

Hypertherm®

EDGE® Pro HyPath

Shape Cutting Control



Instruction Manual

807620 | Revision 5 | English

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One of Hypertherm's long-standing core values is a focus on minimizing our impact on the environment. Doing so is critical to our, and our customers', success. We are always striving to become better environmental stewards; it is a process we care deeply about.

EDGE Pro HyPath CNC

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807620
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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

Carefully read 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

American National Standards Institute (ANSI) guidelines are used for safety signal words and symbols. The 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.
- DANGER safety messages precede related instructions in the manual that will result in serious injury or death if not followed correctly.
- 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 minor injury or damage to equipment if not followed correctly.

INSPECT EQUIPMENT BEFORE USING

All cutting equipment must be inspected as required to make sure it is in safe operating condition. When found to be incapable of reliable and safe operation, the equipment must be repaired by qualified personnel prior to its next use or withdrawn from service.

RESPONSIBILITY FOR SAFETY

The person or entity responsible for the safety of the workplace must:

- Make sure that operators and their supervisors are trained in the safe use of their equipment, the safe use of the process, and emergency procedures.
- Make sure that all hazards and safety precautions identified herein are communicated to and understood by workers before the start of work.
- Designate approved cutting areas and establish procedures for safe cutting.
- Be responsible for authorizing cutting operations in areas not specifically designed or approved for such processes.
- Make sure that only approved equipment, such as torches and personal protective equipment, are used.
- Select contractors who provide trained and qualified personnel, and who have awareness of the risks involved, to do cutting.
- Tell contractors about flammable materials or hazardous conditions that are specific to the site, or hazardous conditions that they may not be aware of.
- Make sure that the quality and quantity of air for ventilation is such that personnel exposures to hazardous contaminants are below the allowable limits.
- Make sure that ventilation in confined spaces is sufficient to allow adequate oxygen for life support, to prevent accumulation of asphyxiants or flammable explosive mixtures, to prevent oxygen-enriched atmospheres, and to keep airborne contaminants in breathing atmospheres below allowable limits.



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.



STATIC ELECTRICITY CAN DAMAGE PRINTED CIRCUIT BOARDS

Use proper precautions when handling printed circuit boards:

- Store printed circuit boards in anti-static containers.
- Wear a grounded wrist strap when handling printed circuit boards.



GROUNDING SAFETY

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

Cutting table Connect the cutting table to an earth ground, in accordance with appropriate national and local electrical regulations.

Input power

- Make 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, make 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. Tighten the retaining nut.
- Tighten all electrical connections to avoid excessive heating.

ELECTRICAL HAZARDS

- Only trained and authorized personnel may open this equipment.
- If the equipment is permanently connected, turn it off, and lock out/tag out power before the enclosure is opened.
- If power is supplied to the equipment with a cord, unplug the unit before the enclosure is opened.
- Lockable disconnects or lockable plug covers must be provided by others.
- Wait 5 minutes after removal of power before entering the enclosure to allow stored energy to discharge.
- If the equipment must have power when the enclosure is open for servicing, arc flash explosion hazards may exist. Follow **all** local requirements (NFPA 70E in the USA) for safe work practices and for personal protective equipment when servicing energized equipment.
- Prior to operating the equipment after moving, opening, or servicing, make sure to close the enclosure and make sure that there is proper earth ground continuity to the enclosure.
- Always follow these instructions for disconnecting power before inspecting or changing torch consumable parts.



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.
- In machine torch applications, never touch the torch body, workpiece, or water in a water table when the plasma system is operating.

Electric shock prevention

All 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 the work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must cut 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, make sure that it is correctly connected to an earth ground.
- Install and ground this equipment according to the instruction manual and in accordance with national and local regulations.
- 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 lead 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 a proper grounding conductor first.
- Each plasma system is designed to be used only with specific torches. Do not substitute other torches, which could overheat and present a safety hazard.



CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire prevention

- Make sure the cutting 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 containers.
- Do not cut containers that have held combustible materials.



WARNING

Explosion Hazard

Hydrogen Detonation with Aluminum Cutting



When you use a plasma torch to cut aluminum alloys under water or on a water table, a chemical reaction between the water and the workpiece, parts, fine particles, or molten aluminum droplets generates significantly more hydrogen gas than occurs with other metals. This hydrogen gas may get trapped under the workpiece. If exposed to oxygen or air, the plasma arc or a spark from any source can ignite this trapped hydrogen gas, causing an explosion that may result in death, personal injury, loss of property, or equipment damage.

Consult with the table manufacturer and other experts prior to cutting aluminum to implement a risk assessment and mitigation plan that eliminates the risk of detonation by preventing hydrogen accumulation.



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

Explosion Hazard
Underwater Cutting with Fuel Gases
Containing Hydrogen

- Do not cut underwater with fuel gases containing hydrogen.
- Cutting underwater with fuel gases containing hydrogen can result in an explosive condition that can detonate during plasma cutting operations.

Also, make sure that the water table, fume extraction (ventilation), and other parts of the cutting system have been designed with aluminum cutting in mind.

Do not cut aluminum alloys underwater or on a water table unless you can prevent the accumulation of hydrogen gas.

Note: With proper mitigation, most aluminum alloys can be plasma cut on a water table. An exception is aluminum-lithium alloys. **Never cut aluminum-lithium alloys in the presence of water.** Contact your aluminum supplier for additional safety information regarding hazards associated with aluminum-lithium alloys.



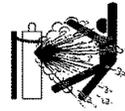
MACHINE MOTION CAN CAUSE INJURY

When an original equipment manufacturer (OEM) makes a cutting system by combining Hypertherm equipment with other equipment, the end-use customer and the OEM are responsible for providing protection against the hazardous moving parts of this cutting system. However, we advise the following to prevent operator injury and equipment damage:

- Read and follow the instruction manual provided by the OEM.
- Maintain a restricted-access area larger than the maximum movement range of the cutting system's moving parts.
- Where there is a risk of collision, do not allow personnel or equipment near the cutting system's moving parts.
- Avoid accidental contact with the CNC touchscreen or joystick. Accidental contact can activate commands and result in unintended motion.
- Do not service or clean the machinery during operation.
- If servicing is required, enable the safety interlock or disconnect and lock out/tag out power to disable the motors and prevent motion.
- Allow only qualified personnel to operate, maintain, and service the machinery.

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 and local regulations.



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 and local regulations.
- Never use a cylinder that is not upright and secured in place.
- Keep the protective cap in place over the 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.



TOXIC FUMES CAN CAUSE INJURY OR DEATH

The plasma arc by itself is the heat source used for cutting. Accordingly, although the plasma arc has not been identified as a source of toxic fumes, the material being cut can be a source of toxic fumes or gases that deplete oxygen.

The fumes produced vary depending on the metal that is cut. Metals that may release toxic fumes include, but are not limited to, stainless steel, carbon steel, zinc (galvanized), and copper.

In some cases, the metal may be coated with a substance that could release toxic fumes. Toxic coatings include, but are not limited to, lead (in some paints), cadmium (in some paints and fillers), and beryllium.

The gases produced by plasma cutting vary based on the material to be cut and the method of cutting, but may include ozone, oxides of nitrogen, hexavalent chromium, hydrogen, and other substances if such are contained in or released by the material being cut.

Caution should be taken to minimize exposure to fumes produced by any industrial process. Depending on the chemical composition and concentration of the fumes (as well as other factors, such as ventilation), there may be a risk of physical illness, such as birth defects or cancer.

It is the responsibility of the equipment and site owner to test the air quality in the cutting area and to make sure that the air quality in the workplace meets all local and national standards and regulations.

The air quality level in any relevant workplace depends on site-specific variables such as:

- Table design (wet, dry, underwater).
- Material composition, surface finish, and composition of coatings.
- Volume of material removed.
- Duration of cutting or gouging.
- Size, air volume, ventilation, and filtration of the workplace.
- Personal protective equipment.
- Number of welding and cutting systems in operation.
- Other workplace processes that may produce fumes.

If the workplace must conform to national or local regulations, only monitoring or testing done at the site can determine whether the workplace is above or below allowable levels.

To reduce the risk of exposure to fumes:

- Remove all coatings and solvents from the metal before cutting.
- Use local exhaust ventilation to remove fumes from the air.
- Do not inhale fumes. Wear an air-supplied respirator when cutting any metal coated with, containing, or suspected to contain toxic elements.
- Make sure that those using welding or cutting equipment, as well as air-supplied respiration devices, are qualified and trained in the proper use of such equipment.
- Never cut containers with potentially toxic materials inside. Empty and properly clean the container first.
- Monitor or test the air quality at the site as needed.
- Consult with a local expert to implement a site plan to make sure air quality is safe.



A PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-on torches

A plasma arc ignites 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 and local regulations.
- 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.

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

- Wear gauntlet gloves, safety shoes, and hat.

- Wear flame-retardant clothing to cover all exposed areas.
- Wear cuffless trousers to prevent entry of sparks and slag.

Also, 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.

| Arc current | Minimum protective shade number (ANSI Z49.1:2012) | Suggested shade number for comfort (ANSI Z49.1:2012) | OSHA 29CFR 1910.133(a)(5) | Europe EN168:2002 |
|----------------|---|--|---------------------------|-------------------|
| Less than 40 A | 5 | 5 | 8 | 9 |
| 41 A to 60 A | 6 | 6 | 8 | 9 |
| 61 A to 80 A | 8 | 8 | 8 | 9 |
| 81 A to 125 A | 8 | 9 | 8 | 9 |
| 126 A to 150 A | 8 | 9 | 8 | 10 |
| 151 A to 175 A | 8 | 9 | 8 | 11 |
| 176 A to 250 A | 8 | 9 | 8 | 12 |
| 251 A to 300 A | 8 | 9 | 8 | 13 |
| 301 A to 400 A | 9 | 12 | 9 | 13 |
| 401 A to 800 A | 10 | 14 | 10 | N/A |



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



NOISE CAN DAMAGE HEARING

Cutting with a plasma arc can exceed acceptable noise levels as defined by local regulations in many applications. Prolonged exposure to excessive noise can damage hearing. Always wear proper ear protection when cutting or gouging, unless sound pressure level measurements taken at the site have verified personal hearing protection is not necessary per relevant international, regional, and local regulations.

Significant noise reduction can be obtained by adding simple engineering controls to cutting tables such as barriers or curtains positioned between the plasma arc and the workstation, and/or locating the workstation away from the plasma arc. Implement administrative controls in the workplace to restrict access and limit operator exposure time, and screen off noisy areas and/or take measures to reduce reverberation in cutting areas by putting up noise absorbers.

Use ear protectors if the noise is disruptive or if there is a risk of hearing damage after all other engineering and administrative controls have been implemented. If hearing protection is required, wear only approved personal protective equipment such as ear muffs or ear plugs with a noise reduction rating appropriate for the situation. Warn others near the cutting area of possible noise hazards. In addition, ear protection can prevent hot splatter from entering the ear.

DRY DUST COLLECTION INFORMATION

In some workplaces, dry dust can represent a potential explosion hazard.

The U.S. National Fire Protection Association's NFPA standard 68, "Explosion Protection by Deflagration Venting," provides requirements for the design, location, installation, maintenance, and use of devices and systems to vent combustion gases and pressures after any deflagration event. Consult with the manufacturer or installer of any dry dust collection system for applicable requirements before you install a new dry dust collection system or make significant changes in the process or materials used with an existing dry dust collection system.

Consult your local "Authority Having Jurisdiction" (AHJ) to determine whether any edition of NFPA standard 68 has been "adopted by reference" in your local building codes.

Refer to NFPA standard 68 for definitions and explanations of regulatory terms such as deflagration, AHJ, adopted by reference, the Kst value, deflagration index, and other terms.

Note 1 – Unless a site-specific evaluation has been completed that determines that none of the dust generated is combustible, then NFPA standard 68 requires the use of explosion vents. Design the explosion vent size and type to conform to the worst-case Kst value as described in Annex F of NFPA standard 68. NFPA standard 68 does not specifically identify plasma cutting or other thermal cutting processes as requiring deflagration venting systems, but it does apply these new requirements to all dry dust collection systems.

Note 2 – Users should consult and comply with all applicable national, state, and local regulations. Publications do not intend to urge action that is not in compliance with all applicable regulations and standards, and this manual may never be construed as doing so.

Introduction

Hypertherm maintains a global Regulatory Management System to ensure that products comply with regulatory and environmental requirements.

National and local safety regulations

National and Local safety regulations shall take precedence over any instructions provided with the product. The product shall be imported, installed, operated and disposed of in accordance with national and local regulations applicable to the installed site.

Certification test marks

Certified products are identified by one or more certification test marks from accredited testing laboratories. The certification test marks are located on or near the data plate.

Each certification test mark means that the product and its safety-critical components conform to the relevant national safety standards as reviewed and determined by that testing laboratory. Hypertherm places a certification test mark on its products only after that product is manufactured with safety-critical components that have been authorized by the accredited testing laboratory.

Once the product has left the Hypertherm factory, the certification test marks are invalidated if any of the following occurs:

- The product is modified in a manner that creates a hazard or non-conformance with the applicable standards.
- Safety-critical components are replaced with unauthorized spare parts.
- Any unauthorized assembly, or accessory that uses or generates a hazardous voltage is added.
- There is any tampering with a safety circuit or other feature that is designed into the product as part of the certification, or otherwise.

CE marking constitutes a manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of Hypertherm products with a CE Marking located on or near the data plate have been tested for compliance with the European Low Voltage Directive and the European EMC Directive. EMC filters needed to comply with the European EMC Directive are incorporated within versions of the power supply with a CE Marking.

Certificates of compliance for Hypertherm products are available from the Downloads Library on the Hypertherm web site at <https://www.hypertherm.com>.

Differences in national standards

Nations may apply different performance, safety or other standards. National differences in standards include, but are not limited to:

- Voltages
- Plug and cord ratings
- Language requirements
- Electromagnetic compatibility requirements

These differences in national or other standards may make it impossible or impractical for all certification test marks to be placed on the same version of a product. For example, the CSA versions of Hypertherm's products do not comply with European EMC requirements, and therefore do not have a CE marking on the data plate.

Countries that require CE marking or have compulsory EMC regulations must use CE versions of Hypertherm products with the CE marking on the data plate. These include, but are not limited to:

- Australia
- New Zealand
- Countries in the European Union
- Russia

It is important that the product and its certification test mark be suitable for the end-use installation site. When Hypertherm products are shipped to one country for export to another country; the product must be configured and certified properly for the end-use site.

Safe installation and use of shape cutting equipment

IEC 60974-9, titled Arc Welding Equipment – Installation and use, provides guidance in the safe installation and use of shape cutting equipment and the safe performance of cutting operations. The requirements of national and local regulations shall be taken into consideration during installation, including, but not limited to, grounding or protective earth connections, fuses, supply disconnecting device, and type of supply circuit. Read these instructions before installing the equipment. The first and most important step is the safety assessment of the installation.

The safety assessment must be performed by an expert, and determines what steps are necessary to create a safe environment, and what precautions should be adopted during the actual installation and operation.

Procedures for periodic inspection and testing

Where required by local national regulations, IEC 60974-4 specifies test procedures for periodic inspection and after repair or maintenance, to ensure electrical safety for plasma cutting power sources built in conformity with IEC 60974-1. Hypertherm performs the continuity of the protective circuit and insulation resistance tests in the factory as non-operating tests. The tests are performed with the power and ground connections removed.

Hypertherm also removes some protective devices that would cause false test results. Where required by local national regulations, a label shall be attached to the equipment to indicate that it has passed the tests prescribed by IEC 60974-4. The repair report shall indicate the results of all tests unless an indication is made that a particular test has not been performed.

Qualification of test personnel

Electrical safety tests for shape cutting equipment can be hazardous and shall be carried out by an expert in the field of electrical repair, preferably someone also familiar with welding, cutting, and allied processes. The safety risks to personnel and equipment, when unqualified personnel are performing these tests, may be much greater than the benefit of periodic inspection and testing.

Hypertherm recommends that only visual inspection be performed unless the electrical safety tests are specifically required by local national regulations in the country where the equipment is installed.

Residual current devices (RCDs)

In Australia and some other countries, local codes may require the use of a Residual Current Devices (RCD) when portable electrical equipment is used in the workplace or at construction sites to protect operators from electrical faults in the equipment. RCDs are designed to safely disconnect the mains electrical supply when an imbalance is detected between the supply and return current (there is a leakage current to earth). RCDs are available with both fixed and adjustable trip currents between 6 to 40 milliamperes and a range of trip times up to 300 milliseconds selected for the equipment installation, application and intended use. Where RCDs are used, the trip current and trip time on RCDs should be selected or adjusted high enough to avoid nuisance tripping during normal operation of the plasma cutting equipment and low enough in the extremely unlikely event of an electrical fault in the equipment to disconnect the supply before the leakage current under a fault condition can pose a life threatening electrical hazard to operators.

To verify that the RCDs continue to function properly over time, both the trip current and the trip time should be tested periodically. Portable electrical equipment and RCDs used in commercial and industrial areas in Australia and New Zealand are tested to the Australian standard AS/NZS 3760. When you test the insulation of plasma cutting equipment to AS/NZS 3760, measure the insulation resistance according to Appendix B of the standard, at 250 VDC with the power switch in the ON position to verify proper testing and to avoid the false failure of the leakage current test. False failures are possible because the metal oxide varistors (MOVs) and electromagnetic compatibility (EMC) filters, used to reduce emissions and protect the equipment from power surges, may conduct up to 10 milliamperes leakage current to earth under normal conditions.

If you have any questions regarding the application or interpretation of any IEC standards described here, you are required to consult with an appropriate legal or other advisor familiar with the International Electrotechnical standards, and shall not rely on Hypertherm in any respect regarding the interpretation or application of such standards.

Higher-level systems

When a system integrator adds additional equipment; such as cutting tables, motor drives, motion controllers or robots; to a Hypertherm plasma cutting system, the combined system may be considered a higher-level system. A higher-level system with hazardous moving parts may constitute industrial machinery or robotic equipment, in which case the OEM or end-use customer may be subject to additional regulations and standards than those relevant to the plasma cutting system as manufactured by Hypertherm.

It is the responsibility of the end-use customer and the OEM to perform a risk assessment for the higher-level system, and to provide protection against hazardous moving parts. Unless the higher-level system is certified when the OEM incorporates Hypertherm products into it, the installation also may be subject to approval by local authorities. Seek advice from legal counsel and local regulatory experts if you are uncertain about compliance.

External interconnecting cables between component parts of the higher level system must be suitable for contaminants and movement as required by the final end use installation site. When the external interconnecting cables are subject to oil, dust, water, or other contaminants, hard usage ratings may be required.

When external interconnecting cables are subject to continuous movement, constant flexing ratings may be required. It is the responsibility of the end-use customer or the OEM to ensure the cables are suitable for the application. Since there are differences in the ratings and costs that can be required by local regulations for higher level systems, it is necessary to verify that any external interconnecting cables are suitable for the end-use installation site.

Introduction

The Hypertherm Environmental Specification requires RoHS, WEEE and REACH substance information to be provided by Hypertherm's suppliers.

Product environmental compliance does not address the indoor air quality or environmental release of fumes by the end user. Any materials that are cut by the end user are not provided by Hypertherm with the product. The end user is responsible for the materials being cut as well as for safety and air quality in the workplace. The end user must be aware of the potential health risks of the fumes released from the materials being cut and comply with all local regulations.

National and local environmental regulations

National and local environmental regulations shall take precedence over any instructions contained in this manual.

The product shall be imported, installed, operated and disposed of in accordance with all national and local environmental regulations applicable to the installed site.

The European Environmental regulations are discussed later in *The WEEE Directive*.

The RoHS directive

Hypertherm is committed to complying with all applicable laws and regulations, including the European Union Restriction of Hazardous Substances (RoHS) Directive that restricts the use of hazardous materials in electronics products. Hypertherm exceeds RoHS Directive compliance obligations on a global basis.

Hypertherm continues to work toward the reduction of RoHS materials in our products, which are subject to the RoHS Directive, except where it is widely recognized that there is no feasible alternative.

Declarations of RoHS Conformity have been prepared for the current CE versions of Powermax plasma cutting systems manufactured by Hypertherm. There is also a "RoHS mark" on the Powermax CE versions below the "CE Marking" on the data plate of CE versions of Powermax series units shipped since 2006. Parts used in CSA versions of Powermax and other products manufactured by Hypertherm that are either out of scope or exempt from RoHS are continuously being converted to RoHS compliance in anticipation of future requirements.

Proper disposal of Hypertherm products

Hypertherm plasma cutting systems, like all electronic products, may contain materials or components, such as printed circuit boards, that cannot be discarded with ordinary waste. It is your responsibility to dispose of any Hypertherm product or component part in an environmentally acceptable manner according to national and local codes.

- In the United States, check all federal, state, and local laws.
- In the European Union, check the EU directives, national, and local laws. For more information, visit www.hypertherm.com/weee.
- In other countries, check national and local laws.
- Consult with legal or other compliance experts when appropriate.

The WEEE Directive

On January 27, 2003, the European Parliament and the Council of the European Union authorized Directive 2002/96/EC or WEEE (Waste Electrical and Electronic Equipment).

As required by the legislation, any Hypertherm product covered by the directive and sold in the EU after August 13, 2005 is marked with the WEEE symbol. This directive encourages and sets specific criteria for the collection, handling, and recycling of EEE waste. Consumer and business-to-business wastes are treated differently (all Hypertherm products are considered business-to-business). Disposal instructions for the CE versions of Powermax plasma systems can be found at www.hypertherm.com/weee.

The URL is printed on the symbol-only warning label for each of these CE version Powermax series units shipped since 2006. The CSA versions of Powermax and other products manufactured by Hypertherm are either out of scope or exempt from WEEE.

The REACH regulation

The REACH regulation (1907/2006), in force since June 1, 2007, has an impact on chemicals available to the European market. The REACH regulation requirements for component manufacturers states that the component shall not contain more than 0.1% by weight of the Substances of Very High Concern (SVHC).

Component manufacturers and other downstream users, such as Hypertherm, are obligated to obtain assurances from its suppliers that all chemicals used in or on Hypertherm products will have a European Chemical Agency (ECHA) registration number. To provide chemical information as required by the REACH regulation, Hypertherm requires suppliers to provide REACH declarations and identify any known use of REACH SVHC. Any use of SVHC in amounts exceeding 0.1% w/w of the parts has been eliminated. The MSDS contains a full disclosure of all substances in the chemical and can be used to verify REACH SVHC compliance.

The lubricants, sealants, coolants, adhesives, solvents, coatings and other preparations or mixtures used by Hypertherm in, on, for, or with its shape cutting equipment are used in very small quantities (except the coolant) and are commercially available with multiple sources that can and will be replaced in the event of a supplier problem associated with REACH Registration or REACH Authorization (SVHCs).

Proper handling and safe use of chemicals

Chemical Regulations in the USA, Europe, and other locations require that Material Safety Data Sheets (MSDS) be made available for all chemicals. The list of chemicals is provided by Hypertherm. The MSDS are for chemicals provided with the product and other chemicals used in or on the product. MSDS can be downloaded from the Downloads Library on the Hypertherm web site at <https://www.hypertherm.com>. On the Search screen, insert MSDS in the document title and click on Search.

In the USA, OSHA does not require Material Safety Data Sheets for articles such as electrodes, swirl rings, retaining caps, nozzles, shields, deflectors and other solid parts of the torch.

Hypertherm does not manufacture or provide the materials that are cut and has no knowledge whether the fumes released from materials that are cut will pose a physical hazard or health risk. Please consult with your supplier or other technical advisor if you need guidance concerning the properties of the material you will cut using a Hypertherm product.

Fumes emission and air quality

Note: The following information on air quality is intended for general information only and should not be used as a substitute for reviewing and implementing applicable government regulations or legal standards in the country where the cutting equipment will be installed and operated.

In the USA, the National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods (NMAM) is a collection of methods for sampling and analyzing contaminants in workplace air. Methods published by others, such as OSHA, MSHA, EPA, ASTM, ISO or commercial suppliers of sampling and analytical equipment, may have advantages over NIOSH methods.

For example, ASTM Practice D 4185 is a standard practice for the collection, dissolution, and determination of trace metals in workplace atmospheres. The sensitivity, detection limit, and optimum working concentrations for 23 metals are listed in ASTM D 4185. An industrial hygienist should be used to determine the optimum sampling protocol, considering analytical accuracy, cost, and optimum sample number. Hypertherm uses a third party industrial hygienist to perform and interpret air quality testing results taken by air sampling equipment positioned at operator stations in Hypertherm buildings where plasma cutting tables are installed and operated.

Where applicable, Hypertherm also uses a third party industrial hygienist to obtain air and water permits.

If you are not fully aware and up to date on all applicable government regulations and legal standards for the installation site, you should consult a local expert prior to purchasing, installing, and operating the equipment.

Introduction

Hypertherm's CE-marked equipment is built in compliance with standard EN60974-10. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN60974-10 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 cutting 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 the 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, signaling 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 as set forth in and in accordance with the manufacturer's written instructions. For example, 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 (nozzle for laser heads) at the same time.

The operator should be insulated from all such bonded metallic components.

Earthing of the 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 steel work, 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.

Electromagnetic Compatibility (EMC)

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 provided in IEC 60974-9, Arc Welding Equipment, Part 9: 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.

Attention

Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Any damage or injury caused by the use of other than genuine Hypertherm parts may not be covered by the Hypertherm warranty, and will constitute misuse of the Hypertherm Product.

You are solely 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 for the specific periods of time set forth herein and as follows: if Hypertherm is notified of a defect (i) with respect to the plasma power supply within a period of two (2) years from the date of its delivery to you, with the exception of Powermax brand 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, with the exception of the HPRXD short torch with integrated lead, which shall be within a period of six (6) months from the date of delivery to you, and with respect to torch lifter assemblies within a period of one (1) year from its date of delivery to you, and with respect to Automation products one (1) year from its date of delivery to you, with the exception of the EDGE Pro CNC, EDGE Pro Ti CNC, MicroEDGE Pro CNC, and ArcGlide THC, which shall be within a period of two (2) years from the date of delivery to you, and (iii) with respect to HyIntensity fiber laser components within a period of two (2) years from the date of its delivery to you, with the exception of laser heads and beam delivery cables, which shall be within a period of one (1) year from its date of delivery to you.

This warranty shall not apply to any Powermax brand power supplies that have been used with phase converters. In addition, Hypertherm does not warranty systems that have been damaged as a result of poor power quality, whether from phase converters or incoming line power. This warranty shall not apply to any product which has been incorrectly installed, modified, or otherwise damaged.

Hypertherm provides repair, replacement or adjustment of the Product as the sole and exclusive remedy, if and only if the warranty set forth herein properly is invoked and applies. 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 pre paid by the customer. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph and with Hypertherm's prior written consent.

The warranty set forth 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 have the right to 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 in any event no longer than fourteen (14) days after learning of any action or threat of action), and Hypertherm's obligation to defend 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 direct, indirect, punitive or exemplary damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranty, failure of essential purpose, or otherwise, and even if advised of the possibility of such damages.

National and local codes

National and local codes governing plumbing and electrical installation shall take precedence 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.

Liability cap

In no event shall Hypertherm's liability, if any, 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 (whether in court, arbitration, regulatory proceeding or otherwise) 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.

Warranty

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.

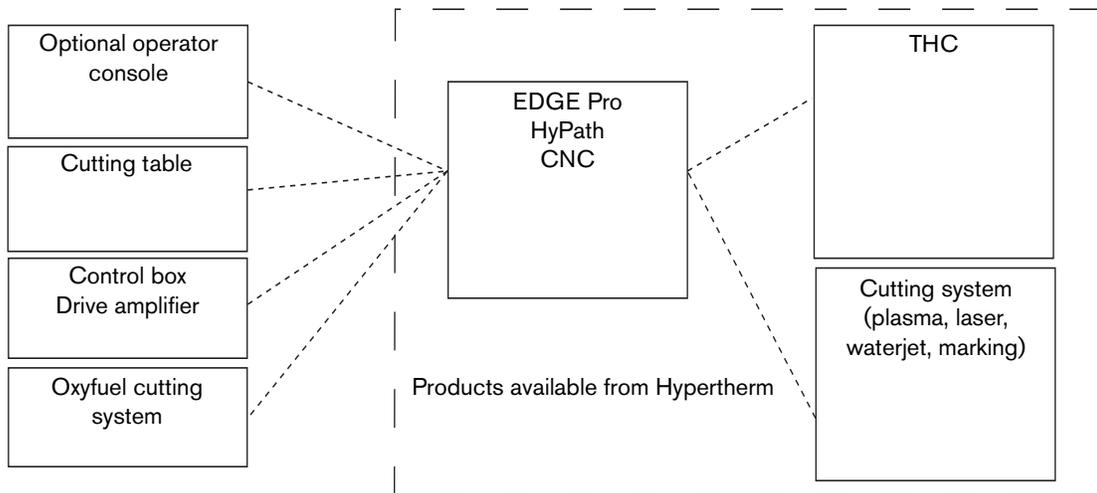
Transfer of rights

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. Within thirty (30) days before any such transfer occurs, you agree to notify in writing Hypertherm, which reserves the right of approval. Should you fail timely to notify Hypertherm and seek its approval as set forth herein, the Warranty set forth herein shall be null and void and you will have no further recourse against Hypertherm under the Warranty or otherwise.

Main features of an automated cutting system

Figure 1 illustrates the relationship between the components of an automated cutting system. The following topics describe these components and their relationships.

Figure 1 Components of an automated cutting system

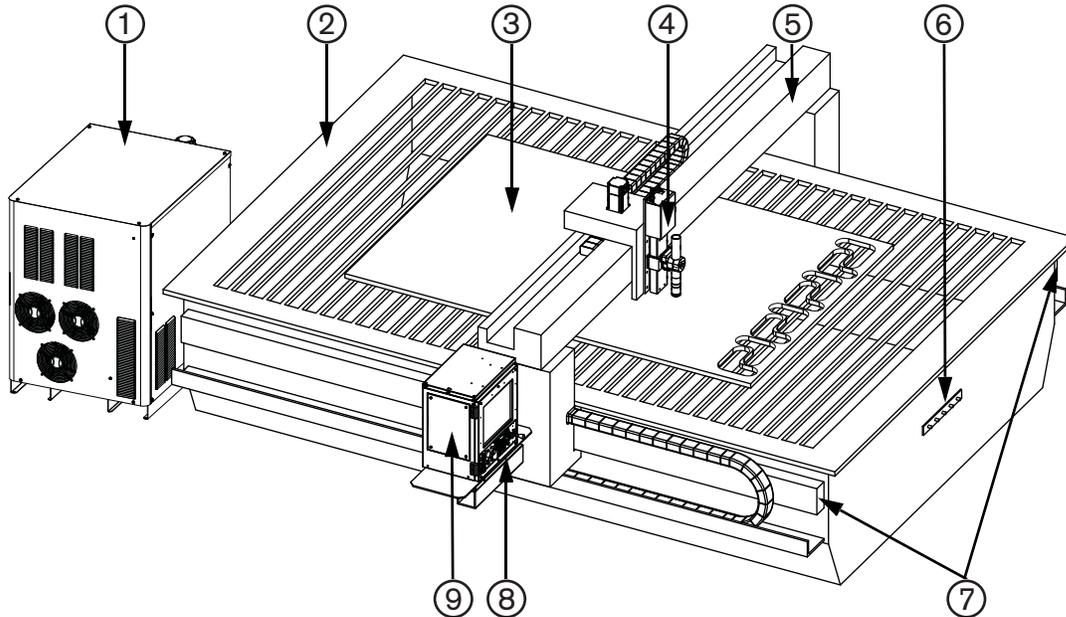


1 – Specifications

Main features of an automated cutting system

Figure 2 illustrates a typical cutting table with an EDGE Pro CNC and other components that are described in the following topics.

Figure 2 Illustration of a plasma cutting table



- 1 Plasma system
- 2 Cutting table
- 3 Workpiece
- 4 Lifter
- 5 Gantry
- 6 Star ground
- 7 Rails
- 8 Operator console
- 9 EDGE Pro HyPath CNC

CNC

The computerized numerical control (CNC) reads part programs and communicates with the other components of the shape cutting system. It controls which parts (shapes) are cut from the workpiece.

Refer to the sections in this manual for more detailed information about the hardware features of the EDGE Pro HyPath CNC. Refer to the following Phoenix™ software manuals for detailed information on the software that operates on the EDGE Pro HyPath CNC:

- Phoenix Software V9 Series Installation and Setup Manual (806410)
- Phoenix Software Operator Manual (806400)
- Phoenix Software V9 Series Programmer's Reference (806420)

Cutting table

The cutting table is the frame that supports the workpiece from which parts are cut. A typical cutting table has two rails that run the length of the table on either side and form the track for the gantry. The gantry rides along these rails and spans the width of the table. A torch height control (THC) is attached to the gantry and provides the vertical movement of the cutting torch. The horizontal motion of the gantry and torch station, and the vertical motion of the torch on the THC provide the three axes that are necessary for controlling the torch's position on the workpiece. Additional equipment can be included on the cutting table to permit bevel and other types of cutting.

Hypertherm does not manufacture cutting tables. For more information on the cutting table in your system, refer to the manual that the table manufacturer supplied.

Cutting system

The cutting tool is the heart of any cutting system and may be a plasma, oxyfuel, laser, or waterjet system. The cutting system controls key parameters, such as the plasma gas and assist gases, and controls how they are mixed. It also provides process parameters, such as standoff and speed for optimal cut quality.

Your cutting system may include a Hypertherm cutting system. Refer to the appropriate manual for additional information. Electronic (PDF) versions of Hypertherm manuals are available at <https://www.hypertherm.com> or on the CNC. If your cutting system is manufactured by another company, refer to the appropriate manual.

Control box

The control box (supplied by the table manufacturer) contains terminal blocks that route power and control signals to the subsystems of the cutting system. The control box may also contain the drive amplifiers that amplify control signals from the CNC to the motors for motion.

Drive system

The speed, smoothness, and accuracy of the cuts are determined by the combination of the CNC, encoders, servo drive amplifiers, THC, gears, rails, servo motors, and how well they are integrated (tuned) by the table manufacturer. The table manufacturer must select and install the drives and motors that will be used with the EDGE Pro HyPath CNC. For more information on the drive system for your cutting system, refer to the manual that the table manufacturer supplied.

1 – Specifications

Main features of an automated cutting system

Torch height control

The THC controls the distance between the torch and the workpiece, also known as the standoff. This standoff is usually defined by height or voltage.

If a Hypertherm THC is part of your system, consult one of the following manuals for more information about installing and using it:

- ArcGlide® THC (806450)
- Sensor™ THC (806400, 806410, and 806420)
- Sensor PHC (806150)

If your THC is manufactured by another company, refer to the manual that the table manufacturer supplied.

Operator console

The EDGE Pro HyPath operator console controls two cutting stations. Additional operator consoles, not manufactured by Hypertherm, may be installed by the table manufacturer to control oxyfuel, markers, ventilation systems, and other devices. For more information about an optional operator console, refer to the manual that the table manufacturer supplied.

Oxyfuel torch

Automated cutting systems can also be configured with oxyfuel torches with or without an oxygen height control (OHC).

If the Hypertherm Sensor™ OHC is configured in your system, refer to the Sensor OHC manual (MANU-0044) for information about installation and operation.

For more information about any other oxyfuel torch, refer to the manual that the table manufacturer supplied.

Marker

A marker can be any device or process that marks a workpiece rather than piercing or cutting it. If the Hypertherm ArcWriter® is configured in your system, refer to the ArcWriter manual (802520) for information about installation and operation. Any HPR® plasma system can also be used for marking. For more information, refer to the appropriate HPR manual.

For other devices or processes, refer to the manual that the table manufacturer supplied.

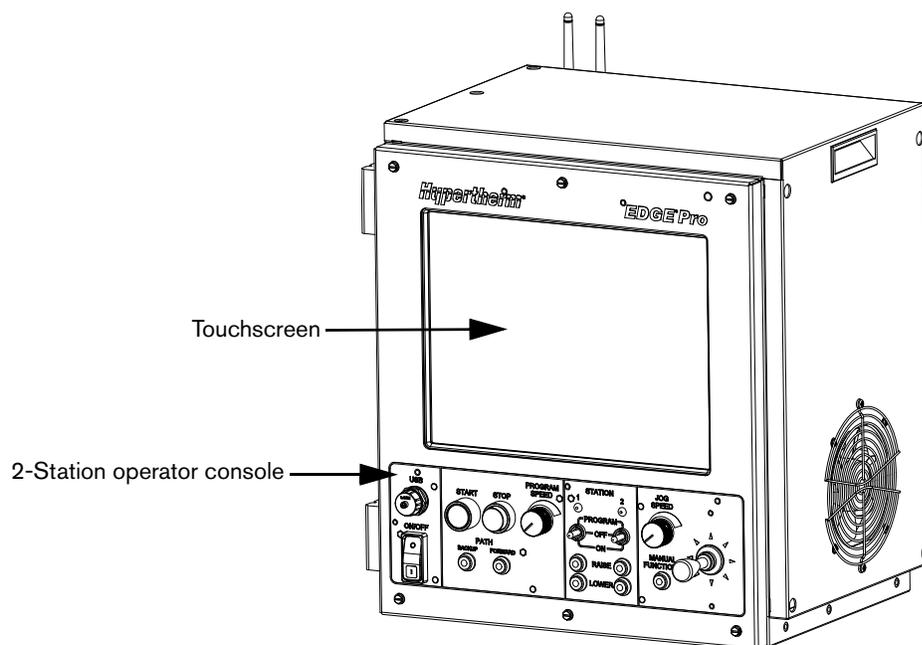
Overview

The EDGE Pro HyPath is a PC-based CNC and uses Hypertherm's Phoenix software to control one or more cutting or marking stations.

