THERMAL ARC®

A THERMADYNE® Company

INVERTER
ARC
WELDER

MODEL 250S DC CC

STICK

TIG - Lift Start

OPERATING MANUAL

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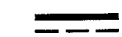
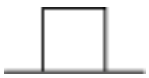
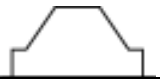
SYMBOL LEGEND

A	**Amperage**
V	**Voltage**
Hz	**Hertz (frequency)**
SEC	**Seconds**
%	**Percent**
	**DC (Direct Current)**
	**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**
VRD	**Voltage Reduction Device Circuit**
	Negative
	**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.

POWER SUPPLIES	**POWER SUPPLIES & WIRE FEEDERS**	**LABOR**
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: ENIGINES ARE NOT WARRANTED BY THERMAL ARC, ALTHOUGH MOST ARE WARRANTED BY THE ENGINE MANUFACTURER, SEE THE ENGINE MANUFACTURES WARRANTY FOR DETAILS.

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

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 :

NOTE

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

ATTENTION

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

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

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.

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	cuivre	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. Eliminez 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-violets 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 dú4ez 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

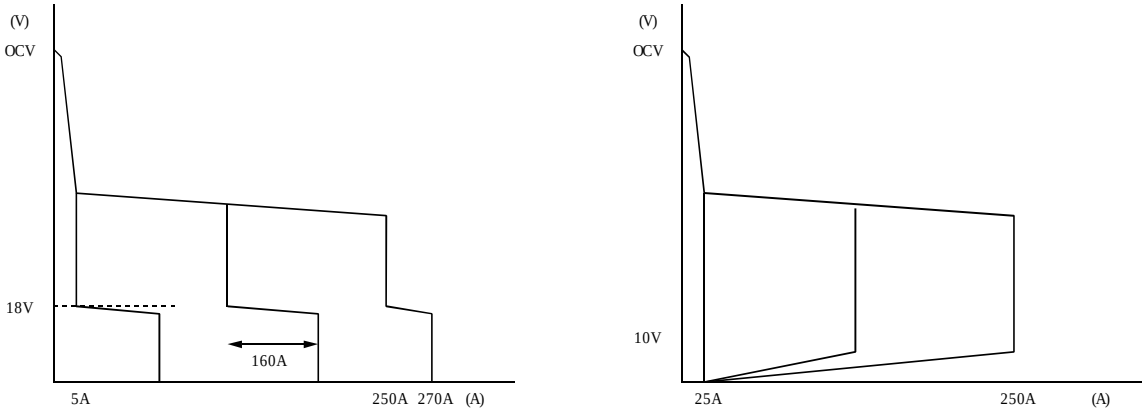
14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126

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 Pro-Lite 250S is a self contained single/three-phase DC arc welding power sources with Constant Current (CC) output characteristics. This unit is equipped with a Digital Volt/Amperage Meter, and lift arc starter, for use with Gas Tungsten Arc Welding (GTAW) and Shielded Metal Arc Welding (SMAW) processes. The power source is totally enclosed in an impact resistant, flame resistant and non-conductive plastic case.



STICK Process LIFT-TIG Process

Figure 1. Model 250S 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 250S-power supply.

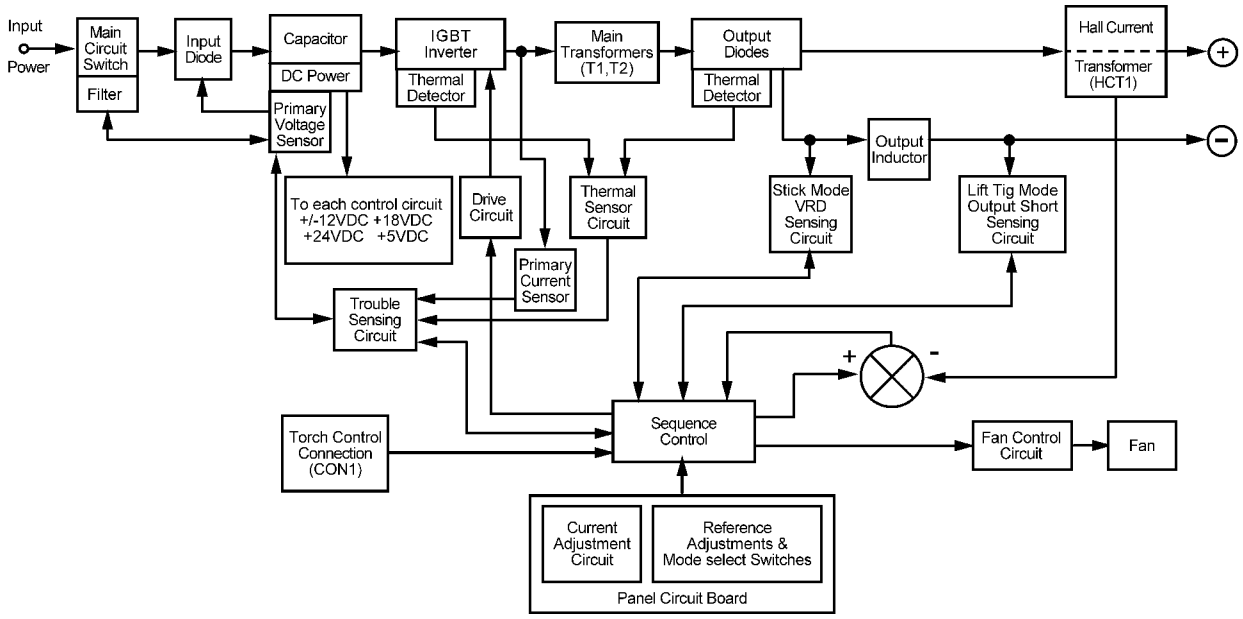


Figure 2. 250S Model functional block diagram

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-Lite 250S 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.*
- *In areas, free from oil, steam and corrosive gases.*
- *In areas, not exposed to direct sunlight or rain.*
- *Ambient temperature between 0 degrees C to 40 degrees C.*
- *In areas, not subjected to abnormal vibration or shock.*
- *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/three-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 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

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

Do not connect an input (WHITE or BLACK or RED) 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) and line 3 (RED) 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.

