Hypertherm®

# Powermax65/85/105 SYNC™

## Troubleshooting Guide

810430 – REVISION 0

ENGLISH

# Register your new Hypertherm system

### Benefits of registration

- ☑ **Safety:** Registration allows us to contact you in the unlikely event a safety or quality notification is required.
- ☑ **Education:** Registration gives you free access to online product training content via the Hypertherm Cutting Institute.
- ☑ **Confirmation of ownership:** Registration can serve as proof of purchase in case of an insurance loss.

Go to **www.hypertherm.com/registration** for easy and fast registration.

If you experience any problems with the product registration process, please contact registration@hypertherm.com.

### For your records

Serial number: _____

Purchase date: _____

Distributor: _____

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Maintenance notes: _____

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Environmental stewardship is one of Hypertherm's core values. www.hypertherm.com/environment

100% Associate-owned

# *Powermax65/85/105 SYNC*

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Original instructions

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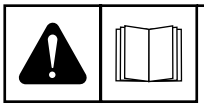
For training and education resources, go to the Hypertherm Cutting Institute (HCI) online at www.hypertherm.com/hci.

# Contents



**ENGLISH**

WARNING! Before operating any Hypertherm equipment, read the safety instructions in your product's manual, the *Safety and Compliance Manual* (80669C), *Waterjet Safety and Compliance Manual* (80943C), and *Radio Frequency Warning Manual* (80945C). Failure to follow safety instructions can result in personal injury or in damage to equipment.

Copies of the manuals can come with the product in electronic and printed formats. Electronic copies are also on our website. Many manuals are available in multiple languages at www.hypertherm.com/docs.

**BG (БЪЛГАРСКИ/BULGARIAN)**

ПРЕДУПРЕЖДЕНИЕ! Преди да работите с което и да е оборудване Hypertherm, прочетете инструкциите за безопасност в ръководството на вашия продукт, „Инструкция за безопасност и съответствие“ (80669C), „Инструкция за безопасност и съответствие на Waterjet“ (80943C) и „Инструкция за предупреждение за радиочестота“ (80945C).

Продуктът може да е съпроводен от копия на ръководствата в електронен и в печатен формат. Тези в електронен формат са достъпни също на уебсайта ни. Много ръководства са налице на няколко езика на адрес www.hypertherm.com/docs.

**CS (ČESKY/CZECH)**

VAROVÁNÍ! Před uvedením jakéhokoli zařízení Hypertherm do provozu si přečtěte bezpečnostní pokyny v příručce k produktu a v *Manuálu pro bezpečnost a dodržování předpisů* (80669C), *Manuálu pro bezpečnost a dodržování předpisů při řezání vodním paprskem* (80943C) a *Manuálu varování ohledně rádiových frekvencí* (80945C).

Kopie příruček mohou být součástí dodávky produktu, a to v elektronické i tištěné formě. Elektronické kopie jsou k dispozici i na našich webových stránkách. Mnoho příruček je k dispozici v různých jazycích na stránce www.hypertherm.com/docs.

**DA (DANSK/DANISH)**

ADVARSEL! Inden Hypertherm udstyr tages i brug skal sikkerhedsinstruktionerne i produktets manual og i *Manual om sikkerhed og overholdelse af krav* (80669C), *Manual om sikkerhed og overholdelse af krav for vandstråleskæring* (80943C), og *Manual om radiofrekvensadvarsel* (80945C), gennemlæses.

Kopier af manualerne kan leveres med produktet i elektronisk og trykt format. Elektroniske kopier findes også på vores hjemmeside. Mange manualer er tilgængelige på flere sprog på www.hypertherm.com/docs.

**DE (DEUTSCH/GERMAN)**

WARNUNG! Bevor Sie ein Hypertherm-Gerät in Betrieb nehmen, lesen Sie bitte die Sicherheitsanweisungen in Ihrer Bedienungsanleitung, das *Handbuch für Sicherheit und Übereinstimmung* (80669C), das *Handbuch für Sicherheit und Compliance bei Wasserstrahl-Schneidanlagen* (80943C) und das *Handbuch für Hochfrequenz-Warnung* (80945C).

Bedienungsanleitungen und Handbücher können dem Gerät in elektronischer Form oder als Druckversion beiliegen. In elektronischer Form liegen sie auch auf unserer Website vor. Viele Handbücher stehen in verschiedenen Sprachen auf www.hypertherm.com/docs zur Verfügung.

**ES (ESPAÑOL/SPANISH)**

¡ADVERTENCIA! Antes de operar cualquier equipo Hypertherm, lea las instrucciones de seguridad del manual de su producto, del *Manual de seguridad y cumplimiento* (80669C), del *Manual de seguridad y cumplimiento en corte con chorro de agua* (80943C) y del *Manual de advertencias de radiofrecuencia* (80945C).

El producto puede incluir copias de los manuales en formato digital e impreso. Las copias digitales también están en nuestra página web. Hay diversos manuales disponibles en varios idiomas en www.hypertherm.com/docs.

**ET (EESTI/ESTONIAN)**

HOIATUS! Enne Hyperthermi mis tahes seadme kasutamist lugege läbi toote kasutusjuhendis olevad ohutusjuhised ning *Ohutus- ja vastavusjuhend* (80669C), *Veejoa ohutuse ja vastavuse juhend* (80943C) ja *Raadiosageduse hoiatusjuhend* (80945C). Ohutusjuhiste eiramine võib põhjustada vigastusi ja kahjustada seadmeid.

Juhiste koopiad võivad tootega kaasas olla elektrooniliselt või trükituna. Elektroonilised koopiad on saadaval ka meie veebilehel. Paljud kasutusjuhendid on erinevates keeltes saadaval veebilehel www.hypertherm.com/docs.

**FI (SUOMI/FINNISH)**

VAROITUS! Ennen minkään Hypertherm-laitteen käyttöä lue tuotteen käyttöoppaassa olevat turvallisuusohjeet, *turvallisuuden ja vaatimustenmukaisuuden käsikirja* (80669C), vesileikkauksen *turvallisuuden ja vaatimustenmukaisuuden käsikirja* (80943C) ja *radiotaajuusvaroitusten käsikirja* (80945C).

Käyttöoppaiden kopiot voivat olla tuotteen mukana sähköisessä ja tulostetussa muodossa. Sähköiset kopiot ovat myös verkkosivustollamme. Monet käyttöoppaat ovat myös saatavissa useilla kielillä www.hypertherm.com/docs.

**FR (FRANÇAIS/FRENCH)**

AVERTISSEMENT! Avant d'utiliser tout équipement Hypertherm, lire les consignes de sécurité du manuel de votre produit, du *Manuel de sécurité et de conformité* (80669C), du *Manuel de sécurité et de conformité du jet d'eau* (80943C) et du *Manuel d'avertissement relatif aux radiofréqunces* (80945C).

Les exemplaires des manuels qui accompagnent le produit peuvent être sous forme électronique ou papier. Les manuels sous forme électronique se trouvent également sur notre site Internet. Plusieurs manuels sont offerts en plusieurs langues à www.hypertherm.com/docs.

**GR (ΕΛΛΗΝΙΚΑ/GREEK)**

ΠΡΟΕΙΔΟΠΟΙΗΣΗ! Πριν θέσετε σε λειτουργία οποιονδήποτε εξοπλισμό της Hypertherm, διαβάστε τις οδηγίες ασφαλείας στο εγχειρίδιο του προϊόντος και στο *εγχειρίδιο ασφάλειας και συμμόρφωσης* (80669C), στο *εγχειρίδιο ασφάλειας και συμμόρφωσης του waterjet* (80943C) και στο *εγχειρίδιο προειδοποιήσεων για τις ραδιοσυχνότητες* (80945C).

Το προϊόν μπορεί να συνοδεύεται από αντίγραφα των εγχειριδίων σε ηλεκτρονική και έντυπη μορφή. Τα ηλεκτρονικά αντίγραφα υπάρχουν επίσης στον ιστότοπό μας. Πολλά εγχειρίδια είναι διαθέσιμα σε διάφορες γλώσσες στο www.hypertherm.com/docs.

**HU (MAGYAR/HUNGARIAN)**

VIGYÁZAT! Mielőtt bármilyen Hypertherm berendezést üzemeltetne, olvassa el a biztonsági információkat a termék kézikönyvében, a *Biztonsági és szabálykövetési kézikönyvben* (80669C), a *Vízsugaras biztonsági és szabálykövetési kézikönyvben* (80943C) és a *Rádiófrekvenciás figyelmeztetéseket tartalmazó kézikönyvben* (80945C).

A termékhez a kézikönyv példányai elektronikus és nyomtatott formában is mellékelve lehetnek. Az elektronikus példányok webhelyünkön is megtalálhatók. Számos kézikönyv áll rendelkezésre több nyelven a www.hypertherm.com/docs weboldalon.

**ID (BAHASA INDONESIA/INDONESIAN)**

PERINGATAN! Sebelum mengoperasikan peralatan Hypertherm, bacalah petunjuk keselamatan dalam manual produk Anda, *Manual Keselamatan dan Kepatuhan* (80669C), *Manual Keselamatan dan Kepatuhan Jet Air* (80943C), dan *Manual Peringatan Frekuensi Radio* (80945C). Kegagalan mengikuti petunjuk keselamatan dapat menyebabkan cedera pribadi atau kerusakan pada peralatan.

Produk mungkin disertai salinan manual atau petunjuk dalam format elektronik maupun cetak. Salinan elektronik juga tersedia di situs web kami. Berbagai manual tersedia dalam beberapa bahasa di www.hypertherm.com/docs.

**IT (ITALIANO/ITALIAN)**

AVVERTENZA! Prima di usare un'attrezzatura Hypertherm, leggere le istruzioni sulla sicurezza nel manuale del prodotto, nel *Manuale sulla sicurezza e la conformità* (80669C), nel *Manuale sulla sicurezza e la conformità Waterjet* (80943C) e nel *Manuale di avvertenze sulla radiofrequenza* (80945C).

Copie del manuale possono accompagnare il prodotto in formato cartaceo o elettronico. Le copie elettroniche sono disponibili anche sul nostro sito web. Molti manuali sono disponibili in diverse lingue all'indirizzo www.hypertherm.com/docs.

**JA (日 本語 /JAPANESE)**

警告 ! Hypertherm 機器を操作する前に、この製品説明書にある安全情報、「安全とコンプライアンスマニュアル」(80669C) 、「ウォータージェットの安全とコンプライアンス」(80943C)、「高周波警告」(80945C) をお読みください。

説明書のコピーは、電子フォーマット、または印刷物として製品に同梱されています。電子コピーは当社ウェブサイトにも掲載されています。説明書の多くは www.hypertherm.com/docs にて複数の言語でご用意しています。

**KO (한국어/KOREAN)**

경고! Hypertherm 장비를 사용하기 전에 제품 설명서와 안전 및 규정 준수 설명서(80669C), 워터젯 안전 및 규정 준수 설명서(80943C) 그리고 무선 주파수 경고 설명서(80945C)에 나와 있는 안전 지침을 읽으십시오.

전자 형식과 인쇄된 형식으로 설명서 사본이 제품과 함께 제공될 수 있습니다. 전자 사본도 Hypertherm 웹사이트에서 보실 수 있으며 설명서 사본은 www.hypertherm.com/docs 에서 여러 언어로 제공됩니다.

**NE (NEDERLANDS/DUTCH)**

WAARSCHUWING! Lees voordat u Hypertherm-apparatuur gebruikt de veiligheidsinstructies in de producthandleiding, in de *Veiligheids- en nalevingshandleiding* (80669C) in de *Veiligheids- en nalevingshandleiding voor waterstralen* (80943C) en in de *Waarschuwingshandleiding radiofrequentie* (80945C).

De handleidingen kunnen in elektronische en gedrukte vorm met het product worden meegeleverd. Elektronische versies zijn ook beschikbaar op onze website. Veel handleidingen zijn in meerdere talen beschikbaar via www.hypertherm.com/docs.

**NO (NORSK/NORWEGIAN)**

ADVARSEL! Før du bruker noe Hypertherm-utstyr, må du lese sikkerhetsinstruksjonene i produktets håndbok, *håndboken om sikkerhet og samsvar* (80669C), *håndboken om vannjet sikkerhet og samsvar* (80943C), og *håndboken om radiofrekvensadvarsler* (80945C).

Eksemplarer av håndbøkene kan følge med produktet i elektronisk og trykt form. Elektroniske eksemplarer finnes også på nettstedet vårt. Mange håndbøker er tilgjengelig i flere språk på www.hypertherm.com/docs.

**PL (POLSKI/POLISH)**

OSTRZEŻENIE! Przed rozpoczęciem obsługi jakiegokolwiek systemu firmy Hypertherm należy się zapoznać z instrukcjami bezpieczeństwa zamieszczonymi w podręczniku produktu, w p*odręczniku bezpieczeństwa i zgodności* (80669C), *podręczniku bezpieczeństwa i zgodności systemów strumienia wody* (80943C) oraz *podręczniku z ostrzeżeniem o częstotliwości radiowej* (80945C).

Do produktu mogą być dołączone podręczniki użytkownika w formie elektronicznej i drukowanej. Kopie elektroniczne znajdują się również w naszej witrynie internetowej. Wiele podręczników jest dostępnych w różnych językach pod adresem www.hypertherm.com/docs.

**PT (PORTUGUÊS/PORTUGUESE)**

ADVERTÊNCIA! Antes de operar qualquer equipamento Hypertherm, leia as instruções de segurança no manual do seu produto, no *Manual de Segurança e de Conformidade* (80669C), no *Manual de Segurança e de Conformidade do Waterjet* (80943C) e no *Manual de Advertência de radiofrequência* (80945C).

Cópias dos manuais podem vir com o produto nos formatos eletrônico e impresso. Cópias eletrônicas também são encontradas em nosso website. Muitos manuais estão disponíveis em vários idiomas em www.hypertherm.com/docs.

**RO (ROMÂNĂ/ROMANIAN)**

AVERTIZARE! Înainte de utilizarea oricărui echipament Hypertherm, citiți instrucțiunile de siguranță din manualul produsului, *manualul de siguranță și conformitate* (80669C), *manualul de siguranță și conformitate Waterjet* (80943C) și din *manualul de avertizare privind radiofrecvența* (80945C).

Produsul poate fi însoțit de copii ale manualelor în format tipărit și electronic. Exemplarele electronice sunt disponibile și pe site-ul nostru web. Numeroase manuale sunt disponibile în mai mult limbi la adresa: www.hypertherm.com/docs.

**RU (РУССКИЙ/RUSSIAN)**

БЕРЕГИСЬ! Перед работой с любым оборудованием Hypertherm ознакомьтесь с инструкциями по безопасности, представленными в руководстве, которое поставляется вместе с продуктом, в *Руководстве по безопасности и соответствию* (80669C), в *Руководстве по безопасности и соответствию для водоструйной резки* (80943C) и *Руководстве по предупреждению о радиочастотном излучении* (80945C).

Копии руководств, которые поставляются вместе с продуктом, могут быть представлены в электронном и бумажном виде. Электронные копии также доступны на нашем веб-сайте. Целый ряд руководств доступны на нескольких языках по ссылке www.hypertherm.com/docs.

**SK (SLOVENČINA/SLOVAK)**

VÝSTRAHA! Pred použitím akéhokoľvek zariadenia od spoločnosti Hypertherm si prečítajte bezpečnostné pokyny v návode na obsluhu vášho zariadenia a v *Manuáli o bezpečnosti a súlade s normami* (80669C), *Manuáli o bezpečnosti a súlade s normami pre systém rezania vodou* (80943C) a v *Manuáli s informáciami o rádiofrekvencii* (80945C).

Návod na obsluhu sa dodáva spolu s produktom v elektronickej a tlačenej podobe. Jeho elektronický formát je dostupný aj na našej webovej stránke. Mnohé z návodov na obsluhu sú dostupné vo viacjazyčnej mutácii na stránke www.hypertherm.com/docs.

**SL (SLOVENŠČINA/SLOVENIAN)**

OPOZORILO! Pred uporabo katerekoli Hyperthermove opreme preberite varnostna navodila v priročniku vašega izdelka, v *Priročniku za varnost in skladnost* (80669C), v P*riročniku za varnost in skladnost sistemov rezanja z vodnim curkom* (80943C) in v *Priročniku Opozorilo o radijskih frekvencah* (80945C).

Izvodi priročnikov so lahko izdelku priloženi v elektronski in tiskani obliki. Elektronski izvodi so na voljo tudi na našem spletnem mestu. Številni priročniki so na voljo v različnih jezikih na naslovu www.hypertherm.com/docs.

**SR (SRPSKI/SERBIAN)**

UPOZORENJE! Pre rukovanja bilo kojom Hyperthermovom opremom pročitajte uputstva o bezbednosti u svom priručniku za proizvod, *Priručniku o bezbednosti i usaglašenosti* (80669C), *Priručniku o bezbednosti i usaglašenosti Waterjet tehnologije* (80943C) i *Priručniku sa upozorenjem o radio-frekvenciji* (80945C).

Уз производ се испоручују копије приручника у електронском или штампаном формату. Електронске копије су такође доступне на нашем веб-сајту. Многи приручници су доступни на више језика на адреси www.hypertherm.com/docs.

**SV (SVENSKA/SWEDISH)**

VARNING! Läs häftet säkerhetsinformationen i din produkts *säkerhets- och efterlevnadsmanual* (80669C), *säkerhets- och efterlevnadsmanualen för Waterjet* (80943C) och *varningsmanualen för radiofrekvenser* (80945C) för viktig säkerhetsinformation innan du använder eller underhåller Hypertherm-utrustning.

Kopior av manualerna kan medfölja produkten i elektroniskt och tryckt format. Elektroniska kopior finns också på vår webbplats. Många manualer finns på flera språk på www.hypertherm.com/docs.

**TH (ภาษาไทย/THAI)**

คำเตือน! ก่อนการใช้งานอุปกรณ์ของ Hypertherm ทั้งหมด โปรดอ่านคำแนะนำด้านความปลอดภัยในคู่มือการใช้สินค้า คู่มือด้านความปลอดภัยและการปฏิบัติตาม (80669C), คู่มือด้านความปลอดภัยและการปฏิบัติตามสำหรับการใช้หัวตัดระบบวอเตอร์เจ็ต (80943C) และ คู่มือคำเตือนเกี่ยวกับความถี่วิทยุ (80945C) การไม่ปฏิบัติตามคำแนะนำด้านความปลอดภัยอาจส่งผลให้เกิดการบาดเจ็บหรือเกิดความเสียหายต่ออุปกรณ์

สำเนาคู่มือทั้งในรูปแบบอิเล็กทรอนิกส์และแบบสิ่งพิมพ์จะถูกแนบมาพร้อมกับผลิตภัณฑ์ สำเนาคู่มือในรูปแบบอิเล็กทรอนิกส์ของผลิตภัณฑ์และสำเนาคู่มือต่าง ๆ ในหลากหลายภาษานั้นยังมีให้บริการบนเว็บไซต์ www.hypertherm.com/docs ของเราอีกด้วย

**TR (TÜRKÇE/TURKISH)**

UYARI! Bir Hypertherm ekipmanını çalıştırmadan önce, ürününüzün kullanım kılavuzunda, *Güvenlik ve Uyumluluk Kılavuzu'nda* (80669C), *Su Jeti Güvenlik ve Uyumluluk Kılavuzu'nda* (80943C) ve *Radyo Frekansı Uyarısı Kılavuzu'nda* (80945C) yer alan güvenlik talimatlarını okuyun.

Kılavuzların kopyaları, elektronik ve basılı formatta ürünle birlikte verilebilir. Elektronik kopyalar web sitemizde de yer alır. Kılavuzların birçoğu www.hypertherm.com/docs adresinde birçok dilde mevcuttur.

**VI (TIẾNG VIỆT/VIETNAMESE)**

CẢNH BÁO! Trước khi vận hành bất kỳ thiết bị Hypertherm nào, hãy đọc các hướng dẫn an toàn trong hướng dẫn sử dụng sản phẩm của bạn, *Sổ tay An toàn và Tuân thủ* (80669C), *Sổ tay An toàn và Tuân thủ Tia nước* (80943C), và *Hướng dẫn Cảnh báo Tần số Vô tuyến* (80945C). Không tuân thủ các hướng dẫn an toàn có thể dẫn đến thương tích cá nhân hoặc hư hỏng thiết bị.

Bản sao của sổ tay có thể đi kèm với sản phẩm ở định dạng điện tử và in. Bản điện tử cũng có trên trang web của chúng tôi. Nhiều sổ tay có sẵn bằng nhiều ngôn ngữ tại www.hypertherm.com/docs.

**ZH-CN (简 体中文/CHINESE SIMPLIFIED)**

警告！ 在操作任何海宝设备之前，请阅读产品手册、《安全和法规遵守手册》(80669C)、《水射流安全和法规遵守手册》 (80943C) 以及 《射频警告手册》(80945C) 中的安全操作说明。

随产品提供的手册可提供电子版和印刷版两种格式。电子版本同时也在我们的网站上提供。很多手册有多种语言版本，详见 www.hypertherm.com/docs.

**ZH-TW (繁 體中文/CHINESE TRADITIONAL)**

警告！在操作任何 Hypertherm 設備前，請先閱讀您產品手冊內的安全指示，包括 《安全和法規遵從手冊》(80669C) 、《水刀安全和法規遵從手冊》( 80943C )，以及 《無線電頻率警示訊號手冊》( 80945C )。

電子版和印刷版手冊複本可能隨產品附上。您也可以前往我們的網站下載電子版手冊。我們的網站上還以多種語言形式提供多種手冊，請造訪 www.hypertherm.com/docs。

# 1 Before You Begin

This manual helps you with the troubleshooting of fault code conditions and related system problems. **The information in this manual is for qualified service technicians only.**

If additional assistance with repairing the system is necessary:

1. Get the serial number for your system from the data plate that is on the rear panel of the plasma power supply.
2. Contact your Hypertherm distributor or authorized repair facility.
3. Contact the nearest Hypertherm office shown in the front of this manual.

For related information, refer to the following documents:

- *Powermax65/85 SYNC Service Parts and Procedures Guide* (810440)
- *Powermax105 SYNC Service Parts and Procedures Guide* (810450)
- *SmartSYNC Torches Service Parts and Procedures Guide* (810460)
- *Powermax65/85/105 SYNC Operator Manual* (810470)
- *Powermax65/85/105 SYNC Mechanized Cutting Guide* (810480)

Technical documentation is available at www.hypertherm.com/docs.

Technical documentation is current as of the date of its release. Subsequent revisions are possible. Refer to www.hypertherm.com/docs for the most recent revisions of released documents.

# 2 Prepare to Troubleshoot Internal Components

Because of the complexity of the circuits in plasma power supplies and torches, it is necessary that service technicians know inverter power supply theory. Refer to How the Plasma Power Supply Operates on page 157. In addition to being technically qualified, technicians must do all testing with safety in mind.

If questions or problems occur during servicing, contact the correct Hypertherm Technical Service office shown in the front of this manual.

## ⚠ WARNING

**ELECTRIC SHOCK CAN KILL**

Turn OFF (**O**) the power and disconnect the electrical power before removing the cover from the plasma power supply. If the plasma power supply is connected directly to a line disconnect box, switch the line disconnect to OFF (**O**). In the U.S., use a "lock-out / tag-out" procedure until the service or maintenance work is complete. In other countries, follow appropriate national or local safety procedures.

Do not touch live electrical parts! Do not touch the tip of the nozzle when the system is powered ON (**I**)! If power is required for servicing, use extreme caution when working near live electrical circuits. Dangerous voltages inside the plasma power supply can cause serious injury or death.

Do not attempt to repair the power PCB or control PCB. Do not cut away or remove any protective conformal coating from these PCBs. To do so risks a short circuit between the AC input circuit and the output circuit and may result in serious injury or death.

## ⚠ WARNING

Always put on correct personal protective equipment (PPE) before you do tests on equipment that is connected to power.

## ⚠ CAUTION

**HOT PARTS CAN CAUSE SEVERE BURNS**

Let the plasma power supply become cool before doing maintenance. Wait for approximately 1 hour to make sure that the temperature of the plasma power supply is approximately at room temperature.

## ⚠ CAUTION

**MOVING BLADES CAN CAUSE INJURY**

Keep hands away from moving parts.

## *NOTICE*

Static electricity can cause damage to printed circuit boards (PCBs). Use correct precautions when you touch PCBs.

Keep PCBs in antistatic containers.

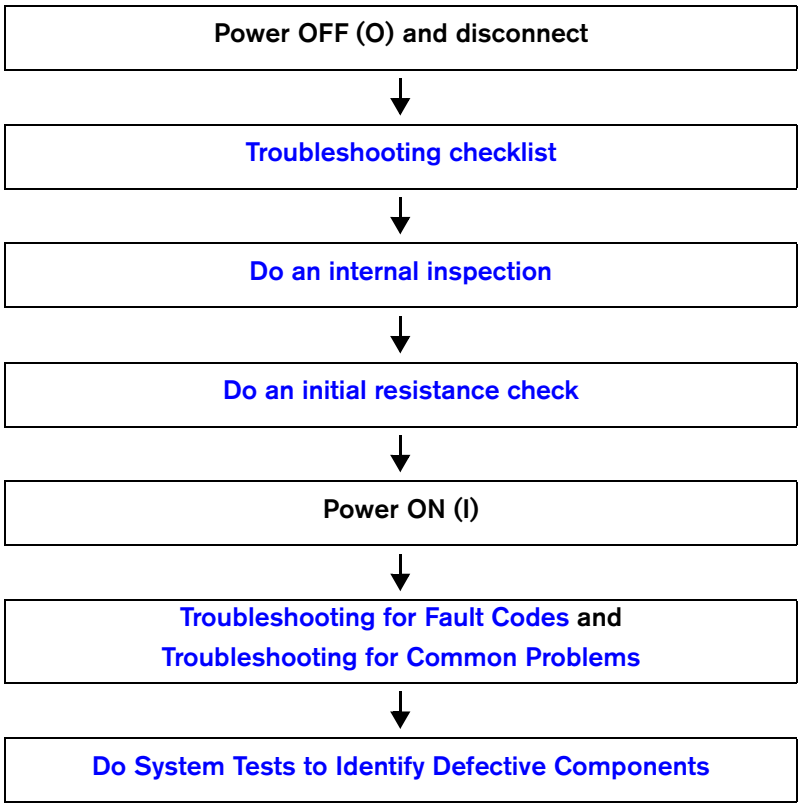
Put on a grounded wrist strap when you touch PCBs.

# Troubleshooting procedures and sequence

When you do the troubleshooting procedures, refer to the following:

- *Safety and Compliance Manual* (80669C) for detailed safety information
- System Diagrams on page 173 for electrical schematics
- Replacement parts and repair procedures in the following documents:
  - *Powermax65/85 SYNC Service Parts and Repair Procedures* (810440)
  - *Powermax105 SYNC Service Parts and Repair Procedures* (810450)
  - *SmartSYNC Torches Service Parts and Repair Procedures* (810460)

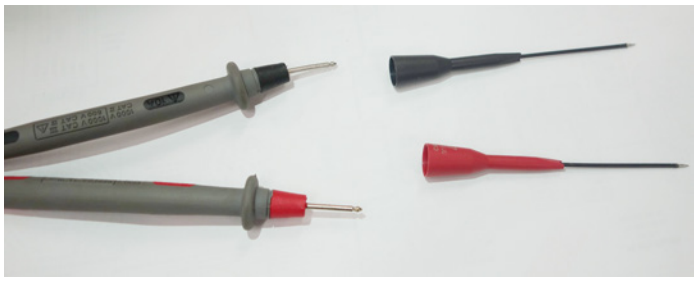
The most recent revisions of technical documentation are available at www.hypertherm.com/docs.



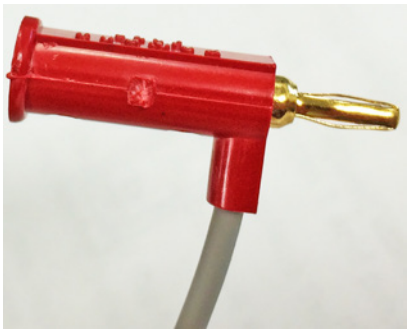

After you repair the problem, do a test of the plasma power supply for correct operation. Refer to Sequence of operation on page 158.

# Get the necessary test equipment

- Multimeter with a variety of test leads, including the following:
  - **Extended thin meter points** – Use extended thin meter points to get a voltage or resistance reading on certain parts of the power PCB.



  - **Miniature banana plugs** – The power PCB contains test points with a diameter of 2.25 mm (0.09 inch) that accept miniature banana plugs (for example, Pamona® 2945 plugs).



- **Hypertherm IGBT tester (128883)** – Refer to Hypertherm IGBT tester on page 32.
- Assorted jumpers and jumper wires.

# Troubleshooting checklist

Make sure that operators go through the following checklist before you remove the cover from the plasma power supply and examine internal components.

| Examine the power source | |
|---|---|
| ☐ | Can the power source supply sufficient power to the plasma power supply for the applications that you are doing?<br>If you are using a generator, make sure that it has sufficient power to let you do a full plasma arc stretch. Refer to Generator considerations on page 62. For power requirements for generators, refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| ☐ | Are the circuit breakers or fuses sufficient for your plasma power supply and for the applications that you are doing? The recommended fuse / breaker sizes let the input current increase quickly when you stretch the plasma arc. |
| ☐ | Did the circuit breaker open (trip)? |

| Make sure that the mechanized cutting system is grounded and set up correctly (if applicable) | |
|---|---|
| ☐ | Is the mechanized cutting system correctly grounded or bonded? For information on grounding best practices, refer to the *Powermax65/85/105 SYNC Mechanized Cutting Guide* (810480). |
| ☐ | Does the routing of all cables keep electromagnetic interference (EMI), also called noise, to a minimum? For information on best practices to decrease noise, refer to the *Powermax65/85/105 SYNC Mechanized Cutting Guide* (810480).<br>For example, keep the torch lead and work lead together by using cable ties or intertwining them like a twisted pair. Also keep the routing of the torch lead and work lead separate from the shielded cables and from all other components of the mechanized cutting system. |
| ☐ | Does other industrial equipment share the same ground as the plasma power supply? This can cause noise problems.<br>For example, do you have an inverter-type welder with a work lead that is connected to the same cutting table (or workpiece) as the plasma power supply? Disconnect the welder from power, and remove its work lead from the cutting table. |
| ☐ | Is excess cable wound into coils? This can cause noise problems. Instead, put the excess cable down flat or in a figure-8 shape. |
| ☐ | If you are using torch height control (THC), is an ohmic contact ring (428895) installed on the Hypertherm cartridge? Is the ohmic contact ring connected correctly to the THC? |
| ☐ | If you are using torch height control (THC) and are connecting to raw arc voltage directly, is the wiring correct?<br>▪ Is the correct wire gauge used?<br>▪ Are the wires connected to the correct locations on the power PCB?<br>▪ Are the wires fully tightened?<br>Incorrect wiring can cause noise problems and in some cases can cause severe damage to the plasma power supply. For instructions on how to correctly connect to raw arc voltage, refer to the *Powermax65/85/105 SYNC Raw Arc Voltage Field Service Bulletin* (810320). |

| Examine the plasma power supply | |
|---|---|
| ☐ | Is the plasma power supply in an upright position on a flat, level surface? |
| ☐ | Does the plasma power supply have sufficient ventilation (approximately 0.25 m or 10 inches of clearance on all sides)? |
| ☐ | Are the louvers in the plasma power supply cover blocked? |
| ☐ | Is the power switch on the rear panel of the plasma power supply operating correctly? |
| ☐ | Is there any visible damage to the plasma power supply? |

| Examine the front panel controls | |
|---|---|
| ☐ | Is the fault LED on? Does a fault code and fault icon show on the status screen? Is the AC LED flashing? Refer to Fault codes and solutions on page 39. |
| ☐ | Make sure that the operating mode is correct. For example, use Expanded Metal mode only when you are cutting expanded metal. |
| ☐ | Does the status screen show the non-default configuration icon (at right) but not the 105 icon? Does the plasma power supply operate as expected? For example, does the plasma power supply not change to the correct operating mode for the Hypertherm cartridge that you installed when you are using a SmartSYNC torch and Hypertherm cartridge?<br>If so, set the plasma power supply back to factory default settings to see if that is a solution to the problem. Push and hold and at the same time for approximately 2 seconds. Refer to Set system settings to factory default on page 156. |

| Examine the power cord* | |
|---|---|
| ☐ | Is the power cord plugged in? Or is it connected correctly to a line-disconnect switch or other power source? |
| ☐ | Is there any visible damage to the power cord? Are any wires exposed or frayed? |
| ☐ | Examine the power cord wires in the power plug or line-disconnect box. Are any of the wires short-circuited? |
| ☐ | Is the power plug correct for the power cord? For example, do not install a 1-phase power *plug* on a 3-phase power *cord*. |
| ☐ | **Powermax65/85 SYNC CSA plasma power supplies:** If you are using the plasma power supply on 1-phase power, did you install a 1-phase power cord? Are the wires in the power cord and power plug correct for 1-phase power? The plasma power supply comes with a 3-phase power cord. Refer to the installation instructions in the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>Powermax105 SYNC plasma power supplies cannot be used on 1-phase power. |
| ☐ | Is the power cord ground wire connected to ground in the plasma power supply and in the power plug or line-disconnect box? |
| ☐ | Are the rest of the power cord wires connected correctly in the plasma power supply and in the power plug or line-disconnect box? Refer to the installation instructions in the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| ☐ | Are the power cord wires fully tightened inside the plasma power supply and in the power plug or line-disconnect box? |

* Make sure that any changes to the plasma power supply or power cord are done by a licensed electrician.

| Examine the work lead and work clamp | |
|---|---|
| ☐ | Is the work lead connected correctly to the plasma power supply? Make sure that you turn the connector clockwise approximately 1/4 turn until the connector is fully engaged in the lock position. |
| ☐ | If you are using a water table, are the work clamp and work lead above the water line? It is very important to prevent the work lead from getting wet.<br>Hypertherm recommends that you do the following:<br>▪ Connect the work lead to the outside frame of the water table.<br>▪ Put the plasma power supply higher than the work clamp and the water table.<br>These steps decrease the likelihood that water will get into the plasma power supply through the work lead. |
| ☐ | Examine the work lead. Are any wires exposed or frayed? Is the lead twisted or kinked? |
| ☐ | Are the work lead and work clamp correctly rated for the plasma power supply? For example, do not use a 65 A work lead with a Powermax85 SYNC plasma power supply. The amperage is identified near the rubber boot of the work lead connector. |
| ☐ | Is the work clamp connected to the workpiece that you are cutting? For mechanized cutting, is the clamp connected to the cutting table? |
| ☐ | Does the work clamp have good metal-to-metal contact? If not, remove any rust, paint, or other debris to give a clean surface for a better connection. |

| Examine the torch and torch lead | |
|---|---|
| ☐ | Is the torch lead connected correctly to the plasma power supply? The torch lead connector makes a click when it is fully connected. |
| ☐ | Examine the torch lead. Are any wires exposed or frayed? Is the lead twisted or kinked? |
| ☐ | Examine the torch handle or shell. Are any wires exposed? Are any wires pinched at the seam where the 2 halves of the shell come together? Are there any other signs of damage to the shell? |
| ☐ | **SmartSYNC hand torches:** Is the status LED on the torch solid yellow or red? Is the status LED flashing yellow? |
| ☐ | **All hand torches:** Are there any signs of damage to the torch trigger? Are the trigger and safety latch operating correctly? |
| ☐ | Is the torch-lock switch operating correctly? The mini machine torch does not have a torch-lock switch. |

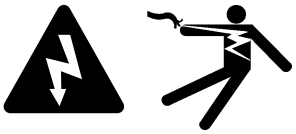
| Examine the Hypertherm cartridge | |
|---|---|
| ☐ | Is the Hypertherm cartridge worn or damaged? A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life. |
| ☐ | Is the Hypertherm cartridge installed correctly? |
| ☐ | Did you select the correct Hypertherm cartridge for the job that you are doing? |
| ☐ | Is the operating mode correct for the Hypertherm cartridge that you are using? Use a cutting cartridge in Cut mode and Expanded Metal mode. Use a gouging cartridge in Gouge mode. |

| Examine the gas supply | |
|---|---|
| ☐ | Is the gas supply hose connected correctly to the fitting on the rear panel of the plasma power supply? |
| ☐ | Is the gas supply hose connected correctly to the air compressor, gas cylinder, or other gas source? |
| ☐ | Examine each fitting and connection point in the gas supply line. Are there any signs of leaks? |
| ☐ | Is the gas supply hose twisted or kinked? Are there any other signs of damage to the hose? |
| ☐ | Is there anything that can be causing the pressure to decrease too much while cutting? For example, is the gas supply hose too long? Are there other devices that use gas from the same source? |
| ☐ | Is sufficient gas pressure getting to the plasma power supply? Refer to page 23. |
| ☐ | Are you able to keep gas pressure constant while you are cutting? Refer to page 23. |

| Examine the gas quality | |
|---|---|
| ☐ | Examine the whole gas supply line. Are there any signs of contamination, such as from oil, water, or dirt? It is extremely important to keep a clean, dry gas line. Refer to page 24. |
| ☐ | Is your air filtration system sufficient to prevent moisture, oil, and other contaminants from getting into the plasma power supply's gas line? Add additional filtration if necessary. Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470) for more information. |
| ☐ | Examine the filter element in the plasma power supply's built-in air filter. Is it contaminated? To replace it, refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |

## Do an internal inspection

**⚠ WARNING**



**SHOCK HAZARD**

You can get a serious electric shock if you touch exposed plasma power supply components. Electric shock can seriously injure or kill you.

You must install the component barrier and the plasma power supply cover. Never operate the plasma power supply unless the component barrier and the plasma power supply cover are in position.

1. Set the power switch on the plasma power supply to OFF (**O**) and disconnect the power cord.
2. Disconnect the gas supply.
3. Remove the plasma power supply cover and the component barrier. Make sure to replace the barrier when you are finished working on the plasma power supply.
4. Inspect the inside of the plasma power supply, especially on the side with the power PCB. Look for broken or loose wiring connections, burn and char marks, and damage to components. Repair or replace internal components as necessary.

# Frequently used troubleshooting procedures

The following procedures are used frequently to help with troubleshooting:



## Do a cold restart or quick restart

### Do a cold restart

1. Set the power switch on the plasma power supply to OFF (**O**).
2. Wait approximately 1 minute.

   If you are using a SmartSYNC hand torch, wait until all the amperage LEDs on the hand torch go off.

3. Set the power switch on the plasma power supply to ON (**I**).

### Do a quick restart

1. Set the power switch on the plasma power supply to OFF (**O**).
2. Immediately set the power switch on the plasma power supply to ON (**I**).

   If a fault occurs while you are using a generator, a quick restart does not always remove the fault. Do a cold restart instead.

## Examine the gas pressure

- **Inlet gas supply:** Incorrect gas pressure can cause errors that prevent cutting or problems with cut quality. Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470) for information on the inlet gas supply requirements. For optimum system performance, make sure that the inlet gas pressure stays between 7.6 bar – 8.3 bar (110 psi – 120 psi) while gas is flowing. **Never use more than the maximum gas pressure of 9.3 bar (135 psi).**
- **Gas hose:** An incoming gas supply hose with too small a diameter can cause problems with cut quality and cut performance. For gas hoses that are less than 15 m (50 feet), use an internal diameter of 10 mm (3/8 inch) or greater. For gas hoses that are 15 m – 30 m (50 feet – 100 feet), use an internal diameter of 13 mm (1/2 inch) or greater.
- **Pressure setting:** The plasma power supply adjusts gas pressure automatically, but you can adjust the gas pressure manually if necessary.

  If you manually adjust the gas pressure and then start to see problems with cut quality or cut performance, set the gas pressure back to the default setting.
- **Gas test:** You can do a gas test to see if the plasma power supply's actual output gas pressure is lower than the set pressure by more than an acceptable quantity. The set pressure is the gas pressure that the system sets to align with the type of cartridge and torch installed.
- **Pressure gauge:** Install an inline pressure gauge at the gas inlet on the back of the plasma power supply, after all external filtration. Use this gauge to monitor the gas pressure during cutting and when the system is idle. The gas pressure should be stable. For optimum system performance, make sure that the inlet gas pressure stays between 7.6 bar – 8.3 bar (110 psi – 120 psi) while gas is flowing.

## Examine the gas quality

It is extremely important to keep a clean, dry gas line to prevent oil, water, dirt, and other contaminants from causing damage to internal components. A clean gas line also helps you to get optimal cut quality and consumable life.

Dirty, oily air is the root cause of many common problems that occur in Powermax plasma power supplies. In some conditions it can void the warranty on the plasma power supply and torch. Refer to the gas quality recommendations in the *Powermax65/85/105 SYNC Operator Manual* (810470).

The plasma power supply's built-in air filter can remove particulates as small as 5 microns. It can also remove some moisture from the gas supply. But if you work in an environment that is extremely warm and humid, or if work site conditions let oil, vapor, or other contaminants into the gas line, install an external filtration system that cleans the gas supply before it gets into the plasma power supply.

**NOTICE**

**DIRTY, OILY AIR CAN CAUSE DAMAGE TO THE AIR FILTER BOWL**

Synthetic lubricants containing esters that are used in some air compressors can cause damage to the polycarbonates in the air filter bowl. Add additional gas filtration if necessary.

To keep a clean gas line:

1. Examine the air filter element in the plasma power supply's built-in air filter. Replace it if it is contaminated. Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470).

2. Clean the air filter bowl. Remove oil, dirt, and other contaminants.

   A yellow residue on the filter bowl shows that oil is getting into the gas supply line.

3. Examine the O-ring at the top of the air filter bowl. Replace it if it has cracks or other damage.

4. If you use an external air filtration system, clean or replace any parts in it that are possibly contaminated.

## Do a check for continuity

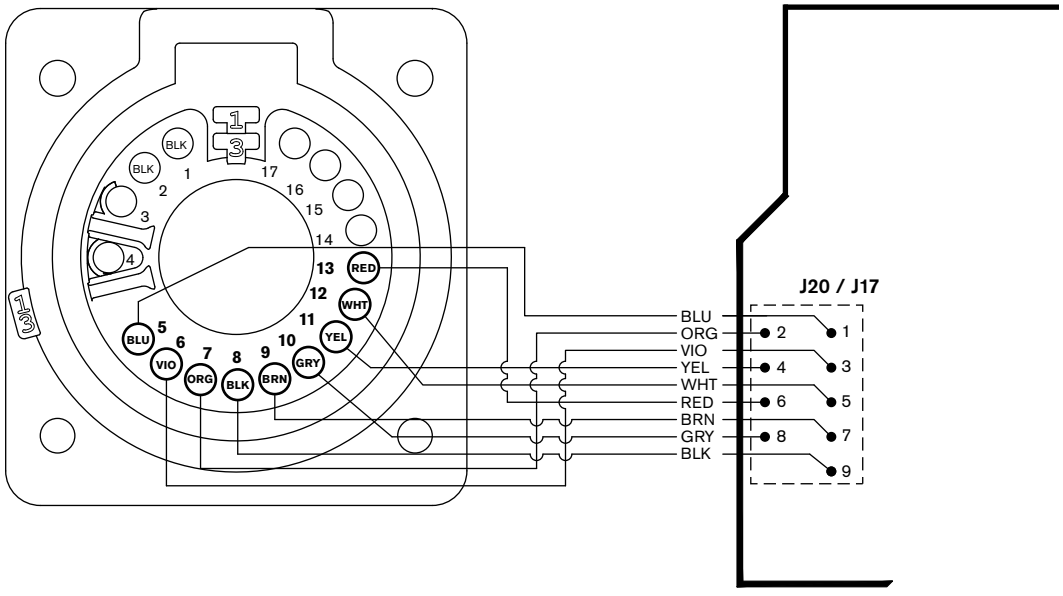
For some torch-related faults, you can do a check for continuity between the following test points to identify if the problem is with the plasma power supply. If there is no continuity between any of these points, replace the quick-disconnect receptacle.

**Table 1** – Continuity test points in the plasma power supply

| Quick-disconnect receptacle | J20 or J17 on the power PCB* | Wire color |
|---|---|---|
| 5 | 1 | Blue |
| 6 | 3 | Violet |
| 7 | 2 | Orange |
| 8 | 9 | Black |
| 9 | 7 | Brown |
| 10 | 8 | Gray |
| 11 | 4 | Yellow |
| 12 | 5 | White |
| 13 | 6 | Red |

* J20 on Powermax65/85 SYNC / J17 on Powermax105 SYNC.

**Table 2** – Continuity test points in the plasma power supply



# Do a gas test

Do a gas test to make sure that sufficient gas pressure is getting to the torch.

**⚠ WARNING**

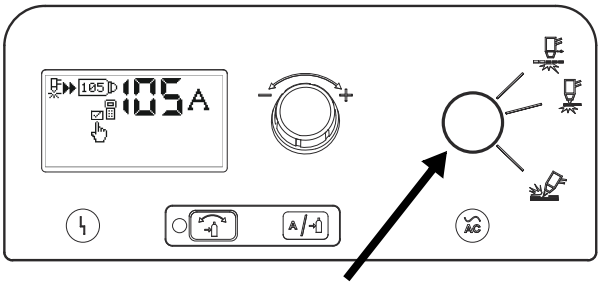
**CHANCE OF BURNS AND CUTS**

Point the torch away from you before doing a gas test. Always keep hands, clothes, and objects away from the torch tip. Never point the torch toward yourself or others.

## Start and stop a gas test in automatic gas pressure mode

1. Set the SmartSYNC torch to the green "ready to fire" (✓) position.
2. **Hand torches:** Fire the torch 1 time to get the warning puffs of air.
3. Make sure that the correct operating mode is selected for the process that you want to examine: Cut mode, Gouge mode, or Expanded Metal mode.
4. Push and hold the operating mode button for 2 seconds until the gas test screen shows.

   Gas flows continuously from the torch when the plasma power supply is in gas test mode.

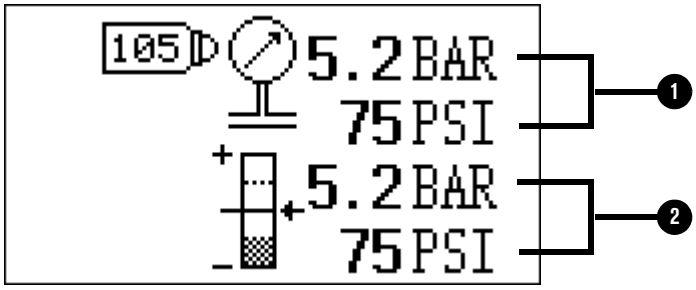



Push and hold for 2 seconds.

5. Use the gas test screen to compare the plasma power supply's actual output gas pressure ❶ to the gas pressure that the system sets ❷ to align with the type of cartridge and torch installed.

   For the system to operate optimally, the output gas pressure ❶ must not be lower than the system's target gas pressure ❷ by more than the following quantities:

   - Cut mode at 105 A: -0.3 bar (-5 psi)
   - Cut mode at 85 A: -0.3 bar (-4 psi)
   - Cut mode at 65 A: -0.2 bar (-3 psi)
   - Cut mode at 45 A: -0.1 bar (-2 psi)
   - Gouge mode at 45 A – 105 A: -0.1 bar (-2 psi)



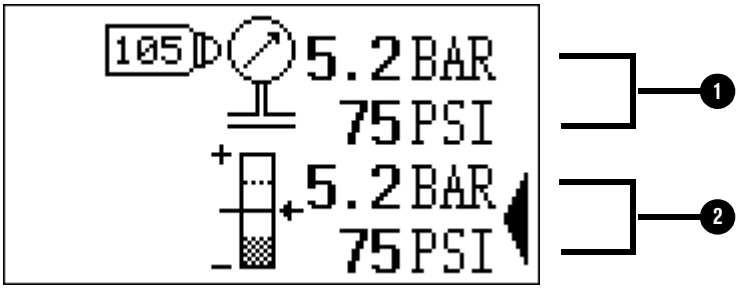

6. Push the operating mode button to stop the gas test and go back to the status screen. Gas stops flowing from the torch.

7. If the output gas pressure was too low in step 5, examine the inlet pressure from the gas supply source.

   It is possible that the solenoid valve electronic regulator must be replaced. Do Test 9 – Solenoid valve electronic regulator on page 112.

## Do a gas test in manual gas pressure mode

If the plasma power supply is in manual gas pressure mode when you start a gas test, the gas test screen shows the plasma power supply's actual output gas pressure ❶ and the manual gas pressure setting ❷.




You can turn the adjustment knob to change the manual gas pressure setting during a gas test.

You can push ○ during a gas test to change from manual gas pressure mode to automatic gas pressure mode or from automatic gas pressure mode to manual gas pressure mode.

# Do an initial resistance check

Make sure that you get all resistance values with the power cord disconnected and all internal plasma power supply wires correctly attached. Before you do an initial resistance check, do the steps in Do an internal inspection on page 21.

If resistance values are not close (±25%) to the values given in this section, isolate the problem by removing wires attached to the resistance check points or component until you find the problem.