The EDGE Pro HyPath CNC has a two-station operator console, a 15-inch touchscreen, and Hypernet®, Ethernet, and wireless LAN communication.

EDGE Pro HyPath CNC features can be configured with multiple drive axes, integrated Sensor THC interface, bevel head control, and networking to download part programs or to support remote diagnostic utilities.

Figure 3 Front view of the EDGE Pro HyPath CNC



1 – Specifications

Features of the EDGE Pro HyPath CNC

Features of the EDGE Pro HyPath CNC

Touchscreen

The touchscreen is a 15-inch LCD monitor combined with software that allows direct user input from the screen. A user makes selections on the screen using check boxes, radio buttons, drop-down menus, and data input. Data input boxes automatically display a numeric or alphanumeric keypad for entries in the fields.

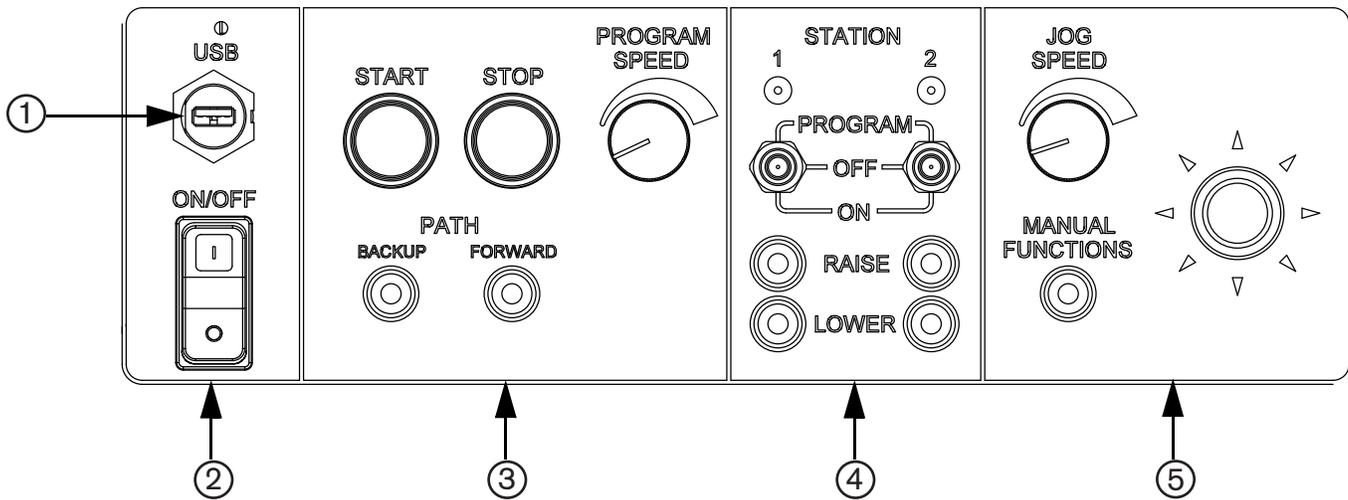
The touchscreen has a resolution of 1024 x 768, or higher.

See *Care and handling of the touchscreen* on page 69 for more information about how to care for the touchscreen.

Operator console

The operator console provides the physical controls that allow you to regulate part program execution, as well as station and manual motion.

Figure 4 EDGE Pro HyPath operator console

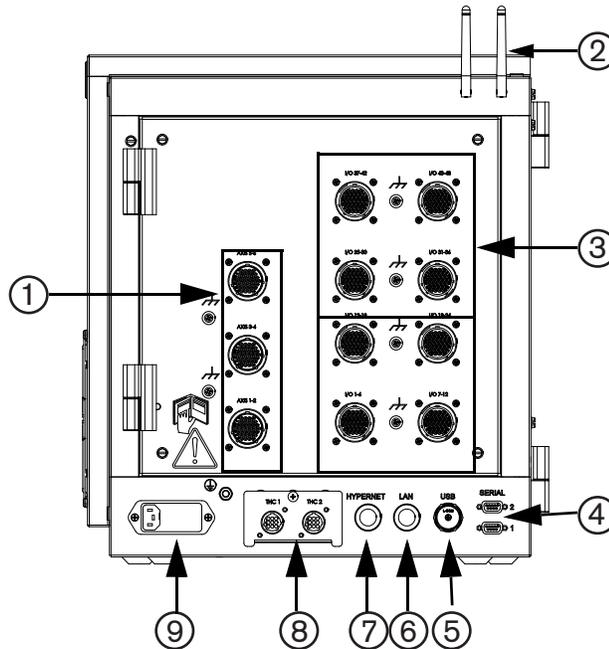


- 1 Data transfer
- 2 Power switch
- 3 Program execution controls
- 4 Station controls
- 5 Manual motion controls

Rear panel

The rear panel of the EDGE Pro HyPath CNC has cable connectors for power, motion control, I/O, and communication ports. These connectors are clearly labeled with their function. In addition, there are two antennas for wireless LAN communication.

Figure 5 Rear panel of a 6-axis, 48 I/O EDGE Pro HyPath CNC



- 1 Drive/encoder connectors
- 2 Wireless antennas
- 3 I/O connectors
- 4 Serial ports
- 5 USB port
- 6 LAN port
- 7 Hypernet port
- 8 Optional Sensor THC interfaces (2)
- 9 AC power input

1 – Specifications

System specifications

System specifications

The following table contains technical specifications for the EDGE Pro CNC.

Table 1 System specifications for the EDGE Pro CNC

| System features | |
|----------------------------|--|
| Processor | Intel® Processor |
| Operating system | Windows XPe |
| RAM | ≥ 1GB |
| LAN port | 1 RJ-45 Ethernet port |
| Hypernet port | 1 Hypernet port for use with the ArcGlide THC and Hypertherm Fiber Laser systems |
| USB ports | 2 USB 2.0 ports |
| Serial ports | 2 RS-422/RS-232 configurable ports with D-sub 9-pin connectors |
| Wireless communication | Complies with 802.11G and 802.11N standards. |
| Onboard monitoring devices | Hardware monitoring, CPU fan, CPU temperature, voltages, POST display |
| Hard drive | SATA drive |
| Operator console | 2-station standard (can be expanded by table manufacturer) |
| Display | 381 mm (15 in.) touchscreen, surface acoustic wave glass |
| Regulatory compliance | CE, CSA, GOST-TR, C-Tick, UkrSEPRO |
| Configuration | |
| Number of I/O | 24/24 or 48/48 |
| I/O Type | Positive logic input, contact closure output |
| Axes available | 2 – 6 |
| Power | |
| AC input | Voltage: 100 VAC to 240 VAC Current: 1.85 A at 100 VAC/0.65 A at 240 VAC Frequency: 50/60 Hz |
| Slow blow fuse | 250 V, 2 A, 5 mm x 20 mm (2) or 0.25 in. x 1.25 in. (1) |
| DC available | 24 V at 1.5 A for table and I/O |

| System features | |
|------------------------|---|
| Environmental | |
| Temperature | -10° C to 40° C (14° F to 104° F) |
| Humidity | 95% maximum relative humidity |
| Ingress Protection | IP21S Protect the equipment from exposure to excessive moisture. |
| Altitude | Operational up to 2000 m (6561 ft) |
| Environment | Pollution degree Level II |
| Mechanical | |
| Height | 490.9 mm (19.33 in.) |
| Width | 435 mm (17.13 in.) |
| Depth | 316 mm (12.43 in.) |
| Weight | 23.64 kg (52 lb) |

1 – Specifications

System specifications

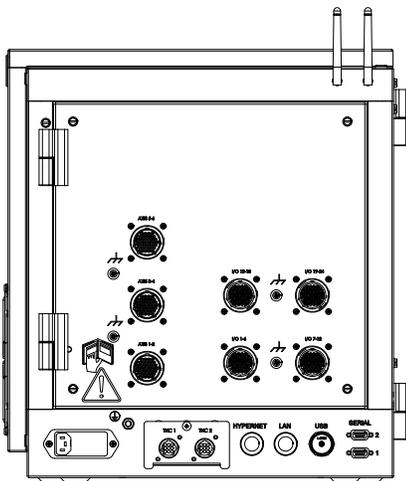
HyPath models

The EDGE Pro HyPath CNC is available in multiple configurations, which are listed in Table 2.

Table 2 EDGE Pro HyPath part numbers

| Part Number | Number of Axes | Number of I/O | Integrated Sensor THC |
|-------------|----------------|---------------|-----------------------|
| 090030 | 2 | 24/24 | Not available |
| 090031 | 3 | 24/24 | Not available |
| 090032 | 4 | 24/24 | Not available |
| 090033 | 5 | 24/24 | Not available |
| 090034 | 6 | 24/24 | Not available |
| 090035 | 4 | 24/24 | 2 |
| 090036 | 5 | 24/24 | 2 |
| 090037 | 6 | 24/24 | 2 |
| 090038 | 2 | 48/48 | Not available |
| 090039 | 3 | 48/48 | Not available |
| 090040 | 4 | 48/48 | Not available |
| 090041 | 5 | 48/48 | Not available |
| 090042 | 6 | 48/48 | Not available |
| 090043 | 4 | 48/48 | 2 |
| 090044 | 5 | 48/48 | 2 |
| 090045 | 6 | 48/48 | 2 |

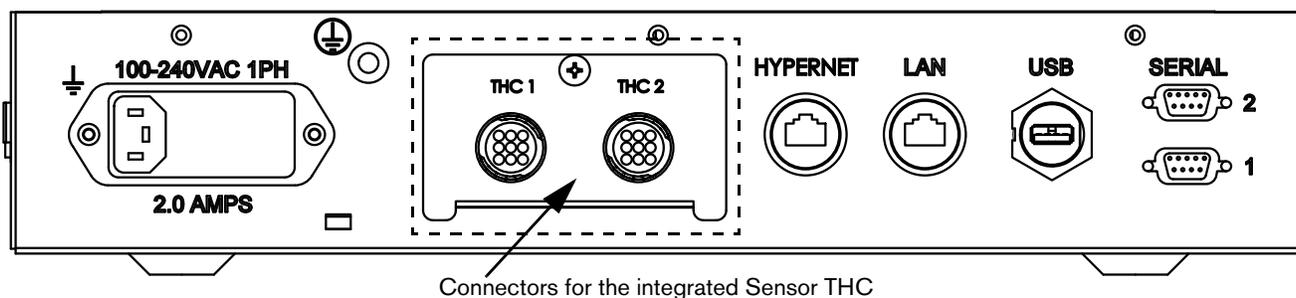
Figure 6 Rear panel of 090045



Integrated Sensor THC

If your EDGE Pro configuration includes one or two optional integrated Sensor THCs, the CNC includes an analog input for each THC. For more information, see *Installation* on page 39.

Figure 7 Interface for the integrated Sensor THC



1 – Specifications

Symbols and Marks

Symbols and Marks

Your product may have one or more of the following markings on or near the data plate. Due to differences and conflicts in national regulations, not all marks are applied to every version of a product.



S mark

The S mark indicates that the power supply and torch are suitable for operations carried out in environments with increased hazard of electrical shock according to IEC 60974-1.



CSA mark

Products with a CSA mark meet the United States and Canadian regulations for product safety. The products were evaluated, tested, and certified by CSA-International. Alternatively, the product may have a mark by one of the other Nationally Recognized Testing Laboratories (NRTL) accredited in both the United States and Canada, such as UL or TÜV.



CE mark

The CE marking signifies the manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of products with a CE marking located on or near the data plate have been tested for compliance with the European Low Voltage Directive and the European Electromagnetic Compatibility (EMC) Directive. EMC filters needed to comply with the European EMC Directive are incorporated within versions of the product with a CE marking.



Eurasian Customs Union (CU) mark

CE versions of products that include an EAC mark of conformity meet the product safety and EMC requirements for export to Russia, Belarus, and Kazakhstan.



GOST-TR mark

CE versions of products that include a GOST-TR mark of conformity meet the product safety and EMC requirements for export to the Russian Federation.



C-Tick mark

CE versions of products with a C-Tick mark comply with the EMC regulations required for sale in Australia and New Zealand.



CCC mark

The China Compulsory Certification (CCC) mark indicates that the product has been tested and found compliant with product safety regulations required for sale in China.



UkrSEPRO mark

The CE versions of products that include a UkrSEPRO mark of conformity meet the product safety and EMC requirements for export to the Ukraine.



Serbian AAA mark

CE versions of products that include a AAA Serbian mark meet the product safety and EMC requirements for export to Serbia.

Upon receipt

- Verify that all the system components on your order have been received. Contact your supplier if any items are missing.
 - EDGE Pro HyPath CNC
 - Power cable (North America) (108884)
 - Power connector (all other regions) (108842)
 - EDGE Pro HyPath CNC instruction manual (807620)
 - Phoenix software instruction manuals (806400, 806410, 806420)
 - Any other optional components that appear on your order form
- Inspect the system components for any physical damage that may have occurred during shipping. If there is evidence of damage, refer to the following topic, *Claims* on page 39. All communications regarding claims must include the model number and serial number located on the back of the CNC.
- Record your product information on the inside front cover of this manual, then use the instructions there to register your product's serial number at www.hypertherm.com.

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, contact your supplier. If you need additional assistance, call Customer Service listed in the front of this manual, or your authorized Hypertherm distributor.

Installation requirements

All installation and service of electrical systems must conform to national and local electrical codes. This work should be performed only by qualified personnel.

2 – Installation

Mounting the CNC

Placement of system components

- Place all system components in position prior to making electrical, gas and interface connections. See *Mounting the CNC* on page 40 for details.
- Ground all system components to earth. See *Recommended grounding and shielding practices* on page 43 for grounding details.

| | |
|---|--|
|  | WARNING! |
|  | Use a 2-man lift to position the EDGE Pro HyPath CNC and avoid bodily injury. |

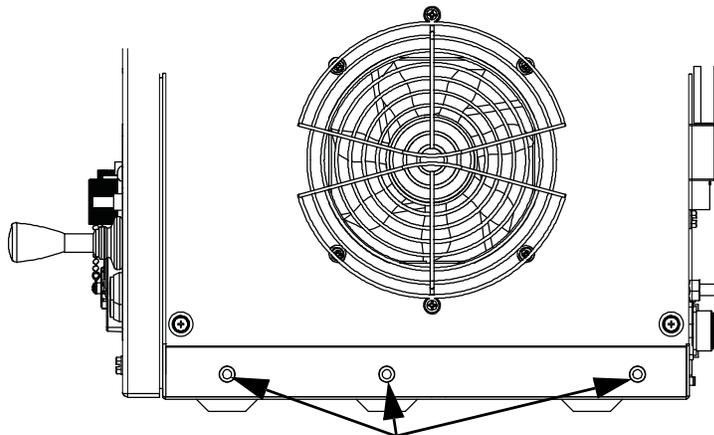
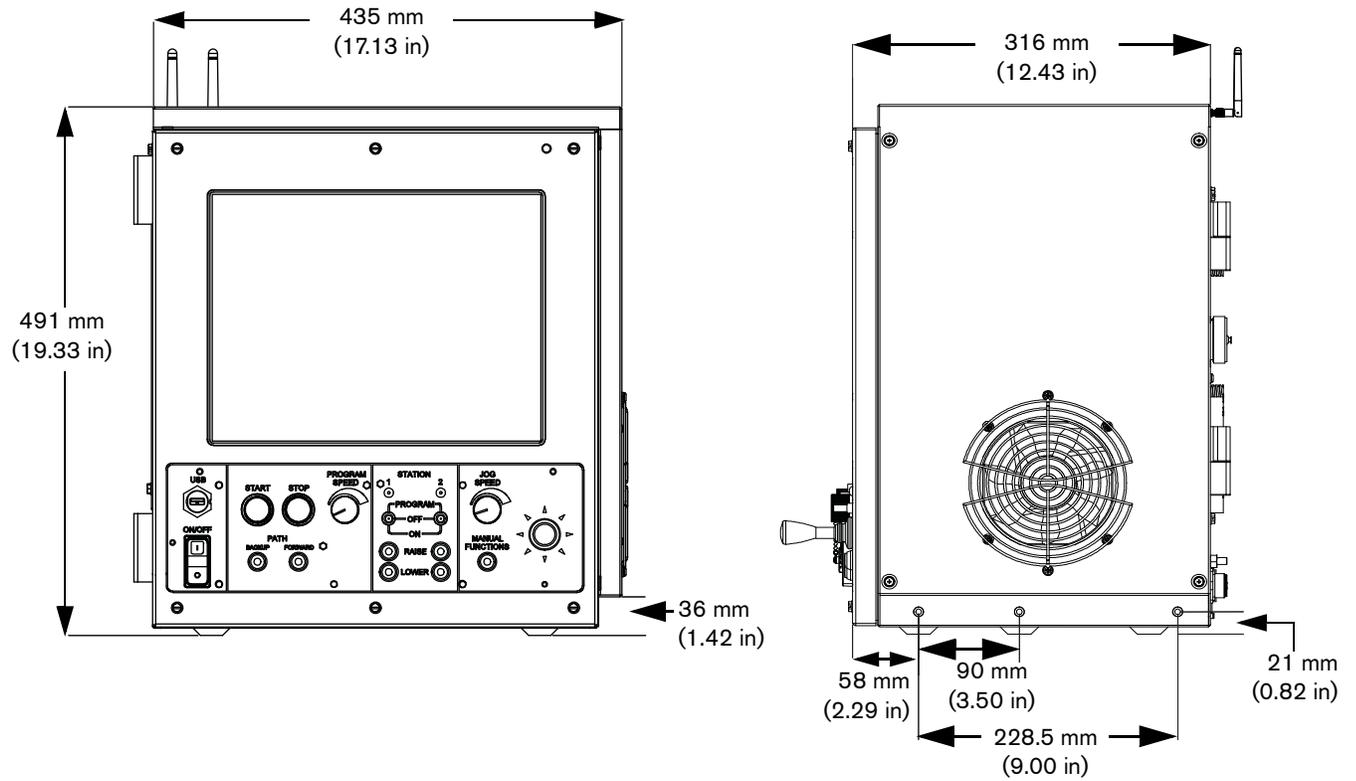
Mounting the CNC

Before you connect the EDGE Pro HyPath CNC to other system components, mount all the components using the appropriate instructions.

Do not allow the system components to lie unsecured on top of cabinets or on the floor.

Enclosure dimensions

Figure 8 Front and side views of the HyPath CNC



Use M6 x 1 hardware for side mounting.
Maximum length inside enclosure must not exceed 7.8 mm (0.31 in.)

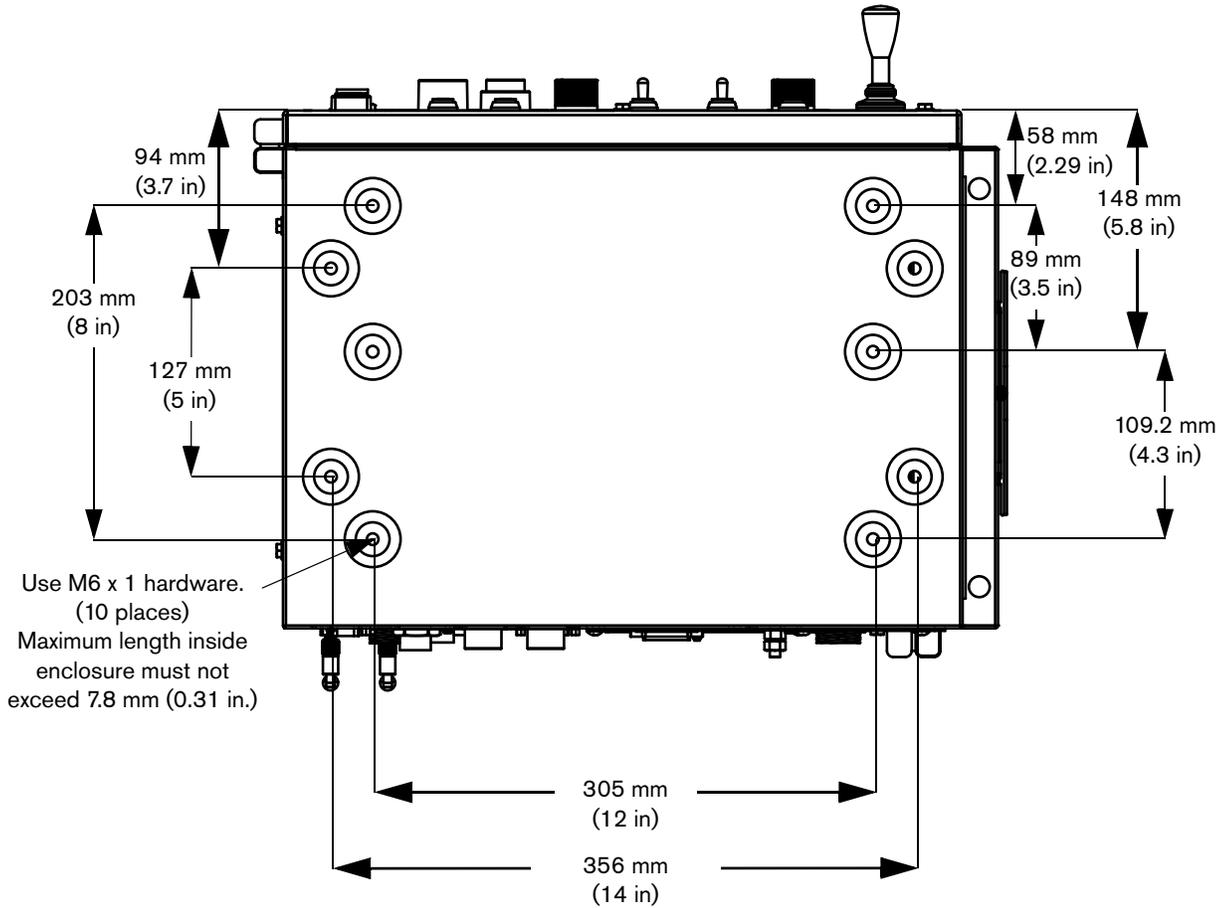
2 – Installation

Mounting the CNC

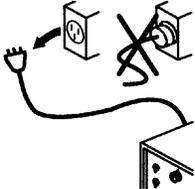
Mounting hole patterns on the bottom of the CNC

The EDGE Pro HyPath CNC has 10 mounting holes on the bottom of the enclosure for mounting the CNC to the cutting table. Fasten the mounting screws through the holes that will provide the most stability for your CNC during the operation of your table.

Figure 9 EDGE Pro HyPath CNC mounting hole pattern



Recommended grounding and shielding practices

| | | |
|---|---|---|
|  |  | <p>WARNING!</p> <p>ELECTRIC SHOCK CAN KILL</p> |
|  | | <p>Disconnect electrical power before performing any maintenance.</p> <p>All work requiring the removal of the plasma system cover must be performed by a qualified technician.</p> <p>See the <i>Safety</i> section of your manual for more safety precautions.</p> |

Introduction

This section describes practices for grounding and shielding to protect a plasma cutting system against radio frequency interference (RFI) and electromagnetic interference (EMI) (also called *noise*). It also describes the DC power ground and the service ground. The diagram at the end of this section shows these types of grounds in a plasma cutting system.

 The grounding practices in this section have been used on many installations with excellent results, and Hypertherm recommends that these practices be a routine part of the installation process. The actual methods used to implement these practices may vary from system to system, but should remain as consistent as possible. However, due to the variation in equipment and installations, these grounding practices may not succeed in every case to eliminate RFI/EMI noise issues.

Types of grounding

Service ground (also called safety ground or potential earth (PE) ground) is the grounding system that applies to the incoming line voltage. It prevents a shock hazard to any personnel from any of the equipment or the cutting table. It includes the service ground coming into the plasma system and other systems such as the CNC and the motor drives, as well as the supplemental ground rod connected to the cutting table. In the plasma circuits, the ground is carried from the plasma system chassis to the chassis of each separate console through the interconnecting cables.

DC power ground (also called cutting current ground) is the grounding system that completes the path of the cutting current from the torch back to the plasma system. It requires that the positive lead from the plasma system be firmly connected to the cutting table ground bus with a properly sized cable. It also requires that the slats, on which the workpiece rests, make firm contact with the table and the workpiece.

RFI and EMI grounding and shielding is the grounding system that limits the amount of electrical noise emitted by the plasma and motor drive systems. It also limits the amount of noise that is received by the CNC and other control and measurement circuits. The grounding practices described in this section mainly target RFI and EMI grounding and shielding.

Grounding practices

1. Unless noted, use only 13.3 mm² (6 AWG) welding cables (047040) for the EMI ground cables shown on the diagram at the end of this section.
2. The cutting table is used for the common, or star, EMI ground point and should have threaded studs welded to the table with a copper bus bar mounted on them. A separate bus bar should be mounted on the gantry as close to

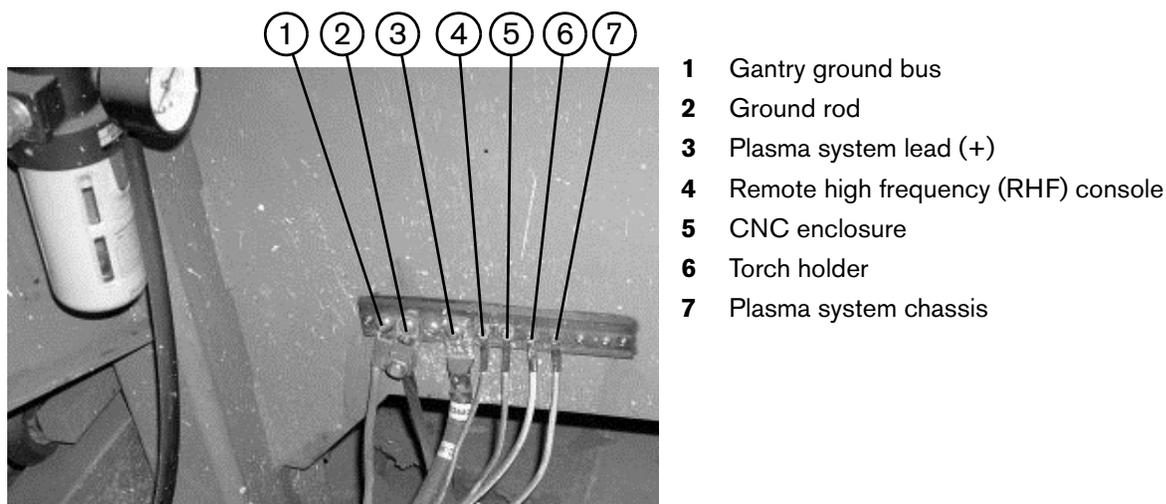
2 – Installation

Mounting the CNC

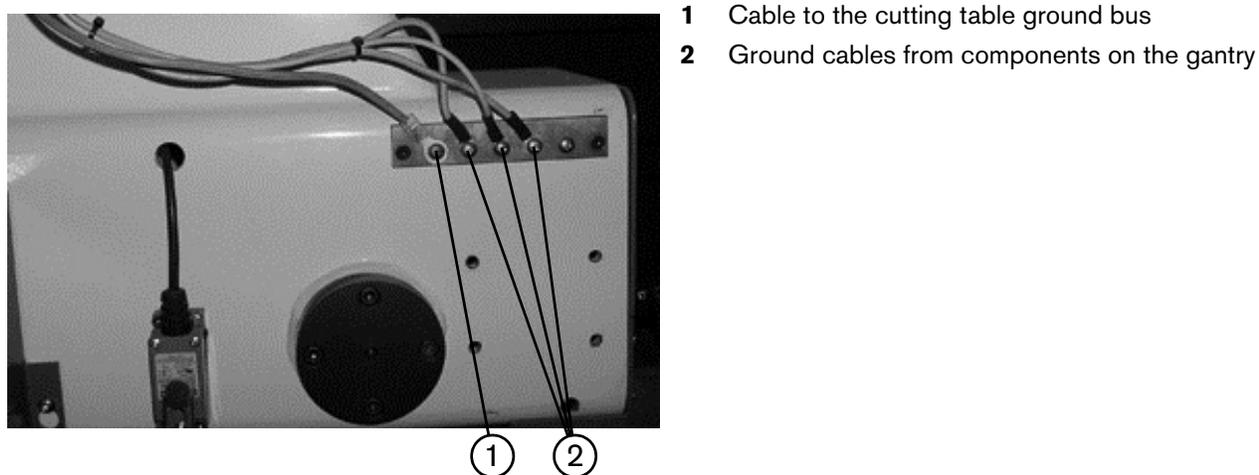
each motor as possible. If there are motors at each end of the gantry, run a separate EMI ground cable from the far motor to the gantry bus bar. The gantry bus bar should have a separate, heavy EMI ground cable 21.2 mm² (4 AWG; 047031) to the table bus bar. The EMI ground cables for the torch lifter and the RHF console must each run separately to the table ground bus.

3. A ground rod that meets all applicable local and national electrical codes must be installed within 6 m (20 ft) of the cutting table. This is a PE ground and should be connected to the cutting table ground bus bar using 13.3 mm² (6 AWG) green and yellow grounding cable (047121) or equivalent.
4. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, between plasma systems in multi-drop connections, and for interconnections between all parts of the Hypertherm system.
5. All hardware used in the ground system must be brass or copper. While you can use steel studs welded to the cutting table for mounting the ground bus, no other aluminum or steel hardware can be used in the ground system.
6. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.
7. For a system with a remote high frequency console (RHF), the positive, negative, and pilot arc leads should be bundled together for as long a distance as possible. The torch lead, work lead, and the pilot arc (nozzle) leads may be run parallel to other wires or cables only if they are separated by at least 150 mm (6 inches). If possible, run power and signal cables in separate cable tracks.
8. For a system with an RHF console, the ignition console should be mounted as closely as possible to the torch, and must have a separate ground cable that connects directly to the cutting table ground bus bar.
9. Each Hypertherm component, as well as any other CNC or motor drive cabinet or enclosure, must have a separate ground cable to the common (star) ground on the table. This includes the ignition console, whether it is bolted to the plasma system or to the cutting table.
10. The metal braided shield on the torch lead must be connected firmly to the ignition console and to the torch. It must be electrically insulated from any metal and from any contact with the floor or building. The torch lead can be run in a plastic cable tray or track, or covered with a plastic or leather sheath.
11. The torch holder and the torch breakaway mechanism – the part mounted to the lifter, not the part mounted to the torch – must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (0.5 inches) wide. A separate cable must run from the lifter to the gantry ground bus bar. The valve assembly should also have a separate ground connection to the gantry ground bus bar.
12. If the gantry runs on rails that are not welded to the table, then each rail must be connected with a ground cable from the end of the rail to the table. The rail ground cables connect directly to the table and do not need to connect to the table ground bus bar.
13. If you are installing a voltage divider board, mount it as closely as possible to where the arc voltage is sampled. One recommended location is inside the plasma system enclosure. If a Hypertherm voltage divider board is used, the output signal is isolated from all other circuits. The processed signal should be run in twisted shielded cable (Belden 1800F or equivalent). Use a cable with a braided shield, not a foil shield. Connect the shield to the chassis of the plasma system and leave it unconnected at the other end.
14. All other signals (analog, digital, serial, and encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing. The shield, not the drain, should be connected to the metal housing of the connector at each end of the cable. Never run the shield or the drain through the connector on any of the pins.

The following picture shows an example of a cutting table ground bus. The components shown here may differ from your system.



The following picture shows an example of a gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground cables from the components mounted on the gantry connect to the bus. A single heavy cable then connects the gantry ground bus to the table ground bus.

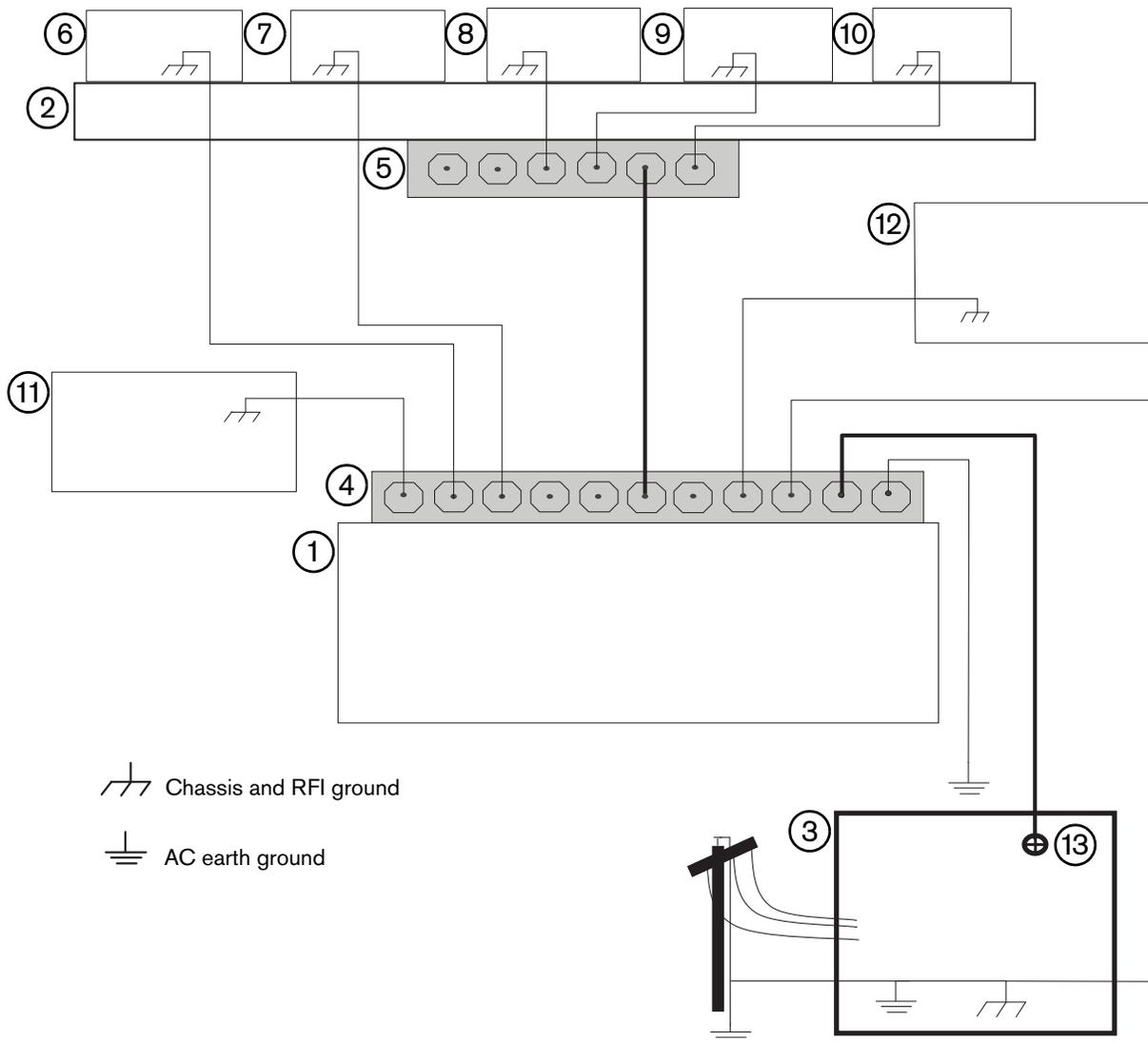


2 – Installation

Mounting the CNC

Grounding diagram

The following diagram shows an example of grounding the components in a plasma cutting system.