Note 3

For Single-Phase operation connect the GREEN, BLACK and WHITE input conductors. Insolate the RED Conductor, it is not used for Single-phase operation.

Input Voltage	Fuse Size
208	75
230	70
460	20

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).

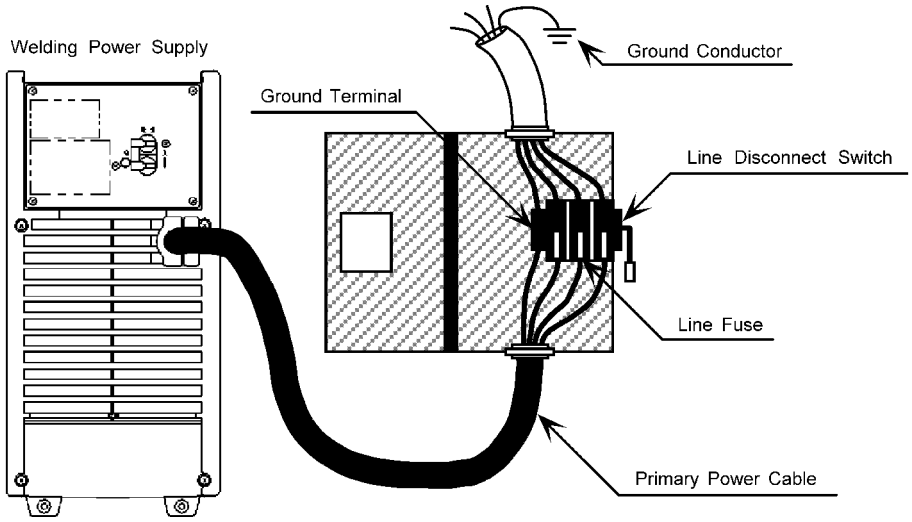


Figure 3. Electrical Input Connections

3.03.02 Input Power

Each unit incorporates an INRUSH circuit and input voltage sensing circuit. When the MAIN CIRCUIT BREAKER 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 4

Note the available input power. Damage to the PCA could occur if 575VAC or higher is applied.

The following 208-230/460V Primary Current recommendations are required to obtain the maximum welding current and duty cycle from this welding equipment:

Model	Primary Supply Lead Size	Minimum Primary Current Circuit Size (Vin/Phase/Amps)	Current & Duty Cycle	
			TIG	STICK
PRO-LITE 250S	8/4 AWG minimum (Factory Fitted)	208/3/24	250A @ 40%	-
		230/3/21		-
		460/3/11		-
		208/3/35		250A @ 40%
		230/3/32		
		460/3/16		
	8/3 AWG minimum	208/1/51	250A @ 40%	-
		230/1/46		-
		208/1/75		250A @ 40%
		230/1/68		

Table 2 – 230/460V 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	250S	
Rated Output Amperes Volts Duty Cycle	208-230/460VAC 250 30 40%	
Duty Cycle	250A / 30V @ 40% 190A / 27V @ 60%	
Output Current Range	5 – 250 Amps	
Open Circuit Voltage	69V	
Dimensions Width Height Length	 7.08” (180mm) 14.17” (360mm) 16.54” (420mm)	
Weight	39.68 lb. 18 kg	
Output @ Rated Load Output Amperes Output Volts Duty Cycle KVA KW	Three-phase 250A 30V 40% 12.5 9.4	Single-phase 250A 30V 40% 15.7 9.4
Output @ No Load KVA KW	 0.5 0.13	 0.5 0.13
Input Volts Three Phase	Amperage Draw @ Rated Load	No Load
208V	35	1.3
230V	32	1.1
460V	16	0.7
Input Volts Single Phase		
208V	75	2.2
230V	68	1.6
460V	-	-

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

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.

