SMART CUT® 6018

Automatic Precision Sectioning
Operating Manual

***SMART CUT®* 6018** is a precision benchtop sectioning saw designed for accurate and repeatable cutting of many laboratory and production materials. The machine uses a **speed regulation motor** that drives the belt to control the cut off wheel. This provides **stable and efficient spindle speed** for both hard and delicate samples. The system is operated through a **touch screen interface** with a clear display and organized control layout.

Cutting feed can be managed through **wheel propulsion** or **table propulsion**, depending on material characteristics or operator preference. The machine also supports **fully automatic cutting** through programmable parameters. Motor speed, feed rate, and travel distance can be set in advance to produce **consistent results** across repeated operations.

The unit includes an **independent stainless steel circulating coolant tank**. The coolant system operates with a mixture of **80 percent water and 20 percent cutting fluid**. This combination provides effective heat removal and protects the **rails and ball screws from corrosion**.

A **built in safety interlock** stops the motor when the cover is opened. The cutting chamber is fully enclosed and fitted with a **transparent viewing cover** for safe and clear observation during cutting. The cutting table supports **multiple clamping fixtures**, all designed for easy removal, cleaning, and repositioning.

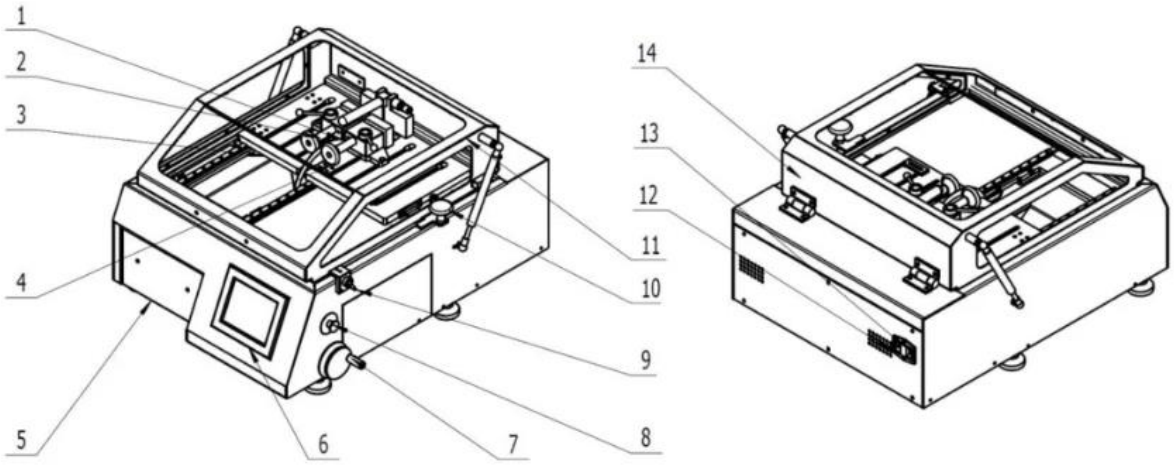
This machine is suitable for **PCB boards**, **electronic components**, **metallographic samples**, and **metal materials up to 30 mm in diameter**. The control structure is simple to understand and provides **reliable and straightforward operation**. The ***SMART CUT®* 6018** delivers stable cutting performance for laboratory, research, and small scale production environments.

SMART CUT® 6018 - Technical Specifications

Category	Specification
Cutting Method	Manual or Automatic operation, Spindle feeding or Table feeding
Feed Speed	Manual or Automatic: 1 to 36 mm per minute, adjustable in 0.1 mm increments
Cut off Wheel	180 mm × 0.8 mm × 22 mm
Maximum Cutting Capacity	30 mm
Maximum Travel	Spindle travel: 140 mm; Table travel: 230 mm
Spindle Speed	500 to 3000 rpm
Electromotor Power	1.2 kW
Cutting Table Size	245 mm × 415 mm, T slot 8 mm

Category	Specification
Clamping Tool	Quick clamp; Jaw height: 45 mm; Vertical clamp opening: 27 mm
Control and Display	5.7 inch touch screen
Power Supply	220 V, 50 Hz, 8 A
Coolant Pump Flow Rate	16 L per minute
Machine Dimensions	620 mm × 740 mm × 380 mm
Net Weight	80 kg

Machine Structure Overview



SMART CUT® **6018** is equipped with a well organized cutting platform designed for safe, accurate, and stable operation. Each component plays a defined role in cutting control, sample handling, cooling, or machine protection.

1. Cut off Wheel - The primary cutting tool used for sectioning metals, ceramics, composites, and electronic materials.

2. Spray Nozzle - Directs coolant to the cutting zone to control heat and protect the blade and sample.

3. Cutting Table - Provides a stable support surface for the sample. Accepts a wide range of clamping fixtures.

4. Quick Clamp - Secures samples quickly and firmly to the cutting table and supports fast positioning.

5. Water Tank - Stores coolant for circulation. Reduces heat and prevents rust on internal components.

6. Touch Screen - Displays all operating parameters and control functions. Allows fast setup and adjustment.

7. Hand Wheel - Assists with manual positioning of the cutting table or sample fixture.

8. Emergency Stop Button - Immediately shuts down machine operation during abnormal or unsafe conditions.

9. Locking Handle - Secures the main cover or structural components in place during cutting.

10. Pushing Rod - Transfers feed motion to the cutting table or drive system.

11. Cover - Encloses the cutting chamber to improve safety and reduce coolant splash. Transparent panels allow clear observation.

12. Power Indicator - Shows active power status during operation.

13. Power Switch - Turns the machine on or off and controls the main power supply.

14. Limit Switch - Stops motion when the table or spindle reaches its programmed travel limit for safe and accurate operation.

Unpacking and Installation

SMART CUT® **6018** is secured to a bottom plate to protect the machine during transportation. Proper unpacking ensures safe handling and prevents damage.

Unpacking Procedure

The transport straps and mounting hardware must be removed before installation. Cut the **iron belt** that secures the outer case. Remove the **bottom edge screws** with a cross screwdriver. Lift the case upward to expose the machine and the bottom plate. Remove all protective packaging. Use a spanner to remove the **bolts located under the bottom plate**. Once the bolts are removed, lift the machine away from the plate.

Check the machine for any visible damage. Verify that all accessories, clamps, hoses, and documents are present. Do not connect power at this stage.

Installation Requirements

Place the machine on a **stable and level table** capable of supporting the full operating weight. Allow sufficient space at the front, sides, and rear for fixture installation, coolant access, and maintenance. The installation surface must resist vibration to ensure accurate cutting performance.

