Arc Products
A Lincoln Electric Company

IM 6101

March, 2012
201329-001 Rev. D

MOTORIZED SLIDE SYSTEM

! IMPORTANT !

- For Your Safety -
Read this manual before
installing or using this equipment

Safety Depends on You
Lincoln arc welding equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.

OPERATOR'S MANUAL AND SERVICE MANUAL

LINCOLN ELECTRIC

World's Leader in Welding and Cutting Products
Sales and Service through Subsidiaries and Distibutors Worldwide
Cleveland, Ohio 44117-1199 U.S.A. TEL: 216.481.8100 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

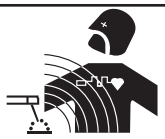
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.



ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

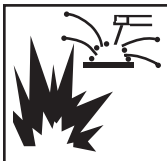
5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.



WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B " Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:
- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

THANK YOU!!!

. . . for purchasing **Arc Products** Equipment. Our commitment to you is to provide an ever expanding family of quality arc positioning equipment, controllers and accessories. Please take a moment to read the following pages as they contain important information regarding proper use of this product and of welding/cutting safety and procedures.

WHO DO I CONTACT		
For help? • Contact your distributor For additional information, such as, Technical Manuals, Service and Parts, Circuit and Wire Diagrams, User's Guides, Distributor Directories • Contact your distributor	To file a claim for loss or damage during shipment • Contact your delivering carrier For assistance in filing or settling claims, • contact your distributor and/or equipment manufacturer's Transportation Department	How to contact Arc Products: Call: 619-628-1022 Fax: 619-628-1028 E-mail: sales@arc-products.com service@arc-products.com Write: Arc Products Attn: Customer Service 1245 30th Street San Diego, CA 92154
ALWAYS PROVIDE MODEL NAME AND PART NUMBER		

Overview

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MOTORIZED SLIDE CONTROL SYSTEM

SAFETY

SAFETY PRECAUTIONS

THIS MANUAL HAS BEEN DESIGNED FOR EXPERIENCED WELDING AND CUTTING EQUIPMENT OPERATORS AND MUST BE READ COMPLETELY BEFORE USING THIS EQUIPMENT. IF YOU LACK EXPERIENCE OR ARE UNFAMILIAR WITH THE PRACTICES AND SAFE OPERATION OF WELDING AND CUTTING EQUIPMENT, PLEASE CONSULT YOUR FOREMAN. DO NOT ATTEMPT TO INSTALL, OPERATE, OR PERFORM MAINTENANCE ON THIS EQUIPMENT UNLESS YOU ARE QUALIFIED AND HAVE READ AND UNDERSTOOD THIS MANUAL. IF IN DOUBT ABOUT INSTALLING OR OPERATING THIS EQUIPMENT, CONTACT YOUR DISTRIBUTOR OR THE CUSTOMER SERVICE DEPARTMENT OF ARC PRODUCTS.

DEFINITIONS

Throughout this manual, NOTE, CAUTION, WARNING and DANGER are inserted to call attention to particular information. The methods used to identify these highlights and the purpose for which each is used, are as follows:

NOTE

Operational, procedural, and background information which aids the operator in the use of the machine, helps the service personnel in the performance of maintenance, and prevents damage to the equipment.

CAUTION

An operational procedure which, if not followed, may cause minor injury to the operator, service personnel and/or bystanders.

WARNING

An operational procedure which, if not followed, may cause severe injury to the operator, service personnel, or others in the operating area.

DANGER

An operational procedure which, if not followed, will cause severe injury or even death to the operator, service personnel or bystanders.

SAFETY INFORMATION

Safety is a combination of good judgment and proper training. Operation and maintenance of any arc welding and cutting equipment involves potential hazards. Individuals who are unfamiliar with cutting and welding equipment, use faulty judgment or lack proper training, may cause injury to themselves and others. Personnel should be alerted to the following potential hazards and the safeguards necessary to avoid possible injury. In addition, before operating this equipment, you should be aware of your employer's safety regulations.

BE SURE TO READ THIS MANUAL BEFORE INSTALLING OR USING THIS EQUIPMENT.

BE SURE TO READ AND FOLLOW ALL AVAILABLE SAFETY REGULATIONS BEFORE USING THIS EQUIPMENT.

ELECTRIC SHOCK

THE VOLTAGES PRESENT IN THE WELDING AND CUTTING ENVIRONMENT CAN CAUSE SEVERE BURNS TO THE BODY OR FATAL SHOCK. THE SEVERITY OF ELECTRICAL SHOCK IS DETERMINED BY THE PATH AND THE AMOUNT OF CURRENT THROUGH THE BODY.

A Install and continue to maintain equipment according to USA Standard C1, National Electric Code.

B Never allow live metal parts to touch bare skin or any wet clothing. Use only dry gloves.

C When welding or cutting in a damp area, or when standing on metal, make sure you are well insulated by wearing dry gloves, rubber soled shoes, and by standing on a dry board or platform.

D Do not use worn or damaged welding or torch cables. Do not overload the cables. Use well maintained equipment.

E When not welding/cutting, turn equipment OFF . Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop the cable around parts of the body.

F The ground cable should be connected to the work piece as close to the work area as possible. Grounds connected to building framework or other locations remote to the

work area reduce efficiency and increase the potential hazard of electric shock. Avoid the possibility of the welding or cutting current passing through lifting chains, crane cables or other electrical paths.

G Keep everything dry you might touch, including clothing, the work area, welding gun, torch and welding or cutting machines. Fix water leaks immediately. Do not operate equipment standing in water.

H Never use a cutting torch or welding gun which is damaged or contains cracked housing.

I Refer to AWS-Z49.1 for grounding recommendations.

SKIN AND EYE BURNS RESULTING FROM BODY EXPOSURE TO ELECTRIC-ARC WELDING AND CUTTING RAYS OR HOT METAL CAN BE MORE SEVERE THAN SUNBURN.

A Use a proper face shield fitted with the correct filter (#10 or greater) and cover plates to protect your eyes, face, neck and ears from the sparks and rays of the cutting/welding arc when cutting/welding or observing cutting/welding. Warn bystanders not to watch the arc and not to expose themselves to the cutting/welding arc rays or to hot metal.

B Wear flameproof gauntlet-type gloves, a heavy long-sleeve shirt, cuff less trousers, high-topped shoes, and a welding helmet or cap (for hair protection) to protect the skin from arc rays and hot sparks or hot metal.

C Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.

D Always wear safety glasses or goggles when in a cutting or welding area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag is hot and may travel a considerable distance. Bystanders should also wear safety glasses or goggles.

E Compressed gas cylinders are potentially dangerous, refer to the suppliers for proper handling procedures.

F Wear ear plugs or other ear protection devices when operating cutting or welding equipment.

FIRE SAFETY

HOT SLAG OR SPARKS CAN CAUSE A SERIOUS FIRE WHEN IN CONTACT WITH COMBUSTIBLE SOLIDS, LIQUIDS OR GASES.

A Move all combustible materials well away from the cutting area or completely cover materials with a non-flammable covering. Combustible materials include but are not limited to wood, clothing, sawdust, gasoline, kerosene, paints, solvents, natural gases, acetylene, propane, and similar articles.

B Do not weld, cut or perform other hot work on used barrels, drums, tanks or other containers until they have been completely cleaned. There must be no substances in the container which might produce flammable or toxic vapors.

C For fire protection, have suitable extinguishing equipment handy for instant use.

WELDING AND CUTTING FUMES AND GASES, PARTICULARLY IN CONFINED SPACES, CAN CAUSE DISCOMFORT AND PHYSICAL HARM IF INHALED OVER AN EXTENDED PERIOD OF TIME.

A At all times, provide adequate ventilation in the welding and cutting area by either natural or mechanical means. Do not weld or cut on galvanized, zinc, lead, beryllium or cadmium materials unless positive mechanical ventilation is provided to prevent inhaling fumes and gases from these materials.

B Do not weld or cut in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying operations. The heat of arc rays can react with solvent vapors to form phosgene, a highly toxic gas, and other irritant gases.

C If you develop momentary eye, nose or throat irritation during welding or cutting, it is an indication that the ventilation is not adequate. Stop work and take the necessary steps to improve ventilation in the welding or cutting area. Do not continue to weld or cut if physical discomfort persists.

D Use an air supplied respirator if ventilation is not adequate to remove all fumes and gases.

E Beware of gas leaks. Welding or cutting gases containing argon are denser than air and will replace air when used in confined spaces. Do not locate gas cylinders in confined spaces. When not in use, shut OFF the gas supply at its source.

Refer to A WS Standard Z49.1 for specific ventilation recommendations.

ADDITIONAL SAFETY HAZARDS

FIRE AND EXPLOSION

Fire and Explosion can result from placing units on, over, or near combustible surfaces.

- Do not install units on, over, or near combustible surfaces.
- Do not install unit near flammables.

FALLING EQUIPMENT

Falling Equipment can cause serious personal injury and equipment damage.

- Use lifting eyes to lift unit only, not running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift units.

- If using fork lifts to move units, be sure forks are long enough to extend beyond opposite side of the unit.

HOT PARTS

Hot parts can cause severe burns.

- Do not touch hot parts bare handed.
- Allow cooling period before working on gun or torch.

MOVING PARTS

Moving Parts can cause injury.

- Keep away from moving parts, such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.

- Keep away from pinch points, such as mechanical slides, drive rolls, carriage assemblies, etc.

MAGNETIC FIELDS CAN AFFECT PACEMAKERS

Magnetic Fields from High Currents can affect pacemaker operation.

- Pacemaker wearers should keep away.
- Wearers of pacemakers should consult their doctors before going near arc welding, gouging, plasma cutting, or spot welding operations.

WELDING WIRE

Welding wire can cause puncture wounds.

- Do not press gun trigger until instructed to do so.
- Do not point the gun toward any part of the body, other people, or any metal when threading welding wire through the gun.

FLYING PIECES OF METAL OR DIRT

Flying pieces of metal or dirt can injure eyes.

- Wear safety glasses with side shields or face shields.

OVERHEATED EQUIPMENT

High output power for long durations can cause equipment to overheat.

- Allow cooling periods.
- Reduce current or reduce duty cycle before starting to weld again.
- Follow rated duty cycle.

HIGH FREQUENCY

High Frequency can cause electrical interference.

- Take appropriate precautions to shield sensitive electronic equipment, such as computers, Programmable Logic Controllers, etc.
- Be sure to ground each component of the system to one ground point, i.e., Earth Ground (Earth) or Protective Earth (PE).

SAFETY REFERENCES

The following publications provide additional information on important welding safeguards.

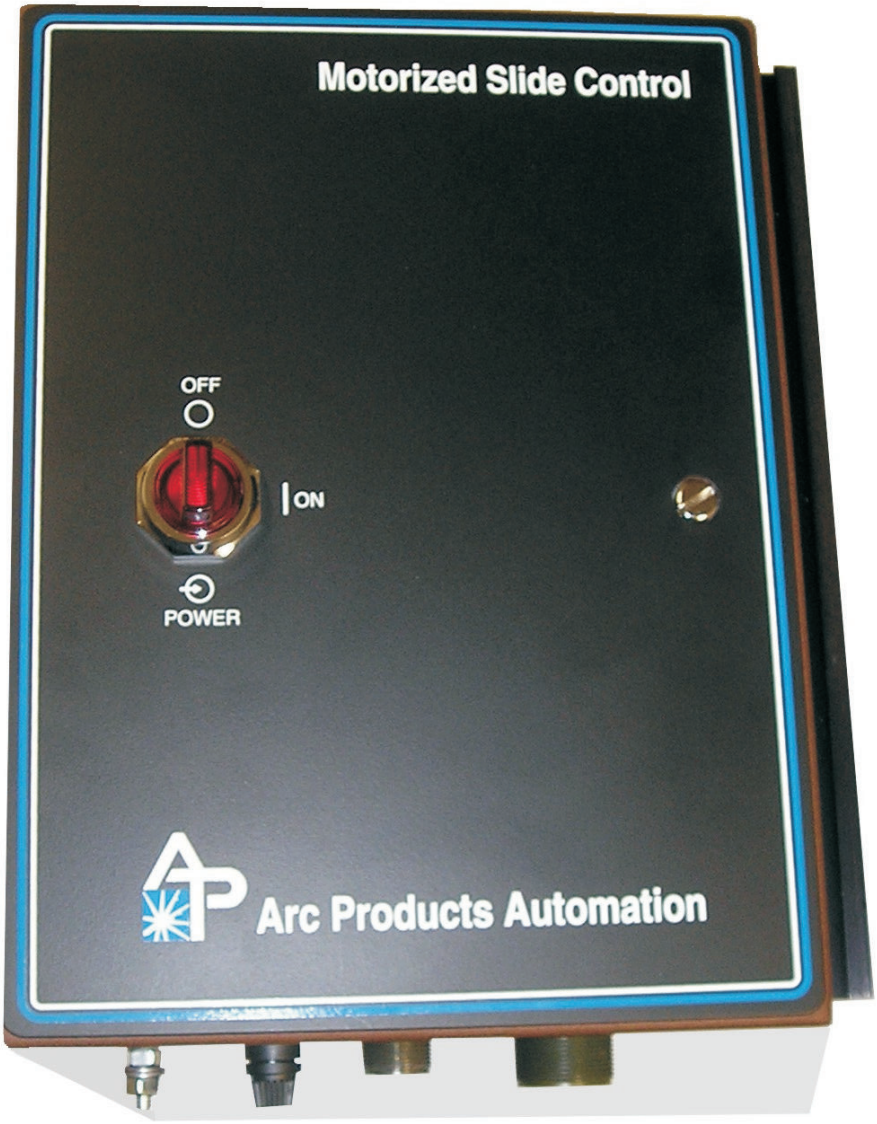
A ANSI/ASC 249.1-1988, American National Standard "Safety in Welding and Cutting".

B Bulletin No. F4-1, "Recommended Safe Practices for the Preparation for Welding and Cutting Containers and Piping that have held Hazardous Substances".

C OSHA Safety and Health Standards, 29CFR 1910, available from the United States Department of Labor, Washington, DC 20210.

D NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 00210.

E NEMA Standards Publication/No. EW1-1989, Electric Arc-Welding Apparatus, approved as ANSI C87.1-1989. Available from National Electrical Manufacturers Association, 155 E. 44th Street, New York, NY 10017.



Motorized Slide Control System

GENERAL INFORMATION

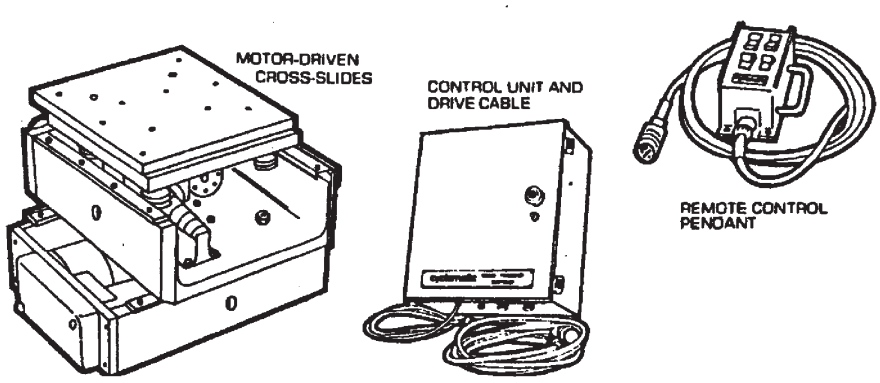


FIGURE 1 - MS40 SYSTEM COMPONENTS

TABLE 1 - MS40 SYSTEM SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	RATING
Load Capacity	6” (152 mm) from Faceplate	40 lbs. (18 Kg)
Standard Stroke Length	Vertical x Horizontal	3” (76 mm) x 3” (76 mm)
Non-Standard Stroke Length	Vertical x Horizontal	6” (152 mm) x 6” (152 mm)
Minimum Envelope	Standard Stroke 3” (76 mm) x 3” (76 mm)	12” (305 mm) Diameter
Drive System		Precision Ball Screw
Control Unit	Enclosure	Standard NEMA Style Sealed enclosure
Remote Control Pendant	Enclosure	Handheld or mounted steel enclosure containing manual
Cross Slide Cable	Standard Length	10’ (3 M)
Power Cable	Standard Length	6’ (1.8 M)
Pendant Cable	Standard Length	10’ (3 M)
Weights	Cross-slide Assembly (cable incl.)	10 lbs. (4.1 Kg)
	Control Unit (power cable incl.)	33 lbs. (15 Kg)
	Remote Control Pendant (cable incl.)	4 lbs. (1.8 Kg)

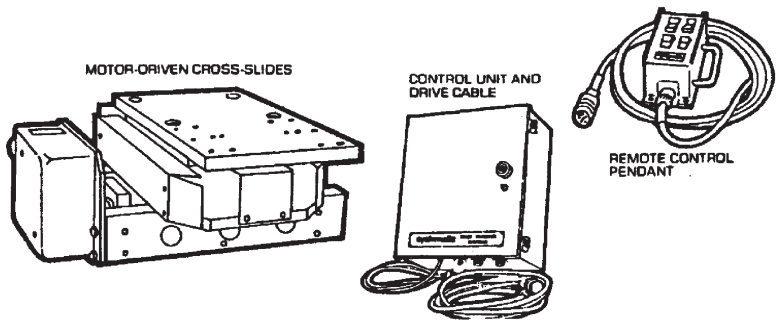


FIGURE 2 - MS250 SYSTEM COMPONENTS

TABLE 2 - MS250 SYSTEM SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	RATING
Load Capacity	12” (305 mm) from Faceplate	200 lbs. (91 Kg) Derated 15 lbs./inch (6.8 Kg/25.4 mm) beyond 12” (305 mm)
Standard Stroke Length	Vertical x Horizontal	5” (127 mm) x 5” (127 mm) or 10“ (254 mm) X 10“ (254 mm)
Non-Standard Stroke Length	Vertical x Horizontal	10” (254 mm) x 10” (254 mm) Inboard Drive Assy 24” (610 mm) x 24” (610 mm) Outboard Drive Assy
Minimum Envelope	Standard Stroke 5” (127 mm) x 5” (127 mm)	17” (431 mm) Diameter
Drive System		Precision Ball Screw
Control Unit	Enclosure	Standard NEMA Style Sealed enclosure
Remote Control Pendant	Enclosure	Handheld or mounted steel enclosure containing manual
Cross-Slide Cable	Standard Length	10’ (3 M)
Power Cable	Standard Length	6’ (1.8 M)
Pendant Cable	Standard Length	10’ (3 M)
Weights	Cross-slide Assembly (5” x 5”)	38 lbs. (16 Kg)
	Control Unit (power cable incl.)	33 lbs. (15 Kg)
	Remote Control Pendant (cable incl.)	4 lbs. (1.8 Kg)

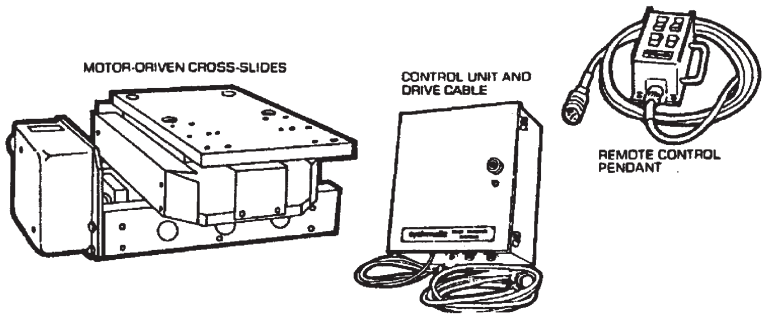


FIGURE 3 - MS450 SYSTEM COMPONENTS

TABLE 3 - MS450 SYSTEM SPECIFICATIONS

DESCRIPTION	SPECIFICATIONS	RATING
Load Capacity	12” (305 mm) from Faceplate	450 lbs. (91 Kg) Derated 45 lbs./inch (6.8 Kg/25.4 mm) beyond 12” (305 mm)
Standard Stroke Length	Vertical x Horizontal	5” (127 mm) x 5” (127 mm) or 10“ (254 mm) X 10“ (254 mm)
Non-Standard Stroke Length	Vertical x Horizontal	10” (254 mm) x 10” (254 mm) Inboard Drive Assy 24” (610 mm) x 24” (610 mm) Outboard Drive Assy
Minimum Envelope	Standard Stroke 5” (127 mm) x 5” (127 mm)	25” (431 mm) Diameter
Drive System		Precision Ball Screw
Control Unit	Enclosure	Standard NEMA Style Sealed enclosure
Remote Control Pendant	Enclosure	Handheld or mounted steel enclosure containing manual
Cross-Slide Cable	Standard Length	10’ (3 M)
Power Cable	Standard Length	6’ (1.8 M)
Pendant Cable	Standard Length	10’ (3 M)
Weights	Cross-slide Assembly (5” x 5”)	65 lbs. (30 Kg)
	Control Unit (power cable incl.)	33 lbs. (15 Kg)
	Remote Control Pendant (cable incl.)	4 lbs. (1.8 Kg)

