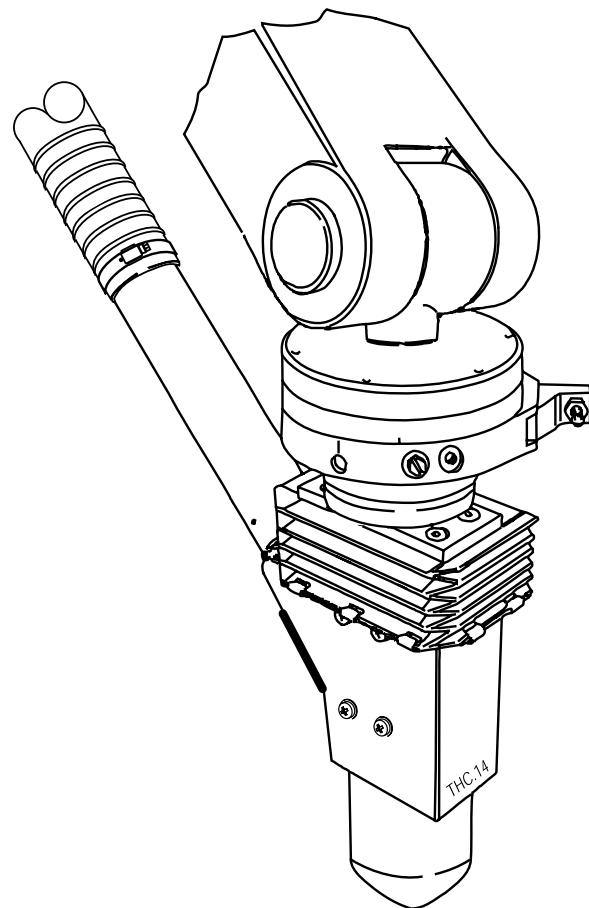


command[®] THC

Robotic Torch Height Control (THC) System

**Instruction Manual
802510 – Revision 7**



EN50199
EN60974-1

Hypertherm[®]
*The world leader in
plasma cutting technology™*

Changed Page	Description	Rev 6 to 7 1/28/05
Cover & Title page	Revision changed from 6 to 7. Art on cover updated to show new encoder.	
3.14, 5.10, 6.3	Changed part number on DC power distribution board from 041509 to 229070	
3.15	Added text to #4 (HPR pierce complete). It is only used for X-Y applications.	
6.2	Changed part number for item number 5 (power source, 130W) from 041509 to 229070	
Appendix A	Removed it. The information on THC selectable responses is now included in Section 3 <i>Set up</i> pages 3-14 and 3-15.	

command®
Robotic
Torch Height Control
(THC) System

Instruction Manual
P/N 802510

Revision 7 - January 2005

Hypertherm, Inc.
P.O. Box 5010
Hanover, NH 03755 USA
www.hypertherm.com

© Copyright 2005 Hypertherm, Inc.
All Rights Reserved

Hypertherm and Command are trademarks of Hypertherm, Inc., and
may be registered in the United States and/or other countries

Hypertherm, Inc.

Etna Road, P.O. Box 5010
 Hanover, NH 03755 USA
 603-643-3441 Tel (Main Office)
 603-643-5352 Fax (All Departments)
 info@hypertherm.com (Main Office Email)

800-643-9878 Tel (Technical Service)

technical.service@hypertherm.com (Technical Service Email)
 800-737-2978 Tel (Customer Service)
 customer.service@hypertherm.com (Customer Service Email)

Hypertherm Automation, LLC

5 Technology Drive, Suite 300
 West Lebanon, NH 03755 USA
 603-298-7970 Tel
 603-298-7977 Fax

Hypertherm Plasmatechnik, GmbH

Technologiepark Hanau
 Rodenbacher Chaussee 6
 D-63457 Hanau-Wolfgang, Deutschland
 49 6181 58 2100 Tel
 49 6181 58 2134 Fax

49 6181 58 2123 (Technical Service)***Hypertherm (S) Pte Ltd.***

No. 19 Kaki Bukit Road 2
 K.B. Warehouse Complex
 Singapore 417847, Republic of Singapore
 65 6 841 2489 Tel
 65 6 841 2490 Fax

65 6 841 2489 (Technical Service)***Hypertherm (Shanghai) Consulting Co., Ltd.***

Suite 305, CIMIC Towers
 1090 Century Boulevard, Pudong
 Shanghai 200120
 P.R. China
 86-21-5835-5362 /3 Tel
 86-21-5835 5220 Fax

86-21-5835-5362 /3 (Technical Service)***Hypertherm***

Branch of Hypertherm, UK, UC
 PO Box 244
 Wigan, Lancashire, England WN8 7WU
 00 800 3324 9737 Tel
 00 800 4973 7329 Fax
00 800 4973 7843 (Technical Service)

France

15 Impasse des Rosiers
 95610 Eragny, France
 00 800 3324 9737 Tel
 00 800 4973 7329 Fax

Hypertherm S.r.l.

Via Torino 2
 20123 Milano, Italia
 39 02 725 46 312 Tel
 39 02 725 46 400 Fax
39 02 725 46 314 (Technical Service)

Hypertherm Europe B.V.

Vaartveld 9
 4704 SE Roosendaal, Nederland
 31 165 596907 Tel
 31 165 596901 Fax
 31 165 596908 Tel (Marketing)
31 165 596900 Tel (Technical Service)
00 800 49 73 7843 Tel (Technical Service)

Japan

1952-14 Yata-Natsumegi
 Mishima City, Shizuoka Pref.
 411-0801 Japan
 81 0 559 75 7387 Tel
 81 0 559 75 7376 Fax

HYPERTHERM BRASIL LTDA.

Rua Jati, 33
 CEP 07180-350 Cumbica
 Guarulhos, SP - Brasil
 55 11 6482 1087 Tel
 55 11 6482 0591 Fax

EMC INTRODUCTION

Hypertherm's CE-marked equipment is built in compliance with standard EN50199. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN50199 may not be adequate to completely eliminate interference when the affected equipment is in close proximity or has a high degree of sensitivity. In such cases it may be necessary to use other measures to further reduce interference.

This plasma equipment is designed for use only in an industrial environment.

INSTALLATION AND USE

The user is responsible for installing and using the plasma equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing the cutting circuit, see *Earthing of Workpiece*. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

ASSESSMENT OF AREA

Before installing the equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a. Other supply cables, control cables, signalling and telephone cables; above, below and adjacent to the cutting equipment.
- b. Radio and television transmitters and receivers.
- c. Computer and other control equipment.
- d. Safety critical equipment, for example guarding of industrial equipment.
- e. Health of the people around, for example the use of pacemakers and hearing aids.
- f. Equipment used for calibration or measurement.
- g. Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.
- h. Time of day that cutting or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

METHODS OF REDUCING EMISSIONS

Mains Supply

Cutting equipment must be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed cutting equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the cutting mains supply so that good electrical contact is maintained between the conduit and the cutting power source enclosure.

Maintenance of Cutting Equipment

The cutting equipment must be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the cutting equipment is in operation. The cutting equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Cutting Cables

The cutting cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential Bonding

Bonding of all metallic components in the cutting installation and adjacent to it should be considered. However, metallic components bonded to the workpiece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note. The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC/TS 62081 Arc Welding Equipment Installation and Use.

Screening and Shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire plasma cutting installation may be considered for special applications.

WARRANTY

WARNING

Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Any damage caused by the use of other than genuine Hypertherm parts may not be covered by the Hypertherm warranty.

WARNING

You are responsible for the safe use of the Product. Hypertherm does not and cannot make any guarantee or warranty regarding the safe use of the Product in your environment.

GENERAL

Hypertherm, Inc. warrants that its Products shall be free from defects in materials and workmanship, if Hypertherm is notified of a defect (i) with respect to the power supply within a period of two (2) years from the date of its delivery to you, with the exception of Powermax Series power supplies, which shall be within a period of three (3) years from the date of delivery to you, and (ii) with respect to the torch and leads within a period of one (1) year from its date of delivery to you. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged. Hypertherm, at its sole option, shall repair, replace, or adjust, free of charge, any defective Products covered by this warranty which shall be returned with Hypertherm's prior authorization (which shall not be unreasonably withheld), properly packed, to Hypertherm's place of business in Hanover, New Hampshire, or to an authorized Hypertherm repair facility, all costs, insurance and freight prepaid. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with Hypertherm's prior written consent. **The warranty above is exclusive and is in lieu of all other warranties, express, implied, statutory, or otherwise with respect to the Products or as to the results which may be obtained therefrom, and all implied warranties or conditions of quality or of merchantability or fitness for a particular purpose or against infringement. The foregoing shall constitute the sole and exclusive remedy for any breach by Hypertherm of its warranty.** Distributors/OEMs may offer different or additional warranties, but Distributors/OEMs are not authorized to give any additional warranty protection to you or make any representation to you purporting to be binding upon Hypertherm.

PATENT INDEMNITY

Except only in cases of products not manufactured by Hypertherm or manufactured by a person other than Hypertherm not in strict conformity with Hypertherm's specifications and in cases of designs, processes, formulae, or combinations not developed or purported to be developed by Hypertherm, Hypertherm will defend or settle, at its own expense, any suit or proceeding brought against you alleging that the use of the Hypertherm product, alone and not in combination with any other product not supplied by

Hypertherm, infringes any patent of any third party. You shall notify Hypertherm promptly upon learning of any action or threatened action in connection with any such alleged infringement, and Hypertherm's obligation to indemnify shall be conditioned upon Hypertherm's sole control of, and the indemnified party's cooperation and assistance in, the defense of the claim.

LIMITATION OF LIABILITY

In no event shall Hypertherm be liable to any person or entity for any incidental, consequential, indirect, or punitive damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise and even if advised of the possibility of such damages.

LIABILITY CAP

In no event shall Hypertherm's liability, whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise, for any claim action suit or proceeding arising out of or relating to the use of the Products exceed in the aggregate the amount paid for the Products that gave rise to such claim.

INSURANCE

At all times you will have and maintain insurance in such quantities and types, and with coverage sufficient and appropriate to defend and to hold Hypertherm harmless in the event of any cause of action arising from the use of the Products.

NATIONAL AND LOCAL CODES

National and Local codes governing plumbing and electrical installation shall take precedent over any instructions contained in this manual. **In no event** shall Hypertherm be liable for injury to persons or property damage by reason of any code violation or poor work practices.

TRANSFER OF RIGHTS

You may transfer any remaining rights you may have hereunder only in connection with the sale of all or substantially all of your assets or capital stock to a successor in interest who agrees to be bound by all of the terms and conditions of this Warranty.

TABLE OF CONTENTS

ELECTROMAGNETIC COMPATIBILITY (EMC)	i
WARRANTY	ii
Section 1 SAFETY.....	1-1
Recognize Safety Information.....	1-2
Follow Safety Instructions.....	1-2
Cutting Can Cause Fire or Explosion	1-2
Electric Shock Can Kill.....	1-3
Cutting Can Produce Toxic Fumes	1-3
A Plasma Arc Can Cause Injury and Burns	1-4
Arc Rays Can Burn Eyes and Skin	1-4
Grounding Safety	1-4
Compressed Gas Equipment Safety	1-5
Gas Cylinders Can Explode If Damaged	1-5
Noise Can Damage Hearing	1-5
Pacemaker and Hearing Aid Operation	1-5
A Plasma Arc Can Damage Frozen Pipes	1-5
Additional Safety Information	1-5
Section 1a SÉCURITÉ.....	1a-1
Identifier les consignes de sécurité.....	1a-2
Suivre les instructions de sécurité	1a-2
Le coupage peut provoquer un incendie ou une explosion	1a-2
Les chocs électriques peuvent être fatals.....	1a-3
Le coupage peut produire des vapeurs toxiques	1a-3
L'arc plasma peut provoquer des blessures ou des brûlures	1a-4
Mise à la masse et à la terre.....	1a-4
Les rayons de l'arc peuvent brûler les yeux et la peau.....	1a-4
Sécurité des bouteilles de gaz comprimé	1a-5
Les bouteilles de gaz comprimé peuvent exploser en cas de dommages	1a-5
Le bruit peut provoquer des problèmes auditifs.....	1a-5
Pacemakers et prothèses auditives.....	1a-5
Un arc plasma peut endommager les tuyaux gelés.....	1a-5
Section 2 DESCRIPTION & SPECIFICATIONS	
General	2-3
Specifications.....	2-4
THC control module	2-4
Plasma interface assembly	2-5
Robotic lifter assembly	2-6
Operator pendant	2-7
Robotic lifter breakaway option	2-8
Section 3 SETUP	
Upon receipt	3-2
Claims.....	3-2

TABLE OF CONTENTS

Power requirements	3-2
System unit mounting	3-3
THC control module	3-3
Plasma interface assembly	3-4
Install robotic lifter assembly	3-6
Install torch breakaway kit (optional)	3-8
System interconnections.....	3-10
THC system cables	3-10
Machine interface cable	3-12
THC selectable responses.....	3-14
DIP switch positions	3-15
Command THC serial protocol.....	3-16
Electrode and work lead sensing wires.....	3-18
Power supply interface cable	3-20
Ohmic contact wire.....	3-22
Grounding requirements	3-23
Power cord grounding	3-23
Protective earth ground	3-23
Cable part numbers and signal lists.....	3-24

Section 4 OPERATION

Operating controls	4-2
THC control module	4-2
Operator pendant	4-2
Pendant display screens	4-4
Pendant programmable fields	4-6
Automatic screen operation	4-6
Manual screen operation	4-8
Setup screen A.....	4-9
Determining pierce height factor	4-12
THC operating cycle time-lines	4-13
Automatic mode time-line.....	4-14
Problems and solutions.....	4-15
Manual mode time-line	4-17
THC selectable responses (DIP switch).....	See Section 3 Setup

Section 5 MAINTENANCE

Routine maintenance	5-2
Robotic lifter maintenance	5-2
Troubleshooting	5-3
Diagnostic screen B	5-3
Error messages	5-4
AC power distribution	5-8
Motor drive board status lights during normal power-up	5-9
DC power distribution	5-10
Control board status lights during normal power-up	5-12
Interface board status lights during normal power-up	5-14

TABLE OF CONTENTS

Section 6 PARTS LIST

THC control module	6-2
Plasma interface assembly	6-4
Operator pendant	6-5
Robotic lifter assembly	6-6
Robotic lifter torch breakaway kit - optional	6-8
Ohmic contact wire	6-9
Power cords	6-9
Interface cables	See Section 3

TABLE OF CONTENTS

Section 1

SAFETY

In this section:

Recognize Safety Information.....	1-2
Follow Safety Instructions	1-2
Cutting Can Cause Fire or Explosion	1-2
Electric Shock Can Kill.....	1-3
Cutting Can Produce Toxic Fumes	1-3
A Plasma Arc Can Cause Injury and Burns	1-4
Arc Rays Can Burn Eyes and Skin	1-4
Grounding Safety	1-4
Compressed Gas Equipment Safety	1-5
Gas Cylinders Can Explode If Damaged	1-5
Noise Can Damage Hearing	1-5
Pacemaker and Hearing Aid Operation	1-5
A Plasma Arc Can Damage Frozen Pipes	1-5
Additional Safety Information	1-5



RECOGNIZE SAFETY INFORMATION

The symbols shown in this section are used to identify potential hazards. When you see a safety symbol in this manual or on your machine, understand the potential for personal injury, and follow the related instructions to avoid the hazard.



FOLLOW SAFETY INSTRUCTIONS

Read carefully all safety messages in this manual and safety labels on your machine.

- Keep the safety labels on your machine in good condition. Replace missing or damaged labels immediately.
- Learn how to operate the machine and how to use the controls properly. Do not let anyone operate it without instruction.

- Keep your machine in proper working condition. Unauthorized modifications to the machine may affect safety and machine service life.

DANGER WARNING CAUTION

A signal word DANGER or WARNING is used with a safety symbol. DANGER identifies the most serious hazards.

- DANGER and WARNING safety labels are located on your machine near specific hazards.
- WARNING safety messages precede related instructions in this manual that may result in injury or death if not followed correctly.
- CAUTION safety messages precede related instructions in this manual that may result in damage to equipment if not followed correctly.



CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire Prevention

- Be sure the area is safe before doing any cutting. Keep a fire extinguisher nearby.
- Remove all flammables within 35 feet (10 m) of the cutting area.
- Quench hot metal or allow it to cool before handling or before letting it touch combustible materials.
- Never cut containers with potentially flammable materials inside – they must be emptied and properly cleaned first.
- Ventilate potentially flammable atmospheres before cutting.
- When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.

Explosion Prevention

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not cut pressurized cylinders, pipes, or any closed container.
- Do not cut containers that have held combustible materials.



WARNING

Explosion Hazard
Argon-Hydrogen and Methane

Hydrogen and methane are flammable gases that present an explosion hazard. Keep flames away from cylinders and hoses that contain methane or hydrogen mixtures. Keep flames and sparks away from the torch when using methane or argon-hydrogen plasma.



WARNING

Hydrogen Detonation with Aluminum Cutting

- When cutting aluminum underwater, or with the water touching the underside of the aluminum, free hydrogen gas may collect under the workpiece and detonate during plasma cutting operations.
- Install an aeration manifold on the floor of the water table to eliminate the possibility of hydrogen detonation. Refer to the Appendix section of this manual for aeration manifold details.



ELECTRIC SHOCK CAN KILL

Touching live electrical parts can cause a fatal shock or severe burn.

- Operating the plasma system completes an electrical circuit between the torch and the workpiece. The workpiece and anything touching the workpiece are part of the electrical circuit.
- Never touch the torch body, workpiece or the water in a water table when the plasma system is operating.

Electric Shock Prevention

All Hypertherm plasma systems use high voltage in the cutting process (200 to 400 VDC are common). Take the following precautions when operating this system:

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.

- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- Do not pick up the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.



CUTTING CAN PRODUCE TOXIC FUMES

Cutting can produce toxic fumes and gases that deplete oxygen and cause injury or death.

- Keep the cutting area well ventilated or use an approved air-supplied respirator.
- Do not cut in locations near degreasing, cleaning or spraying operations. The vapors from certain chlorinated solvents decompose to form phosgene gas when exposed to ultraviolet radiation.
- Do not cut metal coated or containing toxic materials, such as zinc (galvanized), lead, cadmium or

beryllium, unless the area is well ventilated and the operator wears an air-supplied respirator. The coatings and any metals containing these elements can produce toxic fumes when cut.

- Never cut containers with potentially toxic materials inside – they must be emptied and properly cleaned first.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer.



A PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-On Torches

Plasma arc comes on immediately when the torch switch is activated.

The plasma arc will cut quickly through gloves and skin.

- Keep away from the torch tip.
- Do not hold metal near the cutting path.
- Never point the torch toward yourself or others.



ARC RAYS CAN BURN EYES AND SKIN

Eye Protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.

- Use eye protection in accordance with applicable national or local codes.
- Wear eye protection (safety glasses or goggles with side shields, and a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Arc Current
Up to 100 A
100-200 A
200-400 A
Over 400 A



Lens Shade	
AWS (USA)	ISO 4850
No. 8	No. 11
No. 10	No. 11-12
No. 12	No. 13
No. 14	No. 14

Skin Protection Wear protective clothing to protect against burns caused by ultraviolet light, sparks and hot metal.

- Gauntlet gloves, safety shoes and hat.
- Flame-retardant clothing to cover all exposed areas.
- Cuffless trousers to prevent entry of sparks and slag.
- Remove any combustibles, such as a butane lighter or matches, from your pockets before cutting.

Cutting Area Prepare the cutting area to reduce reflection and transmission of ultraviolet light:

- Paint walls and other surfaces with dark colors to reduce reflection.
- Use protective screens or barriers to protect others from flash and glare.
- Warn others not to watch the arc. Use placards or signs.



GROUNDING SAFETY

Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

Work Table Connect the work table to an earth ground, in accordance with appropriate national or local electrical codes.

Input Power

- Be sure to connect the power cord ground wire to the ground in the disconnect box.
- If installation of the plasma system involves connecting the power cord to the power supply, be sure to connect the power cord ground wire properly.
- Place the power cord's ground wire on the stud first, then place any other ground wires on top of the power cord ground. Fasten the retaining nut tightly.
- Tighten all electrical connections to avoid excessive heating.

COMPRESSED GAS EQUIPMENT SAFETY

- Never lubricate cylinder valves or regulators with oil or grease.
- Use only correct gas cylinders, regulators, hoses and fittings designed for the specific application.
- Maintain all compressed gas equipment and associated parts in good condition.
- Label and color-code all gas hoses to identify the type of gas in each hose. Consult applicable national or local codes.



GAS CYLINDERS CAN EXPLODE IF DAMAGED

Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

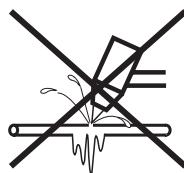
- Handle and use compressed gas cylinders in accordance with applicable national or local codes.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over valve except when the cylinder is in use or connected for use.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use a hammer, wrench or other tool to open a stuck cylinder valve.



NOISE CAN DAMAGE HEARING

Prolonged exposure to noise from cutting or gouging can damage hearing.

- Use approved ear protection when using plasma system.
- Warn others nearby about the noise hazard.



A PLASMA ARC CAN DAMAGE FROZEN PIPES

Frozen pipes may be damaged or can burst if you attempt to thaw them with a plasma torch.



PACEMAKER AND HEARING AID OPERATION

Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.

Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.

To reduce magnetic field hazards:

- Keep both the work cable and the torch lead to one side, away from your body.
- Route the torch leads as close as possible to the work cable.
- Do not wrap or drape the torch lead or work cable around your body.
- Keep as far away from the power supply as possible.

ADDITIONAL SAFETY INFORMATION

1. ANSI Standard Z49.1, *Safety in Welding and Cutting*, American Welding Society, 550 LeJeune Road P.O. Box 351020, Miami, FL 33135
2. ANSI Standard Z49.2, *Fire Prevention in the Use of Cutting and Welding Processes*, American National Standards Institute 1430 Broadway, New York, NY 10018
3. ANSI Standard Z87.1, *Safe Practices for Occupation and Educational Eye and Face Protection*, American National Standards Institute, 1430 Broadway, New York, NY 10018
4. AWS F4.1, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances*, American Welding Society 550 LeJeune Road, P.O. Box 351040, Miami, FL 33135

5. AWS F5.2, *Recommended Safe Practices for Plasma Arc Cutting*, American Welding Society
550 LeJeune Road, P.O. Box 351040, Miami, FL 33135
6. CGA Pamphlet P-1, *Safe Handling of Compressed Gases in Cylinders*, Compressed Gas Association
1235 Jefferson Davis Highway, Arlington, VA 22202
7. CSA Standard W117.2, *Code for Safety in Welding and Cutting*, Canadian Standards Association Standard Sales
178 Rexdale Boulevard, Rexdale, Ontario M9W 1R3, Canada
8. NFPA Standard 51B, *Cutting and Welding Processes*, National Fire Protection Association
470 Atlantic Avenue, Boston, MA 02210
9. NFPA Standard 70-1978, *National Electrical Code*, National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210
10. OSHA, *Safety and Health Standards*, 29FR 1910
U.S. Government Printing Office, Washington, D.C. 20402

SAFETY

Section 1a

SÉCURITÉ

Dans cette section :

Identifier les consignes de sécurité.....	1a-2
Suivre les instructions de sécurité	1a-2
Danger Avertissement Précaution	1a-2
Le coupage peut provoquer un incendie ou une explosion	1a-2
Prévention des incendies, Prévention des explosions	1a-2
Risque d'explosion argon-hydrogène et méthane.....	1a-2
Détonation de l'hydrogène lors du coupage de l'aluminium.....	1a-2
Les chocs électriques peuvent être fatals.....	1a-3
Prévention des chocs électriques	1a-3
Le coupage peut produire des vapeurs toxiques.....	1a-3
L'arc plasma peut provoquer des blessures ou des brûlures	1a-4
Torches à allumage instantané	1a-4
Les rayons de l'arc peuvent brûler les yeux et la peau.....	1a-4
Protection des yeux, Protection de la peau, Zone de coupage	1a-4
Mise à la masse et à la terre.....	1a-4
Câble de retour, Table de travail, Alimentation.....	1a-4
Sécurité des bouteilles de gaz comprimé	1a-5
Les bouteilles de gaz comprimé peuvent exploser en cas de dommages	1a-5
Le bruit peut provoquer des problèmes auditifs.....	1a-5
Pacemakers et prothèses auditives.....	1a-5
Un arc plasma peut endommager les tuyaux gelés.....	1a-5

SÉCURITÉ



IDENTIFIER LES CONSIGNES DE SÉCURITÉ

Les symboles indiqués dans cette section sont utilisés pour identifier les risques éventuels. Si vous trouvez un symbole de sécurité, que ce soit dans ce manuel ou sur l'équipement, soyez conscient des risques de blessures et suivez les instructions correspondantes afin d'éviter ces risques.



SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

Lire attentivement toutes les consignes de sécurité dans le présent manuel et sur les étiquettes de sécurité se trouvant sur la machine.

- Les étiquettes de sécurité doivent rester lisibles. Remplacer immédiatement les étiquettes manquantes ou abîmées.
- Apprendre à faire fonctionner la machine et à utiliser correctement les commandes. Ne laisser personne utiliser la machine sans connaître son fonctionnement.

- Garder la machine en bon état. Des modifications non autorisées sur la machine peuvent engendrer des problèmes de sécurité et raccourcir la durée d'utilisation de l'équipement.

DANGER AVERTISSEMENT PRÉCAUTION

Les signaux DANGER ou AVERTISSEMENT sont utilisés avec un symbole de sécurité, DANGER correspondant aux risques les plus sérieux.

- Les étiquettes de sécurité DANGER et AVERTISSEMENT sont situées sur la machine pour signaler certains dangers spécifiques.
- Les messages d'AVERTISSEMENT précèdent les instructions d'utilisation expliquées dans ce manuel et signalent les risques de blessures ou de mort au cas où ces instructions ne seraient pas suivies correctement.
- Les messages de PRÉCAUTION précèdent les instructions d'utilisation contenues dans ce manuel et signalent que le matériel risque d'être endommagé si les instructions ne sont pas suivies correctement.



LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

- Avant de commencer, s'assurer que la zone de coupage ne présente aucun danger. Conserver un extincteur à proximité.
- Éloigner toute matière inflammable à une distance d'au moins 10 m du poste de coupage.
- Tremper le métal chaud ou le laisser refroidir avant de le manipuler ou avant de le mettre en contact avec des matériaux combustibles.
- Ne jamais couper des récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Aérer toute atmosphère potentiellement inflammable avant d'utiliser un système plasma.
- Lors de l'utilisation d'oxygène comme gaz plasma, un système de ventilation par aspiration est nécessaire.

Prévention des explosions

- Ne pas couper en présence de poussière ou de vapeurs.
- Ne pas couper de bouteilles, de tuyaux ou autres récipients fermés et pressurisés.
- Ne pas couper de récipients contenant des matières combustibles.



AVERTISSEMENT

Risque d'explosion
argon-hydrogène et méthane

L'hydrogène et le méthane sont des gaz inflammables et potentiellement explosifs. Conserver à l'écart de toute flamme les bouteilles et tuyaux contenant des mélanges à base d'hydrogène ou de méthane. Maintenir toute flamme et étincelle à l'écart de la torche lors de l'utilisation d'un plasma d'argon-hydrogène ou de méthane.



AVERTISSEMENT

Détonation de l'hydrogène lors du coupage de l'aluminium

- Lors du coupage de l'aluminium sous l'eau, ou si l'eau touche la partie inférieure de la pièce d'aluminium, de l'hydrogène libre peut s'accumuler sous la pièce à couper et détonner lors du coupage plasma.
- Installer un collecteur d'aération au fond de la table à eau afin d'éliminer les risques de détonation de l'hydrogène. Se référer à l'annexe du manuel pour plus de renseignements sur les collecteurs d'aération.



LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

Toucher une pièce électrique sous tension peut provoquer un choc électrique fatal ou des brûlures graves.

- La mise en fonctionnement du système plasma ferme un circuit électrique entre la torche et la pièce à couper. La pièce à couper et tout autre élément en contact avec cette pièce font partie du circuit électrique.
- Ne jamais toucher le corps de la torche, la pièce à couper ou l'eau de la table à eau pendant le fonctionnement du système plasma.

Prévention des chocs électriques

Tous les systèmes plasma Hypertherm utilisent des hautes tensions pour le coupage (souvent de 200 à 400 V). On doit prendre les précautions suivantes quand on utilise le système plasma :

- Porter des bottes et des gants isolants et garder le corps et les vêtements au sec.
- Ne pas se tenir, s'asseoir ou se coucher sur une surface mouillée, ni la toucher quand on utilise le système plasma.
- S'isoler de la surface de travail et du sol en utilisant des tapis isolants secs ou des couvertures assez grandes pour éviter tout contact physique avec le travail ou le sol. S'il s'avère nécessaire de travailler dans ou près d'un endroit humide, procéder avec une extrême prudence.
- Installer un sectionneur avec fusibles appropriés, à proximité de la source de courant. Ce dispositif permet à l'opérateur d'arrêter rapidement la source de courant en cas d'urgence.
- En cas d'utilisation d'une table à eau, s'assurer que cette dernière est correctement mise à la terre.

- Installer et mettre à la terre l'équipement selon les instructions du présent manuel et conformément aux codes électriques locaux et nationaux.
- Inspecter fréquemment le cordon d'alimentation primaire pour s'assurer qu'il n'est ni endommagé, ni fendu. Remplacer immédiatement un cordon endommagé. **Un câble dénudé peut tuer.**
- Inspecter et remplacer les câbles de la torche qui sont usés ou endommagés.
- Ne pas saisir la pièce à couper ni les chutes lors du coupage. Laisser la pièce à couper en place ou sur la table de travail, le câble de retour connecté lors du coupage.
- Avant de vérifier, de nettoyer ou de remplacer les pièces de la torche, couper l'alimentation ou débrancher la prise de courant.
- Ne jamais contourner ou court-circuiter les verrouillages de sécurité.
- Avant d'enlever le capot du système ou de la source de courant, couper l'alimentation électrique. Attendre ensuite 5 minutes pour que les condensateurs se déchargent.
- Ne jamais faire fonctionner le système plasma sans que les capots de la source de courant ne soient en place. Les raccords exposés de la source de courant sont extrêmement dangereux.
- Lors de l'installation des connexions, attacher tout d'abord la prise de terre appropriée.
- Chaque système plasma Hypertherm est conçu pour être utilisé uniquement avec des torches Hypertherm spécifiques. Ne pas utiliser des torches inappropriées qui pourraient surchauffer et présenter des risques pour la sécurité.



