that allows the levels of vacuum in the upper and lower chambers to be controlled independently.

The system is a combination of Software and hardware upgrades and can be installed on all Renishaw Vacuum casting machines from the 4/0# series onwards with PLC control.

Vario-Vac is particularly useful when casting materials with a high viscosity or when the parts have large areas of thin wall sections and fine detail. It operates by allowing the lower chamber to maintain a lower atmospheric pressure than the upper chamber thus forcing material to progress towards the lower chamber with a greater force than that of gravity. The touch screen interface allows the user a degree of control over the differential pressure applied.

Perquisites

- Hardware upgrade to Vario plate
- Software upgrade to add Vario control module & HMI interface pages.
- Specially designed funnel

10.1 Operating the Vario-Vac system

The Vario-Vac machine has updated software: To Identify if the software is installed the opening page on the HMI interface makes reference to this installation (Figure 27A).

To use the Vario-Vac system the operator should select the 'Vario-Vac' option from the Menu page (Figure 27B).

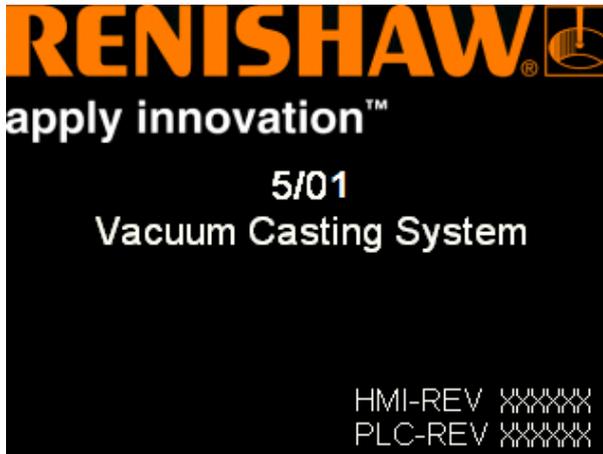


Figure 27A Software version

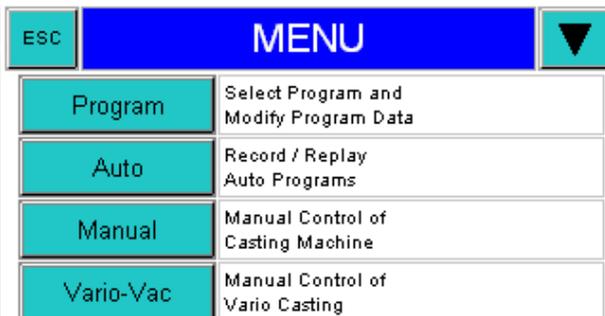


Figure 27B Select Vario-Vac from main menu

Once the operator has navigated to the 'Vario' Page the resin can be mixed following the normal steps. The main changes on this screen are the Dual Vacuum display, the Balance Valve control buttons and the leak buttons.

'Vario-Vac' can be operated in two modes; automatic and manual. The manual operation is shown in Figure 27A. Each button operates as before with the addition of the balance valve

control buttons; these buttons open and close the balance valve as required. The balance valve takes approximately 10 seconds to perform either the open or close movement. Whilst moving, the corresponding lamp will flash when movement is complete the lamp remains on.



Access to the automatic sequence controls Settings page is opened by pressing the on screen vacuum level indicator bar below the 'Pump' button. The settings allow the user to automatically control the 'Vario-Vac' sequence Figure 28B.

The first line of settings control the mixing speed and time before the A cup tips into the B cup. The A TIP time is the time the cup is held in the fully tipped position.

The second line of settings control the mixing time and speed once the tip has completed, before the B cup is tipped. The funnel fill time is the time allowed for the material to pour from The B cup into the funnel creating a seal between the top and bottom chambers. After this time the upper chamber will leak the vacuum thus creating the differential pressure as set in the VARIO PRESSURE setting.

Pressure differential should be kept as low as possible whilst achieving the desired results. This is to reduce stress on hoses and joint connections. Typical operating values for most materials are between 50 mbar and 100 mbar (0.7 psi to 1.5 psi).