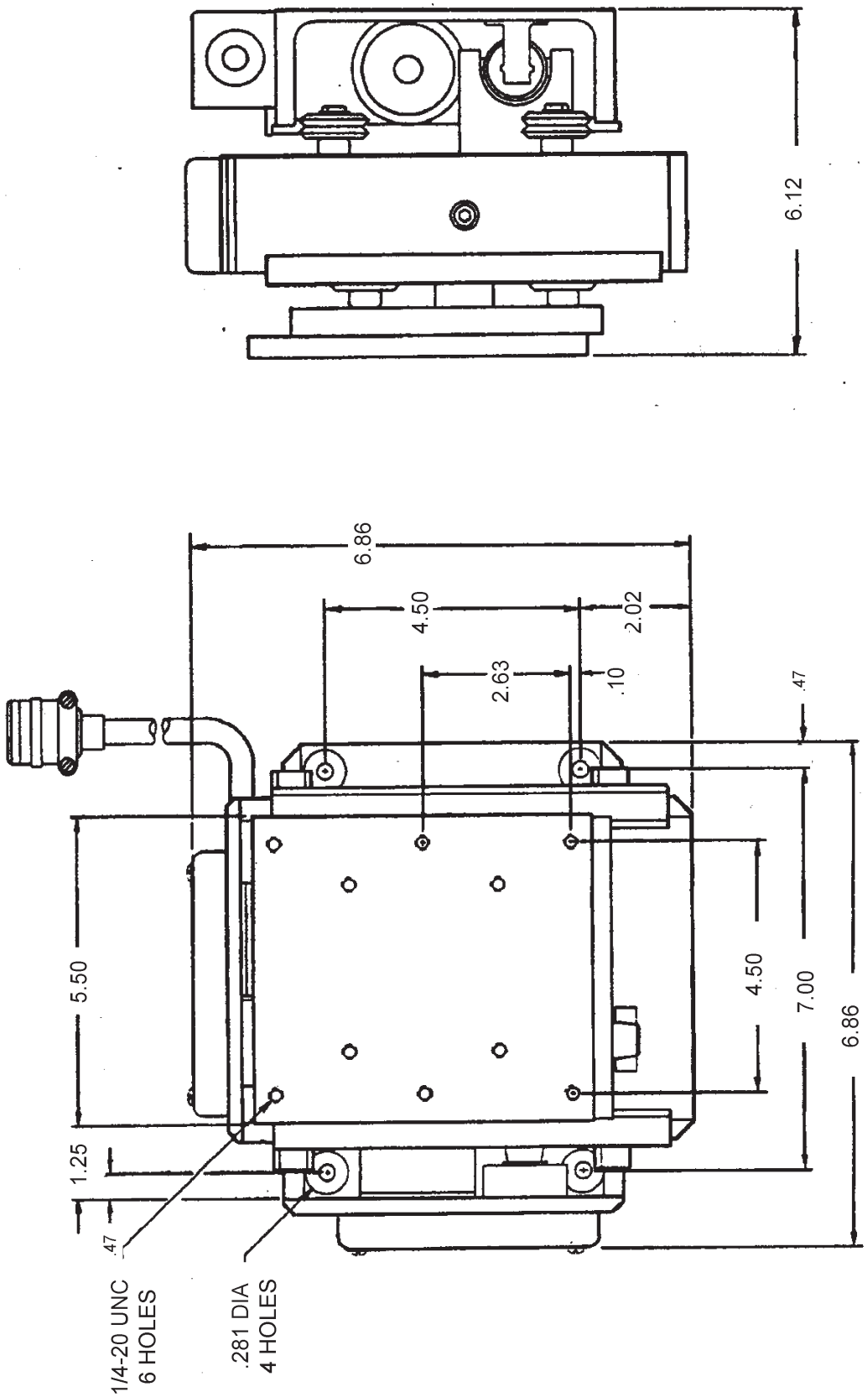


FIGURE 4 - ST40 CROSS-SLIDE MOUNTING DIMENSIONS

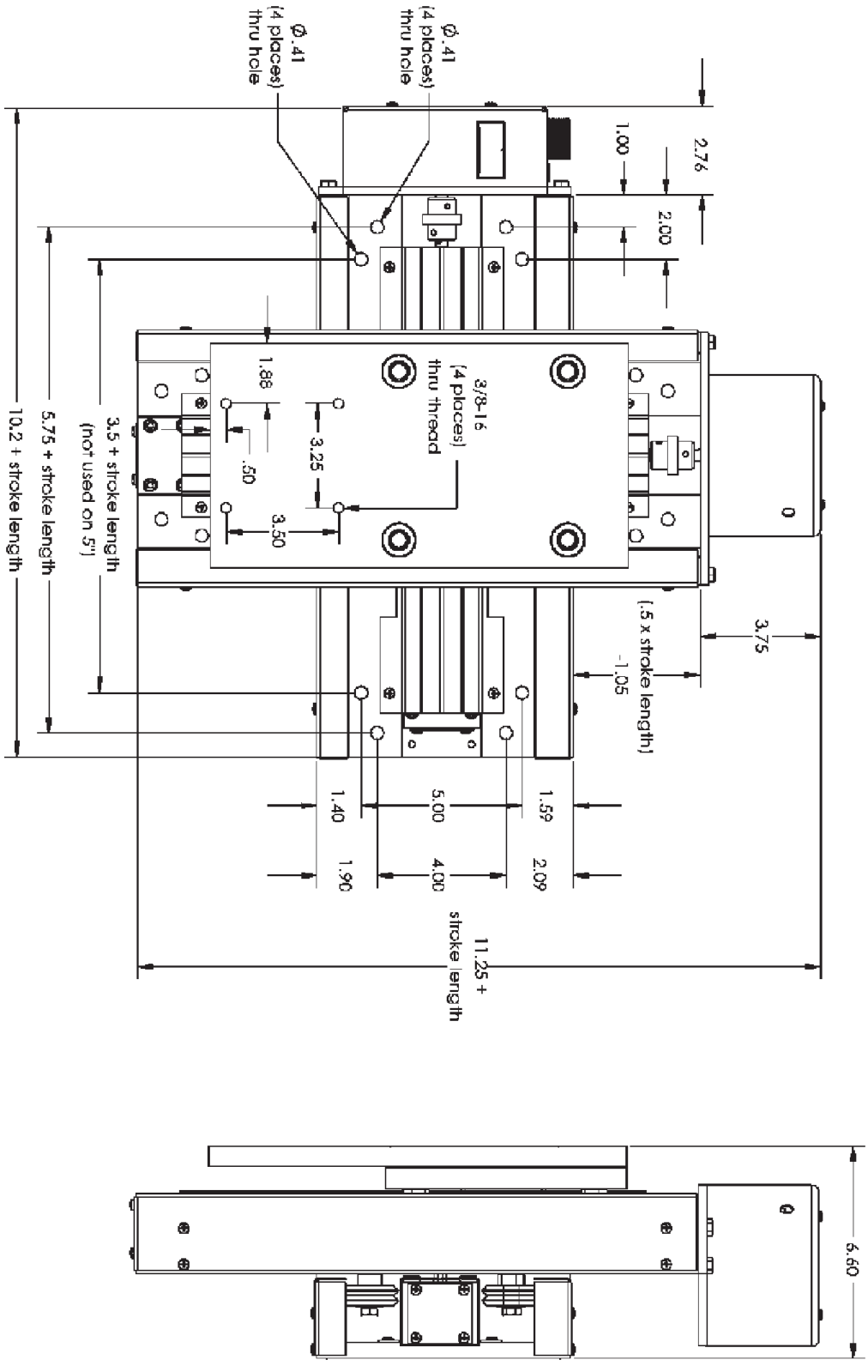


FIGURE 5 - ST250 CROSS-SLIDE MOUNTING DIMENSIONS

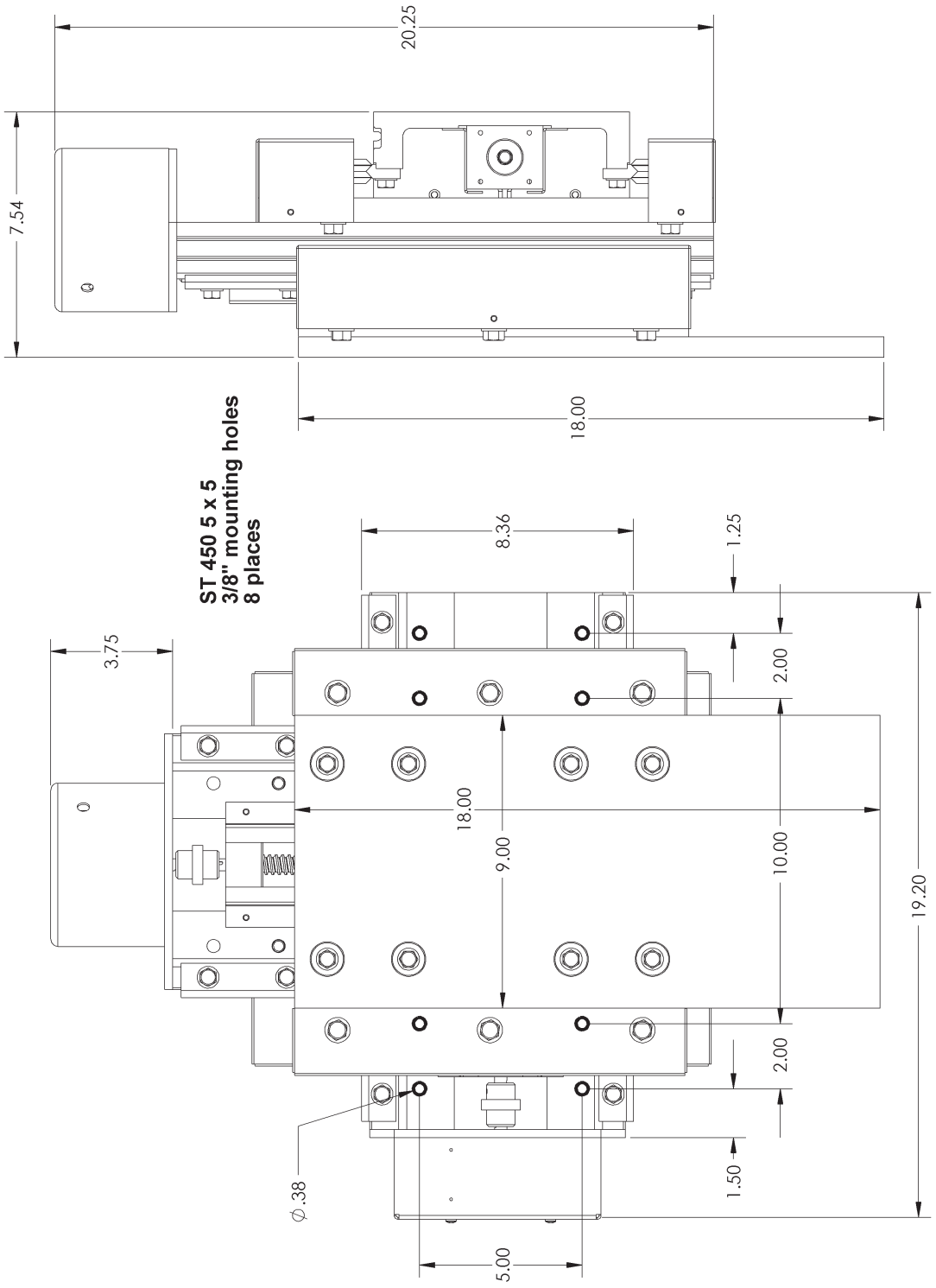


FIGURE 6 - ST450 5 X 5 CROSS SLIDE MOUNTING DIMENSIONS

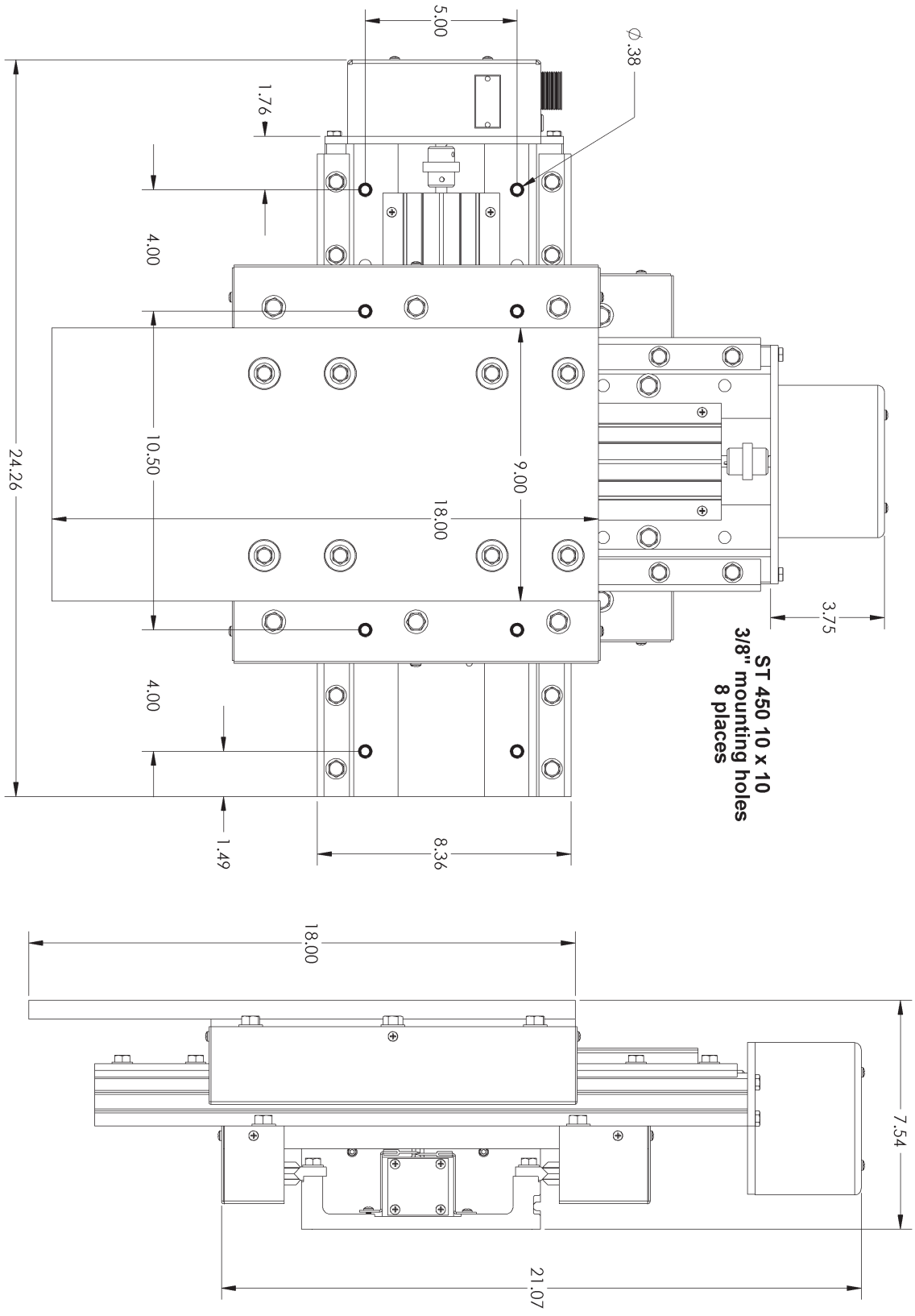


FIGURE 7 - ST450 10 X 10 CROSS SLIDE MOUNTING DIMENSIONS

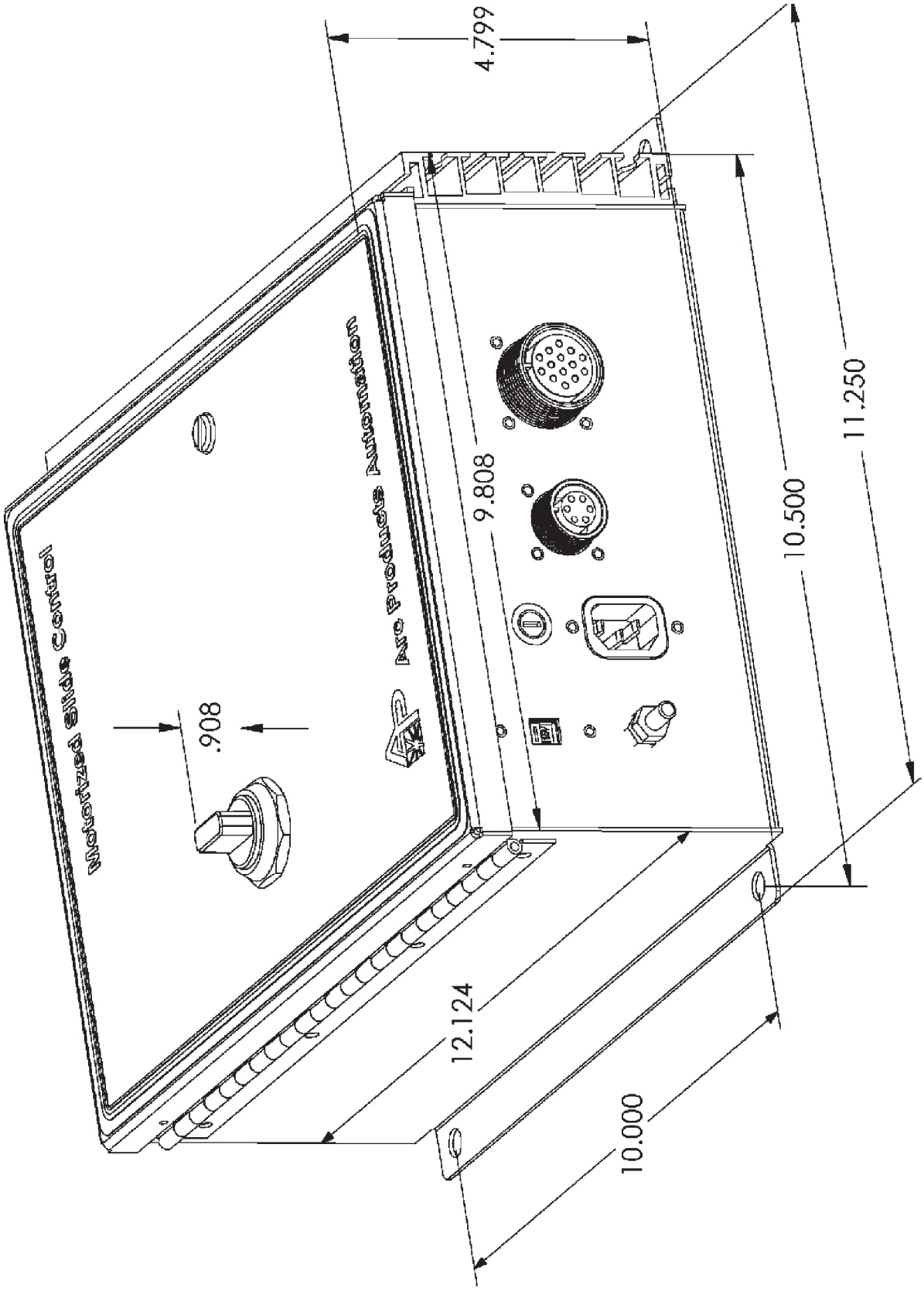


FIGURE 8 - CONTROL UNIT MOUNTING DIMENSIONS

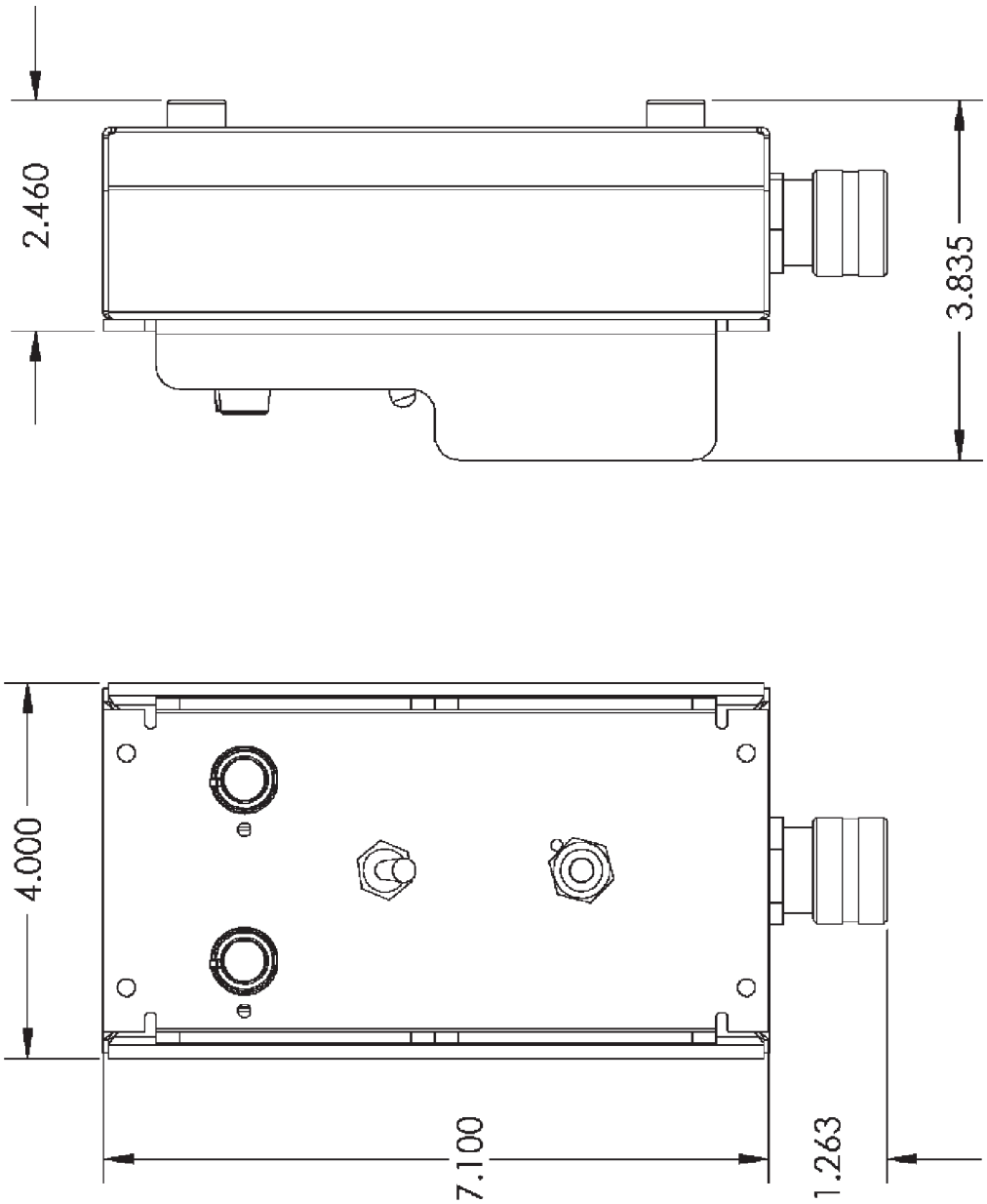


FIGURE 9 - CONTROL PENDANT MOUNTING DIMENSIONS

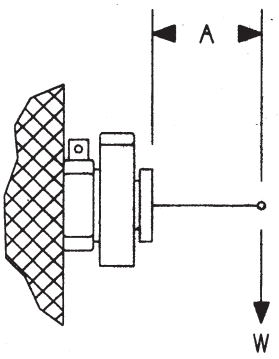


FIGURE 10 - SIDE VIEW, ST40

TABLE 4 - ST40 LOAD SPECIFICATIONS

"A" Inches	6	7	8	9
"W" lbs.	40	30	20	10
"B" Inches	6	7	8	9
"C" Inches	3	3.5	4	4.5
"D" Inches	2	2	2	2

