

# ***THERMAL ARC***<sup>®</sup>

***A THERMADYNE<sup>®</sup> Company***

INVERTER  
ARC  
WELDER

MODEL 185TSW AC/DC CC  
STICK  
TIG - Lift Start  
HF START

**OPERATING MANUAL**


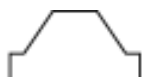


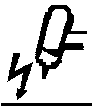













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## SYMBOL LEGEND

<b>A</b>	Amperage
<b>V</b>	Voltage
<b>Hz</b>	Hertz (frequency)
<b>SEC</b>	Seconds
<b>%</b>	Percent
<b>==</b>	DC (Direct Current)
<b>~</b>	AC (Alternating Current)
	Standard Function
	Slope Function
	Slope W/Repeat Function
	Spot Function
	Impulse Starting (High Frequency GTAW)
	Touch Start (Lift Start TIG circuit GTAW)

	STICK (Shielded Metal Arc SMAW)
	Pulse Current Function
	Spot Time (GTAW)
	Remote Control (Panel/Remote)
	Remote Function
	Arc Control (SMAW)
	Gas Post-Flow
	Gas Pre-Flow
<b>VRD</b>	Voltage Reduction Device Circuit
<b>—</b>	Negative
<b>+</b>	Positive
	Gas Input
	Gas Output

## STATEMENT OF WARRANTY

**LIMITED WARRANTY:** Thermal Arc®, Inc., A Thermadyne Company, hereafter, “Thermal Arc” warrants to customers of its authorized distributors hereafter “Thermal; Arc” that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal Arc products as stated below, Thermal Arc shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal Arc’s specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal Arc’s sole option, of any components or parts of the product determined by Thermal Arc to be defective.

**THERMAL ARC MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED. THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHERS, INCLUDING, BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

**LIMITATION OF LIABILITY:** Thermal Arc shall not under any circumstances be liable for special, indirect or consequential damages, such as, but not limited to, lost profits and business interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal Arc with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal Arc whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based. No employee, agent, or representative of Thermal Arc is authorized to change this warranty in any way or grant any other warranty.

**PURCHASER'S RIGHTS UNDER THIS WARRANTY ARE VOID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH IN THERMAL ARC'S SOLE JUDGEMENT MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL ARC PRODUCT.**

**PURCHASER'S RIGHTS UNDER THIS WARRANTY ARE VOID IF THE PRODUCT IS SOLD TO PURCHASER BY NON-AUTHORIZED PERSONS.**

The warranty is effective for the time stated below beginning on the date that the authorized distributor delivers the products to the Purchaser. Notwithstanding the foregoing, in no event shall the warranty period extend more than the time stated plus one year from the date Thermal Arc delivered the product to the authorized distributor.

<u>POWER SUPPLIES</u>	<u>POWER SUPPLIES &amp; WIRE FEEDERS</u>	<u>LABOR</u>
MAIN POWER MAGNETICS (STATIC & ROTATING)	3 YEAR	3 YEAR
ORIGINAL MAIN POWER RECTIFIER	3 YEAR	3 YEAR
POWER SWITCHING SEMI-CONDUCTORS & CONTROL PC BOARD	3 YEAR	3 YEAR
ALL OTHER CIRCUITS AND COMPONENTS INCLUDING BUT NOT LIMITED TO, CONTACTORS, RELAYS, SOLENOIDS, PUMPS, SWITCHES, MOTORS	1 YEAR	1 YEAR

**ENGINES: ENGINES ARE NOT WARRANTED BY THERMAL ARC, ALTHOUGH MOST ARE WARRANTED BY THE ENGINE MANUFACTURER, SEE THE ENGINE MANUFACTURES WARRANTY FOR DETAILS.**

<u>CONSOLES, CONTROL EQUIPMENT, HEAT EXCHANGES, AND ACCESSORY EQUIPMENT</u>	1 YEAR	1 YEAR
<u>PLASMA TORCH AND LEADS, AND REMOTE CONTROLS</u>	180 DAYS	180 DAYS
<u>REPAIR/REPLACEMENT PARTS</u>	90 DAYS	90 DAYS

Warranty repairs or replacement claims under this limited warranty must be submitted to Thermal Arc by an authorized Thermal Arc repair facility within thirty (30) days of purchaser’s notice of any Warranty Claim. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the Purchaser. All returned goods shall be at the Purchaser’s risk and expense. This warranty supersedes all previous Thermal Arc warranties.

Thermal Arc® is a Registered Trademark of Thermadyne Industries Inc.

Effective April 1, 2002

## 1.0 GENERAL INFORMATION

### 1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

#### NOTE

*An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.*

#### CAUTION

*A procedure which, if not properly followed, may cause damage to the equipment.*



#### WARNING

*A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.*

### 1.02 Important Safety Precautions



#### WARNING

**OPERATION AND MAINTENANCE OF ARC WELDING EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.**

*To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-800-462-2782 or your local distributor if you have any questions.*



#### GASES AND FUMES

Gases and fumes produced during the Arc welding/cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.

- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the arc welding/cutting depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	
Vanadium		

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft welding/cutting tables, to capture fumes and gases.
- Do not use the welding torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.



#### ELECTRIC SHOCK

Electric Shock can injure or kill. The arc welding process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.

- Install and maintain equipment according to NEC code, refer to item 4 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.



### FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the arc weld.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.



### NOISE

Noise can cause permanent hearing loss. Arc welding/cutting processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.



### ARC WELDING RAYS

Arc Welding/Cutting Rays can injure your eyes and burn your skin. The arc welding/cutting process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as recommended in Subsection 1.03, item 4.

### 1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018



6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

#### **1.04 Note, Attention et Avertissement**

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief

des informations à caractère important. Ces mises en relief sont classifiées comme suit :

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#### **NOTE**

*Toute opération, procédure ou renseignement général sur lequel il importe d'insister davantage ou qui contribue à l'efficacité de fonctionnement du système.*

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#### **ATTENTION**

*Toute procédure pouvant résulter l'endommagement du matériel en cas de non-respect de la procédure en question.*




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#### **AVERTISSEMENT**

*Toute procédure pouvant provoquer des blessures de l'opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.*

### **1.05 Precautions De Securite Importantes**




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#### **AVERTISSEMENT**

**L'OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L'ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.**

*Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d'éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d'utiliser le matériel. Composez le + 1-800-462-2782 ou votre distributeur local si vous avez des questions.*

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**FUMÉE et GAZ**

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	civre	sélénium
béryllium	manganèse	
vanadium		

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Éliminez toute source de telle fumée.



### CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements

secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.

- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.



### INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



### RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons ultra-violetts très forts. Ces rayons d'arc

nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.
- Respectez le teint de lentille recommandé dans le article 4, page 5.
- Hydrogen gas may be present under aluminum workpieces during the cutting process when being cut underwater or using a water table. DO NOT cut aluminum underwater or on a water table unless the hydrogen gas can be eliminated as the hydrogen gas may detonate.



#### BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous devez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

## 1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS

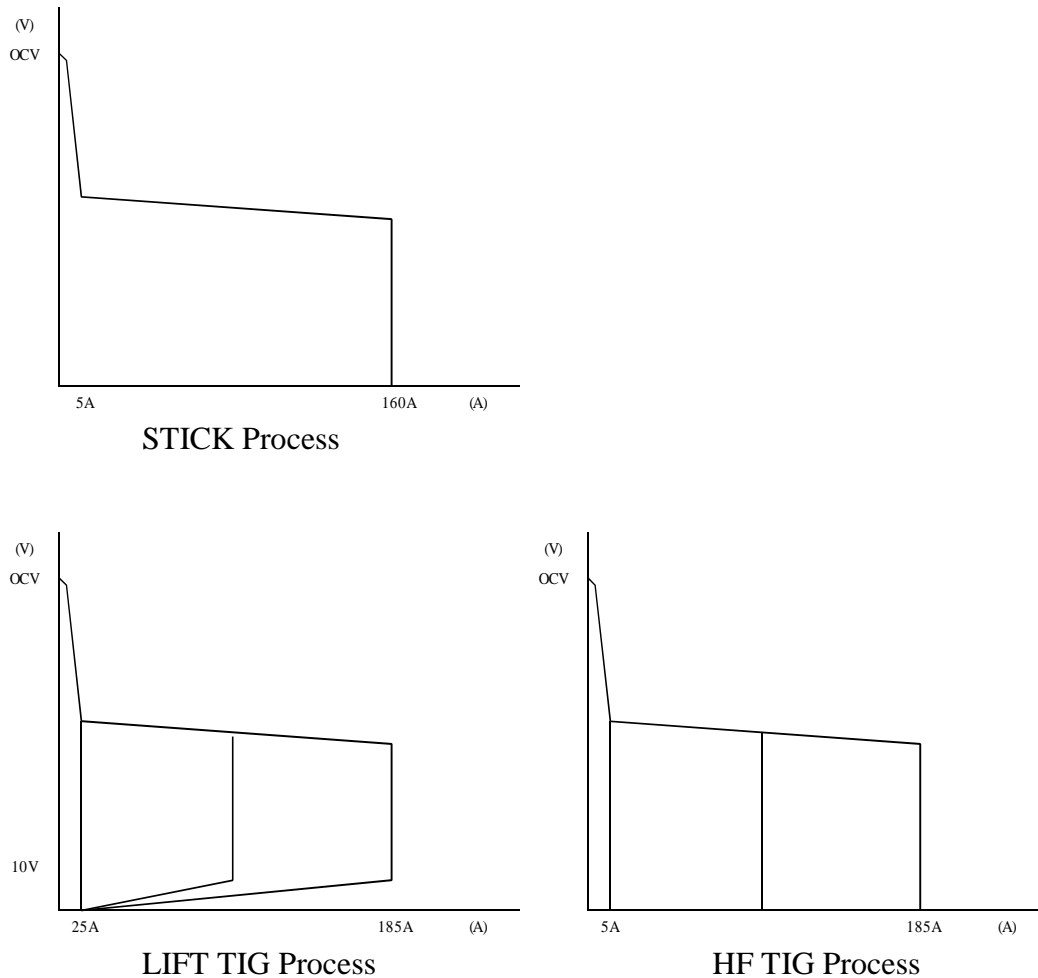
ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. ivret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103
14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

## 2.0 INTRODUCTION AND DESCRIPTION

### 2.01 Description

The Thermal Arc™ Model 185TSW is a self contained single-phase AC/DC arc welding power source with Constant Current (CC) output characteristics. This unit is equipped with a Digital Volt/Amperage Meter, gas control valve, built in Sloper and Pulser, lift arc starter, and high-frequency arc starter for use with Gas Tungsten Arc Welding (GTAW), Gas Tungsten Arc Welding-Pulsed (GTAW-P) Gas Tungsten Arc Welding-Sloped (GTAW-S), and Shielded Metal Arc Welding (SMAW) processes. The power source is totally enclosed in an impact resistant, flame retardant and non-conductive plastic case.



**Figure 1. Model 185TSW Volt-Ampere curve**

---

**Note 1**

Volt-Ampere curves show the maximum Voltage and Amperage output capabilities of the welding power source. Curves of other settings will fall between the curves shown.

## 2.02 Functional Block Diagrams

Figure 2 illustrates the functional block diagram of the 185TSW-power supply.