LE COUPAGE PEUT PRODUIRE DES VAPEURS TOXIQUES

Le coupage peut produire des vapeurs et des gaz toxiques qui réduisent le niveau d'oxygène dans l'air et peuvent provoquer des blessures, voire la mort.

- Conserver le poste de coupage bien aéré ou utiliser un masque respiratoire homologué.
- Ne pas procéder au coupage près d'endroits où s'effectuent le dégraissage, le nettoyage ou la vaporisation. Certains solvants chlorés se décomposent sous l'effet des rayons ultraviolets et forment du phosgène.
- Ne pas couper des métaux peints ou contenant des matières toxiques comme le zinc (galvanisé), le plomb, le cadmium ou le beryllium, à moins que la zone de travail

soit très bien ventilée et que l'opérateur porte un masque respiratoire. Les revêtements et métaux contenant ces matières peuvent produire des vapeurs toxiques lors du coupage.

- Ne jamais couper de récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Quand on utilise ce produit pour le soudage ou le coupage, il dégage des fumées et des gaz qui contiennent des produits chimiques qui, selon l'État de Californie, provoquent des anomalies congénitales et, dans certains cas, le cancer.

SÉCURITÉ



L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

L'arc plasma s'allume immédiatement après que la torche soit mise en marche.

L'arc plasma coupe facilement les gants et la peau.

- Rester éloigné de l'extrémité de la torche.
- Ne pas tenir de métal près de la trajectoire de coupe.
- Ne jamais pointer la torche vers soi ou d'autres personnes.



LES RAYONS DE L'ARC PEUVENT BRÛLER LES YEUX ET LA PEAU

Protection des yeux Les rayons de l'arc plasma produisent de puissants rayons visibles ou invisibles (ultraviolets et infrarouges) qui peuvent brûler les yeux et la peau.

- Utiliser des lunettes de sécurité conformément aux codes locaux ou nationaux en vigueur.
- Porter des lunettes de protection (lunettes ou masque muni d'écrans latéraux et encore masque de soudure) avec des verres teintés appropriés pour protéger les yeux des rayons ultraviolets et infrarouges de l'arc.

Courant de l'arc
Jusqu'à 100 A
100-200 A
200-400 A
Plus de 400 A



Puissance des verres teintés
AWS (É.-U.) ISO 4850
Nº 8 Nº 11
Nº 10 Nº 11-12
Nº 12 Nº 13
Nº 14 Nº 14

Protection de la peau Porter des vêtements de sécurité pour se protéger contre les brûlures que peuvent causer les rayons ultraviolets, les étincelles et le métal brûlant :

- Gants à crissipin, chaussures et casque de sécurité.
- Vêtements ignifugés couvrant toutes les parties exposées du corps.
- Pantalon sans revers pour éviter que des étincelles ou des scories puissent s'y loger.
- Avant le coupage, retirer de ses poches tout objet combustible comme les briquets au butane ou les allumettes.

Zone de coupage Préparer la zone de coupage afin de réduire la réverbération et la transmission de la lumière ultraviolette :

- Peindre les murs et autres surfaces de couleur sombre pour réduire la réflexion de la lumière.
- Utiliser des écrans et autres dispositifs de protection afin de protéger les autres personnes de la lumière et de la réverbération.
- Prévenir les autres personnes de ne pas regarder l'arc.
Utiliser des affiches ou des panneaux.



MISE À LA MASSE ET À LA TERRE

Câble de retour Bien fixer le câble de retour (ou de masse) à la pièce à couper ou à la table de travail de façon à assurer un bon contact métal-métal. Ne pas fixer le câble de retour à la partie de la pièce qui doit se détacher.

Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

- S'assurer que le fil de terre du cordon d'alimentation est connecté à la terre dans le coffret du sectionneur.
- S'il est nécessaire de brancher le cordon d'alimentation à la source de courant lors de l'installation du système, s'assurer que le fil de terre est correctement branché.
- Placer tout d'abord le fil de terre du cordon d'alimentation sur le plot de mise à la terre puis placer les autres fils de terre par-dessus. Bien serrer l'écrou de retenue.
- S'assurer que toutes les connexions sont bien serrées pour éviter la surchauffe.

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

- Ne jamais lubrifier les robinets des bouteilles ou les régulateurs avec de l'huile ou de la graisse.
- Utiliser uniquement les bouteilles, régulateurs, tuyaux et accessoires appropriés et conçus pour chaque application spécifique.
- Entretenir l'équipement et les pièces d'équipement à gaz comprimé afin de les garder en bon état.
- Étiqueter et coder avec des couleurs tous les tuyaux de gaz afin d'identifier le type de gaz contenu dans chaque tuyau. Se référer aux codes locaux ou nationaux en vigueur.



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- Manipuler et utiliser les bouteilles de gaz comprimé conformément aux codes locaux ou nationaux.
- Ne jamais utiliser une bouteille qui n'est pas placée à la verticale et bien assujettie.
- Le capuchon de protection doit être placé sur le robinet sauf si la bouteille est en cours d'utilisation ou connectée pour utilisation.
- Éviter à tout prix le contact électrique entre l'arc plasma et une bouteille.
- Ne jamais exposer des bouteilles à une chaleur excessive, aux étincelles, aux scories ou aux flammes nues.
- Ne jamais utiliser des marteaux, des clés ou d'autres outils pour débloquer le robinet des bouteilles.



LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

Une exposition prolongée au bruit du coupage ou du gougeage peut provoquer des problèmes auditifs.

- Utiliser un casque de protection homologué lors de l'utilisation du système plasma.
- Prévenir les personnes aux alentours des risques encourus en cas d'exposition au bruit.

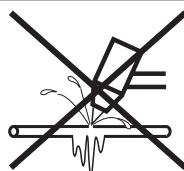


PACEMAKERS ET PROTHÈSES AUDITIVES

Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers. Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage plasma.

Pour réduire les risques associés aux champs magnétiques :

- Garder loin de soi et du même côté du corps le câble de retour et le faisceau de la torche.
- Faire passer le faisceau de la torche le plus près possible du câble de retour.
- Ne pas s'enrouler le faisceau de la torche ou le câble de retour autour du corps.
- Se tenir le plus loin possible de la source de courant.



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

Les tuyaux gelés peuvent être endommagés ou éclater si l'on essaie de les dégeler avec une torche plasma.

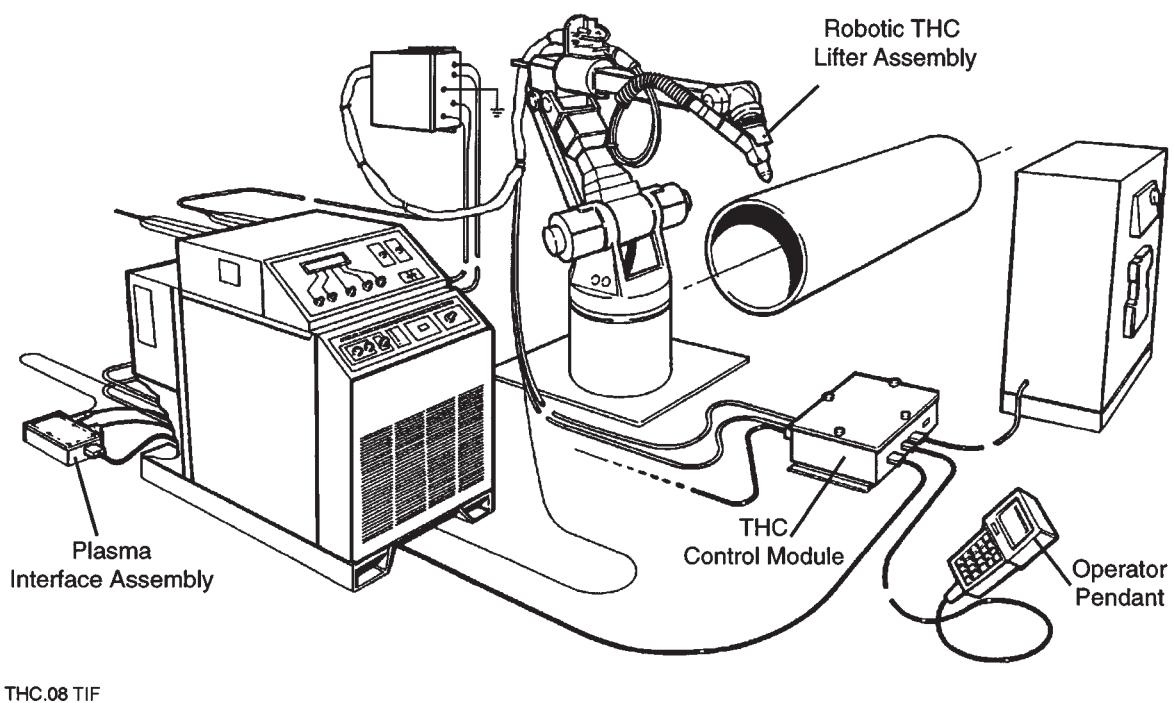
SÉCURITÉ

Section 2**SPECIFICATIONS**

In this section:

General	2-3
Specifications	2-4
THC control module	2-4
Plasma interface assembly	2-5
Robotic lifter assembly	2-6
Operator pendant	2-7
THC breakaway option	2-8

SPECIFICATIONS



**Figure 2-1 Robotic Command THC System
Interfaced with Plasma Cutting System and CNC**

General

Hypertherm's Command robotic torch height control (THC) system uses the plasma arc voltage to control the physical stand-off (distance) between the torch and workpiece during plasma arc cutting. See Figure 2-1. Initial height sensing (IHS) is accomplished by ohmic contact sensing or by a motor stall detection method. The system includes the following:

- **THC control module** (Figure 2-2) The THC control module houses two microcontrollers: a real-time controller and an interface controller. This unit provides initial height sensing, arc voltage control and interfaces with the torch lifter, the CNC machine, operator pendant and the plasma power supply through standard and RS-422 serial interfaces.
- **Plasma interface assembly with voltage divider** (Figure 2-3) The plasma interface houses an interface PCB which provides a link between the THC control module and the plasma power supply. The voltage divider provides an isolated 41 : 1 signal which is derived from the cutting arc voltage. For example, if the arc voltage is 150 volts, the resultant 3.66-volt output signal is used to control the stand-off distance between the torch and workpiece during plasma cutting.
- **Robotic lifter assembly** (Figure 2-4) The robotic lifter assembly includes the lifter and torch quick-disconnect. The lifter moves the torch up and down, under control of the THC control module. Two switches are provided to control the upper (home) and lower limits of the torch lifter Z-axis stroke of 1 inch.
- **Operator pendant (optional)** (Figure 2-5) The operator pendant is an optional remote control which includes an LCD display and keypad used for THC setup and control (parameter entry and menu selection). The main functions provided are: maintenance mode; arc voltage control/manual position mode; retract mid/full; IHS test/run; and voltage, cut height, and pierce delay setpoints; and access to setup and diagnostic screens.
- **Torch breakaway kit (optional)** (Figure 2-6) The torch breakaway (collision sensor) provides a level of protection for the torch, lifter and robotic system. Air pressure locks the THC lifter assembly to the robot mount. The air pressure can be adjusted to change the force required to trip the breakaway. Upon side impact, the breakaway releases from the lock position and allows the torch to float. See Figure 2-4 for torch mounting dimensions with and without the breakaway.

SPECIFICATIONS

Specifications

THC control module

Electrical

Input Power (automatic selecting dual range) 115 VAC or 230 VAC, 1 Phase,
50/60 Hz
Parallel Digital I/O + 12 VDC
Serial Digital I/O (RS-422) + 5 VDC (operator pendant), CNC

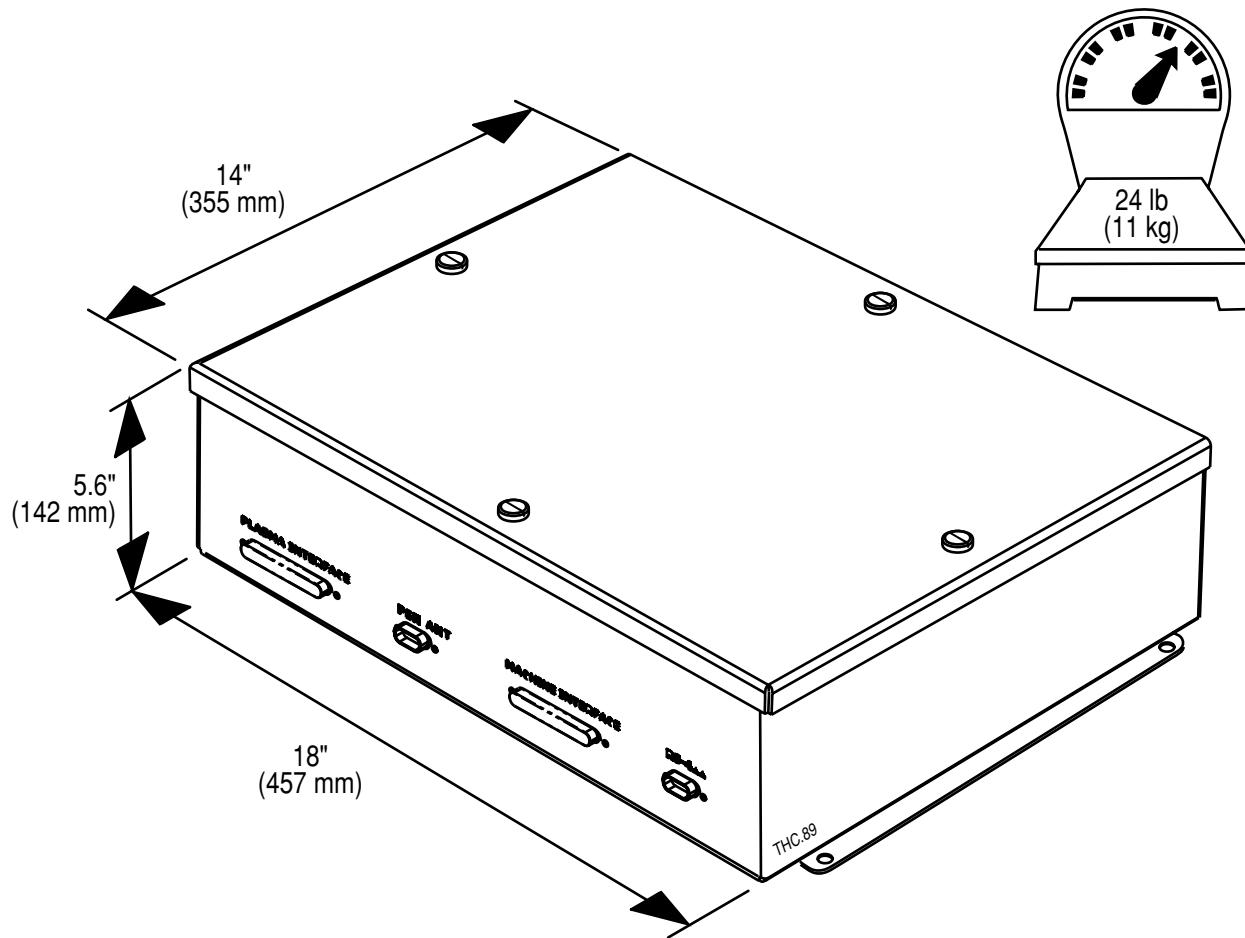


Figure 2-2 THC control module

Plasma interface assembly

Electrical

Input Power.....+ 24 VDC
Parallel Digital I/O+ 12 VDC
Serial Digital I/O (RS-422)+ 5 VDC

Voltage divider function41 :1 Arc Voltage (isolated)

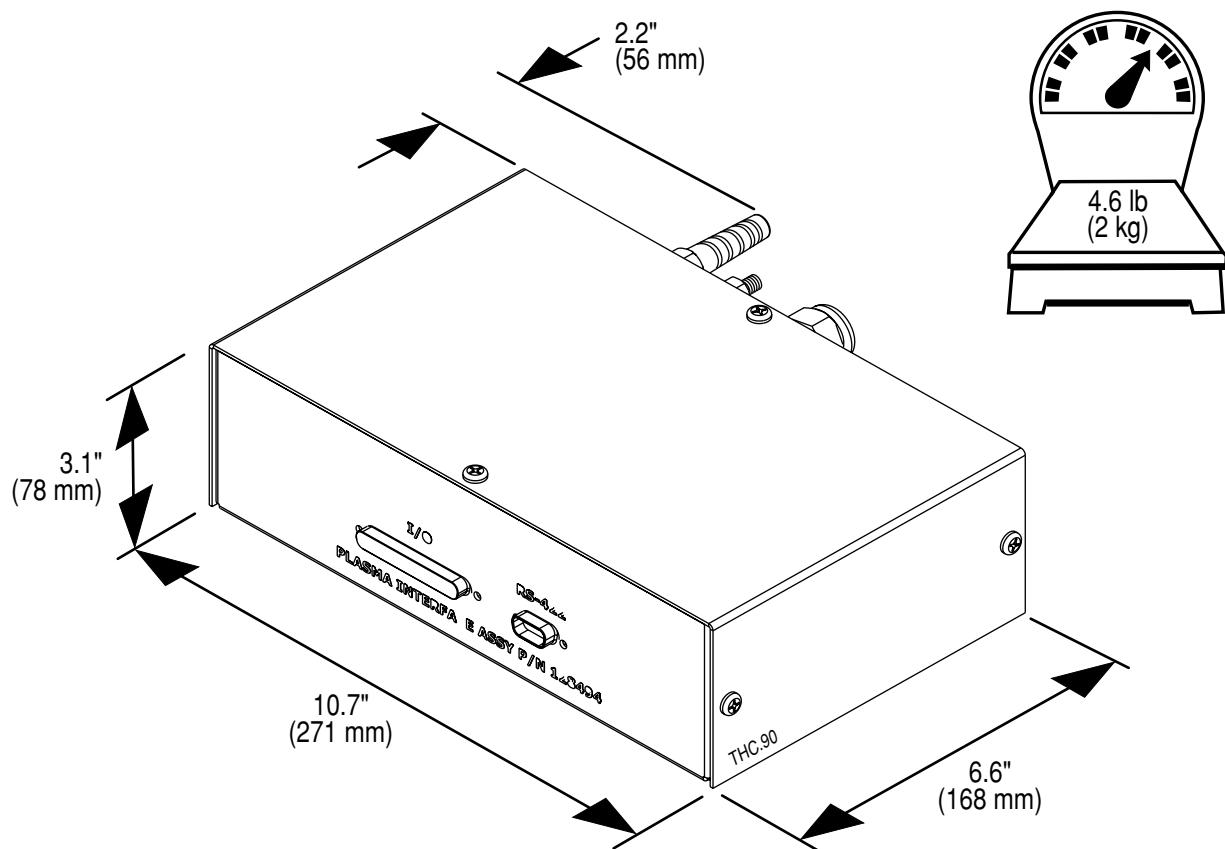


Figure 2-3 Plasma interface assembly

SPECIFICATIONS

Robotic lifter assembly

Electrical

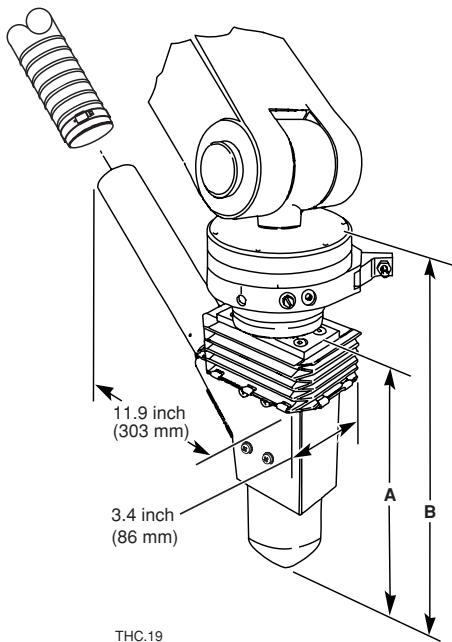
Motor + 5 VDC, 2 phase (1 amp per phase)
Limit switches + 24 VDC

Lifter control function

Motor Stepper
Motor Drive Stepper, chopped constant current
Lifter Limit Switches Home switch and lower limit switch
Maximum Z Axis Speed 100 inches (2540 mm) per minute
Maximum Z Axis Stroke 1 inch (25 mm)

Height Figure 2-4

Weight (includes lifter, disconnect, torch and consumables) 6.3 pounds (2.85 kg)



	Position		
	Fully Retracted	Mid-Travel (Teach)	Fully Extended
A. Without Breakaway Option	10.38 inches (264 mm)	10.88 inches (276 mm)	11.38 inches (289 mm)
B. With Breakaway Option	12.64 inches (321 mm)	13.14 inches (334 mm)	13.64 inches (346 mm)

Figure 2-4 Robotic lifter assembly

Operator pendant

Electrical

Input Power.....+ 12 VDC
Serial Digital I/O (RS-422)+ 5 VDC

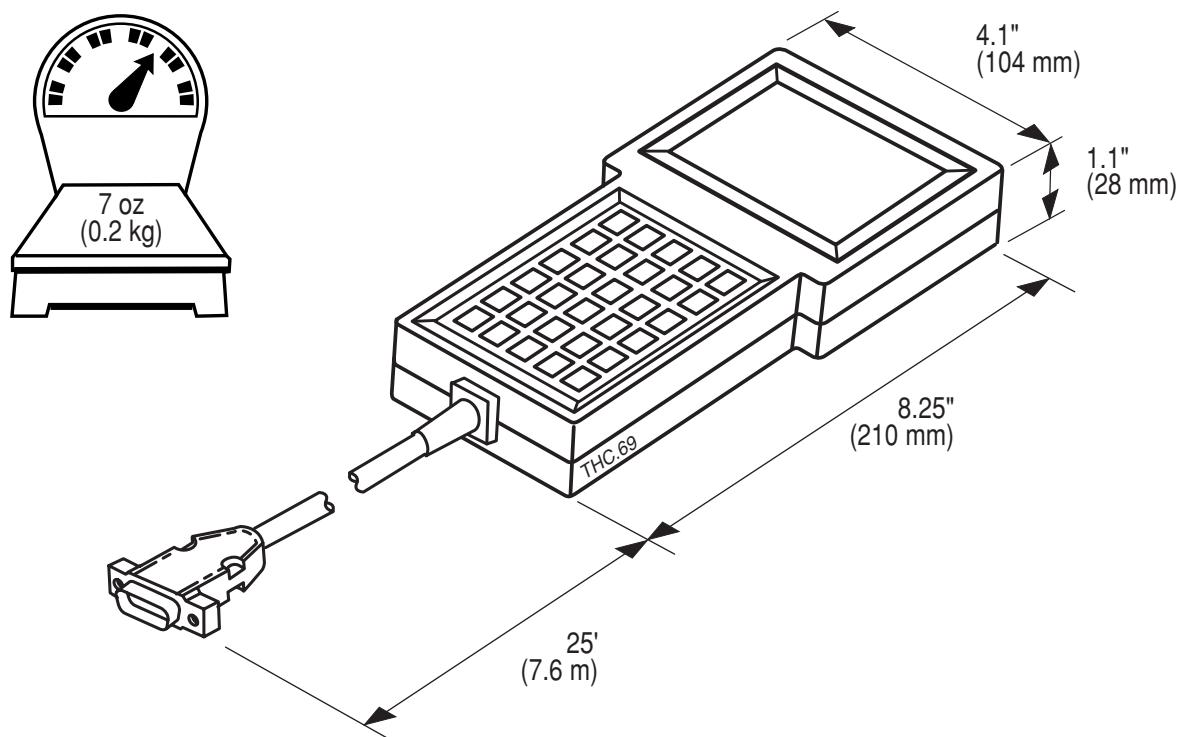


Figure 2-5 Operator pendant

SPECIFICATIONS

Robotic lifter breakaway option

Electrical

Pressure switch CNC emergency stop circuit voltage

Breakaway control function

Shop air pressure 100 psi (6.9 bar) maximum

Size

Breakaway Width 3.8 inches (97 mm)

Breakaway Height (thickness, including
fiberglass and aluminum brackets) 2.25 inches (57 mm)

Air filter/regulator Height 7.06 inches (179 mm)

Air filter/regulator Width 1.56 inches (40 mm)

Air filter/regulator depth (from gauge to back) 3.125 inches (79 mm)

Weight

Breakaway 1.9 pounds (0.86 kg)

Air filter/regulator 1.0 pounds (0.45 kg)

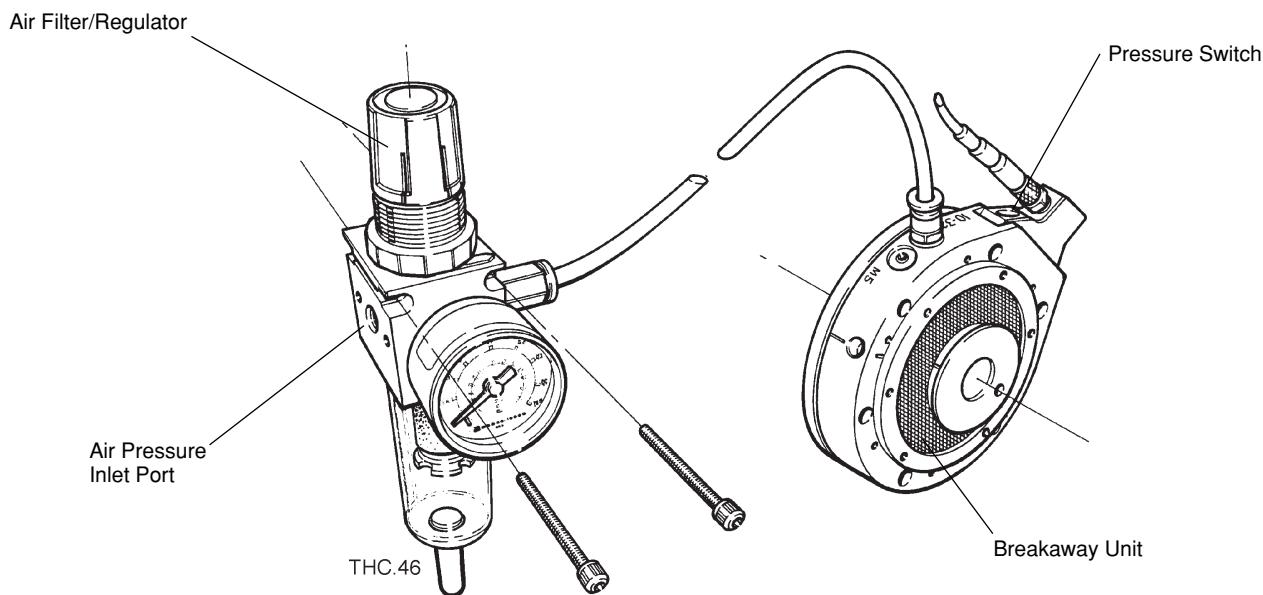


Figure 2-6 Robotic lifter breakaway option

Section 3**SETUP**

In this section:

Upon receipt.....	3-2
Claims	3-2
Power requirements	3-2
System unit mounting.....	3-3
THC control module.....	3-3
Plasma interface assembly.....	3-4
Install robotic lifter assembly	3-6
Install torch breakaway kit (optional)	3-8
System interconnections	3-10
THC system cables	3-10
Machine interface cable.....	3-12
THC selectable responses	3-14
DIP switch positions	3-15
Command THC serial protocol	3-16
Electrode and work lead sensing wires	3-18
Power supply interface cable.....	3-20
Ohmic contact wire	3-22
Grounding requirements	3-23
Power cord grounding	3-23
Protective earth ground	3-23
Cable part numbers and signal lists	3-24

Upon receipt

The THC system is shipped in two containers: one container holds the units; the other holds the cables. The containers should include the following standard and optional components, if ordered:

Standard components

- THC Control Module
- 2 Power Cords, 6.5 ft./2 m
- Plasma Interface Assembly
- Robotic Lifter Assembly
- Interface Cables
 - Lifter Motor Drive Cable (9 pin)
 - 3 Interface Cables (37 pin)
 - Ohmic Contact Wire
 - Power Supply Interface Cable (for Hypertherm power supplies only)
- Command THC System Instruction Manual

Optional components

- Operator Pendant with 25 ft. (7.5 m) Cable
- Pendant Extension Cable (9 pin)
- Torch Mounting Block Kit
- Torch Breakaway Kit

Claims

Claims for damage during shipment – If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

Claims for defective or missing merchandise – If any of the merchandise is defective or missing, call your authorized Hypertherm distributor. If you need additional assistance, call Customer Service listed in the front of this manual.

Power requirements

See THC control module in Section 2.

System unit mounting

Before interconnecting the THC system, mount the units as required, using customer-supplied hardware. Do not allow the units to lie unsecured on top of cabinets or on the floor. Refer to Section 2, *Specifications*, for unit dimensions.

THC control module

- Mount the THC control module close to the CNC controller for easy access to the THC system power and to provide easy access for routing and connecting cables. The unit can be mounted in any position except with the power module (AC receptacle and switch) facing up. The 4 mounting holes, requiring 1/4-inch (6 mm) fasteners, are provided. See Figure 3-1.