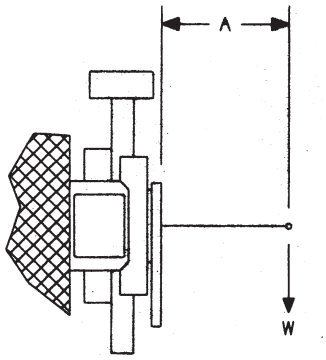


FIGURE 11 - SIDE VIEW, ST250 & ST450

TABLE 5 - ST250 LOAD SPECIFICATIONS

"A" Inches	12	16	20	24
"W" lbs.	250	190	130	70
"B" Inches	12	16	20	24
"C" Inches	4	4	4	4
"D" Inches	3	3	3	3

TABLE 6 - ST450 LOAD SPECIFICATIONS

"A" Inches	12	16	20	24
"W" lbs.	450	340	230	120
"B" Inches	12	16	20	24
"C" Inches	4	4	4	4
"D" Inches	3	3	3	3

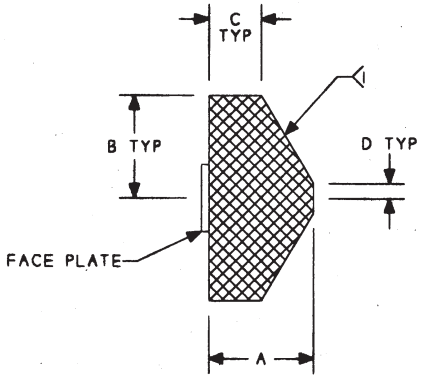


FIGURE 12 - LOAD SPECIFICATIONS ENVELOPE TOP VIEW

NOTE

1> Center of Gravity (CG) of load (W) to be within envelope.

2> ST600B Load Ratings determined with the lower axis positioned horizontally and upper axis positioned vertically.

OPERATION

DRIVE CABLE

The drive cable connects the cross-slide assembly to the control unit. It is used to transmit signals and power between the units. The standard drive cable is 10 feet long (for longer lengths, consult our factory).

CROSS-SLIDE ASSEMBLY

The seam tracker cross-slide assemblies are light weight compact designs consisting of two motorized linear slides mounted at right angles to provide X-Y axis positioning. Guidance along each axis is accomplished through the use of ball bearing vee wheels riding on hardened steel tracks which are in turn mounted to thick wall aluminum channel sections forming the basic structure.

Wheels and tracks are factory adjusted to remove play and provide smooth uniform motion along the full stroke. A DC gear motor coupled to a drive screw provides linear motion along each axis. The drive screws are ball bearing mounted. Damage to the motors and control unit is minimized because of current / voltage limits set in the control unit should the unit reach the end of stroke. However, care should be taken to reduce or eliminate the controller from continuing to command the drive in a stalled condition at end stroke end.

The Motorized Slide control system's model numbers indicate the acceptable load rating of the cross-slide assembly, e.g., MS40 is rated at 40 lbs. Load (see Table 1 - MS40 System Specifications and Table 5 - ST250 Load Specifications beginning on page 12).

Some cross slide models, such as the ST250, include a brake mounted on the vertical motor shaft. With power removed either by switching power off or disconnecting the control cable, the brake is actuated and prevents creep in the slides when heavy loads are applied. In some cases special adjustment may be required (see Troubleshooting Section).

Electrical connections are made at the junction box or the motor cover mounted to the lower slide depending on the model. Connectors are provided for attaching the control.

An adapter plate is furnished which mounts to the face plate of the cross-slides. Insulation is provided between the face plate and adapter plate. Holes can be added to the adapter plate for mounting wire feeder, weld head, torch, wire spool, etc. Optional mounting bracketry is also available on certain models.

CONTROL PENDANT AND CABLE ASSEMBLY

The Motorized Slide control pendant has two ptoentiometers, a toggle switch and one sealed joystick switch mounted in an aluminum housing suitable for handheld or mounted operation. The deescriptions of each component are:

Potentiometer

- Vertical Speed Adjustment
- Horizontal Speed Adjustment

Toggle Switch

Maximum Speed or Adjustable Speed adjustment Selector Switch.

Joystick Switch

- MANUAL (Up/Down) and (Left/Right)

The control pendant connects to the control unit with a 10 foot standard cable attached.

SPECIAL LENGTH CABLE ASSEMBLIES

Special length cables and extension cables can be made to order for the control pendant to the control unit in lengths to 60 feet and for the cross-slide assembly to the control unit up to 95 feet.

NOTE

Long length, non-standard cables normally require heavier gauge conductors to reduce voltage drop. Consult factory before making cable length changes from standard as system performance may be affected.

INSTALLATION

INFORMATION

ALL INSTALLATIONS TO BE MADE WITH AC POWER OFF.

A typical APA Motorized Slide system interconnection diagram is shown in on page 6. The major system components are listed below. When unpacking, check all items for damage and make certain nothing is missing.

- Seam Tracker Cross-Slide Assembly
- Adapter Plate
- Drive Cable
- Control Pendant
- Control Unit
- Manual
- Power Cord

All required lubrication has been performed at the factory and needs no further attention at this time. The interconnecting cables are standard length; however, other lengths may be ordered, if needed.

CROSS-SLIDE ASSEMBLY MOUNTING

APA Cross Slide models ST40 (Figure 4 - ST40 Cross-Slide Mounting Dimensions on page 6), ST250 (Figure 5 - ST250 Cross-Slide Mounting Dimensions on page 7) and ST450 (Figure 6 - ST450 5 x 5 Cross Slide Mounting Dimensions) outline drawings show the size and location of the holes for mounting the unit in any required position. The mounting surface must be nearly flat to assure that no twist will be applied to the base of the slide assembly when it is bolted down, causing a bind in operation.

Also, the mounting surface must be rigid to prevent movement or vibration of the unit during operation. For proper operation, the slide assembly must be oriented correctly with respect to the weld. The lower (horizontal) axis is mounted parallel to the plane of the weld, and the upper (vertical) axis is mounted perpendicular to the plane of the weld (see on page 6).

Once the cross-slide assembly has been mounted, make certain that adequate clearance is maintained between the moving slides and any protrusion that could restrict the full travel of the slides or interfere with the movement of the electrical cable.

CONTROL PENDANT INSTALLATION

The seam tracker control pendant is constructed from a rugged steel housing with mounting brackets (see Figure 9 - Control Pendant Mounting Dimensions on page 11). The control pendant has a standard cable length of 10 feet. Special cable lengths are available upon request.

Complete control of the seam tracker system is achieved through the sealed rocker switches which are in the cover of the control pendant. Manual operation of the vertical and horizontal axes, sidetrack to the right or left and automatic control, as well as the Advance Programming Control option plug-in for the Seam Tracker, are handled with the control pendant assembly.

CONTROL UNIT INSTALLATION

On page , shows the size and location of holes for mounting the control unit in the proper position. It should be located for ready access to the power switch and allow clearance for opening the hinged door. This allows for inspection, replacement of parts or installation of the Advanced Programming Control components, when necessary.

Another important consideration is to make certain that the control unit has unrestricted air flow over the cooling fins to assure adequate cooling during operation.

A chassis ground lug is located near the power cord/RFI Filter connection. Care must be taken that this be connected to a solid earth ground (Protective Earth or PE) in a high noise environment. All system components except the seam sensor and control pendant are connected to chassis ground through cable shields.

WELD HEAD INSTALLATION

Weld head installation is made by bolting the weld head to the cross-slide assembly adapter plate. This plate can have additional holes drilled to accommodate the users weld head, as required. The user must ensure that any added holes or hole patterns permit proper orientation of the weld head and torch axis to the drive axis. Review on page 6 prior to assembly of the weld head to the adapter plate, and before drilling any additional holes.

SYSTEM INTERCONNECTION

Once the cross-slide assembly and control unit are properly mounted, the cables can be connected for operation. On page , shows connector arrangement on the control unit. Connect the control pendant to J1 on the control unit. The drive cable connects to J2.

NOTE

Model ST40 drive cable is permanently attached to the slide assembly. On all other models it is a separate cable assembly which also has a connector at the slide.

WARNING

For your own safety and to ensure proper operation of this equipment, read this manual and all operating precautions before operating the equipment.

With the power off:

a) Read this entire Operator's Manual prior to operation of the APA Seam Tracker System.

b) Be sure that adequate eye protection and

ventilation is provided in the vicinity of the welding area.

Be sure that all insulators and protective covers on the torch and torch lead connections are in place.

Check the following connections on the motorized slide system:

- Control Unit to Cross-Slides
- Control Pendant

Insure that all are properly installed prior to applying power to the control unit.

Insure all cables are of adequate length and clear of moving parts to prevent possible damage during operation.

DURING OPERATION

Keep fingers, hands, etc. away from the cross-slides during operation of the seam tracker.

NOTE

When unit is on and in manual mode, downward drift may occur under heavy load conditions. Directions for correcting this condition can be found in the Troubleshooting section.

DURING MECHANICAL ADJUSTMENTS

Ensure that the AC power is disconnected from the control unit to prevent possible shock when adjusting the control unit, and accidental operation of moving parts being adjusted.

DURING ELECTRICAL ADJUSTMENTS

Do not disconnect connectors or remove circuit boards when the power is connected at the control unit.

INITIAL SET-UP INSTRUCTIONS

To take full advantage of slide assemblies stroke capability, the cross-slide assembly should be positioned at the center of both horizontal and vertical strokes. Weld torch mounting should be such that it is approximately in its nominal welding position relative to the weld joint. This then allows for error compensation in all directions during welding. There are exceptions to this, however.

For example, you may want the majority of the vertical stroke to be available for manually driving the slides upward and clear of the part after welding for inspection, part removal and insertion of a new part.

OPERATING SEQUENCE

Operations

Operating the system is controlled by the user at the control pendant. The user selects the speed of slide adjustment for both vertical and horizontal modes and, using the joystick, positions the slide at the desired location. A provision is also given to allow the system to travel at maximum speed if needed, by selecting the appropriate position on the toggle switch.

These switches are momentary switches and will cause the indicated movement to occur only when depressed and held. Release of the switch causes the movement to stop.

The Speed Range Toggle switch is not momentary and selects the Maximum Speed or Adjustable speed for both Horizontal and Vertical movement.

MAINTENANCE

MAINTENANCE REQUIREMENTS

APA Motorized Slide Systems are designed for trouble-free operation and normally require only minimal preventive care and cleaning. This section of the users manual provides instructions for maintaining user serviceable items. The suggested repair procedure for all user serviceable items is to remove and replace defective assemblies or parts. Service personnel employed by the user should be familiar with electrical and electronic equipment or else service problems should be corrected by factory authorized representatives.

CONTROL UNIT ASSEMBLY

The control unit assembly (on page) consists of an enclosure housing the major electronic assemblies of the seam tracker system. Maintenance is generally limited to periodic dusting of the enclosure. The user should ensure that the unit is not operated with the access door open and/or option plates and cable connector mounting holes open. The user should exercise caution in operating the unit if it has been inadvertently exposed to excessive dust or liquid contamination, since such conditions may cause electrical shorting and/or malfunctioning of the electrical/electronics assemblies. The user should consult with the factory if such conditions have occurred. Repair of the control unit assembly is generally limited to a remove and replace operation.

NOTE

If the user should decide to repair unauthorized items, then the user should exercise caution when repairing the control unit subassemblies and printed circuit boards, since these repairs can void the warranty.

WARNING

When repairing the control unit assembly, disconnect A.C. power from the unit before opening the access door and turn the power switch to OFF.

Assemblies and parts which are authorized for user replacement are listed in Table 12 - Motorized Slide Control Parts List on page 33. Replacement should be performed after the user has determined that the part or assembly to be replaced is the cause of a system problem (see Troubleshooting on page 43).

Replacement of the fuse does not require access to the housing interior; however, the blowing of the fuse may indicate other system problems. The fuse is replaced by unscrewing the fuse holder lid, removing and replacing the blown fuse with a new fuse. Then restore power and turn On system to perform a test run.

Replacement of the printed circuit board, the Main board, involves disconnecting the connectors to the board, removing the mounting screws, and replacing the Main board with another.

The service person should exercise care in removing the Main board to ensure that excessive force is not placed on the connectors or components on the board and that the mounting screws are not over tightened.

The Main board is held by eight screws to stand-offs mounted in the enclosure. Disconnect all necessary cabling at the connection plugs provided. Remove the mounting screws and the Main board. Install another Main board and tighten the mounting screws until snug; do not over tighten as damage to the board and enclosure standoffs may result.

Replacement of heatsink assembly is accomplished by the removal of six screws and the disconnection of the appropriate connectors. Replace with a working assembly. Individual transistors may be replaced by removing two screws and the defective part (easiest if heatsink is out of the control unit.) The replacement part may then be installed in the existing socket provided, using heatsink compound (Thermal Compound) on the transistors to ensure good heat transfer and long life. Secure the replaced transistors with the two screws.

Replacement of other user serviceable items is to be performed according to normal maintenance and repair standards, usually involving the removal of mounting hardware, unplugging the old unit, mounting the replacement part and reconnecting the connectors.

CONTROL PENDANT AND CABLE ASSEMBLY

Maintenance of the control pendant and cable assembly is to periodically remove dust, soot, metal particles, slag, etc., from the face plate.

Repair of the control pendant and cable assembly is limited to replacement of defective units (see Figure 18 - Control Pendant Exploded View on page 34). A wiring diagram includes control pendant schematics for troubleshooting purposes (see Figure 26 - Pendant Schematic on page 49).

CROSS-SLIDE ASSEMBLY

The cross-slide assembly should be maintained by periodic inspections for worn moving parts (e.g. ball screws, couplings, magnetic brakes). Further maintenance includes removing excess dust, weld slag, soot, etc., from the assemblies. If any connectors or parts are damaged during operation, the defective parts should be replaced as soon as practical.

Repair of the cross-slide is limited to the replacement of defective parts and adjustment of the Dual-Vee Guide Rails to remove play between wheels and rails.

Exploded views of the cross-slides in Figures 14, 15, and16 and their parts lists in Tables 7, 8 and 10 are provided to aid in parts ordering and replacement beginning on page 22. The Dual-Vee Guides are adjusted by loosening their retaining screw, adjusting, and re-tightening the screws.

PREVENTIVE MAINTENANCE SCHEDULE

The following schedule is provided to assist in preforming timely maintenance to the system to maintain optimum performance from the system.

Monthly Maintenance

Cross Slides

Proper Function

Verify that the cross-slide assembly travels the full length of its stroke on each axis. Also, it should freewheel at each end of its axis.

Test

Check for axial play on each axis.

Step # 1 - Center the Slides

Position slides in the center of their strokes. Put one hand on the motor assembly (on the left hand slide of the horizontal (lower) axis on most cross slides). Using your other hand, push the cross-slides face plate/adaptor plate toward the motor and then pull it back away from the motor assembly. If no play is felt, go on to step # 2.

If you feel any play on the lower axis; notice the drive screw; if it moves back and forth (not spinning), the assembly needs shimmed.

Step # 2 - Check for Play, Horizontal

If the drive screw does not move back and forth, try to spin the dual-vee wheels without the slide moving. If they do not spin, go to step # 3.

If both the wheels do not spin and the drive screw does not move back and forth and there is still play in the lower axis, the drive screw is showing wear and may need to be replaced.

Step # 3 - Check for Play, Vertical

Check the vertical (upper) axis, using the same procedure starting with Step # 1.

Quarterly Maintenance

Control Unit Assembly

Be sure the control unit is turned off and unplug. Using clean, dry air blowout dust from the inside of the control unit.

Be sure all other connections in the control unit are seated firmly in their receptacles and reconnect the power cord to an electrical outlet. Turn power on and check for proper operation.

SERVO AMPLIFIER CIRCUITRY CALIBRATION

This procedure describes the calibration techniques needed to for regular maintenance. This is useful and may become necessary to perform when a motor or heatsink transistor is replaced. When these components are replaced during troubleshooting or regular maintenance, the feedback to this circuitry also changes, making this calibration necessary.

Tolls Required

Digital Volt-Meter (DVM) capable of reading 3 places to the right of the decimal point.

Oscilloscope

Step # 1 - Adjust HI and VI Full Clock-Wise

Adjust the Servo Amplifier Circuitry trim-pots Horizontal Current (HI) and Vertical Current (VI) full Clock-Wise.

Step # 2 - Monitor TP2 and TP5

Monitor the + 15 VDC (TP2) and - 15VDC (TP5) test points on main board with a digital volt-meter to verify voltage in and out of Servo Amplifier Circuitry on the main board. Use test point TP3 (GND) as reference for the volt-meter.

Step # 3 - Connect the Oscilloscope to R5

Connect an oscilloscope to the Vertical Error signal location at R5.

Step # 4 - Verify Reading

Observe on oscilloscope approximate 0 VDC.

Step # 5 - Adjust VI Trimpot Counter Clock-Wise

Adjust the Vertical Current (VI) Trim-pot Counter Clock-Wise (CCW) until signal on the oscilloscope begins to oscillate.

Step # 6 - Adjust VI Trimpot Clock-Wise

Slowly adjust the Vertical Current (VI) Trim-pot Clock-Wise (CW) until the oscillation just stops, then adjust the trim-pot CW an additional four (4) turns.

Step # 7 - Verify Reading

On the pendant, move the joystick switch up and observe the vertical slide moving up and observe on oscilloscope approximately + 15 VDC.

NOTE

Some ripple may be seen, this is typical

Step # 8 - Repeat Step 7

Perform the same function as in Step # 7, but only in the down position on the joystick. Observe the vertical slide moves down and observe on the oscilloscope, approximately -15 VDC.

NOTE

Some ripple may be seen, this is typical.

Step # 9 - Verify Reading and No Movement

Release the joystick on the pendant and observe approximately 0 VDC on the oscilloscope and observe on the cross-slides, no drive movement.

Step # 10 - Connect the Oscilloscope to R8

Connect an oscilloscope to the Horizontal Error signal location at R8 and observe approximately 0 VDC.

Step # 11 - Adjust HI trimpot Counter Clock-Wise

Adjust the Horizontal Current (HI) Trim-pot Counter Clock-Wise (CAW) until signal on the oscilloscope begins to oscillate.

Step # 12 - Adjust HI Trimpot Clock-Wise

Slowly adjust the Horizontal Current (HI) Trim-pot Clock-Wise (CW) until the oscillation just stops, then adjust the trim-pot CW an additional four (4) turns.

Step # 13 - Verify Reading

On the pendant, move the joystick switch right and observe the horizontal slide move right and observe on the oscilloscope observe approximately + 15 VDC.

NOTE

Some ripple may be seen, this is typical.

