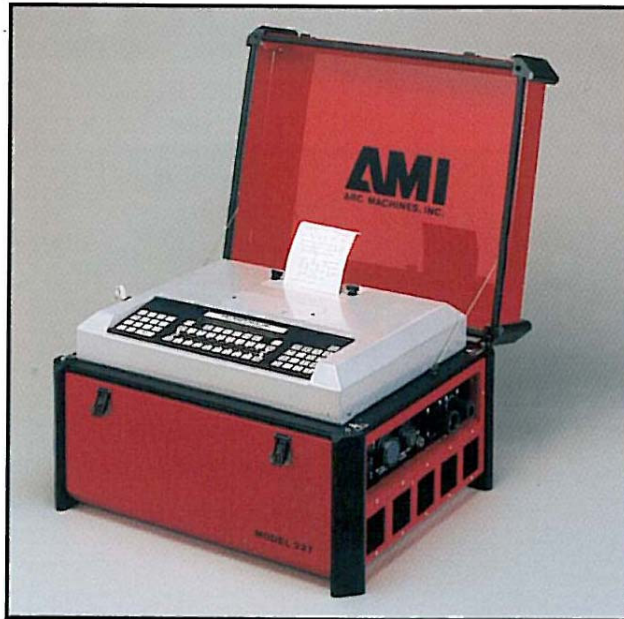


AMI

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MODEL 227 POWER SUPPLY

OPERATION MANUAL

Document No. 740063

**MODEL 227
OPERATION MANUAL****NOTICE**

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The information in this document has been carefully reviewed and is believed to be accurate. However, no responsibility is assumed for inaccuracies.

Information and instructions in this document are subject to change and Arc Machines, Inc. reserves the right to change specifications and data without notice.

**WARNING**

The nature of the GTAW process creates some POTENTIAL HAZARDS. In accordance with international safety regulations the EXCLAMATION SYMBOL indicates that this equipment is considered HAZARDOUS until an operator has been made aware of these POTENTIAL HAZARDS by **READING THIS MANUAL**. The LIGHTNING FLASH SYMBOL indicates that there are potential electrical hazards. The use and display of these symbols make it the OPERATOR'S RESPONSIBILITY TO INSURE THAT HE HAS READ AND/OR BEEN MADE AWARE OF ALL OF THE SAFETY-RELATED ITEMS CONTAINED IN THIS MANUAL.

Publication date : First Edition - February 12, 1992

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REV	DCO #	CHANGE DESCRIPTION	DATE	APR
A	2367	Revised to include required IEC-974 information	10/03/96	GPE
B	3053	Add M227/207-CW Spec-info pgs: iv, v, 1.1, 2.4, 4.14, 4.16, 5.7, 7.6, 7.8, 8.1, 8.2.	04/08/98	GPE
C	3583	Added Offset adj. Information to sect. 7. Replaced Sect. 7, Pg. i & iv.	03/23/00	GPE
D	3682	Removed ref to miller coolant pages 8.1,8.2	7/19/00	GPE
E	4633	Correct typo in section 7.2.14	2/25/08	LEC

**MODEL 227
OPERATION MANUAL**

EFFECTIVITY

Features and operation of the Model 227 are derived mostly from SOFTWARE. This document is based on the latest STANDARD version of SOFTWARE at the time of last revision (see revision page).

Some deviations in actual operation, from this document, are possible depending on the software version of a particular machine. Please feel free to contact Arc Machines Service Department for documentation or information on how software updates effect this document.

**MODEL 227
OPERATION MANUAL**

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OPERATION MANUAL****LIST OF ILLUSTRATIONS**

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**MODEL 227
OPERATION MANUAL**

SECTION I - INTRODUCTION

1.0 INTRODUCTION

This manual is intended to assist users of this equipment in set-up and basic operation. Automated welding requires a good deal of operator expertise which also requires AMI supplied, hands-on training. ***THIS MANUAL IS NOT INTENDED AS A SUBSTITUTE FOR THAT TRAINING.***

The Model 227 (M-227) welding power supply is part of a complete welding system intended for the welding of tubes, pipes and fittings (see figure 1). The complete system consists of the M-227 power supply, adapter cable, gas lines and a variety of different AMI Welding Heads or Torch Fixture devices (Heads and Fixtures are sold separately).

The standard version of the M-227 power supply provides GTAW current with pulsation controls, high frequency arc starting, purge gas controls, weld head arc rotation, cold wire feed, Arc Voltage Control, Torch Weave/Steering (Oscillation) and automatic timing functions. Another version is available without the AVC and Oscillator functions. The M-227 includes a Remote Operators Pendant and comes ready to weld. Users need only to supply input AC power, regulated gas source with flow meter and the appropriate weld head or manual torch.

Some operation conditions may require optional components such as the M227/207-CW Cooling Unit (for liquid cooled weld heads and torches). The M-227 family of options also includes memory back up devices, off-line programming and quality assurance options such as chart recorders.



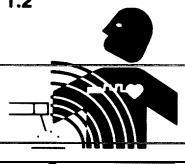



The system can also be used as a manual welding power source using an optional manual torch with a variety of manual welding options such as a variable current foot controller with remote start/stop switch.

NOTE





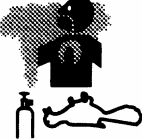


In-depth weld development instructions, weld head set-up, maintenance and troubleshooting are contained in other manuals, documents and training classes and are not included in this manual. Contact your AMI representative for more information about these items.

**MODEL 227
OPERATION MANUAL****SECTION I - INTRODUCTION****1.1 SAFETY PRECAUTIONS**

This section contains cautions and warnings concerning the operation of this equipment and welding equipment in general. However, in addition to reading this manual and before operating this or any welding equipment, users should reference and be familiar with “ANSI-49.1 Safety in Welding and Cutting”. This standard is published by the American National Standards Institute and the American Welding Society.

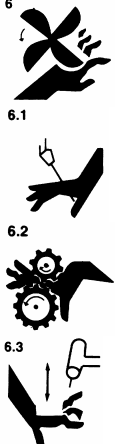
	WARNING: Touching energized electrical parts can cause fatal shocks and burns. When in weld sequence the electrode and work are electrically energized. Incorrectly installed or improperly grounded equipment is a hazard.
	WARNING: This equipment is authorized to use a type of arc starter that produces a High Frequency Radio Wave (sometimes called HF and/or RF Starting). It can cause interference and sometimes even damage to nearby electronic equipment (such as computers) that are un-protected or poorly protected against such interference.
	WARNING: Magnetic Fields from High Currents can affect pacemakers. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR.
	WARNING: Disconnect the input power to the machine before opening or servicing. Discharge all circuits that store high voltage such as capacitor packs. Only QUALIFIED service personnel should open this equipment.
	WARNING: Welding can cause fires or explosions. Do not weld near FLAMMABLE or EXPLOSIVE MATERIALS . Watch for fire. Have proper type of extinguisher in work area.
	WARNING: Welding Operators should wear non-flammable protective clothing, footwear and head gear.

**MODEL 227
OPERATION MANUAL****SECTION I - INTRODUCTION****1.1 SAFETY PRECAUTIONS**

2.2 	WARNING: Never weld on sealed containers or pipes. This may result in an EXPLOSION.
2.3 	WARNING: Welding produces high temperatures in both the welded components and the welding equipment. Both can cause severe burns. Do not touch recently welded components. Avoid touching internal components of the welding system soon after use. Avoid touching torch components and welding fixtures soon after welding.
3 	WARNING: The welding arc emits ultra-violet (UV) radiation and the molten weld gives off infra-red (IR). Both can burn eyes and skin if unprotected. Suitable eye and skin protection must be worn.
4 	WARNING: Weld materials can emit toxic fumes during welding. WELD ONLY IN AREAS WITH ADEQUATE VENTILATION.
4.1 	WARNING: Most GTAW gases like Argon are non-toxic, however, Argon is heavier than air and will displace the normal atmosphere in enclosed areas. DO NOT WELD IN ENCLOSED AREAS WITH OUT PROPER VENTILATION OR RESPIRATORS.
5 	WARNING: AMI factory training is essential for all Welding Operators and Maintenance Technicians who operate AMI equipment.
	WARNING: Before operating, storing or handling, always make sure that the M-227, M-227-RP Pendant, weld heads and cables are not exposed to rain or standing water. SYSTEM COMPONENTS ARE NOT WEATHER-PROOF.

MODEL 227
OPERATION MANUAL
SECTION I - INTRODUCTION

1.1 SAFETY PRECAUTIONS

 <p>6 6.1 6.2 6.3</p>	WARNING: Keep hands and fingers clear from moving parts such as fans, gears rotors, Wire Feed, Rotation and AVC Mechanisms.
	WARNING: The M-227 Power Supply is not intended for pipe thawing or heating in any form.
	WARNING: The M-227 Power Supply weighs in excess of 91 lbs (41.3 kg). It has no handles and is not intended to be carried by a single person. Be sure to follow your local, OSHA, international or employer guidelines for proper methods of lifting and re-locating this equipment.

1.2 OPERATIONAL PRECAUTIONS

The following is a check list for operating personnel to follow to insure minimum system down-time due to improper operation and handling:

1. **TOO AVOID** severe equipment damage **VERIFY** that the M-227 is connected to the correct Input AC power (see section 3.1).
2. Before operating, check all fittings and connectors for proper seating and that all protective boots are in place. If not properly seated or protected, short circuits, poor connections or inert gas leaks could occur.
3. The M-227 is intended for typical GTAW gases **ONLY. NEVER CONNECT OXYGEN OR ACETYLENE TO THE M-227.**
4. Before operating, insure that all cables are routed or protected in such a way that they will not be subject to heat, equipment and/or personnel traffic. Insure that the cables **DO NOT** come in contact with **HOT PIPE**.
5. When storing or handling cables, always keep the protective boots and dust caps on all connectors and fittings until ready to install. A major cause of downtime in any automatic welding system is improper care and use of cables.

MODEL 227
OPERATION MANUAL
SECTION I - INTRODUCTION

1.2 OPERATIONAL PRECAUTIONS

6. Before operating, insure that the M-227 has adequate air flow. Do not restrict the intakes or exhaust vents of the power supply.
7. Before operating, always insure that there is bare metal contact between the weld head components which connect to GROUND (clamp inserts, etc.) and the tube or pipe to be welded.
8. When storing or handling weld heads, always keep them in the protective containers they are shipped in, or optional carrying case, until ready to install.
9. When operating, storing or handling, insure that the system is protected against dirt, dust, etc. NEVER GRIND NEAR AN EXPOSED WELD HEAD OR THE M-227.
10. Do not use acid, corrosives, liquid "Easy Out" or any liquid substance on the M- 227 or any AMI weld head. When cleaning, use only a light solution of Isopropyl alcohol on a soft cloth .
11. When handling, take extreme care to avoid dropping the M-227, weld heads, cables or any accessories.
12. Do not attempt to move tube end into position using the weld head as a lever.
13. Do not add any lubrication like graphite, oil or grease to the weld heads or power supply unless it is specified in the operation or maintenance manual for that equipment.

1.3 RF AND EMI EMISSIONS

1. WHY RF?

"It has long been recognized that in the practice of welding and cutting, there are circumstances where it is required to assist the process using radio frequency voltage. In order to arc weld an electric arc must be created, because of safety and economic concerns, the no load voltage of arc power sources is kept as low as practical. Thus, a source of high voltage with a high safety factor must be utilized. Radio Frequency voltage is the best method of meeting these criteria for many reasons." (quoted from CISPR/B/63).