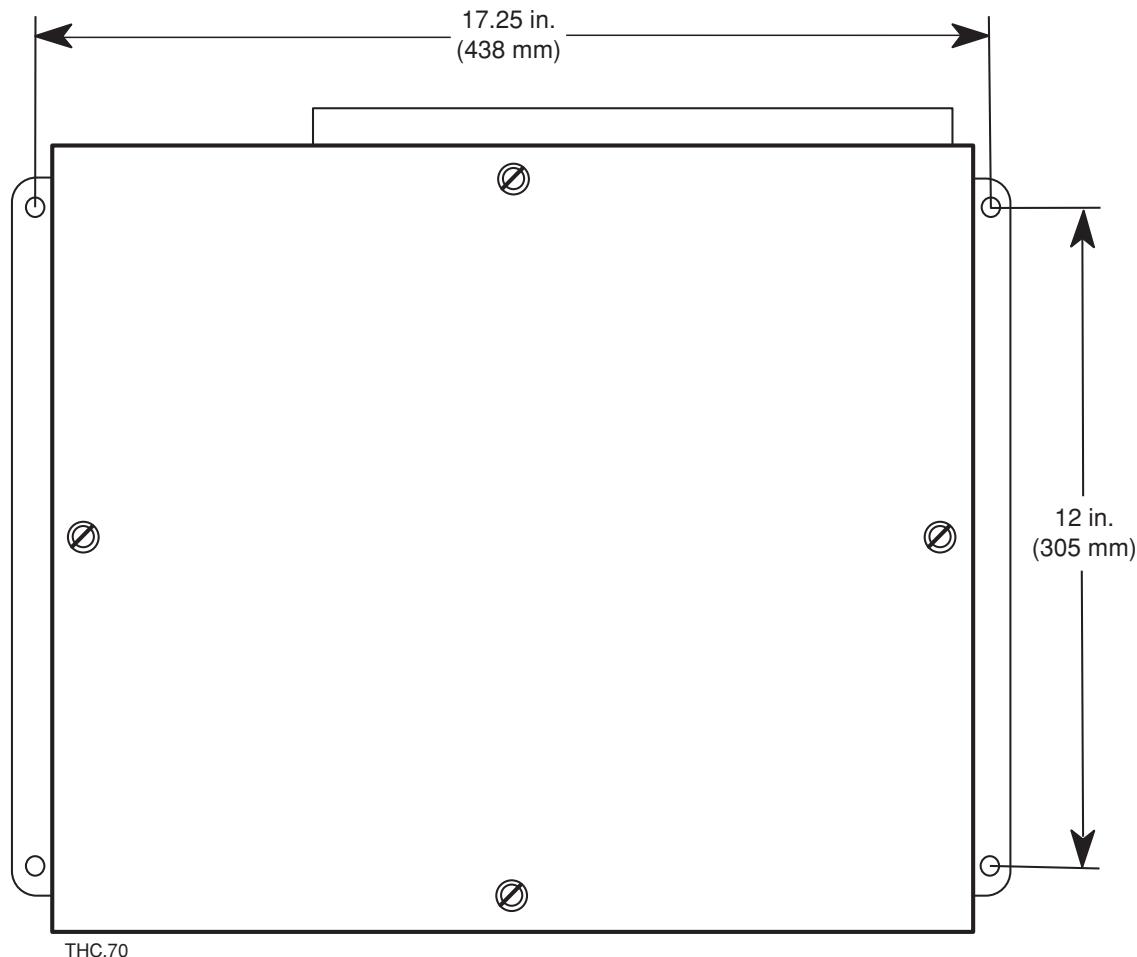


Figure 3-1 THC control module mounting

Plasma interface assembly

- Mount the plasma interface assembly close to the plasma power supply for easy connection of control and process signal wires between the units. The unit can be mounted in any position. The mounting holes require #8 (4 mm) fasteners. See Figure 3-2.

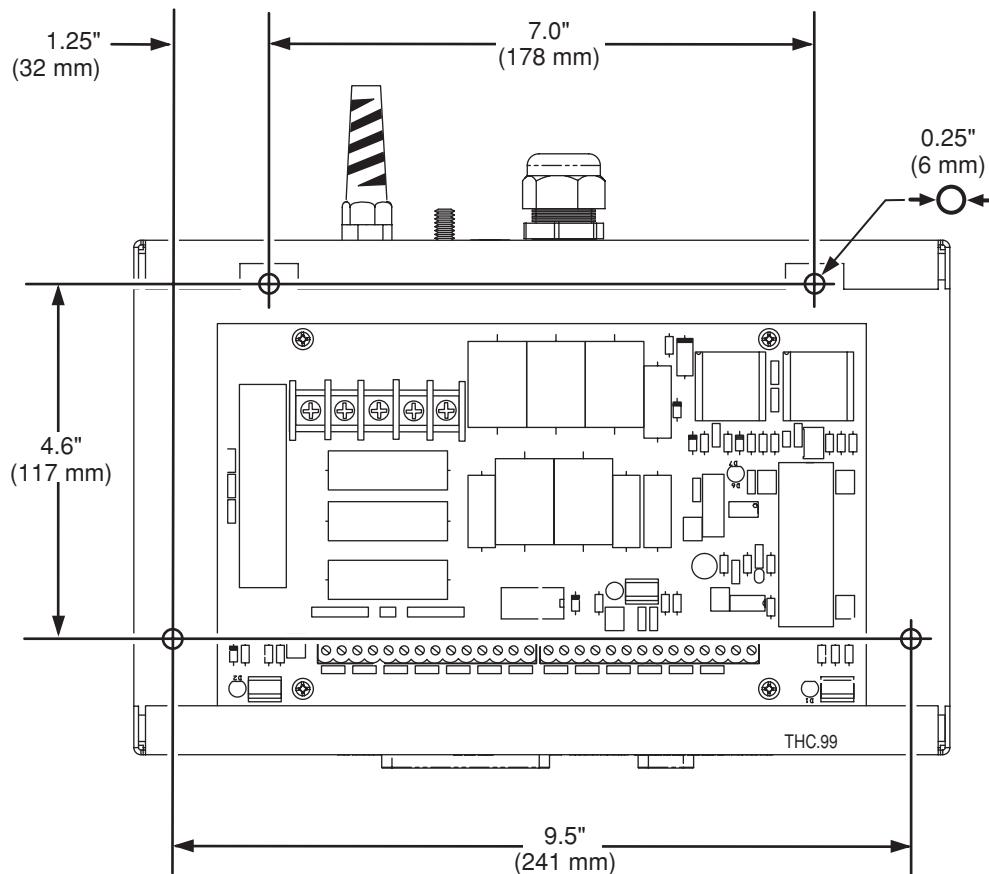


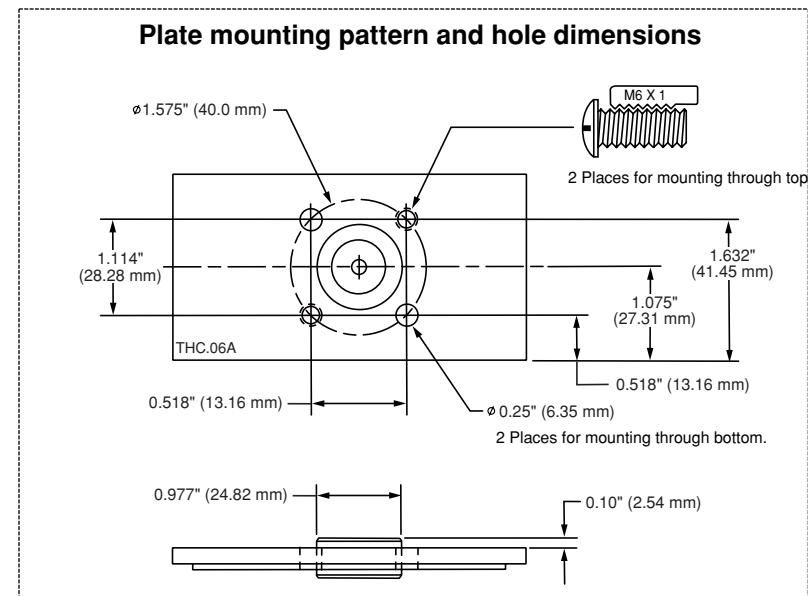
Figure 3-2 THC plasma interface assembly mounting

Blank

Install robotic lifter assembly

See Figure 3-3. If installing the torch breakaway option, go to page 3-8.

1. Hypertherm recommends that a safety breakaway (2) be used to mount the lifter assembly.
2. The customer must provide an interface that will align with the lifter mounting plate (4). Mounting plate (4) dimensions are shown in Figure 3-3.
3. If the lifter can be installed from the top with hex screws (3), proceed as follows:
 - a. Secure lifter (5) to the safety breakaway (2) with hex screws (3).
 - b. Install hex screws (3) through safety breakaway (2) and into the threaded holes of the mounting plate (4).
 - c. Install the safety breakaway and lifter to the robot (1).
4. If the lifter can not be installed from the top with hex screws (3), proceed as follows:
 - a. Remove clips (7), screws (8) and covers (6).
 - b. Secure the lifter (5) to the safety breakaway (2) with hex screws (9).
 - c. Install hex screws (9) through mounting plate (4) and in to threaded holes of the safety breakaway (2).
 - d. Install the covers (6) with clips (7) and screws (8).

**LEGEND**

- (1) Typical robot
- (2) Safety breakaway
(supplied by customer)
- (3) Hex screws, 2 *
- (4) Mounting plate
- (5) Lifter assembly
- (6) Covers, 2
- (7) Clips, 8
- (8) Screws, 8
- (9) Hex screws, 2 *

* Lifter can be secured from above or below the mounting plate (4).

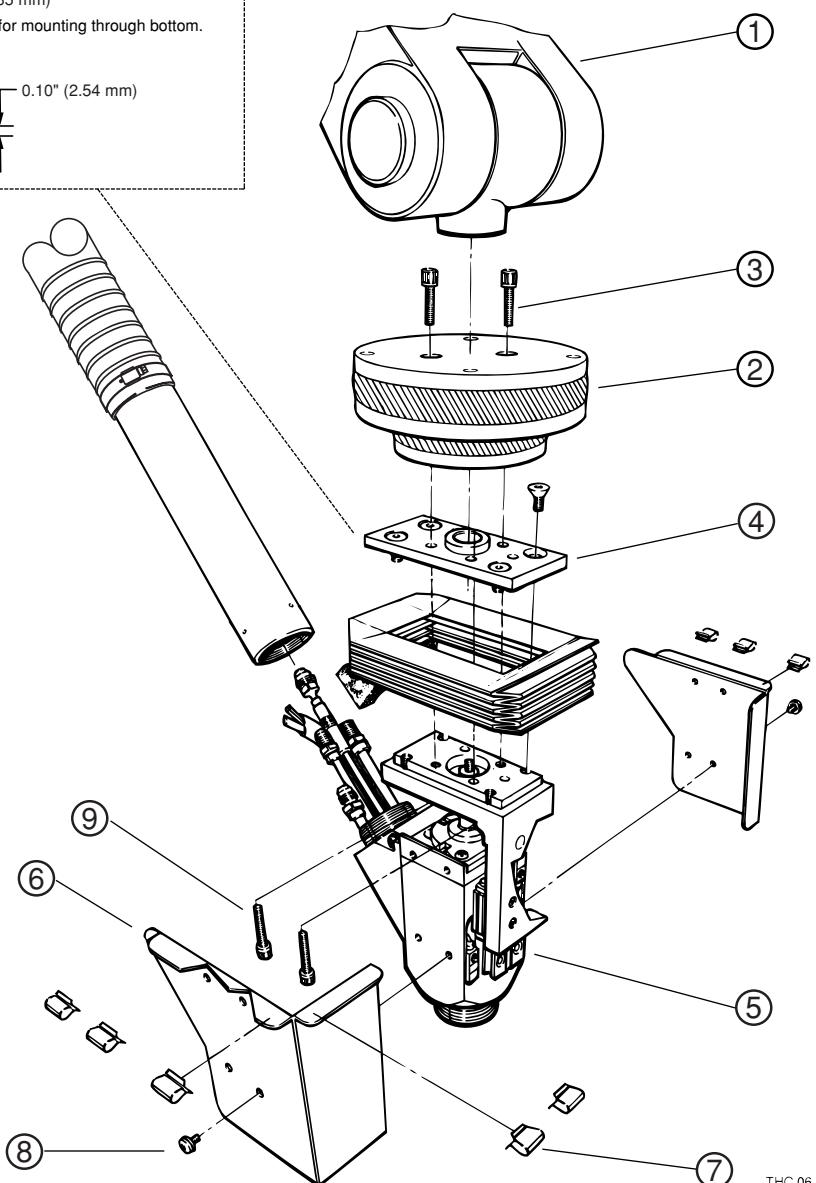


Figure 3-3 Robotic lifter assembly mounting details

SETUP

Install torch breakaway kit (optional)

See Figure 3-4.

1. Machine the fiberglass bracket ② to fit the robot ①.
2. Install the fiberglass bracket ② to the robot ①.
3. Mount the breakaway ③ to the fiberglass bracket ② using screws ④.
4. Secure the aluminum bracket ⑤ to the lifter ⑦ using hex screws ⑥.
5. Attach the lifter ⑦ to the breakaway ③ with the collar ⑧.

LEGEND

- ① Typical robot
- ② Fiberglass bracket
- ③ Breakaway
- ④ Screws, 6
- ⑤ Aluminum bracket
- ⑥ Screws, 2
- ⑦ Lifter assembly
- ⑧ Collar
- ⑨ Cable to CNC
- ⑩ Filter/Regulator
- ⑪ Hex screws, 2
8-32 X 1.5 inch
(4 mm X 40 mm)
Supplied by customer
- ⑫ Tubing

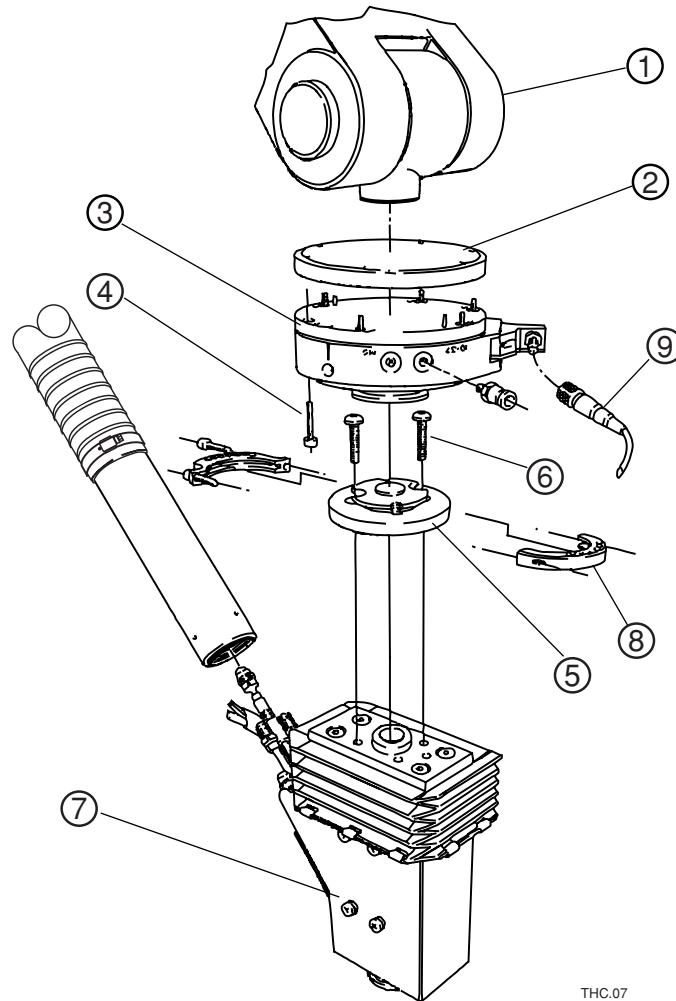
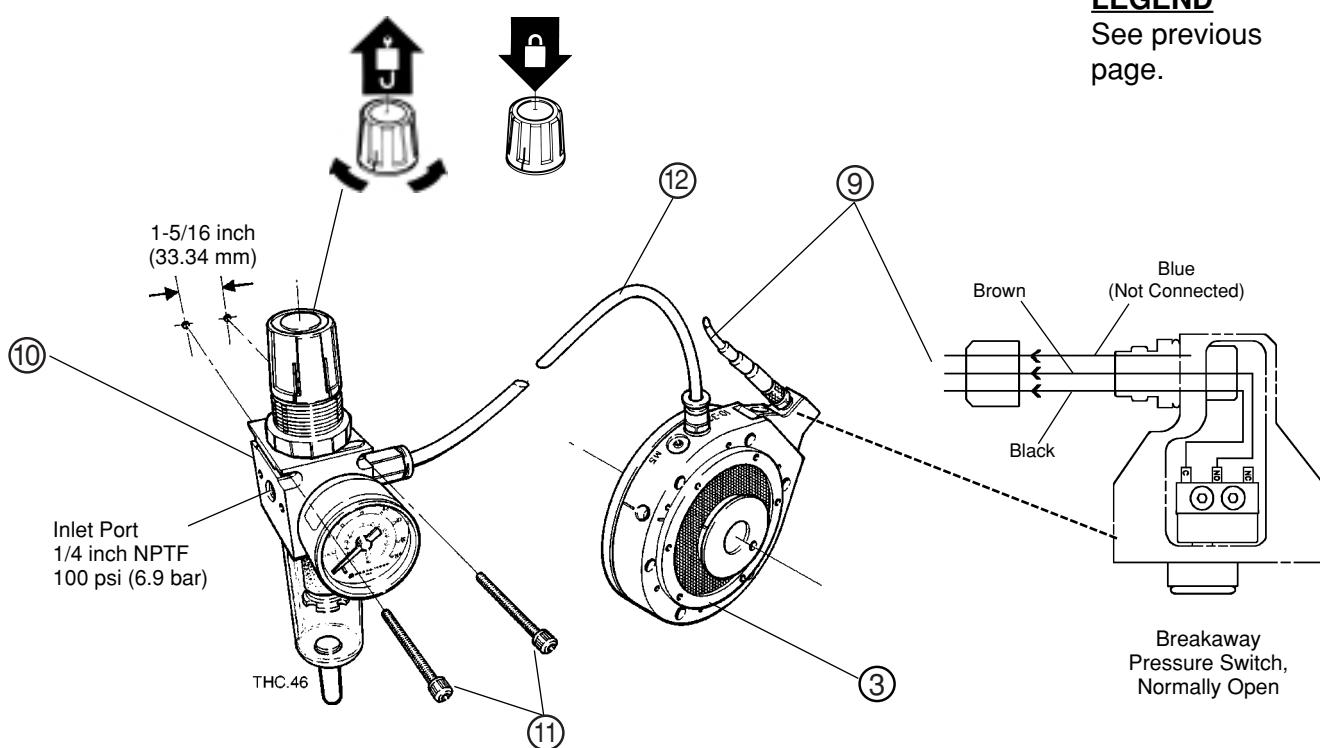


Figure 3-4 Robotic lifter torch breakaway kit mounting details (1 of 2)

6. Install cable ⑨ from the electrical output of the breakaway to the emergency stop circuit at the CNC.
7. Mount the filter/regulator ⑩.
8. Connect tubing between regulator ⑩ and breakaway ⑨.
9. Install air supply to the regulator ⑩ inlet port at 100 psi (6.9 bar) (recommended maximum pressure). The regulator inlet port size is 1/4 inch NPTF.
10. Adjust the regulator ⑩ to indicate 30 psi (2 bar) (recommended starting pressure) on the gauge.
11. Use hand force to simulate a crash and test the breakaway.
12. Adjust the air pressure until the desired trip force is achieved.
13. Enable the emergency stop circuit at the CNC after the breakaway is installed.

LEGEND
See previous page.



Notes:

- Set the inlet pressure to the filter/regulator ⑩ to 100 psi (6.9 bar). Do not exceed 150 psi (10.2 bar).
- The stall force, IHS speed, routing of the leads, and acceleration/deceleration movements can affect the pressure setting required to achieve reliable operation.
- If air pressure is removed (for example, overnight), the breakaway must be manually repositioned when air pressure is applied.

Figure 3-4 Robotic lifter torch breakaway kit mounting details (2 of 2)

System interconnections

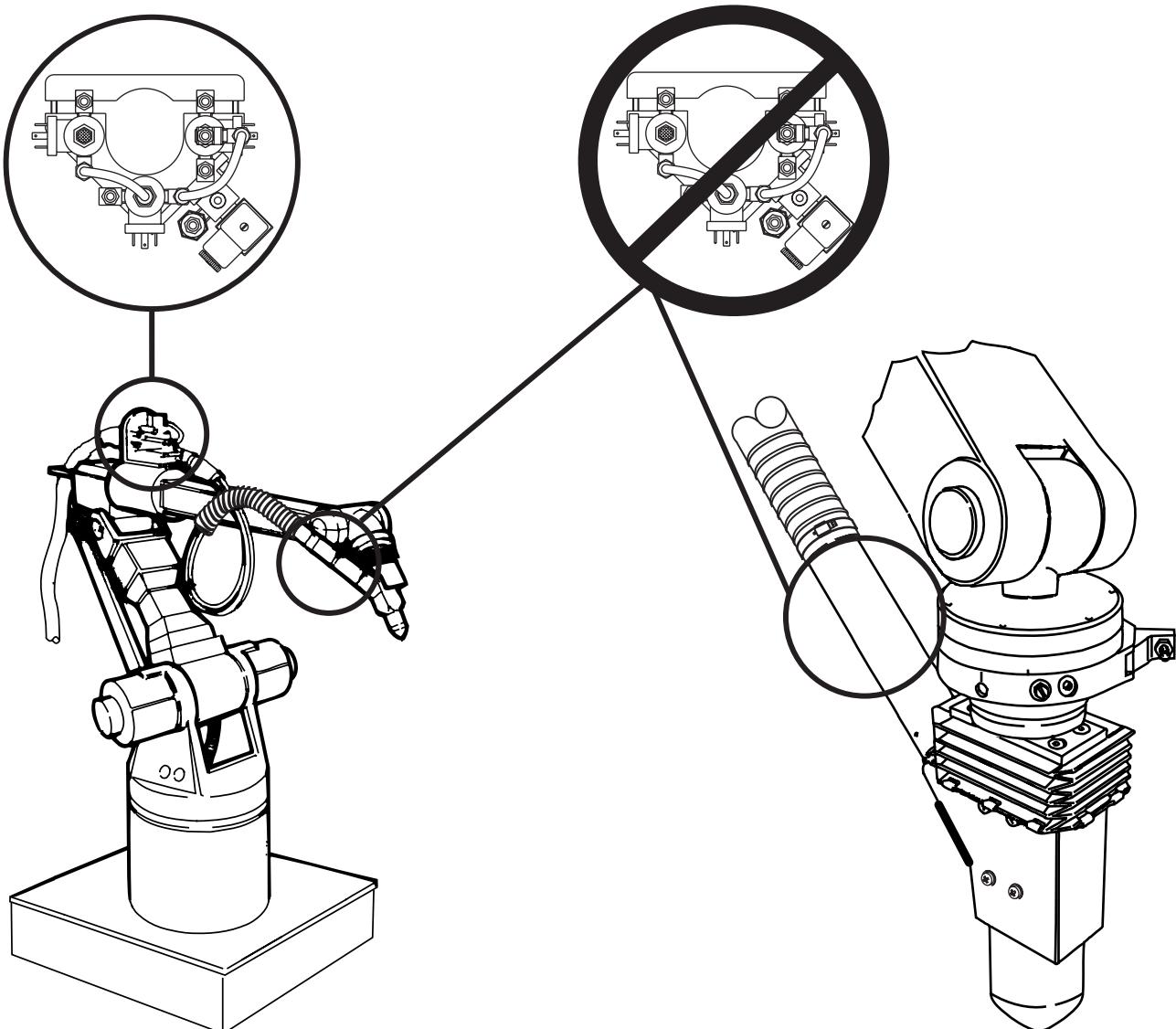
Cable part numbers and signal lists are provided in Figures 3-14 through 3-19.

THC system cables

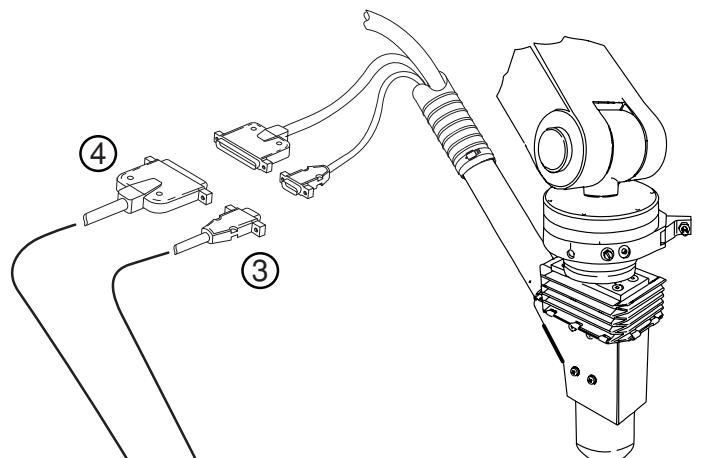
Caution: Do not run the pendant cable in parallel and near to the torch lead.
There is a possibility that electrical noise will cause erratic operation of the operator pendant or damage it.

Install system cables as shown in Figure 3-5.

Warning: Off-valve assembly can not be mounted on the torch sleeve.



- ① Optional operator pendant with cable
optional pendant extension cable
- ② Plasma interface cable
- ③ Motor drive cable
- ④ Lifter I/O interface cable
- ⑤ Power cord (115 VAC shown)
- ⑥ Machine interface cable
- ⑦ Not used



Robotic Lifter Assembly

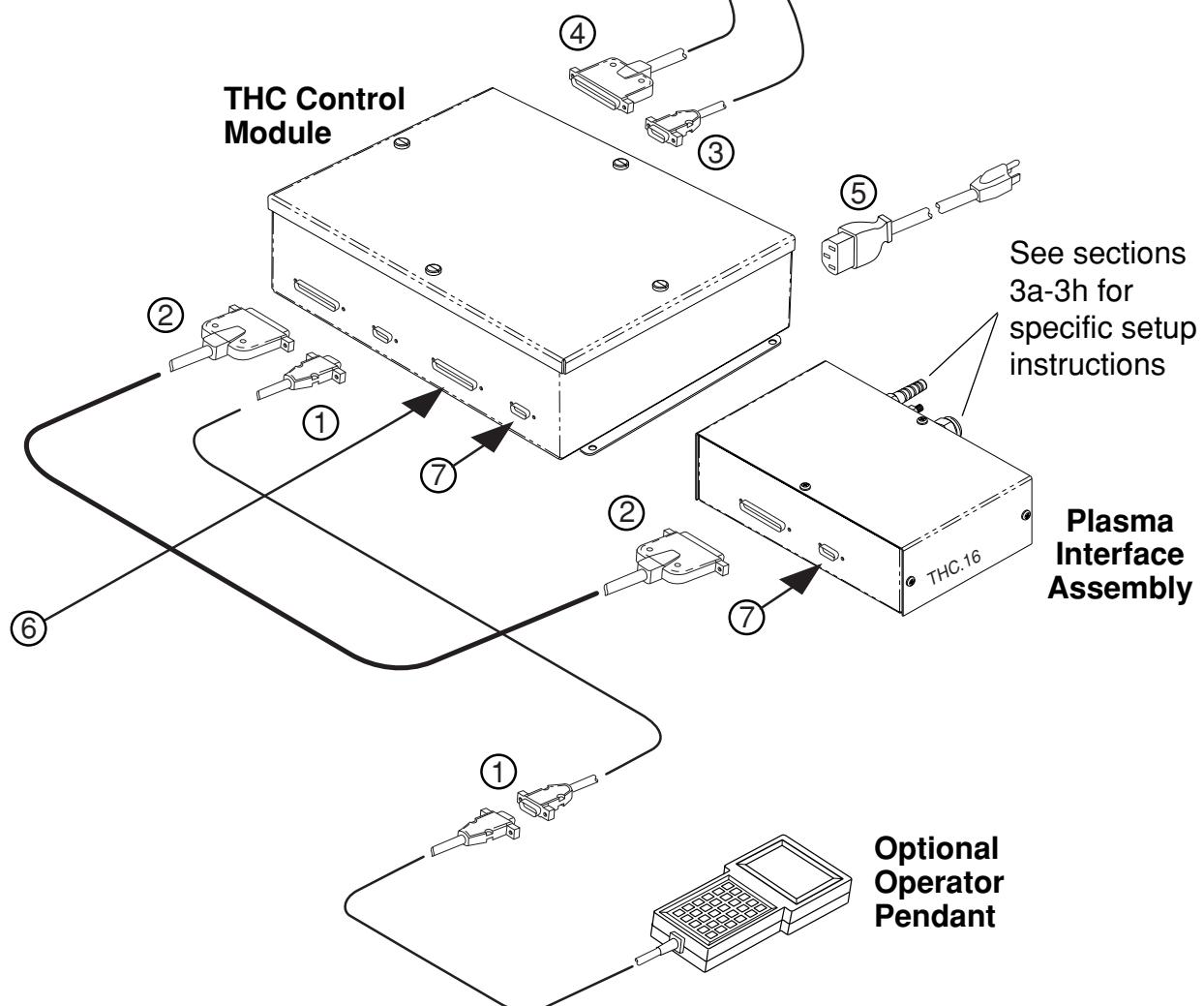


Figure 3-5 THC system cables

Machine interface cable

1. Cable-installed signal - See Figure 3-6.

The machine interface cable provides a signal to verify that the cable is installed properly. Continuity must be provided through pins 3 and 22 so that the signal is not interrupted.

Install a jumper wire in the CNC to provide continuity between pins 3 and 22 when the machine interface cable is installed to the CNC receptacle.

