

# **Operating instruction**

## **Magnetic Sorter 3.01**



Synthetic diamonds contain more or less quantities of metallic inclusions, having in the most cases a ferromagnetic character. As such inclusions influence the thermal and mechanical properties of the diamond grains it is necessary to separate the diamonds into fractions of different magnetic inclusion level.

The magnetic sorter type 3.01 is a precise and powerful magnetic separator, where the lift-type sorter operation principle is combined with advanced electronics and full computer control.

The high repeatability of the operating parameters makes this sorter the ideal machine for laboratory use.



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## **1 Working principle:**

The magnetic sorter is used for sorting super hard materials, as synthetic diamonds in a strong magnetic field.

The sorting process takes place inside the gap of a strong magnetic circuit. Particles containing ferromagnetic inclusions are magnetized by the field. A sufficient gradient in the applied field pulls the magnetized particles into the direction of the highest field strength. In our sorting machine the gradient in the magnetic field lifts the magnetic particles up from the feeders surface when the magnetic force is bigger than the gravity force onto the particle. The magnetic particles are then moved away from the influence of the magnetic field and collected in a sorting box.

This principle guarantees a well defined sorting effect, where other parameters than the magnetic field strength and the general layout of the magnetic circuit have little influence on the result.

The magnetic field in our machine is generated by an electrical coil. The coil current is in direct (non-linear) relation to the magnetic field strength. The magnetic field is set to the desired level by keeping the coil current stable at the desired setpoint.

## **2 Main components:**

The principal components of the magnetic sorter are

- magnetic circuit with coil and rotating pickup disc
- pre-feeder for dispensing the particles out of the storage onto the main feeder (feeder 1)
- main feeding tray for moving the particles through the magnetic field (feeder 2)
- collecting boxes for magnetic and non-magnetic particles
- electronic control gear for coil current and feeder intensity
- cooling system with 2 fans
- electronic coil temperature measurement
- touch screen control panel for easy set-up and operation

ALL operations of the machine elements are controlled by the touch screen panel, there are no additional knobs or switches. This makes the handling of the machine easy, no need to worry about the proper start-up or shutdown sequences.

The touch panel can store up to 5 different sorting set-ups, i.e. combinations of feeder intensity, coil current and pickup rotation speed. The set-ups can be recalled easily, also a modification of the parameters is possible.

### **3 Installation**

#### **3.1 Electrical Connections**

**CAUTION:** Check to insure that all electrical connections and voltage requirements are in agreement with the electrical schematic prior to energizing magnetic sorter.

Input voltage (by customer):

This magnetic sorter is designed for operation on:

|         |   |           |                |
|---------|---|-----------|----------------|
| Voltage | : | 220 V, AC | (Single phase) |
| Cycles  | : | 50/60 Hz  |                |

The machine is internally protected by two automatic circuit breakers 10 A / class "C".

#### **3.2 Grounding**

The machines requires a properly earthed wall outlet with protective ground connector.

#### **3.3 Completing the mechanical set-up**

One part has been removed for preventing damage during the transportation:

- the touch panel control

Please attach this element at the indicated place, the screws came with the element. Make sure that a small gap remains between the outlet of the storage container and the surface of the pre-feeder (feeder1).

### 3.4 Position of the machine

The machine rests on 4 individually adjustable feet's. The final adjustment of the feet should be done in a way that the distribution of the diamonds on the main feeder (feeder 2) is evenly spread over the whole width of the feeder.

The fans on the front and the rear side of the sorter should never be covered, otherwise sooner or later overheating will happen and the sorting process will be stopped.

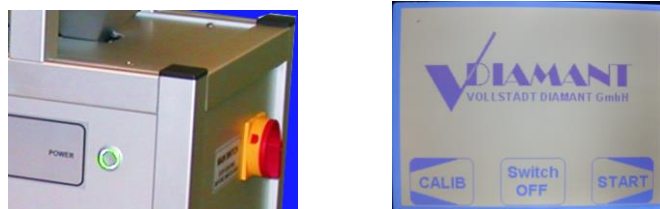
### 3.5 Inspection for transportation damage

Please have a careful look if something was damaged during transportation, notify the transportation agent immediately.

## 4 Usage of the magnetic sorter

### 4.1 Switch on

On the right sight of the machine you find the main power switch. Set this switch to "ON". This enables the START knob on the front panel below the storage container. Press the START knob until the touch panel becomes active and shows the VDIAMANT logo. All further operations are commanded via buttons on the touch panel.



Picture 1: Main switch and start knob, touch panel start menu

## 4.2 Switch off

In order to power down the magnetic sorter always use the button “OFF” in the main menu of the touch panel. DO NOT USE the main power switch, because the machine electronics needs to go through a well defined shut-down sequence.