Keep the machine away from direct sunlight, high humidity, and airborne contaminants. Confirm that the work area has proper ventilation. Ensure that a suitable electrical outlet is located within reach of the power cable.

Final Preparation

Inspect the coolant tank and verify that it is clean before filling. Confirm that the touch screen, clamps, and cover operate smoothly. Do not run the machine until all transport locks, packing materials, and protective films are removed.

Once the machine is positioned, levelled, and fully unpacked, it is ready for electrical connection and initial setup. The next section of the manual provides instructions for power connection and operational checks.

Working Conditions

Proper working conditions are required to ensure safe operation, long service life, and consistent cutting performance. The ***SMART CUT®*** **6018** must be installed and operated in an environment that meets the following requirements.

1. Work Table Requirements

The machine must be placed on a **stable and level work table** to prevent vibration during cutting. A table height of **0.8 meters** is recommended for comfortable operation and clear access to the cutting chamber, clamps, and touch screen. The surface must support the full weight of the machine and resist movement during use.

2. Electrical Requirements

The power supply must comply with standard industrial electrical conditions. The required input is **220 V, 50 Hz**. The machine is supplied with a power cable approximately **one meter** in length. Ensure that the outlet is grounded and located close enough to avoid extension cables. Voltage fluctuations should be avoided to protect the internal electronics and motor.

3. Environmental Requirements

The operating environment must maintain a temperature of **5 to 40 degrees Celsius** with relative humidity between **30 and 90 percent**, noncondensing. Condensation can damage electrical components and must be prevented. The room should have adequate ventilation to avoid heat buildup during extended operation.

Dust, corrosive vapors, and excessive moisture should be avoided. The machine should not be exposed to direct sunlight or installed near equipment that produces heavy vibration.

Installation

The ***SMART CUT®*** **6018** must be prepared correctly before operation. Proper installation ensures safe use, stable cutting performance, and long service life of all mechanical components.

1. Coolant Preparation

Open the water tank cover and fill the coolant reservoir with a mixture of **80 percent water and 20 percent cutting fluid**. This mixture provides effective cooling, reduces heat on the sample surface, and prevents corrosion on the **rails and ball screws**. Only high quality cutting fluids should be used. The fluid brand and type must match the manufacturer's recommendations to maintain lubrication, prevent foaming, and ensure long term pump reliability. Do not operate the machine without coolant.

2. Electrical Connection

Connect the electrical cable to a grounded power outlet that meets the required specifications. After verifying the connection, **switch on the machine** using the main power switch. Confirm that the display activates and that all initial system checks complete without error.

3. Sample Clamping

Open the clamp assembly and position the sample securely on the cutting table. Tighten the clamp until the sample cannot shift during movement. Correct clamping is essential for maintaining cut accuracy and preventing blade damage. Inspect the fixture to ensure that no part of the sample interferes with the wheel path or coolant flow.

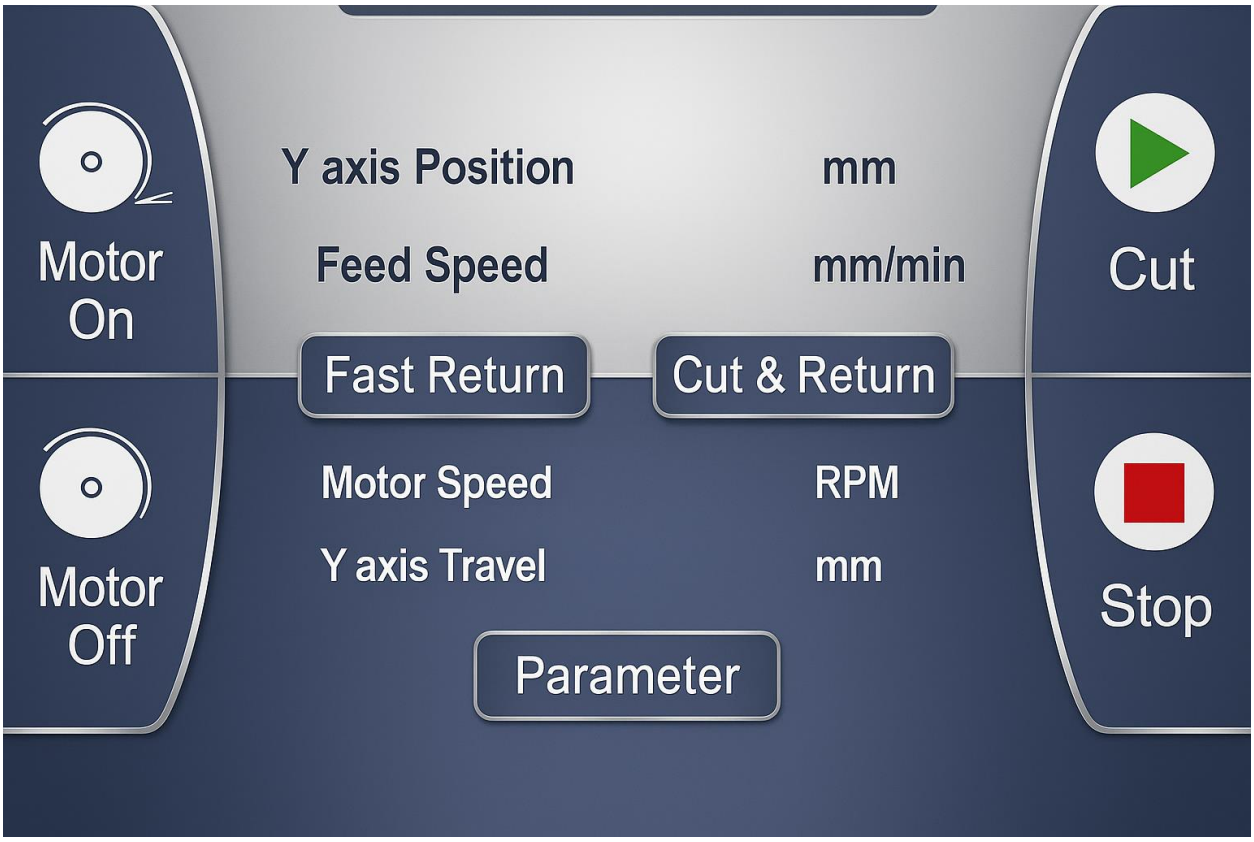
4. Cover Positioning

Close the machine cover and confirm that it makes full contact with the **limit switch**. This switch enables the safety interlock system. The spindle will not start unless the

cover is closed correctly. This protects the operator from coolant splash and rotating components.

