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ALPHA THC SD

PROFESSIONAL TORCH HEIGHT CONTROL



OPERATION MANUAL

Torch Height Controller

Step / Direction • ALPHA THC SD

The THC (Torch Height Controller) automatically controls the height of the plasma torch during cutting. It monitors arc voltage and adjusts Z-axis motion to maintain the specified distance between the torch and the sheet metal, even when the surface is not perfectly flat.

Technical Specifications

Supply Voltage	24 VDC nominal (12-48 VDC)
Current Consumption	120 mA (3W)
Plasma Voltage Input	Photoelectrically isolated
Control Outputs	Optically isolated
Supported Plasma Voltage Ratio	1:1 and 1:50
Anti-Dive Input	Active LOW
Minimum Plasma Voltage	40 VDC
Maximum Plasma Voltage	600 VDC

SAFETY REMINDER

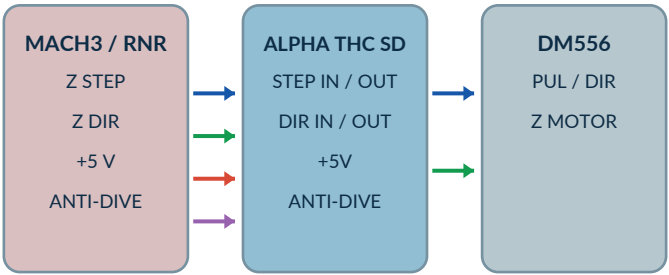
Disconnect the main power to the plasma source and CNC before installation, wiring, inspection or maintenance. Follow the plasma manufacturer's discharge and safety instructions.

Safety Warning - High Voltage

Electric shock can cause serious injury or death. The plasma circuit uses hazardous DC voltages; during cutting, the torch, workpiece and electrically connected parts form part of that circuit.

- Do not touch the torch, workpiece, arc-voltage measurement terminals or exposed conductors while the plasma is energized.
- Before installation, wiring, inspection or maintenance, disconnect the main power to both the plasma source and the CNC. Follow the prescribed lockout/tagout procedure and wait for the discharge time specified by the plasma manufacturer.
- The OFF position of a control or switch does not guarantee that all internal circuits are de-energized. Do not open the plasma power supply or work on live circuits unless you are a properly qualified technician.
- For arc-voltage measurement, use the factory-provided divided-voltage output when available. A direct 1:1 connection must be treated as a high-voltage circuit and must use suitable insulation, wiring and protection.
- Keep your body, gloves, footwear and working area dry. Use appropriate insulating equipment and proper grounding in accordance with the plasma manufacturer’s instructions and applicable electrical codes.
- Installation and maintenance must be performed by personnel familiar with the hazards of plasma systems. Read the plasma power-source manufacturer’s safety instructions before operation.

STEP / DIRECTION Connections



- Mach3/RNR Z STEP → ALPHA THC STEP IN
- Mach3/RNR Z DIR → ALPHA THC DIR IN
- Mach3/RNR +5 V → ALPHA THC +5V
- Mach3/RNR ANTI-DIVE → ALPHA THC ANTI-DIVE
- ALPHA THC STEP OUT → Z driver STEP/PULSE input
- ALPHA THC DIR OUT → Z driver DIR input

RNR Motion and DM556

The RNR Motion board serves as an interface between the computer/Mach3 and the CNC control system. For this application, the DM556 must be set to 400 pulses per revolution. For a typical 1.8° stepper motor, this corresponds to SW5 = OFF, SW6 = ON, SW7 = ON, SW8 = ON. The full wiring diagram is provided at the end of this manual.

ANTI-DIVE

The ANTI-DIVE function prevents incorrect Z-axis adjustments when cutting speed decreases, such as at corners, small holes or contours, lead-in/lead-out sections, and near the end of a cut. Under these conditions arc voltage may rise temporarily, causing an active THC to incorrectly interpret the increase as the torch moving away from the sheet and attempt to lower it.

To use the ALPHA THC SD ANTI-DIVE input automatically, the CAM/post-processor and CNC controller must be configured to output the relevant signal along selected parts of the toolpath. In CAM software such as SheetCam, this can be done with Path Rules, for example at corners, small shapes, lead-ins and lead-outs. The rules must be selected in the specific cutting operation and generate appropriate commands for the Mach3/RNR setup.

