THC1 set
THC1-M control module
and THC1-DV1 voltage divider

CONNECTION AND SETUP MANUAL

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General information

The THC1 set is designed for automatic control of cutting height in plasma cutting devices (АПР). The set consists of two devices — a control module and voltage divider module. The both devices are powered by mains voltage ~220 V. (This solution allows installing the divider module in close proximity to plasma source and precludes the use of any additional power supply sources. The THC1-M measurement module is installed in the system NC control cabinet. The modules are switched using "twisted pair' cable with 8P8C connectors, cable pin-out is detailed in Section 6).

These devices have been fully tested with АПР manufactured by Hypertherm company. They are well-proven as reliable and high-quality equipment. Most of them are equipped with special connectors for connecting the THC units. The ПУРМ-180ма source has been fully tested..

Make sure the following pre-requisites are met for correct operation of the plasma cutters or other manufacturers:
1. They allow connecting devices for automatic cutting height control;
2. Specified electrical output parameters of the cutter match the THC unit parameters.

If the plasma cutter manual does not provide the possibility of the THC unit connection, or plasma cutter parameters do not meet the specified ones,

Delivery set

- THC1-M controller – 1 pc.
- THC1-DV1 divider module – 1 pc.
- Connection and setup manual – 1 pc.
- Ethernet cable – 2 pcs.

Technical Data

<table>
<thead>
<tr>
<th>THC1-M module supply voltage</th>
<th>~220 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful current of THC1-M module</td>
<td>up to 13 mA</td>
</tr>
<tr>
<td>THC1-DV1 module supply voltage</td>
<td>~220 VAC</td>
</tr>
<tr>
<td>Useful current of THC1-DV1 module</td>
<td>up to 3 mA</td>
</tr>
<tr>
<td>Measured voltage of plasma cutter arc (HV input)</td>
<td>0–200 V voltage measurement range; 380 V maximum short-duration voltage</td>
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<tr>
<td>Measured voltage of plasma cutter arc (LV input)</td>
<td>0–8 V voltage measurement range; 18 V maximum short-duration voltage</td>
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<tr>
<td>Control interface</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Control program</td>
<td>MACH3</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>500 mΩ</td>
</tr>
<tr>
<td>Working temperature</td>
<td>0...60 °C</td>
</tr>
<tr>
<td>Overall dimensions of THC1-M (W x H x D)</td>
<td>120 x 112 x 67 mm</td>
</tr>
<tr>
<td>Overall dimensions of THC1-DV1 (W x H x D)</td>
<td>120 x 107 x 67 mm</td>
</tr>
</tbody>
</table>
03. Technical Data

THC1. Set of modules

Fig. 1. Dimensions of module THC1-DV1

Fig. 2. Dimensions of module THC1-M
04. Differences of LV and HV inputs of module THC1-DV1

Almost all currently known plasma installation types provide for connecting a sensor for measuring the current arc voltage. In this case some versions provide the user with "safe" voltage passed through a divider with a known step-down ratio. Such a method of connection to the plasma installation is preferable, as the output voltage is safe for human and imposes lesser requirements to insulation which allows arranging a more convenient connection of THC sensor (LV input). If a voltage divider integrated into the installation is unavailable, then the THC sensor can be connected directly to special terminals inside the plasma installation (HV input). The available THC sensor connection methods shall be described in the plasma installation operation manual. The choice of an input for connection depends on the plasma installation in use. The measurement circuit inside the divider module THC1-DV1 is switched using Control switch (see Section 6 "Purpose of inputs, display and connection).

"Torch Down" traditional for MACH3, the THC1 transmits the effective arc voltage signal over Ethernet. The PLCM series NC controller received this information and adjusts the height and then sends the current adjustment status to the MACH3. In such an approach any Z axis auto-oscillations are eliminated, as the PLCM knows not only the required adjustment direction, but also the overrange value from which the required Z axis offset at a time can be determined. During control based on "classical circuit" where no PLCM controller is present and control is carried out using "Torch UP" and "Torch Down" signals some Z axis oscillations may occur which will affect the cutting quality adversely. In addition to the main measurement function the THC1 set controls plasma ignition and transmits the current ARC OK signal status to the PLCM. Two mechanisms are provided to monitor the arc starting – classical ARC OK signal and the current transformer. The "ARC OK" input is an input galvanically isolated by means of optocoupler. The plasma source switches it by means of a relay. The CT (current transformer) input is used if the plasma source is not equipped with an arc starting monitoring circuit. A current transformer (100A:5A) inductively coupled with plasma source power supply phase conductor is connected to this input (see the connection diagram).