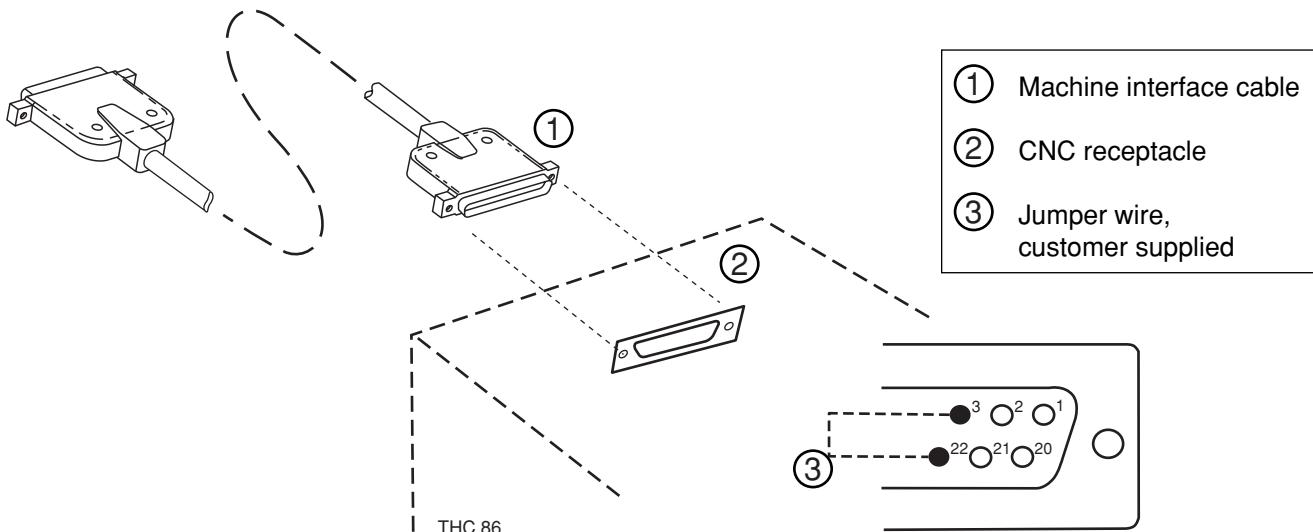


Figure 3-6 CNC cable-installed signal

2. Emergency stop signal - See Figure 3-7.

The machine interface cable provides a signal for emergency stop. Continuity must be provided through pins 16 and 35 so that the signal is not interrupted.

Install a normally closed switch in the CNC to provide continuity between pins 16 and 35 when the machine interface cable is installed to the CNC receptacle.

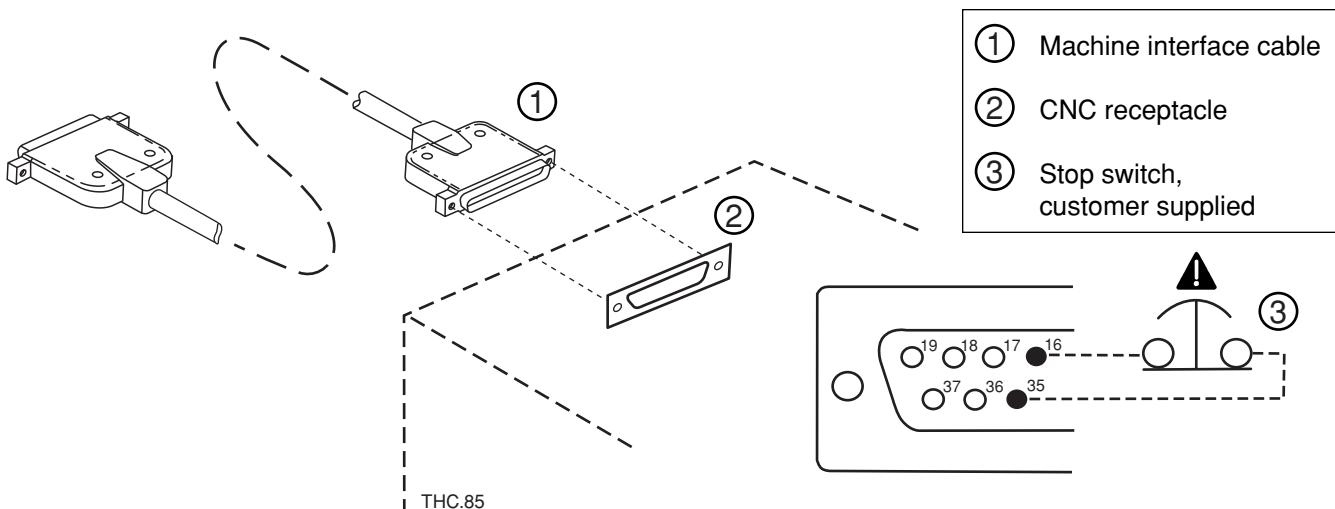


Figure 3-7 CNC emergency stop signal

3. Install the machine interface cable as shown in Figure 3-8.

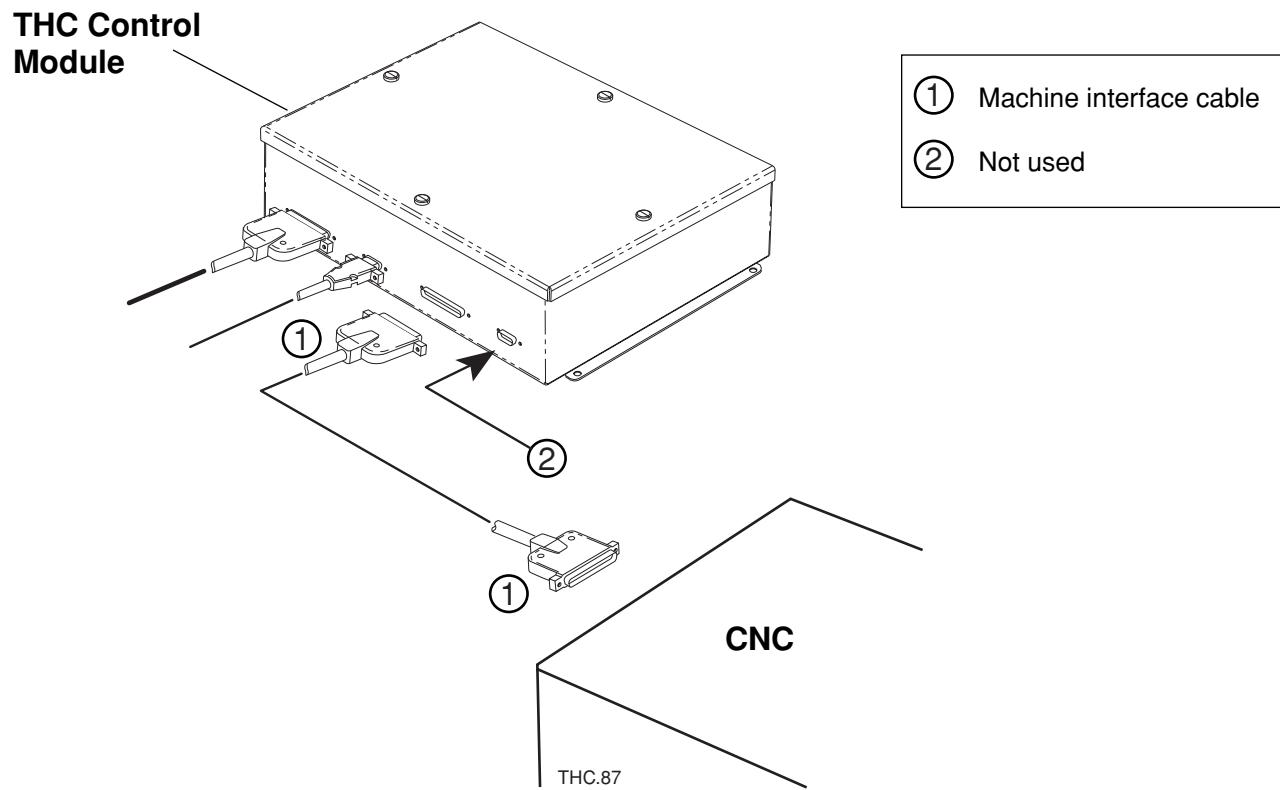


Figure 3-8 Machine interface cable

4. If installation requires removal of a cable connector, all wires must be properly terminated, including shield, or system problems may occur.
See Figure 3-9.

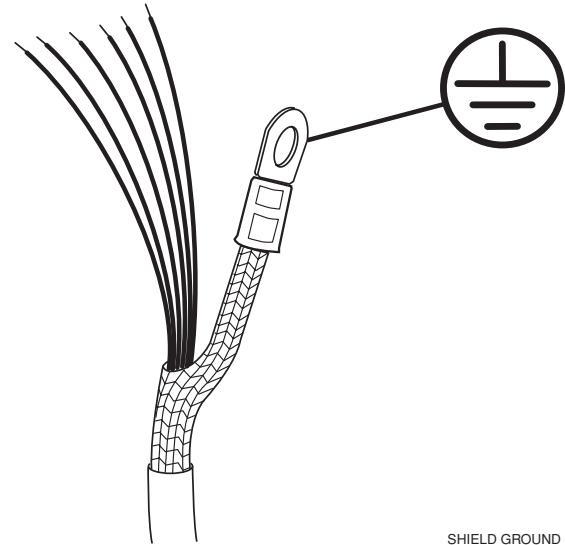
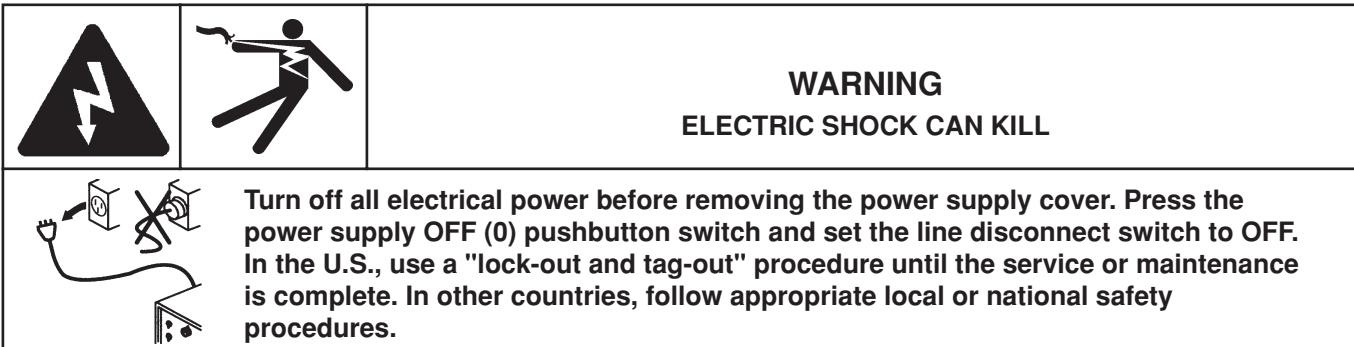


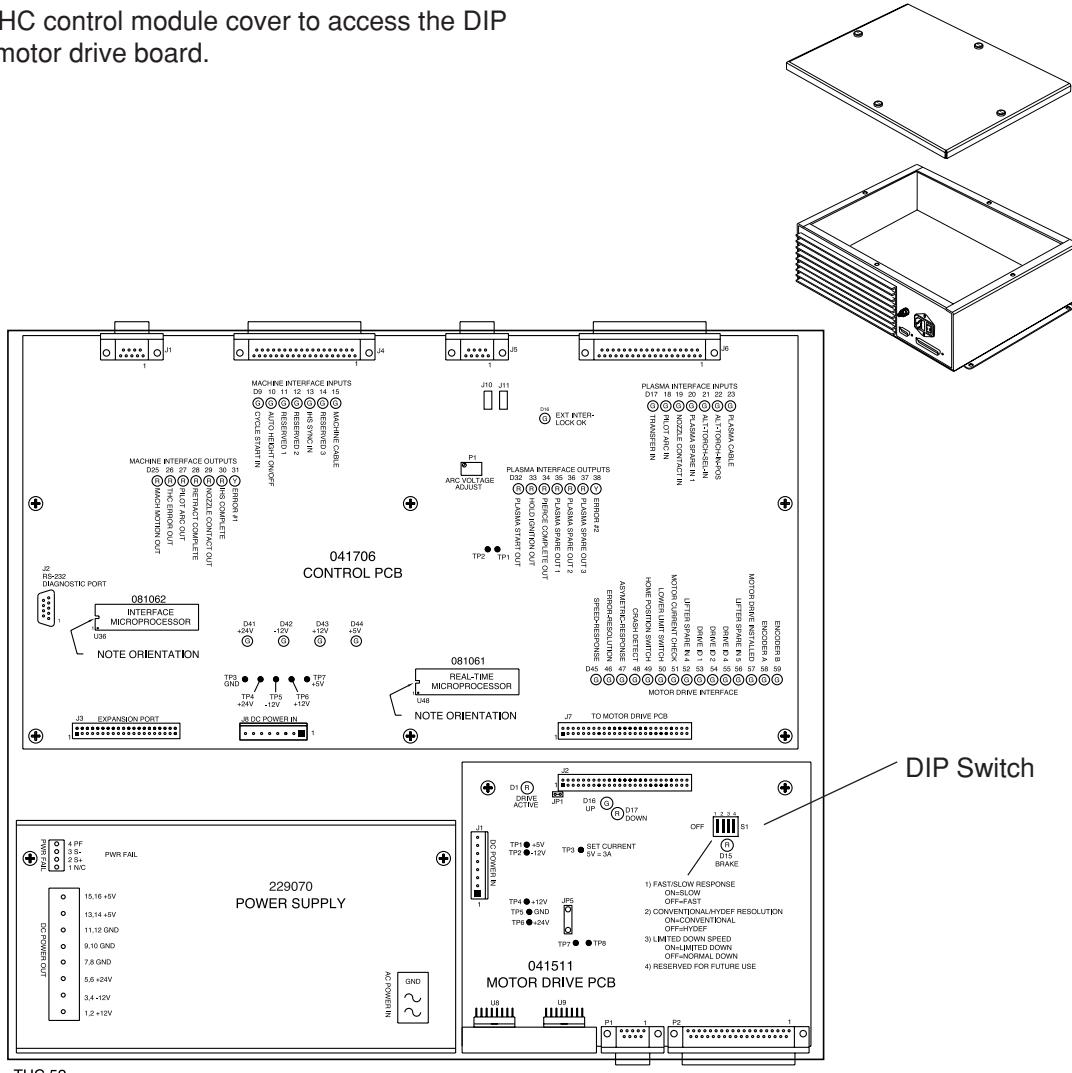
Figure 3-9 Machine interface cable grounding

THC selectable responses

The DIP switch, on the motor drive board, provides adjustable arc voltage control response.



Remove the THC control module cover to access the DIP switch on the motor drive board.



THC.52

Note: The DIP switch positions are set to OFF (default settings) at Hypertherm.

DIP switch positions

1 Fast/Slow response

- **ON** slows response speed of lifter by approximately one half in both up and down directions.
- **OFF** enables "normal" or fast response.

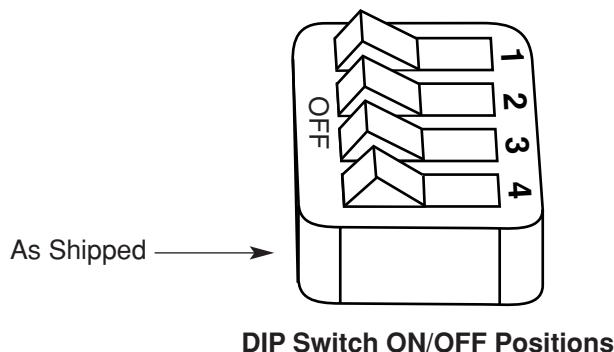
2 Conventional/HyDefinition resolution

- **ON** enables the THC to respond to larger voltage error changes.
- **OFF** enables the THC to respond to smaller error voltage changes.

3 Limited down speed

- **ON** enables lifter to move up at the normal speed, but down at slower speed. This is designed to help where corner diving is a problem.
- **OFF** enables the lifter to move up and down at the "normal" speed.

4 Not Used (HPR pierce complete)



Plasma Systems	*DIP Switch Settings			
	1 Fast/Slow Response	2 Conv/HyDef Resolution	3 Limited Down Speed	4 Not Used
HD3070 Robotic	ON	OFF	ON	—

* These are recommended switch settings. Since cutting machine installations vary, these switches can be adjusted in any combination to achieve desired results.

Command THC serial protocol

Commands can be sent over a serial link to control the function of the torch height control. The interface is 4 wire RS422 on the MACHINE INTERFACE CABLE (pins (1) RX-, (20) RX+, (2) TX-, (21) TX+). The serial frame runs at 19200 baud, 8 data bits, 1 stop bit, and no parity. All bytes in a serial message are ASCII characters. A message consists of a start of message character (>, 0x3E), 2 byte message ID (all message ID's should be capitalized), variable length data, 2 byte checksum, and end of message character (<, 0x3C). For example to put the THC into remote mode >RM1D0<. 'RM' is the message ID, '1' is the data field, and 0xD0 is the checksum (2 hex digits sent as 2 ASCII characters). The response to an accepted command is (^, 0x5E) and the response to an invalid command is (#, 0x23).

Some of the commands can be queried by using (?, 0x3F) as the data. For example to query the actual arc voltage >AV?D6<. The response to this query would be >AV100058<, which represents an actual arc voltage of 100.0 volts with a checksum of 0x58.

Errors can be retrieved over the serial link. There is a discrete output on the machine interface cable (THC Error pins 14,33) which indicates an error has occurred. Using the command >CL8F< errors can be cleared and retrieved. A typical response might be >ERR-Motor Current Fault46< or if there is no error (^, 0x5E) is returned.

Command listing:

Command	ID	Data	Query	Notes
Pierce Delay	PD	0 – 9000 (0 to 9.000 seconds)	yes	Delay before motion output
Pierce Height Factor	PH	50 – 300 (50% to 300%)	yes	Used to set pierce height
Preflow During IHS	PF	0,1 (0 = off, 1 = on)	yes	Improves cycle time
IHS Stall Current	SC	1 – 10 (1 = least force)	yes	Used to set stall force
IHS Speed	IV	1 – 10 (1= slowest)	yes	Used to set IHS speed
IHS Test	IH	0,1 (0 = run, 1 = test)	no	Perform IHS test
Nozzle Contact Active	NC	0,1 (0 = off, 1 = on)	yes	Enable nozzle contact IHS
Machine Acceleration	MA	0 – 9000 (0 to 9.000 seconds)	yes	Delay voltage control
Maintenance Mode	MT	No data	no	Maintenance mode
Auto Kerf	AK	0,1 (0 = off, 1 = on)	yes	Disable voltage control in kerf
Actual Arc Voltage	AV	? (query only)	yes	Returned value is 1/10 volts
Automatic Voltage Control	AA	0,1 (0 = manual, 1 = auto)	yes	Voltage control or manual
Retract	RE	0,1 (0 = full, 1 = partial)	yes	Full or partial retract
Retract Distance	RH	0 – 8000 (0 to 8.000 inches)	yes	Must be in partial retract
Remote Mode	RM	0,1 (0 = off, 1 = on)	yes	Must be ON to use serial link
IO Rev	RI	? (query only)	yes	IO revision
RT Rev	RR	? (query only)	yes	Real Time revision
Homing Speed	HS	1 – 10 (1 = slowest)	yes	Home speed
Unit Conversion	UN	0,1 (0 = inches, 1 = metric)	yes	Units
Lifter Test	LT	No data	no	Perform lifter test
Cut Height	CH	0 – 1000 (0 to 1.000 inches)	yes	Used to set cut height
Arc Voltage Setpoint	VS	500 – 3000 (50.0 to 300.0 volts)	yes	Used to set voltage control
Step Up	S+	No data	no	Move up fixed increment
Step Down	S-	No data	no	Move down fixed increment
Jog Up	J+	No data	no	Continuous movement up
Jog Down	J-	No data	no	Continuous movement down
Clear Error	CL	No data	no	Clear error, send error string
Flush Buffers	FL	No data	no	Reset RX and TX buffers
Error code	EC	? (query only)	yes	Send error code number

Application notes:

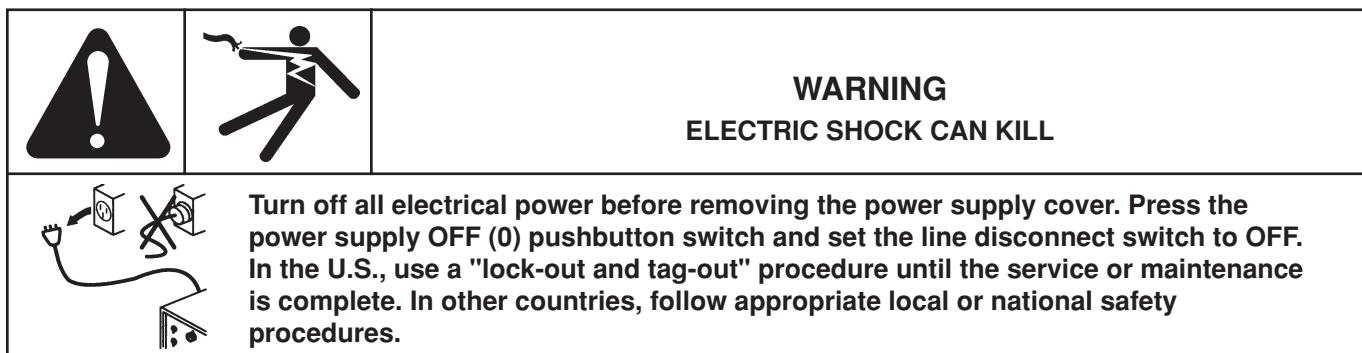
1. To do manual movements Jog up, down and Step up, down the THC must be in manual mode (Automatic Voltage Control = 0).
2. When the THC receives a Jog up or down command, it will move the torch up/down for 50 milliseconds. If a new command is not received after this time the motion will stop. To achieve continuous movement the Jog command must be repeatedly sent faster than once every 50 milliseconds.
3. The Error code command will ONLY retrieve an error code, it will not clear an error. To clear an error the CL (Clear error command must be sent).
4. The revision commands (RR and RI) return the decimal representations of the revisions that are stored (as ASCII characters) in the firmware.

5. Setting the Retract distance (RH) only applies when the THC is in partial retract (Retract = 1).
6. To force the lifter station to go home send the following series of commands : RE1, RE0 (partial retract, then full retract this will force a homing sequence).

Error codes:

Code	Error string
0	"ERR-Torch is in LOWER LIMIT"
1	"ERR-Torch is in HOME LIMIT"
2	"ERR-EEPROM checksum Error"
3	"ERR-Lifter NOT Installed"
4	"ERR-Motion FAIL"
5	"ERR-Watch Dog Timeout FAIL"
6	"ERR-InterProcessor Comm Fail"
7	"ERR-Nozzle Contact at Home"
8	"ERR-Cycle Start ON at INIT"
9	"ERR-Motor Current Fault"
10	"ERR-Machine Cable Missing"
11	"ERR-Plasma Cable Missing"
12	"ERR-Robotic Limit FAIL"
13	"ERR-DIAG FAIL REPOWER THC"
14	"ERR-IOP CHECKSUM FAIL"
15	"ERR-RTP CHECKSUM FAIL"
16	"ERR-NO ERROR"

Electrode and work lead sensing wires



See Figure 3-10.

1. Remove access covers from the power supply, as required.
2. Locate the 1XPCB1 PC board inside the power supply.
3. Install the sensing wires:

- A Fabricate sensing wires as follows:
 - Use 18AWG ($\approx 0.9 \text{ mm}^2$), single pair, unshielded wire, rated for 600V or greater.
 - Wire length: As required, from the power supply to the plasma interface assembly.
 - After installing the wires from the power supply to the plasma interface assembly, install appropriate size fork or ring terminals on the wire ends.
- B Connect one of the sensing wires to the 1XPCB1 PC board where wire No. 126 is connected. Label this wire positive (+).
- C Connect the other sensing wire to the 1XPCB1 PC board where wire No. 140 is connected. Label this wire negative (-).
- D At the plasma interface assembly, connect the negative (-) wire to the J5-2 terminal labeled ELECTRODE. Connect the positive (+) wire to the J5-3 terminal labeled WORK.

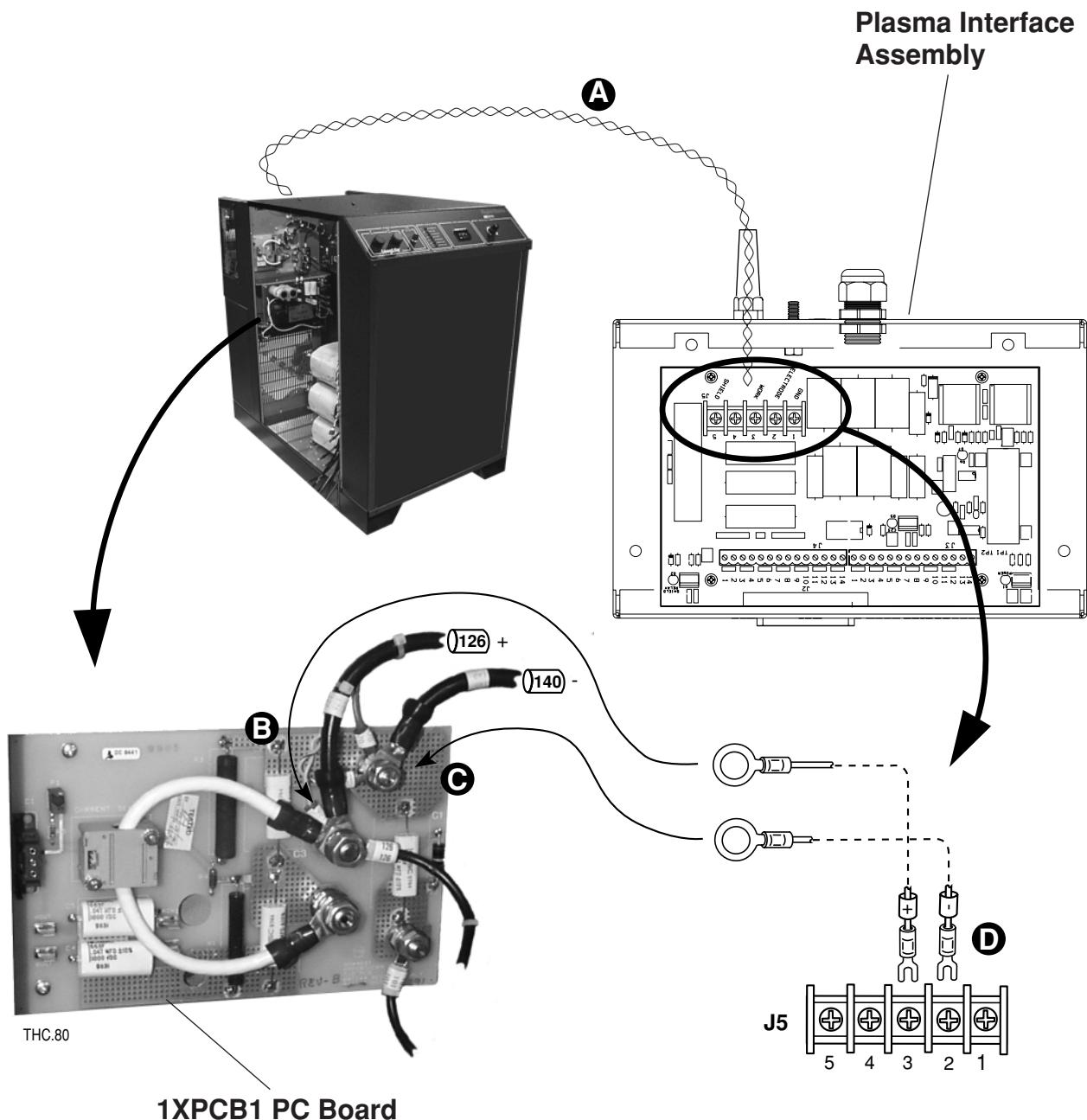
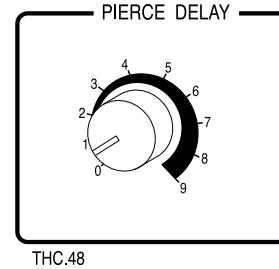


Figure 3-10 HD3070 electrode and work lead sensing wires connection

Power supply interface cable

The HD3070 power supply is equipped with a potentiometer for adjusting the pierce delay time. Disable the pierce delay potentiometer in the power supply per Section 3 of the HD3070 instruction manual.



See Figure 3-11.

- A** Connect the interface cable plug to the 1X1 receptacle on the back of the power supply.
- B** Connect the other plug of the interface cable to the CNC.
- C** Install the 5 pairs of wires of the interface cable to the plasma interface assembly as shown in Figure 3-11.
- D** Install the wire with the fork terminal to the plasma interface assembly as shown in Figure 3-11.

See Figure 3-14 for the interface cable part numbers and signal list.