Step # 14 - Repeat Step 13

Perform the same function as in Step # 13, but only in the left position on the joystick. Observe on the oscilloscope approximately - 15 VDC and observe the horizontal slide moving to the left.

NOTE

Some ripple may be seen, this is typical.

Step # 15 - Verify Reading and No Movement

Release the joystick on the pendant and observe approximately 0 VDC on the oscilloscope and observe on the cross-slides, no drive movement.

This completes the Servo Amplifier Circuitry on the main board.

DRAWINGS AND PARTS LISTS

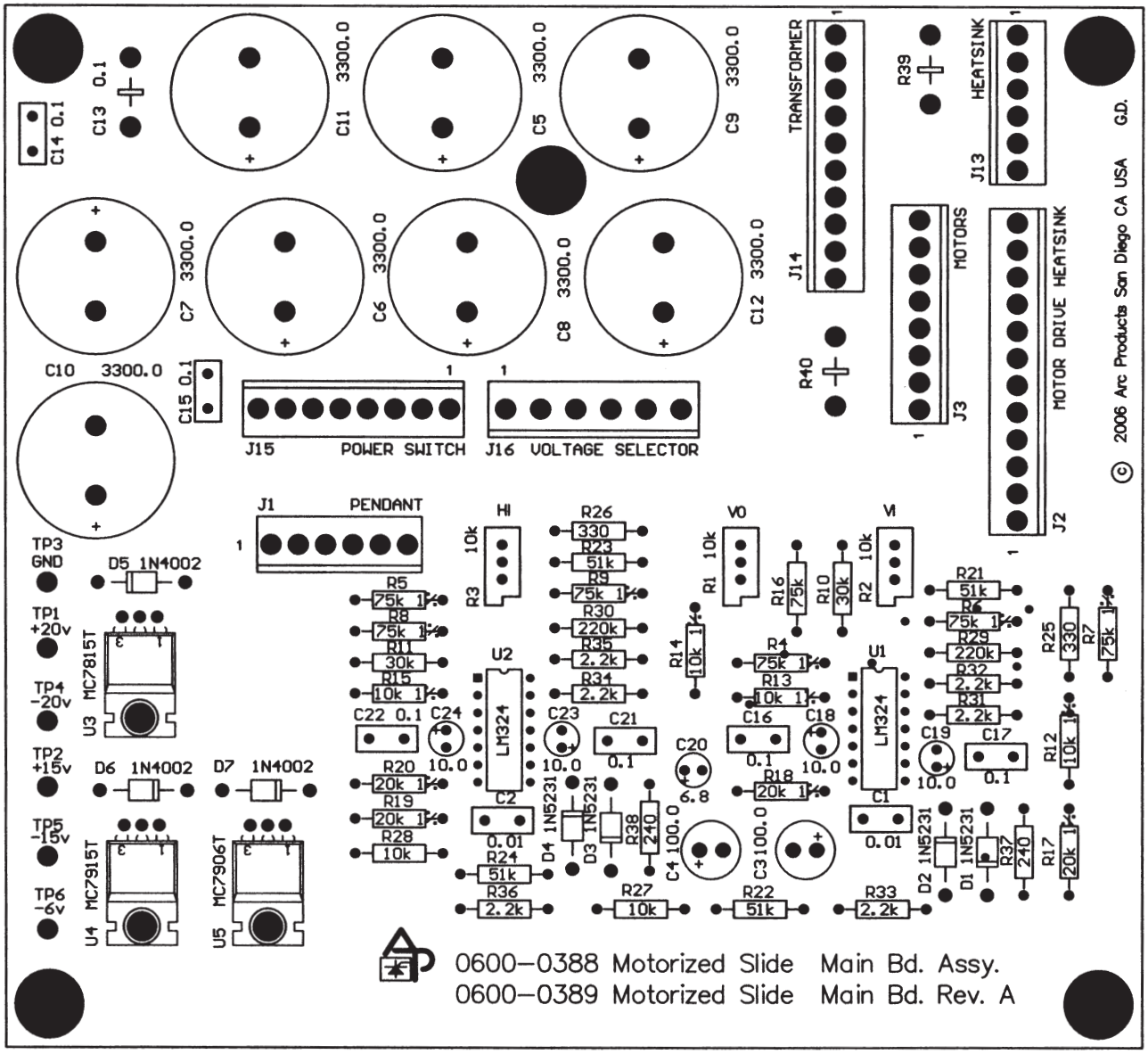


FIGURE 13 - MOTORIZED SLIDE CONTROL MAIN BOARD LAYOUT

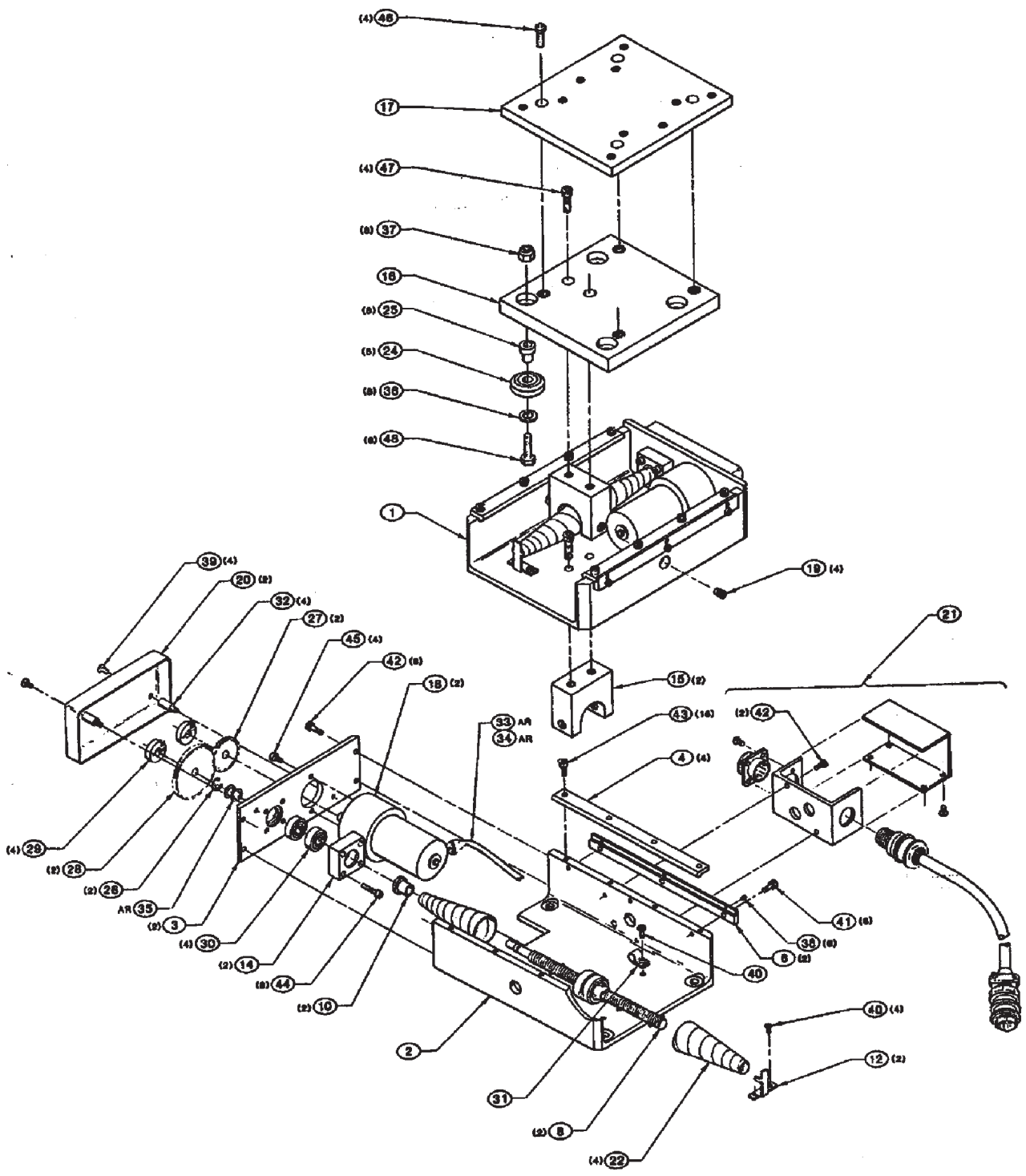


FIGURE 14 - ST40 CROSS-SLIDE EXPLODED VIEW

TABLE 7 - ST40 CROSS-SLIDE PARTS LIST

ITEM #	QPA	UM	PART # 3" X 3"	PART # 6" X 6"	DESCRIPTION
1	1.000	EA	1110-0007	1110-0066	BASE UPP-ST40
2	1.000	EA	1110-0015	1110-0074	BASE LWR ST40
3	2.000	EA	1110-2310	1110-2310	PLATE END - ST40
4	4.000	EA	1116-0000	1116-0034	SEAM TRACKER RAIL - ST40
6	2.000	EA	1110-0121	1110-0155	BAR RAIL ADJ
8	2.000	EA	1116-0042	1116-0077	ASSY SCR ACTR ST40
10	2.000	EA	1110-0180	1110-0091	COVER RETAINER - ST40
12	2.000	EA	1112-0008	1112-0016	COVER RETAINER
14	2.000	EA	1110-0198	1110-0198	BEARING HOUSING ST40A
15	2.000	EA	1110-0210	1110-0210	NUT HOUSING-ST40A
16	1.000	EA	1110-0171	1110-0171	FACEPLATE - ST40
17	1.000	EA	1110-0236	1110-0236	ADAPTER PLATE ST40
18	2.000	EA	1117-0587	1117-0587	MOTOR-ST40
19	4.000	EA	1116-0115	1116-0115	SET SCR HALF DOG - MOD
20	2.000	EA	1116-0107	1116-0107	COVER GEAR - ST40
21	1.000	EA	1106-0048	1106-0048	JUNCTION BOX ASSY - ST40
22	4.000	EA	2000-0015	2000-0058	COVER TELESCOPING .50 X 1.0 X 3.5 STRK
24	8.000	EA	2360-0552	2360-0552	WHEEL GUIDE DUAL VEE #2
25	8.000	EA	2360-0226	2360-0226	BUSHING ADPTR STNRY ¼ X 9/16 L
26	2.000	EA	2416-0157	2416-0157	RING RTNG-BOWED "E" RING .025 THK
27	2.000	EA	2320-0139	2320-0139	GEAR SPUR 36T 32P
28	2.000	EA	2320-0147	2320-0147	GEAR SPUR 60T 32P SS
29	4.000	EA	2040-0544	2040-0544	GEAR CLAMP SPLIT HUB
30	4.000	EA	2320-0112	2320-0112	BEARING BALL
31	1.000	EA	989009-004	989009-004	CLAMP CABLE 1/8 ID
32	4.000	EA	981007-003	981007-003	STDOFF M/F 6-32 X .250 X .562 LG A
33	AR	EA	933001-105	933001-105	SHRINK TUBING 3/16 PVC BLK
34	AR	EA	974031-103	974031-103	WSR F .505 X .317 X .005 SBZ
36	8.000	EA	974005-006	974005-006	WSR, F ¼ .468 X .255 X .032 SBZ
37	8.000	EA	972014-008	972014-008	NUT, 1/4-20 H SS NL
38	6.000	EA	970043-300	970043-300	SCR SET 6-32 X .12 HHC SBZ
39	4.000	EA	970000-302	970000-302	SCR 6-32 X .25 CR1P SBZ
40	5.000	EA	970000-402	970000-402	SCR 8-32 X .25 CR1P SBZ
41	6.000	EA	970015-306	970015-306	SCR 6-32 X .50 HSC SBZ
42	10.000	EA	970015-404	970015-404	SCR 8-32 X .38 HSC SBZ
43	16.000	EA	970015-406	970015-406	SCR 8-32 X .50 HSC SBZ
44	8.000	EA	970015-410	970015-410	SCR 8-32 X .75 HSC SBZ
45	4.000	EA	970015-502	970015-502	SCR 10-32 X .25 HSC SBZ
46	4.000	EA	970015-604	970015-604	SCREW 1/4-20 X .38, HSC SBZ
47	4.000	EA	970015-608	970015-608	SCR 1/4-20 X .62 HSC SBZ
48	8.000	EA	970039-616	970039-616	SCR 1/4-20 X 1.25H SBZ G8
49	1.000	EA	932009-005	932009-005	LUG SOLDER #8 X 5/8 FLT LCKG

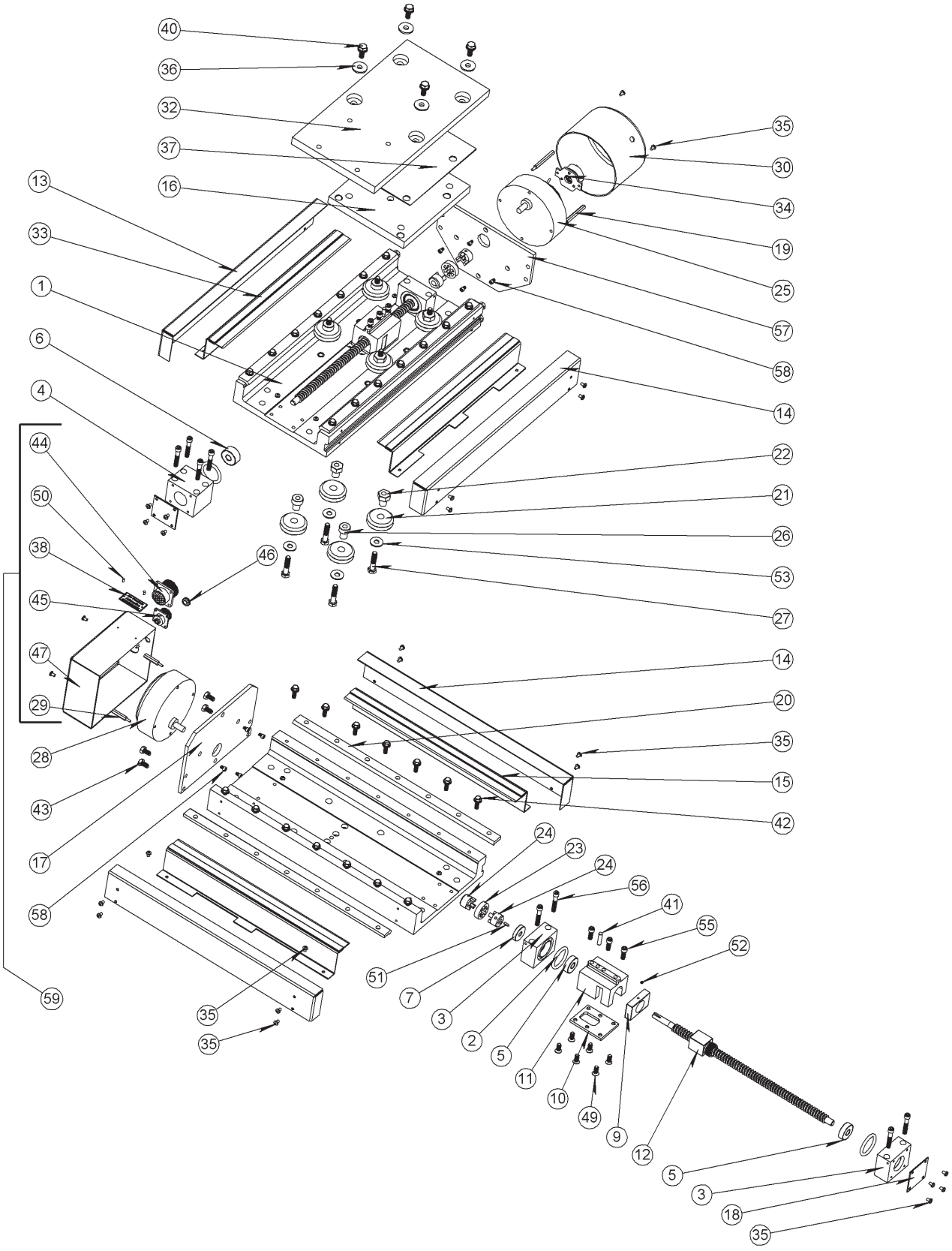


FIGURE 15 - ST250 CROSS-SLIDE EXPLODED VIEW

TABLE 8 - ST250 CROSS-SLIDE PARTS LIST

ITEM #	QPA	UM	PART # 5” X 5”	PART # 10” X 10”	DESCRIPTION
1	2.000	EA	0600-0034	0600-0036	UNIVERSAL BASE,ST250
2	4.000	EA	0600-0366	0600-0366	BEARING BLOCK O-RING
3	3.000	EA	0600-0302	0600-0302	UNIVERSAL BRG BLK ST250
4	1.000	EA	0600-0372	0600-0372	4 BOLT ST250 BRG BLOCK
5	3.000	EA	2320-0244	2320-0244	BEARING BALL, ANLR CONT
6	1.000	EA	0600-0123	0600-0123	BALL BEARING ST250
7	2.000	EA	2380-0128	2380-0128	SEAL OIL .375X1.125X.312
9	2.000	EA	0600-0346	0600-0346	NUT HOUSING INSERT ST250
10	2.000	EA	0600-0339	0600-0339	NUT HOUSING PLATE ST250
11	2.000	EA	0600-0336	0600-0336	NUT HOUSING ST250
12	2.000	EA	0600-0380	0600-0374	ST250 SCREW ACTUATOR ASSY
13	2.000	EA	0600-0064	0600-0068	TRACK COVER, LOWER LEFT
14	2.000	EA	0600-0065	0600-0069	TRACK COVER, LOWER RIGHT
15	4.000	EA	0600-0159	0600-0098	SCREW COVER ASSY ST250
16	1.000	EA	0600-0058	0600-0058	FACEPLATE
17	1.000	EA	0600-0048	0600-0048	END PLATE, LOWER
18	2.000	EA	1112-0211	1112-0211	COVER SEAL, BEARING
19	2.000	EA	0600-0373	0600-0373	2" STAND-OFF
20	4.000	EA	0600-0279	0600-0282	RAIL ST250
21	8.000	EA	2360-0561	2360-0561	WHEEL, GUIDE, DUAL VEE
22	4.000	EA	0600-0054	0600-0054	ADAPTOR BUSHING, ADJUSTABLE
23	2.000	EA	2320-1151	2320-1151	INSERT COUPLING
24	4.000	EA	2320-1160	2320-1160	COUPLING HALF, 3/8 IN
25	1.000	EA	0600-0111	0600-0111	MOTOR ASSY ST250 UPPER
26	4.000	EA	2360-0234	2360-0234	BUSHING ADAPTER
27	8.000	EA	970039-718	970039-718	SCR 5/16-18X1.50 H SBZ G8
28	1.000	EA	1116-0123	1116-0123	GEAR MOTOR, 25:1
29	2.000	EA	981002-004	981002-004	STDOFF HX M/F 8-32X.25X1.12 SS
30	1.000	EA	0600-0377	0600-0377	UPPER MTR CVR ST250 3.5"
32	1.000	EA	1110-0392	1110-0392	ADAPTER PLATE
34	1.000	EA	0600-0094	0600-0094	BRAKE ASSY
35	36.00	EA	970000-402	970000-402	SCREW, 8-32X.25 CR1P SBZ
36	4.000	EA	1110-0406	1110-0406	COLLAR, INSULATING
37	1.000	EA	1112-0237	1112-0237	PLATE, INSULATING
38	1.000	EA	1115-0705	1115-0705	NAMEPLATE SEAM TRACKER
40	4.000	EA	970039-710	970039-710	SCR 5/16-18X.75 H SBZ G8
41	2.000	EA	970039-725	970039-725	DOWEL PIN 1/4 X 1
42	28.00	EA	970039-610	970039-610	SCREW, 1/4-20X.75 H SBZ G8
43	8.000	EA	970039-606	970039-606	SCREW, 1/4-20X.50 H SBZ G8
44	1.000	EA	930014-013	930014-013	CONN CIRC BOX RCPT 20-27P
45	1.000	EA	930014-010	930014-010	CONN CIRC BOX RCPT 14S-6S
46	1.000	EA	976000-005	976000-005	GROMMET RUBBER 5/16ID X 5/8 OD
47	1.000	EA	0600-0060	0600-0060	MOTOR COVER, LOWER

TABLE 9 - ST250 CROSS-SLIDE PARTS LIST

ITEM #	QPA	UM	PART # 5” X 5”	PART # 10” X 10”	DESCRIPTION
49	12.00	EA	970010-608	970010-608	SCR 1/4-20X.62 CR1F SBZ
50	2.000	EA	2414-0201	2414-0201	SCR RND HD U-DRV #2X1/4
51	2.000	EA	2360-0863	2360-0863	3/32 X .375 SQ. KEY
52	2.000	EA	970043-401	970043-401	SET SCREW, 8-32x.19 HHC SBZ
53	8.000	EA	970000-003	970000-003	WASHER 5/16
55	6.000	EA	970015-610	970015-610	SCREW, 1/4-20X.75 HSC SBZ
56	10.00	EA	970015-618	970015-618	SCREW, 1/4-20X1.50 HSC SBZ
57	1.000	EA	0600-0052	0600-0052	END PLATE, UPPER UNIVERSAL
58	8.000	EA	970015-402	970015-402	SCREW, 8-32X.25 HSC SBZ
59	1.000	EA	0600-0099	0600-0099	MTR CVR ASSY LWR ST250