Operation Panel

The operation panel provides direct access to all primary cutting functions of the ***SMART CUT®*** **6018** Each control is designed for clear, safe, and efficient operation. After powering the machine, press **Welcome** to enter the main interface. The functions listed below become active once the system completes initialization.



1. Motor On

The **Motor On** function activates spindle rotation and initiates the cutting system. When the motor starts, the **coolant pump engages automatically**, delivering a steady flow of coolant to the cutting area. This integrated operation ensures that the wheel receives proper lubrication and cooling from the moment rotation begins.

Continuous coolant delivery is essential for maintaining stable cutting conditions. It helps **protect the blade** by reducing friction and preventing excessive heat buildup at the contact surface. Proper cooling also prevents thermal damage to the sample, minimizes structural distortion, and contributes to a cleaner, more uniform cut.

Activating the motor allows the operator to confirm that the spindle rotates smoothly and without vibration before starting the cutting cycle. Observing spindle motion at low load conditions makes it easier to detect imbalance, wheel misalignment, or irregularities in mounting. Any issues identified at this stage should be corrected before proceeding.

The Motor On function is also required for pre cutting checks, such as verifying coolant spray direction, ensuring unobstructed wheel clearance, and confirming that the protective cover is securely locked. Because the coolant pump is tied directly to motor activation, the system ensures that **cooling is always present during cutting**, which prevents accidental dry cutting.

2. Motor Off

The **Motor Off** function stops spindle rotation and immediately disengages the cutting action. When the motor stops, the **coolant pump also shuts off**, halting coolant flow to the cutting zone. This ensures that the wheel, spindle, and clamping area remain stationary and safe for handling.

This condition is required before **changing blades**, adjusting fixtures, or performing any routine cleaning inside the cutting chamber. Attempting to service the machine while the spindle is rotating can cause serious damage to the wheel, the machine components, or the operator. The Motor Off key provides a controlled and reliable method for bringing all rotating parts to a complete stop before proceeding.

Motor Off is also used during setup, inspection, or troubleshooting. After observing the cutting process through the protective cover, the operator may stop the motor to evaluate wheel wear, coolant distribution, or sample positioning. Because spindle motion ceases immediately, the operator can work safely without residual rotation or unexpected movement.

In addition, the Motor Off function protects the motor from overheating during extended idle periods. When cutting operations are paused for long durations, turning the motor off reduces energy consumption and prevents unnecessary wear on the spindle bearings and drive system.

Using Motor Off as part of standard operating practice ensures safe handling, protects mechanical components, and supports proper machine maintenance procedures.

3. Cut

The **Cut** function initiates the automatic cutting cycle after all parameters have been set. Motor speed, feed rate, and Y axis travel must be entered and confirmed in the Parameter menu before activating this mode. Once these conditions are satisfied, pressing the Cut key allows the machine to begin a **fully controlled and consistent cutting sequence**.

During automatic cutting, the system regulates spindle rotation, coolant delivery, and feed motion to maintain **stable cutting forces** and prevent overheating. This controlled motion is suitable for a wide range of materials, including metals, ceramics, composites, PCB substrates, and electronic components. The machine maintains uniform contact between the wheel and the sample, which improves surface finish, reduces chipping, and extends wheel life.

The automatic cycle is also designed to reduce operator involvement. Once started, the system monitors travel limits and cutting progress. The spindle advances according to the programmed distance and stops automatically when the cycle is complete or when

the Stop key is pressed. This improves process repeatability and ensures consistent dimensional accuracy across multiple samples.

Before activating the Cut function, all clamps must be secured, coolant flow must be confirmed, and the protective cover must be closed. The safety interlock must engage to allow cutting to begin. Proper setup ensures safe operation and prevents unintended wheel contact with the sample or fixtures.

The Cut function is the primary operating mode for achieving **precision sectioning** in laboratory, research, and production environments.

4. Stop

The **Stop** key immediately halts the cutting cycle at any stage of operation. This function is essential for maintaining safety and protecting both the machine and the sample. When the Stop key is pressed, spindle feed motion stops, and the system holds its current position until further instructions are given.

This feature is used when adjusting the setup, correcting sample alignment, verifying clamping stability, or addressing coolant flow issues. It is also the primary control for responding to any **abnormal condition**, such as excessive vibration, unexpected noise, or signs of wheel loading. The ability to interrupt cutting instantly helps prevent wheel damage, sample breakage, and unnecessary wear on mechanical components.

Pressing Stop does not shut down the entire system. Power to the machine remains active, and the operator can resume operation after resolving the issue. This allows efficient workflow management and prevents unnecessary restarts of the spindle or coolant pump. Before resuming cutting, all conditions must be checked to ensure that safe operation can continue.

The Stop key is part of the machine’s built in safety structure. It provides a controlled and predictable interruption method that keeps the operator in full control of the cutting process at all times.

5. Fast Return

The **Fast Return** function moves the spindle back to the original starting position at a high travel speed. This feature is designed to reduce idle time between cuts and improve overall workflow efficiency. After completing a cutting cycle, the spindle may remain at the end of the programmed travel distance. Fast Return brings it back to the home position quickly, allowing the operator to prepare the next sample without delay.

Fast Return is also used after manual adjustments, alignment checks, or parameter changes. When the spindle has been moved forward for setup purposes, activating this function ensures a **precise and repeatable return point**, which is essential for

consistent cutting conditions. The machine follows a controlled but rapid reverse motion that minimizes wear on linear guides and maintains smooth travel.

The movement stops automatically when the spindle reaches the origin. This prevents overtravel and helps protect the motion system from mechanical stress. Before initiating Fast Return, the operator must ensure that no tools, fixtures, or hands are near the moving components.

This function contributes to faster cycle times, improved productivity, and better process organization, especially in applications involving multiple samples or repetitive cutting tasks.

6. Cut and Return

The **Cut and Return** function performs a complete automatic cutting cycle followed by a rapid, unattended return of the spindle to the home position. Once activated, the machine advances through the programmed cutting parameters, completes the sectioning process, and then initiates a controlled high speed return movement without requiring additional input from the operator.

This combined sequence improves workflow efficiency, especially when processing multiple samples of similar size and material. By eliminating the need for manual repositioning after each cut, the system reduces downtime and maintains a consistent starting position for every cycle. This is especially valuable in laboratory environments, production settings, and repetitive sample preparation tasks where uniformity and throughput are essential.

The return movement is monitored by the internal control system to ensure accurate positioning and to prevent overtravel. Once the spindle reaches the origin point, motion stops automatically, allowing the operator to load the next sample or adjust fixtures immediately. This helps maintain smooth process continuity and reduces fatigue associated with manual repositioning.

