MiniTHC 2

MANUAL

APR 27 2016

www.minithc.com

(i) to switch THC language, press and hold knob for 7 seconds.

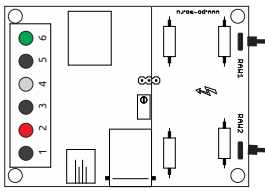
(i) para cambiar el idioma de THC, mantenga pulsada la perilla durante 7 segundos.

(i) для переключения языка, нажмите и держите регулятор 7 секунд.

Table of Contents

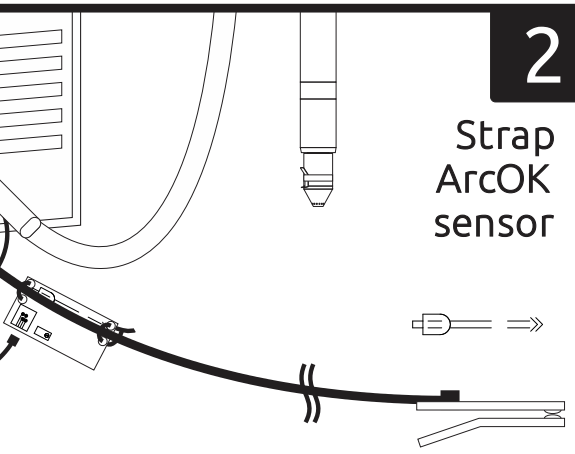
1

Connect
raw arc voltage



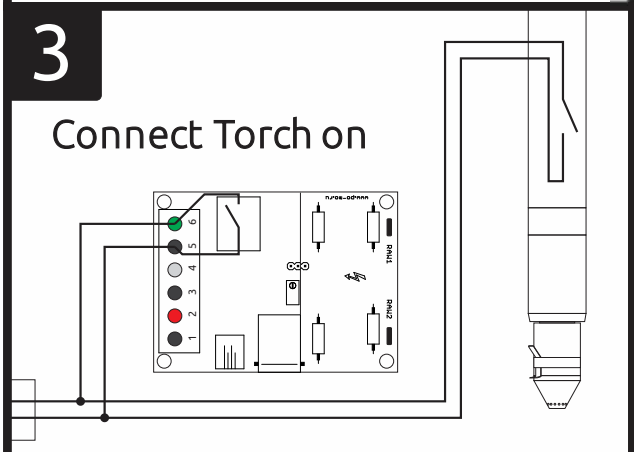
2

Strap
ArcOK
sensor



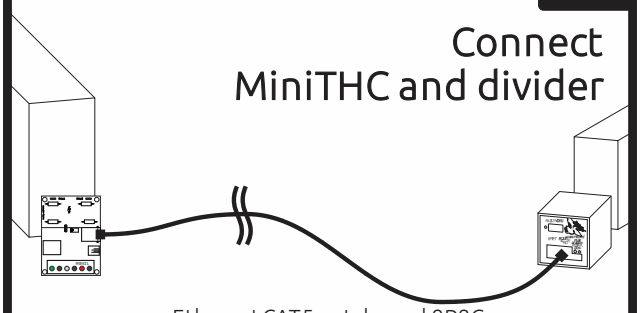
3

Connect Torch on



4

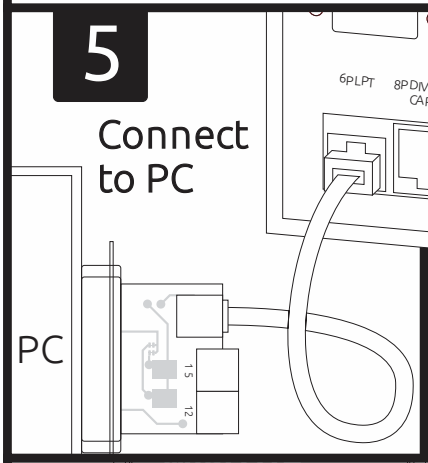
Connect
MiniTHC and divider



Ethernet CAT5 patch cord 8P8C
(max 30 m / 100 ft)

5

Connect
to PC



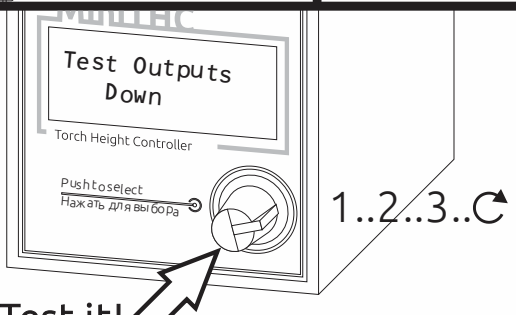
6

Connect
power

7

Run setup

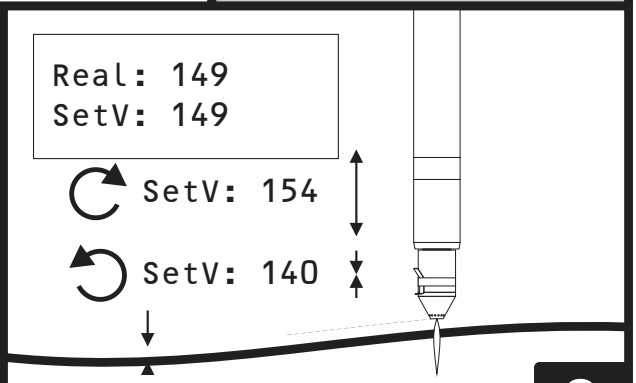
8



Test it!
Press knob
3 times

- ☐ Torch On
- ☐ Torch Up
- ■ Torch Down

9

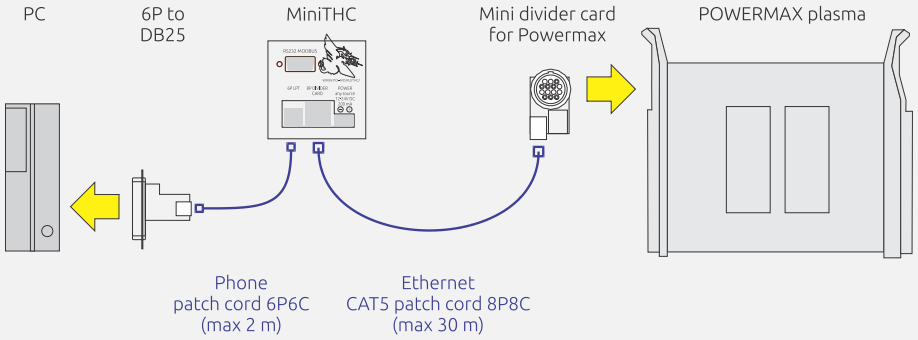


Cut!

INSTALLATION

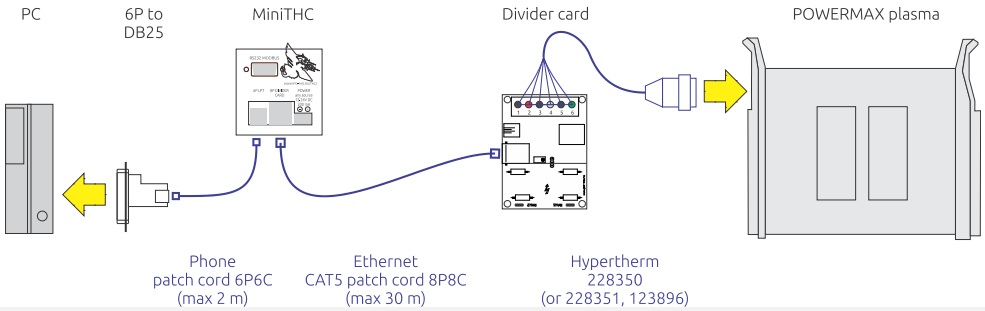
(!) IMPORTANT: Do not cut or crimp twisted pair cable while the MiniTHC is turned on.
This can lead to failure of the power supply module inside MiniTHC (see *Repair*).

Installation for Hypertherm Powermax using Minidivider for Powermax
(*Thermal Dynamics requires an Automation Interface Card with voltage output)



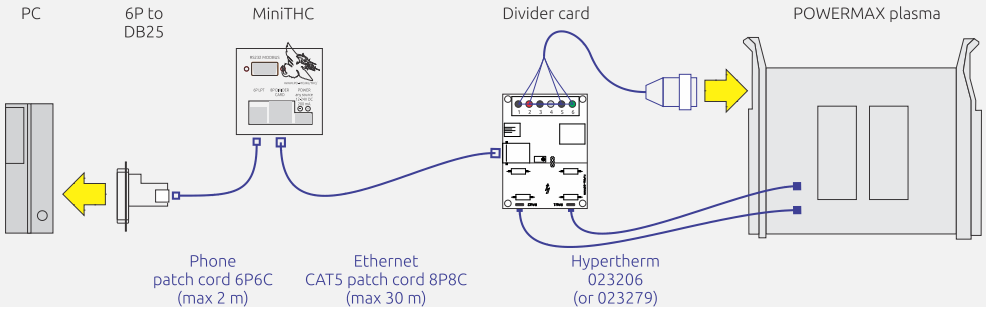
Powermax 45
Powermax 65
Powermax 85
Powermax 105
Powermax 125
TD Cutmaster A60 *
TD Cutmaster A80 *
TD Cutmaster A120 *
TD Cutmaster 52 *
TD Cutmaster 82 *
TD Cutmaster 102 *
TD Cutmaster 152 *

Installation for Hypertherm Powermax using interface cable 228350



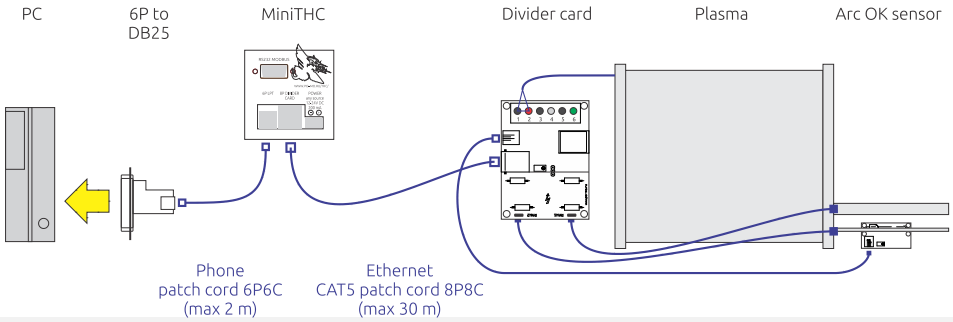
Powermax 45
Powermax 65
Powermax 85
Powermax 105
Powermax 125

Installation for Hypertherm Powermax using interface cable 023206



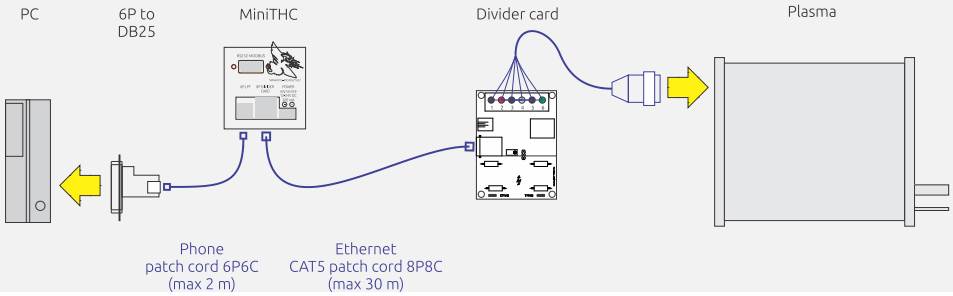
Powermax 45
Powermax 65
Powermax 85
Powermax 105
Powermax 125
Powermax 1250
Powermax 1650

Installation for any plasma cutter



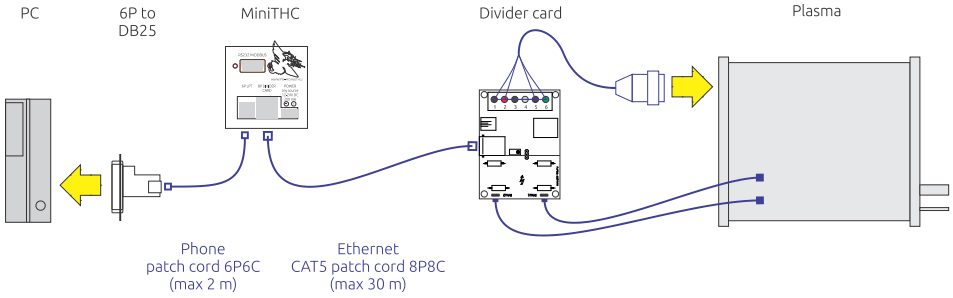
Any plasma

Installation for plasma cutter with interface port
(the cutter has a built-in divider 50:1)



Thermal Dynamics:
AutoCut 100
AutoCut 200

Installation for plasma cutter with interface port
(the cutter has no built-in divider)



Kjellberg Cutfire 100i
Kjellberg PA-S
Kjellberg FineFocus

Helvi PC123

Sibir 140PR CNC

Jackle Plasma 110i
Jackle Power Plasma 2

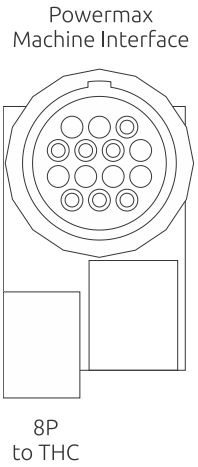
Delivery Set

1. MiniTHC (head unit)
2. THC-LPT adapter (8P to DB25), including cable
3-A. Either Minidivider
3-B. Either Universal divider, including Hall current sensor and its cable
4. Patch cord cable (optional)

Dimensions

	Dimensions in mm:	Installation size in mm:	Weight in g:
MiniTHC (head)	72 × 72 × 100	67 × 67 × 80 (depth)	148
Minidivider	54 × 35 × 37		
Universal Divider (v3)	87 × 64	80 × 57	65

Minidivider for Powermax



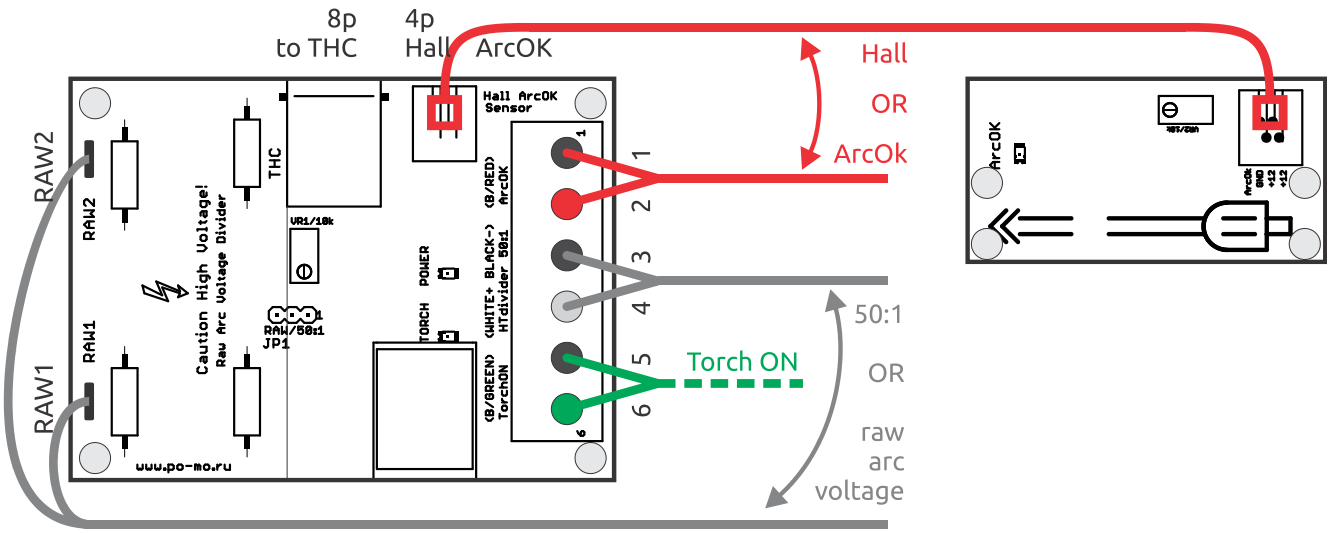
This is a smaller version of a universal divider card. It is only suitable for Hypertherm Powermax 45, 65, 85, 105, or 125, a Thermal Dynamics Cutmaster A60, A80, A120, 52, 82, 102, or 152 with the round 14-pin CPC connector on cutter.

