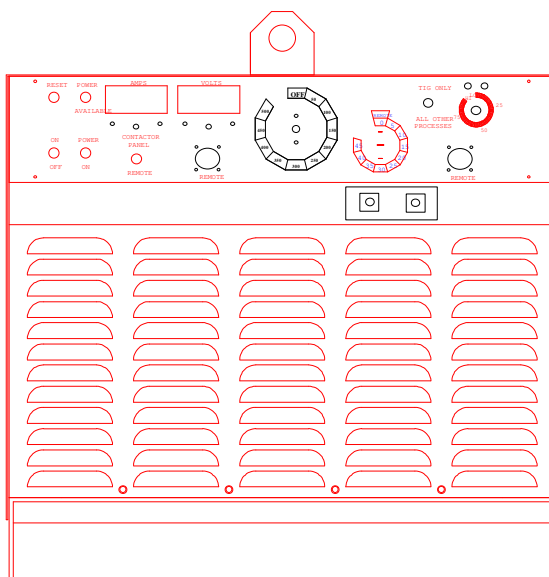


OPERATORS MANUAL FOR THE

# MV 445/545-DPM/STA



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## **WARNING**

### **OPERATOR / USER RESPONSIBILITY**

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically. Defective equipment should not be used.

Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, Advanced Fusion Technologies (Aftek) recommends that a request for service advice be made to the Aftek authorized distributor from whom purchased or directly to the Aftek home office.

## **RETURN MATERIAL AUTHORIZATION**

- A. No equipment and/or parts will be accepted by Aftek when returned unless prior authorization has been granted by the product support department. All equipment, and/or parts must be returned freight prepaid.
- B. Warranty parts may, at the discretion of the product support department be shipped prior to the return of the defective parts. The parts will be invoiced to the customer at their established prices, and a credit memo will be issued only upon receipt of the defective material at Aftek. In no event will Aftek issue a credit memo for any returned material if that material has not been returned to Aftek within sixty (60) days of authorization. At that time, the invoice issued will be due and payable.
- C. The product support department of Aftek, upon receipt of defective items, will evaluate and have final authorization as to the validity of the warranty claim.
- D. Upon receipt of authorized equipment at Aftek that is not covered under warranty, Aftek personnel will inspect the equipment and an estimate of repairs will be made. This will be transmitted to the customer prior to any work being performed by Aftek, and, upon customer authorization, a purchase order will be requested.

## **FREIGHT CLAIMS**

Under federal ICC regulations, goods shipped F.O.B. point of origin are the property of the buyer, therefore, Aftek cannot file freight claims for damage to goods during shipment. Aftek is not authorized or allowed to do so.

## **IMPORTANT NOTE:**

It is the responsibility of the customer to ensure that all internal electrical connections are tight on initial installation, and, further, to inspect tightness of connections at periodic intervals. Aftek engineering will assist in formulating these requirements, depending on application of the product.

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## **I. SAFETY PRECAUTIONS**

**WARNING:** These safety precautions are for your protection. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below. Failure to observe these safety precautions can result in personal injury or death.

**1. PERSONAL PROTECTION:** Skin and eye burns from exposure to rays from an electric arc or hot metal can be more severe than sunburn. Therefore:

- a. Use a face shield fitted with the correct filter and cover plates to protect your eyes, face, neck, and ears from sparks and rays of the arc when operating or observing operations. **WARN** bystanders not to watch the arc and not expose themselves to the rays of the electric arc or hot metal.
- b. Wear flameproof gauntlet-type gloves, heavy long- sleeve shirts, cuff-less trousers, high-topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and sparks of hot metal. A flameproof apron may be desirable as protection against radiated heat and sparks.
- c. Hot sparks or metal can lodge in rolled up sleeves, trouser cuffs, or pockets. Sleeves and collars should be kept buttoned and pockets eliminated from the front of clothing.
- d. Protect other nearby personnel from arc rays and hot sparks with a suitable non-flammable partition.
- e. Always wear safety glasses or goggles when in a work area. Use safety glasses with side shields or goggles when chipping slag or grinding. Chipped slag may be hot and can travel considerable distances. Bystanders should also wear safety glasses or goggles.
- f. Some gouging and cutting processes produce excessively high noise levels and require ear protection.

**2. FIRE PREVENTION:** Hot slag or sparks can cause serious fires when in contact with combustible solids, liquids, or gases. Therefore:

- a. Remove all combustible materials well away from the work area or completely cover the materials with a protective non-flammable covering. Such combustible materials include wood, clothing, sawdust, gasoline kerosene, paints, solvents, natural gas, acetylene, propane, and other similar materials.
- b. Hot sparks or hot metals can fall into cracks in floors or wall openings and cause a hidden smoldering fire. Make certain that such openings are protected from hot sparks and metal.
- c. Do not weld, cut or perform other hot work until the workplace has been completely cleaned so that there are not substances on the workplace which might produce flammable or toxic vapors.
- d. For fire protection, have fire extinguishing equipment (such as a garden hose, water pail, sand bucket, or portable fire extinguisher) handy for instant use.
- e. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire.

- f. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes", which is available from the National Fire Protection Association, 470 Atlantic Avenue, Boston MA 02210.
- 3. ELECTRICAL SHOCK:** Contact with live electrical parts can cause severe burns to the body or fatal shock. Severity of electrical shock is determined by the path and amount of current through the body. Therefore:
- a. Never allow live metal parts to touch bare skin or any wet clothing. Be sure gloves are dry.
  - b. When standing on metal or operating in a damp area, make certain that you are well insulated. Wear dry gloves and rubber soled shoes and stand on a dry board or platform.
  - c. Always ground the power supply by connecting a ground wire between the power supply and an approved electrical ground.
  - d. Do not use worn or damaged cables. Do not overload the cable. Use well-maintained equipment.
  - e. When not operating, turn off the equipment. Accidental grounding can cause overheating and create a fire hazard. Do not coil or loop cable around parts of the body.
  - f. Be sure the proper size ground cable is connected to the work-piece as close to the work area as possible. Grounds connected to building framework or other remote locations from the work area increase the possibility of output current passing through lifting chains, crane cables, or various electrical paths.
  - g. Keep everything dry, including clothing, work area, cables, electrode holder, and power supply. Fix water leaks immediately.
  - h. Refer to American National Standard Z49.1 in Item 6 below for specific grounding recommendations. Do not mistake the work lead for a ground cable.
- 4. VENTILATION:** Fumes, particularly in confined spaces, can cause discomfort and physical harm. Do not breathe fumes. Therefore:
- a. At all times provide adequate ventilation in the work area by natural or mechanical ventilation means. Do not weld, cut or gouge on materials such as galvanized zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
  - b. Do not operate in locations close to chlorinated hydrocarbon vapors coming from degreasing or spraying solvent vapors to form phosgene, a highly toxic gas, or other irritant gases.
  - c. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work area. Do not continue to operate if physical discomfort persists.
  - d. Refer to American National Standard Z49.1 (ANSI) in Item 6 below for specific ventilation recommendations.
- 5. EQUIPMENT MAINTENANCE:** Faulty or improperly maintained equipment can result in poor work, but most importantly it can cause physical injury or death through fires or electrical shock. Therefore:

- a. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
  - b. Before performing any maintenance work inside a power supply, disconnect the power supply from the electrical power source.
  - c. Maintain cables, grounding wire, connections, power cord and power supply in safe working order. Do not operate any equipment in faulty conditions.
  - d. Do not abuse any equipment or accessories. Keep equipment away from heat sources such as furnaces, wet conditions such as water puddles, oil or grease, corrosive atmospheres and inclement weather.
  - e. Keep safety devices and cabinet covers in position and in good repair.
  - f. Use equipment for its intended purpose. Do not modify it in any manner.
- 6. ADDITIONAL SAFETY INFORMATION:** For more information on safe practices for setting up and operating electrical welding and cutting equipment, and on good working habits, the following publications are available from the American Welding Society, 2501 N.W. 7th Street, Miami, Florida 32125:
- a. "Safety in Welding and Cutting" AWS Z49.1 (ANSI)
  - b. "Recommended Safe Practices for Gas-Shielded Arc Welding" AWS A.6.1.
  - c. "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping that have held Hazardous Substances" AWS F4.1.
  - d. "Recommended Safe Practices for Plasma Arc Cutting" AWS A6.3.
  - e. "Recommended Safe Practices for Plasma Arc Welding" AWS C5.1.
  - f. "Recommended Safe Practices for Air Carbon Arc Gouging and Cutting" AWS C5.3.
  - g. "Arc Welding Safely" booklet.

## **II. GENERAL DESCRIPTION**

This unit is a constant current power source suitable for Stick, TIG, and Arc air gouging operations. As an option our patented DEMAND PULSE circuits can be added which offers the user MIG welding capabilities as well as ease of operation, set up and weld setting, and "ON DEMAND" arc control based on patented, reliable solid state circuitry.

**TABLE 1. SPECIFICATIONS**

Model	Amp Range	Output	Duty Cycle	Open Circuit Voltage	Height	Width	Depth	Weight
MV445	5-445	400	60%	60	24	26	36	325
MV545	5-545	400	60%	60	24	26	36	335

### **A. INSTALLATION**

WELDER LOCATION - The welder should be located so that the passage of air through the front and rear is not obstructed. Allow at least 6 to 8 inches between intake louvers and any wall or obstruction.

NOTE: In outdoor installation equipment life will be prolonged if the welder is protected from severe weather conditions. A semi-enclosed shelter located against the sheltered side of a building with a canopy over the welder is recommended.

**NEVER OPERATE THE POWER SOURCE WITH THE COVER REMOVED.** Not only is this a safety hazard, but, since the welder is air cooled, the cooling air flow is directed by the covers in place.

### **B. ELECTRICAL CONNECTIONS**

The first thing that is required for the electrical installation of this power source is to know the primary three phase line voltage to which it is to be connected. The welder is wired for either 230/460-60Hz, or 380/400/415-50Hz, therefore, it is necessary to connect the copper links on the tap board located above the main transformer for the proper voltage. All AFTEK power sources are shipped with the tap board connected for the highest line voltage possible (460V-60Hz, or 415V-50Hz). The tap board voltage connections are shown in FIGURE 1 and on a decal on the lifting yoke assembly.

Electrical protection of the primary input source is the responsibility of the user. Primary line connection to the power source is also the user's responsibility and subject to the national, state, county, city and company electrical codes. Therefore, it is very important that the proper fuses (circuit breakers) and wire sizes be used in the primary line connections to the power source. TABLE 2 lists the recommended primary four-conductor wire and fuse sizes for the operating line voltage.

FIGURE 1 - TAPBOARD CHANGEOVER LABEL

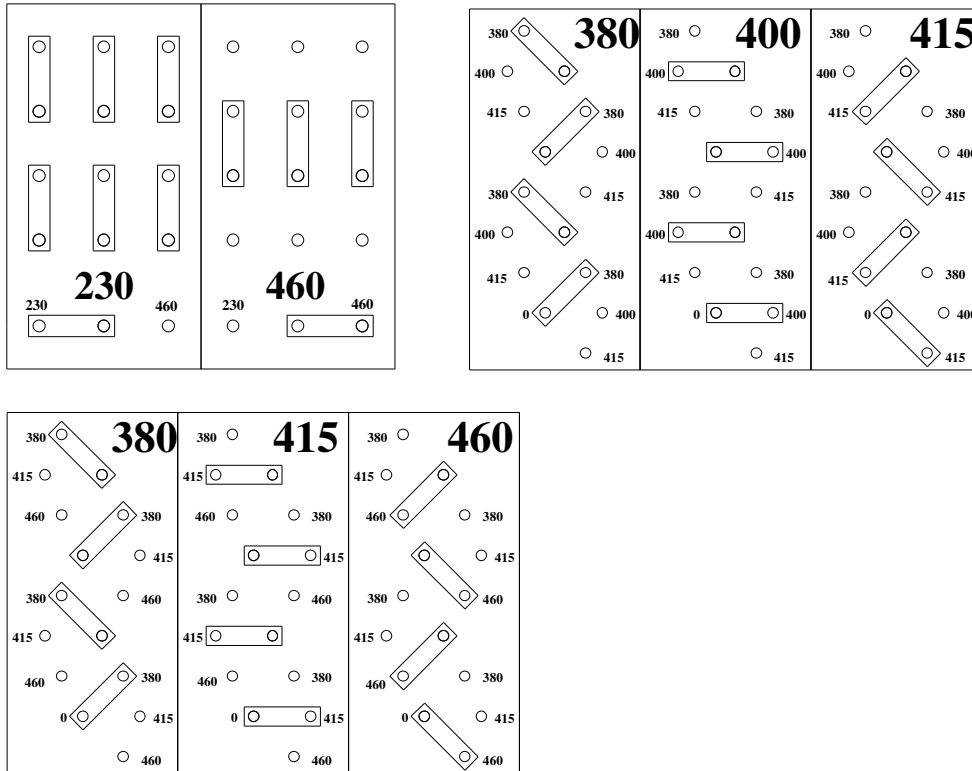


TABLE 2. RECOMMENDED PRIMARY WIRING AND FUSING

Input Voltage	230	380	400	415	460
Input amperage	69	42	40	38	35
Fuse size	75	50	50	50	40
Wire size	6	8	8	8	8