Once the differential set pressure has been reached the final timer setting will time out. This is the time during which the resin is allowed to fill the mould. Once this time has expired the chambers will leak to atmosphere under controlled conditions such that the upper chamber always maintains a higher pressure than the lower chamber until normal atmosphere is reached to prevent resin from exiting the mould. A differential of less than 250 mbar (3.6 psi) is also maintained.

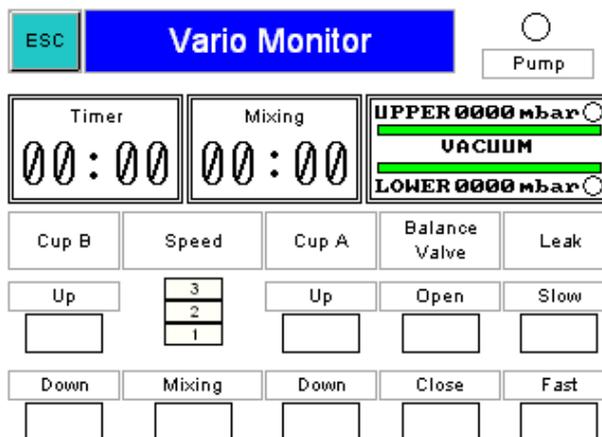


Figure 28A Vario-Vac manual control screen

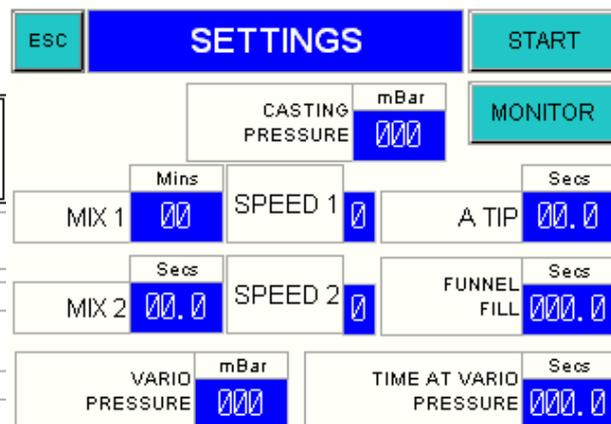


Figure 28B Auto settings screen

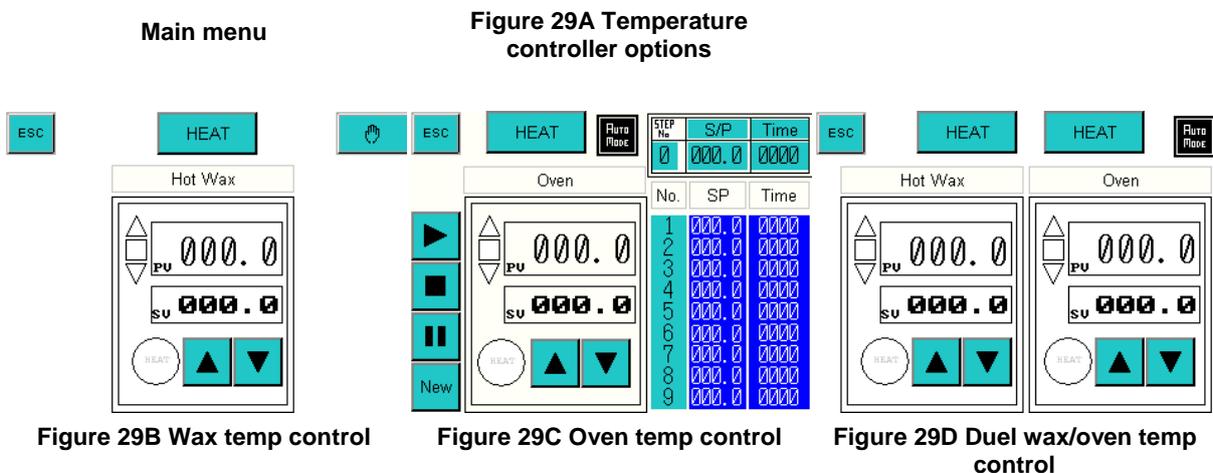
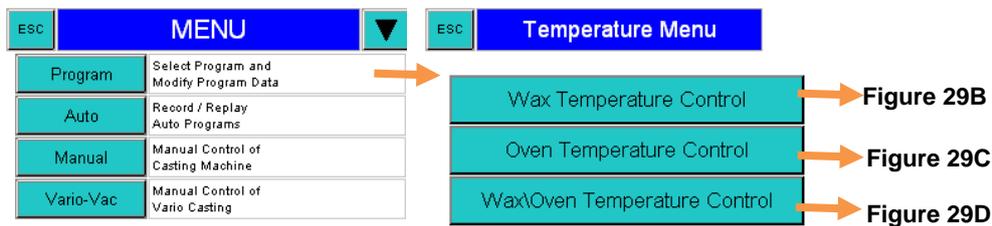
Once the settings have been entered using the keypad at the bottom of the screen the process can be started using the START button on the Settings page pressing the

