

# Operating instruction

# Shape Sorter

**Type : 4.1**



The shape sorter are used to sort a batch of diamond or other grains of the same size range according to different shapes

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## **General**

Please read this instruction before working with the device.

This operating and maintenance instruction contains useful hints for a safe and undisturbed operation of your **Shape-Sorter**.

## **Operating principle**

The shape sorter is a system for sorting industrial diamonds and other materials of defined particle sizes by its morphological characteristics. It consists of an oscillating table, oscillating storage reservoir, feeding system, and fifteen sorting boxes. The inclination and tilt as well as the amplitude of the table can adjusted continuously. The surface of the table is made of aluminium. This system allows to sort into 15 different fractions.

The operational principle based on the different moving behaviour of particles on an inclined oscillating table. Using this system one can classify different shapes, as spheres, cubes, cubooctahedrons, broken particles, irregular shapes, platelets, etc.

By oscillation, the diamonds moved from the backside corner of the sorting tray towards the open edge with the collecting receptacles at the opposite edge.

The inclination of the sorting table causes the following effect:

The blocky crystals approaching the shape of a ball are roll down the incline and are collect at the lower boxes. The needle-like ore irregular shaped crystals, which are not able to roll, are move upwards by the oscillation and are collected in the upper boxes.

*The operating range of the shape sorting table had to be adapted to the grain types to be sorted by adjusting incline angle and amplitude of oscillation.*

## **Hardware**

The Shape Sorter system consists of

- oscillating tray
- diamond feeding bowl
- 15 collecting boxes

The operating is controlled via tablet PC. The shape sorter is working *in Manuel modus or Automatic modus*.

*Manuel modus:* all the parameters are freely adjustable

*Automatic modus:* All the parameters of the different materials will be saved in product definitions. This database can be used again in automatic modus.

The inclination of the oscillating tray is continuously adjusted via motors. The inclination angles are measured electronically and displayed.

The vibration frequency of the oscillating tray is electronically provided.

Changes in the mains frequency have no influence of the vibration.

An acceleration sensor serves for precisely controlling of the oscillation amplitude and so the equipment is capable to take a certain amount of mains fluctuations.