After the touch panel has shut down the machine the input power is really zero. No need to operate the main switch.




Before opening any cover panels of the machine switch off the main power switch and unplug the power cord.

You should use the main power switch only in case of a malfunction of the electronics to cut off the power in an immediate way.

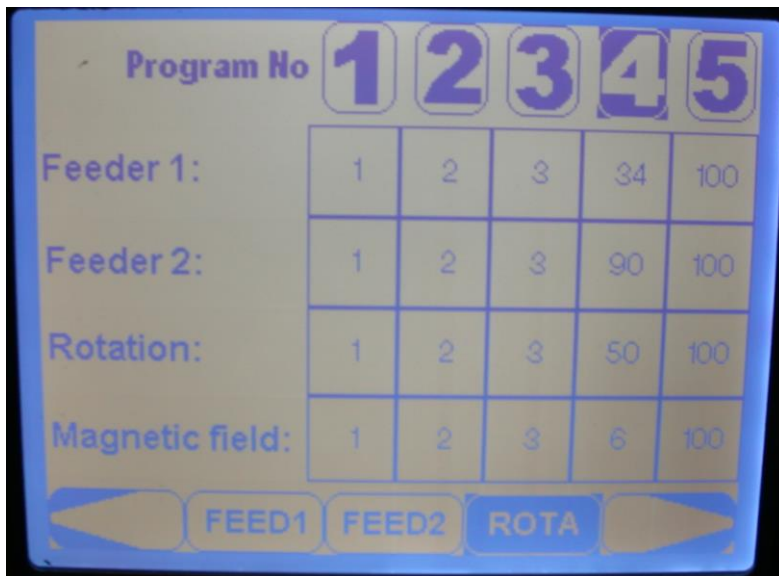
Once again: the usage of the main power switch to cut off a regularly running sorting machine might cause a permanent damage of the coil current source.







## 4.3 Menu pages of the touch panel

### 4.3.1 Start page

|   |  |
|---|--|
|  | Enter the parameter set-up page, this page is for manufacturers use only         |
|  | This button switches the machine safely off. Use only this button to switch off. |
|  | Enter the program selection page.  |

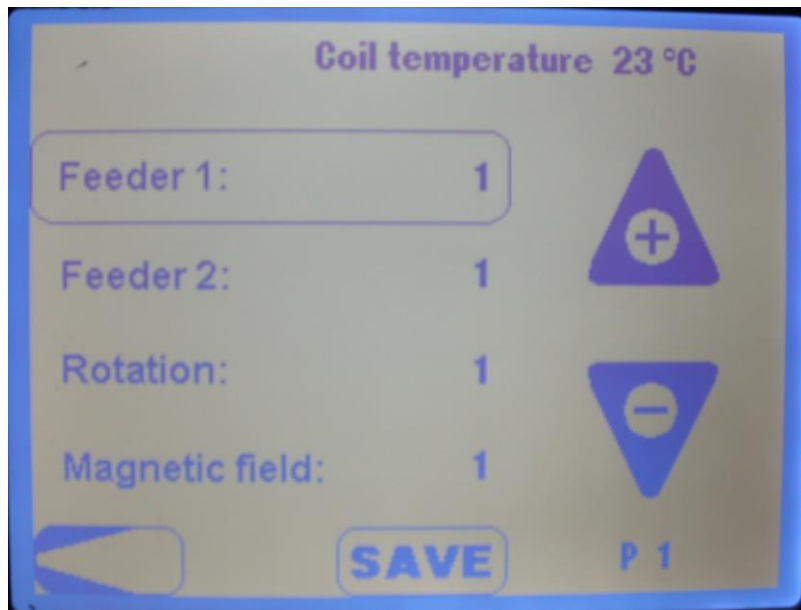
### 4.3.2 Program Select page





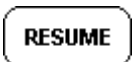


|   |  |
|---|--|
|   | Enter the start page, from there you can switch off the machine  |
|  | Activate feeder1 at approx. 80%  |
|  | Activate feeder2 at approx. 80%  |
|  | Activate rotation at approx. 70%   |
|  | Start the selected program, enter the operating page   |
|  | <p>Select 1 out of 5 predefined programs (this program can be modified in the operating page)</p> <p>The parameters for the given program are shown in a table for your convenience.</p> |

### 4.3.3 Operating page





|   |  |
|---|--|
| <b>Feeder 1:</b>  | Allows for changing the feeder 1 value with the up and down buttons  |
| <b>Feeder 2:</b>  | Allows for changing the feeder 2 value with the up and down buttons  |
| <b>Rotation:</b>  | Allows for changing the rotation speed value with the up and down buttons  |
| <b>Magnetic field:</b>  | Allows for changing the magnetic field (coil current) value with the up and down buttons   |
|  | Increase the active value by 1 (maximum is 100)  |
|  | Decrease the active value by 1, minimum is 0   |
|  | Save the currently active parameters as default for the current program number   |
|  | Stop the current program and enter the program select page, from there you can go back to the start page and switch the machine off  |
|  | Resume operation with the current settings after the program was stopped due to overtemperature of the coil, the button becomes visible when the coil temperature is back below the overtemperature limit (65°C in our case) |