Cut and Return works in coordination with the machine’s safety interlock system. The spindle operates only when the protective cover is closed and the limit switch is engaged. This ensures that the combined cutting and return sequence remains safe, controlled, and fully compliant with operational safety requirements.

This integrated function enhances cutting precision, reduces handling time, and supports a streamlined workflow for high quality and repeatable cutting operations.

Parameter Setting Interface

Press the **Parameter** key to enter the parameter setting interface. This menu controls all operating values that determine cutting speed, travel distance, and motion behavior. Accurate parameter entry is essential for achieving consistent and repeatable results.

1. Motor Speed

Defines the **spindle rotation speed**. Press the numerical field to open the input panel and enter the desired value. Correct motor speed selection helps control heat generation and cutting load, especially on brittle or hard materials.

2. Feed Speed

Defines the **cutting speed along the Y axis**. Press the numerical field to enter the required value. Proper feed speed ensures smooth cutting, prevents excessive blade wear, and improves surface quality of the sample.

3. Y Axis Travel

Defines the **total Y axis cutting distance** under automatic cutting mode. Press the numerical field to input the required travel length. This value determines how far the spindle will advance during an automatic cycle.

4. Save Function

Press **Save** to store the current parameters under a selected **Process Number**. Up to **ten sets** of parameters can be stored. The default Process Number is 1. Saved programs can be recalled whenever repeated cutting operations or identical sample types are processed.

5. Manual Forward Movement

Press the **up arrow** to move the spindle forward during manual positioning. This function is used when aligning the blade with the sample or verifying setup conditions.

6. Manual Backward Movement

Press the **down arrow** to move the spindle backward. This assists with sample repositioning, fixture adjustments, and clearance checks.

7. Auto Mode

In **Auto** mode, the spindle moves automatically according to the programmed parameters. Motion stops when the **Stop** key is pressed or when the system reaches its programmed travel limit. Auto mode is the only mode in which **automatic cutting** can occur. The system defaults to Auto upon entering the parameter interface.

8. Inching Mode

In **Inching** mode, each press of the up or down key moves the spindle **1.5 mm**. This mode is used for fine positioning, especially when the blade is within **5 mm of the sample**. Inching prevents accidental contact and provides precise control in final alignment.

9. Pump Control

Pump On and **Pump Off** control coolant flow. These functions can also be used during cleaning of the cutting chamber, nozzle, and table.

The Parameter Setting Interface provides complete control over spindle behavior, cutting speed, and travel distances. Proper setup ensures stable cutting, protects the blade, and delivers repeatable high quality results for all supported materials.

Usage Instructions

The following steps describe the correct operating procedure for the ***SMART CUT®*** **6018** Proper use of the machine ensures safe operation, stable cutting performance, and long service life of the cut off wheel and mechanical components.

1. Wheel Selection

Selecting the correct cut off wheel is essential for achieving accurate, stable, and repeatable cutting results. Wheel performance is directly influenced by the **material type**, **material hardness**, **sample geometry**, and the **desired surface quality**. Before switching on the power, a suitable wheel must be installed based on the material to be sectioned.

Diamond and resin bond wheels are commonly used for metals, ceramics, composites, electronic components, and PCB materials. The **bond type** determines how diamonds are held in the wheel, which affects cutting speed, heat generation, and wear rate. Harder materials generally require a softer bond to expose new cutting edges, while softer materials may require a harder bond to maintain stability and prevent excessive wear.

Wheel **thickness** must also be selected carefully. Thinner wheels reduce cutting force and heat, which is important for delicate samples or thin sections. Thicker wheels provide greater rigidity and are recommended for dense metals or materials that require deep sectioning. Incorrect wheel thickness can lead to deflection, chipping, or inefficient material removal.

In addition, the **maximum safe operating speed** of the wheel must always be respected. Each wheel has a defined maximum linear velocity. Operating beyond this limit may cause wheel failure or unsafe conditions. Wheel labels and documentation must be reviewed to verify compatibility with the spindle speed used during cutting.

Using an incorrect or unsuitable wheel can result in **poor cut quality**, **thermal damage**, **sample deformation**, or **premature blade wear**. Proper wheel selection ensures controlled cutting forces, consistent performance, and longer service life of both the wheel and the machine.

2. Machine Preparation

Proper preparation of the machine is required before loading any sample or setting cutting parameters. Begin by turning on the **main power switch** and allowing the system to complete its initial diagnostic checks. These checks ensure that the control interface, spindle motor, safety interlock, and coolant system are ready for operation.

Open the protective cover and pull the **cutting table to its lowest position**. This provides full access to the clamping fixtures and cutting area. Once the table is positioned, secure it using the **right locking handle**. Locking the table prevents unintended movement during setup and ensures that the sample can be aligned accurately.

All fixtures, clamps, and mounting accessories must be inspected before use. Confirm that each component is **clean, free of debris**, and securely fastened. Residue or misalignment can affect cutting accuracy, restrict coolant flow, or cause uneven loading on the cut off wheel. If the machine has been idle for a long period, verify that the coolant lines and spray nozzles are unobstructed.

Check that the **cutting wheel is properly mounted** and tightened according to the manufacturer's specifications. Verify that the wheel rotates freely without contact against guards or fixtures. Ensure that the cover hinge, limit switch, and safety components function smoothly.

At this stage, the operator should also confirm that the coolant reservoir is filled with the correct mixture and that the workstation surrounding the machine is clean, dry, and unobstructed. Adequate workspace helps prevent contamination and facilitates safe operation.

Proper machine preparation establishes a stable foundation for accurate cutting and ensures that all mechanical and safety systems are positioned for reliable performance.

3. Sample Clamping

Correct clamping of the sample is essential for safe operation and accurate cutting results. Begin by opening the **clamp assembly** and placing the sample on the cutting table in the desired orientation. Ensure that the surface of the table and all contact points are clean so that the sample seats properly without tilting or rocking.

Position the sample so that the cutting wheel will engage the target area without interference from fixtures or clamps. The alignment must be checked from both the front and side views to confirm that the cutting path is clear. Once positioned, tighten the clamp assembly until the sample is held **firmly and securely**. There must be no perceptible movement or vibration when the sample is pressed lightly by hand.

Proper clamping is critical for **cutting accuracy**, as even small shifts can result in angled cuts, uneven section thickness, or material damage. Stable clamping also protects the cut off wheel by ensuring that the cutting load remains uniform. Uneven pressure or sample instability can cause wheel binding, excessive wear, or chipping of the cutting edge.

For irregularly shaped or small samples, auxiliary clamping fixtures may be required. These fixtures should be selected based on material type, geometry, and clamping

surface stability. The operator must verify that clamps do not obstruct the coolant spray or restrict spindle travel.