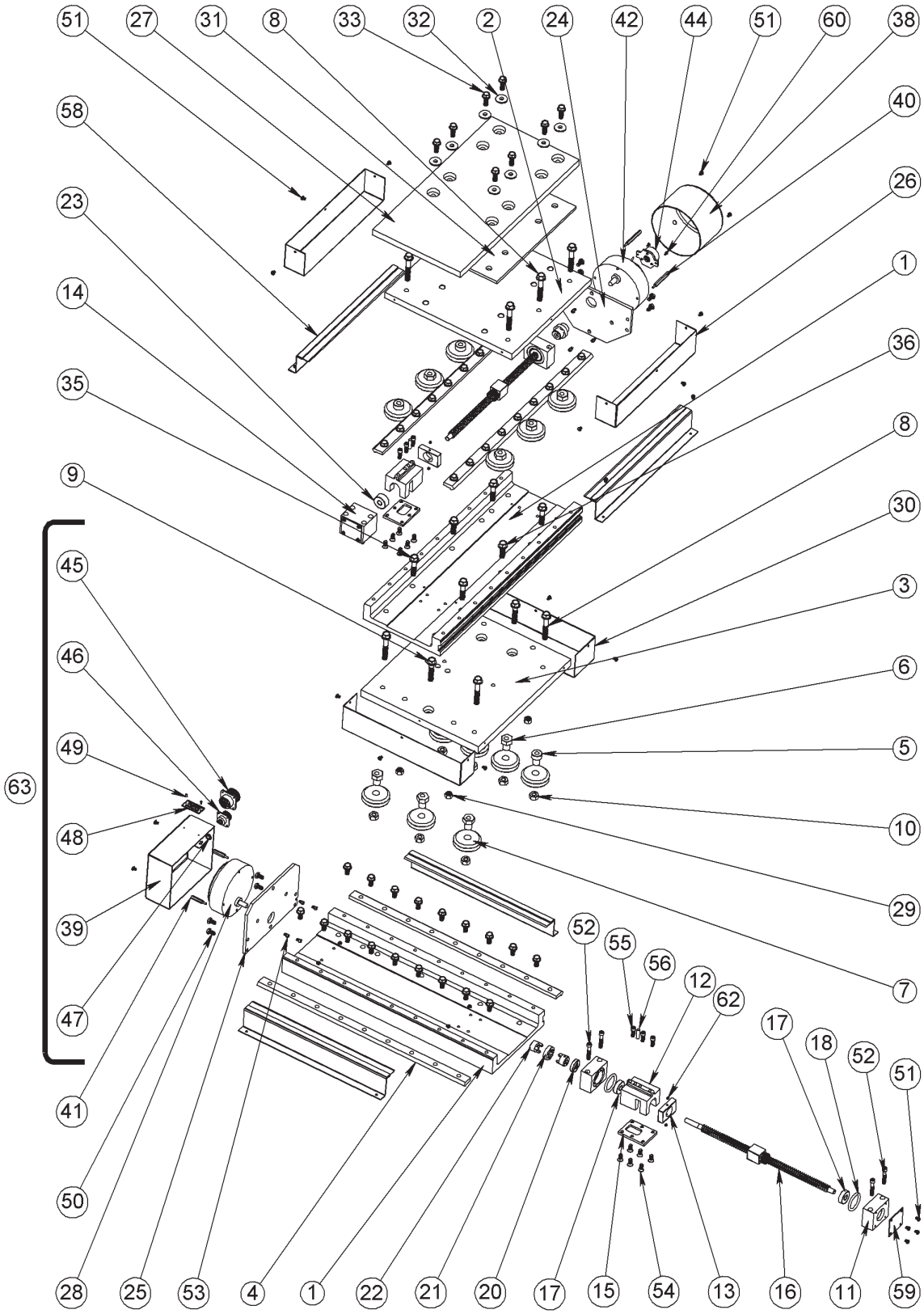


FIGURE 16 - ST450 CROSS SLIDE EXPLODED VIEW

TABLE 10 - ST450 CROSS SLIDE PARTS LIST

ITEM #	QPA	UM	PART # (5 X 5)	PART # (10 X 10)	DESCRIPTION
1	2.000	EA	0600-0074	0600-0076	BASE ST450
2	1.000	EA	0600-0078	0600-0078	FACEPLATE ST450
3	1.000	EA	0600-0079	0600-0079	INTERMEDIATE PLATE ST450
4	4.000	EA	0600-0430	0600-0431	RAIL ST450
5	4.000	EA	2360-0242	2360-0242	BUSHING ADPTR STNRY 3/8X7/8 L
6	9.000	EA	2360-0277	2360-0277	BUSHING ADPTR ADJ 3/8X7/8 L
7	8.000	EA	2360-0579	2360-0579	WHEEL GUIDE DUAL VEE (4)
8	10.000	EA	970039-711	970039-711	3/8-16 X 2.5 GR8 FLANGE HD
9	3.000	EA	970039-822	970039-822	SCREW 3/8-16X2.00 H SBZ G8
10	13.000	EA	970039-712	970039-712	3/8-16 FLANGE LOCKNUT
11	3.000	EA	0600-0302	0600-0302	UNIVERSAL BRG BLK 250/450
12	2.000	EA	0600-0336	0600-0336	NUT HOUSING ST250/450
13	2.000	EA	0600-0346	0600-0346	NUT HOUSING INSERT ST250/450
14	1.000	EA	0600-0372	0600-0372	4 BOLT ST250/450 BRG BLOCK
15	2.000	EA	0600-0339	0600-0339	NUT HOUSING PLATE ST250/450
16	2.000	EA	0600-0380	0600-0374	ST250/450 SCREW ACT. ASSY
17	3.000	EA	2320-0244	2320-0244	BEARING BALL ANLR CONT
18	4.000	EA	0600-0366	0600-0366	BEARING BLOCK O-RING
20	2.000	EA	2380-0128	2380-0128	SEAL OIL .375X1.125X.312
21	2.000	EA	2320-1151	2320-1151	INSERT COUPLING (BF7)
22	2.000	EA	2320-1160	2320-1160	COUPLING HALF3/8 IN
23	1.000	EA	0600-0123	0600-0123	BALL BEARING ST250/450
24	1.000	EA	0600-0052	0600-0052	MOTOR PLATE UPPER UNIVERSAL
25	1.000	EA	0600-0048	0600-0048	MOTOR PLATE LOWER
26	3.000	EA	1112-0105	1112-0105	COVER WHEEL
27	1.000	EA	0600-0418	0600-0418	ADAPTER PLATE ST450
28	1.000	EA	0600-0513	0600-0513	GEAR MOTOR. 50:1-OUTBD
30	1.000	EA	0600-0432	0600-0432	WHEEL COVER DEEP ST450
31	1.000	EA	0600-0419	0600-0419	PHENOLIC PLATE ST450
32	8.000	EA	1110-0406	1110-0406	COLLAR INSULATING
33	8.000	EA	970039-714	970039-714	SCR 5/16-18X1.00 H SBZ G8
36	2.000	EA	970039-713	970039-713	3/8-16 X 1.25 FLANGE HEAD BOLT
38	1.000	EA	0600-0377	0600-0377	UPPER MTR CVR ST250/450 3.5"
39	1.000	EA	1116-0298	1116-0298	MOTOR COVER LOWER
40	2.000	EA	0600-0289	0600-0289	STAND-OFF 8-32 X 1/4 X 2.00
41	2.000	EA	0600-0121	0600-0121	STANDOFF 8-32 X 1/4 X 1.OO
42	1.000	EA	0600-0429	0600-0429	ST450 UPPER MTR ASSY
44	1.000	EA	0600-0094	0600-0094	BRAKE ASSY
45	1.000	EA	930014-013	930014-013	CONN CIRC BOX RCPT 20-27P
46	1.000	EA	930014-010	930014-010	CONN CIRC BOX RCPT 14S-6S
47	2.000	EA	976000-005	976000-005	GROMMET RUBBER 5/16ID X 5/8 OD
48	1.000	EA	0600-0127	0600-0127	NAME PLATE AP AUTOMATION
49	2.000	EA	2414-0201	2414-0201	SCR RND HD U-DRV #2X1/4

TABLE 11 - ST450 CROSS SLIDE PARTS LIST

ITEM #	QPA	UM	PART # (5 X 5)	PART # (10 X 10)	DESCRIPTION
50	8.000	EA	970039-606	970039-606	SCREW 1/4-20X.50 H SBZ G8
51	28.000	EA	970000-402	970000-402	SCREW 8-32X.25 CR1P SBZ
52	10.000	EA	970015-618	970015-618	SCREW 1/4-20X1.50 HSC SBZ
53	8.000	EA	970015-402	970015-402	SCREW 8-32X.25 HSC SBZ
54	12.000	EA	970010-608	970010-608	SCR 1/4-20X.62 CR1F SBZ
55	6.000	EA	970015-610	970015-610	SCR 1/4-20X.62 HSC SBZ
56	2.000	EA	970039-725	970039-725	DOWEL PIN 1/4 X 1
58	4.000	EA	0600-0159	0600-0098	SCREW COVER ASSY.5" ST250/450
59	2.000	EA	1112-0211	1112-0211	COVER SEAL BEARING
60	2.000	EA	970000-202	970000-202	SCREW 4-40X.25 CR1P SBZ
62	2.000	EA	970043-400	970043-400	SCR SET 8-32X.12 HHC SBZ
63	1.000	EA	0600-0099	0600-0099	MTR CVR ASSY LWR ST250/450
64	2.000	IN	2360-0862	2360-0862	KEY STOCK 3/32 SQ
65	2.000	FT	0600-0359	0600-0359	MOTOR CABLE 4 COND
66	36.000	EA	970039-710	970039-710	SCR 5/16-18X.75 H SBZ G8

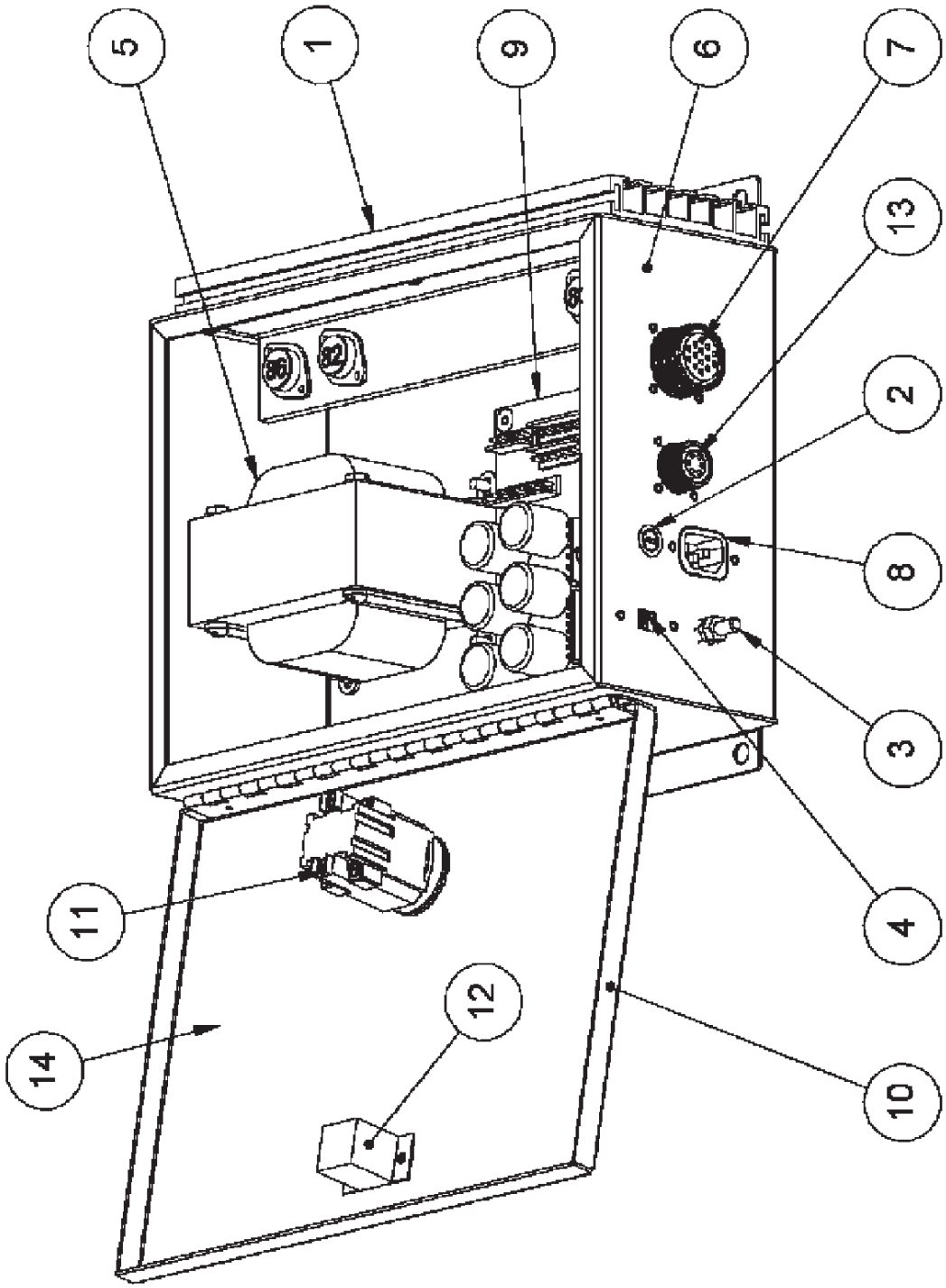


FIGURE 17 - MOTORIZED SLIDE CONTROL EXPLODED VIEW

TABLE 12 - MOTORIZED SLIDE CONTROL PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	1101-2002-4	MOTOR DRIVER ASSY
2	1.000	EA	1101-2002-6	FUSE/ FUSE HOLDER (See Figure 22 - Voltage Selector Switch assembly Exploded View on page 40)
3	1.000	EA	1101-2002-6	EARTH GROUND STUD, 1/4-20 (See Figure 22 - Voltage Selector Switch assembly Exploded View on page 40)
4	1.000	EA	1101-2002-6	VOLTAGE SELECTOR SWITCH ASSY (See Figure 22 - Voltage Selector Switch assembly Exploded View on page 40)
5	1.000	EA	1101-2002-2	CONTROL TRANSFORMER ASSY (See Figure 20 - Transformer Assembly Exploded View on page 37)
6	1.000	EA	0600-0426	CONTROL ENCLOSURE
7	1.000	EA	1101-2002-5	CONTROL DRIVE CABLE ASSY (See Figure 23 - Drive Connector Harness Exploded View on page 41)
8	1.000	EA	1101-2002-6	RFI/EFI FILER (See Figure 22 - Voltage Selector Switch assembly Exploded View ON PAGE 40)
9	1.000	EA	0600-0388	MAIN BOARD ASSY
10	1.000	EA	0600-0425	CONTROL DOOR
11	1.000	EA	1101-2002-8	POWER SWITCH ASSY (See Figure 19 - Power Switch Assembly Exploded View on page 36)
12	1.000	EA		CONTROL DOOR LATCH
13	1.000	EA	0600-0435	CONTROL PENDANT CABLE ASSY (See Figure 24 - Pendant Connector Harness Exploded View on page 42)
14	1.000	EA	0600-0424	APA MS OVERLAY
15	1.000	EA	989003-001	CBL TIE MNT ADH BACK .75IN SQ (NOT SHOWN)
16	0.417	FT	2040-0536	GROMMET CATERPILLAR (NOT SHOWN)
17	4.000	EA	974006-005	WSR F #10 .374X.195X.032 B
18	7.000	EA	974010-004	WSR SL #8.293X.175X.040 SBZ
19	6.000	EA	974000-004	WSR F #8 .438X.188X.049 SBZ
20	4.000	EA	974010-005	WSR SL #10 .334X.202X.047 SBZ
21	6.000	EA	972000-003	NUT 6-32 H SBZ
22	8.000	EA	974010-004	WSR SL #8.293X.175X.040 SBZ
23	8.000	EA	970000-404	SCR 8-32X.38 CR1P SBZ
24	1.000	EA	1175-0079	LABEL CAUTION 110/220VAC (NOT SHOWN)
25	0.625	EA	999005-005	TAPE NEO FOAM ADH 1/8INX1/4THK
26	8.000	EA	972000-002	NUT 4-40 H SBZ
27	5.000	EA	979001-001	CABLE TIE .75 BUNDLE DIA (NOT SHOWN)
28	4.000	EA	972000-005	NUT 10-32 H SBZ
29	15.000	EA	970000-406	SCR 8-32X.50 CR1P SBZ
30	1.000	EA	929000-001	3 CONDCTR PWR SPLY CORD (NOT SHOWN)
31	4.000	EA	970000-204	SCR 4-40X.38 CR1P SBZ
32	8.000	EA	974010-002	WSR SL #4.209X.121X.025 SBZ

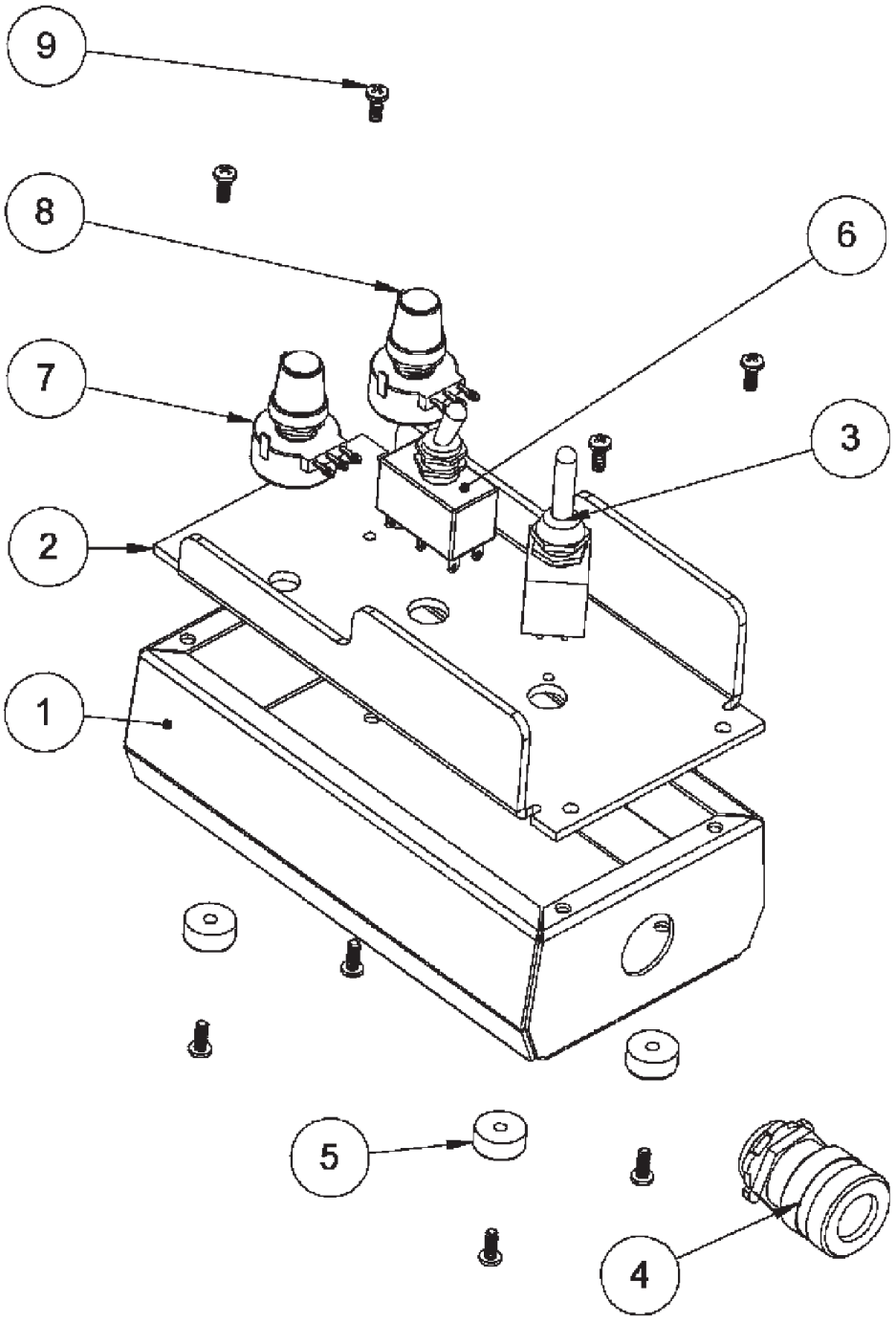


FIGURE 18 - CONTROL PENDANT EXPLODED VIEW

TABLE 13 - CONTROL PENDANT PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	0600-0383	MOTORIZED SLIDE PENDANT ENCLOSURE
2	1.000	EA	0600-0288	MOTOROIZED SLIDE PENDANT FACEPLATE
3	1.000	EA	2066-0112	SW JOY STICK 9 POS SNGL POLE
4	1.000	EA	2040-0579	CBL FTTNG W/NUT&BSH .375-.500
5	4.000	EA	0600-0026	FEET, RUBBER
6	1.000	EA	2060-0071	SWITCH TOGGLE DTSP
7	2.000	EA	903002-011	POT 10K LINEAR 10% 3T CERMET
8	2.000	EA	940024-001	KNOB SM SKIRT/LT GRAY POINTER
9	8.000	EA	970021-404	SCR 8-32X.38 HSBC SBZ
10	1.000	EA	900007-003	CAP CER .1UF 500V +80 -20% (NOT SHOWN)
11	1.000	EA	0600-0433	APA MTRZD SLIDE PNDT CBL ASSY (NOT SHOWN)