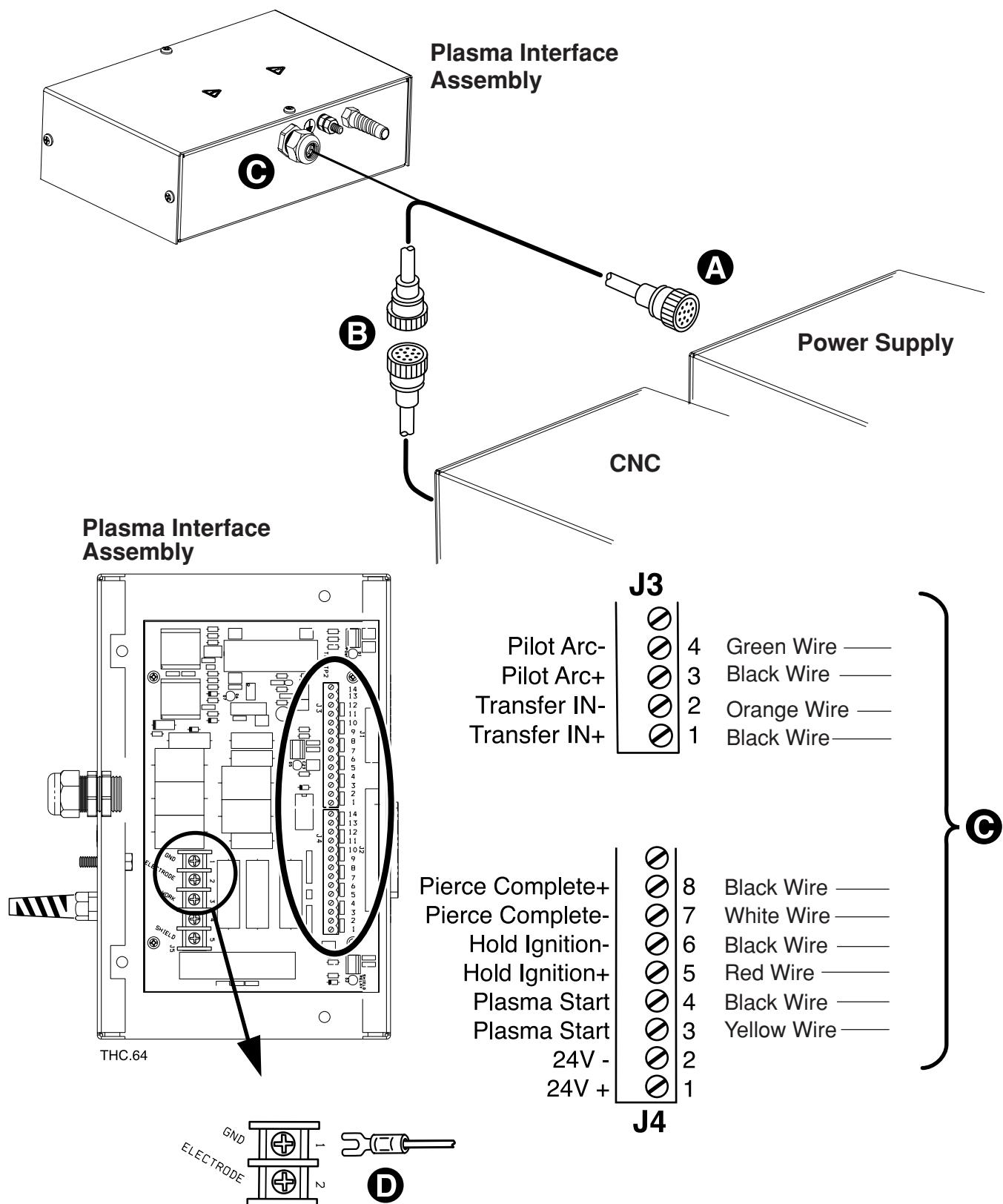


Figure 3-11 HD3070 power supply interface cable connections

Ohmic contact wire

- A Install the ohmic contact wire through the strain relief of the plasma interface assembly.
- B Install appropriate size fork terminal on the wire end and attach the wire to the J5-5 terminal labeled SHIELD.
- C Install the other end of the ohmic contact wire to the IHS tab on the torch retaining cap.

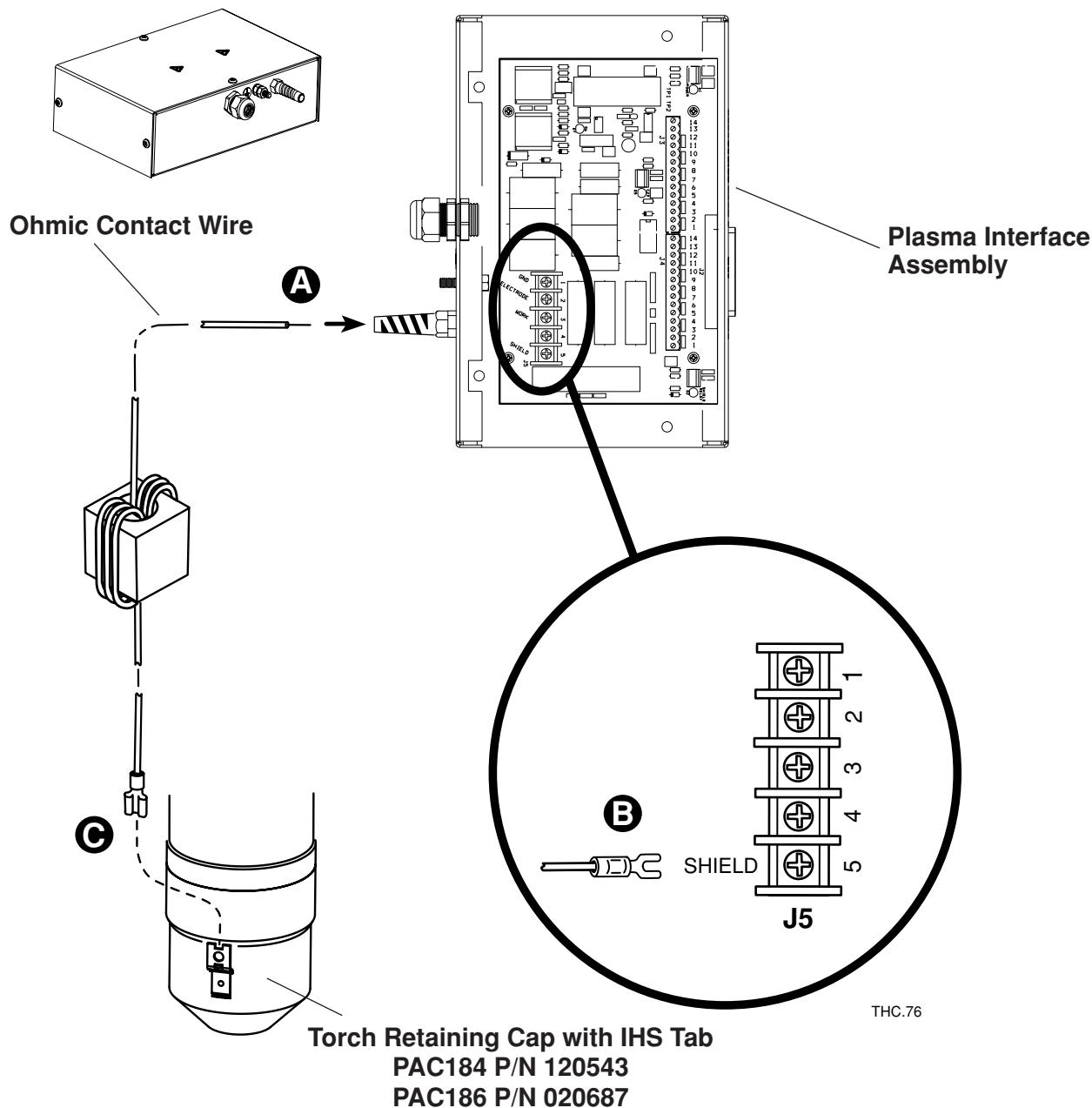


Figure 3-12 HD3070 ohmic contact wire connection

Grounding requirements

To ensure personal safety and proper operation, and to reduce electromagnetic interference (EMI), the THC system must be properly grounded.

Power cord grounding

The THC control module must be properly grounded through the power cord according to national or local electrical codes.

Protective earth ground

- Install protective earth (PE) grounding cables to the 3 THC components as shown in Figure 3-13. Grounding must comply with national or local electrical requirements.
- The PE cables must be supplied by the customer.

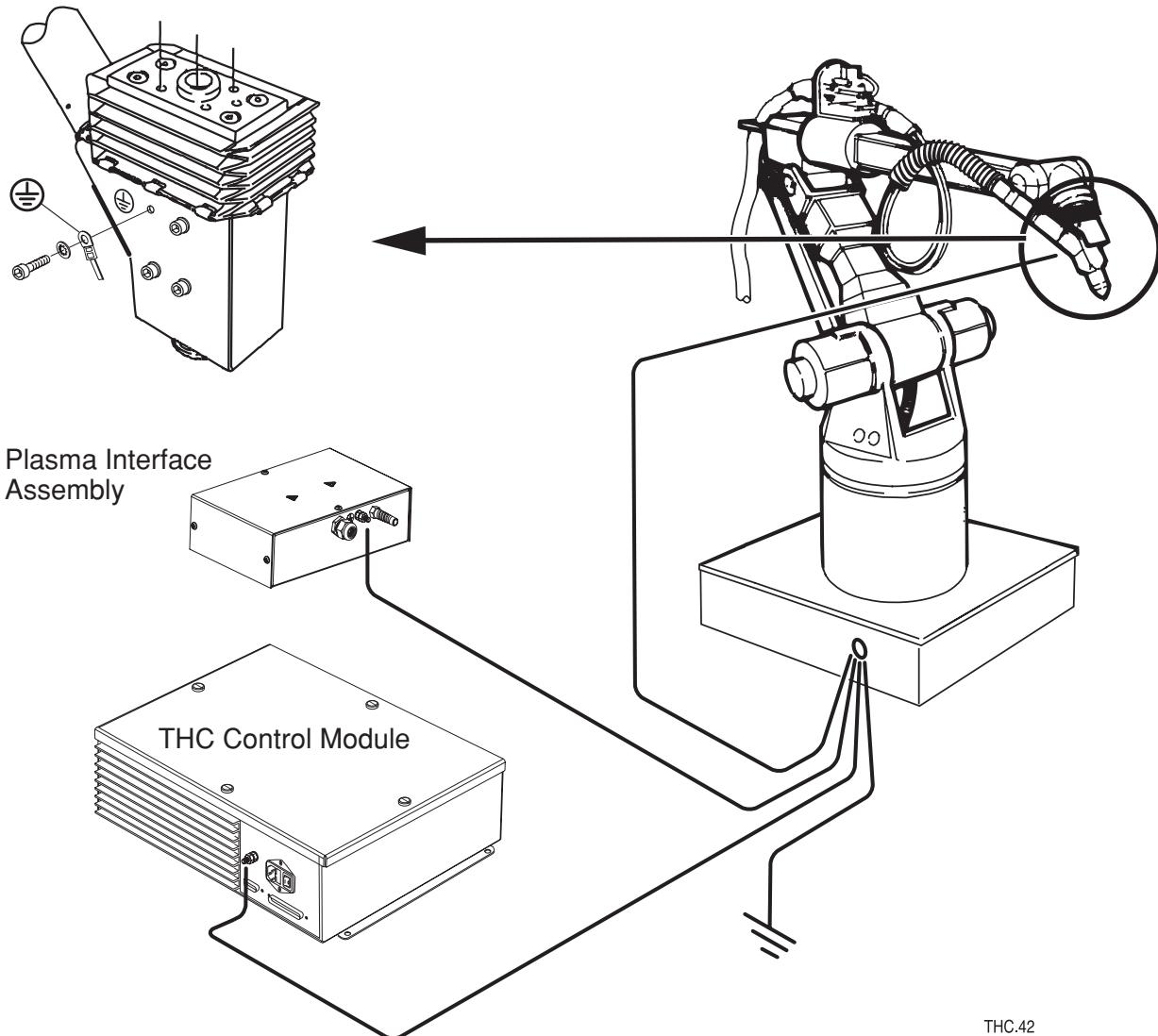
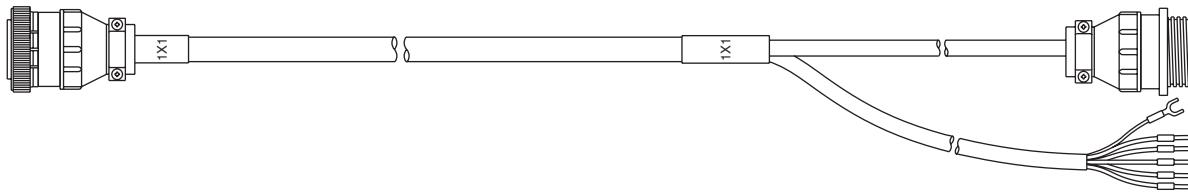


Figure 3-13 THC component PE grounding

SETUP

<u>Part number</u>	<u>Description</u>	<u>Length</u>
123270	HD3070 power supply interface cable	6 ft./1.8 m



Signal Name	Color	Power Supply End (1X1)	CNC End	Plasma Interface End	Function
Hold I/O - Hold I/O + Drain	Black Red Drain	1 5 10	Not Connected	J5-6 J5-5	(Optional) Hold Ignition (I/O) signal used for preflow during IHS. Also used by power unit to synchronize operation of multiple torch installations.
Pierce Complete - Pierce Complete + Drain	Black White Drain	2 6 11	Not Connected	J5-8 J5-7	(Optional) Pierce Complete signal used by power unit to time transition from pierce gas flow to cut gas flow. User enters this time delay into THC.
Torch Ignition Out - Torch Ignition Out + Drain	Black Green Drain	3 7 12	Not Connected	J6-4 J6-3	(Optional) Torch Ignition Out signal. Maintained during torch ignition. Contact closes after torch ignition. Dry contact closure.
Plasma On - Plasma On + Drain	Black Yellow Drain	9 15 14	Not Connected	J5-4 J5-3	Plasma On signal maintained during plasma cut. If signal is lost, system must be restarted.
Transfer Out - Transfer Out + Drain	Black Orange Drain	37 32 26	Not Connected	J6-2 J6-1	Arc Transfer signal. Contact closes after arc transfer and pierce delay (set on power supply front panel). Dry contact closure.
Power Off Power Off Drain	Black Blue Drain	4 8 13	4 8 13	Not Connected	These signals connect to the CNC. Refer to HD3070 Instruction manual for signal information.
External Interlock External Interlock Drain	Red Blue Drain	16 17 18	16 17 18	Not Connected	
Power On Input Power On Input Drain	Black Brown Drain	29 34 23	29 34 23	Not Connected	
Power Interlocks Power Interlocks Drain	Red White Drain	35 30 24	35 30 24	Not Connected	
1/50 AC Volts 1/50 AC Volt Drain	Red Green Drain	33 28 37	33 28 37	Not Connected	

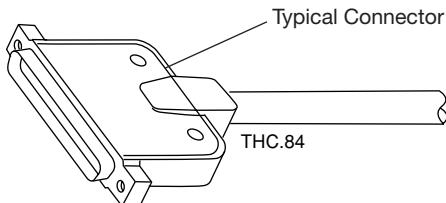
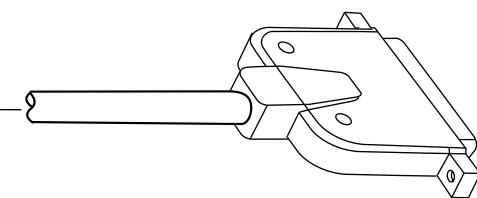
Shaded area indicates plasma interface assembly connections.

Plasma Interface Assembly other J5 and J6 connection points:

- J5-1 (+) and J5-2 (-) - Available 24 VDC, 500 mA maximum
- J5-9 through J5-14 - Reserved for future use.
- J6-5 (+) and J6-6 (-) - Alternate Nozzle Contact. An optically isolated signal that indicates nozzle is in ohmic contact with work. Ohmic contact is represented by a logic 1.
- J6-7 through J6-12 - Reserved for future use.
- J6-13 and J6-14 - Protective earth ground.

Figure 3-14 HD3070 interface cable - part number & signal list

<u>Part number</u>	<u>Length</u>	<u>Part number</u>	<u>Length</u>
123209	5 ft./1.5 m	123215	40 ft./12.2 m
123210	10 ft./3 m	123216	45 ft./13.7 m
123211	15 ft./4.6 m	123023	50 ft./15.2 m
123212	20 ft./6.1 m	123217	75 ft./23 m
123022	25 ft./7.6 m	123218	100 ft./30.5 m
123213	30 ft./9.1 m	123219	125 ft./38 m
123214	35 ft./10.6 m	123220	150 ft./45.6 m

THC Control Module**Lifter Assembly**

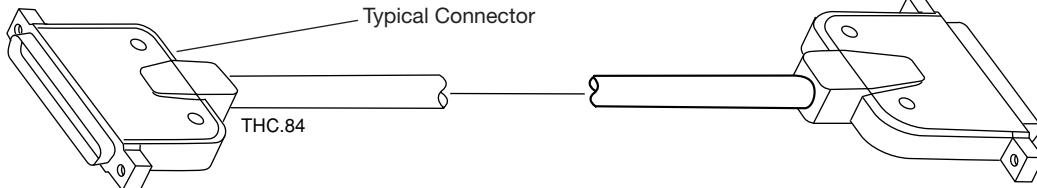
<u>Pin Number</u>	<u>Color</u>	<u>Signal Name</u>	<u>Function</u>	<u>Pin Number</u>
1, 20	Black/Red		Not connected	1, 20
2, 21	Black/green		Not connected	2, 21
3, 22	Black/Blue		Not connected	3, 22
5 Input 24	Black Brown	Drive ID2 - Drive ID2 +	Lifter ID Most Significant Bit (Binary 3)	5 Output 24
6 Input 25	Black Orange	Drive ID1 - Drive ID1 +	Lifter ID (Binary 2)	6 Output 25
7 Input 26	Red White	Drive ID0 - Drive ID0 +	Lifter ID Least Significant Bit (Binary 1)	7 Output 26
8 Output 27	Red Green	Lifter Up - Lifter Up +	Active when lifter is moving up.	8 Input 27
9 Input 28 Input 10 Output	Red Blue Red	Lower Limit Switch Com. Lower Limit Switch Lower Limit Switch 24V	Limit switch common. A switch closure at input indicates torch is at bottom of travel or zero travel position. Limit switch power.	9 Output 28 Output 10 Input
11 Output 29 Output 30 Output	Red Yellow Brown	Home Switch Home Switch Common Home Switch 24V	A switch closure at input indicates torch is at top of travel or maximum travel position. Home switch common. Home switch power.	11 Input 29 Input 30 Input
16 Output 35	Green Brown	Lifter Down - Lifter Down +	Active when lifter is moving down.	16 Input 35
17 Output 36	Green Orange	Lifter Brake Out - Lifter Brake Out +	Powers electro-mechanical brake on lifter.	17 Input 36
4 Input 23	Black Yellow	Lifter Spare In 5 - Lifter Spare In 5 +	Spare	4 Output 23
12 Output 31	Red Orange	Crash Detect - Crash Detect +	Spare	12 Input 31
13 Output 32	Green White	Lifter Spare 3 - Lifter Spare 3 +	Spare	13 Input 32
14 Output 33	Green Blue	Reserved Reserved	Spare	14 Input 33
15 Output 34	Green Yellow	Lifter Spare 1 - Lifter Spare 1 +	Spare	15 Input 34
18 37	White Black	24 VDC Common 24 VDC + Reserved	Available 24 VDC, 500 mA maximum. Not Connected	18 Input 37 19

Figure 3-15 Lifter I/O cable - part numbers & signal list

SETUP

<u>Part number</u>	<u>Length</u>	<u>Part number</u>	<u>Length</u>
123209	5 ft./1.5 m	123215	40 ft./12.2 m
123210	10 ft./3 m	123216	45 ft./13.7 m
123211	15 ft./4.6 m	123023	50 ft./15.2 m
123212	20 ft./6.1 m	123217	75 ft./23 m
123022	25 ft./7.6 m	123218	100 ft./30.5 m
123213	30 ft./9.1 m	123219	125 ft./38 m
123214	35 ft./10.6 m	123220	150 ft./45.6 m

THC Control Module



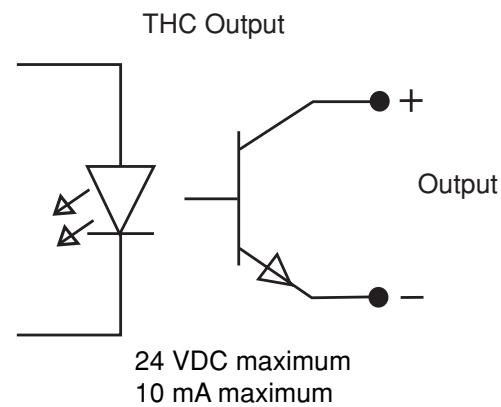
<u>Pin Number</u>	<u>Color</u>	<u>Signal Name</u>	<u>Function</u>	<u>Signal Name</u>	<u>Pin Number</u>	<u>Notes, page 3-22</u>
1 Input 20	Black Red	RX- RX+	RS-422 serial inverting receiver. RS-422 serial non-inverting receiver.	TX- TX+	1 Output 20	
2 Output 21	Black Green	TX- TX+	RS-422 serial inverting transmitter. RS-422 serial non-inverting transmitter.	RX- RX+	2 Input 21	
* 3 Input 22	Black Blue	Machine Cable - Machine Cable +	Machine cable recognition used for verifying installation of Machine interface cable to CNC.		3 Output 22	3
5 Input 24	Black Brown	IHS Sync - IHS Sync +	IHS Sync holds torch firing, but allows preflow gas to flow.		5 Output 24	2
* 8 Input 27	Red Green	Auto Height On/Off - Auto Height On/Off +	Auto Height On/Off enables or disables Auto Height. Auto Height is Off when input is active.		8 Output 27	2
* 9 Input 28	Red Blue	Cycle Start - Cycle Start +	Cycle Start (plasma start) initiates start of programmed cycle. CNC must provide a contact closure to activate this input.		9 Output 28	2
10 Output 29	Red Yellow	IHS Complete - IHS Complete +	IHS Complete output to CNC to synchronize multiple torch installations. When all connected torches are in position, IHS Sync In signal is deactivated to proceed with torch ignition.		10 Input 29	1
12 Output 31	Red Orange	Retract Complete - Retract Complete +	Retract Complete output verifies to CNC that the torch has retracted and it is safe to move to next start position.		12 Input 31	1
13 Output 32	Green White	Pilot Arc - Pilot Arc +	Pilot Arc output verifies to CNC that a pilot arc has been established.		13 Input 32	1
14 Output 33	Green Blue	THC Error - THC Error +	THC Error output alerts CNC that an error has occurred.		14 Input 33	1
* 15 Output 34	Green Yellow	Machine Motion - Machine Motion + the cutting machine.	Machine Motion output verifies to CNC that a pierce delay has been completed and notifies CNC to start movement of		15 Input 34	1
* 16 Input 35	Green Brown	Ext. Emergency Interlock- Ext. Emergency Interlock+	Allows installation of an emergency stop switch (normally closed).		16 Output 35	4
18 Output 37	White Black	24 VDC Common 24 VDC +	Available 24 VDC, 500 mA maximum		18 Input 37	1
36 Output 4 Input 23	Orange Black	24 VDC Common Spare 3 -	Available 24 VDC, 500 mA maximum Spare		36 Input 4 Output 23	1
6 Input 25	Yellow Black	Spare 3 +			6 Output 25	
7 Input 26	Orange Black	Spare 2 -	Spare		7 Output 26	
11 Output 30	Red White	Spare 2 +			11 Input 30	
17	Brown Green	Spare 1 -	Spare		17	
19	Green	Spare 1 +	Not Used Not Connected		19	

* Minimum connections needed for proper operation of Command THC

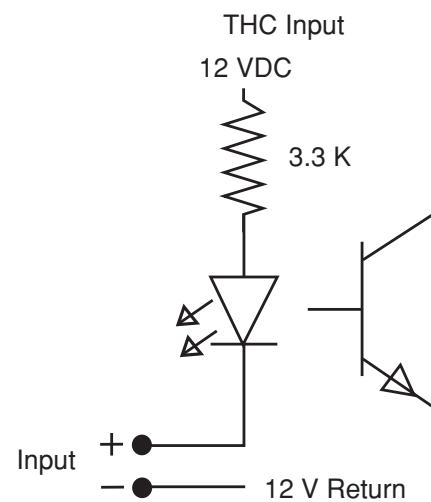
Figure 3-16 Machine interface cable – part numbers & signal list

NOTES to Figure 3-16

NOTE 1. All THC outputs are optically coupled transistors with maximum ratings of 24 VDC and 10 mA.



NOTE 2. All THC inputs are optically isolated 12 VDC signals. Signals are made active by sinking 3 mA per input.



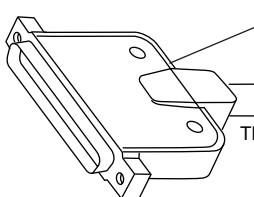
NOTE 3. Jumper required in CNC. See instructions on page 3-12.

NOTE 4. Stop switch required in CNC. See instructions on page 3-12.

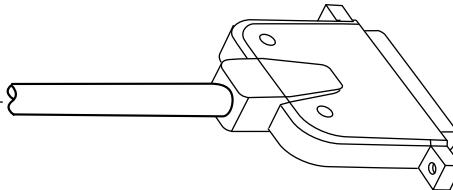
SETUP

<u>Part number</u>	<u>Length</u>	<u>Part number</u>	<u>Length</u>
123209	5 ft./1.5 m	123215	40 ft./12.2 m
123210	10 ft./3 m	123216	45 ft./13.7 m
123211	15 ft./4.6 m	123023	50 ft./15.2 m
123212	20 ft./6.1 m	123217	75 ft./23 m
123022	25 ft./7.6 m	123218	100 ft./30.5 m
123213	30 ft./9.1 m	123219	125 ft./38 m
123214	35 ft./10.6 m	123220	150 ft./45.6 m

THC Control Module



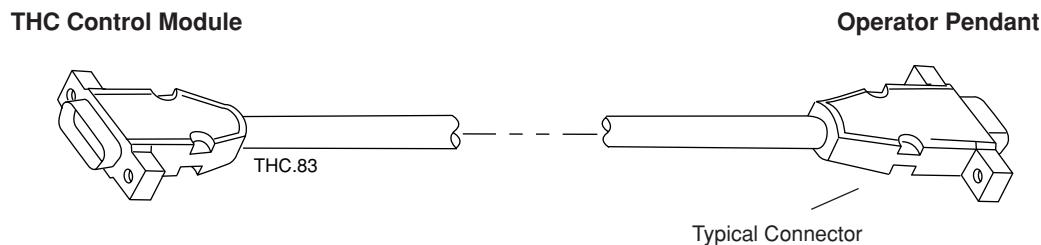
Plasma Interface Assembly



<u>Pin Number</u>	<u>Color</u>	<u>Signal Name</u>	<u>Function</u>	<u>Signal Name</u>	<u>Pin Number</u>
1 Input 20	Black Red	RX- RX+	RS-422 serial inverting receiver. RS-422 serial non-inverting receiver.	TX- TX+	1 Output 20
2 Output 21	Black Green	TX- TX+	RS-422 serial inverting transmitter. RS-422 serial non-inverting transmitter.	RX- RX+	2 Input 21
3 Input 17	Black Green	Plasma Cable - Plasma Cable +	Plasma cable recognition used for automatic detection of plasma interface board.		3 Output 17
7 Input 26	Red White	Nozzle Contact - Nozzle Contact +	Nozzle Contact is active when nozzle or shield is in ohmic contact with the plate.		7 Output 26
8 Input 27	Red Green	Pilot Arc In - Pilot Arc In +	Pilot Arc input verifies that a successful pilot arc has been established.		8 Output 27
9 Input 28	Red Blue	Transfer In - Transfer In +	Transfer In input verifies that a transfer has occurred.		9 Output 28
10 Output 29	Red Yellow	Nozzle H.V. Relay - Nozzle H.V. Relay +	Relay active during arc initiation to isolate the THC interface PCB from high voltage.		10 Input 29
13 Input 32	Green White	Pierce Complete - Pierce Complete +	Pierce Complete output verifies that the THC internal pierce complete timer has timed out.		13 Output 32
14 Output 33	Green Blue	Hold Ignition - Hold Ignition +	Hold Ignition holds the torch from firing, but allows preflow gas to flow.		14 Input 33
15 Output 34	Green Yellow	Plasma Start - Plasma Start +	Plasma Start signal is used to initiate the arc.		15 Input 34
16 Input 35	Green Brown	Arc Volts - Arc Volts +	Arc Volts is the measured arc voltage between the electrode and work, divided by 41.		16 Output 35
18 Output 37	White Black	24 VDC Common 24 VDC +	Available 24 VDC, 500 mA maximum		18Input 37
36 Output 4 Input 23	Orange Black Yellow	24 VDC Common Torch 2 Select - Torch 2 Select +	Available 24 VDC, 500 mA maximum Spare		36 Input 4 Output 23
5 Input 24	Black	Torch 1 Select -	Spare		5Output 24
6 Input 25	Brown	Torch 1 Select +	Spare		6Output 25
11 Output 30	Red Brown	Spare 1 - Spare 1 +	Spare		11 Input 30
12 Output 31	Red Orange	Plasma Spare 2 - Plasma Spare 2 +	Spare		12 Input 31
19	Blue	Plasma Spare 1 - Plasma Spare 1 +	Not Connected Not Used		19 22

Figure 3-17 Plasma interface cable – part numbers & signal list

<u>Part number</u>	<u>Length</u>
123018	25 ft./7.6 m
123019	50 ft./15.2 m



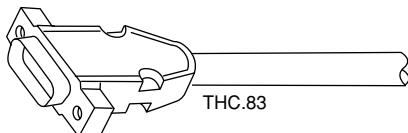
Pin Number	Color	Signal Name	Function	Signal Name	Pin Number
1 Input 2	Black Green	RX- RX+	RS-422 serial inverting receiver. RS-422 serial non-inverting receiver.	TX- TX+	1 Output 2
6 Output 3	Black White	TX- TX+	RS-422 serial inverting transmitter output. RS-422 serial non-inverting transmitter output.	RX- RX+	6 Input 3
5 Output 9	Black Red	12 VDC common 12 VDC +	12 VDC, 500 mA maximum		5 Input 9
4,7,8			Not Connected		4,7,8

Figure 3-18 Pendant interface cable – part numbers & signal list

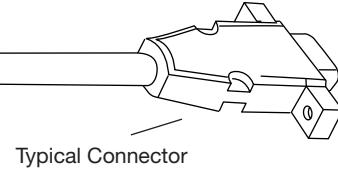
SETUP

<u>Part number</u>	<u>Length</u>	<u>Part number</u>	<u>Length</u>
123197	5 ft./1.5 m	123203	40 ft./12.2 m
123198	10 ft./3 m	123204	45 ft./13.7 m
123199	15 ft./4.6 m	123021	50 ft./15.2 m
123200	20 ft./6.1 m	123205	75 ft./23 m
123020	25 ft./7.6 m	123206	100 ft./30.5 m
123201	30 ft./9.1 m	123207	125 ft./38 m
123202	35 ft./10.6 m	123208	150 ft./45.6 m

THC Control Module



THC Lifter Motor



<u>Pin Number</u>	<u>Color</u>	<u>Signal Name</u>	<u>Function</u>	<u>Pin Number</u>
5 Output 4	Red Black	Motor Phase A + Motor Phase A -	Powers lifter motor, phase A+.	5 Input 4
9 Output 8	Red Black	Motor Phase A + Motor Phase A -	Powers lifter motor, phase A-.	9 Input 8
3			Not connected	3
7 Output 6	Red Black	Motor Phase B + Motor Phase B -	Powers lifter motor, phase B+.	7 Input 6
2 Output 1	Red Black	Motor Phase B + Motor Phase B -	Powers lifter motor, phase B-.	2 Input 1

Figure 3-19 Motor drive cable – part numbers & signal list

Section 4**OPERATION**

In this section:

Operating controls	4-2
THC control module.....	4-2
Operator pendant	4-2
Pendant display screens	4-4
Pendant programmable fields.....	4-6
Automatic screen operation	4-6
Manual screen operation	4-8
Setup screen A.....	4-9
Determining pierce height factor	4-12
THC operating cycle time-lines	4-13
Automatic mode time-line	4-14
Problems and solutions	4-15
Manual mode time-line	4-17
THC selectable responses (DIP switch).....	See section 3 <i>Setup</i>

OPERATION

Operating controls

THC control module

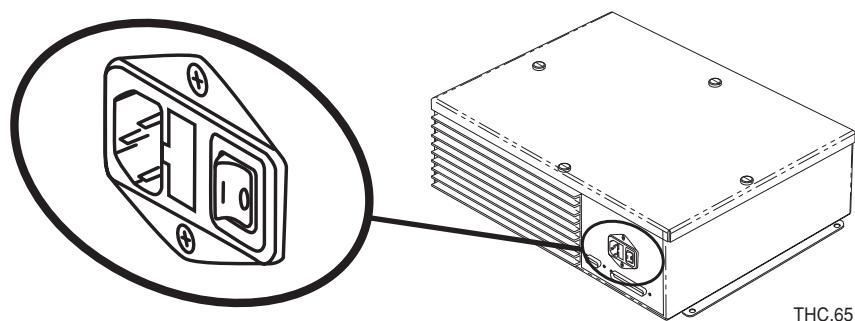


Figure 4-1 Power switch

Operator pendant

The operator pendant consists of the LCD display, the keypad, and the connecting cable. See Figure 4-2 and the following table for pendant keypad use.