After clamping, gently move the table forward to check for clearance and proper alignment. If any resistance or misalignment is detected, reposition the sample before proceeding. Confirm that the protective cover can close fully without contacting the sample or fixtures.

Proper sample clamping ensures reliable operation, reduces the risk of tool damage, and contributes to consistent, high quality cutting results.

4. Cover Positioning

The protective cover must be closed correctly before any cutting operation can begin. After the sample is clamped and the cutting table is secured, lower the **protective cover** until it reaches its fully closed position. Confirm that the cover engages the **limit switch** located on the machine frame. This engagement activates the safety interlock system, which allows the spindle and feed mechanisms to operate.

The machine will not start if the cover is not aligned with the limit switch. This prevents the operator from being exposed to rotating components, coolant spray, or unexpected table movement. The interlock ensures that cutting functions are enabled only when the workspace is properly enclosed.

The cover must close smoothly and without obstruction. If resistance is felt, check for misplaced tools, clamps, or sample overhang that may interfere with the cover path. The viewing window should remain clean and transparent to allow safe monitoring of the cutting process during operation.

Regular inspection of the **hinges, seals, and switch alignment** is recommended. Wear or contamination in these areas may prevent the cover from fully engaging the interlock. If the cover fails to activate the switch, the machine must not be used until the issue is corrected.

Correct cover positioning is essential for operator safety, protects internal components from debris and coolant splash, and ensures compliance with operating requirements for all cutting modes.

5. Automatic Cutting

Automatic cutting is the primary operating mode for achieving consistent, repeatable, and high precision sectioning. Before activating this mode, all required cutting parameters must be entered accurately. Set the **motor speed**, **feed speed**, and **Y axis travel distance** according to the material type, wheel specifications, and desired cut quality. These values determine the behavior of the spindle and feed system throughout the cutting cycle.

After verifying the parameters, press the **Motor On** key. This starts spindle rotation and activates the **coolant pump** automatically. Proper coolant flow is essential for controlling heat, maintaining wheel life, and preventing thermal damage to the sample. The operator must confirm that coolant is directed correctly at the cutting zone before proceeding.

Once spindle rotation and coolant flow are established, press the **Cut** key to initiate automatic cutting. The system will begin advancing the spindle at the programmed feed rate and continue until it reaches the defined travel limit. Throughout the cycle, the machine maintains stable cutting forces and constant wheel engagement with the sample.

The cutting process should be monitored through the **transparent protective cover**. Observation ensures that feed motion remains smooth, coolant distribution is adequate, and no abnormal vibration or wheel loading occurs. If any irregularities are detected, the cycle can be stopped immediately using the Stop key.

Automatic cutting reduces operator involvement and improves repeatability, especially when processing multiple samples with identical dimensions. The controlled motion helps achieve uniform section thickness, reduced chipping, and enhanced cut surface quality across a wide range of materials, including metals, ceramics, composites, and PCB structures.

Proper setup, parameter selection, and coolant management ensure that automatic cutting operates safely and delivers reliable, high quality results.

6. Manual Cutting (Optional)

Manual cutting provides greater control over feed movement and is used when fine adjustments or slow, deliberate cutting actions are required. This mode is recommended for **short cutting distances**, **delicate or fragile samples**, and situations in which the operator must confirm wheel alignment before initiating a full automatic cycle.

Manual feed can be applied in two ways. The **right hand wheel** allows precise, incremental advancement of the cutting table. This method is preferred when working with brittle materials or when avoiding sudden contact with the wheel is critical. The slow, controlled motion reduces the risk of chipping, cracking, or thermal stress on the sample.

Alternatively, the operator may **unlock the table handle** and guide the table forward manually. This provides a smooth, continuous feed motion suitable for quick cuts or preliminary test passes. When using manual push feed, the operator must maintain consistent pressure to prevent abrupt loading on the wheel.

Manual cutting also supports **initial alignment checks**, allowing the operator to verify that the wheel contacts the correct location on the sample before committing to automated movement. Small adjustments to the table position or clamping setup can be made easily in this mode.

Manual feed speed must remain **moderate and controlled**. Excessive force can overload the wheel, reduce coolant effectiveness, and compromise cut quality. For PCB materials or other layered structures, a forward and backward sweeping motion may improve chip removal and prevent blockage.

Manual cutting provides flexibility and precision during setup, test cuts, and specialized operations where full automation is not required. When used correctly, it enhances safety, protects the wheel, and ensures accurate alignment for subsequent automatic cutting cycles.

7. Parameter Guidelines

Parameters must be set before automatic cutting. Accurate parameter selection ensures stable cutting forces and predictable material removal. As a general guideline, a **feed speed of 5 mm per minute** is suitable for standard iron, carbon steels, and low alloy metals. These materials tolerate moderate cutting forces and produce consistent chip formation at this rate.

For **high hardness materials** or **brittle ceramics**, a **feed speed of 3 mm per minute** is recommended. These materials are sensitive to heat and mechanical shock. A lower feed rate reduces the risk of microcracking, surface chipping, and thermal damage. Reduced feed motion also limits stress on the wheel, allowing the abrasive surface to remain sharp and stable throughout the cut.

Lower speeds help control heat, reduce chipping, and maintain wheel life. Excessive feed rates can overload the spindle, increase friction, and accelerate wear of both the wheel and the sample. Improper feed speed selection may also cause coolant starvation at the cutting interface, leading to poor surface finish or uneven material removal.

Additional adjustments may be required based on several factors, including:

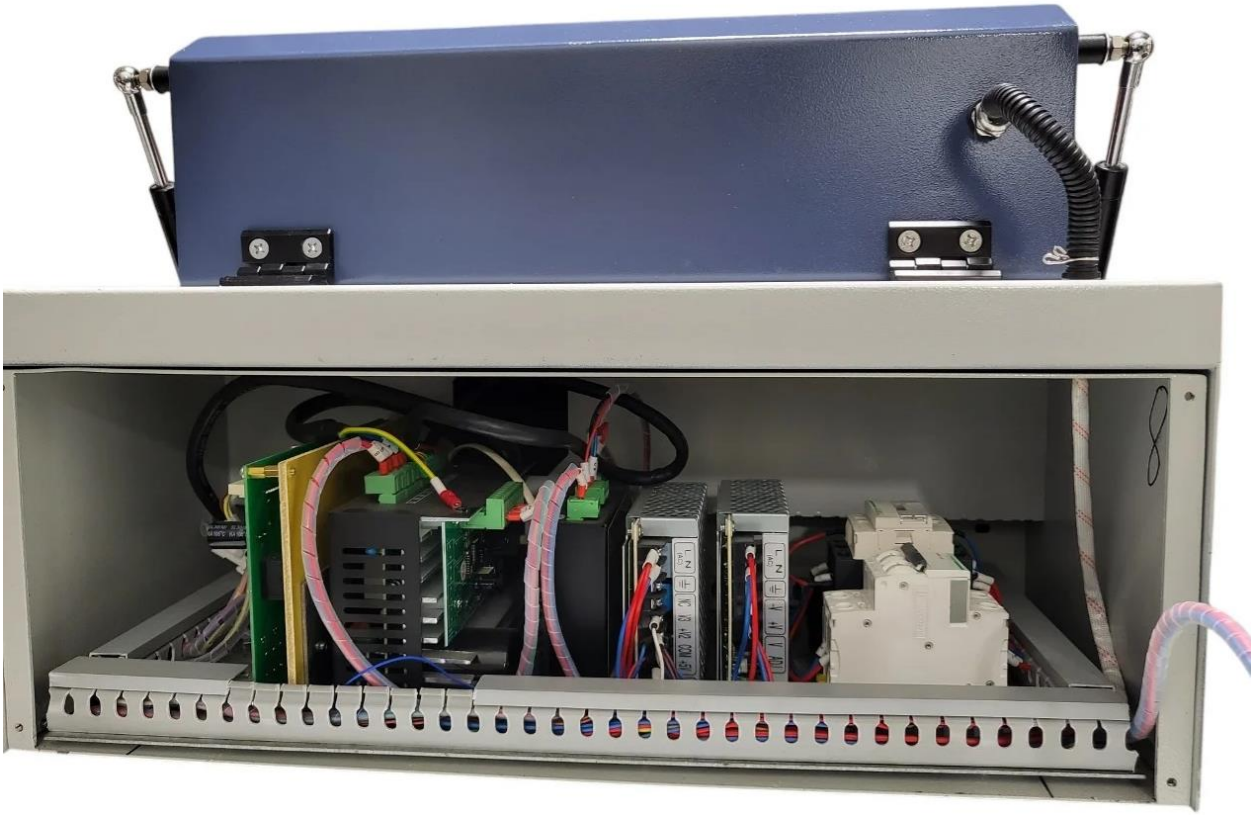
- **Wheel type and bond**. Softer bonds release abrasive faster and may require slower feeds. Harder bonds allow higher cutting loads but may increase heat on dense materials.
- **Material microstructure**. Composite materials, layered structures, and heat treated metals may require reduced speeds to prevent delamination or distortion.
- **Coolant effectiveness**. Coolant concentration, flow rate, and nozzle alignment influence heat dissipation. Poor coolant performance often requires slower cutting speeds.

• **Desired cut quality**. Cuts requiring minimal deformation, low kerf loss, or polished edges may require lower feed speeds and optimized spindle rotation.

The operator should evaluate these variables and adjust parameters as necessary. Proper parameter selection improves cutting accuracy, protects machine components, and ensures consistent high quality results across different materials and wheel types.

Maintenance

Regular maintenance is required to ensure safe operation, extend machine life, and maintain consistent cutting quality. The following procedures should be performed at the specified intervals or whenever abnormalities are observed.



1. Pre-operation Check

Inspect the machine before each use. Confirm that all components are in **normal working condition**, including clamps, wheels, coolant lines, table movement, and safety interlocks. Do not operate the machine if any abnormal noise or vibration is detected.

2. Touch Screen Protection

Keep the **touch screen dry and free of dirt**. Moisture or debris may cause malfunction, reduce sensitivity, or damage internal circuits. Clean the surface only with a soft cloth.

3. Motor Rotation Direction

Verify the **motor rotation direction** before cutting. The spindle must rotate according to the wheel specifications. If rotation is incorrect, stop the machine and adjust immediately to prevent wheel damage and unsafe cutting conditions.

4. Wheel Compatibility

The machine supports **diamond cut off wheels** and **resin bond cut off wheels**. When using resin wheels, ensure that the **spindle speed does not exceed the wheel's maximum safe linear speed**. Over-speed operation may lead to wheel breakage or unsafe cutting performance.

5. Lubrication

Check lubrication points regularly. Use an oil gun to apply **lubricating oil to the spindle** and all designated lubrication fittings. Proper lubrication reduces wear, prevents overheating, and maintains smooth motion.

6. Cooling System and Filter

Clean the **coolant filter** on a regular schedule to prevent clogging. Restricted flow reduces cooling performance and increases heat on both the sample and the wheel. Drain and replace coolant when contaminated or when cutting performance declines.

7. Coolant Quality

Always use an **anti rust coolant** with proper dilution. This maintains cooling efficiency, prevents corrosion of rails and lead screws, and improves cut quality. Contaminated or incorrect coolant may damage internal components.

8. Motion Verification

After powering on the machine, check **table feed** and **spindle feed** manually. Movement should be smooth and free of resistance. Stop operation and inspect the machine if unusual stiffness or noise is observed.

9. Manual Cutting Practices

Manual feed should be applied at a **controlled and moderate speed**. Excessive feed may overload the wheel or cause sample chipping. For PCB and similar materials, a

forward and backward cutting motion helps prevent blockage and improves chip removal.

10. Motor Service

Before servicing the motor, switch off the power and open the upper machine shell. Handle all internal components carefully. Disconnect the **screen cable connectors** and note their orientation for correct reassembly.

11. Power Management

Turn off the **rear power switch** when the machine is not in use. This protects the electronics and reduces unnecessary power consumption.

Cautions

The following cautions must be observed to ensure operator safety, prevent equipment damage, and maintain reliable cutting performance. Failure to follow these instructions may result in injury or improper operation.

1. Operator Training

This machine must be operated only by personnel who are **properly trained** and fully familiar with its controls, safety systems, and cutting procedures. Each operator must understand spindle operation, feed mechanisms, clamping requirements, and coolant management before using the equipment. Training should include hands on instruction, review of the operating manual, and observation of proper cutting practices.

Untrained users must not operate, adjust, or service the equipment under any circumstances. Improper use can result in equipment damage, personal injury, or compromised cutting quality. Operators must be aware of all **safety interlocks**, emergency controls, and correct start up and shutdown procedures. They must also know how to respond to abnormal conditions such as unusual noise, vibration, or coolant loss.

Training should cover appropriate wheel selection, proper sample clamping, parameter setting, and inspection of the cutting area before each operation. Personnel must understand the importance of following maintenance procedures, including lubrication, coolant replacement, and cleaning of filters and guide rails.