Strictly speaking, it is not a "divider" card because it does not have a high voltage divider (and there is no Hall current sensor). Minidivider Powermax utilizes a built-in divider set to 50:1 in Powermax cutters and for connecting into CPC interface connector. The Minidivider is not suitable for Powermax 1250 or 1650, since they do not have the built-in divider. As in a universal divider, the Minidivider card has a "Torch on" relay on board.

When using a Minidivider for Powermax, the universal divider and the Hall current sensor are not required.

Skip chapter Installation, next see *Probe sensors*.

Universal Divider



Jumper JP1	1-2 use a low voltage from the cutter with built-in divider “50:1”
	2-3 use a “RAW” voltage (high voltage) divider on board
RAW1, RAW2	high voltage input contacts
Hall ArcOK Sensor	4P connector for Hall current sensor
123456 Terminal	for Hypertherm interface cable

	1-2 ArcOK input, shorting two contacts indicates work arc
	3-4 low voltage input (50:1 ratio)
	5-6 Torch On relay output
THC	8P connector for head unit THC (patch cord)

Installation into a plasma cutter

For proper operation, a THC divider card must be connected to the plasma cutter, and must obtain the actual arc voltage and "work arc" signal. Also, both divider cards have a "Torch On" relay on board.

1. Voltage input: THC measures the voltage of the plasma via a high voltage divider (raw arc input) or a low voltage input using a built-in divider (50:1) in the plasma cutter.

2. Work arc input (Arc OK): via Hall current sensor or a plasma cutter output.

3. Torch On output: connected parallel to button on torch or into connector on the plasma cutter (if provided).

Which divider to use?

For Hypertherm Powermax 45, 65, 85, 105, or 125, a Thermal Dynamics Cutmaster A60, A80, A120, 52, 82, 102, or 152 is a preferable Minidivider for Powermax - it connects directly into the CPC interface connector on the plasma cutter.

For all other cutters, you should use a universal divider.

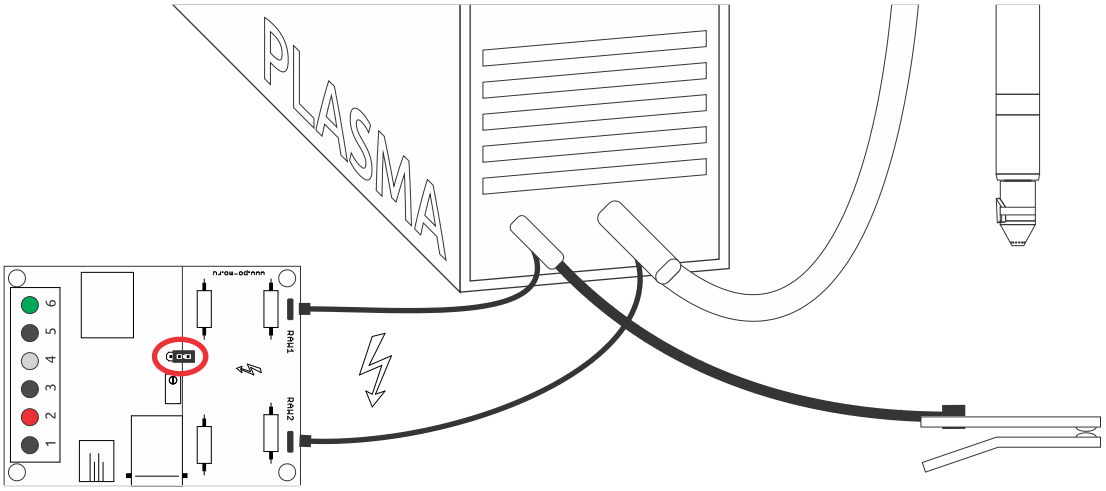
If your plasma cutter has a built-in divider 50:1, you can connect the divider card for using this low voltage. This is the preferred option.

All Hypertherm Powermax cutters have a built-in divider, set by default to 50:1. To use the built-in divider in Hypertherm Powermax, you will need an interface cable Hypertherm 228350 (or 228351 or 123896). In cables 023206 and 023279, the voltage wires are not connected.

While connecting to the built-in divider 50:1, the low voltage wires are connected to the two middle connectors of the 6-pin terminal, which ensures polarity. Set the jumper JP1 on the divider in position 1-2 (50:1).

While connecting the raw (high) arc voltage, the two wires must be connected to the two terminals, RAW1 RAW2, on the edge of the divider board. There is no polarity. Set the jumper JP1 on the divider in position 2-3 (RAW).

Connecting the High-Voltage Divider



THC is able to use a raw (high) arc voltage if the plasma cutter does not provide built-in divider 50:1.To get a high arc voltage, you will need to take the arc voltage of the plasma cutter (according to the manual) and connect the wires to the high voltage inputs on the divider card

For Hypertherm Powermax cutters, see the appropriate section.

Connect the two wires to the high voltage divider contacts (the two tips on the edge of the board marked RAW1 and RAW2), no polarity. Set the jumper JP1 in position 2-3 (RAW).

(!) IMPORTANT: Do not measure the raw arc voltage with a digital multimeter; only measure with an analog one.

(!) IMPORTANT: Make the wires connected to the divider as short as possible. These wires are powerful EM interference "transmitting antenna."

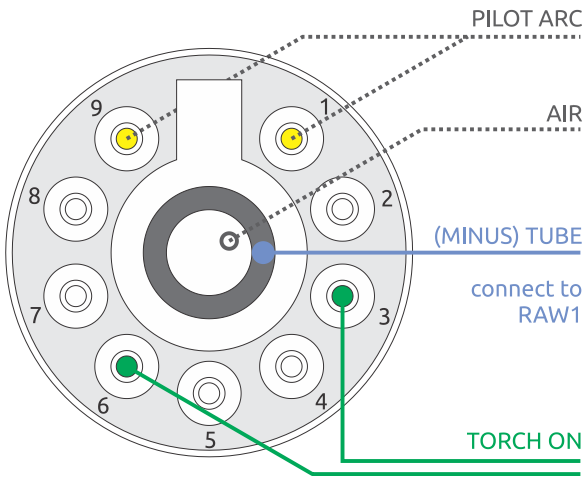
(!) IMPORTANT: Properly insulate high voltage wires! When connecting the raw (high) arc voltage, the spark can "jump" onto the cutter case or mounting screws holding the divider board.

Connecting to the Central Adaptor (CE)

You can also get a raw (high) voltage by connecting one wire to the torch wire, and the second wire to the ground clamp.

Most modern torches have a Central Adaptor (CE) connector. In this type of connector, the power wire is the central air tube. Connect one wire to the tube. Connect the second wire to the ground clamp.

The illustration shows the view from the torch, Trafimet reference pinout. Other pinouts may vary. Be sure to



check that the “Torch On” contact is located the same way before turning on the plasma.

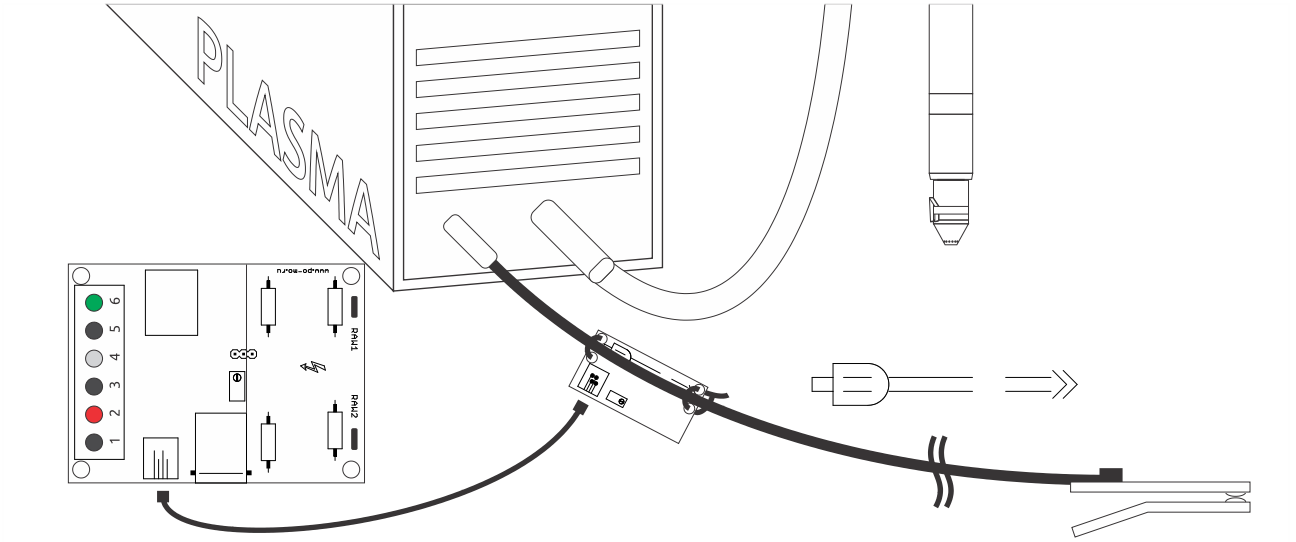
Connect pin RAW1 to the central tube connector Central Adaptor; connect RAW2 to the ground clamp.

Connect the “Torch On” pins to the divider card (pins 5 and 6).

Test the High Voltage Input

Plug the two high voltage contact inputs RAW1 and RAW2 into the wall plug (230 V or 120 V). On the screen, you should see the voltage 160V or 85V, accordingly.

Connecting the Hall sensor ARC OK

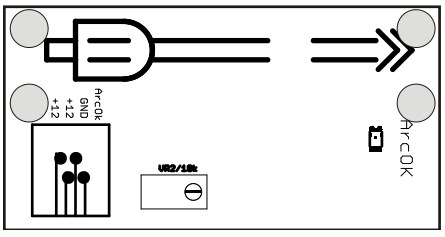


While the torch is on, the cutter first starts the pilot arc (the arc inside the torch), and then pilot arc transfers to the metal sheet (work arc), or is extinguished after 2-5 seconds . Cutting is possible only with the work arc.

The THC should receive the ARC OK signal (work arc) from the plasma cutter **or** the Hall current sensor.

The Hall current sensor is connected only to those devices that do not provide an ARC OK signal (Arc good, XFER, Transfer, Start machine motion, Motion, OK TO MOVE, DIV_FINISH, Transfer arc on, Main arc on).

Hall Sensor



The Hall sensor is a standard 3-wire PNP NO normal open sensor 12 volts. The arrangement of contacts are as follows: Output, GND, +12, and +12.

Place the ground clamp cable from the plasma cutter above the arrow mark on the sensor; fasten the sensor to the cable with two cable ties through the holes on the board. The arrow mark should be pointed in the direction of the clamp (worktable).

Hall sensor uses a standard cable 4p4c for the handset (mirrored pinout).

Hall Sensor Calibration

Turn the variable resistor VR2 until the ARC OK LED light turns on. Slowly turn the VR2 in the opposite direction until the ARC OK LED goes off.

Check if the Hall sensor works properly:

The sensor should respond to a magnetic screwdriver (depending on the orientation of a screwdriver).

The THC should not provide the ARC OK signal, as long as the pilot arc fires in the air (away from the metal).

The THC should provide the ARC OK signal; when the pilot arc "feels" a metal sheet, a current flows through the ground clamp cable and the arc turns into a work arc.

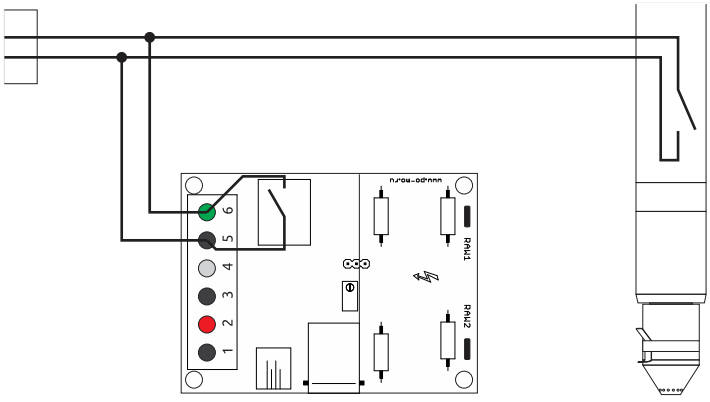
Putting the ARC OK signal in "always on" state

In rare cases, some plasma cutters may need to set the ARC OK signal into a state of “always on.” Therefore, the THC will not see the difference between the pilot and the work arc, and, when any voltage appears, it immediately begins corrections.

To put it in an “always on” state, short contacts 1-2 at the 6-pin connector on the divider board.

1-2: black / red ARC OK

Torch On relay



The THC can control torch on and off. The divider board has a fully galvanic isolated relay. To turn the torch on, the relay closes contacts 5 and 6 at the divider board.

To connect the Hypertherm Powermax, use the interface cable.

For other cutters, connect the button on the hand torch (or mechanized torch safety line) to the divider.

5-6: black / green Torch ON

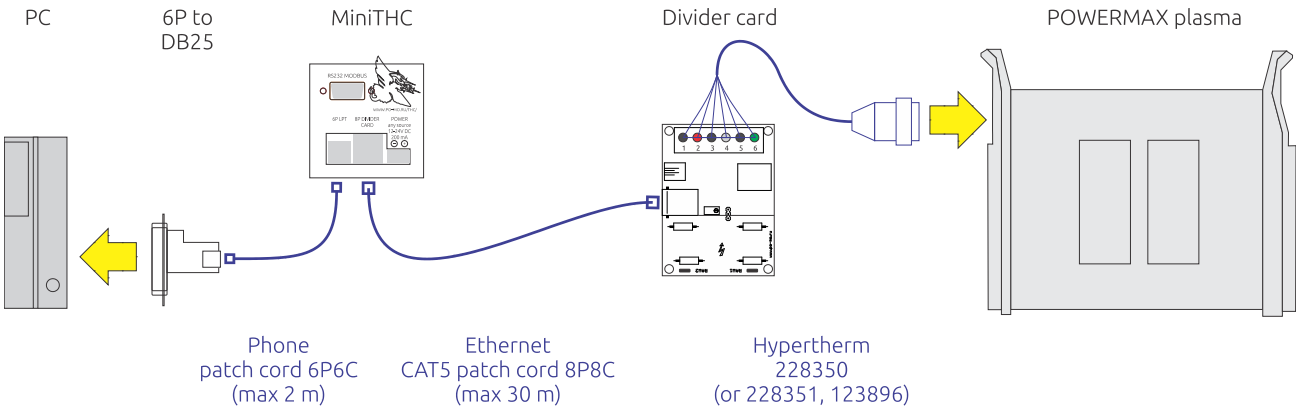
Most modern cutters utilize a Central Adaptor (CE) connector. Find the two thin wires in CE connector that are connected to the button at the torch (if you are using a hand torch), and connect the relay outputs on the THC divider board parallel to these wires.