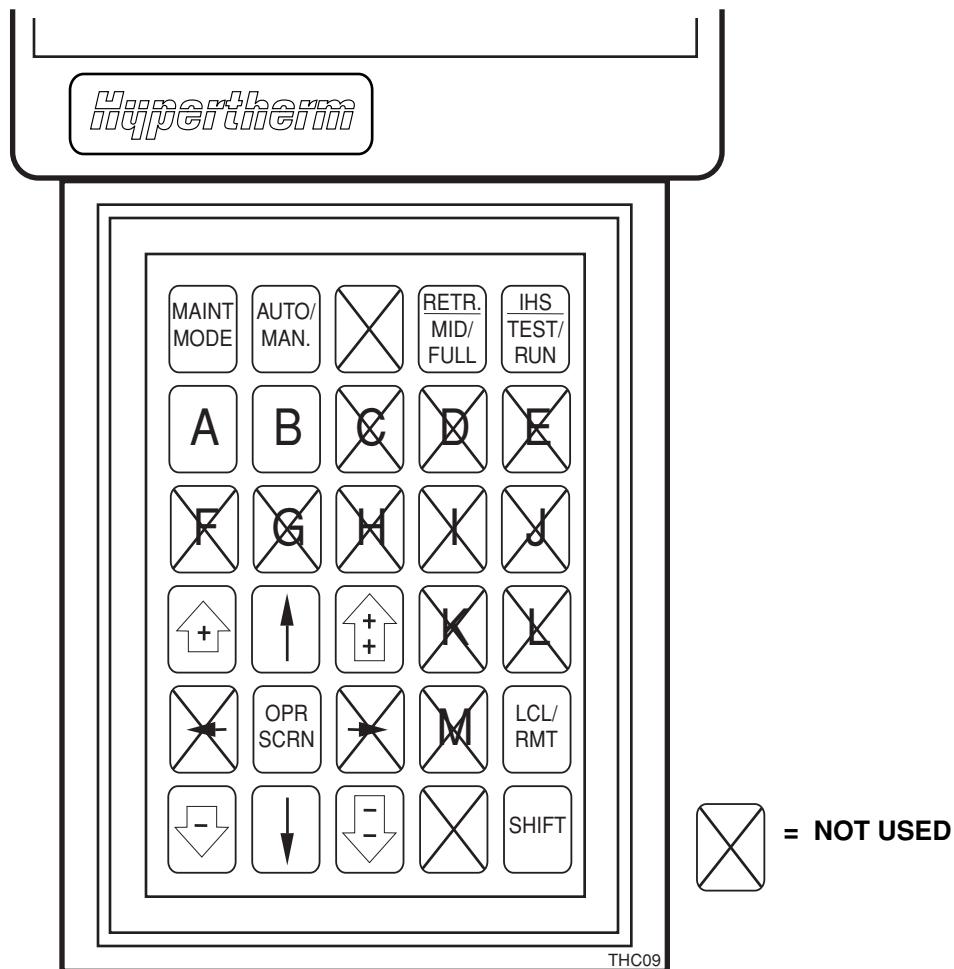


Figure 4-2 Operator pendant key pad

KEY	FUNCTION / USE
	Lifter moves to home position (full up) and system ignores the Cycle Start signal.
	Selects main operating screen for either automatic or manual control mode.
	Selects the height the torch retracts after completing a cut. FULL = full retract MID = programmable dimension
	Initiates IHS test; Torch moves to plate and then retracts to cutting height. Press again to return to RUN mode.
 	Selects data field for changing operating parameters.
   	Changes the value of selected field. Changes torch height while in manual mode.  small increase  large increase  small decrease  large decrease
	Returns to main operating screen (automatic or manual).
	Selects operator pendant (local) or CNC (remote) as control. Press SHIFT key to enable this key.
	Enables LCL/RMT key. Enables B key when viewing the Diagnostic Screen.
	Selects Setup Screen A.
	Selects Diagnostic Screen B. Press SHIFT B to begin diagnostic.

Pendant display screens

Pendant display screens are shown in Figure 4-3.

SCREEN	TO GET TO THIS SCREEN	FUNCTION
AUTOMATIC OPERATION	Press 	Can view and adjust basic operating parameters. Can perform initial height sensing (IHS). Automatic voltage control (AVC) is active. Torch height is automatically adjusted during a cut to maintain the displayed Set Arc Volts.
MANUAL OPERATION	Press 	Torch height can be changed (stationary or during a cut) by pressing the yellow increment (arrow up) or decrement (arrow down) keys. No IHS, AVC, or Rapid Pull-back.    
SETUP A	Press 	Can view and adjust detailed operating parameters. Press OPR SCRN <i>to return to main operation screen.</i>
DIAGNOSTIC B	Press 	Can perform limited on-site testing of the THC controls, cabling and lifter. Proper testing requires that the lifter have an unobstructed path through full length of stroke. Also displays Firmware revision and type of lifter installed. Press OPR SCRN <i>to return to main operation screen.</i>
REMOTE MODE	Press  and  or from CNC	Turns system control over to the CNC. No parameters can be changed from the pendant. Press same keys to return to main operation screen.
MAINTENANCE MODE	Press 	Informs operator that the system is in the maintenance mode. The lifter is in the home position (full up) and the system will not respond to the Cycle Start signal. Press MAINT MODE <i>to return to main operation screen.</i>

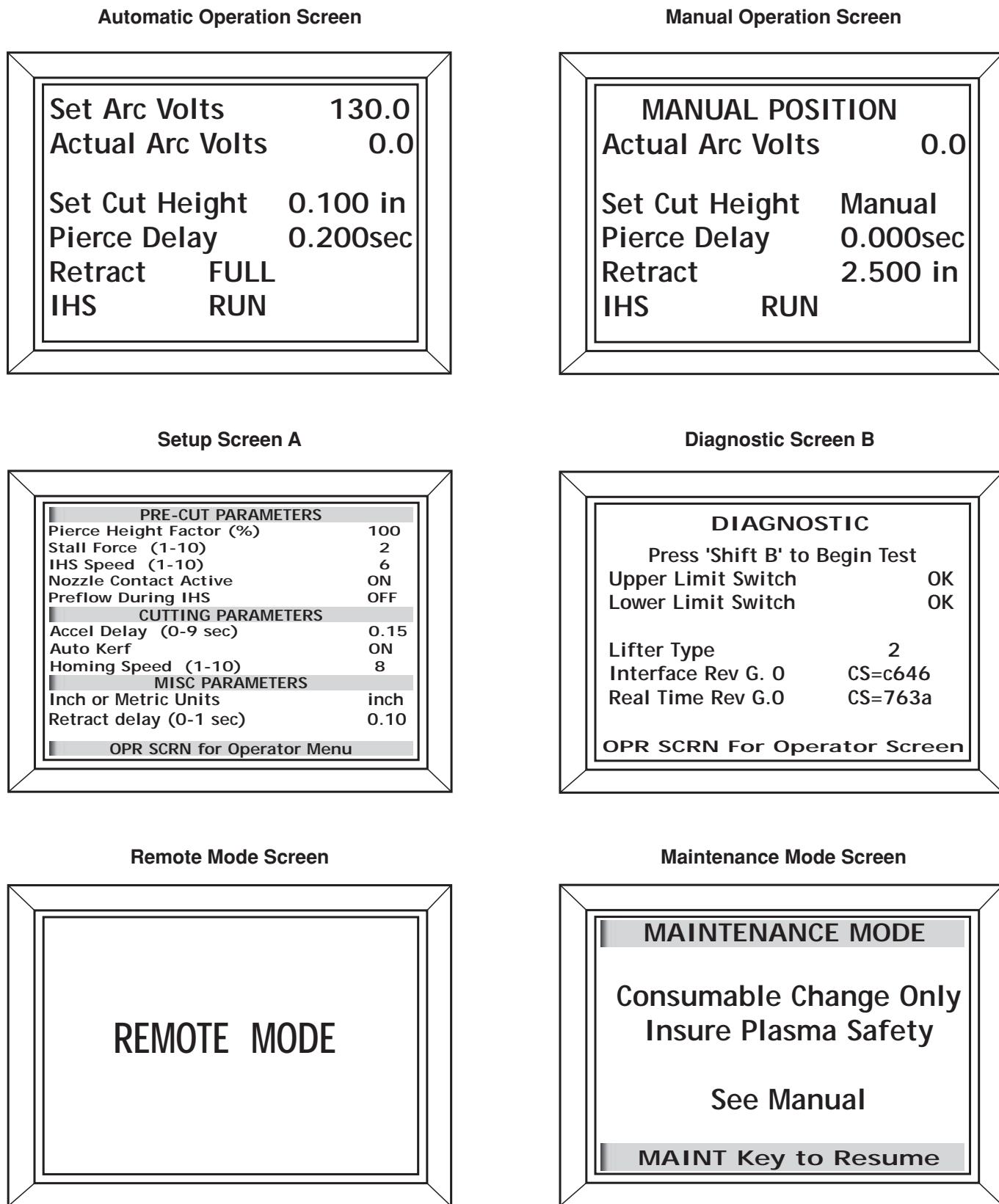
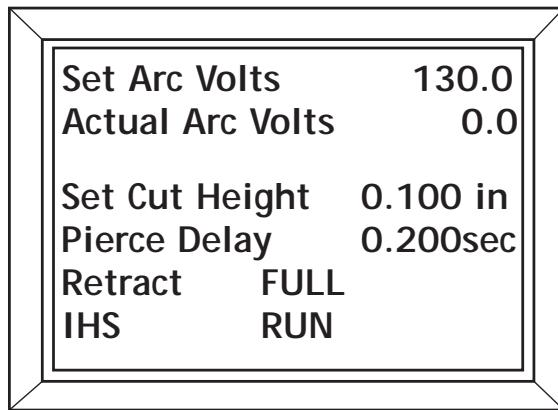


Figure 4-3 Pendant Display Screens

Pendant programmable fields

The following fields can be changed to adjust system operating parameters.

Automatic Operation Screen



Set Arc Volts

Sets the automatic voltage control (AVC) setpoint. Set Arc Volts can be changed any time (stationary or during a cut). When the AUTO mode is selected and after the Pierce Delay and Machine Accel Delay times have elapsed, the arc voltage is controlled by the THC (torch height). The THC adjusts the torch height during a cut, to maintain the Set Arc Volts.

Small change: +/- 0.5 V

Large change: +/- 5 V

Setpoint range: 50–300 V

Set Cut Height

Sets the initial cutting height before AVC is activated. Also sets the pierce height. See *Determining Pierce Height Factor* later in this section.

During a normal cut cycle, the torch will move down and sense the workpiece, and then retract to the Pierce Height. At this point the THC will issue a "Start" signal to the plasma system and wait for a "Transfer" signal. **The torch will move to the Set Cut Height after the Pierce Delay time has elapsed.**

Small change: +/- 0.010 inch/0.2 mm

Large change: +/- 0.100 inch/2 mm

Setpoint range: 0.010–1 inch (0.25–25.4 mm)

Pierce Delay

Sets Pierce Delay (motion dwell time). After receiving the "Transfer" signal from the plasma system, the THC will delay both "Machine Motion" and the "Pierce Complete" signals during the pierce delay time. After the "Pierce Delay" time, the "Machine Motion" output will become active and the cutting machine will begin to move. At the same time **the torch height will rapidly adjust to the Set Cut Height setting and the Machine Accel Delay will begin.**

Note: For best performance, use the THC pierce delay, not the CNC pierce delay. The Pierce Complete signal only applies to HyDefinition plasma systems.

  Small change: +/- 0.010 second

  Large change: +/- 0.100 second

Setpoint range: 0–9 seconds

Retract

Select the FULL mode for normal operation. The torch will retract to the fully retracted position between cuts.

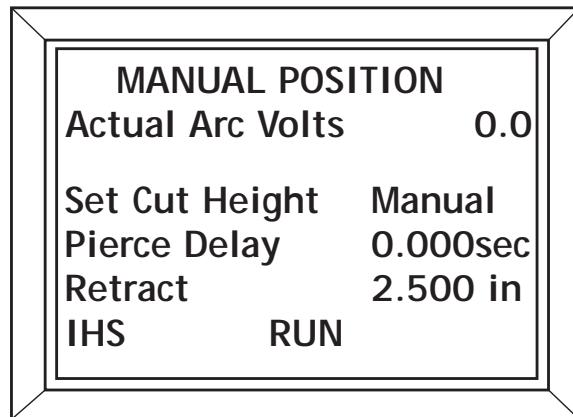
Select the TEACH mode when training the robot a new series of moves. The torch will move to the mid-travel position, providing 1/2 inch (12.7 mm) of travel in both the up and down directions. The torch will not operate while the THC is in the TEACH mode.

IHS

Selects IHS TEST (no plasma arc) or RUN mode. This control is used to test the IHS without firing the torch. When IHS TEST is selected, the torch will sense the workpiece (with ohmic contact sensing or limited force stall sensing) and then retract to the piercing height. Then when IHS RUN is selected, the torch will retract to the set retract height. After testing, return to the RUN mode for proper cutting operation.

OPERATION

Manual Operation Screen



Torch Position

Torch height can be changed when the torch is stationary or during a cut.



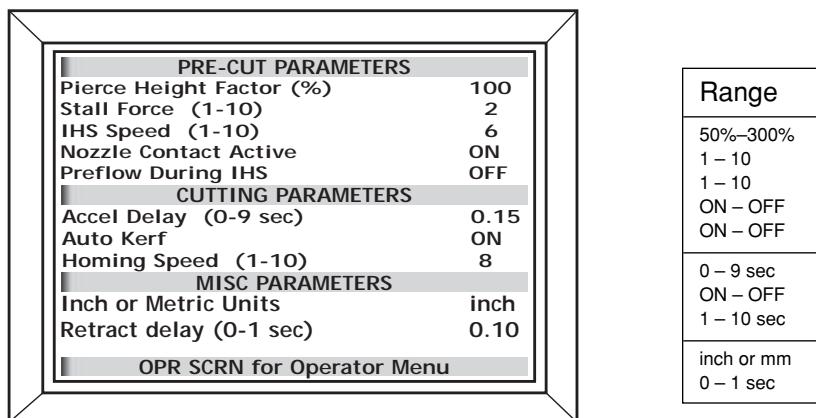
Small change: +/- 0.002 inch/0.05 mm



Large change: starts/stops continuous motion

NOTE: IHS and AVC are disabled when viewing the Manual Operation Screen.

Setup Screen A



Pierce Height Factor

A percent value used to calculate the pierce height.

During a normal cut cycle, the torch will move down and sense the workpiece, then retract to the pierce height (Set Cut Height X Pierce Height Factor). At this point the THC will issue a "Start" signal to the plasma system and wait for a "Transfer" signal.

See *Determining Pierce Height Factor* later in this section.

Stall Force

Sets the lifter downward force during the IHS cycle. This value is a compromise between IHS speed, accuracy and lifter load capacity. Normally this value is set to the lowest force that will reliably move the lifter at the set IHS Speed. This setting will result in the least plate deflection and the greatest IHS accuracy.

This limited-force-stall sensing is the backup mode to the ohmic contact plate sensing. System will default to limited-force-stall sensing if the Nozzle Ohmic Contact is set to OFF.

The use of Stall Force sensing is not as accurate as ohmic contact sensing. To compensate for plate deflection, the user may need to increase the values for Set Cut Height and/or Pierce Height Factor.

Setpoint range: Relative value between
 1 (minimum) and 10 (maximum)

IHS Speed

Sets the lifter downward speed during the IHS cycle. This value is a compromise between lifter speed and IHS accuracy.

Note: At lower speeds the IHS accuracy will be improved. At excessive speeds the torch tip may be damaged and decrease IHS accuracy.

Setpoint range: Relative value between
 1 (minimum) and 10 (maximum)

OPERATION

Nozzle Contact Active

Sets ohmic contact sensing to ON or OFF. When sensing is ON, the torch will advance to the workpiece during IHS, contact the plate and complete an electrical circuit, providing ohmic sensing by the THC.

This parameter should remain ON for most applications. May be disabled (OFF) to get a more reliable IHS when cutting underwater or when cutting extremely dirty or rusty metal. Limited-stall-force sensing is always active and provides secondary sensing to nozzle ohmic contact sensing.

Preflow During IHS

Sets Preflow During IHS to ON or OFF. When this parameter is ON, the "Plasma Start" and "Hold Ignition" signals will be activated at the start of an IHS cycle.

The "Hold Ignition" signal makes it possible to increase the overall machine throughput. This is done by allowing the two normally sequential processes of IHS and preflow to occur simultaneously. When the IHS cycle is complete and the torch is positioned at the piercing height, the "Hold Ignition" signal is deactivated, allowing the power supply to ignite the torch.

Note that the gas preflow time is determined by the plasma system and will not be reduced by activating this parameter. This function occurs with no interaction with the CNC and is totally under THC control. Some Hypertherm power supplies may not include a "Hold Ignition" signal.

Machine Accel Delay

Sets a delay to allow the cutting machine to reach a steady cutting speed before activating the automatic voltage control (AVC). If AVC is active before the cutting machine reaches a steady cutting speed, the torch may dive toward the plate. During the Machine Accel Delay time, the torch will maintain the Set Cut Height.

This delay is based on the cutting machine acceleration time to reach steady state speed. **Set this delay as low as possible without allowing the torch to dive excessively at the beginning of the cut.**

Auto Kerf Detect

Sets Auto Kerf Detect to ON or OFF. Reduces the probability of the torch diving toward the plate when the arc is crossing a kerf. When this parameter is ON, the THC will constantly monitor the arc voltage for sudden changes. If a sudden change is detected, the THC will assume the torch is crossing a kerf and will maintain the torch height until the arc voltage becomes steady, when AVC is resumed.

If the part being cut does not require crossing a kerf, this parameter should be set to OFF (inactive).

Homing Speed

Sets the lifter retract (homing) speed. This value is a compromise between machine speed and the amount of weight on the lifter. At lower speeds, the lifter is capable of lifting heavier loads.

Setpoint range: Relative value between
1 (minimum) and 10 (maximum)

Inch or Metric Units

Units can be set for inches or millimeters.

Retract Delay

Sets a retract delay to allow time for the arc to ramp down and extinguish. This time delay will start when the CNC removes the "Cycle Start" signal and the plasma system is commanded to shutdown. After this programmed delay the torch will retract. **Set this delay as short as possible, so that the torch does not retract when the plasma arc is still active.**

Retract Delay should be used on Hypertherm LongLife plasma systems.

Determining pierce height factor

Typical pierce height factor

See Figure 4-4 for sequence of events.

The Pierce Height Factor is a percentage of the cut height. The factor is entered into the THC pendant and the system calculates the required pierce height. The Cut Height will be maintained until the Machine Acceleration Delay time has elapsed, then Automatic Voltage Control will control torch height.

The default pierce height factor is 150%. Typically, this value is left at 150%.

EXAMPLE: Cut Height = 0.100 inch
 Pierce Height Factor = 150%
 0.100 inch X 150% = 0.150 inch*
 Pierce Height = 0.150 inch

*THC system performs this calculation.

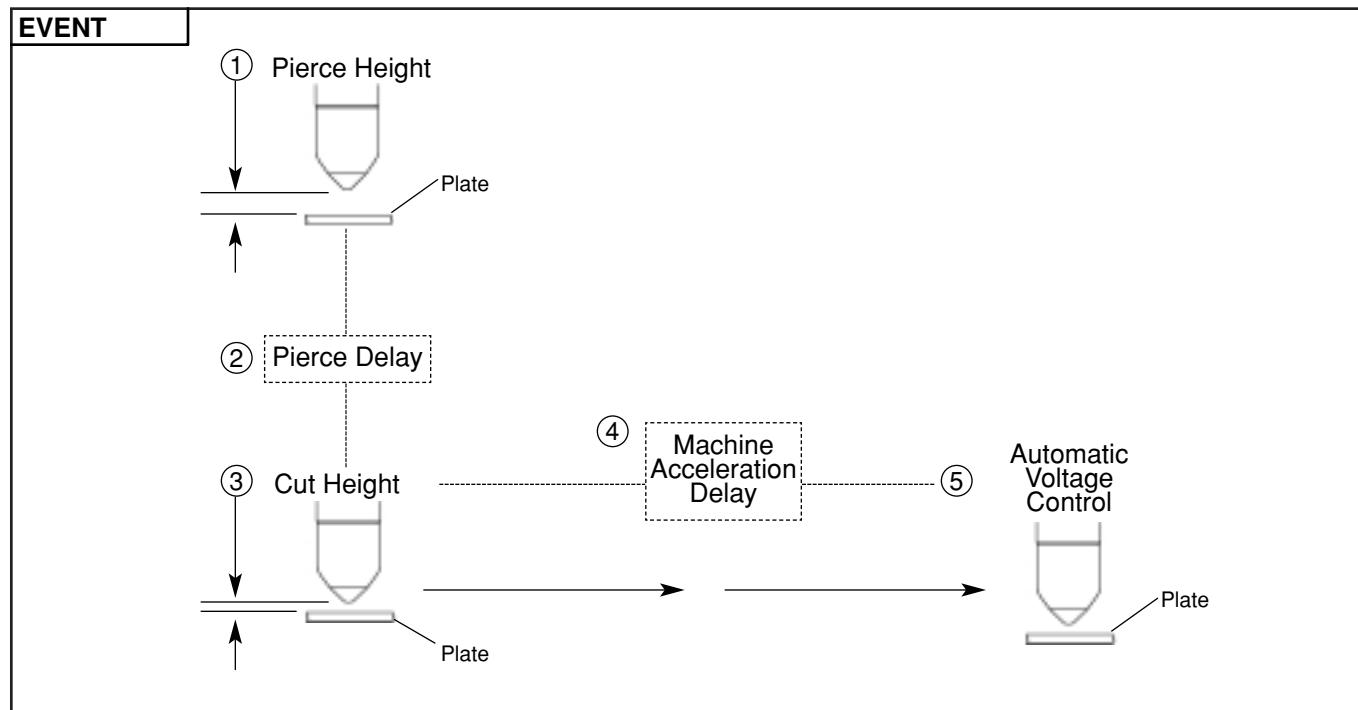
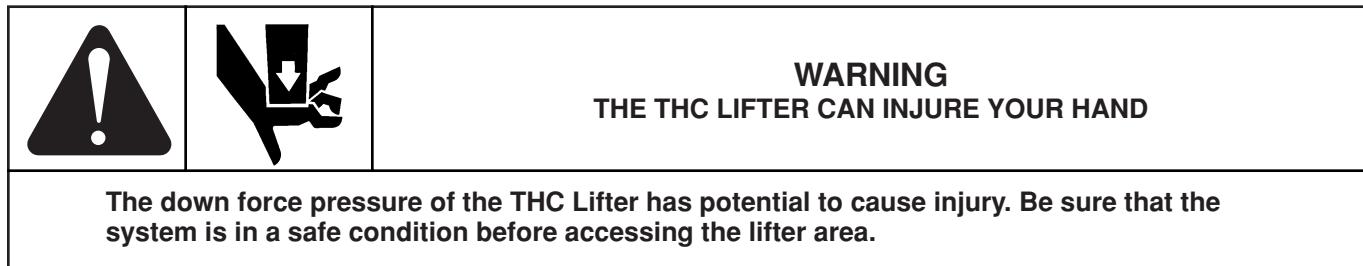


Figure 4-4 Typical pierce height factor – sequence of events

THC operating cycle time-lines

The following pages describe the normal operating cycle time-lines for the THC in the automatic and manual modes. Table 4-1 lists the problems that can occur during a typical operating cycle in the automatic mode, as well as solutions that can be done by the operator. The numbers shown in an operating cycle correspond to the numbers in the list of problems and solutions.



Automatic mode time-line

Start

1. CNC traverses to next piercing position.
2. For multiple torch /THC installations only: CNC issues INS-SYNC-IN signal to each THC. This signal holds arc firing until all THCs are at IHS position.
3. CNC issues a CYCLE-START-IN to THC.
4. If Preflow During IHS is enabled, THC issues a PLASMA-START-OUT and a HOLD-IGNITION-OUT signal to plasma power supply.
- 5a. If Nozzle Contact (ohmic contact) is enabled, torch approaches plate at programmed speed and stall force until nozzle makes ohmic contact with plate; then retracts slowly until nozzle ohmic contact is lost and then retracts to pierce height.
or
- 5b. If Nozzle Contact (ohmic contact) is disabled, torch dives at programmed speed and stall force, until a motor stall is detected and then retracts to pierce height.
6. For multiple torch /THC installations only: THC issues IHS-COMPLETE-OUT signal to CNC. When all IHS-COMPLETE-OUT signals have been satisfied, CNC releases IHS-SYNC-IN signal.
7. If Preflow During IHS is not enabled, THC issues a PLASMA-START-OUT signal to plasma power supply.
8. If Preflow During IHS is enabled, THC releases arc HOLD-IGNITION-OUT signal.
9. Preflow completes, if it has not already completed.
10. Torch ignites.
11. Arc transfers to workpiece. Plasma power supply issues ARC-TRANSFER-IN to THC.
12. Programmed pierce delay signal elapses.
13. Torch quickly dives from pierce height to programmed cut height; programmed MACHINE ACCEL DELAY begins; THC issues PIERCE-COMPLETE-OUT signal to plasma power supply; and THC issues MACHINE-MOTION-OUT signal to CNC to begin profiling part.
14. After MACHINE ACCEL DELAY elapses, arc voltage control (AVC) begins. During AVC, an AUTO-HEIGHT-ON/OFF from CNC freezes torch position (traditional CORNER HOLD). During AVC, CNC should issue an AUTO-HEIGHT-OFF when CNC not moving at programmed velocity. During AVC, if AUTO KERF DETECT is enabled, torch position is frozen when crossing kerfs.
15. At end of cut, CNC releases CYCLE-START-IN signal to THC. Programmed retract delay begins.
16. Programmed retract delay time elapses and the THC raises torch until home limit switch is reached or partial retract height is checked.
17. THC issues RETRACT-COMPLETE-OUT signal to CNC allowing traverse to next cut position.

Cycle completed, return to Start for next cycle.

Table 4-1 THC operating cycle (automatic mode) process problems and solutions

Problem	Solution
(Refer to operating cycle time-line on previous page)	
1. No response to CYCLE-START-IN at THC.	<ul style="list-style-type: none"> Check power to THC. On THC control PCB, D41 - D44 should be illuminated. Check line input fuses in THC power module. Check for bad Cycle Start connection. Check on THC control PCB, Machine Interface Inputs, that D9 is illuminated. Check on control PCB, Machine Interface Inputs, that D15 is illuminated. Check on control PCB, External Interlock OK, that D16 is illuminated. Check that Maintenance Mode is not selected on pendant or do query on RS-422.
2. Arc ignites before IHS is complete.	<ul style="list-style-type: none"> Check that Preflow During IHS is OFF (disabled) on Setup Screen A. If plasma power supply has a Hold signal, check that it is wired properly.
3. Torch does not approach workpiece at programmed IHS speed and stall force.	<ul style="list-style-type: none"> Check that THC is in Automatic Mode. If not, press <AUTO/MAN>key on keypad. Check that Stall Force is not set too low on Setup Screen A. Check that IHS Speed is not set too high on Setup Screen A. Check for cable and hose obstructions that may stop movement.
4. Inaccurate IHS with nozzle ohmic contact.	<ul style="list-style-type: none"> Check that THC is in Automatic Mode. If not, press <AUTO/MAN>key on keypad to select Automatic Mode. Check that Nozzle Ohmic Contact is ON (enabled) on Setup Screen A. Check that nozzle ohmic contact wire is not disconnected. Ensure wire is connected at both ends. Check Pierce Height Factor on Setup Screen A. Check that torch retaining cap is tight. Check for water on the workpiece. If present, use Stall Force sensing. Refer to 5b on previous page. Check for coating (oil, plastic, etc.) on the workpiece. If present, use Stall Force sensing. Refer to 5b on previous page. Check nozzle/shield, clean or replace. Check work lead connection.
5. Inaccurate IHS with Stall Force sensing	<ul style="list-style-type: none"> Check that Nozzle Ohmic Contact is OFF (disabled) on Setup Screen A. Check Pierce Height Factor on Setup Screen A. Check that Stall Force is not set too high on Setup Screen A. Check that workpiece is not deflecting excessively. Check the worktable supports under the workpiece. Offset workpiece deflection by adjusting Set Cut Height on Automatic Operating Screen and Pierce Height Factor on Setup Screen A to achieve desired results.
6. Torch fails to ignite.	<ul style="list-style-type: none"> Ensure plasma system is operational. Check for proper IHS piercing height. Check torch. Check that IHS SYNC is off. Check on THC control PCB, PlasmaInterface Inputs, that D13 is extinguished. Check torch consumables.
7. Torch arc fails to transfer to workpiece.	<ul style="list-style-type: none"> Check that Pierce Height is not too high by checking Set Cut Height on Main Operating Screen and Pierce Height Factor on Setup Screen A. Check work lead connection. Check torch consumables. Check for Transfer signal on control PCB, Machine Interface Inputs, that D17 is illuminated.