**MODEL 227
OPERATION MANUAL**

SECTION I - INTRODUCTION

1.3 RF AND EMI TRANSMISSIONS

2. RF REGULATION

The FCC regulates the RF emission limitations for welding equipment by the use of an IEC (international) regulation created by the Special Committee on Radio Interference (known as CISPR) subcommittee B. The regulation of record is:

CISPR/B/63

“CODE OF PRACTICE FOR THE USE OF WELDING AND CUTTING POWER SOURCES UTILIZING RADIO FREQUENCY VOLTAGE FOR STARTING OR STABILIZING THE ARC.”

The regulation states that due to the variety of work requirements and conditions it is virtually impossible to establish fixed, normalized and predictable tests and test setups for RF limits that would actually mean something. Instead of limits they state the following:

“The manufacturer must design and produce equipment that is functional but at the same time, design this equipment to keep electromagnetic radiation at a minimum.”

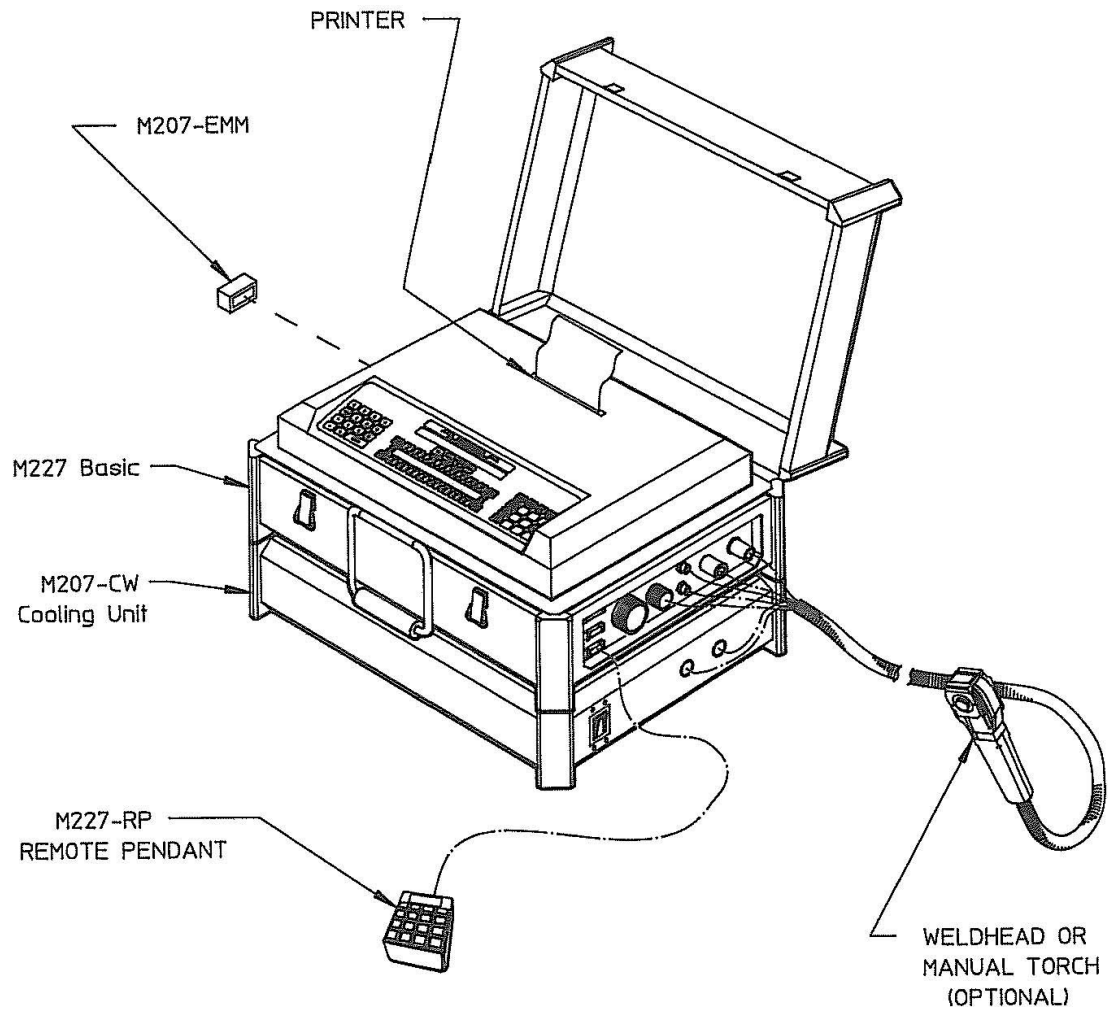
“The user has the responsibility to install and use the power source per the instructions of the manufacturer. Through this practice, it is reasonable to assume that the probability of electromagnetic disturbances will be significantly reduced. However, if some electromagnetic disturbances are felt, then it is the responsibility of the USER of the equipment to resolve the situation.”

3. RF PROTECTION

AMI policy is to comply with the IEC (and thus FCC) regulations. Our design rules and procedures include testing and observing this area. We can assure our customers that every effort has been made to reduce RF emissions to the absolute minimum from our power sources.

However, this does not mean that a user will not have occasional problems with RF interference with other equipment due to the use of our equipment. This is the nature of RF starting.

**MODEL 227
OPERATION MANUAL**



SYSTEM CONFIGURATON

**MODEL 227
OPERATION MANUAL**

SECTION I - INTRODUCTION

1.3 RF AND EMI TRANSMISSIONS

3. RF PROTECTION (continued)

Most RF noise interference problems are going to be either set-up related or caused by poor or no filtering on the behalf of the equipment that is being interfered with. Most problems are easily correctable but each one must be looked at on a “case by case basis.”

4. EMI SUPPRESSION

The M-227 is equipped with a heavy-duty Pi-Network filter, connected to the input power line, to prevent propagation of EMI either into or out of the M-227. The all-metal enclosures and internal shields prevent radiated EMI.

1.4 SHOCK HAZARD WARNING

As already stated in this manual “High Voltage” is present on exposed internal terminals. The ELECTRODE (tungsten and M-9 rotors) is also an “exposed terminal” and by its nature the GTAW process requires electrical potential to be present on the electrode during arc starting and of course during the welding.

All AMI Power Supplies contain a “bleeder” circuit to ground any residual potential after welding or after an aborted or bad “arc start” attempt. However, these circuits take a few seconds to operate or COULD FAIL.

“THE ELECTRODE SHOULD ALWAYS BE CONSIDERED A POSSIBLE SHOCK HAZARD”. This is especially true when ever the system is in “weld sequence” ready to weld, is welding, or has just finished welding. However, equipment/component failure, system abuse, or improper maintenance could result in electrical potential at the weld head “even when not in weld sequence”.

The users/operators of this equipment must take all precautions necessary to avoid contact with the ELECTRODE at “ALL TIMES”. The only exception is when actually replacing or adjusting the electrode and this should be done “WITH THE POWER TURNED OFF”.

If performed with the power “ON” the system must be in test mode out of weld sequence and the USER MUST OBSERVE COMMON SAFETY PRACTICES such as grounding the electrode to insure discharge before actually touching it. REMEMBER, there is a “POSSIBLE” shock hazard in all welding power supplies at “ALL” times.




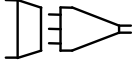
Most AMI Power Supplies feature High Frequency (HF) Arc Starting. This is a High Voltage/High Frequency electrical transmission process. To eliminate any HF shock possibility “AVOID ALL CONTACT” with the Welding WORK (ground), the ELECTRODE or the WELD HEAD during arc start.

MODEL 227
OPERATION MANUAL
SECTION II - SPECIFICATION

The following contains only general specifications about the M-227 Power Supply. More detailed information is available in AMI Specification No. 227.

2.0 ELECTRICAL

1. RATING PLATE DEFINITIONS

1) Company: Arc Machines, Inc. USA		Country: USA	3) Model: Model 227	6) Standards: NEMA EW1 IEC 974-1
8) Process:  G.T.A.W.	10) Type:  DC	9) Output Continuous Current: Minimum 3A / 5V Maximum 200A / 20V Output Pulsed Current Minimum 3A / 5V Maximum 225A / 20V		
23) Shock Rating: 	11) No-load Voltage: U₀ = 59V	12) Duty Cycle: X = 100% ALL RATED OUTPUTS		
15) Input:  1 ~ 50/60 HZ	18) Voltage: U₁ = 110V 220V	19) Input Current: I_{1max} = 30A I_{1eff} = 30A 30A 30A	21/22) Rating/Class: IP21	

- 1) - Manufacturer and Country of Origin.
- 3) - Model Number Rating Plate applies to.
- 4) - Serial Number (located on M-227 Center Plate, not on rating plate).
- 6) - International and USA Standards that the equipment meets.
- 8) - Weld Process symbol for GTAW welding.
- 9) - Rated MIN and MAX Outputs at Continuous Current with no pulsation.
Rated MIN and MAX Outputs when current is pulsing.
MAX current output using 110 VAC input is 100 Amperes.
- 10) - Symbol that output is Direct Current (DC) only.
- 11) - Rated No Load Output Voltage (open circuit voltage) is 59 volts.
- 12) - The M-227 is a 100 % Duty Cycle for the rated outputs (9).
- 15) - Input Voltage type contains symbol for single (1) phase Alternating Current (AC) input at 50 or 60 Hz frequency.
- 18) - Nominal Input Voltage value is 110 VAC or 220 VAC.
- 19) - Rated maximum current required from the AC supply. Given for both **I₁** maximum (**I_{1max}**) and **I₁** effective (**I_{1eff}**). 30 Ampere service is required for both 110 VAC and 220 VAC operation.

2.1

**MODEL 227
OPERATION MANUAL**

SECTION II - SPECIFICATION

2.0 ELECTRICAL

1. RATING PLATE DEFINITIONS

- 21) - International Protection (IP) rating. The M-227 is rated IP21 which includes protection against a limited amount of exposure to rain (does not make it weather proof or intended for all weather usage).
- 22) - The M-227 is rated as class I. No symbol is used for class I equipment.
- 23) - “S” Symbol indicates a welding power source which is suitable for an environment with an increased electric shock hazard.

- 2. INPUT POWER, DETAIL** - The M-227, as shipped standard, can operate on the following Single Phase input AC:

<i>Voltage</i>	<i>Tolerance</i>	<i>Freq.</i>	<i>Max Input Current</i>
100 VAC	+ 32%, -10%	50/60 Hz	30 amperes
110 VAC	+ 20%, -18%	50/60 Hz	30 amperes
115 VAC	+ 15%, -22%	50/60 Hz	30 amperes
120 VAC	+ 10%, -25%	50/60 Hz	30 amperes
200 VAC	+ 32%, -10%	50/60 Hz	30 amperes
208 VAC	+ 27%, -13%	50/60 Hz	30 amperes
220 VAC	+ 20%, -18%	50/60 Hz	30 amperes
230 VAC	+15%, -22%	50/60 Hz	30 amperes
240 VAC	+ 10%, -25%	50/60 Hz	30 amperes

+/- % indicates the allowable input voltage change to maintain performance as specified. Maximum input current is based on maximum output current at maximum arc voltage. See section 3.1 for installation.

- 3. OUTPUT POWER** - Straight polarity, constant current DC regulation intended for GTAW welding only. Static characteristic of the M-227 is flat.

Minimum current Output all cases = 3 Amperes DC

Maximum current Output:

Set up for 110 VAC input = 100 Amperes DC continuous or peak pulse.

Set up for 220 VAC input = 200 Amperes DC continuous current

225 Amperes DC peak pulse

NOTE

The M-227 is limited, by software, not to be able to be programmed for an average current (between primary and background) of greater than 200 Amperes. However, a peak pulse can be up to 225 amperes as long as the average does not exceed 200 amperes.

- 4. CIRCUIT BREAKER** - ON/OFF, two pole, 30 Ampere at 250 VAC.