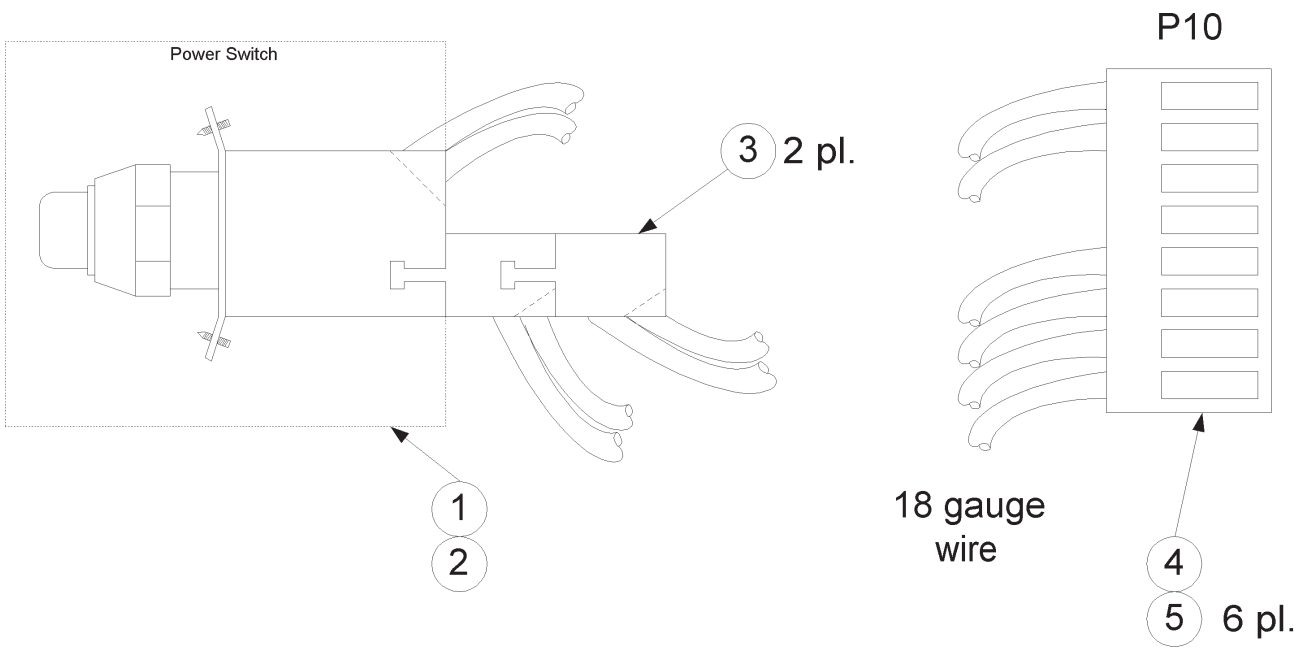


FIGURE 19 - POWER SWITCH ASSEMBLY EXPLODED VIEW

TABLE 14 - POWER SWITCH ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	2066-0171	SWITCH, SELECT 1-3/16 RED
2	1.000	EA	2100-0086	INCANDESCENT LAMP, ½ 28V
3	2.000	EA	2068-0172	BLOCK CONTACT N.O.
4	1.000	EA	2208-0181	CONN RECT PLUG (8CKT)
5	6.000	EA	2212-0018	TERMINAL CRIMP PIN 18-24 GA

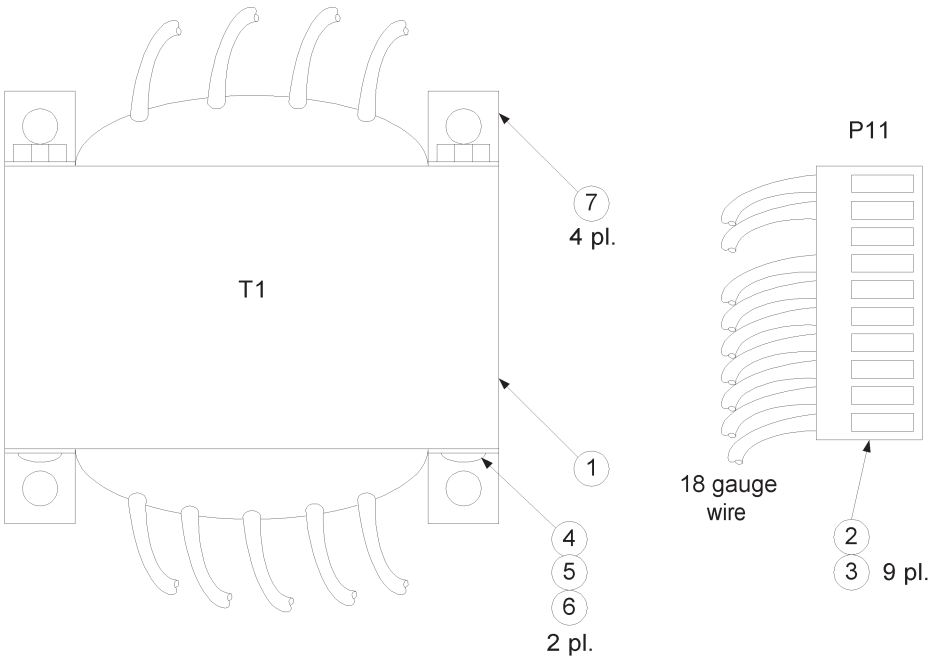


FIGURE 20 - TRANSFORMER ASSEMBLY EXPLODED VIEW

TABLE 15 - TRANSFORMER ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	1117-1118	XFRMR 115/230VAC,30VCT/10.5VAC
2	1.000	EA	2208-0199	CONN RECT PLUG (10CKT)
3	9.000	EA	2212-0018	TERMINAL CRIMP PIN 18-24 GA
4	2.000	EA	970000-426	SCR 8-32X2.50 CR1P SBZ
5	2.000	EA	972001-004	NUT 8-32 FH SBZ SL GB
6	2.000	EA	974010-004	WSR, SL #8.293X.175X.040 SBZ

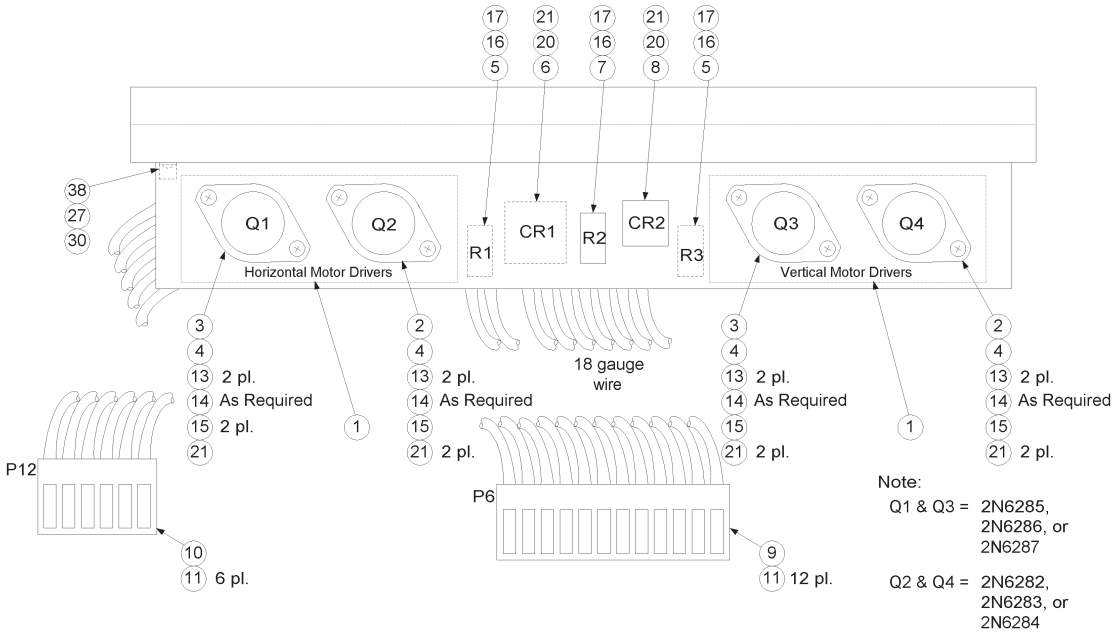


FIGURE 21 - MOTOR DRIVER HEATSINK ASSEMBLY EXPLODED VIEW

TABLE 16 - MOTOR DRIVER HEATSINK ASSEMBLY PARTS LISTS

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	2.000	EA	1103-0491	TRANSISTOR REPLACEMENT KIT
			CONSISTING OF:	
2	2.000	EA	2708-0081	XSTR 2N6282 PWR 60V NPN (ALT: 2N6283 OR 2N6284)
3	2.000	EA	2708-0103	XSTR 2N6285 PWR 80V PNP (ALT: 2N6286 OR 2N6287)
4	4.000	EA	2716-0000	INSULATOR MICA TO-3
5	2.000	EA	902004-019	RES WW .1 OHM +/- 3% 5W
6	1.000	EA	2702-0186	RECITIFIER BRIDGE CBR35-01P
7	1.000	EA	2610-1093	RES WW 250 OHM +/- 3% 10W
8	1.000	EA	2702-0178	RECTIFIER BRIDGE 2AMP 200V
9	1.000	EA	2208-0202	CONN RECT PLUG (12 CKT)
10	1.000	EA	2208-0172	CONN RECT PLUG (6 CKT)
11	18.00	EA	2212-0019	TERMINAL CRIMP MOLEX 18-20 .156
12	2.000	EA	2500-0692	CAP CER 680PF (NOT SHOWN)
13	8.000	EA	970015-412	SCREW 8-32 X .88 HSC SBZ
14	0.000	AR	3070-0058	THERMAL COMPOUND

TABLE 17 - MOTOR DRIVER HEATSINK ASSEMBLY PARTS LISTS (CONT.)

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
15	4.000	EA	2716-0034	TRANSISTOR SOCKET TO-3
16	6.000	EA	970000-103	SCREW 2-56 X .31 CR1P SBZ
17	6.000	EA	974010-001	WASHER SPLIT LOCK # 2
20	2.000	EA	970000-308	SCREW 6-32 X .62 CR1P SBZ
21	10.000	EA	974010-003	WASHER SPLIT LOCK # 6
27	1.000	EA	970000-502	SCREW 10-32 X .25 CR1P SBZ
30	1.000	EA	974010-005	WASHER SPLIT LOCK # 10
38	1.000	EA	989009-005	CABLE CLAMP 3/16” PVC BLACK

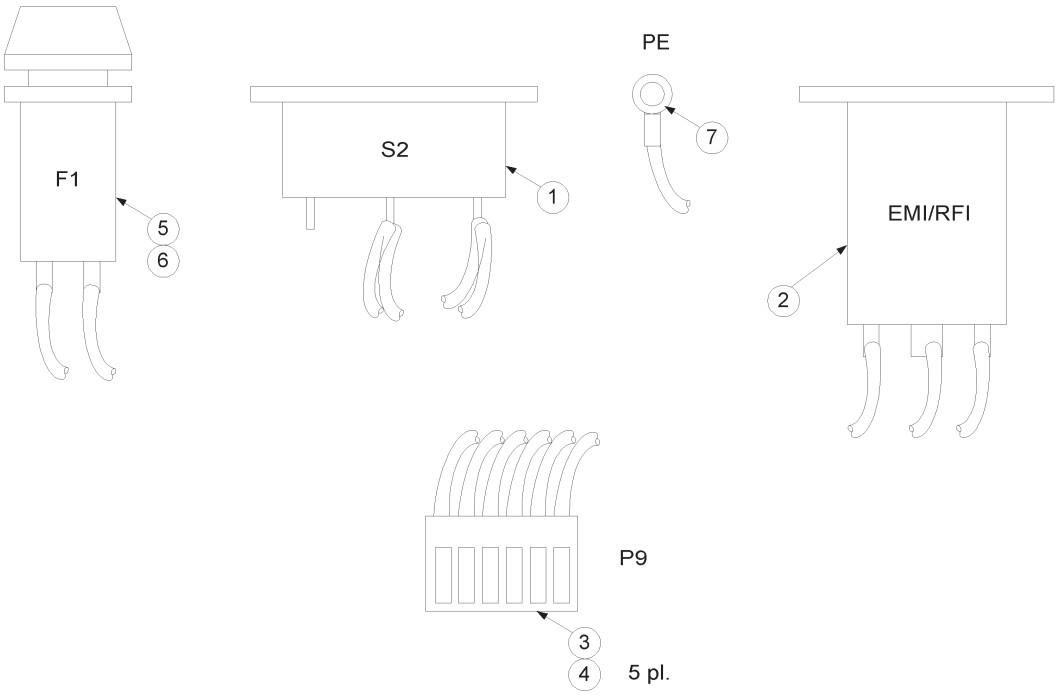


FIGURE 22 - VOLTAGE SELECTOR SWITCH ASSEMBLY EXPLODED VIEW

TABLE 18 - VOLTAGE SELECTOR SWITCH ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	920035-001	SLIDE SW 2 POS LINE VOLT SEL
2	1.000	EA	2120-0123	FILTER RFI-PWR LINE 3 AMP
3	1.000	EA	2208-0551	CONN RECT PLUG (6 PIN) .200"P
4	5.000	EA	2212-0152	TERMINAL CRIMP PIN 18-24 GA
5	1.000	EA	2120-0000	FUSE CARRIER 1/4 X 1 1/4 FEK
6	1.000	EA	2120-0263	FUSE 7-1/2A 250V
7	1.000	EA	2340-0618	TERM RING 1/4 22/16 RED

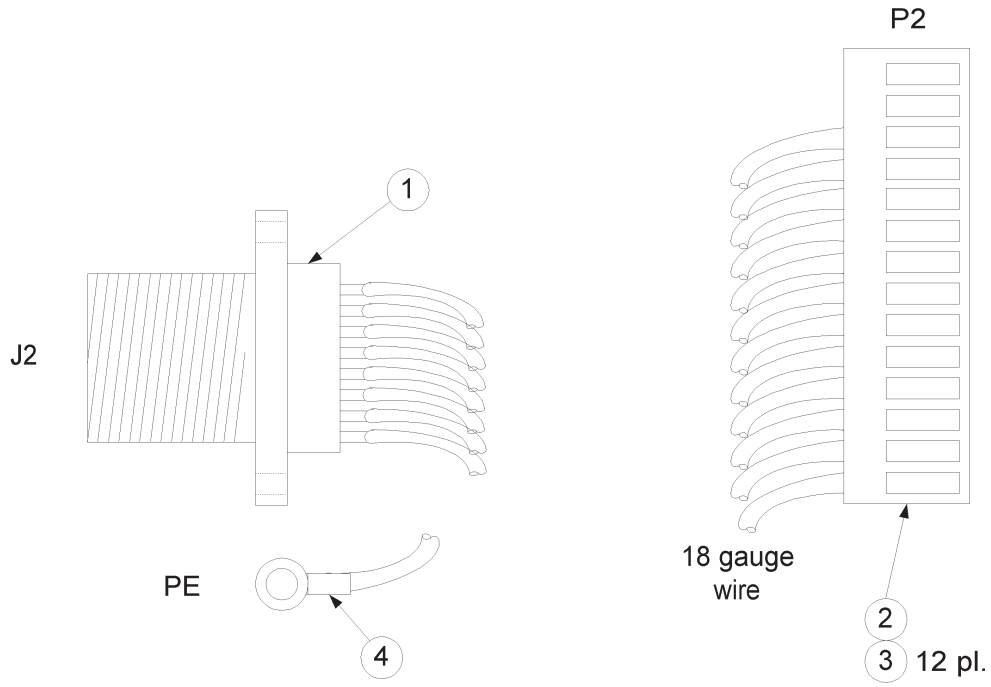


FIGURE 23 - DRIVE CONNECTOR HARNESS EXPLODED VIEW

TABLE 19 - DRIVE CONNECTOR HARNESS ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	930014-001	CONN CIRC BOX RCPT 20-27S
2	1.000	EA	2208-0211	CONN RECT PLUG (14CKT)
3	1.000	EA	2212-0018	TERMINAL CRIMP PIN 18-24 GA
4	1.000	EA	2340-0588	TERM RING INSUL #6 X .92 LG

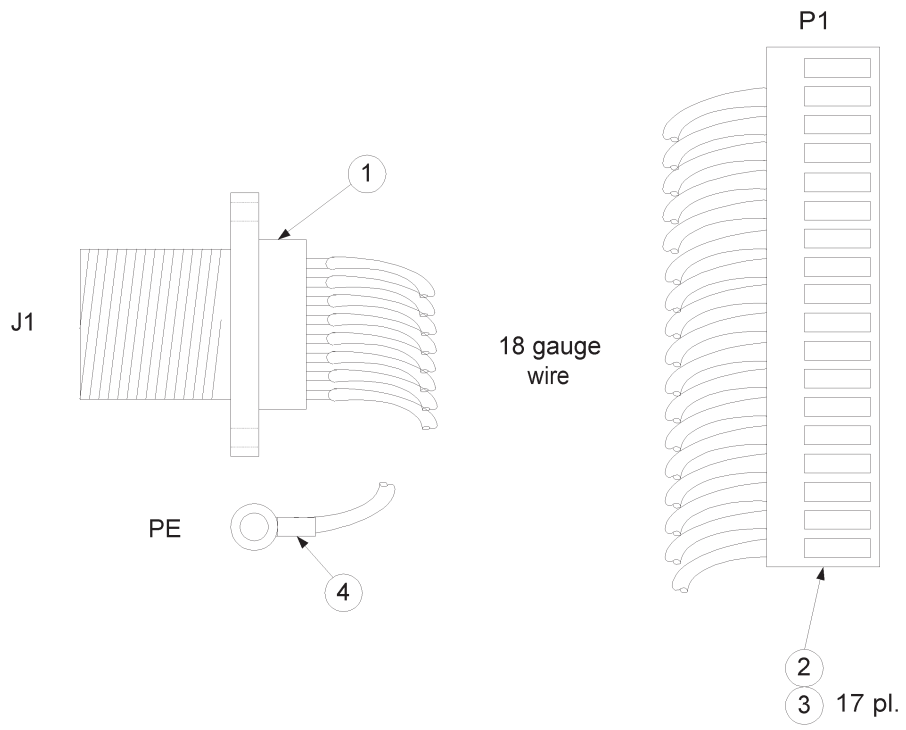


FIGURE 24 - PENDANT CONNECTOR HARNESS EXPLODED VIEW

TABLE 20 - PENDANT CONNECTOR HARNESS ASSEMBLY PARTS LIST

ITEM #	QPA	UM	PART NUMBER	DESCRIPTION
1	1.000	EA	930014-015	CONN CIRC BOX RCPT 22-14S
2	1.000	EA		CONN RECT PLUG (6 CKT)
3	17.000	EA	2212-0018	TERMINAL CRIMP PIN 18-24 GA
4	1.000	EA	2340-0588	TERM RING INSUL #6 X .92 LG

TROUBLESHOOTING

The following list describes typical problems and suggested corrective procedures.

The CIRCUIT DESCRIPTIONS section, which includes block diagrams and schematics, will also be a helpful reference for troubleshooting.

Full line voltage is exposed inside the control unit.

Do not turn power “On” when the Main board is removed, partially removed or disconnected.

Many of the Integrated Circuits (IC’s) on the Main board are CMOS logic, and require standard CMOS precautions against damage by static electricity discharge.

RECOMMENDED SPARES FOR TROUBLESHOOTING

This manual was written in a manner to provide enough detail to identify individual components and parts for maintenance purposes. A recommended spare parts lists is given in Table 24 - Recommended Spare Parts on page 44. For troubleshooting, the following items are recommended to isolate most problems.