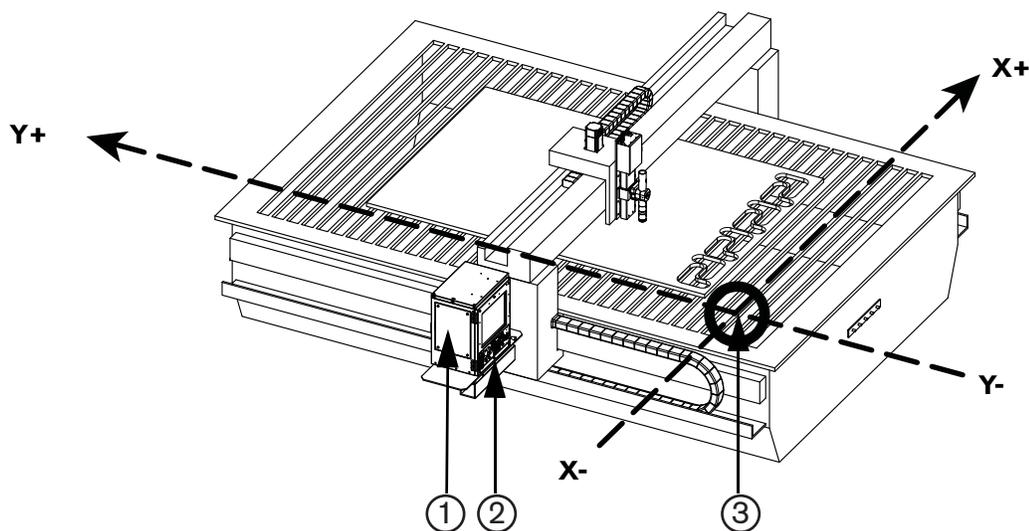
- | | |
|---|---|
| 1 Cutting table | 8, 9 System-specific component such as metering console, gas console, or selection console |
| 2 Gantry | 10 CNC chassis |
| 3 Plasma system | 11 Torch height control module (ArcGlide, Command THC) |
| 4 Table ground bus bar | 12 System-specific component such as a cooler or chiller |
| 5 Gantry ground bus bar | 13 DC power ground |
| 6 Torch height control lifter (ArcGlide, Sensor THC, Sensor PHC, or other) | |
| 7 RHF console (not on all systems). Connect to table ground bus bar. | |

X and Y axis configuration

To configure the X and Y axes, first decide which axis on the table will be the X axis and where the home position will be.

Next, define the X and Y orientation and home position in Phoenix software (Setups > Password > Machine Setups) to match the configuration you want on the table. The definition of the axes orientation and home position in software and on the table must agree so the system can execute the part programs as expected.

Figure 10 Example of a shape cutting system configured with an EDGE Pro HyPath CNC



- 1 EDGE Pro HyPath CNC
- 2 CNC operator console
- 3 Table origin and Home position (0,0)

2 – Installation

The operator console

The operator console

The EDGE Pro HyPath CNC comes with a 2-station operator console that allows you to operate two cutting torches or stations.

The operator console allows you to:

- Start and stop the cutting program
- Switch to manual mode
- Manually jog the torch with the joystick
- Jog forward or backward on path
- Adjust the jog and cutting feed rates
- Activate or deactivate the 2 cutting stations

The device I/O for the operator console are assigned to Input and Output 129 and higher, as listed in Table 3.

Operator console and dedicated I/O

The I/O for the devices on the operator console of the CNC are all pre-assigned as factory defaults. These I/O assignments begin at 129.

Table 3 Operator console and dedicated I/O assignments

| Function | Input No. | Output No. |
|------------------------------|----------------|------------|
| Front Panel Start | 129 | |
| Front Panel Stop | 130 | |
| Front Panel Manual | 131 | |
| Front Panel Forward On Path | 132 | |
| Front Panel Backward On Path | 133 | |
| Jog Up | 134 | |
| Jog Down | 135 | |
| Jog Left | 136 | |
| Jog Right | 137 | |
| Auto Select 1 | 138 | |
| Manual Select 1 | 139 | |
| Raise Torch 1 | 140 | |
| Lower Torch 1 | 141 | |
| Auto Select 2 | 142 | |
| Manual Select 2 | 143 | |
| Raise Torch 2 | 144 | |
| Lower Torch 2 | 145 | |
| Station Enable LED 1 | | 129 |
| Station Enable LED 2 | | 130 |
| Speed Pot 1 (Program Speed) | Analog Input 1 | |
| Speed Pot 2 (Jog Speed) | Analog Input 2 | |
| Scaled interior temperature | Analog Input 4 | |

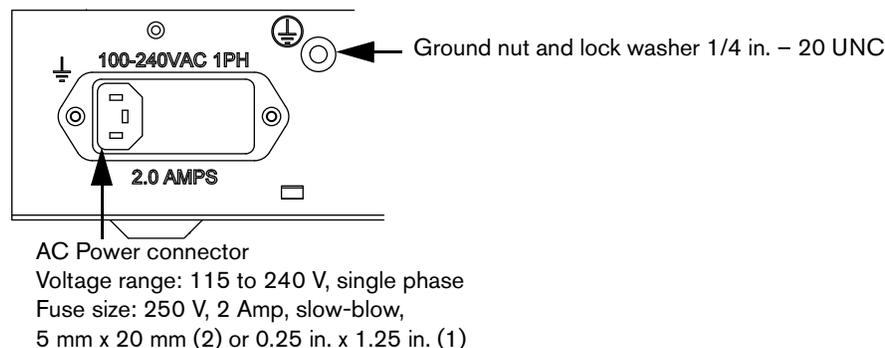
Note: If you load a setup file from a different Hypertherm CNC, these I/O assignments will not change. Phoenix software restores these assignments the next time it starts up.

AC power

Power input

Figure 11 illustrates the power input connector on the rear of the EDGE Pro HyPath CNC.

Figure 11 AC power input connector

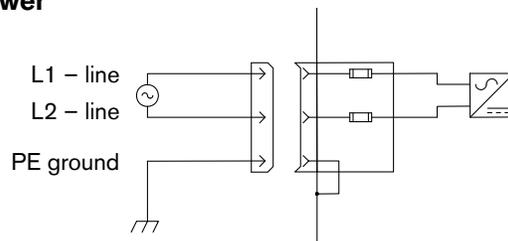


An AC power cable is standard equipment for North America, and is shipped with the CNC. For other regions, use a power cable that has an IEC-60320-C13 end which meets the requirements of local code and power connections.

To create a power cable, use the power connector (108842) that ships with the CNC and connect a 3-wire cable for line, neutral, and ground signals according to local electrical codes. For more electrical specifications, see *System specifications* on page 34. Figure 12 shows examples of how power cables can be created.

Figure 12 Input VAC wiring examples

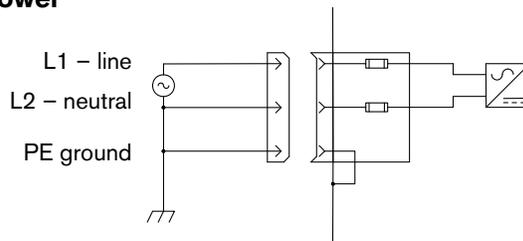
Customer-supplied power



EDGE Pro HyPath CNC (as shipped)

Power entry module:
2 Fuses: 250 V, 2A, slow blow, 5 mm x 20 mm

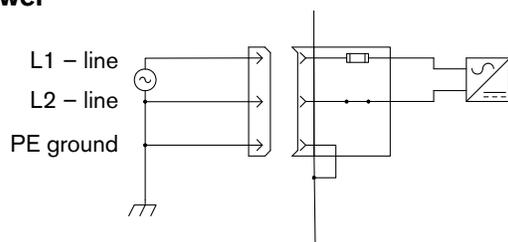
Customer-supplied power



EDGE Pro HyPath CNC (as shipped)

Power entry module:
2 Fuses: 250 V, 2 A, slow blow, 5 mm x 20 mm

Customer-supplied power



EDGE Pro HyPath CNC (field selectable option)

Power entry module:
1 Fuse: 250 V, 2 A, slow blow, 0.25 in. x 1.25 in.

2 – Installation

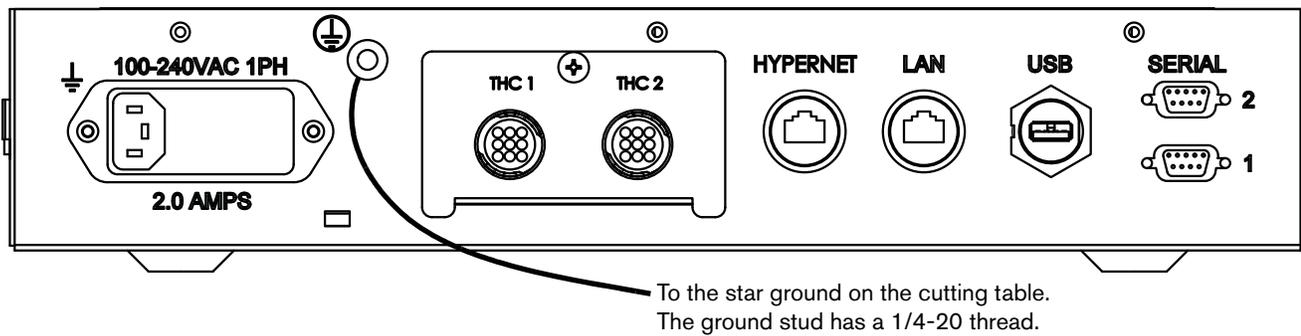
AC power

Chassis grounding

The CNC must be properly grounded according to national and local electrical codes for safe operation. Use a number 16 mm² (6 AWG) wire between the ground stud on the rear of the CNC and the star ground on the cutting table, as shown in Figure 13.

| | | |
|---|---|---|
|  |  | <p style="text-align: center;">WARNING! ELECTRIC SHOCK CAN KILL</p> |
| <p style="text-align: center;">This ground connection must be wired for safe and reliable operation.</p> | | |

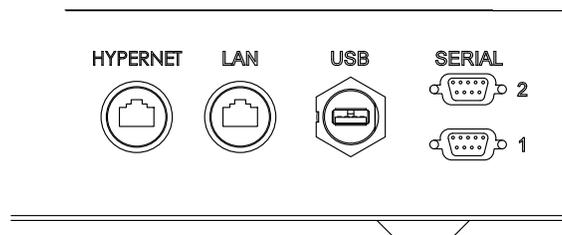
Figure 13 Ground cable on the CNC



Communication interfaces

Figure 14 illustrates the interface ports and their location on the rear of the EDGE Pro HyPath CNC.

Figure 14 Interface ports



Hypernet interface

The Hypernet interface allows the EDGE Pro HyPath CNC to connect to an ArcGlide THC and plasma system using the Hypernet protocol over shielded, Ethernet Cat-5e cables. This configuration must include an industrial-grade Ethernet switch to route communication from the EDGE Pro HyPath CNC to the other units in the system. See *Parts List* for Hypernet cable lengths and part numbers.

LAN interface

The RJ-45 LAN interface allows the EDGE Pro HyPath CNC to connect to a local area network (LAN) for downloading parts and using Remote Help. See *Parts List* for LAN cable lengths and part numbers.

For more information on setting up the CNC to communicate over a LAN, see the *Phoenix Software V9 Series Installation and Setup Manual (806410)*.

USB interface

The USB 2.0 port on the back of the EDGE Pro HyPath CNC, like the one on the operator console, can be used to load programs or to connect a USB keyboard or mouse.

Serial ports

The two serial RS-232/RS-422 ports on the back of the EDGE Pro HyPath CNC are configurable ports and accept D-sub 9-pin connectors. Transmission rate is up to 115K Baud. Both ports are preset for RS-422 as the default. For more information, see *Utility and serial isolation board (141307)* on page 105.

Wireless antennas

The wireless antennas on the back of the EDGE Pro HyPath CNC are connected to the wireless network board (141223). The wireless board conforms to 802.11N and 802.11G standards and connects to either a wireless G or N LAN. It provides wireless G or better performance for part program downloads, Remote Help, or other network tasks. For information about connecting your CNC to a wireless network, see *Networking* in the *Phoenix Software V9 Series Installation and Setup Manual (806410)*.

2 – Installation

HyPath connections

HyPath connections

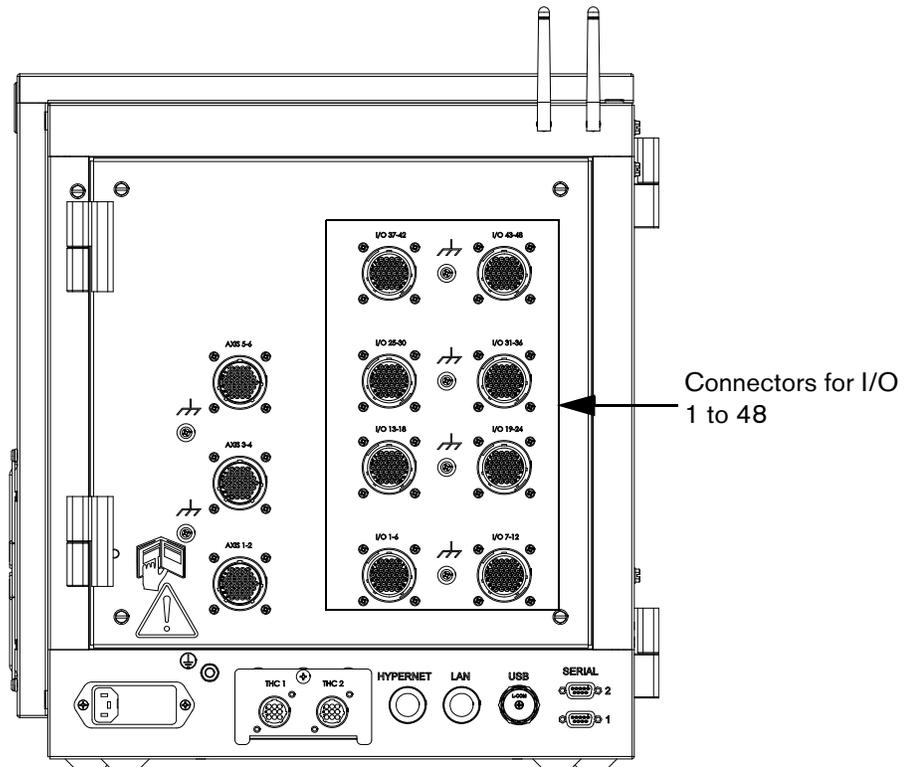
HyPath I/O

The HyPath I/O PCB provides 24 inputs and 24 outputs. Two I/O boards can be configured in the EDGE Pro for 48 inputs and 48 outputs. Each HyPath I/O PCB has four circular plastic connectors (CPCs). Each CPC transmits 6 inputs and 6 outputs.

Figure 15 illustrates an EDGE Pro HyPath configured with 48 I/O.

HyPath I/O assignments are made in Phoenix software, on the I/O Setup screen. For more information, see the *Phoenix Software V9 Series Installation and Setup Manual (806410)*.

Figure 15 Rear view of the EDGE Pro HyPath CNC with connections for 48 I/O, 6-axis servo, and 2 Sensor THCs



Inputs

All EDGE Pro HyPath CNC inputs:

- Use positive logic that requires a positive voltage to activate the inputs.
- Are opto-coupled and have a range of +4.7 V minimum to +32 V maximum. The internal series resistor equals 4.7 K ohm.
- Use +24 VDC field power supply on both the HyPath I/O and 6-axis servo boards with a total external usage of 1.5 A.

Input circuit examples

Figure 16 shows a typical connection to a limit switch, a push button switch, a home switch, a station select switch (toggle switch), a relay contact, or an emergency-stop button.

Figure 16 Normally-open switch supplied by the customer

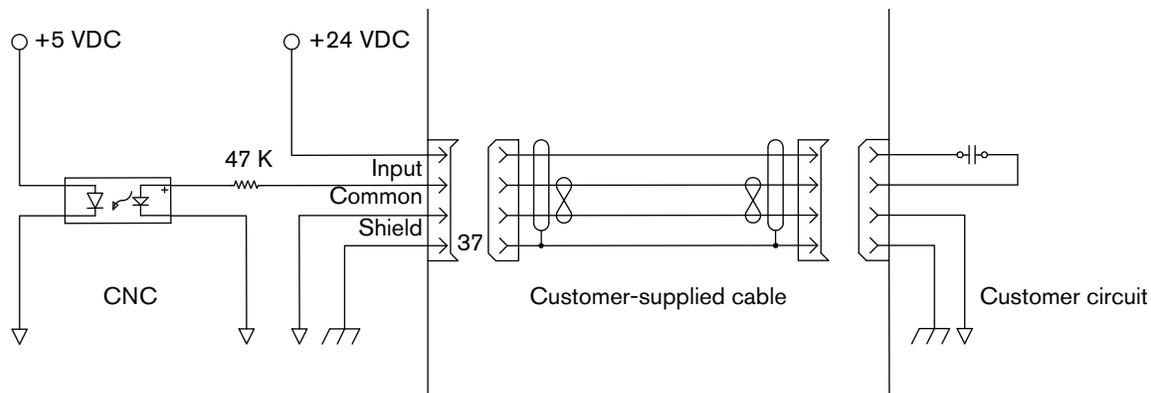


Figure 17 shows an example of a connection to an opto-isolator. This type of circuit is typically found in a THC and a plasma system.

Figure 17 Customer-supplied opto-isolator switch

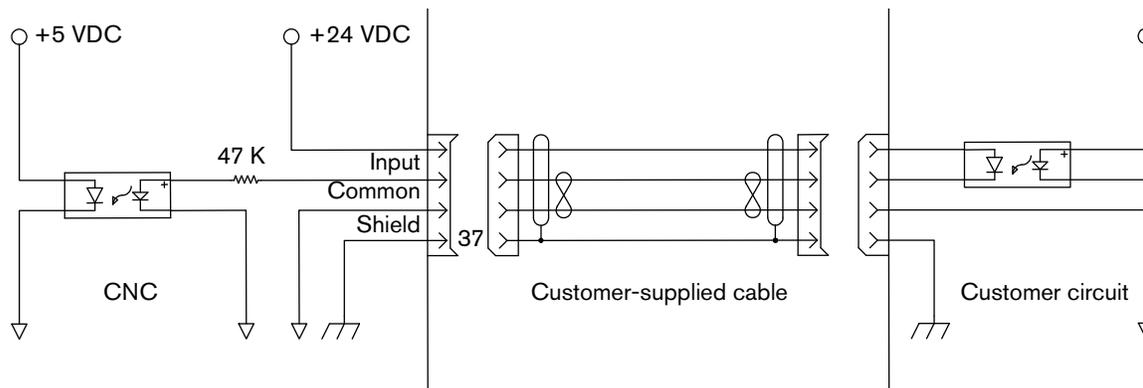
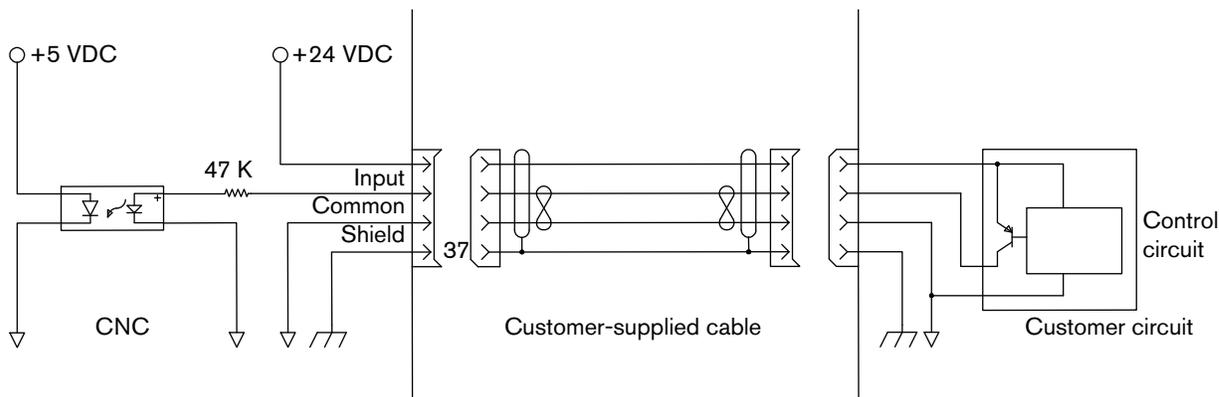


Figure 18 shows a typical connection to a PNP-style proximity sensor input.

Figure 18 Customer-supplied proximity switch – PNP sourced



2 – Installation

HyPath connections

Outputs

All EDGE Pro HyPath CNC outputs use:

- Relay contact closure (003179). The relay outputs are normally open contacts. Outputs can be set to normally closed by setting the output logic in the I/O screen in the Phoenix software.
- 5 V to 32 V switching voltage; 5 A continuous-resistive load; 2 A continuous-inductive load.

Output circuit examples

Figure 19 shows typical connections to a relay coil. Notice that the commons are connected together and a diode (supplied by customer) is used between DC coil connections.

Figure 19 AC coil – supplied by customer

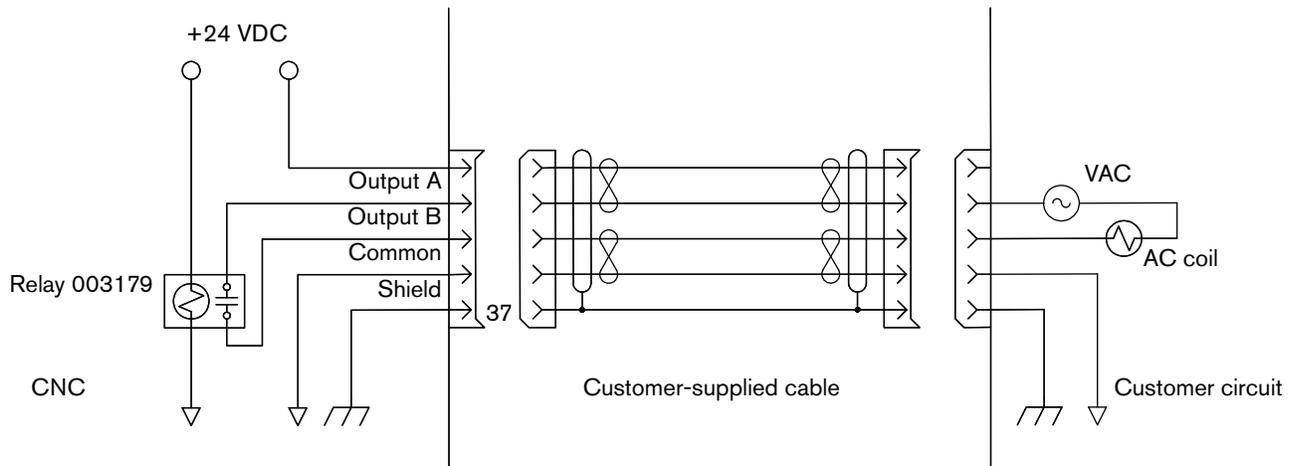


Figure 20 24 VDC coil – CNC sourced

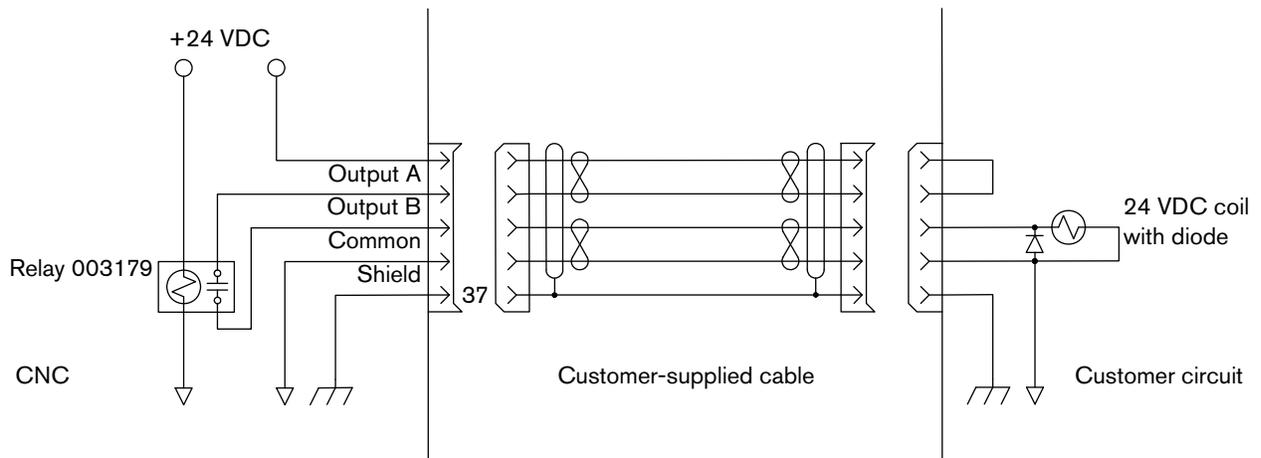


Figure 21 24 VDC coil

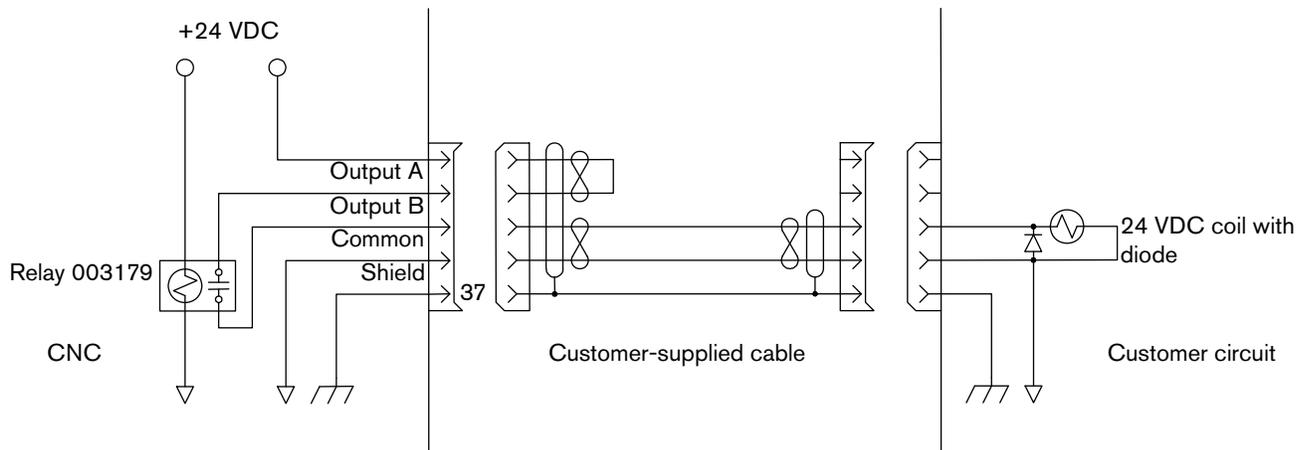


Figure 22 AC relay

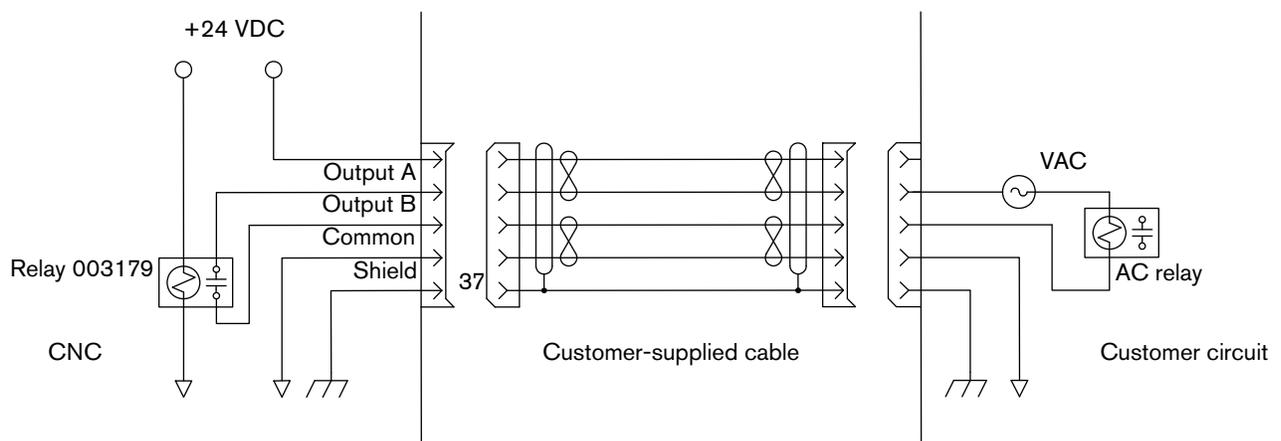
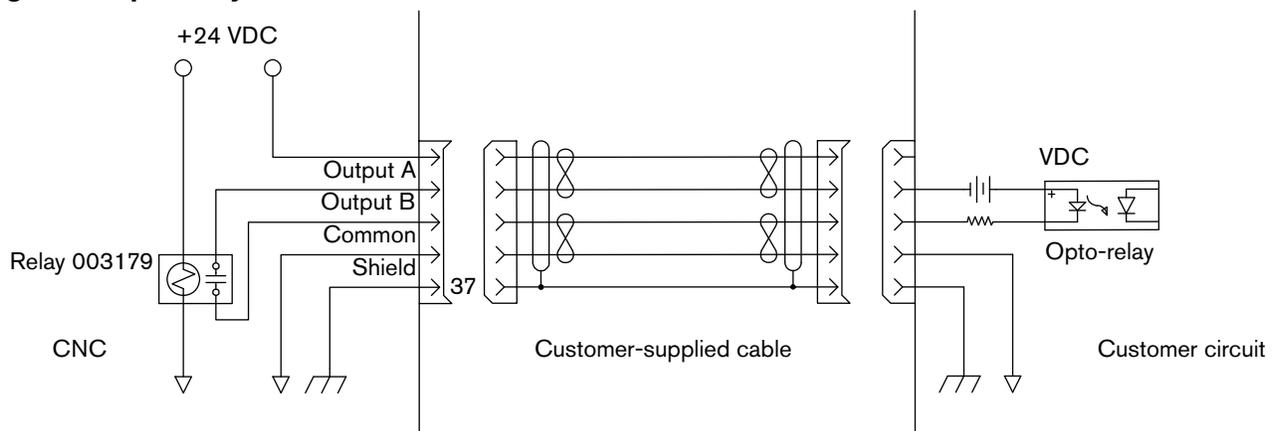


Figure 23 shows a typical connection to an opto-isolator. The input is typical for a THC or plasma system.

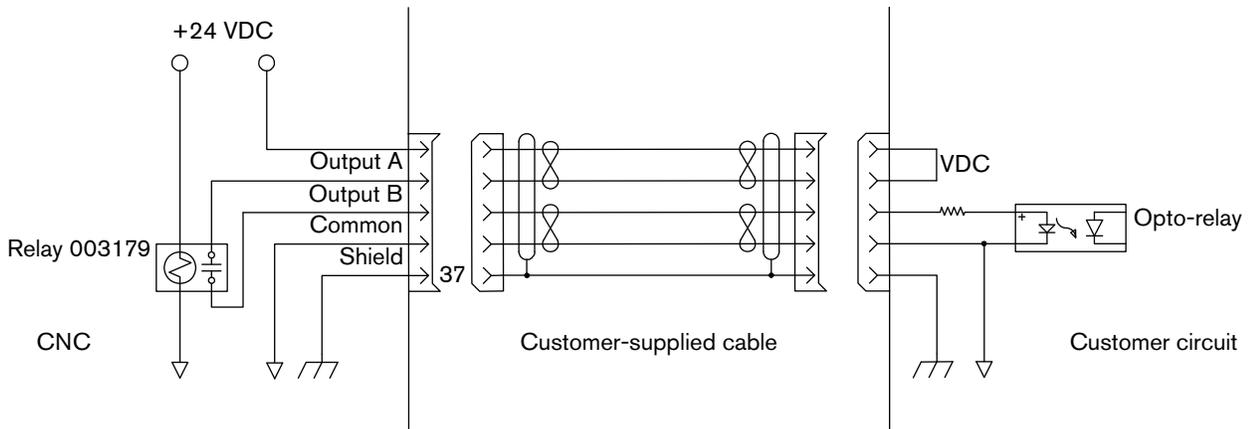
Figure 23 Opto-relay



2 – Installation

HyPath connections

Figure 24 Opto-relay – CNC sourced



I/O connection

This section describes the HyPath I/O cables, connectors, and the I/O signals that are transmitted across them.

Note:

- Isolate all external commons from the chassis ground.
- If external voltage is used to activate I/O, connect the external source's common to the internal +24 V common.
- HyPath systems have the I/O for each connector printed above the connectors.

Cables

Use the following information to order or create connectors for HyPath I/O cables.

The HyPath I/O mating connector is a 37-pin, female circular connector.

- Hypertherm kit: 228492
 - Cable connector: AMP 206305-1
 - Cable clamp: AMP 206138-8
 - Pin contacts (37): AMP 66103-3 (20 – 24 AWG)

The following pages provide additional specifications and pinout information for the HyPath interface boards.

Figure 25 HyPath I/O connectors

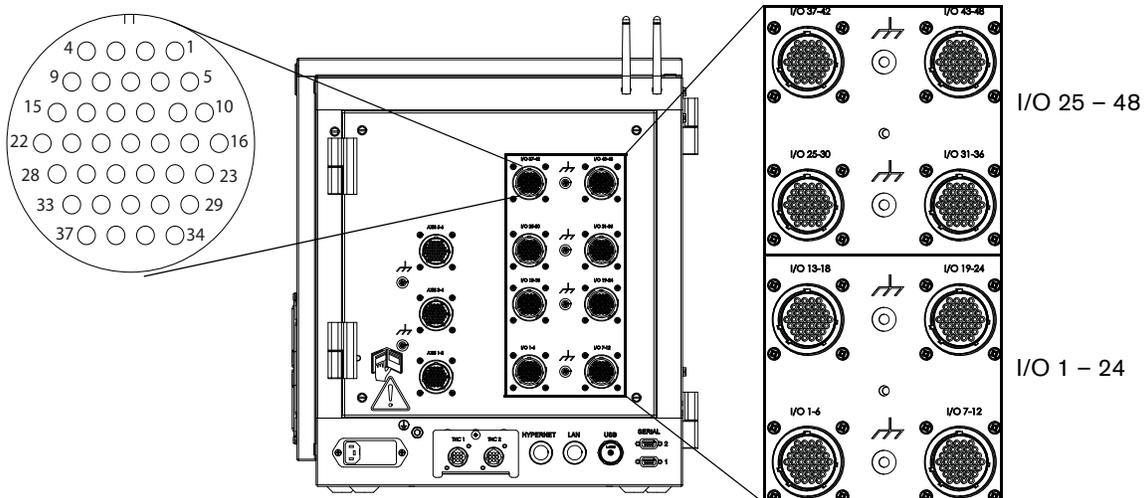


Table 4 HyPath pinouts for 24 I/O

| Pin no. | Connector J7 I/O 1 – 6 | Connector J6 I/O 7 – 12 | Connector J5 I/O 13 – 18 | Connector J4 I/O 19 – 24 |
|---------|---------------------------|----------------------------|-----------------------------|-----------------------------|
| 1 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 2 | Input 1 | Input 7 | Input 13 | Input 19 |
| 3 | Common | Common | Common | Common |
| 4 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 5 | Input 2 | Input 8 | Input 14 | Input 20 |
| 6 | Common | Common | Common | Common |
| 7 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 8 | Input 3 | Input 9 | Input 15 | Input 21 |
| 9 | Common | Common | Common | Common |
| 10 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 11 | Input 4 | Input 10 | Input 16 | Input 22 |
| 12 | Common | Common | Common | Common |
| 13 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 14 | Input 5 | Input 11 | Input 17 | Input 23 |
| 15 | Common | Common | Common | Common |
| 16 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 17 | Input 6 | Input 12 | Input 18 | Input 24 |
| 18 | Common | Common | Common | Common |
| 19 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 20 | Output 1A | Output 7A | Output 13A | Output 19A |
| 21 | Output 1B | Output 7B | Output 13B | Output 19B |
| 22 | +24 V field | +24 V field | +24 V field | +24 V field |
| 23 | Output 2A | Output 8A | Output 14A | Output 20A |
| 24 | Output 2B | Output 8B | Output 14B | Output 20B |
| 25 | +24 V field | +24 V field | +24 V field | +24 V field |
| 26 | Output 3A | Output 9A | Output 15A | Output 21A |
| 27 | Output 3B | Output 9B | Output 15B | Output 21B |
| 28 | +24 V field | +24 V field | +24 V field | +24 V field |
| 29 | Output 4A | Output 10A | Output 16A | Output 22A |
| 30 | Output 4B | Output 10B | Output 16B | Output 22B |
| 31 | +24 V field | +24 V field | +24 V field | +24 V field |
| 32 | Output 5A | Output 11A | Output 17A | Output 23A |
| 33 | Output 5B | Output 11B | Output 17B | Output 23B |
| 34 | +24 V field | +24 V field | +24 V field | +24 V field |
| 35 | Output 6A | Output 12A | Output 18A | Output 24A |
| 36 | Output 6B | Output 12B | Output 18B | Output 24B |
| 37 | Shield | Shield | Shield | Shield |

2 – Installation

HyPath connections

Table 5 HyPath pinouts for 48 I/O

| Pin no. | Connector J7 I/O 25 – 30 | Connector J6 I/O 31 – 36 | Connector J5 I/O 37 – 42 | Connector J4 I/O 43 – 48 |
|----------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 1 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 2 | Input 25 | Input 31 | Input 37 | Input 43 |
| 3 | Common | Common | Common | Common |
| 4 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 5 | Input 26 | Input 32 | Input 38 | Input 44 |
| 6 | Common | Common | Common | Common |
| 7 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 8 | Input 27 | Input 33 | Input 39 | Input 45 |
| 9 | Common | Common | Common | Common |
| 10 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 11 | Input 28 | Input 34 | Input 40 | Input 46 |
| 12 | Common | Common | Common | Common |
| 13 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 14 | Input 29 | Input 35 | Input 41 | Input 47 |
| 15 | Common | Common | Common | Common |
| 16 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 17 | Input 30 | Input 36 | Input 42 | Input 48 |
| 18 | Common | Common | Common | Common |
| 19 | +24 VDC source | +24 VDC source | +24 VDC source | +24 VDC source |
| 20 | Output 25A | Output 31A | Output 37A | Output 43A |
| 21 | Output 25B | Output 31B | Output 37B | Output 43B |
| 22 | +24 V field | +24 V field | +24 V field | +24 V field |
| 23 | Output 26A | Output 32A | Output 38A | Output 44A |
| 24 | Output 26B | Output 32B | Output 38B | Output 44B |
| 25 | +24 V field | +24 V field | +24 V field | +24 V field |
| 26 | Output 27A | Output 33A | Output 39A | Output 45A |
| 27 | Output 27B | Output 33B | Output 39B | Output 45B |
| 28 | +24 V field | +24 V field | +24 V field | +24 V field |
| 29 | Output 28A | Output 34A | Output 40A | Output 46A |
| 30 | Output 28B | Output 34B | Output 40B | Output 46B |
| 31 | +24 V field | +24 V field | +24 V field | +24 V field |
| 32 | Output 29A | Output 35A | Output 41A | Output 47A |
| 33 | Output 29B | Output 35B | Output 41B | Output 47B |
| 34 | +24 V field | +24 V field | +24 V field | +24 V field |
| 35 | Output 30A | Output 36A | Output 42A | Output 48A |
| 36 | Output 30B | Output 36B | Output 42B | Output 48B |
| 37 | Shield | Shield | Shield | Shield |

HyPath 6-axis servo connection

The HyPath 6-axis servo board provides the drive and encoder connections for up to 6 independent servo axes.