MODEL 227 OPERATION MANUAL

SECTION II - SPECIFICATION

2.1 PHYSICAL CONSTRUCTION

Cabinet material - aluminum

Height = 13.9 inch (353.1mm) cover closed
12.3 inch (312.4 mm) cover removed

Width = 22.75 inch (577.9 mm)

Depth = 19.25 inch (489.0 mm)

Weight = 91 lbs (41.3 kg)

2.2 PROGRAMMABLE FUNCTIONS

PREPURGE TIME	= 010	-	999 seconds
POSTPURGE TIME	= 000	-	999 seconds
UPSLOPE TIME	= 00.0	-	99.9 seconds
DOWNSLOPE TIME	= 00.0	-	99.9 seconds
ROTATION START DELAY	= 00.0	-	99.9 seconds
ROTATION MODE SETTINGS	= CONT - STEP - OFF		
ROTATION DIRECTION	= CW	-	CCW
PRIMARY ROTATION SPEED	= 0.00	-	20.0 RPM
BACKGROUND ROTATION SPEED	= 0.00	-	20.0 RPM
WIRE FEED START DELAY	= 00.0	-	99.9 seconds
PRIMARY WIRE FEED SPEED	= 000	-	200 IPM
BACKGROUND WIRE FEED SPEED	= 000	-	200 IPM
WIRE FEED STOP DELAY	= 00.0	-	99.9 seconds
WIRE FEED RETRACT TIME	= 0.0	-	1.0 seconds
PRIMARY AVC	= 5.0	-	20.0 volts
BACKGROUND AVC	= 5.0	-	20.0 volts
AVC START DELAY TIME	= 00.0	-	99.9 seconds
AVC STOP DELAY TIME	= 00.0	-	99.9 seconds
AVC MODE SETTINGS	= CONT - SAMPLE - OFF		
OSCILLATION MODE	= ON	-	OFF
TORCH OSCILLATION AMPLITUDE	=		Determined by Head Type
OSCILLATION IN and OUT DWELL TIMES	= 0.00	-	9.99 seconds
OSCILLATION EXCURSION TIME	= 0.00	-	9.99 seconds
PULSE MODE SETTINGS	= ON - OFF - SYNC (to osc)		
PRIMARY PULSE TIME	= 0.00	-	9.99 seconds
BACKGROUND PULSE TIME	= 0.00	-	9.99 seconds
LEVELS	= 1	-	99
LEVEL TIME (each level)	= 000	-	999 seconds*
PRIMARY CURRENT	= 3	-	225 amperes*
BACKGROUND CURRENT	= 3	-	225 amperes*

* = Can be in increments of 0.1

**MODEL 227
OPERATION MANUAL****SECTION II - SPECIFICATION**

- 2.3 MULTI-LEVEL FUNCTIONS - The following functions can be programmed to change value during a given weld sequence.

<u>FUNCTION</u>	<u>POSSIBLE CHANGES</u>
LEVEL TIME	= 1 to 99 levels
PRIMARY CURRENT	= 1 to 99 levels
BACKGROUND CURRENT	= 1 to 99 levels
PRIMARY PULSE TIME	= 1 to 99 levels
BACKGROUND PULSE TIME	= 1 to 99 levels
PULSE MODE (ON/OFF/SYNC)	= 1 to 99 levels
PRIMARY ROTATION RPM	= 1 to 99 levels
BACKGROUND ROTATION RPM	= 1 to 99 levels
ROTATION MODE (CONT/STEP/OFF)	= 1 to 99 levels
PRIMARY WIRE FEED SPEED	= 1 to 99 levels
BACKGROUND WIRE FEED SPEED	= 1 to 99 levels
AVC MODE	= 1 to 99 levels
PRIMARY AVC	= 1 to 99 levels
BACKGROUND AVC	= 1 to 99 levels
OSC AMPLITUDE	= 1 to 99 levels
OSC DWELL and EXCURSION TIMES	= 1 to 99 levels

- 2.4 NON-PROGRAMMABLE FUNCTIONS

WIRE FEED MODE SWITCH	= ON/OFF
SYSTEM MODE KEY SWITCH	= PROGRAM/OPERATE/LOCK
MANUAL PURGE	= ON/OFF

- 2.5 AMBIENT TEMPERATURE RANGE - 32 F (0 C) to 110 F (45 C).

- 2.6 CABLE OPERATING DISTANCE LIMITS - Standard = 50 ft (15.2 m)
Maximum = 100 ft (30.5 m)

The standard distance consists of a 40 ft Pipe Weld Head Adapter cable and a 10 ft Weld Head cable combined together. The maximum distance is achieved by adding extension cables to the standard cables.

The above are considered normal limits and using a standard M227/207-CW or M207-CW Cooling Unit Option. With special options, greater distances can be achieved. Consult with an AMI technical representative for more information.

MODEL 227
OPERATION MANUAL
SECTION III - INSTALLATION

3.0 INSPECTION

1. After unpacking, inspect all items for obvious physical damage and loose parts. If damage is evident, contact a factory representative before using.

NOTE

If water condensation is apparent, dry the unit before using.

2. All M-227's are shipped with a variety of peripheral equipment such as gas hoses, fittings, manuals (including this one) and electrical drawings. An exact list of these items is included with each power supply shipment. This manual will reference some of those items, so before beginning installation, these items should be located and be available.

3.1 POWER CONNECTION



WARNING



Do not connect the M-227 power supply to any AC power other than the ones listed in section 2.0.2.

The M-227 can operate on 9 different input line voltages and must be set up for the one you are using. Use the following procedure to insure that the M-227 is set-up for the correct AC power.

1. The M-227 is supplied with a 25 ft power cord. One end has a connector on it that plugs into the side of the M-227. The wires on the other end are pig-tailed (no connector). A suitable AC line connector, matching the input power, must be supplied and installed by the user. Color coding of the power cord is as follows:

Black = Hot (high line side)
White = Neutral (low line side)
Green/Yellow = Ground (protective earth ground)

NOTE

For additional ground reference there is a ground symbol silk-screened next to the ground pin on the M-227 Input AC connector on the Input Panel.

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SECTION III - INSTALLATION

3.1 POWER CONNECTION

2. Install the AC line connector onto the power cord.

NOTE

DO NOT PLUG THE M-227 INTO THE AC POWER SOURCE UNTIL ALL INSTALLATION STEPS OF THIS MANUAL ARE COMPLETE.

3. Insure that the circuit breaker (CB-1) is in the OFF (down) position (see figure 3).
4. Using figure 2 and 3 as a reference, locate the power SELECT SWITCH (next to the input power connector). The switch is concealed by a cover plate and only the top of the switch handle can be seen through a hole in the plate. The plate is labeled as to what voltage it is currently set for.
5. If the M-227 is to be run on 100, 110, 115 or 120 VAC, this switch must be in the 110 VAC position. If it is to be run on 200, 208, 220, 230 or 240 VAC, it must be in the 220 VAC position.
6. To change the power select switch position, remove the cover retaining screws (see figure 3) and remove the cover. Set the switch to the alternate position and install the cover plate. It must be flipped over so the hole in the plate will fit over the switch handle in the new position. This will automatically expose the alternate voltage label on the other side.

3.2 WELDING GAS CONNECTIONS

1. An Arc Input Gas Hose is supplied with the M-227. This hose is made of material selected specifically for automatic welding. **HOSES MADE FROM OTHER MATERIAL ARE NOT RECOMMENDED** (especially rubber, nylon or tygon).
2. The 10 foot (3m) hose should be installed from the gas regulator/flowmeter (user supplied) to the ARC GAS INPUT fittings required to mate with the M-227 and most domestic (USA) inert gas flow meters.

The arc gas line is controlled by a solenoid and flow sensor in the M-227 and **MUST BE** connected to the M-227 (not directly to the weld head or torch). After installing the hose and fittings loosely by hand, tighten the retaining nuts slightly with a wrench to insure there are no leaks, but do not over-tighten. The use of plumbers tape or grease is not recommended.

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SECTION III - INSTALLATION

3.2 WELDING GAS CONNECTIONS

CAUTION

The M-227 arc gas solenoid valve is rated at 50 PSI (345KPa) maximum pressure, DO NOT EXCEED THIS RATING.

3. No I.D. Purge line is provided, but most GTAW welds will require the inside be purged with Argon. Most piping situations will require I.D. purging from sources and entry points a long distance from the M-227, so no outlet or monitoring is provided. However, be sure to provide an I.D. purge if the weld procedure requires it.

3.3 ADAPTER CABLE TO M-227 INSTALLATION

The M-227 comes standard with a 40 ft Pipe Weld Head Adapter Cable. This will be used for most Weld Heads. However, some Weld Heads will use a different Adapter Cable or additional cables. The correct cables required should be resolved at the time of order. The following section refers mainly to the connection of the Pipe Weld Adapter Cable.

NOTE

The Pipe Weld Head Adapter Cable consists of a 40 ft Control Adapter Cable and a 40 ft Service Adapter Cable. The two cables are not tied together as a unit.



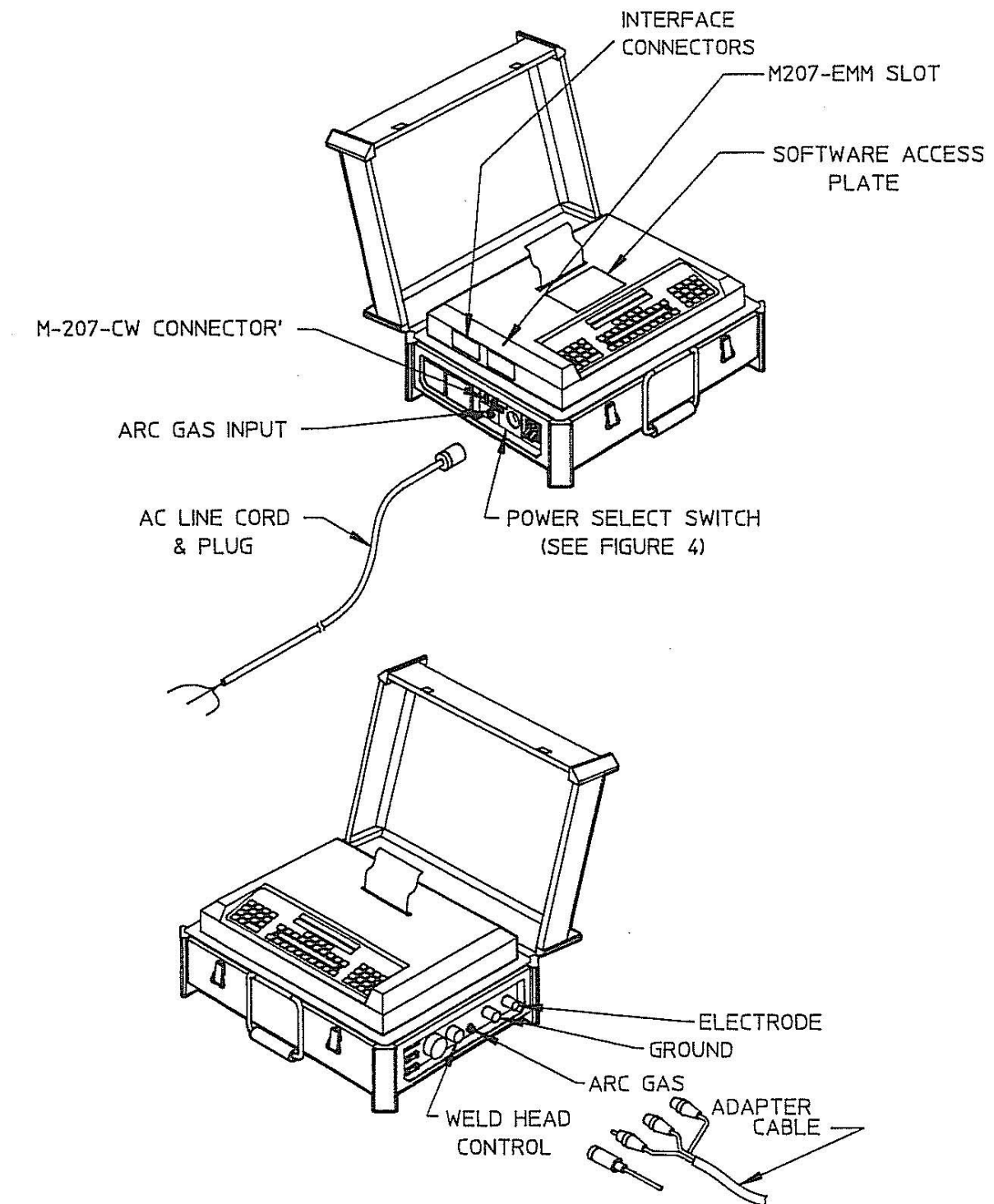
WARNING



Always turn the power supply off before making any cable or connection changes to the M-227 power supply.