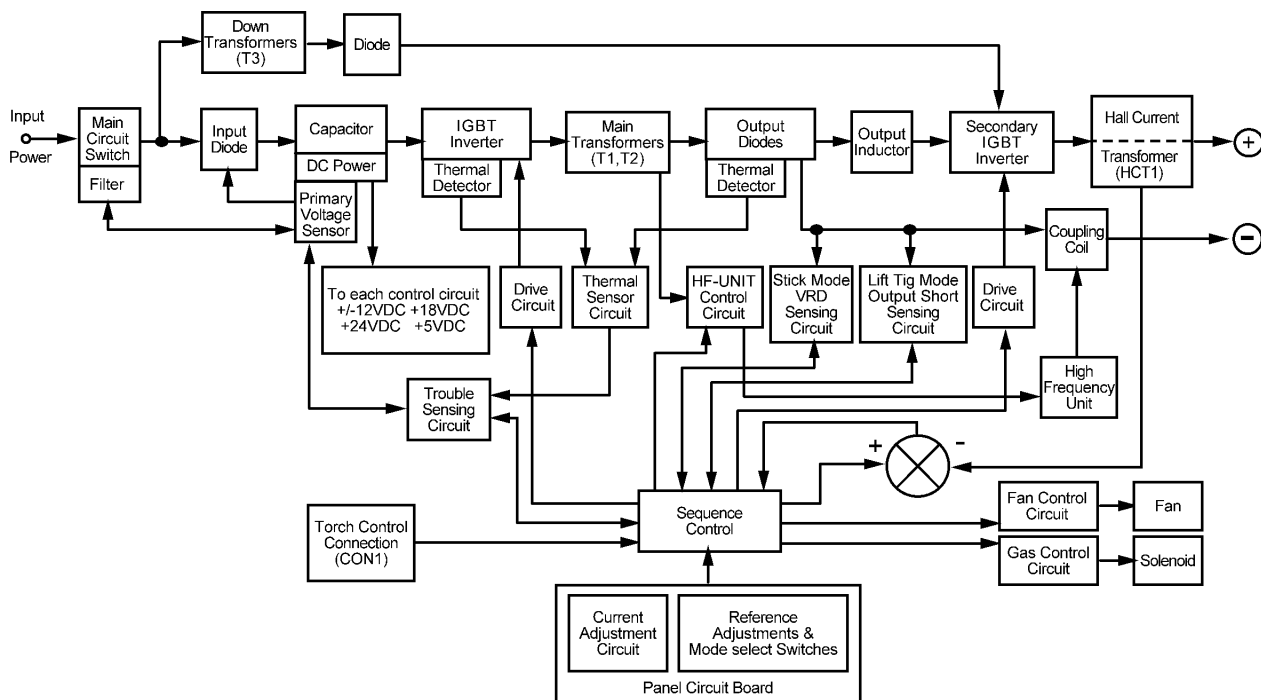


Figure 2. 185TSW Model Functional Block Diagram

## 2.03 Transporting Methods

These units are equipped with a handle for carrying purposes.



### WARNING 1

*ELECTRIC SHOCK can kill. DO NOT TOUCH live electrical parts. Disconnect input power conductors from de-energized supply line before moving the welding power source.*



### WARNING 2

*FALLING EQUIPMENT can cause serious personal injury and equipment damage.*

Lift unit with handle on top of case.

Use handcart or similar device of adequate capacity.

If using a fork lift vehicle, place and secure unit on a proper skid before transporting.

## 3.0 Installation Recommendations

### 3.01 Environment

The Pro-Wave 185TSW is designed for use in hazardous environments.

*Examples of environments with increased hazardous environments are -*

- a) In locations in which freedom of movement is restricted, so that the operator is forced to perform the work in a cramped (kneeling, sitting or lying) position with physical contact with conductive parts;
- b) In locations which are fully or partially limited by conductive elements, and in which there is a high risk of unavoidable or accidental contact by the operator, or
- c) In wet or damp hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulation properties of accessories.

*Environments with hazardous environments do not include places where electrically conductive parts in the near vicinity of the operator, which can cause increased hazard, have been insulated.*

### 3.02 Location

Be sure to locate the welder according to the following guidelines:

- *In areas, free from moisture and dust.*
- *Ambient temperature between 0 degrees C to 40 degrees C.*
- *In areas, free from oil, steam and corrosive gases.*
- *In areas, not subjected to abnormal vibration or shock.*
- *In areas, not exposed to direct sunlight or rain.*
- *Place at a distance of 12" (304.79mm) or more from walls or similar that could restrict natural airflow for cooling.*



#### **WARNING 3**

---

*Thermal Arc advises that this equipment be electrically connected by a qualified electrician.*

---

### 3.03 Electrical Input Connections



#### WARNING 4

---

*ELECTRIC SHOCK can kill; SIGNIFICANT DC VOLTAGE is present after removal of input power.*

---

DO NOT TOUCH live electrical parts.

SHUT DOWN welding power source, disconnect input power employing lockout/tagging procedures. Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

#### 3.03.01 Electrical Input Requirements

Operate the welding power source from a single-phase 50/60 Hz, AC power supply. The input voltage must match one of the electrical input voltages shown on the input data label on the unit nameplate. Contact the local electric utility for information about the type of electrical service available, how proper connections should be made, and any inspection required.

The line disconnect switch provides a safe and convenient means to completely remove all electrical power from the welding power supply whenever necessary to inspect or service the unit.

---

#### Note 2

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These units are equipped with a two-conductor with earth power cable that is connected at the welding power source end for single-phase electrical input power.

**Do not** connect an input (WHITE or BLACK) conductor to the ground terminal.

**Do not** connect the ground (GREEN) conductor to an input line terminal.

Refer to figure 3 and:

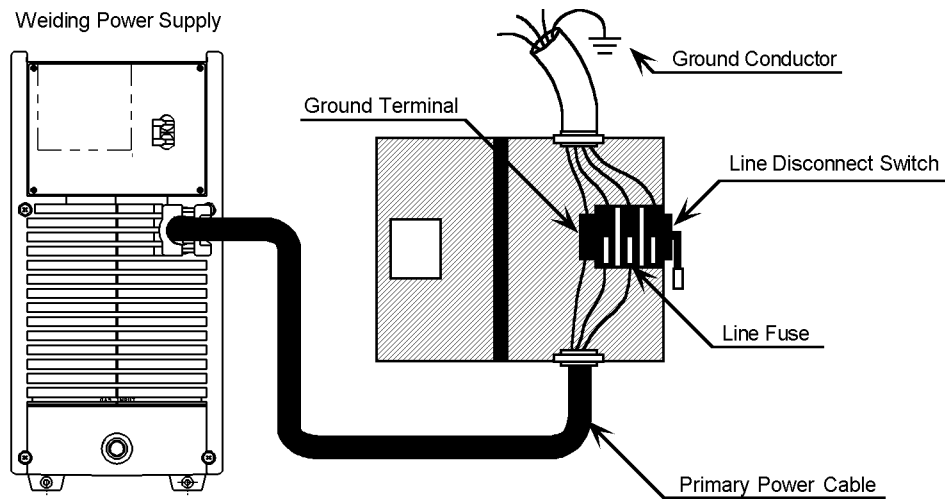
1. Connect end of ground (GREEN) conductor to a suitable ground. Use a grounding method that complies with all applicable electrical codes.
2. Connect ends of line 1 (BLACK) and line 2 (WHITE) input conductors to a de-energized line disconnect switch.
3. Use Table 1 and Table 2 as a guide to select line fuses for the disconnect switch.



Input Voltage	Fuse Size
208V	45 Amps
230V	40 Amps

**Table 1. Electrical Input Connections**

**NOTE:** Fuse size is based on not more than 200 percent of the rated input amperage of the welding power source (Based on Article 630, National Electrical Code).



**Figure 3. Electrical Input Connections**

### 3.03.02 Input Power

Each unit incorporates an INRUSH circuit and input voltage sensing circuit. When the MAIN CIRCUIT SWITCH is turned on, the inrush circuit provides a pre-charging of the input capacitors. SCR's in the Power Control Assembly (PCA) will turn on after the input capacitors have charged to full operating voltage (after approximately 5 seconds).

**Note 3**

Note the available input power. Damage to the PCA could occur if 460VAC or higher is applied.

The following 208/230V Primary Current recommendations are required to obtain the maximum welding current and duty cycle from this welding equipment:

Model	Primary Supply Lead Size (Factory Fitted)	Minimum Primary Current Circuit Size (Vin/Amps)	Current & Duty Cycle	
			TIG	STICK
Pro-Wave 185TSW	12/3 AWG minimum	230/29	185 @ 30%	
		208/32		
		230/38	-	160 @ 40%
		208/40	-	

**Table 2 – 208/230V Primary Current Circuit sizes to achieve maximum current**

### 3.03.03 High Frequency Introduction

The importance of correct installation of high frequency welding equipment cannot be over-emphasized. Interference due to high frequency initiated or stabilized arc is almost invariably traced to improper installation. The following information is intended as a guide for personnel installing high frequency welding machines.

#### *Warning*

##### *Explosives*

The high frequency section of this machine has an output similar to a radio transmitter. The machine should NOT be used in the vicinity of blasting operations due to the danger of premature firing.

##### *Computers*

It is also possible that operation close to computer installations may cause computer malfunction.

### 3.03.04 High Frequency Interference

Interference may be transmitted by a high frequency initiated or stabilized arc welding machine in the following ways:

#### *Direct Radiation*

Radiation from the machine can occur if the case is metal and is not properly grounded. It can occur through apertures such as open access panels. The shielding of the high frequency unit in the Power Source will prevent direct radiation if the equipment is properly grounded.

#### *Transmission via the Supply Lead*

Without adequate shielding and filtering, high frequency energy may be fed to the wiring within the installation (mains) by direct coupling. The energy is then transmitted by both radiation and conduction. Adequate shielding and filtering is provided in the Power Source.

#### *Radiation from Welding Leads*

Radiated interference from welding leads, although pronounced in the vicinity of the leads, diminishes rapidly with distance. Keeping leads as short as possible will minimize this type of interference. Looping and suspending of leads should be avoided where possible.

#### *Re-radiation from Unearthed Metallic Objects*

A major factor contributing to interference is re-radiation from unearthed metallic objects close to the welding leads. Effective grounding of such objects will prevent re-radiation in most cases.

### 3.04 Specifications

Parameter		185TSW	
Rated Output			
Amperes		185	
Volts		17.4	
Duty Cycle		25%	
Duty Cycle	TIG	185A / 17.4V @ 30% 160A / 16V @ 40% 130A / 15V @ 60% 100A / 14V @ 100%	
	STICK	160A / 26V @ 40% 130A / 25V @ 60% 100A / 25V @ 100%	
Output Current	TIG	5 – 185 (DC) 5 – 185 (AC) @ 60Hz, 50% Cleaning	
Range	STICK	5 – 160 (DC) 5 – 160 (AC) @ 60Hz, 50% Cleaning	
Open Circuit Voltage		69V	
<b>Dimensions</b>			
Width		7.08" (180mm)	
Height		14.7" (360mm)	
Length		16.54" (420mm)	
Weight		41.8 lb. 19 kg	
<b>Output @ Rated Load</b>			
Output Amperes		160A	
Output Volts		26V	
Duty Cycle		40%	
KVA		8.7	
KW		5.2	
<b>Output @ No Load</b>			
KVA		0.5	
KW		0.13	
<b>Input Volts Single Phase</b>		Amperage Draw @ Rated Load	No Load Amps
208V		40	2.2
230V		38	1.6

Thermal Arc continuously strives to produce the best product possible and therefore reserves the right to change, improve or revise the specifications or design of this or any product without prior notice. Such updates or changes do not entitle the buyer of equipment previously sold or shipped to the corresponding changes, updates, improvements or replacement of such items.

### **3.05 Duty Cycle**

The duty cycle of a welding power source is the percentage of a ten (10) minute period that it can be operated at a given output without causing overheating and damage to the unit. If the welding amperes decrease, the duty cycle increases. If the welding amperes are increased beyond the rated output, the duty cycle will decrease.



#### **WARNING 5**

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*Exceeding the duty cycle ratings will cause the thermal overload protection circuit to become energized and shut down the output until the unit has cooled to normal operating temperature.*

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#### **CAUTION 1**

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*Continually exceeding the duty cycle ratings can cause damage to the welding power source and will void the manufactures warranty.*

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#### **NOTE 4**

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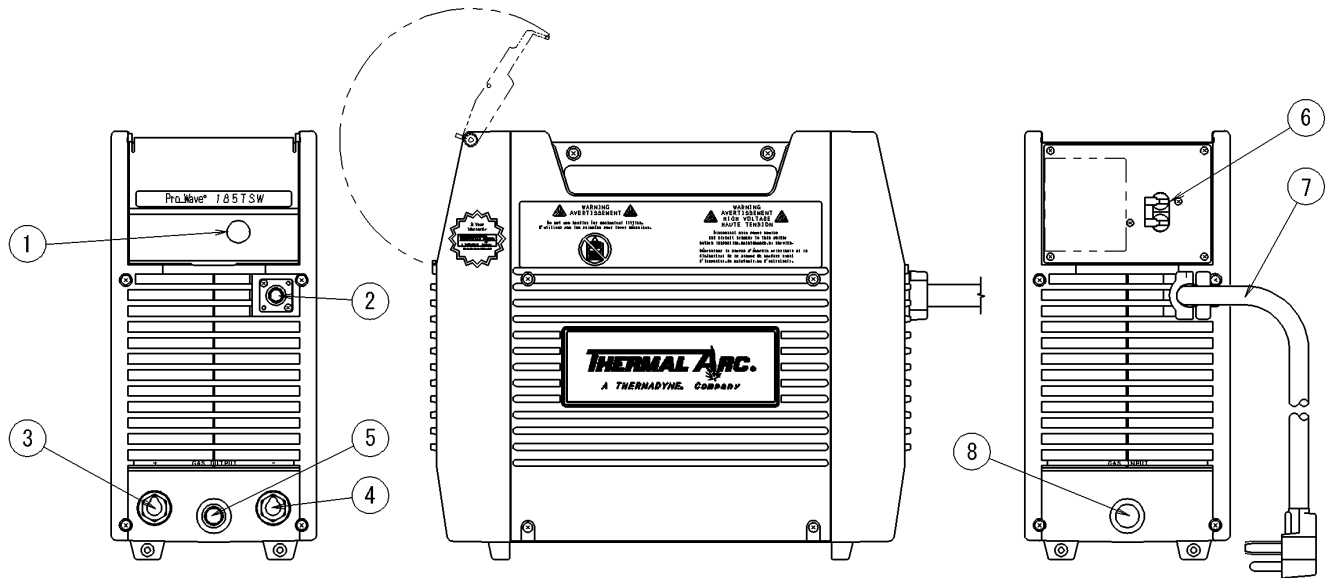
*Due to variations that can occur in manufactured products, claimed performance, voltages, ratings, all capacities, measurements, dimensions and weights quoted are approximate only. Achievable capacities and ratings in use and operation will depend upon correct installation, use, applications, maintenance and service.*

