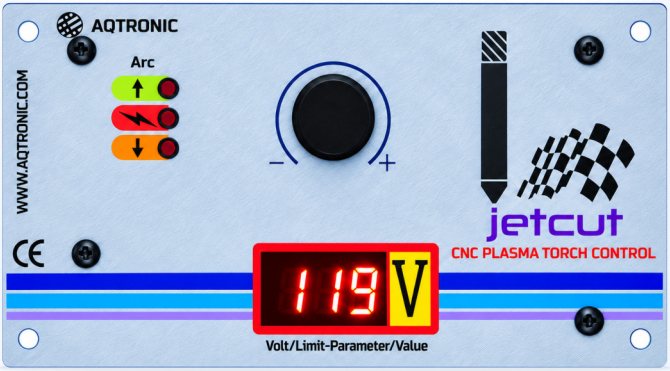
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CNC PLASMA TORCH CONTROL



OPERATION MANUAL

JETCUT THC

Overview

The **JetCut Torch Height Controller (THC)** measures plasma arc voltage and controls cutting height to maintain a consistent torch-to-workpiece distance during CNC plasma cutting.



Two control interfaces

- **UP / DOWN / OK:** separate optically isolated output commands for a CNC controller (OSC = 0).
- **STEP / DIRECTION:** STEP pulses and direction commands for the Z-axis motor driver (OSC = 1-14).

Measurements and reference

Plasma Voltage is the measured arc voltage; **Target Voltage** is the reference used to maintain the desired torch height.

READ BEFORE INSTALLATION

Safety Warning - High Voltage

Electric shock can cause severe injury or death. Plasma cutting circuits can carry hazardous DC voltage, including at the torch and workpiece.

- Disconnect and isolate power to the plasma source and CNC before wiring, inspection or maintenance. Allow capacitors to discharge.
- Never touch the arc-voltage input, exposed conductors, torch or workpiece while energized.
- Use a manufacturer-approved divided-voltage output whenever available. Direct **1:1** arc voltage requires high-voltage-rated protection.
- Never put raw 1:1 arc voltage on the **1:50** divided input.
- Keep the work area dry, use protective grounding and follow the plasma source safety manual.
- Installation and any energized high-voltage measurements must be performed by qualified personnel.

Before live cutting

Test signals and Z-axis direction with the torch and plasma source disabled.

ELECTRICAL AND MECHANICAL

Technical Specifications

Parameter	Specification
Supply Voltage	24 VDC (12-48V DC)
Current Consumption	120 mA (3W)
Measurement Ratios	1:1 / 1:50
Low-voltage threshold	40 VDC reference
Control Outputs	Optically isolated NPN, open collector
Maximum Plasma Voltage	600 VDC
Display	3-digit 7-segment LED
Dimensions	140 x 70 x 50 mm
Weight	200 g

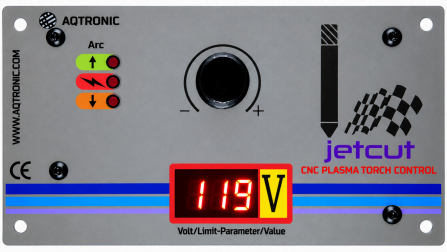
Check installation requirements

Match the plasma-source divider ratio to the correct input. Use suitable electrical protection and cooling for all connected equipment.

OPERATING CONTROLS

Front Panel & Display

JetCut uses a three-digit LED display, a rotary knob for adjusting **Target Voltage**, and indicators for control activity. Press the knob to enter the parameter menu.



Voltage terminology

- **Plasma Voltage:** the arc voltage measured through the selected input during cutting.
- **Target Voltage:** the adjustable reference that corresponds to the required cutting height.

On a stable straight cut, rotate the knob to make small Target Voltage adjustments and verify the actual torch height.

PLASMA VS TARGET

How Height Control Works

During a stable cut, arc voltage normally rises as the torch moves farther from the metal and falls as it approaches.

Measured vs target	Command	Action
Plasma Voltage < Target	UP	Raise the torch
Plasma Voltage > Target	DOWN	Lower the torch
Within HyS band	HOLD	No correction

For example, at a 124 V target, a 119 V measured value normally requests an UP correction. Confirm actual motor direction before cutting.

Important

Wrong Z-axis direction, wrong driver polarity, poor probing or incorrect pierce height must not be compensated for by arbitrarily changing Target Voltage.

USING THE KNOB

Start-up & Normal Operation

1 Power on

The JetCut starts its display sequence. It then waits for a valid plasma arc voltage.