After you repair the problem, refer to Sequence of operation on page 158 to do a test of the plasma power supply for correct operation.

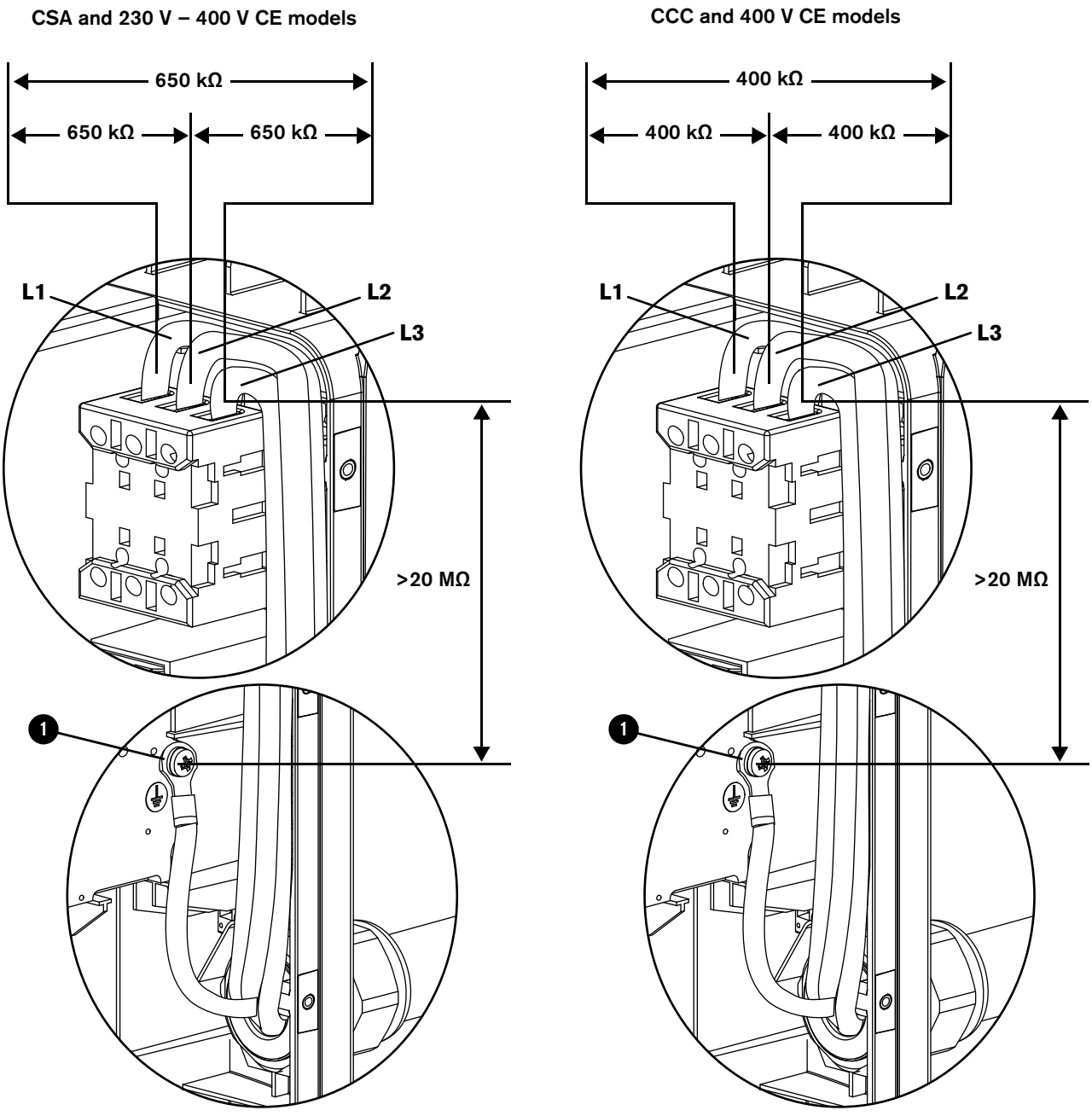
## Examine the power switch

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Disconnect the torch from the plasma power supply.
3. Remove the plasma power supply cover and the component barrier.
4. Set the power switch on the plasma power supply to ON (**I**).
5. Measure the resistance across the input leads. Refer to Figure 1 on page 29. The leads have the labels **L1**, **L2**, and **L3** on the power switch.
   - **CSA and 230 V – 400 V CE models:** The resistance across the input leads = 650 kiloohms (kΩ).
   - **CCC and 400 V CE models:** The resistance across the input leads = 400 kiloohms (kΩ).

**6.** Measure the resistance from the input leads to ground to make sure that they read as open. Look for the ⏚ symbol on the heatsink ❶. For all models, the resistance from input to ground must read as greater than 20 megaohms (MΩ).

With the power disconnected and the power switch set to OFF (**O**), all circuits must read as open. The electrical values shown are ±25%.

**Figure 1** – Power switch in the plasma power supply



7. Measure the output resistance for the values shown in the following tables and figures:
   - **Powermax65/85 SYNC:** Refer to Table 3 and Figure 2 on page 30.
   - **Powermax105 SYNC:** Refer to Table 4 and Figure 3 on page 31.

**Table 3** — Powermax65/85 SYNC power switch resistance values

| Measure resistance from | CSA power PCB location | CE/CCC power PCB location | Approximate values with torch disconnected |
|---|---|---|---|
| Work lead to nozzle | J26 to black wire | J27 to black wire | 230 kΩ |
| Work lead to electrode | J26 to J28 (red wire) | J27 to J29 (red wire) | 15 kΩ |
| Electrode to nozzle | J28 (red wire) to black wire | J29 (red wire) to black wire | 230 kΩ |
| Output to ground | | | > 20 MΩ |

**Figure 2** — Powermax65/85 SYNC

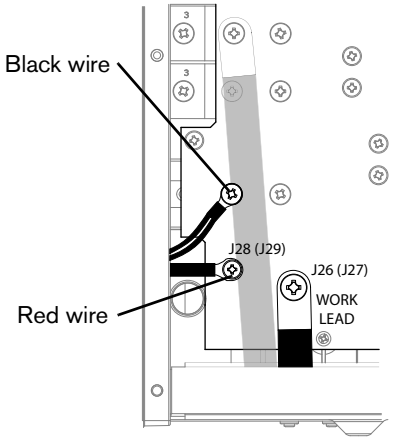
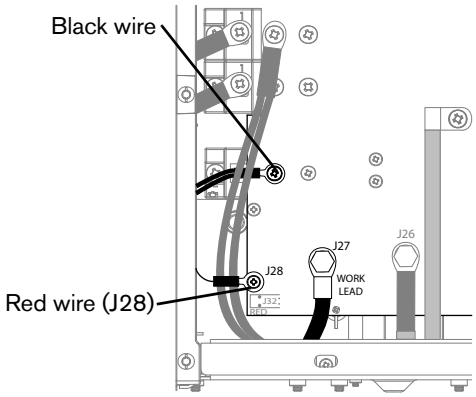


**Table 4** — Powermax105 SYNC power switch resistance values

| Measure resistance from | Power PCB location | All models with torch disconnected |
|---|---|---|
| Work lead to nozzle | J27 to black wire | 230 kΩ |
| Work lead to electrode | J27 to J28 (red wire) | 9 kΩ |
| Electrode to nozzle | J28 (red wire) to black wire | 230 kΩ |
| Output to ground | | > 20 mΩ |

**Figure 3** — Powermax105 SYNC

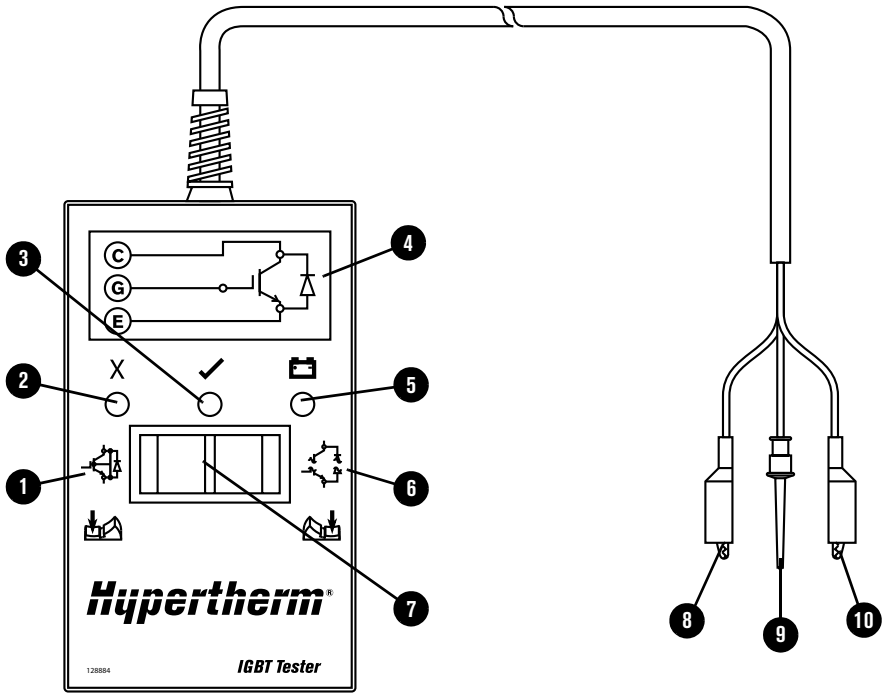



8. If you do not find a problem during the internal inspection or the initial resistance check, and the power supply still does not operate correctly, do the following:
   - Refer to Troubleshooting for Common Problems on page 63. This section gives the causes and solutions for many common troubleshooting conditions.
   - Refer to the system wiring diagrams on page 173.
   - Make sure that you understand the theory of operation before you do troubleshooting procedures. Refer to Theory of operation on page 169.
   - Before you purchase a major replacement component, make sure that you correctly identify the problem and solution with Hypertherm Technical Service or the nearest Hypertherm repair facility.

# Hypertherm IGBT tester

Use the Hypertherm IGBT (insulated gate bipolar transistor) tester (128883) as described in the following sections. Or you can assemble your own IGBT tester from the schematic diagram shown on page 38 and use it to do IGBT tests.

**Table 5** — Hypertherm IGBT tester




1 Test for short-circuited IGBT
2 Fail LED (red)
3 Pass LED (green)
4 Circuit diagram
5 Low battery LED (red)
6 Test for open circuit in the IGBT
7 Rocker switch
8 Collector (red)
9 Gate (yellow)
10 Emitter (black)

## Indicator LEDs and device tests

A minimum of 8 V is necessary to provide the correct power to the circuitry of the Hypertherm IGBT tester.

**Green “pass” LED**

✓ When illuminated, this LED indicates that the IGBT passed the test for an open circuit in the IGBT when the switch is pressed to the right or for a short-circuited IGBT when the switch is pressed to the left.

**Red “fail” LED**

X When illuminated, this LED indicates that the IGBT failed the test for an open circuit in the IGBT when the switch is pressed to the right or for a short-circuited IGBT when the switch is pressed to the left.

**Red “low battery” LED**

When illuminated, this LED indicates that the remaining voltage in the battery is insufficient to power the test circuitry. Replace the battery.

## IGBT test preparation

Do the following before you do a test with the Hypertherm IGBT tester:

- Connect the colored leads to the IGBT as shown on the next page.
- Electrically isolate the IGBT from all other circuits. If the IGBT is installed in a plasma power supply, remove the power PCB and disconnect its lead connections before you do the IGBT test.

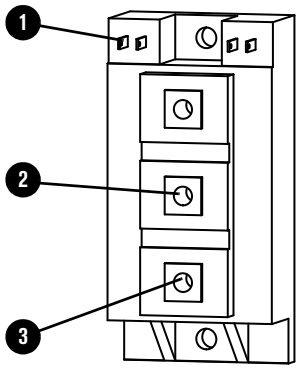
***NOTICE***

If you do not isolate the IGBT, you can get incorrect readings and cause damage to the IGBT tester.

The illustrations in Figure 4 on page 34 shows 3 common configurations of an IGBT. Each connection on the IGBT has a label with an abbreviation. These label abbreviations can be C/E/G or 1/ 2/ 3 with a schematic that shows numbers and pin functions.

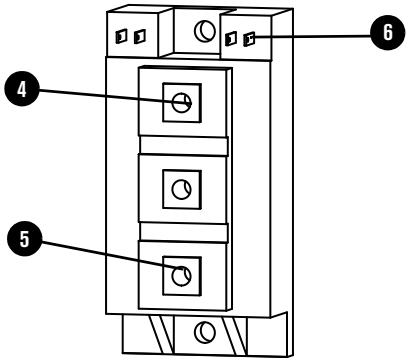
**Figure 4** – Common IGBT configurations

**IGBT module, Inverter test 1**



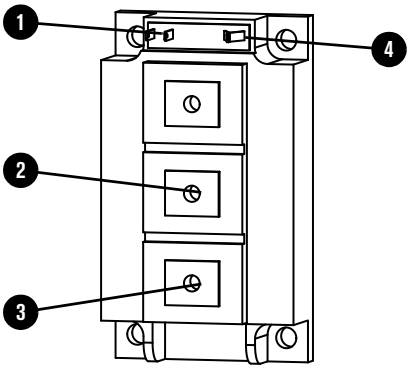

**1** Yellow lead Gate 2 (G2)
**2** Black lead Emitter 2 (E2)
**3** Red lead Collector 2 (C2)

**IGBT module, Inverter test 2**



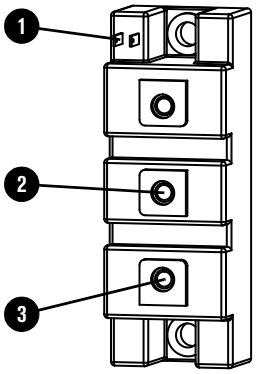

**4** Red lead Collector 1 (C1)
**5** Black lead Emitter 1 (E1)
**6** Yellow lead Gate 1 (G1)

**IGBT module, PFC**




**1** Yellow lead Gate (G)
**2** Black lead Emitter (E)

**IGBT, Pilot arc**




**3** Red lead Collector (C)
**4** This pin is for the IGBT internal temperature sensor. Do not use the IGBT tester here.

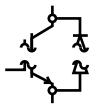
## IGBT device test for the Hypertherm tester

Using the Hypertherm IGBT tester, push and hold the switch in the necessary position to do each test shown in the following table.

| Switch Position | LED | | | Meaning | Corrective action |
|---|---|---|---|---|---|
| | Fail | Pass | Battery | | |
| Left | **X** | - | - | IGBT is short-circuited | Replace IGBT |
| Left | - | **X** | - | IGBT passed the short-circuit test | None |
| Left | - | - | **X** | Battery below 8 V | Replace battery |
| Left | - | - | - | Dead battery | Replace battery |
| Right | **X** | - | - | IGBT has an open circuit | Replace IGBT |
| Right | - | **X** | - | IGBT passed the test for an open circuit | None |
| Right | - | - | **X** | Battery below 8 V | Replace battery |
| Right | - | - | - | Dead battery | Replace battery |

## Troubleshooting steps for the Hypertherm IGBT tester

1. Examine the leads and the IGBT tester for damage.
2. Make sure that the battery voltage is higher than 8 V.
3. Do a test of the IGBT tester, as shown in the following table. If the results do not agree with the values in the table, replace the lead connections.

| Connect leads | Test for short circuit  | Test for open circuit  |
|---|---|---|
| None | Pass | Fail |
| Red to black | Fail | Pass |

## IGBT device test for a non-Hypertherm tester

The device tester shown on page 38 has one LED and one push-button switch that are used in combination to do 2 tests.

Do the following before you do a test of an IGBT:

- Electrically isolate the IGBT from all other circuits.
- If the IGBT is installed in a plasma power supply, remove the power PCB and disconnect its lead connections.

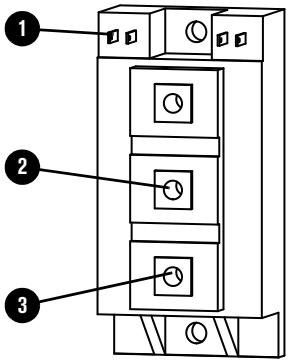
**NOTICE**

If you do not isolate the IGBT, you can get incorrect readings and cause damage to the IGBT tester.

1. Examine the IGBT for cracks or black marks. Replace the IGBT if it has damage.
2. Make sure that the battery voltage is higher than 8 V.
3. Connect the test leads as shown in Figure 5 on page 37.
4. Make sure that the test leads are connected and the push-button switch is not engaged. Is the LED illuminated?
   - If yes, the IGBT is short-circuited. Replace the IGBT.
   - If no, continue with the next step.
5. Make sure that the test leads are connected, and push the push-button switch. Does the LED illuminate?
   - If yes, the IGBT is operating correctly.
   - If no, the IGBT has an open circuit. Replace the IGBT.

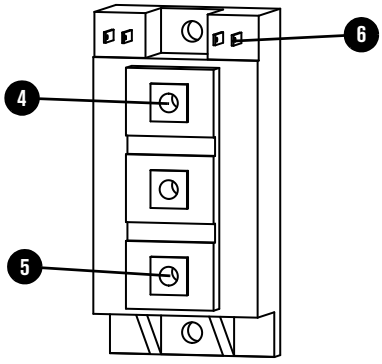
**Figure 5** – Common IGBT configurations

**IGBT module, Inverter test 1**



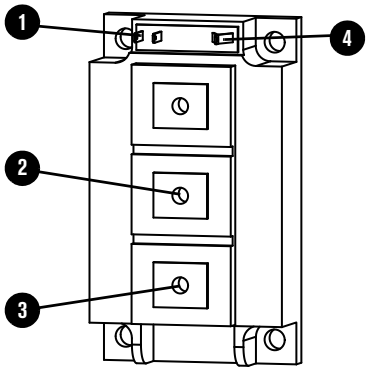

1 Yellow lead Gate 2 (G2)
2 Black lead Emitter 2 (E2)
3 Red lead Collector 2 (C2)

**IGBT module, Inverter test 2**



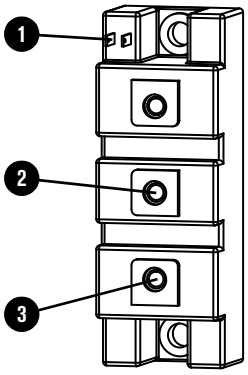

4 Red lead Collector 1 (C1)
5 Black lead Emitter 1 (E1)
6 Yellow lead Gate 1 (G1)

**IGBT module, PFC**




1 Yellow lead Gate (G)
2 Black lead Emitter (E)

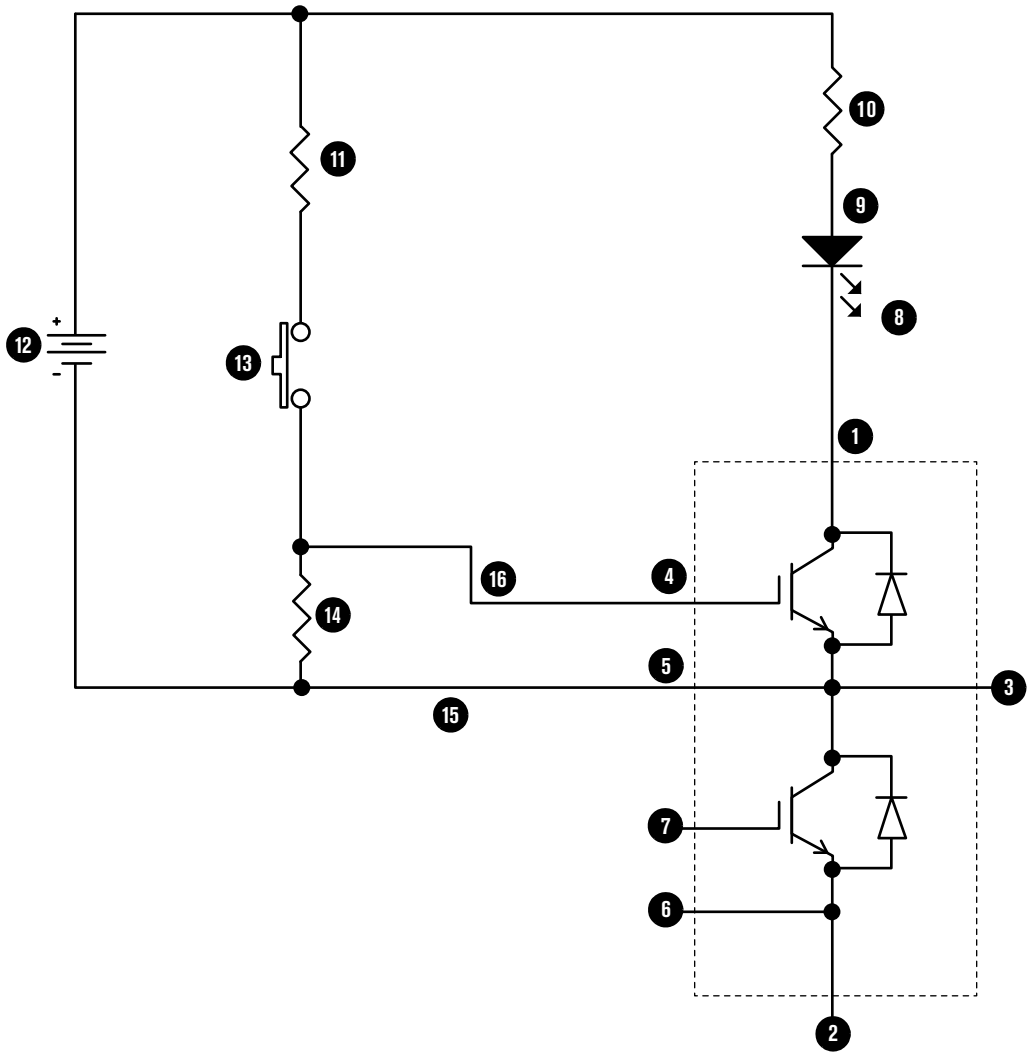
**IGBT, Pilot arc**




3 Red lead Collector (C)
4 These pins are for the IGBT internal temperature sensor. Do not use the IGBT tester here.

## Schematic to build an IGBT tester

**Figure 6** – IGBT tester schematic




**1** Collector 1 (C1)
**2** Emitter 2 (E2)
**3** Collector 2, Emitter 1(C2, E1)
**4** Gate 1 (G1)
**5** Emitter 1 (E1)
**6** Emitter 2 (E2)
**7** Gate 2 (G2)
**8** Red minigrabber test clip
**9** D1 Red LED lamp
**10** R3 2.0K
**11** R4 2.0K
**12** 9 VDC battery
**13** Normally open (N.O.) push-button switch
**14** R1 3.01M
**15** Black minigrabber test clip
**16** Yellow minigrabber test clip

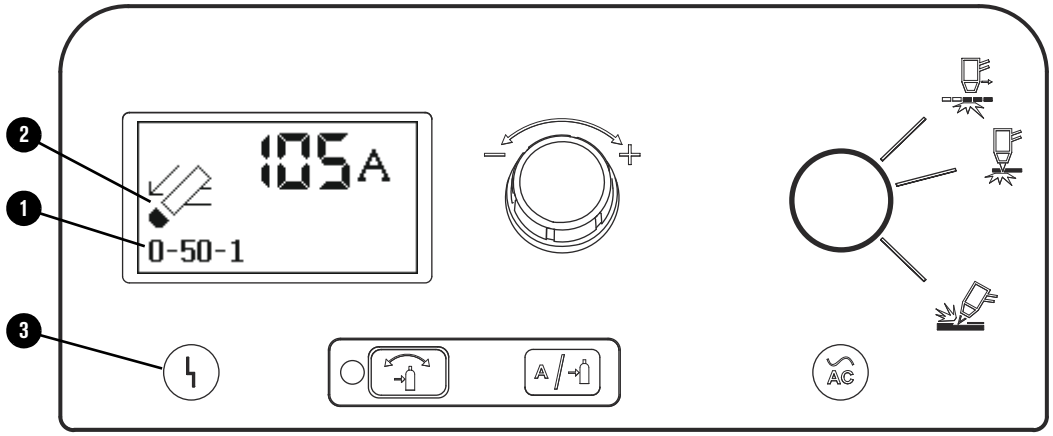
# 3 Troubleshooting for Fault Codes

## Fault codes and solutions

When a fault occurs with the plasma power supply or the torch, a fault code ❶ and related fault icon ❷ show on the status screen. The yellow fault LED ❸ also comes on.

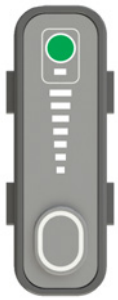
> The yellow fault LED does not come on for the 0-11-*n*, 0-12-*n*, 0-14-1, 0-98-1, or 0-98-2 fault codes.

Fault codes are in the format *N-nn-n*. The fault code value identifies the importance of the fault: the higher the number, the higher the importance. If more than one fault occurs at the same time, the fault code with the highest importance shows.




The Power Supply Log screen shows the 10 most recent faults. Refer to Internal component faults on page 145.

The status LED on the SmartSYNC hand torch also shows the fault status.



**Green** = prepared to cut

**Yellow** = a 0-*nn-n* fault code, or the torch is locked

**Red** = a 0-32-0, 1-*nn-n*, 2-*nn-n*, or 3-*nn-n* fault code

When the status LED on the hand torch is yellow, the LED can be flashing or solid, as follows:

- The yellow status LED flashes quickly (multiple flashes per second) for fault codes that are notices. Notices show the  or  fault icon. Refer to Identify fault icons on page 41.
- The yellow status LED also flashes quickly for the 0-32-1 fault code to remind you that it is necessary to install a new cartridge. The 0-32-1 fault code shows the  fault icon.
- The yellow status LED flashes slowly (one flash every 1–2 seconds) for the 0-98-2 torch communication fault code.
- The yellow status LED also flashes slowly when the system is in basic mode. Refer to page 155.
- The yellow status LED is solid (does not flash) for all other 0-*nn-n* fault codes.

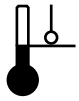
## Identify fault icons

**Notice –** This icon identifies faults that have a negative effect on cut quality or performance but do not prevent the plasma power supply from continuing to operate in most conditions. The 0-14-0 fault code shows this icon but will stop the system from operating.

**Fault –** This icon identifies faults that cause the plasma power supply to stop cutting.

**Error –** This icon identifies faults for which repair or replacement of internal components is necessary.

**Torch Cap Sensor –** This icon identifies when the SmartSYNC torch is in the yellow lock (**X**) position. It also identifies fault conditions in which the Hypertherm cartridge is loose, incorrectly installed, or missing.



**Temperature –** This icon identifies fault conditions in which the plasma power supply is outside the range of permitted operating temperatures.

**Gas –** This icon identifies fault conditions in which the gas supply is disconnected from the plasma power supply or there is a problem with the gas supply.

**Cartridge Not Recognized –** This icon shows when a cartridge cannot communicate with the plasma power supply.

When a cartridge cannot communicate with the plasma power supply, the plasma power supply cannot set operating parameters or record cartridge data.

**Cartridge End-of-Life –** This icon shows when the cartridge is at end-of-life. Hypertherm strongly recommends that you install a new cartridge when you get this fault.


**Internal Serial Communications Interface –** This icon identifies faults with serial communications that occur between the LCD/control PCB and the DSP PCB.

**Cartridge Communications –** This icon identifies faults with wireless communications that occur between the Hypertherm cartridge and the SmartSYNC torch.


**Torch Communications –** This icon identifies communication faults that occur between the SmartSYNC torch and the DSP PCB in the plasma power supply.

## Remove fault code conditions

Refer to the following tables to identify and troubleshoot each fault condition.

A label with descriptions for many common fault codes comes with the system. Put the label on the plasma power supply or near your work area for reference.

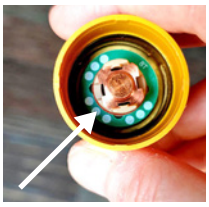
### Operational faults (0-*nn*-*n*)

Fault codes in the **0-*nn*-*n*** format identify operational faults. These faults do not show on the Power Supply Log screen.

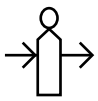
An operational fault code can be for a notification or for a condition that stops the cutting process. Hypertherm recommends that you do the steps in the following table for all fault codes that occur.

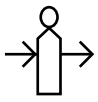
| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| **0-11-0** |  |  Flashes yellow | The remote control operating mode is incorrect or not permitted for the installed cartridge.<br>The permitted operating modes for cutting cartridges are 1 (Cut mode) and 2 (Expanded Metal mode). The permitted operating mode for a gouging cartridge is 3 (Gouge mode). | These fault codes do not stop the system from operating. Hypertherm recommends that you do the following.<br>There is a problem with the remote control or the software interface to the system. The system cannot interpret the operating mode, output current, or gas pressure information coming from the controller.<br>▪ Examine the programming code for incorrect process variables.<br>▪ Repair the controller. |
| **0-11-1** | | | The remote control output current (A) is incorrect or not permitted for the installed cartridge.<br>The permitted values relate to the minimum and maximum output current (A) for the plasma power supply and the installed cartridge. | |
| **0-11-2** | | | The remote control gas pressure is incorrect or not permitted.<br>The permitted gas pressure relates to the selected process and operating mode, and to the installed torch, torch lead, and cartridge. | |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-12-1 |  |  Flashes yellow | The gas pressure output is low. | These fault codes do not stop the system from operating. Hypertherm recommends that you do the following.<br>▪ For **0-12-1** faults, increase the inlet gas pressure from the gas supply source. For optimum system performance, make sure that the inlet gas pressure stays between 7.6 bar – 8.3 bar (110 psi – 120 psi) while gas is flowing. For minimum inlet pressure specifications, refer to the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>▪ **Never exceed the maximum gas pressure of 9.3 bar (135 psi).**<br>▪ Make sure that none of the gas lines are kinked or blocked.<br>▪ Do a gas test to see if the plasma power supply's actual output gas pressure is lower than the set pressure by more than an acceptable quantity. Refer to Do a gas test on page 26.<br>▪ The gas subsystem is not operating correctly. Examine the solenoid valve. Do Test 10 – Solenoid valve pressure sensor on page 115. |
| 0-12-2 | | | The gas pressure output is high. | |
| 0-12-3 | | | The gas pressure output is not stable. | |
| 0-13-0 |  |  Yellow<br>  Flashes green<br>  Flashes yellow | The alternating current (AC) input power is not stable. | This fault code does not stop the system from operating. In some conditions, the system can operate at a decreased capacity. Hypertherm recommends that you do the following.<br>▪ Do a cold restart.<br>▪ If applicable, disconnect the system from generator power. Refer to Generator considerations on page 62.<br>▪ If you continue to get this fault, have an electrical technician correct the power source. |

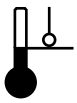
| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-14-0 |  |  Yellow  Flashes yellow | There is a problem with the cartridge installation. | This fault shows when you install a cartridge, and it cannot send data to the plasma power supply. This fault code stops the system from operating.<br>Do one of the following:<br>▪ Set the torch-lock switch to the yellow lock (**X**) position and then back to the green "ready to fire" (✓) position.<br>▪ Do a quick restart.<br>▪ Install the cartridge again.<br>Electrical noise can cause a bad data connection. For example, high frequency electrical noise from TIG welders can cause interference. Keep electrical noise in the work area as low as possible.<br>If you do not remove this fault code, the system automatically adjusts the following settings to prevent possible damage to the workpiece and cartridge:<br>▪ It sets the output current to 45 A.<br>▪ It sets the operating mode to Cut mode.<br>▪ It sets the output gas pressure to cut pressure. The system adjusts the pressure even if the system is in manual gas pressure mode when the fault occurs.<br>If necessary, you can manually change these settings to cut without a data connection. To prevent the system from adjusting these settings when communication with the cartridge is broken, put the system in basic mode. Refer to Smart mode versus basic mode on page 155. |
| 0-14-1 |  |  Flashes yellow | The cartridge is not recognized. | This fault shows when a cartridge cannot send data to the plasma power supply for some reason. This fault code does not stop the system from operating.<br>▪ When this fault occurs, you can continue to cut or gouge, but **you must set the output current (A) and the operating mode manually**. Also, the system cannot collect data about the Hypertherm cartridge.<br>▪ Lightly blow air into the cartridge to remove all dust or other contamination. Install the cartridge again.<br>▪ Make sure that the green ring inside the cartridge is not broken.  |

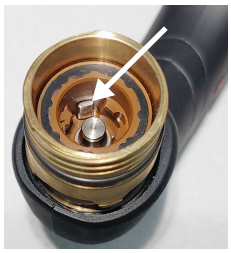
| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-19-9 |  |  Yellow  Flashes yellow | The input power stopped. Or, power PCB hardware protection occurred for components in the plasma power supply.<br>Fault 0-19-9 can occur up to 9 times before becoming a 2-*nn-n* or 3-*nn-n* fault as long as the power is not stopped.<br>If fault code 0-19-9 shows when you set the plasma power supply to ON (**I**), wait 1 minute to see if the fault code changes.<br>A cold restart sets the 0-19-9 fault counter back to zero. | This fault code stops the system from operating. Do the following.<br>▪ This fault can be the result of electrical noise. Wait for the fault to go away, and continue to cut.<br>▪ If you use serial communications, this fault can occur temporarily on the CNC when you set the plasma power supply to OFF (**O**). Wait for 1 minute for the fault to go away on its own.<br>▪ If this fault continues to occur, a 3-*nn-n* fault code can show on the status screen to identify a hardware fault with an internal component. Go to Internal component faults (1-*nn-n, 2-nn-n, 3-nn-n)* on page 57 for possible solutions to each fault condition.<br>▪ In many conditions, a 0-19-9 fault occurs as a result of inverter saturation (fault code 3-51-1) or a defective auxiliary switch (fault code 2-01-0).<br>▪ For a 3-51-1 fault, do Test 3 – Output diodes on page 90.<br>▪ For a 2-01-0 fault, do Test 12 – Auxiliary (AUX) switch on page 123. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-20-0 |  |  Yellow  Yellow | The gas pressure is lower than the minimum pressure for the selected process, operating mode, torch, lead length, and Hypertherm cartridge type.<br>The gas pressure is inconsistent at your work site. | This fault code does not stop the system from operating. Do the following.<br>▪ Examine all the connections for the input gas supply. Make sure that there are no leaks or loose connections.<br>▪ Make sure that the incoming gas supply hose has an internal diameter of 10 mm (3/8 inch) or greater if the hose is less than 15 m (50 feet). For hoses that are 15 m – 30 m (50 feet – 100 feet), use an internal diameter of 13 mm (1/2 inch) or greater.<br>▪ Make sure that there is sufficient inlet gas pressure from the gas supply source.<br>▪ Manually adjust the gas pressure on the plasma power supply.<br>▪ Do a gas test to see if the plasma power supply's actual output gas pressure is lower than the set pressure by more than an acceptable quantity. Refer to page 26.<br>▪ If there is no apparent problem with the inlet gas supply, examine the air filter bowl and air filter element in the plasma power supply. Clean or replace as necessary.<br>▪ If the gas pressure or air compression is inconsistent at the work site, and cut quality and performance are satisfactory, you can set the low gas pressure detection feature to off. Use the **UPL** field on the Feature Configuration screen. Refer to Default feature configuration on page 153.<br>▪ With correct air connected to the plasma power supply, do Test 10 – Solenoid valve pressure sensor on page 115. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-21-0 |  |  Yellow  Yellow | The gas flow stopped during cutting (an excessive change to arc voltage occurred). | This fault code stops the system from operating. The fault code goes away the next time that you fire the torch unless there is a condition that prevents the torch from firing, such as a kink or blockage in the torch lead. Do the following.<br>The DSP PCB monitors the nozzle-to-electrode voltage. If it finds a rapid change in that voltage, the inverter stops. Usually this identifies a rapid loss of gas pressure from a kinked or blocked gas supply line.<br>▪ Make sure that the correct gas inlet pressure is available.<br>▪ Make sure that none of the gas lines are kinked or blocked.<br>▪ Make sure that the torch lead is not leaking. Also make sure that it is not kinked or twisted.<br>▪ Install a new Hypertherm cartridge.<br>▪ For mechanized applications, lock out the torch height control.<br>▪ Make sure that gas flows through the solenoid valve electronic regulator in gas test mode. Replace the solenoid valve assembly if necessary.<br>▪ The DSP PCB or the power PCB are possibly defective.<br>▪ Do Test 9 – Solenoid valve electronic regulator on page 112. |
| 0-22-0 |  |  Yellow  Yellow | There is no gas supply input. | This fault code stops the system from operating. The fault code goes away when you connect the gas supply to the plasma power supply unless there is a blockage in the gas line. Do the following.<br>▪ Make sure that the input gas supply is connected correctly to the plasma power supply.<br>▪ Examine all the connections for the input gas supply. Make sure that there are no blockages in the gas line. Make sure that there are no leaks or loose connections.<br>▪ Restart the plasma power supply.<br>▪ Make sure that the input gas supply is connected to the plasma power supply, and do Test 10 – Solenoid valve pressure sensor on page 115. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| **0-30-0** |  |  Yellow  | There is a torch stuck open (TSO) condition.<br>The nozzle and electrode components inside the Hypertherm cartridge are not touching after a Start signal is received. | These fault codes stop the torch from firing a plasma arc. In some conditions, you can fire the torch again and continue to cut.<br>**If the fault occurred when you first installed the cartridge and tried to fire the torch, do the following:**<br>▪ If the Hypertherm cartridge became loose or was removed while the plasma power supply was ON and the torch-lock switch was set to the green "ready to fire" position (✓), set the power switch on the plasma power supply to OFF (**O**), correct the problem, and set the power switch to ON (**I**) to remove the fault.<br>▪ Examine the Hypertherm cartridge. Make sure that it is not worn or damaged.<br>▪ **Hand torch:** Move the torch-lock switch to the yellow lock (**X**) position, then move the torch-lock switch to the green "ready to fire" (✓) position. Fire the torch 1 time to get the warning puffs of air. This can clean away unwanted material that has collected around the tip of the cartridge.<br>▪ Remove the cartridge and carefully shake it to remove unwanted material that has collected inside the cartridge. This material can cause 0-30-0 faults to occur. A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life.<br>▪ Install a new Hypertherm cartridge.<br>**If the fault occurred during postflow or during a cut, do the following:**<br>▪ Examine the gas line. Refer to Examine the gas pressure on page 23 and Examine the gas quality on page 24.<br>▪ Do Test 6 – Torch stuck open (TSO) or torch stuck closed (TSC) on page 98. |
| **0-30-1** | | Yellow | There is a torch stuck closed (TSC) condition.<br>The nozzle and electrode components inside the Hypertherm cartridge will not disconnect from each other after a Start signal is received. | |
| **0-32-0** |  |  Yellow  Red | The system sensed that the cartridge in use is at end-of-life. | This fault code stops the system from operating. Install a new cartridge to remove the fault condition.<br>▪ If you restart the plasma power supply and try to use the same cartridge, the 0-32-1 fault code shows to remind you that the cartridge is at end-of-life. **Hypertherm strongly recommends that you install a new cartridge.** For information on the Hypertherm cartridge end-of-life detection feature, refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-32-1 |  |  Yellow  Flashes yellow | A cartridge is installed that had the 0-32-0 fault before and is at end-of-life. | This fault code does not stop the system from operating.<br>▪ The 0-32-1 fault code reminds you that the cartridge is at end-of-life. **Hypertherm strongly recommends that you install a new cartridge.** For information on the Hypertherm cartridge end-of-life detection feature, refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| 0-40-0 |  |  Yellow  | The boost power-factor correction insulated-gate bipolar-transistor (PFC IGBT) is too cold.<br>This is applicable to CSA and to Powermax105 SYNC 230 V – 400 V CE models only. | These fault codes stop the system from operating. Do the following. You can continue to use the system when its internal temperature is no longer too hot or too cold. Hypertherm recommends that you operate the system only in external temperatures between -10°C to 40°C (14°F to 104°F).<br>▪ The system is possibly overheated. Keep the plasma power supply ON to let the fan decrease the temperature of the internal components.<br>▪ Make sure that there is sufficient air flow around the plasma power supply.<br>▪ Make sure that the plasma power supply cover is installed with the louvers in front of the fan.<br>▪ Make sure that the component barrier is in place on the power PCB side of the plasma power supply.<br>▪ Make sure that the fan is operating correctly. Do Test 11 – Fan on page 120.<br>▪ The system is possibly too cold to operate. If the internal temperature of the plasma power supply gets near -30°C (-22°F), move the system to a warmer location.<br>▪ Do Test 4 – Inverter thermal sensor and PFC temperature sensor on page 91. |
| 0-40-1 | | Yellow | The boost PFC IGBT is too hot.<br>This is applicable to CSA and to Powermax105 SYNC 230 V – 400 V CE models only. | |
| 0-40-2 | | | The inverter IGBT is too cold. | |
| 0-40-3 | | | The inverter IGBT is too hot. | |

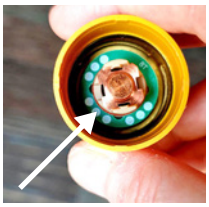
| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-50-0 |  |  Yellow  Yellow | The cartridge is off, the torch was disconnected, or the torch was in the yellow lock (**X**) position during a restart. | This fault code stops the system from operating. Do the following.<br>▪ This fault code shows when you do a restart while the torch-lock switch is in the yellow lock (**X**) position. Move the torch-lock switch to the green "ready to fire" (✓) position to continue. Refer to fault code **0-50-1** below.<br>▪ This fault code also shows if the torch is disconnected when you set the plasma power supply to ON (**I**). Connect the torch to the plasma power supply. Do a quick restart.<br>▪ This fault code also shows when a cartridge is not installed correctly. Remove the Hypertherm cartridge and install it correctly.<br>▪ **Machine torch:** This fault code shows when you remove the cartridge without first setting the power switch to OFF (**O**) or moving the torch-lock switch to the yellow lock (**X**) position. Lock and unlock the torch, or do a quick restart.<br>▪ **Mini machine torch:** This fault code can show if you change the cartridge while the power switch on the plasma power supply is set to ON (**I**). Do a quick restart.<br>▪ If the Hypertherm cartridge is in good condition and is installed correctly, the torch has possible damage. If possible, do a test with a different torch that is known to operate correctly.<br>▪ Make sure that the plunger in the torch head moves freely. Push down the plunger and then release. A plunger in good condition goes back to its start position. If the plunger no longer operates correctly, replace the torch body.  <br>▪ Do Test 8 – Torch cap switch on page 108. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| **0-50-1** |  |  Yellow  Yellow | The torch-lock switch is set to the yellow lock (**X**) position. | This fault code stops the system from operating. Do the following. A restart is not necessary.<br>▪ **Hand torch:** Move the torch-lock switch to the green "ready to fire" (✓) position. Fire the torch 1 time to get the warning puffs of air. Fire the torch again to get a plasma arc.<br>▪ **Machine torch:** Move the torch-lock switch to the green "ready to fire" (✓) position. Fire the torch to get a plasma arc.<br>▪ **Mini machine torch:** This fault code is not applicable to the mini machine torch. |
| **0-50-2** | none |  Yellow | The torch-lock switch is set to the green "ready to fire" (✓) position, but the torch is not prepared to fire. | This fault code identifies a condition in which an additional step is necessary *for hand torches* before the hand torch will fire a plasma arc.<br>▪ When you move the torch-lock switch to the green "ready to fire" (✓) position, the fault code changes from 0-50-1 to 0-50-2, and the  icon goes off.<br>▪ **Hand torch:** Fire the torch 1 time to get the warning puffs of air. The 0-50-2 fault code goes off, and the LED on the hand torch changes from yellow to green. The torch is now prepared to fire a plasma arc.<br>▪ **Machine torch:** The 0-50-2 fault code shows for approximately 1 second and then goes off. Fire the torch to get a plasma arc. There are no warning puffs of air. If the 0-50-2 fault code does not go off, send a STOP signal from the CNC to remove the fault.<br>▪ **Mini machine torch:** This fault code is not applicable to the mini machine torch. |
| **0-50-3** | none |  Yellow | The system is reading data from the cartridge. | This fault code flashes quickly while the system reads configuration data from the cartridge. Wait for the fault code to go away on its own.<br>▪ **The system will not cut until the fault code goes away.**<br>▪ This fault code can show for up to 6 seconds if electrical noise causes interference with the data connection.<br>▪ If the system cannot read the data from the cartridge, a different fault code will show.<br>▪ **Hand torch:** The usual behavior is to see a 0-50-2 fault code after 0-50-3 goes away. Fire the torch 1 time to get the warning puffs of air. The 0-50-2 fault code goes away. The torch is now prepared to fire a plasma arc. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| **0-51-0** | | Yellow<br>  <br>Yellow | The plasma power supply was receiving a signal to start cutting at the same time that the power switch was set to ON (**I**).<br>With a machine torch, this condition is sometimes referred to as a "stuck start." | This fault code stops the system from operating. Do the following. A quick restart is necessary.<br>▪ **Hand torch:** The torch trigger was being held in the "fire" position when the power switch on the plasma power supply was set to ON (**I**). Release the trigger and do a quick restart of the plasma power supply.<br>▪ **Machine torch:** The plasma power supply was receiving a Start signal when the power switch was set to ON (**I**). Set the Start signal to off, and do a quick restart of the plasma power supply.<br>▪ If possible, do a test with a different torch that is known to operate correctly.<br>▪ Do Test 7 – Start signal on page 102. |
| **0-52-0** | | Yellow<br>  <br>Yellow | The torch is not connected. | This fault code stops the system from operating. Do the following. A quick restart is necessary.<br>▪ Make sure that the torch lead is correctly connected to the FastConnect receptacle on the front of the plasma power supply. Do a quick restart.<br>▪ Do a check for continuity at the FastConnect receptacle. Refer to page 25.<br>▪ If you disconnect the torch while the plasma power supply is set to ON (**I**), you get the 0-52-0 fault code.<br>▪ If you disconnect the torch while the plasma power supply is set to OFF (**O**), you get the 0-50-0 fault code the next time you set the plasma power supply to ON (**I**). |
| **0-60-0** | AC | Yellow<br>  <br>Yellow | An AC input voltage phase loss occurred.<br>This is applicable only to CE models and to Powermax105 SYNC CSA models. | This fault code stops the system from operating. Do the following. A cold restart is necessary.<br>▪ Have an electrical technician examine all input phases and fuses/breakers for correct voltage at the power source and at the plasma power supply.<br>▪ If applicable, disconnect the system from generator power, or set the generator mode feature to on. Refer to Generator considerations on page 62.<br>▪ Do Test 1 – Voltage input on page 78. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-60-1 | AC | Yellow  Yellow | An AC input voltage is too low. | This fault code stops the system from operating. Do the following. A cold restart is necessary.<br>▪ The input line voltage is too low (more than 15% below the rated voltage). Have an electrical technician examine the line and increase the voltage.<br>▪ If applicable, disconnect the system from generator power, or set the generator mode feature to on. Refer to Generator considerations on page 62.<br>▪ Do Test 1 – Voltage input on page 78.<br>▪ This fault code is not applicable for Powermax65/85 SYNC CSA models. |
| 0-60-2 | AC | Yellow  Yellow | An AC input voltage is too high. | This fault code stops the system from operating. Do the following. A cold restart is necessary.<br>▪ The input line voltage is too high (more than 10% above the rated voltage). Have an electrical technician examine the line and decrease the voltage.<br>▪ If applicable, disconnect the system from generator power, or set the generator mode feature to on. Refer to Generator considerations on page 62.<br>▪ Do Test 1 – Voltage input on page 78.<br>▪ This fault code is not applicable for Powermax65/85 SYNC CSA models. |
| 0-61-0 | | Yellow  Yellow | An AC input is not stable. Shut down the system. | This fault code stops the system from operating. Do the following. A cold restart is necessary.<br>▪ The current from the incoming power line is unstable. Stop power to the system and correct the line resonance problem before continuing.<br>▪ If possible, connect the system to a different AC power source.<br>▪ Make sure that the plasma power supply is not being used on a phase converter.<br>▪ If applicable, disconnect the system from generator power, or set the generator mode feature to on. Refer to Generator considerations on page 62.<br>▪ This fault code is not applicable for Powermax65/85 SYNC CSA models. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-98-0 |  |  Yellow<br>  Yellow | An internal communication failure occurred between the LCD/control PCB and the DSP PCB. | This fault code does not stop the system from operating. The system can continue to cut, but Hypertherm recommends that you find the cause of the problem first because the controls on the front panel are not available. Do the following:<br>▪ Set the power switch on the plasma power supply to OFF (**O**). Wait until all the amperage LEDs on the SmartSYNC hand torch go off. (Or, wait approximately 1 minute.) Set the power switch to ON (**I**).<br>▪ Make sure that the ribbon cable between the LCD/control PCB and the DSP PCB inside the plasma power supply is fully connected to both PCBs.<br>▪ If the problem continues, replace the ribbon cable. Refer to *Powermax65/85 SYNC Service Parts and Procedures Guide* (810440) or *Powermax105 SYNC Service Parts and Procedures Guide* (810450).<br>If the system is in basic mode when the fault occurs, the system automatically adjusts the following settings to prevent damage to the cartridge:<br>▪ It sets the output current to 45 A.<br>▪ It sets the operating mode to Cut mode.<br>▪ It sets the output gas pressure to cut pressure. The system adjusts the pressure even if the system is in manual gas pressure mode when the fault occurred.<br>The system keeps these settings until you install a new cartridge, do a cold restart, or change the settings from the CNC (if applicable). If the system stays in this fault condition after a cold restart, it goes back to smart mode and sets the output current (A), operating mode, and output gas pressure to go with the cartridge that is installed on the SmartSYNC torch. For more information on smart mode and basic mode, refer to page 155. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 0-98-1 |  |  Yellow | An RF communication failure occurred between the cartridge and the torch. | This fault code does not stop the system from operating. Hypertherm recommends that you do the following.<br>When this fault occurs, the Hypertherm cartridge is not sending data to the system, so the system cannot collect data about the cartridge. The problem can be with the Hypertherm cartridge or with the SmartSYNC torch.<br>You can continue to cut or gouge, but **you must set the output current (A) and the operating mode manually**.<br>**Cartridge:**<br>▪ Make sure that the Hypertherm cartridge is installed correctly.<br>▪ Make sure that the green ring inside the cartridge is not broken.<br>▪ If you have a Hypertherm cartridge reader (528083), do a test to identify if the reader can pull data from the cartridge.<br>▪ Install a new Hypertherm cartridge.<br>  <br>**Torch:**<br>▪ The RF component on the PCB in the SmartSYNC torch has damage. Make sure that the wires in the torch are in the correct slots in the torch PCB and are connected correctly. Do Test 14 – Radio Frequency (RF) communication errors on page 126. |
| 0-98-2 |  |  Flashes yellow | A communication failure occurred between the torch and the plasma power supply. | This fault code does not stop the system from operating. Hypertherm recommends that you do the following.<br>When this fault occurs, the SmartSYNC torch is not sending data to the plasma power supply, so the system cannot collect data about the Hypertherm cartridge. There can be a problem with the PCB in the torch, with the torch lead, with the quick-disconnect receptacle, or with the torch communication circuitry on the PCB in the plasma power supply. Do Test 14 – Radio Frequency (RF) communication errors on page 126.<br>You can continue to cut or gouge, but **you must set the output current (A) and the operating mode manually**. |

## Internal component faults (1-*nn-n*, 2-*nn-n*, 3-*nn-n*)

Fault codes in the 1-*nn-n*, 2-*nn-n*, and 3-*nn-n* formats identify possible damage to components inside the plasma power supply. These faults show on the Power Supply Log screen.