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## 4.0 OPERATOR CONTROLS

### 4.01 Pro-Wave 185TSW Controls



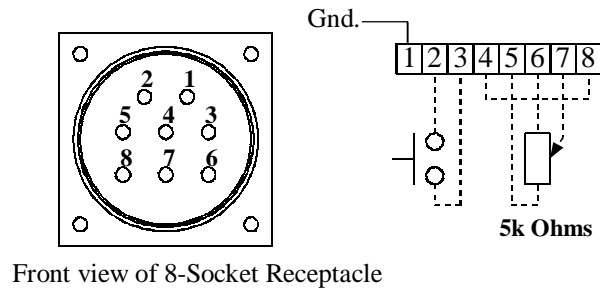
**Figure 4— Pro-Wave 185TSW Power Source**

#### 1 Control Knob

This control sets the selected weld parameter, rotating it clockwise increases the parameter that is indicated on the digital meter. Pushing the knob inward displays the actual welding voltage.

#### 2 Remote Control Socket

The 8 pin Remote Control Socket is used to connect remote current control devices to the welding Power Source. To make connections, align keyway, insert plug, and rotate threaded collar fully clockwise.



Socket Pin	Function
1	Earth (Ground)
2	Torch Switch Input (24V) to energize weld current. (connect pins 2 & 3 to turn on welding current)
3	Torch Switch Input (0V) to energize weld current (connect pins 2 & 3 to turn on welding current)
4	Connect pin 4 to pin 8 to instruct machine that a remote current control device is connected (12V DC supply)
5	5k ohm (maximum) connection to 5k ohm remote control potentiometer
6	Zero ohm (minimum) connection to 5k ohm remote control potentiometer
7	Wiper arm connection to 5k ohm remote control potentiometer
8	Connect pin 4 to pin 8 to instruct machine that a remote current control device is connected (0V)

### 3 Positive Terminal

Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

### 4 Negative Terminal

Welding current flows from the Power Source via heavy duty Dinse type terminal. It is essential, however, that the male plug is inserted and turned securely to achieve a sound electrical connection.

---

#### **CAUTION 2**

---

*Loose welding terminal connections can cause overheating and result in the male plug being fused in the bayonet terminal.*

### 5 Gas Outlet

The Gas Outlet is a 5/8 18 UNF female gas fitting.

### 6 ON/OFF Switch

This switch connects the Primary supply voltage to the inverter when in the ON position. This enables the Power Supply.



#### **WARNING 6**

---

*When the welder is connected to the Primary supply voltage, the internal electrical components maybe at 240V potential with respect to earth.*

---

### 7 Input Cable







The input cable connects the Primary supply voltage to the equipment.



*8 Gas Inlet*

The Gas Inlet is a 5/8 18 UNF female gas fitting.

**4.02 Weld Process selection for Pro-Wave 185TSW**

Weld Process Selection	Weld Mode			Description
	STICK	HF TIG	LIFT TIG	
 <i>STD</i>	Yes	Yes	Yes	2T operation in TIG Modes using remote devices to control contactor & current
 <i>SLOPE</i>	No	Yes	Yes	4T operation in TIG Modes with crater fill using a remote contactor device to control sequence.
 <i>REPEAT</i>	No	Yes	Yes	4T operation in TIG Modes with repeat operation and crater fill using a remote contactor device.
 <i>SPOT</i>	No	Yes	No	2T operation spot welding in HF TIG using a remote contactor device.
 <i>PULSE ON/OFF</i>	No	Yes	Yes	Pulse operation in TIG Modes
	Yes	Yes	Yes	Selects AC or DC weld current

**Table 3 – Weld Process selection verses Weld Mode for Pro-Wave 185TSW**

### 4.03 Weld Parameter Descriptions for Pro-Wave 185TSW

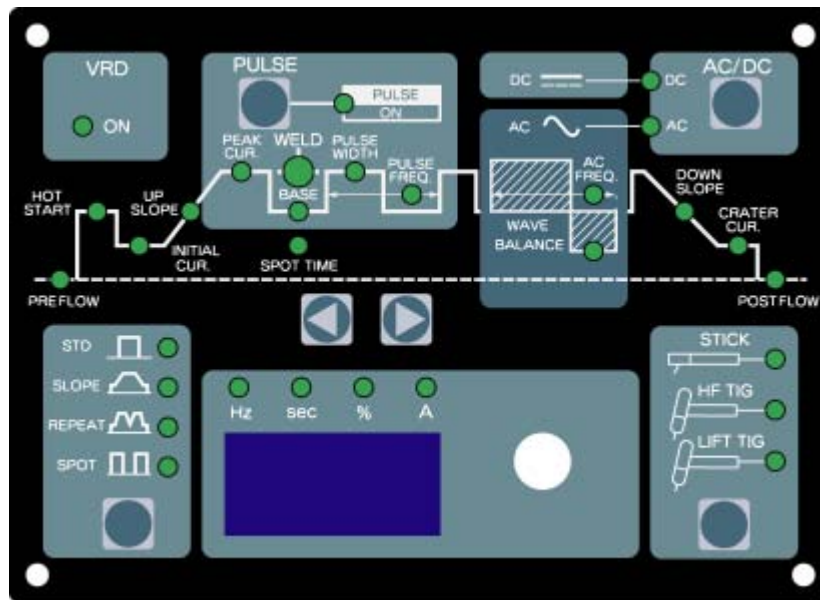



Figure 5 Pro-Wave 185TSW Front Panel with Parameter Description

Parameter	Description
 <i>PRE-FLOW</i>	This parameter operates in TIG modes only and is used to provide gas to the weld zone prior to striking the arc, once the torch trigger switch has been pressed. This control is used to dramatically reduce weld porosity at the start of a weld.
<i>HOT START</i>	This parameter operates in all weld modes except Lift TIG mode and is used to heat up the weld zone in TIG modes or improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. It sets the peak start current on top of the <i>BASE (WELD)</i> current. e.g. <i>HOT START</i> current = 130 amps when <i>BASE (WELD)</i> = 100 amps & <i>HOT START</i> = 30 amps
<i>INITIAL CUR.</i>	This parameter operates in <i>SLOPE</i> or <i>REPEAT</i> (4T) TIG modes only and is used to set the start current for TIG. The Start Current remains on until the torch trigger switch is released after it has been depressed.
<i>UP SLOPE</i>	This parameter operates in TIG modes only and is used to set the time for the weld current to ramp up, after the torch trigger switch has been pressed then released, from <i>INITIAL CUR</i> to <i>PEAK</i> or <i>BASE</i> current
<i>PEAK CUR.</i>	This parameter sets the <i>PEAK</i> weld current when in <i>PULSE</i> mode
<i>WELD</i>	This parameter sets the TIG <i>WELD</i> current in <i>STD</i> , <i>SLOPE</i> , <i>REPEAT</i> and <i>SPOT</i> modes when <i>PULSE</i> is off. This parameter also sets the <i>STICK</i> weld current.
<i>BASE</i> (Background Current)	This parameter sets the Background current when in Pulse TIG mode.

Parameter	Description
<i>SPOT TIME</i>	This parameter sets the duration of the <i>SPOT TIME</i> in <i>HF TIG</i> mode only
<i>PULSE WIDTH</i>	This parameter sets the percentage on time of the <i>PULSE FREQUENCY</i> for <i>PEAK</i> weld current when the <i>PULSE</i> is on.
<i>PULSE FREQ.</i>	This parameter sets the <i>PULSE FREQUENCY</i> when the <i>PULSE</i> is on.
<i>AC FREQUENCY</i>	This parameter operates in AC mode only and is used to set the frequency for the AC weld current.
<i>WAVE BALANCE</i>	<p>This parameter is used for aluminum AC TIG mode and is used to set the penetration to cleaning action ratio for the AC weld current. Generally <i>WAVE BALANCE</i> is set to 50% for AC <i>STICK</i> welding. The <i>WAVE BALANCE</i> control changes the ratio of penetration to cleaning action of the AC TIG welding arc. Maximum weld penetration is achieved when the <i>WAVE BALANCE</i> control is set to 10%. Maximum cleaning of heavily oxidised aluminium or magnesium alloys is achieved when the <i>WAVE BALANCE</i> control is set to 65%.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><b>WAVE BALANCE=50%</b></p> <p>Balanced with 50% penetration and 50% cleaning</p> </div> <div style="text-align: center;"> <p><b>WAVE BALANCE=10%</b></p> <p>Maximum Penetration and reduced cleaning</p> </div> <div style="text-align: center;"> <p><b>WAVE BALANCE=65%</b></p> <p>Maximum Cleaning and reduced penetration</p> </div> </div>
<i>DOWN SLOPE</i>	This parameter operates in TIG modes only and is used to set the time for the weld current to ramp down, after the torch trigger switch has been pressed, to <i>CRATER CUR.</i> This control is used to eliminate the crater that can form at the completion of a weld.
<i>CRATER CUR.</i>	This parameter operates in <i>SLOPE</i> or <i>REPEAT (4T)</i> TIG modes only and is used to set the finish current for TIG. The <i>CRATER</i> Current remains on until the torch trigger switch is released after it has been depressed.
<i>POST-FLOW</i> 	This parameter operates in TIG modes only and is used to adjust the post gas flow time once the arc has extinguished. This control is used to dramatically reduce oxidation of the tungsten electrode.

**Table 4 – Weld Parameter Descriptions for Pro-Wave 185TSW**

#### 4.04 Weld Parameters for Pro-Wave 185TSW

Weld Parameter	Parameter Range	Factory Setting	Incremental Unit	Weld Mode		
				STICK	HF TIG	LIFT TIG
<i>PRE-FLOW</i>	0.0 to 1.0 sec	0.1 sec	0.1 sec	No	Yes	Yes
<i>HOT START</i>	0 to 70A	20A	1A	Yes	Yes	No
<i>INITIAL CUR.</i>	5 to 185A	30A	1A	No	Yes	Yes
<i>UP SLOPE</i>	0 to 15 sec	1 sec	0.1 sec	No	Yes	Yes
<i>PEAK CUR.</i>	5 to 185A	120A	1A	No	Yes	Yes
<i>WELD CUR (TIG)</i>	5 to 185A	80A	1A	No	Yes	Yes
<i>WELD CUR (STICK)</i>	5 to 160A	80A	1A	Yes	No	No
<i>SPOT TIME</i>	0.5 to 5.0 sec	2 sec	0.1 sec	No	Yes	Yes
<i>PULSE WIDTH</i>	15 to 80%	50%	1%	No	Yes	Yes
<i>PULSE FREQ.</i>	0.5 to 500Hz	100.0Hz	See Table 6	No	Yes	Yes
<i>AC FREQUENCY</i>	15 to 150Hz	50Hz	1Hz	Yes	Yes	Yes
<i>WAVE BALANCE</i>	10 to 65%	50%	1%	Yes	Yes	Yes
<i>DOWN SLOPE</i>	0 to 25 sec	3 sec	0.1 sec	No	Yes	Yes
<i>CRATER CUR.</i>	5 to 185A	30A	1A	No	Yes	Yes
<i>POST-FLOW</i>	0.0 to 60 sec	10 sec	0.1 sec	No	Yes	Yes

**Table 5 – Weld Parameters for Pro-Wave 185TSW**

<i>PULSE FREQ.</i> Range	Incremental Unit
0.5 to 20Hz	0.1Hz
20 to 100Hz	1Hz
100 to 500Hz	5Hz