(!) IMPORTANT: Please note that, on plasma cutters with a high frequency (HF) start, wires to the button often causes strong electromagnetic interference.

The button on the torch will work parallel to the THC relay. Please note that, with a parallel connection, "safety protection against accidental activation while changing consumables" will not work, as it simply breaks the circuit to the button when you unscrew the cap. The machine can turn the torch on when you change consumables.

Examples of Installation for Specific Plasma Cutters

All Hypertherm Powermax with Interface Cable 228350



Using interface cable Hypertherm 228350, it is very easy to connect Powermax to the THC. You only need to connect three pairs of wires from the interface cable to the 6-pin connector to the specified color on the divider board:

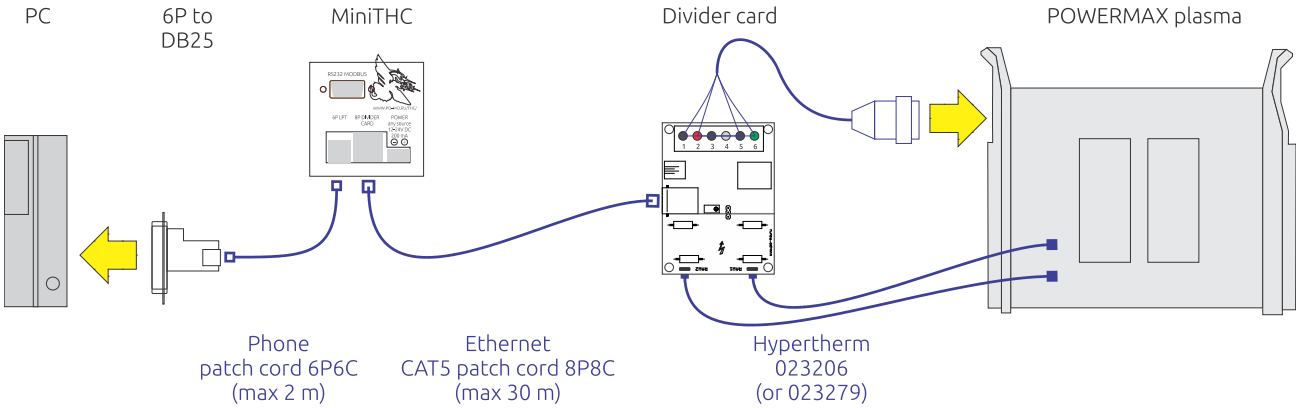
1-2: black / red	ARC OK
3-4: black (−) / white (+)	DIVIDER 50:1. Pay attention to polarity!
5-6: black / green	Torch ON

Set the jumper JP1 on the divider in position 1-2 (50:1).

Check that the built-in divider of Powermax is set to the default value of 50:1.

Connection of the Hall current sensor is not required.

All Hypertherm Powermax with Interface Cable 023206



If you are using interface cable Hypertherm 023206, it will have three pairs of wires, but only two pairs of wires will be connected (ARC OK and TORCH ON). A white-black pair of wires (divided voltage) will not be connected.

Tip: You can modify the interface cable to connect contacts 5 and 6 in the CPC connector to an unused pair of wires, white-black, and use this cable as a regular cable 228350.

Standard Option: You have to use the two pairs of wires used in the interface cable to transmit signals ARC OK and TORCH ON, and bring a separate wire with the raw arc voltage. To get the raw arc voltage, please refer to the "Machine Interface for Raw Arc Voltage" manual at the Hypertherm website.

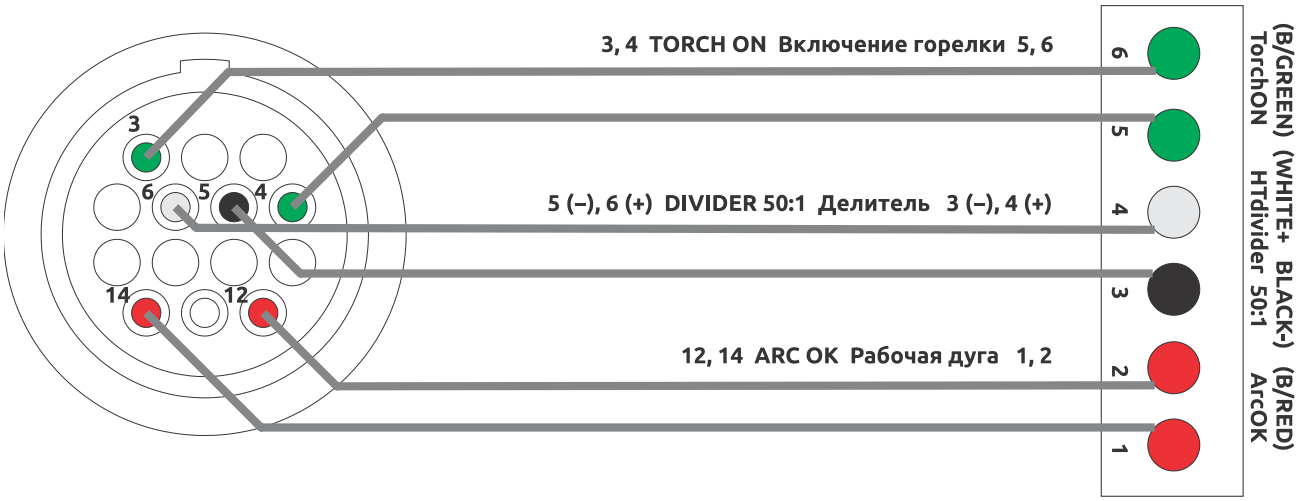
These wires must be connected to the high voltage divider inputs RAW1 and RAW2. Set the jumper JP1 on the divider in position 2-3 (RAW).

Connect the two pairs of wires from the interface cable to the specified colors on the 6-pin connector divider:

1-2: black / red	ARC OK
5-6: black / green	Torch ON

Connection of the Hall current sensor is not required.

Hypertherm Powermax Interface Connector



Pin number in the interface connector	Signal	Wire in the cable,	Contact at divider	Signal description
12, 14	ARC OK	black / red	1, 2	Work arc
5	DIVIDER 50:1	black (–)	3	Minus of HT divided 50:1 voltage
6	DIVIDER 50:1	white (+)	4	Plus of HT divided 50:1 voltage
3, 4	TORCH ON	black / green	5, 6	Torch On

Drawing of cutter connector, outside view.

Colors shown as the standard factory cable Hypertherm. Inside the cutter box, the wire colors on the interface may vary.

Hypertherm Powermax 105 and 125

Using the Minidivider: Just insert the Minidivider into the CPC connector and turn it until it clicks.

With interface cable Hypertherm 228350 - see *All Hypertherm Powermax with interface cable 228350*.

With interface cable Hypertherm 023206, it is necessary to bring the wire with raw arc voltage from the plasma cutter. According to the "Machine Interface for Raw Arc Voltage" manual at the Hypertherm website, it is J28 and J27. Next, see *All Hypertherm Powermax with 023206 interface cable.*

To connect without an interface cable, see *Hypertherm Powermax interface connector*

Hypertherm Powermax 65 and 85

Using the Minidivider: Just insert the Minidivider into the CPC connector and turn it until it clicks.

With interface cable Hypertherm 228350 - see *All Hypertherm Powermax with interface cable 228350.*

With interface cable Hypertherm 023206, it is necessary to bring the wire with raw arc voltage from the plasma cutter. According to the "Machine Interface for Raw Arc Voltage" manual at the Hypertherm website, it is contacts J28 and J26 for CSA models, and contacts J29 and J27 for CE models. Next, see *All Hypertherm Powermax 023206 interface cable.*

To connect without an interface cable, see *Hypertherm Powermax interface connector*

Hypertherm Powermax 45

Using the Minidivider: Just insert the Minidivider into the CPC connector and turn it until it clicks.

With Interface cable Hypertherm 228350 - see *All Hypertherm Powermax interface cable 228350.*

With interface cable Hypertherm 023206, it is necessary to bring the wire with raw voltage from the plasma cutter. According to the "Machine Interface for Raw Arc Voltage" manual at the Hypertherm website, it is

contacts J19 and J21 (for 400-volt CE and 480-volt models, contacts J18 and J21). Next, see *All Hypertherm Powermax 023206 interface cable.*

To connect without an interface cable, see *Hypertherm Powermax interface connector.*

Hypertherm Powermax 1650, 1250

With interface cable Hypertherm 023206, it is necessary to bring the wire with raw arc voltage from the plasma cutter. According to the manual on the Hypertherm website, it is contacts J15 and J16. Next, see *All Hypertherm Powermax 023206 interface cable.*

To connect without an interface cable, see *Hypertherm Powermax interface connector.*

Hypertherm interface cable 223327-223332

This interface cable utilizes voltage levels to transmit signals. Do not connect this interface cable directly to the divider.

Thermal Dynamics

If your plasma cutter provides CNC connector, use Minidivider card.

Otherwise connect divider to terminal inside plasma cutter.

CNC connector	Terminal / pin inside cutter	Signal	Contact divider	Signal Description
12, 14	J10: 1, 3	OK TO MOVE	1, 2	Work arc
3, 4	J10: 6, 8	/START	5, 6	Torch On
5		− DIVIDED /50	3	Minus voltage 1:50
6		+ DIVIDED /50	4	Plus voltage 1:50
	ELECTRODE1	− ARC VOLTS	RAW 1	Minus high-voltage arc
	WORK1	+ ARC VOLTS	RAW 2	Plus high-voltage arc

Kjellberg

All Kjellberg cutters use interface connector X102, but, depending on the model, the numbering of contacts can be different:

Pin number in the usual connector X102	Pin number in the youngest models	Signal	Contact divider	Signal Description
A1, A2	3, 4	MAIN ARC ON	1, 2	Work arc
A9	13	CATHODE	RAW 1	Minus high voltage arc
B8	7	NOZZLE	-	Minus (the nozzle)
C9	8	WORKPIECE	RAW 2	Plus high-voltage arc
B2, B3	5, 6	TORCH ON	5, 6	Torch On

Sibir CNC

The connector and pin number	Signal	Contact divider	Signal Description
4 pin: 1, 2	The main arc	1, 2	Work arc
4 pin: 3, 4	On / Off	5, 6	Torch On
2 pin: 1	Plus arc	RAW 1	Plus high-voltage arc
2 pin: 2	Minus the arc	RAW 2	Minus high voltage arc

Helvi

The connector and pin number	Signal	Wire in the cable,	Contact divider	Signal Description
CNC1: C, D	DIV_FINISH	yellow / green	1, 2	Work arc
CNC1: A, G	DIV_START	red / blue	5, 6	Torch on
CNC2: +	DIV_ARC +	red	RAW1	Plus high-voltage arc
CNC2: –	DIV_ARC–	blue	RAW2	Minus high voltage arc

Jackle

Pin number in the connector Remote Control	Signal	Contact divider	Signal Description
I, J	Cutting current flow	1, 2	Work arc
G, H	Torch trigger	5, 6	Torch On
A	Arc voltage 10V	RAW1	Plus high-voltage arc
C	Ground	RAW2	Minus high voltage arc

Rehm Barracuda RTC

17-pin interface	Signal	Contact divider	Signal Description
4	Arc trigger –	2	Work ac
2	Arc trigger +	1	Work arc
4, 6 (6 must be coupled with 1)	Torch trigger	5, 6	Torch on
4	GND	3	Minus arc voltage
9 (5)	Arc voltage	4	Plus arc voltage 1:50 (1:100)

Everlast PowerPlasma

12-pin CNC interface	Signal	Contact divider	Signal Description
9, 10	OK to Move	1, 2	Work ac
1, 2	Start/Stop	5, 6	Torch On
4	Divided arc voltage (–)	3	Minus arc voltage 1:50
6	Divided arc voltage (+)	4	Plus arc voltage 1:50

Jasic Cut 100C (J71)

10-pin socket	Signal	Contact divider	Ext. power supply	Signal Description
8, 9	Arc started successfully	1, 2		Work ac

1	Start trigger		−12V	Connect −12V to pin 1 of plasma cutter
		6	+12V	Connect +12V to pin 6 of divider card
2	Start trigger	5		Torch On
7, 10	Ground Arc voltage output	3 (−), 4 (+)		Divided arc voltage

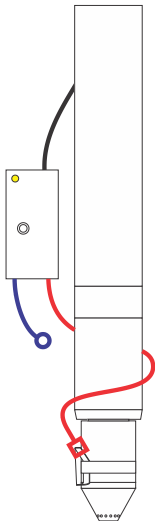
Probe sensors

The machine must be equipped with a probe sensor to find metal surfaces (or two probes, which is better).

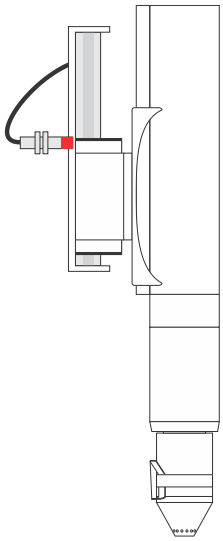
Before cutting, the machine should check the height of the metal surface under the torch, lowering it until it touches the metal and triggers the probe sensor. Then, the torch rises to a pierce height, and, if this height is correct, the pilot arc goes into the working arc immediately.

From the viewpoint of Mach3, it is the same sensor/trigger as the other triggers. This sensor connects to the breakout board, or THC-LPT adapter, and tells Mach3 when the torch has touched metal. When the sensor triggers (torch touch metal), Mach3 should receive the signal PROBE (DIGITIZE).