### 1-*nn-n* fault codes

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 1-00-0 |  |  Yellow  Red | A DSP PCB fault occurred. | ▪ These faults are internal processor checks. They usually are not caused by a hardware failure.<br>▪ Do a cold restart. In some conditions, a restart can remove the fault condition.<br>▪ If restarting the plasma power supply does not remove the fault condition, it is possible that the DSP PCB or the power PCB must be replaced. |
| 1-20-0 | | | An input/output (I/O) fault occurred. | |
| 1-30-0 | | | A flash memory fault occurred. | |

### 2-*nn-n* fault codes

The following fault codes usually identify a problem with the DSP PCB or the power PCB:

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 2-00-0 |  |  Yellow  Red | The analog-to-digital converter (ADC) value is out of range. | ▪ Do a cold restart.<br>▪ If restarting the plasma power supply does not remove the fault condition, it is possible that the DSP PCB or the power PCB must be replaced. |
| 2-01-0 | | | The auxiliary switch is disconnected. | ▪ Examine the auxiliary switch cable. Make sure that it is correctly connected to the power switch and to the power PCB.<br>▪ Do Test 12 – Auxiliary (AUX) switch on page 123. |
| 2-10-0 |  |  Yellow  Red | The inverter IGBT temperature sensor is open. | ▪ Examine the related wiring.<br>▪ Do Test 4 – Inverter thermal sensor and PFC temperature sensor on page 91.<br>▪ If you do not find a problem, it is possible that the inverter heatsink temperature sensor assembly must be replaced. |
| 2-10-1 | | | The inverter IGBT temperature sensor short-circuited. | |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 2-11-0<br>2-11-1 |  |  <br>Yellow<br>  <br>Red | The pressure sensor is open.<br>The pressure sensor short-circuited. | ▪ Examine the related wiring.<br>▪ Do Test 10 – Solenoid valve pressure sensor on page 115. |
| 2-20-0 |  |  <br>Yellow<br>  <br>Red | The DSP PCB does not recognize the torch. | ▪ Make sure that the torch lead is correctly connected to the FastConnect receptacle on the front of the plasma power supply. Do a quick restart.<br>▪ Examine the FastConnect receptacle to make sure that the pin-out is correct. Refer to Do a check for continuity on page 25. Also refer to the wiring diagram for your system, starting on page 173. |

### 3-*nn-n* fault codes

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| **3-00-0** |  |  Yellow Red | The DC bus voltage (VBUS) is out of range. | ▪ Examine the circuitry for the PFC IGBT (CSA and Powermax105 SYNC CE/CCC 230 V – 400 V models only).<br>▪ Use an IGBT tester to do a test of the PFC IGBT (CSA and Powermax105 SYNC CE/CCC 230 V – 400 V models only).<br>▪ Measure the bus voltage from Test Point (TP) W (-) to TP R (+) on the power PCB. Refer to Test 2 – DC power bus on page 83. Does the voltage match the bus voltage value in the **VB** field on the **POWER SUPPLY DATA** screen? If not, replace the DSP PCB. Refer to Test 5 – Flyback circuit (DC minor voltages) on page 94. |
| **3-10-0** |  |  Yellow Red | The fan speed is less than the minimum speed. | ▪ Clean the fan assembly.<br>▪ Do Test 11 – Fan on page 120. |
| **3-10-1** | | | A fan fault occurred. | ▪ Examine the related wiring.<br>▪ Do Test 11 – Fan on page 120.<br>▪ If necessary, replace the fan. |
| **3-11-0** |  |  Yellow Red | The PFC IGBT temperature sensor is open. | This is applicable to CSA and Powermax105 SYNC CE/CCC 230 V – 400 V models only.<br>▪ Examine the related wiring.<br>▪ Do Test 4 – Inverter thermal sensor and PFC temperature sensor on page 91.<br>▪ If necessary, replace the PFC IGBT. |
| **3-11-1** | | | The PFC IGBT temperature sensor short-circuited. | |
| **3-11-2** | | | There is a PFC IGBT temperature sensor circuit fault. | This is applicable to CSA and CE/CCC 230 V – 400 V models only.<br>▪ Examine the temperature circuit on the power PCB.<br>▪ Do Test 4 – Inverter thermal sensor and PFC temperature sensor on page 91.<br>▪ If Test 4 does not identify the problem, replace the power PCB. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 3-20-0 |  |  Yellow  Red | The fill valve is not connected. | ▪ Examine the related wiring.<br>▪ Do Test 9 – Solenoid valve electronic regulator on page 112.<br>▪ If necessary, replace the solenoid valve assembly. |
| 3-20-1 | | | The dump valve is not connected. | |
| 3-20-2 | | | The plasma power supply does not recognize the solenoid valve electronic regulator. | ▪ The DSP PCB does not recognize the solenoid valve electronic regulator.<br>▪ Make sure that the jumper at J4 (Powermax65/85 SYNC CSA models) or J6 (all other models) on the power PCB is in the correct position. Refer to the wiring diagram for your system, starting on page 173. |
| 3-20-3 | | | The solenoid valve electronic regulator is not receiving power. | ▪ Carefully examine the 10-pin connector at J4 (Powermax65/85 SYNC CSA models) or J6 (all other models) on the power PCB.<br>▪ If necessary, replace the solenoid valve assembly. |
| 3-41-0 |  |  Yellow  Red | A driver integrated circuit (IC) fault occurred. | ▪ A signal fault occurred in the Start/Transfer relay or the soft-start (inrush current) relay on the power PCB. |
| 3-42-0 | | | The 5 VDC or 24 VDC supply is out of range. | ▪ The 5 VDC or 24 VDC supply from the flyback circuit is out of range.<br>▪ Do Test 5 – Flyback circuit (DC minor voltages) on page 94. |
| 3-42-1 | | | The 18 VDC supply is out of range. | The 18 VDC supply from the flyback circuit is out of range.<br>▪ Replace the power PCB.<br>▪ Examine the inverter IGBT, and replace it if necessary. |
| 3-43-0 | | | The inverter capacitors are not balanced. | The inverter capacitors are not balanced when the voltage across one or both of the capacitors is more than 25% different than nominal.<br>▪ Make sure that the bus voltage is correct for each capacitor in your system. Do Test 2 – DC power bus on page 83.<br>▪ Do a test of the inverter IGBT. Refer to Hypertherm IGBT tester on page 32.<br>▪ Replace the bulk capacitors. |
| 3-44-1 | | | The PFC IGBT current is too high.<br>This is applicable to CSA and to Powermax105 SYNC 230 V – 400 V CE models only. | The current in the PFC IGBT is too high.<br>▪ Do a test of the PFC IGBT. Refer to Hypertherm IGBT tester on page 32.<br>▪ Replace the PFC IGBT if it is defective.<br>▪ If necessary, replace the power PCB. |

| Fault code | Fault icon | Fault LEDs | Description | Solutions |
|---|---|---|---|---|
| 3-51-1 |  |  Yellow  Red | An inverter IGBT saturation fault occurred. The inverter current is too high. | The top and bottom inverter IGBTs are starting in phase instead of 180° out of phase.<br>▪ Do a test of the 2 inverter IGBTs. Refer to Hypertherm IGBT tester on page 32.<br>▪ Do Test 3 – Output diodes on page 90.<br>▪ Replace the module if either IGBT is defective.<br>▪ If necessary, replace the power PCB. |
| 3-52-0 | | | A short circuit caused high-current distortion in the inverter IGBT. This is sometimes referred to as a shoot-through. | |
| 3-60-0 |  |  Yellow  Red | The DSP PCB does not recognize the power PCB. | ▪ Make sure that the correct power PCB is installed for the plasma power supply. |
| 3-70-0 |  |  Yellow  Red | There is an internal serial communications fault between the DSP PCB and power PCB. | There is a fault with the communication between the DSP PCB and the power PCB.<br>▪ Examine the cable that connects to both the DSP PCB and the power PCB.<br>▪ If necessary, replace the DSP PCB or the power PCB. |

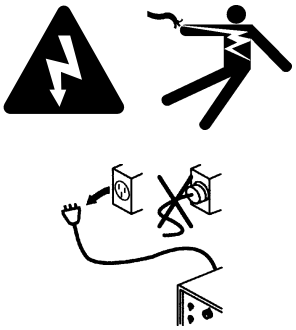
# Generator considerations

- If a fault occurs while you are using a generator, it is possible that doing a quick restart does not remove the fault condition. Instead, set the power switch on the plasma power supply to OFF (**O**) and wait approximately 1 minute before setting the power switch to ON (**I**).
- Problems with input line voltage (fault codes 0-13-0, 0-60-*n*, and 0-61-0) can occur more frequently with some generators. If you consistently see these fault codes, you can temporarily set the **GEN** setting to on. This setting is on the Feature Configuration screen (**FEATURE CONFIG**). **Hypertherm recommends that only experienced operators change this setting.** This setting decreases the system's sensitivity to changes in current and voltage from incoming power.
  - Make sure that you set the **GEN** field to off when you are not using a generator.
- If you continue to have problems with input line voltage, disconnect the plasma power supply from the generator, and connect it to a power receptacle with sufficient power.
  - Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470) for generator specifications.

# 4 Troubleshooting for Common Problems

This section is for common troubleshooting problems that do not include fault codes.

## ⚠ WARNING



**ELECTRIC SHOCK CAN KILL**

Disconnect electric power before doing installation or maintenance. You can get a serious electric shock if electric power is not disconnected. Electric shock can seriously injure or kill you.

All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

Refer to the *Safety and Compliance Manual* (80669C) for more safety information.

## ⚠ WARNING

**INSTANT-ON TORCHES – PLASMA ARC CAN CAUSE INJURY, BURNS**

Ignition of the plasma arc occurs immediately when you pull the torch trigger. Before changing the cartridge, one of the following steps is necessary. Whenever possible, complete the first step.

- Set the power switch on the plasma power supply to OFF (**O**).

  OR

- Move the torch-lock switch to the yellow lock (**X**) position. Pull the trigger to make sure that the torch does not fire a plasma arc.

# Problems with system performance

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The cut quality is unsatisfactory, or the cut does not sever the workpiece. | The cartridge is worn, the work lead connection is not satisfactory, the output from the plasma power supply is too low, the power PCB is supplying low current, or the selected operating mode is not correct. | ▪ The cartridge is worn. | ▪ Examine the Hypertherm cartridge. Replace it if it is worn or has damage. A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life. |
| | | ▪ There is not a good connection between the work clamp and the workpiece.<br>▪ The workpiece is dirty.<br>▪ There is damage to the work clamp or to the work lead. | ▪ If possible, move the work clamp closer to the area of the workpiece you are cutting.<br>▪ Clean the area where the work clamp comes into contact with the workpiece or cutting table. Remove any rust, paint, or other residue. Make sure that there is good metal-to-metal contact.<br>▪ Examine the work clamp for damage. Repair or replace it if necessary.<br>▪ Make sure that the cutting table is correctly grounded and has good contact with the workpiece. |
| | | ▪ The output current (A) is set too low. | ▪ Increase the output current (A) as necessary. |
| | | ▪ The operating mode setting on the plasma power supply is not correct for the cutting application. | ▪ If you are in basic mode, make sure that the Hypertherm cartridge aligns with the operating mode. Use a gouging cartridge in Gouge mode. Use a cutting cartridge in Cut mode or Expanded Metal mode. For more information on basic mode, refer to page 155. |
| | | ▪ An extension cord is not sufficient for the system. | ▪ Operate the plasma power supply without using an extension cord. If you must use an extension cord, use a heavy conductor cord of the shortest possible length. |
| | | ▪ The pilot arc IGBT is defective. | ▪ Do Test 13 – Pilot arc IGBT on page 125. |
| | | ▪ The power PCB is defective. | ▪ Do Test 1 – Voltage input on page 78.<br>▪ Do Test 2 – DC power bus on page 83.<br>▪ Do Test 3 – Output diodes on page 90. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The ON / OFF power switch is set to ON (I), but the power ON LED ( ) is off. | Voltage to the control circuits is not sufficient, or a power component has a short circuit. | ▪ Voltage to the system is missing.<br>▪ Voltage to the system is incorrect.<br>▪ The power switch is defective.<br>▪ An input diode is defective. | ▪ Make sure that the power cord is connected correctly to the power outlet or line-disconnect switch box.<br>▪ Make sure that the power is on at the main power panel or at the line-disconnect switch box.<br>▪ Make sure that the circuit breaker did not open (trip).<br>▪ Make sure that the line voltage is not too low (more than 15% below the rated voltage). Refer to the electrical specifications in the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>▪ Do Test 1 – Voltage input on page 78 to do a check of the incoming voltage and the power switch.<br>▪ Do Test 12 – Auxiliary (AUX) switch on page 123. This test is not applicable for Powermax65/85 SYNC CE/CCC models. |
| | | ▪ The fan is defective.<br>▪ The solenoid valve is defective.<br>▪ The power PCB is defective. | ▪ Do Test 5 – Flyback circuit (DC minor voltages) on page 94. |
| | | ▪ An IGBT is defective.<br>▪ The power PCB is defective. | ▪ Do Test 1 – Voltage input on page 78.<br>▪ Do Test 2 – DC power bus on page 83.<br>▪ Do Test 3 – Output diodes on page 90. |
| | | ▪ The control PCB is defective. | ▪ Replace the control PCB. |
| | | ▪ The DSP PCB is defective. | ▪ Replace the DSP PCB. |
| The power ON LED ( ) is on. No fault codes show on the main screen, but no gas flows when you fire the torch. | The start signal is not getting to the control PCB. | ▪ There can be damage to the torch or to the torch lead.<br>▪ The control PCB can be defective.<br>▪ The power PCB can be defective. | ▪ Examine the torch and the torch lead for damage.<br>▪ If the start icon ( ) does not show on the main screen when the torch is fired, do Test 7 – Start signal on page 102. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The power ON LED ( ) flashes or goes off while you are cutting. | A power component has a short circuit. | ▪ The fan is defective. | ▪ Do Test 11 – Fan on page 120. |
| | | ▪ The DSP PCB is defective.<br>▪ An IGBT is defective.<br>▪ The power PCB is defective. | ▪ Do Test 1 – Voltage input on page 78.<br>▪ Do Test 2 – DC power bus on page 83.<br>▪ Do Test 3 – Output diodes on page 90. |
| The plasma arc does not transfer to the workpiece. | The continuity between the work lead and the workpiece is unsatisfactory. | ▪ The workpiece is dirty.<br>▪ The work clamp has damage.<br>▪ The pierce height is too high. | ▪ Clean the area where the work clamp comes into contact with the workpiece or cutting table. Remove any rust, paint, or other residue. Make sure that there is good metal-to-metal contact.<br>▪ Examine the work clamp for damage. Repair or replace it if necessary.<br>▪ Make sure that the cutting table is correctly grounded and has good contact with the workpiece.<br>▪ Decrease the cut height. |
| Gas flows from the torch when you set the plasma power supply to ON (**I**), but you did not fire the torch. | The incoming gas pressure is too high. | ▪ The gas pressure from the air compressor or cylinder is too high. | ▪ Make sure that the gas supply is not more than 9.3 bar (135 psi). |
| | The system is not adjusting the gas pressure correctly. | ▪ The solenoid valve electronic regulator is defective.<br>▪ The DSP PCB is defective.<br>▪ The power PCB is defective. | ▪ Do Test 9 – Solenoid valve electronic regulator on page 112.<br>▪ Do Test 10 – Solenoid valve pressure sensor on page 115. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| Gas flows when you fire the torch, but there is no plasma arc, or you lose the arc quickly. | The cartridge is worn or has damage. | ▪ The cartridge is not installed correctly.<br>▪ The cartridge is at end-of-life. | ▪ Make sure that the cartridge is not too loose or too tight.<br>▪ Install a new cartridge. |
| | There is damage to the cartridge or to the torch lead. | ▪ The electrode in the cartridge is not moving correctly.<br>▪ There is damage to the torch lead. | ▪ Do Test 6 – Torch stuck open (TSO) or torch stuck closed (TSC) on page 98. |
| | The gas flow is too high or is not sufficient. | ▪ The gas pressure is too high or too low.<br>▪ The gas supply line has leaks or blockages. | ▪ Make sure that the inlet gas pressure stays between 7.6 bar – 8.3 bar (110 psi – 120 psi) while gas is flowing.<br>▪ Make sure that the gas supply is not more than 9.3 bar (135 psi).<br>▪ Repair gas leaks and blockages.<br>▪ Adjust the gas pressure on the plasma power supply manually. |
| | The gas quality is unsatisfactory. | ▪ The filter element in the air filter is dirty.<br>▪ Oil, moisture, or other contaminants are in the gas supply line. | ▪ Replace the air filter element.<br>▪ Add additional, external filtration that is applicable for the work environment. Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>▪ Flush the gas supply line with nitrogen to remove oil and moisture. |
| | The input power is not sufficient. | The electrical supply installation for one or more of the following is not sufficient:<br>▪ Circuit breaker or fuse<br>▪ Supply wire<br>▪ Extension cord | ▪ Refer to the installation specifications in the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| | An internal power component is defective. | ▪ The inverter IGBT module is defective.<br>▪ The power PCB is defective. | ▪ Use an IGBT tester to do a test of the inverter IGBT module. |
| | There is a capacitor voltage imbalance on the power PCB. | ▪ Resistors on the power PCB are defective.<br>▪ The bulk capacitors are defective. | Do the following tests. If the voltage across the bulk capacitors is not balanced, replace the power PCB.<br>▪ Do Test 1 – Voltage input on page 78.<br>▪ Do Test 2 – DC power bus on page 83.<br>▪ Do Test 3 – Output diodes on page 90 |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The plasma arc goes out while you are cutting, or the torch will intermittently not fire. | The plasma arc cannot keep contact with the workpiece. | ▪ The work lead is defective. Or the work lead connection is not sufficient for some reason.<br>▪ Expanded Metal mode is necessary for the material you are cutting. | ▪ If possible, move the work clamp closer to the area of the workpiece you are cutting.<br>▪ Examine the work lead for a loose connection at the plasma power supply and at the work clamp.<br>▪ Clean the area where the work clamp comes into contact with the workpiece or cutting table. Remove any rust, paint, or other residue. Make sure that there is good metal-to-metal contact.<br>▪ Put the system in Expanded Metal mode if the metal you are cutting has a slotted or mesh pattern, or if it has a lot of holes. |
| | The fan is overloading the flyback circuit. | ▪ The fan is defective. | ▪ Do Test 11 – Fan on page 120.<br>▪ Do Test 5 – Flyback circuit (DC minor voltages) on page 94. |
| The system is in Expanded Metal mode, but the torch does not keep the plasma arc when you move the torch off of the metal. | The Expanded Metal mode feature is not operating correctly. | ▪ The operating mode setting on the plasma power supply is not correct. | ▪ Make sure that the operating mode is correctly set to Expanded Metal mode.  |
| | | ▪ The DSP PCB is defective.<br>▪ The power PCB is defective. | Do the following tests, and replace defective components as necessary:<br>▪ Do Test 1 – Voltage input on page 78.<br>▪ Do Test 2 – DC power bus on page 83.<br>▪ Do Test 3 – Output diodes on page 90. |
| You lost the plasma arc while cutting, but the torch produces an arc when you fire the torch again. | There is a problem with the cartridge, the air filter element, or the input gas pressure. | ▪ The cartridge is worn or has damage. | ▪ Replace the cartridge. |
| | | ▪ The filter element in the air filter is dirty. | ▪ Replace the air filter element. |
| | | ▪ The gas pressure is too low or too high. | ▪ Adjust the gas pressure on the plasma power supply manually.<br>▪ For optimum system performance, make sure that the inlet gas pressure stays between 7.6 bar – 8.3 bar (110 psi – 120 psi) while gas is flowing. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The plasma arc makes sputtering and hissing sounds. | There is a problem with the air filter element, or it is necessary to clean the input gas supply. | ▪ The filter element in the air filter is dirty. | ▪ Replace the air filter element. |
| | | ▪ There is moisture in the gas supply line. | ▪ Examine the gas supply line for signs of moisture. Clean or replace external filtration components as necessary.<br>▪ Flush the gas supply line with nitrogen to remove oil and moisture.<br>▪ If necessary, add additional, external filtration that is applicable for the work environment. Refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| The system is not cutting at full cutting power, and the plasma arc does not time out after 5 seconds. | The system is not connected to ground sufficiently. | ▪ The work lead connection is not satisfactory. | ▪ If possible, move the work clamp closer to the area of the workpiece you are cutting.<br>▪ Clean the area where the work clamp comes into contact with the workpiece or cutting table. Remove any rust, paint, or other residue. Make sure that there is good metal-to-metal contact. |
| | | ▪ The work lead has damage. | Measure the resistance across the work lead. If the resistance is greater than 3 ohms (Ω), repair or replace the work lead. Identify the work lead connection on the power PCB as follows:<br>▪ Powermax65/85 SYNC models: J26<br>▪ All other models: J27 |
| | | ▪ The pilot arc IGBT is defective. | ▪ Do Test 13 – Pilot arc IGBT on page 125. |
| | | ▪ The DSP PCB is defective. | ▪ Replace the DSP FSB. |
| | The output from the plasma power supply is too low. | ▪ The output current (A) is set too low. | ▪ Use the adjustment knob to increase the output current (A) as necessary. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| Nothing shows on the LCD screen, but the ON / OFF power switch is set to ON (**I**), and the power ON LED ( ) is on. | Voltage to the control circuits is not sufficient, or a power component has a short circuit. | ▪ Voltage to the system is missing.<br>▪ Voltage to the system is incorrect.<br>▪ There is a blown fuse. | ▪ Make sure that the power cord is connected correctly to the power outlet or line-disconnect switch box.<br>▪ Make sure that the power is on at the main power panel or at the line-disconnect switch box.<br>▪ Make sure that the circuit breaker did not open (trip).<br>▪ Make sure that the line voltage is not too low (more than 15% below the rated voltage). Refer to the electrical specifications in the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>▪ Examine the fuses in the line-disconnect switch box. Replace bad fuses as necessary. |
| | | ▪ The fan has a short circuit. | ▪ With the power disconnected, disconnect the fan from the power PCB. Set the plasma power supply to ON (**I**). If the LED screen comes on, replace the fan.<br>▪ If the LED screen does not come on, do Test 11 – Fan on page 120. |
| The LCD screen on the front panel is too bright or too dark. | The ambient temperature of the work site is having an effect on the LCD screen. | ▪ Very hot environments can make the LCD screen darker.<br>▪ Very cold environments can make the LCD screen brighter. | ▪ Adjust the brightness and contrast settings as necessary on the LCD Display screen (**LCD DISPLAY**). Refer to LCD display brightness and contrast on page 148. |
| The Hypertherm cartridge end-of-life detection feature is on, but it is not working. | The cartridge end-of-life detection feature cannot be on in some conditions. | ▪ The plasma power supply temporarily disables the cartridge end-of-life detection feature when specified conditions occur, even when the feature is on. | For the cartridge end-of-life detection feature to be in effect, make sure that the following conditions are not in effect:<br>▪ You install a FineCut hand cutting cartridge.<br>▪ You set the output current below 40 A for any type of Hypertherm cartridge.<br>▪ You set the output current (A) below 55 A *and* the field not to smart mode (SMART). Refer to page 153.<br>▪ You set the output current (A) below 55 A *and* torch communication with the plasma power supply is broken. |

| Problem | Meaning | Causes | Solutions |
|---|---|---|---|
| The system changes the gas pressure after you set it manually. | The manual gas pressure mode gets overridden in some conditions. | The following conditions cause the system to override a manual gas pressure setting with the default gas pressure setting that matches the type of cartridge installed on the torch:<br>▪ Install a different type of cartridge.<br>▪ Adjust the gas pressure while the torch is locked and then unlock the torch. | ▪ Go back to manual gas pressure mode, and set the gas pressure again. Make sure that the torch is unlocked before you set the gas pressure. |
| The system changes the output current (A) or the operating mode after you set them. | You changed those settings while the torch was locked. | ▪ The system does not keep changes to the output current (A) or operating mode while the torch-lock switch is in the yellow lock (**X**) position or while there is an 0-50-*n* “cartridge off” fault condition. | ▪ Set the torch-lock switch to the “ready to fire” (✓) position *before* you adjust the amperage or operating mode.<br>▪ When you set the torch-lock switch to the “ready to fire” (✓) position, the system automatically sets the amperage and operating mode to match the type of cartridge installed on the torch. |
| The LCD screen shows a **FACTORY RESET?** message when you try to go to the service screens. | You pushed the incorrect buttons on the front panel. | ▪ The **FACTORY RESET?** message shows when you push and hold ○ and A/⏻ for approximately 2 seconds. | ▪ To get out of the **FACTORY RESET?** message, make sure that the **Cancel** button is selected, and push A/⏻. This sends you back to the screen you were on without making changes. Refer to Set system settings to factory default on page 156.<br>▪ To go to the service screens, push and hold A/⏻ for 2 seconds. |

# Common cutting and gouging problems

## Hand cutting problems

For troubleshooting common mechanized cutting problems, refer to the *Powermax65/85/105 SYNC Mechanized Cutting Guide* (810480).

| Problem | Solution |
|---|---|
| Pulling the torch trigger does not fire an arc. Instead, the torch puts out short puffs of air, and the plasma power supply sounds like it is releasing pressure. | ▪ The first time that you pull the torch trigger after you set the torch-lock switch to the "ready to fire" (✓) position, multiple puffs of air quickly come from the torch. With each puff of air, the plasma power supply makes a pressure-release sound. This is a warning that occurs when you lock and then unlock the torch without setting the power switch on the plasma power supply to OFF (**O**). (The 0-50-1 fault code also shows on the status screen.) **This does not identify a fault condition.** The purpose of the warning is to tell you that the torch is unlocked and will fire a plasma arc the next time that you pull the trigger. |
| The plasma arc sputters or hisses, or you lose the plasma arc. | ▪ Make sure that the Hypertherm cartridge is installed correctly.<br>▪ Examine the Hypertherm cartridge. Replace it if it is worn or damaged. A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life.<br>▪ Examine the gas filtration system for signs of moisture. Refer to page 24. |
| Cartridge life is shorter than expected. | ▪ Examine the gas pressure and the gas supply hose. Refer to page 23.<br>▪ Examine the gas filtration system for signs of moisture. Refer to page 24.<br>▪ Restart the plasma power supply. Does it correctly recognize the type of Hypertherm cartridge installed? Does it correctly set the amperage and operating mode for the cartridge? If it does not, look at the LCD screen. Do you see the non-default configuration icon (at right)? If yes, put the plasma power supply in smart mode if it is in basic mode. Refer to page 155.  <br>▪ Examine the cut data on the Cartridge Data screen (refer to page 136) and the Power Supply Data screen (refer to page 138). Also refer to the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| The plasma arc does not transfer to the workpiece. | ▪ Clean the area where the work clamp touches the workpiece. Remove any rust, paint, or other material. Make sure that there is good metal-to-metal contact.<br>▪ Examine the work clamp for damage. Repair or replace it if necessary.<br>▪ Move the torch closer to the workpiece and fire the torch again.<br>▪ Examine the work lead for signs of damage. Replace it if necessary. Refer to the *Powermax65/85/105 SYNC Parts Guide* (810490). |

| Problem | Solution |
|---|---|
| The plasma arc goes out but ignites when you pull the torch trigger again. | ▪ Decrease the length of the arc stretch. Whenever possible, drag the torch on the workpiece.<br>▪ Examine the Hypertherm cartridge. Replace it if it is worn or damaged. A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life.<br>▪ Make sure that the incoming gas supply hose has an internal diameter of 9.5 mm (3/8 inch) or greater.<br>▪ Examine the gas filtration system for contamination that is possibly interfering with plasma power supply performance. Refer to page 24.<br>▪ If you manually adjusted the gas pressure before this problem occurred, set the gas pressure back to the default setting. |
| The torch does not cut completely through the workpiece. | ▪ Examine the Hypertherm cartridge. Replace it if it is worn or damaged. A higher rate of 0-30-0 faults is typical as a cartridge gets near end-of-life.<br>▪ Decrease your cut speed.<br>▪ Make sure that the operating mode is correct for the Hypertherm cartridge that you are using. If the system is not in smart mode, set the operating mode manually. Use a gouging cartridge in Gouge mode. Use a cutting cartridge in Cut mode or Expanded Metal mode.<br>▪ Restart the plasma power supply. Does it correctly recognize the type of Hypertherm cartridge installed? Does it correctly set the amperage and operating mode for the Hypertherm cartridge? If it does not, look at the LCD screen. Do you see the non-default configuration icon (at right)? If yes, put the plasma power supply in smart mode if it is in basic mode. Refer to page 155. If no, there is possibly a problem with the Hypertherm cartridge, torch, or plasma power supply.<br>▪ Make sure that the torch is being used correctly.<br>▪ Increase the output current (A) on the plasma power supply.<br>▪ If the output current (A) cannot be increased, make sure that the thickness of the metal being cut is less than the maximum capacity for this plasma power supply. Refer to the cutting specifications in the *Powermax65/85/105 SYNC Operator Manual* (810470).<br>▪ Clean the area where the work clamp touches the workpiece. Remove any rust, paint, or other material. Make sure that there is good metal-to-metal contact.<br>▪ Examine the torch lead. Make it straight if it is twisted or kinked. Replace it if it is damaged.<br>▪ Examine the gas pressure and the gas supply hose. Refer to page 23.<br>▪ Adjust the gas flow rate. Refer to the gas supply specifications in the *Powermax65/85/105 SYNC Operator Manual* (810470). |
| When I try to adjust the output current (A) using the button on the SmartSYNC hand torch, the amperage setting on the plasma power supply does not change. | ▪ Is the system in basic mode? The amperage-adjustment control on the hand torch cannot be used when the system is in basic mode. Refer to Smart mode versus basic mode on page 155. If the status screen shows the non-default configuration icon (at right), set the plasma power supply to factory default settings to go back to smart mode. Push and hold ○ and A/ at the same time for approximately 2 seconds. |

| Problem | Solution |
|---|---|
| The fault LED on the hand torch flashes yellow, but no fault code or fault icon shows on the status screen. | ▪ The fault LED on the hand torch flashes yellow when the system is in basic mode. When you go back to smart mode, the fault LED on the torch changes to green. Refer to Smart mode versus basic mode on page 155. |

## Hand gouging problems

When gouging, always make sure of the following:

- A Hypertherm gouging cartridge is installed.
- The Hypertherm cartridge is not worn or damaged.
- The operating mode is set to Gouge mode.
  - When you install a Hypertherm gouging cartridge, the plasma power supply automatically sets the operating mode to Gouge mode. There is a condition in which the operating mode does **not** automatically set to Gouge mode even if a Hypertherm gouging cartridge is used.

| Problem | Solution |
|---|---|
| The arc goes out during gouging. | ▪ Decrease the arc stretch (standoff).<br>▪ Put the torch in a more upright position. |
| The torch tip hits the molten metal (slag). | ▪ Increase the arc stretch (standoff).<br>▪ Keep the torch tip pointed in the direction of the gouge that you want to make. |
| The gouge has too much depth. | ▪ Tilt the torch down so that it is closer to the workpiece.<br>▪ Increase the arc stretch (standoff).<br>▪ Increase the gouging speed.<br>▪ Decrease the output current (A). |
| The gouge does not have enough depth. | ▪ Put the torch in a more upright position.<br>▪ Decrease the arc stretch (standoff).<br>▪ Decrease the gouging speed.<br>▪ Increase the output current (A). |
| The gouge has too much width. | ▪ Put the torch in a more upright position.<br>▪ Decrease the arc stretch (standoff).<br>▪ Increase the gouging speed.<br>▪ Decrease the output current (A). |
| The gouge does not have enough width. | ▪ Tilt the torch down so that it is closer to the workpiece.<br>▪ Increase the arc stretch (standoff).<br>▪ Decrease the gouging speed.<br>▪ Increase output current (A). |

# 5 Do System Tests to Identify Defective Components

## Important information before you do these system tests

**⚠ WARNING**

Use extreme caution when working near live electrical circuits. Dangerous voltages are inside the plasma power supply that can cause serious injury or death.

Live voltages can continue to be present on the DC bus for at least 30 seconds after disconnecting the input power. Wait for bus voltages to be fully released before you do any tests.

While testing, do not touch the nozzle at the end of the torch. Dangerous voltages can cause serious injury.

Refer to the WARNING on page 13 before continuing.

Do the following before you do the tests in this section:

- Do an internal inspection on page 21.
- Do an initial resistance check on page 28.

The tests in this section must be done by a qualified service technician. Wear the proper personal protective equipment, and use approved tools and measurement equipment.

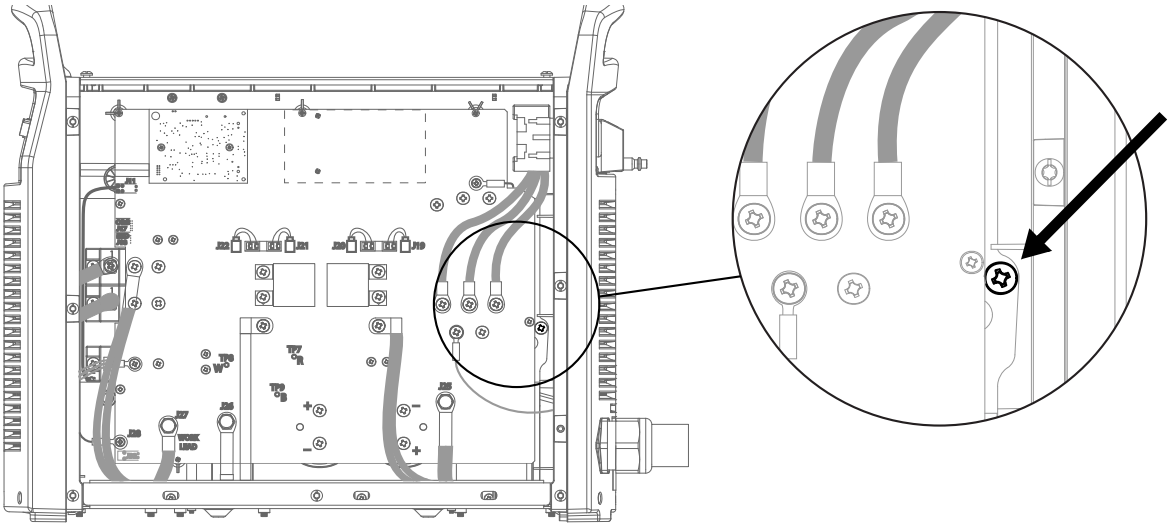
Before you purchase a major replacement component, make sure that you have correctly identified the problem with help from Hypertherm Technical Service or the nearest Hypertherm repair facility.

## System tests in this section

| System test | Associated fault codes |
|---|---|
| Test 1 – Voltage input on page 78 | 0-60-*n* |
| Test 2 – DC power bus on page 83 | 3-43-0 |
| Test 3 – Output diodes on page 90 | 3-51-1, 3-52-0 |
| Test 4 – Inverter thermal sensor and PFC temperature sensor on page 91 | 0-40-*n*, 2-10-*n*, 3-11-*n* |
| Test 5 – Flyback circuit (DC minor voltages) on page 94 | 3-00-0, 3-42-*n*, 3-43-*n* |
| Test 6 – Torch stuck open (TSO) or torch stuck closed (TSC) on page 98 | 0-30-*n* |
| Test 7 – Start signal on page 102 | 0-51-0, general |
| Test 8 – Torch cap switch on page 108 | 0-50-0 |
| Test 9 – Solenoid valve electronic regulator on page 112 | 0-21-0, 3-20-*n* |
| Test 10 – Solenoid valve pressure sensor on page 115 | 0-12-0, 0-20-0, 0-22-0, 2-11-*n* |
| Test 11 – Fan on page 120 | 0-40-*n*, 3-10-*n* |
| Test 12 – Auxiliary (AUX) switch on page 123 | 2-01-0 or unreported interlock at START |
| Test 13 – Pilot arc IGBT on page 125 | General |
| Test 14 – Radio Frequency (RF) communication errors on page 126 | 0-98-1, 0-98-2 |

## How to attach to ground

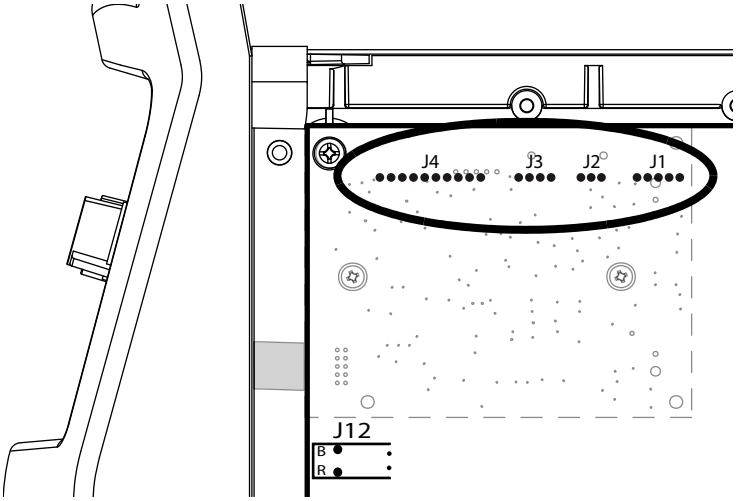
For tests where it is necessary to attach the multimeter to ground, use the ground screw on the heatsink.



## How to get voltage measurements for internal components

For some tests it is necessary to get access to pins on the power PCB in order to measure voltage. The pins for the following components are behind the DSP PCB. Use extended thin meter points to measure voltage on these pins. Refer to Get the necessary test equipment on page 16.

**Figure 7** – J1, J2, J3, and J4 pins in Powermax65/85 SYNC CSA



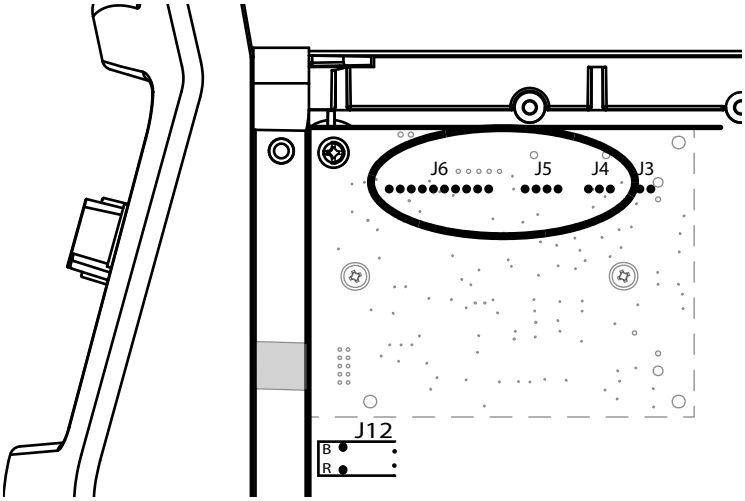

**J1** = Auxiliary switch

**J2** = Inverter temperature sensor

**J3** = Fan

**J4** = Solenoid valve electronic regulator

**Figure 8** – J4, J5, and J6 pins in Powermax65/85 SYNC CE/CCC

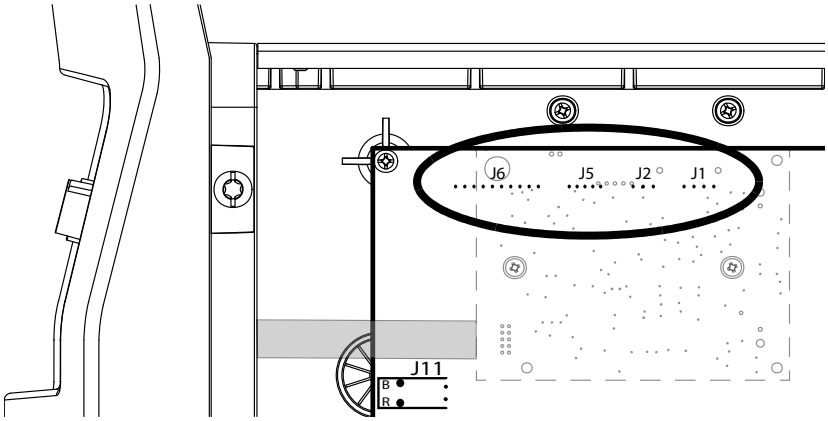



**J4** = Inverter temperature sensor

**J5** = Fan

**J6** = Solenoid valve electronic regulator

**Figure 9** – J1, J2, J5, and J6 pins in Powermax105 SYNC




**J1** = Fan

**J2** = Inverter temperature sensor

**J5** = Auxiliary switch

**J6** = Solenoid valve electronic regulator

# Test 1 – Voltage input

**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

When you get an AC input voltage fault (**0-60-0**, **0-60-1**, or **0-60-2**), do the following.

## Examine the incoming power

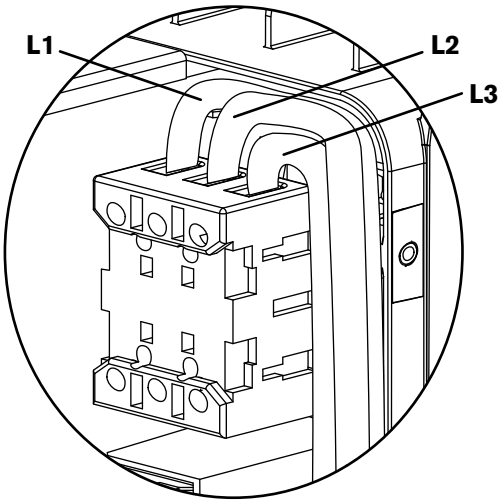
1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Connect the power cord to the power source, but keep the plasma power supply set to OFF (**O**).

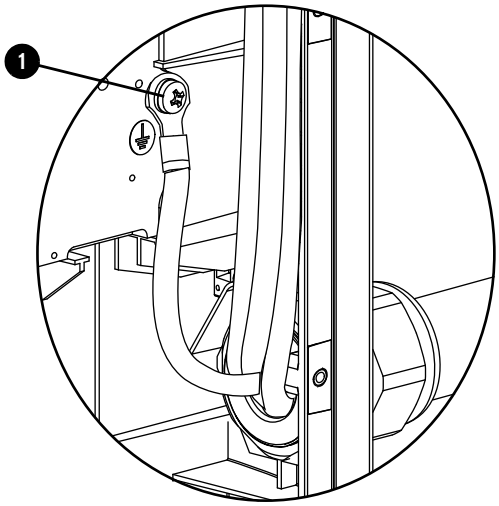
4. Measure the voltage on the input leads as follows:

   **a.** Measure the voltage from each input lead to ground. The leads have the labels **L1**, **L2**, and **L3** on the power switch. Look for the ⏚ symbol on the heatsink ❶ to identify the ground screw.

   **b.** Measure the line voltage across the input leads, as follows:

   - ❑ **L1** to **L2**
   - ❑ **L2** to **L3**
   - ❑ **L1** to **L3**




5. Is the AC voltage between each pair of input wires equal to the line voltage of the incoming circuit, based on the model of the plasma power supply?

   - If yes, an additional check is necessary to identify if the problem is with the power switch or with a different component. Continue with Examine the power switch and the plasma power supply.
   - If no, continue with the next step.

6. If the voltage across the input leads is not correct, have a qualified service technician examine the following electrical components:

   - Power cord
   - Receptacle where the power cord connects to the power source
   - Circuit breakers or fuses

   For example, make sure that the circuit breakers or fuses are sufficient for the plasma power supply. For the power cord, make sure that the wires are connected to the correct locations in the plasma power supply and in the line-disconnect box. Also make sure that the power cord wires are fully tightened.

## Examine the power switch and the plasma power supply

1. Make sure that the power switch on the plasma power supply is ON (I).
2. Measure the input voltage to the input diode bridge. The AC voltage between each pair of input wires must be equal to the line voltage.
3. Is the voltage to the power switch correct, but the voltage to the input diode bridge is low?
   - If yes, replace the power switch.
   - If no, continue with the next step.
4. Measure the output voltage of the input diode bridge. Refer to Figure 10 or Figure 11.

   ```
   Output VDC = Line Voltage x 1.414 VDC
   ```

   All values are ±15%.