**WARNING: AFTER UNCRATING THIS POWER SOURCE AND BEFORE WELDING, REMOVE THE ROOF AND CHECK THE UNIT FOR LOOSE WIRES, NUTS AND BOLTS. IT IS SOMETIMES POSSIBLE FOR WIRING AND FASTENERS TO LOOSEN DURING SHIPMENT.**

1. Remove the side panel and connect the copper links on the tap board for the proper operating line voltage.
2. Provide primary leads of the proper size and adequate protection (see TABLE 2) and in accordance with all national and local electrical codes.
3. Provide suitable strain relief for the primary power leads to the power source.
4. Connect the three (3) "hot" leads to the main contactor and the ground lead to the ground bolt mounted next to the contactor. Both primary contactor and ground bolt are located on the base to the rear of the main transformer.

5. When complete, secure the roof.

## **C. CONTROL LOCATIONS AND DESCRIPTIONS**

### **1. VOLTMETER**

Indicates the arc voltage at the output terminals during welding, and the open circuit voltage at the output terminals when the power source is energized but not welding. Meter is calibrated to +/- 2% accuracy.

### **2. AMMETER**

Indicates welding and gouging amperage. Meter is calibrated to +/- 2% accuracy.

### **3. POWER ON SWITCH**

This is the main power switch to energize the unit. The Power On light indicates that the power source has been turned on. NEVER open access doors or attempt to service the unit when this light is on.

**Note:** For all "STA" and SMAW units, this switch energizes the main contactor and fan. For all DPM units, in the OFF position (switch down), the cooling fan is off and the primary contactor is disabled. In the ON position, (switch up) the green POWER ON light is on, the fan is on, and the power source is operational by placing the PANEL / REMOTE switch in the PANEL position or by having contact closure between the appropriate pins of the WIRE FEEDER Amphenol connector with the switch in the REMOTE position. (See the Amphenol connector section below for more details.)

### **4. PANEL / REMOTE Toggle Switch (With DPM)**

This switch selects the operation of the main contactor in the power supply. In the PANEL position (switch up), the main contactor is energized with the internal 115VAC and the output welding terminals are "hot" all the time as required for SMAW (stick electrode), GTAW (TIG) welding and air arc gouging. In the remote position, contact closure must be supplied between the appropriate pins of the WIRE FEEDER Amphenol connector to operate the main contactor.

### **5. WIRE FEEDER Amphenol Connector (DPM)**

Auxiliary 24 VAC is provided between pins A and G in the WIRE FEEDER Amphenol connector, and is fused with a 5 amp, reset circuit breaker. Auxiliary 115 VAC is provided between pins I and G. (See the table below for pin assignments) These will run most wire feeders. For a ground connection, attach the ground wire to pin K of the Amphenol.

Contact closure between either A and B (24 volt) or pins I and J (115 volt) will energize the primary welding contactor.

If a feeder is to be used that does not provide contact closure only for the contactor operation, a "slave" relay must be added between Pins A and B (or I and J) and the wire feeder. In other words, if the feeder to be used supplies only 115 VAC for contactor operation connects the coil of a 115 VAC relay to it and connects a set of normally open contacts to pins I and J.

A 14 pin male Amphenol cable plug is provided with the power source for customer convenience in connecting to the wire feeder.

**TABLE 5. PIN ASSIGNMENT**

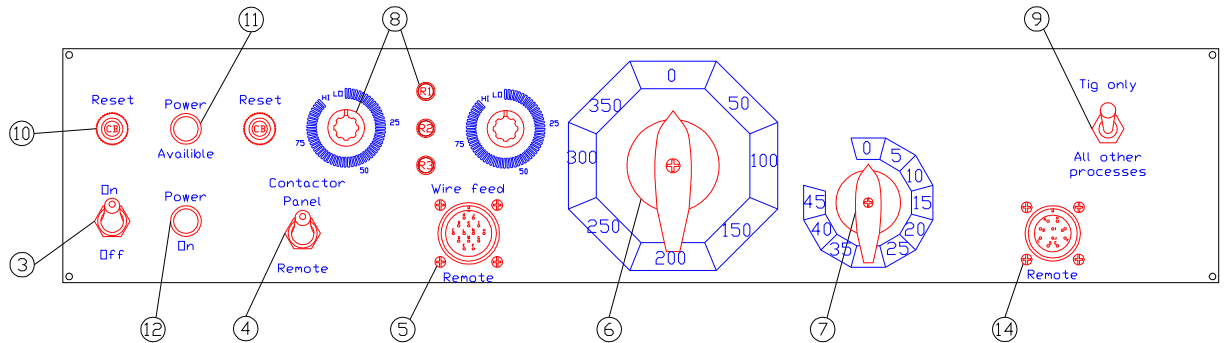
Pin	Use
A	24 VAC
B	Contact closure to A
G	Circuit common
I	115 VAC
J	Contact closure to I
K	Chassis ground

The pinout is the same as Miller Invision 456. **WHEN USING MILLER 70 SERIES FEEDERS, THE DIPSWITCH INSIDE THE FEEDER MUST BE RESET FOR PROPER OPERATION. FOLLOW INSTRUCTIONS IN FEEDER MANUAL.**

**6. COARSE CURRENT CONTROL**

This switch adjusts the output current in 50 amp increments. Each additional turn of the switch adds in another 50A of welding current. The legend around the switch is to be used as a guide which is based on an arc voltage of 25 volts. If the arc voltage is higher than this value, the actual amperage will be less than the legend indicates. If the arc voltage is lower, the amperage will be greater. The same applies to the fine current control switch.