**Table 4-1 THC operating cycle (automatic mode) process problems and solutions
(continued)**

Problem	Solution
8a. Arc extinguishes immediately after transfer/excessively large pierce hole.	<ul style="list-style-type: none">Check Pierce Delay on Automatic Operating Screen; the delay is set too long. (The torch dwells in the piercing position too long before machine motion.)Check that Machine Motion Out is active after Pierce Delay ends. Check on control PCB, Machine Interface Outputs, that D25 is illuminated.
8b. Torch moves before workpiece is pierced all the way through.	<ul style="list-style-type: none">Check Pierce Delay on Automatic Operating Screen, the delay is set too short.
9. Torch dives below cutting height immediately after pierce delay and before AVC begins.	<ul style="list-style-type: none">Increase Set Cut Height on Automatic Operating Screen and decrease Pierce Height Factor on Setup Screen A.Increase Machine Accel Delay on Setup Screen A.
10A. Torch dives toward workpiece immediately after AVC begins.	<ul style="list-style-type: none">Increase Set Arc Volts on Automatic Operating Screen.Increase Machine Accel Delay on Setup Screen A.Decrease Set Cut Height on Automatic Operating Screen.
10b. Torch retracts from workpiece immediately after AVC begins.	<ul style="list-style-type: none">Decrease Set Arc Volts on Automatic Operating Screen.Increase Set Cut Height on Automatic Operating Screen.Check plasma interface arc voltage wiring.
10c. Erratic voltage control	<ul style="list-style-type: none">Check for faulty grounds (work lead connection).Check for water leaks.
11. Retract begins before arc has extinguished.	<ul style="list-style-type: none">Increase Retract Delay on Setup Screen A.
12. Failure to retract	<ul style="list-style-type: none">Decrease Homing Speed on Setup Screen A.Check for obstructions in the torch path and torch lead set.

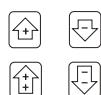
Manual mode time-line

Start

1. CNC traverses to next piercing position.
2. CNC issues a CYCLE-START-IN to THC.
3. THC issues a PLASMA-START-OUT to plasma power supply.
4. Preflow completes, if it has not already completed.
5. Torch fires and arc transfers to workpiece.
6. Plasma power supply issues TRANSFER-OUT signal to THC.
7. Programmed pierce delay signal elapses. THC issues PIERCE-COMPLETE-OUT signal to plasma power supply; and THC issues MACHINE-MOTION-OUT signal to CNC to begin profiling part.
8. At end of part profile, CNC releases CYCLE-START-IN signal to THC. Torch position freezes until arc has extinguished (until plasma power supply transfer signal is released to THC).

Cycle completed, return to Start for next cycle.

Note: At any time, the operator can manually jog the torch position up or down using the + up arrow or the - down arrow keys.



OPERATION

Section 5**MAINTENANCE**

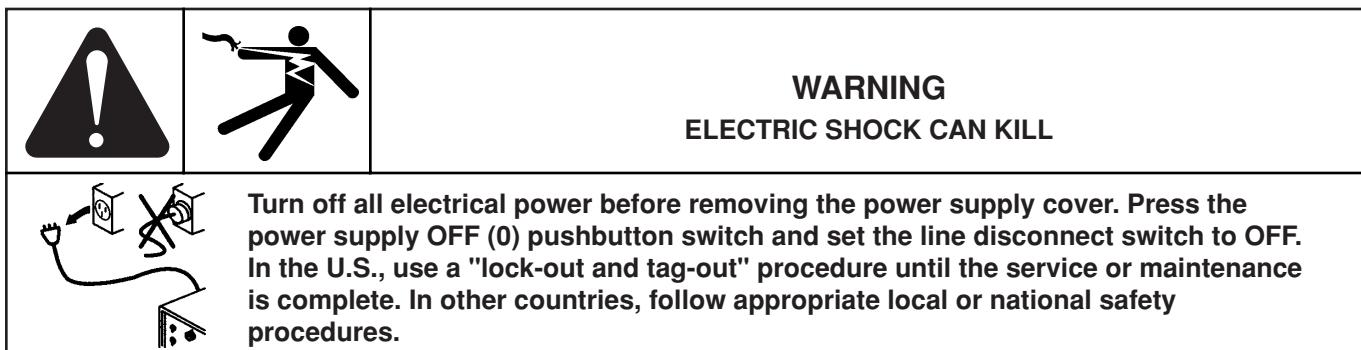
In this section:

Routine maintenance	5-2
Robotic lifter maintenance.....	5-2
Troubleshooting	5-3
Diagnostic screen B.....	5-3
Error messages	5-4
AC power distribution	5-8
Motor drive board status lights during normal power-up	5-9
DC power distribution	5-10
Control board status lights during normal power-up.....	5-12
Interface board status lights during normal power-up	5-14

MAINTENANCE

Routine maintenance

Every 3 months complete the following:



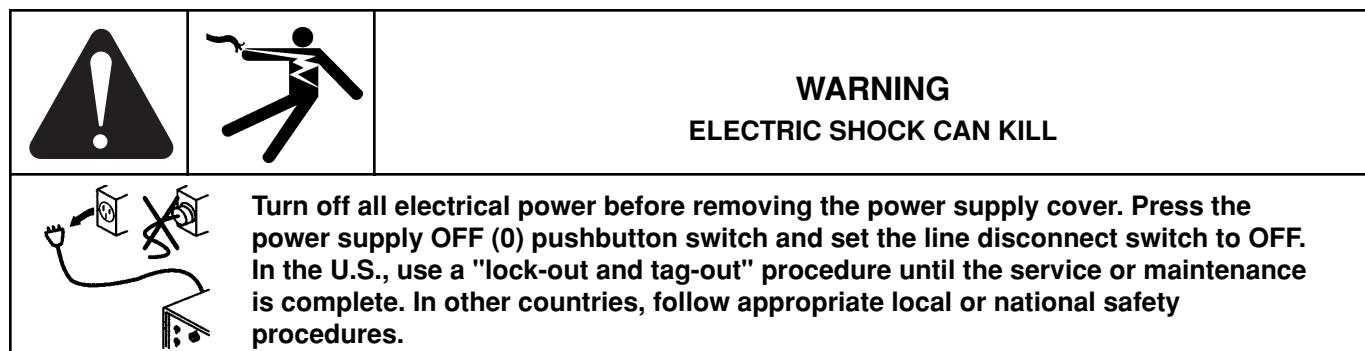
1. Check the THC control module, plasma interface assembly, lifter assembly and associated cables for wear and damage.
2. Check the inside of the THC control module and plasma interface assembly for dirt. Use compressed air to clean the units. If the work environment is extremely dirty, clean the units more often.
3. Replace or repair damaged parts.

Robotic lifter maintenance

Do not grease or lubricate any part of the lifter assembly.

If the robotic lifter requires maintenance, do not try to service it. Call Hypertherm Technical Service.

Troubleshooting



NOTE: See Section 4, *Operation*, for THC operating cycle process problems and solutions.

Diagnostic screen B

Diagnostic Screen B, Figure 5-1, is used to allow limited on-site testing of the THC controls, cables and lifter. The lifter must have an unobstructed path through its full length of travel to complete testing. Press <SHIFT-B> to begin the test.

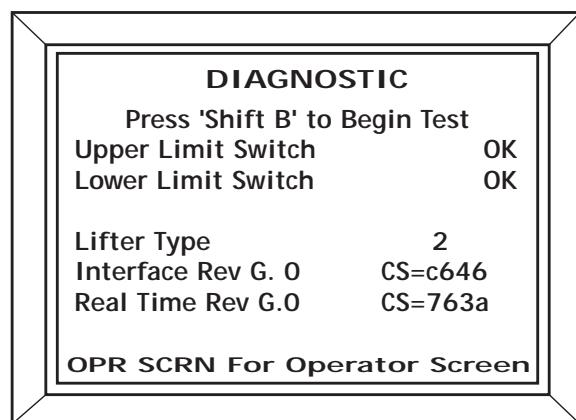


Figure 5-1 Diagnostic Screen B

Error Messages

The error messages in Table 5-1 are displayed on the pendant or on the CNC via the RS-422 serial interface. The error messages for the RS-422 serial interface are the same as for the Pendant except they are preceded by ERR -. Refer to Figures 5-1 and 5-3 through 5-5, as indicated, for some corrective actions.

Table 5-1 Robotic THC error messages

Error Message*	Clear Error	Description of Error	Corrective Action
Torch is in LOWER LIMIT	Press OPR SCRN Key	During IHS the torch did not reach the workpiece. During cutting the torch hits the Lower Limit.	<ul style="list-style-type: none"> Reposition lifter, torch or workpiece. Select Diagnostic Screen B by pressing on keypad. Then press <SHIFT-B> to start tests. Check for the following: <ul style="list-style-type: none"> "Lower Limit Switch" indicates "Ok" "Lifter Type" indicates 1 (Robotic lifter) On THC control PCB, Motor Drive Interface, D54 should be illuminated. D53 and D55 should be extinguished. Place THC in Manual Position Mode. <ul style="list-style-type: none"> Jog torch to Lower Limit position to activate switch. On THC control PCB, Motor Drive Interface, D50 should illuminate. Jog torch up to deactivate switch, D50 should extinguish. Check Lower Limit switch and cable, replace if required.
Torch is in HOME LIMIT	Press OPR SCRN Key	During IHS the torch retracted to the Home Limit.	<ul style="list-style-type: none"> Reposition lifter, torch or workpiece. Stall Force and IHS speed in combination or separately are improperly set. <ul style="list-style-type: none"> Try a lower speed or a higher stall force. Select Diagnostic Screen B by pressing on keypad. Then press <SHIFT-B> to start tests. Check for the following: <ul style="list-style-type: none"> "Upper Limit Switch" indicates "Ok" "Lifter Type" indicates s 1 (Robotic lifter) Place THC in Manual Position Mode. <ul style="list-style-type: none"> Jog torch to Home position to activate switch. On THC control PCB, Motor Drive Interface, D49 should illuminate. Jog torch down to deactivate switch, D49 should extinguish. Check Home Limit switch and cable, replace if required.
EEPROM Checksum Error	Press OPR SCRN Key	Changed the processors. This error will occur one time after upgrading software.	<ul style="list-style-type: none"> Clear error by pressing <OPR SCRN> key and then reenter parameters.
Lifter NOT Installed	Repower	Power up with no lifter cable installed.	<ul style="list-style-type: none"> Check that lifter I/O cable is connected at both ends.
Robotic Limit FAIL	Press OPR SCRN Key	Torch did not reach Home position during full retract.	<ul style="list-style-type: none"> Verify torch is not blocked from moving. Place THC in Manual Position Mode. <ul style="list-style-type: none"> Jog torch to Home position to activate switch. On THC control PCB, Motor Drive Interface, D49 should illuminate. Jog torch down to deactivate switch, D49 should extinguish. Check Home Limit switch and cable, replace if required.

* Error messages for the RS-422 serial interface are the same as for the pendant except they are preceded by ERR -. Error messages for the RS-422 serial interface are cleared by using the CL command.

MAINTENANCE

Table 5-1 Robotic THC error messages (continued)

Error Message*	Clear Error	Description of Error	Corrective Action
Watch Dog Timeout FAIL	Repower	A processor on THC control PCB has failed.	<ul style="list-style-type: none"> Call Hypertherm Technical Service.
InterProcessor Comm Fail	Repower	Changed real-time processor to a higher revision level.	<ul style="list-style-type: none"> Check firmware revisions in both processors for compatibility. Call Hypertherm Technical Service.
Nozzle Contact at Home	Press OPR SCRn Key	Nozzle contact is being sensed with lifter at Home position.	<ul style="list-style-type: none"> Check ohmic contact wire connections at shield and inside plasma interface assembly. Check ohmic contact wire for a short to ground.
Cycle Start ON at INIT	Press OPR SCRn Key	Cycle start is active during THC power up or while exiting Maintenance Mode.	<ul style="list-style-type: none"> Verify CNC start up signal is inactive.
Motor Current Fault	Press OPR SCRn Key	Cable not installed or external interlock not satisfied.	<ul style="list-style-type: none"> Install cable. On THC control PCB, Motor Drive Interface, D51 should illuminate. On THC control PCB, Ext Interlock Ok, D16 should be illuminated. If not, jumper machine interface cable at CNC at pins 16 and 35 on plug J6.
Machine Cable Missing	Repower	Cable not installed or external interlock not satisfied.	<ul style="list-style-type: none"> Install cable. On THC control PCB, Machine Interface Inputs, D15 should illuminate. On THC control PCB, Ext Interlock Ok, D16 should be illuminated. If not, jumper machine interface cable at CNC at pins 3 and 22 on plug J6.
Plasma Cable Missing	Repower	Cable not installed	<ul style="list-style-type: none"> Check cable connections at both ends. On THC control PCB, Plasma Interface Inputs, D23 should illuminate.
Diag FAIL	Repower	Torch inhibited from reaching Home Limit position during diagnostic test.	<ul style="list-style-type: none"> Place THC in Manual Position Mode and jog torch to Home position to activate switch. On THC control PCB, Motor Drive Interface, D49 should illuminate.

* Error messages for the RS-422 serial interface are the same as for the pendant except they are preceded by ERR .
 Error messages for the RS-422 serial interface are cleared by using the CL command.

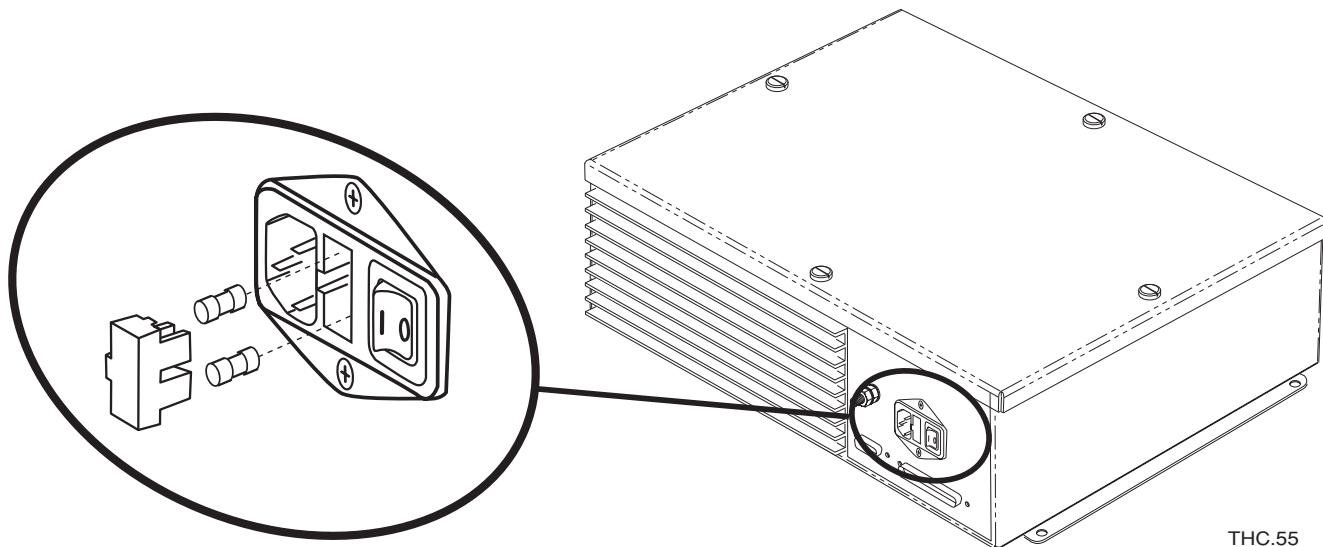
Table 5-1 Robotic THC error messages (continued)

Error Message*	Clear Error	Description of Error	Corrective Action
Diag FAIL	Repower	Torch inhibited from reaching Lower Limit position during diagnostic test.	<ul style="list-style-type: none">Place THC in Manual Position Mode and jog torch to Lower limit to activate switch. On THC control PCB, Motor Drive Interface, D50 should illuminate.
OP CHECKSUM FAIL	Press <SHIFT-H>	Changed firmware. This error will occur one time after upgrading firmware.	<ul style="list-style-type: none">Clear error by pressing <SHIFT-H> on pendant.
RTP CHECKSUM FAIL	Press <SHIFT-H>	Changed firmware. This error will occur one time after upgrading firmware.	<ul style="list-style-type: none">Clear error by pressing <SHIFT-H> on pendant.

* Error messages for the RS-422 serial interface are the same as for the pendant except they are preceded by ERR .
Error messages for the RS-422 serial interface are cleared by using the CL command.

AC power distribution

Check fuses. Remove fuses by gently prying out the fuse holder. See Figure 5-2 and Table 5-2.



THC.55

Figure 5-2 AC power and fuses**Table 5-2 AC power and fuses**

AC Power	Input Filter Fuses	Power Supply AC Power In
Ground (Chassis)	—	TB1-1
115 VAC (N)	3.15A, 250V	TB1-2
115 VAC (L)	3.15A, 250V	TB1-3
Ground (Chassis)	—	TB1-1
230 VAC (N)	3.15A, 250V	TB1-2
230 VAC (L)	3.15A, 250V	TB1-3

Motor drive board status lights during normal power-up

The following LEDs are located on the motor drive PCB inside the control module. See Figure 5-3.

LED	Signal Function	Status
D1	Drive Active	On
D15	Brake Released	On
D16	Up	Off
D17	Down	Off

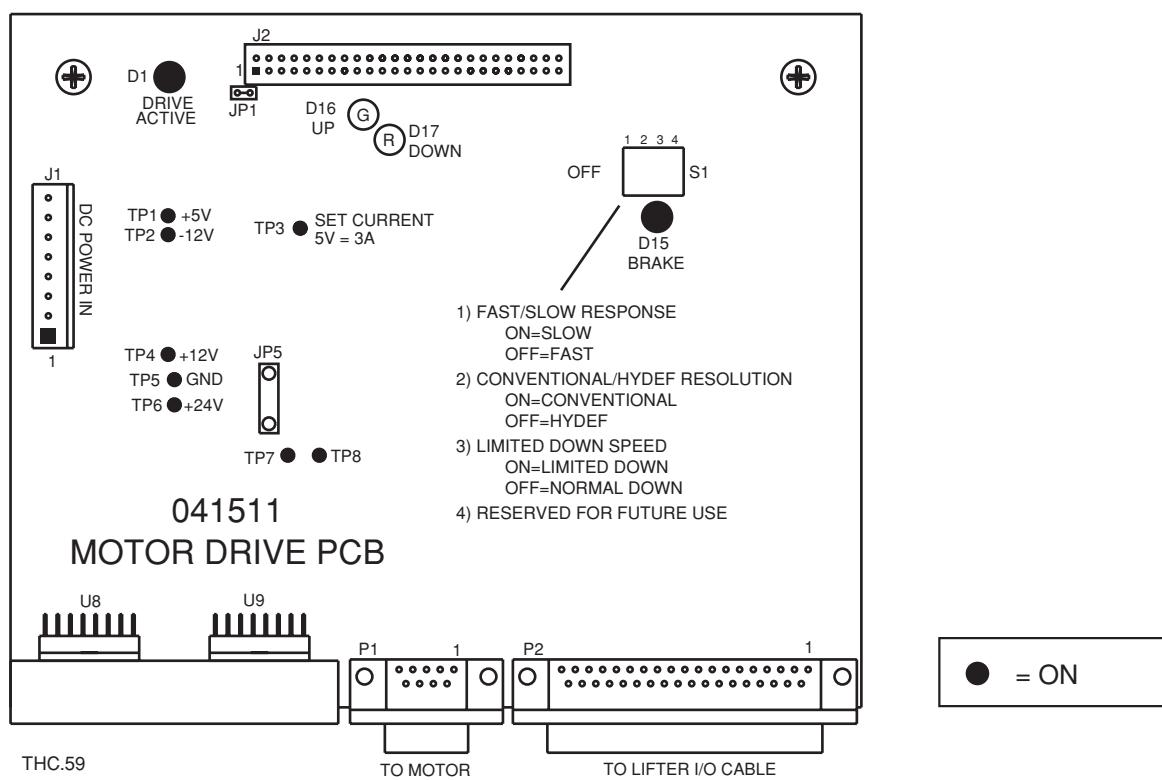
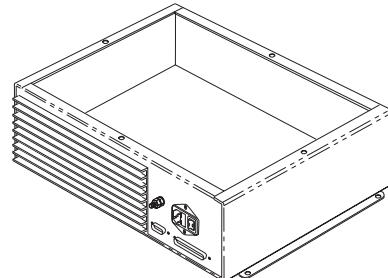
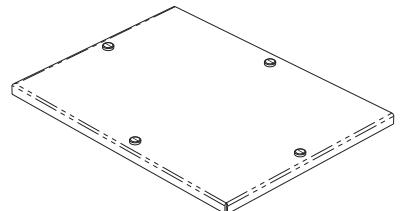


Figure 5-3 Motor drive board

DC power distribution

The following connections are located on the power supply board inside the control module. See Figure 5-4 and Table 5-3.

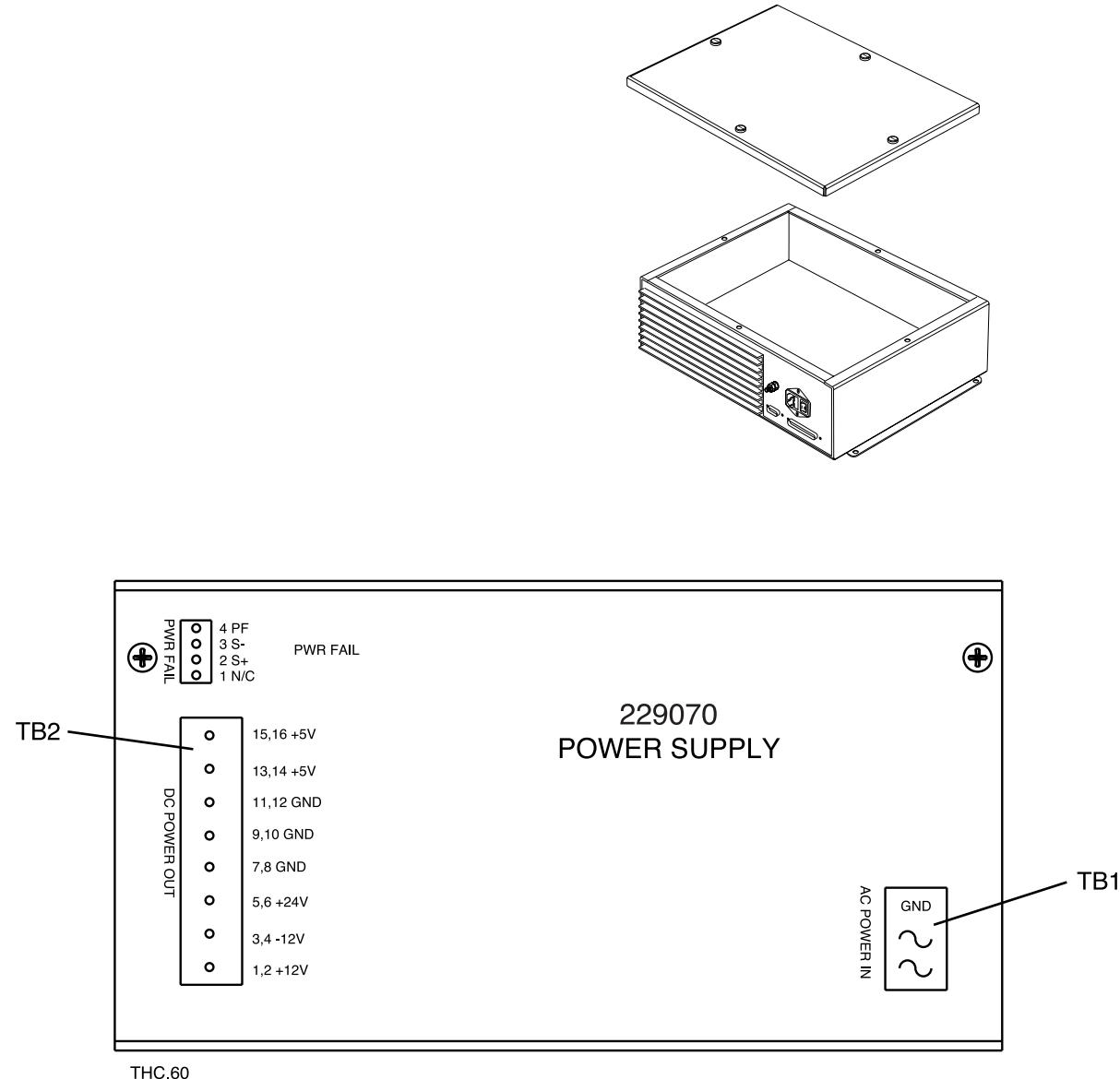


Figure 5-4 Power supply board

Table 5-3 DC power, LEDs and test points

DC Power	Wire Color	Wire Connection Points/LEDs and Test Points		
		Power Supply PCB DC Power Out	Motor Drive PCB DC Power In	Control PCB DC Power In
+ 12 VDC Common	Blue White	TB2-1 TB2-3		J8-3/D43 & TP6 J8-4/D42 & TP5
+ 12 VDC Common	Blue White	TB2-2 TB2-4	J1-3/TP4 J1-4/TP2	
+ 24 VDC Ground	Blue White	TB2-5 TB2-7		J8-5/D41 & TP4 J8-6/TP3 Ground
+ 24 VDC + 24 VDC Ground	Blue Blue White	TB2-6 TB2-8	J8-7 J1-5/TP6 J1-6/TP5 Ground	J8-8
Ground + 5 VDC	White Blue	TB2-11 TB2-15		J8-2 Ground J8-1/D44 & TP7
Ground + 5 VDC	White Blue	TB2-12 TB2-16	J1-2 Ground J1-1/TP1	
+ 5 VDC Ground	Blue White	TB2-13 TB2-10		Resistor 1 mounted on heatsink

Control board status lights during normal power-up

The following LEDs are located on the control board inside the control module. See Figure 5-5.

LED	Signal Function	Status	LED	Signal Function	Status
D9 – cycle start input		Off	D41 – +24v		On
D10 – auto height on/off		Off	D42 – -12v		On
D11 – spare input		Off	D43 – +12v		On
D12 – spare input		Off	D44 – +5v		On
D13 – IHS sync input		Off	D45 – response switch 1 (user-definable response)		Off
D14 – spare input		Off	D46 – response switch 2 (user-definable response)		Off
D15 – machine cable		On	D47 – response switch 3 (user-definable response)		Off
D17 – transfer input		Off	D48 – crash detect (Future use)		Off
D18 – pilot arc input		Off	D49 – home position		On momentarily, then Off
D19 – nozzle contact		Off	D50 – lower limit switch		Off
D20 – spare input		Off	D51 – motor current check		On
D21 – torch 1 select		Off	D52 – response sw4		Off
D22 – torch 2 select		Off	D53 – drive ID 1		On
D23 – plasma cable		On	D54 – drive ID 2		Off
D25 – machine motion output		Off	D55 – drive ID 4		Off
D26 – THC error out		Off	D56 – spare input		Off
		(On if there is error)	D57 – motor drive installed		On
D27 – pilot arc output		Off	D58 – encoder A		On or Off
D28 – retract complete		On	D59 – encoder B		On or Off
D29 – spare out		Off			
D30 – IHS complete		Off			
D31 – error #1 (Not functional)		On			
D32 – plasma start output		Off			
D33 – hold ignition output		Off			
D34 – pierce complete out		Off			
D35 – spare out		Off			
D36 – spare out		Off			
D37 – high voltage relay active		Off			
D38 – error #2 (Not functional)		On			

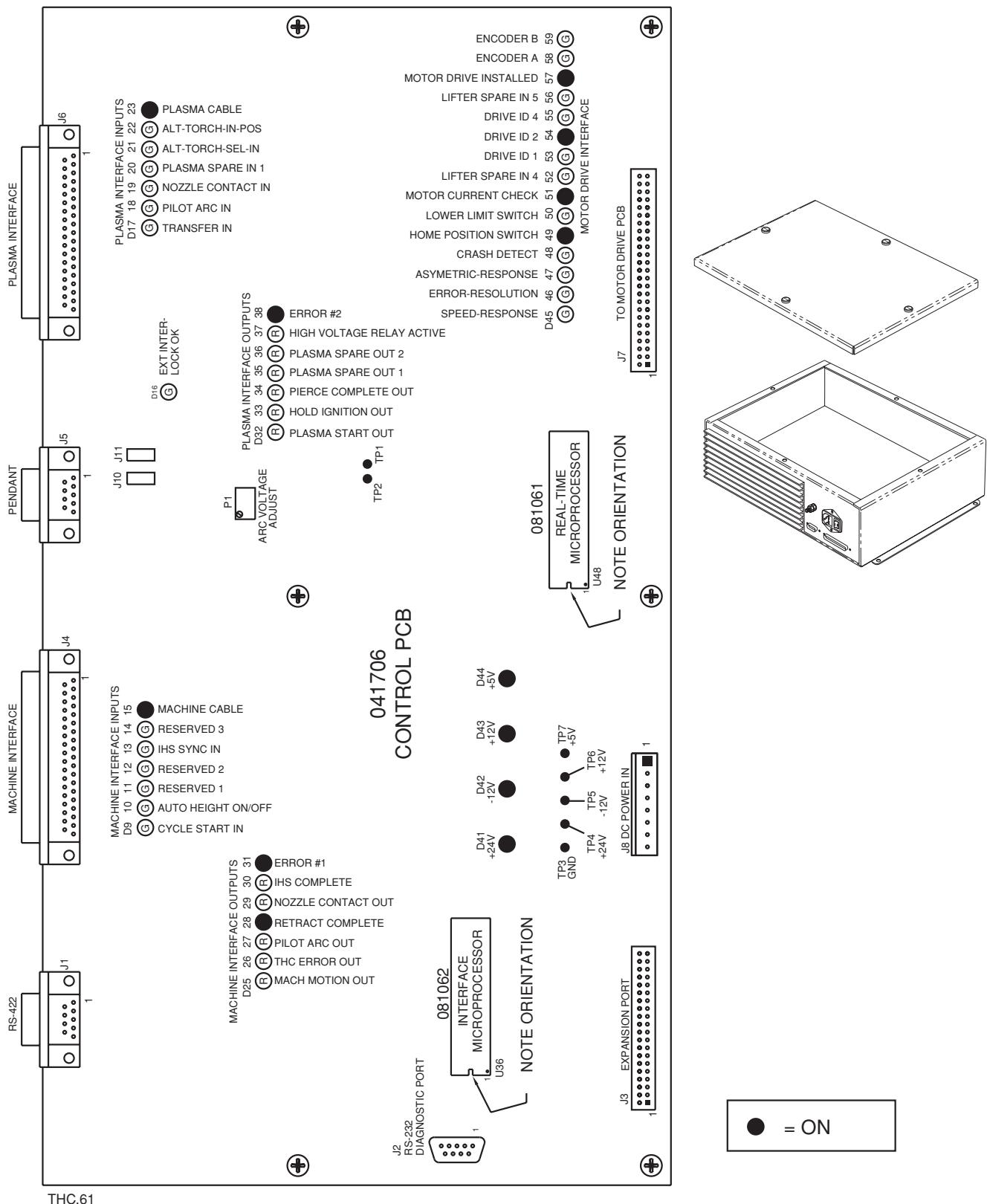


Figure 5-5 Control board

Interface board status lights during normal power-up

The following LEDs and test points are located on the interface board. See Figure 5-6.