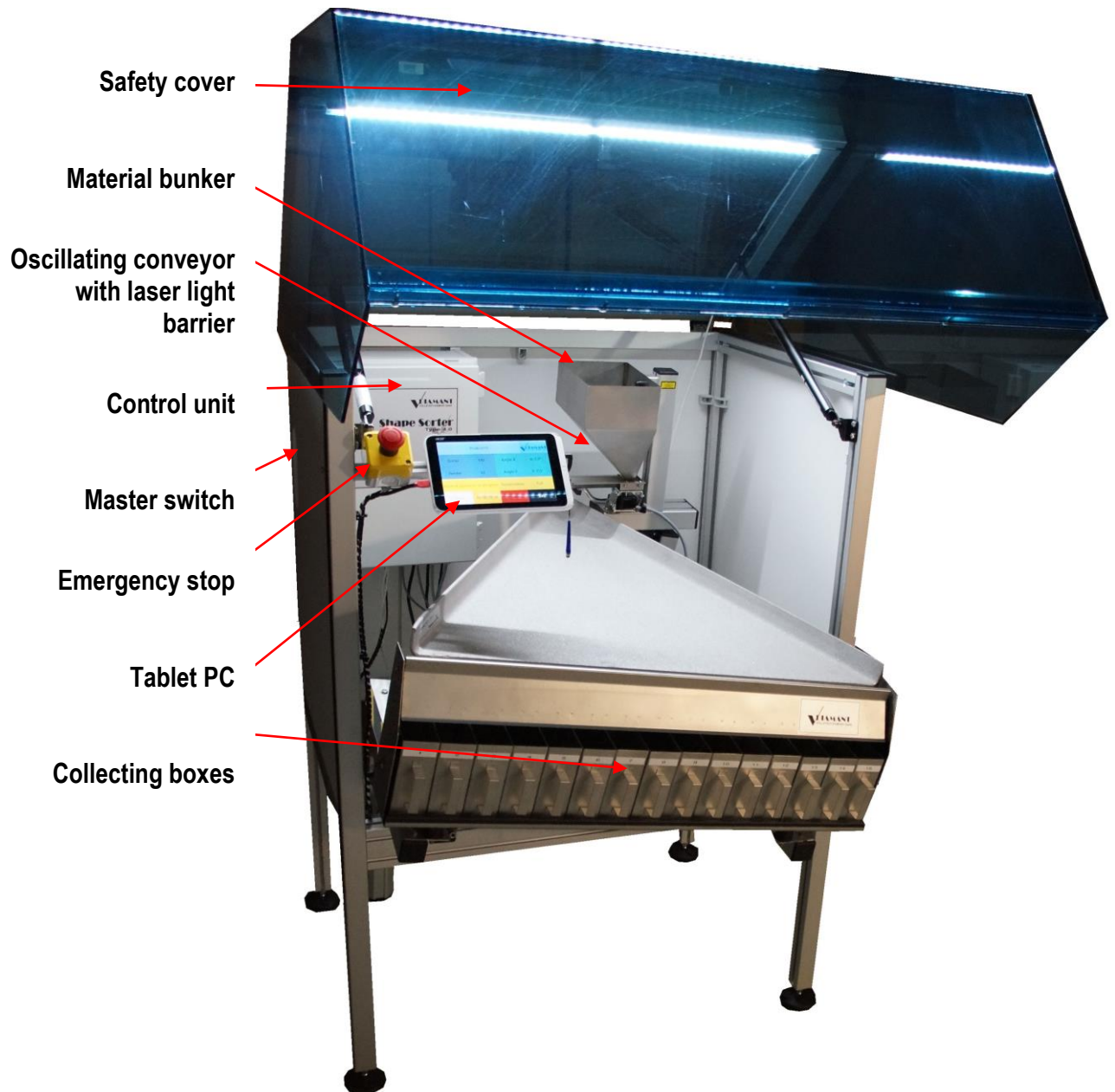
The grains to be sorted are filled into the charging funnel and fed onto the table by a adjustable vibrating chute for a evenly forming thin layer of the sorting surface.

The particle have to move almost unhindered.

This continuous material feed is done by a electronically controlled oscillating conveyor with laser light barrier.

## **Main components**

The Shape sorter system consists of :



All functions of the system are controlled by the tablet PC. There are no additional controls or settings. This ensures easy operation and especially stable operation.

## **Installation**

### *General*

**Attention: This device must be operated and maintained only by instructed persons.**

Please start the system only after reading the manual and especially safety instructions.

### *Electrical connection*

The shape sorter has only to connect with a correctly installed wall outlet with a protective grounding conductor (PE). Never change the protective action by a cable without a protective grounding conductor.

Please produce by a proven expert an equivalent protection in accordance with the relevant installation regulations when power is supplied from power grids without earth connection.

*Power supply:*                      230 V/ 50Hz ,4 A

### *Location*

To ensure proper operation of the shape sorter please choose the location so that the following environmental conditions are fulfilled:

- Temperature: +18 ... +30 °C
- Permissible relative humidity: 45 to 60 %,
- Place the sorting tabel at a solid, law vibration and horizontal surface
- Free from excessive changes of temparature and humidity
- Sufficient room in front of and over the system

The equipment has four rotary feet for levelling uneven areas and highs.

Do not use the device for extended periods of high humidity. Avoid condensing humidity on the device.

Let very cold systems at first acclimate at room temperature (about +20°C)- disconnected from the mains supply.

## Handling

### Start

The main switch is located on the control unit. Setting the switch to "ON". This activates the power supply of the control and the tablet PC. Press "Power On" on the tablet PC and switch on.