**Figure 10** – Powermax65/85 SYNC

| 1-phase | |
|---|---|
| **L** | Black (CSA) |
| **N** | White (CSA) |
| **PE** | Green (CSA) |

| 3-phase | |
|---|---|
| **L1** | Black (CSA)<br>Brown (CE/CCC) |
| **L2** | White (CSA)<br>Black (CE/CCC) |
| **L3** | Red (CSA)<br>Gray (CE/CCC) |
| **PE** | Green (CSA)<br>Green/yellow (CE/CCC) |

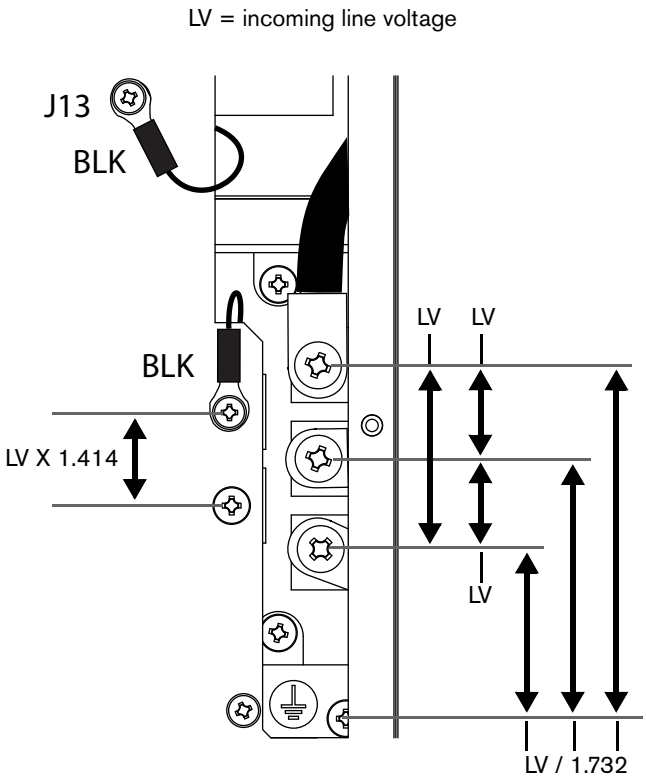
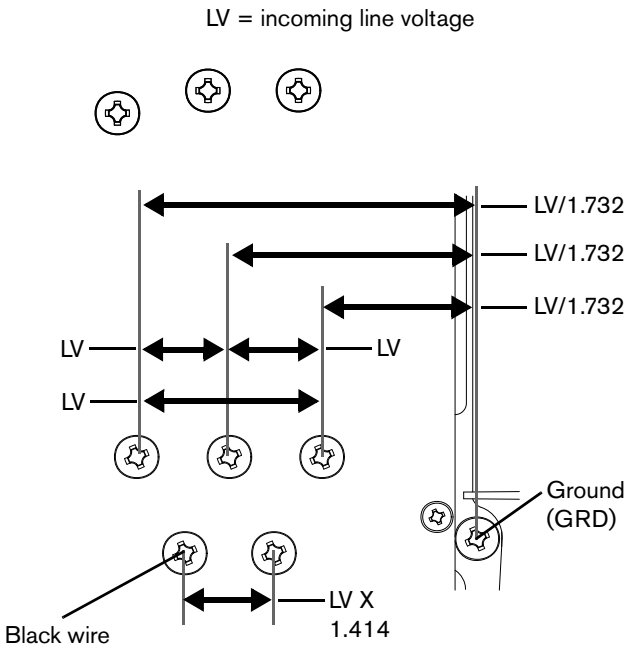
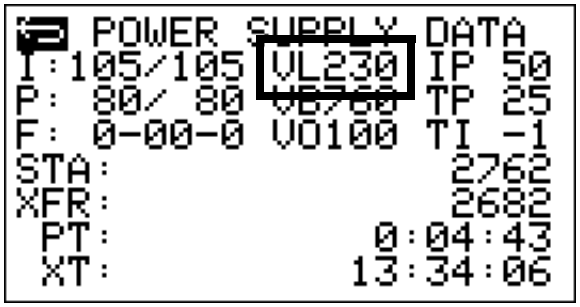


**Figure 11** – Powermax105 SYNC

| 3-phase | |
|---|---|
| **L1** | Black (CSA)<br>Brown (CE/CCC) |
| **L2** | White (CSA)<br>Black (CE/CCC) |
| **L3** | Red (CSA)<br>Gray (CE/CCC) |
| **PE** | Green (CSA)<br>Green/yellow (CE/CCC) |



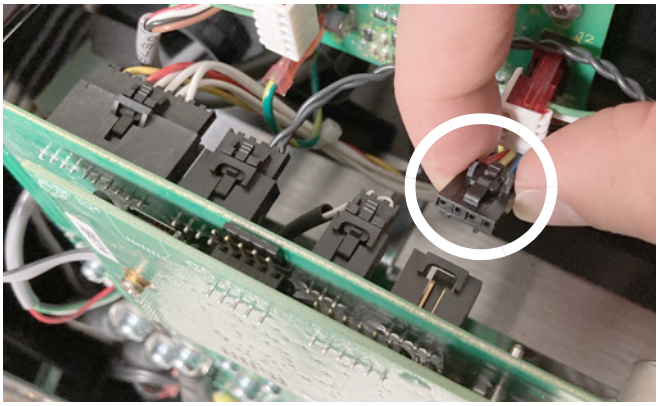

5. If the diode bridge output value is correct, but you continue to get an 0-60-*n* fault code, do the following:
   a. Go to the **POWER SUPPLY DATA** screen.
   b. Make sure that the value in the **VL** field is ±15% of the AC line voltage.



**6.** If the value in the **VL** field correct, but you continue to get a 0-60-*n* fault code, do the following:

**a.** Do a check for a short-circuited fan. Disconnect the fan from the power PCB, as follows:

- ❑ J3 in Powermax65/85 SYNC CSA models
- ❑ J5 in Powermax65/85 SYNC CE/CCC models
- ❑ J1 in all Powermax105 SYNC models



Another possible indication of a short-circuited fan is when nothing shows on the LCD screen after the plasma power supply is set to ON (I).

**b.** With the fan disconnected, does the problem go away?

- ❑ If yes, replace the fan.
- ❑ If no, perform the steps in Test 5 – Flyback circuit (DC minor voltages) on page 94 that are related to the fan. If the problem continues, examine the DSP PCB.

**c.** Disconnect the DSP PCB from the power PCB. Carefully remove the conformal coating from the pins, if necessary. Too much of this coating can prevent a good connection with the power PCB.

**d.** If the problem continues, replace the DSP PCB.

**e.** If the problem continues after a new DSP PCB is installed, replace the power PCB.

For all CSA models, and for Powermax105 SYNC 230 V – 400 V CE models, also replace the PFC IGBT module.

# Test 2 – DC power bus

If you get the **3-43-0** fault code, use this test to do a check of the internal capacitors.

## *NOTICE*

Do not use a multimeter with test leads for this test. This can cause a short circuit between the bus and the heatsink. Use miniature banana plugs instead, and attach them to the test point (TP) openings in the power PCB.

## Measure the voltage

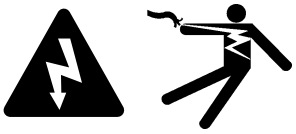
## ⚠ WARNING

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

## ⚠ WARNING



**ELECTRIC SHOCK CAN KILL**

Wait for internal voltages to be fully released before you touch the bulk capacitors.

The bulk capacitors can be charged for up to 10 minutes after the plasma power supply is set to OFF (**O**).

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. **Wait for approximately 10 minutes for internal voltages to be fully released.**
3. Remove the plasma power supply cover and the component barrier.
4. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (**I**).

5. Measure the voltage of the inverter IGBT ❶. For the correct voltages for your system, refer to Figure 12 on page 85 and Figure 13 on page 86.

   All values are ±15%.

6. Measure the voltage between the bulk capacitors ❷ before you fire the torch.

7. Measure the voltage between the bulk capacitors while you fire the torch.

8. The voltage between the bulk capacitors must be approximately the same before and during torch operation. The voltage must also be approximately half of the bus voltage, as shown in Table 6.

**Table 6**

| Powermax system and input power | Correct voltage (approximate) |
|---|---|
| Powermax65/85/105 SYNC CSA on 200 VAC – 480 VAC input power | 375 VDC |
| Powermax65/85/105 SYNC CSA on 600 VAC input power | 425 VDC |
| Powermax65/85 SYNC CE/CCC | 280 VDC |
| Powermax105 SYNC 230 V – 400 V CE | 375 VDC |
| Powermax105 SYNC 380 V CCC | 265 VDC |
| Powermax105 SYNC 400 V CE | 280 VDC |

9. If the voltage measurements are out of range, replace the power PCB.

**Figure 12** – Powermax65/85 SYNC voltages for inverter IGBT and bulk capacitors

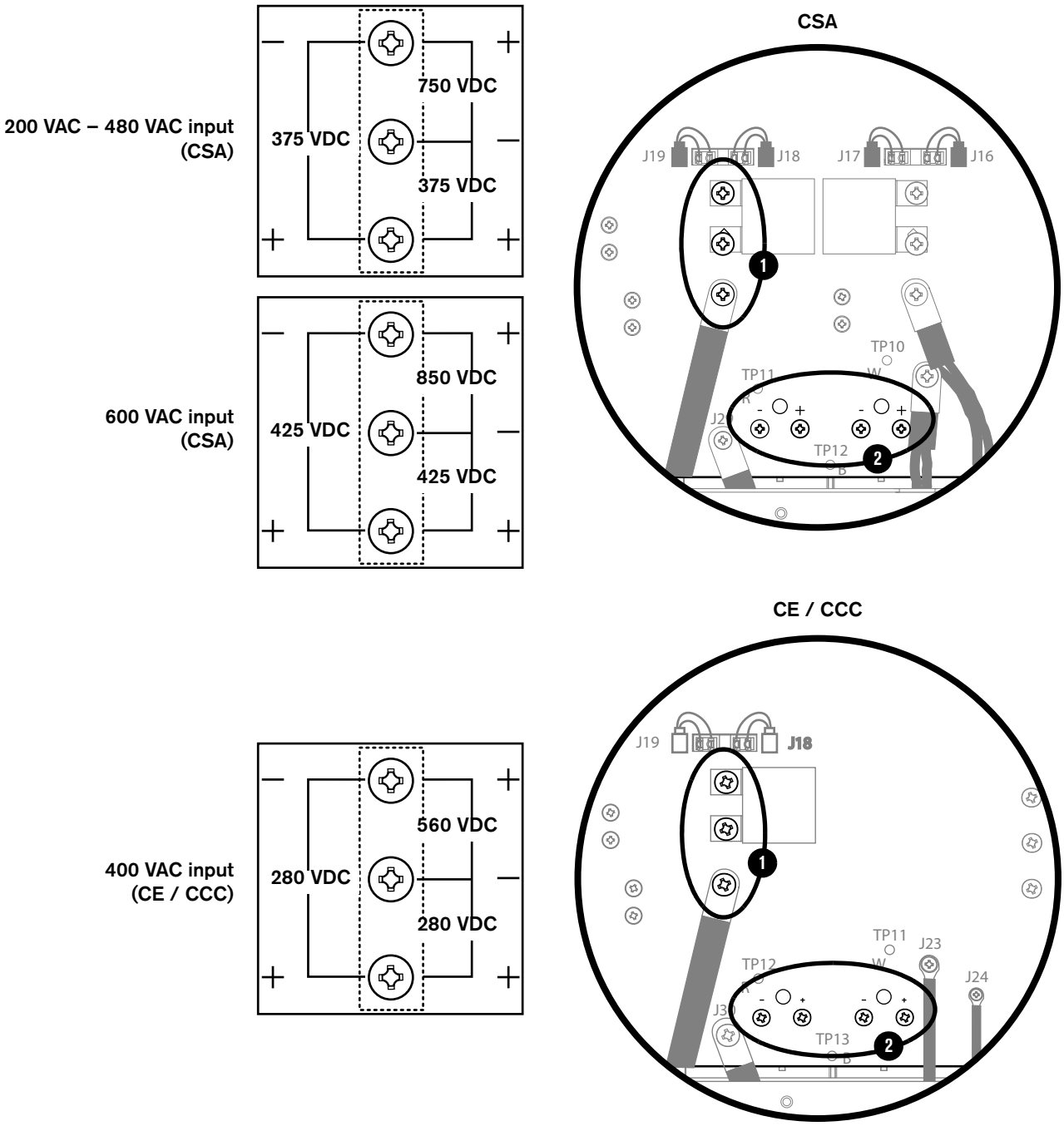
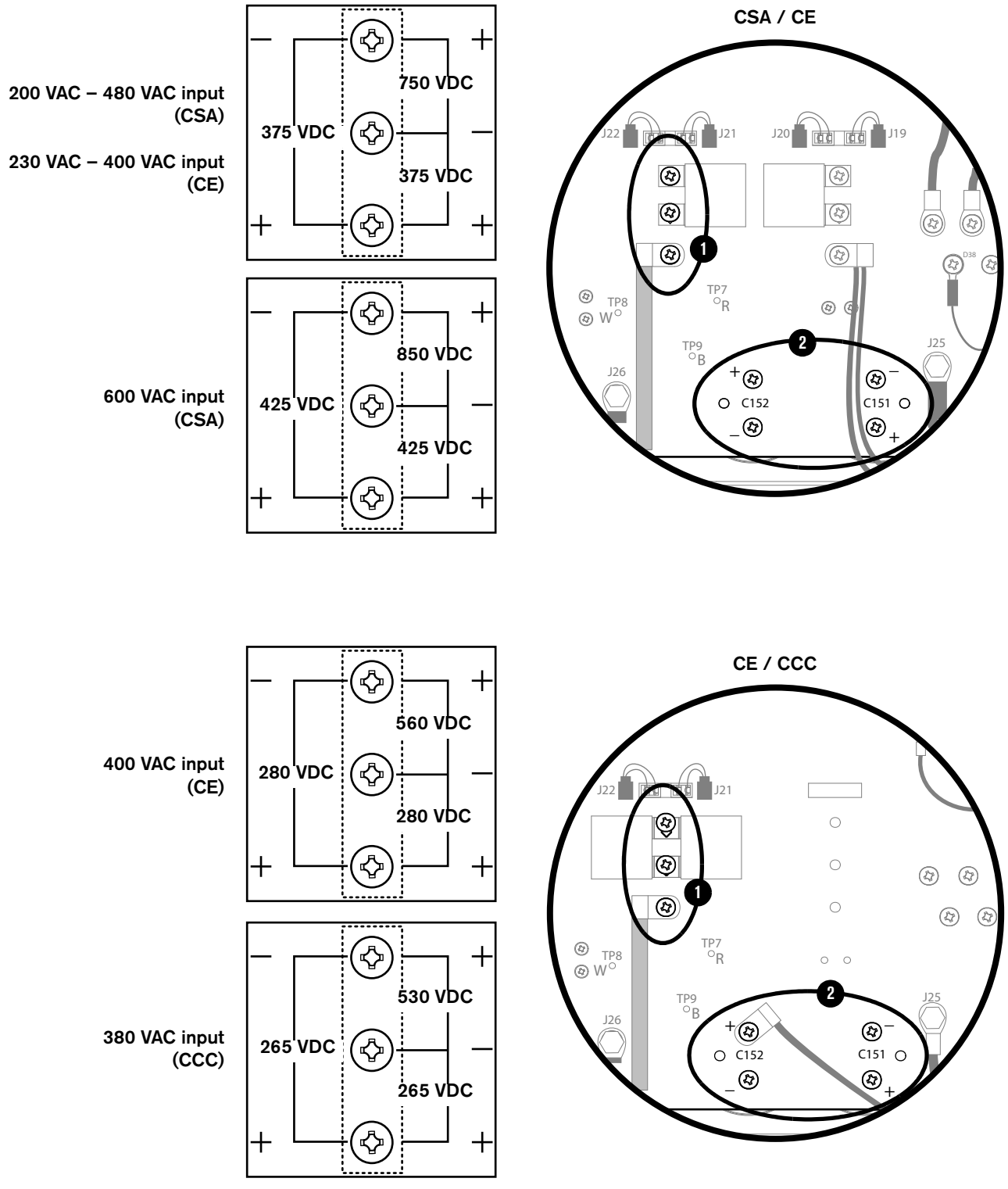
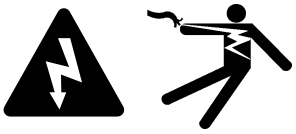


**Figure 13** – Powermax105 SYNC voltages for inverter IGBT and bulk capacitors



## Measure the resistance

**⚠ WARNING**



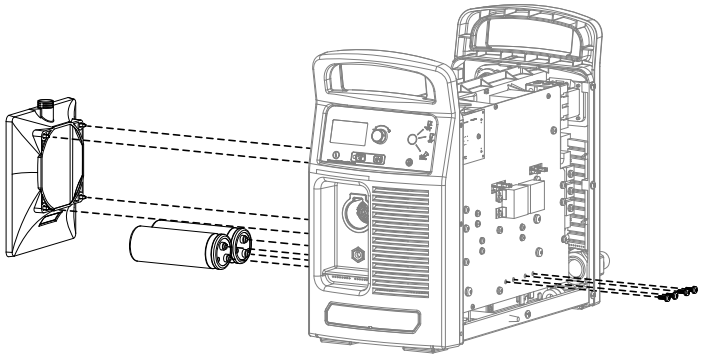
**ELECTRIC SHOCK CAN KILL**

Wait for internal voltages to be fully released before you touch the bulk capacitors.

The bulk capacitors can be charged for up to 10 minutes after the plasma power supply is set to OFF (**O**).

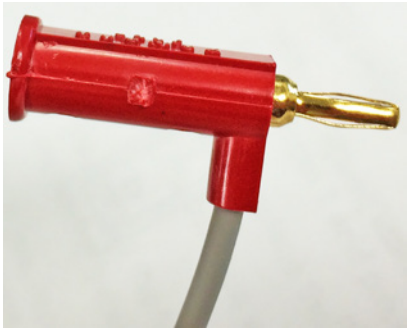
To get all resistance values, make sure that the power cord is disconnected from the power source and all internal power supply wires are securely attached.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. **Wait for approximately 10 minutes for internal voltages to be fully released.**
3. Remove the 2 bulk capacitors, as follows:
   a. From the power PCB side, remove the 4 bulk capacitor mounting screws.
   b. From the fan side, remove the 2 bulk capacitors by pulling them straight out of the plasma power supply. Remove the fan shroud from the fan if necessary.

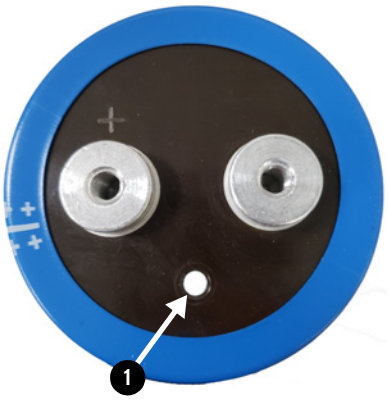


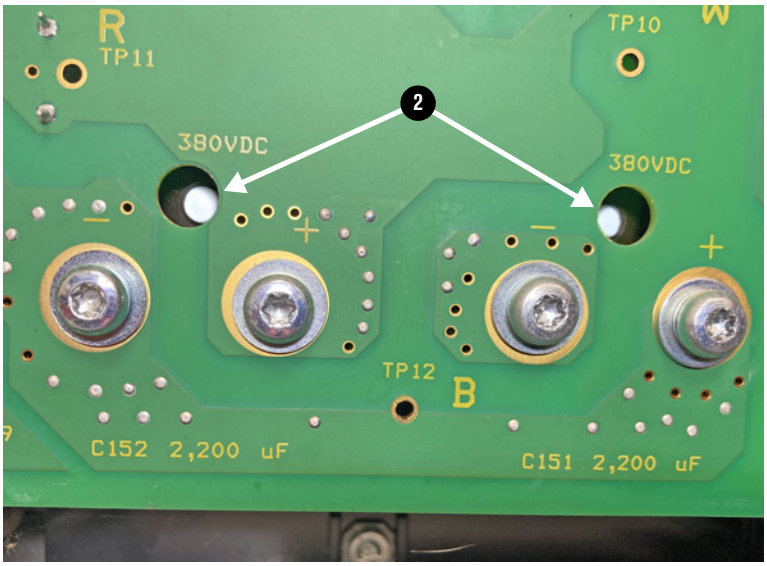
4. Measure the resistance between the test points (**TP*n***) on the power PCB as shown in Figure 14 on page 89 and Figure 15 on page 89. Use miniature banana plugs (for example, Pamona® 2945 plugs) to connect to the test points.

   If miniature banana plugs are not available, use small test clips that you can attach to the copper contacts in the test point openings on the power PCB.



**5.** Put the 2 bulk capacitors back into the plasma power supply. Position each capacitor so that the gray polarity dot ❶ on the capacitor aligns with the viewing hole ❷ on the power PCB.

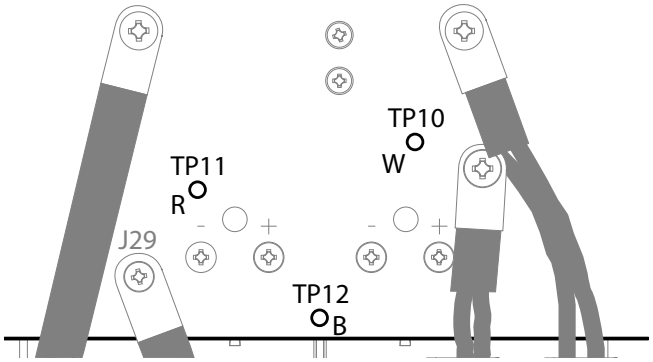



**6.** From the power PCB side, attach the bulk capacitors to the power PCB with the 4 mounting screws. Install the screws by hand first. For Powermax65/85 SYNC, tighten the screws to 2.3 N·m (20 lbf·in). For Powermax105 SYNC, tighten the screws to 4.0 N·m (35 lbf·in).

**Figure 14** – Powermax65/85 SYNC test points

| CSA | |
|---|---|
| **Test points** | **Resistance** |
| TP10 and TP12 | 25 kΩ |
| TP11 and TP12 | 25 kΩ |




| CE / CCC | |
|---|---|
| **Test points** | **Resistance** |
| TP11 and TP13 | 18 kΩ |
| TP12 and TP13 | 18 kΩ |

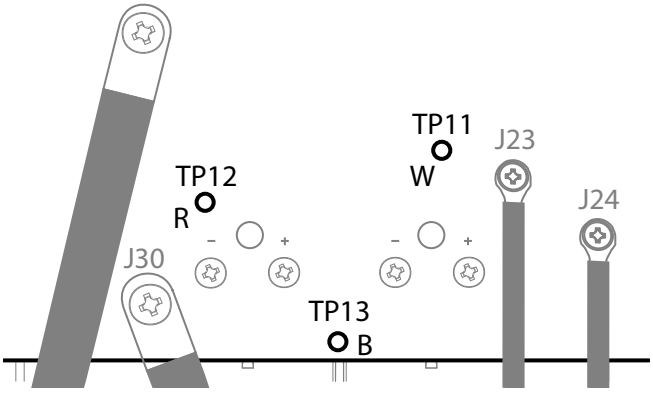
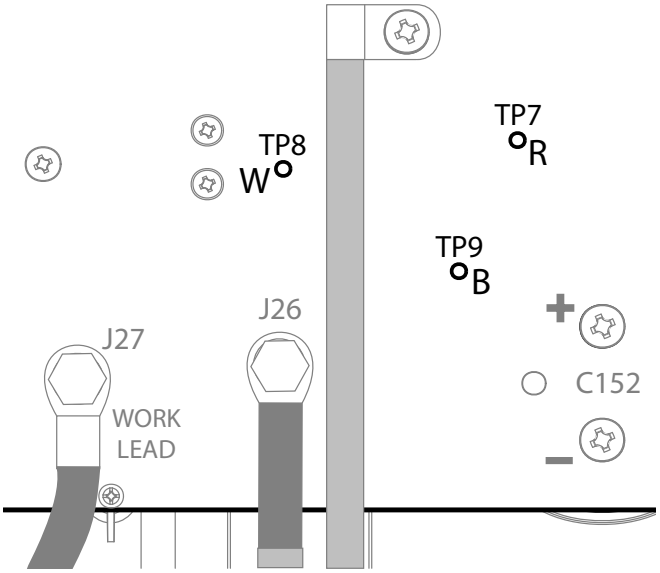



**Figure 15** – Powermax105 SYNC test points

| 200 V – 600 V CSA / 230 V – 400 V CE | |
|---|---|
| **Test points** | **Resistance** |
| TP7 and TP9 | 25 kΩ |
| TP8 and TP9 | 25 kΩ |

| 380 V CCC / 400 V CE | |
|---|---|
| **Test points** | **Resistance** |
| TP7 and TP9 | 18 kΩ |
| TP8 and TP9 | 18 kΩ |

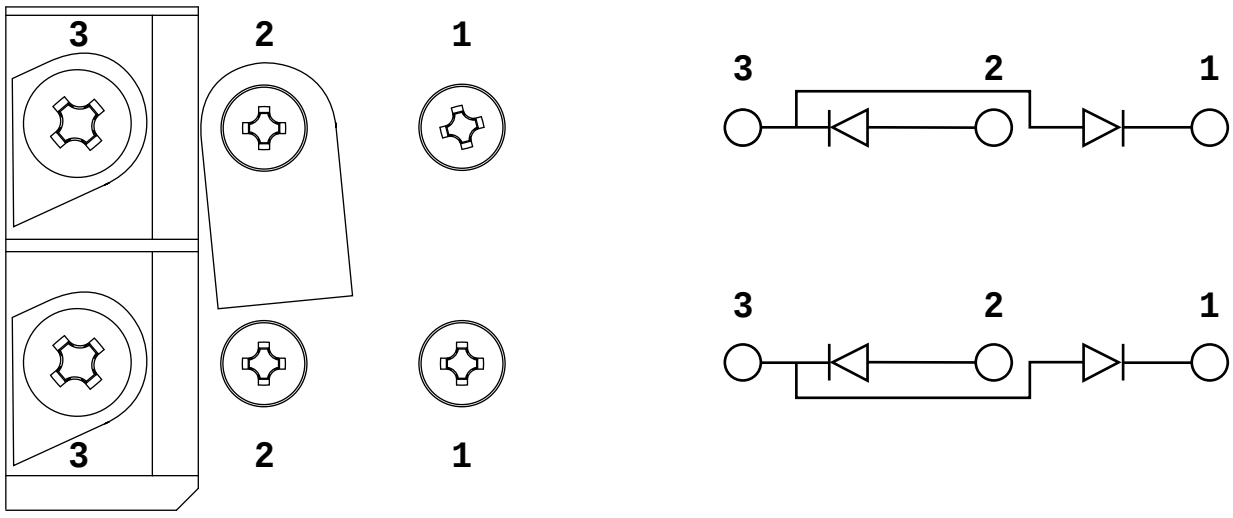


# Test 3 – Output diodes

Do this test if you get the **3-51-1** or **3-52-0** fault code.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Put a multimeter in ohmmeter (resistance) mode or diode test mode, and measure the resistance on all 4 diodes in the bridge. For each diode, put the black (common) lead on 3. Refer to Figure 16. A diode that is operating correctly gives the following values:
   - The value is open (very high resistance) with the meter leads in one direction.
   - The value is within the range of 0.1 V – 1.0 V with the meter leads in the opposite direction.
4. If a diode has one of the following conditions, replace both output diode bridges. Always replace output diodes as a pair.
   - The diode has a value less than 0.1 V. In this condition, the diode is short-circuited.
   - The diode has a value greater than 1.0 V in both directions. In this condition, the diode has an open circuit.

**Figure 16** – Output diode connections on the power PCB



# Test 4 – Inverter thermal sensor and PFC temperature sensor

Use this test to do a check of the internal temperature sensors.

## Identify the fault code

1. Identify the fault code that is showing on the main screen.
2. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
3. **Wait for approximately 1 hour to make sure that the temperature of the plasma power supply is approximately at room temperature.**
4. Remove the plasma power supply cover and the component barrier.
5. Do the procedure for the fault code you saw in step 1, as follows:
   - Procedure for fault codes 0-40-0, 0-40-1, 3-11-0, or 3-11-1 on page 91
   - Procedure for fault codes 0-40-2, 0-40-3, 2-10-0, or 2-10-1 on page 92

## Procedure for fault codes 0-40-0, 0-40-1, 3-11-0, or 3-11-1

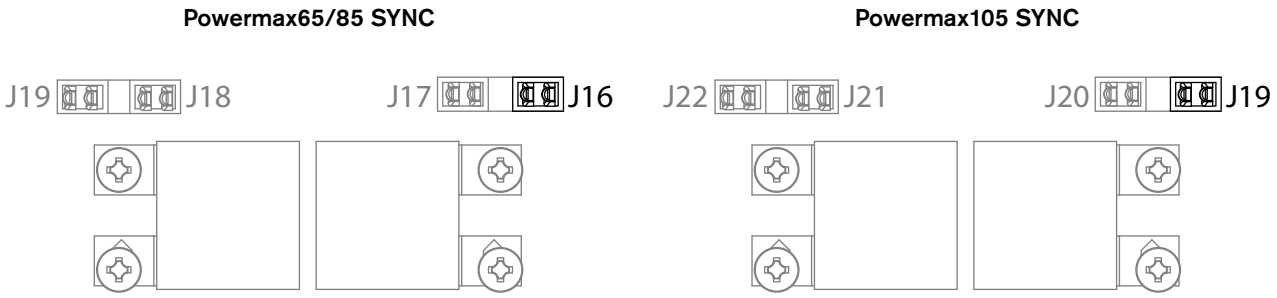
This procedure is only for the following systems:

- All Powermax65/85/105 SYNC CSA models
- Powermax105 SYNC 230 V – 400 V CE models

1. Disconnect the PFC temperature sensor from J16 (Powermax65/85 SYNC) or J19 (Powermax105 SYNC) on the power PCB. Refer to Figure 17 on page 92.
2. Measure the resistance between pin 1 and pin 2 on the connector. Is the resistance approximately 5 kiloohms (kΩ)?
   - If yes, continue with the next step.
   - If no, replace the PFC IGBT and its gate drive cable. A replacement PFC IGBT from Hypertherm comes with a new gate drive cable.

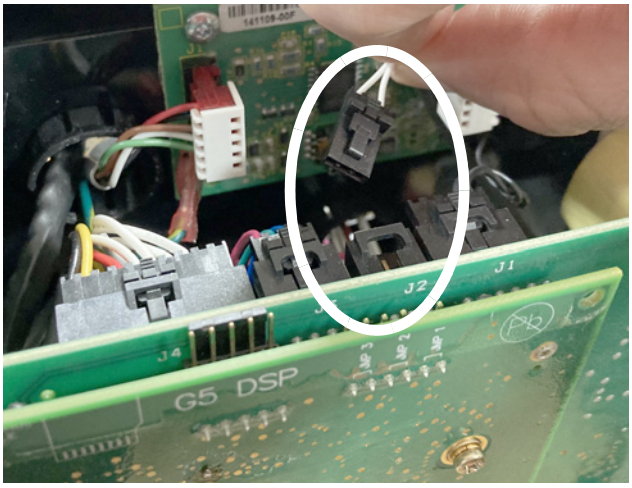
3. Measure the resistance between pin 1 and pin 2 on the power PCB. Is the resistance approximately 4.7 kiloohms (kΩ)?
   - If yes, replace the DSP PCB.
   - If no, replace the power PCB.

**Figure 17** – PFC temperature sensor



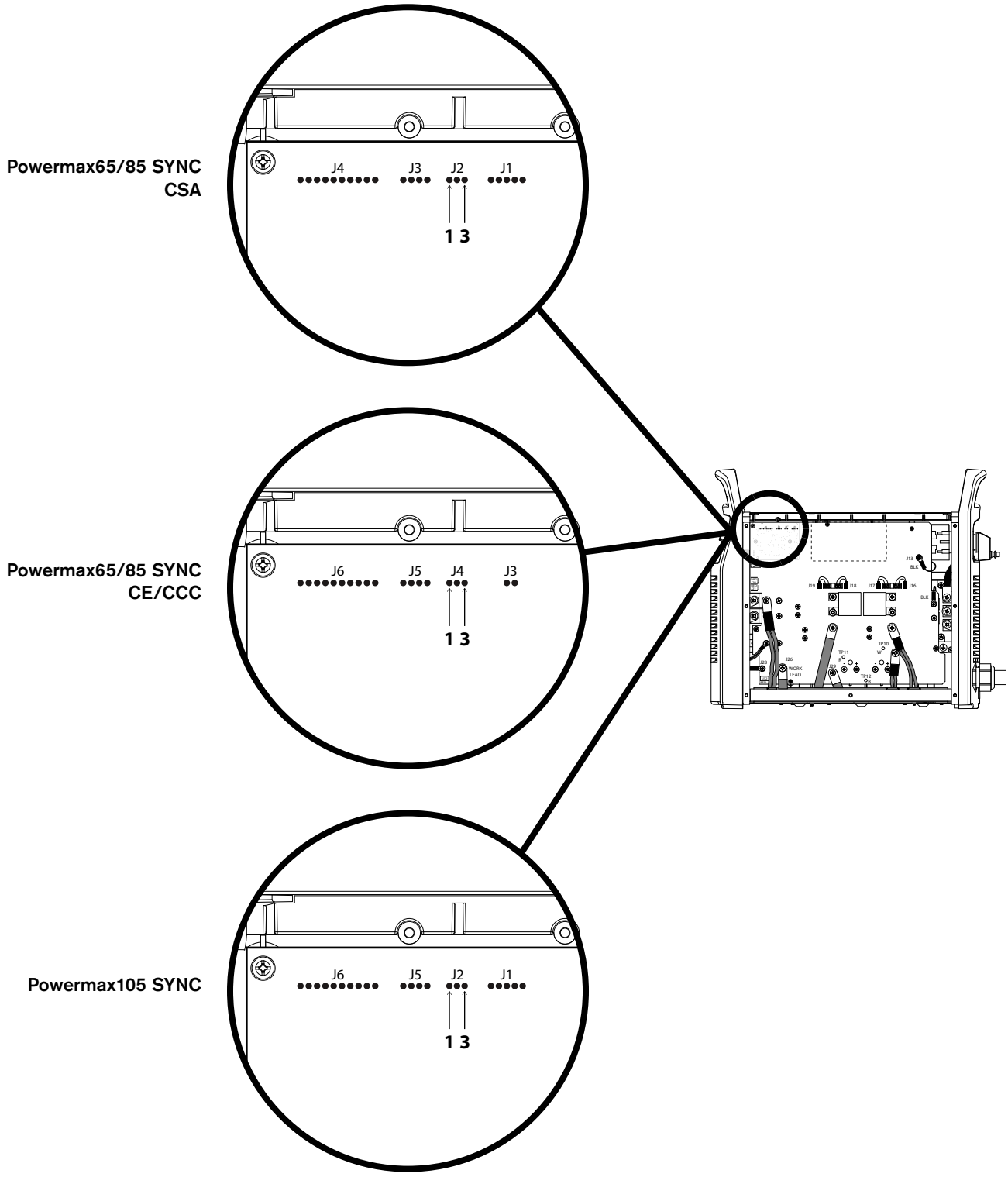

## Procedure for fault codes 0-40-2, 0-40-3, 2-10-0, or 2-10-1

1. Disconnect the inverter thermal sensor from the power PCB, as follows:
   - J2 in Powermax65/85 SYNC CSA models
   - J4 in Powermax65/85 SYNC CE/CCC models
   - J2 in all Powermax105 SYNC models




2. Measure the resistance between pin 1 and pin 3 on the connector. Is the resistance approximately 10 kiloohms (kΩ) (±1.5 kΩ)?
   - If yes, continue with the next step.
   - If no, replace the thermal sensor.
3. Remove the DSP PCB.
4. Keep the thermal sensor disconnected, and measure the resistance between pin 1 and pin 3 on the power PCB. Refer to Figure 18 on page 93. Is the resistance approximately 57.6 kiloohms (kΩ)?
   - If yes, replace the DSP PCB.
   - If no, replace the power PCB.

**Figure 18** – Inverter thermal sensor pins on power PCB



# Test 5 – Flyback circuit (DC minor voltages)

Use this test if you get a **3-00-0**, **3-42-*n***, or **3-43-*n*** fault code. Minor voltages are missing.

The flyback circuit is the source of minor DC voltages for the internal fan, solenoid valve electronic regulator, and power PCB.

A short-circuited fan can prevent you from getting correct voltage measurements in this test. If nothing shows on the LCD screen after the plasma power supply is set to ON (**I**), this can be an indication of a short circuit in the fan.

**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (**I**).

***NOTICE***

Do not use -VBUS to attach to ground. Doing so could make the plasma power supply unserviceable. Use the ground screw on the heatsink. Refer to How to attach to ground on page 76.

4. Measure the voltages for the internal components shown in Table 7 on page 95. Refer to Figure 19 on page 97.

**Table 7**

| System | Component | Pin number to ground | Correct voltage (±15%) |
|---|---|---|---|
| **Powermax65/85 SYNC CSA** | Fan | Pin 1 on J3 | +48 VDC |
| | Solenoid valve electronic regulator | Pin 7 on J4 | +48 VDC |
| | | Pin 5 on J4 | +24 VDC |
| | | Pin 4 on J4 | +5 VDC |
| | Power PCB | Pin 4 on J11 | +3.3 VDC |
| **Powermax65/85 SYNC CE/CCC** | Fan | Pin 1 on J5 | +48 VDC |
| | Solenoid valve electronic regulator | Pin 7 on J6 | +48 VDC |
| | | Pin 5 on J6 | +24 VDC |
| | | Pin 4 on J6 | +5 VDC |
| | Power PCB | Pin 4 on J14 | +3.3 VDC |
| **Powermax105 SYNC** | Fan | Pin 1 on J1 | +48 VDC |
| | Solenoid valve electronic regulator | Pin 7 on J6 | +48 VDC |
| | | Pin 5 on J6 | +24 VDC |
| | | Pin 4 on J4 | +5 VDC |
| | Power PCB | Pin 4 on J15 | +3.3 VDC |

**5.** Is the 48 VDC measurement for the fan correct?

- If yes, continue with the next step.
- If no, disconnect the fan connector from the power PCB. Measure the voltage again from pin 1 to ground. Is the voltage correct now?
  - ❑ If yes, replace the fan.
  - ❑ If no, continue with the next step.

**6.** Are the 48 VDC, 24 VDC, and 5 VDC measurements for the solenoid valve electronic regulator all correct?

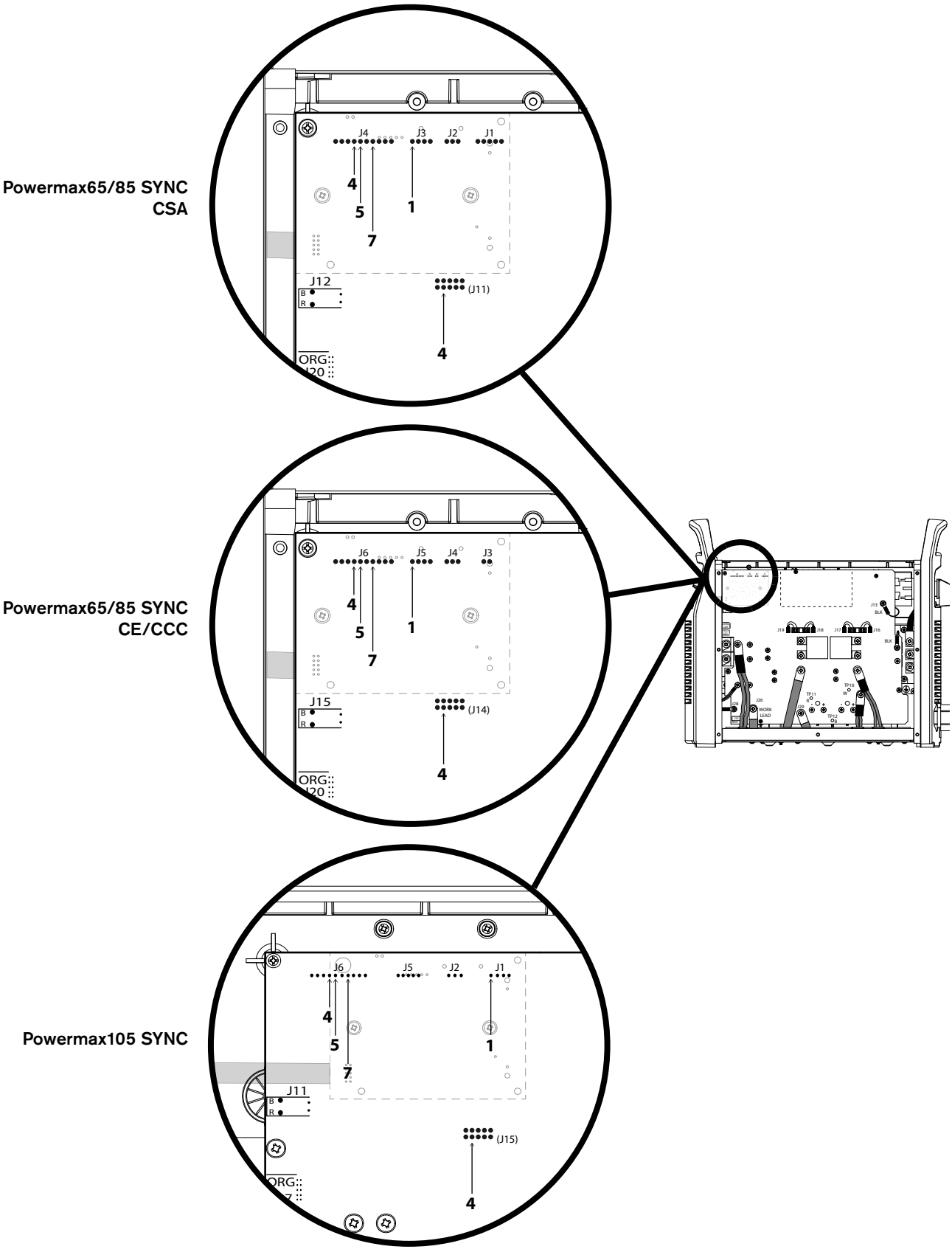
- If yes, continue with the next step.
- If no, disconnect the solenoid valve electronic regulator from the power PCB. Measure the voltage again from pin 7, pin 5, or pin 4 to ground. Is the voltage correct now?
  - ❑ If yes, replace the solenoid valve assembly.
  - ❑ If no, continue with the next step.

**7.** Is the 3.3 VDC measurement on the power PCB correct?

- If yes, continue with the next step.
- If no, remove the DSP PCB from the system. Measure the voltage again from pin 4 to ground. Is the voltage correct now?
  - ❑ If yes, continue with the next step.
  - ❑ If no, replace the power PCB.

8. Install the DSP PCB, but disconnect the ribbon cable from J6 on the DSP PCB. Measure the voltage again from pin 4 to ground. Is the voltage correct now?
   - If yes, replace the control PCB.
   - If no, replace the DSP PCB.
9. If all of the voltage measurements are correct but you continue to see the same fault code, replace the power PCB.

**Figure 19** – Component pins on power PCB

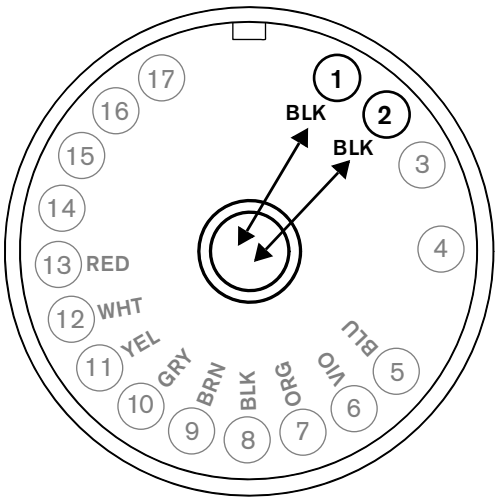


# Test 6 – Torch stuck open (TSO) or torch stuck closed (TSC)

Use this test when you get **0-30-*n*** faults during postflow and the Hypertherm cartridge is in good condition and is installed correctly.

## Examine the torch

1. Do a gas test for 2 minutes. Refer to page 26.
2. Monitor the gas pressure while the gas is flowing. If the pressure decreases gradually, look for the following conditions that can cause the pressure to decrease:
   - Does the torch lead have any kinks?
   - Are there cable ties around the torch lead that are too tight?
   - Is there heavy equipment putting too much weight on part of the torch lead?
   - Are there signs of damage to the torch lead that can cause gas pressure leaks?
3. Connect a different torch to the plasma power supply that is known to operate correctly. Does the 0-30-*n* fault go away?
   - If yes, continue with the next step.
   - If no, continue with Examine the plasma power supply on page 99.
4. Do a check for continuity on the original torch, as follows:
   **a.** Make sure that a cartridge is installed on the torch and that the torch is **not** connected to the plasma power supply.
   **b.** Do a check for continuity between pin 1 in the torch connector and the brass in the center of the connector.
   **c.** Do a check for continuity between pin 2 in the torch connector and the brass in the center of the connector.




5. Is there continuity on both pins?
   - If yes, the problem can be with the plasma power supply, not the torch. Continue with Examine the plasma power supply on page 99.
   - If no, replace the torch lead.

## Examine the plasma power supply

**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

### Measure the resistance at idle and with gas flowing

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Make sure that a torch is connected to the plasma power supply and a cartridge is installed on the torch.
4. Make sure that the torch is set to the green “ready to fire” (✓) position.
5. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (**I**).
6. With the system at idle, do a check for continuity between the black wires that connect to the pilot arc IGBT ❶ and the red wire that connects to J28 ❷ on the power PCB (or J29 on Powermax65/85 SYNC CE/CCC models). Refer to Figure 20 on page 100 and Figure 21 on page 100.
7. Start a gas test.
8. With gas flowing from the torch, measure the resistance again between the pilot arc IGBT and J28 (or J29). Refer to Figure 20 on page 100 and Figure 21 on page 100. Is the resistance greater than 10 kiloohms (kΩ)?
   - If yes, continue with the next step.
   - If no, there is possibly a problem with the solenoid valve electronic regulator. Do Test 9 – Solenoid valve electronic regulator on page 112.
9. Stop the gas test.

**Figure 20** – Powermax65/85 SYNC

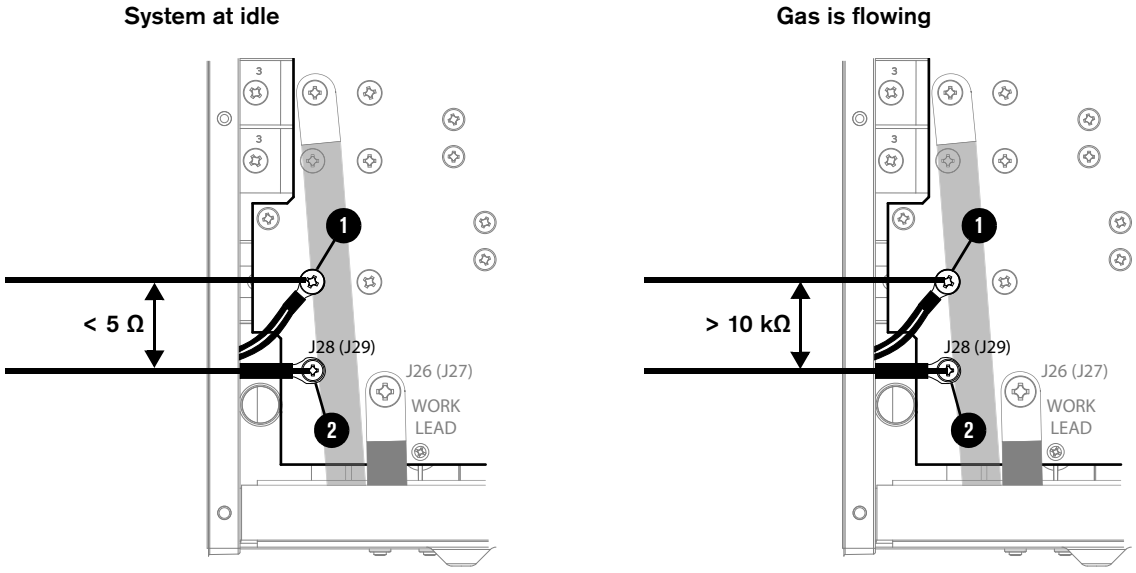
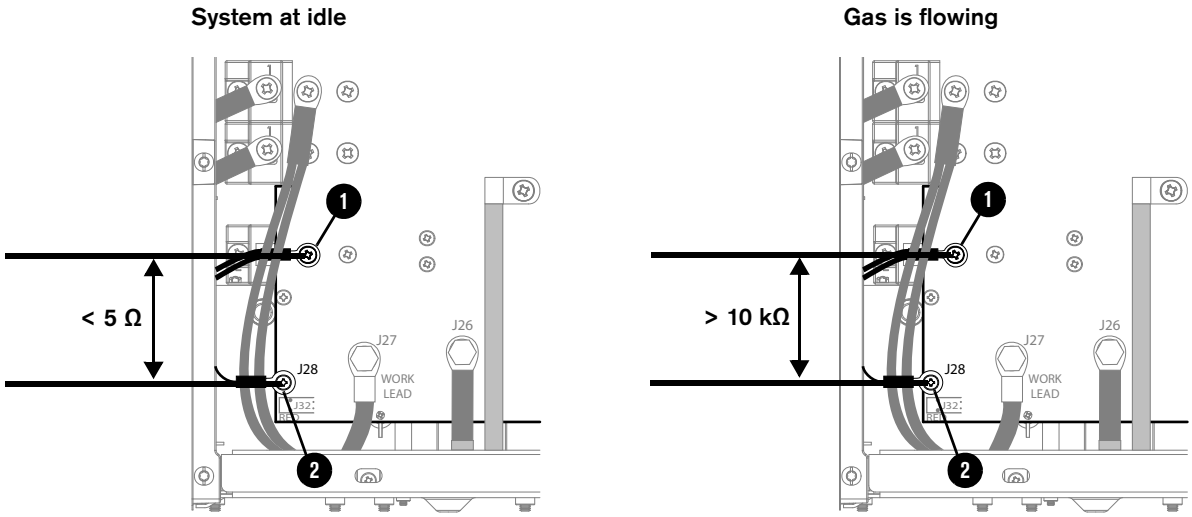



**Figure 21** – Powermax105 SYNC




## Measure the resistance with the power OFF

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Measure the resistance again between the pilot arc IGBT and J28 (or J29). Is the resistance less than 100 ohms (Ω)?
   - If yes, continue with the next step.
   - If no, continue with step 5.
3. Disconnect the torch from the plasma power supply.

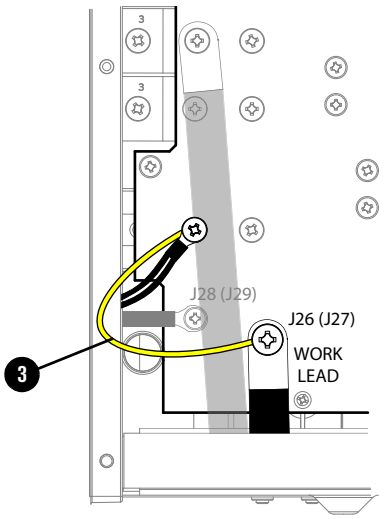
4. Measure the resistance again between the pilot arc IGBT and J28 (or J29). Is the resistance still less than 100 ohms (Ω)?
   - If yes, use an IGBT tester to do a check for a short-circuited pilot arc IGBT. Replace the pilot arc IGBT if it is short-circuited.
   - If no, continue with the next step.
5. Put a new cartridge on the torch.
6. Measure the resistance again between the pilot arc IGBT and J28 (or J29). Is the resistance now less than 100 ohms (Ω)?
   - If yes, the original cartridge is bad.
   - If no, continue with the next step.