**Table 6 – *PULSE FREQ.* Range and Incremental Units**

#### 4.05 Power Source Features

Feature	Description
<i>New Digital Control</i>	<ul style="list-style-type: none"> <li>• Almost all welding parameters are adjustable</li> </ul>
<i>Touch Panel Switches</i>	<ul style="list-style-type: none"> <li>• Touch switches eliminate mechanical damage</li> </ul>
<i>Front Control Cover</i>	<ul style="list-style-type: none"> <li>• Protects front panel controls</li> </ul>
<i>Digital Meter</i>	<ul style="list-style-type: none"> <li>• Displays selected weld parameter value</li> <li>• Displays weld current when welding</li> <li>• Displays weld current for 20 seconds after weld has been completed</li> <li>• A selected weld parameter value can be adjusted at any time even while welding</li> </ul>
<i>Intelligent Fan Control</i>	<ul style="list-style-type: none"> <li>• The intelligent cooling system is designed to reduce dust and foreign material build-up, whilst providing optimum cooling.</li> <li>• Fan speed reduces approximately 30 seconds after machine is turned on</li> <li>• Fan speed increases when internal components reaches operating temperature</li> </ul>
<i>ON/OFF switch</i>	<ul style="list-style-type: none"> <li>• Primary voltage Supply ON/OFF switch located on rear panel</li> </ul>
<i>Voltage Reduction Device (VRD)</i>	<p>Reduces the OCV when the power supply is not in use. Eliminates the need for add on voltage reducers and has no effect on arc starting.</p> <ul style="list-style-type: none"> <li>• VRD fully complies to IEC 60974-1</li> <li>• When Stick mode is selected the green VRD light is ON when not welding and red when welding.</li> <li>• When in TIG modes VRD is off.</li> </ul>
<i>Control Knob</i>	<ul style="list-style-type: none"> <li>• For the selected weld parameter, rotating the knob clockwise increases the parameter</li> <li>• Rotating the knob counter-clockwise decreases the parameter</li> <li>• A selected weld parameter value can be adjusted at any time even while welding</li> <li>• Pushing the knob in displays actual arc voltage.</li> </ul>
<i>Self Diagnosis Using Error Codes</i>	<ul style="list-style-type: none"> <li>• An error code is displayed on the <i>Digital Meter</i> when a problem occurs with Primary supply voltage or internal component problems. Refer to troubleshooting guide.</li> </ul>

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## 5.0 SET-UP FOR SMAW (STICK) AND GTAW (TIG)

Conventional operating procedures apply when using the Welding Power Source, i.e. connect work lead directly to work piece and electrode lead is used to hold electrode. Wide safety margins provided by the coil design ensure that the Welding Power Source will withstand short-term overload without adverse effects. The welding current range values should be used as a guide only. Current delivered to the arc is dependent on the welding arc voltage, and as welding arc voltage varies between different classes of electrodes, welding current at any one setting would vary according to the type of electrode in use. The operator should use the welding current range values as a guide, then finally adjust the current setting to suit the application.

**Figure 6– 185TSW AC/DC Set-up**



### **WARNING 7**

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*Before connecting the work clamp to the work and inserting the electrode in the electrode holder make sure the Primary power supply is switched off.*

---

### **CAUTION 3**

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*Remove any packaging material prior to use. Do not block the air vents at the front or rear or sides of the Welding Power Source.*

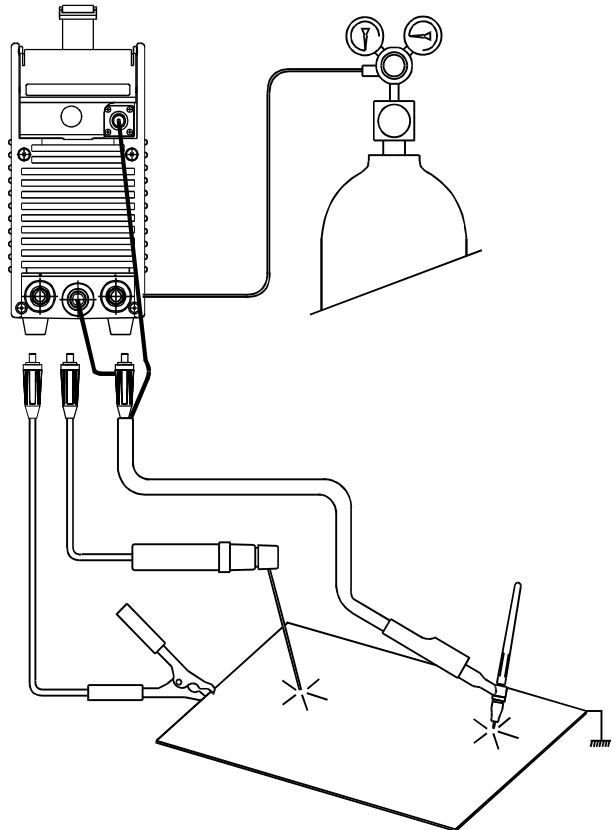
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### **CAUTION 4**

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*DO NOT change the Weld Mode or Weld Process Mode until after POST-FLOW time has finished.*

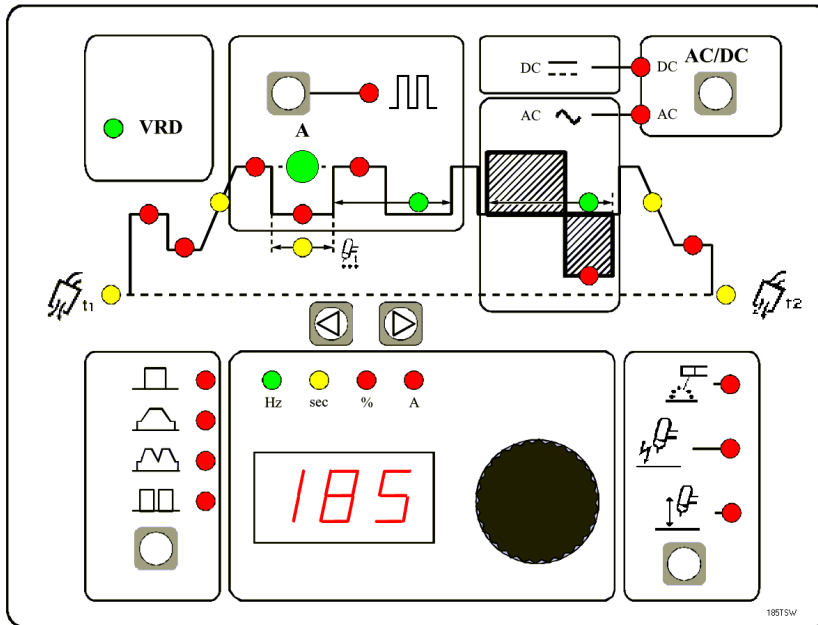
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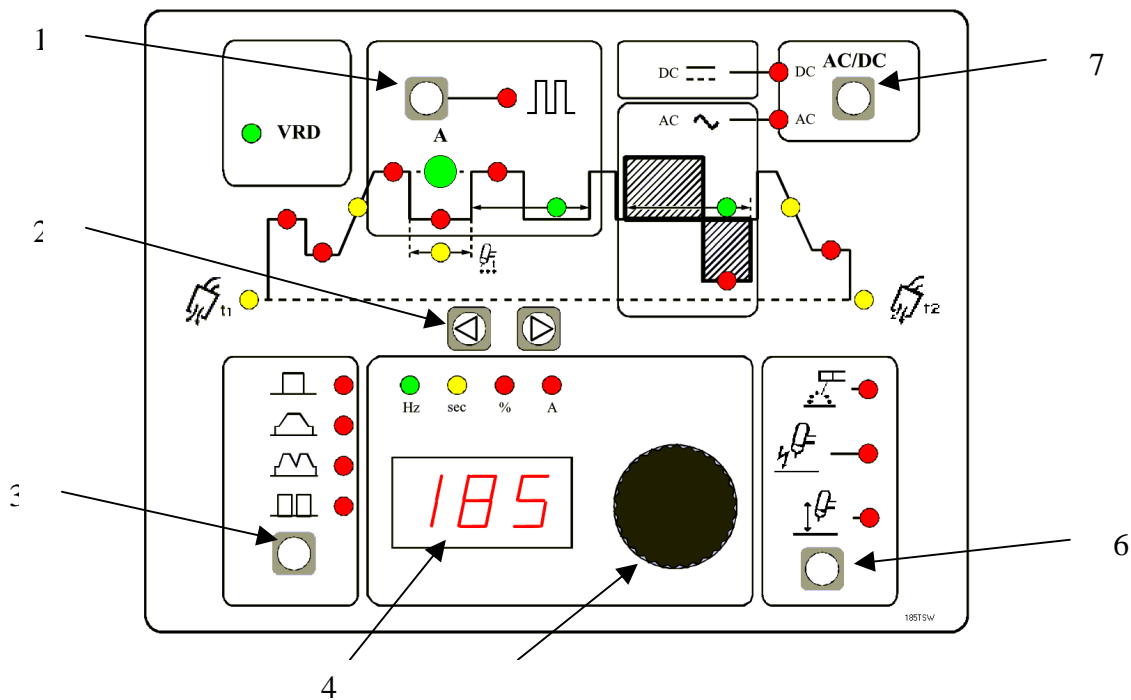
## 6.0 SEQUENCE OF OPERATION



**NOTE:** Scroll Buttons are used to select the parameters to be set. The LED's show which function is being adjusted on the weld sequence graph. Refer to the Symbols Table located in the front of the manual for Symbol descriptions.



**Figure 7 185TSW Front Panel**





1. Pulse function – Pressing this button enables the TIG current pulse functions.
2. Scroll Buttons – used to select the parameters to be set. The LED's show which function is being adjusted on the Sequence Graph.
3. TIG Mode Functions – Pressing this button scrolls through the output TIG function modes (Standard, Slope, Slope w/repeat, Spot).
4. Digital LED display – Welding amperage and parameter values are displayed in this window. Internal warnings such as over temperature, low or high input voltage applied are signaled to the operator by a warning sound and error message on the screen.
5. Control knob – allows the operator to adjust the output amperage within the entire range of the power source, also used to set each parameter value. Pushing the knob inward displays the actual welding voltage.
6. Process Button – This button selects between STICK, Lift or HF TIG mode. A remote control device is required for use during LIFT TIG and HF TIG operation. See section 4.01, section 2 “*Remote Control Socket*”, for complete details of the remote device.
7. AC/DC Button – Selects between AC or DC welding output.

### **6.01 Stick Welding**

- Connect work lead to negative terminal
- Connect electrode lead to positive terminal
- Switch machine on
- Set *AC* or *DC* weld current. If *AC* is selected then set *AC FREQ* to 60Hz & *WAVE BALANCE* to 50%.
- Connect remote control device if required

Use the Scroll Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

- Set *HOT START*
- Set *WELD* current

Commence welding

## 6.02 AC or DC HF TIG Welding

- Connect work lead to positive terminal
- Connect TIG torch to negative terminal
- Switch machine on
- Set AC or DC weld current. If AC is selected then set *AC FREQ* & *WAVE BALANCE*
- Connect remote control device. . See section 4.01, section 2 “*Remote Control Socket*”, for complete details of the remote device.

Use the Scroll Buttons to move to the parameter to be set. The LED will show which function is being adjusted on the weld sequence graph. Use the control knob to adjust each parameter.