2 Standby

Three dashes (---) indicate that the controller is waiting for a valid input.

3 Set Target Voltage

Rotate the knob to change the target reference, including during a stable cutting pass.

4 Start the cut

After arc ignition and the configured delay, the system compares the measured and target voltages.

5 Adjust gradually

Make small target changes on a straight, steady cut. Confirm correct pierce and cut heights first.

PARAMETER OVERVIEW

Menu Navigation

Press the rotary knob to enter the settings. Rotate to select a parameter and adjust its value. Choose ESC to return to the normal display.

Code	Description
OSC	Control interface / STEP speed
HYS	Hysteresis
DLY	Pierce Delay
CAL	Plasma Voltage Calibration
LCU	Low Voltage Cut
ANT	Anti-Dive protection
TST	Test Z Axis and outputs
ESC	Exit parameter menu

Menu labels

The parameter codes remain the same as those displayed by the JetCut controller.

CONTROL INTERFACE

OSC - Output Mode & Speed

The OSC parameter selects the output interface. In Step/Direction mode it also sets the correction speed of the stepper motor.

OSC value	Operating interface
0	**UP / DOWN / OK** interface
1-14	**STEP / DIRECTION** interface

Speed adjustment in SD mode

For OSC values from **1 to 14**, increasing the value increases the STEP pulse frequency and the stepper-motor correction speed. A lower value produces slower movement; a higher value produces faster movement.

Set up safely

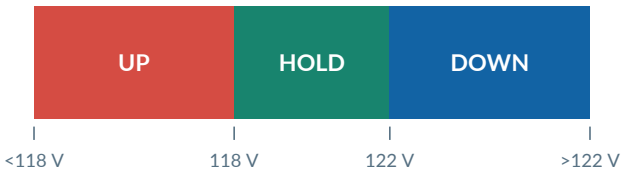
After changing OSC, check signal assignment, motor direction and Z-axis limits using TST with the plasma source disabled.

STABLE Z-AXIS CORRECTION

HYS - Hysteresis

Hysteresis creates a no-correction band around **Target Voltage**. It prevents continual small UP/DOWN changes from tiny fluctuations in the plasma voltage.

Example: Target 120 V / HyS 2 V



No movement inside the 118-122 V band

- A **lower HYS** value gives more sensitive height correction.
- A **higher HYS** value reduces oscillation but can reduce height accuracy.

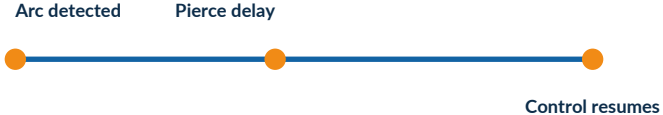
Example settings

Target 120 V with HYS 2 V gives an approximately **118-122 V** neutral band. Begin with HYS = 1 V and fine-tune if the axis hunts.

ALLOW TIME FOR STABLE CUTTING

DLY - Pierce Delay

During ignition and piercing, Plasma Voltage can be unstable. DLY temporarily delays normal height corrections while the arc stabilizes.



Ignore unstable voltage while piercing.

- Use a longer delay when thick material needs more pierce time.
- Avoid unnecessarily long delays, which postpone correction while the material height changes.

Reference starting value

A starting setting of **DLY = 1** can be adjusted according to the piercing time and stability of the arc.

VALID PLASMA DETECTION

LCU - Low Voltage Cut

LCU defines the minimum valid **Plasma Voltage** for automatic height correction. It prevents low or residual voltage from triggering unwanted motion before a stable cutting arc is established.

How to adjust LCU

- Set LCU above any persistent low reading seen when the plasma source is idle.
- Keep LCU below the usual Plasma Voltage during a stable cutting pass.
- If the controller does not detect a valid arc, check both the ratio wiring and LCU threshold.

Initial reference

A 40 V threshold is a practical reference. Verify the correct adjustment for your plasma equipment.

PREVENT UNWANTED TORCH DIVE

ANT - Anti-Dive

At the end of a cut or near an edge, Plasma Voltage may rise suddenly. Without protection, the THC may interpret the spike as an excessive cutting height and command the torch downward.

Plasma Voltage > Target Voltage + ANT

Temporary correction suppression

↓

Protects against end-of-cut torch dive

ANT suppresses height corrections when the measured value exceeds the Target Voltage plus the selected Anti-Dive margin.

Selection of protection margin

Set the ANT margin above normal cutting fluctuations so the protection operates during abnormal spikes rather than steady cutting.