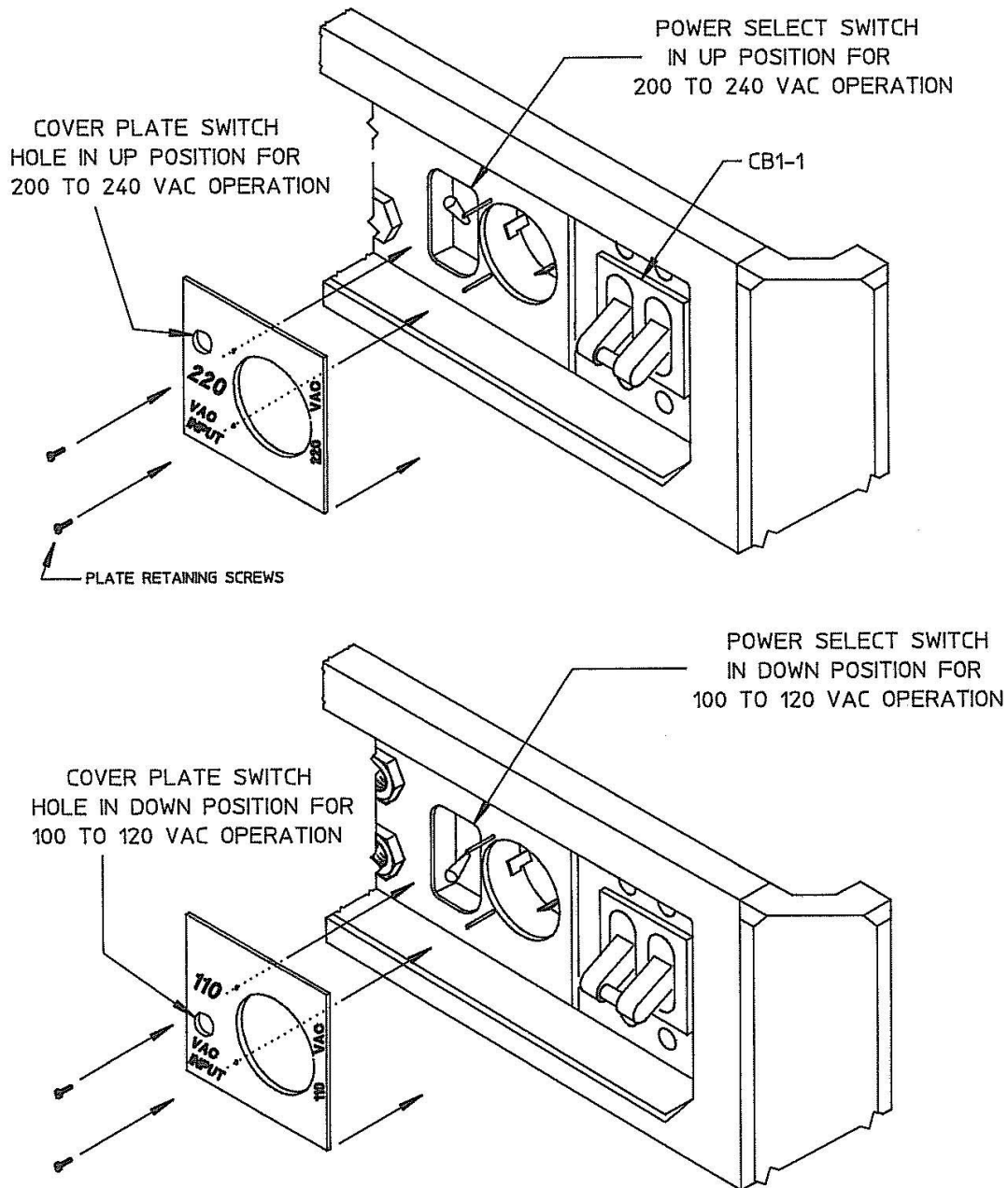
1. One end of an adapter cable ALWAYS connects to the weld head. The other end connects to the M-227 or to a weld head extension cable. The connector types and keyways are different for each item (except gas). Use the following steps for connection to the M-227 (see figure 2 and 4).
2. Connect the Service Adapter ELECTRODE connector to its respective terminal on the M-227. Align the keyway, push in and twist clockwise until fully locked.
3. Weld head CONTROL connector - Just before installing, unscrew the dust caps on the electrical connectors on the cable and M-227. Insert the multi-pin electrical connector into the M-227. Insert the multi-pin electrical connector into the M-227 connector labeled PIPE WELD HEAD CONTROL. Note the positioning keyway and NEVER FORCE or use tools on the cable connections. Hand tighten the connecting ring after the pins are firmly seated.

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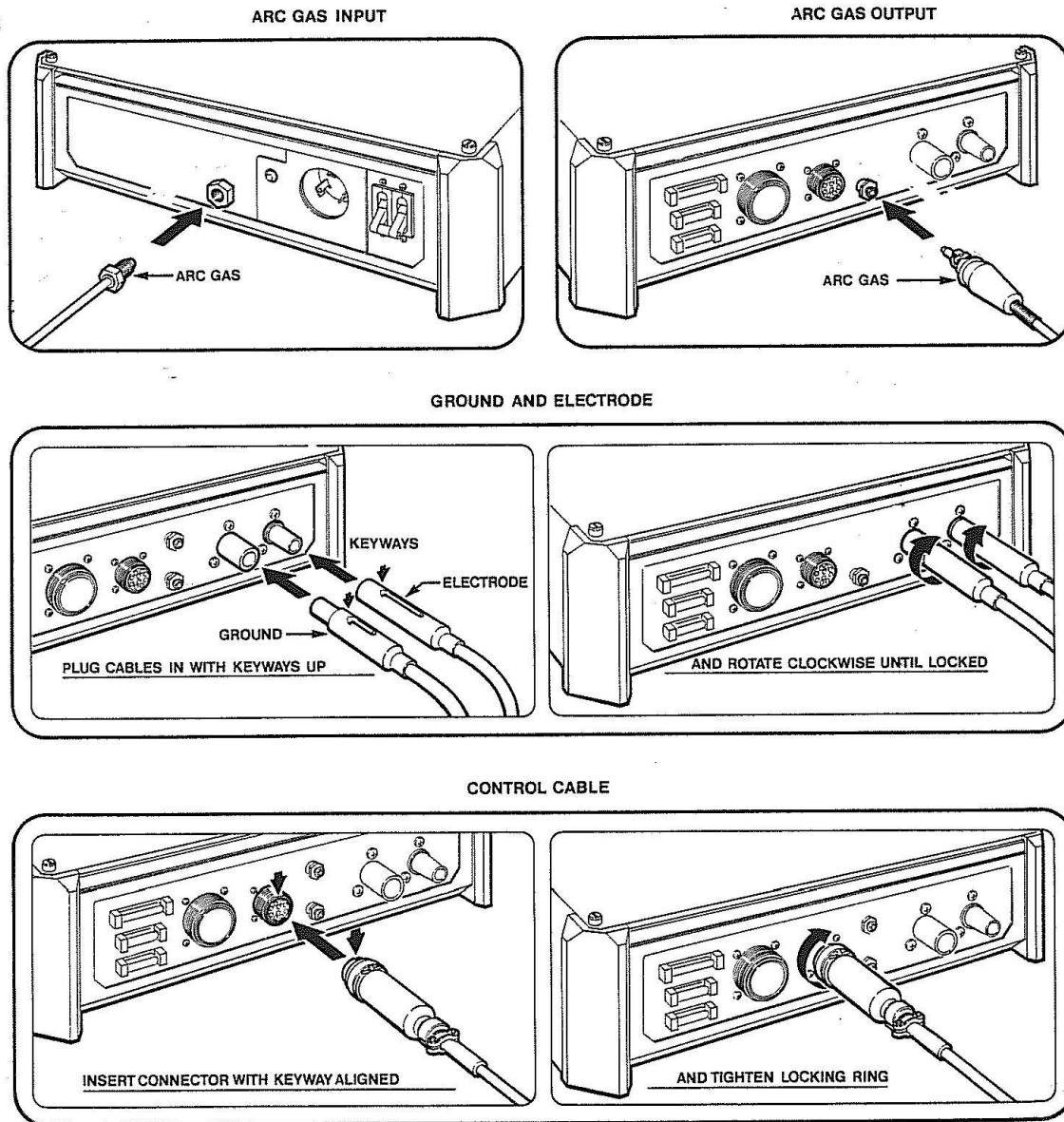
INSTALLATION LOCATIONS

**MODEL 227
OPERATION MANUAL**



AC POWER SET-UP

**MODEL 227
OPERATION MANUAL**



CABLE CONNECTIONS

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SECTION III - INSTALLATION

- 3.3 ADAPTER CABLE INSTALLATION (continued)
4. Insert the Service cable male gas quick-disconnect into the M-227 ARC GAS OUTPUT connector.
 5. Insert the two coolant quick-disconnects into the COOLANT IN and COOLANT OUT connectors on the CW (if being used). The cable coolant connectors are interchangeable and it does not matter which one goes to in or out.
- 3.4 WELD HEAD INSTALLATION - The weld head cable connects to the adapter cable. Refer to the Weld Head Operation manual as you perform this installation.
1. The male brass quick dis-connect on the adapter cable provides the electrode power and one leg of the coolant path. Connect it to the mating female quick dis-connect on the Weld Head.
 2. Connect the other coolant quick dis-connect and gas quick dis-connect (they are different types and sizes) to their mates on the Weld Head Cable.
 3. After the Electrode, Coolant and Gas connectors are secure and checked, slide the rubber boots on each line together and secure them in place. These boots provide both a safety factor to prevent shorting to ground and also act as a retainer to prevent the connectors from coming apart.
 4. Unscrew the CONTROL connector dust caps on both cables just before installing. Insert the adapter connector into the head connector. Note the positioning keyway and NEVER FORCE or use tools on the cable connections. Using just your hand, tighten the connecting ring until the pins are firmly seated. Screw the two dust caps together to prevent them from swinging around.
- 3.5 GROUND (WELDING WORK) CABLE INSTALLATION
1. A 50 ft Ground Cable with a “C” type clamp on one end and a Cam-lok quick dis-connect is provided.
 2. Connect the quick dis-connect to the GROUND connector on the M-227 or the Ground Extension Cable if one is provided.
 3. Connect the Ground Clamp to a “bare” metal surface on the Pipe to be welded. It should be placed as close to the weld as possible.

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OPERATION MANUAL
SECTION III - INSTALLATION

3.6 REMOTE PENDANT INSTALLATION

Always turn the power supply OFF before making any cable or connection changes to the M-227 power supply.

1. Insert the M-227-RP cable connector into the M-227 Panel connector labeled REMOTE.
2. If a M-227-RP extension is used, it is installed between the M-227 and the RP.
3. If required the M-227 can be operated without the RP Unit.