CAUTION 1

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

NOTE 5

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-Lite 250S Controls

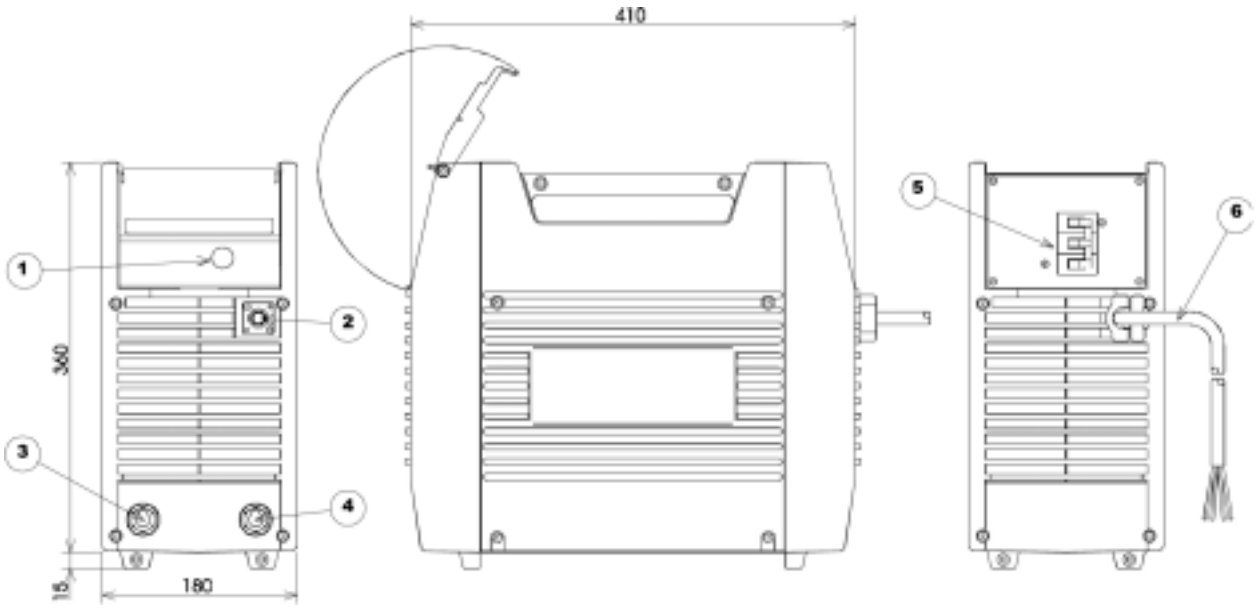


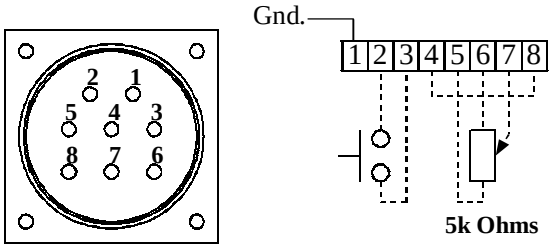
Figure 4. – Pro-Lite 250S Power Source

1 *Control Knob*

This control sets the selected weld parameter, rotating it clockwise increases the parameter and is indicated on the digital meter. Pushing the knob in previews the actual welding voltage while welding.

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.



Front view of 8-Socket Receptacle

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 *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 primary potential with respect to earth.

6 *Input Cable*

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

SMART Logic Switch (Not Shown)

Manual slide switch mounted on the back panel selects for proper input voltage. If this slide is not set to the position that matches the input voltage from the electrical source the Smart Logic circuit will inhibit welding power source output. The digital meter will show primary input error code.

4.02 Weld Parameter Description

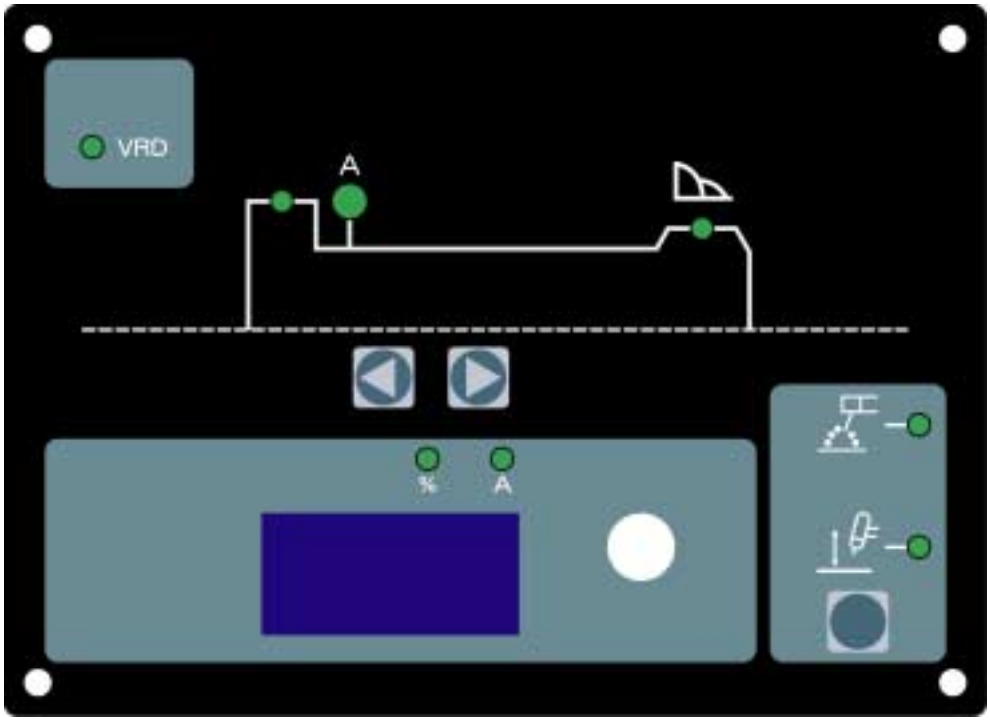


Figure 5. - Pro-Lite 250S Front Panel with Parameter Description

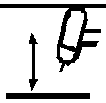
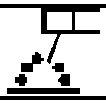
Parameter	Description
HOT START	This parameter operates in STICK weld mode and is used to improve the start characteristics for stick electrodes. e.g. low hydrogen electrodes. It sets the peak start current on top of the *(WELD)* current.
A	Weld Current (Amperage)- sets the STICK and TIG WELD current.
	ARC CONTROL - This parameter provides a suitable short circuit current in STICK welding to improve electrode sticking and arc stability.
	LIFT TIG mode of operation. A remote control device is required for use during LIFT TIG operation. See section 4.01, section 2 "*Remote Control Socket*", for complete details of the remote device.
	STICK Mode of operation

Table 3 – Weld Parameter Descriptions

4.03 Weld Parameters for Pro-Lite 250S

Weld Parameter	Parameter Range	Factory Setting	Incremental Unit	Weld Mode	
				STICK	LIFT TIG
HOT START	0 to 70A	20A	1A	Yes	No
WELD CUR	5 to 250A 230V	80A	1A	Yes	Yes
ARC CONTROL	0 to 100%	10%	1%	Yes	No