Main switch

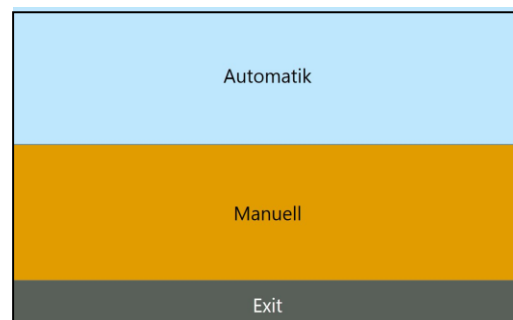


Power On

When the PC is active, all the settings are loaded and the operating program starts automatically and *stored in the ID Operations.log file as device started*



load settings

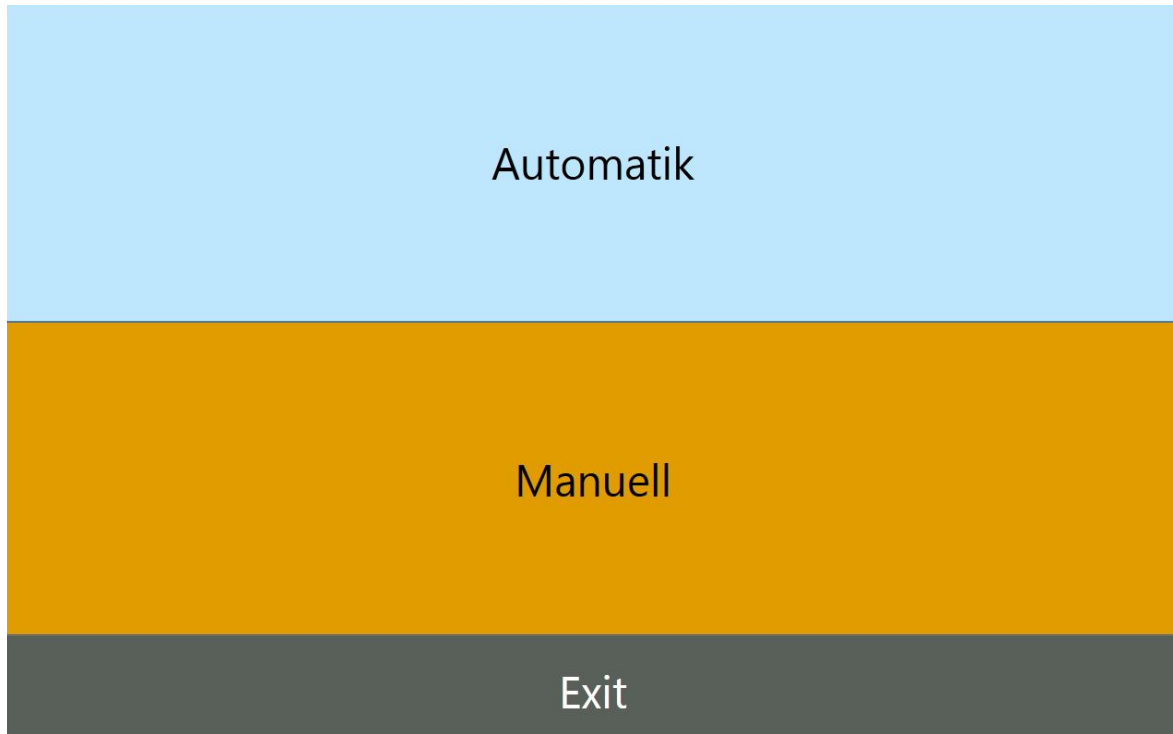


Start- screen

The other control operations are realized via buttons on the touch panel.

## Operating of the tablet PC

### Start screen



<b>Automatik</b>	<b>Start menu <i>Automatic</i></b>
<b>Manuell</b>	<b>Start menu <i>Manuell</i></b>
<b>Exit</b>	<b>Exit - switch</b> Please use the button for switch off the system <i>(this information are stored in the ID Operations.log file as device shut down )</i>



Menu Manuell

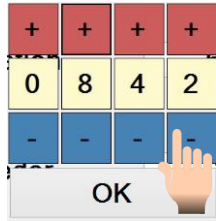
X up	Feeder status		Y up
X down	Angle X	Angle Y	Y down
Sorter --	93	<input checked="" type="checkbox"/> On	Sorter ++
Feeder --	47	<input checked="" type="checkbox"/> On	Feeder ++
Save		Exit	