CAUTION

Installation is now complete but before proceeding with POWER ON it is EXTREMELY important to have a basic understanding of SYSTEM FUNCTIONS. Read section IV (system functions) before proceeding with OPERATION (section V) or PROGRAMMING (section VI).

**MODEL 227
OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.0 INTRODUCTION

The M-227 is intended for use with AMI orbital welding heads and has functions designed for these weld heads. This section describes what these functions are and may, where needed for clarification, indicate how they are commonly (but not always) used.

Step 4.1 is a general description; the remaining steps describe, in more detail, the items of step 4.1. Only FUNCTION is discussed here. Details of function ranges and tolerances can be found in section II of this manual and the AMI Specification No. 227. Details about operating these functions can be found in section V.

4.1 FUNCTIONAL DESCRIPTION, GENERAL

1. LIBRARY - The heart of the M-227 is its MEMORY. The values of each function, for a given weld, are only programmed one time. After that the M-227 will store the function values (for that weld) by WELD SCHEDULE NUMBER (#) and description.

When a particular weld type is needed to be made the Operator can locate it in the WELD SCHEDULE LIBRARY by description or by weld schedule number (#).

2. WELD SEQUENCE AND LEVELS - Selected weld schedules are started by manually initiating the SEQUENCE START. Once the sequence is started the system operation can be totally automatic.

In addition to functions to start and stop the weld, the weld sequence includes the ability to preset changes in function values and modes. These changes are called LEVELS and as many as 100 levels can be used for each weld sequence. All weld schedules start with (and must have) Level 1.

If preset changes are desired they will be set in LEVELS 2, 3, ETC. The LEVELS advance from 1 to 2, 2 to 3, etc. automatically as a function of time, or they can be advanced by the Operator manually.

3. CURRENT SOURCE AND CONTROL - The M-227 is a pulsed, 225 ampere peak, constant current, straight polarity, GTAW power source. The current value(s) can be set between 3 and 225 Amps.

NOTE

The M-227 is limited, by software, not to be able to be programmed for an average current (between primary and background) greater than 200 Amperes. However, a peak pulse can be up to 225 amperes as long as the average does not exceed 200 amperes.

**MODEL 227
OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.1 FUNCTIONAL DESCRIPTION, GENERAL

4. **TRAVEL FUNCTION** - The system is equipped with a motor servo controller that provides the power and regulation for rotating the arc around the weld seam. The system controls the movement in revolutions per minute (RPM) or inches per minute (IPM) depending on weld head type.

NOTE

The motor servo can only work properly if the weld head being used is equipped with a motor assembly designed for operation on the M-227.

5. **WIRE FEED FUNCTION** - The system is equipped with a motor servo controller that provides the power and regulation for feeding Wire into the weld puddle. The system controls the feed in Inches per Minute (IPM).
6. **AVC FUNCTION** - The standard M-227 comes with an Arc Voltage Control (AVC) Motor Servo. A version of the M-227 is also available without AVC. The AVC in conjunction with a weld head with an AVC motor is used to maintain the desired Arc Gap between the Electrode and the weld puddle.
7. **TORCH OSCILLATION** - The standard M-227 comes with an OSC Motor Servo. A version of the M-227 is also available without OSC. The OSC in conjunction with a weld head with an OSC motor is used to perform both cross-seam steering during a weld and to provide welding weave across the weld during rotation.
8. **PULSATION** - The system can rapidly change or PULSE back and forth between two (2) different values of CURRENT, TRAVEL, WIRE FEED and AVC. The normal or HIGH value is designated the PRIMARY value. The other or LOW value is designated the BACKGROUND value. This pulsation is done as a function of time by using the PRIMARY and BACKGROUND PULSE TIMES to set an exact amount of time for each PRIMARY and BACKGROUND function to occur or the pulsation can be synchronized to the movement of the Torch Oscillator function.
9. **OVERRIDES** - The weld schedule programmer can set the M-227 to allow the operator to change the value of some weld schedule functions. The programmer can also set limits to the amount of changes the operator can make to each function.

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OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.1 FUNCTIONAL DESCRIPTION, GENERAL

10. FAULT STATUS - The system continuously monitors certain function such as gas flow, coolant flow, ground fault, system temperature and input AC. If there are any problems the system will alert the operator and in some cases, where weld quality might be affected, the system will stop the welding process.
11. GAS FUNCTIONS - As stated, the M-227 is intended for the GTAW process. This process requires a welding gas (usually inert) for operation and the M-227 is equipped with a gas solenoid and input/output connectors for the control of the welding (arc) gas.
12. PRINT FUNCTIONS - Built into the M-227 is a Thermal Printer. The printer allows copies of the Library and complete weld schedule to be made.

4.2 WELD LIBRARY AND WELD DESCRIPTION

Each weld schedule programmed into the system memory is identified and displayed (when selected) with the following information:

1. # = Individual WELD SCHEDULE NUMBER from 001 to 100.
2. OD = Outside diameter in inches or mm of the weld.
3. WALL = Wall thickness in inches or mm of the weld.
4. MAT = Uses abbreviations to identify the base material the schedule is programmed to run.
5. HEAD = Uses Weld Head Model number to identify what AMI Head the schedule is programmed to run.
6. PASS = Indicates total number of weld passes programmed to complete the weld.

4.3 WELD SEQUENCE - Although the M-227 can be used as a manual welding power source, it is primarily intended to follow an automatic SEQUENCE. After a weld schedule is selected and the weld head is setup, the SEQUENCE will be manually started by the operator and the following events will occur automatically (see figure 5 for the timing chart):

1. **EVENT 1: PREPURGE** - Welding gas will start to flow (for the entire weld) from the gas source (user supplied) through the power supply to the weld head. Complete gas coverage should be obtained before the arc is struck. How long it flows before the arc is struck is called the PREPURGE TIME.

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SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

2. **EVENT 2: ARC START** - When PREPURGE time is complete the M-227 will initiate an arc. The Arc Start MODE can be set to either RF or TOUCH. In RF mode a high frequency pulse will be generated to establish an arc between the electrode and the weld joint. In TOUCH mode the AVC will perform a TOUCH START and initiate the arc (can only be used with Weld Heads with an AVC function).
3. **EVENT 3: LEVEL 1 TIME, START LEVEL, UPSLOPE, TRAVEL and WIRE START DELAY, AVC START DELAY and OSC UPSLOPE** - When the arc is established the following functions all start at the same time:
 1. **LEVEL 1 TIME** - When the arc is established all weld functions are considered to be in LEVEL 1. If the TIMER MODE is in AUTO the LEVEL 1 Timer will start to count and the M-227 will stay in LEVEL 1 until this time is complete. If the TIMER MODE is set to MANUAL the system will still be in LEVEL 1 but the timer will not be counting and the system will stay in LEVEL 1 until the operator manually advances or ends the sequence.
 2. **WELD CURRENT START LEVEL** - As the arc is established the weld current will jump to a small value. This current is used to stabilize the arc and is called the START LEVEL. Its value is programmable and may need to be changed depending on certain conditions. However, it is not a multi-level function and it is only used to help initiate the arc.
 3. **WELD CURRENT UPSLOPE** - Sometimes it may be necessary to raise the weld current to full value slowly. This is called UPSLOPE. When the arc is established the weld current will start to rise to the PRIMARY and BACKGROUND (if pulsed) value programmed in LEVEL 1. The time it takes to rise to full value is the UPSLOPE TIME.
 4. **PRIMARY and BACKGROUND PULSE TIMES** - When the arc is established and the LEVEL 1 PULSE MODE is programmed to the ON position, the weld current will be pulsing between the PRIMARY and BACKGROUND functions at the rate set by the Level 1 PULSE TIMES.
 5. **TRAVEL START DELAY** - Rotation of the arc should not occur in most cases, until full penetration of the weld has been achieved. When the arc is established the TRAVEL START DELAY time will begin to count. When this programmable period of time is complete the weld head will start to rotate the arc.

4.4

**MODEL 227
OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

3. EVENT 3:

6. WIRE FEED START DELAY - Feeding of the Wire should not occur, in most cases, until travel has started. When the arc is established the WIRE FEED START DELAY time will begin to count. When this time is complete the wire will be able to feed if the Wire Mode is set to ON.
7. AVC START DELAY - The AVC should not be turned on until the current is near full value and the puddle has stabilized. When the arc is established the AVC START DELAY time will begin to count. When this time is complete the AVC will be able to operate.
8. OSCILLATOR UPSLOPE - The Torch Oscillator Upslope is linked to the current Upslope time. During the Current Upslope time the Oscillator Amplitude (movement) will start at 0 amplitude and slowly increase to the full program value of OSC Amplitude by the end of current Upslope.
9. OSCILLATOR DWELL and EXCURSION TIMERS - The Oscillator movement is based on time. The Level 1 Dwell and Excursion Timers start counting at the beginning of Event #3 (if OSC MODE is set to ON).

4. EVENT 4: FULL LEVEL FUNCTIONS - Sometime after the arc is established, depending on the weld schedule, the current UPSLOPE, OSC UPSLOPE and all START DELAYS (Travel, Wire, AVC) will be completed and all of the following functions will be in effect:

1. LEVEL 1 TIME - Will be counting towards 0. During its count all of the below functions will be occurring:
2. LEVEL 1 PULSE MODE - The PULSE MODE can be set in each LEVEL to work several different ways:

ON = In the ON mode system will pulse between PRIMARY and BACKGROUND function values using the PULSE TIMERS for timing control.

OFF = In the OFF mode all system functions will be in PRIMARY only. No BACKGROUND functions will be done.

SYNC = In the SYNC Mode the system will pulse between PRIMARY and BACKGROUND function values using the Oscillator Dwell and Excursion Timers for pulse control.

4.5

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SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

4. EVENT 4: FULL LEVEL FUNCTIONS -

3. LEVEL 1 PRIMARY PULSE TIME - If the LEVEL 1 PULSE MODE is ON this function will now be timing the Primary pulses (see Event 3).
4. LEVEL 1 BACKGROUND PULSE TIME - If the LEVEL 1 PULSE MODE is ON this function will now be timing the Background pulses.
5. LEVEL 1 PRIMARY AMPS - After UPSLOPE the system will be regulating this programmed value of current each time the system goes to Primary Pulse either using the Level 1 Primary Pulse Time or the Level 1 Osc Dwell Time if the Level 1 Pulse Mode is in SYNC.
6. LEVEL 1 BACKGROUND AMPS - If the LEVEL 1 PULSE MODE was programmed to ON or SYNC, the system will be regulate the Level 1 Background current value after each Level 1 Primary pulse.
7. LEVEL 1 TRAVEL MODE - After the TRAVEL START DELAY time is complete the Travel will function in one of these programmable modes.

OFF = Will prevent rotation from occurring.

CONT = Runs the travel at the PRIMARY-RPM speed only, regardless of PULSE MODE.

STEP = Will pulse the travel between the PRIMARY-RPM and BACKGROUND-RPM speed. If the TRAVEL MODE is in STEP but the PULSE MODE is in OFF then only PRIMARY will occur (without pulsing there are no background functions).