**FIGURE 2 - FRONT PANEL CONTROLS**



**7. FINE CURRENT CONTROL**

Output current may be adjusted in 5 amp increments by the fine current control switch. The legend around the switch is to be used as a guide which is based on an arc voltage of 25 volts. If the arc voltage is higher than this value, the actual amperage will be less than the legend indicates. If the arc voltage is lower, the amperage will be greater.

**8. DEMAND PULSE CONTROL AND INDICATOR Leads**

Some models offer a one turn potentiometer to allow the operator to select the arc voltage at which the additional current "kick" turns on; other models offer a High/Off/Low toggle switch. This function is explained in detail in the next section. These light emitting diodes indicate the operation of the **DEMAND PULSE** circuits. When lit, the LED indicates that the circuit is "kicking" the arc.

### **9. TIG ONLY / ALL OTHER PROCESSES Toggle Switch (DPM)**

In the TIG ONLY position (switch up) the 2 **DEMAND PULSE** circuits are disabled to assure a smooth constant current for this welding process. In the ALL OTHER PROCESSES position (switch down) the **DEMAND PULSE** circuits are fully operational to provide the additional amperage required to make a transfer.

### **10. RESET BREAKER**

This are separate circuit breakers for the 24 volt and 115 volt that will open if for any reason the main cooling fan short circuits or if the power supplied to the wire feeder amphenol short circuits or the accessory (wire feeder, etc.) being used draws amperage above the capacity of the auxiliary transformer.

### **11. POWER AVAILABLE LIGHT**

This light indicates that the primary power lines are active in the unit. NEVER open access doors or attempt to service the unit when this light is on.

### **12. POWER ON LIGHT**

This light indicates that the fan is on, and the unit is ready for welding.

### **13. WELDING OUTPUT TERMINALS**

These terminals provide the necessary output for a welding lead and ground cable.

### **14. REMOTE CONTROL FOR FINE CURRENT ADJUSTMENT**

This 10 pin amphenol is provided for remote controlling the fine control. In order to use this option the fine control switch must be turned off. The remote control pendant offered as an option controls the fine amperage just like the switch on the panel.

## **III. GENERAL OPERATING INSTRUCTIONS**

### **A. ENERGIZING THE UNIT**

NO power source access panels should be opened while there is power applied to the input cables of the welding unit. Check all incoming primary lines with a volt-ohmmeter to ensure whether the primary circuit breaker is on or off.

The unit is energized by switching the ON / OFF toggle switch up to the ON position. A green POWER ON light will come on. This means that the machine is capable of welding and auxiliary output power is available. The cooling fan will also come on. Push the toggle switch down to the OFF position to turn the unit off. Turn all power off before making secondary connections.

### **B. SECONDARY CABLE (OUTPUT) CONNECTIONS**

The welder output terminals are located on the slanted part of the front panel. There are two (2) output terminals. The terminal on the right is the NEGATIVE, the terminal on the left is the POSITIVE terminals (its output is controlled by the coarse and fine amperage selector switches).

It is important that properly sized cables be used for both the electrode and work (ground). Table 3 may be used as a guide for the selection of the welding cables electrode and work (ground). It is to be noted that in Table 3 the "voltage drop" value is for the total weld circuit, that is, for the length of the electrode **plus** the work (ground) cables.

**TABLE 3. WELDING AND GROUND CABLE SELECTION**

CONDUCTOR SIZE - AWG	Current capacity	Voltage Drop Per 100ft. / 62m
2	225	3.75
1	280	3.50
1/0	340	3.37
2/0	420	3.29
3/0	505	3.17
4/0	605	3.13
250 MCM	730	3.12
500 MCM	1050	2.11
750 MCM	1500	2.54

\*Based on a 40 degree C ambient temperature. \*\*Length is total of weld circuit (electrode plus work cables)

**C. AUXILIARY AND WIRE FEEDER HOOK-UP (DPM)**

Auxiliary 24 VAC is provided between pins A and G in the WIRE FEEDER Amphenol connector, and is fused with a 5 amp, reset circuit breaker. Auxiliary 115 VAC is provided between pins I and G. (See the table below for pin assignments) These will run most, if not all, present day wire feeders. For a ground connection, attach the ground wire to pin K of the Amphenol.

Contact closure between either A and B (24 volt) or pins I and J (115 volt) will energize the primary welding contactor.

If a feeder is to be used that does not provide contact closure only for the contactor operation, a "slave" relay must be added between Pins A and B (or I and J) and the wire feeder. In other words, if the feeder to be used supplies only 115 VAC for contactor operation connect the coil of a 115 VAC relay to it and connect a set of normally open contacts to pins I and J.

A 14 pin male Amphenol cable plug is provided with the power source for customer convenience in connecting to the wire feeder.

**TABLE 4. PIN ASSIGNMENT**

The pinout is the same as Miller Invision 456. **WHEN USING MILLER 70 SERIES FEEDERS, THE DIPSWITCH INSIDE THE FEEDER MUST BE RESET FOR PROPER OPERATION. FOLLOW INSTRUCTIONS IN FEEDER MANUAL.**

Pin	Use
A	24 VAC
B	Contact closure to A
G	Circuit common
I	115 VAC
J	Contact closure to I
K	Chassis ground

## D. GENERAL WELD SETTINGS

### SMAW - STICK ELECTRODE

**Note:** Not all units are equipped with demand pulse modules. Some units have two modules and others have three depending on options. Some units control the settings for the demand pulse modules with a potentiometer and others with a toggle switch. Check your machine to determine which kind you have.

1. Connect the electrode (LEAD) to the desired polarity: (+) terminal for reverse polarity, (-) terminal for straight polarity, and the work (GROUND) to the other.
2. Set the 5 amp and 50 amp switches to the desired outputs, taking into account that the R1, R2 and R3 circuits will automatically add more current to the welding arc as needed. Normally if a welding electrode runs at 95 amps, setting the output for 75 amps will give equal or better arc characteristics because of the automatic DEMAND PULSE.
3. Be sure the work (GROUND) cable is connected to either the work piece or at some point that is electrically equivalent to the piece being welded. Remember that the ground cable size must be as big as or bigger than the electrode cable. Refer to Table 3.
4. **Units with potentiometer for setting of the demand pulse modules.**  
Set the DEMAND PULSE CONTROL knob to the setting (from 0-100). Most applications work well with the control at 75. Remember that the arc voltage at which R1 and R2 turn on is 6 volts at setting 0, and 15 arc volts at setting 100. R2 is fixed at the factory to turn on at 12 arc volts.