The board provides three male circular connectors. Each connector provides connections for two independent servo axes.

Axis selections are made in Phoenix software on the Machine Setup screen. For more information, see the *Phoenix Software V9 Series Installation and Setup Manual* (806410).

HyPath servo cable

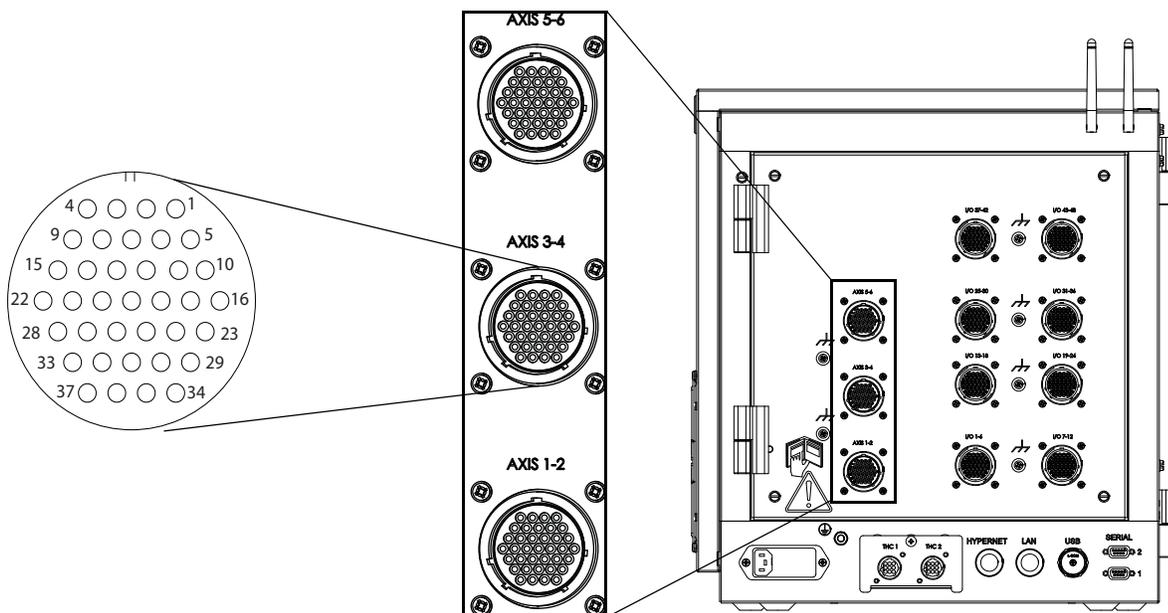
Use the following information to create connectors for HyPath servo cables.

The HyPath servo connector is a 37-pin, male circular connector:

- Hypertherm kit: 228491
 - Cable connector: AMP 206150-1
 - Cable clamp: AMP 206138-8
 - Socket contacts (37): AMP 66105-3 (20 – 24 AWG)

Figure 26 shows the location of the servo connectors on the rear panel of the EDGE Pro.

Figure 26 HyPath servo connectors



2 – Installation

HyPath 6-axis servo connection

Drive/encoder pinouts

Axis A = Axis 1, Axis 3, Axis 5

Axis B = Axis 2, Axis 4, Axis 6

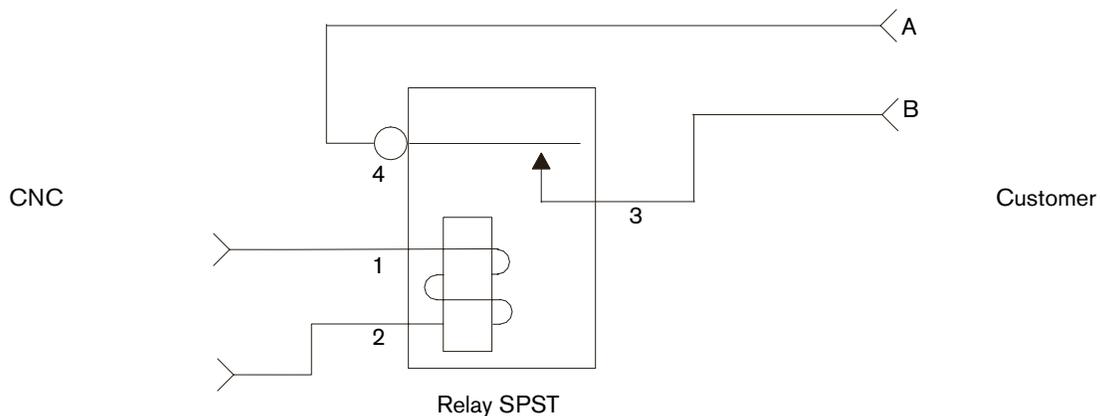
| Pin no. for A Axis | Signal | Pin no. for B Axis |
|--------------------|-------------------|--------------------|
| 1 | Axis shield | 20 |
| 2 | Encoder +5 V out | 21 |
| 3 | Encoder common | 22 |
| 4 | Encoder +12 V out | 23 |
| 5 | Encoder common | 24 |
| 6 | Encoder +24 V out | 25 |
| 7 | Encoder common | 26 |
| 8 | Encoder Axis A | 27 |
| 9 | Encoder Axis A\ | 28 |
| 10 | Encoder Axis B | 29 |
| 11 | Encoder Axis B\ | 30 |
| 12 | Encoder Axis Z | 31 |
| 13 | Encoder Axis Z\ | 32 |
| 14 | Axis enable A | 33 |
| 15 | Axis enable B | 34 |
| 16 | Axis DAC output | 35 |
| 17 | Analog common | 36 |
| 18 | Axis shield | 37 |
| 19 | Shield | |

Note:

- Z channel is the marker pulse channel which is 1 pulse/revolution.
- Not all axes may be available. Verify how many axes are available on your CNC in the Control Information screen (select Setups > Diagnostics) in Phoenix software.

Figure 27 shows the axis enable relay contacts for each axis on the 6-axis servo board.

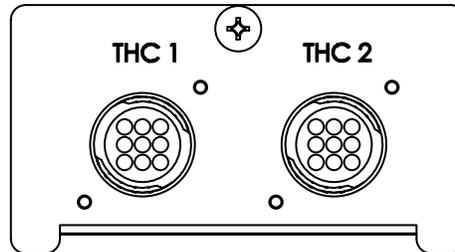
Figure 27 Axis enable relay contacts on the 6-axis servo board



Integrated THC I/O configuration

THC I/O Interface

Figure 28 THC1 and THC 2 Interface



THC I/O pinouts

| Pin no. | THC 1 | THC 2 | Signal |
|---------|----------------|----------------|---|
| 1 | Common | Common | Common |
| 2 | Input + | Input + | Nozzle contact sense + |
| 3 | Input - | Input - | Nozzle contact sense - |
| 4 | Output + | Output + | Nozzle contact enable + (relay contact) |
| 5 | Output - | Output - | Nozzle contact enable - (relay contact) |
| 6 | Analog Input + | Analog Input + | THC + |
| 7 | Analog Input - | Analog Input - | THC - |
| 8 | Output + | Output + | Hold ignition (relay contact) |
| 9 | Output - | Output - | Hold ignition (relay contact) |
| | Ground Stud | Ground Stud | Shield |

2 – Installation

Integrated THC I/O configuration

THC cables

The following list and tables provide the details for the connectors on the Sensor THC, the EDGE Pro CNC, and the voltage divider board (VDC3) (141201). Use this information to manufacture the cables and connectors to connect these devices in your system.

The THC cable connector is a 9-pin, male, circular connector:

- Hypertherm kit: 228495
 - Cable connector: AMP 206708-1
 - Cable clamp: AMP 206966-7
 - Socket contacts (9): AMP 66105-3 (20 – 24 AWG)

J1 Power connector on VDC3

| Pin no. | Signal |
|---------|-----------------|
| 1 | 120 VAC line |
| 2 | 120 VAC neutral |

Pinout for the cable between J2 on VDC3 and THC 1 or THC2 on the CNC

| J2 I/O Connector on VDC3 | | THC1 and THC2 connector on the CNC | |
|--------------------------|-----------------------------------|------------------------------------|-------------------------|
| Pin no. | Signal | Pin no. | Outputs |
| 1 | 24 VDC common (out) | 1 | 24 VDC common (in) |
| 2 | +24 VDC (out) | 2 | Nozzle contact sense + |
| 3 | Nozzle contact sense (output) | 3 | Nozzle contact sense - |
| 4 | Nozzle contact enable (input) | 4 | Nozzle contact enable + |
| 5 | 24 VDC common (out) | 5 | Nozzle contact enable - |
| 6 | + Analog out | 6 | + Analog in |
| 7 | - Analog out (analog common) | 7 | - Analog in |
| 8 | EMI chassis ground (cable shield) | | |

J3 Field connector on VDC3 (black terminal strip)

| Pin no. | Signal |
|---------|---|
| 1* | EMI chassis ground |
| 2 | Electrode (connection to negative connection inside plasma system) |
| 3 | Work (connection to the positive connection inside the plasma system) |
| 4 | No connection |
| 5 | Torch tip shield |

* This pin is not connected under normal conditions. If you have noise problems, connect this pin to an adjacent metal chassis.

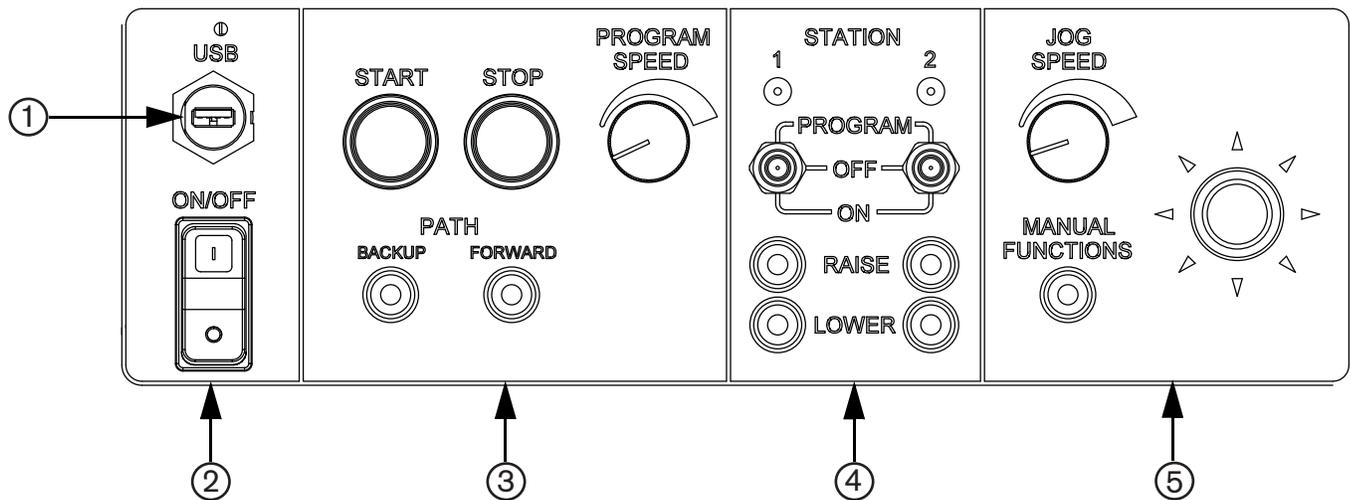
Operating the CNC

The EDGE Pro CNC supports a touchscreen with an optional USB-connected keyboard and mouse for entering information and navigating the software. For more information, see the *Phoenix Software Operator Manual (806400)*.

For more information about the components of your cutting system that are supplied by your table manufacturer, refer to the manuals supplied by the manufacturer.

An operator console powers up the CNC and controls machine motion such as station selection, raising or lowering the cutting tool, and positioning the cutting tool before starting a part program.

Figure 29 The EDGE Pro operator console is shown below.



- 1 Data transfer
- 2 Power switch
- 3 Program execution controls
- 4 Station controls
- 5 Manual motion controls

3 – Operation

Operating the CNC

Touchscreen LCD

The Phoenix software is designed for touchscreens with 1024 x 768 resolution. You can enter data into the software by touching the window controls and fields. Any field that requires data input automatically displays an on-screen keypad when you double-tap it.

Touchscreens, drops of water, and unintended motion

Drops of water can be a safety concern if the CNC is installed on an X-Y water table and the Watch Window displays jog keys. If water splashes from the table onto the touchscreen, the drops can activate a jog key and create unintended motion on the table. Unintended motion can result in danger to the operator and other people, damage to machinery, or faults in cutting. To prevent motion caused by drops of water on the touchscreen:

- Insure that your hands are dry when you use the touchscreen.
- Install the CNC so that the touchscreen is shielded from water splashes.
- If water could accidentally hit the touchscreen, do not display the jog keys in the Watch Window.

For additional information, contact your local Hypertherm Technical Service team.

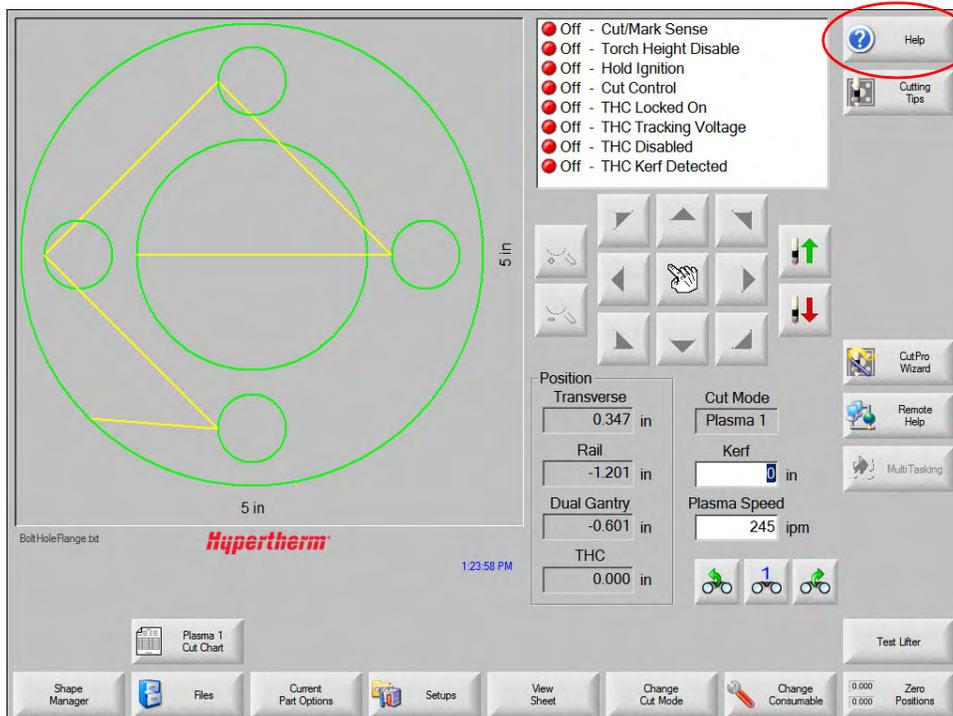
Screen navigation

The keys located at the bottom of the screen in the software are called soft keys. The soft keys correspond to function keys on a PC keyboard. OK and Cancel soft keys let you save or cancel changes that you make in a screen.



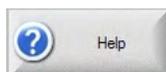
For more information, refer to the *Phoenix Software Operator Manual (806400)*.

Note: The features shown on each screen vary depending on the user level (Beginner, Intermediate, or Advanced) and the features enabled on the Special Setups and Station Configuration screens. This manual assumes the CNC is in Advanced Mode and shows all features.



Help

Choose the Help soft key to display information about each screen



Choose the OK soft key to exit the Help screen and return to the control screen.



The Show Bookmarks soft key opens the navigation pane.

View additional manuals

The Help screen may also display soft keys for other types of information, for example:

- Manuals for the Hypertherm equipment installed with your CNC, such as plasma systems or torch height controls.
- Manuals for equipment provided by your table manufacturer.

Choose any of these keys to view this additional information.

3 – Operation

Automated operations

Show bookmarks

Note: Choose the Show Bookmarks soft key on the Help screen to view the list of Help topics. Click on a topic in the list to view it.



Automated operations

The Phoenix software includes two wizards that automate workpiece alignment and part cutting operations.

Align Wizard

The Align Wizard automates several tasks including aligning a nest on a workpiece, adjusting for a skewed workpiece, and positioning the torch at the program start location.

To start the Align Wizard, choose Current Part Options on the Main screen, then choose Align. The Align Wizard may launch automatically. If not, choose the Align Wizard soft key.

For more information, see *Align Wizard* in the *Phoenix Software V9 Series Operator Manual* (806400).

CutPro Wizard

The CutPro Wizard automates common cutting tasks including loading a part or nest, selecting the cutting process, aligning the part or nest on the workpiece, and starting the program.

The CutPro Wizard may launch automatically when you start the CNC. If not, choose the CutPro Wizard soft key on the Main screen to start the wizard. For more information on the CutPro Wizard see *Cutting Parts* in the *Phoenix Software V9 Series Operator Manual* (806400).

Updating Phoenix software

Hypertherm provides regular updates to the Phoenix software. You can download the most current software from the website www.hypertherm.com. Choose Products > Automated cutting > Controls > Phoenix software updates to open the Phoenix Software Update downloads page. On this page you can download:

- Phoenix software update (update.exe)
- Phoenix Help file (Help.exe)
- Cut charts (CutChart.exe)

To download the updates in your language, follow the instructions in the *Release Notes* document on the Phoenix Software Update downloads page.

Before you update the Phoenix software, follow these guidelines:

- Back up your system files: On the Main screen, choose Files > Save to Disk > Save System Files to Disk. See Saving System Files in Diagnostics and Troubleshooting in the *Phoenix Software Operator Manual* (806400) for more information.
- Copy the files that you download from Hypertherm.com to the root folder of a USB memory stick. The CNC cannot read files inside folders.
- Be prepared to restart the CNC after you have updated the software.

Updating the software

1. At the CNC, plug the memory stick that contains the file update.exe into a USB port.
Note: Verify that update.exe resides in the root folder of the memory stick.
2. On the Main screen, choose Setups > Password. Double-tap the screen to display an on-screen keyboard.
3. Enter UPDATESOFTWARE (all upper case, one word) and choose Enter. The Phoenix software automatically reads the memory stick and installs the new software.

Updating the Help

1. At the CNC, plug the memory stick that contains the file Help.exe into a USB port.
Note: Verify that Help.exe resides in the root folder of the memory stick.
2. On the Main screen, choose Setups > Password. Double-tap the screen to display an on-screen keyboard.
3. Enter UPDATEHELP (all upper case, one word) and choose Enter. The Phoenix software automatically reads the memory stick and installs the new help file.

Updating the cut charts

Hypertherm provides cut charts in two different file types: .fac and .usr. The .fac files are the factory-default cut charts. These cut charts cannot be changed. The .usr cut charts contain any changes you have made to a cut chart and saved with the Save Process soft key.

The cut chart update file (CutChart.exe) contains both .fac and .usr cut chart files. The update automatically overwrites all .usr cut charts. Before installing the update, back up your modified cut charts.

3 – Operation

Updating Phoenix software

Hypertherm recommends saving modified cut charts as custom cut charts. When you create a custom cut chart, Phoenix creates a .usr file with a unique name. This prevents the custom cut charts from being overwritten by the .usr files in CutChart.exe. See the Phoenix Software Operator Manual (806400) for instructions.

To back up modified cut charts:

1. At the CNC, insert a memory stick into a USB port.
2. On the Main screen, choose one of the cut chart soft keys, such as Plasma 1 Cut Chart.
3. Choose the Save Cut Charts soft key. Phoenix copies all the cut charts associated with the Plasma 1 Power Supply Type onto the memory stick.

To update the cut charts:

1. At the CNC, plug the memory stick that contains the file CutChart.exe into a USB port.
Note: Verify that CutChart.exe resides in the root of the memory stick. The CNC cannot read files inside folders.
2. On the Main screen, choose Process, and choose one of the cut chart soft keys such as Plasma 1 Cut Chart.
3. Choose the Load Cut Charts soft key, then choose Yes when prompted to load cut charts from the memory stick. Phoenix extracts the cut charts and copies them to the hard drive.
4. If you have modified cut charts to copy back onto the hard drive, you will need to exit Phoenix and use Windows® Explorer to copy your .usr files back onto the hard drive. The cut chart folder is c:\Phoenix\CutCharts.

| | | |
|--|---|---|
|  |  | <p style="text-align: center;">WARNING! ELECTRIC SHOCK CAN KILL</p> |
| <p>Disconnect electrical power before performing any maintenance.</p> <p>Only qualified personnel can work inside the CNC cabinet with AC power connected.</p> <p>See <i>Safety</i> on page 11 for more safety precautions.</p> | | |

Introduction

Hypertherm assumes that the service personnel who perform troubleshooting testing are high-level electronic service technicians who have worked with high-voltage electro-mechanical systems. Knowledge of final isolation troubleshooting techniques is also assumed.

In addition to being technically qualified, maintenance personnel must perform all testing with safety in mind. For more information, see *Safety* on page 11 for operating precautions and warnings.

Care and handling of the touchscreen

The following tips will help keep the touchscreen functioning at the optimal level:

- To clean the touchscreen, use window or glass cleaner. Put the cleaner on a soft clean rag and wipe the touchscreen. Never apply the cleaner directly to the touchscreen.
- Avoid getting liquids inside your touchscreen. If liquid does get inside, have a qualified service technician check it before you power it on again.
- Do not wipe the screen with a cloth or sponge that could scratch the surface.
- Do not use alcohol (methyl, ethyl or isopropyl) or any strong solvent. Do not use thinner or benzene, abrasive cleaners or compressed air.

4 – Maintenance and Diagnostics

Diagnostic tests

Diagnostic tests

Machine interface tests

You can perform diagnostic tests with the following connectors (in kit 228511) and Phoenix software to test the interface ports on the EDGE Pro HyPath CNC:

- LAN and Hypernet (228503)
- Serial interface (228504)
- USB (228505)
- I/O (228497 – green, 228498 – red)
- Axes (228499)
- THC (228536)

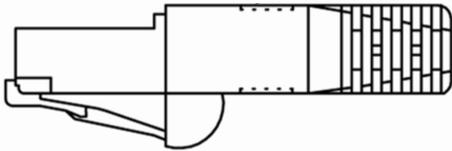
To begin an interface test:

1. From the Main screen, choose Setups > Diagnostics > Machine Interface.
2. Enter the Machine password.
3. On the Machine Interface screen, choose the connector you want to test on the image of the CNC.
4. Follow the instructions in the following topics and on the individual test screens.

LAN and Hypernet tests

The LAN and Hypernet tests both use the same tester, shown in Figure 30.

Figure 30 LAN and Hypernet tester



Conduct this test if:

- The CNC is not communicating with the ArcGlide or plasma system.
- The CNC is not communicating with the local area network.

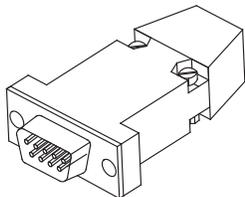
To test a LAN or Hypernet port:

1. On the Machine Interface screen, choose the LAN or Hypernet port.
2. Follow the instructions on the screen to plug in the tester.
3. Choose Test on the Hypernet or LAN test screen. A message informs you if the test is successful.
4. If either test fails, run the test on the motherboard. If the test fails again, replace the internal cable (223010, 223011, or both).
5. Repeat the test. If the test fails again, replace the motherboard (141110).

Serial test

The EDGE Pro is equipped with two serial ports. Serial 1 and 2 support RS-422 or RS-232 communications, depending on the jumper position. For more information, see *Utility and serial isolation board (141307)* on page 105.

Figure 31 Serial tester



Conduct this test if:

- Processes or information communicated through the serial port are not operating properly.
- The CNC is unable to download files through the serial port.
- The serial link to the plasma supply fails.

To test serial communications with the test hardware:

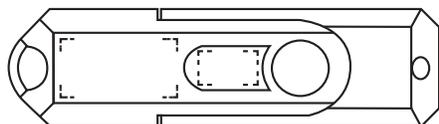
1. On the Machine Interface screen, choose the serial port you want to test.
2. On the CNC, plug the serial test hardware into the port you selected.
3. Choose Test on the serial test screen. A message informs you if the test is successful.
4. If the test fails, plug the tester into one of the serial ports on the motherboard and choose Test again.
5. If the test passes, contact your table manufacturer to replace the utility and serial isolation board (141307).
6. If the test fails, contact your table manufacturer to replace the motherboard (141110).

If you do not have the hardware tester, use the online serial diagnostic test. Choose Setups > Diagnostics > Ports and follow the instructions on the screen.

USB test

Use this test to check the USB ports on the front and back of the CNC. The diagnostic software will test the first USB memory stick that it finds, so it is important to remove all USB memory sticks before conducting this test.

Figure 32 USB tester



Conduct this test if the memory stick is not shown as an option when you try to load or save part programs or update cut charts, software, or Help.

To test the USB port on the back of the CNC:

1. Verify that no USB memory stick is installed.
2. On the Machine Interface screen, choose the USB port on the back of the CNC.
3. Follow the instructions on the screen to insert the memory stick in the USB port on the back of the CNC.
4. Press Test. A message informs you if the test is successful.

4 – Maintenance and Diagnostics

Diagnostic tests

To repeat this test for the USB port on the front of the CNC:

1. Verify that no USB memory stick is installed.
2. On the Operator Interface screen, choose the USB port on the front of the CNC.
3. Follow the instructions on the screen to insert the memory stick in the USB port on the front of the CNC.
4. Press Test. A message informs you if the test is successful.

If the test fails on a USB port, contact your table manufacturer to replace the motherboard (141 1 10).

I/O test

To test I/O contacts:

1. On the Machine Interface screen, choose the I/O port you want to test.
2. Follow the instructions on the screen to connect the HyPath (green) test plug into the I/O port you selected on the back of the CNC.
3. Press Test. A message informs you if the test is successful.
4. If the test fails, follow the instructions on the screen to connect the second HyPath (red) test plug to isolate the I/O point that is causing the problem.

After the second test, the screen reports the number of the failed input or output.

5. Contact your OEM or system integrator with the following information:
 - If an input has failed, rewire the input to a free input point, then reassign the input function in the Phoenix software.

- If an output has failed, you can remove a relay from a spare output on the I/O board (141070) and replace the relay at the failed output. No rewiring is required. Use Figure 33 and Table 6 to determine which relay to replace. To order a new relay, the part number is 003179.

Figure 33 Output relays on the HyPath I/O board (141070)

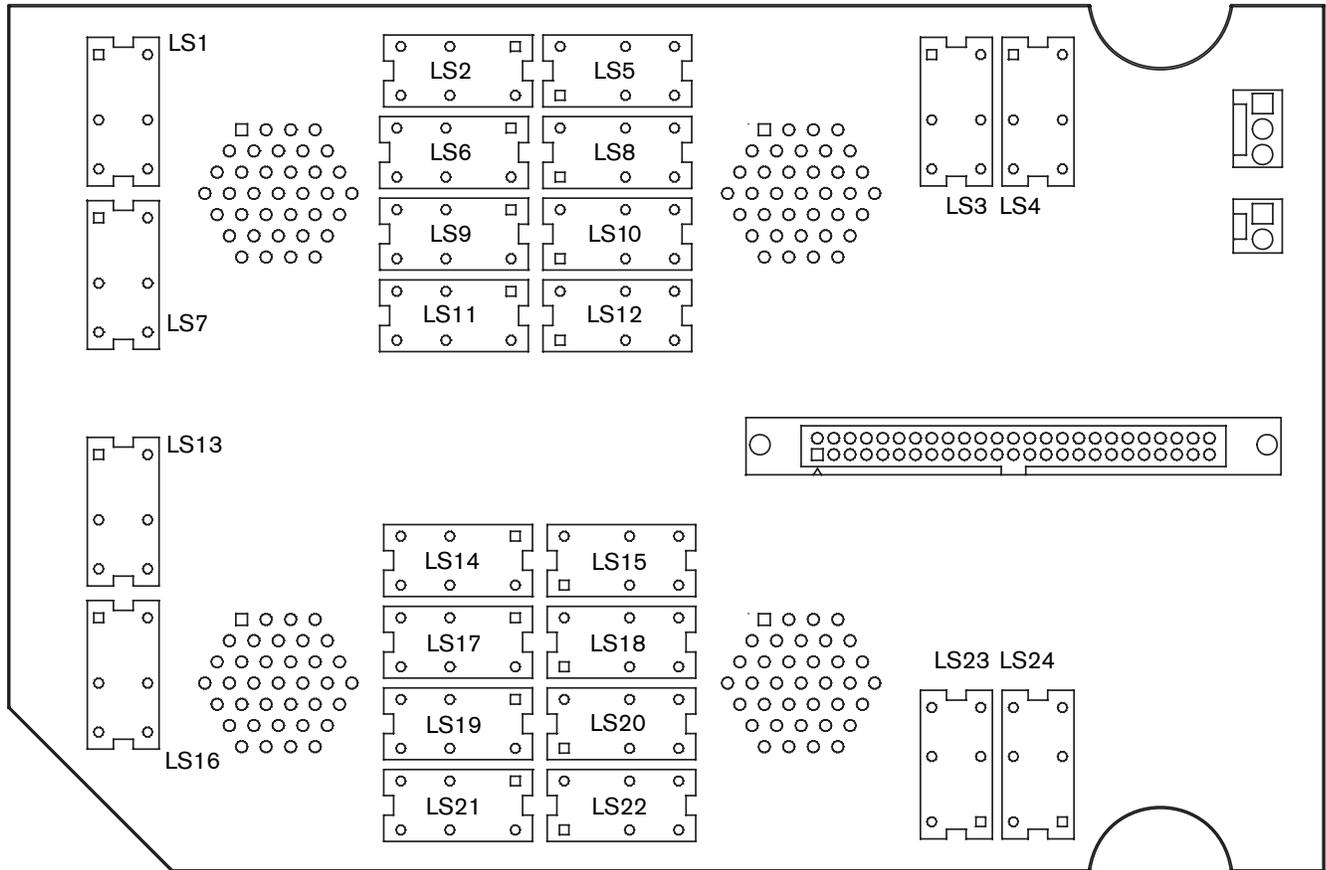


Table 6 HyPath output and relay numbers

| Output no. (1 to 24) / (25 to 48) | Relay no. | Output no. (1 to 24) / (25 to 48) | Relay no. |
|-----------------------------------|-----------|-----------------------------------|-----------|
| 1 / 25 | LS24 | 13 / 37 | LS3 |
| 2 / 26 | LS15 | 14 / 38 | LS5 |
| 3 / 27 | LS23 | 15 / 39 | LS4 |
| 4 / 28 | LS18 | 16 / 40 | LS8 |
| 5 / 29 | LS22 | 17 / 41 | LS12 |
| 6 / 30 | LS20 | 18 / 42 | LS10 |
| 7 / 31 | LS14 | 19 / 43 | LS2 |
| 8 / 32 | LS13 | 20 / 44 | LS1 |
| 9 / 33 | LS17 | 21 / 45 | LS6 |
| 10 / 34 | LS16 | 22 / 46 | LS7 |
| 11 / 35 | LS19 | 23 / 47 | LS9 |
| 12 / 36 | LS21 | 24 / 48 | LS11 |

4 – Maintenance and Diagnostics

Diagnostic tests

Axis test

| | | |
|---|---|--|
|  |  | <p style="text-align: center;">WARNING! MOVING PARTS CAN CAUSE DAMAGE AND INJURY</p> |
| <p>To avoid unexpected machine motion and personal injury while using the Drive Diagnostics screen:</p> <ol style="list-style-type: none">1. Disconnect all axis cables from the CNC.2. De-couple the motor drive mechanics responsible for table and component movement. | | |

This test verifies axis operation. Conduct this test if there is:

- A runaway axis
- No motion
- Erratic motion
- A high number of position errors
- Multiple parts are not cut the correct size

To test an axis:

1. On the Machine Interface screen, choose the axis port you want to test.
2. Follow the instructions on the screen to connect the HyPath (green, 228496) axis simulator board to the CNC axis port you selected.
3. On the Machine Interface screen, choose Test. A message informs you if the test is successful.

If the test fails, contact your table manufacturer to check or replace these parts in the following order:

1. Servo board (141292 for 2, 3, and 4 axes, 141067 for 5 or 6 axes)
2. MCC board (141061)
3. Ribbon cable (223014)

THC test

This test allows you to verify the operation of the THC 1 and 2 ports, one at a time.

Conduct this test if:

- Nozzle contact is not functioning properly, for example if IHS using ohmic contact is not sensing the workpiece or is not accurate; if the torch is running into the workpiece during cutting without retracting; or if the torch is firing in the air.
- Arc voltage feedback is not functioning properly.
- The torch is rising off the workpiece or driving into the workpiece during the first part of a cut after piercing.

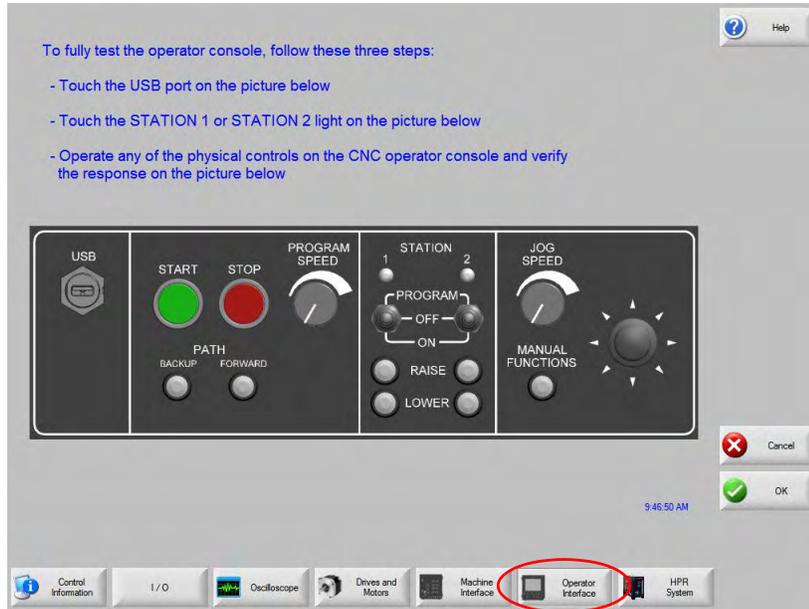
To test a THC port:

1. On the Machine Interface screen, press the THC port you want to test.
2. Follow the instructions on the screen to connect the THC test cable (228502) to the CNC at the THC port you selected.
3. On the Machine Interface screen, press Test. A message informs you if the test is successful.
4. If the test fails, contact your table manufacturer to replace the analog board.

Operator console test

Perform these tests if any function on the integrated operator console is not working as expected.

Note: None of the components on the screen allow motion or any action to take place on the CNC or cutting table.



To test the controls on the operator console:

1. On the Machine Interface screen, press the Operator Interface soft key.
2. On the Operator Interface screen, follow the instructions on the screen and in the following steps.
3. To test the USB port, touch it on the picture on the Operator Interface screen then follow the instructions on the screen.
4. To test the indicator lamps for Station 1 or 2, touch the corresponding light on the picture on the Operator Interface screen.
5. You can also operate any component on the operator console of the CNC and watch the corresponding component on the screen. Verify that the operation of the component on the screen matches what you do on the console.
6. If the test for a single component fails, replace that component.