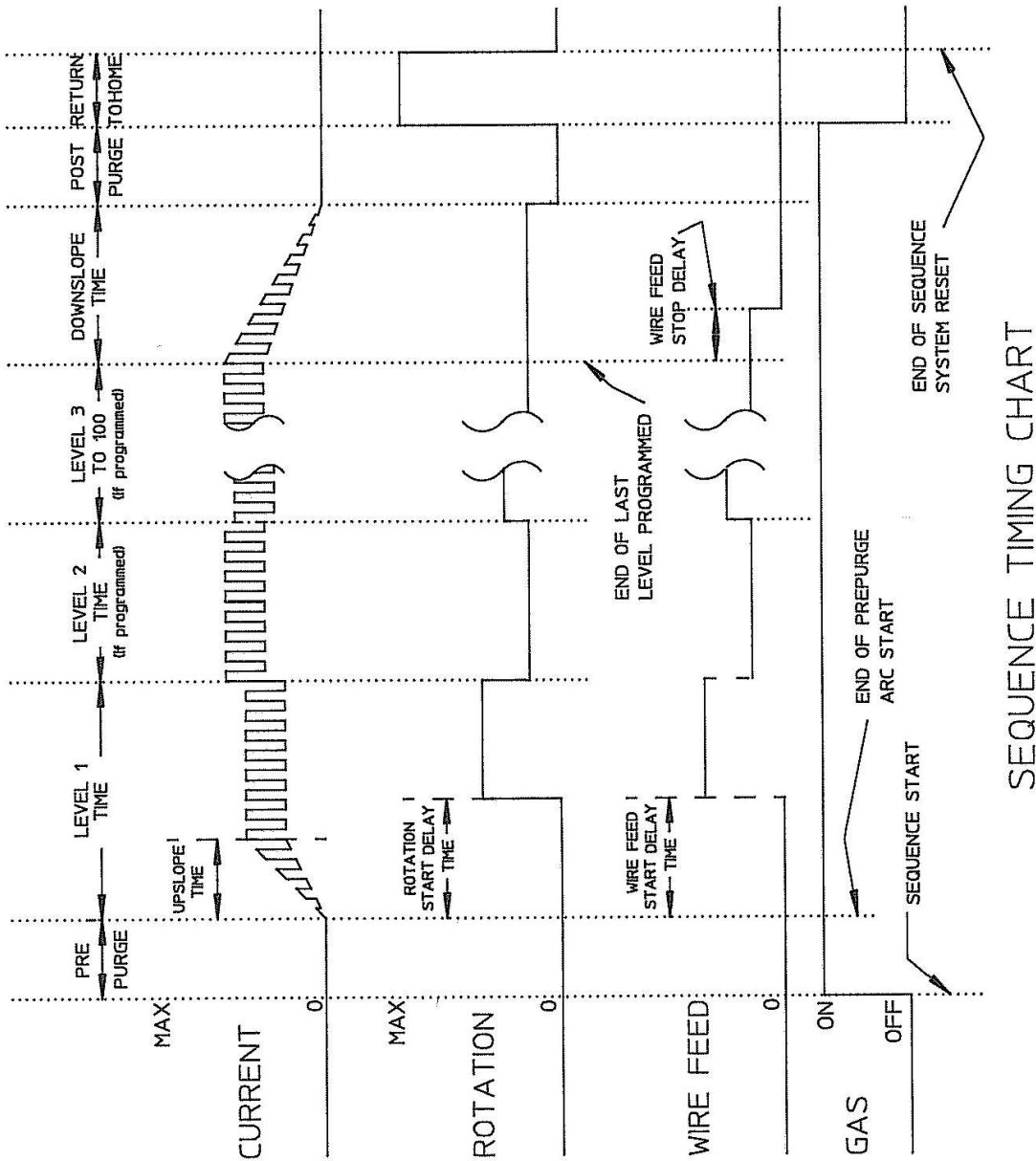
8. LEVEL 1 PRIMARY-RPM - After the Travel Start Delay time is complete the travel function will begin. If the Level 1 Travel Mode is programmed to CONT the travel will be rotating the arc at the Primary-RPM rate continuously regardless of any pulsing. If the Travel Mode is STEP it will rotate the arc at the Primary-RPM speed each time the system goes to PRIMARY.
9. LEVEL 1 BACKGROUND RPM - If the LEVEL 1 PULSE MODE is in ON or SYNC and the TRAVEL MODE is in STEP the system will rotate the arc at the BACKGROUND-RPM each time the system goes to a BACKGROUND pulse.

NOTE

Travel direction is programmable CLOCKWISE or COUNTER-CLOCKWISE. After the Travel Start Delay the Head will rotate in the programmed direction. The direction is not programmable by LEVELS.

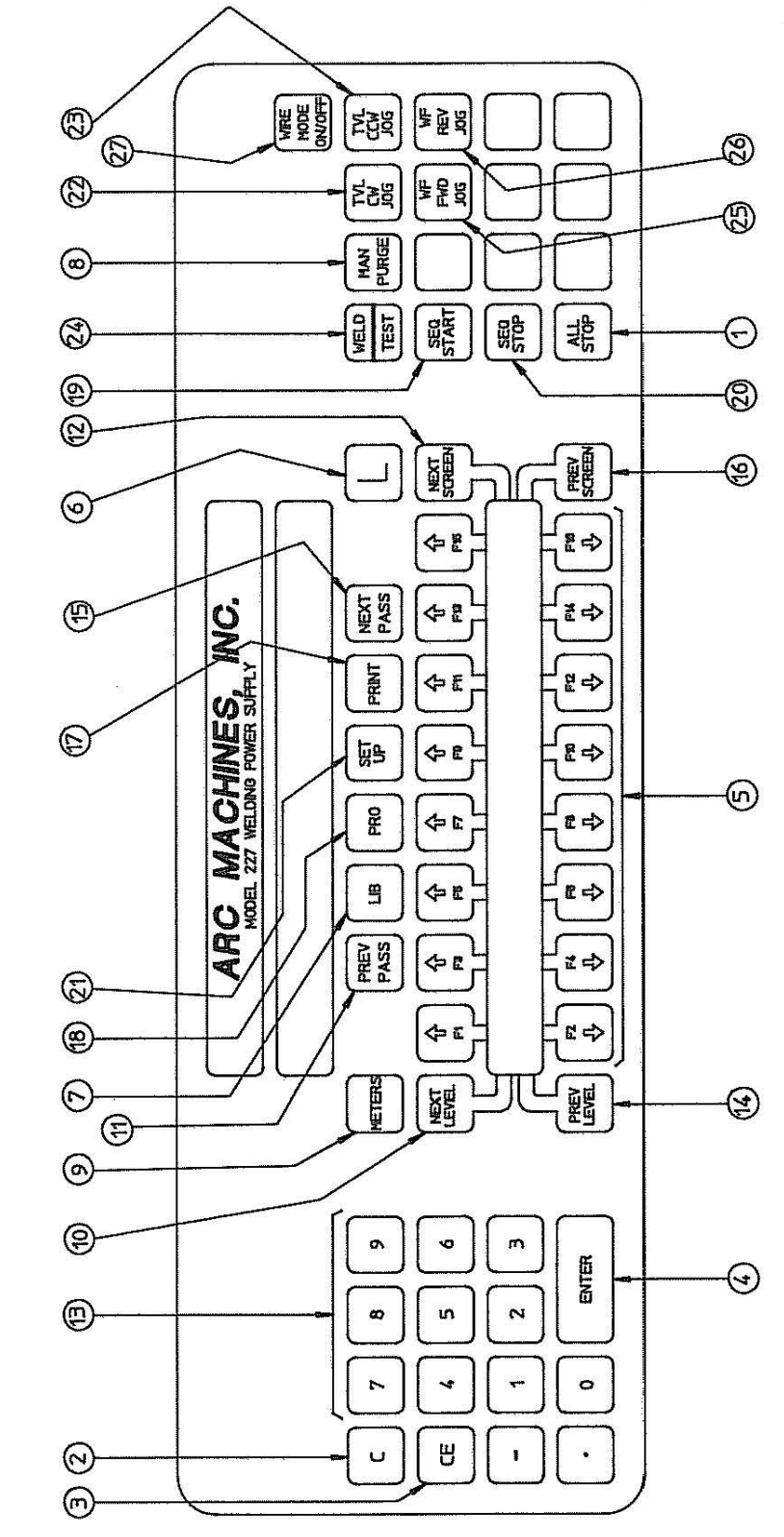
4.6

MODEL 227
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SEQUENCE TIMING CHART

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PANEL KEY LOCATIONS

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OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

4. EVENT 4: FULL LEVEL FUNCTIONS -

10. LEVEL 1 PRIMARY WIRE - After the Wire Start Delay time is complete the Wire Feeder will feed at the Primary Wire Feed value whenever the system is in Primary and the Wire Mode is set to ON.
11. LEVEL 1 BACKGROUND WIRE - After the Wire Start Delay is complete the Wire Feeder will feed at the Background Wire Feed value whenever the system is in Background and the Wire Mode is ON.
12. LEVEL 1 AVC MODE - The AVC can be set in each Level to work several different ways:

OFF = Will prevent the AVC servo from operating.

CONT = Allows the AVC to work continuously both in the PRIMARY and BACKGROUND functions, using the Level 1 AVC value when in Primary and using the Level 1 Background AVC value when in Background.

SAMP/PRI = Allows the AVC to work only during the PRIMARY current, using only the Primary AVC value. The AVC position will not move during Background.

SAMP/BCK = Allows the AVC to work only during the BACKGROUND current, using only the Background AVC value. The AVC position will not move during Primary.

13. LEVEL 1 PRIMARY AVC - After the AVC START DELAY time is complete and the AVC MODE is in CONT or SAMP/PRI. the AVC will maintain this value during the Primary current.
14. LEVEL 1 BACKGROUND AVC - After the AVC START DELAY time is complete and the AVC MODE is in CONT or SAMP/BCK the AVC will maintain this value during the Background current.
15. LEVEL 1 OSCILLATOR AMPLITUDE - Is the distance the Torch Oscillator will move from full IN to full OUT during the EXCURSION TIME programmed in LEVEL 1.
16. LEVEL 1 OSCILLATOR EXCURSION TIME - The time in LEVEL 1 that the oscillator will travel from full IN to full OUT position.
17. LEVEL 1 IN DWELL TIME - The amount of time the oscillator will stay at the IN position before EXCURSION to the OUT position.
18. LEVEL 1 OUT DWELL TIME - The amount of time the oscillator will stay at the OUT position before EXCURSION to the IN position.

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SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

5. **EVENT 5: LEVEL 2 TO LAST PROGRAMMED LEVEL** - As the arc is rotated around the weld it is usually necessary to program changes in the current, pulse times, modes and rotation speed. These changes are called LEVELS and up to 100 can be programmed for each sequence. Each LEVEL contains the same functions and options as EVENT 4. In TIMER MODE AUTO each LEVEL TIME sets the duration of that level. TIMER MODE MANUAL the system will stay in a programmed level until MANUAL ADVANCED by the Operator (from the Remote Pendant).
6. **EVENT 6: DOWNSLOPE** - When the last programmed LEVEL is complete the WELD SEQUENCE will begin the process of stopping as follows:
 1. **Current and Oscillator DOWNSLOPE** - To avoid cratering and cracking of the weld the current and oscillator need to be reduced slowly. The last LEVEL PRIMARY-AMP value and BACKGROUND-AMP value (if pulsed) and OSC AMPLITUDE will start to decrease towards 0. The time it takes to reach arc cutoff (about 3 amps) is called the DOWNSLOPE time and it is programmable.
 2. **WIRE STOP DELAY TIMER** - At the end of the last Level the WIRE STOP DELAY time will start counting. The WIRE will continue to feed until this time is complete. When the wire quits feeding the wire will automatically retract (go in reverse) for the programmed RETRACT TIME.
 3. **AVC STOP DELAY** - At the end of the last Level the AVC STOP DELAY time will start counting. The AVC will continue to operate until this time is complete.

NOTE

The ROTATION function does not have a STOP DELAY. The Weld Head will continue to TRAVEL for the DOWNSLOPE time and then turn off.

7. **EVENT 7: POSTPURGE** - At the end of DOWNSLOPE, when the current is less than 3 amperes, the arc will go out. All functions except gas flow will stop. The gas should not be stopped until the weld and electrode are cooled enough to prevent oxidation. How long the gas continues to flow is called the POSTPURGE TIME.