<b>Feederstatus</b>	<b>Status of material flow</b> ( <i>full or empty</i> )
<b>X up</b>	<b>Sorting angel increase</b>
<b>X down</b>	<b>Sorting angel decrease</b>
<b>Y up</b>	<b>Forward angel increase</b>
<b>Y down</b>	<b>Forward angel decrease</b>
<b>Sorter ++</b>	<b>Vibration intensity increase</b>
<b>Sorter --</b>	<b>Vibration intensity decrease</b>
<input checked="" type="checkbox"/> <b>On</b>	<b>Sorting start or turn off</b>
<b>Feeder ++</b>	<b>Current diamond supply increase</b>
<b>Feeder --</b>	<b>Current diamond supply decrease</b>
<input checked="" type="checkbox"/> <b>On</b>	<b>Diamond supply start or turn off</b>
<b>Save</b>	<b>Save the current parameter as database</b> <i>(this information are stored in the ID <a href="#">Settings.log</a> file as <a href="#">Product defined: NAME</a> )</i>
<b>EXIT</b>	<b>Back to the start screen</b>

Vibration intensity and diamond supply



Press for change the respective parameter



**OK** saves the current parameter

Save Produkt



Saves the product definition

(this information are stored in the ID Settings.log file as Product defined: NAME )


Add new product definition	
Product name	Product
Feedrate	54
Sorter amplitude	90
Angle X	13,2
Angle Y	14,7
Cancel	OK



**OK** Saves the current parameter under the individual product name.

## Menu Automatik

### Menu product selection

Product:	Product5
Feedrate:	Product5
Sorter Amplitude:	Product1
Angle X:	Product2
Angle Y:	Product3 7,3
	
<input type="button" value="Delete product"/> <input type="button" value="Cancel"/> <input type="button" value="OK"/>	

<b>Product</b>
<b>Delete Product</b>
<b>OK</b>


**Product selection** from the database

**Delete product from the database**

(this information are stored in the ID Settings.log file as Product deleted: NAME )

**OK** Take over the parameters from the database

### Automatik - Menu

Product5			
Sorter	29	Angle X	X: 13,1°
Feeder	76	Angle Y	Y: 14,7°
Please press START		Feederstatus	Full
Start	00	Stop	Exit

<b>Product xxxx</b>
<b>Sorter</b>
<b>Feeder</b>
<b>Angel X</b>
<b>Angel Y</b>
<b>Feederstatus</b>

**Name of the product**



**Adjusted vibration intensity of the system**

**Adjusted diamond supply of the system**

**Current sorting angel**

**Current forward angel**

**Current status of material flow** (full or empty)

Product5			
Sorter	29	Angle X	X: 0,2°
Feeder	76	Angle Y	Y: 7,3°
Normal operation in progress		Feederstatus	Full
Start 	0d 00:00:51	Stop	Exit

**Please press  
START**

***Please start the process with the Start-Button***

**Start**

***Start the process***

*(this information are stored in the ID\_Processing.log file as Adjustment started)*

**Adjusting angle X**

***Adjusting angle X (Motor X)***

**Adjusting angle Y**

***Adjusting forward angle Y (Motor Y)***

**Normal operation  
in progress**

***Normal operation in progress***

**1d: 05:22:51**

***Separate clock of the sorting process***

*(this information are stored in the ID\_Processing.log file as Processing started)*

**STOP**

***Stop the X and Y motors during the start of the process parameters***

*(this information are stored in the ID\_Processing.log file as Processing cancelled )*

**EXIT**

***Back to the start screen***

*(this information are stored in the ID\_Processing.log file as Processing stopped)*

## Switch off

For switch off the system please use the button **EXIT** on the start screen of the tablet PC.C.



Now you can deactivate the complete system by switching off the master switch.

## Logging Functionality

### General information

Every machine gets its unique ID number (serial number **SN-xxxxxx**)

The program of the control computer created automatically 3 log files with the ID of the machine in the file name.

In the ID\_settings.log file of the device are record the power on and power off time. of the device.