The following additional parameters shall be set to the PLCM controller for controlling the plasma cutter height:

• He required voltage on the arc (to be selected based on the plasma installation manual). This value can be zero. In this case, upon expiry of "control delay" time after ignition, voltage on the arc will be measured and assumed as the required value, and this value will be maintained during cutting.
• Will "ARC OK" signal be used? If yes, then after the plasma cutter activation command the PLCM will not move until a confirmation of "ARC OK" actuation is received from the THC1.

05. Operating principle

The principle of design of the automatic plasma cutter arc height control system using THC1 set differs from other similar systems of other manufacturers. In addition to signals "Torch UP: and
05. Operating principle

This function can be disabled, then movement will begin irrespective of "ARC OK" signal status. In case of arc extincts during movement and ARC OK signal disappears, movement will continue irrespective of the selected mode. The matter is the arc extinction is a standard situation which may occur, for example, if the cut out blank has already dropped out, but the cutting contour was set with some overlapping, and the machine needs to cover some more distance before it extinguishes plasma.

• "Control delay" sets the time in seconds for which control will be suspended after the torch activation. During metal burning-through voltage in the arc is almost always much above the standard value, and if control is not blocked in this time, the torch will begin moving down trying to normalize voltage. The delay depends on metal thickness and can amount 0 to 5–10 seconds.

• "Overvoltage" (previously referred to as "permissible voltage tolerance") sets the limit set overvoltage at which control is allowed. If the current voltage exceeds the set voltage by a greater value, then control is suspended until voltage returns to specified range. This is due to the fact that voltage in the arc depends on cutting rate also. The plasma installation manual details recommended voltage values for a particular torch speed. The MACH3 decelerates the torch in turns, which results in growth of arc voltage and, consequently, in lowering of the torch. Besides, when the operating plasma head passes over the existing metal cut, the voltage increases for a short time interval also. This parameter has been introduced so that the system would not react to such violent voltage fluctuations. Its value is selected experimentally and is usually 5–10% of the required voltage.

THC1-DV1 module:
220 VAC – connection to ~220 V AC mains.
HV – an input for applying 30 to 200 V measured voltage;
LV – an input for applying 0 to 8 V measured voltage;
ARC OK – input of arc_ok signal.
ETHERNET – connection to a router or PC network card; DATA CABLE – connection to THC1-M module;
POWER – (green) indicator of applied supply voltage;
ARC OK (green) – the indicator shows presence of "arc ok" signal (it is disabled in CT mode);
TORCH FIRE (green) – it backs up TORCH FIRE output status. It is on, if the contacts are closed and it is off, if they are opened;
ERROR – (red) is lit in case of an error;
LINK – (green) signal of data transmission over Ethernet network;
CONNECT – (green) signal of communication with Mach3;
UP – (yellow) up adjustment signal;
DOWN – (yellow) down adjustment signal.

THC1-M module:
220 VAC – connection to ~220 V AC mains.
ETHERNET – connection to a router or PC network card; DATA CABLE – connection to THC1-DV1 module;
POWER – (green) indicator of applied supply voltage;
ARC OK (green) – the indicator shows presence of "arc ok" signal (it is disabled in CT mode);
TORCH FIRE (green) – it backs up TORCH FIRE output status. It is on, if the contacts are closed and it is off, if they are opened;
ERROR – (red) is lit in case of an error;
LINK – (green) signal of data transmission over Ethernet network;
CONNECT – (green) signal of communication with Mach3;
UP – (yellow) up adjustment signal;
DOWN – (yellow) down adjustment signal.