- Set *PRE-FLOW* time
- Set *HOT START* current
- Set *POST-FLOW* time
- Set *WELD* current
- Set *POST-FLOW* time

Slope Mode Parameters if required

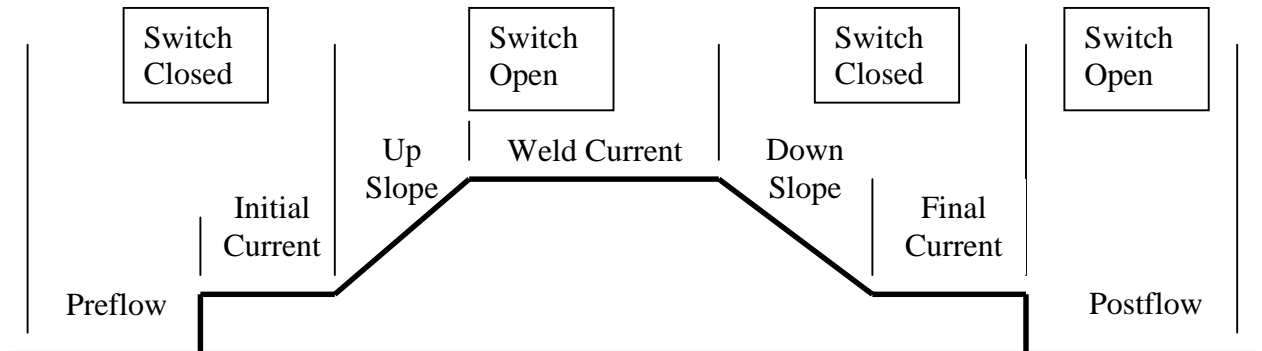
- Set *INITIAL CUR* current
- Set *UP SLOPE* time
- Set (WELD) *PEAK CUR* current
- Set *BASE* current
- Set *DOWN SLOPE* time
- Set *CRATER CUR* current

Pulse Mode parameters if required

- Set *PULSE WIDTH* % for *PEAK CURRENT*
- Set *PEAK CURRENT*
- Set *PULSE FREQ*

Commence welding

### 6.02.01 Slope Mode Sequence



#### *Note 5*

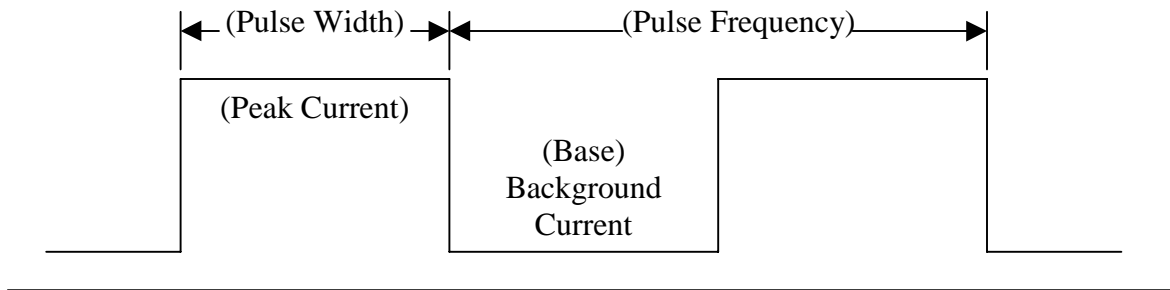
Slope function operates with a Remote ON/OFF device only.

- 1) To start Slope sequence Close remote switch contacts. Once the welding arc is established the Power Source will maintain initial current setting as long as the remote switch contacts are closed.
  - a) In the HF TIG mode, after Prewflow time, High Frequency is present at the torch. When the torch is positioned close to the work the welding current will transfer to the work and establish the arc at the initial current setting.
  - b) In the Lift TIG mode, after Prewflow time, Lift Start current is present at the torch. When the electrode is touched to the work and lifted off, the welding arc is established at the initial current setting.
- 2) Open Remote Switch – current increases to weld current. Once welding arc has reached weld current the power source will maintain weld current as long as the remote switch contacts are open.
- 3) Close Remote Switch – Welding current decreases to final current setting. Once final welding current is reached the power source will maintain final current setting as long as the remote switch contacts are closed.
- 4) Open Remote Switch – Welding arc stops and post flow begins.

### 6.02.02 Slope Mode with repeat sequence

The repeat function is operated during the down slope cycle of the Slope Sequence and is active through the down slope period only. During the down slope period by opening the Remote Switch contacts the current will increase back to weld current. Within the Down Slope period the repeat function can operated as many times as desired. To continue slope cycle and end slope sequence close remote switch contacts and allow weld current to reach final current setting. Once final current setting is reached opening the Remote Switch again will turn off the welding arc and post flow begins.

### 6.02.03 Pulse Controls



The Pulse controls are used primarily to control heat input. Pulse offers a number of advantages as follows:

- 1) Control puddle – size and fluidity (especially out of position).
- 2) Increase penetration
- 3) Travel speed control
- 4) Better consistent quality
- 5) Decreased distortion on lighter or thinner materials.

### 6.02.03 Pulse controls continued

Pulse-current provides a system in which the welding current continuously changes between two levels. During the periods of Peak current, heating and fusion takes place, and during the background (base) current periods, cooling and solidification take place. Pulse Width is the time in one cycle the current remains at the peak current setting. Pulse Frequency, measured in Hertz, is the number of cycles per second the current travels between peak and background current settings. It is as if the foot rheostat were moved up and down to increase and decrease the welding current on a regular basis. The faster you moved the foot rheostat up and down the faster the frequency.

## 7.0 BASIC TIG WELDING GUIDE

### 7.01 Explanation of “Fluttery Arc” when AC TIG Welding on Aluminum

The following will assist in understanding the phenomenon of Arc Flutter, also referred to as Arc Rectification.

The basic thesis is that the fluttering is caused by lack of oxide in the weld pool.

The oxide layer on the plate reduced the energy for electron emission. Electron emission from the weld pool (DC+) causes the oxide layers to be disrupted, the so-called “cleaning action”. However once the cleaning action has produced a mirror like surface weld pool the effect of the oxide layer is limited because the oxide layer has dissipated. This makes electron emission from the weld pool more difficult and increases the chance of arc instability.

This idea is supported by the observation that once fluttering starts it can be made to stop by working the arc away from the mirror like weld pool to an area of oxide coated material. As soon as this is done the arc settles back to a stable condition. So while the arc is “consuming” oxide coated plate the instability does not occur. But once the arc is stationary, the pool becomes thoroughly “cleaned” by electron emission, the fluttering begins.

Tests conducted on various types of AC TIG power sources, Fluttery Arc is not confined to one type of power source or it’s design, both conventional and inverter types suffer from the same problem.

#### *AC TIG on aluminum*

The Problem: Arc appears unstable and pulses or flutters. ie. appears to rapidly change welding current.

<b>Conditions that accentuate arc flutter:</b>	<b>Conditions that minimizes arc flutter:</b>
<ul style="list-style-type: none"> <li>• Cold work piece,</li> </ul>	<ul style="list-style-type: none"> <li>• Preheat the work piece,</li> </ul>
<ul style="list-style-type: none"> <li>• Very short arc length,</li> </ul>	<ul style="list-style-type: none"> <li>• Increase the arc length,</li> </ul>
<ul style="list-style-type: none"> <li>• Weld pool crater about 0.39” to 0.47” (10 to 12mm) diameter,</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce filler rod material to the weld pool, which introduces oxides.</li> </ul>
<ul style="list-style-type: none"> <li>• Arc field in one spot to produce “mirror” clean weld pool,</li> </ul>	<ul style="list-style-type: none"> <li>• Move the weld pool around to introduce oxides to the weld pool.</li> </ul>
<ul style="list-style-type: none"> <li>• Increased cleaning action. ie. Prolonged oxide emission from a stationary weld pool increases the likelihood of arc flutter,</li> </ul>	<ul style="list-style-type: none"> <li>• Decrease the cleaning action by turning the <i>WAVE BALANCE</i> to below 50% or move the weld pool around.</li> </ul>
<ul style="list-style-type: none"> <li>• Accentuated when tungsten running near its current capacity, ie. Molten ball on end.</li> </ul>	<ul style="list-style-type: none"> <li>• Use a larger diameter tungsten electrode.</li> </ul>

**Table 7 – Reduction of Arc Flutter**

Conclusion: Fluttery arc in AC TIG is a physical phenomenon independent of machine design.

### 7.02 Electrode Polarity

Connect the TIG torch to the - / *TORCH* terminal and the work lead to the + / *WORK* terminal for direct current straight polarity. Direct current straight polarity is the most widely used polarity for DC TIG welding. It allows limited wear of the electrode since 70% of the heat is concentrated at the work piece.

### 7.03 Tungsten Electrode Current Ranges

Electrode Diameter	AC Current (Amps)	DC Current (Amps)
0.040" (1.0mm)	30 – 70	30 – 60
1/16" (1.6mm)	60 – 95	60 – 115
3/32" (2.4mm)	125 – 150	100 – 165
1/8" (3.2mm)	130 – 225	135 – 200
5/32" (4.0mm)	190 – 280	190 – 280
3/16" (4.8mm)	250 – 340	250 – 340

Table 8 – Current ranges for varies tungsten electrode sizes

### 7.04 Tungsten Electrode Types

Electrode Type (Ground Finish)	Welding Application	Features	Color Code
Thoriated 2%	DC welding of mild steel, stainless steel and copper.	Excellent arc starting, Long life, High current carrying capacity.	Red
Zirconated 1%	High quality AC welding of aluminium, magnesium and their alloys.	Self cleaning, Long life, Maintains balled end, High current carrying capacity.	White
Ceriated 2%	AC & DC welding of mild steel, stainless steel, copper, aluminium, magnesium and their alloys	Longer life, More stable arc, Easier starting, Wider current range, Narrower more concentrated arc.	Grey

Table 9 – Tungsten electrode types

### 7.05 Guide for Selecting Filler Wire Diameter

Filler Wire Diameter	AC Current Range (Amps)	DC Current Range (Amps)
1/16" (1.6 mm)	30-95	20 - 90
3/32" (2.4 mm)	125-160	65 - 115
1/8" (3.2 mm)	180-240	100 - 165
3/16" (4.8 mm)	220-320	200-350

**Table 10 – Filler wire selection guide**

**NOTE 6**

*The filler wire diameter specified in*

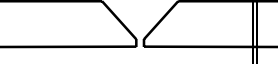


*Table 10 is a guide only, other diameter wires may be used according to the welding application.*

### 7.06 Shielding Gas Selection

Alloy	Shielding Gas Argoshield is a registered trademark of BOC Gases Limited.
Aluminium & alloys	Welding Argon, Argoshield 80T, 81T
Carbon Steel	Welding Argon
Stainless Steel	Welding Argon, Argoshield 71T, 80T, 81T
Nickel Alloy	Welding Argon, Argoshield 71T
Copper	Welding Argon, Argoshield 81T
Titanium	Welding Argon, Argoshield 80T, 81T

**Table 11 – Shielding gas selection**

### 7.07 TIG Welding Parameters for Low Carbon & Low Alloy Steel Pipe

Electrode Type & Diameter	Current Range DC Amperes	Filler Rod for Root Pass	Joint Preparation
Thoriated 2% 3/32" (2.4 mm)	120 - 170	Yes	
Thoriated 2% 3/32" (2.4 mm)	100 - 160	Yes	
Thoriated 2% 3/32" (2.4 mm)	90 - 130	No	

**Table 12 – TIG welding parameters for low carbon & low alloy steel pipe**

### 7.08 Welding Parameters for Aluminum

Base Metal Thickness	AC Current for Aluminum	Tungsten Electrode Diameter	Filler Rod Diameter (if required)	Argon Gas Flow Rate Liters/min	Joint Type
0.040" 1.0mm	30-45 35-50	0.040" 1.0mm	1/16" 1.6mm	5-7	Butt/Corner Lap/ Fillet
0.045" 1.2mm	40-60 45-70	0.040" 1.0mm	1/16" 1.6mm	5-7	Butt/Corner Lap/ Fillet
1/16" 1.6mm	60-85 70-95	1/16" 1.6mm	1/16" 1.6mm	7	Butt/Corner Lap/ Fillet
1/8" 3.2mm	125-150 130-160	3/32" 2.4mm 1/8" 3.2mm	3/32" 2.4mm	10	Butt/Corner Lap/ Fillet
3/16" 4.8mm	180-225 190-240	1/8" 3.2mm	1/8" 3.2mm	10	Butt/Corner Lap/ Fillet
1/4" 6.4mm	240-280 250-320	3/16" 4.8mm	3/16" 4.8mm	13	Butt/Corner Lap/ Fillet

Table 13 – AC TIG welding parameter

### 7.09 Welding Parameters for Steel

Base Metal Thickness	DC Current for Mild Steel	DC Current for Stainless Steel	Tungsten Electrode Diameter	Filler Rod Diameter (if required)	Argon Gas Flow Rate Liters/min	Joint Type
0.040" 1.0mm	35-45 40-50	20-30 25-35	0.040" 1.0mm	1/16" 1.6mm	5-7	Butt/Corner Lap/ Fillet
0.045" 1.2mm	45-55 50-60	30-45 35-50	0.040" 1.0mm	1/16" 1.6mm	5-7	Butt/Corner Lap/ Fillet
1/16" 1.6mm	60-70 70-90	40-60 50-70	1/16" 1.6mm	1/16" 1.6mm	7	Butt/Corner Lap/ Fillet
1/8" 3.2mm	80-100 90-115	65-85 90-110	1/16" 1.6mm	3/32" 2.4mm	7	Butt/Corner Lap/ Fillet
3/16" 4.8mm	115-135 140-165	100-125 125-150	3/32" 2.4mm	1/8" 3.2mm	10	Butt/Corner Lap/ Fillet
1/4" 6.4mm	160-175 170-200	135-160 160-180	1/8" 3.2mm	5/32" 4.0mm	10	Butt/Corner Lap/ Fillet

Table 14 – DC TIG welding parameters



## **8.0 Basic Arc Welding Guide**

### **8.01 Electrode Polarity**

Stick electrodes are generally connected to the '+' terminal and the work lead to the '-' terminal but if in doubt consult the electrode manufacturers literature.