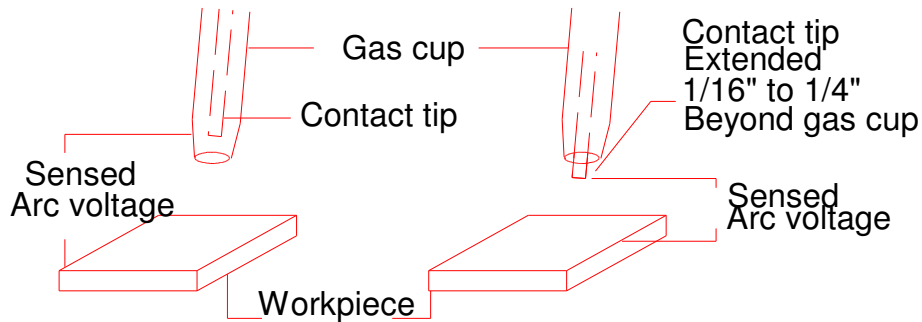
#### **Units with toggle switches for setting of the demand pulse modules.**

Set the DEMAND PULSE CONTROL switch to either HI or LOW. Most applications work well with the control at HI. Remember that the arc voltage at which R1 and R2 turn on is 10 volts at setting LO, and 15 arc volts at the HI setting. R3 is fixed at the factory to turn on at 12 arc volts.

## GMAW - Mig Welding

1. Since this welding process is based on sensing the true arc voltage, certain adjustments to a regular "MIG" welding system must be made. First is the stick out distance between the gun's contact tip and the work piece. See Figure 3.

**FIGURE 3. RECOMMENDED POSITION OF CONTACT TIP**



2. Be sure the work (GROUND) cable is connected to either the work piece or at some point that is electrically equivalent to the piece being welded. Remember that the ground cable size must be as big as or bigger than the electrode cable.
3. Determine the welding current required, taking into account the wire size, chemistry of wire, the piece being welded, bead appearance, etc., and the additional **DEMAND PULSE** from R1, R2 and R3 (if equipped).
4. Set the desired current on the power source. Since this welding process "pulses" in additional current as the arc demands to prevent short circuits, you will find that the current set on the power source will be considerably less than in conventional GMAW with CV power sources.

For example, on a conventional GMAW constant voltage system using 0.035 E70S-6 (mild steel wire), for out of position welding, a current of 90 to 120 amps is normally used. However, with the **DEMAND PULSE** process, because of R1, R2 and R3, it will be found that a setting of only 70 to 95 amps will result in extremely suitable arc for out of position welding. The lower base current results in less distortion, a smaller heat effected zone and a much more manageable weld puddle without cold lap or lack of fusion defects.

In the **DEMAND PULSE** welding process, the arc voltage is sensed as being the voltage between the end of the contact tip and the work piece. Consequently, having too much stick out, as shown in FIGURE 3, will give the system an erroneous reading, whereas a correct extension of the tip will result in a truer sense of the real arc voltage and, at the same time, provide more operator visibility of the arc and lessen the effects of wire cast and helix.

5. Select the desired shielding gas and adjust the flow rate for 20 to 30 CFH. Excessive flow rates (40 CFH and over for the common shielding gases) will not only waste gas, but will effect the weld bead (it would be like welding in a hurricane).
6. Wire Feed Setting - in the DEMAND PULSE welding process, the arc voltage (length of arc) is determined entirely by the speed of the wire being fed. If the wire is being fed too

fast, wire stubbing will occur. If the wire is fed too slowly, the arc will have a tendency to burn back into the contact tip. You will find that there is a "window" of wire feed speeds where a desirable arc will be produced. The fast end of the window will result in stubbing if the welding gun is suddenly moved into a "wall". The slow side of the "window" will be found to be a very long, unmanageable arc. It has been found that in welding with mild steel wire that the best wire feed for overhead and vertical welding is on the fast side of the "window". If wire speed is on the slow side of the "window" it may result in "balling" of the wire in the overhead position. If beaded shape is a prime concern, adjust the wire feed speed to give the bead profile desired. For a very flat bead wire feed must be slowed down to where the arc sounds like a cross between globular and spray.

7. Set the DEMAND PULSE CONTROL knob to the setting resulting in the welding arc you feel is best. For potentiometer models the arc voltage at which R1 turns on is 6 volts at 0 and 15 volts at 100. R2 is factory fixed at 12 arc volts. On toggle switch models High is 15 volts, low is 10 volts on both; R3 is fixed at 12 volts. The 3 LEDs light up to show when each fires. For .035 wire, carbon or stainless, set R1 to High, R2 to "off" or low. Set the wire feed speed to deliver a smooth arc, with R1 LED glowing almost steadily. R2 and R3 may flicker, but basically, .035 needs only one pulse module to produce a steady arc with no spatter.

For .045, R2 may need to be on high – try it on low and high. R2 was added to help the arc when welding .045 and larger wires using CO2. With mixed gases, many times R1 is set to high, R2 to low. Sometimes, especially on very thin materials, it works to turn BOTH R1 and R2 "OFF", and use just R3 at the fixed 12 volts. Experiment!

If "stubbing" occurs, reduce wire speed until the arc is "crisp", looks and sounds like short-arc. If the arc is wandering, or a large ball forms, increase wire speed.

### **FCAW - Flux Cored**

1. In welding with flux cored wire it has been found that welding at the fast end of the wire feed will cause stubbing if the operator dramatically shortens the stick out. The surest way to set the wire feed speed properly is to adjust the wire speed to the proper voltage required by the wire being used.
2. Because flux cored wires usually are designed for higher arc voltages (21 - 30V), the R1 and R2 turn on arc voltages may be lower than desired, and so the **DEMAND PULSE CONTROL** knob should be set between 75 and 100 or on HIGH on the toggle switch models.