Fig. 3. Interconnecting cable (standard Ethernet patch cord) diagram
06. Purpose of outputs, display and connection

Position of DIP switches of THC-DV1 module

Fig. 4. Connection of modules to a source equipped with a voltage divider
Position of DIP switches of THC1-DV1 module

Fig. 5. Connection of modules to a plasma source without a voltage divider
Position of DIP switches of THC1-DV1 module

To network switch or PC
Twisted pair (connector 8P8C)
NC control console

Fig. 6. Connection of modules to a plasma source without a voltage divider and Arc ok output
Fig. 7. Connection of modules without a PLCM controller

To THC-DV1 module

To PC network card

AC220V

Data cable

Ethernet

R2 10k

12V

R1 10k

PLC4x-G2
06. Fig. 8. Diagram of connection to АР РУРМ-180МА

**THC1. Set of modules**

**IGNITION**

**CT**

**+**

**-**

**THC1-DV1**

**A1**

**Power supply source**

**A3**

**Control unit**

**A2**

**Oscillator**

**Item to be cut**

**Plasma torch**

**Overheating**

**Cathode**

**Nozzle**

**Source**

**Supply**

**Fig. 8. Diagram of connection to АР РУРМ-180МА**
The THC1-DV1 device is installed in close proximity to the plasma source. It minimizes the length of high-voltage wires and allows energizing the module from the line to which the source is connected. The THC1-M module is installed in the NC rack and connected to PC via a network switch (in case the PLCM controller is used) or directly to the PC network card (if the PLCM is unavailable). The data transmission line (DATA CABLE) has no galvanic coupling between modules which allows avoiding any interference induction by plasma source to the NC control rack. When the PLCM movement controller is absent in the system (PC control movement using LPT port), it is necessary to send signals UP and DOWN to vacant inputs, since these inputs are galvanically isolated by means of an optocoupler, it is necessary to use an external power supply source and current-limiting resistors.

The Mach 3 is set up conventionally, according to the user manual. To operate this device, it is necessary to install a set of specialized SW which can be downloaded from Purelogic company web site. Also some additional Microsoft libraries may be required for the installation. For more details use "Useful information" link which is in the section of this device on our web site. To install the SW, run THC-setup.exe file which is available at the link "скачать ПО" ("Download SW") in the section of this device on our web site. Once the plug-in is installed, it is necessary to activate it. To do that, in Mach3 program go to menu Config->Config Plugins and select checkbox opposite the item "THC-Purelogic-RND...", then re-start Mach3. After restart THC Control item shall appear in Plugin Control menu, which means correct plug-in installation.

Once the plug-in is set up, apply the supply voltage to THC1-M. "Power" LED should light up. Now connect the TCH-1M to LAN. The green " Link" LED should light up. Select menu item Plugins Control -> THC control in MACH3 menu. A window shown in Fig. 9 will appear. All THC devices found in the network will be listed at the top of this window. If the list is empty, try to press "Обновить" ("Refresh") button. For a device to be found, IP address of your PC and THC1 address must be located in the same subnetwork. By default, THC1's address is 192.168.10.12, which means that the PC's address shall begin with 192.168.10.xxx, and the last number must not coincide with the PLCM's or THC1's address. If the device does not appear in the list, see FAQ section. It should be noted that for the THC module to be successfully found by the plug-in, the device shall be connected to the same network card as the PLCM controller, i.e. if two network cards are installed in the computer, and the PLCM controller is connected to one of them, and the THC1 device is connected to the other one, then the THC1 module will not operate. Both devices shall only be connected to PC via a network switch. The setup procedure of a network card for the PLCM controller operation is detailed in the movement controller manual. If THC1 is used without a PLCM movement controller, and height is monitored by means of UP and DOWN signals via PC's LPT port, no network switch is necessary. The DHCP switch box is only checked if there is a DHCP server or router in the network. That is to say, if PLCM and THC modules are connected to PV through a router, then IP addresses are assigned to the devices automatically. In case of connection through an ordinary network switch the controller will receive an unknown IP and will be "lost" in the network – the selection field will remain empty when Refresh button is pressed. The way out is using "Адрес по умолчанию" ("Default address") button. The button restores factory network settings to all THC devices in the network (Fig. 10). If it is required to assign the THC an address different from the factory setting, then it is necessary to select "Фиксированный адрес" ("Fixed address") position of the radio button. In "IP-address" field enter 192.168.10.XX (xx – address different from the PC's and PLCM controller's address) Subnet mask 255.255.255.0. The field "Default gateway" may be left blank. After pressing the button "Установить адрес" ("Set address") the controller will store the changed settings.
06. Purpose of outputs, display and connection

Then press Refresh button. The module to be connected to the network will be determined in the device selection field.