### **8.02 Effects of Stick Welding Various Materials**

#### *High tensile and alloy steels*

The two most prominent effects of welding these steels are the formation of a hardened zone in the weld area, and, if suitable precautions are not taken, the occurrence in this zone of under-bead cracks. Hardened zone and under-bead cracks in the weld area may be reduced by using the correct electrodes, preheating, using higher current settings, using larger electrode sizes, short runs for larger electrode deposits or tempering in a furnace.

#### *Manganese steels*

The effect on manganese steel of slow cooling from high temperatures is to embrittle it. For this reason it is absolutely essential to keep manganese steel cool during welding by quenching after each weld or skip welding to distribute the heat.

#### *Cast Iron*

Most types of cast iron, except white iron, are weldable. White iron, because of its extreme brittleness, generally cracks when attempts are made to weld it. Trouble may also be experienced when welding white-heart malleable, due to the porosity caused by gas held in this type of iron.

#### *Copper and alloys*

The most important factor is the high rate of heat conductivity of copper, making preheating of heavy sections necessary to give proper fusion of weld and base metal.

#### *Types of Electrodes*

Arc Welding electrodes are classified into a number of groups depending on their applications. There are a great number of electrodes used for specialized industrial purposes, which are not of particular interest for everyday general work. These include some low hydrogen types for high tensile steel, cellulose types for welding large diameter pipes, etc. The range of electrodes dealt with in this publication will cover the vast majority of applications likely to be encountered; are all easy to use and all will work on even the most basic of welding machines.

## 9.0 ROUTINE MAINTENANCE

The only routine maintenance required for the power supply is a thorough cleaning and inspection, with the frequency depending on the usage and the operating environment.



### **WARNING 8**

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*Disconnect primary power at the source before opening the enclosure. Wait at least two minutes before opening the enclosure to allow the primary capacitors to discharge.*

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To clean the unit, open the enclosure (please refer to Section 8.01.01, Opening the Enclosure in the 185TSW Service Manual P/N 430429-512) and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean, if necessary; with solvents that are recommended for cleaning electrical apparatus.

### **CAUTION 5**

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*Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.*

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## 10.0 BASIC TROUBLESHOOTING



### WARNING 9

*There are extremely dangerous voltages and power levels present inside this product. Do not attempt to open or repair unless you are an Accredited Thermal Arc Service Agent and you have had training in power measurements and troubleshooting techniques.*

If major complex subassemblies are faulty, then the Welding Power Source must be returned to an Accredited Thermal Arc Service Agent for repair.

The basic level of troubleshooting is that which can be performed without special equipment or knowledge.

### 10.01 TIG Welding Problems

Weld quality is dependent on the selection of the correct consumables, maintenance of equipment and proper welding technique.

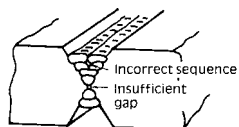
Description	Possible Cause	Remedy
1 Excessive bead build-up or poor penetration or poor fusion at edges of weld.	Welding current is too low.	Increase weld current and/or faulty joint preparation.
2 Weld bead too wide and flat or undercut at edges of weld or excessive burn through.	Welding current is too high.	Decrease weld current.
3 Weld bead too small or insufficient penetration or ripples in bead are widely spaced apart.	Travel speed too fast.	Reduce travel speed.
4 Weld bead too wide or excessive bead build up or excessive penetration in butt joint.	Travel speed too slow.	Increase travel speed.
5 Uneven leg length in fillet joint.	Wrong placement of filler rod.	Re-position filler rod.

Description	Possible Cause	Remedy
6 Electrode melts when arc is struck.	<p>A Electrode is connected to the '+' terminal.</p> <p>B <i>WAVE BALANCE</i> is greater than 50%.</p>	<p>A Connect the electrode to the '-' terminal.</p> <p>B Reduced <i>WAVE BALANCE</i> to below 50% or increase the electrode size.</p>
7 Dirty weld pool.	<p>A Electrode contaminated through contact with work piece or filler rod material.</p> <p>B Gas contaminated with air.</p>	<p>A Clean the electrode by grinding off the contaminates.</p> <p>B Check gas lines for cuts and loose fitting or change gas cylinder.</p>
8 Electrode melts or oxidizes when an arc is struck.	<p>A No gas flowing to welding region.</p> <p>B Torch is clogged with dust.</p> <p>C Gas hose is cut.</p> <p>D Gas passage contains impurities.</p> <p>E Gas regulator turned off.</p> <p>F Torch valve is turned off.</p> <p>G The electrode is too small for the welding current.</p> <p>H <i>WAVE BALANCE</i> is set above 50%.</p>	<p>A Check the gas lines for kinks or breaks and gas cylinder contents.</p> <p>B Clean torch.</p> <p>C Replace gas hose.</p> <p>D Disconnect gas hose from torch then raise gas pressure and blow out impurities.</p> <p>E Turn on.</p> <p>F Turn on.</p> <p>G Increase electrode diameter or reduce the welding current.</p> <p>H Reduced <i>WAVE BALANCE</i> to below 50% or increase the electrode size.</p>
9 Poor weld finish.	Inadequate shielding gas.	Increase gas flow or check gas line for gas flow problems.
10 Arc flutters during TIG welding.	<p>A Tungsten electrode is too large for the welding current.</p> <p>B Absence of oxides in the weld pool.</p>	<p>A Select the right size electrode. Refer to Basic TIG Welding guide.</p> <p>B Refer Basic TIG Welding Guide for ways to reduce arc flutter.</p>
11 Welding arc can not be established.	<p>A Work clamp is not connected to the work piece or the work/torch leads are not connected to the right welding terminals.</p> <p>B Torch lead is disconnected.</p>	<p>A Connect the work clamp to the work piece or connect the work/torch leads to the right welding terminals.</p> <p>B Connect it to the '-' terminal.</p>

Description	Possible Cause	Remedy
	C Gas flow incorrectly set, cylinder empty or the torch valve is off.	C Select the right flow rate, change cylinders or turn torch valve on.
12 Arc start is not smooth.	A Tungsten electrode is too large for the welding current. B The wrong electrode is being used for the welding job. C Gas flow rate is too high. D Incorrect shielding gas is being used. E Poor work clamp connection to work piece.	A Select the right size electrode. Refer to Basic TIG Welding Guide. B Select the right electrode type. Refer to Basic TIG Welding Guide. C Select the correct rate for the welding job. Refer to Basic TIG Welding Guide. D Select the right shielding gas. Refer to Basic TIG Welding Guide. E Improve connection to work piece.

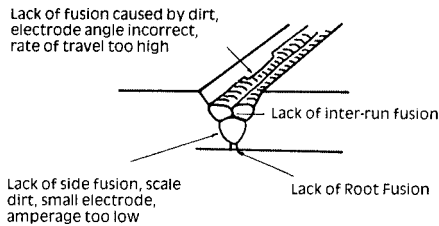
### 10.02 Stick Welding Problems

Description	Possible Cause	Remedy
1 Gas pockets or voids in weld metal (Porosity).	A Electrodes are damp. B Welding current is too high. C Surface impurities such as oil, grease, paint, etc.	A Dry electrodes before use. B Reduce welding current. C Clean joint before welding.
2 Crack occurring in weld metal soon after solidification commences.	A Rigidity of joint. B Insufficient throat thickness. C Cooling rate is too high.	A Redesign to relieve weld joint of severe stresses or use crack resistance electrodes. B Travel slightly slower to allow greater build up in throat. C Preheat plate and cool slowly.
3 A gap is left by failure of the weld metal to fill the root of the weld.	A Welding current is too low. B Electrode too large for joint. C Insufficient gap. D Incorrect sequence.	A Increase welding current B Use smaller diameter electrode. C Allow wider gap. D Use correct build-up sequence.



**Figure 8— Example of insufficient gap or incorrect sequence**

<p>4 Portions of the weld run do not fuse to the surface of the metal or edge of the joint.</p>	<p>A Small electrodes used on heavy cold plate.  B Welding current is too low.  C Wrong electrode angle.  D Travel speed of electrode is too high.  E Scale or dirt on joint surface.</p>	<p>A Use larger electrodes and pre-heat the plate.  B Increase welding current.  C Adjust angle so the welding arc is directed more into the base metal.  D Reduce travel speed of electrode.  E Clean surface before welding.</p>
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**Figure 9 – Example of lack of fusion**

<p>5 Non-metallic particles are trapped in the weld metal (slag inclusion).</p>	<p>A Non-metallic particles may be trapped in undercut from previous run.  B Joint preparation too restricted.  C Irregular deposits allow slag to be trapped.  D Lack of penetration with slag trapped beneath weld bead.  E Rust or mill scale is preventing full fusion.  F Wrong electrode for position in which welding is done.</p>	<p>A If bad undercut is present, clean slag out and cover with a run from a smaller diameter electrode.  B Allow for adequate penetration and room for cleaning out the slag.  C If very bad, chip or grind out irregularities.  D Use smaller electrode with sufficient current to give adequate penetration. Use suitable tools to remove all slag from corners.  E Clean joint before welding.  F Use electrodes designed for position in which welding is done, otherwise proper control of slag is difficult.</p>
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**Figure 10 – Examples of slag inclusion**

### 10.03 Power Source Problems

Description	Possible Cause	Remedy
1 The welding arc cannot be established.	<p>A The Primary supply voltage has not been switched ON.</p> <p>B The Welding Power Source switch is switched OFF.</p> <p>C Loose connections internally.</p>	<p>A Switch ON the Primary supply voltage.</p> <p>B Switch ON the Welding Power Source.</p> <p>C Have an Accredited Thermal Arc Service Agent repair the connection</p>
2 Maximum output welding current can not be achieved with nominal Mains supply voltage.	Defective control circuit.	Have an Accredited Thermal Arc Service Agent repair the connection
3 Welding current reduces when welding.	<p>A Loose welding cable connections.</p> <p>B Incorrect welding cable size.</p> <p>C Improper input connections.</p> <p>D Poor electrode condition.</p> <p>E Wrong welding polarity.</p>	<p>A Tighten all welding cable connections.</p> <p>B Use proper size and type of cable.</p> <p>C Refer to Section 2.05 Electrical Input Requirements.</p> <p>D Replace electrode.</p> <p>E Verify output torch connections.</p>
4 No gas flow when the torch trigger switch is depressed.	<p>A Gas hose is cut.</p> <p>B Gas passage contains impurities.</p> <p>C Gas regulator turned off.</p> <p>D Torch trigger switch lead is disconnected or switch/cable is faulty.</p>	<p>A Replace gas hose.</p> <p>B Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities.</p> <p>C Turn gas regulator on.</p> <p>D Reconnect lead or repair faulty switch/cable.</p>

Description	Possible Cause	Remedy
<p>5 Gas flow won't shut off.</p>	<p>A Weld Mode (<i>STD, SLOPE, REPEAT</i> or <i>SPOT</i>) was changed before <i>POST-FLOW</i> gas time had finished.</p> <p>B Gas valve is faulty.</p> <p>C Gas valve jammed open.</p> <p>D <i>POST-FLOW</i> control is set to 60 sec.</p>	<p>A Strike an arc to complete the weld cycle. OR Switch machine off then on to reset solenoid valve sequence.</p> <p>B Have an Accredited Thermal Arc Service Agent repair or replace the gas valve</p> <p>C Have an Accredited Thermal Arc Service Agent repair or replace the gas valve</p> <p>D Reduce <i>POST-FLOW</i> time.</p>
<p>6 The TIG electrode has been contaminated due to the gas flow shutting off before the programmed <i>POST-FLOW</i> time has elapsed.</p>	<p>The Weld Process Mode (<i>STICK, HF TIG</i> or <i>LIFT TIG</i>) was changed before <i>POST-FLOW</i> gas time had finished.</p>	<p>Do not change Weld Process Mode before the <i>POST-FLOW</i> gas time had finished.</p>



## 11.0 Voltage Reduction Device (VRD)

### 11.01 VRD Specification

Description	Pro-Wave 185TSW	Notes
VRD Open Circuit Voltage	15.3 to 19.8V	Open circuit voltage between welding terminals.
VRD Resistance	148 to 193 ohms	The required resistance between welding terminals to turn ON the welding power.
VRD Turn OFF Time	0.2 to 0.3 seconds	The time taken to turn OFF the welding power once the welding current has stopped.

### 11.02 VRD Maintenance

#### Routine inspection and testing (power source)

An inspection of the power source, an insulation resistance test and an earth resistance test should be carried out

- a) For transportable equipment, at least once every 3 months; and
- b) For fixed equipment, at least once every 12 months.