## **E. WELDING HINTS**

### **DO'S**

1. Connect the ground cable at a point where it is electrically the same as the work piece.
2. Position the contact tip so that it extends 1/16" to 1/4" beyond the end of the gun nozzle.
3. Set the welding current (heat) at the power source in GMAW-- do not adjust the wire feed speed for arc "heat".

4. Allow for the R1, R2 and R3 circuits additional current "PULSES" in setting the current on the power source.
5. Be sure that the wire feeds smoothly and consistently. Variations in wire feed speeds will cause a very erratic arc.

### **DO NOT'S**

1. Increase the wire feed speed if more "heat" is wanted. If more heat is wanted, increase the current setting at the power source. Increasing wire feed speed will only result in lowering arc voltage and will cause stubbing.
2. Positioning the contact tip inside the end of the gas nozzle results in a false arc voltage to the system and, because of cast and helix in the wire, makes the operator work a lot harder to keep a good looking bead.
3. Set gas flow too high or too low. The gas is used to shield the weld puddle only. If there is too much gas, it will agitate the weld puddle, causing spatter and ropey welds. Too little gas will result in porosity and "dirty" weld.
4. Overlook the ground (work) connection--be sure it is connected at a point where it is electrically the same as the work piece.
5. Assume that the shield gas is proper because the label on the bottle says so. Contaminated gas bottles do exist.
6. Overlook leaks in the gas system - loose connection of fitting or holes in the gas hoses will result in defective welds.

## **IV. TECHNICAL INFORMATION**

### DEMAND PULSE WELDING PROCESS

The MV445-DPM is not only unique in design, but also in method of metal transfer in the SMAW (Stick), GMAW (Mig), and FCAW (Flux Core) processes.

Welding operations differ greatly in the weld supply requirements. For example, the weld supply characteristic will vary as a function of the materials to be welded, joint designs, electrodes used, welding process, welding position and the preferences of the individual welding operator. The MV445 automatically adapts itself for these varied requirements with the only adjustment being the desired weld current for SMAW (Stick), GTAW (Tig) and the desired weld current and the wire feed speed for GMAW (Mig) and FCAW (Flux Core).

The MV445-DPM operates on the simple basis of Ohms Law. Ohm's law states that voltage (V) divided by resistance (Ohms) equals' current (Amps). Based on this law it can easily be calculated that with a 60 volt source and a 25 volt arc, the difference is  $60V - 25V = 35V$ . Therefore, if a 0.7 ohm resistor is added to the circuit the difference between the 60V source and the 25V arc of 35V is absorbed by the 0.7 ohm resistor. Namely,  $35V$  divided by 0.7 ohms ( $35/.7$ ) is 50 amps.

Three patented electronic circuits are used in this welding process. The three circuits are identical except for the arc voltage at which they turn on. They are referred to as R1, R2 and R3.

The arc voltage at which R1 and R2 are turned on is adjustable by a one turn potentiometer (or toggle switch depending on model) on the front panel which allows the "turn on" arc voltage to be adjusted from 6V (LO on the potentiometer, low on the switch is 10 volts) to 15V (HI on the potentiometer and toggle switch). The arc voltage at which R3 turns on is factory fixed at 12 volts. The arc voltage is sensed within the power source and the electronic circuits are automatically turned on whenever the arc voltage demands it.

For example, with the potentiometer or switch set at HI, equating to a 15V arc and when the arc voltage reaches 15 volts, the R1 circuit turns on, adding about 100 amps to the arc. If this additional arc current did not transfer the weld metal causing the arc voltage to decrease to below 15 volts and the arc voltage reaches 12V the second circuit, R3, will automatically add another 100 amps or so to the arc and cause metal transfer without short circuiting. If the R2 circuit was set for low then it would kick in at 10 volts. The additions of the added 100A currents are turned on and off as fast as a billionth of a second. These two circuits are only on for as long as the arc demands them.

The constant current **DEMAND PULSE** process, with its unique method of only pulsing "on demand" as the welding arc tries to short circuit, virtually eliminates the problems inherent in the SHORT-CIRCUITING MIG process, the fixed PULSE ARC process, and CONVENTIONAL CONSTANT CURRENT stick electrode welding, including cold laps, lack of fusion, and "fisheyes".

## **V. TROUBLESHOOTING GUIDE**

<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
Unit will not turn on to weld but the power on light comes on	Thermostat in transformer or rectifier is tripped	Wait for thermostat to reset
	Amphenol connector improperly wired	Check instruction manual
	Faulty contactor coil	Replace contactor
Line fuses blow when the machine is turned on	Shorted diode	Replace diode
	Improper connections instructions	Refer to installation
	Shorted transformer coil	Check for shorted or grounded windings, replace if necessary
Erratic arc "single phasing"	Blown diode	Replace diode
	Blown line fuse	Replace fuse
Circuit Breaker on control panel trips	Worn or faulty motor	Replace motor
	Faulty contactor coil	Replace contactor
	Improper wire feeder connections	Refer to hookup instructions
Line fuse blows after a short time	Fuses too small	Replace with proper size
No welding output	Ground cable not connected	Connect ground
	Transformer or rectifier overheated	Wait for them to cool
Current does not increase for each step of the switch	Faulty switch	Replace switch
	Faulty resistor coil	Replace resistor
Ram module light does not come on	Faulty light	Replace light
	Faulty Ram module	Replace module
	Potentiometer turned to "0"	Turn the knob up
	Tig Only/All Other Proc. switch in the Tig position	Turn the switch to the All Other Processes position

## **VI. MAINTENANCE**

**\*\*\*\*\*WARNING\*\*\*\*\***

**Before performing any maintenance or repair work on the unit, remove the line branch fuses or open the wall disconnect switch or circuit breaker. Turning the POWER switch OFF does not remove the voltage from all points in the machine.**

Routine maintenance and inspection is suggested to increase the reliability and extend the life of the equipment. Inspection frequency is handled on a case by case basis, however, a maximum period between routine inspections is 6 months, but depending on the area in which the unit is operating and the amount of dust present, the inspections may be more frequent.

### **A. CLEANING**

Periodically the side panels and covers should be removed and the accumulated dust blown out of the unit with a clean dry source of compressed air. Particular attention should be paid to the rectifier heat sinks and the main transformer as dust accumulation will hamper the cooling of these critical components. The frequency between cleaning will depend largely on the location of the unit. Do not use any degreasing compounds or water to clean the resistors in the unit, doing so will result in a fire or electrical hazard.