MONITOR button allows the process to be monitored. No controls are accessible from this screen. Pressing ESC returns the user to the SETTINGS screen ESC from the settings screen returns the user to the Manual screen.

10.2 System data

The screen by pressing the TEMP button on the main menu (accessed by pressing the down arrow) will depend on the options included in your machine.

- If only the Heated Cup option is fitted, then screen Figure 29B be displayed
- If the Heated Oven option is fitted then the screen in Figure 29C will be displayed,
- If both options are fitted then the menu screen shown in Figure 29A will be displayed permitting screens shown in Figure 29B, Figure 29C and Figure 29D to be opened.



10.3 Hot wax control

The screen shown in Figure 29B/D displays the control for the Hot Wax (Heated Cup) temperature.

Temperature of the cup is displayed in the upper window (PV) in centigrade and the lower window displays the set value (SV) also in centigrade.

The two buttons under these windows allow the user to raise or lower the set value. The value will scroll in either the up or downward direction as long as the button is pressed. The heater is turned on and off by the HEAT button at the top of the screen. The round lamp (HEAT ON) to the left of the raise/lower buttons indicates this.

Three further lamps to the left of the PV window indicate the direction of the actual temperature in relation to the SV, e.g. if the temperature is low, the down arrow will be lit.

10.4 Oven control

The screen shown in Figure 30A displays the control for the oven temperature. The current temperature of the oven is displayed in the upper window (PV) in centigrade and the lower window displays the set value (SV) also in centigrade.

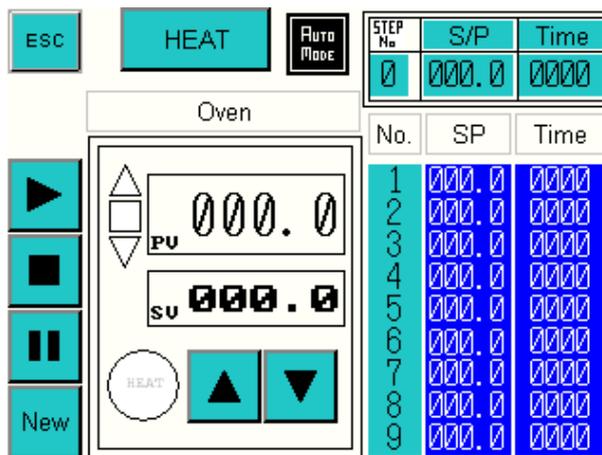


Figure 30A Oven temperature control

10.5 Manual mode

The two buttons under these windows allow the user to raise or lower the set value. The value will scroll in either the up or downward direction as long as the button is pressed. The heater is turned on and off by the HEAT button at the top of the screen. The round lamp (HEAT ON) to the left of the raise/lower buttons indicates this.