Only trained and authorized individuals may modify parameters, replace wheels, or access internal components. This ensures consistent performance, protects machine integrity, and maintains a safe working environment.

2. Safety Interlock Verification

The **safety interlock system** is a critical component of the machine's protective structure and must be verified before every use. The operator must check the **safety limit switch** to confirm that it engages correctly when the protective cover is fully closed. This switch prevents the spindle and feed mechanisms from operating unless the cutting chamber is securely enclosed.

If the limit switch does not activate, or if the cover fails to depress the switch completely, the machine must not be used. A defective or misaligned safety interlock can expose the operator to **rotating components**, **coolant spray**, and unexpected table movement. These conditions represent serious safety risks and must be corrected immediately.

Verification includes checking that the cover closes smoothly, the switch is firmly mounted, and the signal is properly recognized by the control system. If the machine attempts to start with the cover open, or if the touch screen displays an interlock error, the operator should stop the machine and inspect the switch mechanism for dirt, mechanical damage, or loose wiring.

Periodic inspection of the **cover hinges, frame alignment**, and **electrical connections** is recommended to maintain reliable interlock function. The safety system must never be bypassed or disabled during any part of operation or maintenance. Proper interlock verification ensures safe working conditions and protects both the operator and the equipment.

3. Electrical Safety

Confirm that the **supplied voltage matches the required specification** before powering the machine. Always ensure that the main power switch is off before connecting or disconnecting the power cable. Incorrect voltage or improper electrical connection may damage internal components.

4. Cleaning Procedures

All cleaning tasks must be performed with the machine **completely powered off**. The main power switch must be turned off and the spindle must come to a full stop before any cleaning work is started. Cleaning while the machine is energized can result in accidental activation, electrical hazards, or contact with rotating components.

The cutting chamber, table surface, and clamping fixtures should be cleaned after each use to remove abrasive particles, coolant residue, and sample debris. Residue buildup can affect clamping stability, restrict coolant flow, and reduce overall cutting precision. Use nonabrasive tools and soft cloths to avoid scratching internal surfaces.

Coolant spray nozzles must be inspected regularly and cleaned if blocked. Obstructions can prevent proper coolant distribution, leading to overheating, wheel damage, or poor cut quality. The **coolant tank**, filters, and return channels must be emptied and rinsed periodically to prevent sediment accumulation and bacterial growth.

Water must never be sprayed directly onto the **touch screen, electrical cabinet,** or control panel. Moisture in these areas can cause short circuits or reduce the service life of sensitive components. Only approved cleaning solutions should be used near electronics, and all surfaces must be dried thoroughly after cleaning.

During cleaning, inspect all visible components for wear, corrosion, or abnormal conditions. Early identification of issues allows maintenance to be performed before they affect performance. Cleaning procedures are an essential part of routine operation and help ensure a safe, reliable, and longlasting machine.

5. Safety Devices and Labels

The machine is equipped with **safety labels, protective covers, and interlock devices**. Do not remove, modify, or bypass any of these features. They are essential for safe operation. If any protective device is damaged or missing, discontinue use until repairs are completed.

6. General Safety Practices

Safe operation of the machine requires constant attention to the surrounding environment and adherence to established safety procedures. All **hands, tools, clothing, and loose objects** must be kept away from the cutting area while the spindle is rotating. Items near the wheel can become entangled, thrown, or cause sudden loading on the spindle, creating a severe hazard.

Never reach into the chamber unless the machine is **fully powered off** and the spindle has stopped completely. Residual rotation can be difficult to see, especially at low speeds. Contact with a moving wheel can cause serious injury or damage to the sample.

Adequate **lighting** must be maintained in the work area to allow clear observation of the cutting zone, sample alignment, and coolant flow. Poor visibility may lead to incorrect setup or failure to detect abnormal cutting conditions. The floor surface must remain **clean, dry, and free of obstructions** to prevent slipping, tripping, or accidental contact with the machine.

Loose clothing, long hair, gloves, or jewelry must not be worn near the equipment. These items can become caught in moving parts. Operators should wear appropriate protective equipment, including **safety glasses**, **lab coats**, and **non slip footwear**. Hearing protection may be required in high noise environments.

Cut off wheels must be handled with care. They should not be dropped, struck, or exposed to excessive force. Damaged wheels can fail during operation and pose a serious safety risk. Before each use, the wheel must be inspected carefully for cracks, chips, or irregularities.

Operators should remain attentive during the entire cutting process. Distractions can delay response to abnormal conditions such as vibration, loss of coolant, or unusual noise. Following these safety practices ensures a controlled working environment and reduces the risk of injury or equipment damage.

7. Emergency Conditions

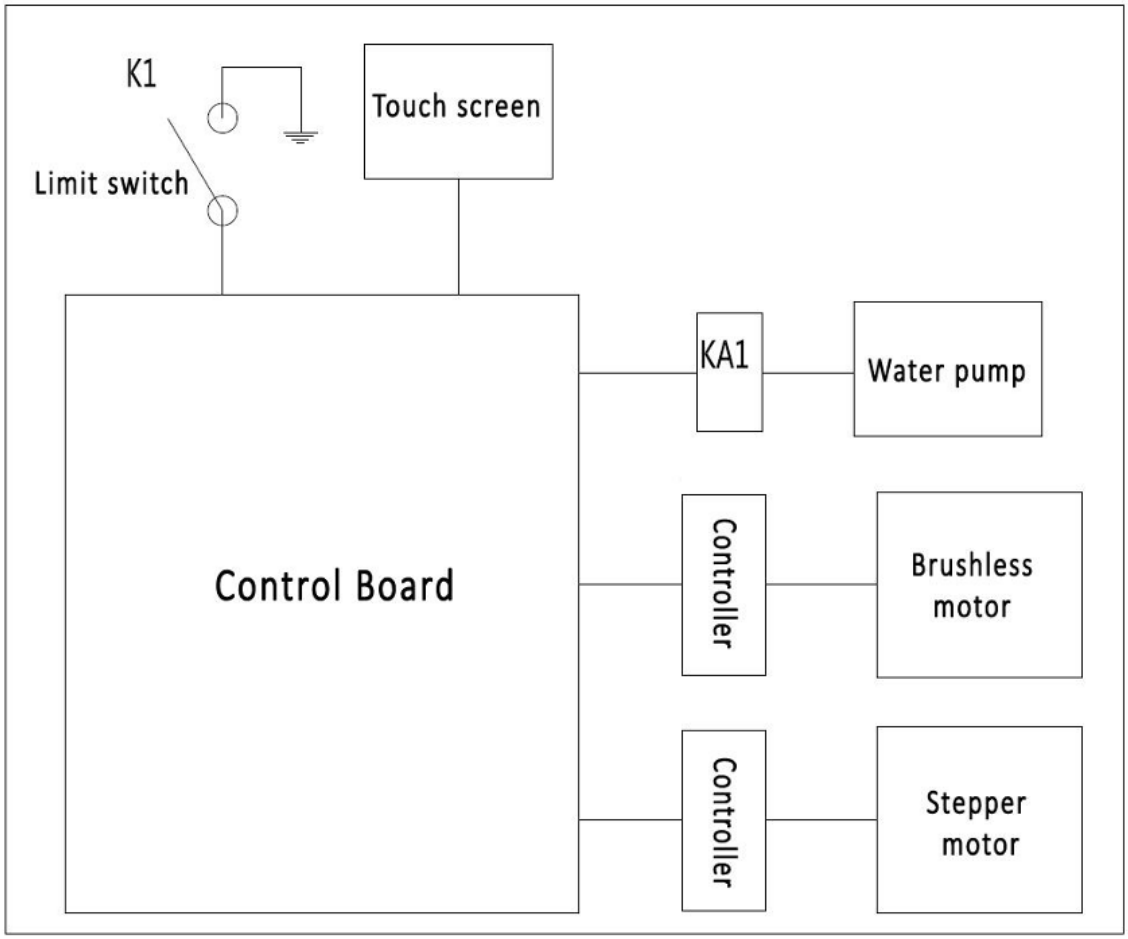
If **abnormal vibration, noise, smoke, or coolant leakage** is observed at any time, the operator must stop the machine immediately. These conditions indicate that one or more components are not functioning correctly. Continued operation may lead to wheel failure, spindle damage, electrical hazards, or safety risks to personnel.