REFERENCE COMPARISON

CAL - Plasma Calibration

CAL aligns a consistent difference between the displayed **Plasma Voltage** and a trustworthy reference measurement. This is a display/measurement adjustment, not a change to the physical plasma-source voltage.

Calibration sequence

- Check the wiring and selected 1:1 or 1:50 ratio first.
- Use a suitable calibrated meter and the correct procedure for the voltage involved.
- Apply only the correction necessary to align the JetCut reading with the reference.

High-voltage warning

Direct 1:1 measurements of energized plasma circuits require qualified personnel and properly rated test equipment. Never use a general low-voltage meter on raw arc voltage.

COMMISSIONING TOOLS

TST, ESC & Reference Values

TST - Test Z Axis

Runs an output test with sequential UP and DOWN status indications. Use it to verify CNC inputs and direction of movement without a cutting arc.

ESC - Exit Menu

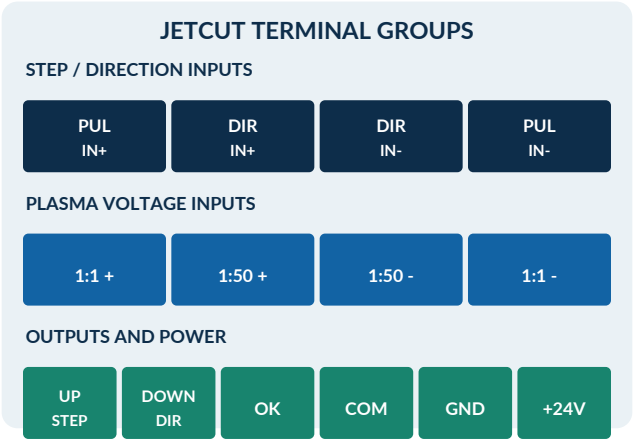
Returns to the normal display after completing parameter changes.

Parameter	Starting / reference value
OSC	0 = UDO / 1-14 = SD
HYS	1 V
DLY	1
CAL	0 V
LCU	40 V
ANT	80 V margin

READ ACTUAL TERMINAL LABELS

Connector Reference

This simplified terminal diagram follows the terminal functions shown on the JetCut housing. Terminal position and polarity must be checked directly on the device before connection.



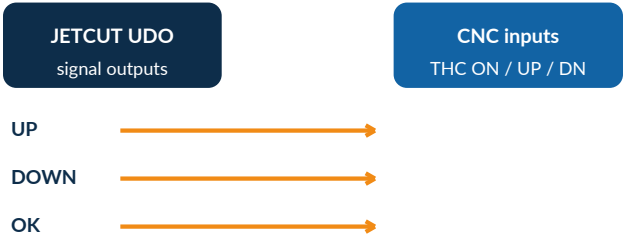
Terminal groups

- **Upper left:** PUL/DIR input pairs from the CNC motion controller.
- **Lower left:** separate 1:1 and 1:50 plasma-voltage measurement connections.
- **Right:** UP/STEP, DOWN/DIR, OK, COM, GND and +24V.

UDO MODE - OSC = 0

UP / DOWN / OK Control

In UDO mode, the controller issues separate **UP**, **DOWN** and **OK** signals. The CNC reads these inputs and controls Z-axis movement through its normal motion system.



Typical use

- Connect the optically isolated outputs to matching CNC or breakout-board inputs.
- Assign and verify ON/UP/DOWN input states in the CNC software.

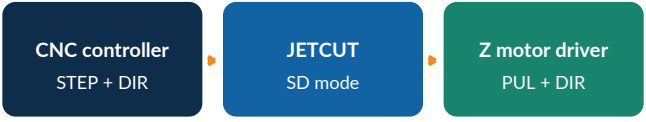
Electrical interface

The outputs are described as opto-isolated NPN open collector. Check the breakout-board input common, supply and required pull-ups.

SD MODE - OSC = 1-14

STEP / DIRECTION Control

In SD mode, JetCut generates Z-axis correction pulses and direction commands. The UP/STEP terminal is used for STEP pulses; DOWN/DIR is used for the direction command.



OSC sets output STEP pulse frequency.

Match direction, logic levels and driver limits.

- Set **OSC from 1 to 14** to select Step/Direction operation.
- Higher OSC values produce a higher stepper-motor correction speed.
- Check pulse and direction polarity, driver compatibility and safe Z-axis travel before cutting.

SD speed

Start with a low OSC value, test movement without plasma, then increase until the response suits the Z-axis mechanics.