### **B. ELECTRICAL CONNECTIONS**

The primary input cables and welding output cables should be periodically inspected for proper connection and signs of overheating. It is important that the cables be properly sized and that the connections are tight. Loose connections at the output of the module will result in a breakdown of the insulating material of the connector and eventually a short. On units equipped with stud type terminals a wrench must be used to tighten the connections. There should be no load on the output of the unit while connections are being made, and it is recommended that the main contactor be de-energized while making connections.

### **C. FAN MOTORS**

Fan motors must be oiled annually. On units not equipped with oil ports, no lubrication is necessary.

### **D. VENTILATION**

It is important that the unit get proper ventilation. This includes placing the unit so that none of the panels are obstructed. All sheet covers and panels must be in place to provide adequate air flow direction over the components. Ventilation is provided by forced air, therefore, the fans must be inspected for proper operation.

### **E. CONTROL CIRCUIT FUSES**

If the on switch fails to energize the unit and it has been established that the line fuses are good, the problem may be the control circuit fuses. Check these fuses only after opening the main disconnect switch. These fuses are located by the voltage changeover tapboard. Check across the fuses for continuity. Only replace the fuse with a fuse of the proper rating, a failure to do so may result in permanent damage to the unit.

### **F. RECTIFIER ASSEMBLY**

During the periodic cleanings it is important to blow the accumulated dust off of the rectifier heat sinks. The build up of dust on the heat sink reduces the amount of heat that the rectifier can dissipate. Cleaning the rectifier periodically increases the life span of the diodes and helps prevent premature failures.

In the event of a diode failure, a visual inspection cannot be relied upon to determine whether a diode is faulty. The proper way to check the diode is with a Volt-Ohmmeter. When using the meter insure the meter is set on the lowest resistance scale or on the diode checking position if so equipped.

#### Inspection

1. Before checking the diodes it is necessary to remove the input cables from the transformer. If the cables are not removed, the reading taken will be false. Only remove the cables from the transformer to the input of the diodes (the small end). Do not loosen the large nuts connecting the diode to the heatsink.
2. A diode has the property of conducting in only one direction, therefore if the diode conducts in both directions or in neither direction it is considered faulty.

#### Replacement procedure

1. Before installing new diodes it is necessary to apply a thin coat of thermal joint compound to the surface that mates with the heat sink. GC Type Z9 or the equivalent compound is to be used. Only a thin coat of compound should be applied to the surface.
2. Fasten the diode the heat sink with a torque of approximately 25 foot-pounds.
3. Reconnect the input cables to the diode input with the hardware provided. For units equipped with diodes that have a stud type input, torque the input nut to approximately 7 foot-pounds. This bolt is made of soft copper and excessive tightening will damage the diode.

### **G. THERMAL OVERLOAD PROTECTION**

The unit is provided with thermal overload protection on both the rectifier and the transformer. In the case that either is overload, the temperature will increase until either of the thermostats actuates. The thermal switch is a normally closed devise that when overheated will open the circuit to the main contactor. When this occurs allow approximately 5 minutes and the thermostat will automatically reset.