When ANTI-DIVE is activated, the ALPHA THC SD temporarily suspends height corrections and holds the Z axis steady. Height control can resume after leaving the designated region. The ALPHA THC SD ANTI-DIVE input is Active LOW.

Settings

1. TARGET VOLTAGE

Adjustable from the main display • Example: 120 V

The desired arc voltage around which the ALPHA THC SD maintains cutting height. It is changed from the normal display using the UP/DOWN buttons.

Start with the voltage corresponding to the actual correct cut height, and make small changes during a straight cut at constant speed. The correct value depends on the plasma system, torch, current, material and speed.

After power is connected, the display shows three dashes (---), indicating standby until arc voltage is detected. During cutting, the unit monitors voltage and applies the necessary Z-axis corrections. Target Voltage can also be changed during cutting.

2. OSC - Oscillation

Factory setting: 14

OSC sets the speed of Z-axis movement during cutting. It changes the STEP pulse frequency and therefore the speed with which the torch responds to height corrections.

Reducing OSC slows Z motion and makes the torch response gentler.

3. HyS - Hysteresis

Range: 1-15 V • Factory setting: 1 V

Creates a zone around TARGET VOLTAGE in which the UP/DOWN control signals remain inactive.

A lower value gives more sensitive correction; a higher value produces calmer motion. Start at 1 V.

4. dLy - Delay

Range: 1-15 s • Factory setting: 1 s

Sets the delay after the cutting arc is detected before normal height correction starts.

A lower value engages sooner; a higher value allows more time for piercing and stabilization.

5. CAL - Calibration

Range: -35 to +35 V • Factory setting: 0 V

Corrects a fixed difference between the ALPHA THC measurement and a reliable external reference.

Use CAL only for a constant offset, after comparing against a suitable external measuring instrument. Example: reference 120 V; THC reading 117 V; CAL +3 V.

6. LCU - Low Voltage Cut

Range: 40-99 V • Factory setting: 40 V

The lower limit of the voltage range in which control is permitted. Below this value, control outputs are disabled.

Keep this setting sufficiently below the normal cutting arc voltage.

7. ANT - High Voltage Cut

Range: 0-150 V • Factory setting: 30 V

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
ANT suppresses height corrections when the measured value

exceeds the Target Voltage plus the selected Anti-Dive margin.

8. AdE - Anti-Dive Enable / Disable

Values: 0 / 1

Determines whether the optional Anti-Dive input is used or bypassed.

When Anti-Dive is not used and its input remains open, the ALPHA THC SD interrupts communication to the Z axis. Therefore, set AdE to 1 if this feature is not used.

9. TEST

TEST function

Simulates controller operation so that Z-axis motion can be checked without a normal cutting cycle.

Use it during commissioning to verify the correct Z-axis direction and the STEP/DIR signal chain.

10. ESCAPE

Exit the parameter menu

Use UP/DOWN to select the menu exit. After making adjustments, select ESC and verify on the main display that TARGET VOLTAGE is set correctly.

Troubleshooting

TARGET VOLTAGE

If the torch moves too close to or tends to touch the workpiece during cutting, gradually increase the Target Voltage. Conversely, if the torch is too high and moves away from the workpiece, gradually decrease Target Voltage until the desired cutting height is achieved.

OSC - Oscillation

When cutting sharp or large curves, if the torch cannot follow changes in sheet-metal height quickly enough and tends to touch the sheet, gradually increase OSC. This increases the response/correction speed of the Z axis.

HyS - Hysteresis

HyS defines the range around Target Voltage within which the THC does not make continuous small corrections. If the Z axis makes excessively frequent small up-and-down movements, a slight increase in HyS may help. However, an excessively high value reduces the accuracy of maintaining the desired cutting height.

dLy - Delay

If the torch does not remain steady during piercing and immediately after arc ignition, or if the THC starts correcting height before the arc stabilizes, increase dLy. The delay allows the plasma system to finish piercing and the arc to stabilize before automatic height control begins.