SIGNAL-LEVEL INTERFACE

Optical Isolation & Pull-ups

JetCut uses **opto-isolated open-collector NPN outputs**. The receiving CNC or breakout-board input circuit must provide compatible signal referencing and pull-up voltage.

Signal	Function
UP / STEP	UP request or STEP pulses
DOWN / DIR	DOWN request or direction
OK	Arc/operation status output
COM	Common for isolated signal interface
GND	JetCut supply negative
+24V	JetCut supply positive

Pull-up example only

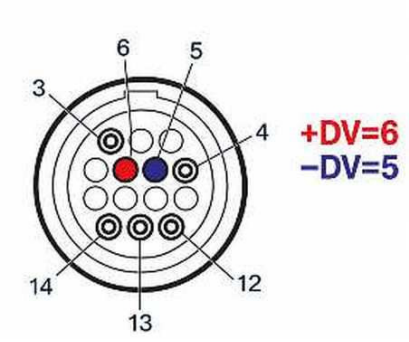
A **4.7 kohm** pull-up can be used as a signal-conversion example when 3.3/5 V TTL interfacing is needed. Use only if compatible with the actual breakout-board specifications. Do not bridge isolated commons blindly.

MEASURING ARC VOLTAGE

Arc-Voltage Connections

JetCut accepts **raw 1:1 arc voltage** or a **1:50 divided-voltage** signal. Use an approved divided-voltage output from the plasma cutter whenever available and match the input terminals to the chosen ratio.

Example: Hypertherm Powermax45



Illustrative 1:50 connector assignment: +DV = pin 6 and -DV = pin 5. Verify the exact connector and cutter revision before making connections. This pinout is not universal.

High-voltage safety

Never connect raw 1:1 arc voltage to divided-voltage terminals. All wiring must be performed with the plasma source safely isolated.

WIRING PRECAUTIONS

Before Connecting

Divided-voltage input

Use the matching +DV and -DV pair from the plasma source and connect it only to the JetCut 1:50 measurement input.

Direct arc-voltage input

The 1:1 interface carries hazardous DC voltage. Use only appropriately rated cables, insulation and protection. Keep high-voltage wiring away from sensitive control electronics.

Verify the CNC interface

Check JetCut supply polarity, the isolated signal common and the CNC input assignments. Verify the selected OSC mode before testing the Z axis.

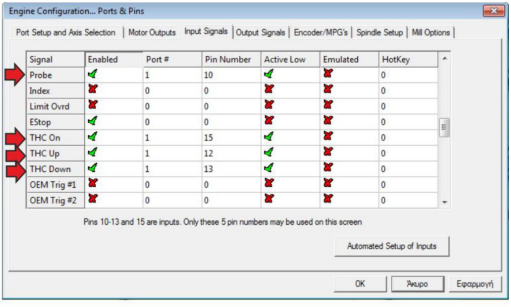
Installation restriction

Only qualified personnel should wire, inspect or measure energized plasma-voltage circuits.

CNC INPUTS - UDO

Mach3 Input Configuration

In Mach3, select **Config > Ports and Pins > Input Signals**, enable the required THC signals and enter the port, pin and active state for the breakout board.

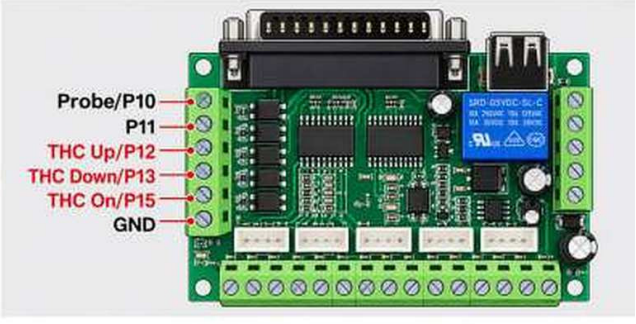


Example input	Mach3 pin
Probe	P10
THC Up	P12
THC Down	P13
THC On	P15

Example pins only. Verify wiring and active-state polarity on the actual breakout board.

Breakout Board and Z Axis

The breakout board receives JetCut output commands and passes corresponding signals to the CNC controller. Probe, THC Up, THC Down and THC On assignments must match the configured input channels.



Functional check

- With OSC = 0, use TST and check the relevant inputs in Mach3 diagnostics.
- Confirm that UP and DOWN request the intended Z-axis direction.

Board pin assignments vary between CNC controllers.