The owners of the equipment shall keep a suitable record of the periodic tests.

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#### *Note 7*

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*A transportable power source is any equipment that is not permanently connected and fixed in the position in which it is operated.*

In addition to the above tests and specifically in relation to the VRD fitted to this machine, the following periodic tests should also be conducted by an accredited Thermal Arc service agent.

Description	IEC 60974-1 Requirements
VRD Open Circuit Voltage	Less than 20V; at $V_{in}=230V$
VRD Turn ON Resistance	Less than 200 ohms
VRD Turn OFF Time	Less than 0.3 seconds

If this equipment is used in a hazardous location or environments with a high risk of electrocution then the above tests should be carried out prior to installation at this location.

## 12.0 Power Source Error Codes

Description	Possible Cause	Remedy	Remarks
<p>1 <u>E01 error code displayed</u> Temperature sensor TH1 (protects IGBTs) is greater than 80°C for about 1 second.</p>	<p>A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked.</p>	<p>A Let Power Source cool down then keep within its duty cycle. B Have an Accredited Thermal Arc Service Agent investigate. C Unblock vents then let Power Source cool down.</p>	<p>Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E01 resets when TH1 decreases to 70°C for about 30 seconds.</p>
<p>2 <u>E02 error code displayed</u> Temperature sensor TH2 (protects secondary diodes) is greater than 80°C for about 1 second.</p>	<p>A The Welding Power Source's duty cycle has been exceeded. B Fan ceases to operate. C Air flow is restricted by vents being blocked.</p>	<p>A Let Power Source cool down then keep within its duty cycle. B Have an Accredited Thermal Arc Service Agent investigate C Unblock vents then let Power Source cool down.</p>	<p>Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E02 resets when TH2 decreases to 70°C for about 30 seconds.</p>
<p>3 <u>E03 error code displayed</u> Primary (input) current too high.</p>	<p>A Primary current is too high because welding arc is too long. B Mains supply voltage is more than 10% below nominal voltage .</p>	<p>A Reduce length of welding arc. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check for low Mains voltage.</p>	<p>Weld current ceases. Buzzer sounds constantly. Switch machine off then on to reset E03 error.</p>
<p>4 <u>E04 error code displayed</u> Output voltage exceeds the secondary voltage specification.</p>	<p>TIG torch cable and/or work lead are too long or leads are coiled.</p>	<p>Reduce the length of the TIG torch cable and/or work lead or un-coiled leads.</p>	<p>Weld current ceases. Buzzer sounds constantly. Switch machine off then on to reset E04 error.</p>

<b>Description</b>	<b>Possible Cause</b>	<b>Remedy</b>	<b>Remarks</b>
5 <u>E11 error code displayed</u> Over Primary supply (input) voltage at primary capacitors is exceeded for one second.	Primary supply voltage is greater than the nominal voltage plus 10%.	Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Primary voltage.	Weld current ceases. Buzzer sounds constantly. Error code E11 automatically will reset when the voltage reduces.
6 <u>E14 error code displayed</u> Under mains supply (input) voltage warning primary capacitors is reduced for one second.	Mains supply voltage is less than the nominal operating voltage less 10%.	Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage.	Weld current available. Buzzer sounds intermittently. Error code E14 automatically will reset when the voltage increases.
7 <u>E12 error code displayed</u> Under mains supply (input) voltage primary capacitors is reduced for one second.	Mains supply voltage is down to a dangerously low level.	A Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check the primary cable and fuses.	Weld current ceases. Buzzer sounds constantly. Error code E12 automatically will reset when the voltage increases.
8 <u>E81 error code displayed</u> Wrong Primary supply (input) voltage connected.	When 3 phase machine is first turned on with the wrong Primary supply (input) voltage connected.	Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage.	No weld current is available. Buzzer sounds constantly. Switch machine off.
9 <u>E82 error code displayed</u> Rated voltage selection circuit abnormality.	The Primary supply (input) voltage fluctuates and is not stable.	Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage.	No weld current is available. Buzzer sounds constantly. Switch machine off then on to reset E82 error.

<b>Description</b>	<b>Possible Cause</b>	<b>Remedy</b>	<b>Remarks</b>
10 <u>E83 error code displayed</u> CPU checks mains supply (input) voltage when the on/off switch on rear panel of machine is turned ON.	The Primary supply (input) voltage fluctuates and is not stable.	Have an Accredited Thermal Arc Service Agent check connector plug on input PCB and the Mains voltage	No weld current is available. Buzzer sounds constantly. Switch machine off then on to reset E83 error.
11 <u>E85 error code displayed</u> Pre-charge abnormality.	Due to malfunction inside the Welding Power Source, primary capacitors are not charging correctly.	Have an Accredited Thermal Arc Service Agent service the machine	No weld current is available. Buzzer sounds constantly. Switch machine off then on to reset E85 error.
12 <u>E93 error code displayed</u> <u>Memory chip (EEPROM) on control PCB can not read/write weld parameters.</u>	Memory chip (EEPROM) error.	Have an Accredited Thermal Arc Service Agent check the control PCB.	Weld current ceases. Buzzer sounds constantly. Switch machine off.
13 <u>E94 error code displayed</u> Temperature sensor TH1 for IGBTs or sensor TH2 for secondary diodes are open circuit.	The Welding Power Source's temperature sensors have malfunctioned.	Have an Accredited Thermal Arc Service Agent check or replace the temperature sensors	Weld current ceases. Buzzer sounds constantly. Switch machine off.
14 <u>E99 error code displayed</u> Mains supply (input) voltage has been turned off but control circuit has power from the primary capacitors.	A Main on/off switch on machine has been turned off B Mains supply (input) voltage has been turned off.	A Turn on/off switch on. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check the Mains voltage and fuses.	Weld current ceases. Buzzer sounds constantly. Must switch machine off then on to reset E99 error.

### 13.0 PARTS LIST

DWG. No.	Description	Type & Rating	QTY.	Code No.	Order No.
C1	Capacitor	ECQE12104MZ DC1250V 0.1uF	1	42422137100	10-2270
CC1	Coupling Coil	F2A636900 185A CC	1	F2A636900	10-6626
CON1	Remote Socket	206433-1 8P (with Wiring Assembly)	1	U0A706100	10-6627
D1	Diode	DFA50BA160	1	454160160	10-6628
D2	Diode	DBA200UA60	1	4583A0060	10-6629
D4	Diode	DBA200UA60	1	4583A0060	10-6629
D5	Diode	DBA200UA60	1	4583A0060	10-6629
D10	Diode	S2VB60 600V	1	444014023	10-6630
FAN1	Fan	109E5724H507 DC 24V 16.8W	1	U0A733500	10-6839
FCH1	Inductor	F2A676800 185A AC/DC FCH	1	F2A676800	10-6631
HCT1	Current Sensor	HC-TN200V4B15M 200A 4V	1	11251003000	10-5003
HF.UNIT 1	HF. Unit	HF.UNIT (WK-4840 U02)	1	U0A632200	10-6632
	HF. Gap	U0A601100	1	U0A601100	10-6633
L105	Inductor	1615MRE RING CORE	1	63200006500	10-6538
PCB1	Printed Circuit Board	WK-4914 U04 MAIN_PCB (with Insulation Sheet EBA501500) with Thunder Label	1	U0A705100	10-6634
PCB2	Printed Circuit Board	WK-4819 U01 DETECT PCB	1	P0A481901	10-6635
PCB3	Printed Circuit Board	WK-4921 U02 CONNECT_PCB	1	P0A492102	10-6636
PCB4	Printed Circuit Board	WK-4915 U04 2ND_DIODE with Thunder Label	1	U0A705200	10-6637
PCB5	Printed Circuit Board	WK-4916 U02 2_IGBT_PCB	1	P0A491602	10-6638
PCB6	Printed Circuit Board	WK-5157 U05 TIG CONTROL	1	P0A515705	10-6846
PCB7	Printed Circuit Board	WK-4920 U10 AC TIG PANEL	1	P0A492010	10-6640
PCB8	Printed Circuit Board	WK-4917 U06 FILTER_240V	1	P0A491706	10-6641

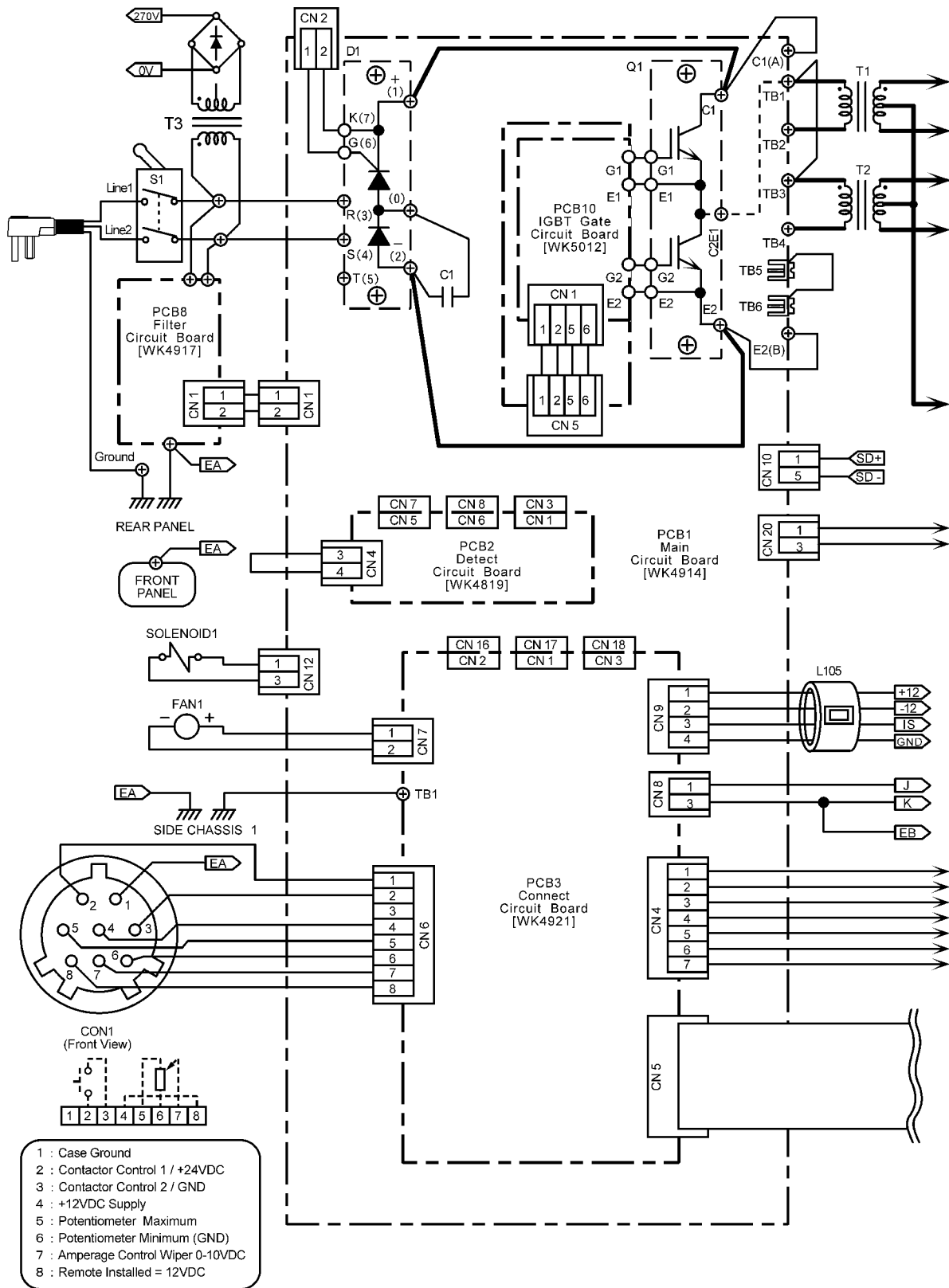
### 13.0 PARTS LIST Continued

DWG. No.	Description	Type & Rating	QTY.	Code No.	Order No.
Q1	Transistor	CM100DUS12F-1 600V 100A (with WK-5012 U01)	1	U0A705300	10-6642
Q2	Transistor	GCA200CA60 (with WK-3367 U04)	1	U0A705400	10-6643
R1	Resistor (For HF Unit)	ERF20HMJ151 20W 150 Ω	1	40310211500	10-5081
R2	Resistor	JG23V101J 68W 100 Ω	2	40511000200	10-5137
S1	Switch	DCP-52SR50C-480V 2P-480V	1	25850003500	10-6644
SOL1	Solenoid Valve	5505NBR1.5 DC24V 11 VA/10W (with Gas Inlet and PC4-02)	1	U0A705700	10-6645
T1	Transformer	F2A708300 250A MTR	1	F2A708300	10-6646
T2	Transformer	F2A708300 250A MTR	1	F2A708300	10-6646
T3	Transformer	F2A758000 AC/DC DTR	1	F2A758000	10-6648
TH1,2	Thermistor	ERTA53D203 20K"/25°C B=3950K	1	U0A733300	10-6784
	Front Panel	E0D005300	1	E0D005300	10-6890
	Rear Panel	E0D005500	1	E0D005500	10-6891
	Side Panel	E0D006100	2	E0D006100	10-6650
	Front Control Cover	J4B493400	1	J4B493400	10-6651
	Rear Control Cover	JCA849400 (with Label)	1	U0A705500	10-6652
	Protection Cover	E0C303200	1	E0C303200	10-6653
	Encoder Cover	EBA514400	1	EBA514400	10-6654
	PCB Cover	E1B537600 (with Caution Label)	1	U0A705600	10-6655
	Name Label	N4A007600	2	N4A007600	10-6656
	Side Label	N4A009200	2	N4A009200	10-6657
	Warning 1 Label	N0B891300	1	N0B891300	10-5497
	Warning 2 Label	N0B476400	2	N0B476400	10-5496