CAL - Calibration

If the arc voltage displayed by the ALPHA THC SD differs from the value measured with a suitable external measuring instrument, the reading may be corrected using CAL. Calibration mainly aligns the displayed value with the reference. A small display difference does not necessarily mean the THC cannot control height correctly, because control is based on the relationship between measured voltage and the selected Target Voltage.

LCU - Low Voltage Cut

When the plasma is in standby and no arc is active, the ALPHA THC SD should normally be outside the active control range. If residual voltage or electrical noise causes the THC to continue detecting a voltage above the lower limit, gradually increase LCU until the display returns to three dashes (---). The setting must remain below the actual arc voltage during normal cutting.

ANT - High Voltage Cut

If the torch tends to dive suddenly toward the sheet at the end of a cut, gradually decrease ANT. As the arc leaves the material or the cut stops, arc voltage may increase abruptly. ANT sets an upper limit so the THC stops height corrections when this value is exceeded instead of interpreting the sudden voltage change as an actual change in cutting height.

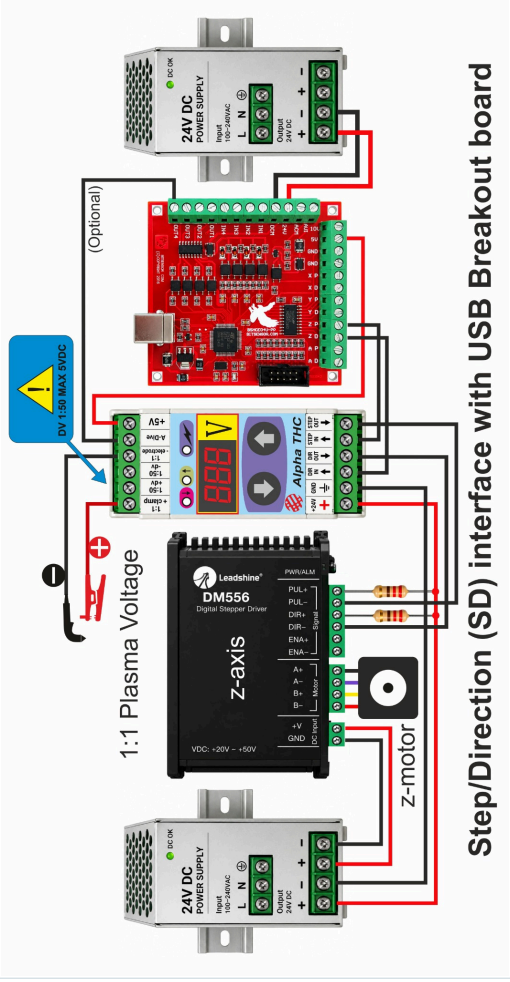
AdE - Anti-Dive Enable / Disable

Check that AdE matches the way the ANTI-DIVE input is used. With an external Anti-Dive signal from the CNC, the ALPHA THC SD can temporarily suspend Z-axis corrections in the relevant toolpath regions. If the ANTI-DIVE input is not used, configure the parameter according to the operating instructions so that communication of the Z signals is not blocked.

Quick Settings Reference

TARGET VOLTAGE	From main display · e.g. 120 V
OSC	Factory: 14
HyS	1-15 V · Factory: 1 V
dLy	1-15 s · Factory: 1 s
CAL	-35 to +35 V · Factory: 0 V
LCU	0-99 V · Factory: 40 V
ANT	0-150 V · Factory: 30 V
AdE	0 / 1 · Set to 1 if Anti-Dive is unused
TEST	Checks Z-axis motion without cutting
ESC	Exits the parameter menu

Values are reproduced from the parameter descriptions in this manual.


Step/Direction (SD) interface with USB Breakout board
24V DC POWER SUPPLY
Input 100~240VAC
Output 24V DC
DC OK
(Optional)
DV 1:50 MAX 5VDC
1:1 Plasma Voltage
Alpha THC
Leadshine
DM556
Digital Stepper Driver
z-axis
PWR/ALM
PUL+
PUL-
DIR+
DIR-
ENA+
ENA-
Signal
A+
A-
B+
B-
Motor
+V
GND
DC Input
VDC: +20V ~ +50V
z-motor



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