07. FAQ

1. The "Link" LED does not blink when Ethernet cable is connected to THC1.
   
   **Possible causes:** damaged cable, malfunctioning network switch, malfunctioning network card, connection options cannot be determined automatically.
   
   **Explanation:** This LED indicates data exchange between the device and PC (or DHCP server) via Ethernet.
   
   **Remedy:** Check cables, connections, operability of the equipment and its settings using methods similar to troubleshooting in LAN. Set 10Mbit/Full Duplex connection mode in the network card settings.

2. When Ethernet cable is connected to THC1-M the "Link" LED blinks, but the 192.168.10.12 address device is not pinged.
   
   **Possible causes:**
   1. The controller’s IP address is not the default setting.
   2. The computer's IP address is not set up correctly.
   
   **Explanations:** By default the THC1-M device has preset address 192.168.10.12, so the computer’s IP shall be located in the same subnetwork for successful connection.
   
   **Remedy:**
   1. Reset the device settings to default settings (see the instruction below).
   2. Set up the PC's address to any address of 192.168.10.xx network manually or using set_ip.exe utility from the SW archive (see the installation instruction).

3. The Ethernet PLCM is pinged but is not available from the plug-in configuration window.

   **Possible causes:** A firewall or some other program blocks traffic between PLCM and computer.
   
   **Explanations:** To detect all PLCM devices in LAN, the plug-in uses UDP broadcast queries. Some programs in OS Windows, for example, a firewall or anti-virus software, can block such network queries.
   
   **Remedy:** Find and disable the program blocking the traffic.

4. How to create your own screen set.
   
   If you wish to create your own screen for operation with THC1, the necessary controls are listed below: DRO #1332 – required arc voltage, V DRO #1333 – current (measured) voltage, V DRO #1334 – control delay after ignition, s DRO #1336 - maximum voltage tolerance, V UserLED #1326 – attribute of use of ARC OK signal.

08. Warranty

Warranty service life is 12 months from the purchase date. The warranty is only preserved if operation and scheduled maintenance conditions are observed.

1. **General provisions**
   
   1.1. If the goods is purchased as component parts, Seller shall guarantee operability of each component part individually, but is not responsible for the quality of their joint operation (incorrect selection of component parts. In case of any questions you can consult the company’s specialists).
   
   1.2. Seller does not provide any warranty for compatibility of the purchased goods and the goods possessed by Buyer, or purchased by them from any third parties.
   
   1.3. Specifications and configuration of the product can be changed by
manufacturer without prior notice due to continuous technical improvement of the products.

2. **Conditions for access to warranty service**
2.1. The goods is accepted for warranty service in the same configuration in which it was purchased.

3. **Warranty service procedure**
3.1. The warranty service is carried out by testing (checking for) the declared malfunction of the product.
3.2. The warranty service is carried out if the malfunction is confirmed.

4. The warranty does not cover glass, electric lamps, starters and consumable materials, and:
4.1. any goods damaged due to improper transportation and storage conditions, incorrect connection, off-design operation, or in conditions not stipulated by the manufacturer (including temperature and humidity beyond recommended range), damaged due to effect of exterior circumstances (power supply voltage surges, natural disasters, etc.), and mechanically or thermally damaged goods.
4.2. Goods with traces of effect and (or) ingress of foreign objects, substances (including dust), liquids, insects and those with extraneous texts.
4.3. Goods with traces of unauthorized tampering and (or) repair (tampering signs, primitive soldering, traces of component replacement, etc.).
4.4. The goods having self-diagnostic means indicating improper operation conditions.
4.6. The Goods operated in conditions where power supply did not comply with manufacturer's requirements, and if the electrical network and equipment protection devices are unavailable.
4.7. The Goods which was re-sold by the initial buyer to third-party persons.
4.8. The Goods damaged due to use of low-quality or outdated spare parts, consumable materials, accessories and if spare parts, consumable materials and accessories not recommended by the manufacturer were used.
4.10. Highly technical Goods in respect of which installation and assembly works were carried out neither by Seller's specialists, nor by organizations recommended by Seller, except cases directly stipulated in the goods documentation.
It was manufactured and accepted in accordance with mandatory requirements of the applicable technical documentation and deemed ready for operations.

Batch No.:  

QCD:
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