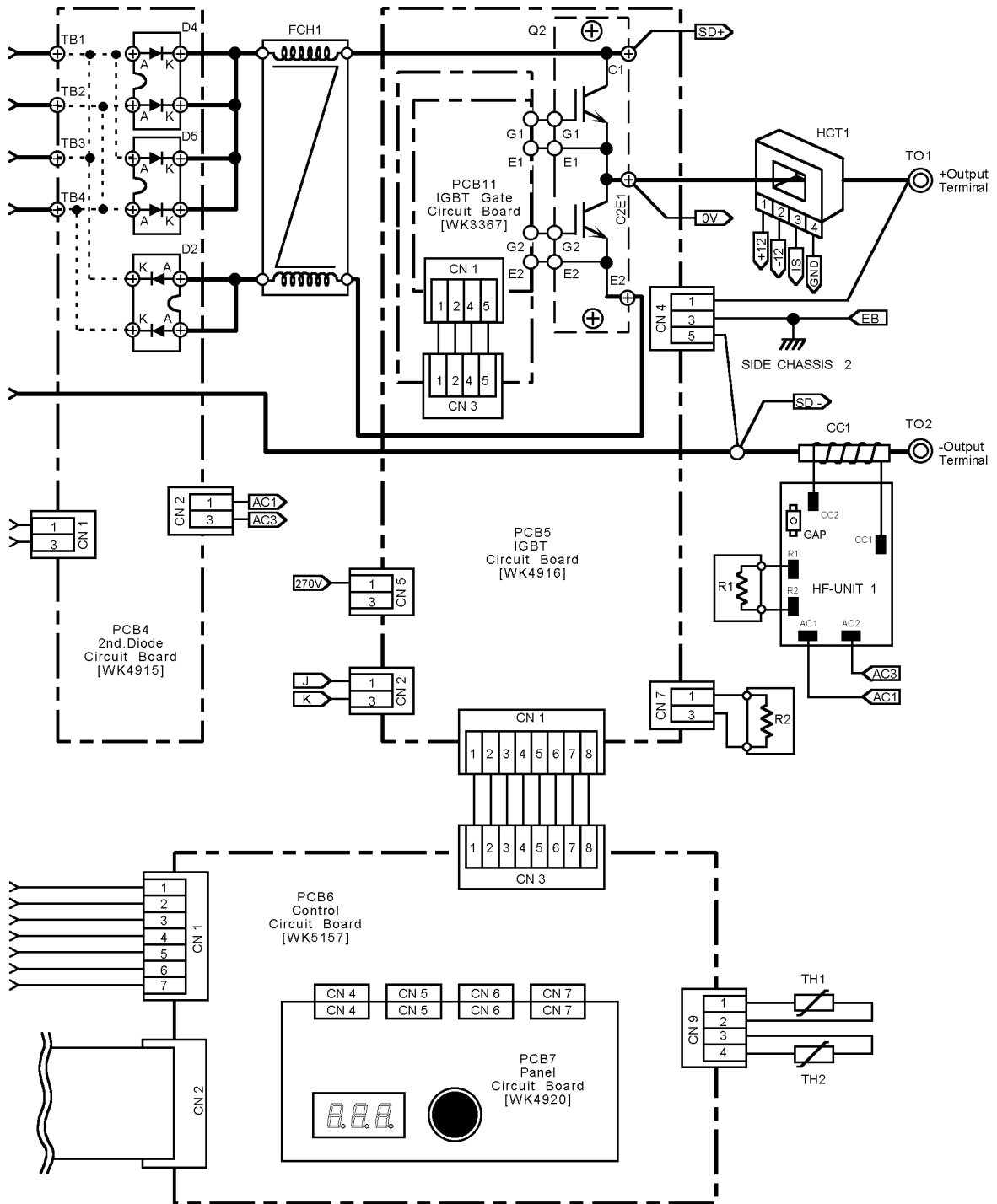
### 13.0 PARTS LIST Continued

DWG. No.	Description	Type & Rating	QTY.	Code No.	Order No.
	Output Terminal Label	N4A040100	1	N4A040100	10-6658
	Gas Outlet	EBA077600 (with PC4-02)	1	U0A705800	10-6659
	C-Ring		2	53003000600	10-5184
	Output Terminal (female)	TRAK-BE35-70S	2	26999025900	10-6660
	Input Cable	132" 10/3 SOW BLK W/6-50P	1	52031130000	10-6844
	Input Cable Clamp	EBA045800	1	EBA045800	10-6662
	Heatsink	E1B538500	1	E1B538500	10-6663
	Heatsink	E1B538600	1	E1B538600	10-6664
	Knob	2621603	1	50990001600	10-6665
	Knob Cap	3021104	1	50990000300	10-6666
	Control Cover Sheet	N0B882200	1	N0B882200	10-6667
	Flat Cable	EAA547301	1	EAA547301	10-6668
	Post1(M4-M5)	EBA424900	2	EBA424900	10-6669
	Post4(M4-M4)	EBA431100	3	EBA431100	10-6670
	Post5(M4-M4)	EBA431200	6	EBA431200	10-6671
	Post6(M5-M5)	EBA431300	1	EBA431300	10-6672
	Post7(M5-M5)	EBA435900	3	EBA435900	10-6673
	Post8(M5-M5)	EBA436000	3	EBA436000	10-6674
	D2-4 Bus Bar	EBA305600	2	EBA305600	10-6675
	CC Bus Bar	EBA306200	1	EBA306200	10-6676
	S1 Bus Bar	ECA321000	2	ECA321000	10-6677
	Clip	#74 NATURAL (Plastic Tab)	4	60602422000	10-5259
	Transformer Chassis	JCA903200	1	JCA903200	10-6678
	Right Chassis	J2C970700	1	J2C970700	10-6679
	Left Chassis	J2C970800	1	J2C970800	10-6680
	Nylon Hose	T0425B Nylon Hose L=0.5m	1	U0A706000	10-6681
	Output Terminal (male)	TRAK-SK50	2	26999025800	10-2020
	Operators Manual		1		430429-503
	Service Manual				430429-512

# APPENDIX A – INTERCONNECT DIAGRAM







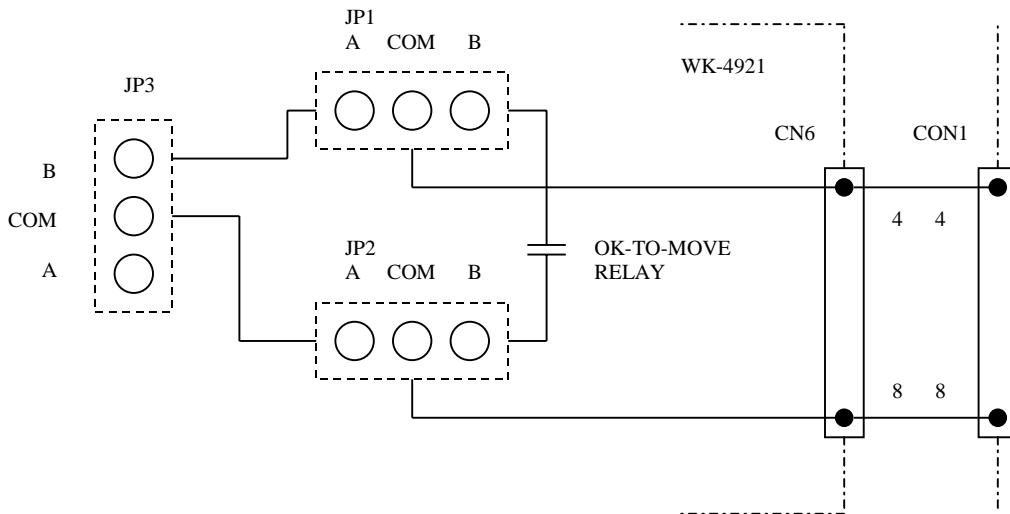
# APPENDIX B - AUTOMATION

## JUMPER SETTING FOR "OK-TO-MOVE". Models 185TSW

Three jumpers (JP1, JP2 and JP3) are provided on PC Board WK-4921 for automation purposes. This PCB is mounted horizontally on top of the unit just under the cover. This PCB can be accessed by removing the side covers by loosening 4 screws on each the front and rear panel, then removing the 4 side panel screws as well as the 2 handle screws. Carefully pull the front and rear panels outward to release and remove the side cover. Remove two plastic clips holding the PCB protective cover in place and lift the sheet up and over the unit. The jumpers will be accessible on the top portion of the PCB. See figure on next page for the location of the PCB.

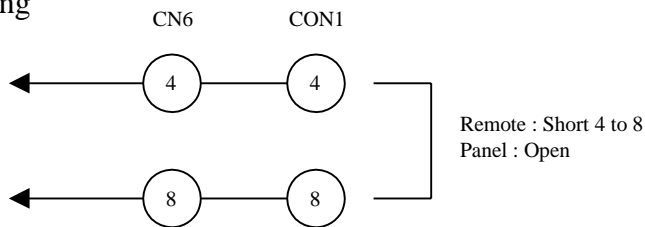
All units are shipped from the factory with the jumpers set in position "A". This is for normal semi-automatic operation utilizing a remote device, such as a foot control. The 8-pin remote operates as described earlier in this manual.

Placing all jumpers in position "B" would be primarily used for automation with an arc establish relay, remote amperage and contactor. An arc-establish signal is located from pins 4 and 8 when in this mode. Placing jumpers JP1 and JP2 in "B" position and jumper JP3 in "A" position would have the configuration of an arc-establish signal and remote contactor, but the unit's front panel would control the amperage.



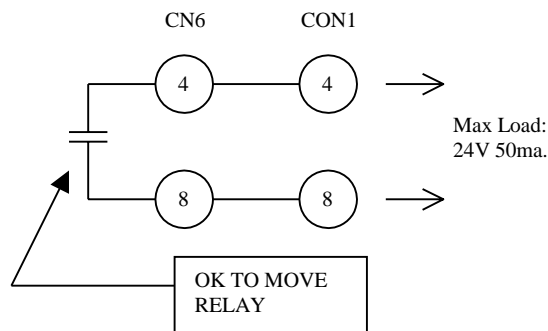
- Set All "A" position : factory shipping

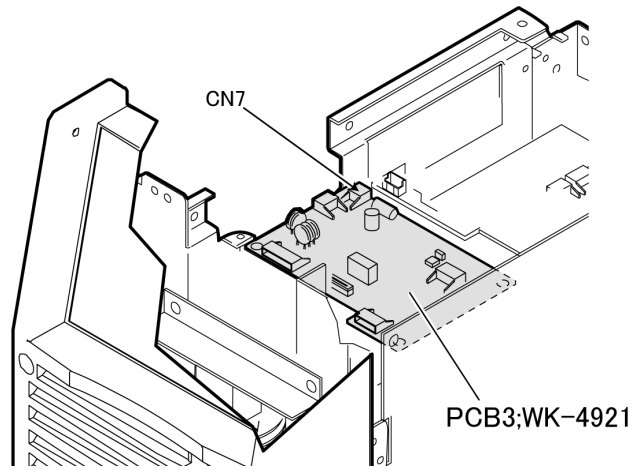
	POSITION
JP1	A
JP2	A
JP3	A



- Use "OK TO MOVE signal"

	POSITION	
JP1	B	B
JP2	B	B
JP3	B	A
A/V	REMOTE	PANEL





**Figure 11 – Location of PCB WK-4921**