There are several options for implementing this sensor:



Ohmic sensor



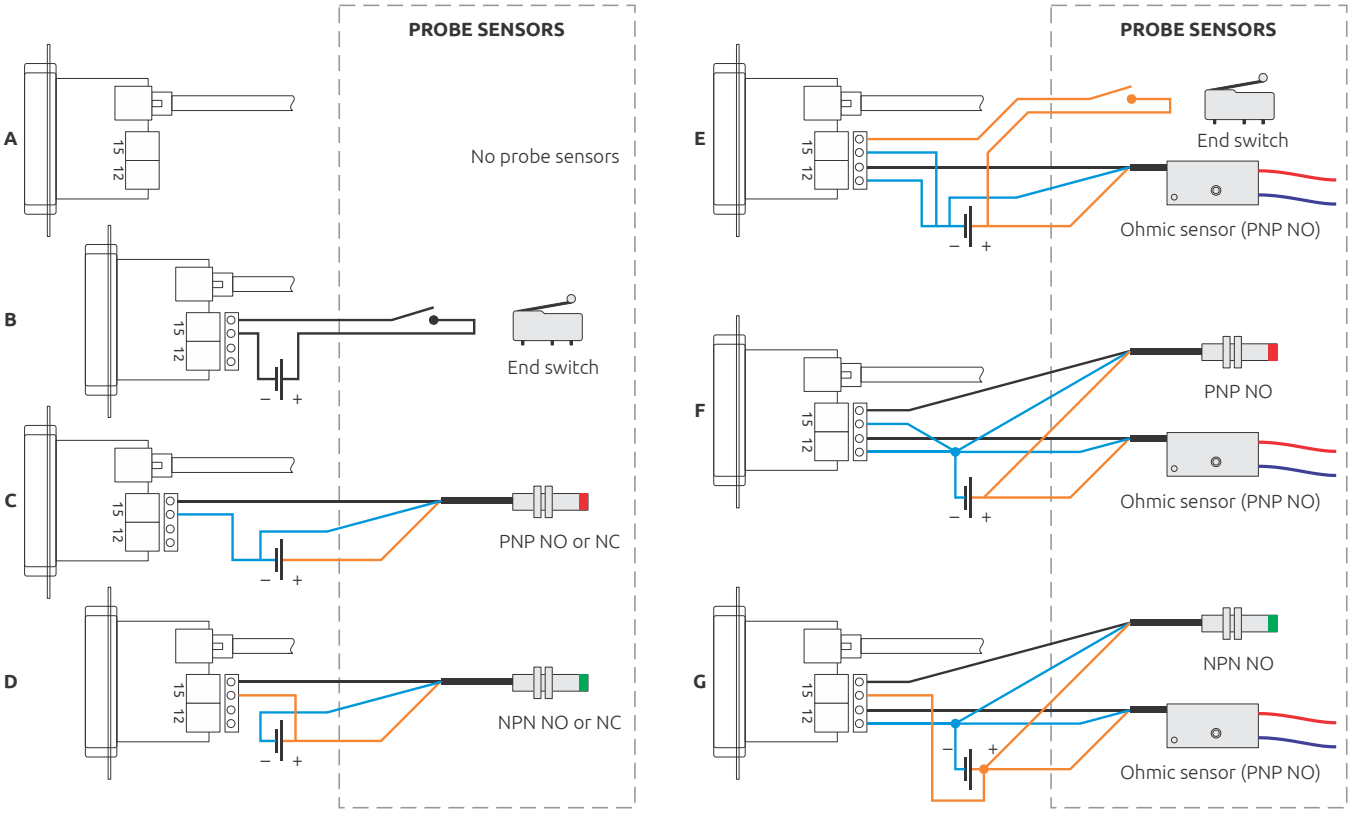
"Floating torch" sensor

A) An ohmic sensor, which constantly checks the resistance between the shield of torch and the surface of metal. This sensor is well suited for thin metal because the torch does not push the sheet. It does not work well with the water table, tinted, or rusty metal.

B) A "floating torch" sensor. When the torch pushes against the sheet, it is shifted upwards on the guideway and triggers the inductive sensor or trigger (B, C, D).

C) And, of course, it is possible to start the cut manually by setting the torch height above the surface (A).

THC-LPT adapter



Using an adapter for the LPT port with the MiniTHC, you can connect two probe sensors at the same time.

The device is equipped with one of the LPT adapter's revisions:

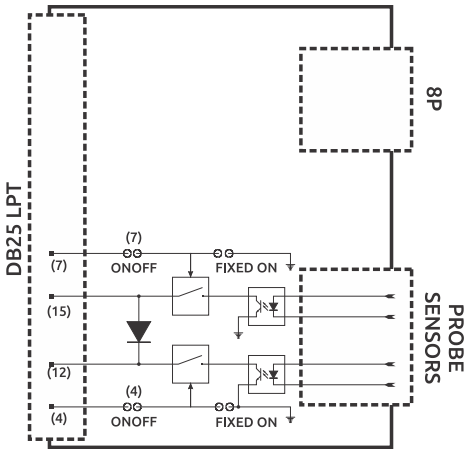
- rev4, 8P connector to connect MiniTHC, and two bidirectional optopairs inputs (12-24V) for the probe sensors. The central input will trigger both inputs. Each probe input can be switched off and ignored using special "off pins."

Input	**Pin**	**Off pin (w switchable inputs)**	**Signal in Mach3**	**Usage**
Central input for probe sensor	15 + 12	7	INPUT2	To connect the floating torch sensor. Will activate both probe pins
Outer input for probe sensor	12	4	PROBE (DIGITIZE)	To connect the ohmic sensor. Will activate only one pin.

The central input for probe sensors triggers both inputs (pin 15 and pin 12) at once. Set up this input as INPUT2 in Mach3. The script will be able to distinguish this sensor from the other sensors.

The outer input triggers only one input (pin 12). Thus, pin 12 is triggered at any of the inputs, and this allows the lowering of the torch to be stopped on any probe sensor. Set up this input in Mach3 as the input PROBE.

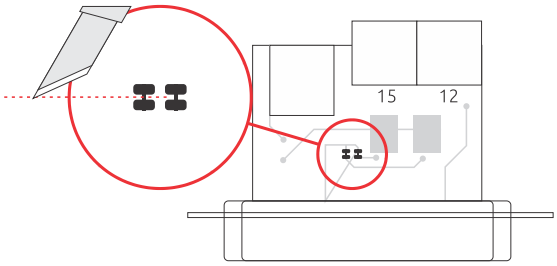
The polarity of the contacts on each input does not matter (bidirectional opto-isolators).



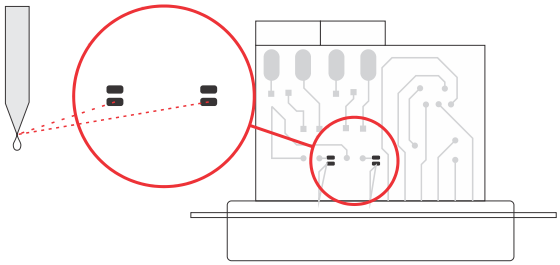
Remaking into Adapter with Switchable Inputs

A probe sensor can be permanently closed. For example, if the shield on the torch gets a drop of metal, the ohmic sensor will be permanently closed.

For this purpose, software can switch off the input. The machine can turn off closed probe input, ignore it, and continue to work with the second probe sensor.



1. Cut wires

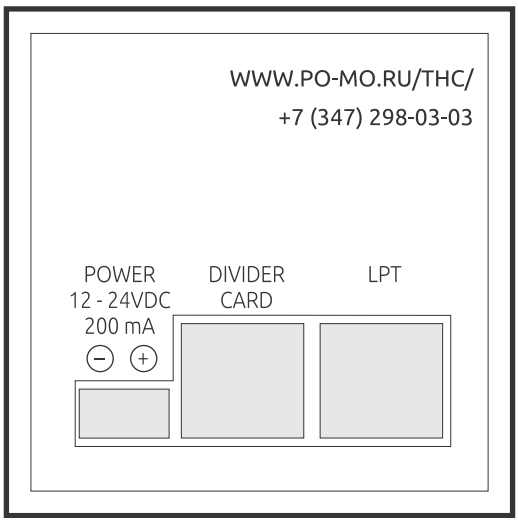


2. Solder wires

On the front side of the LPT adapter, cut two tiny tracks between the contacts.

On the reverse side, solder each pair of contacts.

Connecting to a Computer



Connectors

We tried to make the most reliable device that would work with the most extreme examples of plasma cutters. Therefore, all inputs and outputs in MiniTHC are galvanically isolated, even power. The power connector and 6P connector is completely electrically isolated from the power supply and the computer. In 8P, the connector is galvanically isolated from the relay.

Power Connector

MiniTHC requires a power supply of 12 to 24 volts. The power consumption at 12 V is 200 mA.

THC is galvanically isolated by power through the DCDC module. This means that you can safely connect it to the power supply of a computer, power supply of sensors, or any other power supply. You can even use a PWM power supply, such as a thumb-sized power supply for LED.

Nevertheless, it is best to power the THC from an individual, dedicated power supply of 12V or 24V.

(!) IMPORTANT: The built-in power module is not protected against short circuits in dependents, such as the relay on divider card. Therefore it is prohibited to cut the patch cord connecting the MiniTHC with the divider while the MiniTHC power is on. See *Repair*.

While the computer is booting up, its port state may spontaneously switch its state. The plasma cutter might turn on for one second.

8P Divider card Connector

Wire "patch cord" (twisted pair). Length up to 30 m. Connectors 8P8C RJ45.

Use a standard computer cable "patch cord" to connect the MiniTHC and the Divider (or Minidivider for Powermax). This cable has the same wire colors on both ends.

You can make your own cable using a "CAT5 twisted pair" (8-wires), crimper tool, and two connectors.

(!) IMPORTANT: Do not use a "cross-link" cable; it will lead to failure of the head unit MiniTHC power supply. See *Repair*

1, 3, 5 GND (ground)
2 THC Voltage (1 ... 5 V).
Divided 50:1 voltage input. Can be calibrated using a potentiometer inside the MiniTHC
4 Torch ON.
Output to control relay on and off (low current switch, do not connect relay on it).
6 ARC OK
7, 8 +12 V power, 20 mA max.
Power for the ARC OK sensor and relay.

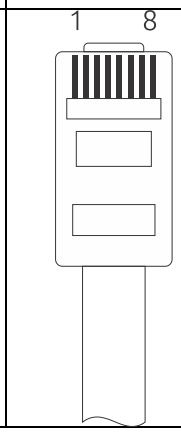
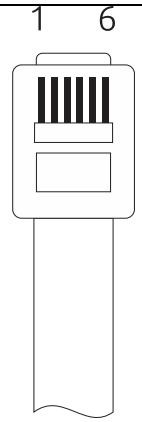
(!) IMPORTANT: Shortage of GND and +12 V will fail power module. See *Repair*

8P LPT Connector

MiniTHC 2 using 8P connectors, MiniTHC 1 using 6P connectors.

Wire "patch cord" (twisted pair). Length up to 2 m. Connectors 8P8C RJ45 (6P6C RJ25).

All signals in the MiniTHC are galvanically isolated. You can use them without an additional opto-coupler.

MiniTHC 2 (with 8P LPT)				**MiniTHC 1 (with 6P LPT)**			
1		GND (ground)		1	<—	Torch ON	
2	—>	ARC OK		2	<—	THC LOCK	
3	—>	THC UP		3	—>	THC UP	
4	<—	Torch ON		4	—>	THC DOWN	
5	—>	THC DOWN		5	—>	ARC OK	
6	<—	C-axis protocol / Charge Pump		6		GND (ground)	
7	<—	THC LOCK/CORNER					
8		Reserved					

Where to Connect?

The device can be connected to the second LPT port or breakout board (BOB). MODBUS interface removed from version 2.2, see manual «MiniTHC2 MODBUS interface".

Each option has its pros and cons.

Keep in mind that one LPT-port of the computer can utilize only 5 input signals, one of which is always busy with the ESTOP signal. Of the remaining 4, the THC will take another 3 signals: THC UP, THC DOWN, and THC ON (ARC OK). The remaining signal is required for the probe sensor PROBE.

The above applies to the breakout board connected to one LPT port.

The best option for the plasma cutter is using a second LPT port. The expansion card PCI-LPT costs roughly $10. In this case, the machine will have 10 inputs, and the first LPT port can be used to connect to the breakout board, and it will have 5 free inputs; for the second LPT port, you can connect the THC using a THC-LPT adapter.

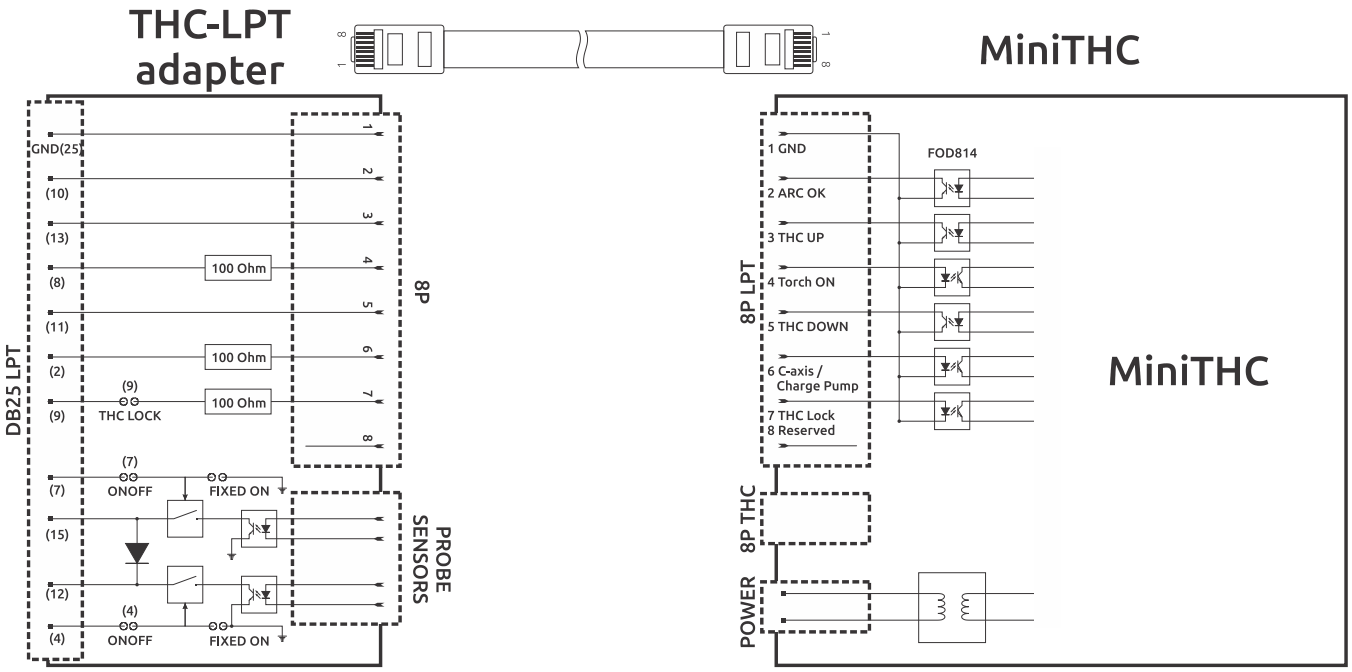
Via Motion Controller

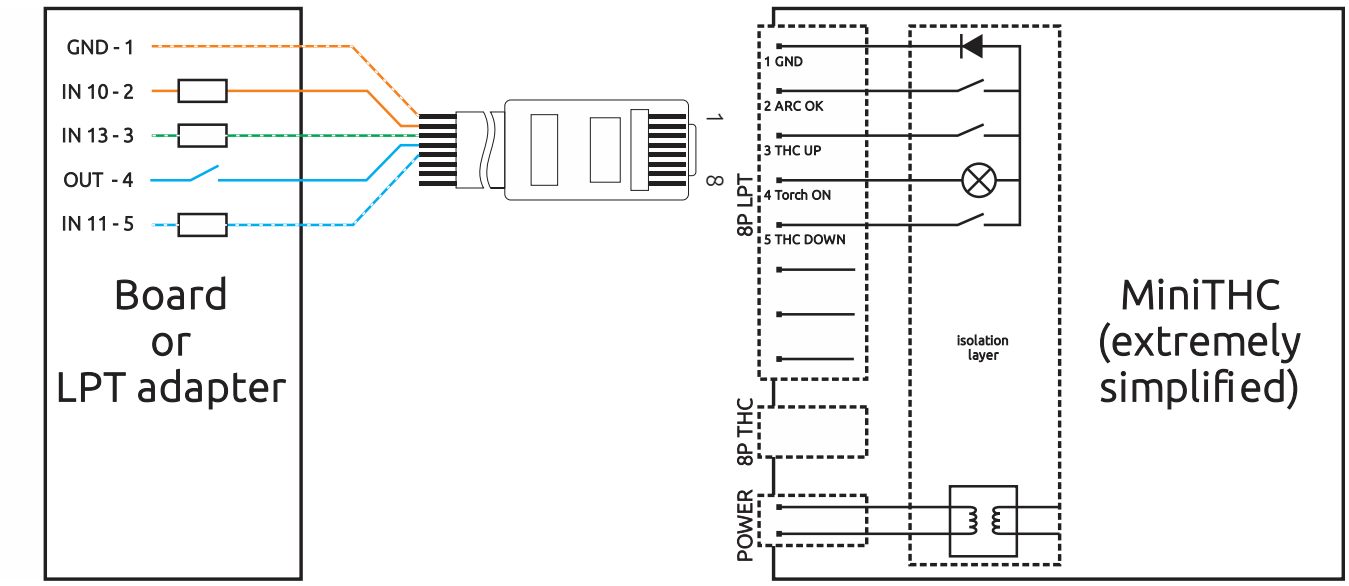
When using the Motion Controller (KFLOP, Purelogic E3, SmoothStepper, JNC, CSMIO), it is necessary to connect the THC that way so signals from the THC are translated through the Motion Controller. Generally, Motion Controllers emulate multiple ports, and have adapter kits IDC26-to-DB25. Connect the adapter to the LPT connector DB25. The Mach3 setup will need to be configured the same way as LPT2. See *Via second LPT-port.*