4.04 Power Source Features

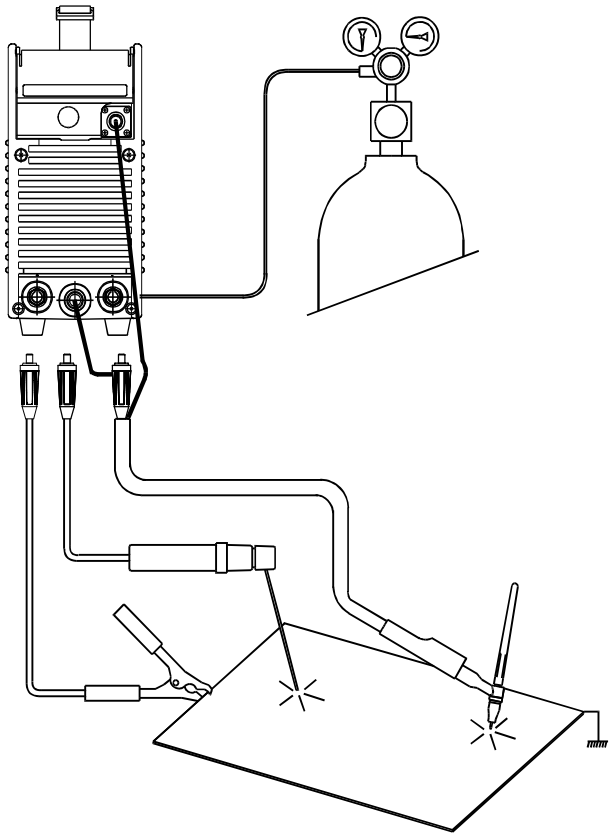
Feature	Description
New Digital Control	• Almost all welding parameters are adjustable
Touch Panel Switches	• Touch switches eliminate mechanical damage
Front Control Cover	• Protects front panel controls
Digital Meter	• Displays selected weld parameter value • Displays weld current when welding • Displays weld current for 20 seconds after weld has been completed • A selected weld parameter value can be adjusted at any time even while welding
Intelligent Fan Control	• The intelligent cooling system is designed to reduce dust and foreign material build-up, whilst providing optimum cooling. • Fan speed reduces approximately 30 seconds after machine is turned on • Fan speed increases when internal components reaches operating temperature
ON/OFF switch	• Primary voltage Supply ON/OFF switch located on rear panel
Voltage Reduction Device (VRD)	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. • VRD fully complies to IEC 60974-1 • When Stick mode is selected the green VRD light is ON when not welding and red when welding. • When in TIG modes VRD is off.
Control Knob	• For the selected weld parameter, rotating the knob clockwise increases the parameter • Rotating the knob counterclockwise decreases the parameter • A selected weld parameter value can be adjusted at any time even while welding • Pushing the knob in displays actual arc voltage.

Feature	Description
Self Diagnosis Using Error Codes	• An error code is displayed on the *Digital Meter* when a problem occurs with Primary supply voltage or internal component problems. Refer to troubleshooting guide.

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. – 250S Set-up



WARNING 7

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

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.

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 Symbols Table located in the front of the manual for Symbol descriptions.

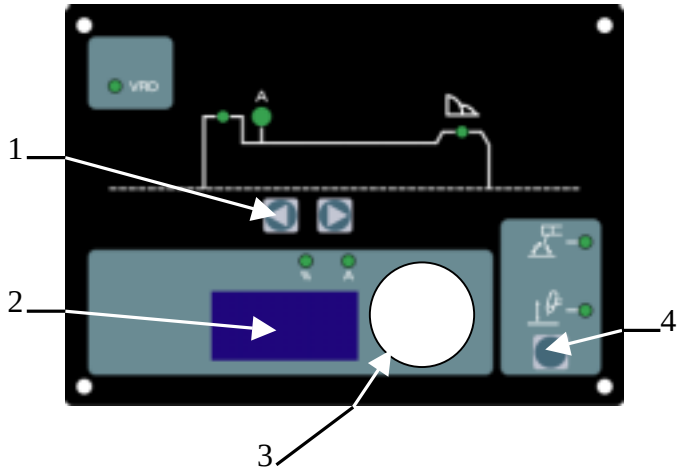


Figure 7. - 250S Front Panel

1. Scroll Buttons – used to select the parameters to be set. The LED's show which function is being adjusted on the weld sequence graph.
2. 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.
3. 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.
4. Process Button – This button selects between STICK or Lift TIG mode. A remote control device is required for use during LIFT TIG operation. See section 4.01, section 2 "*Remote Control Socket*", for complete details of the remote device.

6.01 Stick Welding

- Connect work lead to negative terminal
- Connect electrode lead to positive terminal
- Switch machine on
- 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
- Set Arc Control

Commence welding

6.02 DC LIFT TIG Welding

- Connect work lead to positive terminal
- Connect TIG torch to negative terminal
- Switch machine on
- Set weld current.
- Connect remote control device. A remote control device is required for use during LIFT TIG operation. 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 *WELD* current

Commence welding

7.0 BASIC TIG WELDING GUIDE

7.01Electrode 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.

7.02 Tungsten Electrode Current Ranges

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

Table 4 – Current ranges for varies tungsten electrode sizes

7.03 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
Ceriated 2%	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 5 – Tungsten electrode types

7.04 Guide for Selecting Filler Wire Diameter

Filler Wire Diameter	DC Current Range (Amps)
1/16” (1.6 mm)	20 - 90
3/32” (2.4 mm)	65 - 115
1/8” (3.2 mm)	100 - 165
3/16” (4.8 mm)	200-350

Table 6 – Filler wire selection guide

NOTE 6

The filler wire diameter specified in Table 6 is a guide only, other diameter wires may be used according to the welding application.

7.05 Shielding Gas Selection

Alloy	Shielding Gas
Aluminium & alloys	Argon
Carbon Steel	Argon
Stainless Steel	Argon
Nickel Alloy	Argon
Copper	Argon
Titanium	Argon

Table 7 – Shielding gas selection

7.06 TIG Welding Parameters for Low Carbon & Low Alloy Steel Pipe

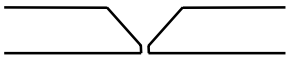
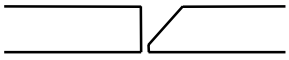
Electrode Type & Diameter	Current Range DC Amperes	Filler Rod for Root Pass	Joint Preparation
Thoriated 2% 3/32” (2.4 mm)	120 - 170	Yes	
Thoriated 2% 3/32” (2.4 mm)	100 - 160	Yes	
Thoriated 2% 3/32” (2.4 mm)	90 - 130	No	

Table 8 – TIG welding parameters for low carbon & low alloy steel pipe

7.07 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
¼” 6.4mm	160-175 170-200	135-160 160-180	1/8” 3.2mm	5/32” 4.0mm	10	Butt/Corner Lap/ Fillet

Table 9 – DC TIG welding parameters

8.0 BASIC ARC WELDING GUIDE

8.01Electrode 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 electrodes 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.