If multiple components fail, contact your table manufacturer to replace one or all of the following parts:

- Ribbon cable to the operator console board (223013)
- Operator console board (141058)
- Utility and serial isolation board (141307)

4 – Maintenance and Diagnostics

Troubleshooting

Hypertherm assumes that the service personnel performing the troubleshooting are high-level electronic service technicians who have worked with high-voltage electro-mechanical systems. Knowledge of final isolation troubleshooting techniques is also assumed.

In addition to being technically qualified, service personnel must perform all tests with safety in mind. See *Safety* on page 11 for operating precautions and warnings.

| | | |
|--|---|---|
|  |  | <p style="text-align: center;">WARNING! ELECTRIC SHOCK CAN KILL</p> |
| <p>Disconnect electrical power before performing any maintenance.</p> <p>Only qualified personnel can work inside the CNC cabinet with AC power connected.</p> <p>See the <i>Safety</i> section in this manual for more safety precautions.</p> | | |

| | | |
|---|--|--|
|  |  | <p style="text-align: center;">WARNING! MOVING PARTS CAN CAUSE DAMAGE AND INJURY</p> |
| <p>To avoid unexpected machine motion and personal injury, disconnect the motor drive mechanics responsible for table and component movement before using the Drive Diagnostics screen.</p> <p>To avoid damage to the THC and motors, use extreme caution when you select the TEST THC soft key or the TEST ALL soft key on the Drive Diagnostics screen.</p> | | |

| | |
|---|--|
|  | <p style="text-align: center;">CAUTION!</p> |
| <p>Turn OFF power to the CNC whenever you remove or reconnect a cable.</p> | |

The procedures on the following pages provide information about solving problems that you could encounter during operation of your CNC.

Power

The CNC does not turn on when the ON/OFF button is pressed.

1. Verify that the power cord is plugged into the back of the CNC.
2. Verify that the wall circuit breaker is active.
3. Verify that the fuse in the power entry module is functional. Replace it, if necessary (008872).
4. Open the CNC enclosure and verify that the D6 AC lamp is illuminated on the power distribution board. See page 100.
5. If the lamp is not illuminated, replace the surge board or the power entry harness (kit 228464). See *Surge board (141134)* on page 99 or *Power distribution board (141153)* on page 100.
6. Verify the connections for the ON/OFF switch on the operator console.
7. Verify that the green LED on the motherboard is illuminated. This LED indicates power is reaching the motherboard. See page 97. If it is not illuminated, replace the ATX power supply (kit 228473), or contact your table manufacturer for additional troubleshooting.
8. Check the 2-digit code in the POST display on the motherboard. The 00 code indicates that Windows can boot up; all other codes indicate that Windows cannot boot up.
9. Verify that the green and white wires from the utility and serial isolation board (141307) are connected to the motherboard.
10. Contact your table manufacturer.

The “Field power failure” error message is posted on the CNC.

This situation indicates a low output voltage from the CNC field power supply. Usually, low output voltage is caused by a table I/O short or an overload of the CNC's built-in power supply and the overload is reported as a fault.

1. Disconnect I/O and axes cables from the CNC to determine if the fault clears to help determine whether the issue is the table wiring or a component inside the CNC.
2. Verify that the cable between the utility and serial isolation board (141307) and the power distribution board (141153) is connected at both ends.
3. Verify that all other cables are properly connected.
4. Verify that the ATX power supply is operating.
5. Verify that the LEDs on the power distribution board are illuminated. See page 100.
6. If the LEDs on the power distribution board are not illuminated, replace the board.

The power switch is on and illuminated, but the touchscreen remains black.

1. Verify that the AC power connections are plugged into the touchscreen.
2. Verify that the VGA cable is connected to both the touchscreen and the motherboard.
3. Look at the motherboard to see if there is a BIOS fault (any code except 00).
4. Verify that the ambient temperature is within the operating range of the CNC. See *System specifications* on page 34.

Operator console

A button, function, or LED on the operator console is not responding when the corresponding switch is activated by the operator.

1. Choose Setups > Diagnostics > Operator Interface.
2. Move or press any of the components on the physical operator console to verify the proper operation on the CNC screen.

4 – Maintenance and Diagnostics

Troubleshooting

3. If any of these tests fail:
 - Verify that I/O for the operator console is set up correctly in Phoenix software. See *Phoenix Software V9 Series Installation and Setup Manual* (806410) for details.
 - Replace the individual component on the operator console (see *Parts List* for the appropriate part number).

Input failure

- An input is in an unexpected state or fails to change state.
- The table is not performing as set up when reaching limit switches.
- A continuous fault is occurring and will not clear.

For HyPath interfaces with the hardware testers (228497 and 228498), see *Diagnostic tests* on page 70.

For HyPath interfaces without the testers:

1. Choose Setups > Diagnostics > I/O > and enter the Machine password.
2. Exercise the input device on the table and verify that the state of the input changes on the CNC screen.
3. Use a multimeter to verify that the input logic changes.
4. If the state of the input does not change, rewire the input to a spare input on the CNC.
5. If the screen shows that the input state still does not change, replace the following components and repeat the test after each replacement:
 - a. HyPath 24 I/O board (141070)
 - b. Ribbon cable (223015)
 - c. MCC board (141061)

Output failure

- An output is in an unexpected state or fails to change state.
- A continuous fault is occurring and will not clear.

For HyPath interfaces with the hardware testers (228497 and 228498), see *Diagnostic tests* on page 70.

For HyPath interfaces without the testers:

1. Power off the table and disconnect interface cables from the back of the CNC.
2. Choose Setups > Diagnostics > I/O and enter the Machine password.
3. Exercise the output through the CNC to see if the output reacts as expected. If an output point fails, replace components in the following order and repeat the test after each replacement:
 - a. The output relay (replace with an unused relay, a replacement relay (003179), or replace the 24 I/O board.)
 - b. The MCC board (141061)
 - c. The ribbon cable (223016 for outputs 1 – 24 and 223015 for outputs 25 – 48)
4. If the output point still fails, a table component has failed. Contact your table manufacturer.

Hypernet connection

Communications with components connected to the Hypernet are not working properly. See *Diagnostic tests* on page 70.

LAN connection

- Downloading part programs over the LAN is not working properly.
- Previously mapped network drives are not shown when trying to load a part program.

If you have the test hardware, see *Diagnostic tests* on page 70.

If you do not have the test hardware, contact your local network administrator to test the device and local network connections.

Motion issues

- Motion is erratic.
- An axis “runs away”.
- No motion is observed.
- There is a high number of position errors.
- Parts may not be to tolerance.

For HyPath interfaces with the servo hardware tester (228496)

If you have the servo hardware tester, you can test the servo interface in two procedures:

1. Check the CNC internal hardware.
2. Check the table setup.

To check the CNC internal hardware:

1. Shut down the CNC and disconnect AC power.
2. Disconnect all axis cables from the rear panel of the CNC.
3. Reconnect AC power and restart the CNC.
4. In Phoenix, choose Setups > Diagnostics > Machine Interface > and enter the Machine password.
5. Test each of the axis connectors on the back of the CNC by pressing one of the axis connectors on the touchscreen and following the on-screen instructions.
 - If the test passes, the CNC hardware is functional. The problem is either with the CNC setup parameters or table components. Verify your setup parameters and proceed with the next procedure to check the table setup.
 - If the test fails, the problem is with one of the CNC components. Verify that clean and field power LEDs are illuminated on the power distribution board (141153, see page 100).
6. Contact your table manufacturer for additional troubleshooting. You may need to replace one or more of the following components. Repeat the test after each replacement:
 - a. Servo board (141292 for 2, 3, or 4 axes, 141067 for 5 or 6 axes)
 - b. MCC board (141061)
 - c. Ribbon cable (223014)

To check the table setup:

1. Shut down the CNC and disconnect AC power.
2. Reconnect all axis cables to the rear panel of the CNC.
3. To avoid potential damage to the table and components, de-couple all motor shafts to prevent table motion before performing the next steps.
4. Reconnect AC power and restart the CNC.
5. Choose Setups > Diagnostics > Drives and Motors and enter the Machine password.
6. Enter the following values:
 - Pulse Type = Single
 - Pulse Direction = Alternating

4 – Maintenance and Diagnostics

Troubleshooting

- Pulse Magnitude = 1 V
 - Pulse Duration = 0.5 seconds
7. Press the Test Transverse and Test Rail soft keys, one at a time, and verify that the motors move in both directions for each test.
 - If there is no movement in any of the axes, in any direction, check the axis setup parameters in Phoenix software.
 - If there is no movement in one of the directions, troubleshoot the appropriate motor, drive amplifier, and electrical connections.
 - If you see appropriate motion in all directions, proceed to Step 8.
 8. Repeat Step 7. This time, observe the transverse and rail position coordinates in the Watch Window.
 - If these coordinates are changing in a repeatable manner, all components are working as expected and the table should be re-tuned.
 - If the coordinates are not changing when the table is moving, the encoders may be faulty and should be replaced.

For HyPath interfaces without the servo tester:

1. To avoid potential damage to the table and components, de-couple all motor shafts to prevent table motion before performing the next steps.
2. In Phoenix, choose Setups > Diagnostics > Drives and Motors > and enter the Machine password.
3. Enter the following values:
 - Single for Pulse Type
 - Alternating for Pulse Direction
 - Pulse Magnitude = 1 V
 - Pulse Duration = 0.5 seconds
4. Press the Test Transverse and Test Rail soft keys, one at a time, and verify that the motors move in both directions for each test.
 - If there is no movement in any of the axes, in any direction, check the axis setup parameters in Phoenix software.
 - If you see appropriate motion in all directions, the table components are not the problem. Proceed to Step 6.
 - If there is no movement in one of the directions, take note of which motor or axis it is and proceed to Step 5.
5. In the back of the CNC, switch the Axis 1-2 and Axis 3-4 cables, and repeat the test starting with Step 2.
 - For 2-axis systems, you must switch the motors physically. If the problem stays with the motor, check the electrical wiring before you replace the affected motor or drive amplifier.
 - If the problem changes motors, verify that clean and field power LEDs are illuminated on the power distribution board (141153, see page 100).
6. Contact your table manufacturer for additional troubleshooting. You may need to replace one or more of the following components. Repeat the test after each replacement:
 - a. Servo board (141292 for 2, 3, or 4 axes, 141067 for 5 or 6 axes)
 - b. MCC board (141061)
 - c. Ribbon cable (223014)

THC 1 and THC 2

- Nozzle contact is not functioning properly.
- IHS using ohmic contact is not sensing the workpiece properly.
- The torch is firing in the air.
- The torch is running into the workpiece without retracting.
- Arc voltage feedback is not functioning as expected.

For HyPath interfaces with the THC tester (228536):

1. In Phoenix, choose Setups > Diagnostics > Machine Interface and enter the Machine password.
2. Test each of the THC connectors on the back of the CNC by pressing one of the THC connectors on the touchscreen and following the on-screen instructions. If the test passes, contact Technical Service for additional troubleshooting.
3. If the test fails, replace the Analog board (141125) and repeat the test.
4. If the test fails again, contact your table manufacturer.

Serial communication issues

- Processes and information communicated through the serial ports are not operating properly.
- P-S link fail messages are occurring.
- You cannot download files over a configured serial port.
- HPR-link fail messages are occurring when the CNC uses serial communications with the HPR.

Note: This test only works with RS-422 configured ports. Refer to *Utility and serial isolation board (141307)* on page 105 for information about how to determine whether the port is set up for RS-422.

With the serial port hardware tester (228504):

1. In Phoenix, choose Setups > Diagnostics > Machine Interface and enter the Machine password.
2. Test each of the serial port connectors on the back of the CNC by pressing one of the serial port connectors on the touchscreen and following the on-screen instructions.
3. If the test passes, verify that the ports are set up for RS-422 or RS-232, as needed by the external components connected to the serial port.
4. If the test fails, replace the following items one at a time and repeat the tests after each replacement:
 - a. Utility and serial isolation board (141307)
 - b. Ribbon cable (229245, 229249, or 229250)
 - c. Motherboard (141110)

Without the serial port tester

1. Verify that the serial jumpers on the utility and serial isolation board (141307) are set properly, for RS-422 or RS-232, for the device you are communicating with.
2. In Phoenix, choose Setups > Diagnostics > Ports and perform the on-screen loop-back test.
3. If the loop-back test fails, verify the connections between the following components:
 - Serial isolation board or utility and serial isolation board (141307)
 - Ribbon cable (for serial board only, 229245, 229249, or 229250)
 - Motherboard (141110)

4 – Maintenance and Diagnostics

Troubleshooting

USB port

If the CNC is not recognizing a device in a USB port:

1. Verify that another computer can read the memory stick.
2. Verify that no other memory sticks are installed. The CNC can only read one memory stick at a time.
3. Verify that all files are on the root of the memory stick. The CNC cannot read files inside folders.
4. In Phoenix, choose one of the following paths:
 - Setups > Diagnostics > Machine Interface and enter the Machine password
 - Setups > Diagnostics > Operator Interface
5. Press the USB port on the operator console or rear panel on the touchscreen and follow the on-screen instructions.
6. If the test in Step 5 fails, repeat the test using the other USB port (operator console or rear panel).
7. If the test in Step 6 fails, install the memory stick directly into the motherboard and repeat the test.
8. If the test in Step 7 fails, contact Technical Service. The problem is with the motherboard, the USB ports on the CNC, or the connection cables.

Cut quality or plasma performance issues

Press the “Cutting Tips” soft key on the Main screen and follow the on-screen instructions to improve cut quality.

The CNC feels excessively warm

1. Verify that the external fan is running. If it is running slowly, clean the fan.
2. If the fan is not running and ambient temperature is above 20° C (70° F):
 - a. In Phoenix, choose Setups > Password and enter the FANON password to verify that the fan is enabled.
 - b. Verify that the internal harness between the fan and the utility board is connected.
 - c. Remove the fan shroud and verify that the connections to the fan are in place.
 - d. Replace the external fan (kit 228472).
3. If the external fan is running and the CNC is still excessively warm, open the front door of the CNC and verify that the internal chassis fan is running. If the fan is not running, replace the internal fan (kit 228474).

Loading files

The CNC is loading files slower than when it was first installed or is taking a long time to perform operations that used to happen faster.

1. In Phoenix, choose Setups > Password and enter the Special password, then choose System.
2. If all five numbers on the screen are blue, the CNC is performing as designed.
3. If any of the five numbers on the screen are red, the CNC is operating more slowly than is needed for peak performance.
 - a. Restart the CNC. After 5 minutes, choose Setups > Password and enter the Special Password, then choose System and recheck the numbers. If the five numbers are blue, the CNC is operating as expected.
 - b. If any of the five numbers are red, there may be other programs that are running on the CNC besides Phoenix that are negatively affecting performance. Close these other programs. Call Technical Service for additional troubleshooting.
4. If the CNC is having difficulty connecting to the network, files will load slowly. Verify network connections.

Wireless troubleshooting

Refer to the *Phoenix Software V9 Series Installation and Setup Manual (806410)* for information about networking.

Follow these guidelines if you are experiencing problems using the wireless network on your CNC:

- The wireless network board (141223) requires a bus mastering slot on the motherboard. On the motherboard (141110), PCI slot 1 is not a bus mastering slot. Verify that the wireless board is installed in PCI slot 2.
- The wireless network board conforms to 802.11N and 802.11G standards and connects to either a wireless G or N local area network (LAN). It provides wireless G or better performance for part program downloads, remote help, or other network tasks.
 - An 802.11G wireless network can operate at reasonable speeds up to 38 m (125 ft) from the wireless router or access point, even if the path between the CNC and the access point is obstructed with a wall or door.
 - An 802.11N wireless network can operate at reasonable speeds up to 70 m (230 ft) from the wireless router or access point. However, 802.11N communication requires a clear line of sight between antennas.
 - When in doubt, use the 802.11G wireless network connection.

Note: The network must be set to broadcast its SSID for it to be visible as a connection.

- Make sure the wireless network board appears in the Windows Device Manager under the “Network Adapters” heading, and does not have a yellow ! or ? next to it.
- Use the Windows Network Connections Manager to locate your router or wireless network access point. Choose Start > Settings > Network Connections.
- If the network connection wizard does not list any company wireless networks, check the network availability using a Windows XP laptop or other wi-fi device to verify the router or access point connection is available at that physical location.
- Signal strength diminishes with distance. A wireless network connection does not require 100% signal strength to be effective (shown as four solid bars on the screen). If the Network Connections Manager shows two or three signal strength bars, the network connection is reasonable.
- If the connection speed frequently dips below 24 Mbs or signal strength dips below two bars, move the wireless router or access point closer to the CNC, or add another access point closer to the CNC.
- For best network performance, minimize the number of clients on the wireless network.
- Avoid connecting slower wireless devices to the network (for example, 802.11B devices) as the entire network may degrade to that level of performance.

4 – Maintenance and Diagnostics

Component locations and information

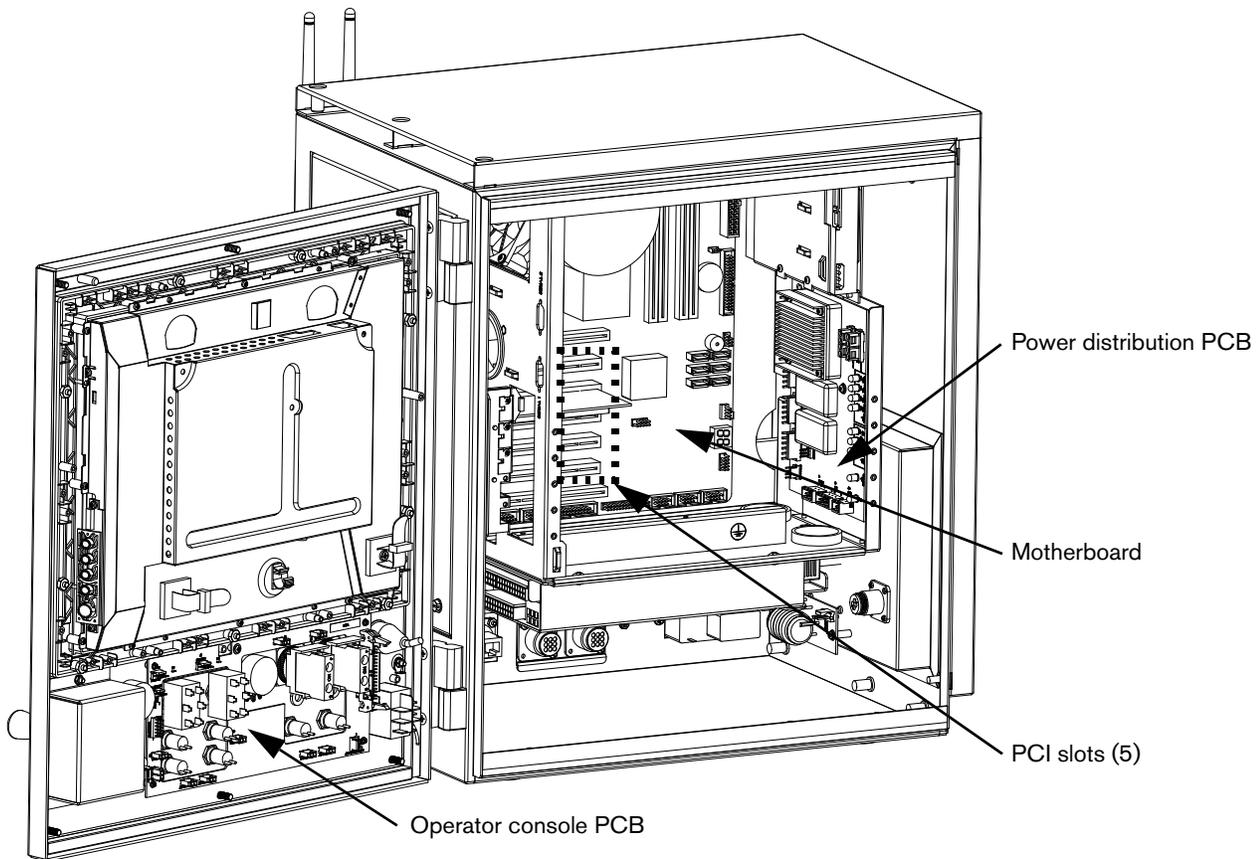
Component locations and information

The following pages provide details about the major components of the EDGE Pro HyPath CNC. Refer to *Parts List* for the corresponding replacement kits and part numbers.

Note: Use the instructions in *Replacement Parts for EDGE Pro CNC Field Service Bulletin (806440)* to replace parts in the EDGE Pro CNC. In addition:

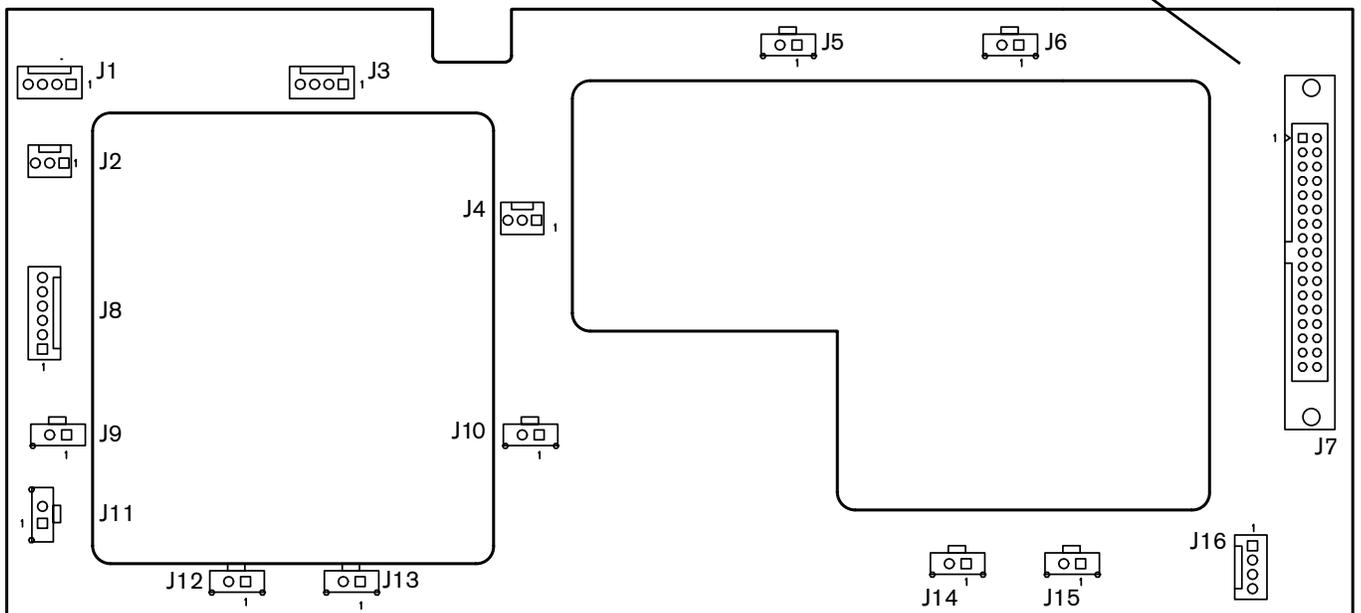
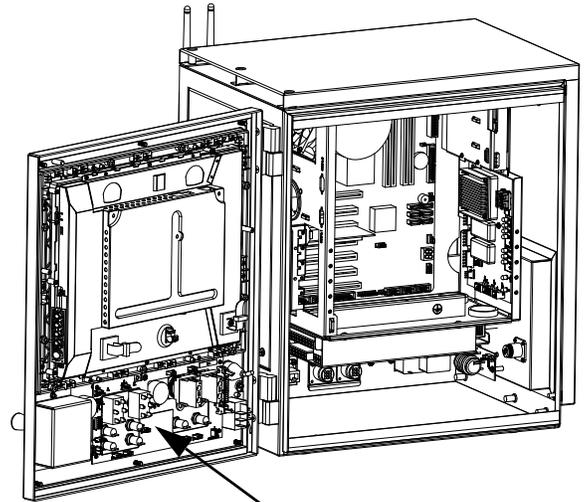
- Use common safety precautions when replacing parts in the CNC.
- Turn off electrical power to the CNC before opening panels on the enclosure.
- Use common safety precautions when handling printed circuit boards.
- Store PC boards in anti-static containers.
- Wear a grounded wrist strap when handling PC boards.

Figure 34 Front internal view of the EDGE Pro HyPath CNC



Operator console board (141058)

Figure 35 Operator console board



4 – Maintenance and Diagnostics

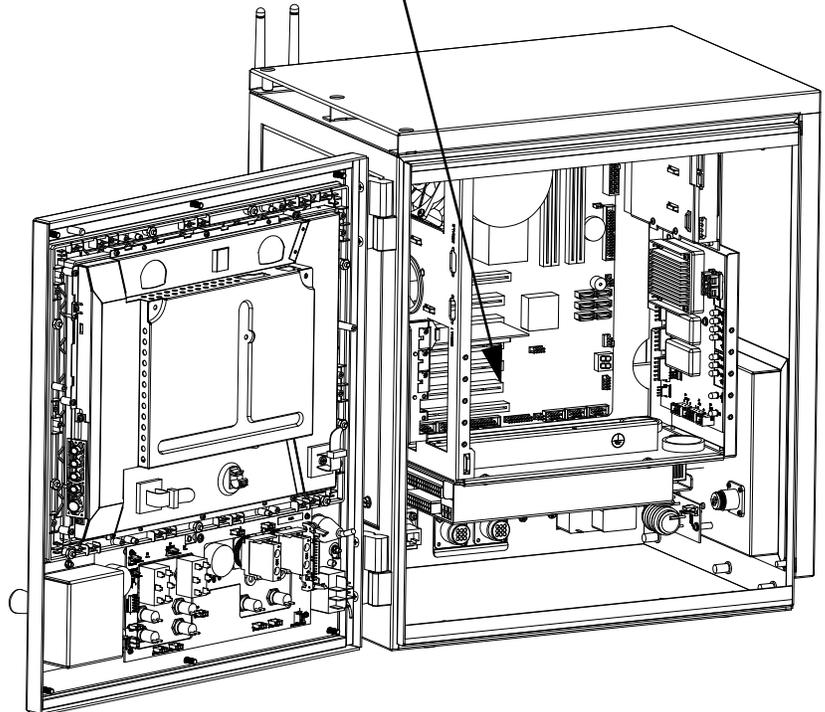
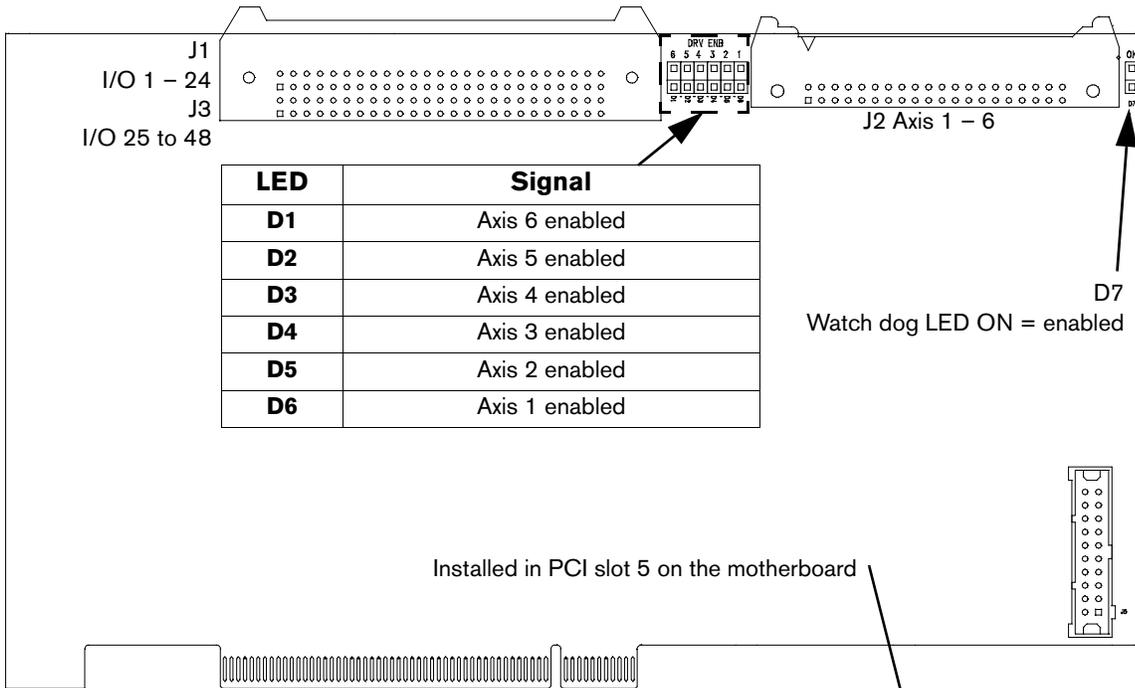
Operator console board (141058)

Table 7 Pinouts for J1 – J16

| Pin no. | Signal | Pin no. | Signal | Pin no. | Signal |
|-----------------------------|--------------------|--------------------------|-----------------------------------|-------------------------|----------------------|
| J1 Station 2 | | J7 To utility PCB | | J8 Joy stick | |
| 1 | Auto select 2 | 1 | Start | 1 | Up |
| 2 | Logic ground | 2 | Stop | 2 | Down |
| 3 | Manual select 2 | 3 | Manual | 3 | Left |
| 4 | Not used | 4 | Forward on path | 4 | Right |
| J2 Jog potentiometer | | 5 | Backward on path | 5 | Logic ground |
| 1 | Logic ground | 6 | Joystick +Y | 6 | Logic ground |
| 2 | Analog (jog speed) | 7 | Joystick -Y | J9 Raise 2 | |
| 3 | 4.096 V reference | 8 | Joystick -X | 1 | Logic ground |
| J3 Station 1 | | 9 | Joystick +X | 2 | Raise torch 2 |
| 1 | Auto select 1 | 10 | Logic ground | J10 Raise 1 | |
| 2 | Logic ground | 11 | Logic ground | 1 | Logic ground |
| 3 | Manual select 1 | 12 | Not connected Front panel ID 1 | 2 | Raise torch 1 |
| 4 | Not used | 13 | Ground Front panel ID 0 | J11 Manual | |
| J4 Cut potentiometer | | 14 | Not connected Front panel ID 1 | 1 | Logic ground |
| 1 | Logic ground | 15 | Logic ground | 2 | Manual switch |
| 2 | Analog (cut speed) | 16 | Logic ground | J12 Lower 2 | |
| 3 | 4.096 V reference | 17 | Not connected Front panel ID 2 | 1 | Logic ground |
| J5 Stop | | 18 | Auto select 1 | 2 | Lower torch 2 |
| 1 | Logic ground | 19 | Manual select 1 | J13 Lower 1 | |
| 2 | Stop switch | 20 | Raise torch 1 | 1 | Logic ground |
| J6 Start | | 21 | Lower torch 1 | 2 | Lower torch 1 |
| 1 | Logic ground | 22 | Auto select 2 | J14 Forward | |
| 2 | Start switch | 23 | Manual select 2 | 1 | Logic ground |
| | | 24 | Raise torch 2 | 2 | Forward on path |
| | | 25 | Lower torch 2 | J15 Back | |
| | | 26 | Station enable LED1 | 1 | Logic ground |
| | | 27 | Station enable LED2 | 2 | Backward on path |
| | | 28 | Motherboard On/Off 1 | J16 Power switch | |
| | | 29 | Motherboard On/Off 2 | 1 | Logic +12 V |
| | | 30 | Cut speed | 2 | Motherboard On/Off 1 |
| | | 31 | Jog speed | 3 | Motherboard On/Off 2 |
| | | 32 | 4.096 V Reference | 4 | Logic ground |
| | | 33 | Logic +5 V | | |
| | | 34 | Logic +12 V | | |

6-Axis MCC board (141061)

Figure 36 6-axis MCC board connectors and LEDs



4 – Maintenance and Diagnostics

6-Axis MCC board (141061)

Table 8 Pinouts for J1 – I/O 1 – 24

| Pin no. | Signal | Pin no. | Signal |
|----------------|---------------|----------------|---------------|
| 1 | Input 1 | 26 | Output 13 |
| 2 | Output 1 | 27 | Input 14 |
| 3 | Input 2 | 28 | Output 14 |
| 4 | Output 2 | 29 | Input 15 |
| 5 | Input 3 | 30 | Output 15 |
| 6 | Output 3 | 31 | Input 16 |
| 7 | Input 4 | 32 | Output 16 |
| 8 | Output 4 | 33 | Input 17 |
| 9 | Input 5 | 34 | Output 17 |
| 10 | Output 5 | 35 | Input 18 |
| 11 | Input 6 | 36 | Output 18 |
| 12 | Output 6 | 37 | Input 19 |
| 13 | Input 7 | 38 | Output 19 |
| 14 | Output 7 | 39 | Input 20 |
| 15 | Input 8 | 40 | Output 20 |
| 16 | Output 8 | 41 | Input 21 |
| 17 | Input 9 | 42 | Output 21 |
| 18 | Output 9 | 43 | Input 22 |
| 19 | Input 10 | 44 | Output 22 |
| 20 | Output 10 | 45 | Input 23 |
| 21 | Input 11 | 46 | Output 23 |
| 22 | Output 11 | 47 | Input 24 |
| 23 | Input 12 | 48 | Output 24 |
| 24 | Output 12 | 49 | Ground |
| 25 | Input 13 | 50 | Ground |

Table 9 Pinouts for J2 – axis 1 – 6

| Pin no. | Signal | Pin no. | Signal |
|----------------|------------------|----------------|------------------|
| 1 | /Axis 1 enable | 21 | Axis 5B Ch |
| 2 | /Axis 2 enable | 22 | Axis 5Z Ch |
| 3 | /Axis 3 enable | 23 | Axis 6A Ch |
| 4 | /Axis 4 enable | 24 | Axis 6B Ch |
| 5 | /Axis 5 enable | 25 | Axis 6Z Ch |
| 6 | /Axis 6 enable | 26 | Logic ground |
| 7 | /Watchdog enable | 27 | Logic ground |
| 8 | Axis 1A | 28 | Analog common |
| 9 | Axis 1B | 29 | Axis 1 analog |
| 10 | Axis 1Z | 30 | Axis 2 analog |
| 11 | Axis 2A | 31 | Axis 3 analog |
| 12 | Axis 2B | 32 | Axis 4 analog |
| 13 | Axis 2Z | 33 | Axis 5 analog |
| 14 | Axis 3A | 34 | Axis 6 analog |
| 15 | Axis 3B | 35 | Logic ground out |
| 16 | Axis 3Z | 36 | Logic +5 V |
| 17 | Axis 4A | 37 | Logic +5 V |
| 18 | Axis 4B | 38 | Logic +12 V |
| 19 | Axis 4Z | 39 | Logic -12 V |
| 20 | Axis 5A | 40 | Logic ground |

4 – Maintenance and Diagnostics

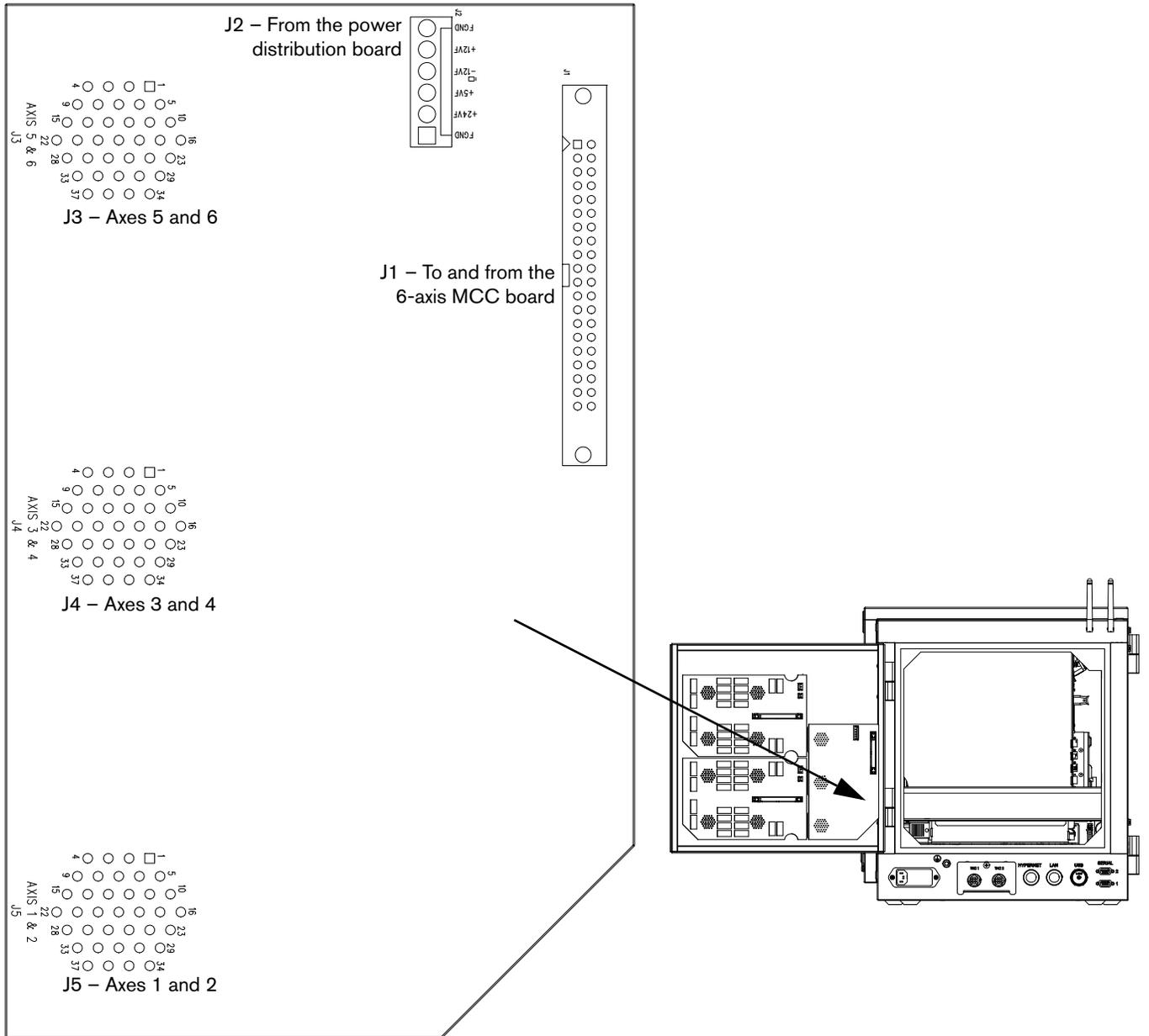
6-Axis MCC board (141061)