TABLE 21 - TROUBLESHOOTING

PROBLEM #	DESCRIPTION	CAUSE	SOLUTION
Problem 1 - Lamp Off	Lamp is not lit	• Unit unplugged • Blown Fuse • Lamp is bad	• Plug unit into an appropriate AC Source • Replace Fuse • Replace Lamp
Problem 2 - No Operation	Power Switch and Indicator Lamp are ON, but nothing works	• Cables disconnected from the control to other components of the system • Connectors are disconnected inside the control • Main board voltages are not present	• Check cables from the control to other components of the system • Check connectors inside the control unit • Check Main board voltages, ±20VDC, ±15VDC, and ±6VDC
Problem 3 - Horizontal Drift	Cross-slide drifts horizontally	• Main board is out of calibration	• Calibrate the Servo Amplifier Circuitry on the Main board
Problem 4 - Vertical Drift	Cross-slide drifts vertically	• Main board Vertical Offset may need adjustment • Main board is out of calibration	• Adjust Vertical Offset on the Main board • Calibrate the Servo Amplifier Circuitry on the Main board
Problem 5 - System Oscillation	System oscillates while operating	• The system is mounted on a fixture that is not stable • The cross-slides have mechanical play in the horizontal and/or vertical axes	• Check the fixture for rigidity and eliminate the instability • Check the cross-slides for mechanical play or looseness and eliminate it
Problem 6 - Slides will not Drive	Cross-slides will not drive in one or more directions	• Switches on the pendant assembly are faulty • Main board is faulty • Heatsink assembly is faulty	• Switch commands from the pendant assembly are not getting to the main board • Check Test Points on the Main board to verify the signals are being received and sent to the motors on the cross-slides (see the following tables)
Problem 7 - Slides Drive, One Direction	System continuously drives at full speed in one direction with no control	• Main board is faulty • One or more transistors on the heatsink assembly may be faulty	• Check the Test Points on the Main board to determine if the Main board is or is not giving commands to drive the system, if no commands are given from the main board, check the heatsink assembly (see the following tables) • Check the transistors on the heatsink assembly

PROBLEM #	DESCRIPTION	CAUSE	SOLUTION
Problem 8 - Slides Drive, Both Direction	System continuously drives at full speed in two directions with no control	• One of the regulated voltages on the Main board is faulty	• Check the voltages on the Main board • Replace the Main board
Problem 9 - Motor Oscillation	One or both of the cross-slide motors is oscillating continuously and the heatsink assembly is becoming hot	• The IR Compensation Adjustment on the Main board is out of adjustment for vertical or horizontal axes	• Adjust the IR Compensation Adjustment on the Main board counterclockwise until the oscillation just stops, then continue adjusting the potentiometer 4 more turns to complete the adjustment.

TABLE 22 - VOLTAGE TEST POINTS

TP #	DESCRIPTION	VALUES
TP1	+20 VDC	+20 VDC ±1.0 VDC
TP2	+15 VDC	+15 VDC ±0.5 VDC
TP3	Logic Ground	
TP4	-20 VDC	-20 VDC ±1.0 VDC
TP5	-15 VDC	-15 VDC ±0.5 VDC
TP6	-6 VDC	-6 VDC ±0.5 VDC

TABLE 23 - DRIVE SIGNAL TEST POINTS

REF #	DESCRIPTION	VALUES
R25	Vertical Error (HE)	UP ≈ +12.5 VDC DN ≈ -12.5 VDC
R26	Horizontal Error (VE)	RIGHT ≈ +12.5 VDC LEFT≈ -12.5 VDC

TABLE 24 - RECOMMENDED SPARE PARTS

ITEM #	QTY	PART #	DESCRIPTION
1	2	2120-0263	Fuse
2	1	2100-0086	Power Lamp
3	1	0600-0388	Main Board
4	2	1110-2093	Insulator
5	1	2702-0186	Rectifier
6	1	1103-0491	Transistor Kit

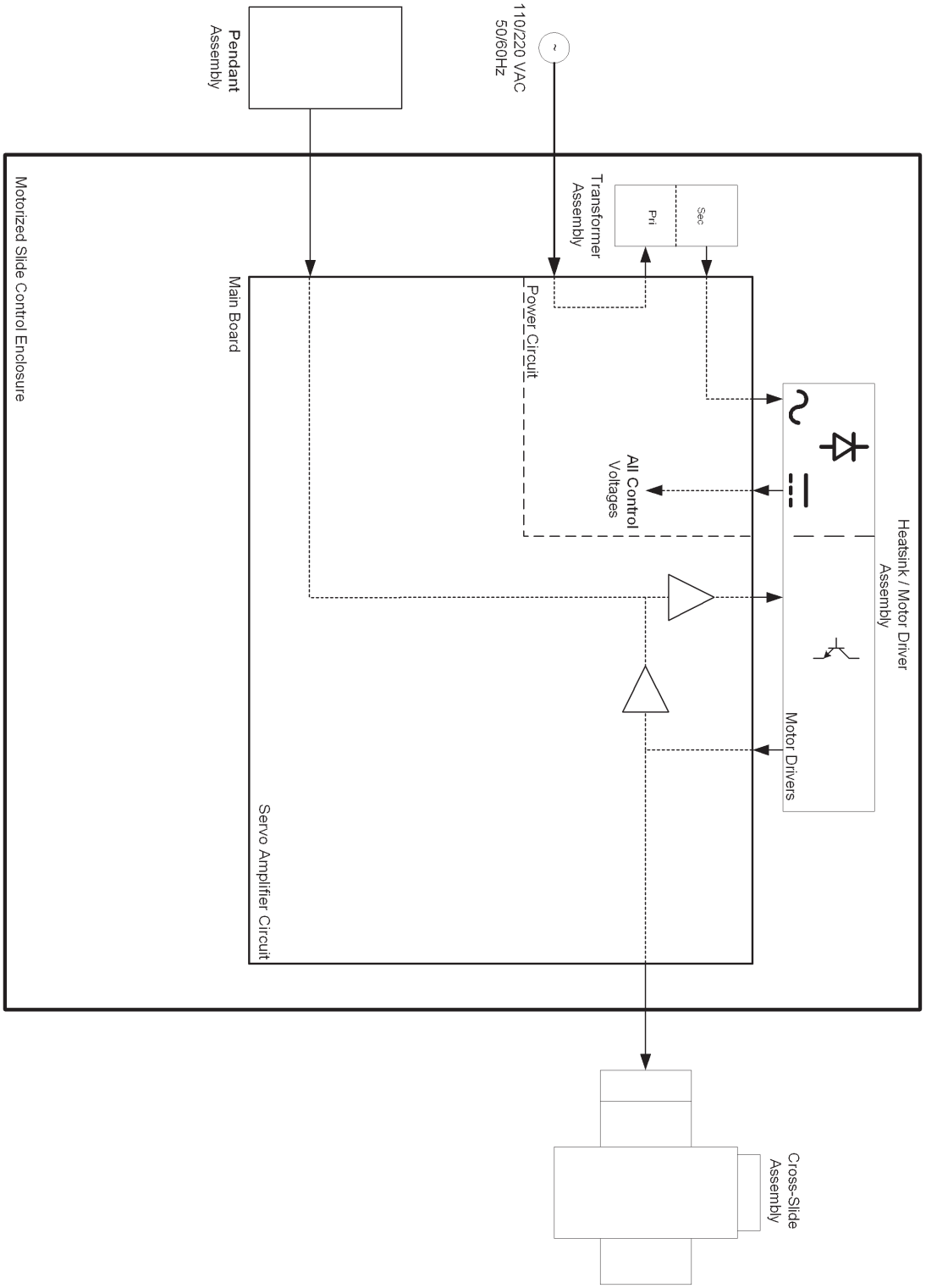


FIGURE 25 - MOTORIZED SLIDE SIGNAL FLOW

CIRCUIT DESCRIPTIONS

WARNING

For use by Qualified Service Technicians

The APA Motorized Slide system's electronic circuitry consists primarily of two nearly identical servo systems, one for the horizontal axis and one for the vertical axis.

Signals received from the pendant assembly's joystick switch from the operator are transferred to the slides in the form of movements, i.e., left/right and up/down.

All controls to operate the motorized slide system are located on the pendant assembly.

SYSTEM WIRING DIAGRAM

The Figure 27 - Motorized Slide Control Block Diagram and Figure 28 - Motorized Slide Control Block Diagram (Cont.) beginning on page 50 and Figure 26 - Pendant Schematic on page 49 is a circuit diagram of the entire seam tracker system. These diagrams include detailed schematics of all portions of the system except the Main board. Schematics of the ST40 and ST250 drives are shown in Figure 27, as well. Substituting one drive for the other is the only electrical difference between ST40 and the ST250 Motorized Slide Systems.

The Figures 26 and 27 show all wires and connector pins in the interfaces between the various assemblies in the control unit. Figure 17 - Motorized Slide Control Exploded View on page 32 and Figure 18 - Control Pendant Exploded View on page 34 identifies the major assemblies covered in Figure 26 and 27. The physical location of sub-assemblies packaged inside the control unit assembly are shown in Figure 17 - Motorized Slide Control Exploded View. Parts lists for each assembly are also included in the Drawings and Parts Lists section beginning on page 21.

MAIN BOARD ASSEMBLY

This section will describe generally the circuitry, signal flows and test points on the Main board to assist in a better understanding and more effective and accurate troubleshooting of the system. The Figure 13 - Motorized Slide Control Main Board Layout on page 21 is a drawing of the board to assist in placement of the Test Points for better understanding and troubleshooting. In addition to the board layout drawing, Figure 25 - Motorized Slide Signal Flow on page 45 illustrates very simply the flow of signals in the motorized Slide system.

Voltage Regulation

The Main board contains control circuitry for the system and also performs primary input voltage and control voltage regulation. Input voltage to the control unit is supplied to the Main board through a fuse and Radio Frequency Interference and Electro-Magnetic Interference (RFI/EMI) filter and voltage selector switch mounted on the bottom of the enclosure. The system will operate from 110/220 VAC, 50/60 Hz at less than 3 amps input power.

The voltage into the control unit is brought to the Main board and is then routed through the power On/Off switch located on the door of the enclosure. Once the switch is in the On position, voltage is passed through the transformer to step down the primary input voltage to approximately 30VAC with a Center Tap (two secondaries at 15 VAC), and a third secondary of approximately 10 VAC (is not used). A fourth 115VAC secondary winding is routed directly to the heatsink assembly and is rectified to ≅ 130VDC for used with a cross-slide assembly with brakes installed on the motors or screw shafts. No filtration is provided on this voltage, due to the brake coil acting as a current filter to smooth the power.

The 30 VAC is rectified on the heatsink assembly and sent back to the Main board where the ±20 VDC (TP1 +20 VDC and TP4 -20 VDC) is filtered through 8 electrolytic capacitors. The ±20 VDC is used as the source voltage for the motor driver circuit and is also regulated down to ±15 VDC (TP2 +15 VDC and TP5 -15 VDC (for servo amplification--Pre-amplifier)). The ±15 VDC is also regulated down to -6 VDC (TP6 -6 VDC). All voltages are referenced to power ground on TP3 GND.

Control Circuitry Description

The following will describe in basic terms how the motorized slide system functions, beginning from remote pendant assembly, and Motor Drivers (heatsink assembly).

Pendant Control

Moving the joystick switch allows Left, Right, Up and Down control (movement) of the cross-slides. As the operator selects either the Left, Right, Up or Down manual controls, the generated signals can be monitored at R5 (Vertical Error) and R8 (Horizontal Error). The voltages when these manual controls are selected will generate a +12 VDC ±1.0 VDC for Up or Right and -12 VDC ±1.0 VDC for Down and Left.

Signals generated by the Joystick switch are adjustable by the two potentiometers on the pendant assembly, one for each axis. These potentiometers

adjust the amplitude of the signal to the main board and ultimately adjust the speed of the cross slides movement.

The toggle switch on the pendant, Speed Range, selects either maximum speed of the cross slides (no adjustment) or adjustable speed range set by the potentiometers.

Servo Amplifier

The primary purpose of the Servo Amplifier Circuitry is to amplify the signals generated by the pendant to the appropriate levels required by the complementary Darlington Push-Pull Transistors located on the heatsink assembly used to drive the motors and to regulate the motor current.

What is actually required of the Servo Amplifier is that it produces a motor speed proportional to the error signal voltage from the pendant. Motor speed is regulated by measuring back EMF from the motor. The technique used to regulate motor speed is known as IR Compensation.

Motor Speed is made up of two parts, Voltage and Current. The resistance from one motor to another will vary. The motor resistance can be accommodated by adjusting R2 Vertical IR Comp and R3 Horizontal IR Comp. An EMF Sense Resistor (0.1 ohms) for each axis is used as a shunt to accurately measure and limit the motor current.

The adjustment procedure is to turn R2 and R3 counter-clockwise until the horizontal slide oscillates or vibrates. Then turn them clockwise to the point where oscillations stop, which should be checked by alternately driving the slides using the joystick with normal operating weight on the cross-slides. When this point has been established, turn these potentiometers, R2 & R3, clockwise an additional four turns to allow a margin for circuit variations due to temperature, etc.

NOTE

If R2 and R3 is backed off too far (Clockwise), the servo will have sluggish response.

The signal through R8 is derived from motor current, which can be sensed directly. The Motor's DC resistance enters in as a constant factor, the exact value of which is accounted for by trimpot adjustment, R3 , as described later. Motor current is sensed as a voltage across the 0.1 ohm "horizontal EMF sense" resistor. The resistor's voltage drop is fed to the differential inputs, pins 5 & 6, of amplifier U2. The signal is further amplified when it reaches the output of U2 pin 8, where it is connected through trimpot R3 to drive R8. R3 adjusts the amount of motor current proportional voltage fed back for correct compensation.

The vertical and horizontal channels are identical, except for the R2 trimpot on the vertical channel. R2 is normally adjusted completely clockwise, which makes the circuit completely the same as the horizontal channel. With heavy loads, the vertical slide may creep down while the control is turned On and at idle. In this case, R1 is adjusted counter-clockwise just enough to offset the creep.