When an abnormal condition is detected, the machine must remain off until the cause is identified and corrected. Vibration may result from wheel imbalance, loose flanges, worn bearings, or improper mounting. Unusual noise may indicate mechanical interference, misalignment, or internal damage to the drive components. Smoke or burning odor often signals excessive friction, electrical overload, or contaminated coolant. Coolant leakage can originate from the tank, hoses, seals, spray nozzles, or pump connections.

Each issue must be investigated methodically. Inspect the cut off wheel, clamping fixtures, drive belt, coolant lines, and electrical components. Confirm that all screws, bolts, and fittings are tight and that no foreign objects are present in the cutting chamber. Repairs or adjustments must be made only by trained personnel.

Restarting the machine without addressing the underlying problem can result in **permanent equipment damage**, reduced cutting quality, or a serious safety incident. Proper response to abnormal conditions ensures long machine life, stable cutting performance, and a safe operating environment.

Electrical Diagram



Troubleshooting Guide

The following table outlines common operating issues, possible causes, and recommended corrective actions. All troubleshooting must be performed with the power switched off unless otherwise specified. If a problem cannot be resolved using these steps, discontinue use and contact qualified service personnel.

Issue	Possible Cause	Solution
Touch screen is ineffective	Communication failure or loose plug	Fasten plug connections securely
	Damaged circuit board	Replace circuit board
	Touch screen failure	Replace touch screen
Touch screen not lighting	Blown fuse	Replace fuse
	Power supply failure	Check and restore power
Motor does not run	Faulty limit switch	Replace limit switch
	Controller malfunction	Replace controller
No response when pressing Motor On	Protective cover not closed	Close cover until limit switch engages
	Touch screen failure	Replace touch screen
No water flow / weak water flow	Pump failure	Replace pump
	Low coolant level	Add water and cutting fluid
	Clogged filter or coolant line	Clean or replace filter and flush coolant path
Cutting spindle does not move	Step drive failure	Replace step drive
	Mechanical obstruction	Inspect rails and remove obstructions
Spindle vibration or excessive noise	Wheel imbalance or improper mounting	Reinstall or replace wheel
	Loose wheel flange	Tighten wheel flange
	Damaged spindle bearings	Inspect and replace bearings
Poor cutting quality	Incorrect wheel type or grit	Select proper wheel
	Feed speed too high	Reduce feed speed
	Incorrect spindle speed	Adjust RPM
	Insufficient coolant flow	Check pump, lines, and nozzles
	Worn or glazed wheel	Dress or replace wheel
Sample or wheel overheating	Coolant not reaching cutting zone	Adjust coolant nozzle
	Incorrect coolant mixture	Correct ratio to 80 percent water and 20 percent fluid
	Pump flow weak	Clean or replace pump
	Feed too aggressive	Reduce feed rate
Machine does not start	Main power switch off	Turn on main power
	Emergency stop engaged	Reset emergency stop

	Damaged power cable	Inspect and replace cable
	Blown internal fuse	Replace fuse
Unstable spindle speed	Motor driver malfunction	Inspect or replace motor controller
	Voltage fluctuations	Check electrical supply
	Loose drive belt	Adjust or replace belt
Coolant leaks or overflow	Blocked return flow	Clear return path
	Damaged tank seal	Replace seal
	Overfilled coolant tank	Reduce coolant level
Table movement is jerky or stiff	Dirty or dry guide rails	Clean and lubricate rails
	Damaged bearings	Replace bearings
	Misaligned table	Realign table assembly
Touch screen freezes or responds slowly	Software malfunction	Restart machine
	Control board overheating	Improve cooling, inspect ventilation
	Loose communication cable	Secure cable connections
Automatic cutting stops mid cycle	Travel limit reached early	Check programmed Y travel
	Sensor or limit switch malfunction	Inspect and replace if required
	Parameter input error	Re enter correct parameters
Excessive wheel wear	Wrong wheel type or bond	Select correct wheel
	RPM too high	Adjust spindle speed
	Coolant insufficient	Improve coolant delivery
	Feed too aggressive	Reduce feed speed
Sample slipping in clamp	Insufficient clamping force	Retighten clamp
	Worn clamp jaws	Replace jaws
	Incorrect sample positioning	Reposition sample properly

Additional Notes for Troubleshooting

• Always verify power input, interlock engagement, and cable connections before replacing components.
• Inspect wiring harnesses for looseness, corrosion, or damage that may interrupt communication or power delivery.
• Ensure that the protective cover is fully closed, since the machine will not operate unless the safety interlock is activated.

• When replacing electronic components such as the circuit board, touch screen, controller, or step drive, ensure that all connectors are properly seated.
• If coolant flow is weak but not completely absent, check for clogged filters or blocked spray nozzles before replacing the pump.
• After any repair, perform a full operational test to confirm that the system runs smoothly and safely.