## Do a check of the pilot arc IGBT

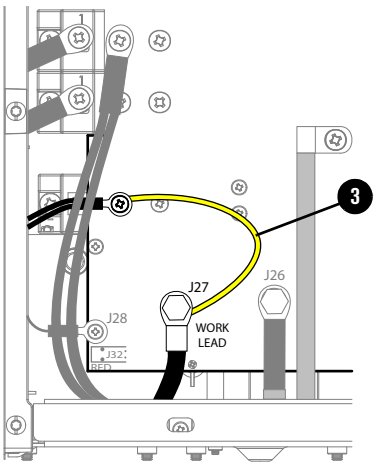
1. Make sure that the plasma power supply is still OFF and is disconnected from power.
2. Install a jumper wire ❸ from the pilot arc IGBT to the work lead connector on the power PCB, as follows. Refer to Figure 22.
   - Use a wire that is 8 AWG at a minimum.
   - Connect to the work lead at J26 on Powermax65/85 SYNC CSA models.
   - Connect to the work lead at J27 on Powermax65/85 SYNC CE/CCC models and all Powermax105 SYNC models.
3. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (I).
4. Try to fire the torch. If the torch fires a plasma arc, replace the pilot arc IGBT.

**Figure 22** – Jumper wire from pilot arc IGBT to work lead

**Powermax65/85 SYNC**




**Powermax105 SYNC**



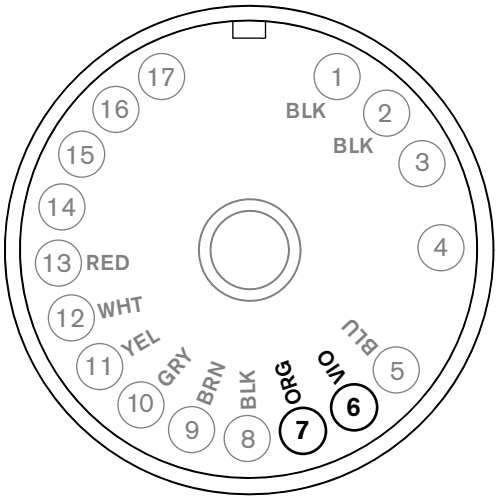
# Test 7 – Start signal

Use this test if you fire the torch but there is no plasma arc.

## Test 7 – Procedure for a hand torch

1. Make sure that the torch is set to the green “ready to fire” (✓) position.
2. Look at the main screen as you set the power switch on the plasma power supply to ON (I). Do you see the “torch started” icon ( ) and the 0-51-0 fault code?


   - If yes, continue with the next step.
   - If no, continue with step 5.
3. Disconnect the torch from the plasma power supply.
4. Make sure that the torch trigger is not being pulled, and measure the resistance between pin 6 and pin 7 in the torch connector. Is the resistance very low?

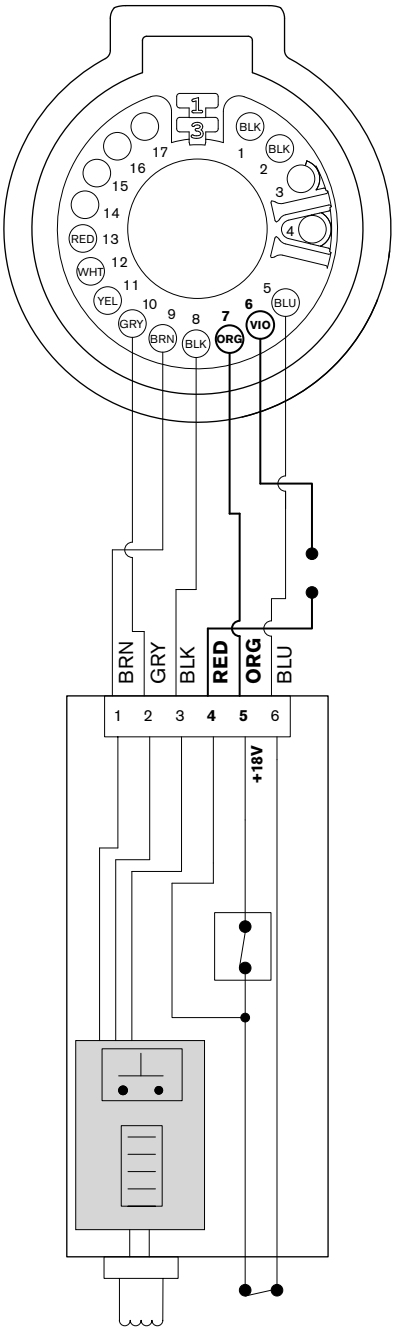



   - If yes, do a check for short circuits in the torch lead. Replace the torch lead if the wires in it are short-circuited.
     - Also do a check for short circuits in the trigger switch assembly. Replace the trigger switch if it is short-circuited.
   - If no, reconnect the torch to the plasma power supply, and continue with the next step.
5. Does the “torch started” icon ( ) show as you fire the torch?
   - If yes, continue with step 8.
   - If no, disconnect the torch from the plasma power supply, and continue with the next step.
6. Measure the resistance between pin 6 and pin 7 in the torch connector while you are pulling the torch trigger. Is the resistance very high?
   - If yes, do a check for open circuits in the torch lead. Replace the torch lead if there are open circuits.
     - Also do a check of the trigger switch for open circuits. Replace the trigger switch if there are open circuits.
   - If no, continue with the next step.

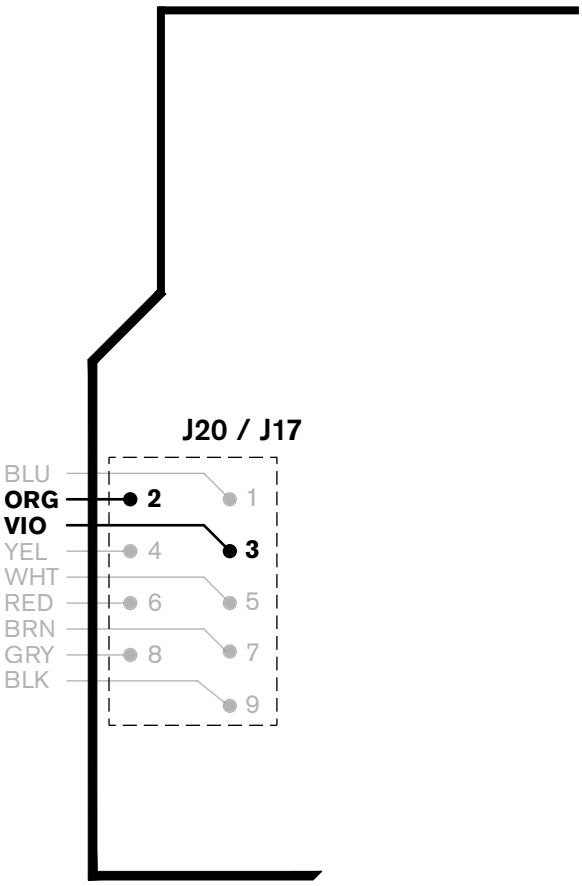
7. If the torch continues to not fire a plasma arc, and gas does not flow from the torch, do a check for continuity between the torch and the plasma power supply, as follows:
   a. Put the torch on its side. Remove the left side of the torch shell.
   b. Do a check for continuity between pin 4 on the torch PCB (red wire) and pin 3 at J20 (Powermax65/85 SYNC) or J17 (Powermax105 SYNC) on the power PCB. Refer to Figure 23 on page 104.
   c. Do a check for continuity between pin 5 on the torch PCB (orange wire) and pin 2 at J20 (Powermax65/85 SYNC) or J17 (Powermax105 SYNC) on the power PCB. Refer to Figure 23 on page 104.
   d. If you do not have continuity between the pins, examine the DSP PCB. Continue with the next step.
8. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
9. Remove the plasma power supply cover and the component barrier.
10. Disconnect the DSP PCB from the power PCB. Carefully remove the conformal coating from the pins, if necessary. Too much of this coating can prevent a good connection with the power PCB.
11. If the problem continues, replace the DSP PCB.
12. If the problem continues after a new DSP PCB is installed, replace the power PCB.

**Figure 23** – Pins for continuity check between torch and plasma power supply

**Pin 4 and pin 5 on torch PCB**




**Pin 2 and pin 3 on power PCB**



## Test 7 – Procedure for a machine torch

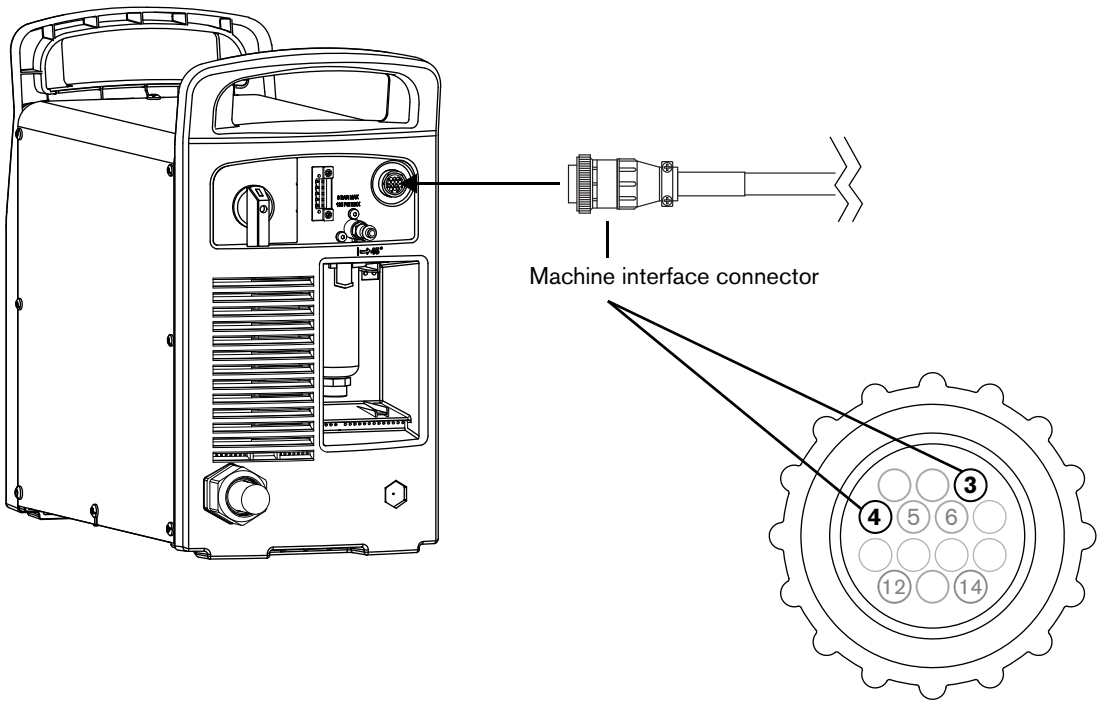
1. Make sure that the torch is set to the green “ready to fire” (✓) position.
2. Look at the main screen as you set the power switch on the plasma power supply to ON (**I**). Do you see the “torch started” icon ( ) and the 0-51-0 fault code?


   - If yes, continue with Examine the CNC and the machine interface cable.
   - If no, continue with Examine the plasma power supply on page 106.

### Examine the CNC and the machine interface cable

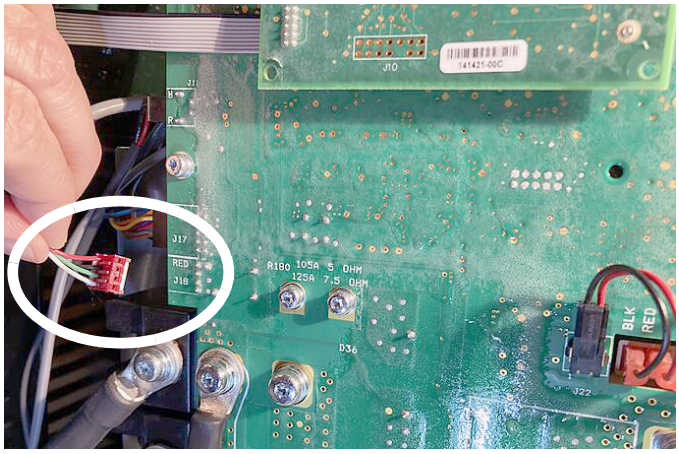
1. Disconnect the machine interface cable from the rear of the plasma power supply. This is the 14-pin cable that connects the plasma power supply to the CNC. Refer to Figure 24 on page 106.
2. Do a quick restart. If the fault code goes away and the system operates correctly, reboot the CNC. This can remove a start signal if there is one pending.
3. Connect the machine interface cable to the plasma power supply, and do a quick restart again. If you continue to see the 0-51-0 fault code, disconnect the machine interface cable from the plasma power supply again.
4. Do a check for continuity on pin 3 and on pin 4 in the machine interface cable connector. Refer to Figure 24 on page 106. Is there continuity on both pins?
   - If yes, there can be a problem with the CNC or with the cable. Continue with the next step.
   - If no, there can be a problem in the plasma power supply. Continue with Examine the plasma power supply on page 106.
5. Do a check for open circuits in the machine interface cable between pin 3 and the CNC and pin 4 and the CNC. Are the signals open?
   - If yes, there can be a problem with the CNC. Continue with step 7.
   - If no, there can be a problem with the cable. Continue with the next step.
6. Disconnect the machine interface cable from the CNC. Do a check for short-circuited wires in the cable. If there is a wire that is short-circuited, replace the machine interface cable.
7. If there is not a problem with the machine interface cable, contact a support technician for the CNC to identify possible problems that can prevent the torch from firing.

**Figure 24** – Pins for plasma start on machine interface cable




## Examine the plasma power supply

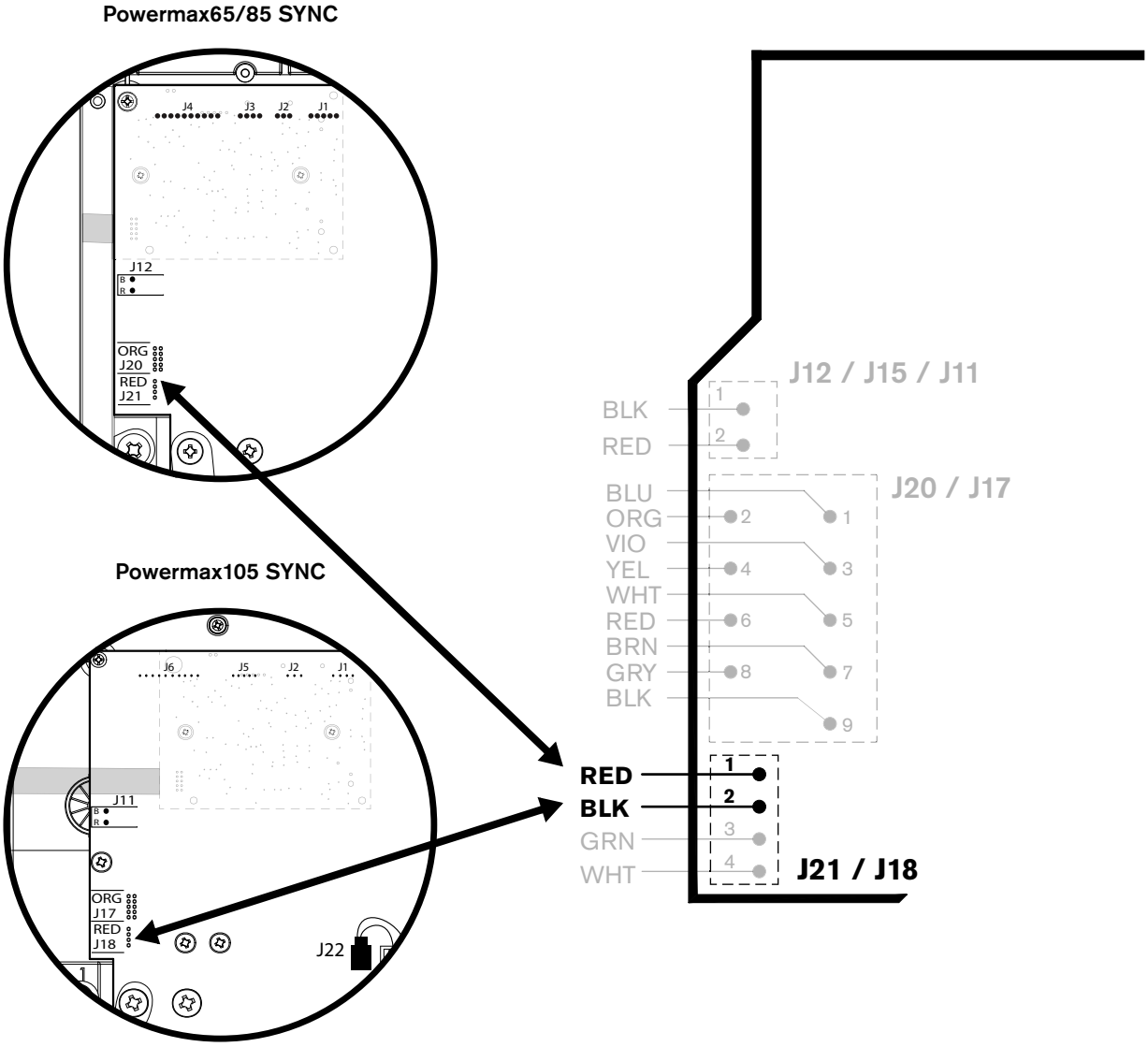
1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Disconnect the 4-pin machine interface connector from the side of the power PCB, as follows:
   - J21 in Powermax65/85 SYNC models
   - J18 in Powermax105 SYNC models



4. At J21or J18 on the power PCB, do a check for continuity on pin 1 (red) and pin 2 (black). Refer to Figure 25. Is there continuity on both pins?
   - If yes, there is possibly a problem with the wiring harness for the machine interface receptacle. Replace the machine interface receptacle with voltage divider PCB assembly (228697 for Powermax65/85 SYNC; 528045 for Powermax105 SYNC).
   - If no, there is possibly a problem with the power PCB. Replace the power PCB.*

* The problem will more often be with the power PCB. In unusual situations, there can be a problem with the DSP PCB. If possible, install a different DSP PCB that is known to operate correctly before you replace the power PCB to see if the problem goes away.

**Figure 25** – Machine interface pins for plasma start on the power PCB

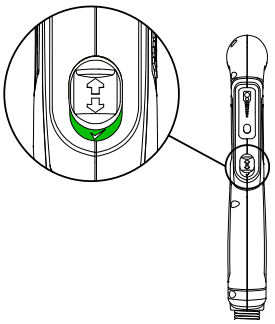


# Test 8 – Torch cap switch

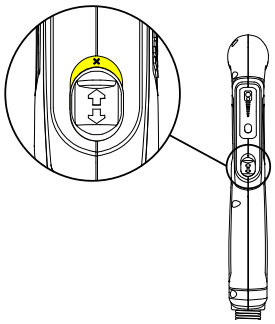
If a new Hypertherm cartridge does not cause the 0-50-0 fault to go away, there can be a problem with the torch or with the plasma power supply.

## Examine the torch and torch lead

1. Disconnect the torch from the plasma power supply.
2. Make sure that a cartridge is correctly installed on the torch. The cartridge must not be too loose or too tight.
3. Make sure that the torch is set to the green “ready to fire” (✓) position.



4. Measure the resistance between pin 5 and pin 7 in the torch connector. Refer to Figure 26 on page 109. Is the resistance very low?
   - If yes, continue with the next step.
   - If no, the cap-sensor switch in the torch is open. Continue with step 7.
5. Set the torch to the yellow lock (**X**) position.



6. Measure the resistance between pin 5 and pin 7 in the torch connector again. Is the resistance open?
   - If yes, continue with Examine the plasma power supply on page 110.
   - If no, the cap-sensor switch circuit is closed. Continue with the next step.

**7.** Do a check for continuity on the torch wires, as follows:

**a.** Remove the left side of the torch shell.

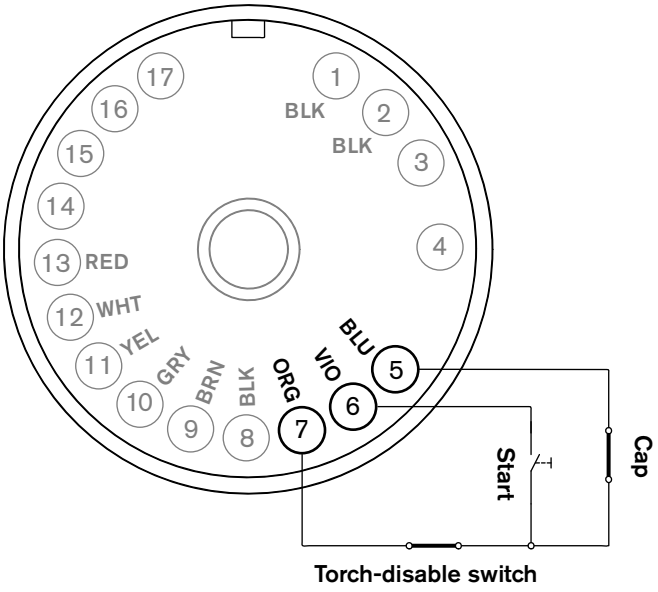
**b.** Do a check for continuity between the blue wire and pin 5 (BLU) in the torch connector.

**c.** Do a check for continuity between the orange wire and pin 7 (ORG) in the torch connector.

**8.** Do both torch wires have continuity?

- If yes, replace the cap-sensor switch.
- If no, replace the torch lead.

**Figure 26** – Torch connector pins



## Examine the plasma power supply

**⚠ WARNING**

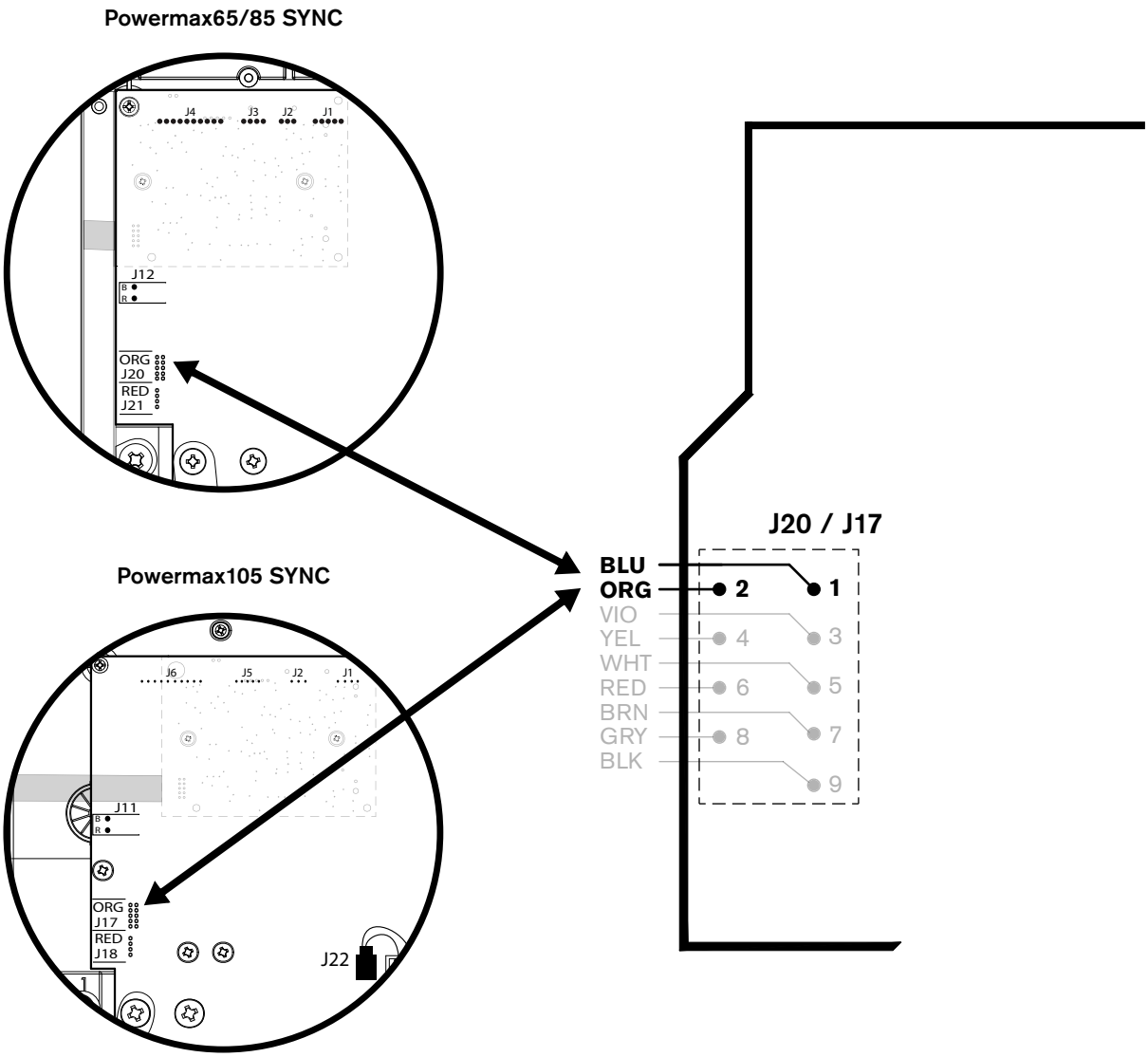
**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Make sure that a cartridge is installed on the torch.
4. Make sure that the torch is set to the green “ready to fire” (✓) position.
5. Connect the torch to the plasma power supply.
6. Do a check for continuity between pin 1 and pin 2 at J20 (Powermax65/85 SYNC) or J17 (Powermax105 SYNC) on the power PCB. Refer to Figure 27 on page 111. Is there continuity?
   - If yes, continue with the next step.
   - If no, do a check for continuity at the quick-disconnect receptacle. Refer to Do a check for continuity on page 25.
7. Make sure that the power is OFF (**O**), and put a jumper wire between pin 1 and pin 2 on J20 or J17.
8. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (**I**).
9. Does the 0-50-0 fault code show on the main screen?
   - If yes, replace the power PCB.
   - If no, replace the DSP PCB.

**Figure 27** – Machine interface pins on power PCB



# Test 9 – Solenoid valve electronic regulator

If you get a 3-20-*n* fault code, do this test to identify if the solenoid valve electronic regulator or power PCB is possibly defective.

**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

## Do a test of the solenoid valve with the gas supply disconnected

1. Set the power switch to OFF (**O**), and disconnect the power cord from the power source.
2. Remove the plasma power supply cover.
3. Remove the component barrier.
4. Disconnect the gas supply.
5. Set the power switch to ON (**I**). Does the solenoid valve make an audible clicking sound?
   - If yes, examine the gas hoses that connect to the solenoid valve assembly. Refer to Figure 28. If the hoses are twisted, kinked, or have other damage, replace them. Reconnect the gas supply. Set the power switch to ON (**I**), and fire the torch.
   - If no, continue with the next step.

**Figure 28** – Gas hoses connected to the solenoid valve assembly

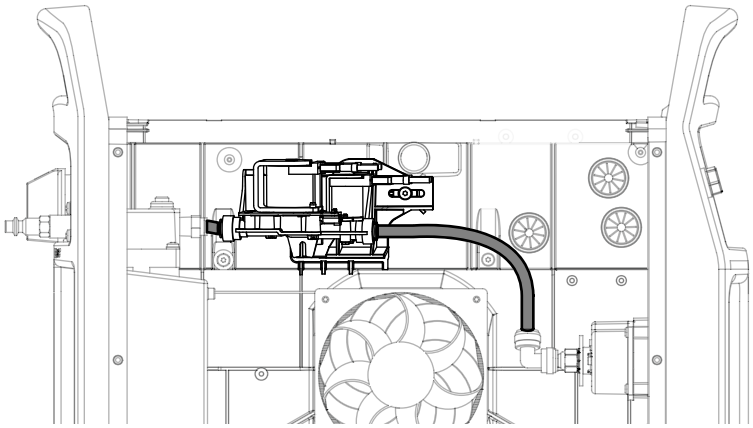
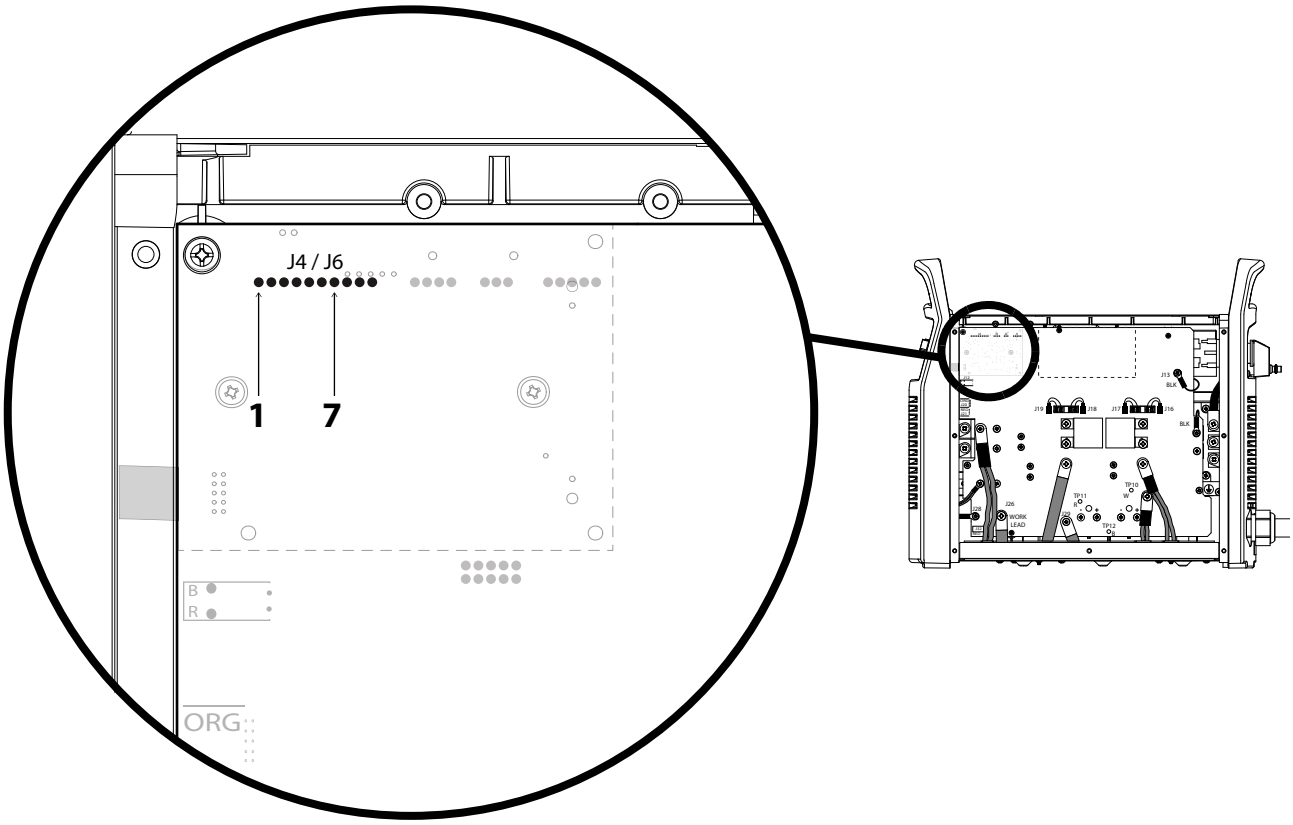


**Figure 29** – Solenoid valve pins on the power PCB

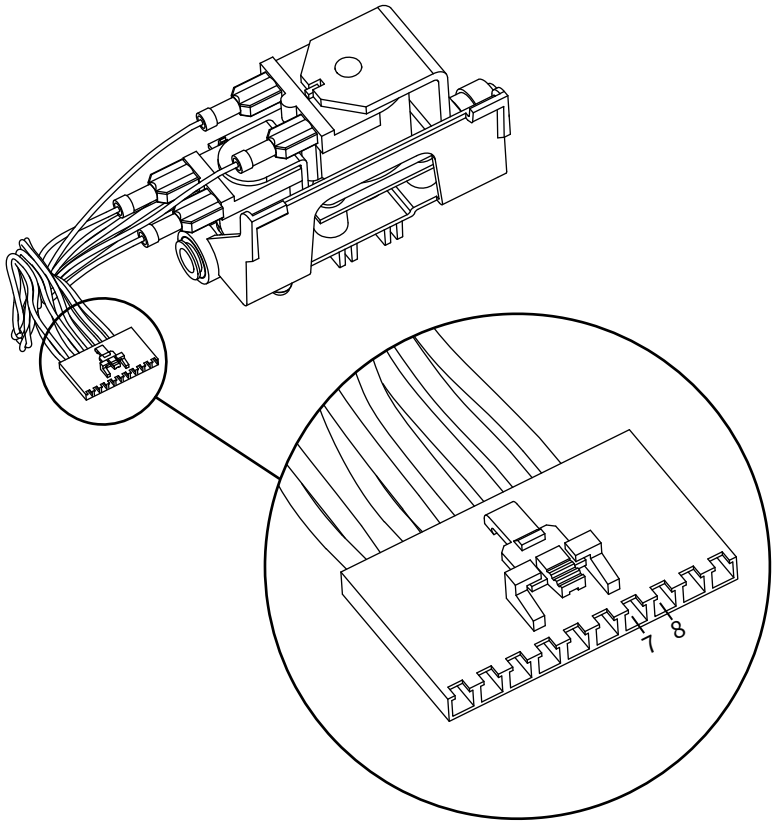



6. Measure the voltage between pin 1 and pin 7 at J4 or J6 on the power PCB. Refer to Figure 29. Is the voltage approximately 48 VDC?
   - If yes, replace the solenoid valve.
   - If no, continue with Do a test of the solenoid valve after disconnecting from the power PCB on page 114.

## Do a test of the solenoid valve after disconnecting from the power PCB

1. Disconnect the solenoid valve from J4 or J6 on the power PCB.
2. Measure the voltage again between pin 1 and pin 7 at J4 or J6 on the power PCB. Is the voltage approximately 48 VDC?
   - If yes, continue with the next step.
   - If no, replace the power PCB.
3. Do a resistance check to make sure that the solenoid valve is defective. Measure the resistance between pin 7 and pin 8 on the solenoid valve connector. Refer to Figure 30. If the resistance is less than 44 ohms (Ω), approximately, replace the solenoid valve.

**Figure 30** – Pins on the solenoid valve connector



# Test 10 – Solenoid valve pressure sensor

If you get a 2-11-*n* fault code, do this test to identify if the solenoid valve, DSP PCB, or power PCB is possibly defective. The 2-11-*n* fault codes identify an electrical problem that is most likely not related to the gas supply.

## Do a check for electrical interference and pinched wires

1. Electrical interference can have a negative effect on the operation of the solenoid valve. Move the plasma power supply to another location. If you continue to get a 2-11-*n* fault code, continue with the remaining instructions.
2. Set the power switch to OFF (**O**), and disconnect the power cord from the power source.
3. Remove the plasma power supply cover.
4. Remove the component barrier.
5. Examine the connection to the torch lead at the quick-disconnect receptacle. Is the connection secure? Are the wires in the torch lead pinched, twisted, or damaged? Replace the torch lead if necessary.

## Examine the power input and solenoid valve coils

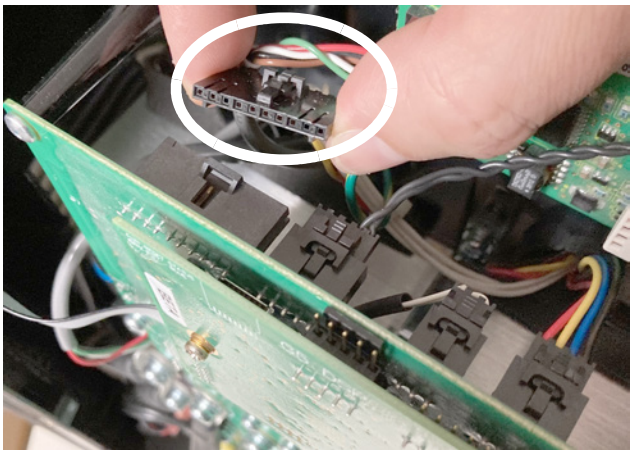
**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

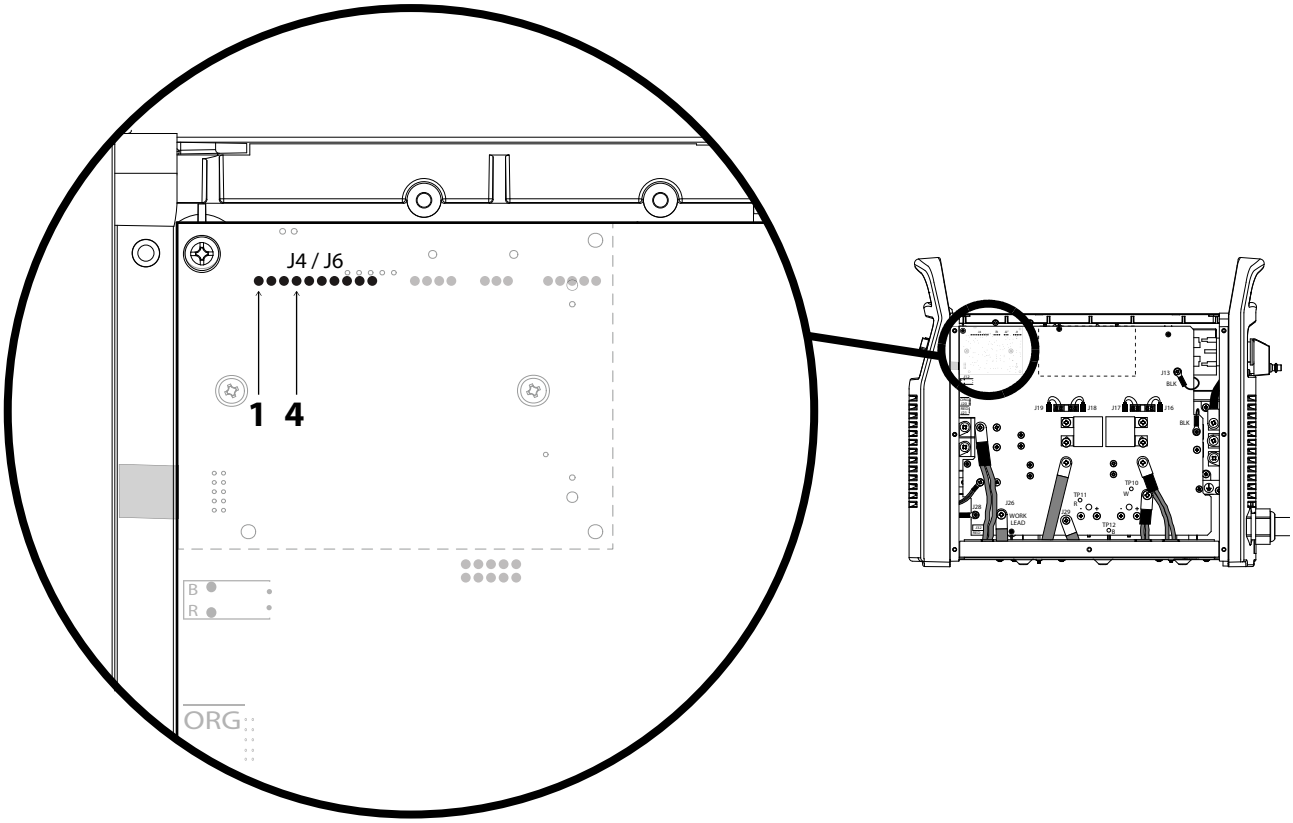
Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

1. Disconnect the solenoid valve from J4 (Powermax65/85 SYNC CSA) or J6 (Powermax65/85 SYNC CE/CCC and Powermax105 SYNC) on the power PCB.
2. Reconnect the electrical power. Set the power switch to ON (**I**).



3. Measure the voltage between pin 1 and pin 4 at J4 or J6 on the power PCB. Refer to Figure 31. Is the voltage approximately 5 VDC?
   - If yes, continue with the next step.
   - If no, replace the power PCB.

**Figure 31** – Solenoid valve pins on the power PCB



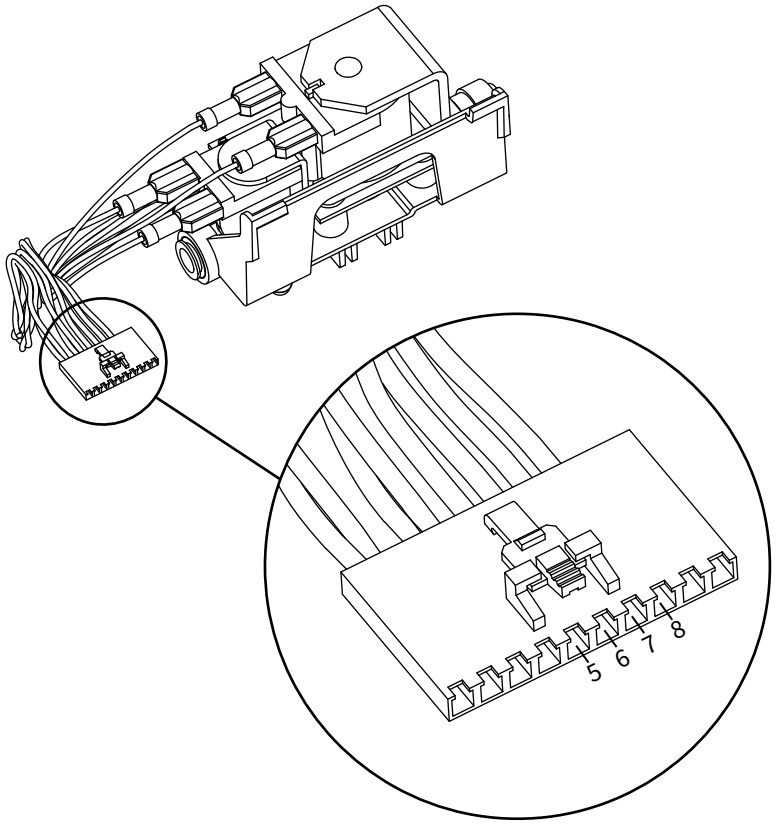
**4.** Measure the resistance on the solenoid valve J4 or J6 connector as follows:

- The correct resistance between pin 5 and pin 6 is approximately 22 ohms (Ω) (±3 Ω).
- The correct resistance between pin 7 and pin 8 is approximately 44 ohms (Ω) (±5 Ω).

Are the resistance values correct?

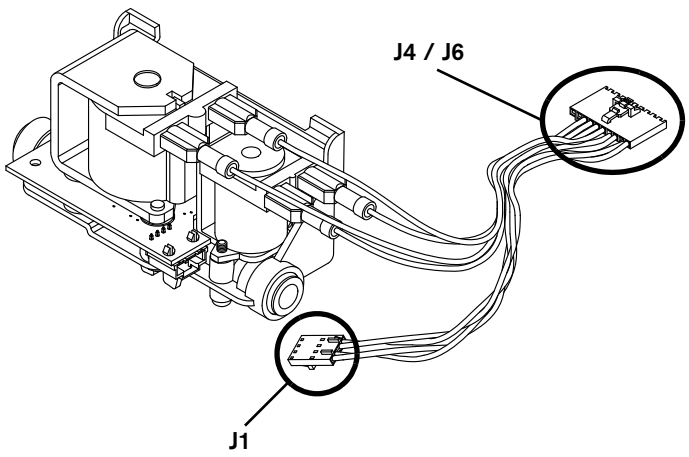
- If yes, continue with the next step.
- If no, replace the solenoid valve.

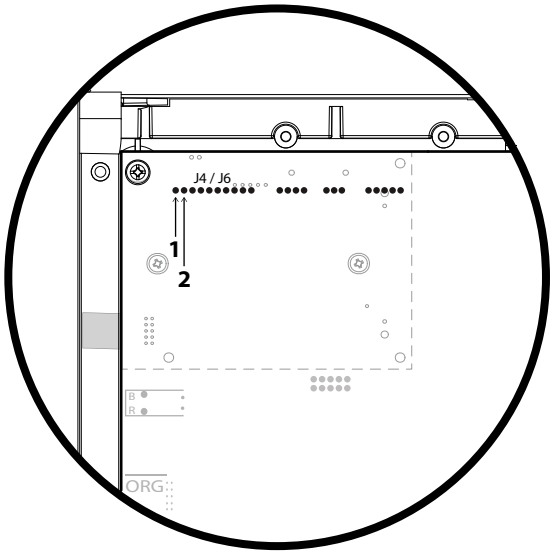
**Figure 32** – Pins of solenoid valve connector



## Examine the solenoid valve sensor and power PCB sensor input

1. Set the power switch to OFF (**O**).
2. Disconnect the solenoid valve from J4 or J6 on the power PCB.
3. Disconnect the J1 connector from the solenoid valve PCB.
4. Are any of the pins on the connectors or on the solenoid valve PCB damaged?
   - If yes, replace the solenoid valve.
   - If no, continue with the next step.
5. Reconnect the valve to J4 or J6 on the power PCB.
6. Reconnect J1 to the solenoid valve PCB.
7. Disconnect the gas supply.
8. Set the power switch set to ON (**I**).
9. Do a check of the output signal from the solenoid valve pressure sensor. If the sensor is operating correctly, the output signal is approximately 0.2 VDC at 0 bar (0 psi). Measure the voltage between pin 1 and pin 2 on J4 or J6. Is the voltage 0.18 VDC – 0.22 VDC, but you continue to get the 2-11-*n* fault code?
   - If yes, continue with the next step. The solenoid valve pressure sensor is operating correctly. The DSP PCB is not reading the pressure signal correctly, or the power PCB is not sending the pressure signal to the DSP PCB.
   - If no, replace the solenoid valve.



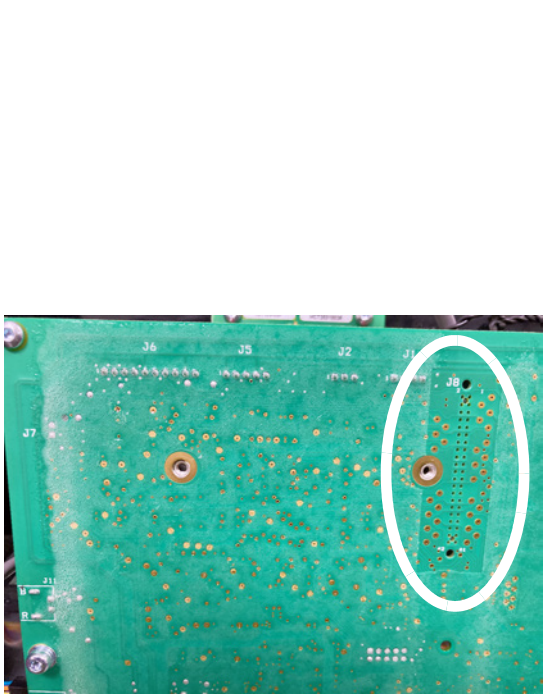



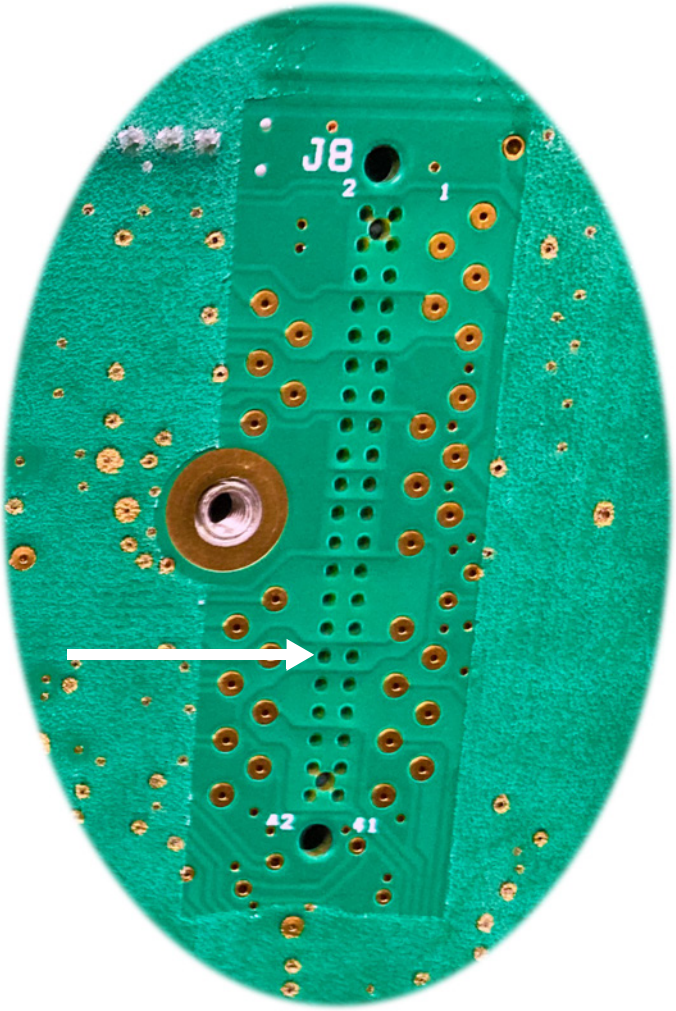
**10.** Disconnect the DSP PCB from the power PCB by removing the 2 mounting screws.