Table 10 Pinouts for J3 – I/O 25 to 48

| Pin no. | Signal | Pin no. | Signal |
|----------------|---------------|----------------|---------------|
| 1 | Input 25 | 26 | Output 37 |
| 2 | Output 25 | 27 | Input 38 |
| 3 | Input 26 | 28 | Output 38 |
| 4 | Output 26 | 29 | Input 39 |
| 5 | Input 27 | 30 | Output 39 |
| 6 | Output 27 | 31 | Input 40 |
| 7 | Input 28 | 32 | Output 40 |
| 8 | Output 28 | 33 | Input 41 |
| 9 | Input 29 | 34 | Output 41 |
| 10 | Output 29 | 35 | Input 42 |
| 11 | Input 30 | 36 | Output 42 |
| 12 | Output 30 | 37 | Input 43 |
| 13 | Input 31 | 38 | Output 43 |
| 14 | Output 31 | 39 | Input 44 |
| 15 | Input 32 | 40 | Output 44 |
| 16 | Output 32 | 41 | Input 45 |
| 17 | Input 33 | 42 | Output 45 |
| 18 | Output 33 | 43 | Input 46 |
| 19 | Input 34 | 44 | Output 46 |
| 20 | Output 34 | 45 | Input 47 |
| 21 | Input 35 | 46 | Output 47 |
| 22 | Output 35 | 47 | Input 48 |
| 23 | Input 36 | 48 | Output 48 |
| 24 | Output 36 | 49 | Ground |
| 25 | Input 37 | 50 | Ground |

6-Axis servo board (141067)

Figure 37 6-axis servo board



4 – Maintenance and Diagnostics

6-Axis servo board (141067)

Table 11 Pinouts for J1 – To and from the 6-axis MCC board

| Pin no. | Signal | Pin no. | Signal |
|---------|------------------|---------|---------------------|
| 1 | /Axis 1 enable | 21 | Axis 5B |
| 2 | /Axis 2 enable | 22 | Axis 5Z |
| 3 | /Axis 3 enable | 23 | Axis 6A |
| 4 | /Axis 4 enable | 24 | Axis 6B |
| 5 | /Axis 5 enable | 25 | Axis 6Z |
| 6 | /Axis 6 enable | 26 | Logic ground |
| 7 | /Watchdog enable | 27 | Logic ground enable |
| 8 | Axis 1A | 28 | Analog common |
| 9 | Axis 1B | 29 | Axis 1 analog |
| 10 | Axis 1Z | 30 | Axis 2 analog |
| 11 | Axis 2A | 31 | Axis 3 analog |
| 12 | Axis 2B | 32 | Axis 4 analog |
| 13 | Axis 2Z | 33 | Axis 5 analog |
| 14 | Axis 3A | 34 | Axis 6 analog |
| 15 | Axis 3B | 35 | Logic ground |
| 16 | Axis 3Z | 36 | Logic +5 V |
| 17 | Axis 4A | 37 | Logic +5 V |
| 18 | Axis 4B | 38 | Logic +12 V |
| 19 | Axis 4Z | 39 | Logic -12 V |
| 20 | Axis 5A | 40 | Logic ground |

Table 12 Pinouts for J2 – From the power distribution board

| Pin no. | Signal |
|---------|--------------|
| 1 | Field ground |
| 2 | +24 V |
| 3 | +5 V |
| 4 | -12 V |
| 5 | +12 V |
| 6 | Field ground |

Table 13 Pinouts for J3 – J5 – To the encoder connectors

| J3 (axes 5 and 6) J4 (axes 3 and 4) J5 (axes 1 and 2) | | |
|--|-------------------|---------------------------------|
| Pin no. for axes 1, 3, 5 | Signal | Pin no. for axes 2, 4, 6 |
| 1 | Axis shield | 20 |
| 2 | Encoder +5 V out | 21 |
| 3 | Encoder common | 22 |
| 4 | Encoder +12 V out | 23 |
| 5 | Encoder common | 24 |
| 6 | Encoder +24 V out | 25 |
| 7 | Encoder common | 26 |
| 8 | Encoder Axis A | 27 |
| 9 | Encoder Axis /A | 28 |
| 10 | Encoder Axis B | 29 |
| 11 | Encoder Axis /B | 30 |
| 12 | Encoder Axis Z | 31 |
| 13 | Encoder Axis /Z | 32 |
| 14 | Axis enable A | 33 |
| 15 | Axis enable B | 34 |
| 16 | Axis DAC output | 35 |
| 17 | Analog common | 36 |
| 18 | Shield | 37 |
| 19 | Cable shield | |

4 – Maintenance and Diagnostics

24 I/O board (141070)

24 I/O board (141070)

Figure 38 24 I/O board

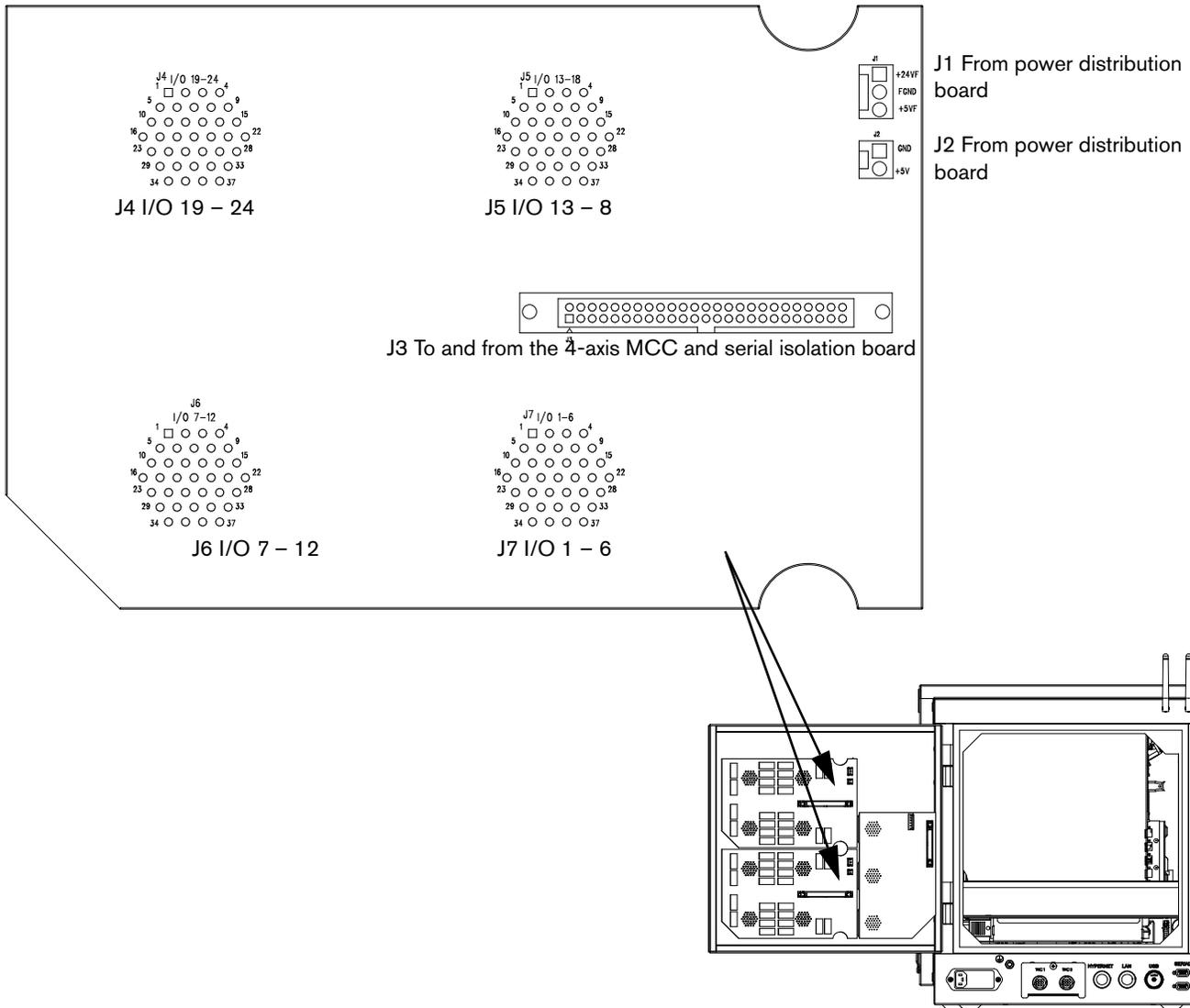


Table 14 Pinouts for J1 and J2

| J1 – From the power distribution board | |
|--|--------------|
| Pin no. | Signal |
| 1 | +24 V |
| 2 | Field ground |
| 3 | +5 V |
| J2 – From the power distribution board | |
| 1 | Ground |
| 2 | +5 V |

Table 15 Pinouts for J3 – To and from MCC and serial isolation boards

| Pin no. | Signal | Pin no. | Signal |
|---------|-----------|---------|-----------|
| 1 | Input 1 | 26 | Output 13 |
| 2 | Output 1 | 27 | Input 14 |
| 3 | Input 2 | 28 | Output 14 |
| 4 | Output 2 | 29 | Input 15 |
| 5 | Input 3 | 30 | Output 15 |
| 6 | Output 3 | 31 | Input 16 |
| 7 | Input 4 | 32 | Output 16 |
| 8 | Output 4 | 33 | Input 17 |
| 9 | Input 5 | 34 | Output 17 |
| 10 | Output 5 | 35 | Input 18 |
| 11 | Input 6 | 36 | Output 18 |
| 12 | Output 6 | 37 | Input 19 |
| 13 | Input 7 | 38 | Output 19 |
| 14 | Output 7 | 39 | Input 20 |
| 15 | Input 8 | 40 | Output 20 |
| 16 | Output 8 | 41 | Input 21 |
| 17 | Input 9 | 42 | Output 21 |
| 18 | Output 9 | 43 | Input 22 |
| 19 | Input 10 | 44 | Output 22 |
| 20 | Output 10 | 45 | Input 23 |
| 21 | Input 11 | 46 | Output 23 |
| 22 | Output 11 | 47 | Input 24 |
| 23 | Input 12 | 48 | Output 24 |
| 24 | Output 12 | 49 | Ground |
| 25 | Input 13 | 50 | Ground |

4 – Maintenance and Diagnostics

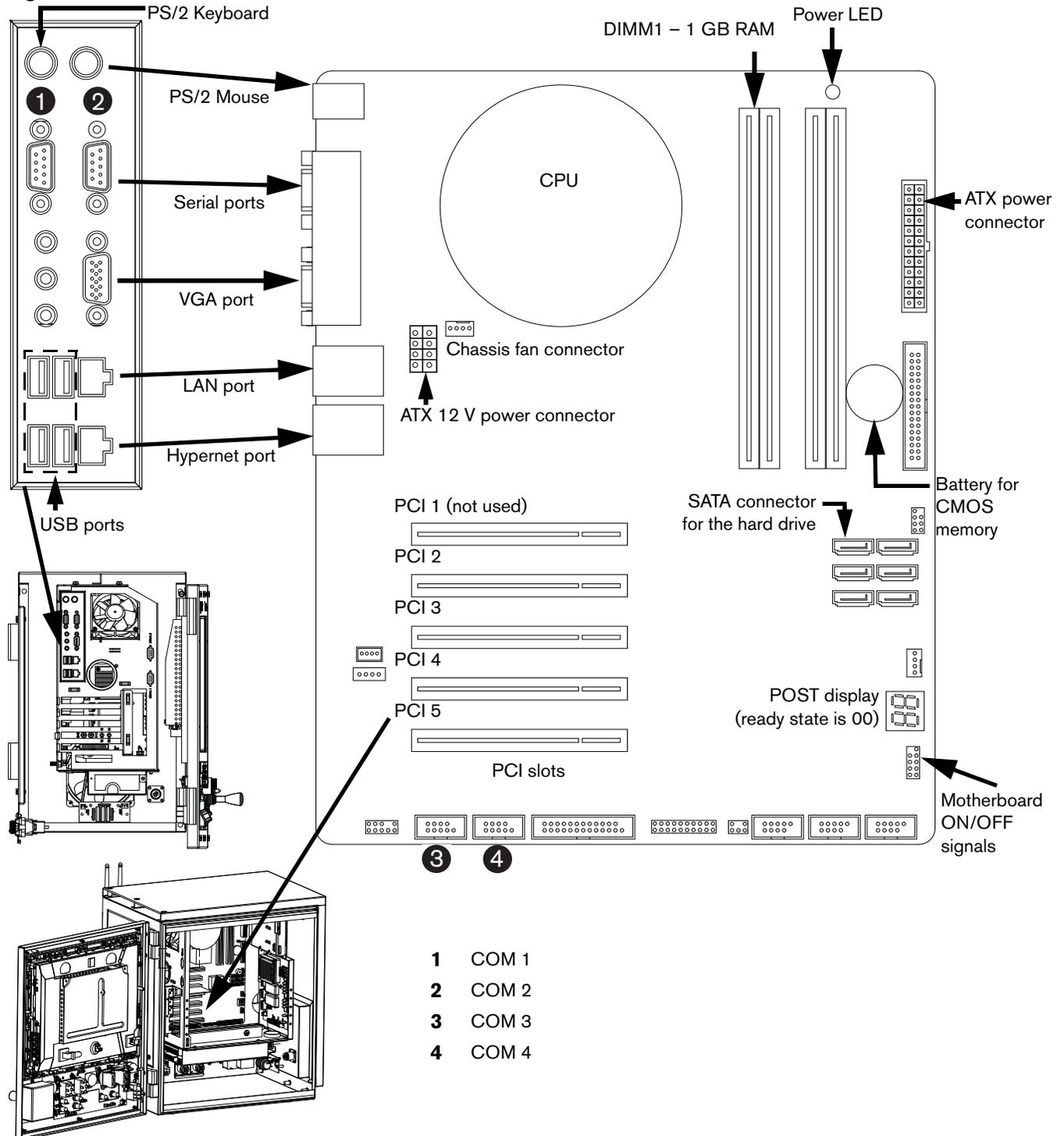
24 I/O board (141070)

Table 16 Pinouts for J4 – J7, I/O 1 – 24

| Pin no. | J4 I/O 19 – 24 | J5 I/O 13 – 18 | J6 I/O 7 – 12 | J7 I/O 1 – 6 |
|----------------|-----------------------|-----------------------|----------------------|---------------------|
| 1 | +24 V field | +24 V field | +24 V field | +24 V field |
| 2 | Input 19 | Input 13 | Input 7 | Input 1 |
| 3 | Common | Common | Common | Common |
| 4 | +24 V field | +24 V field | +24 V field | +24 V field |
| 5 | Input 20 | Input 14 | Input 8 | Input 2 |
| 6 | Common | Common | Common | Common |
| 7 | +24 V field | +24 V field | +24 V field | +24 V field |
| 8 | Input 21 | Input 15 | Input 9 | Input 3 |
| 9 | Common | Common | Common | Common |
| 10 | +24 V field | +24 V field | +24 V field | +24 V field |
| 11 | Input 22 | Input 16 | Input 10 | Input 4 |
| 12 | Common | Common | Common | Common |
| 13 | +24 V field | +24 V field | +24 V field | +24 V field |
| 14 | Input 23 | Input 17 | Input 11 | Input 5 |
| 15 | Common | Common | Common | Common |
| 16 | +24 V field | +24 V field | +24 V field | +24 V field |
| 17 | Input 24 | Input 18 | Input 12 | Input 6 |
| 18 | Common | Common | Common | Common |
| 19 | +24 V field | +24 V field | +24 V field | +24 V field |
| 20 | Output 19A | Output 13A | Output 7A | Output 1A |
| 21 | Output 19B | Output 13B | Output 7B | Output 1B |
| 22 | +24V field | +24 V field | +24 V field | +24 V field |
| 23 | Output 20A | Output 14A | Output 8A | Output 2A |
| 24 | Output 20B | Output 14B | Output 8B | Output 2B |
| 25 | +24 V field | +24 V field | +24 V field | +24 V field |
| 26 | Output 21A | Output 15A | Output 9A | Output 3A |
| 27 | Output 21B | Output 15B | Output 9B | Output 3B |
| 28 | +24 V field | +24 V field | +24 V field | +24 V field |
| 29 | Output 22A | Output 16A | Output 10A | Output 4A |
| 30 | Output 22B | Output 16B | Output 10B | Output 4B |
| 31 | +24 V field | +24 V field | +24 V field | +24 V field |
| 32 | Output 23A | Output 17A | Output 11A | Output 5A |
| 33 | Output 23B | Output 17B | Output 11B | Output 5B |
| 34 | +24 V field | +24 V field | +24 V field | +24 V field |
| 35 | Output 24A | Output 18A | Output 12A | Output 6A |
| 36 | Output 24B | Output 18B | Output 12B | Output 6B |
| 37 | Shield | Shield | Shield | Shield |

Motherboard (141110)

Figure 39 Motherboard



| | PCI slot 2 | PCI slot 3 | PCI slot 4 | PCI slot 5 |
|-------------------------------------|-------------------|------------------|------------------|--------------|
| HyPath 24 or 48 I/O | Wireless (141223) | not used | Utility (141307) | MCC (141061) |
| HyPath 24 or 48 I/O with Sensor THC | Wireless (141223) | Utility (141307) | Analog (141125) | MCC (141061) |

4 – Maintenance and Diagnostics

Analog board (141125)

Analog board (141125)

Figure 40 Analog board

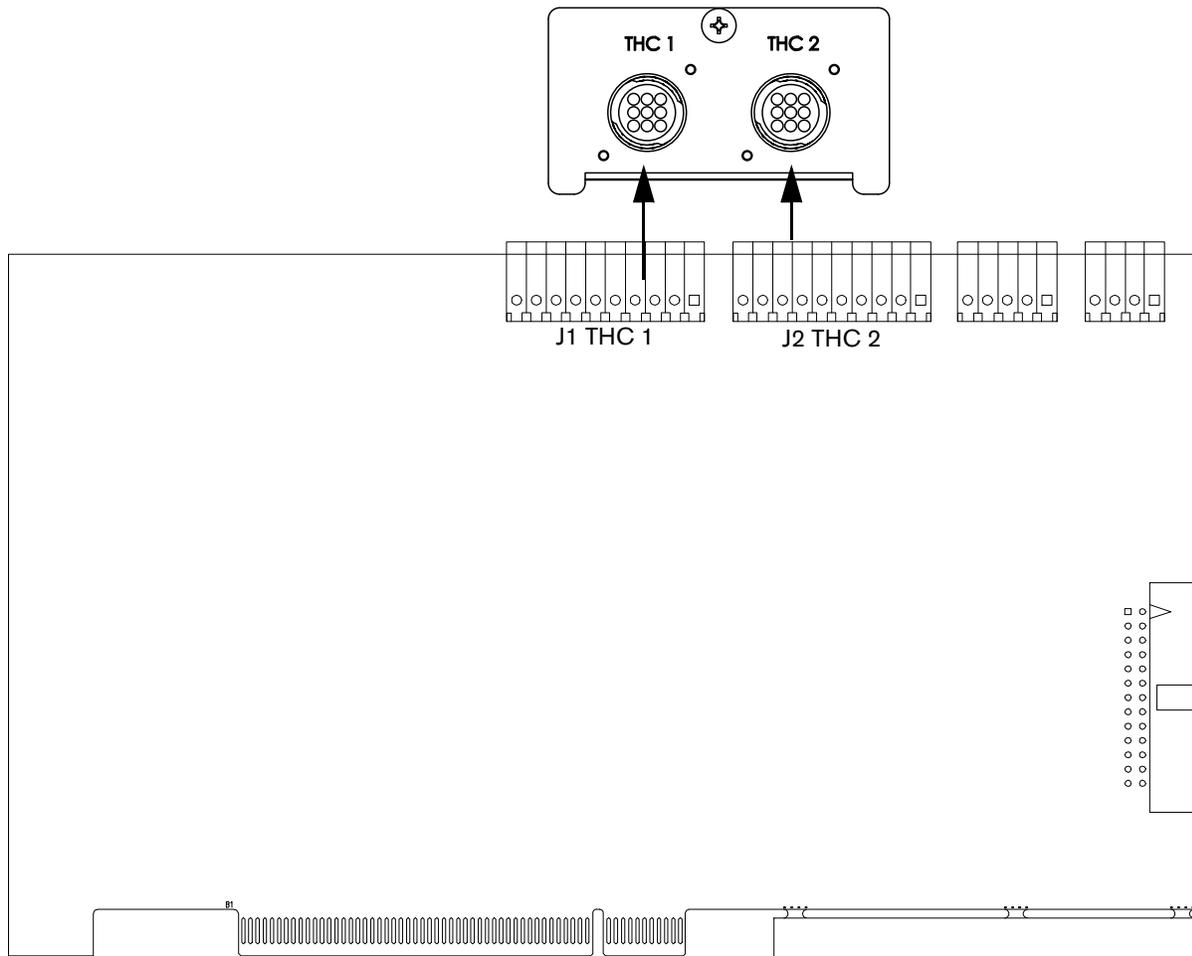


Table 17 Pinouts for J1 and J2

| Pin no. | J1 – to THC1 | J2 – to THC 2 | Signal |
|---------|-----------------|-----------------|--|
| 1 | Common | Common | Common |
| 2 | Input 5+ | Input 6+ | Nozzle contact sense+ (relay contact) |
| 3 | Input 5- | Input 6- | Nozzle contact sense- (relay contact) |
| 4 | Output 1 | Output 3+ | Nozzle contact enable+ (relay contact) |
| 5 | Output 1- | Output 3- | Nozzle contact enable- (relay contact) |
| 6 | Analog input 1+ | Analog input 2+ | THC+ |
| 7 | Analog input 1- | Analog input 2- | THC- |
| 8 | Output 2+ | Output 4+ | Hold ignition (relay contact) |
| 9 | Output 2- | Output 4- | Hold ignition (relay contact) |
| 10 | Shield | Shield | Shield |

Surge board (141134)

Figure 41 Surge board

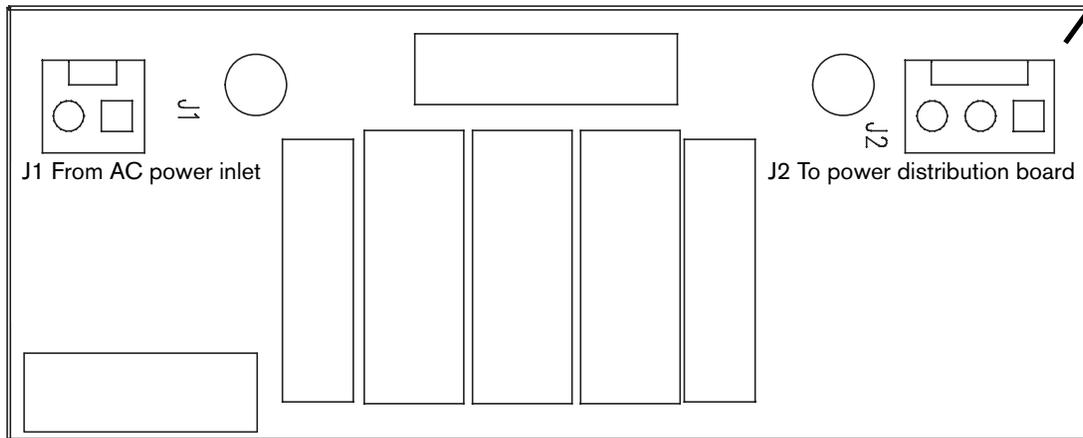
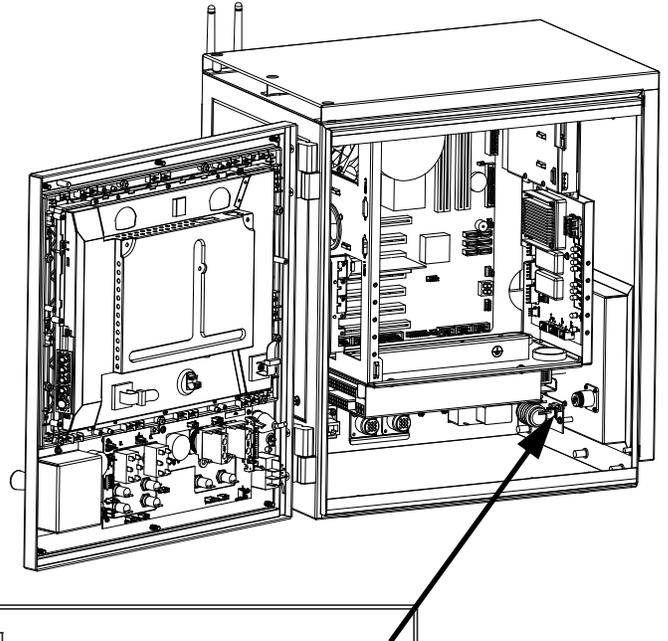


Table 18 Pinouts for J1 and J2

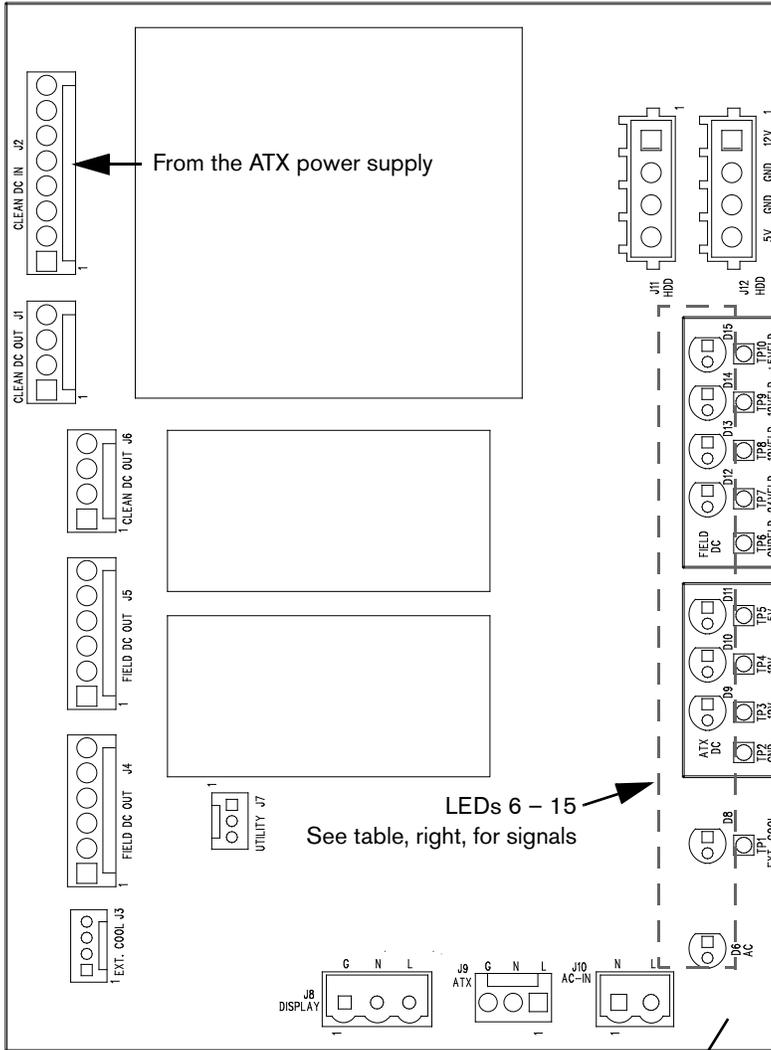
| Pin no. | Signal |
|---|---------|
| J1 – From AC power inlet | |
| 1 | Neutral |
| 2 | Line |
| J2 – To power distribution board (J10) | |
| 1 | Neutral |
| 2 | Line |
| 3 | Ground |

4 – Maintenance and Diagnostics

Power distribution board (141153)

Power distribution board (141153)

Figure 42 Power distribution board



| LED | Signal | Color |
|-----|----------------|-------|
| D15 | +5 V Field DC | Green |
| D14 | 12 V Field DC | Green |
| D13 | -12 V Field DC | Green |
| D12 | 24 V Field DC | Green |
| D11 | 5 V ATX DC | Green |
| D10 | 12 V ATX DC | Green |
| D9 | -12 V ATX DC | Green |
| D8 | External fan | Green |
| D6 | AC power | Green |

Note: LED D6 is illuminated at full brightness when 220 VAC is supplied to the CNC and at half brightness when 120 VAC is supplied.

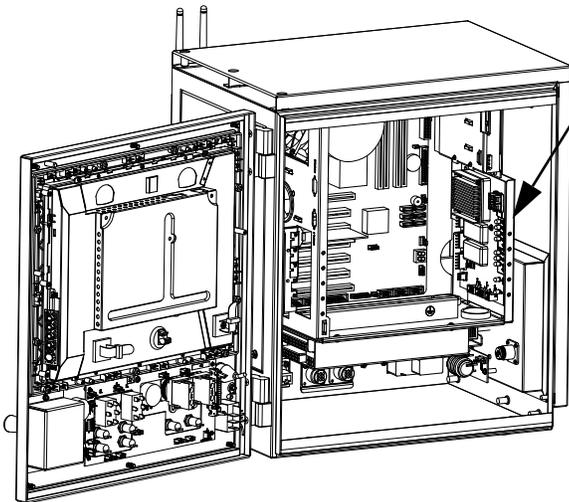


Table 19 Pinouts for J1 – J12

| Pin no. | Signal | Pin no. | Signal |
|------------------------------|-------------------|--|-------------------|
| J1 – Clean DC out | | J6 – Clean DC out | |
| 1 | Logic +5 V fused | 1 | Logic +5 V fused |
| 2 | Logic -12 V fused | 2 | Logic -12 V fused |
| 3 | Logic +12 V fused | 3 | Logic +12 V fused |
| 4 | Logic ground | 4 | Logic ground |
| J2 – Clean DC in | | J7 – Utility | |
| 1 | Logic +5 V | 1 | Fan disable |
| 2 | Logic +12 V | 2 | Field power good |
| 3 | Logic +12 V | 3 | Logic ground |
| 4 | Logic +12 V | J8 – Display | |
| 5 | Logic -12 V | 1 | Earth ground |
| 6 | Logic ground | 2 | Line 2 |
| 7 | Logic ground | 3 | Line 1 |
| 8 | Logic ground | J9 – ATX power supply | |
| J3 – External cooling | | 1 | Line 1 |
| 1 | Fan +24 V | 2 | Line 2 |
| 2 | Fan interlock 2 | 3 | Earth ground |
| 3 | Fan interlock 1 | J10 – AC in (from surge board J2) | |
| 4 | Field ground | 1 | Line 2 |
| J4 – Field DC out | | 2 | Line 1 switched |
| 1 | Field ground | J11 and J12 HDD | |
| 2 | +24 V | 1 | Logic +12 V |
| 3 | +5 V | 2 | Logic ground |
| 4 | -12 V | 3 | Logic ground |
| 5 | +12 V | 4 | Logic +5 V |
| 6 | Field ground | | |
| J5 – Field DC out | | | |
| 1 | Field ground | | |
| 2 | +24 V | | |
| 3 | +5 V | | |
| 4 | -12 V | | |
| 5 | +12 V | | |
| 6 | Field ground | | |

4 – Maintenance and Diagnostics

4-Axis servo board (141292)

4-Axis servo board (141292)

Figure 43 4-Axis servo board

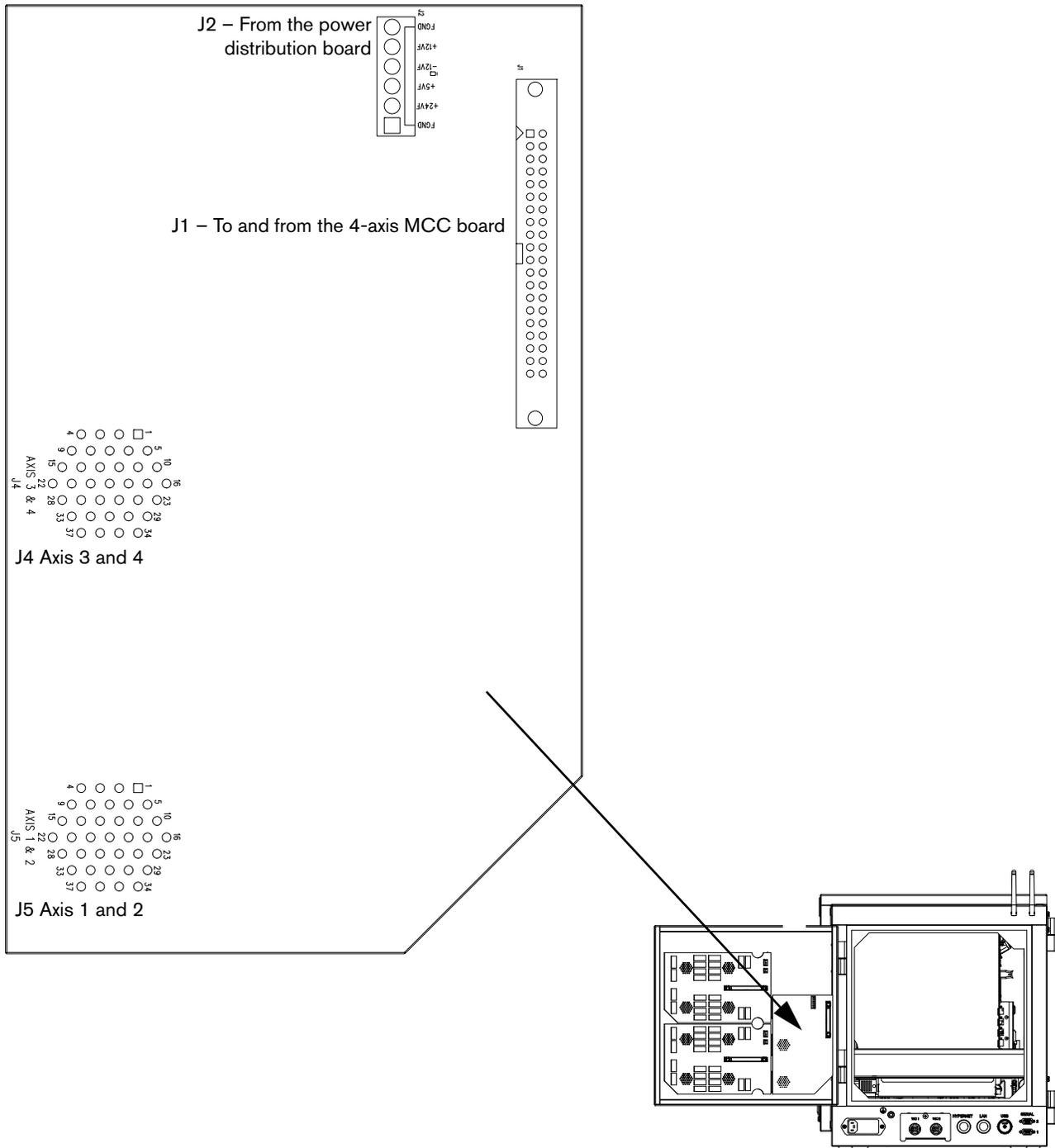


Table 20 Pinouts for J1 – To and from the 4-axis MCC board

| Pin no. | Signal | Pin no. | Signal |
|----------------|------------------|----------------|---------------------|
| 1 | /Axis 1 enable | 21 | Not connected |
| 2 | /Axis 2 enable | 22 | Not connected |
| 3 | /Axis 3 enable | 23 | Not connected |
| 4 | /Axis 4 enable | 24 | Not connected |
| 5 | Not connected | 25 | Not connected |
| 6 | Not connected | 26 | Logic ground |
| 7 | /Watchdog enable | 27 | Logic ground enable |
| 8 | Axis 1A | 28 | Analog common |
| 9 | Axis 1B | 29 | Axis 1 analog |
| 10 | Axis 1Z | 30 | Axis 2 analog |
| 11 | Axis 2A | 31 | Axis 3 analog |
| 12 | Axis 2B | 32 | Axis 4 analog |
| 13 | Axis 2Z | 33 | Not connected |
| 14 | Axis 3A | 34 | Not connected |
| 15 | Axis 3B | 35 | Logic ground |
| 16 | Axis 3Z | 36 | Logic +5 V |
| 17 | Axis 4A | 37 | Logic +5 V |
| 18 | Axis 4B | 38 | Logic +12 V |
| 19 | Axis 4Z | 39 | Logic -12 V |
| 20 | Not connected | 40 | Logic ground |