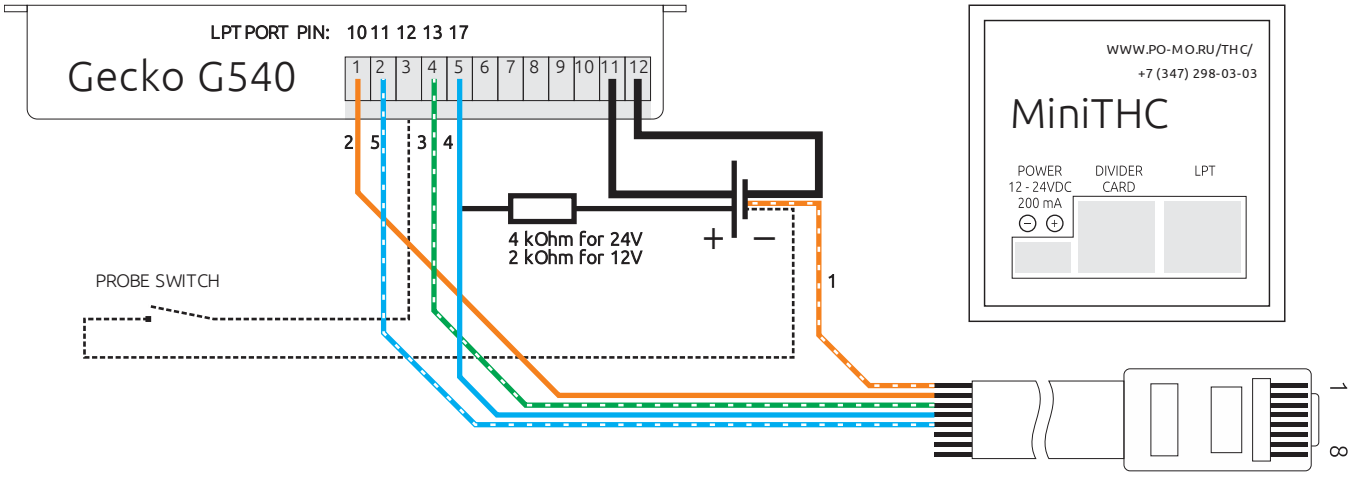
Via Breakout Board

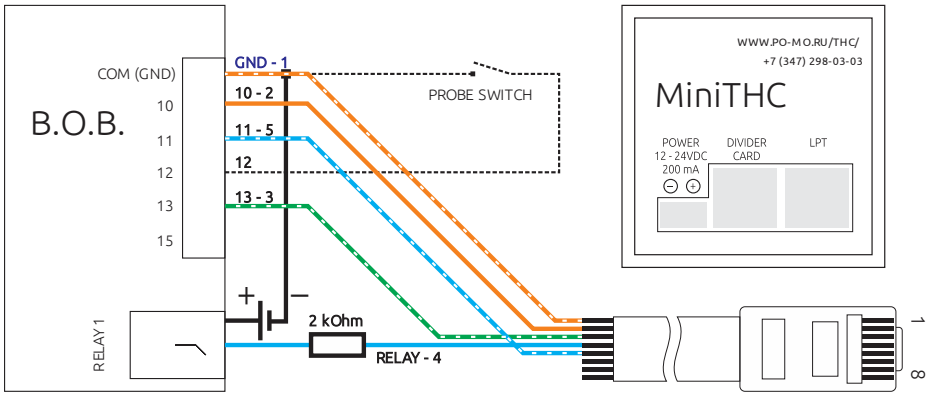
Wire "patch cord" (twisted pair). Length up to 1 m. Connectors 8P8C RJ45.

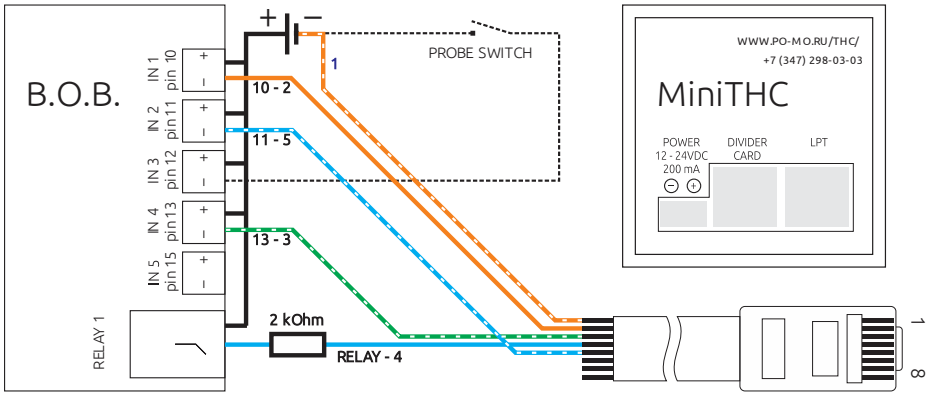
The THC outputs are optopaired. Optopairs in the THC outputs (2, 3, and 5) work, closing the corresponding pin with the ground (1). Optopair inputs (4 and 6) in the THC triggers on voltage between the pin and ground. The maximum voltage at optopairs is 24 volts (check datasheet FOD814).

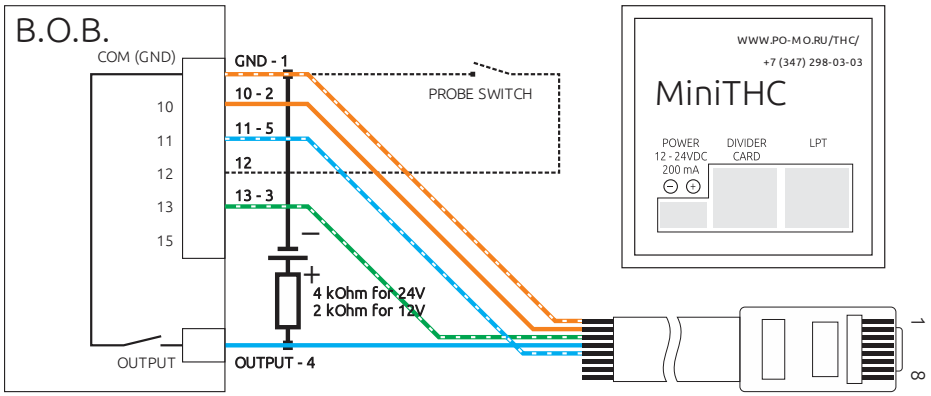


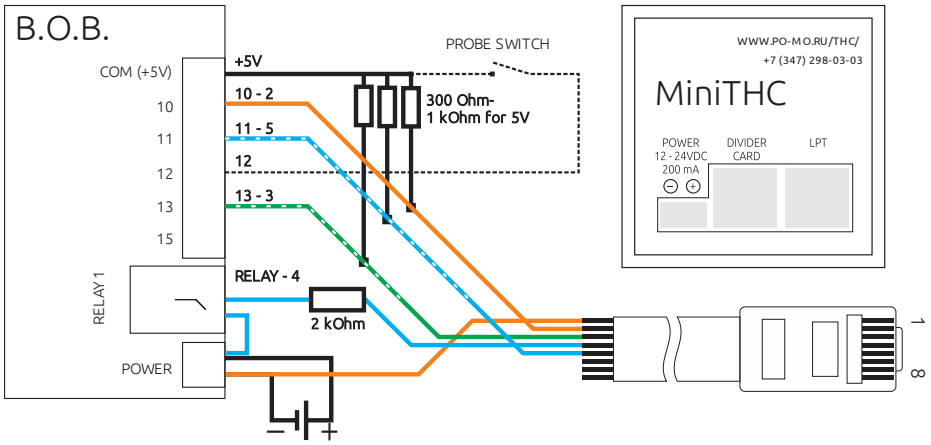

GND - 1
IN 10 - 2
IN 13 - 3
OUT - 4
IN 11 - 5
Board
or
LPT adapter
1
8
8P LPT
1 GND
2 ARC OK
3 THC UP
4 Torch ON
5 THC DOWN
8P THC
POWER
isolation
layer
MiniTHC
(extremely
simplified)


LPT PORT PIN: 10 11 12 13 17
Gecko G540
1 2 3 4 5 6 7 8 9 10 11 12
2 5
3 4
4 kOhm for 24V
2 kOhm for 12V
+
–
PROBE SWITCH
1
WWW.PO-MO.RU/THC/
+7 (347) 298-03-03
MiniTHC
POWER
12 - 24VDC
200 mA
DIVIDER
CARD
LPT
1
8


B.O.B.
COM (GND)
10
11
12
13
15
RELAY 1
GND - 1
10 - 2
11 - 5
12
13 - 3
PROBE SWITCH
2 kOhm
RELAY - 4
WWW.PO-MO.RU/THC/
+7 (347) 298-03-03
MiniTHC
POWER
12 - 24VDC
200 mA
DIVIDER
CARD
LPT
1
8


B.O.B.
IN 1 pin 10
IN 2 pin 11
IN 3 pin 12
IN 4 pin 13
IN 5 pin 15
RELAY 1
1
10 - 2
11 - 5
13 - 3
PROBE SWITCH
2 kOhm
RELAY - 4
WWW.PO-MO.RU/THC/
+7 (347) 298-03-03
MiniTHC
POWER
12 - 24VDC
200 mA
DIVIDER
CARD
LPT
1
8


B.O.B.
COM (GND)
10
11
12
13
15
OUTPUT
GND - 1
10 - 2
11 - 5
12
13 - 3
PROBE SWITCH
4 kOhm for 24V
2 kOhm for 12V
OUTPUT - 4
WWW.PO-MO.RU/THC/
+7 (347) 298-03-03
MiniTHC
POWER
12 - 24VDC
200 mA
DIVIDER
CARD
LPT
1
8


B.O.B.
COM (+5V)
10
11
12
13
15
RELAY 1
POWER
+5V
10 - 2
11 - 5
12
13 - 3
PROBE SWITCH
300 Ohm-
1 kOhm for 5V
RELAY - 4
2 kOhm
WWW.PO-MO.RU/THC/
+7 (347) 298-03-03
MiniTHC
POWER
12 - 24VDC
200 mA
DIVIDER
CARD
LPT
1
8

Via Second LPT-port

This is the best option for plasma. Install a computer expansion LPT card, install the drivers for it, and list the address of the second port in Mach3.

Use the THC-LPT adapter included with the device. The adapter also has inputs for two probe sensors. See *Probe sensors.*

How to find the address of the second port in Windows

Go to Control Panel -> Device Manager -> COM & LPT ports -> Port LPT2 (LPT3) -> Properties -> Resources

Find the input-output range (I/O Range). There may be several on each port. Write down the first number (e.g., D030), and set this value to Mach3 by going to menu -> Config -> Ports and Pins -> Port # 2 in hexadecimal notation (e.g. 0xD030).

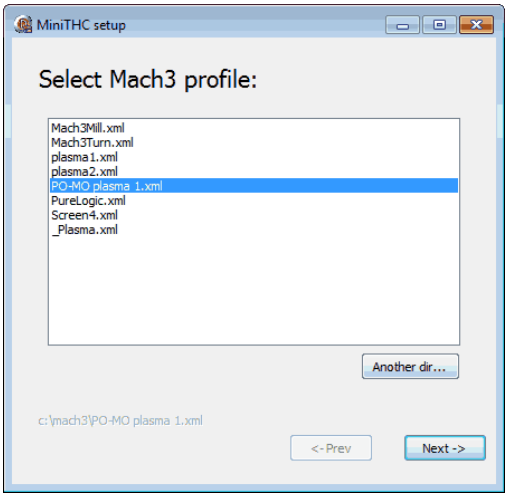
Click three times on the MiniTHC knob to switch to test output, and check that the signals are displayed correctly in Mach3. See *Test outputs.*

Set up Mach3

Download the installer to automatically set up the MiniTHC in Mach3.

You can set the input and output signals according to the instructions below.

Installer for Mach3



1. Select the Mach3 profile that you want to set up.
2. Select the port to which the MiniTHC is connected:
    a) LPT port 2 (the second LPT port)
    b) Breakout board
    c) You can also skip this step by pressing “Skip”
3. For LPT port 2 option, program will scan your computer for available LPT ports and addresses, but it may not succeed. You can choose any unreachable port and set its address in Mach3 later.
4. The program will offer to write two groups of settings in the profile: global settings for plasma router (optimal settings of constant velocity, spindle, and THC limits), and THC signals settings.
5. The “Save Profile” button saves the changes in the profile.