**11.** Measure the resistance between pin 2 on J4 or J6 on the power PCB and pin 32 on J8. Refer to Figure 33. Is the voltage approximately 100 ohms (Ω)?

- If yes, replace the DSP PCB.
- If no, replace the power PCB.

**Figure 33** – Pin 32 on J8 on power PCB



# Test 11 – Fan

Use this test if you have one of these conditions:

- The system shows a 3-10-*n* fault code, which is related to the fan.
- Nothing shows on the LCD screen after the plasma power supply is set to ON (**I**). This can be an indication of a short-circuited fan.

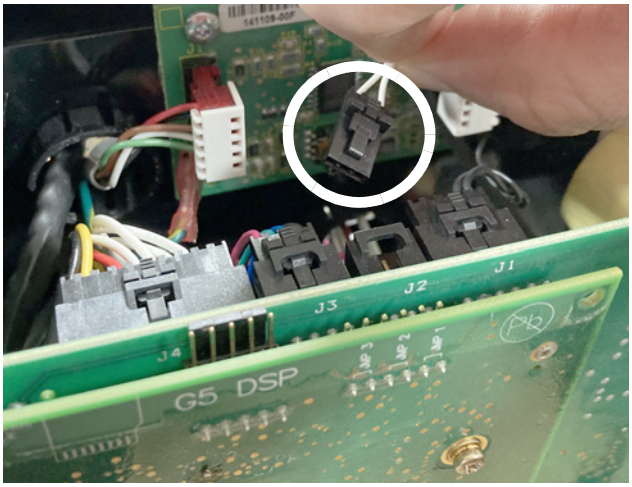
**⚠ WARNING**

**ELECTRIC SHOCK CAN KILL**

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

Use extreme caution if you do service or maintenance work on a plasma power supply when it is connected to an electric power source and the outer cover or panels are removed.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Disconnect the inverter thermal sensor from the power PCB, as follows:
   - J2 in Powermax65/85 SYNC CSA models
   - J4 in Powermax65/85 SYNC CE/CCC models
   - J2 in all Powermax105 SYNC models




4. Put a jumper between pin 1 and pin 3 in the receptacle for the inverter thermal sensor.
5. Connect the power cord to the power source, and set the power switch on the plasma power supply to ON (**I**).

   With the inverter thermal sensor disconnected, the fan operates as soon as the system is on.
6. Make sure that the fan stays connected to the power PCB, as follows:
   - J3 in Powermax65/85 SYNC CSA models
   - J5 in Powermax65/85 SYNC CE/CCC models
   - J1 in all Powermax105 SYNC models

7. Measure the DC voltage between pin 1 and pin 4 at the fan connector. Use extended thin meter points to get the voltage reading on the external side of the power PCB. Refer to Figure 34 on page 122. Is the voltage approximately 48 VDC (±2.4 VDC)?
   - If yes, replace the fan.
   - If no, continue with the next step.

8. Disconnect the fan from the power PCB.

9. Measure the voltage again between pin 1 and pin 4 at the fan receptacle on the power PCB. Is the voltage approximately 48 VDC (±2.4 VDC)?
   - If yes, replace the fan.
   - If no, do Test 5 – Flyback circuit (DC minor voltages) on page 94.

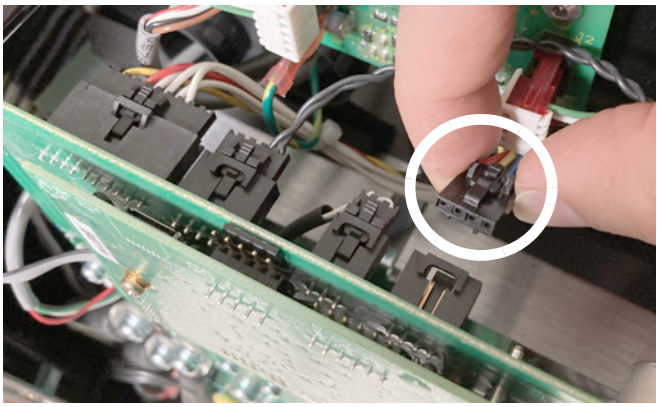
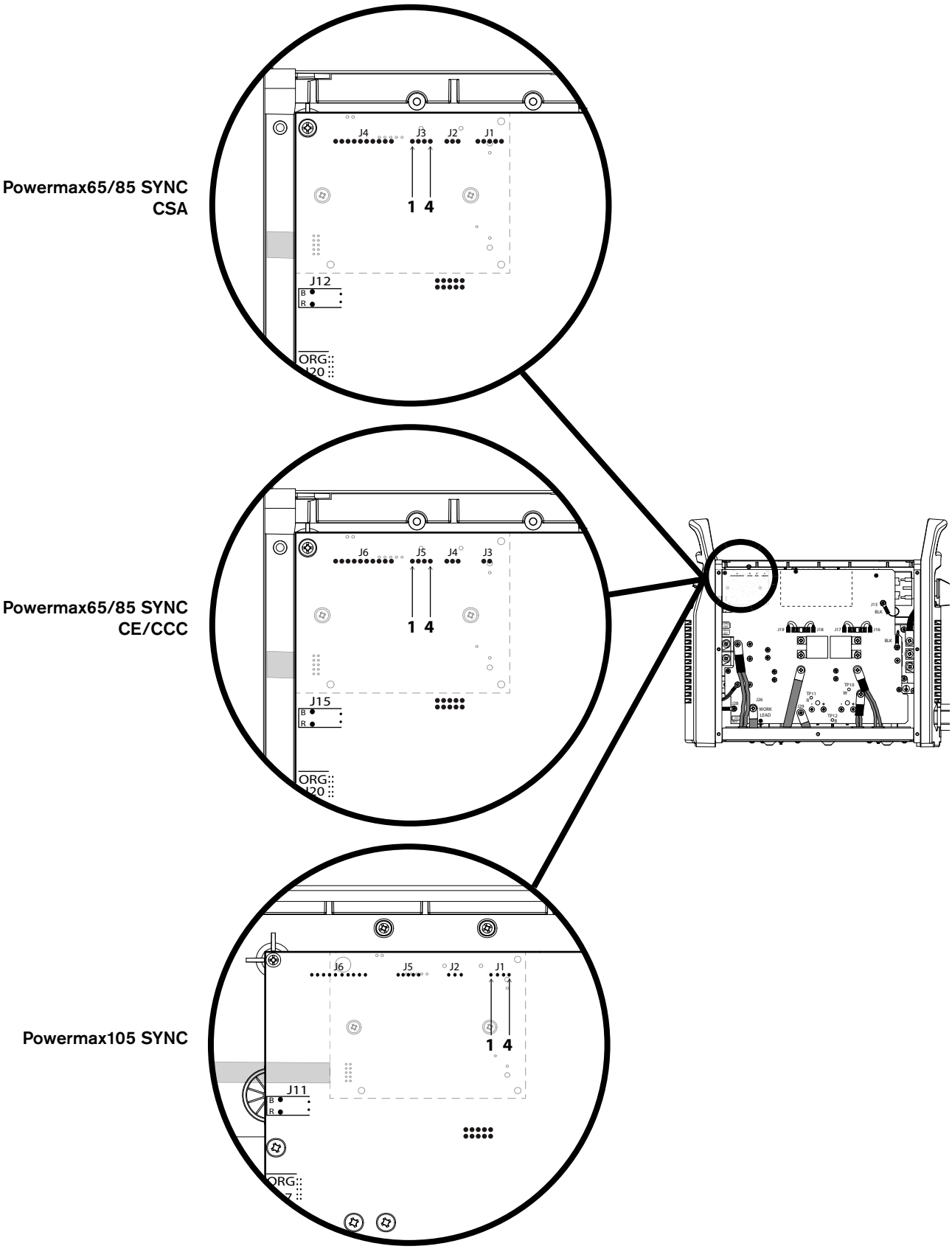


**Figure 34** – Fan pins on power PCB



# Test 12 – Auxiliary (AUX) switch

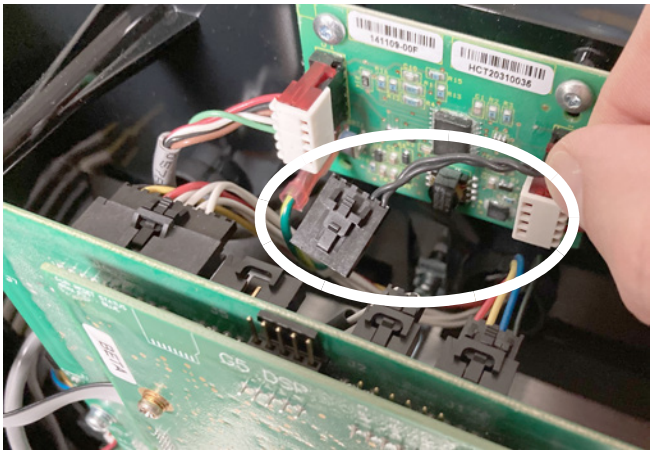
Use this test if you see one of these conditions:

- The main screen is blank after you set the plasma power supply to ON.
- The 2-01-1 fault code shows.

This test is not applicable for Powermax65/85 SYNC CE/CCC models.

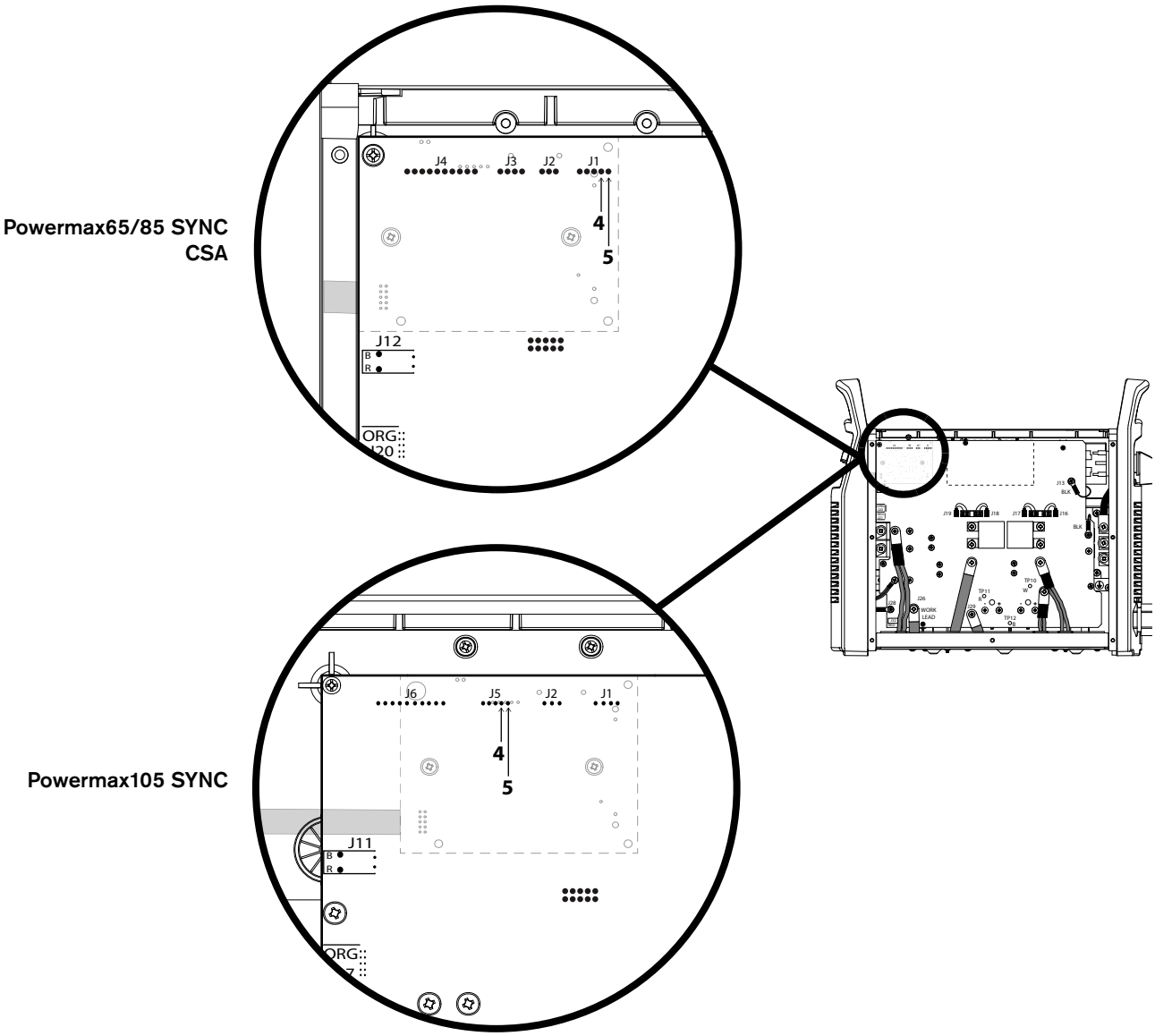
1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. **Powermax65/85 SYNC CSA:** Disconnect the auxiliary switch cable from J1 on the power PCB.

   **Powermax105 SYNC:** Disconnect the auxiliary switch cable from J5 on the power PCB.



4. With the power switch on the plasma power supply set to OFF (**O**), measure the resistance between pin 4 and pin 5 on the auxiliary cable's connector. Refer to Figure 35 on page 124. If there is high resistance between the pins, do a check for an open circuit or a short circuit on the auxiliary switch receptacle on the power PCB and on the power switch.

**Figure 35** – Auxiliary switch pins on power PCB



# Test 13 – Pilot arc IGBT

Do this test to identify if the pilot arc IGBT is operating correctly.

1. Set the power switch on the plasma power supply to OFF (**O**), and disconnect the power cord.
2. Remove the plasma power supply cover and the component barrier.
3. Remove the cartridge from the torch, but make sure that the torch is connected to the plasma power supply.
4. Measure the resistance between the center contact on the torch head and the work clamp. If the resistance is less than 5 kiloohms (kΩ), continue with the next step.
5. Measure the resistance between the 2 pilot arc screws on the power PCB. Refer to Figure 36. If the resistance is less than 5 kiloohms (kΩ), replace the pilot arc IGBT.

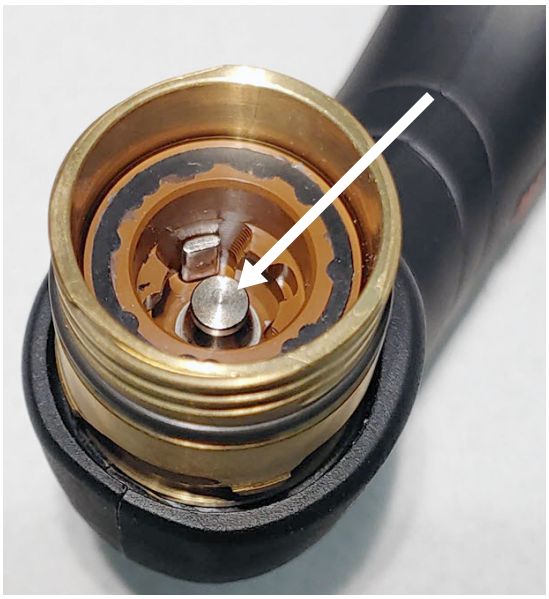
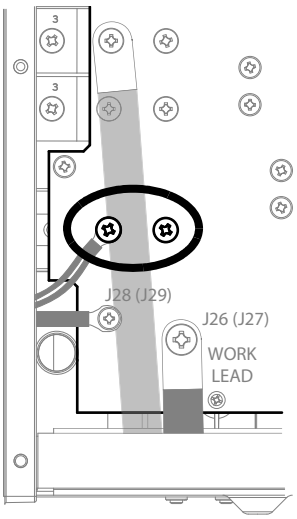
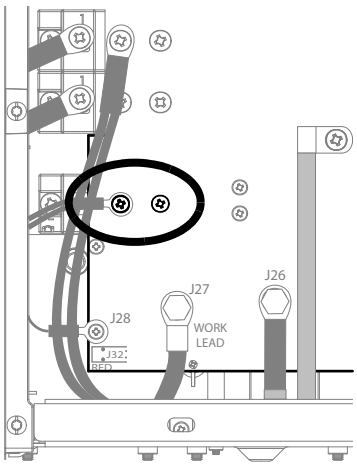


**Figure 36** – Pilot arc IGBT screws on the power PCB

**Powermax65/85 SYNC**




**Powermax105 SYNC**



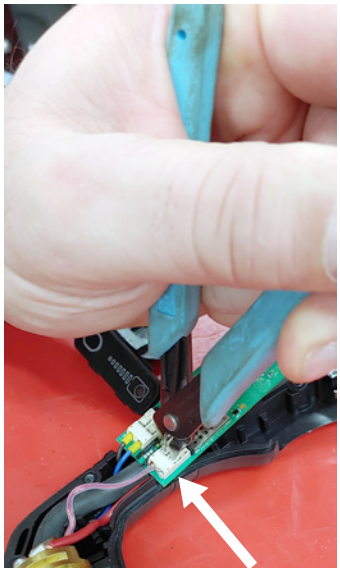
# Test 14 – Radio Frequency (RF) communication errors

The 0-98-1 and 0-98-2 fault codes identify different types of Radio Frequency (RF) communication problems.

## 0-98-1 fault: cartridge or torch

If a new Hypertherm cartridge does not cause the 0-98-1 fault to go away, there can be a problem with the antenna on the torch PCB or the wires that connect to the antenna. Do the following:

1. Disconnect the SmartSYNC torch from the plasma power supply.
2. Put the torch on its side. Remove the left side of the torch shell.
3. Are the 2 antenna wires securely connected to the torch PCB?
   - If yes, continue with the next step.
   - If no, adjust the antenna wires as necessary until they connect fully and securely in the connector on the torch PCB.
4. Disconnect the 2 antenna wires from the torch PCB, as follows:
   a. Lightly push down the tabs on the antenna connector on the torch PCB with your thumb or fingers. You can also use a tool to push down the tabs if the points are not too sharp. The pliers shown to the right are one example.
   b. While you hold down the tabs, pull the antenna wires out of the connector.



5. With the antenna wires disconnected, measure the resistance of the antenna coil in the connector on the torch PCB. Is the resistance less than 1 ohm (Ω)?
   - If yes, the antenna wires have possible damage. Replace the torch body.
   - If no, the antenna on the torch PCB has possible damage. Replace the torch PCB.

# 0-98-2 fault: torch or plasma power supply

If you see an 0-98-2 fault, do the following to identify if the cause of the fault is with the torch or with the plasma power supply.

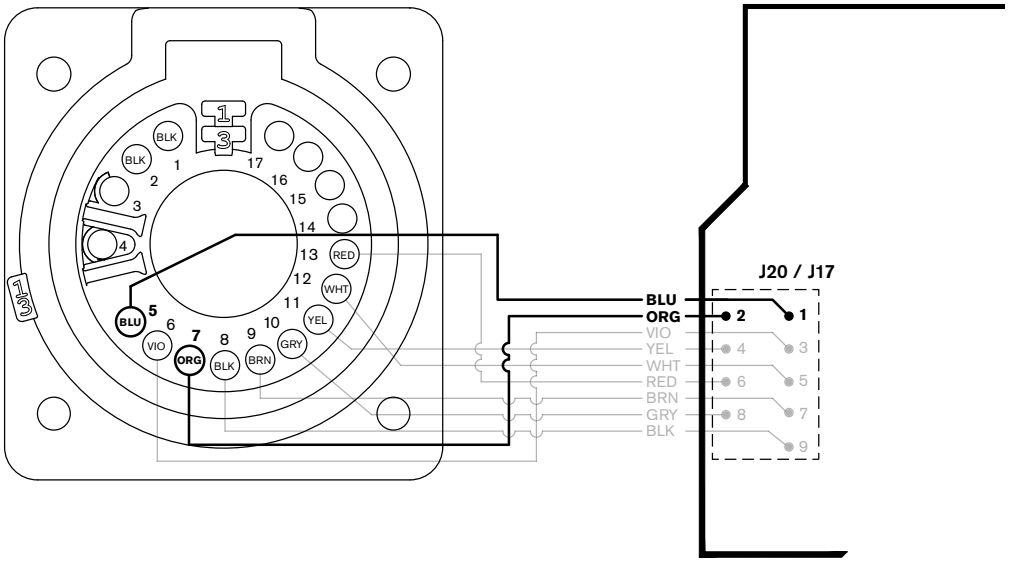
## Do a test of the plasma power supply

1. Set the power switch on the plasma power supply to OFF (**O**).
2. Disconnect the SmartSYNC torch from the plasma power supply.
3. Set the power switch on the plasma power supply to ON (**I**).

   A 0-50-0 fault code shows if the torch is disconnected when you set the plasma power supply to ON (**I**).

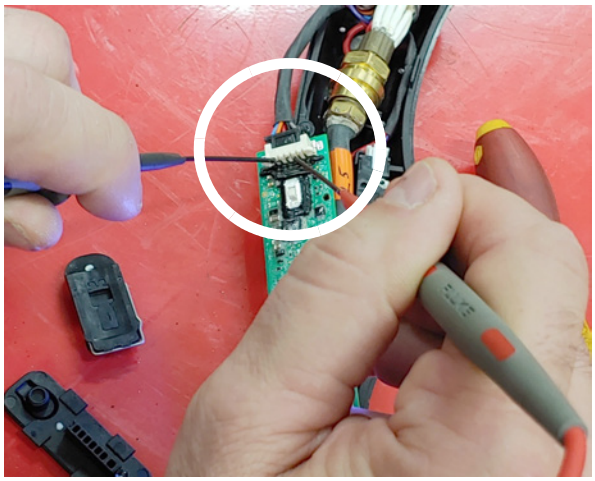
4. In the quick-disconnect receptacle on the front of the plasma power supply, measure the voltage between pin 5 (blue wire) and pin 7 (orange wire). Refer to Figure 37. Is the voltage approximately 18 VDC?
   - If yes, the problem is possibly with the torch. Continue with Do a test of the torch on page 128.
   - If no, continue with the next step.
5. At the J20 connector (for Powermax65/85 SYNC) or the J17 connector (for Powermax105 SYNC) on the power PCB, measure the voltage between pin 1 (blue wire) and pin 2 (orange wire). Refer to Figure 37. Is the voltage approximately 18 VDC?
   - If yes, replace the quick-disconnect receptacle.
   - If no, replace the power PCB.
     - If communication faults continue, replace the DSP PCB.

**Figure 37** – Quick-disconnect receptacle pinout



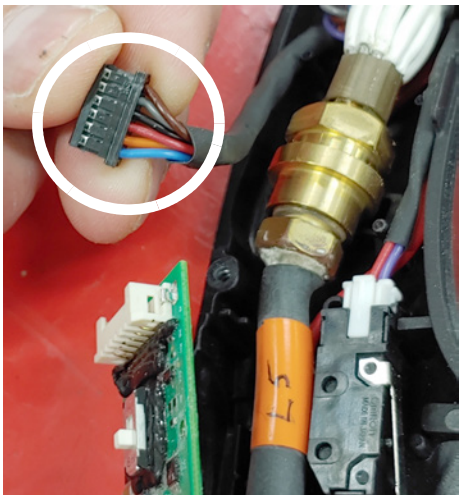
## Do a test of the torch

1. Connect the SmartSYNC torch to the plasma power supply.
2. Remove the left side of the torch shell.
3. Make sure that all wires are correctly and securely connected to the torch PCB.
4. At the torch lead receptacle on the torch PCB, measure the voltage between pin 3 (black wire) and pin 5 (orange wire). Keep the wires from the torch connected, and measure the voltage at the rear of the receptacle, as shown. Is the voltage approximately 18 VDC?



   - If yes, continue with the next step.
   - If no, continue with step 8.

5. Do a check for continuity between the torch and the plasma power supply, as follows:
   a. Do a check for continuity between pin 1 on the torch PCB (brown wire) and pin 7 at J20 (Powermax65/85 SYNC) or J17 (Powermax105 SYNC) on the power PCB. Refer to Figure 38 on page 130.
   b. Do a check for continuity between pin 2 on the torch PCB (gray wire) and pin 8 at J20 (Powermax65/85 SYNC) or J17 (Powermax105 SYNC) on the power PCB. Refer to Figure 38 on page 130.
   c. If there is continuity between the pins, continue with step 10.
   d. If there is not continuity between the pins, continue with the next step.
6. Disconnect the torch from the plasma power supply.
7. Do a check for continuity on the torch, as follows:
   a. Do a check for continuity between pin 1 on the torch PCB and pin 9 in the torch connector. This is the brown wire in the torch. Refer to Figure 39 on page 131.
   b. Do a check for continuity between pin 2 on the torch PCB and pin 10 in the torch connector. This is the gray wire in the torch. Refer to Figure 39 on page 131.
   c. If there is continuity between the pins, continue with step 9.
   d. If there is not continuity between the pins, replace the torch lead.



8. Disconnect the torch lead connector from the torch PCB.

9. Measure the voltage again between pin 3 (black wire) and pin 5 (orange wire). This time, put the multimeter leads directly in the sockets for pin 3 and pin 5. Is the voltage approximately 18 VDC?
   - If yes, replace the power PCB.
   - If no, continue with the next step.

10. Connect a different SmartSYNC torch to the plasma power supply that is known to operate correctly. Do you continue to get the 0-98-2 fault?
    - If yes, replace the power PCB.
    - If no, there is a possible problem with the original torch. Continue with the next step.

11. Connect the original SmartSYNC torch to the plasma power supply. Is the torch a hand torch or a mechanized torch?
    - **Hand torch:** Are any LEDs on the torch PCB illuminated or flashing?
      - If yes, replace the torch PCB.
      - If no, replace the torch lead.
    - **Mechanized torch:** Replace the torch PCB. If the 0-98-2 fault does not go away, replace the torch lead.
    - If communication faults continue, examine the DSP PCB. Continue with the next step.

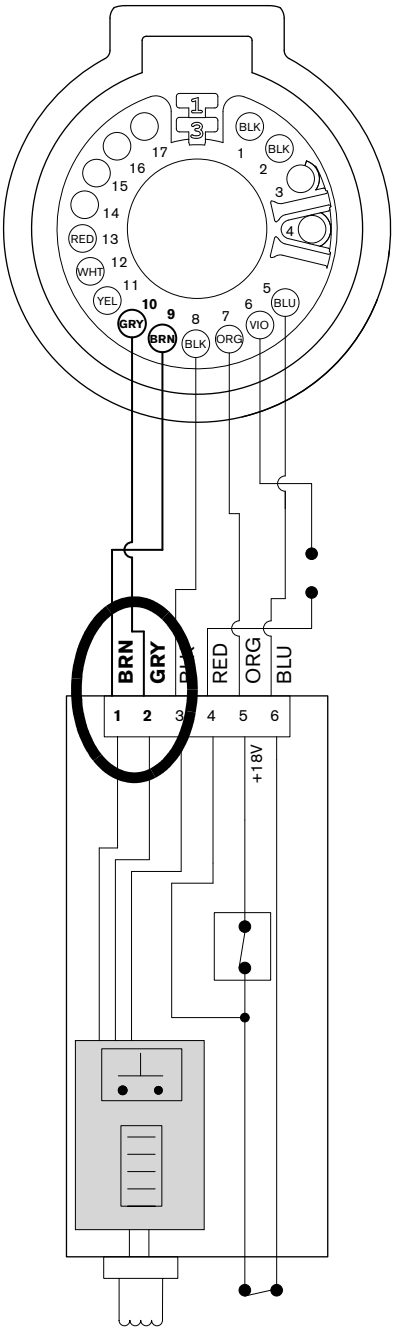
12. Disconnect the DSP PCB from the power PCB. Carefully remove the conformal coating from the pins, if necessary. Too much of this coating can prevent a good connection with the power PCB.

13. If the problem continues, replace the DSP PCB.

14. If the problem continues after a new DSP PCB is installed, replace the power PCB.

**Figure 38** – Pins for resistance check between torch and plasma power supply

**Pin 1 and pin 2 on torch PCB**




**Pin 7 and pin 8 on power PCB**

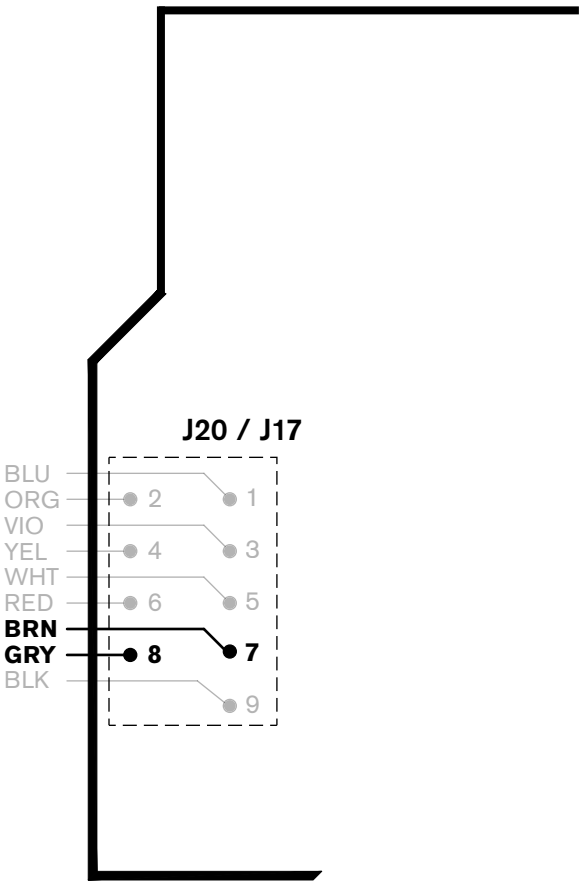
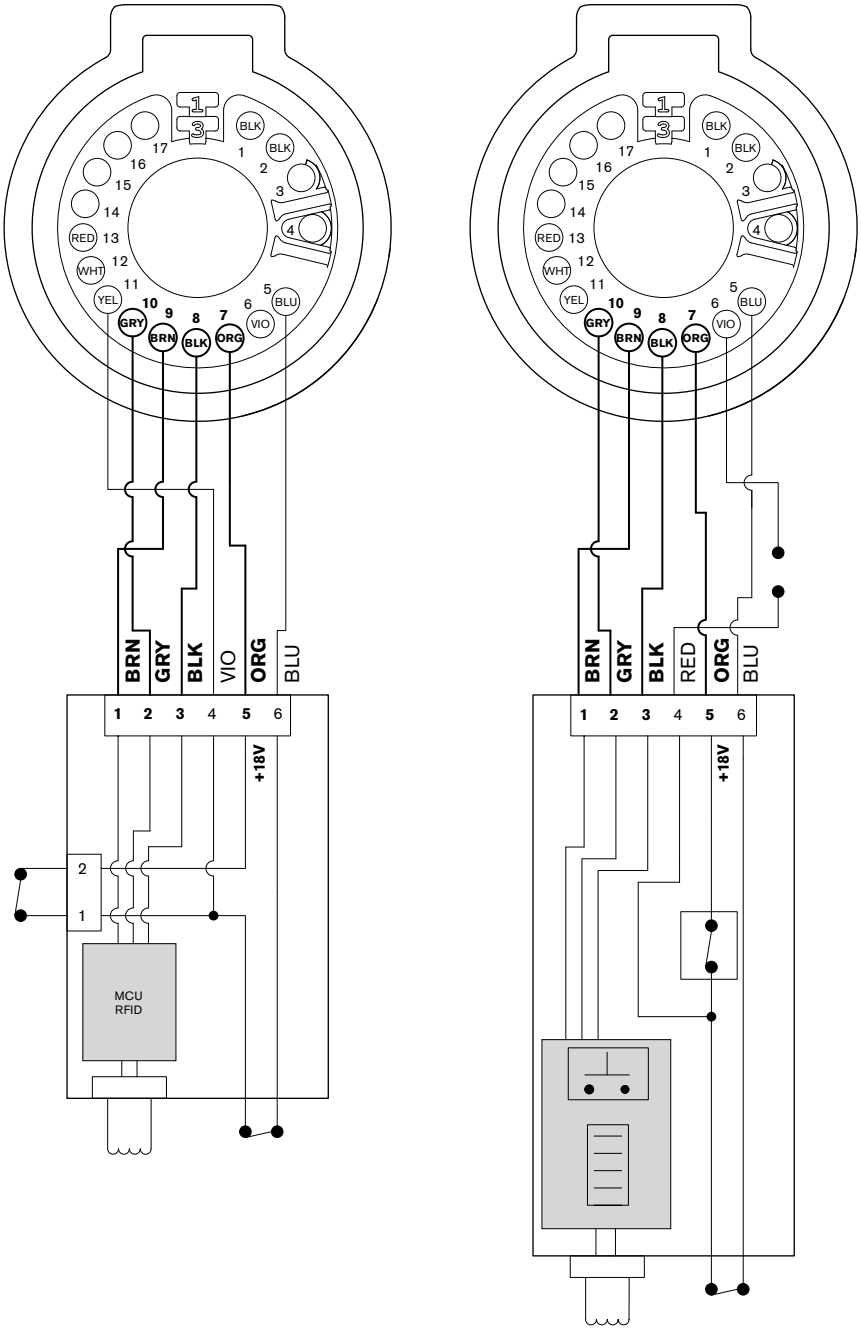


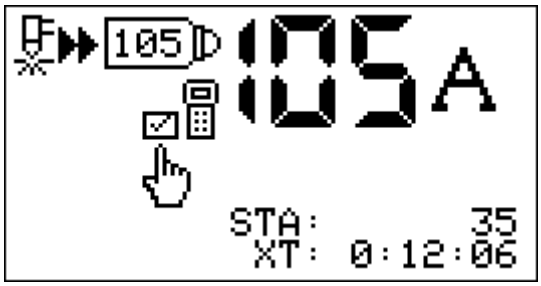
**Figure 39** – Torch lead connector pins



# 6 Access Service Information and Settings

## View current system status

By default the status screen shows system status information.




**Torch started –** This icon shows that the torch has received a start signal and has started a pilot arc.

**Torch is transferring –** This icon shows that the plasma arc transferred to the workpiece and the torch is cutting or gouging.

**System process –** This icon shows the maximum output current (A) of the Hypertherm cartridge.

If there are no cartridge communications with the plasma power supply, this icon does not show on the status screen.


**Current setting (amperage) –** This is the current at which the plasma power supply will cut or gouge, in amperage.

Use either the adjustment knob on the plasma power supply or the amperage-adjustment control on the hand torch to change the output current. Installing a Hypertherm cartridge of a different amperage also changes the current setting.

**Non-default configuration –** This icon shows that at least one default system setting has been changed.

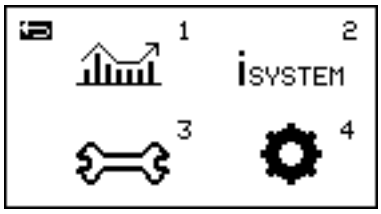
**Remote control –** This icon shows that a CNC or other controller is controlling the plasma power supply. The front panel controls are disabled during remote mode operation. But fault codes and fault icons still show as they would otherwise, and you can go to the menu screens to see information about the plasma power supply, torch, and cartridge.


**Cartridge data –** These fields show the total number of pilot arc starts (**STA**) and the cumulative plasma arc transfer time (**XT**) for the life of the Hypertherm cartridge that is installed on the torch. These fields do not show by default. Refer to page 149.

From the status screen you can access other screens that show system information and settings.

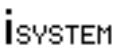
# Go to the main menu screen

1. To go to the main menu screen, push and hold [A/⏻] for 2 seconds.
2. Turn the adjustment knob to go to an icon on the screen.
3. Push [A/⏻] to select the icon.

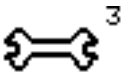




**Cartridge and plasma power supply data –** Select this icon to go to use data and other information about the Hypertherm cartridge and the plasma power supply.




**System information –** Select this icon to go to service-related information about printed circuit boards (PCBs) in the plasma power supply and in the SmartSYNC torch.




**Service –** Select this icon to go to service-related information about fault codes, radio frequency (RF) settings and logs, and cut counter transfers.


**Settings –** Select this icon to go to system settings that you can change, such as the brightness and contrast of the LCD screen.

**Back –** Select this icon to go back to the screen you were on before.

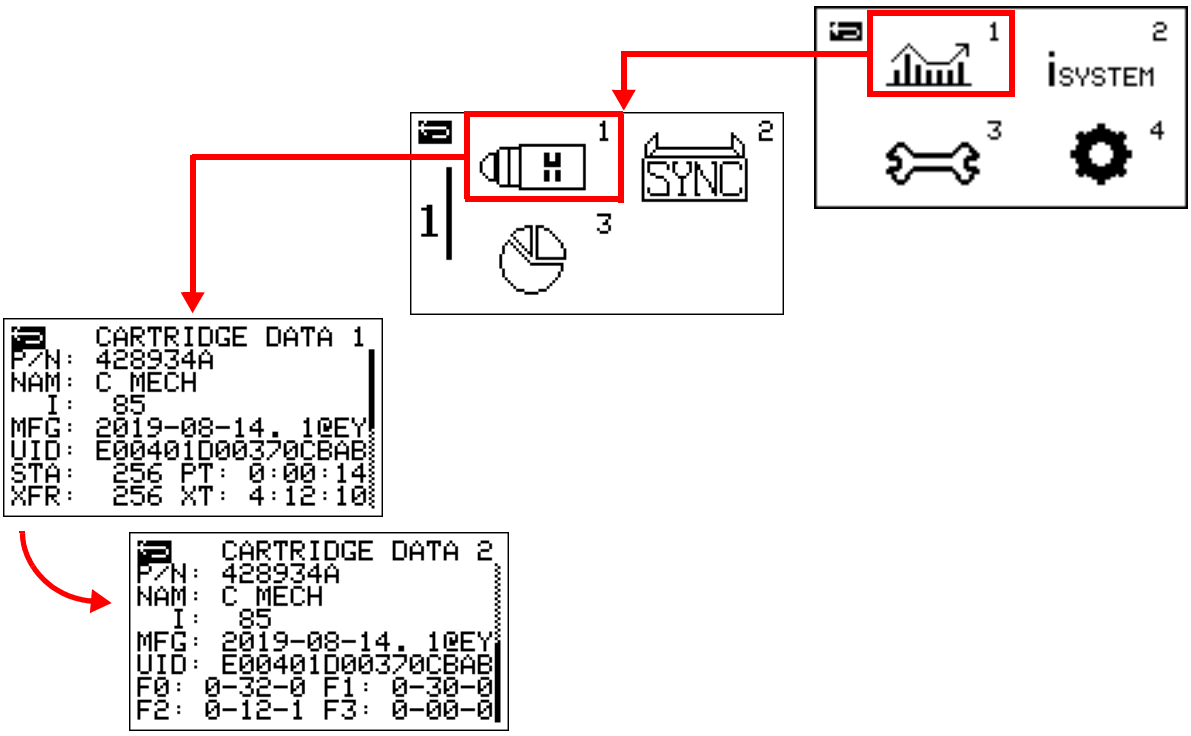
**Tip:** Push the ○[⏻] button to immediately go back to the status screen.

# View system performance, operation, and fault data

## Cartridge performance and fault data

Go to the Cartridge Data screen (**CARTRIDGE DATA**) to see information about the Hypertherm cartridge that is installed on the torch.

1. Select  on the main menu screen.
2. Select  to go to the **CARTRIDGE DATA 1** screen.
3. Turn the adjustment knob to scroll down and see the **CARTRIDGE DATA 2** screen.




**P/N –** This field shows the part number (*nnnnnn*) and the version (*X*) of the Hypertherm cartridge.

**NAM –** This field shows the Hypertherm cartridge type.

- **C HAND** = Standard cutting cartridge for hand torch
- **C HFNC** = FineCut cartridge for hand torch
- **C MECH** = Standard cutting cartridge for machine torch
- **C MFNC** = FineCut cartridge for machine torch
- **C FLUSH** = FlushCut cartridge
- **G RMVL** = Maximum Removal gouging cartridge
- **G CNTL** = Maximum Control gouging cartridge

**I –** This field shows the amperage for which the Hypertherm cartridge is rated.

**MFG –** This field shows the manufacture date of the Hypertherm cartridge in year-month-day format (*YYYY-MM-DD*) followed by the manufacturer identification number (*.nn*) and the manufacture location code (*@nn*).

**UID –** This field shows the unique identification number of the Hypertherm cartridge.

**STA –** This field shows the total number of pilot arc starts that the Hypertherm cartridge has done in its life.

**XFR –** This field shows the total number of arc transfers that the Hypertherm cartridge has done in its life.

**PT –** This field shows the cumulative pilot arc time in hours, minutes, and seconds (*HH:MM:SS*) that the Hypertherm cartridge has had in its life.

**XT –** This field shows the cumulative arc transfer time in hours, minutes, and seconds (*HH:MM:SS*) that the Hypertherm cartridge has had in its life.

**F0, F1, F2, F3 –** These fields show the 4 most recent operational fault codes that occurred while cutting or gouging with the cartridge. Operational fault codes are in the format 0-*nn-n*. Refer to page 39.

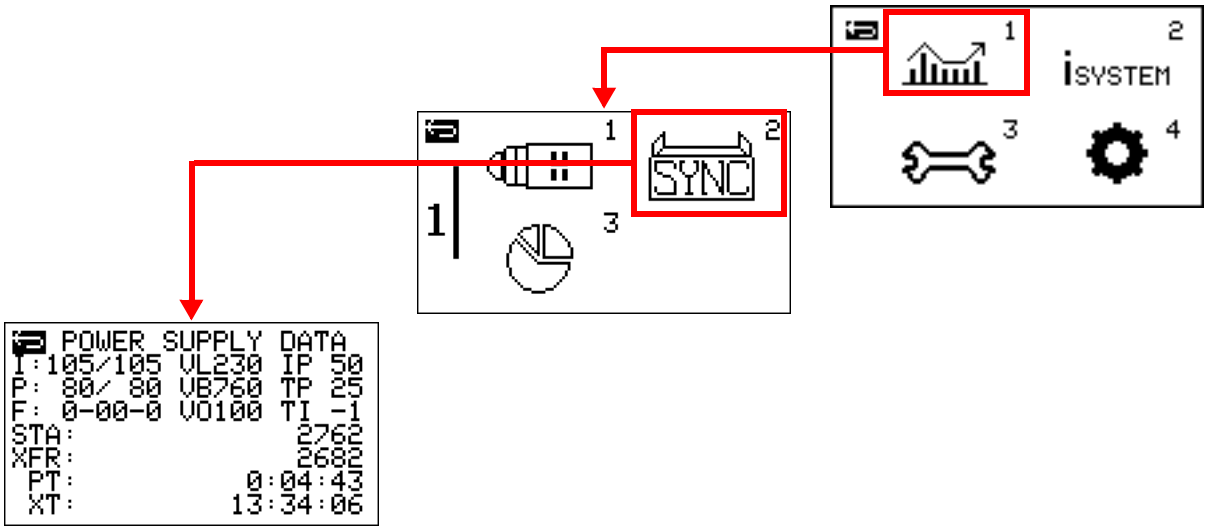
To see these fields, scroll down to the **CARTRIDGE DATA 2** screen.

# Plasma power supply performance and operation data

Go to the Power Supply Data screen (**POWER SUPPLY DATA**) to see information about plasma power supply performance and use.

1. Select  on the main menu screen.

2. Select  to go to the **POWER SUPPLY DATA** screen.




**I –** This field shows the set current followed by the live output current (in amperage). You can use the first part of this field to adjust the set current if necessary for troubleshooting.

**P –** This field shows the inlet set pressure followed by the actual output gas pressure (in psi). When the system in manual mode, you can use the first part of this field to adjust the set pressure if necessary for troubleshooting.

The system cannot go into manual mode from this screen.

**F –** This field shows the active fault code (if any).

**VL –** This field shows the input voltage.

**VB –** This field shows the bus voltage (VBUS).

**VO –** This field shows the arc voltage.

**IP –** This field shows the boost PFC IGBT current in amperage. This field shows on the screen for CSA and for Powermax105 SYNC 230 V – 400 V CE models only.

**TP –** This field shows the boost PFC IGBT temperature in Celsius. This field shows on the screen for CSA and for Powermax105 SYNC 230 V – 400 V CE models only.

**TI –** This field shows the inverter IGBT temperature in Celsius.

**STA –** This field shows the total number of torch starts the plasma power supply has done in its life.

**XFR –** This field shows the total number of arc transfers the plasma power supply has done in its life.

**PT –** This field shows the cumulative pilot arc time in hours, minutes, and seconds (*HH:MM:SS*) that the plasma power supply has had in its life.

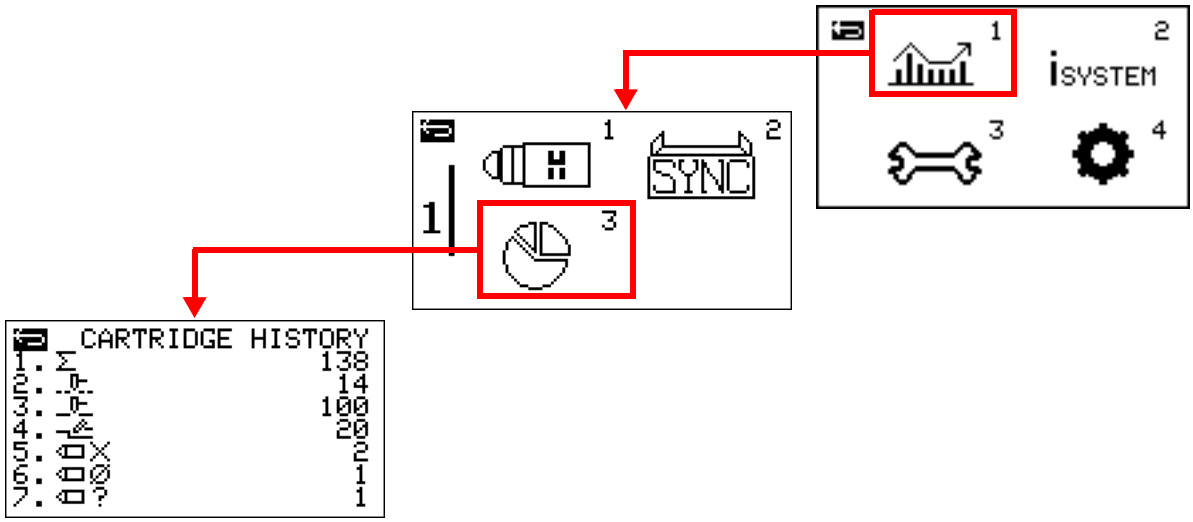
**XT –** This field shows the cumulative arc transfer time in hours, minutes, and seconds (*HH:MM:SS*) that the plasma power supply has had in its life.

# Cumulative cartridge data for the plasma power supply

Go to the Cartridge History screen (**CARTRIDGE HISTORY**) to see cumulative data for different types of cartridge starts for the life of the plasma power supply.

1. Select  on the main menu screen.

2. Select  to go to the **CARTRIDGE HISTORY** screen.




Σ – This field shows the total number of pilot arc starts for all cartridge types that the plasma power supply has done in its life.

– This field shows the total number of Hypertherm cutting cartridge starts that the plasma power supply has done in its life while in Expanded Metal mode.

– This field shows the total number of Hypertherm cutting cartridge starts that the plasma power supply has done in its life while in Cut mode.

– This field shows the total number of Hypertherm gouging cartridge starts that the plasma power supply has done in its life.

– This field shows the total number of pilot arc starts that the plasma power supply has done while cartridges were in an end-of-life condition.

– This field shows the total number of pilot arc starts that the plasma power supply has done while there was no communication between the plasma power supply and the torch or cartridge. For example, the value in this field includes pilot arc starts when the system is in an 0-98-*n* fault condition or when the system is set to basic mode.

– This field shows the total number of pilot arc starts that the plasma power supply has done while an unrecognized type of cartridge was used.