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SECTION IV - SYSTEM FUNCTIONS

4.3 WELD SEQUENCE

8. **EVENT 8: RETURN TO HOME AND RESET** - When POSTPURGE is complete the gas will shut off. When the gas shuts off, Weld Heads with “Return to Home” functions (M-9, M-95, M-79) will then have the rotor automatically return to the open position for removal. The System will then reset and be ready to make another weld.

4.4 PANEL KEYS - The following are descriptions of all active operating keys contained on the system Main Panel (see figure 6):

1. **ALL STOP KEY** - Active only during weld sequence in test or weld mode. When pressed it will stop the sequence, turn off the arc with no downslope and start the postpurge process (see 4.3 event 7).
2. **C KEY** - Used for screen clear or cancel, it will end (without storing) the screen being displayed and return to the beginning of any step. The screen will prompt the operator to indicate what will happen if the C key is pressed.
3. **CE KEY** - The Clear Entry key is used to clear numbers entered with the numeric keys before the ENTER key is pressed. Use this key when a mistake is made using the numeric keys.
4. **ENTER KEY** - Used at the end of each step to indicate completion and to move to the next step or screen.
5. **F KEYS** - These are function keys numbered 1 to 16. Each key is aligned with a portion of the display and are used to activate, cycle or alter the item displayed above or below it. Each key will alter different functions depending on what screen is being displayed. Use of the F keys is always prompted by the screens.
6. **L KEY** - The M-227 is multi-lingual. Pressing this key will change the display from English to French to German, etc.. The L key is always active.
7. **LIB KEY** - Used to access the LIBRARY (weld schedule memory/storage).
8. **MANUAL PURGE KEY** - Active at all times. Used for manually turning on the gas solenoid. When ON, the gas solenoid will be energized and it will stay ON until this key is manually pressed again.
9. **METER KEY** - Only one of the displays is used as a BAR GRAPH METER during Welding. Limited functions are shown. Use this key to access the desired meter function. Remember that meter readouts are provided for functional troubleshooting only. They are not intended for verification of system performance.

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OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.4 PANEL KEYS

10. NEXT LEVEL KEY - Active when weld schedules with more than one level are being displayed. An * will appear on the displays to indicate that more levels are programmed for that weld schedule.
11. NEXT PASS KEY - Used to retrieve from memory the next weld pass parameters for the weld schedule being used.
12. NEXT SCREEN KEY - Active when another screen (more data) is available for a weld schedule or function. An * will appear on the display to indicate that more data is available on the next screen.
13. NUMERIC KEYS - Used to select weld schedule number (3) or to enter numbers during programming, overriding and set-up functions.
14. PREV LEVEL KEY - Same as NEXT LEVEL but levels appear in reverse order.
15. PREV PASS KEY - Used to retrieve from memory the previous parameters used for the previous pass.
16. PREV SCREEN KEY - Same as NEXT SCREEN but screens appear in reverse order.
17. PRINT KEY - If pressed when the status screen is displayed a copy of system hours and software revision will be printed. If pressed during the library screen a copy of the entire library will be printed. If pressed while displaying a weld schedule the entire weld schedule will be printed. This key will not be activate any other time. It cannot be used during an actual weld sequence. The date will be printed on every copy.
18. PRO KEY - Active only if the OPERATE MODE SWITCH is in the PROGRAM position. Pressing the PRO key from the Status screen will access the programming modes. During programming the PRO key is also used to store information.
19. SEQ START KEY - Active with the schedule screen. When pressed this key will start the weld sequence (see 4.3).
20. SEQ STOP KEY - Active only during weld sequence. When pressed this key will stop the weld sequence and start the downslope function (4.3 event 6).

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4.4 PANEL KEYS

21. SET UP KEY - Active at all times except during a weld sequence. When pressed this key will allow access to various set-up options (see 4.8).
22. TVL CW JOG KEY - Active at all times. When pressed the weld head will rotate the electrode in the counterclockwise direction
23. TVL CCW JOG KEY - Active at all times. When pressed the weld head will rotate the electrode in the counterclockwise direction.
24. WELD/TEST KEY - At power on the M-227 will always be in the TEST mode. In TEST mode a weld sequence can be run but NO ARC will be struck. The user must press this key to initiate WELD mode. Once this is done the M-227 will stay in WELD mode as long as the same weld schedule is displayed. Changing schedules will cause the system to return to the TEST mode.
25. WIRE JOG FWD KEY - Used to feed the wire out manually before sequence for installation and set-up purposes.
26. WIRE JOG REV KEY - Used to pull the wire back manually before sequence for installation and set-up purposes. This key should be used sparingly because most weld heads do not have a reel take up function and the wire can back-lash if too much wire is retracted.
27. WIRE MODE ON/OFF KEY - After Wire Start Delay the Wire can only turn on if the wire mode is set to ON.
28. AVC UP JOG KEY - Used to move, prior to and after welding, the AVC (and torch) in the up direction.
29. AVC DOWN JOG KEY - Used to move, prior to and after welding, the AVC (and torch) in the down direction.
30. OSC IN JOG KEY - Used to STEER the Oscillator and torch toward (IN) the Weld Head.
31. OSC OUT JOG KEY - Used to STEER the Oscillator and torch away (OUT) from the Weld Head.
32. STOP PRINT KEY - This key will allow the user to stop the printing process for any reason.
33. PAPER FEED KEY - This key allows the user to advance the paper in the printer.

**MODEL 227
OPERATION MANUAL****SECTION IV - SYSTEM FUNCTIONS****4.5 OPERATE MODE SWITCH**

This is a three position switch with a locking key. When set to the desired position (mode) the key can be removed, to prevent any non-key holder from changing the mode.

1. **OPERATE/WELD SELECT POSITION** - The OPERATE mode is for standard welding operations. It allows access to all weld schedules and set-up screens. All normal system operations, such as weld sequence, etc. are performed in this mode. In this mode the operator CANNOT perform any PROGRAMMING functions or changes to the memory such as creating, modifying, transferring or deleting.
2. **MODE LOCK** - After weld schedule has been selected it may be locked-in to prevent selection of any other weld schedule. This feature is intended primarily for when the operator is welding out-of-sight of the M-227 or if a supervisor wishes to insure that ONLY a particular weld schedule is used.
3. **PROGRAM/OPERATE** - In order to CREATE, MODIFY, TRANSFER, COPY or DELETE a weld schedule in the system memory, the mode switch must be set to this position. All system operations, such as weld sequence, can also be performed in this mode.

**CAUTION**

Authorization and access to the OPERATE MODE KEY should be controlled. When the switch is set to the PROGRAM mode the operator may permanently MODIFY (change) or DELETE weld schedule information contained in the system memory.

4.6 FAULTS

The M-227 has the ability to monitor certain functions. If they are not working correctly a system fault (FLT) will alert the operator to the problem. The following is a description of each type of fault (FLT):

1. **TEMP FLT** - Power supply internal TEMPERATURE IS TOO HIGH
Fault creates an ALL STOP condition if it occurs during weld sequence.
2. **COOL FLT** - Insufficient TORCH COOLANT FLOW. Active only with the M227/207-CW or M207-CW option and the fault can be disabled from the SETUP Screen.
When active the fault creates an ALL STOP condition if it occurs during weld sequence.
3. **LVPS FLT** - Problem with the Low Voltage DC Power Supplies. Fault creates SEQ STOP if it occurs during weld sequence.

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OPERATION MANUAL**

SECTION IV - SYSTEM FUNCTIONS

4.6 FAULTS

4. **GAS FLT** - TORCH GAS FLOW is not detected. Fault creates an ALL STOP if it occurs during a weld.
5. **INPUT FLT** - If the M-227 cannot achieve desired outputs because of inadequate AC input. Fault creates a SEQ STOP if it occurs during a weld.
6. **SENSOR 1,2,3** - User defined (see 4.7, 4.8 and 5.8).
7. **BAD START** - Indicates that the system was unable to sustain an arc.
8. **STUB OUT** - If the Arc Voltage gets too low or the electrode should touch the puddle then a stub out will occur.
9. **HIGH VOLTS** - If the Arc Voltage gets too high a fault will occur.
10. **GROUND FAULT** - On Heads with Ground Fault Sense, if the Work Ground is not connected to the Work piece the system will detect this and prevent arc start.
11. **OSC LIMIT** - On Heads with OSC limit switches, if they are engaged the system will create an ALL STOP.
12. **AVC LIMIT** - On Heads with AVC limit switches, if they are engaged the system will create an ALL STOP.

The method of alerting the operator depends on what the fault is and when it occurs. A problem with TEMP, LVPS or INPUTAC when the M-227 is first turned on will create a FAULT SCREEN and the fault must be corrected before the M-227 will proceed with any other functions.

A problem with COOL, GAS or SENSOR is common at power on or when preparing for welding. These items will only create the FAULT SCREEN if they occur during weld sequence. BAD START appears only during weld sequence (after pre-purge) and does not create a fault screen.

STUB OUT and HIGH VOLTS will only occur during a weld and will cause an ALL STOP condition. After postpurge the normal “return to home” sequence will also be disabled.

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SECTION IV - SYSTEM FUNCTIONS

4.7 SENSOR 1, 2, 3 FAULTS

The M-227 has 3 separate inputs that the user can define for creating a fault condition based on some external problem. The most common is connecting a gas analyzer(s) to the M-227 to detect excessive Oxygen in the I.D. purge of a weld. The user must make these connections and uses the SET-UP screen (see 5.8) to define what a fault is for this external input.

4.8 SET-UP FUNCTIONS

The following SET-UP functions provide some customizing and calculating features to enhance system performance:

1. **CALCULATE** - Calculates TUNGSTEN LENGTH, IPM to RPM conversions and WELD TIME.
2. **WELD-SELECT** - The M227-RP may select up to 4 pre-determined weld schedules from memory. This function defines the schedules that are picked.
3. **COOLANT FAULT** - Used to enable or disable Coolant Fault whether or not a M227/207-CW or M207-CW is connected.
4. **REV** - Used to display the SOFTWARE REVISION of a particular M-227. Depending on intended use, M-227's may have different software revisions.
5. **PRINT EMM** - Used to print a copy of the EMM memory.
6. **AMP - TIME** - Used to change the last significant digit of Level Current or Level Time from whole numbers to tenths (000 to 000.0).
7. **ARC V FLT** - Used to de-activate STUB OUT and HIGH VOLT faults. These faults are usually needed to be turned off for manual welding.
8. **SENSORS** - Activates and defines EXTERNAL Fault inputs (see 5.8).
9. **PRINTER** - Used to select AUTO or MANUAL print mode.
10. **OSC SPEED** - Used to set the speed that the OSC IN Key and OSC OUT key move the Oscillator Steering.
11. **DATE RESET** - Used to reset the DATE.
12. **AVC JOG SPEED** - Used to set the speed of the AVC JOG UP and AVC JOG DOWN. Primarily used to refine Touch Start Operation.
13. **OPERATOR I.D.** - Allows the Operator to enter his name or ID number. Once entered it will be printed on all copies of weld schedules.
14. **POWER SUPPLY SERIAL NUMBER** - Allows entry of Power Supply Serial #. Once entered it will be printed on all copies of weld schedules.