Ports and pins

Signal name in Mach3	Port	Pin	Active		Signal

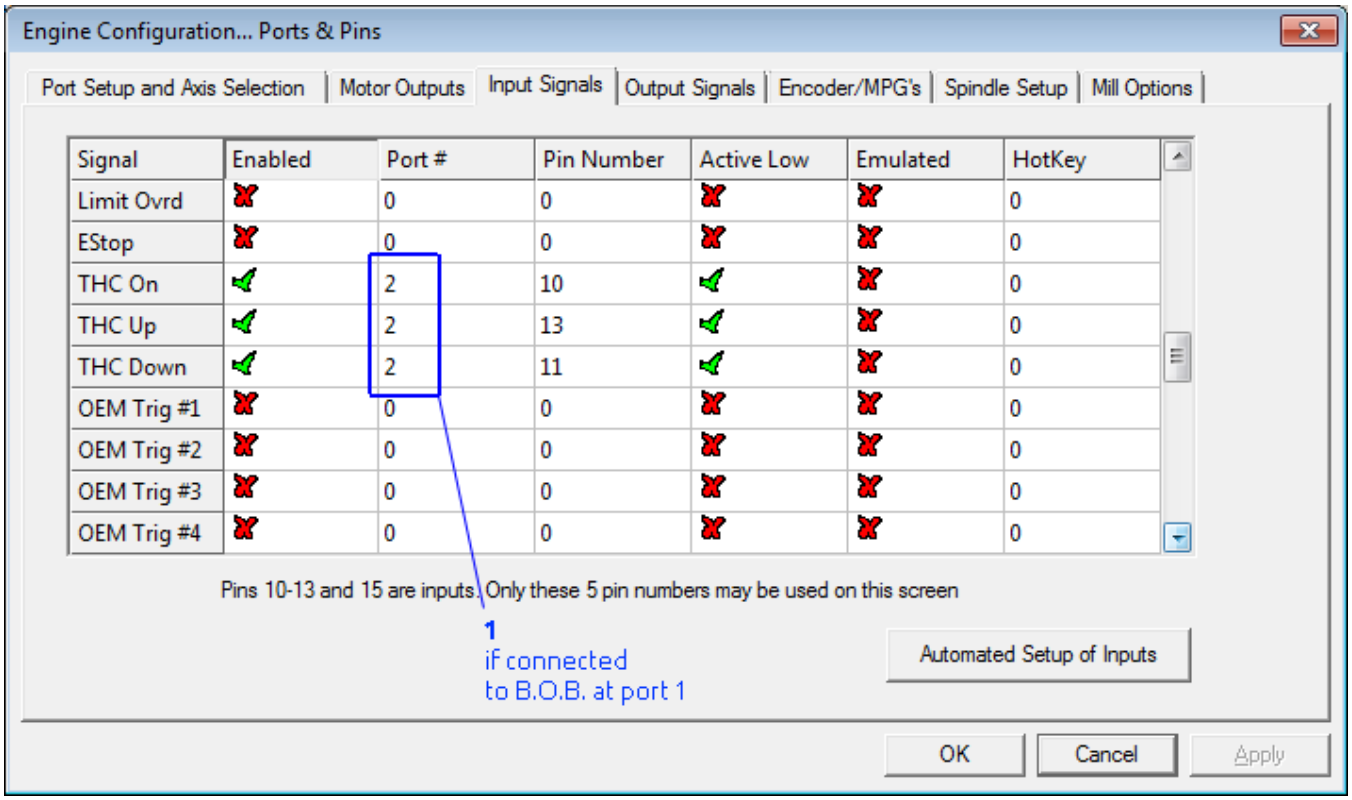
			Low		
Input signals:					
THC ON	2	10	V	↯	Work arc (ARC OK)
THC UP	2	13	V	▲	Up signal (THC UP)
THC DOWN	2	11	V	▼	Down signal (THC DOWN)
PROBE (DIGITIZE)	2	12	V		Signal from the first probe sensor - ohmic sensor *
INPUT # 2	2	15	V		Signal from the second probe sensor - floating torch sensor *
Output signals:					
OUTPUT # 1	2	8	X	Ч	Turn torch on (TORCH ON)
OUTPUT # 5	2	9	X	ϴ	Lock device (THC LOCK/CORNER)
OUTPUT # 2	2	4 (or 7)	X		Forced off the probe inputs at pin 12 and 15 respectively **
C axis	2	2 (step)	X		C-axis protocol ***

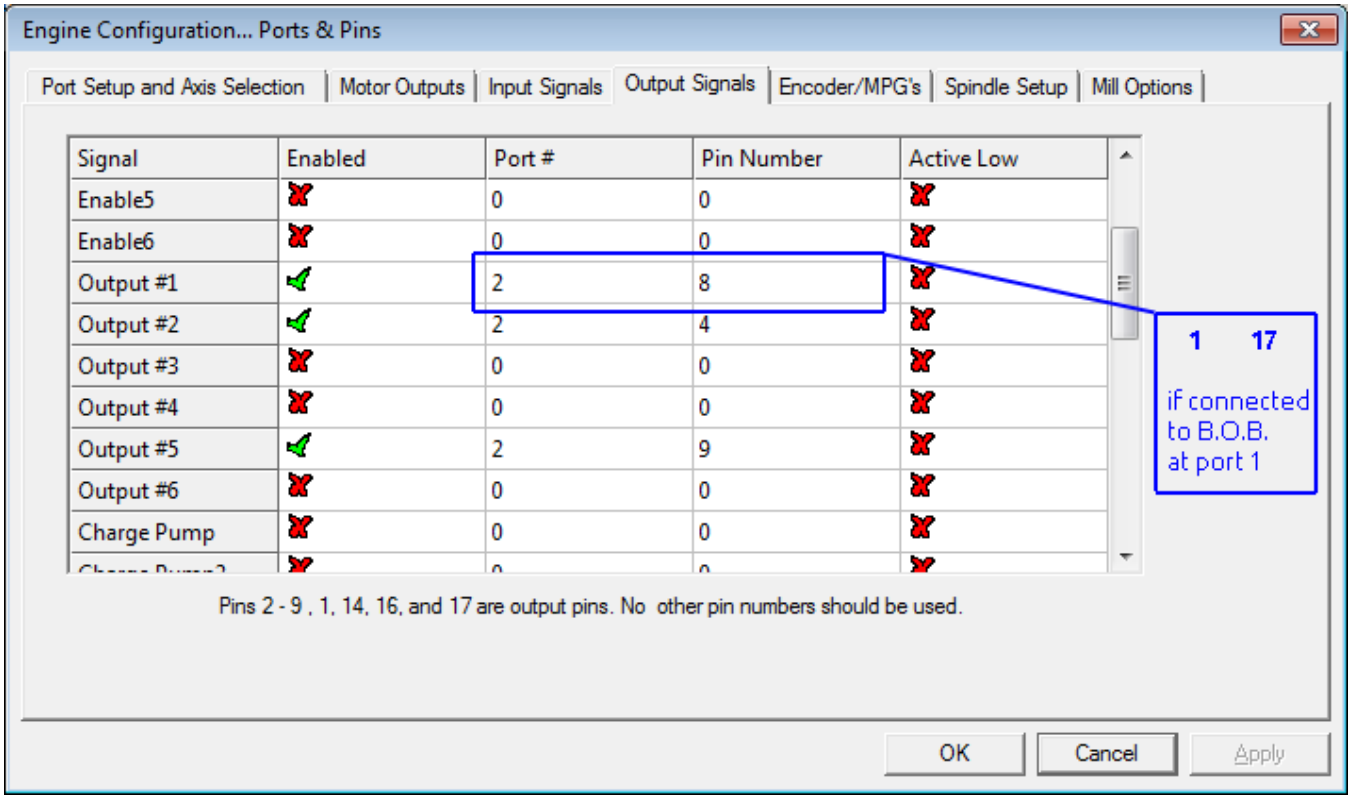
** Probe sensors are not included with the THC. Set up these signals only if probe sensors are connected to the THC-LPT adapter*

*** Only THC-LPT adapter with switchable inputs*

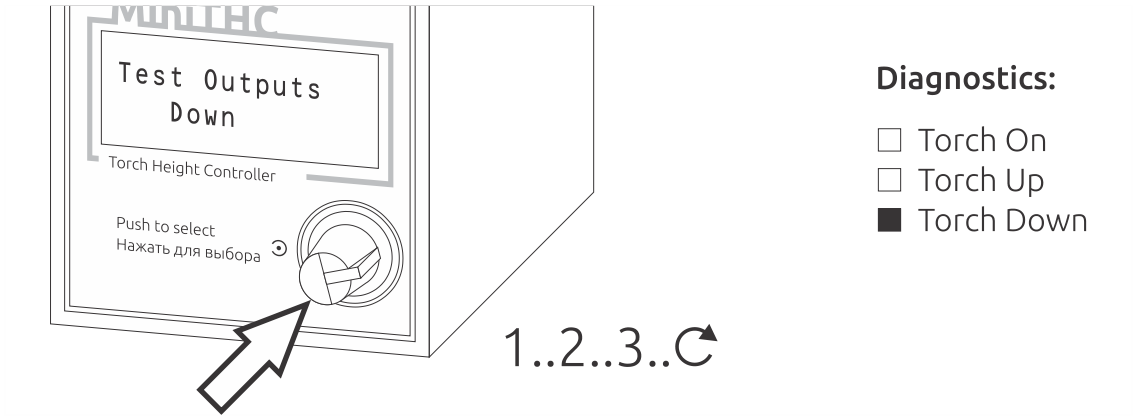
**** Only for G-code inline THC settings programming*

If you are connecting via a breakout board in the first LPT-port, you should specify port 1, respectively.





Test outputs



Click the knob three times to switch to "Test outputs" mode.

Go to the Mach3 screen Diagnostics (Alt-7).

In turn, check the appearance of signals THC UP, THC DOWN, and THC ON at the diagnostic screen turning knob on the THC. Check that the signals corresponds to each other.

Automation and Scripting

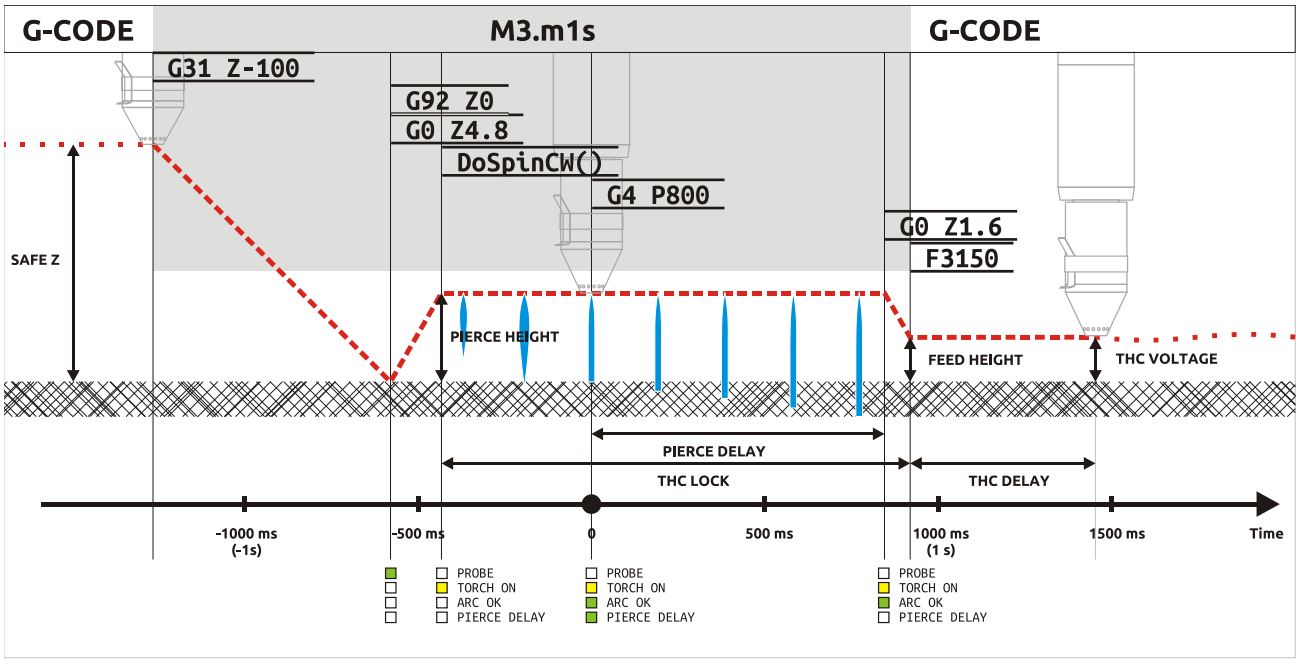
Operation Flow of the Machine

For cutters with a pilot arc, every cutting begins with:

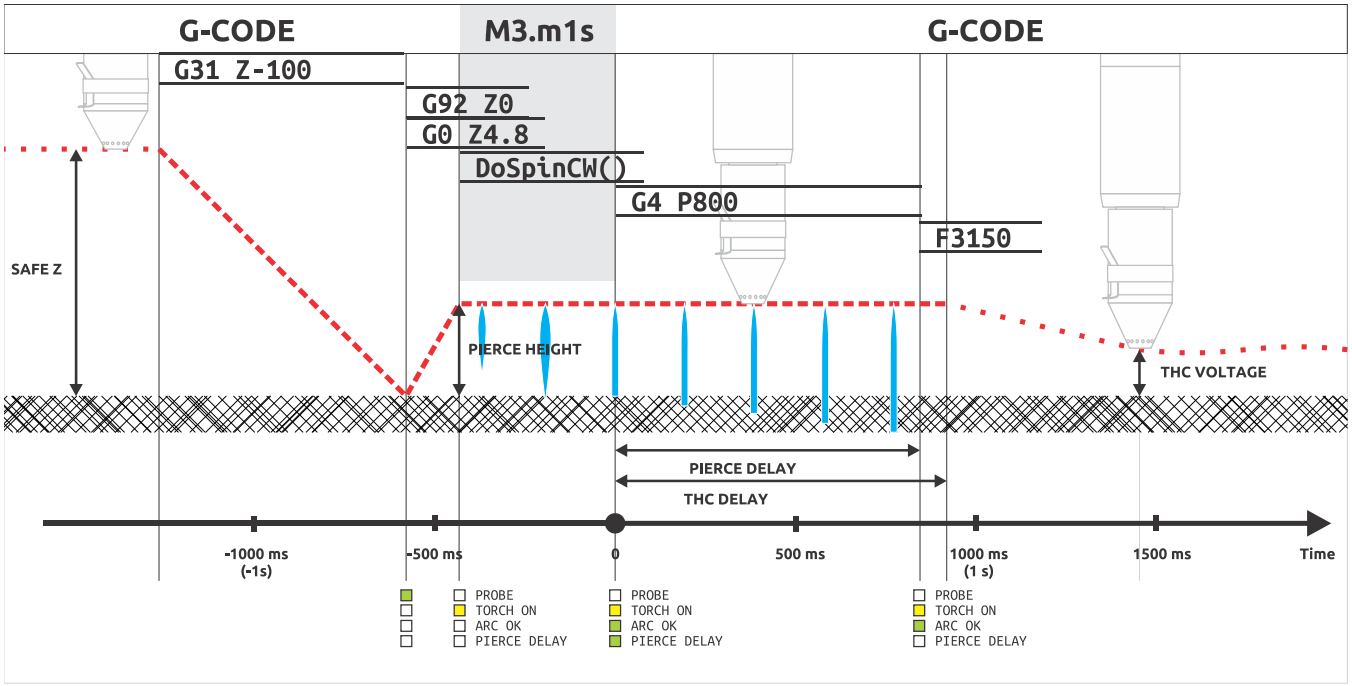
Procedure:	**Command Example to G-code**
Lower the torch to touch metal	G31 Z-100
Reset the current Z coordinate to 0 (in case of the most common "floating torch", it may be a negative value because the torch moved up to touch the trigger probe)	G92 Z-1
Raise the torch to pierce height	G0 Z4.8
Turn torch on	M3
Pilot arc starts a. The pilot arc goes into a work arc, and the cutter sends signal ARC OK b. The pilot arc does not reach the metal and the torch turns off after 2 seconds	
ARC OK signal reached the THC, and it begins to countdown the THC delay	
The THC ON signal reaches Mach3, and it continues to execute the code	G4P800 (Pierce delay of 800 ms)
Lower torch to the cutting height	G0 Z1.5
Set the cutting speed FEED	F3150 (Feed 3150 mm / min)
Begin the cut on program	G1 X99
The THC countdown delays to zero and starts to send correction commands by voltage level	

The code for probing and delays may be generated each time by a postprocessor with a G-code, or can be embedded in macro M3.

Probe and pierce code embedded in macro M3:



Probe and pierce code generated by the postprocessor with G-code:



Locking the THC

ϴ lock/corner signal, no move up or down

The THC can be locked at the time of piercing or corner, using the signal THC LOCK, lock the device. In this case, the THC will not issue commands up and down (the ARC OK signal continues to work). During the lock, the padlock icon appears on the THC screen. After the lock is gone, the device counts down the THC delay and begins to work.

Before using THC LOCK with THC-LPT adapter, solder points marked THC LOCK.