#### 4.3.4 Parameter setup page (for manufacturers use only)



A keyboard appears. Please do not use this page, it is for the manufacturers use only. The parameters are protected by password, so nothing bad will happen if you accidentally land at this page and type something in. You can leave the page by pressing the “ok” key two times.

## 5 Recommended operating procedure

Some thumb rules for smooth and stable sorting:

- adjust the material throughput to a level where the particles on the main feeder (feeder 2) can move freely and don't interfere with each other
- set the magnetic field strength as low as possible in order to prevent bulks of high magnetic material around the gap on the main feeder
- The sorter needs no warm-up time, the parameters will not change over the time. Only the coil temperature will increase, the value is displayed in the operating panel.
- The allowed maximum for the coil temperature is 65 .. 68°C. Values above the maximum will cause the control unit to stop the sorting process safely. The feeders

will stop and then the magnetic field and the rotation of the disc will go down to zero. When the temperature is back below the maximum you can use the “RESUME” button to continue sorting with the old parameters. The rotation of the disc and the magnetic field will be readjusted and then the feeders start again.

- Have in mind that an increase in the magnetic field strength will increase the damping on the oscillation of the main feeder. If you command a very high magnetic field it might be necessary to give a little more power to the main feeder – and vice versa.

- The rotating speed of the pickup disc and the feeding rate of the pre-feeder do not depend on the magnetic field strength.

## **6 Stability and repeatability**

Special care is taken for the stability of the magnetic field. A high precision current source is used for maintaining a constant current and therefore a constant magnetic field despite of coil temperature and coil resistance. Within the operating range of 65°C maximum coil temperature the magnetic field remains nearly independent of the operating time and the delivered power to the coil.

The presets for the 5 sorting programs are stored in the non-volatile memory of the control panel, so you can re-establish the sorting conditions at any time.

## **7 Maintenance**

Keep the machine clean, especially the pickup disc, the storage container, the sorting boxes and the feeders.

Use alcohol for cleaning of the metallic surfaces.

Use the commercially available flatscreen cleaner for cleaning the touchpanel unit.

Never use water!

Shut down and unplug the machine before cleaning.

The machines internal circuit breakers are accessible behind the right handed side wall plate, unplug the machine from the mains before you reset the breakers.

## 8 Safety instructions

### 1. LIFTING



### **CAUTION**

Move and locate this machine with caution. This machine weighs approximately 140kg. Proper care should be taken in mounting this unit to avoid unstable and potentially dangerous situations.

### 2. ELECTRICAL



### **DANGER-HIGH VOLTAGE**

### **OPERATION: WARNING**

Voltages encountered within this magnetic sorting machine/controller are dangerous and can be fatal. This magnetic sorting machine/controller is designed to prevent accidental shock when properly used. However, no engineering design can render safe a device which is used carelessly. Therefore, the instruction contained in the user's manual must be followed whenever this magnetic sorting machine/controller is used.

### 3. MECHANICAL



### **CAUTION**

The power introduced into the rotating part is minimized to a level that the rotation can be easily stopped by hand. Due to the inertia of the disc it might hurt you however, if your finger becomes stuck in a gap between disc and other parts! Use a brush for cleaning works!

### 4. MAGNETICAL



### **CAUTION**

The magnetic field is VERY strong. Metallic parts might be attracted suddenly if they come too close to the poles of the magnetic circuit. Switch the field off during cleaning works.

## 9 Technical data:

|                              |   |  |
|------------------------------|---|--|
| Power supply                 | : | 220 V, 50/60 Hz, 10 A                              |
| Operating power requirement: | : | < 650 W  |
| Max. magnetic flux density   | : | 0...~ 1500 mT (digital adjustment, not calibrated) |
| Roll Speed                   | : | 0...34 rpm (digital adjustment)                    |
| Feeding Rate                 | : | 0...600 g/hr (digital adjustment, not calibrated)  |
| Size of Material (max)       | : | ~ 1 mm   |
| Maximum coil temperature     | : | 60 ... 68 °C (programmed machine specific)         |
| Weight                       | : | 140 kg   |
| <b>Geometric dimensions</b>  |   |  |
| Machine                      | : | length 850mm, width 380mm, height 1200 mm          |
| Min. working area            | : | approx. length 1000mm, width 1700mm                |

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