Metals being joined	Electrode	Comments
Mild steel	6013	Ideal electrodes for all general purpose work. Features include out standing operator appeal, easy arc starting and low spatter.
Mild steel	7014	All positional electrode for use on mild and galvanized steel furniture, plates, fences, gates, pipes and tanks etc. Especially suitable for vertical-down welding.
Cast iron	99% Nickel	Suitable for joining all cast irons except white cast iron.
Stainless steel	318L-16	High corrosion resistance. Ideal for

Metals being joined	Electrode	Comments
		dairy work, etc. On stainless steels.
Copper, Bronze, Brass, etc.	Bronze 5.7 ERCUSI-A	Easy to use electrode for marine fittings, water taps and valves, water trough float arms, etc. Also for joining copper to steel and for bronze overlays on steel shafts.
High Alloy Steels, Dissimilar Metals, Crack Resistance. All Hard-To-Weld Jobs.	312-16	It will weld most problematical jobs such as springs, shafts, broken joins mild steel to stainless and alloy steels. Not suitable for Aluminum.

Table 10 - Types of Electrodes

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9.0 BASIC TROUBLESHOOTING

WARNING 8

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.

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

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

9.02 Stick Welding Problems

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

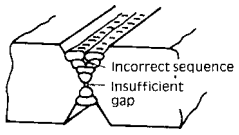


Figure 8 – Example of insufficient gap or incorrect sequence

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

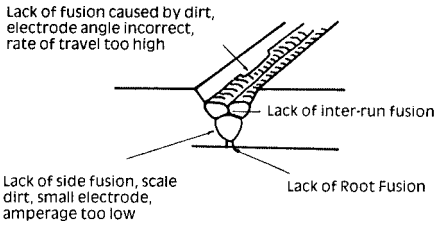
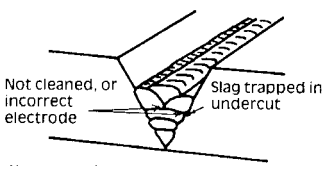


Figure 9 – Example of lack of fusion

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



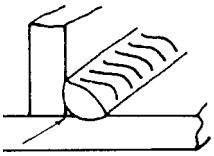


Figure 10 – Examples of slag inclusion

9.03 Power Source Problems

Description	Possible Cause	Remedy
1 The welding arc cannot be established	A The Primary supply voltage has not been switched ON. B The Welding Power Source switch is switched OFF. C Loose connections internally.	A Switch ON the Primary supply voltage. B Switch ON the Welding Power Source. C Have an Accredited Thermal Arc Service Agent repair the connection.
2 Maximum output welding current can not be achieved with nominal Mains supply voltage.	Defective control circuit	Have an Accredited Thermal Arc Service Agent inspect then repair the welder.
3 Welding current reduces when welding	Poor work lead connection to the work piece.	Ensure that the work lead has a positive electrical connection to the work piece.
4 No gas flow when the torch trigger switch is depressed.	A Gas hose is cut. B Gas passage contains impurities. C Gas regulator turned off.	A Replace gas hose. B Disconnect gas hose from the rear of Power Source then raise gas pressure and blow out impurities. C Turn gas regulator on.

10.0 VOLTAGE REDUCTION DEVICE (VRD)

10.01 VRD Specification

Description	Pro-Lite 250S	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

10.02 VRD Maintenance

Routine inspection and testing (power source)

An inspection of the power source, an insulation resistance test and an earth resistance test shall 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.

Note 7

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 Vin=208-230V or 460V
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 entering this location.

11.0 POWER SOURCE ERROR CODES

Description	Possible Cause	Remedy	Remarks
1 <u>E01 error code displayed</u> Temperature sensor TH1 (protects IGBTs) is greater than 80ºC for about 1 second	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	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.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E01 resets when TH1 decreases to 70ºC for about 30 seconds.
2 <u>E02 error code displayed</u> Temperature sensor TH2 (protects secondary diodes) is greater than 80ºC for about 1 second	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	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.	Weld current ceases. Buzzer sounds constantly. Fan operates at max speed. E02 resets when TH1 decreases to 70ºC for about 30 seconds.
3 <u>E03 error code displayed</u> Primary (input) current too high	A Primary current is too high because welding arc is too long. B Mains supply voltage is more than 10% below nominal voltage	A Reduce length of welding arc. B Have an Accredited Thermal Arc Service Agent or a qualified electrician check for low Mains voltage.	Weld current ceases. Buzzer sounds constantly. Switch machine off then on to reset E03 error.

	Description	Possible Cause	Remedy	Remarks
4	E11 error code displayed 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.
5	E14 error code displayed 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.
6	E12 error code displayed 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 & fuses.	Weld current ceases. Buzzer sounds constantly. Error code E12 automatically will reset when the voltage increases.
7	E81 error code displayed 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.
8	E82 error code displayed Link switch plug not connected	Link switch plug not connected	Have an Accredited Thermal Arc Service Agent check connector plug on input PCB	No weld current is available. Buzzer sounds constantly. Switch machine off.

	Description	Possible Cause	Remedy	Remarks
9	E83 error code displayed 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.
10	E93 error code displayed Memory chip (EEPROM) on control PCB can not read/write weld parameters	Memory chip (EEPROM) error	Have an Accredited Thermal Arc Service Agent check the control PCB	Weld current ceases. Buzzer sounds constantly. Switch machine off.
11	E94 error code displayed 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.
12	E99 error code displayed 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.