Three further lamps to the left of the PV window indicate the direction of the actual temperature in relation to the set value (SV), e.g. if the temperature is low, the down arrow will be lit, when the temperature is at the set point the centre square lamp will be lit.

10.6 Automatic mode

However, this screen allows the user to define a temperature profile which the oven will follow for up to nine steps. This gives the user a greatly enhanced control over the oven temperature over time. This profile can then be saved and re-used as required. The set up and use of the profile feature is described below.

10.6.1 Entering Profile Elements

The display shows the current values for each step on the right of the screen. These values are edited using a 'pop-up' keypad. The keypad is activated by use of the 'Key' button on the lower left of the screen. Values are then entered on the keypad. The current value being edited will have a flashing box around it. When the desired value has been entered, pressing the Enter key will accept the value and move the box (cursor) onto the next value. The order in which they are edited are as shown on the screen, i.e. Temperature set point then time.

It should be noted that not every step has to be used. If a step is not required, then simply enter zeros for both temperature and time. Also, should a temperature be entered but the time entered as zero, the step will not be used and will simply move onto the next step.

Once the profile has been edited the 'Hide' button closes the keypad.

10.6.2 Running a Profile

Once a profile has been edited and the keypad closed, the user can then run the new profile. This is done using the standard PLAY button (Right Arrow). Once the PLAY button has been pressed, the oven temperature will follow the profile. The current step, set point and time can be seen in the top right of the screen. Whilst running the PLAY button will flash.

At any time during playback the user can pause the profile by pressing the PAUSE button. This will hold the profile in its current state until the PAUSE button is pressed a second time. Whilst in Pause mode, the button will flash.

The profile will end when all 9 steps have been completed. Alternatively, the STOP button can be pressed at any time to stop the profile and reset it. When PLAY is pressed again, the profile will start from the beginning.

- Before carrying out any operation on the vacuum pump or its filters, allow the equipment to stand idle for at least one hour.
- Never use any oil but the correct grade as recommended.
- Check the oil level regularly. The optimal frequency depends greatly on usage and should be set after observation at short intervals (e.g. daily or weekly) during the first periods of use.

11 Maintenance

11.1 Oil changes

The first oil change for a new pump should be made after 150 hours of operation.

The period between subsequent changes may be varied to match actual usage. Assuming a full working week of forty hours, Renishaw suggest that the oil be changed at intervals of three months, corresponding to 520 hours (refer to the maintenance schedule in the pump manufacturer's manual in case of any doubt). Longer periods allow the build-up of sludge and other deposits, which may shorten the life of the pump by causing excessive wear.

A copy of the pump manufacturer's manual is supplied with the casting machine. For the user's convenience, the following instructions summarise the procedure for maintenance of the pump, but the manual itself should be consulted for explicit instructions for changes of oil and/or filter as well as other cleaning operations.

- Run the pump as normal for 10 to 15 minutes to warm the oil, then turn off.
- Open the drain tap at the bottom left of the pump and allow it to drain (through a hose) into a suitable receptacle.
- Close the drain tap and ensure any spills are thoroughly cleaned up.
- Refill with the correct grade of clean vacuum pump oil as described in the pump manual supplied. Replace the filler plug.
- Close the vacuum chamber doors and operate the pump for three or four minutes to check operation and for any leaks.
- Renishaw recommend that the exhaust filter is also changed.
- Operating the machine in very humid conditions can cause moisture to be drawn into the vacuum pump, where it will form a layer of water at the bottom of the sump and cause the level to rise about the gauge line. If you notice this affect (which is most easily discernible after a period of non-use, such as over a night); drain off the layer through the drain tap to bring the oil down to the correct level.

11.2 Batteries

This machine contains lithium batteries, for memory back-up, for example in the HMI. The lifetime of these batteries is several years, and as they backup data and settings they are replaced as part of the routine Renishaw servicing. Should a battery require changing sooner than the service interval, please contact the Renishaw service team for advice. These batteries contain metals that are hazardous to the environment and should be disposed of appropriately.