SCHEMATICS AND BLOCK DIAGRAMS

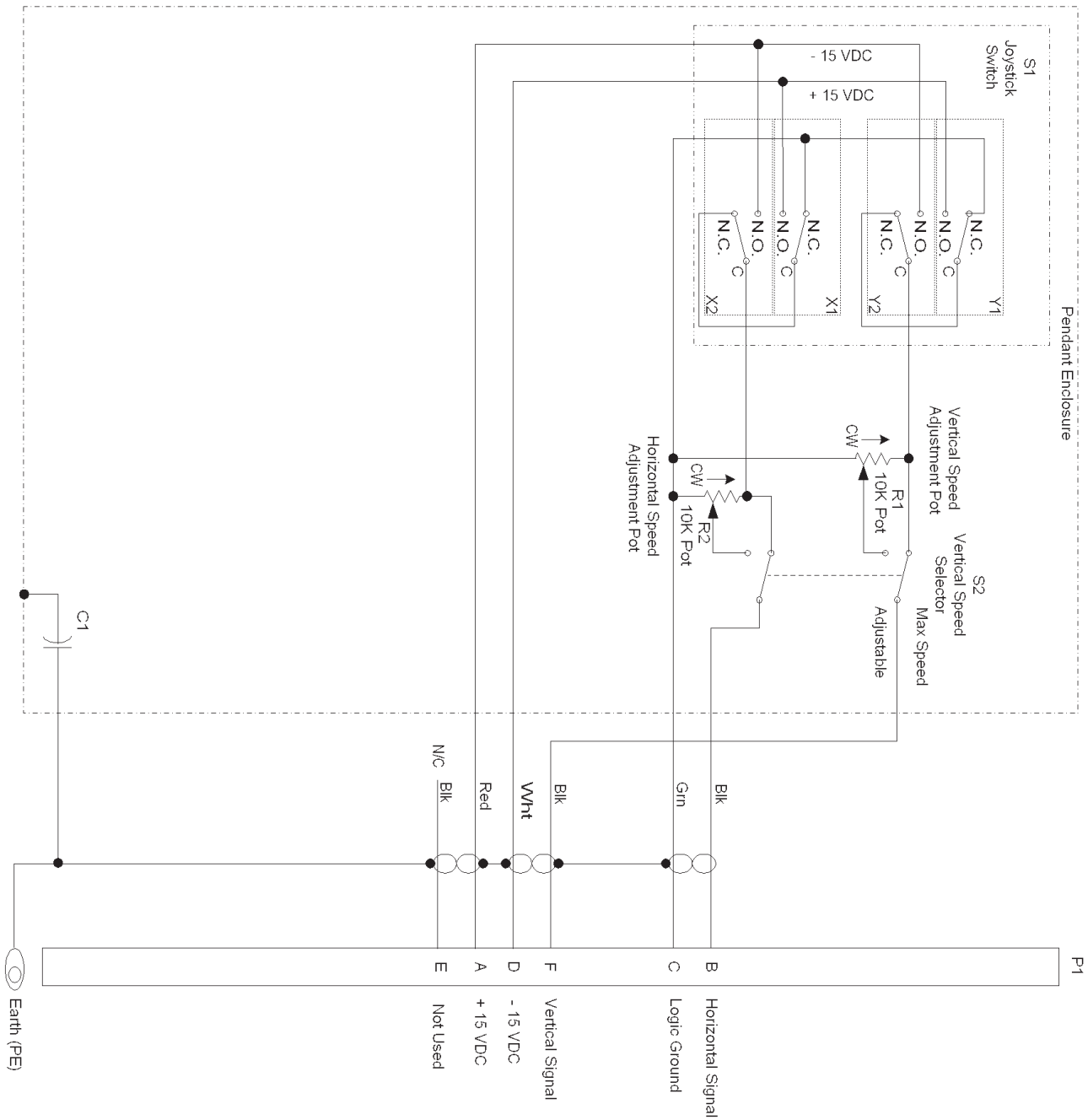


FIGURE 26 - PENDANT SCHEMATIC

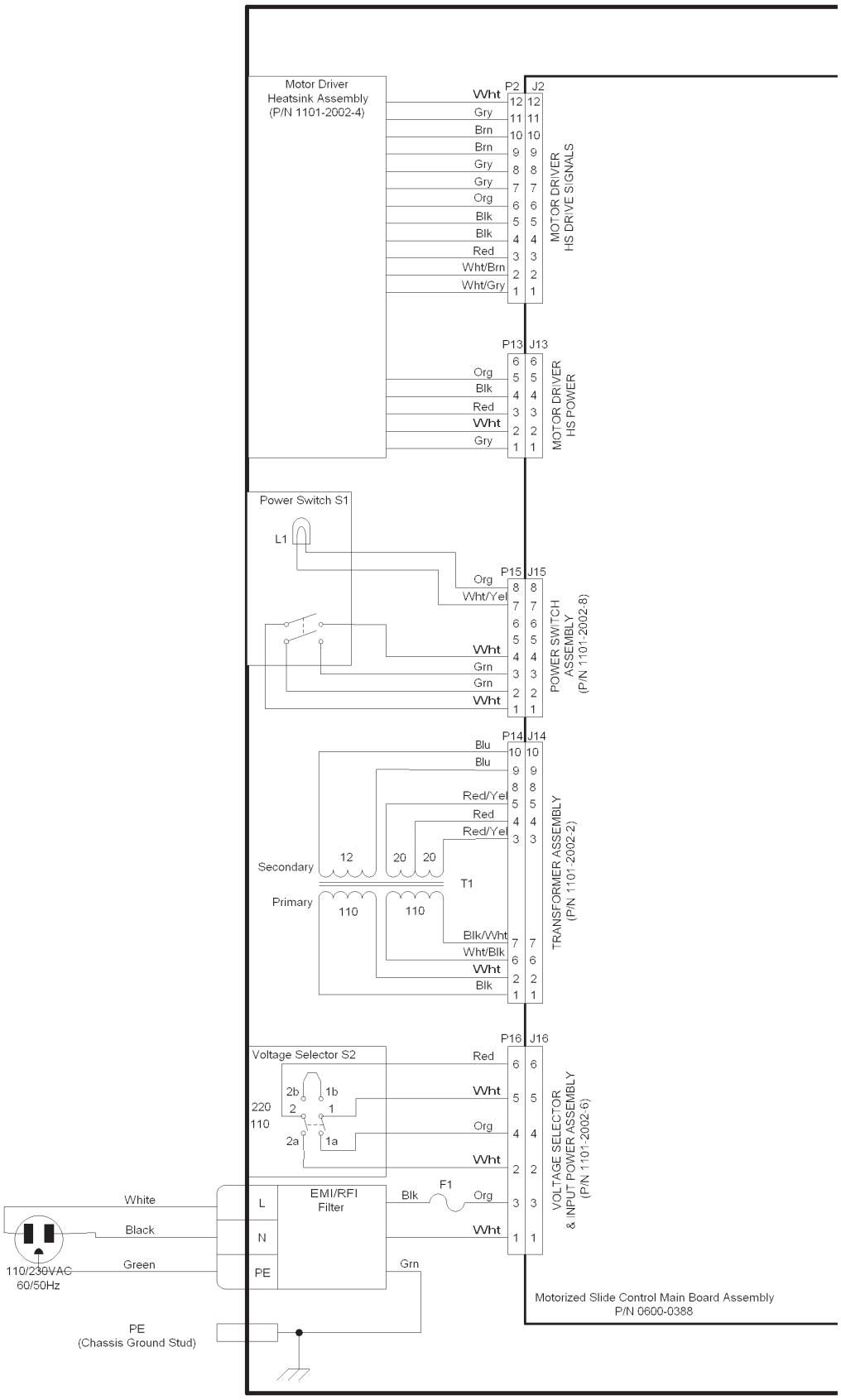


FIGURE 27 - MOTORIZED SLIDE CONTROL BLOCK DIAGRAM

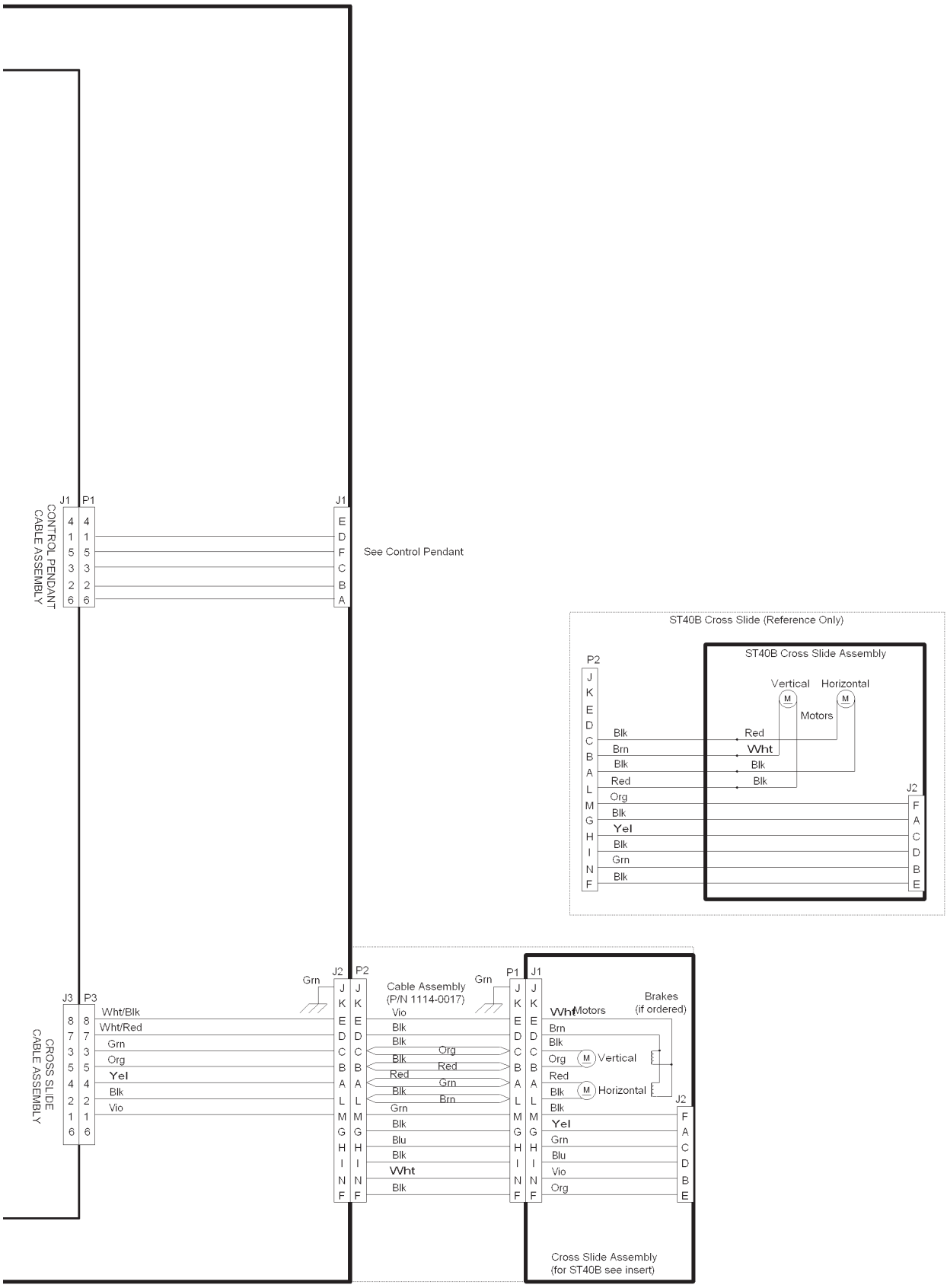


FIGURE 28 - MOTORIZED SLIDE CONTROL BLOCK DIAGRAM (CONT.)

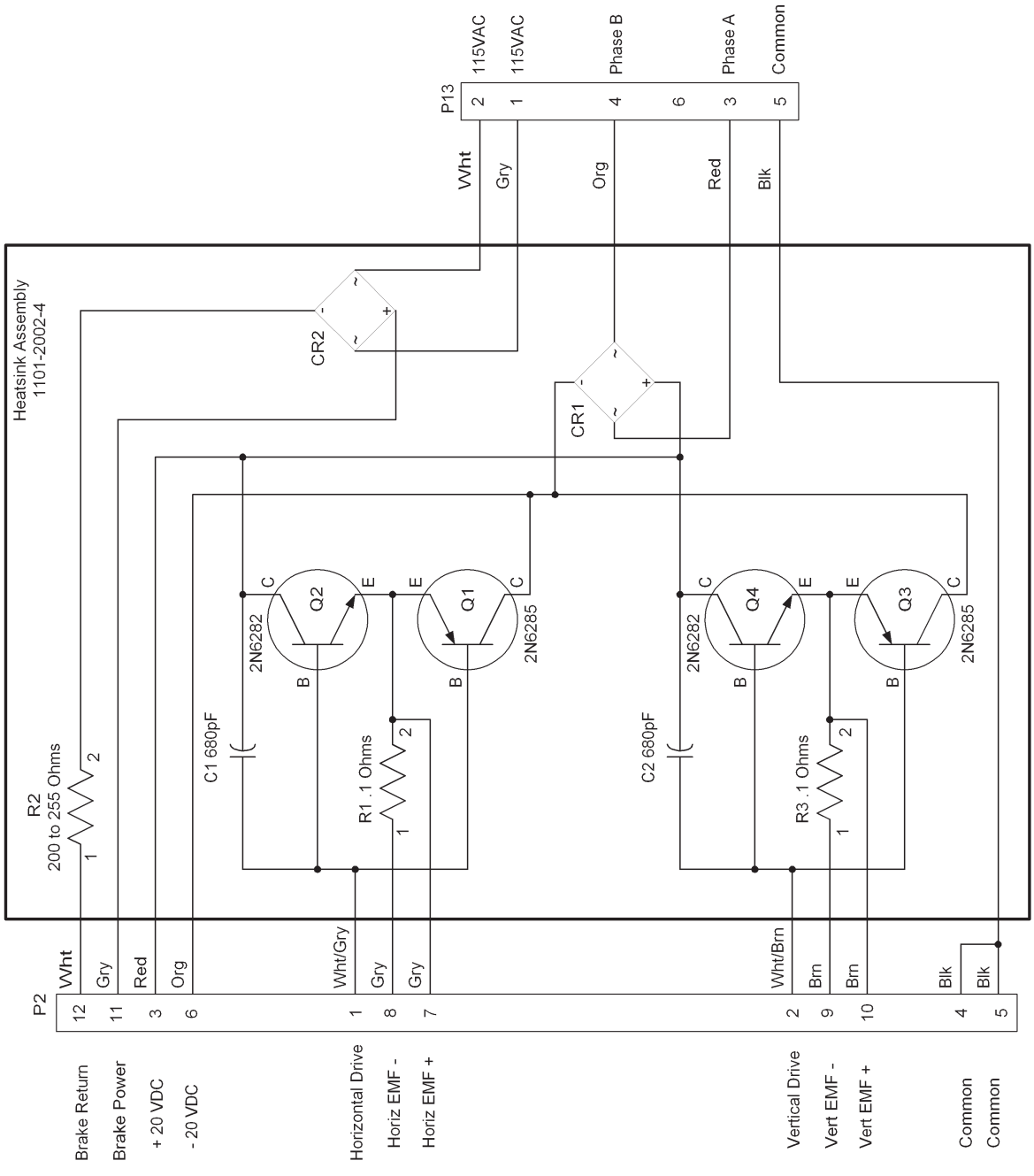


FIGURE 29 - MOTOR DRIVER HEATSINK SCHEMATIC DIAGRAM

OPTIONAL EQUIPMENT

ROTARY TABLE BRACKET

Engineered and designed for use with ST250 seam tracker systems, the Rotary Table Bracket allows the user to position equipment at any point through 360 degrees and lock it into place. Used primarily for fillet weld applications where angling of the torch is necessary or for operations requiring the removal of welding equipment away from the immediate work area to provide ample access for inspection, part removal, etc.

Convenient indexing detents are provided every 90 degrees and positive positioning of table is achieved by means of a short, single stroke of the locking handle. Two adjustable stops are also included, providing the user the facility to accurately re-position equipment after it has been rotated away from the operating position. Sturdily constructed from solid aluminum the mounting plate houses a large diameter ball bearing carrying the rotating faceplate on which the welding equipment is mounted.

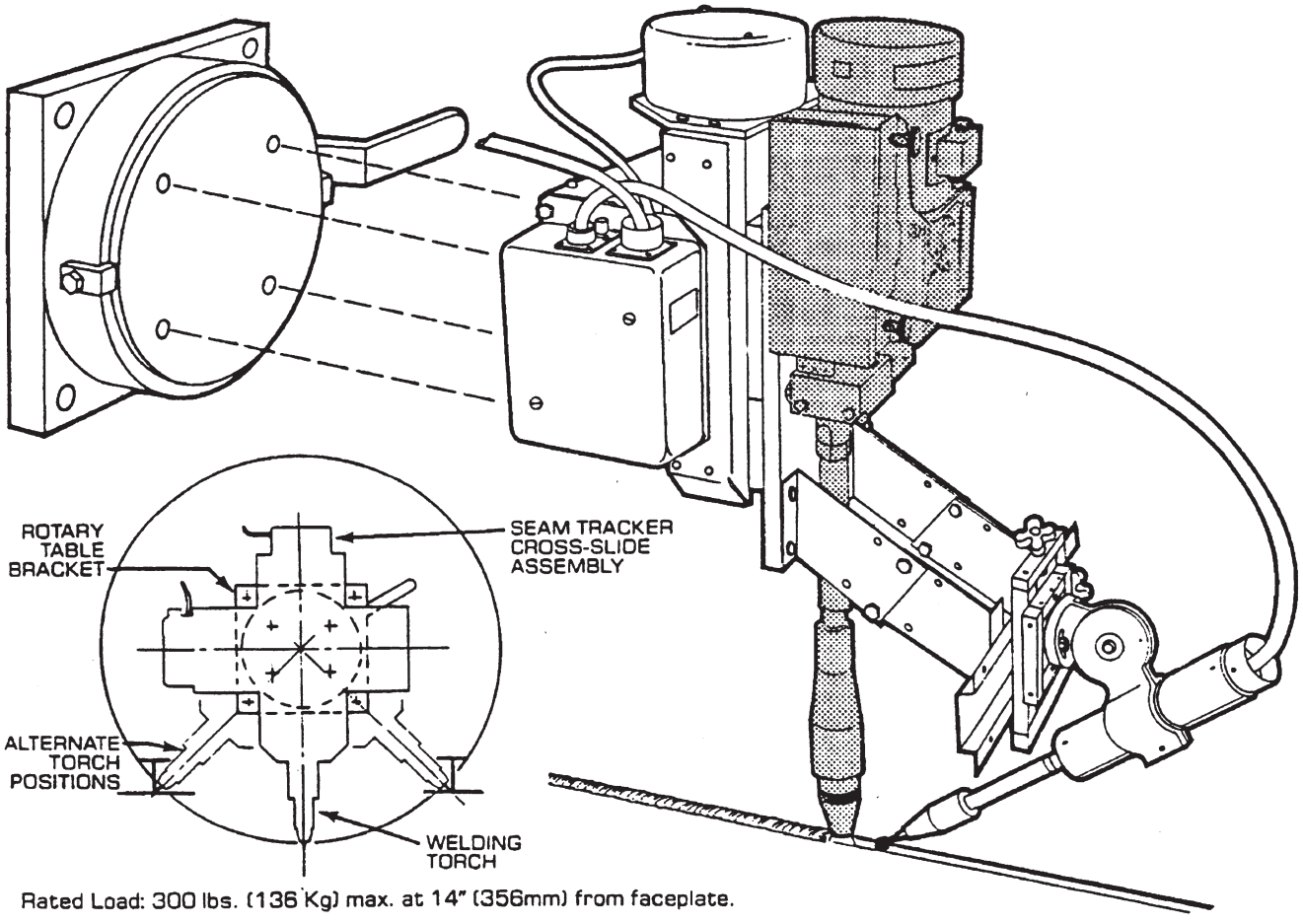


FIGURE 30 - ROTARY TABLE BRACKET

INDEX

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U

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P-706

PARTS LIST FOR

Arc Products Replacement Parts Cross Reference List

P-706-C.1

# Indicates a change this printing.

	DESCRIPTION	ARC PRODUCTS NO.	LECO NO.	QTY
1	5-Axis Probe Bracket Assembly	1100-0258	K52026-1	
2	Sensor Cable Assembly	1114-0378	K52033-1	
3	1/8” Diameter Round	1106-1923	KP52028-1	
4	Insulator, Omni Guide	1110-2093	KP52029-1	
5	1/16” Diameter Round	1106-1974	KP52047-1	
6	1” Diameter Ball	1106-1982	KP52048-1	
7	3/4” Diameter Ball	1106-1991	KP52049-1	
8	5/8” Diameter Ball	1106-2008	KP52050-1	
9	1/2” Diameter Ball	1106-2016	KP52051-1	
10	3/8” Diameter Ball	1106-2024	KP52052-1	
11	1/4” Diameter Ball	1106-2032	KP52053-1	
12	3” Extension Tip	1110-2107	KP52055-1	
13	Remote Panel/Harness Asbly-APC	1103-2002-3	S29276-38	
14	APA St. Pendant Adv Prog Option	1101-2004	S29276-39	
15	St. Panel and Overlay Assembly	0600-0381	S29276-41	
16	Upper Mtr Cvr ST250 3.5”	0600-0377	S29276-53	
17	Switch, Select 1-3/16 Red	2066-0171	S29276-64	
18	Pot 10K Linear 10% 3TCERMET	903002-011	S29276-69	
19	Switch Sidetrack	1116-0352	S29276-70	
20	Advanced Program Control Assembly	1103-2002-1	S29276-72	
21	Control Transformer Assembly	1101-2002-2	S29276-74	
22	Lamp Lens Translucent Red Sm	941000-101	S29276-78	
23	Lamp 387	941000-011	S29276-81	
24	Lamp Holder LH73/1	941000-200	S29276-202	
25	Switch PB 10 Amp Black	2062-0081	S29276-247	
26	Switch Toggle DTSP`	2060-0071	S29276-248	
27	Main Board Assembly	0600-0388	S29276-304	
28	Lamp Lens Translucent Yellow Sm	941000-103	S29276-85	
29	Mtr Cvr Assembly Lwr ST250	0600-0099	S29276-91	
30	Gear Motor, 25:1	1116-0123	S29276-96	
31	Sw Mushroom Stop St Pendant	1116-0400	S29276-98	
32	Switch Auto/Man	1116-0387	S29276-99	
33	Std Off HXx M/F 8-32 x .25 x 1.12 (SS)	981002-004	S29276-106	
34	Knob Sm Skirt/Lt Gray Pointer	940024-001	S29276-108	
35	Shield, Seam Sensor	1110-1062	S29276-110	
36	Slide Assembly Probe H.D	1106-0692	S29276-111	
37	Brake Assembly	0600-0094	S29276-113	
38	Motor Driver Assembly	1101-2002-4	S29276-117	
39	Main Board Assembly	1101-2002-3	S29276-118	
40	Motor Assembly ST250 Upper	0600-0111	S29276-119	
41	Transistor Socket to-3	2716-0034	S29276-120	
42	Pivot - Machined	1110-0805	S29276-121	
43	Sw Joystick 9 Pos Single Pole	2066-0112	S29276-122	
44	Arm Assembly - Probe Adjust	1106-0684	S29276-124	
45	Transistor Replacement Kit	1103-0491	S29276-125	
46	Sensor Module	1106-0838	S29276-128	
47	3 Conductor Power Supply Cord	929000-001	S29276-129	
48	Collar, Insulating	1110-0406	S29276-131	
49	Sensor Rebuild Kit	See Kit BOM’s	S29080	
50	CS40 3 in Strk Rebuild Kit	See Kit BOM’s	S29081	
51	CS40 6 in Strk Rebuild Kit	See Kit BOM’s	S29082	
52	CS250 5 in Strk Rebuild Kit	See Kit BOM’s	S29083	

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# Indicates a change this printing.

	DESCRIPTION	ARC PRODUCTS NO.	LECO NO.	QTY
53	CS250 10 in Strk Rebuild Kit	See Kit BOM's	S29084	
54	CS450 5 in Strk Rebuild Kit	See Kit BOM's	S29085	
55	CS450 10 in Strk Rebuild Kit	See Kit BOM's	S29086	
56	Probe Bracket Assembly Rebuild Kit	See Kit BOM's	S29087	
	REBUILD KIT BOM's:			
	Sensor Rebuild Kit, Includes:		S29080	
	Lower Rod	1110-1054		1
	Support, Lever Arm	1110-1208		1
	Arm Lever	1110-1216		1
	Arm Lever	1110-1224		1
	Pin Elliptical Adjust	1110-1241		1
	Sphere 1/8 in Chrome Steel G25	2360-0030		1
	Clamp Rod	1110-1101		1
	ST40 3" Rebuild Kit, Includes:		S29081	
	Bar Rail Adj	1110-0121		1
	Assembly SCR Actr ST40	1116-0042		1
	Cover Retainer - ST40	1110-0180		1
	Motor - ST40	1117-0587		1
	Set SCR Half Dog - Mod	1116-0115		2
	Cover Telescoping .50 x 1.0 x 3.0 Strk	2000-0015		2
	Wheel Guide Dual Vee #2	2360-0552		4
	Gear Clamp Split Hub	2040-0544		2
	Bearing Ball	2320-0112		2
	ST40 6" Rebuild Kit, Includes:		S29082	
	Bar Rail Adj	1110-0155		1
	Assembly SCR Actr ST40	1116-0077		1
	Cover Retainer - ST40	1110-0091		1
	Motor - ST40	1117-0587		1
	Set SCR Half Dog - Mod	1116-0115		2
	Cover Telescoping .50 x 1.0 x 3.0 Strk	2000-0058		2
	Wheel Guide Dual Vee #2	2360-0552		4
	Gear Clamp Split Hub	2040-0544		2
	Bearing Ball	2320-0112		2
	ST250 5" Rebuild Kit, Includes:		S29083	
	Bearing Ball, Anlr Cont	2320-0244		2
	Ball Bearing ST250	0600-0123		1
	Seal Oil .375 x 1.125 x .312	2380-0128		1
	ST250 Screw Actuator Assembly	0600-0380		1
	Screw Cover Assembly ST250	0600-0159		2
	Wheel, Guide, Dual Vee	2360-0561		4

P-706-C.3

# Indicates a change this printing.

	DESCRIPTION	ARC PRODUCTS NO.	LECO NO.	QTY
	ST250 10” Rebuild Kit, Includes:		S29084	
	Bearing Ball, Anlr Cont	2320-0244		2
	Ball Bearing ST250	0600-0123		1
	Seal Oil .375 x 1.125 x .312	2380-0128		1
	ST250 Screw Actuator Assembly	0600-0374		1
	Screw Cover Assembly ST250	0600-0098		2
	Wheel, Guide, Dual Vee	2360-0561		4
	ST250 10” Rebuild Kit, Includes:		S29085	
	Wheel Guide Dual Vee (4)	2360-0579		6
	ST250 Screw Actuator Assembly	0600-0380		1
	Bearing Ball, Anlr Cont	2320-0244		2
	Ball Bearing ST250	0600-0123		1
	Screw Cover Assembly ST250	0600-0159		2
	ST250 10” Rebuild Kit, Includes:		S29085	
	Wheel Guide Dual Vee (4)	2360-0579		6
	ST250 Screw Actuator Assembly	0600-0380		1
	Bearing Ball, Anlr Cont	2320-0244		2
	Ball Bearing ST250	0600-0123		1
	Screw Cover Assembly ST250	0600-0159		2
	ST450 10” Rebuild Kit, Includes:		S29086	
	Wheel Guide Dual Vee (4)	2360-0579		6
	ST250 Screw Actuator Assembly	0600-0374		1
	Bearing Ball, Anlr Cont	2320-0244		2
	Ball Bearing ST250	0600-0123		1
	Screw Cover Assembly ST250	0600-0098		2
	Probe Bracket Assembly Rebuild Kit, Includes:		S29087	
	Nut Drive - Lower Axis	1110-3898		1
	Nut Drive - Upper Axis	1110-3901		1
	GIB Slide - 1-1/2 in Str	1112-0156		2

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● パネルやカバーを取り外したままで機械操作をしないで下さい。	Japanese **注意事項**
●頭部遠離煙霧。 ●在呼吸區使用通風或排風器除煙。	●維修前切斷電源。	●儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا كانت الاغطية الحديدية الواقية ليست عليه.	Arabic **تحذير**

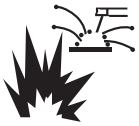
LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的説明以及應該使用的銀捍材料，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقرأ بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

			
WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。	● 燃えやすいものの側での溶接作業は絶対にしてはなりません。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或濕衣物切勿接觸帶電部件及銲條。 ● 使你自己與地面和工件絕緣。	● 把一切易燃物品移離工作場所。	● 佩戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

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