Table 21 Pinouts for J2 – From the power distribution board

| Pin no. | Signal |
|----------------|---------------|
| 1 | Field ground |
| 2 | +24 V |
| 3 | +5 V |
| 4 | -12 V |
| 5 | +12 V |
| 6 | Field ground |

4 – Maintenance and Diagnostics

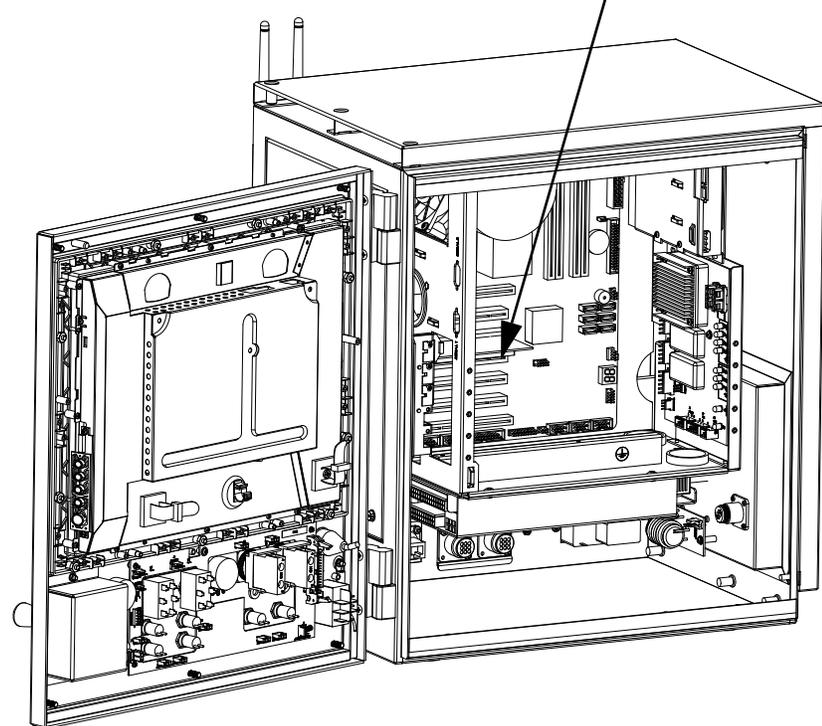
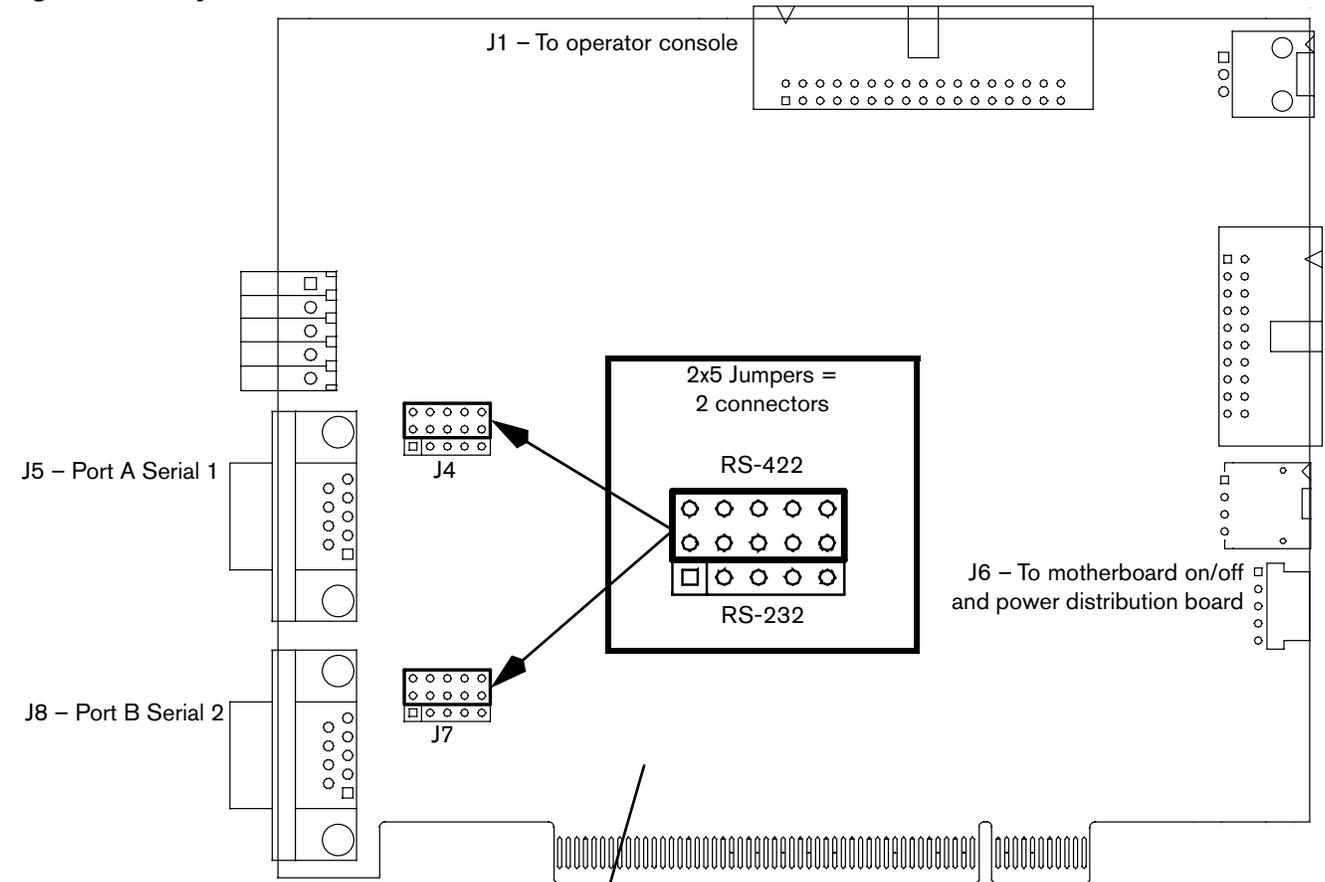
4-Axis servo board (141292)

Table 22 Pinouts for J4 and J5 – Encoder connectors

| J4 (axes 3 and 4) J5 (axes 1 and 2) | | |
|--|-------------------|---------------------------------|
| Pin no. for axes 1 and 3 | Signal | Pin no. for axes 2 and 4 |
| 1 | Axis shield | 20 |
| 2 | Encoder +5 V out | 21 |
| 3 | Encoder common | 22 |
| 4 | Encoder +12 V out | 23 |
| 5 | Encoder common | 24 |
| 6 | Encoder +24 V out | 25 |
| 7 | Encoder common | 26 |
| 8 | Encoder Axis A | 27 |
| 9 | Encoder Axis /A | 28 |
| 10 | Encoder Axis B | 29 |
| 11 | Encoder Axis /B | 30 |
| 12 | Encoder Axis Z | 31 |
| 13 | Encoder Axis /Z | 32 |
| 14 | Axis enable A | 33 |
| 15 | Axis enable B | 34 |
| 16 | Axis DAC output | 35 |
| 17 | Analog common | 36 |
| 18 | Shield | 37 |
| 19 | Cable shield | |

Utility and serial isolation board (141307)

Figure 44 Utility and serial isolation board



This board is installed on the motherboard in PCI slot 4 for a CNC with no integrated THC and in PCI slot 3 for a CNC with an integrated THC.

4 – Maintenance and Diagnostics

Utility and serial isolation board (141307)

Table 23 Pinouts for J1 – J8

| Pin no. | Signal | Pin no. | Signal |
|--|----------------------|--|----------------------|
| J1 – To and from the operator console | | J5 – Serial port A, Serial 1 | |
| 1 | Start | 1 | Not connected |
| 2 | Stop | 2 | Transmit A- |
| 3 | Manual | 3 | Receive A- |
| 4 | Forward on path | 4 | Transmit A+ |
| 5 | Backward on path | 5 | Signal ground 1 |
| 6 | Joystick +Y | 6 | Not connected |
| 7 | Joystick -Y | 7 | Receive A+ |
| 8 | Joystick -X | 8 | Not connected |
| 9 | Joystick +X | 9 | Not connected |
| 10 | Ground | J6 – To motherboard on/off and power distribution | |
| 11 | Ground | 1 | Field power |
| 12 | Front panel ID1 | 2 | Chiller |
| 13 | Front panel ID0 | 3 | Logic ground |
| 14 | Front panel ID1 | 4 | Motherboard ON/OFF 1 |
| 15 | Ground | 5 | Motherboard ON/OFF 2 |
| 16 | Ground | J8 – Serial port B, Serial 2 | |
| 17 | Front panel ID2 | 1 | Not connected |
| 18 | Auto select 1 | 2 | Transmit B- |
| 19 | Manual select 1 | 3 | Receive B- |
| 20 | Raise torch 1 | 4 | Transmit B+ |
| 21 | Lower torch 1 | 5 | Signal ground 2 |
| 22 | Auto select 2 | 6 | Not connected |
| 23 | Manual select2 | 7 | Receive B+ |
| 24 | Raise torch 2 | 8 | Not connected |
| 25 | Lower torch 2 | 9 | Not connected |
| 26 | Station enable LED 1 | | |
| 27 | Station enable LED 2 | | |
| 28 | Motherboard ON/OFF 1 | | |
| 29 | Motherboard ON/OFF 2 | | |
| 30 | Cut speed | | |
| 31 | Jog speed | | |
| 32 | 4.096 V | | |
| 33 | 5 V | | |
| 34 | 12 V | | |

VDC for integrated Sensor THC (141201)

If your cutting system includes an integrated Sensor THC, you must install one of these VDC boards in each plasma system in your cutting system.

Figure 45 VDC3

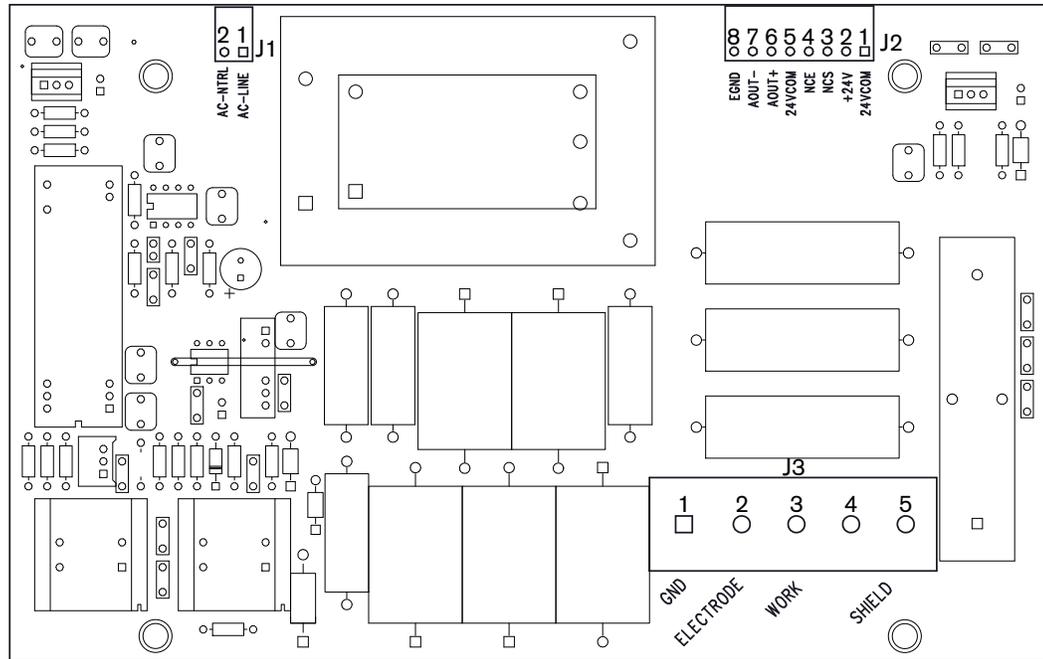


Table 24 Pinouts for J1 – J3

| Pin no. | Signal | Pin no. | Signal |
|----------------------------|-----------------------------------|------------------------------|--------------------|
| J1 – AC power inlet | | J3 – Torch connection | |
| 1 | 120 VAC line | 1* | EMI chassis ground |
| 2 | 120 VAC neutral | 2 | Electrode |
| J2 – THC I/O | | 3 | Work |
| 1 | 24 VDC common (out) | 4 | No connection |
| 2 | +24 VDC (out) | 5 | Torch tip shield |
| 3 | Nozzle contact sense (output) | | |
| 4 | Nozzle contact enable (input) | | |
| 5 | 24 VDC common (out) | | |
| 6 | + Analog out | | |
| 7 | - Analog out (analog common) | | |
| 8 | EMI chassis ground (cable shield) | | |

* This pin is not connected under normal conditions. If you have noise problems, connect this pin to an adjacent metal chassis.

4 – Maintenance and Diagnostics

VDC for integrated Sensor THC (141201)

Section 5

Parts List

Diagnostic kits

| Part | Kit number | Description |
|----------------|------------|--|
| HyPath testers | 228511 | Axis tester (228496) THC tester (228536) Green I/O tester (228497), Red I/O tester (228498) Ethernet and Hypernet tester (228503) Serial interface tester (RS-232 or RS-422 on the utility and serial isolation board) (228504) USB tester (228505) |

Cables

| Part | Part number | Description |
|-------------------------|-------------|------------------|
| Hypernet and LAN cables | 209195 | Ferrite filter |
| | 223212 | 3.2 m (10 ft) |
| | 223222 | 6.08 m (20 ft) |
| | 223119 | 7.62 m (25 ft) |
| | 223223 | 10.66 m (35 ft) |
| | 223008 | 15.25 m (50 ft) |
| | 223099 | 22.86 m (75 ft) |
| | 223100 | 30.48 m (100 ft) |
| | 223101 | 45.72 m (150 ft) |
| | 223102 | 60.96 m (200 ft) |

Cable connector kits

| Kit number | Description |
|------------|-----------------------|
| 228492 | I/O cable connector |
| 228491 | Servo cable connector |
| 228495 | THC cable connector |

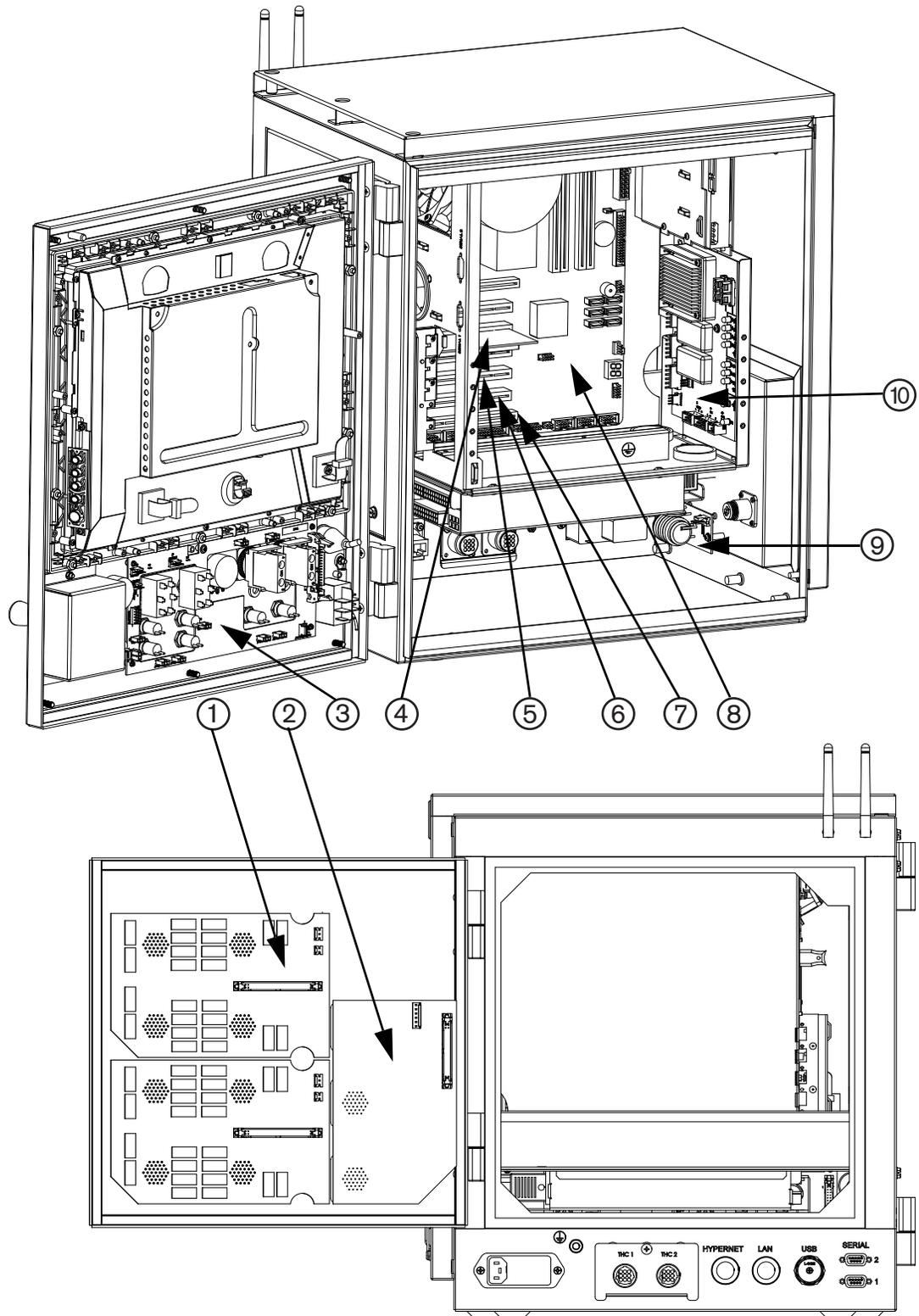
5 – Parts List

HyPath PCB kits

HyPath PCB kits

| Location | Kit number | Description |
|------------------|---------------------|--|
| 1 | 228453 | I/O board (141070) |
| 2 | 428106, 228452 | 4-axis servo board (141292) 6-axis servo board (141067) |
| 3 | 228450 | Operator console board (141058) |
| 4 (PCI 2) | 428063 | Wireless board (141223), includes 2 cables and antennas |
| 5 (PCI 3) | 428001 | Utility and serial isolation board (141307, for models with Sensor THC) |
| 6 (PCI 4) | 428001 or 228459 | Utility and serial isolation board (141307) or Analog board (141125 for models with Sensor THC) |
| 7 (PCI 5) | 428004 | 6-axis MCC board (141061) |
| 8 | 228454 | Motherboard (141110), with CPU, heatsink/fan, and RAM |
| 9 | 228460 | Surge board (141134) |
| 10 | 228448 | Power distribution board (141153) |

Figure 46 HyPath PCBs



5 – Parts List

Additional kits

Additional kits

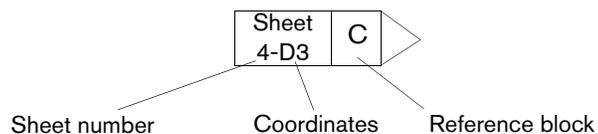
| Part | Kit number | Description |
|---|------------|---|
| ATX power supply | 228473 | 1 U, 400 W, with harness and bracket |
| Subchassis cooling fan | 228474 | Internal |
| CPU fan | 428012 | Internal |
| Relay for 24-I/O board (141070) | 003197 | |
| Battery for motherboard | 428011 | 3 V lithium, coin cell, CR2032-type |
| Fuse (1) for power entry module | 008872 | 250 V 2 A, slow-blow, 0.25 in. x 1.25 in. |
| Fuses (2) for power entry module | 228464 | 250 V, 2 A, slow-blow, 5 mm x 20 mm |
| Power entry module | 228464 | Includes harness and 5 mm x 20 mm fuses |
| Wireless antenna (2) | 428107 | |
| Ribbon cable for utility and serial board | 229245 | |
| USB cable kit | 428059 | |
| HASP hardware key | 228446 | |
| Hard drive, SATA | 228447 | Includes Windows XPe operating system |
| 15-inch LCD touchscreen | 228462 | |
| Joy stick | 228471 | |
| Speed potentiometer | 228470 | |
| Stop switch assembly, red | 228468 | |
| Start switch assembly, green | 228467 | |
| Power switch | 228465 | |
| Station select toggle switch | 228469 | |
| White pushbutton switch assembly | 228463 | |
| Hypernet/LAN RJ-45 connector | 228445 | |

Section 6

Wiring Diagrams

This section contains the wiring diagrams for the system. When you trace a signal path, or reference the *Parts List* or *Troubleshooting* sections, the following conventions will help you understand the organization of the wiring diagrams:

- Sheet numbers are located in the lower, right-hand corner of each page.
- References to other pages use the following connection symbol:



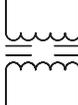
Use the sheet number to find the reference sheet. Line up the coordinates A–D on the Y axis and numbers 1–4 on the X axis of each sheet to find the reference blocks (similar to a road map).

6 – Wiring Diagrams

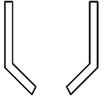
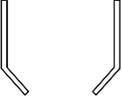
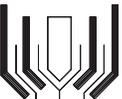
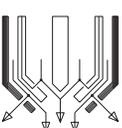
Wiring diagram symbols

Wiring diagram symbols

| | | | | | |
|---|--------------------|---|------------------------------|---|-----------------------------------|
|  | Battery |  | Ground clamp |  | Receptacle |
|  | Cap, polarized |  | Ground, chassis |  | Relay, coil |
|  | Cap, not polarized |  | Ground, earth |  | Relay, normally closed |
|  | Cap, feed-through |  | IGBT |  | Relay, normally open |
|  | Circuit breaker |  | Inductor |  | Relay, solid state, AC |
|  | Coax shield |  | LED |  | Relay, solid state, DC |
|  | Current sensor |  | Lamp |  | Relay, solid state |
|  | Current sensor |  | MOV |  | Resistor |
|  | DC supply |  | Pin |  | SCR |
|  | Diode |  | Socket |  | Shield |
|  | Door interlock |  | Plug |  | Shunt |
|  | Fan |  | PNP transistor |  | Spark gap |
|  | Feed-through LC |  | Potentiometer |  | Switch, flow |
|  | Filter, AC |  | Push button, normally closed |  | Switch, level, normally closed |
|  | Fuse |  | Push button, normally open |  | Switch, pressure, normally closed |

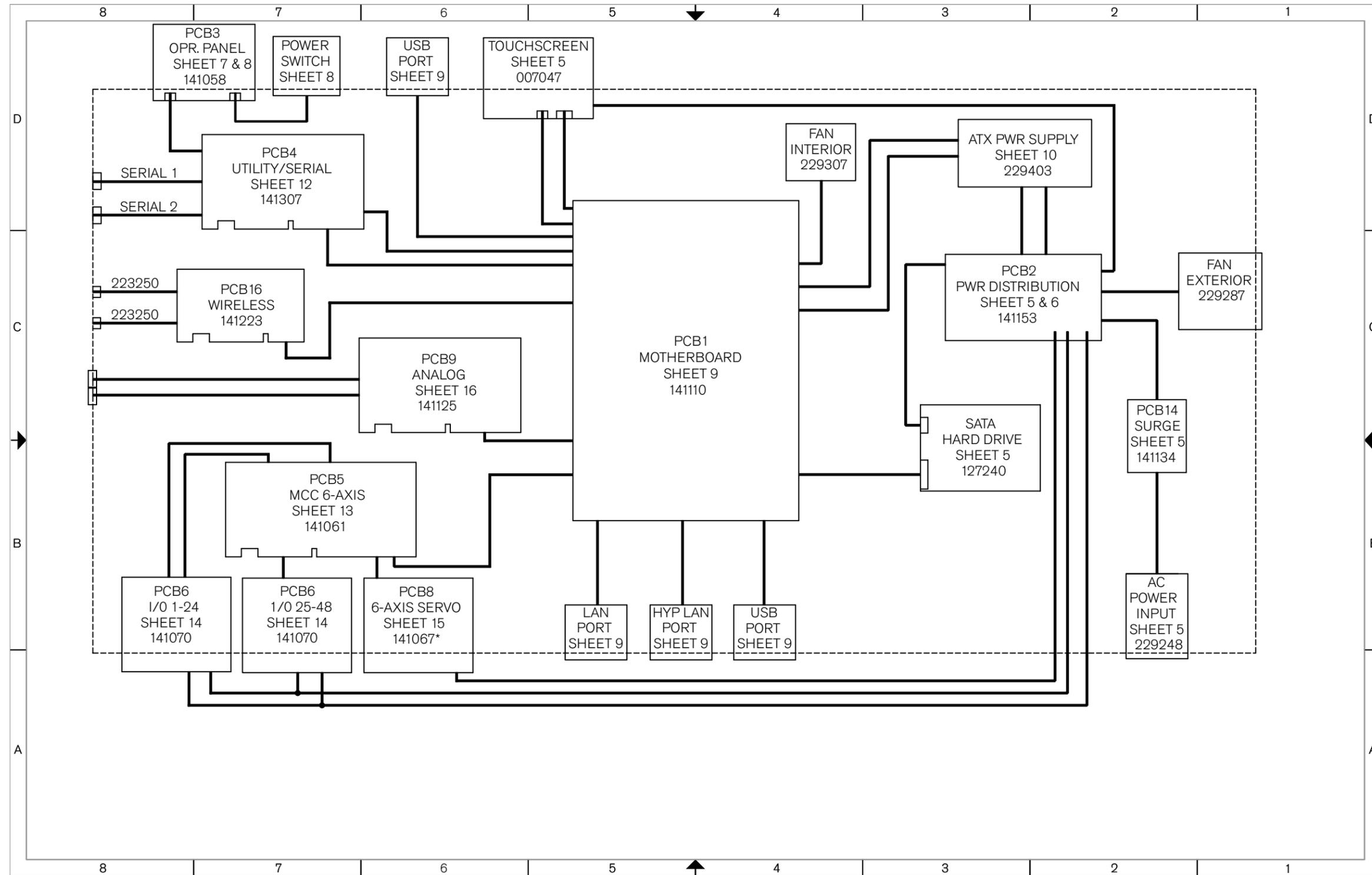
| | | | | | |
|--|--------------------------------------|--|---------------------------|---|-----------------|
|  | Switch, pressure, normally open |  | Time delay open, NO/off |  | Valve, solenoid |
|  | Switch, 1 pole, 1 throw |  | Time delay open, NC/on |  | Voltage source |
|  | Switch, 1 pole, 2 throw |  | Time delay closed, NO/off |  | Zener diode |
|  | Switch, 1 pole, 2 throw, center off |  | Transformer | | |
|  | Switch, temperature, normally closed |  | Transformer, air core | | |
|  | Switch, temperature, normally open |  | Transformer, coil | | |
|  | Terminal block |  | Triac | | |
|  | Time delay closed, NC/off |  | VAC source | | |

Torch symbols

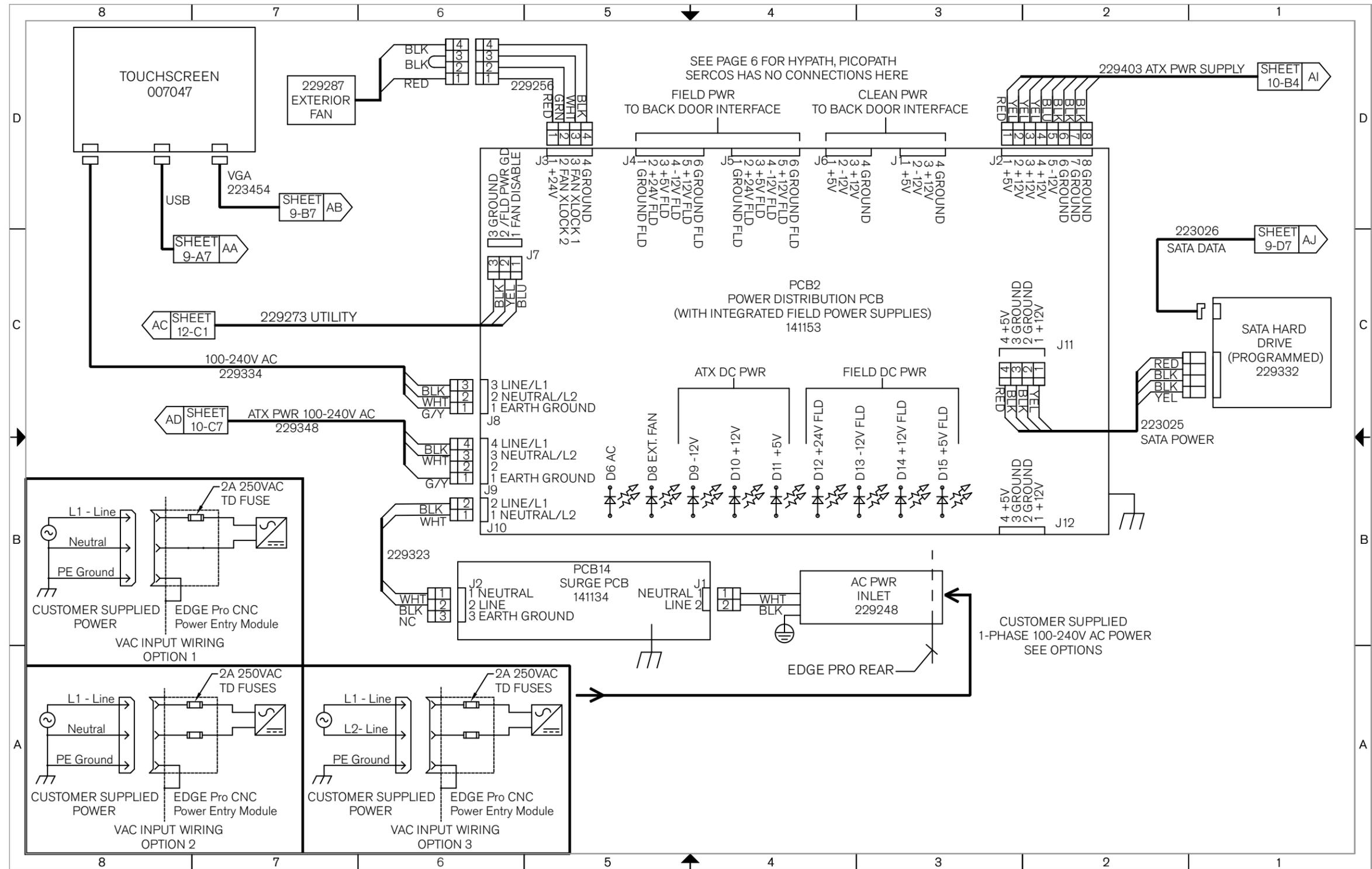
| | |
|---|----------------------|
|  | Electrode |
|  | Nozzle |
|  | Shield |
|  | Torch |
|  | Torch, HyDefinition™ |

6 – Wiring Diagrams

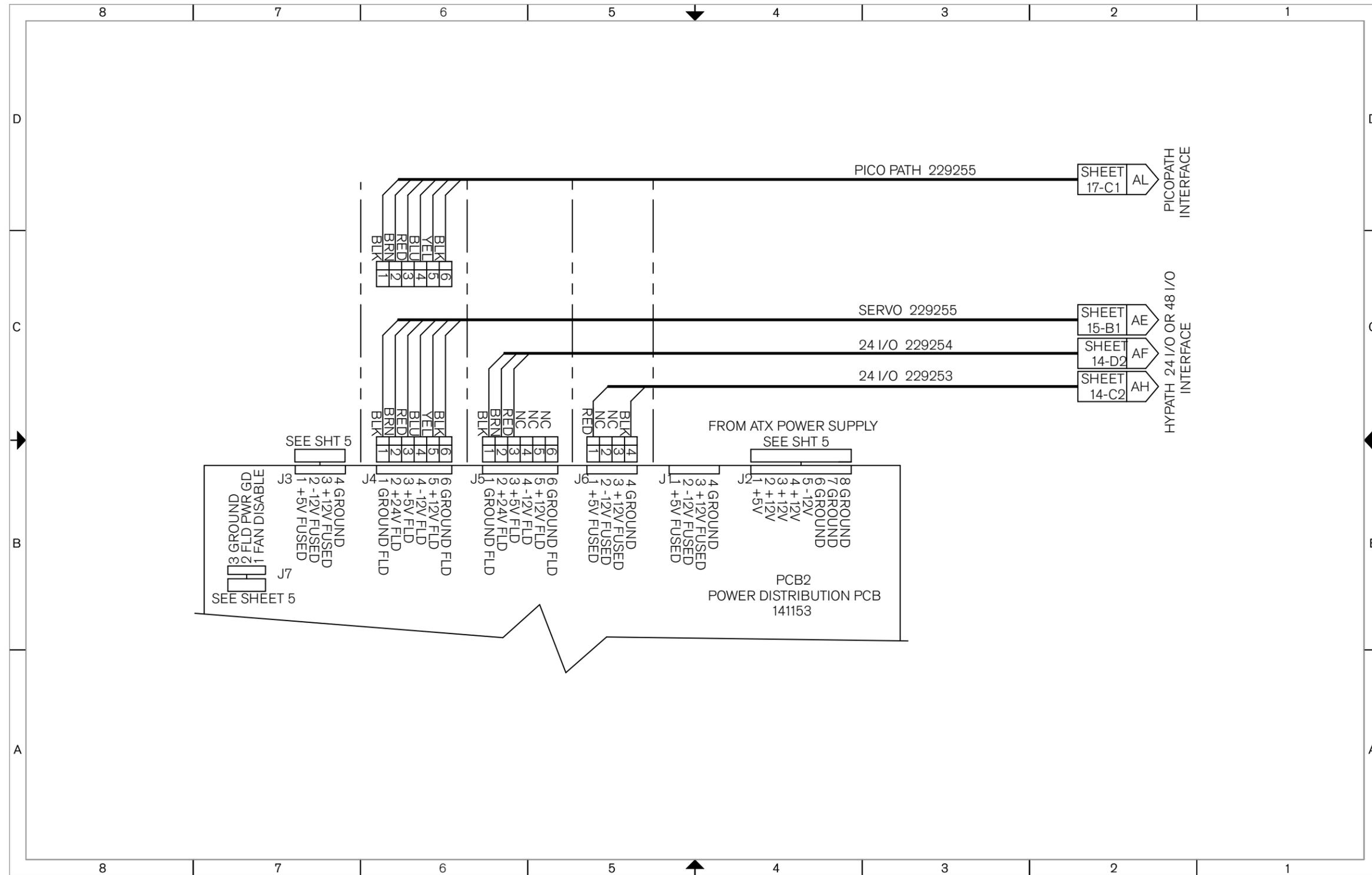
Wiring diagram symbols



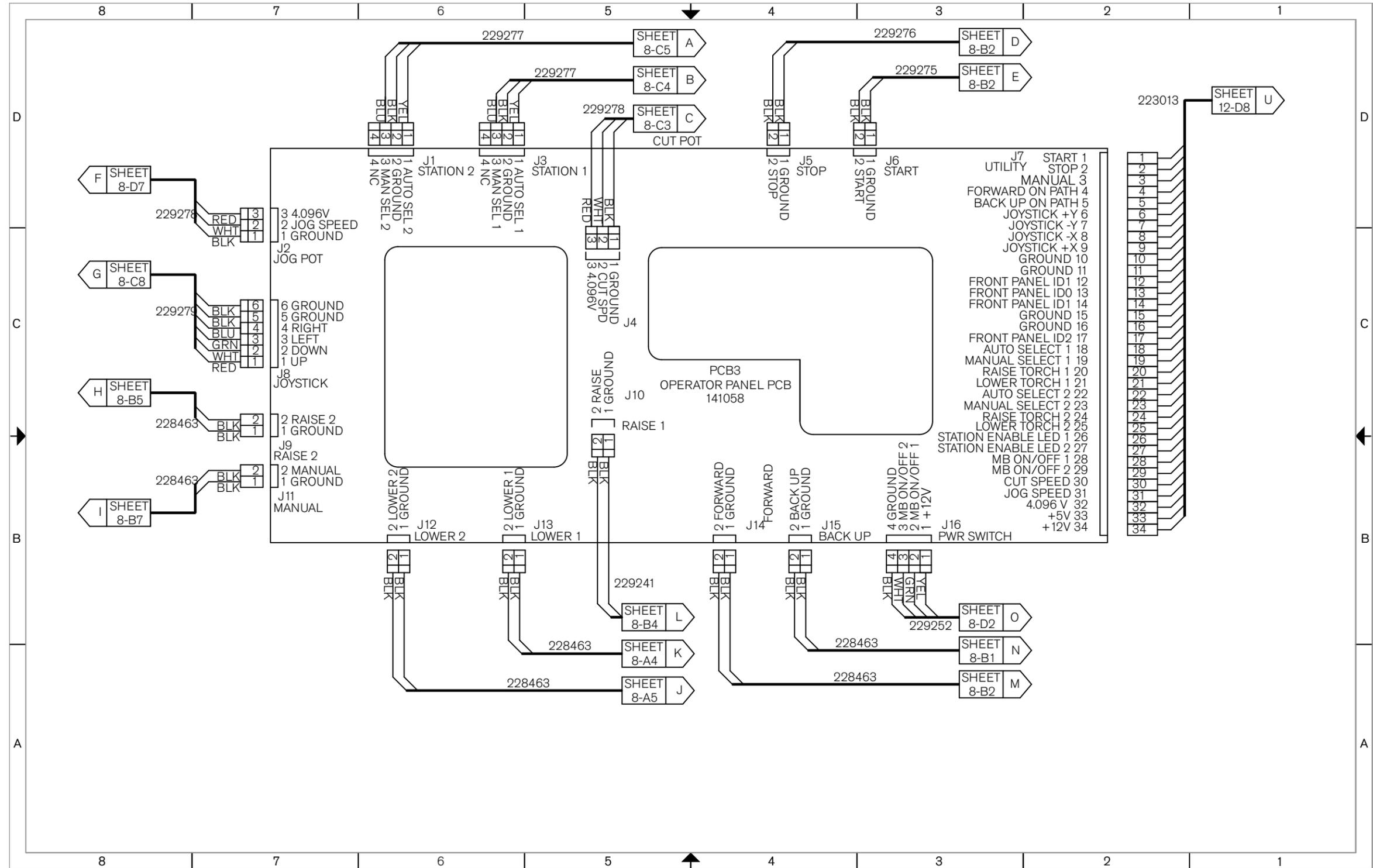
Sheet 2 – EDGE Pro CNC with HyPath interface