The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or Renishaw distributor.

12 Safety

12.1 Safe working practice

Users of equipment should satisfy themselves that they comply with the requirements of the relevant legislation within the United Kingdom (or equivalent regulations within the country of use).

Particular attention is drawn to the following:

- Health and Safety at Work etc. Act 1974;
- Personal protective Equipment at Work Regulations 2002;
- Provision and Use of Work Equipment Regulations 1998;
- Provision and Use of Work Equipment Regulations

In general terms, the Regulations require that equipment provided is:

- Suitable for the intended use
- Safe for use, maintained in a safe condition and, in certain circumstances, inspected to ensure this remains the case
- Used only by people who have received adequate information, instruction and training; and accompanied by suitable safety measures, e.g. protective devices, markings and warnings.

12.2 Personal Protective Equipment

Users should be aware of the requirements of the Personal Protective Equipment at Work Regulations 1992 when providing equipment.

The main requirements of the PPE at Work Regulations 1992 is that personal protective equipment is to be supplied and used at work wherever there are risks to health and safety that cannot be adequately controlled in other ways.

Because the effectiveness of PPE can easily be compromised, e.g. by not being worn properly, it should always be considered as a last resort and only used where other precautions cannot adequately reduce the risk of injury.

Even where engineering controls and safe systems of work have been applied, some hazards might remain. In considering methods of safeguarding machinery the use of personal protective equipment may be used to minimise the risk of injury. This includes the need for special clothing, including footwear, hearing, eye and respiratory protection.

The guidance shown below may be used to consider the risks which may or may not be present. The user should make his own assessment of risks depending upon the circumstances of use.

12.3 Signage

Appropriate workplace signage to inform personnel of the necessary requirements should be displayed.



Wear protective eyewear



dust masks,



Protective clothing, and/or gloves.

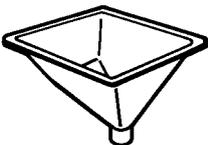
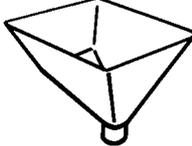
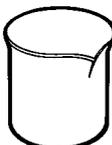
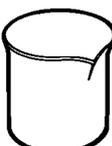


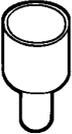
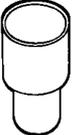
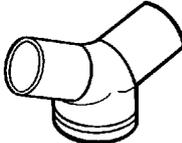
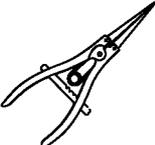
Wash hands thoroughly with soap and water after use.

Now wash your hands please

Table 34A Example safety signage

13 Appendix 1 - Standard accessories range

Product	Drawing	Part number	Notes
Whisk no. 1 NG		765280000	Since April 2003 for machines produced after serial number 15/E/1
Funnel no. 2 NG		766700000	Since April 2003 for machines produced after serial number 15/E/1
Disposable insert for funnel no. 2 NG		766690000	Since April 2003 for machines produced after serial number 15/E/1
Mixing cup no. 1 (small)		765250000	0.5 L Ø bottom 86 mm Ø top 112 mm height 117 mm
Disposable insert for mixing cup no. 1 (small)		765410000	0.5 L
Mixing cup no. 1 (large)		764990000	1 L Ø bottom 112 mm Ø top 140 mm height 125 mm
Disposable insert for mixing cup no. 1 (large)		765610000	1 L
Hose Joint small		765160000	Ø 20 mm to Ø 10 mm

Hose Joint medium		765170000	Ø 35 mm to Ø 15 mm
Hose Joint large		765150000	Ø 35 mm to Ø 25 mm
Hose Joint – L (small)		765680000	Ø 25 mm
Hose Joint – L (large)		765690000	Ø 35 mm to Ø 25 mm
Hose Joint – Y (small)		765180000	Ø 35 mm to Ø 15 mm
Hose Joint – Y (large)		765670000	Ø 35 mm to Ø 25 mm
Mould opener (standard)		765240000	
Mould opener (with ratchet)		765000000	

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