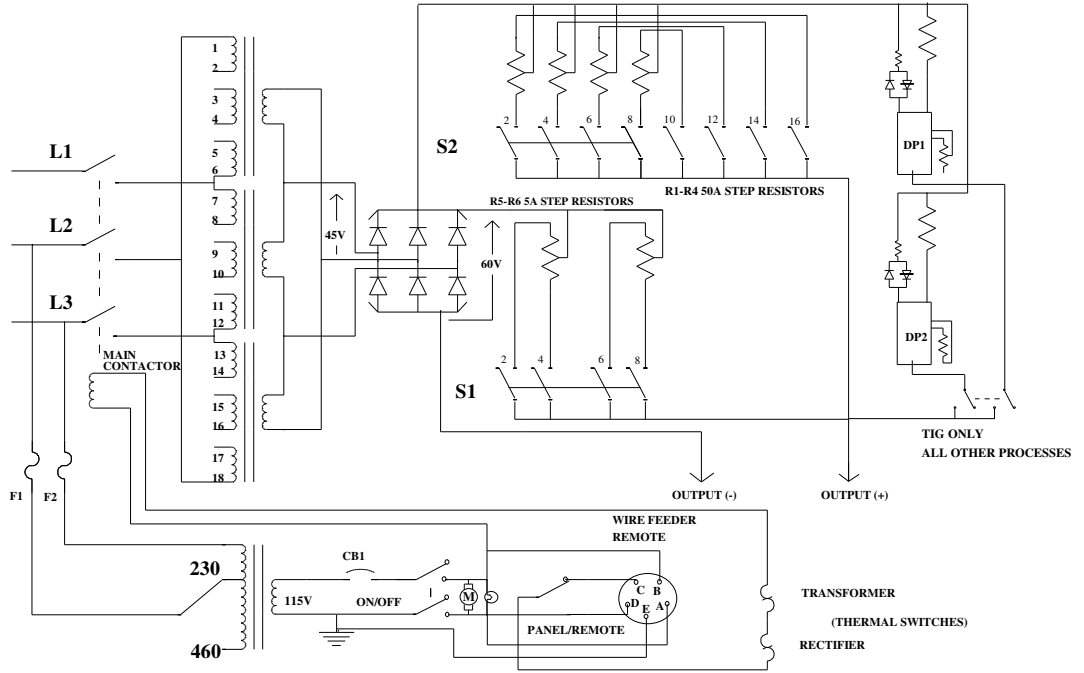
## VI. PARTS BREAKDOWN

### PART NO.    DESCRIPTION

112551	Rear panel
112552	Roof
112553	Resistor support baffle large holes
112554	Resistor locking bar
112555	Fan mount
112556	Base
112557	Lifting assembly
112558	Resistor support baffle small holes
112560	Resistor cover plate
112561 -445	Silkscreen panel, with meters MV445
112561 -545	Silkscreen panel, with meters MV545
112562	Front panel
112563 -445	Silkscreen panel, without meters MV445
112563 -545	Silkscreen panel, without meters MV545
122013	Rectifier heatsink
142242	Output copper
143000	Shunt 800A
151028	Tap board 230/460
151029	Tap board 380/400/415
151216	Panel mount output insulator
185001	Amphenol dust cover
185002	Amphenol strain relief
185003	Amphenol shell
185009	Amphenol Panel mount case
185016	Amphenol 5 socket insert
185017	Amphenol 5 pin male
186028	Fuse KTK-15
220250	Diode positive
220251	Diode negative
228000	Light, amber ( Power Available )
228001	Light, green ( Power On )
232000	Circuit breaker 5A
240007	Fan motor 1/15 hp. 115V 50/60 Hz
246000	Fan blade 12" 24 degree (for 60 Hz machine)
246002	Fan blade 12" 30 degree (for 50 Hz machine)
250000	Contactors 3 Ph. 115V coil
250200	Control transformer 0.5 KVA 230/460 60 Hz
250207	Control transformer 0.1 KVA 230/460 60 Hz
250208	Control transformer 0.5 KVA 380/400/415 50/60 Hz
250211	Control transformer 0.1 KVA 380/400/415 50/60 Hz
250213	Control transformer 0.1 KVA 380/415/460 50/60 Hz
259900	Amp meter
259950	Volt meter
260002	Panel / Remote switch SPDT 15A
260005	Tig only switch DPST 50A
260007	Switch, DPST, On / Off switch
262005	Potentiometer
264010	45 A Switch

264018	400 A Switch Coarse adjustment
264020	500 A Switch Coarse adjustment
400300	Demand pulse module
500100	Resistor 5.8 ohm (10 and 15 amps)
500101	Resistor 9.3 ohm (5 and 15 amps)
500150	Resistor 1.0 ohm center tapped (DP module resistor)
500152	Resistor 1.15 ohm (50 amp step)
600227	Transformer 400A 60 % 380/400/415 50/60 Hz
600228	Transformer 400A 60 % 380 only 50/60 Hz
600229	Transformer 400A 60 % 230/460 60 Hz
600231	Transformer 400A 60 % 380/415/460 50/60 Hz
802206	Light for DP module
802529	Main wiring harness (DPM machine)
802530	Meter harness
802531	Main wiring harness (STA machine)

# 445 DPM 230/460 60 HZ



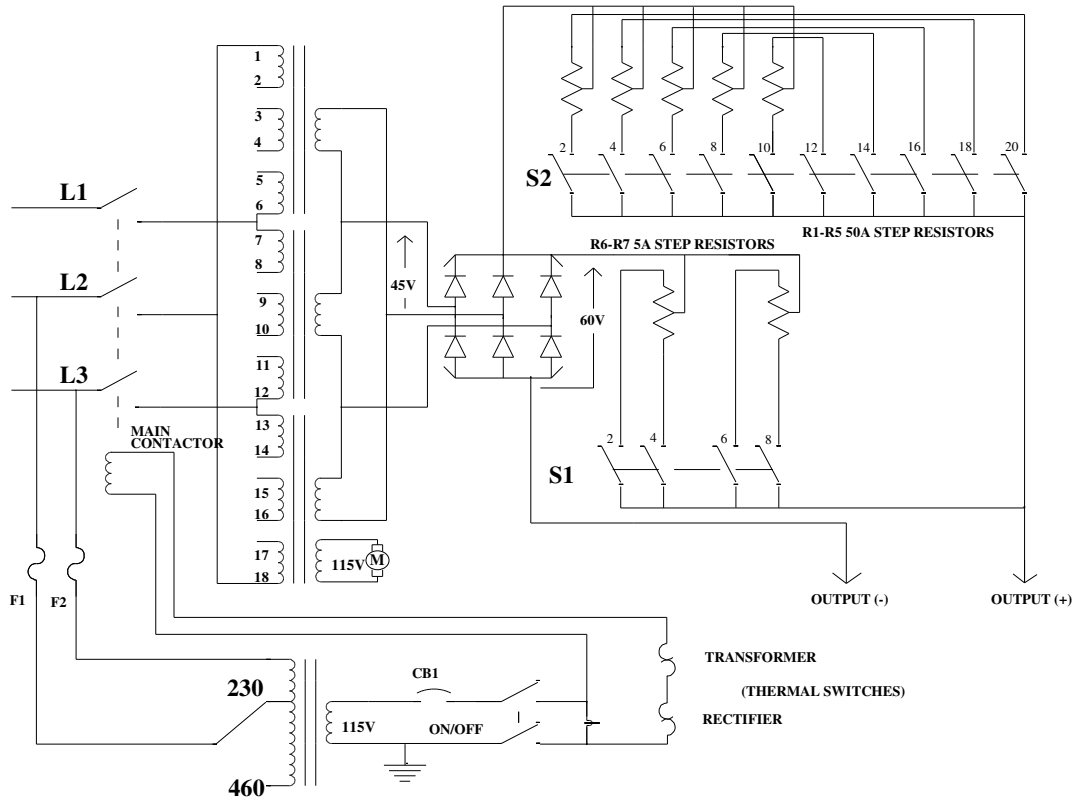
SWITCHING CONFIGURATION FOR S1  
45 AMP SWITCH

CONTACT	8	6	4	2	0				
AMPERAGE	5	10	15	20	25	30	35	40	45
CONTACTS			X	X	X	X	X	X	X

SWITCHING CONFIGURATION FOR S2  
400 AMP SWITCH

CONTACTS	8	6	4	2	0				
AMPERAGE	5	10	15	20	25	30	35	40	45
CONTACTS			X	X	X	X	X	X	X

# 545 STA 230/460 60 HZ



12AUG93

SWITCHING CONFIGURATION FOR S1  
45 AMP SWITCH

CONTACT	8							X	X	X	X	
	6				X	X	X	X	X	X	X	
	4		X	X	X			X	X			
	2	X	X	X	X			X			X	
	0	5	10	15	20	25	30	35	40	45		
												AMPERAGE

CONTACTS

SWITCHING CONFIGURATION FOR S2  
500 AMP SWITCH

CONTACTS	20																		X							
	18																		X	X						
	16																		X	X	X					
	14																		X	X	X	X				
	12																		X	X	X	X	X			
	10																		X	X	X	X	X	X		
	8																		X	X	X	X	X	X	X	
	6																		X	X	X	X	X	X	X	X
	4																		X	X	X	X	X	X	X	X
	2																		X	X	X	X	X	X	X	X
	0	50	100	150	200	250	300	350	400	450	500															
																										AMPERAGE