12.0 PARTS LIST

DWG. No.	Description	Type & Rating	QTY.	Code No.	Order No.
C1	Capacitor	ECQE12104MZ DC1250V 0.1uF	1	42422137100	10-2270
CON1	Remote Socket	206433-1 8P (with Wiring Assembly)	1	U0A706100	10-6627
D1	Diode	DFA75BA160	1	454170160	10-6735
D2	Diode	DBA200UA40	1	4582A0040	10-6687
D3	Diode	DBA200UA40	1	4582A0040	10-6687
D4	Diode	DBA200UA40	1	4582A0040	10-6687
D5	Diode	DBA200UA40	1	4582A0040	10-6687
FAN1	Fan	109E5724H507 DC 24V 16.8W	1	U0A733500	10-6839
FCH1	Inductor	F2A719500 FCH	1	F2A719500	10-6736
HCT1	Current Sensor	HC-TN200V4B15M 200A 4V	1	11251003000	10-5003
PCB1	Printed Circuit Board	WK-4914 U02 MAIN_PCB (with Insulation Sheet EBA501500) with Thunder Label	1	U0A674900	10-6737
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 U02 2ND DIODE with Thunder Label	1	U0A722000	10-6738
PCB5	Printed Circuit Board	WK-5157 U03 TIG CONTROL	1	P0A515703	10-6845
PCB6	Printed Circuit Board	WK-4920 U11 STICK	1	P0A492011	10-6739
PCB7	Printed Circuit Board	WK-4917 U04 FILTER 480V	1	P0A491704	10-6740
PCB10	Printed Circuit Board	WK-5019 U01 CAP PCB	1	P0A501901	10-6741
PCB11	Printed Circuit Board	WK-4923 U01 B RELAY PCB	1	P0A492301	10-6742

12.0 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	CM100DUS12F-1 600V 100A (with WK-5012 U01)	1	U0A705300	10-6642
S1	Switch	DCP-103SR100C-480V 3P	1	25850003700	10-6857
S2	Switch	SDKGA4-A-1-A 250V 5A	1	24704531400	10-5222
T1	Transformer	F2A767200 250A MTR HV	1	F2A767200	10-6744
T2	Transformer	F2A767200 250A MTR HV	1	F2A767200	10-6744
TH1, 2	Thermistor	ERTA53D203 20K"/25ºC B=3950K	1	U0A733300	10-6784