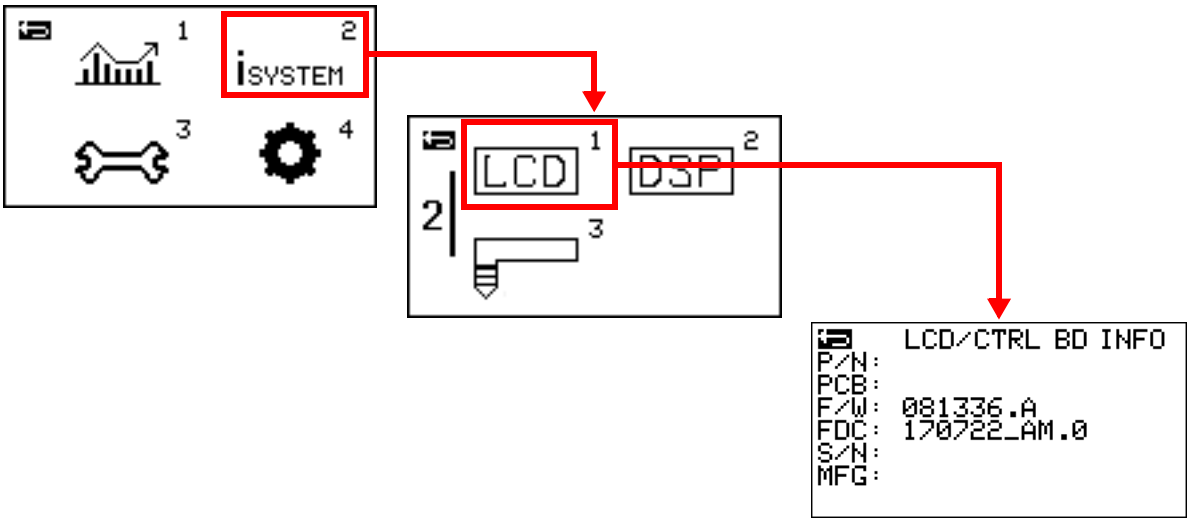
In basic mode, the system continues to record data for field 1 and 6. For all other fields, the system does not record data in basic mode.

# View printed circuit board (PCB) and firmware information

## LCD/Control PCB information

Go to the LCD/Control PCB Information screen (**LCD/CTRL BD INFO**) to see service-related information about the firmware on the plasma power supply's LCD/control PCB.

1. Select iSYSTEM 2 on the main menu screen.
2. Select LCD 1 to go to the **LCD/CTRL BD INFO** screen.




**F/W –** This field shows the part number (*nnnnnn*) and the version (*.x*) of the firmware on the LCD/control PCB.

**FDC –** This field shows the code for the firmware's build day (*nnnnnn_xx*) and the bootloader version (*.n*) of the firmware.

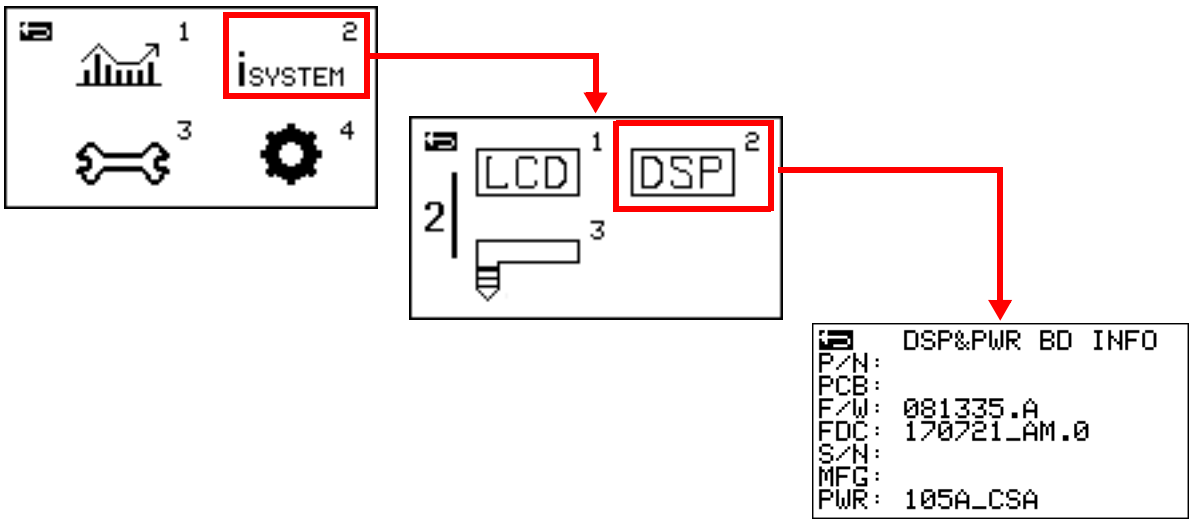
The other fields on this screen are for internal Hypertherm use only.

# DSP PCB and Power PCB information

Go to the DSP PCB and Power PCB Information screen (**DSP&PWR BD INFO**) to see service-related information about the plasma power supply's power PCB and the firmware on the digital signal processing (DSP) PCB.

1. Select iSYSTEM 2 on the main menu screen.

2. Select DSP 2 to go to the **DSP&PWR BD INFO** screen.




**F/W –** This field shows the part number (*nnnnnn*) and the version (*.x*) of the firmware on the DSP PCB.

**FDC –** This field shows the code for the firmware's build day (*nnnnnn_xx*) and the bootloader version (*.n*) of the firmware.

**PWR –** This field shows the model of power PCB that is installed in the plasma power supply.

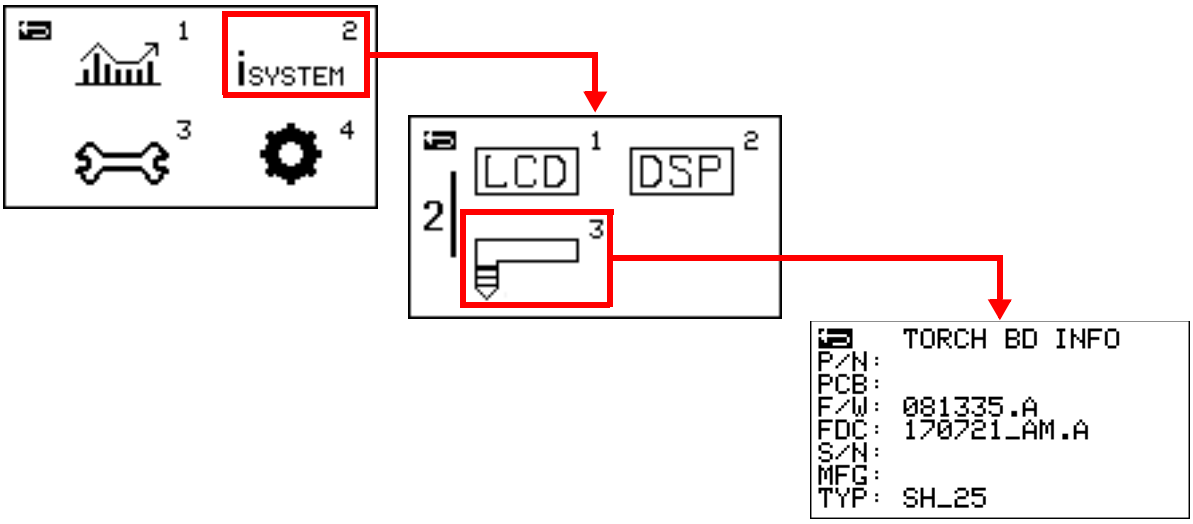
The other fields on this screen are for internal Hypertherm use only.

# Torch PCB information

Go to the Torch PCB Information screen (**TORCH BD INFO**) to see service-related information about the SmartSYNC torch that is connected to the plasma power supply.

The plasma power supply cannot show torch information for a non-SmartSYNC torch.

1. Select iSYSTEM on the main menu screen.
2. Select the torch icon to go to the **TORCH BD INFO** screen.




**F/W –** This field shows the part number (*nnnnnn*) and the version (*.x*) of the firmware on the torch PCB.

**FDC –** This field shows the code for the firmware's build day (*nnnnnn_xx*) and the bootloader version (*.x*) of the firmware.

**TYP –** This field shows the torch type followed by the length of the torch lead in feet.

- **SH** = SmartSYNC hand torch
- **SM** = SmartSYNC machine torch
- **BH** = Hand torch, and the plasma power supply is in basic mode. Refer to page 155.
- **BM** = Machine torch, and the plasma power supply is in basic mode. Refer to page 155.

The other fields on this screen are for internal Hypertherm use only.

# View internal component faults and radio frequency logs

## Internal component faults

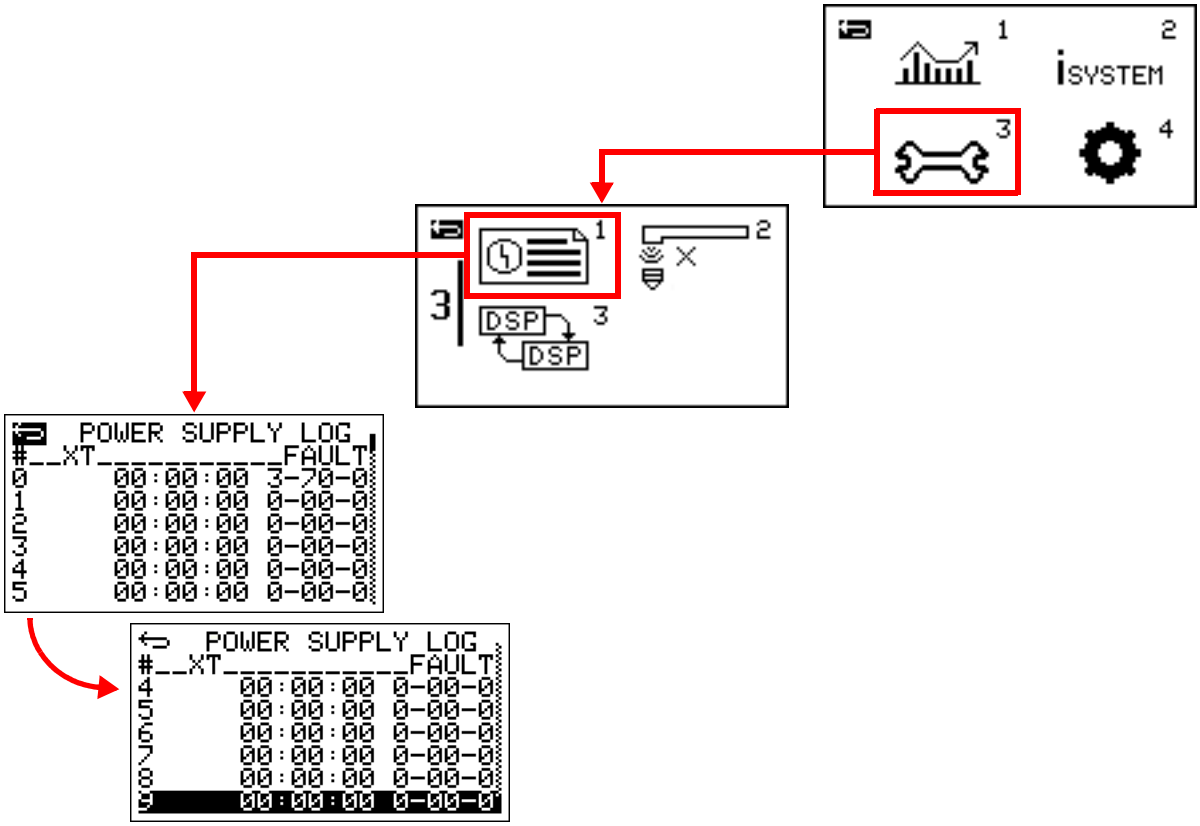
Go to the Power Supply Log screen (**POWER SUPPLY LOG**) to see the 10 most recent internal component faults that have occurred on the plasma power supply. This is a service screen that helps to identify possible damage to components inside the plasma power supply.

The plasma power supply does not show operational fault codes (0-*nn*-*n*) on this screen.

1. Select  on the main menu screen.

2. Select  to go to the **POWER SUPPLY LOG** screen.

3. Turn the adjustment knob to move through the list.




**# –** This field shows the list of fault codes numbered **0** – **9**, starting with the most recent faults.

**XT –** This field shows when each fault occurred. The value is a timestamp in hours (HH), minutes (MM), and seconds (SS): *HH*:*MM*:*SS*. This value is related to the **XT** field on the Power Supply Data screen (**POWER SUPPLY DATA**). Refer to page 138. The timestamp shows when the fault occurred in relation to the cumulative arc transfer time for the plasma power supply.

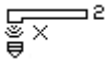
**FAULT –** This field shows the fault code number that identifies each fault. The format is *N-nn-n*. Refer to page 39.

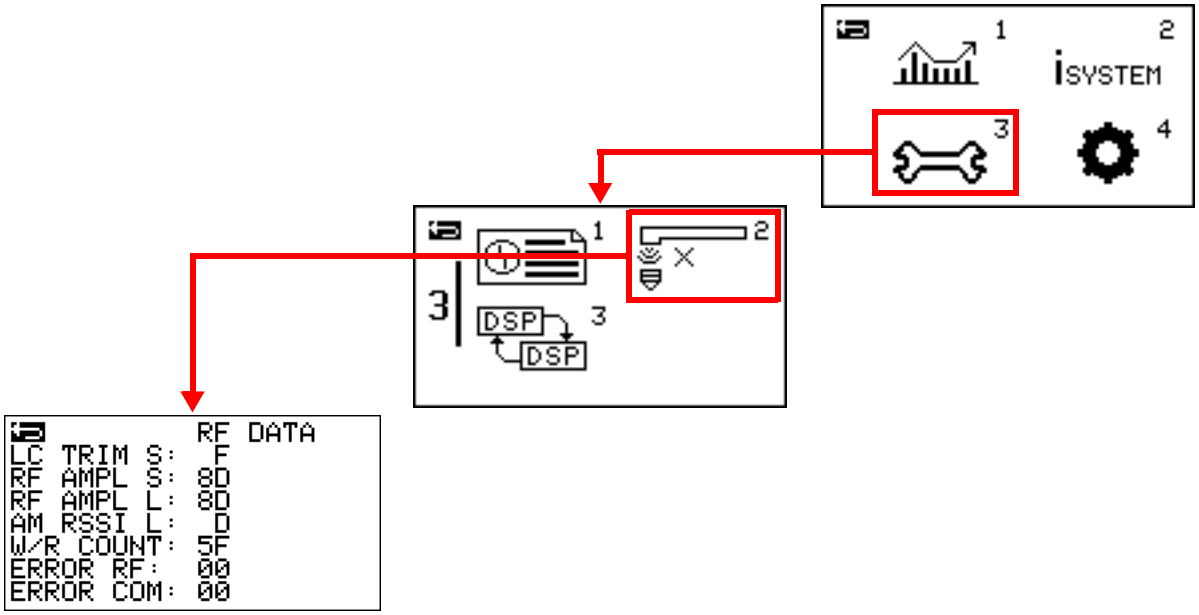
## Radio Frequency (RF) settings and operation logs

Go to the Radio Frequency Data screen (**RF DATA**) to see service-related information about radio frequency (RF) settings and logs.

To see values on this screen, make sure that there is a cartridge installed on the torch and that the torch is set to the green "ready to fire" (✓) position.

1. Select  on the main menu screen.

2. Select  to go to the **RF DATA** screen.




All values on this screen are in hexadecimal format.

**LC TRIM S –** This field shows the trim setting for the LC circuit that the system is tuned to. (*L* = inductance, *C* = capacitance.)

**RF AMPL S –** This field shows the raw RF amplitude that the system is tuned to.

**RF AMPL L –** This field shows the most recent raw RF amplitude.

**AM RSSI L –** This field shows the received signal strength indicator (RSSI) of the most recently used amplitude modulation (AM) channel. RSSI is a measurement of how strong the radio signal is between the transmitter and the receiver.

**W/R COUNT –** This field shows how many write/read occurrences have been done to the test cell.

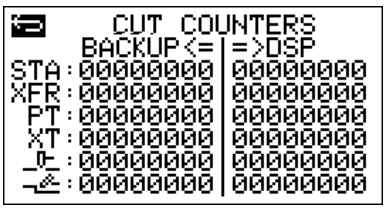
**ERROR RF –** This field shows how many RF operation errors have occurred.

**ERROR COM –** This field shows how many torch communication errors have occurred.

## Cut counter data for backups

Go to the Cut Counters Transfer screen (**CUT COUNTERS**) to do a transfer of the plasma power supply's cut counter data before installing a new DSP PCB.

For instructions on how to use this screen, refer to the *Powermax65/85/105 SYNC DSP PCB Replacement Field Service Bulletin* (810950).

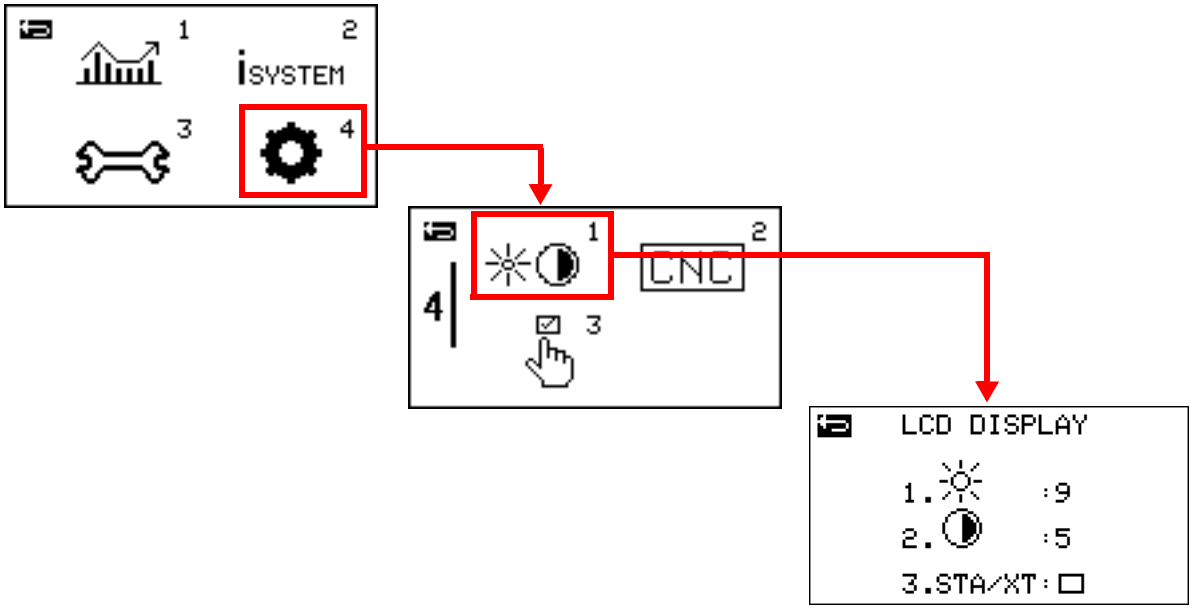


# View or change system settings

## LCD display brightness and contrast

Do the following to adjust the brightness and contrast of the liquid-crystal display (LCD) screen:

1. Push and hold [A/⏎] for 2 seconds to go to the main menu screen.
2. Turn the adjustment knob to go to ⚙ 4. Push [A/⏎] to select it.
3. Turn the adjustment knob to go to ☼◑ 1, and push [A/⏎] to select it. The LCD Display screen (**LCD DISPLAY**) shows.




4. Turn the adjustment knob to adjust the value in the ☼ field to increase or decrease the **brightness** of the LCD screen.

   Push [A/⏎] to enter the value.

   - 0 = Darkest setting
   - 9 = Brightest setting

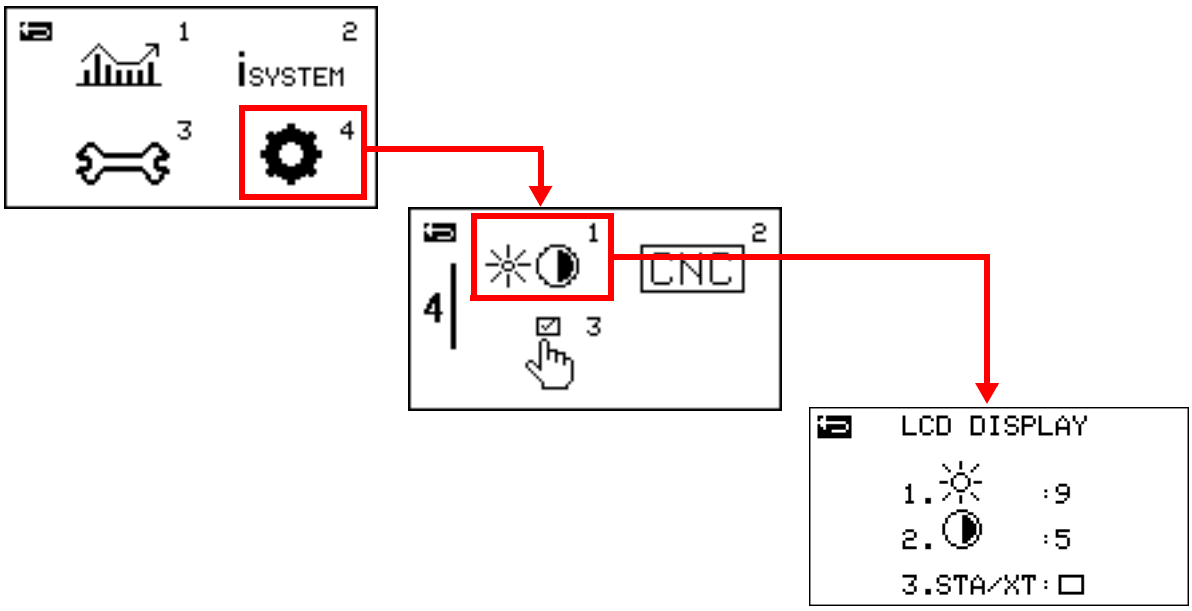
5. Adjust the value in the ◑ field to increase or decrease the **contrast** of the LCD screen.
   - 0 = Lowest contrast
   - 9 = Highest contrast

When you are done, push the ○[↶] button to go back to the status screen.

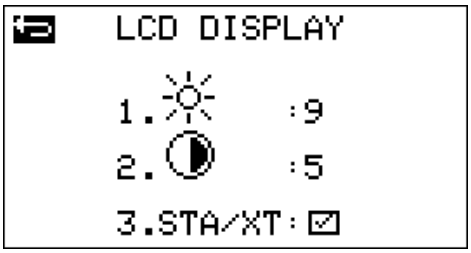
## Show cartridge data on the status screen

You can show the cartridge data for pilot arc starts (**STA**) and arc transfer time (**XT**) on the status screen. When you set the **STA/XT** field to on, these values stay on the status screen until you set the **STA/XT** field to off.

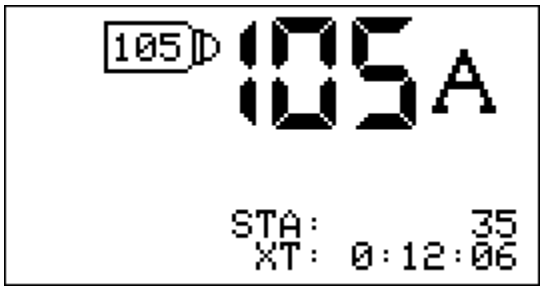
1. Push and hold [A/⏻] for 2 seconds to go to the main menu screen.
2. Turn the adjustment knob to go to ⚙ 4. Push [A/⏻] to select it.
3. Turn the adjustment knob to go to ☀◑ 1, and push [A/⏻] to select it. The LCD Display screen (**LCD DISPLAY**) shows.




4. Turn the adjustment knob to go to the **STA/XT** field, and push [A/⏻] to select it.
5. Turn the adjustment knob to set the **STA/XT** field to on: ☑.
6. Push [A/⏻] to apply the setting.



7. Push ○ to go back to the status screen. The **STA** and **XT** fields now show on the screen.

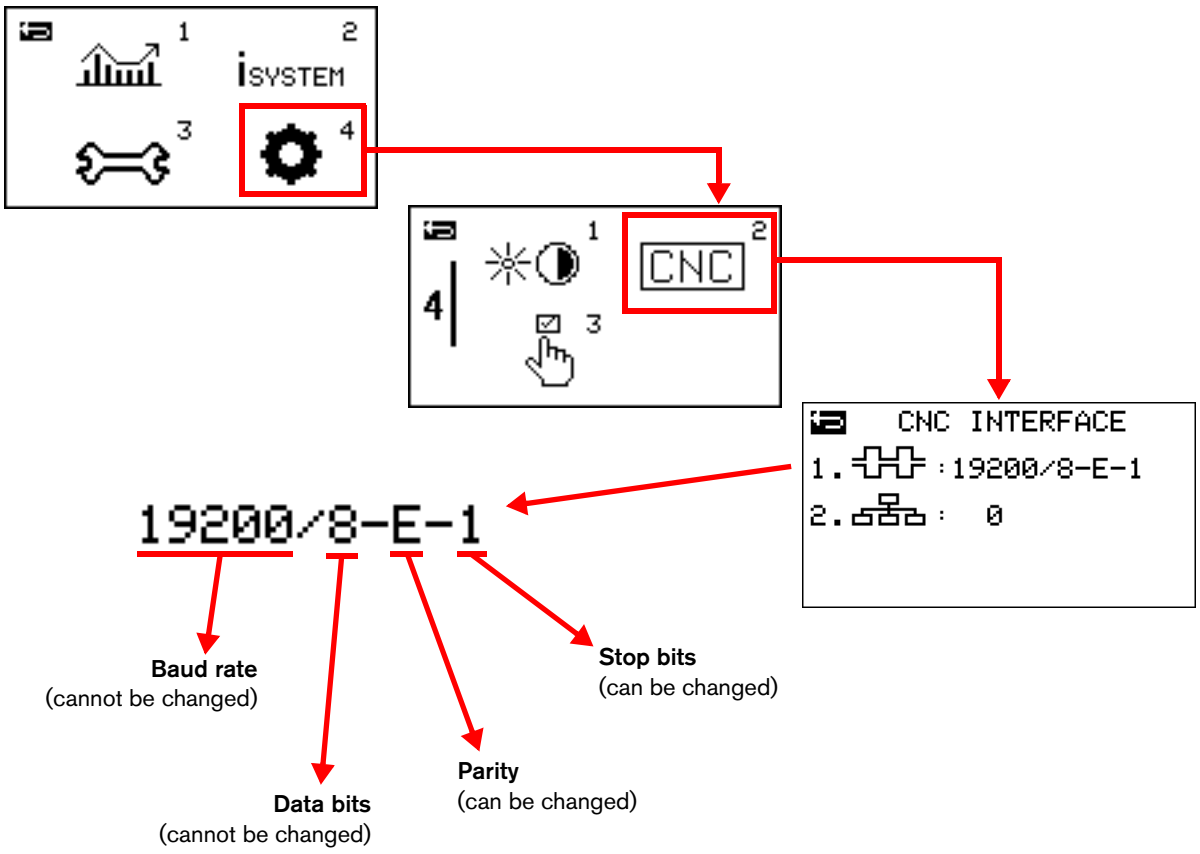



## Serial communications parameters

Use the CNC Interface Settings screen (**CNC INTERFACE**) to set parameters for serial communication.

1. Select ⚙ 4 on the main menu screen.
2. Select CNC 2 to go to the **CNC INTERFACE** screen.
3. Turn the adjustment knob to go to the field you want to change.
4. Push A/→ to select the field.
5. Turn the adjustment knob to change the value in the field.

**6.** Push [A/⏎] to select the new value.



 – Set the parity-check configuration and stop-bit configuration for this Powermax. Make sure that the values in this field are the same as the values at the CNC.

Select one of the following values for **parity checking**:

| | |
|---|---|
| **E** | Even (default) |
| **O** | Odd |
| **N** | No parity checking |

Select one of the following values for **stop bit**:

| | |
|---|---|
| **1** | 1 stop bit (default) |
| **2** | 2 stop bits |

 – This is the Modbus node address for this Powermax. The default value is zero (**0**).

- **For cutting systems with 1 Powermax plasma power supply:** Keep the default value of zero (**0**).

  A value of zero (**0**) lets the CNC set the node address for the Powermax automatically. The node address is set by the first valid Modbus request message that the Powermax receives from the CNC after the Powermax power switch is set to the ON (**I**) position. This field continues to show a value of zero (**0**) during Modbus communication to indicate that the node address is being controlled by the CNC.

- **For cutting systems with 2 or more Powermax plasma power supplies:** Select a unique number from 1 to 255 for each Powermax.

  - After you set the node address for this Powermax, do a cold restart.
  - Make sure that the CNC uses this node address when it communicates with each Powermax.

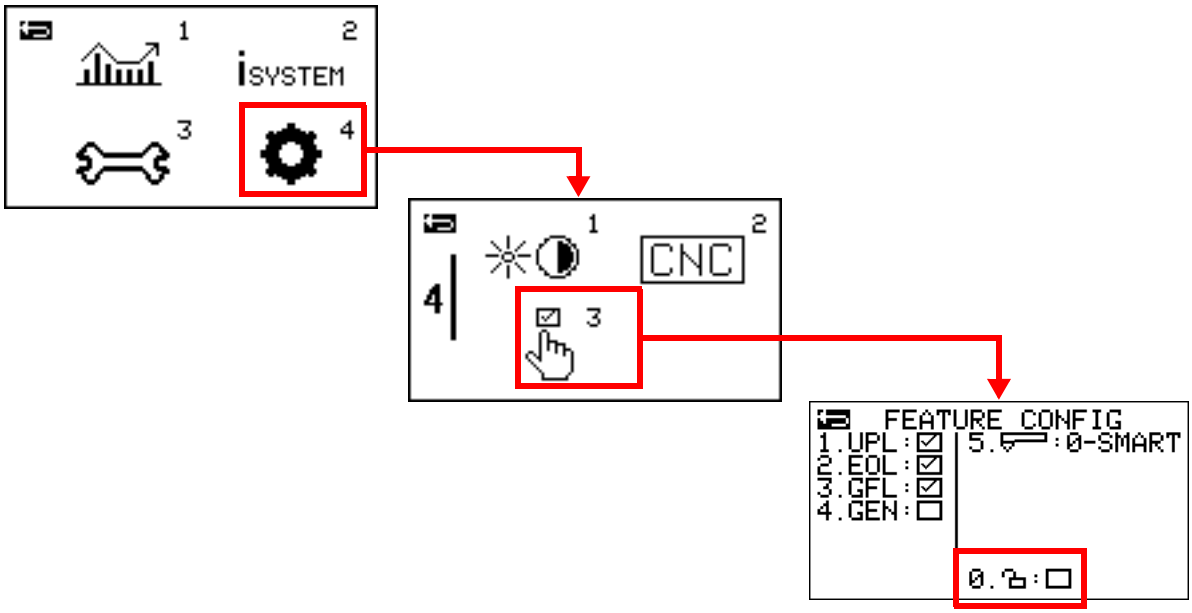
## Default feature configuration

Go to the Feature Configuration screen (**FEATURE CONFIG**) to change system settings. **Changing these fields from their default settings is recommended only for experienced operators.**

Changing one of these fields from the default setting causes the non-default configuration icon (at right) to show on the status screen.

By default, this screen is locked. To change any of the settings on this screen, you must first unlock the screen using the icon.

1. Push and hold [A/⌂] for 2 seconds to go to the main menu screen.
2. Select ⚙ 4 on the main menu screen.
3. Select ☑ 3 to go to the **FEATURE CONFIG** screen.
4. Turn the adjustment knob to go to the field.
5. Push [A/⌂] to select the field.
6. Turn the adjustment knob to set the field to the unlock position: : ☑.
7. Push [A/⌂] to apply the unlock setting.
8. Turn the adjustment knob to go to another field on the screen.
9. Push [A/⌂] to select the field.
10. Turn the adjustment knob to change the value for the selected field.
11. Push [A/⌂] to keep the new value.




**UPL –** Set the low gas pressure detection feature to on or off. When you set this field to off, the system no longer shows the 0-20-0 fault code. This field is on by default.

Hypertherm recommends that you keep this field on. But you can set it to off if the inlet gas pressure at your work site is not stable or if it stays low enough that you get frequent 0-20-0 faults.

Setting this field to off can cause decreased cut quality and cartridge life. If the input gas pressure goes too low, damage to the torch and the cartridge can be the result.

**EOL –** Set the Hypertherm cartridge end-of-life (**EOL**) detection feature to on or off. When you set this field to off, the system no longer shows the 0-32-0 or 0-32-1 fault codes when the cartridge gets to end-of-life.

This field is on by default. But the system temporarily sets the feature to off when any one of the following conditions occurs:

- You install a FineCut hand cutting cartridge.
- You set the output current below 40 A for any Hypertherm cartridge.
- The output current is set below 55 A **and** the field is not set to smart mode (SMART). Refer to page 155.
- The output current is set below 55 A **and** there are no cartridge communications with the plasma power supply.

**GFL –** Do not use this setting. It is reserved for future development.

**GEN –** Set the generator mode feature to on or off. When you set this field to on, the system decreases its sensitivity to changes in current and voltage from incoming power, which can cause fault conditions. These changes in input power are common with some generators. This field is off by default.

Hypertherm recommends that you keep this field off. Setting this field to on can increase the risk of the plasma power supply overheating.

Make sure that you set this field to off when you are not using a generator.

– Set the Hypertherm cartridge data and SmartSYNC data detection feature to on or off. This feature is referred to as *smart mode*. This field contains the following settings:

- **0-SMART** = Smart mode. This is the default setting.
- **1-TORCH** = Torch mode. Do not use this setting. It is reserved for future development.
- **2-BASIC** = Basic mode.

Hypertherm recommends that you only use smart mode. Refer to Smart mode versus basic mode on page 155.

## Smart mode versus basic mode

By default the system is in smart mode. Hypertherm recommends that you keep the system in smart mode. But very experienced operators can use basic mode to help with troubleshooting if necessary. To go into basic mode, set the field to **BASIC**.

When there is no cartridge communication with the plasma power supply, or when torch communication with the plasma power supply is broken, the system operates as if it is in basic mode, regardless of the setting in the field.

### Smart mode

When the system is in smart mode and you use a Hypertherm cartridge with a SmartSYNC torch, the system does many things for you automatically, including the following:

- It sets the operating mode and the output current (A) to the correct settings for your Hypertherm cartridge. For example, if you install a 65 A gouging cartridge, the system automatically goes into Gouge mode and sets the amperage to 65 A.
- It records use data for the Hypertherm cartridge and for the plasma power supply. You can see cartridge data on the **CARTRIDGE DATA** screen. You can see plasma power supply data on the **POWER SUPPLY DATA** screen.
- It adjusts the gas pressure to the correct settings for your Hypertherm cartridge and torch.

When the system is in smart mode and you use a Hypertherm cartridge with a SmartSYNC torch, the system process icon (at right) shows on the status screen.


### Basic mode

When the system is in basic mode, it does not set the operating mode or the output current (A) for you. You must adjust those settings manually.

System behavior also changes in the following ways:

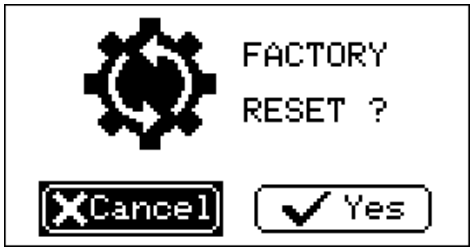
- The system does not record data on pilot arcs or arc transfers for the cartridge. The system also does not record some data for the plasma power supply. Refer to Cumulative cartridge data for the plasma power supply on page 140.
- Cartridge end-of-life detection is disabled when the output current (A) is below 55 A for any type of Hypertherm cartridge.
- The fault LED on the hand torch flashes yellow for as long as the system is in basic mode.
- The amperage-adjustment control on the hand torch does not adjust the amperage for as long as the system is in basic mode.

When the system is in basic mode, the non-default configuration icon (at right) shows on the status screen instead of the system process icon.

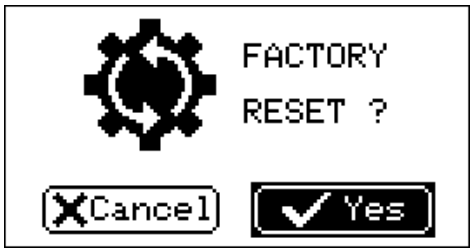
## Set system settings to factory default

To set the plasma power supply to factory default settings, do the following. You can do these steps on all screens.

1. Push and hold ○ and A/ at the same time for approximately 2 seconds until the **FACTORY RESET?** message shows.




2. Turn the adjustment knob to go to Yes, and push A/ to select it. The system goes back to factory default settings, as follows:
   - The brightness, contrast, and CNC interface fields go back to their default settings.
   - All of the fields on the Feature Configuration (**FEATURE CONFIG**) screen go back to their default settings.




   - The non-default configuration icon (at right) no longer shows on the status screen.

   - If you have a Hypertherm cartridge on a SmartSYNC torch, the system process icon (at right) shows on the status screen.


   - The system goes back to the factory default settings for the cartridge installed on the torch. These settings are for output current (A) and operating mode.

# 7 How the Plasma Power Supply Operates

This section contains reference information that explains how the plasma power supply operates and that identifies internal components, as follows:

# Sequence of operation

- Power OFF (**O**)

↓

- Connect the gas supply to the gas fitting on the plasma power supply.
- Connect the work lead to the plasma power supply and workpiece.
- Connect the torch to the plasma power supply.
- Connect the plasma power supply to the power source.
- Make sure that incoming power is ON at the power source (for example, a line-disconnect box).
- Set the ON/OFF power switch to ON (**I**).

↓

- The green power ON LED illuminates. The system is ready for operation.
- Set the torch-disable switch to the yellow lock (**X**) position.
- Install a cartridge on the torch.
- Set the torch-disable switch to the green "ready to fire" (✓) position.
- Make sure the yellow fault LED does not show on the front panel. Refer to page 39.

↓

- The operating mode and the output current (A) automatically adjust to align with the cartridge installed on the torch.
- The gas pressure automatically adjusts for optimal cutting to align with the system settings and the torch and cartridge that are connected to the plasma power supply.

↓

- Position the torch over the workpiece.
- Pull the plasma start trigger on the hand torch, or send a start signal to the machine torch.

↓

- The gas solenoid valve opens.
- The gas flow starts.
- The plasma cutting arc starts.

↓

- Pull the torch lightly across the workpiece to make a cut.
- The workpiece falls off after the cut.
- Release the plasma start trigger on the hand torch or the remote start switch for the machine torch.

↓

- The plasma arc extinguishes.
- Gas postflow continues to decrease the temperature of the cartridge.

↓

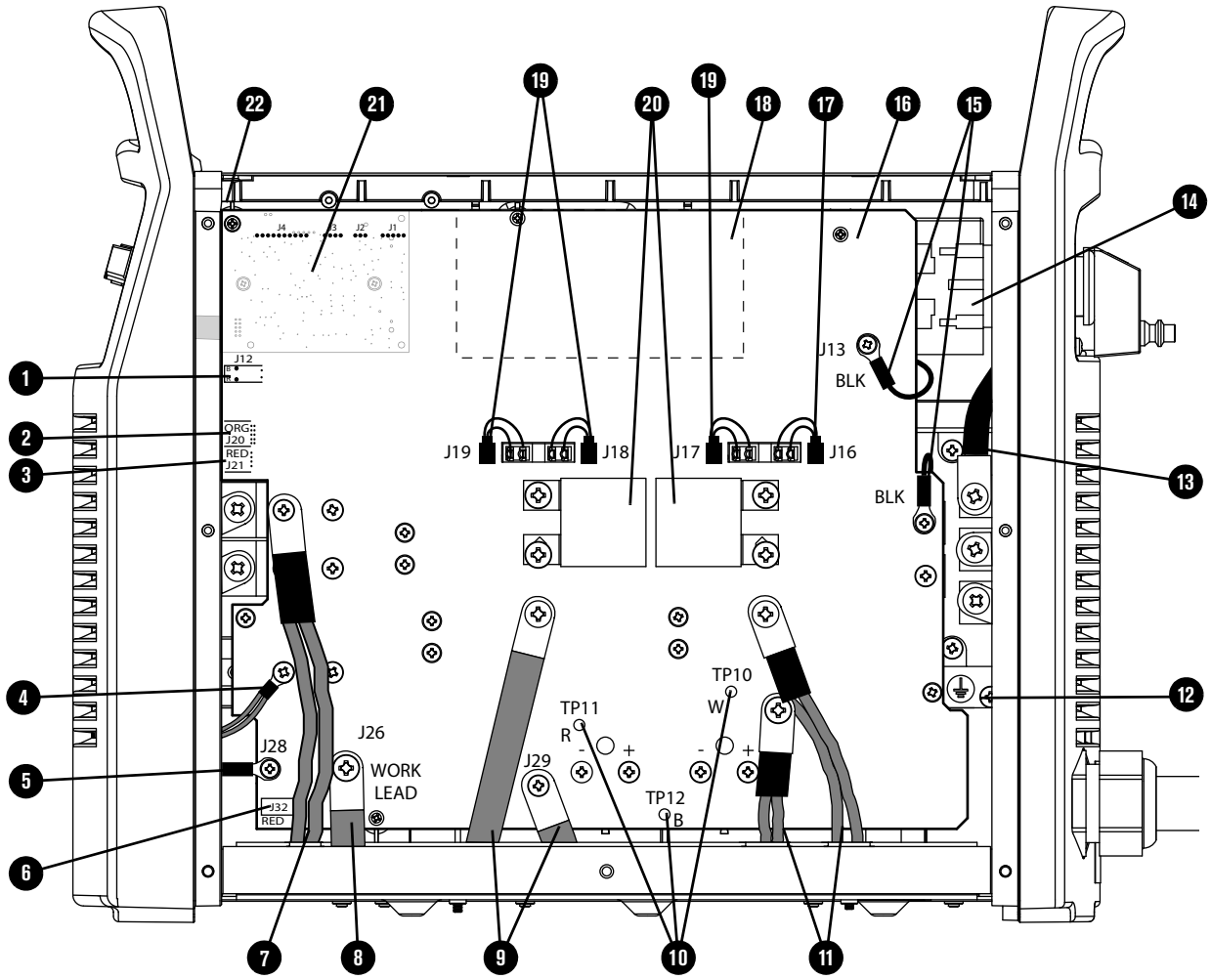
- The gas solenoid valve closes.
- The gas flow stops.

↓

- Set the ON/OFF power switch to OFF (**O**).

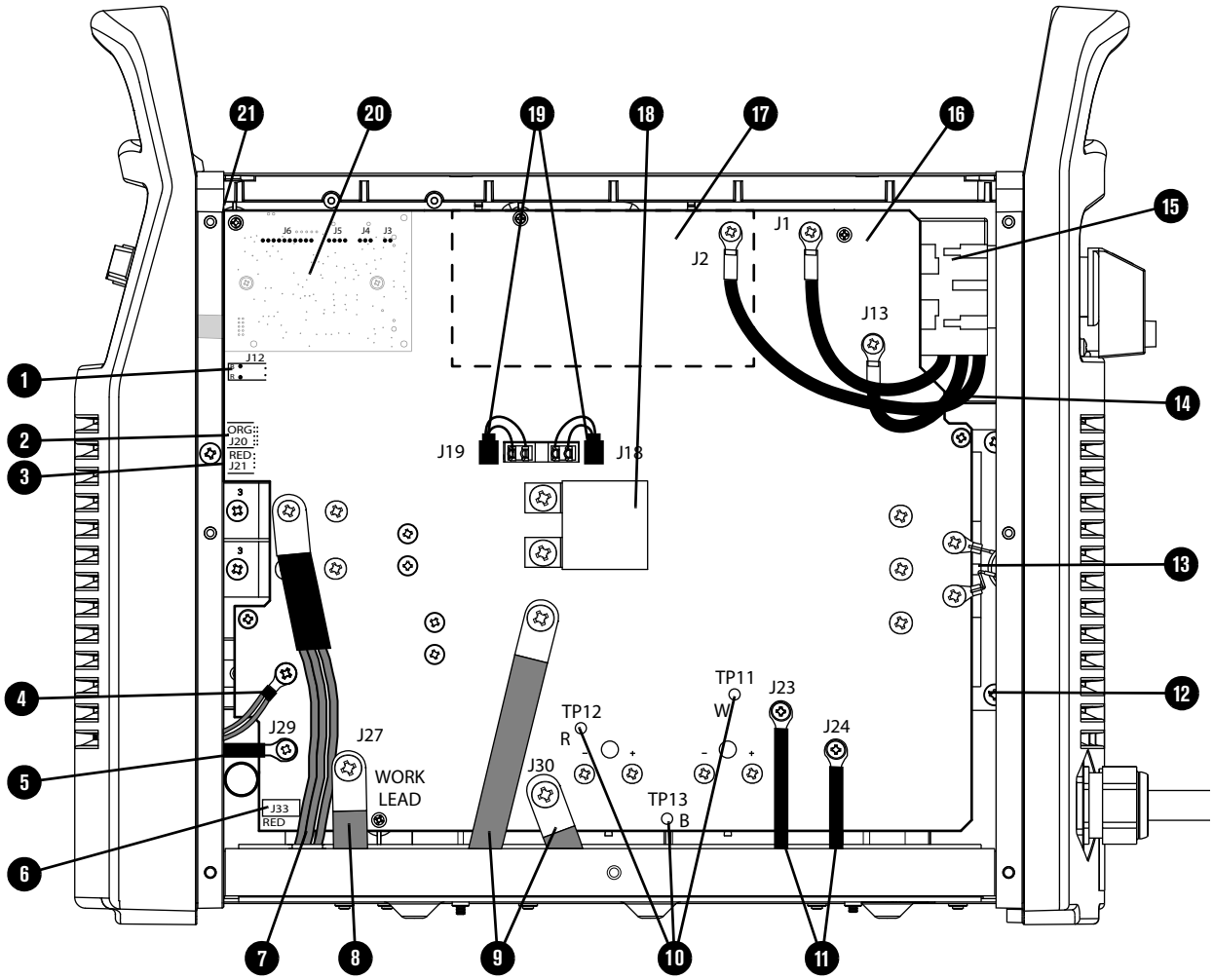
# Powermax65/85 SYNC plasma power supply overviews

**Figure 40** – 200 V – 600 V CSA plasma power supply



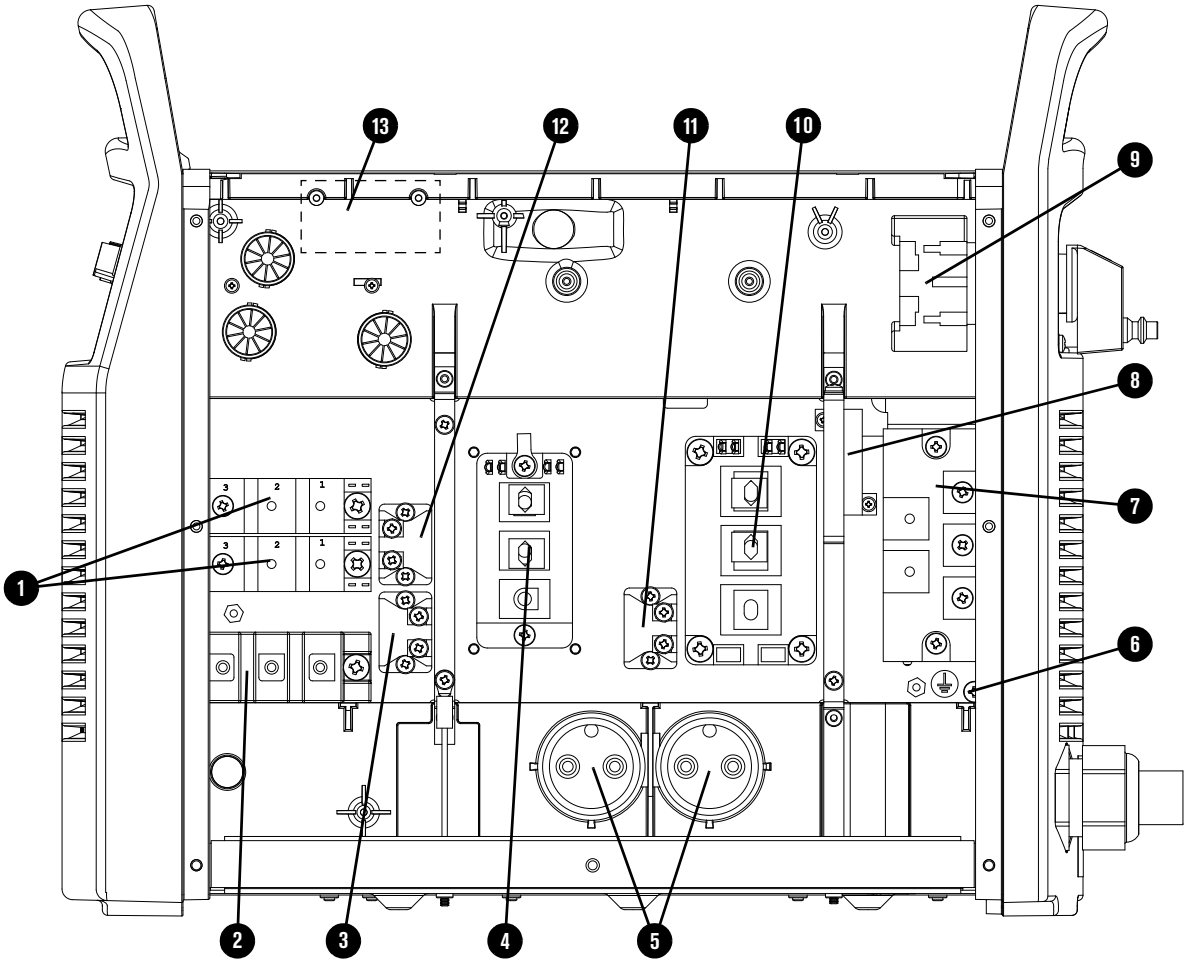

1 J12 connector
2 J20 connector
3 J21 connector
4 Nozzle wire
5 Electrode wire
6 J32 connector
7 Output inductor wire
8 Work lead
9 Transformer wires
10 Test points
11 PFC inductor wires
12 Ground
13 AC input wires (3)
14 Power switch
15 Damper resistor wires
16 Power PCB
17 PFC temperature sensor
18 Flyback circuit
19 Gate drive connectors (3)
20 3uF capacitors
21 Digital signal processor (DSP) PCB
22 Control PCB (in front panel)