C-axis protocol

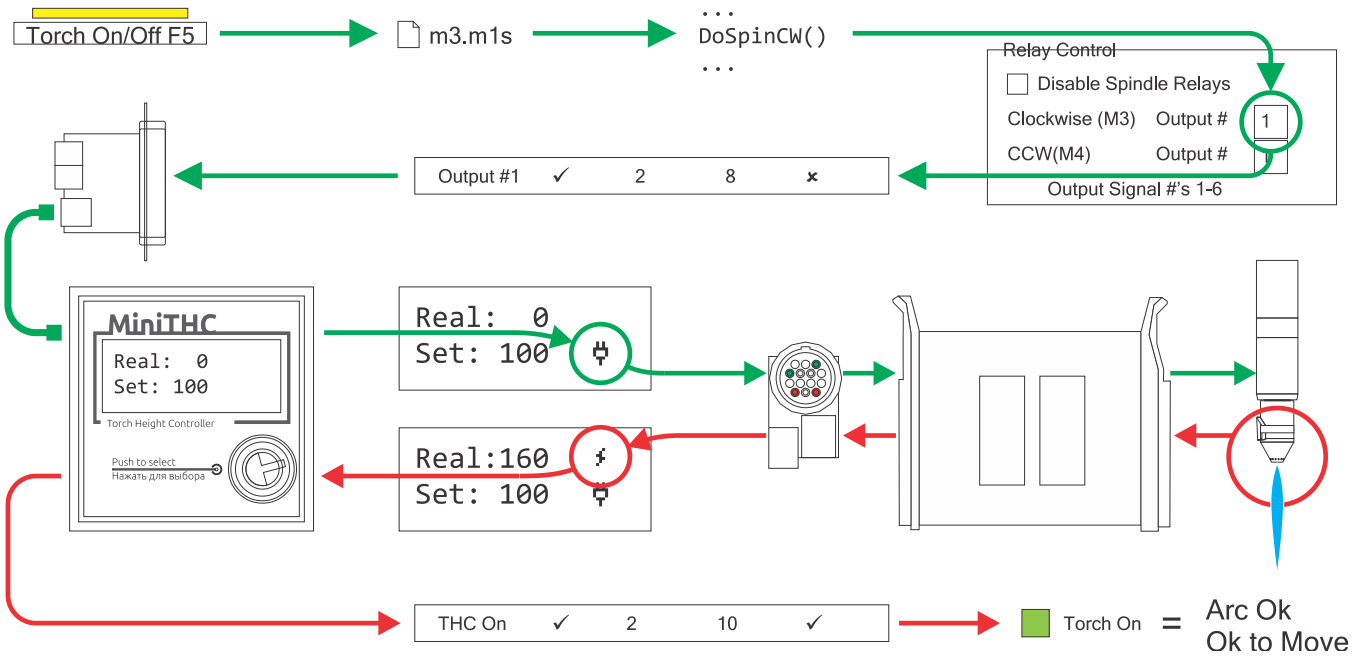
Used to set THC parameters. Transmission speed 6000-25000 steps/sec. The intervals between frames 100-500 msec.

MiniTHC v2.0 – v2.3	MiniTHC v2.3	MiniTHC 2.3
G91 G0 C7 'start frame 7 G4P100 G0 C40 'thickness, 30mm G4P100 G0 C95 'process, 85A G4P100 G0 C156 'voltage, 146V G4P100 G0 C12 'feed, 200mm/sec G4P100 G0 C37 'pierce delay, 2.7sec	G92 C0 G0 C8 'start frame 8 G4 P100 G92 C0 G0 C145 'set voltage 145V G4 P100 G92 C0 G0 C15 'set delay 1.5sec G4 P100	G92 C0 G0 C9 'start frame 9 G4 P100 G92 C0 G0 C160 'set voltage 160V G4 P100 G92 C0 G0 C5 'end frame 5

G4P100 G0 C70 'pierce height, 6mm G4P100 G0 C25 'feed height, 1.5mm G4P100 G0 C5 'end frame 5 G90	G92 C0 G0 C5 'end frame 5	

Technical Notes

Mach3 and TORCH ON



Antidive Behavior and Time Evaluation

▽ signal down, ANTIDIVE protection is triggered

For a complete description of the system ANTIDIVE, see *Setting the antidive protection.*

This is automated function, and it is tend to errors. It is preferable to use THC LOCK/CORNER function.

The device uses an alpha-beta filter for estimating changes in voltage. The device evaluates the current feed, thus the necessary duration of the antidive time, according to the established voltage. The time chosen will cause the machine to move T100 or DURAMAX torch for 5 mm.

$$ANTIDIVETIME = \frac{5\ mm}{3790 * \left(\frac{VOLTAGE}{100}\right)^{-18.83}}\ (sec)$$

Repair and Maintenance of the THC

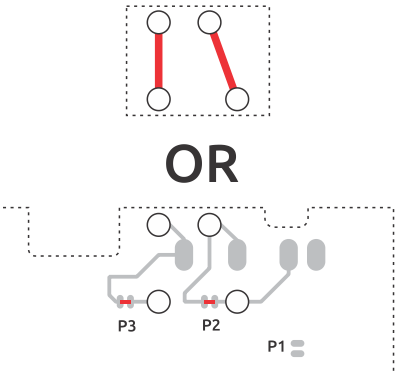
Power Module

If the MiniTHC did not turn on when powered up, it is highly likely that the built-in DCDC power module is damaged:

"PEAK P6BU-1215ELF" or compatible "SMAU M01-12".

Or "P6CU-1212."

It is possible to replace the power supply module with the same or compatible type, or to install a makeshift electrical fuse. Using a makeshift fuse with the MiniTHC requires power strictly 12V and does not protect all other devices on the same power supply from plasma interference.



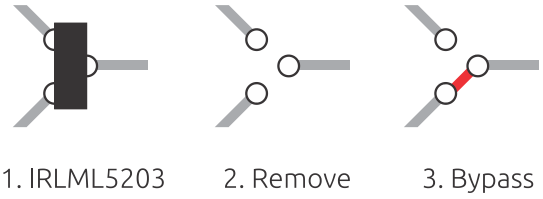
In order to add a makeshift fuse, open the MiniTHC case, find the big black box inside, and wire contacts at the back side as shown at drawing **or** solder points marked P2, P3.

In case of reversed polarity burnout, solder point marked P1.

Reversed Polarity Protection at Divider

In case of reversed polarity protection transistor IRLML5203 burnout, located at the divider card, the divider stops to receive low voltage of divider 50:1 (the RAW high voltage circuit continues to work).

The replacement of the transistor is pretty difficult; it is preferable to remove it and set the wire as shown in the drawing. After removing the protection, the polarity of the divided voltage 50:1 from cutter to divider should not be jumbled at all.



Error codes

100000	CPU frequency
010000	temperature (010000 cold, 020000 hot)
001000	power low
000100	divider card not connected

OPERATION

It's simple. The higher the voltage, the higher the torch floats above the metal sheet. Less voltage = lower height. Turn the knob to the right, the torch rises; turn the knob to the left, it descends.

Language Switching

To change the THC language, press and hold the knob for 7 seconds.

Screen and Modes

Icons:

⧖ THC delay countdown

▼ THC DOWN, signal down

▲ THC UP, signal up

▽ signal down, but ANTIDIVE protection is triggered

○ nothing

ϟ THC ON, signal ARC OK

Ψ TORCH ON, torch on

Θ LOCK/CORNER, no move up or down

Screens:

On the main screen, the top line displays the actual voltage on the tip, and the bottom line displays the user-set required voltage.

```
Real:   0
Set : 141
```

The second screen is used to configure the THC delay in milliseconds (see *Setting the THC delay*).

```
Delay t (ms)
     200
```

The third screen is used to configure the ANTIDIVE protection sensitivity 0 to 10 (see *Setting Antidive protection*).The same setting can be set by simultaneous pressing and rotation of knob.

```
Antidive
     Off
```

The fourth screen is designed to perform the test THC signals (see *Test outputs*).

```
Test outputs
 Off
```

Which Cutting Parameters to Set?

Cutting parameters (feed, voltage, delays) are specified in the manual of your plasma cutter.

If you are using our Mach3 screenset, then it displays the voltage, which should be set on the MiniTHC. Screenset also calculates the feed, delays, and immediately begins using them. See *Screenset MiniTHC for Powermax.*

You can also use our calculators for iOS and Android. See *Plasma calculators.*

Screenset and calculators compute parameters for use in "spherical cow" conditions: perfect steel sheets, new consumables, and flawless mechanics of the machine. Under real conditions, you may need to add +2 volts to the computed voltage and set the 90% feed rate for servo motors (+4 volts, 80% feed for stepper motors).

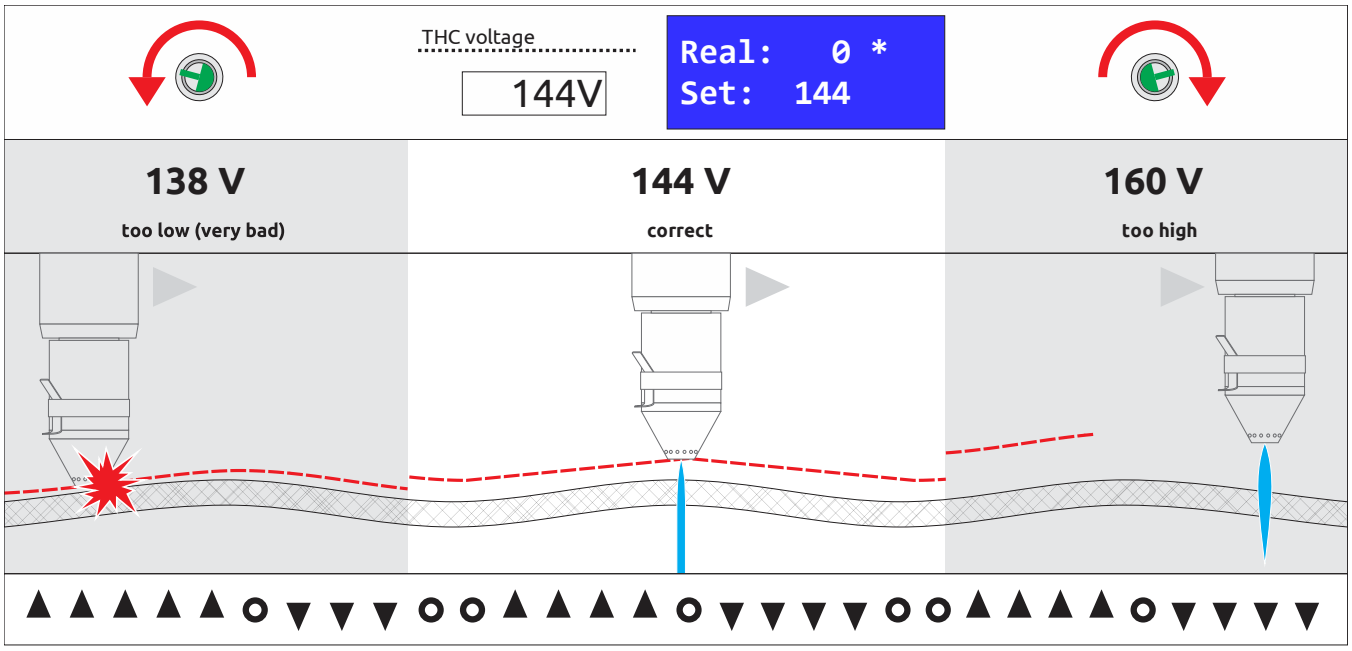
Voltage

The higher the voltage, the higher the torch will float over the metal sheet during cutting. Turn the knob to the right to increase the target voltage, and the THC will increase the distance between the torch and the metal. Turn the knob to the left, and the torch will go lower. This can be done during cutting.

(!) IMPORTANT: Do not lower the torch to the metal. This will damage the consumables.

As the voltage is increased, compared to the calculations; it is necessary to lower the feed rate (cutting speed).

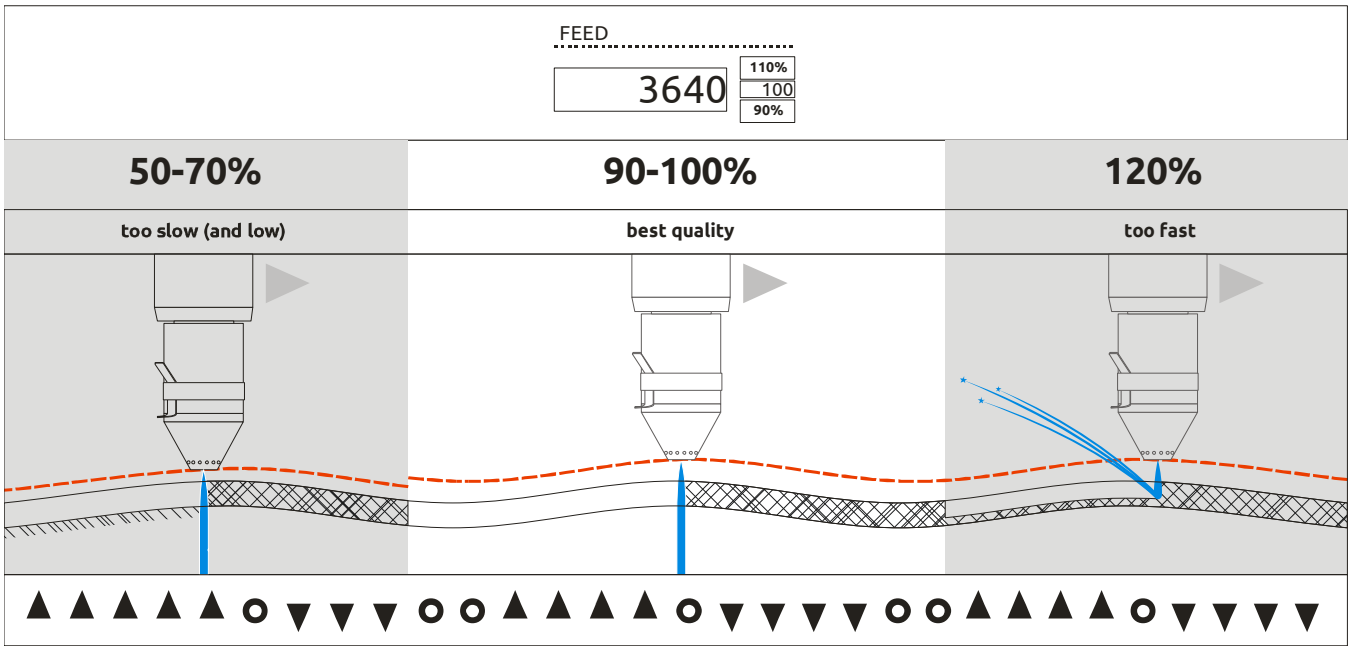
As electrodes burn out, it may need additional voltage.



Feed (Cutting Speed)

If the feed is too low, it results in the formation of metal droplets on the lower side of the metal.

If the feed is too high, the torch does not have time to cut through the metal and molten metal will be removed upward. This will damage the torch. Try to avoid it.



Setting the THC Delay

⧗ THC delay countdown to begin corrections

After the appearance of the ARC OK signal, the THC starts torch height correction with a slight delay. The default setting is 300 milliseconds (0.3 seconds).

The THC delay should be greater than the pierce delay; otherwise, the torch will start lowering before piercing ends, which will damage the consumables.

The delay is adjusted by the single press of the knob. The THC delay is in milliseconds.