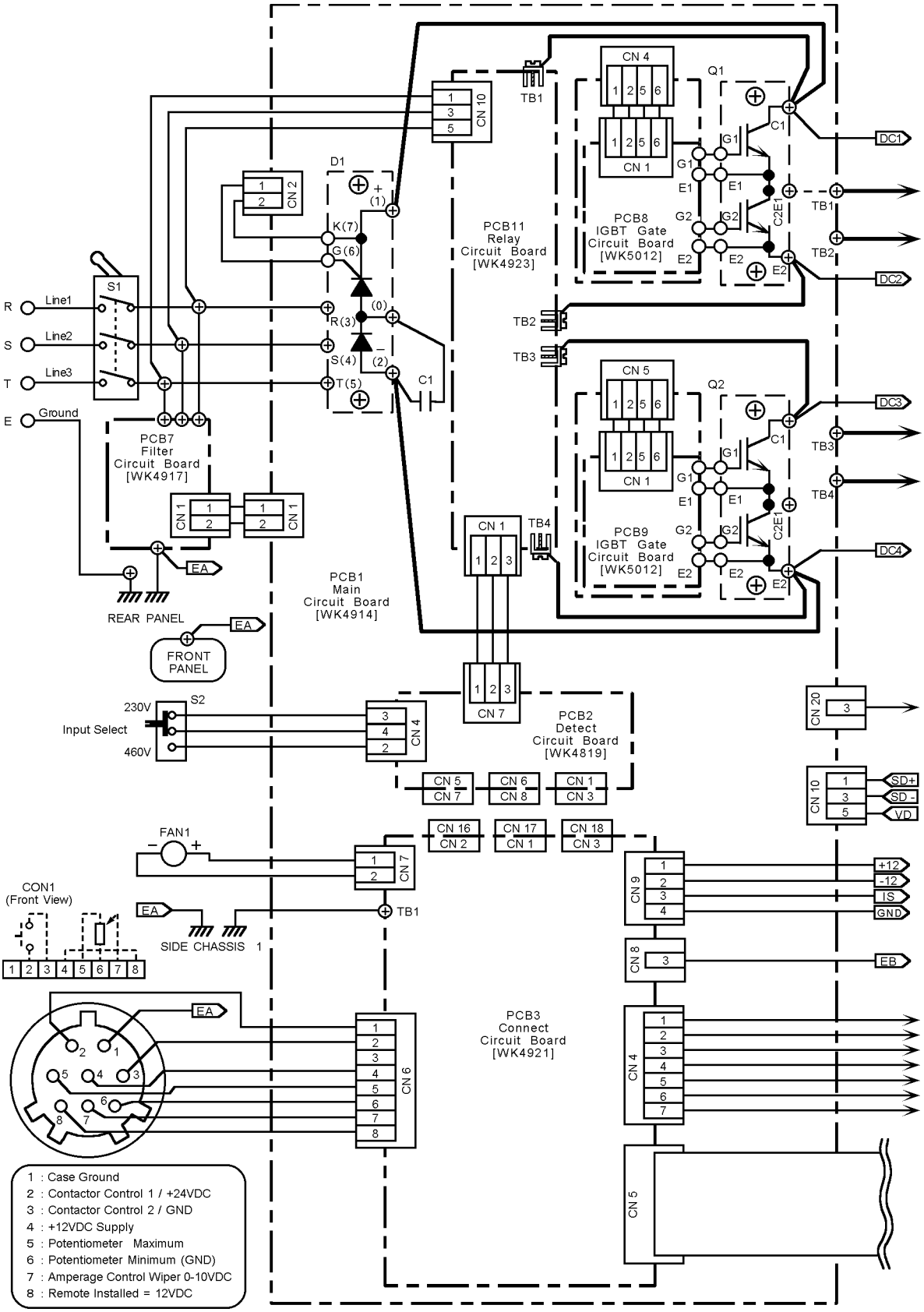
12.0 PARTS LIST Continued

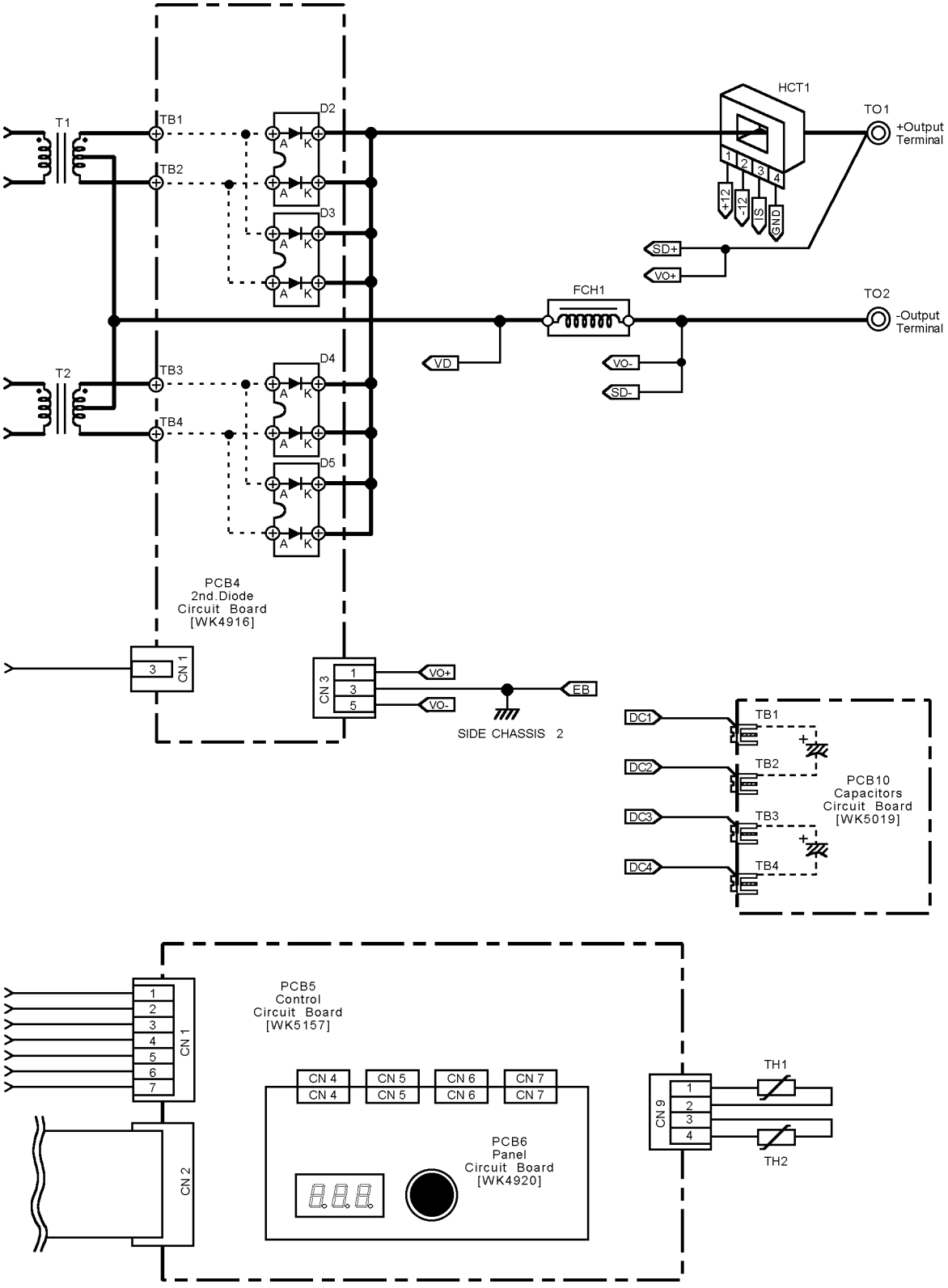
DWG. No.	Description	Type & Rating	QTY	Code No.	Order No.
	Front Panel	E0D005300	1	U0A722100	10-6648
	Rear Panel	E0D005500	1	U0A722200	10-6649
	Side Panel	E0D006100	2	E0D006100	10-6650
	Front Control Cover	J4B493400	1	J4B493400	10-6651
	Rear Control Cover	JDA173200	1	U0A722300	10-6745
	Protection Cover	E0C303200	1	E0C303200	10-6653
	Encoder Cover	EBA514400	1	EBA514400	10-6654
	PCB Cover	E1B537600 (with Caution Label)	1	U0A705600	10-6655
	PCB Sheet	EBA618000 For PCB11	1	EBA618000	10-6747
	Name Label	N4A056000	2	N4A056000	10-6746
	Side Label	N4A009200	2	N4A009200	10-6657
	Warning Label 1	N0B891300	1	N0B891300	10-5497
	Warning Label 2	N0B476400	1	N0B476400	10-5496
	Output Terminal Label	N4A040300	1	N4A040300	10-6748
	Output Terminal (female)	TRAK-BE35-70S	2	26999025900	10-6660
	Input Cable	SOOW AWG8X4C L=3.4m	1	U0A722400	REF. ONLY
	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	N0B882300	1	N0B882300	10-6749
	Flat Cable	EAA547301	1	EAA547301	10-6668