At the automatic mode, all relevant information in the ID\_Processing.log file are stored.

In the manual mode are stored the definition of new products and the erasing of old products at the ID\_Settings.log file.

The USB port on the control computer is used to automatically store the files on a USB – Stick. The USB – Stick must be called VDIAMANT.



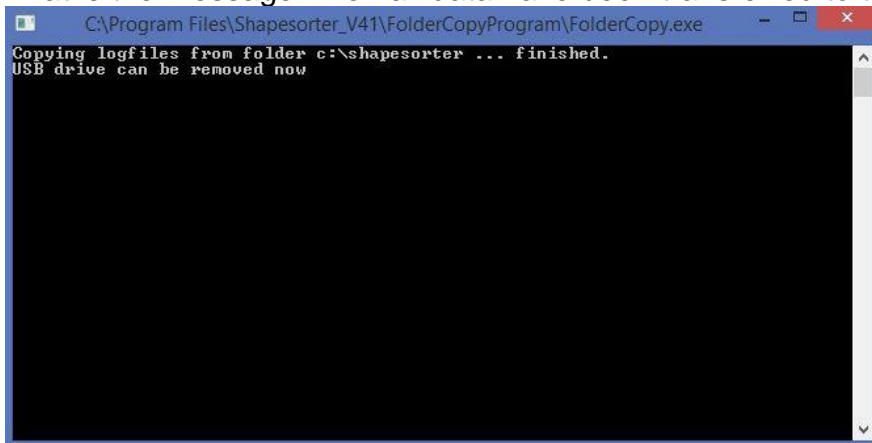
*Auto Save onto the USB Stick*

## Folder Copy Program

That's the message if an incorrect USB – Stick used.



That is the message when all data have been transferred to the USB – Stick.



### Example: Operations log file

#### **SN-000001\_Operations.log**

date time device started  
date time device shut down

### Example: Processing log file

#### **SN-000001\_Processing.log**

date time Adjustment started: *Product name*  
date time Processing cancelled: *Product name*

date time Adjustment started: *Product name*  
date time Processing started: *Product name*; Feedrate=48; SorterAmplitude=26; AngleX=15; AngleY=12  
date time Processing stopped: *Product name*

### Example: Settings log file

#### **SN-000001\_Settings.log**

date time Product defined: *Product name* ; Feedrate=50; SorterAmplitude=200; AngleX= 10; AngleY=6  
date time Product deleted: *Product name*

## Separation

### General information

#### Sorting angel:

("X axis")

The sorting angle determines the distribution and the situation of the particles on the deck. This configuration can be influenced by a change of the intensity of the vibration.

*Small sorting angle:*

(= small inclination of the tray) and/or strong vibration brings the particle current towards the upper edge of the deck.

*Great sorting angle*

(= large inclination of the tray) and /or weak vibration brings the particle current towards the lower edge of the deck.

**Attention :**

**Smaller, lightweight particles (for example 325/400 mesh) required a higher intensity of vibration than larger and heavier particles. Therefore, at the same time should be set a large sorting angle, so that the diamonds can distribute on the deck and run not only at the top of the deck.**

#### Forward angel:

("Y-axis")

The x-axis determines at which speed the diamonds run over the deck (dwell time) .

Small forward angle :

The productivity is too low.

Great forward angle :

The diamonds don't have any time to orientate themself on the deck. Only a narrow part of the deck is covered with diamonds. The sorting effect is insufficient.

**Attention :**

**Larger and heavier particles require a smaller forward angle than smaller, lightweight particles.**

### ***Intensity of the vibration: Regulator "sort"***

The vibration intensity influences the position of the particle current at constant sorting angle on the deck. The required intensity of the vibration is dependent on the grain size of the particles.

### ***Diamond supply: Regulator "feed"***

The feeding rate has to be adjusted so that a continuous material supply is ensured. The particles density should be low enough to allow for free movement of the single particles.

### **Typical sorting problems**

#### **Some bad particles in a good mixture:**

The sorting angle must be big so that the majority of the good crystals can run in the lower area of the deck.