SOFTWARE PROTECTION

Mach3 THC Travel Limits

Mach3 can restrict automatic torch-height corrections to a defined travel range. Limits that are too narrow can stop useful movement; excessively wide limits can permit unsafe Z-axis travel.



The screenshot illustrates a change in THC Max and THC Min values. These are **examples only** and are not recommended settings for every machine.

Recommended procedure

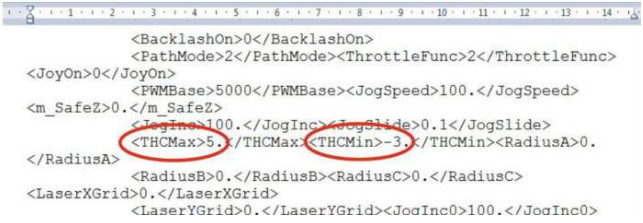
- Select limits for the actual axis travel, units and torch clearance.
- Perform a dry run before enabling the plasma cutting arc.

THC SETTINGS IN XML

Mach3 Profile Configuration

Some Mach3 installations store THC travel limits in the active machine-profile XML file. Prefer the settings inside Mach3 where available.

Plasma.XML



If profile editing is required

- Back up the machine profile and close Mach3 before editing.
- Confirm units, Z-axis limits and torch clearance when restarting.

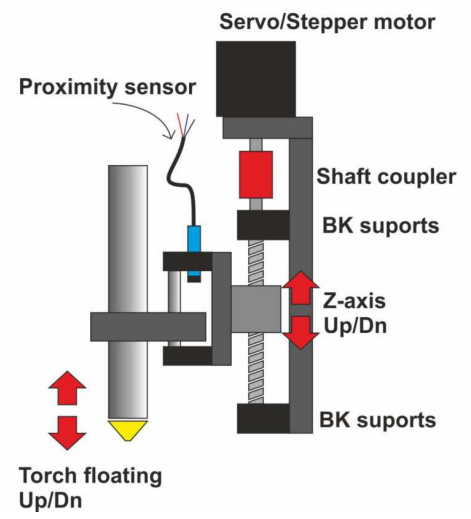
Check before cutting

Configuration changes must be validated through a controlled test without a live arc.

FINDING THE SHEET SURFACE

Probing and Floating Z Axis

Before piercing, the CNC may locate the metal surface with a floating torch holder and proximity sensor. This establishes the reference position used to set pierce height.

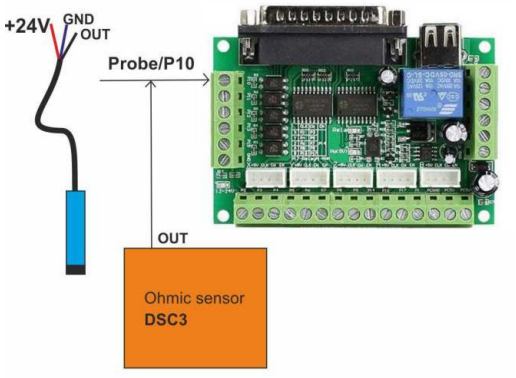


Configure probe offset and pierce height in the CAM post-processor or CNC software. Confirm correct retract motion and repeatability before cutting.

SENSING THIN SHEET METAL

Ohmic Probing and Z Axis

Ohmic probing detects electrical contact between torch and workpiece. It can improve surface measurement on thin sheet that may flex under a mechanical floating probe.



Shared probe inputs

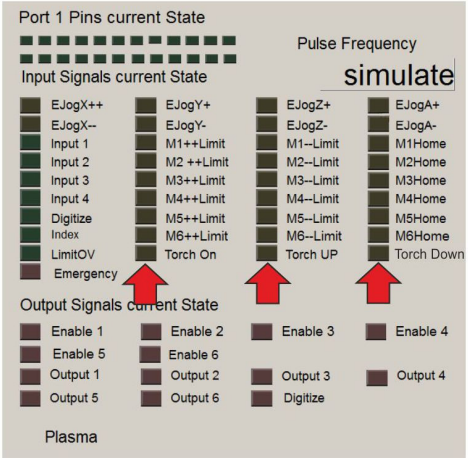
A proximity sensor and an ohmic module may share a probe input only when their output types, wiring references and electrical isolation are compatible.

Z-axis motion

Tune Steps per Unit, speed, acceleration and travel limits to the ballscrew and motor-driver settings.

Testing and Commissioning

After checking connections, use **TST** with the plasma arc disabled. Observe the ON, UP and DOWN inputs in Mach3 diagnostics while each output is activated.