12.0 PARTS LIST Continued

DWG. No.	Description	Type & Rating	QTY	Code No.	Order No.
	Post4(M4-M4)	EBA431100	4	EBA431100	10-6670
	Post5(M4-M4)	EBA431200	8	EBA431200	10-6671
	Post6(M5-M5)	EBA431300	2	EBA431300	10-6672
	Post7(M5-M5)	EBA435900	1	EBA435900	10-6673
	Post9(M5-M5)	EBA491700	4	EBA491700	10-6750
	Post11(M5-M5)	EBA643600	3	EBA643600	10-6751
	D2-5 Bus Bar	EBA366300	1	EBA366300	10-6752
	CC Bus Bar	EBA707600	1	EBA707600	10-6753
	S1 Bus Bar	ECA321000	3	ECA321000	10-6868
	Output Bus Bar1	EBA456400	1	EBA456400	10-6754
	Output Bus Bar2	EBA456600	1	EBA456600	10-6755
	Clip	#74 NATURAL	4	606024220	10-5259
	Transformer Chassis	JCA903200	1	JCA903200	10-6678
	Right Chassis	J2C970700	1	J2C970700	10-6679
	Left Chassis	J2C970800	1	J2C970800	10-6680
	Output Terminal (male)	TRAK-SK50	2	26999025800	10-2020
	Operating Manual	K1A208600 250S	1	K1A208600	430429-506
	Service Manual				430429-516

APPENDIX A - INTERCONNECT DIAGRAM

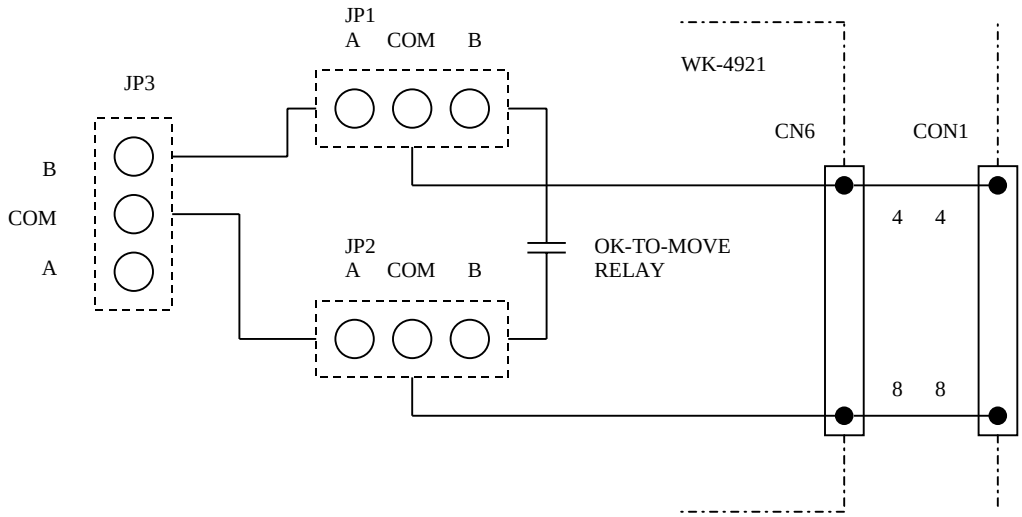



T1
TB1
TB2
D2
D3
HCT1
TO1
+Output Terminal
+12
-12
IS
GND
SD+
VO+
FCH1
TO2
-Output Terminal
VD
VO-
SD-
T2
TB3
TB4
D4
D5
PCB4
2nd.Diode
Circuit Board
[WK4916]
CN 1
CN 3
VO+
VO-
EB
SIDE CHASSIS 2
DC1
DC2
DC3
DC4
TB1
TB2
TB3
TB4
PCB10
Capacitors
Circuit Board
[WK5019]
PCB5
Control
Circuit Board
[WK5157]
CN 2
CN 4
CN 5
CN 6
CN 7
PCB6
Panel
Circuit Board
[WK4920]
CN 9
TH1
TH2

APPENDIX B - AUTOMATION

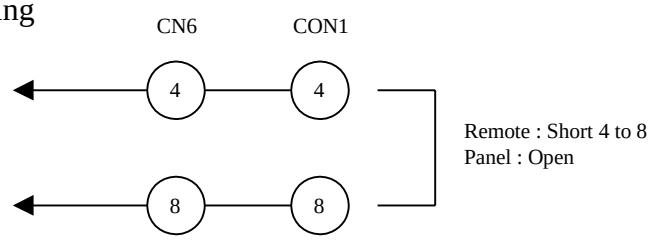
JUMPER SETTING FOR "OK–TO–MOVE". Models 250S/TS

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**.**



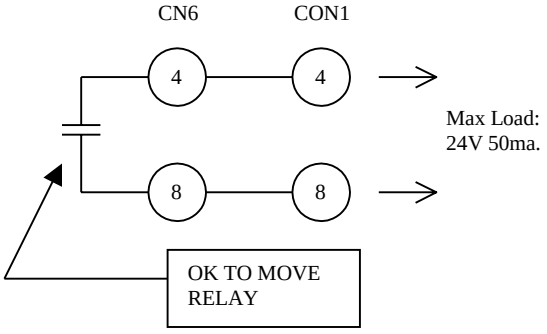
• Set All "A" position : factory shipping

	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



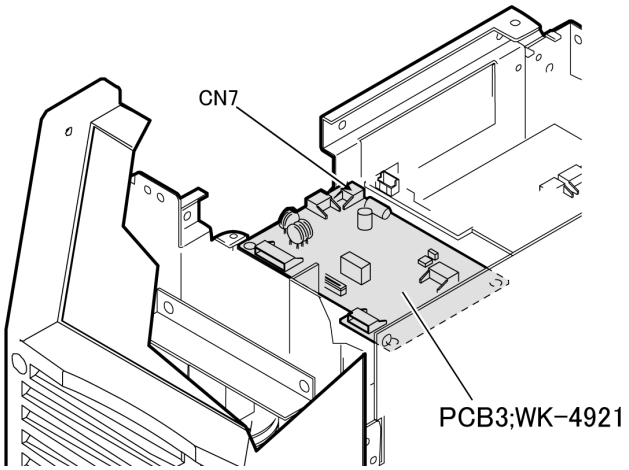


Figure 11 – Location of PCB WK-4921