#### **Some good crystals in a bad mixture:**

By a little sorting angle one achieves that only the best crystals can remain on the lower edge of the deck and the rest of the mixture into the upper collecting boxes is transported.

### ***Other significant influential factors***

#### ***Particel size within the goods to sort:***

The particle size has to be sorted within a batch has to be in the same range, as specificity from FEBA or ANSI (US-mesh) classification. If the particle size too different then will take place on the sorting deck a "sieving" because smaller particle with a constant density are lightweight and will be transported to the top of the deck by the oscillation energy regardless of their form.

#### ***Climate of the room:***

Temperature and humidity can influence the sorting result strongly. The parameters must remain constant while processing one batch.

#### ***Mains frequency:***

Power frequency and voltage fluctuations have no effect on the sorting result.



## Operation

Before starting the sorting procedure the surface of the sorting table has to be cleaned by means of a clean tissue and alcohol and dried afterwards.

**Attention: Please pay attention that the surface is free of diamonds at cleaning!**



The grains to be sorted are filled into the charging funnel and fed onto the table by a vibrating chute. The feeding rate and the parameters of the table, i.e. the 2 angles of inclination of the table, are set to give an even distribution of grains from the left to the right margin of the table. The vibration amplitude of the table is kept constant for all sorting procedures. Good, blocky shaped grains with smooth faces migrate to the lower, right-hand side; irregular, angular, fractured and sliver shaped crystals with rough surfaces migrate to the upper, left-hand side of the table. The grains are collected in a row of collecting boxes at the front edge of the table, according to their distribution on the table surface: blocky grains in the right-hand side boxes, irregular grains in the left-hand side boxes.

The grain fractions in the boxes are checked under the optical microscope. For the objective check of these parameters, we recommend the automatic particle analyser from our range of **Dialnspect** products. That is the best solution for your size and shape analysis of abrasives.

If the separation is not sufficient, the sorting procedure is repeated with selected fractions. The table parameters are again adjusted to give a well spread distribution on the table and an improved separation of crystal shapes. The grain fractions shall finally be equivalent in shape to reference samples.

Special separation procedures may be applied, if only one edge of the spectrum of grain shapes shall be separated from the main mass, e.g. if only irregular, angular particles shall be sorted out. In this case the inclination of the sorting table is set very steep. Only the irregular shaped crystals migrate upwards on the table surface and separate from the bulk volume of grains. The main portion of grains moves along the low right-hand side of the table and is collected in the right-hand side boxes. The fraction of irregular grains is collected in the boxes of the right-hand side and eventually of the centre. The cut point of sorting can be determined by checking the grain shape of each box.

By an opposite sorting procedure only extreme blocky crystal grains can be sorted out. In this case, the inclination of the sorting table is set very flat. The bulk volume of grains then moves to the right and only the fraction of very blocky crystal grains keep to the left-hand side of the table, where it can be collected.

## Short instruction

**You can recognize**

**What is the reason?**



sorting angle to big  
and / or intensity of the vibration to weak.



sorting angle to small  
and/or intensity of the vibration to strong



forward angle to big



forward angle to small  
and/or intensity of the vibration to weak (app. 0)



all adjustments are perfect

Operation	Process parameter and Remarks
1 Setting atmospheric conditions	45...60% r.H. and 20...25°C (constant)
2 Cleaning sorting table and collecting boxes	isopropyl alcohol
3 Setting table parameters	acc. to grain size and grain type
4 Filling diamond into funnel	max. mass depending on grain size
5 Switch the control unit ON	
6 Setting the table parameter	<p><b>x-axis</b> 0...15°  <u>Switch inclination x-axis</u> :  up for more inclination  down for less inclination</p> <p><b>y-axis</b> 0...15°  <u>Switch inclination y-axis</u>:  up for more inclination  down for less inclination</p> <p><i>acc. to grain size and type</i></p>
7 Feeding diamond grains by vibrating chute	<u>regulator feed control</u> :(0...253) right for more depending on grain size and type
8 Adjusting the vibration of the oscillating tray	<u>regulator sorting control</u> : (0...253) right for more
9 Adjusting sorting parameters <i>(see step 6 and 8)</i>	even distribution of grains on table
10 Checking grain fractions	visual inspection under optical stereo microscope or DialInspect
11 <i>Repeating sorting procedure with selected fractions and adjusted parameters</i>	<i>to improve sorting</i>

## **Maintenance- Cleaning**

Keep the machine clean, especially the material bunker, the collection boxes and the laser light barrier. All the metallic surfaces can be cleaned with alcohol.