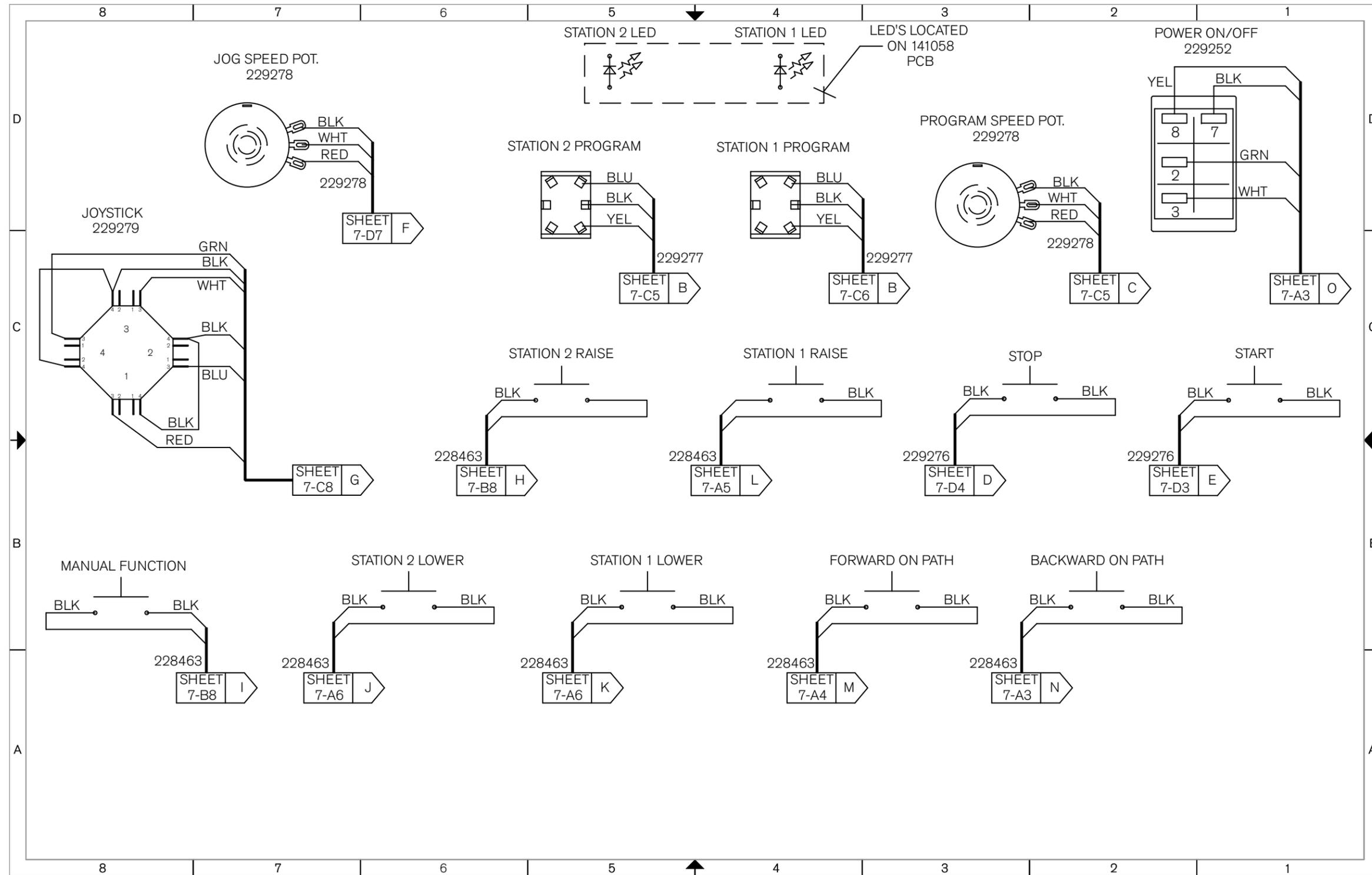
Sheet 5 – Power distribution board (141153) and surge board (141134)



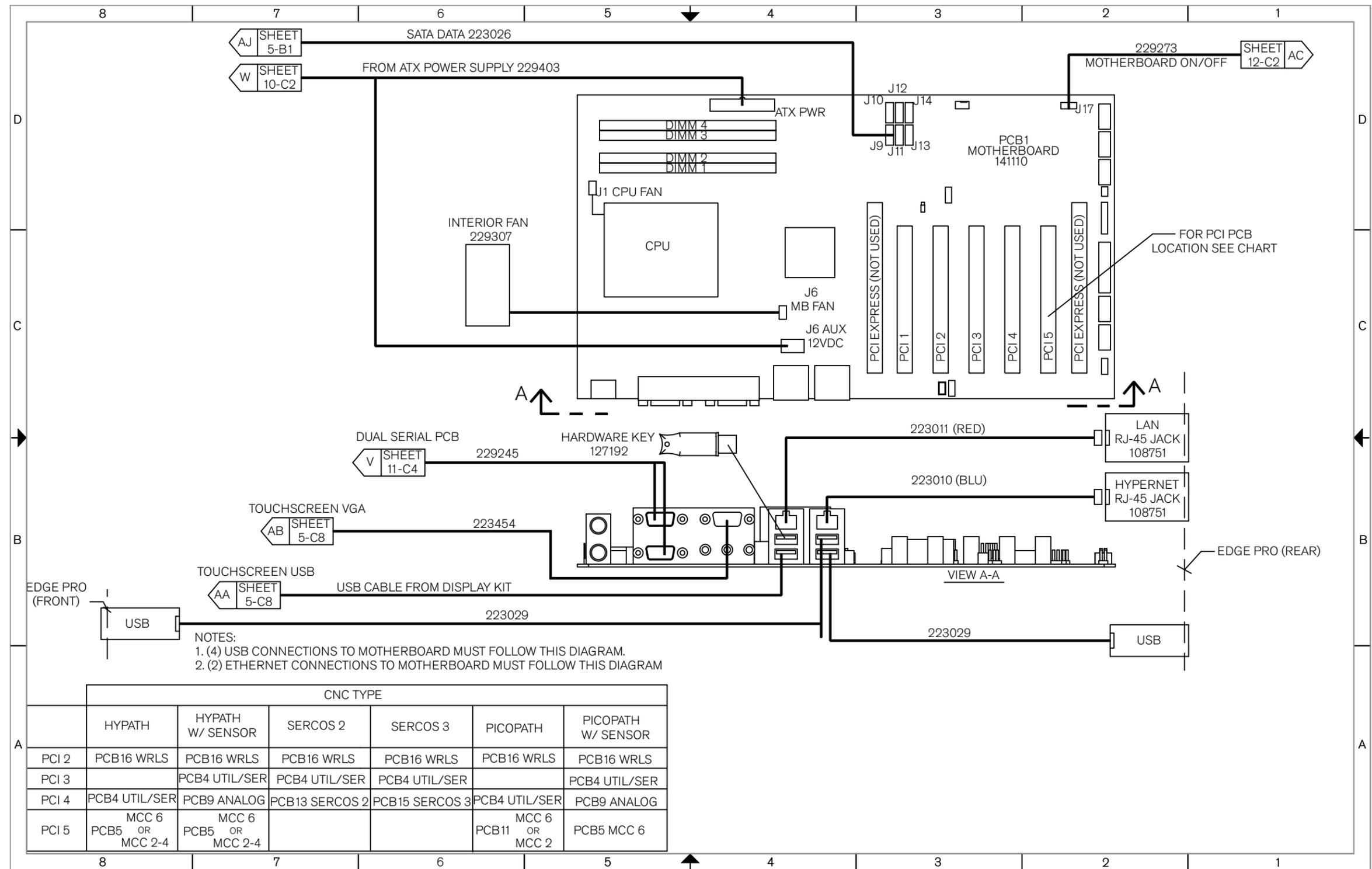
Sheet 6 – Power distribution board, field and clean power out (J4 – J6) (141153)



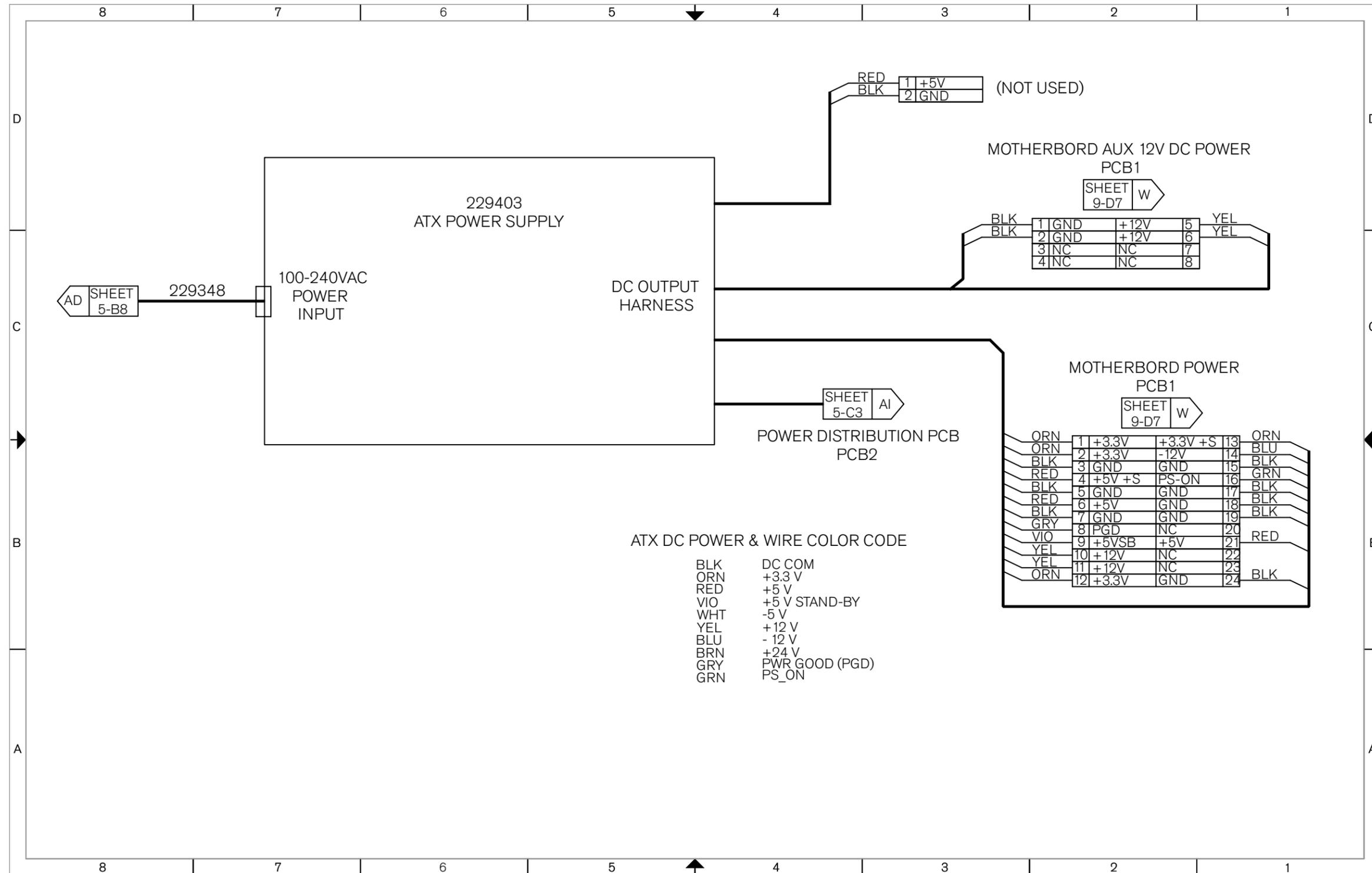
Sheet 7 – Operator console board (141058)



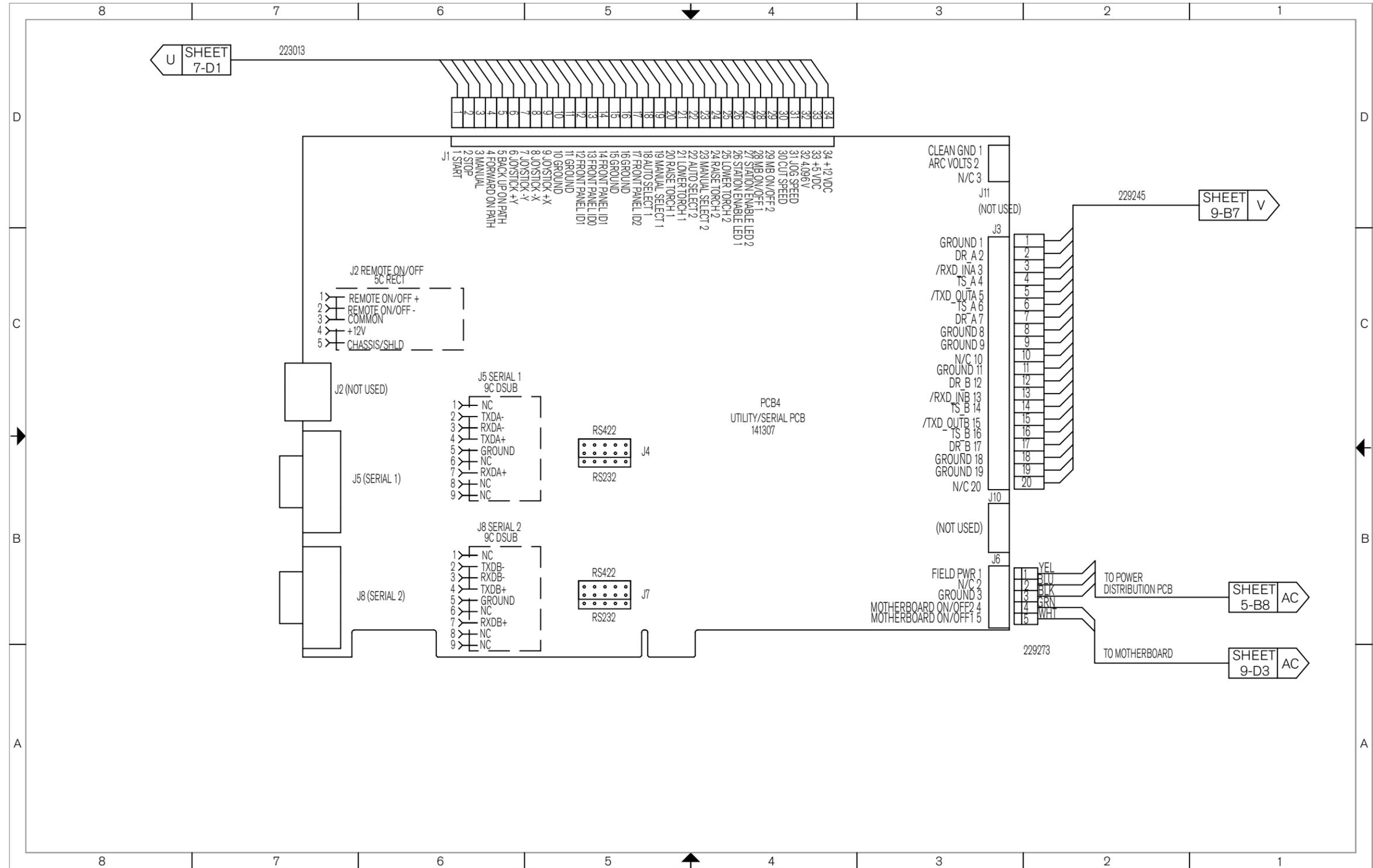
Sheet 8 – Operator console components (141058)



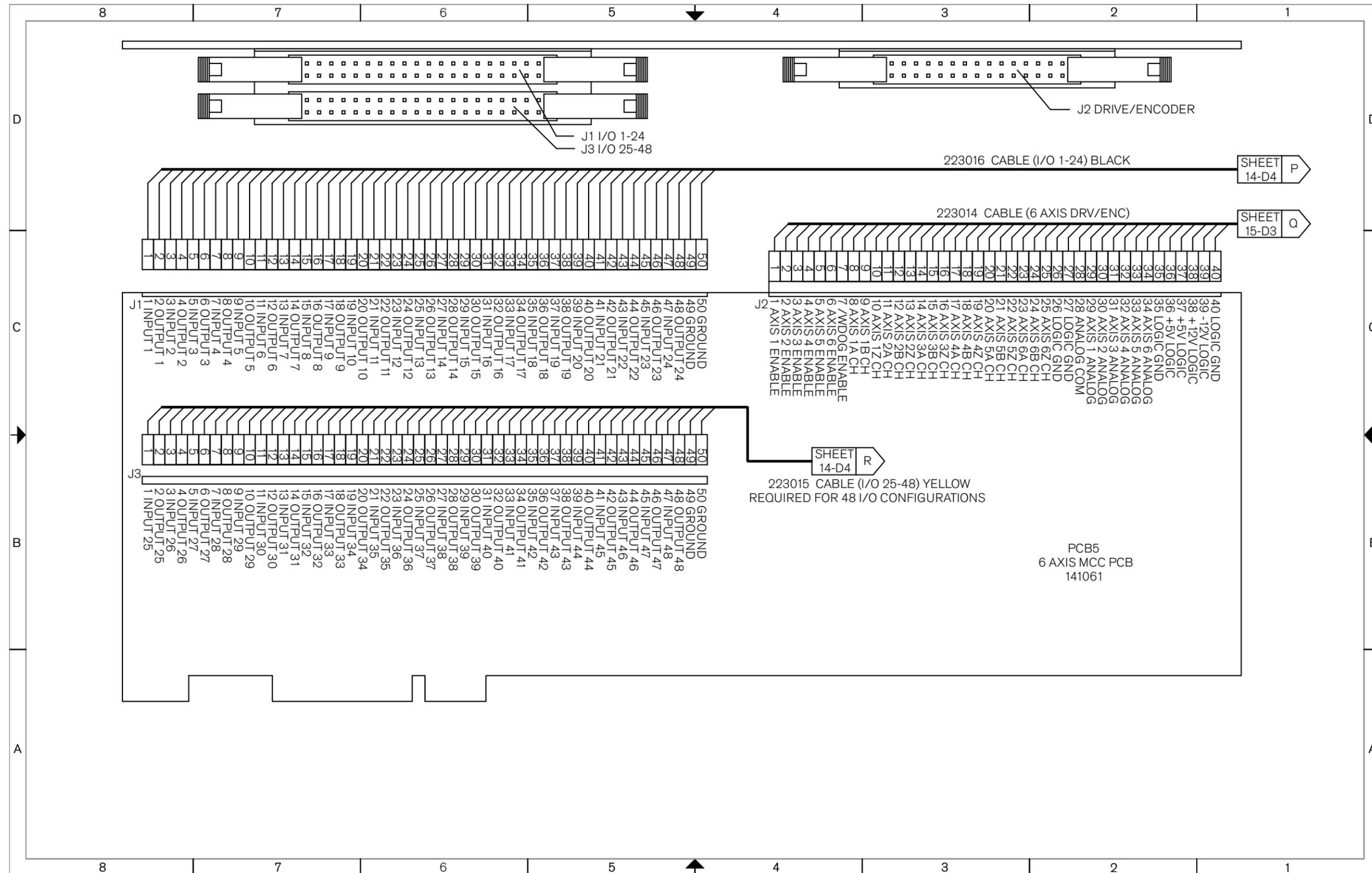
Sheet 9 – Motherboard (141110)



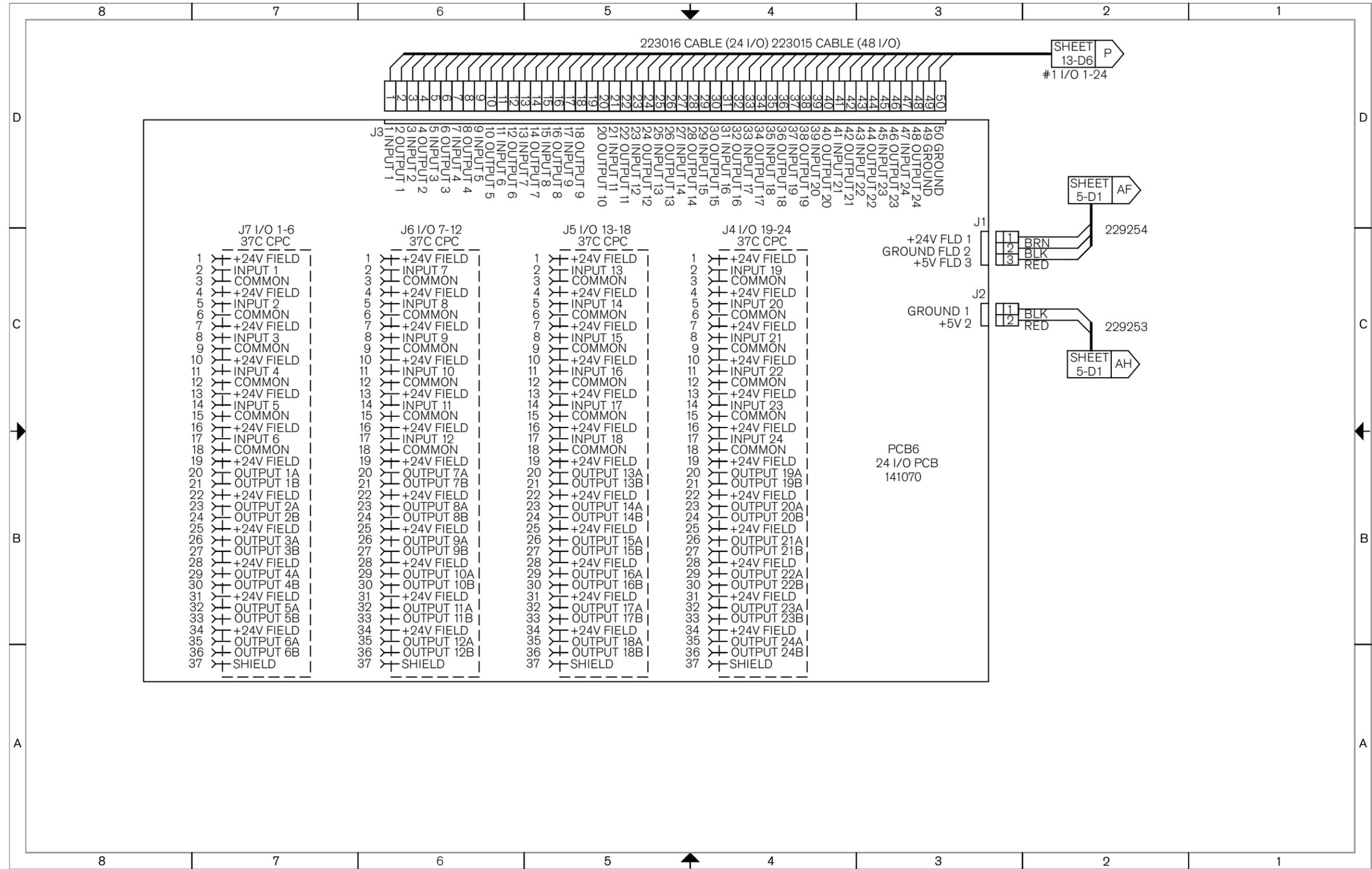
Sheet 10 – ATX power supply (229403)



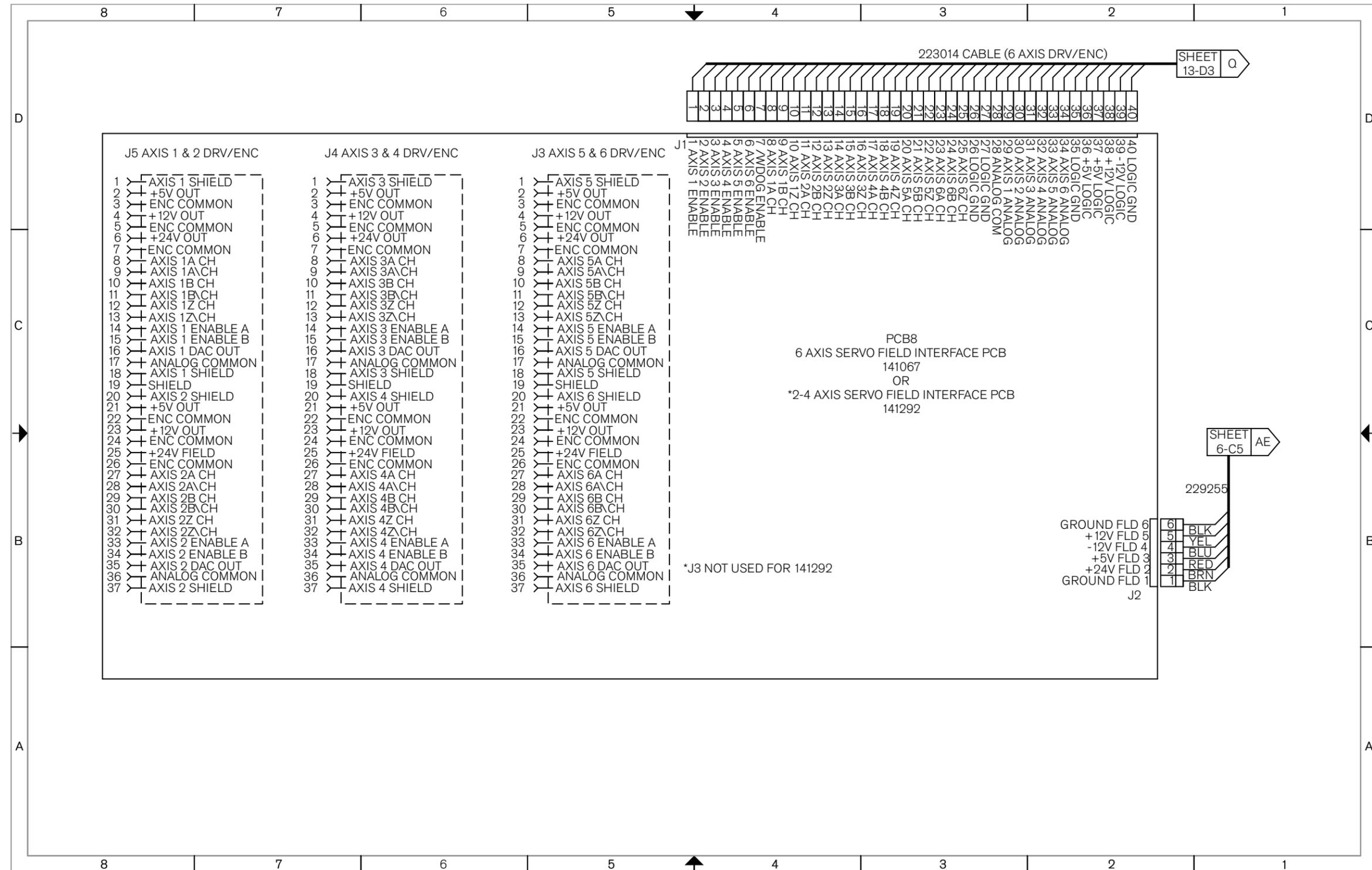
Sheet 12 – Utility and serial isolation board (141307)



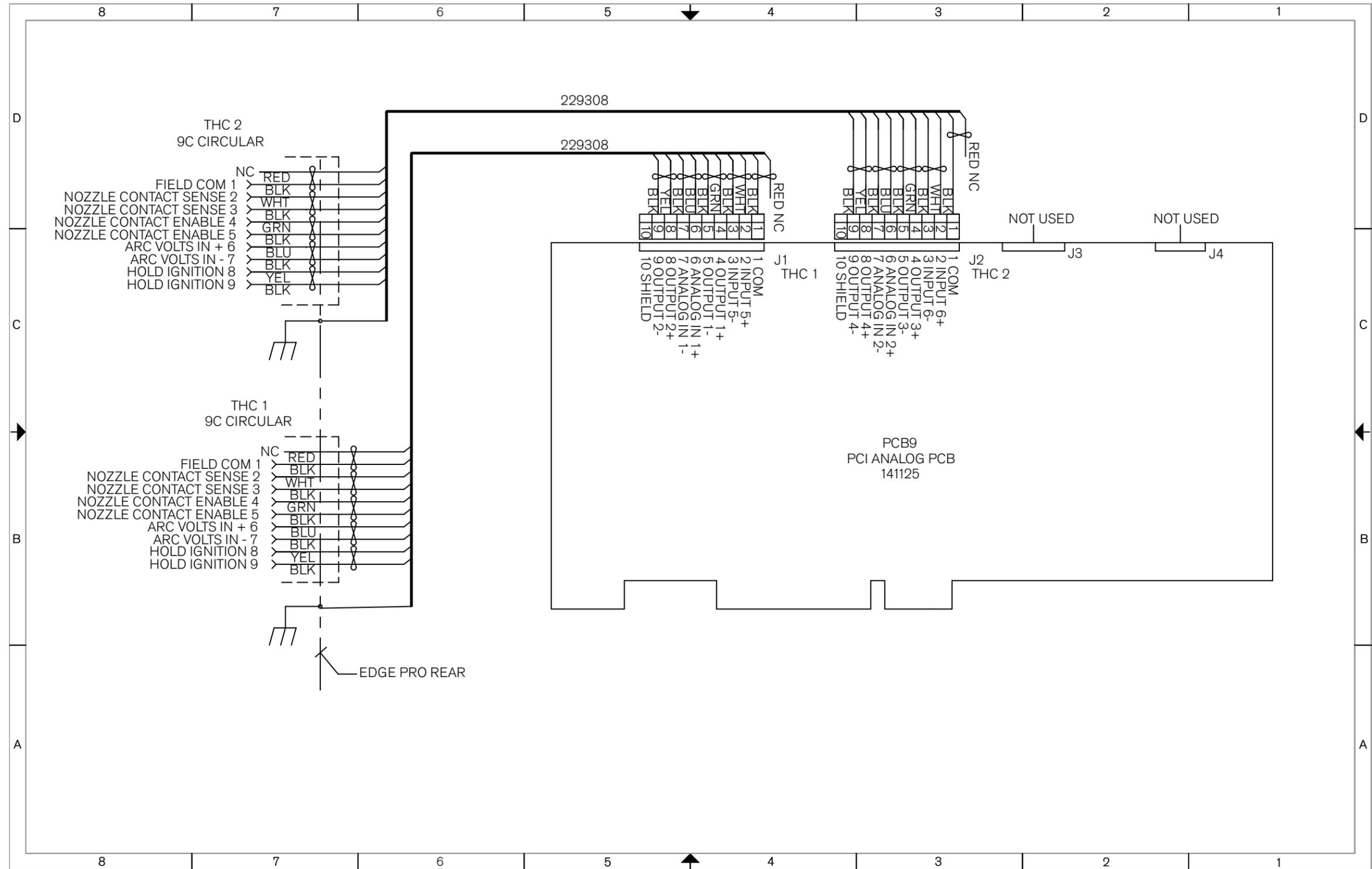
Sheet 13 – 4- and 6-Axis MCC board (141061)



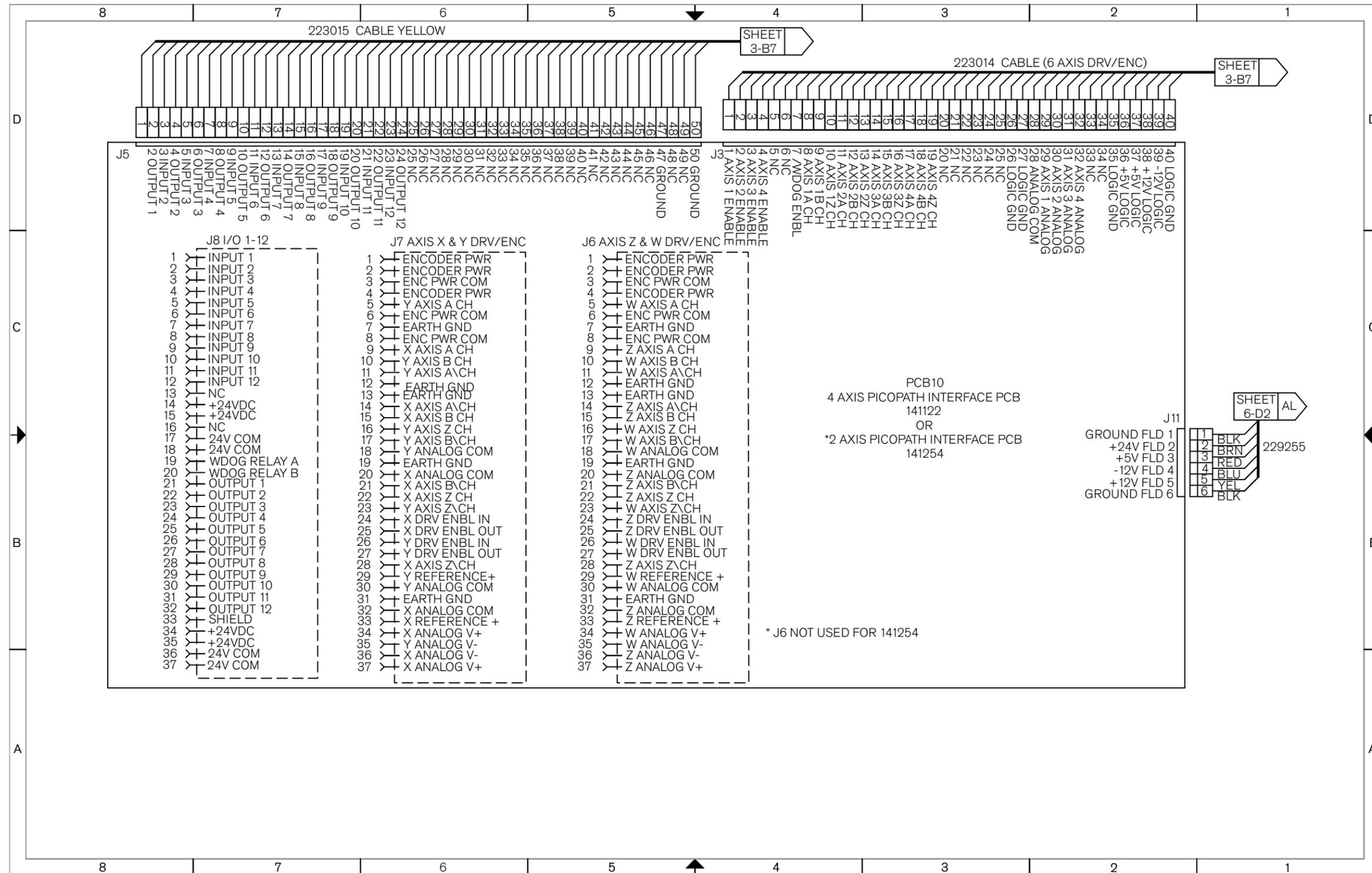
Sheet 14 – 24 I/O board (141070)



Sheet 15 – 4- and 6-Axis servo board (141292 and 141067)



Sheet 16 – Sensor THC analog board (141125)



Sheet 17 – 2- and 4-Axis servo and 12 I/O boards (141254 and 141122)