Confirm the actual movement direction of the Z axis, the selected OSC interface and the signal polarity before cutting.

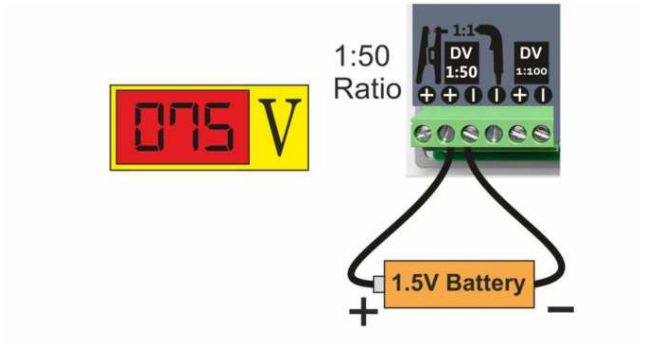
If signals do not respond

Check the input mapping, common/reference wiring, opto-isolated interface and output polarity.

SAFE 1:50 REFERENCE CHECK

Voltage Readings

A known low-voltage reference can be used to illustrate scaling at the divided-voltage input. With a 1:50 ratio, a 1.5 V input corresponds to approximately 75 V on the display.



Calibration

If a correctly rated reference measurement and Plasma Voltage disagree consistently, the CAL function can correct the displayed value. First verify the ratio and wiring.

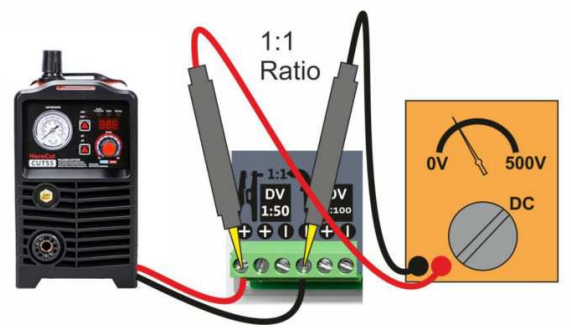
Never use raw voltage here

This is a low-voltage example only. Do not apply direct 1:1 plasma voltage to the 1:50 input.

REFERENCE-MEASUREMENT PRECAUTIONS

CAL - Display Calibration

CAL adjusts a fixed difference between the JetCut Plasma Voltage display and a suitable external reference meter. It does not change the actual arc voltage generated by the plasma source.



The illustration shows the general relationship of a reference meter and an arc-voltage measurement input. **Do not reproduce an energized test without qualified high-voltage procedures.**

High voltage warning

Any direct 1:1 measurement of an energized plasma circuit requires rated instruments, appropriate isolation and qualified personnel.

COMMISSIONING SEQUENCE

Quick Setup Checklist

- Confirm 24 VDC supply polarity and all terminal connections.
- Select a suitable 1:1 or 1:50 Plasma Voltage interface.
- Set OSC = 0 for UDO or OSC = 1-14 for Step/Direction operation.
- Configure CNC inputs, STEP/DIR routing, Z-axis travel and safety limits.
- Set probe offset, pierce height and appropriate machine coordinates.
- Run TST with the plasma source disabled and check output signals.
- Verify physical torch movement direction with restricted Z-axis travel.
- Adjust Target Voltage during a stable straight cut.
- Review HYS, DLY, LCU, CAL and ANT as required.

Electrical safety

Do not change power or signal wiring while equipment is energized.

FAST REFERENCE

Troubleshooting

Symptom	What to check
No Plasma Voltage	Source voltage, divider ratio, LCU, polarity and terminals
Wrong Z direction	Driver polarity, CNC mapping and motor direction
Z axis hunts	HYS and voltage stability
Correction during piercing	DLY and pierce sequence
Torch dives at cut end	ANT voltage margin and end-of-cut behavior
No CNC response	TST, input assignment, COM and pull-up compatibility
Wrong voltage reading	Measurement ratio and CAL reference check

AQTRONIC support

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CONTROL SETTINGS

Parameter Quick Reference

Parameter	Description
Target Voltage	Cutting-height voltage reference
Plasma Voltage	Measured cutting-arc voltage
OSC = 0	UP / DOWN / OK output interface
OSC = 1-14	Step/Direction interface and motor speed
HYS	Hysteresis band
DLY	Pierce Delay
CAL	Plasma Voltage Calibration
LCU	Low Voltage Cut
ANT	Anti-Dive voltage margin
TST	Output and Z-axis test
ESC	Exit parameter menu



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