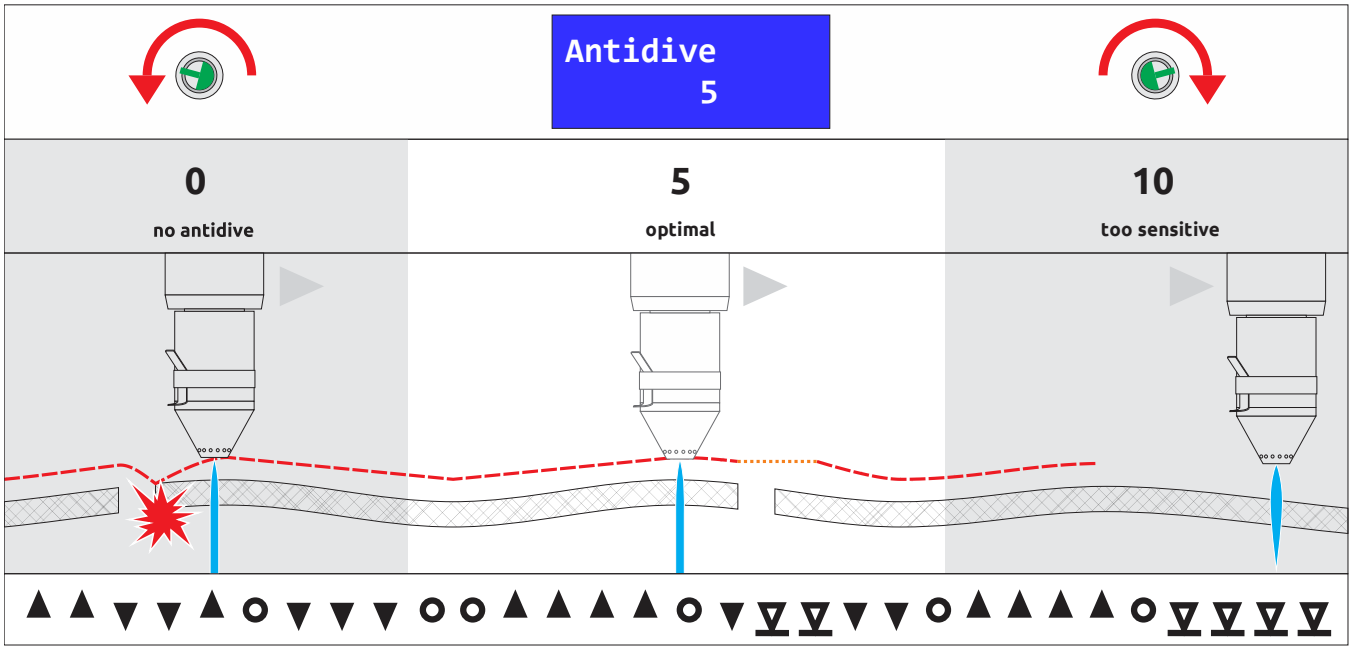
If the padlock icon appears on the screen during piercing, the device executes the THC delay after unlocking.

Setting Antidive Protection

▽ signal down, ANTIDIVE protection is triggered

When the plasma is finishing cutting the contours, it passes over the cut section of the metal sheet. The arc is stretching, the voltage quickly jumps up, and the THC tends to lower the torch closer to the metal. Touching the torch to the molten metal can result in damage to the nozzle.

To configure the protection against such dives, there is an “ANTIDIVE” setting.



The setting is adjusted by pressing and simultaneously turning the knob.

The setting can be set between level 0 (off) and level 10 (maximum sensitivity). At level 0, the THC will move the torch "down" in any case. At level 10, the THC will block most of torch movements “down”. The higher the level of “ANTIDIVE”, the less likely it is that the torch will “fall” into the cut.

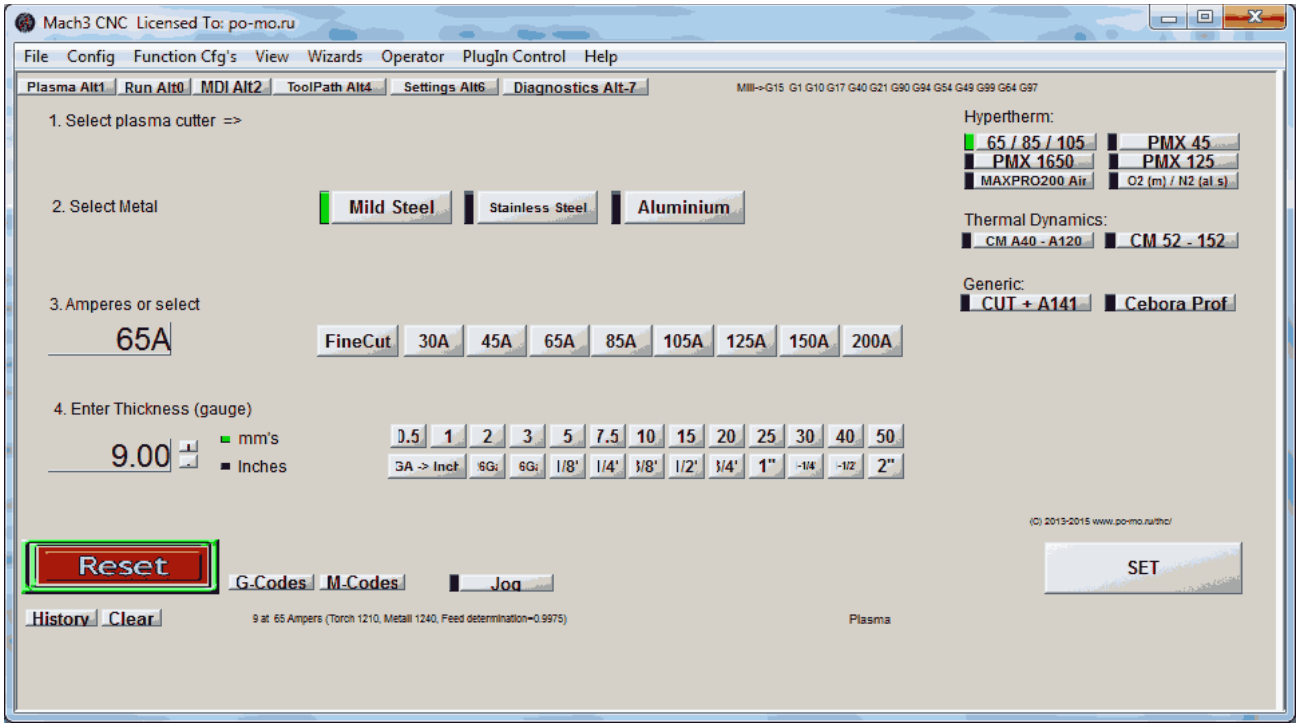
When dive protection is triggered on, the screen will display the icon of empty arrow down.

When the torch moves over the already-cut section of the metal, the arc voltage will quickly jump up, and the antidive protection will be triggered. Antidive protection will be active for a few seconds, then will turn off again so the THC can work downwards. The appropriate duration of the antidive is estimated by the THC itself, based on the voltage. The time chosen will cause the machine to move the torch for 5 mm.

For example, for 134 volts, the antidive time will be 0.3 seconds; for 140 volts, it will be 0.75 seconds; for 150 volts, it will be almost 3 seconds; and for 160 volts, it will be 9 seconds. The minimum antidive time is 0.3 seconds and the maximum is 5 seconds.

Screenset MiniTHC for Powermax

Press the SELECT PROCESS button.



In the top row, select the plasma cutter you are using:

65/85/105	Powermax 65, 85, or 105 (with DURAMAX torch), standard consumables
45	Powermax 45 (with T45m torch)
1650	Powermax 1250 or 1650 (with T100M2 torch)
125	Powermax 125 (with Hyamp torch)
MAX200	MAX PRO 200

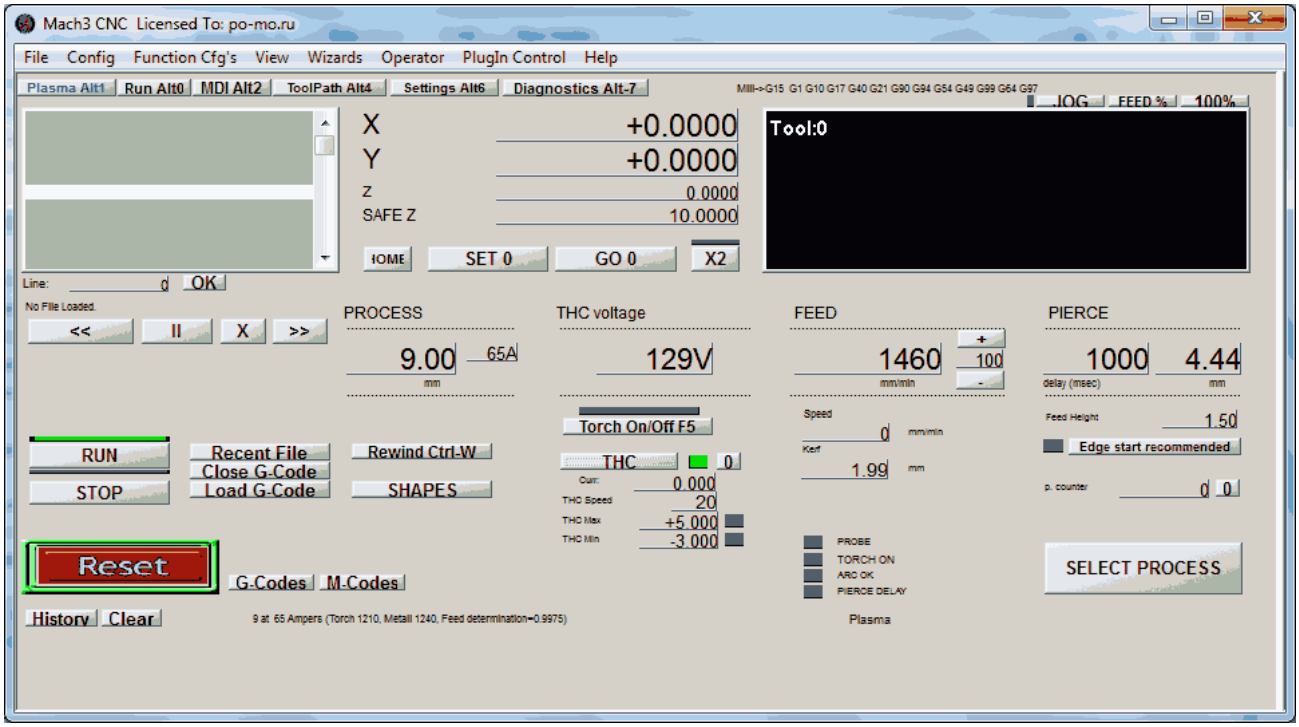
In the second row, select the material for cutting: mild steel, stainless steel, or aluminum

In the third row, select the nozzle (and current on cutter). For the 1650 cutter, select the closest value - 45 instead of 40 or 65 instead of 60.

In the fourth line, enter the material thickness or select it from the list. You can enter any thickness, for example 13.8 mm (and screenset displays the correct feed for this particular thickness). There is also a "Ga->Inch" button, which converts the entered sheets gauge into imperial units. The gauge conversion depends on the selected material.

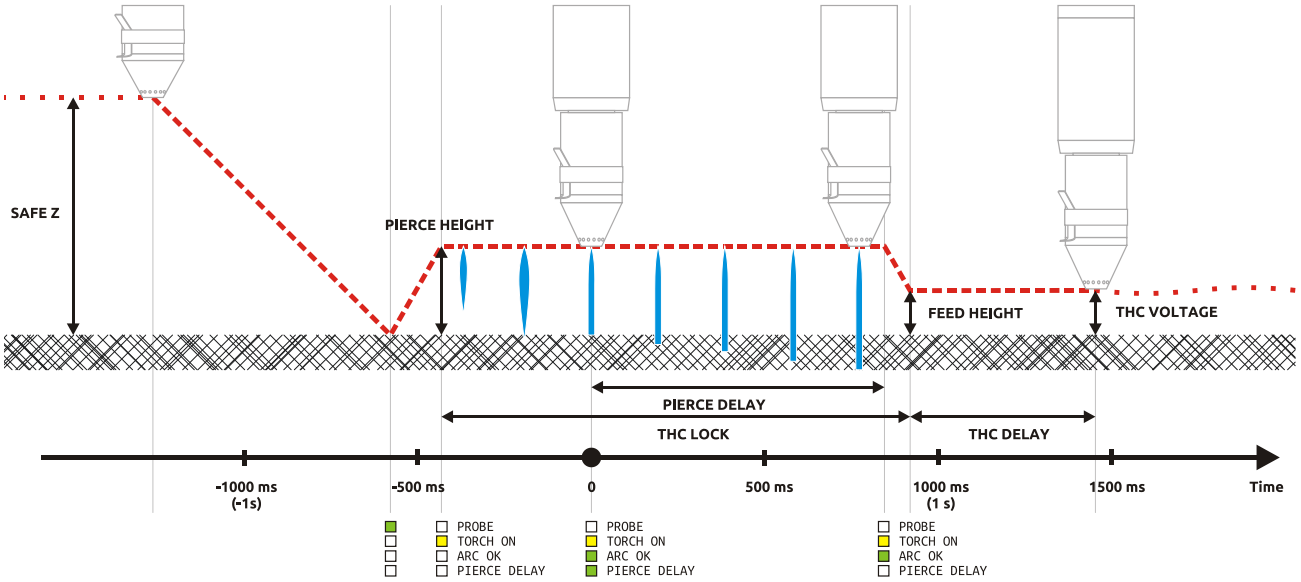
Press the SET button.

If all parameters are correct, the screenset will automatically switch back to the first screen. If some parameters require correction, screenset will try to correct them, and then it will require pressing SET again.



The screenset will compute the following parameters (on the screen from left to right):

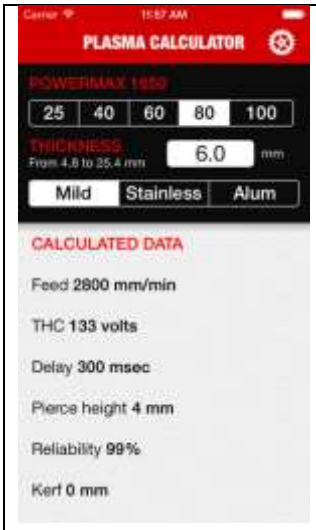
English title	Note	DRO code
THC voltage	This voltage should be set to MiniTHC	1202 OEM 817 (Spindle Speed)
Feed	If g-code program or script force command F, it will override this value	1200 OEM 18 (Feed Rate)
Pierce delay	1000 ms corresponds to a 1 second delay	OEM 177
Pierce height		1201
Feed height		1204
Kerf	Reference parameter	1205
Pierce counter	Incremented each piercing	1203
Edge start recommended	Too thick for piercing. If this signal lights, your cutter manual recommends to start cutting from the edge of the sheet	LED 1205
Feed determination	The accuracy of the calculation of the feed. The accuracy is calculated for each process; for most processes it is within 0.980-0.999, which gives excellent and predictable results	-



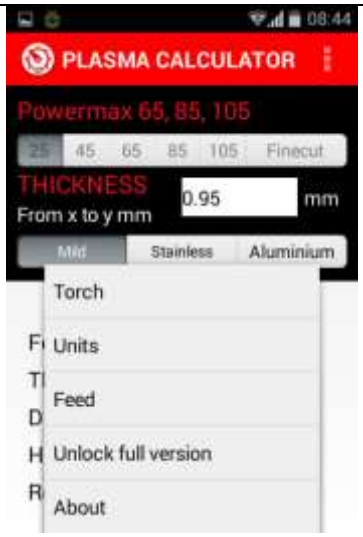
Plasma calculators for iPhone and Android

Parametric calculators for plasma cutting estimate the optimal feed rate, the THC voltage, delay, pierce, and cut heights, all based on the selected cutter, current, metal, and sheet thickness.

The calculator can be operated in both the metric and imperial systems. The feed rate can be set in mm/min or mm/sec (same as inches/min or inches/sec).



The calculator can be downloaded at iTunes: https://itunes.apple.com/en/app/id827635625



The calculator can be downloaded at Google Play: https://play.google.com/store/apps/details?id=ru.po_mo.Plasma_Calculator