**Figure 41** – 380 V CCC / 400 V CE plasma power supply



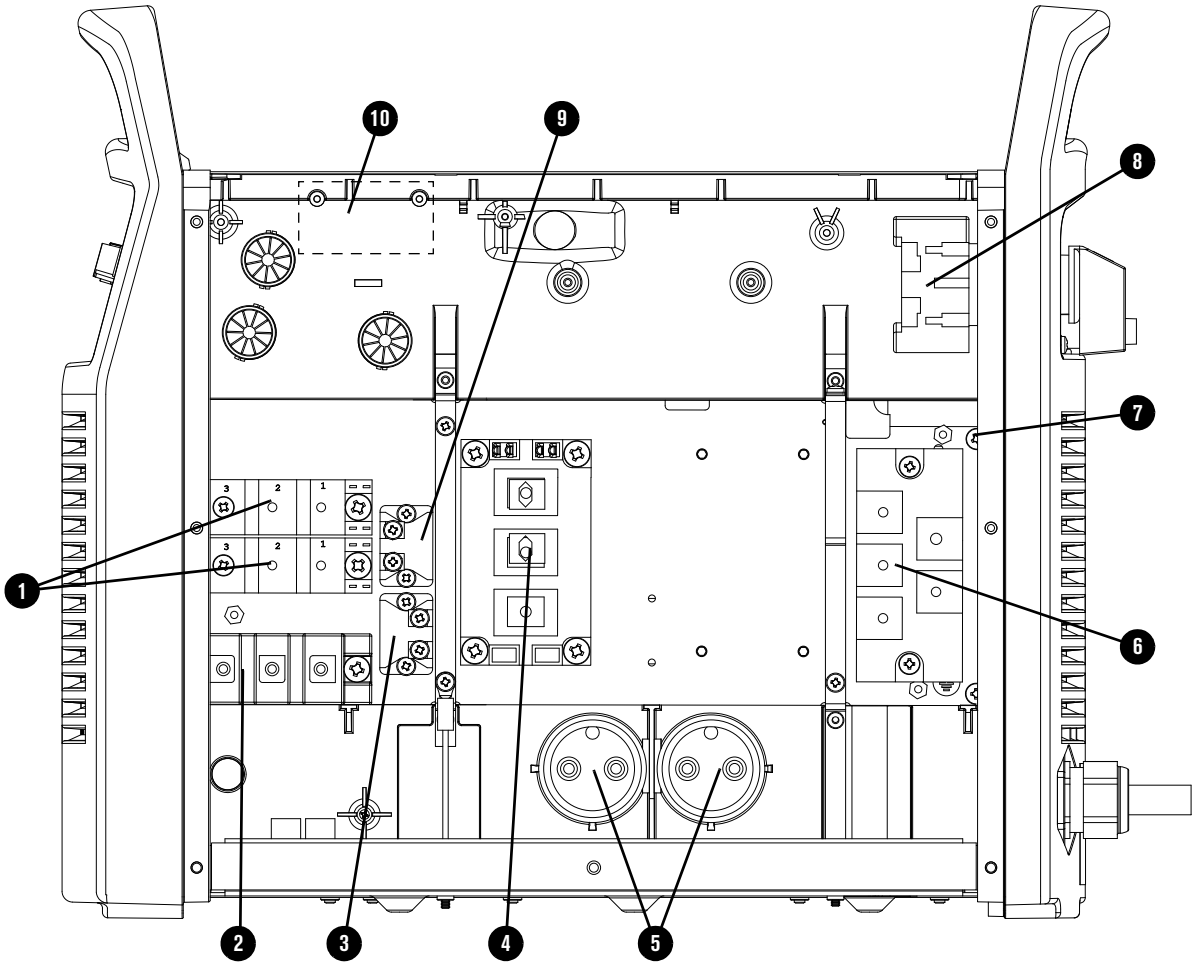

1 J12 connector
2 J20 connector
3 J21 connector
4 Nozzle wire
5 Electrode wire
6 J33 connector
7 Output inductor wire
8 Work lead
9 Transformer wires
10 Test points
11 PFC inductor wires
12 Ground
13 MOV assembly
14 AC input wires (3)
15 Power switch
16 Power PCB
17 Flyback circuit
18 3uF capacitors
19 Gate drive connectors
20 Digital signal processor (DSP) PCB
21 Control PCB (in front panel)

**Figure 42** – 200 V – 600 V CSA plasma power supply (power PCB removed)




**1** Output bridge diode
**2** Pilot arc IGBT
**3** Inverter snubber resistor
**4** Inverter IGBT module
**5** Bulk capacitors
**6** Ground
**7** Input diode bridge
**8** Snubber resistor
**9** Power switch (S1)
**10** PFC IGBT
**11** PFC snubber resistor
**12** Output snubber resistor
**13** Optional serial PCB

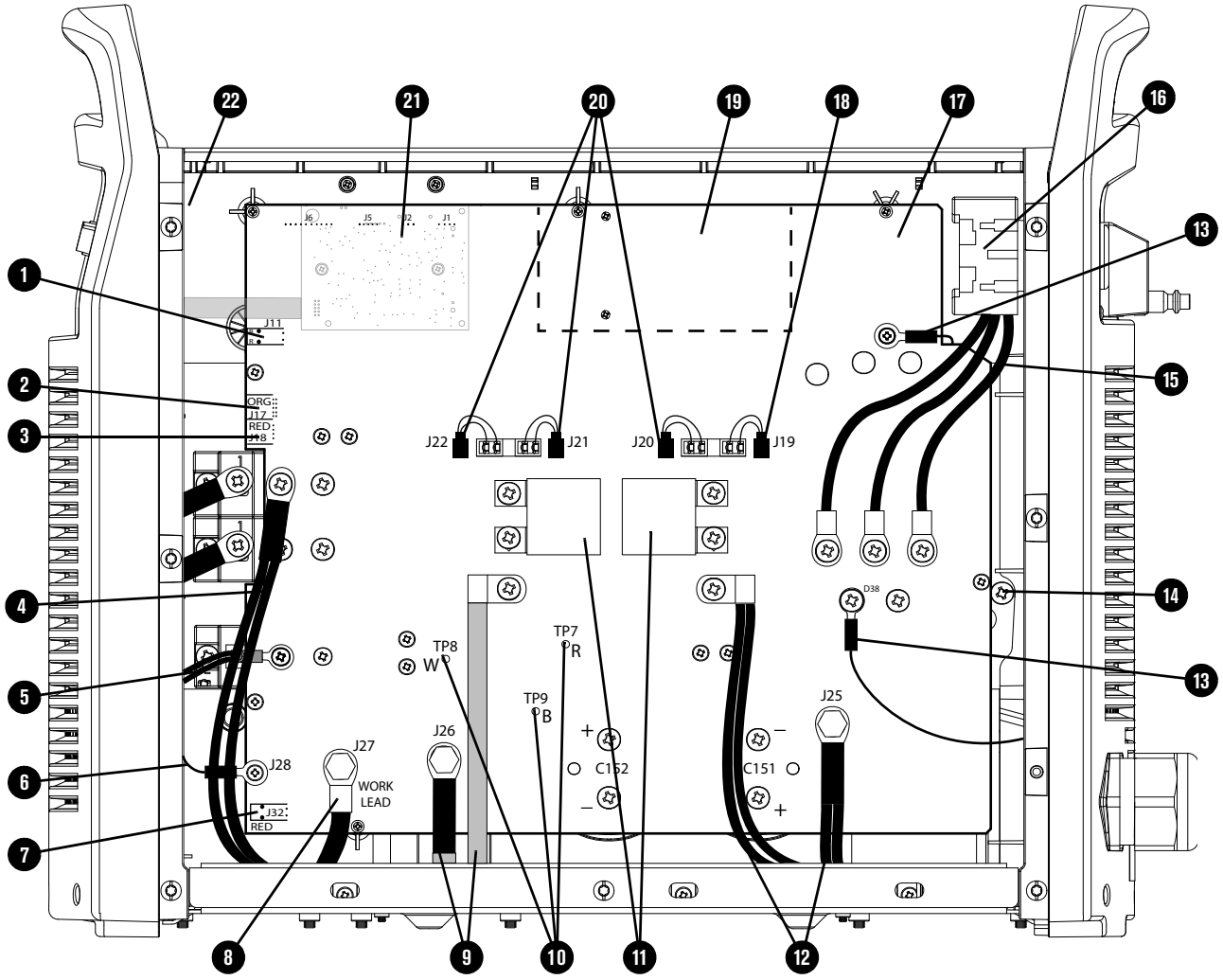
**Figure 43** – 380 V CCC / 400 V CE plasma power supply (power PCB removed)




**1** Output bridge diode
**2** Pilot arc IGBT
**3** Inverter snubber resistor
**4** Inverter IGBT module
**5** Bulk capacitors
**6** Input diode bridge
**7** Ground
**8** Power switch (S1)
**9** Output snubber resistor
**10** Optional serial PCB

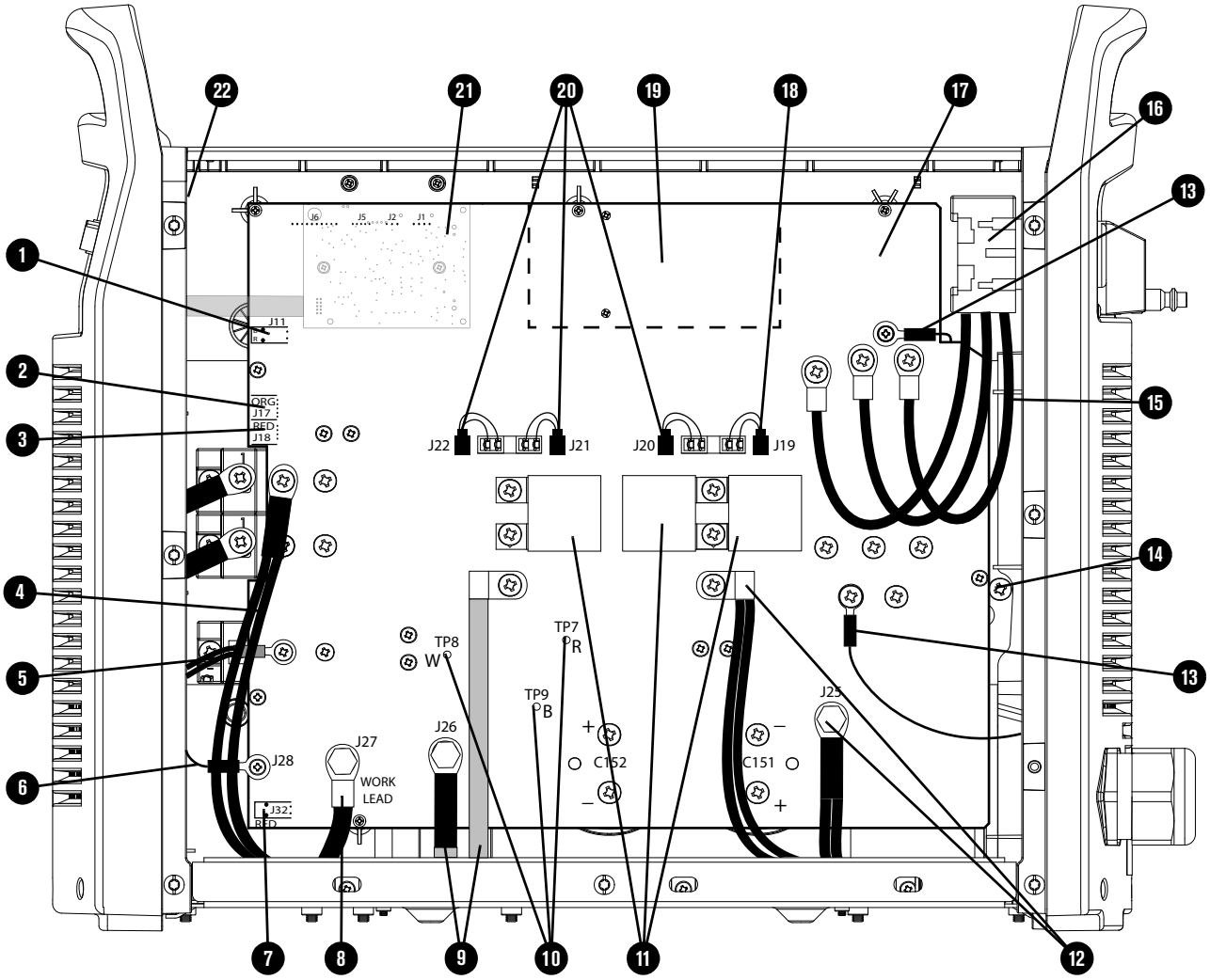
# Powermax105 SYNC plasma power supply overviews

**Figure 44** – 200 V – 600 V CSA plasma power supply




1 J11 connector
2 J17 connector
3 J18 connector
4 Output inductor wires
5 Nozzle wires
6 Electrode wire
7 J32 connector
8 Work lead
9 Transformer wires
10 Test points
11 3uF capacitors
12 PFC inductor wires
13 Damper resistor wires
14 Ground
15 AC input wires (3)
16 Power switch
17 Power PCB
18 PFC temperature sensor
19 Flyback circuit
20 Gate drive connectors
21 Digital signal processor (DSP) PCB
22 Control PCB (in front panel)

**Figure 45** – 230 V – 400 V CE plasma power supply

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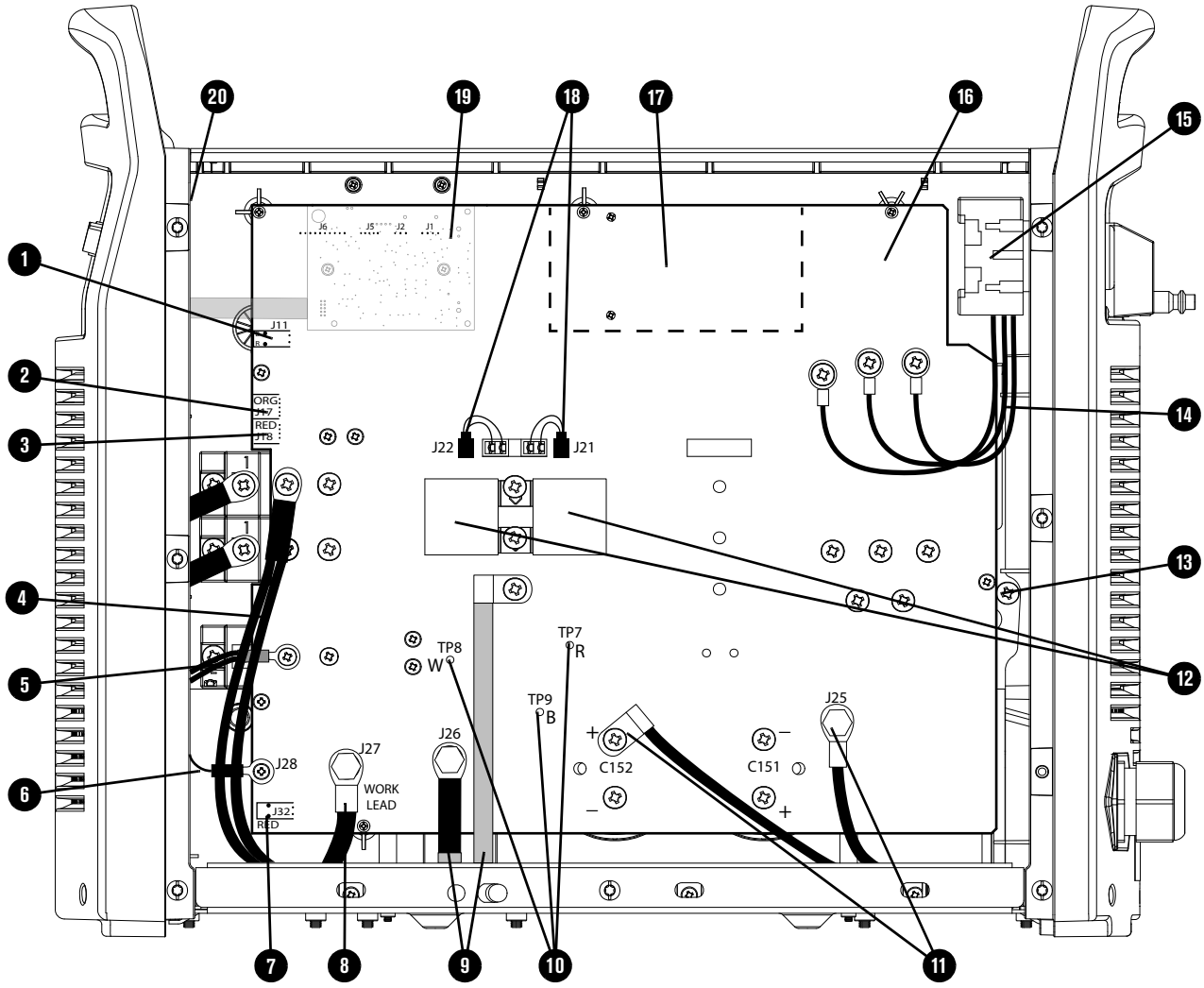
16 Power switch
17 Power PCB
18 PFC temperature sensor
19 Flyback circuit
20 Gate drive connectors
21 Digital signal processor (DSP) PCB
22 Control PCB (in front panel)

**Figure 46** – 380 V CCC / 400 V CE plasma power supply

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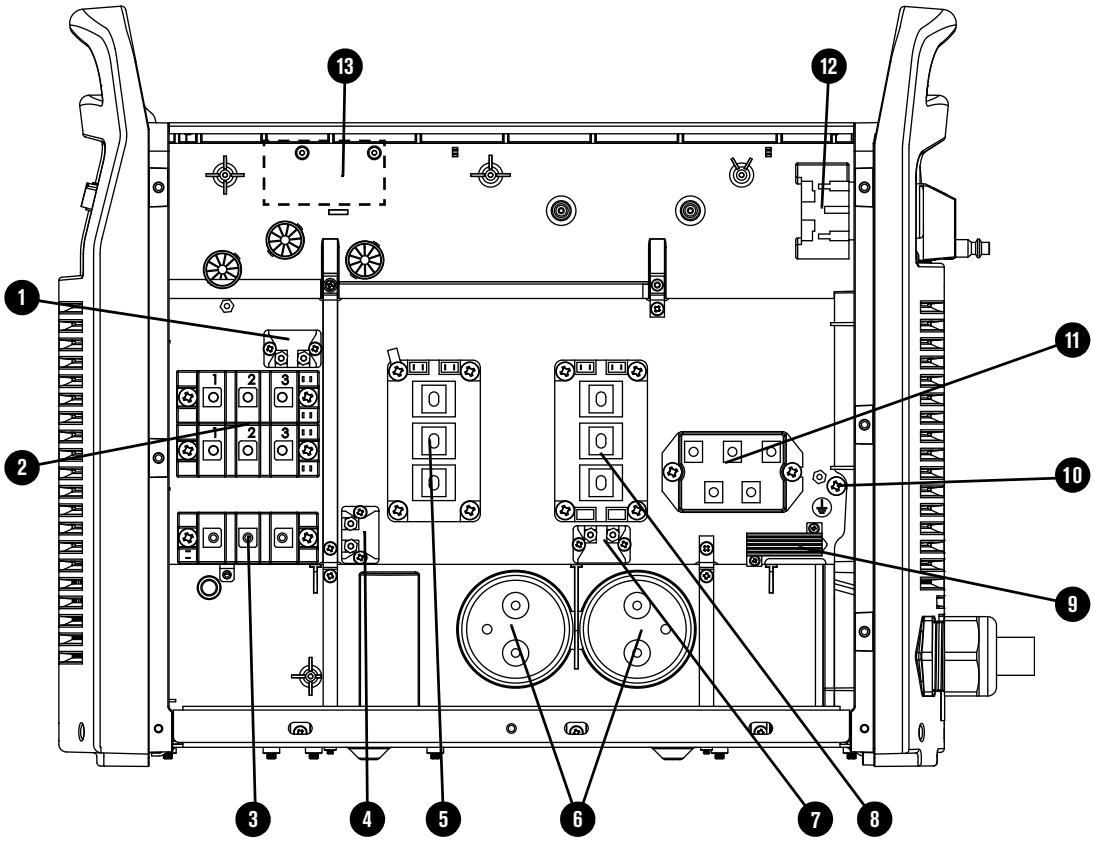
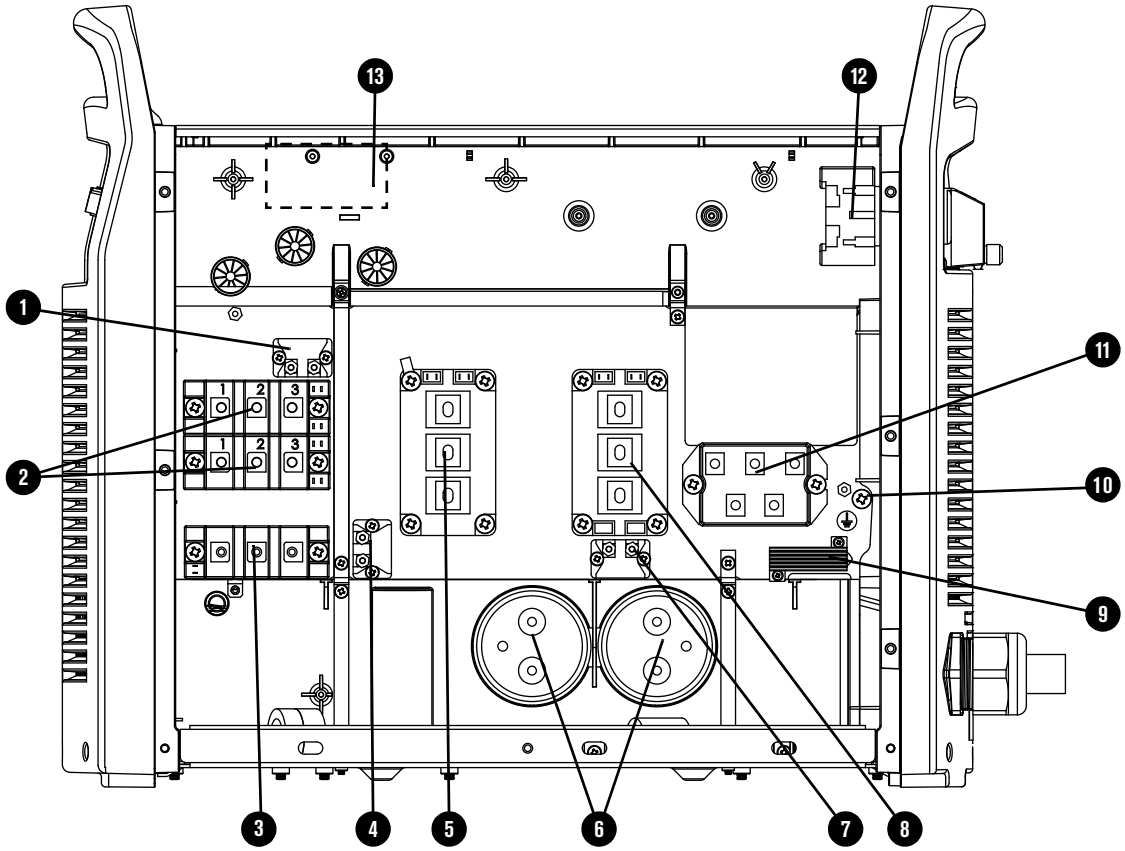
12 3uF Capacitors
13 Ground
14 AC input wires (3)
15 Power switch
16 Power PCB
17 Flyback circuit
18 Gate drive connectors
19 Digital signal processor (DSP) PCB
20 Control PCB (in front panel)

**Figure 47** – 200 V – 600 V CSA plasma power supply (power PCB removed)



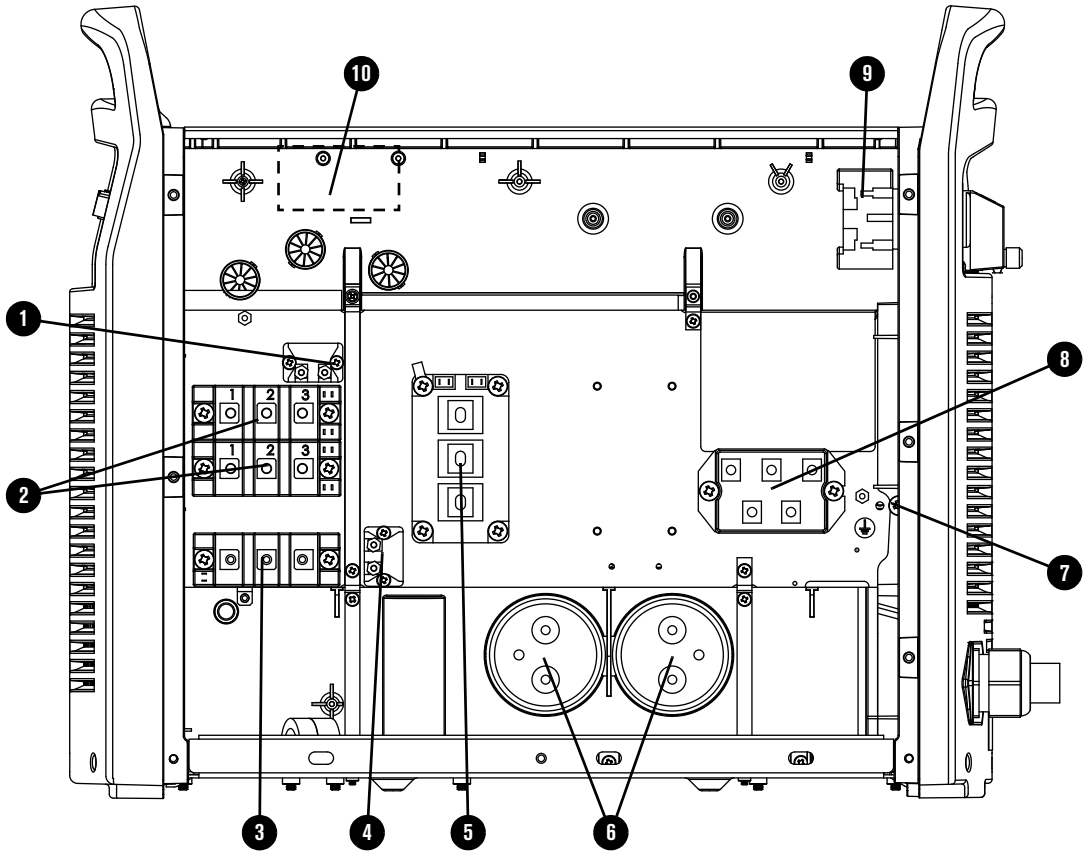

**1** Output snubber resistor
**2** Output diode bridge
**3** Pilot arc IGBT
**4** Inverter snubber resistor
**5** Inverter IGBT module
**6** Bulk capacitor
**7** PFC snubber resistor
**8** PFC IGBT module
**9** Damper resistor
**10** Ground
**11** Input diode bridge
**12** Power switch (S1)
**13** Optional serial PCB

**Figure 48** – 230 V – 400 V CE plasma power supply (power PCB removed)




**1** Output snubber resistor
**2** Output diode bridge
**3** Pilot arc IGBT
**4** Inverter snubber resistor
**5** Inverter IGBT module
**6** Bulk capacitors
**7** PFC snubber resistor
**8** PFC IGBT module
**9** Damper resistor
**10** Ground
**11** Input diode bridge
**12** Power switch (S1)
**13** Optional serial PCB

**Figure 49** – 380 V CCC / 400 V CE plasma power supply (power PCB removed)




**1** Output snubber resistor
**2** Output bridge diode
**3** Pilot arc IGBT
**4** Inverter snubber resistor
**5** Inverter IGBT module
**6** Bulk capacitors
**7** Ground
**8** Input diode bridge
**9** Power switch (S1)
**10** Optional serial PCB

# Theory of operation

## Powermax65/85 SYNC

### 200 V – 600 V CSA 1-phase or 3-phase functional description

AC power goes into the system through the power switch (S1) to the input diode bridge (D50). The voltage from the bridge supplies the power factor correction (PFC) boost converter, which supplies a nominal 760 VDC bus voltage. The bus supplies voltage and current to the inverter and the flyback circuit (DC to DC converter) on the power PCB (PCB3). The power PCB provides noise suppression and spike protection. The power PCB resistors (RT4, RT5) and relays (K2, K3) do a "soft start."

The PFC boost converter has an insulated gate bipolar transistor (Q11), PFC choke, and control circuit. It supplies a 760 VDC bus voltage when the input AC voltage is between 200 VAC and 540 VAC. At 600 VAC, the nominal bus voltage is 840 VDC.

The inverter has a dual IGBT package (Q12), the power transformer, an output current sensor, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The output bridge (D48 and D51) corrects the output of the isolation transformer.

The output circuitry has 2 current sensors located on the power PCB, the pilot arc IGBT (Q13), and the output choke.

The digital signal processor (PCB2) monitors and controls the system's operation and safety circuits. The amperage adjustment knob on the control PCB (PCB1) is used to set the output current: 20 A – 65 A for the Powermax65 SYNC or 25 A – 85 A for the Powermax85 SYNC. The system compares the setpoint to the output current by monitoring the current sensors and adjusting the output of the inverter IGBTs (Q12).

### 380 V CCC / 400 V CE 3-phase functional description

AC power goes into the system through the power switch (S1) to the input diode bridge (D45). The voltage from the bridge supplies a nominal 530 VDC to 560 VDC bus voltage. The bus supplies voltage and current to the inverter and the flyback circuit (DC to DC converter) on the power PCB (PCB3). The power PCB provides noise suppression and spike protection. The power PCB resistors (RT4, RT5) and relay (K2) do a "soft start."

The inverter has a dual IGBT package (Q9), the power transformer, a current sensor, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The output bridge (D44 and D46) corrects the output of the isolation transformer.

The output circuitry has 2 current sensors located on the power PCB, the pilot arc IGBT (Q10), and the output choke.

The digital signal processor (PCB2) monitors and controls the system's operation and safety circuits. The amperage adjustment knob on the control PCB (PCB1) is used to set the output current: 20 A – 65 A for the Powermax65 SYNC or 25 A – 85 A for the Powermax85 SYNC. The system compares the setpoint to the output current by monitoring the current sensors and adjusting the output of the inverter IGBTs (Q9).

# Powermax105 SYNC

## 200 V – 600 V CSA 3-phase functional description

AC power goes into the system through the power switch (S1) to the input diode bridge (D38). The voltage from the bridge supplies the power factor correction (PFC) boost converter, which supplies a nominal 760 VDC bus voltage. The bus supplies voltage and current to the inverter and the flyback circuit (DC to DC converter) on the power PCB (PCB3). The power PCB provides noise suppression and spike protection. The power PCB resistors (RT4, RT5) and relays (K2, K3) do a "soft start."

The PFC boost converter has an insulated gate bipolar transistor (Q11), PFC choke, and control circuit. It supplies a 760 VDC bus voltage when the input AC voltage is between 200 VAC and 540 VAC. At 600 VAC, the nominal bus voltage is 840 VDC.

The inverter has a dual IGBT package (Q12), the power transformer, an output current sensor, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The output bridge (D36 and D37) corrects the output of the isolation transformer.

The output circuitry has 2 current sensors located on the power PCB, the pilot arc IGBT (Q13), and the output choke.

The digital signal processor (PCB2) monitors and controls the system's operation and safety circuits. The amperage adjustment knob on the control PCB (PCB1) is used to set the output current: 30 A – 105 A. The system compares the setpoint to the output current by monitoring the current sensors and adjusting the output of the inverter IGBT module (Q12).

## 230 V – 400 V CE 3-phase functional description

AC power goes into the system through the power switch (S1) to the input diode bridge (D38). The voltage from the bridge supplies a nominal 760 VDC bus voltage. The bus supplies voltage and current to the inverter and the flyback circuit (DC to DC converter) on the power PCB (PCB3). The power PCB provides noise suppression and spike protection. The power PCB resistors (RT4, RT5) and relay (K2) do a "soft start."

The PFC boost converter has an insulated gate bipolar transistor (Q11), PFC choke, and control circuit. It supplies a nominal 760 VDC bus voltage.

The inverter has a dual IGBT package (Q12), the power transformer, a current sensor, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The output bridge (D36 and D37) corrects the output of the isolation transformer.

The output circuitry has 2 current sensors located on the power PCB, the pilot arc IGBT (Q13), and the output choke.

The digital signal processor (PCB2) monitors and controls the system's operation and safety circuits. The amperage adjustment knob on the control PCB (PCB1) is used to set the output current: 30 A – 105 A. The system compares the setpoint to the output current by monitoring the current sensors and adjusting the output of the inverter IGBT module. (Q12).

## 380 V CCC / 400 V CE 3-phase functional description

AC power goes into the system through the power switch (S1) to the input diode bridge (D38). The voltage from the bridge supplies a nominal 530 VDC to 560 VDC bus voltage. The bus supplies voltage and current to the inverter and the flyback circuit (DC to DC converter) on the power PCB (PCB3). The power PCB provides noise suppression and spike protection. The power PCB resistors (RT4, RT5) and relay (K2) do a "soft start."

The inverter has a dual IGBT package (Q12), the power transformer, a current sensor, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The output bridge (D36 and D37) corrects the output of the isolation transformer.

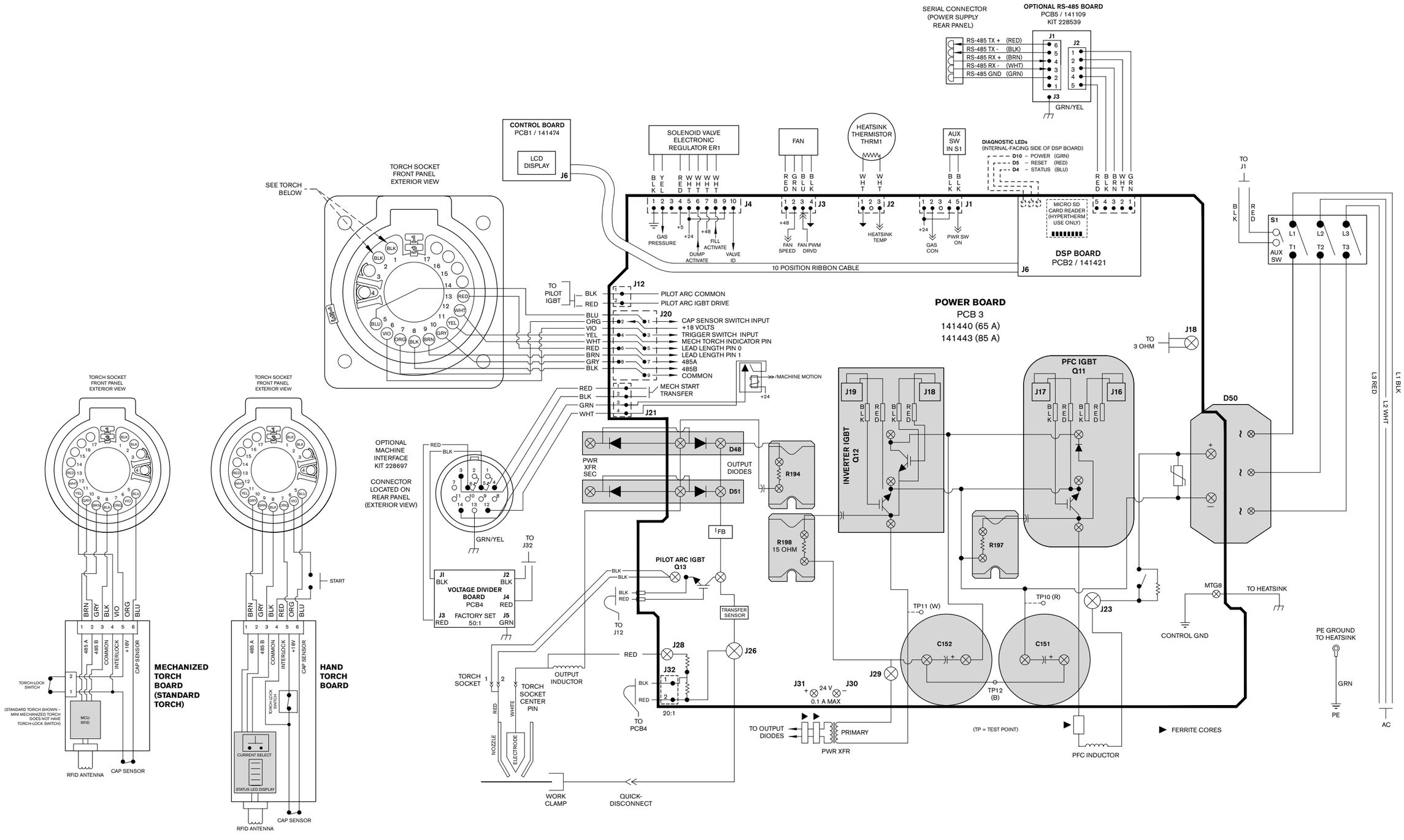
The output circuitry has 2 current sensors located on the power PCB, the pilot arc IGBT (Q13), and the output choke.

The digital signal processor (PCB2) monitors and controls the system's operation and safety circuits. The amperage adjustment knob on the control PCB (PCB1) is used to set the output current: 30 A – 105 A. The system compares the setpoint to the output current by monitoring the current sensors and adjusting the output of the inverter IGBT module. (Q12).

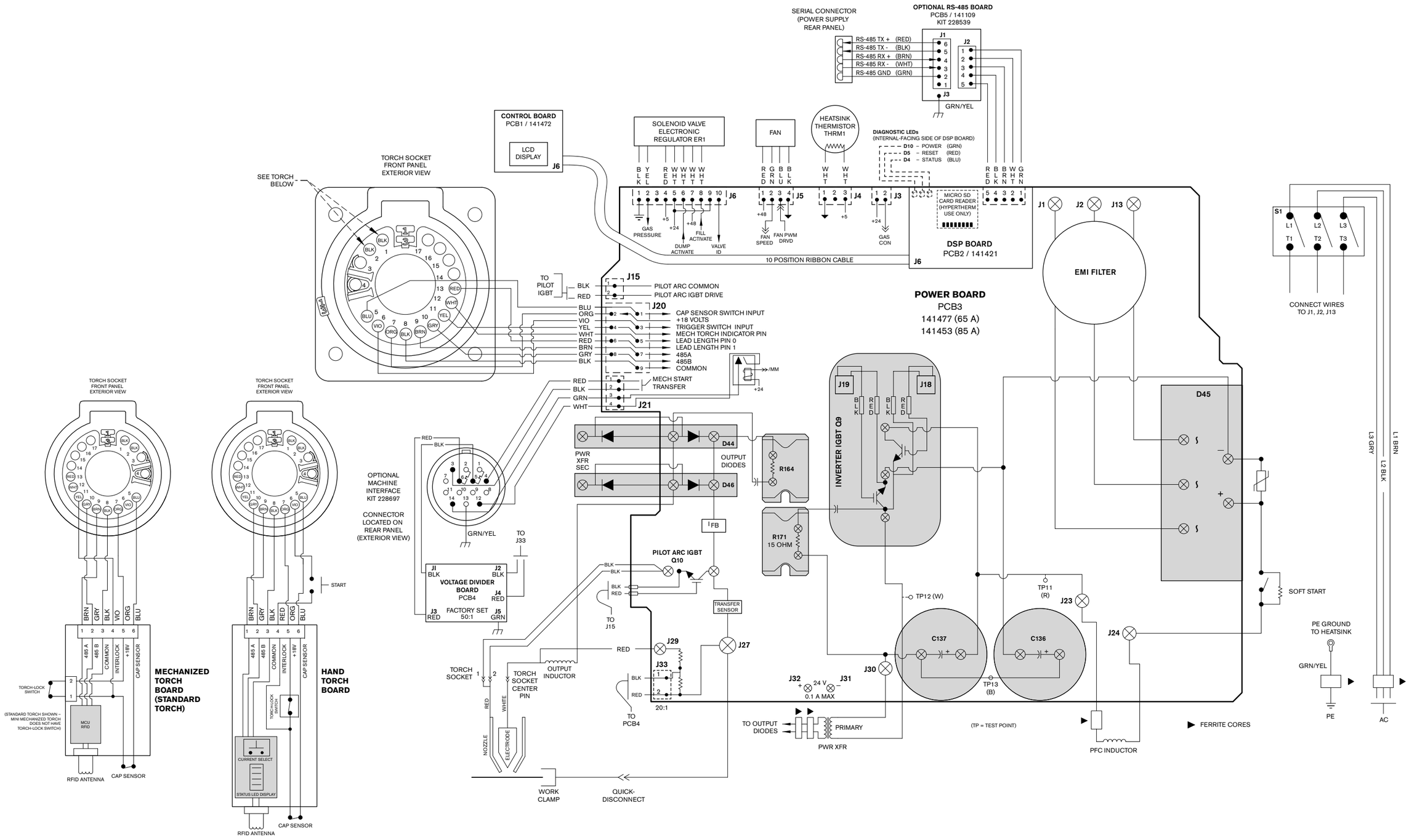
# 8 System Diagrams

This section contains the following system diagrams:

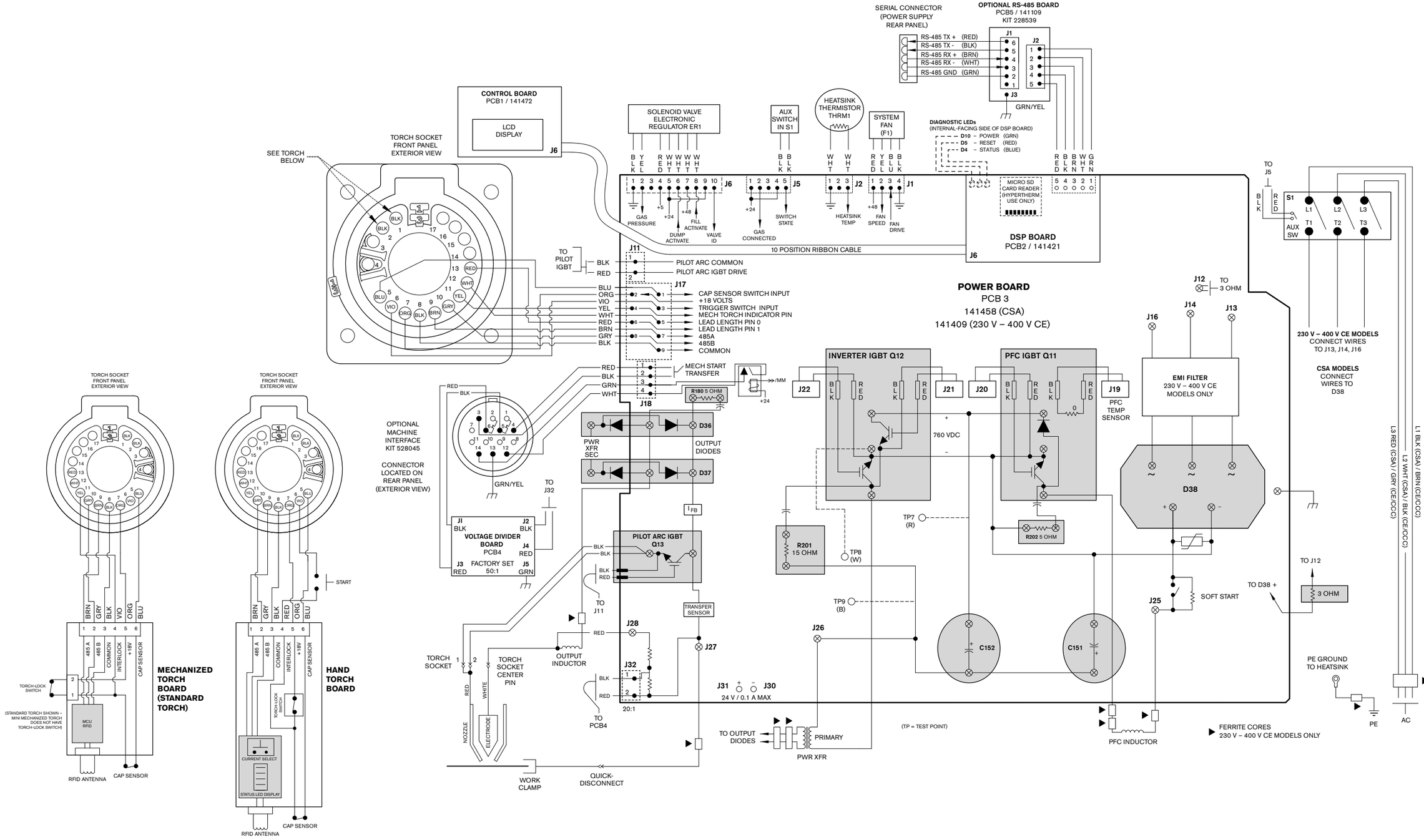
# Powermax65/85 SYNC schematic – CSA models



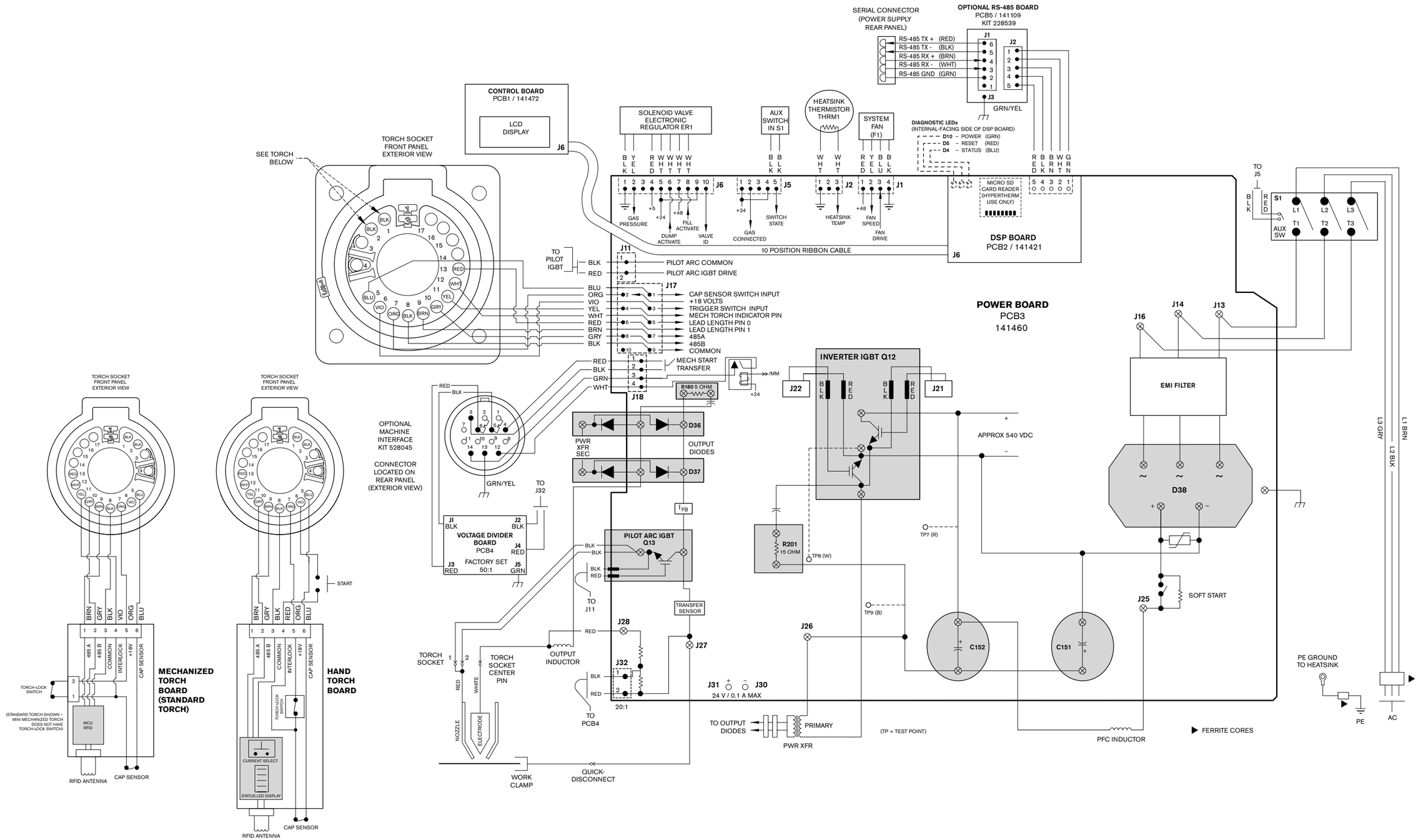
# Powermax65/85 SYNC schematic – CE/CCC models



# Powermax105 SYNC schematic – CSA models and 230 V – 400 V CE models



# Powermax105 SYNC schematic – 380 V CCC models and 400 V CE models



## Timing chart for torch start