LED	Signal Function	Status
D1	Power	On
D2	Shield Relay	Normally On – Off when arc initiates.
D5	Plasma Start	On when plasma start signal to the power supply is active.
D6	Ohmic Contact	Normally Off – On when torch is in contact with the plate. (HD3070, MAX200, HT2000, HT2000LHF, HT4400 only)

Test Points TP1 (ground) and TP2 (+) allow the measurement of the isolated electrode-to-work voltage divided by 82.

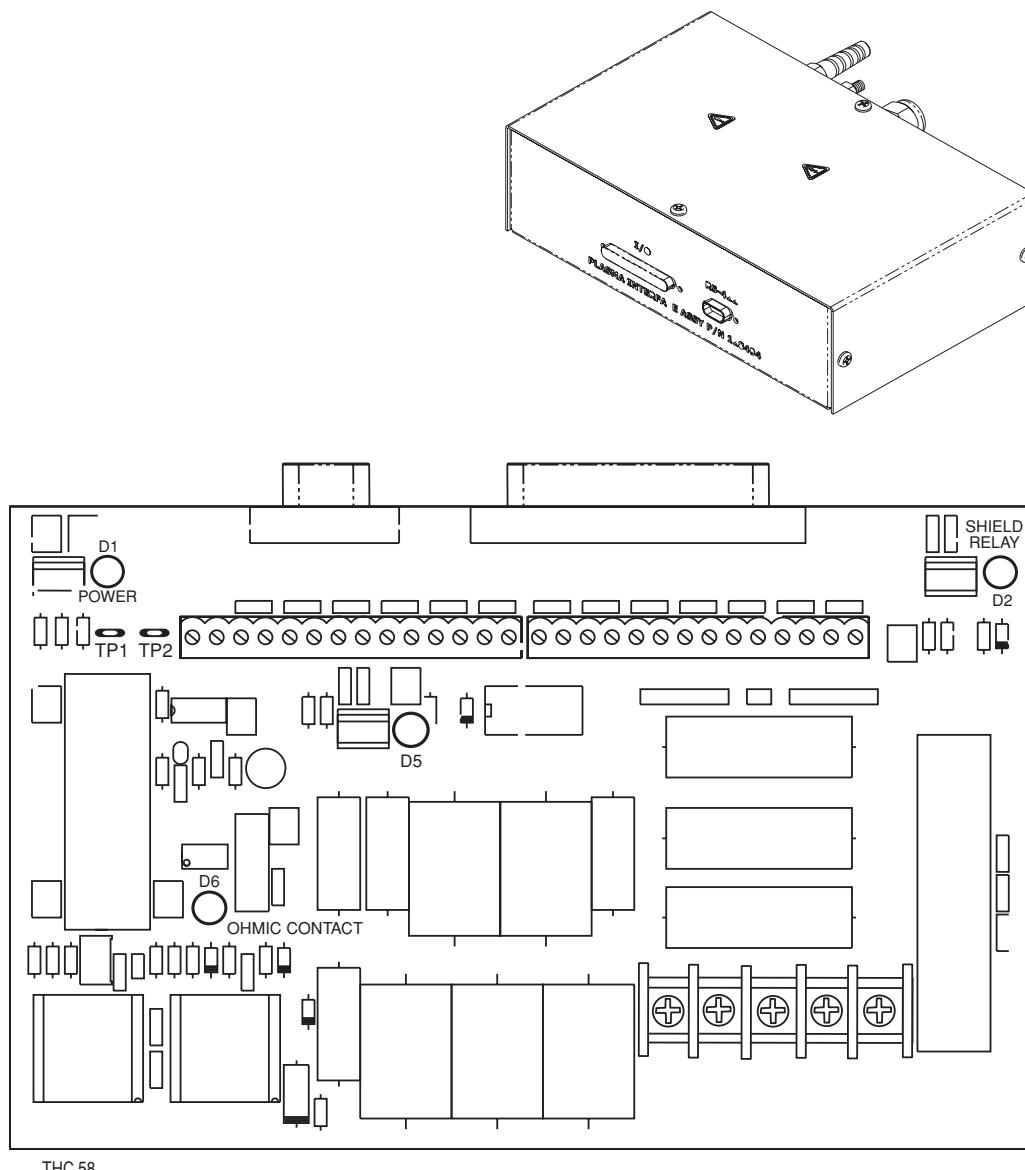


Figure 5-6 Interface board

Section 6**PARTS LIST**

In this section:

THC Control Module	6-2
Plasma Interface Assembly	6-4
Operator Pendant	6-5
Robotic Lifter Assembly	6-6
Robotic Lifter Torch Breakaway Kit - Optional	6-8
Ohmic Contact Wire	6-9
Power Cords	6-9
Interface Cables	See Section 3

PARTS LIST

THC Control module

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
-	053018	THC Control Module	1
1	002261	Enclosure, THC Control Module	1
	129067	Heatsink SA, THC Control Module	1
2	004705	Heatsink, THC	
3	005186	Module, Power Entry, Fused Filter	1
4	008971	Fuse, T,3.15 Amp H 250V 5 mm x 20 mm	2
5	229070	Power Source, 130W (see Fig. 6-2)	1
6	041511	PCB Assy, Motor Driver (see Fig. 6-2)	1
7	128407	PCB Assy, Control (see Fig. 6-2)	1
	081061	Firmware, Real-Time Microprocessor	1
	081062	Firmware, Interface Microprocessor	1
8	123254	Cable, THC 50/C Ribbon (not shown)	1
9	129066	Harness Wiring THC (not shown)	1

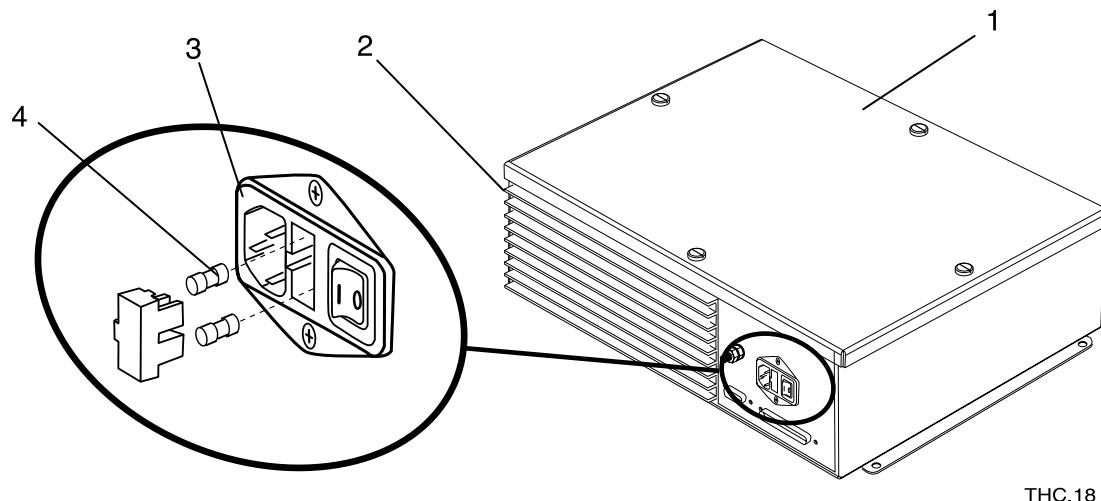


Figure 6-1 THC control module exterior

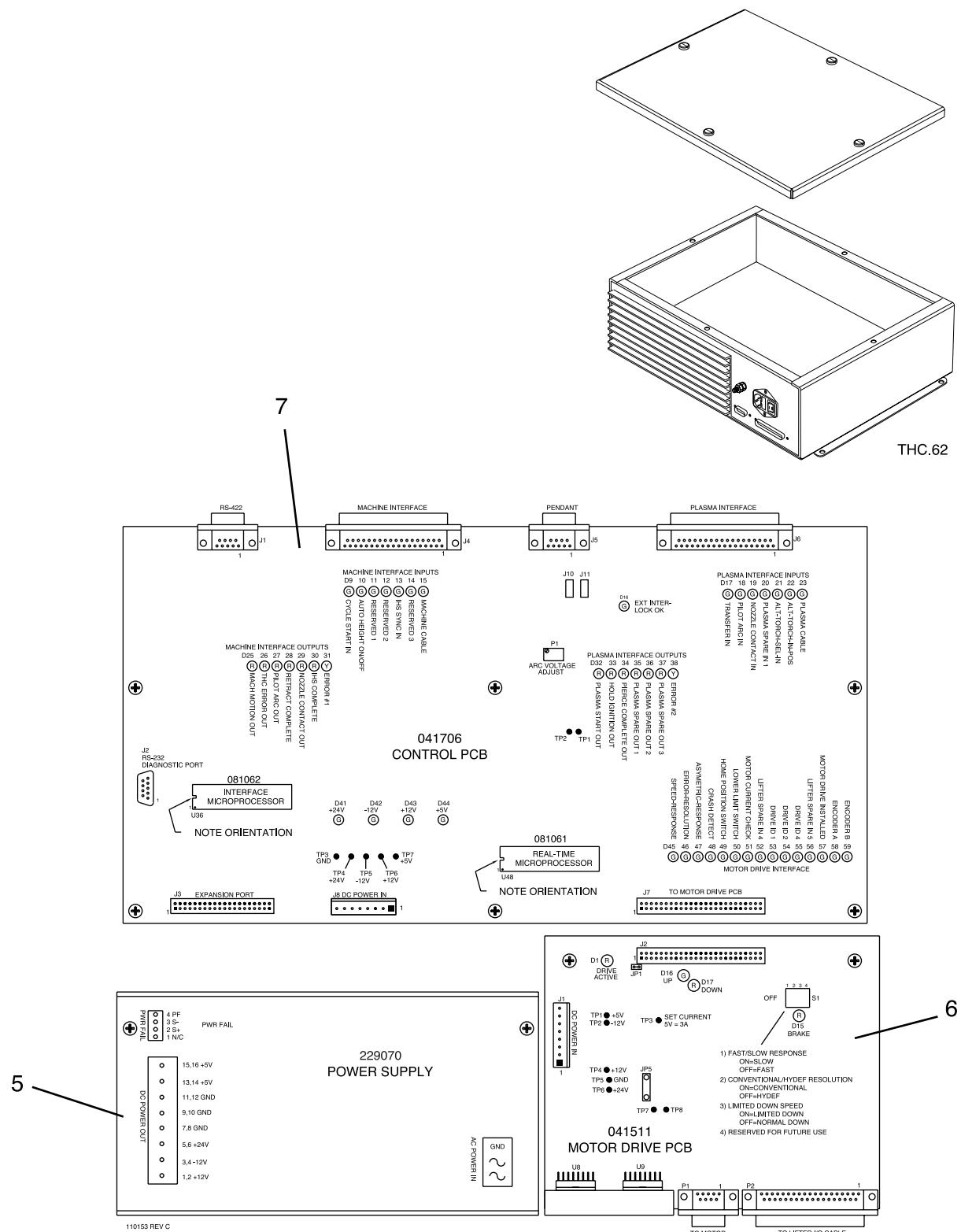


Figure 6-2 THC control module interior

PARTS LIST

Plasma interface assembly

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
1	128494	Plasma Interface Assembly	1
2	128408	Enclosure, Plasma Interface	1
		PC BD Assy, Plasma Interface	1

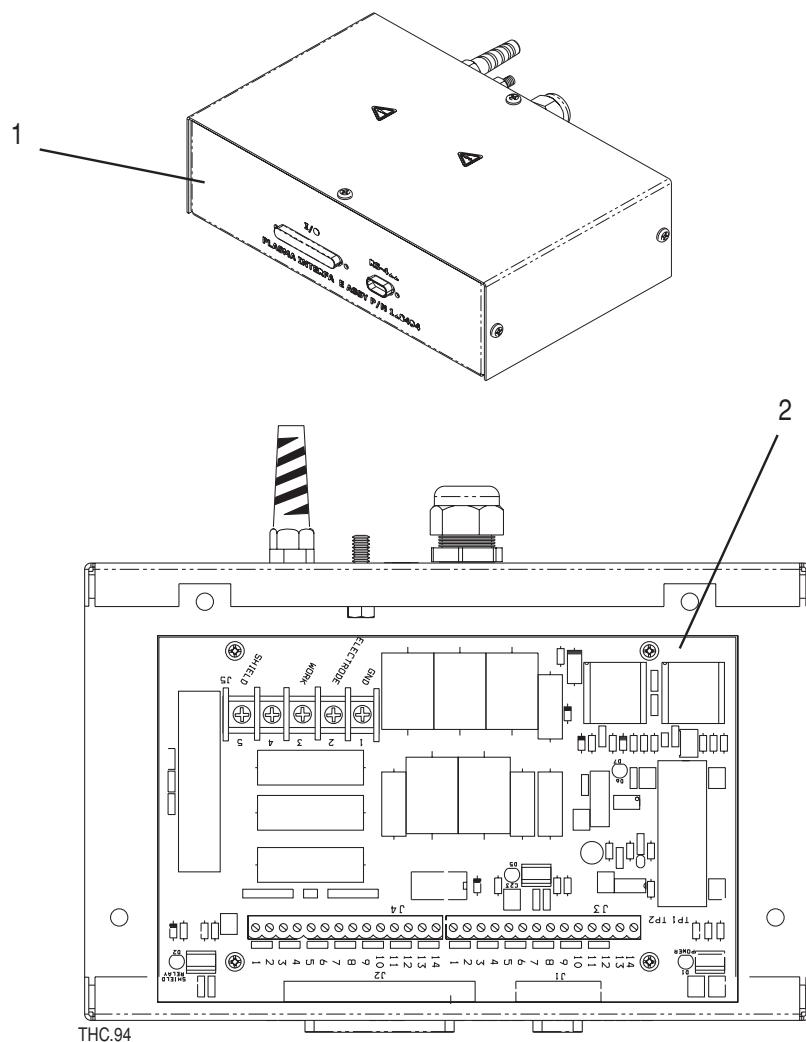


Figure 6-3 THC control module exterior

Operator pendant

Index No.	Part No.	Description	Quantity
1	053019	Pendant, Operator, with 25 ft. cable	1

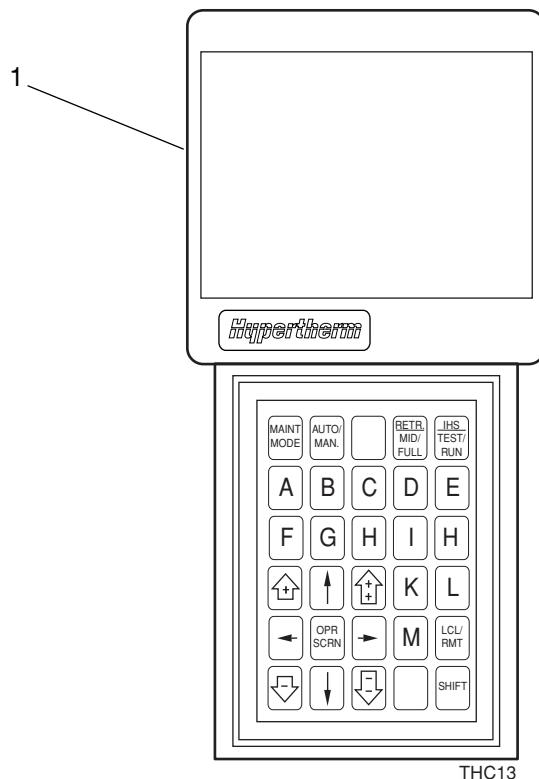


Figure 6-4 Operator pendant

PARTS LIST

Robotic lifter assembly

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
	128049	Robotic Lifter Assembly	1
1	129085	Plate, Boot Attaching	1
2	002262	Boot, Command THC Bellows, Flexible Cover Clip, 9/32 Inch Stainless Steel	1 1 2 8
3	005195	Sensor, Lower Limit	1
4	027467	Rail, Bearing	1
5	005195	Sensor, Upper Limit	1
6	031120	Subassembly, Motor/Leadscrew	1
7	120256	Sleeve, Lead Supporting	1
8	015090	Hose Clamp: 1-5/16 x 2-1/4	1
9	004908	Strain Relief	1

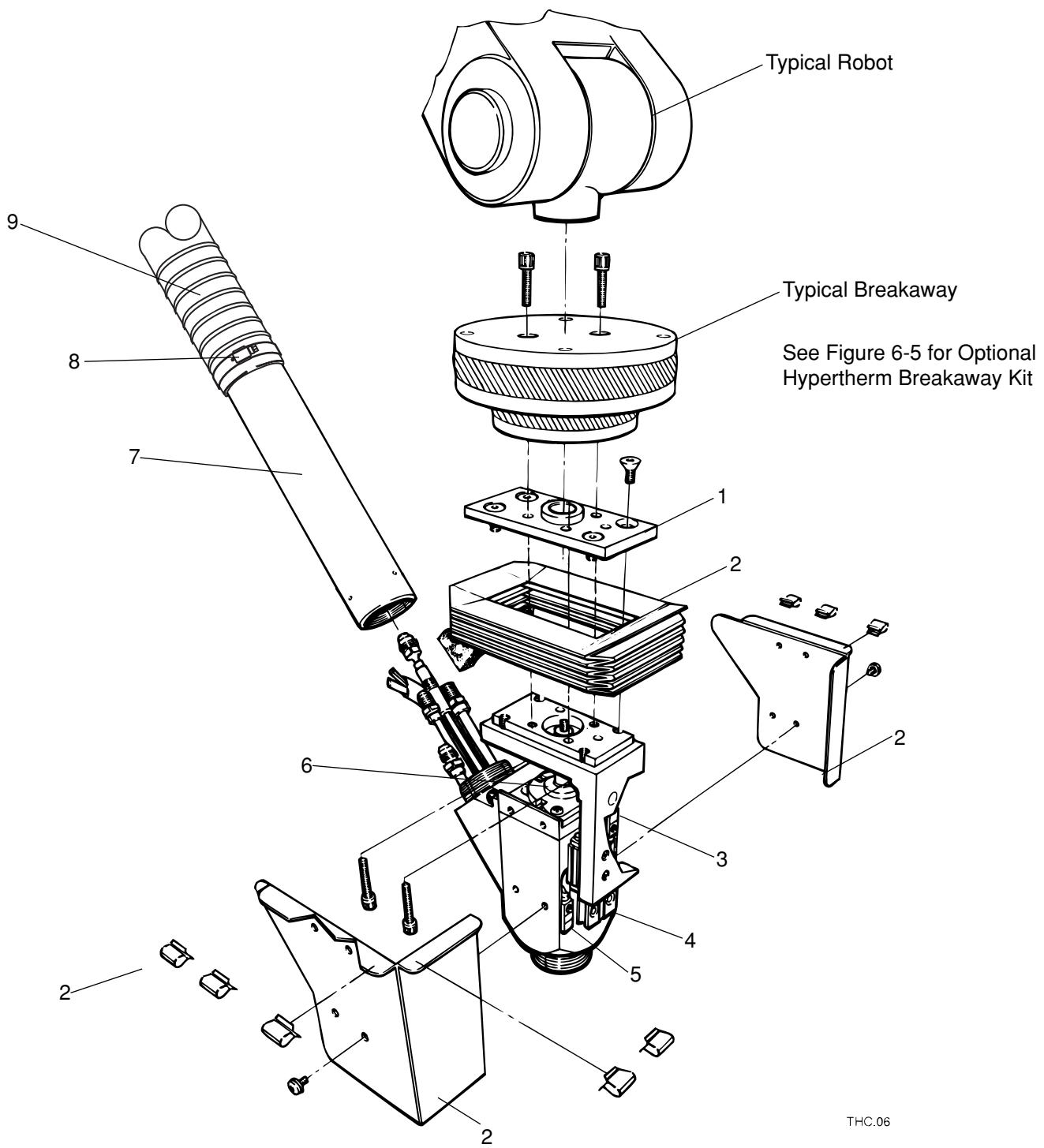


Figure 6-5 Robotic lifter assembly

PARTS LIST

Robotic Lifter Torch Breakaway Kit - Optional

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
1	128280	Kit, Robotic Lifter Torch Breakaway	1
1	004773	Bracket, Breakaway Robotic Fiberglass	1
		Screw	6
2	027574	Breakaway, Command THC	1
2a	123596	Cable, Command THC Torch Breakaway	1
		Screw	2
		Collar	1
3	004772	Bracket, Breakaway Robotic Aluminum	1
4	015317	Connector, Male 10-32 X 1/4 Inch, Push In Tube	1
5	075510	Screw, Socket Cap, M6 X 20 Hex BTN S/Z	2
6	046078	Tubing, 1/4 inch O.D. Synflex	10 ft. (3m)
129361	129361	Regulator/Filter Assembly	
7	011039	Filter/Regulator	1
8	011038	Gauge, Pressure 150 PSI (10.2 Bar) Maximum	1
9	015285	Adapter, 1/8 Inch NTP X 1/4 Inch Push In Tube	1

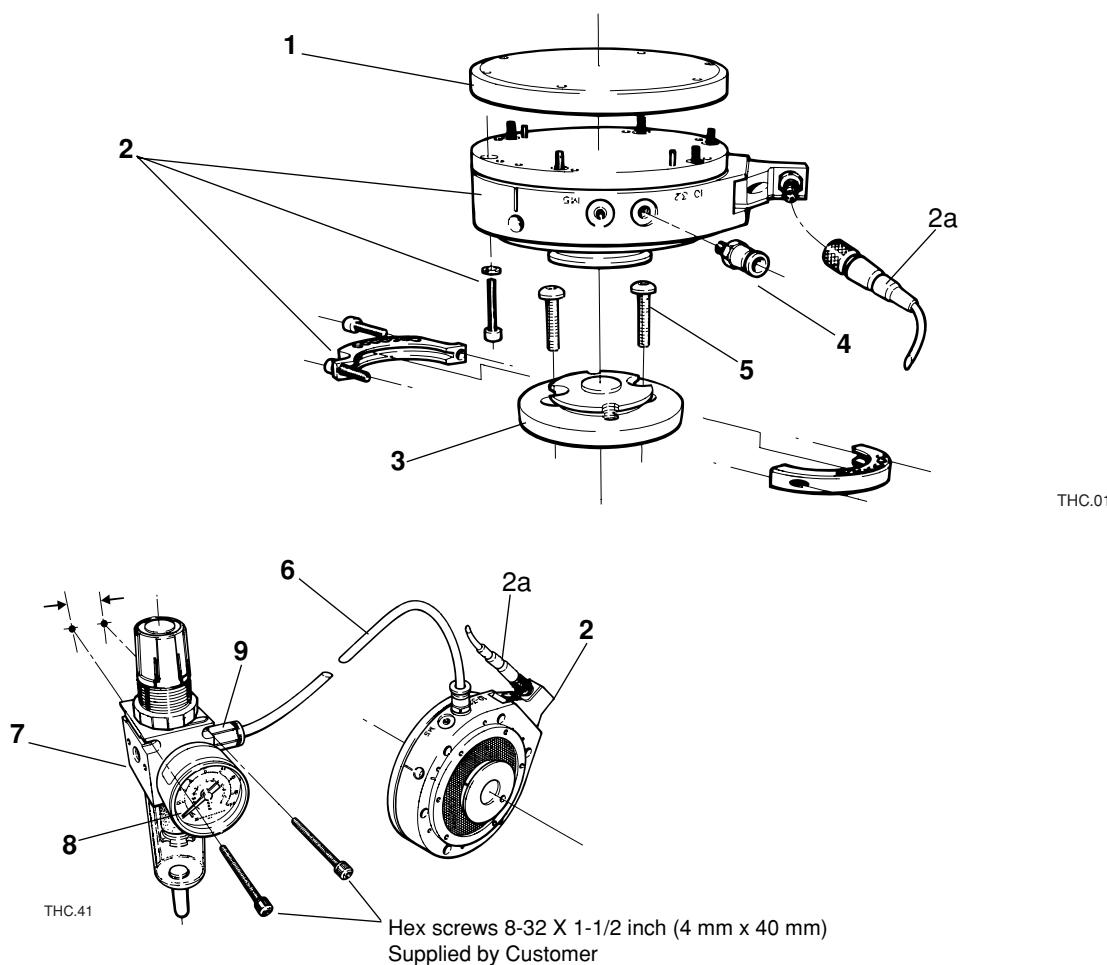


Figure 6-6 Robotic lifter torch breakaway kit

Ohmic contact wire

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Length</u>	<u>Quantity</u>
1	123464	Wire, Ohmic Contact	10 ft./3 m	1
	123465		20 ft./6.1 m	
	123221		25 ft./7.6 m	
	123222		30 ft./9.1 m	
	123223		40 ft./12.2 m	
	123039		50 ft./15.2 m	
	123224		75 ft./23 m	
	123225		100 ft./30.5 m	
	123226		125 ft./38 m	
	123227		150 ft./45.6 m	

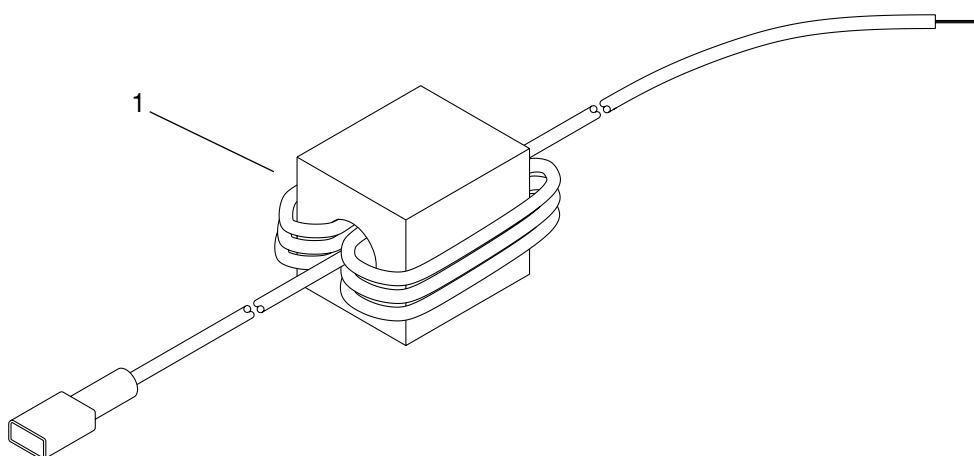


Figure 6-7 Ohmic contact wire

Power cords

<u>Index No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
1	008960	Cable, Power, Domestic 115 VAC	1
2	008961	Cable, Power, International 230 VAC (not shown)	1

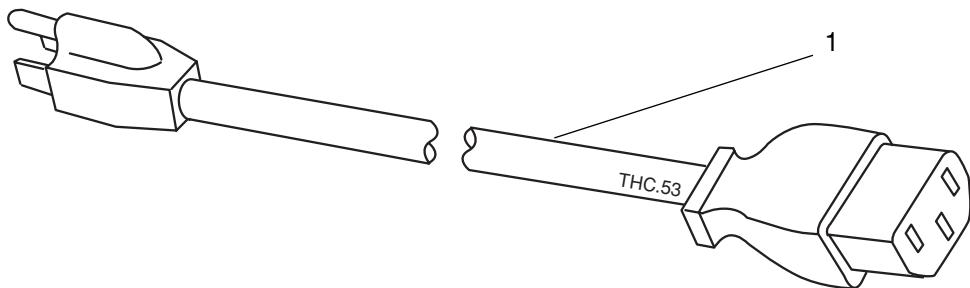


Figure 6-8 Power cord

PARTS LIST