***Attention: Please pay attention that the surface is free of diamonds before cleaning so that the surface cannot be damaged!***

The vibratory drives are wear-free and require no maintenance. The conveyor rail and the deck can show signs of wear after a prolonged use. Those parts must be replaced when the sort process would be substantially affected. The control unit is also wear-free and requires no maintenance.

Please use for cleaning of the tablet PC special Flatscreen cleaner.

Never use water!

Turn off the machine before cleaning always at the main switch.

## **Operating errors**

Replace defective fuses with ones of the specified type and rating.

## **9. Safety instructions**



Please study, understand and follow all instructions in this instruction manual before operating! Also observe all safety and accident prevention regulations.

Please require strict compliance with clearly defined safety precautions and rules of conduct.

### *Usage according to regulations*

The Shape Sorter may only be used for commercial purposes for compliant sorting of industrial diamonds and similar materials.

### *Personnel requirements*

It is the responsibility of the operator to ensure that only qualified personnel perform the installation and maintenance of the system.

Persons who operate the shape sorter have be instructed by qualified personnel and have to read the manual.

All persons who operate the shape sorter or working within the vicinity of the system, will advised of the safety instructions and procedures for emergencies.

### *Operator's obligations*

The operator has to identify the additional risks, which can arise on site, and create a risk analysis for the nearby area.

## Risk of human injury

### **Danger of crushing**

Danger of crushing to hands and fingers in the area of the machine frame and all moving part.

In case of danger, the angular motors can be stopped with the **emergency stop switch.**

Please focus on you head and hands during pulling down of the saftety cover.



### **Danger from electric current**

Non- compliance can result in personal injury, death, or damages to materials. Disconnect the supply voltage before assembly/ disassembly and replacing fuses from the power supply. Protective conductor connections need to check periodically for proper functioning.



### **Risk of eye injury**

Do not look into the laser! Laser protection regulations: Transmitter corresponds to laser class 1 according EN60825-1: 2003-10.

Therefore, no additional protective measures are required during the process.



## Correct reaction in dangerous situations

### **Abnormal function of the system**

Please stop immediately the system by danger of personal injury. Please stop by **emergency switch** or/and with the main switch **"OFF/AUS"** on the control unit.



## **Technical data:**

Dimensions (lxwxh)	:	about 1000 x 970 x 1400 mm / <i>closed</i> about 1000x970x2100 mm / <i>open</i>
Weight	:	about 125 kg
Protection class	:	IP42
Power supply	:	230 V, 50 Hz, 4 A

### Inclination

X - axis	:	15°
Y - axis	:	15°

### Sorting table

Typ 0	:	D46 ... D 76
Typ 1	:	D91 ... D 126
Typ 2	:	D151 ... D 251
Typ 3	:	D301 ... D 601
Typ 4	:	from D 601

Edge length	:	800 mm
Surface material	:	Aluminium

<u>Yield</u>	:	ca. 800 ct./h (30/40 mesh) ca. 500 ct./h (40/50 mesh) ca. 100 ct./h (325/400 mesh)
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### Feeder

Type	:	Particle Feeder
Storage reservoir volume	:	3,5 l
Material	:	V2A

### Sorting boxes

Quantity	:	15
Volume	:	500ml
Material	:	V2A

### Control unit

Tablet PC	:	Acer Iconia W3-810
Electrical connection	:	12VDC
Operating system	:	Windows 8.1
Software	:	ShapeSorter 4.0
Display	:	8,1 Zoll
Operating conditions	:	20...25°C/45...60%r.H.
Cleaning	:	with alcohol

**Manufacturer** : **Vollstaedt-Diamant GmbH**

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