**MODEL 227
OPERATION MANUAL****SECTION IV - SYSTEM FUNCTIONS**

- 4.9 GLOSSARY OF DISPLAY SYMBOLS AND ABBREVIATIONS - The M-227 displays contain many abbreviations. The following is an alphabetical listing:

AL	= Aluminum
AMP	= Amperes
BCK	= Background (low value of a function that pulses)
CAL	= Calibrate or calibration
CCW	= Counterclockwise
CONT	= Continuous operation
COOL	= Coolant flow
CS	= Carbon steel
CW	= Clockwise
DLY	= Delay time
EXT	= External input or function
FLT	= Fault
HAS	= Hastaloy
INC	= Inconel
INPUTAC	= Input power AC voltage check
IPM	= Inches per minute
LIB	= Library, listing of programmed weld schedules
LVL	= Level or levels
LVPS	= Low voltage DC power supply check
MAT	= Material
MNL	= Monel
OD	= Outside diameter
OK	= Mean monitored function is operating properly.
PRE-PURGE-POST	= PREPURGE, postpurge columns.
PRI	= Primary function value
PRI-AMP-BCK	= Primary amp, background amp columns
PRI-PULSE-BCK	= Primary time, background time columns
PRI-RPM-BCK	= Primary speed, background speed columns
PRO	= Program mode
REV	= Software revision or sometimes Reverse
ROT	= Rotation or travel function
ROT DLY	= Rotation or travel start delay time
RPM	= Revolutions per minute
SP	= Special material
SS	= Stainless steel
SYS HOURS	= System hours indicate total power-on time.
TEMP	= Power supply internal temperature
TI	= Titanium
#	= Weld schedule number
*	= Indicates that more information is available

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- 4.10 GLOSSARY OF DISPLAY TERMS - The M-227 displays contain many terms that do not relate directly to a function or sequence. The following is a listing of those terms:

AMIWELD	= Name, type and revision of software
ARC GAP	= Distance needed between electrode and weld.
ARC HOURS	= Total hours system has been welding.
BAD START	= Problem has occurred with RF start.
CALCULATE	= Function calculates RPM or tungsten length.
CANCEL	= Ends step without storing or completing.
COPY	= Allows a schedule to be copied with a new #.
CREATE	= For creating a new weld schedule.
DATE RESET	= Resets date function.
DELETE	= Used to delete a weld schedule from memory.
INVALID NUMBER	= Can appear by attempting to CREATE a weld schedule that already exists or by Selecting a weld schedule that does not exist.
MODE LOCK	= Screen cannot be changed. Weld schedule (if selected) will be locked in.
MODIFY	= Used to permanently change a weld schedule.
OPERATE	= Operate mode only, cannot program.
OVERRIDES	= Ability to change a value temporarily.
PROGRAM/OPERATE	= Ability to program or operate.
RING	= Insert ring is used for filler material.
ROTOR OD	= Outside diameter of M-9 rotor.
SENSOR 1,2,3	= User defined faults.
STORE	= Puts weld information into memory.
TRANSFER	= Allows copying of memory to another M-227 or to the M-227-EMM.
TYPE	= Describes the basic type of weld.
WALL	= Wall thickness of the weld.
WARNING	= Used to indicate that if step is continued a permanent loss of information will result.

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SECTION V - OPERATION

5.0 INTRODUCTION

Operation covers those steps that must be taken to actually perform a weld. Programming and development of schedules are not covered in this section.

It is very important to insure, before operating, that the operator has **INSTALLED** the M-227 per section III and has a good understanding of functions from section IV. Function explanations are not covered in this section.

The M-227 uses two displays to provide information and instructions for use. For the most part, the information and instructions presented on these displays are adequate explanation of operation. This section is only intended as a guideline to get started with for first time users **AFTER HAVING ATTENDED AN AMI M-227 TRAINING CLASS.**

5.1 INITIAL POWER ON/STATUS SCREEN

1. Before connecting or energizing the AC power; verify that all input power set up requirements of Section III have been complied with.



WARNING



Applying 200 VAC or greater input power to a M-227 set up for 110 VAC operation ***WILL CAUSE THE INPUT VARISTERS TO FAIL. MAKE SURE THE INPUT POWER SET UP IS CORRECT FOR THE POWER BEING USED.***

2. The M-227 can be turned on without the adapter cable, gas hoses or weld head connected. However, to verify proper operation they must be connected. Insure that all of these connections are per Section III.
3. Plug in the AC power cable to the AC source. Move the circuit breaker (CB1) to the ON position.
4. After a few seconds the STATUS SCREEN will appear as shown on the next page:

NOTE

If the input power is too low it is possible for the screens not to turn on, be scrambled or get a fault screen indicating a LVPS fault. If these conditions occur recycle CB1. If they continue to occur check the input power and the power setup of the M-227.

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OPERATION MANUAL**

SECTION V - OPERATION

5.1 INITIAL POWER ON/STATUS SCREEN

4. (continued)

UPPER SCREEN

TO WELD PRESS LIB	TO PROGRAM PRESS PRO
SYS HOURS - 00000.0	ARC HOURS - 00000.0

LOWER SCREEN

TEMP-OK	INPUTAC-OK	GAS-OK	LVPS-OK
COOL-OK	SENSOR1-OK	2-OK	3-OK

Actual hours will appear where the above show 0. COOL, GAS or SENSOR 1,2,3 may indicate FLT where OK appears. This is considered normal at power-up.

5.2 USE OF NEXT/PREV SCREENS/LEVELS

Weld schedules contain more data than can be shown at one time. To display this data the NEXT/PREV SCREEN keys and NEXT/PREV LEVEL keys must be used. These keys are located at the corners of the lower display. When there is more data on another screen or level, a flashing * will appear in the appropriate corner (s) to indicate that more information is available.

Screen/Level keys are used in selection of a weld schedule and all weld schedules use 8 basic Lower Screen Displays that appear in the following order:

1. **PROMPT SCREEN** = Appears when a weld schedule is called up from memory. Gives instructions in lower display and shows Library Description, Weld Mode and Fault Status in upper display.
2. **LEVEL 01 AMPS - TIME - PULSE** = Displays the value of Amps, Level Time and Pulse Times for Level 1.
3. **LEVEL 01 RPM/IPM - MODES** = Displays the value of Travel Speeds, Travel Mode and Pulse Mode for Level 1.
4. **LEVEL 01 WIRE -AVC-AVC MODE** = Displays the value of Wire Feed Speeds, AVC settings and AVC MODE for Level 1.
5. **LEVEL 01 OSC** = Displays the value of Osc Amplitude, IN Dwell, Out Dwell and Excursion times for Level 1.

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5.2 USE OF NEXT/PREV SCREENS/LEVELS

6. **PURGE - SLOPE - ROT DELAY** = Displays the time for Prepurge, Postpurge, Upslope, Downslope Rotation Direction and Rotation Start
7. **WF DELAY - RETRACT - T/MODE - OSC MODE** = Displays settings for Wire Feed Start Delay, Stop Delay, Wire Retract Time, Timer Mode and Osc Mode
8. **AVC DELAY - START MODE - RESPONSE - START LEVEL** = Displays settings for AVC Start Delay, Stop Delay, Response and Start Level.

Pressing the NEXT SCREEN key will advance the display in the above order. When viewing screen 2 to 8 (above) pressing the PREV SCREEN key will reverse the order.

The weld schedule can be programmed to have up to a 100 levels of screen 2, 3, 4 and 5. When viewing screen 2, 3, 4 or 5 the operator can press the NEXT LEVEL key to view the values for the next level for those same functions (if programmed).

When displaying level 2 or greater, pressing the PREV LEVEL key will then display the previous level.

Pressing the NEXT SCREEN or PREV SCREEN key after using the NEXT LEVEL or PREV LEVEL key will display the NEXT SCREEN for that LEVEL, except if the next screen is 1, 6, 7 or 8, these screens are the same for all levels.

Reference figure 7 for a flow chart on the use of NEXT/PREV SCREEN and LEVEL keys.

5.3 WELD SCHEDULE SELECTION

The following describes how to select a weld schedule from the LIBRARY. The Operate Mode switch must be in the OPERATE or PROGRAM position. Be sure to have read section 5.2 (use the Next/Prev keys) before proceeding.

1. The STATUS Screen of 5.1 should be displayed. If not press the C key until until the STATUS screen appears.
2. Press the LIB key and the following display will appear:

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5.3 WELD SCHEDULE SELECTION

2. (continued)

USE SCREEN KEYS TO FIND # PRESS ENTER OR IF # IS KNOWN ENTER #--- PRESS ENTER
--

#	OD	WALL	MAT	HEAD	PASSES *
001	1.500	.065	SS	95	10 *

Instructions are displayed on the upper screen. The first weld schedule in memory (may not be #001) will be displayed on the lower screen.

3. If you know what weld schedule you want, enter its number using the numeric keys. The numbers will appear in the --- area as you enter them. If you make a mistake press CE and start over. When you have entered and verified the correct number press the ENTER key. After a few seconds your selected weld schedule will appear on the display. Proceed to step 5.
4. To find the weld schedule you want press the NEXT SCREEN key. The next weld schedule in memory will be displayed. Continue pressing the NEXT SCREEN key until the desired weld schedule appears. When the desired schedule appears, press the ENTER key. After a few seconds your selected weld schedule will appear on the display.

5. When the weld schedule is called up from memory it will appear on the screens like this:

#	OD	WALL	MAT	HEAD	PASS	READY
001	1.500	.065	SS	95	01	TO TEST

USE NEXT SCREEN FOR VALUES THEN F KEYS * TO CHANGE VALUES - USE SEQ START TO WELD
--

READY TO TEST may say FAULT _____ with an explanation in the _____ space as to what the fault is. The fault must be corrected before proceeding.

5.4 PASS ADVANCE

1. When a Weld Schedule is selected it will always come up showing the first pass (01). Pressing the NEXT PASS Key will access the second (02) pass (if there is one).
2. Use the PREV PASS key to return to Pass 01. Continue to use the NEXT/PREV PASS Keys to access the desired Weld Pass Parameters.



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5.5 VIEWING FUNCTION VALUES

NOTE

Insure that section 5.2 (use of Next/Prev keys) has been reviewed before proceeding.

1. Pressing the NEXT SCREEN key after the weld schedule has been selected from the library will result in the following screen:

#	OD	WALL	MAT	HEAD	PASS	READY
001	1.500	.065	SS	95	01	TO TEST

LVL-TIME	PRI--AMP--BCK			PRI-PULSE-BCK		
01 000	000		000	0.00		0.00*

The above shows amperes, pulse times and level time (duration) for level 1 of the schedule.

2. After reviewing this information the operator can do one of the following:
 1. Make changes to these level 1 functions (see 5.6)
 2. Press the NEXT LEVEL or NEXT SCREEN key to review the entire weld schedule as depicted in figure 7 and make changes if desired.
3. Press the SEQ START key to run this weld sequence

5.6 OVERRIDING FUNCTION VALUES

Each weld schedule in the M-227 library can be programmed to allow unlimited, limited or NO changes to be made to the function values of the weld schedule. If the weld schedule allows changes to be made use the following procedure.

1. Use the NEXT SCREEN and/or NEXT LEVEL keys until the function value to be changed appears on the screen.
2. Directly above and below each function value is an F key. When either one is pressed the first time, the function to be changed will start to blink.
3. The value can be changed two ways. A small INCREASE in the value can be made by pressing the UPPER F key. A DECREASE in the value can be made by pressing the LOWER F key. Each time the F key is pressed the value will change by the smallest programmable increment. Large changes should be done by using the numeric keys. With the function blinking (step 2) enter the new value using the numeric key pad. Verify that the new value appears on the display. If you make a mistake press the CE key and try again.

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SECTION V - OPERATION

5.6 OVERRIDING FUNCTION VALUES

4. When the new value is displayed and verified, press the ENTER key. The function will stop blinking and the system is ready to change another value or to operate.
5. MODES such as TIMER, ROT, etc. are not controlled by any limits and can be changed overridden by the Operator by using the F key to change the MODE.

5.7 SET UP FUNCTIONS

There are two types of SET UP screens. Both are accessed with the SET UP key. One type appears when the System Mode is set to Operate and both appear when The System Mode is set to OPERATE and both appear when the System Mode is set to PROGRAM.

NOTE

The SET UP screens offer special functions that can ENHANCE or in some cases CHANGE the way the M-227 operates. It is important for the user to understand these features. Under some conditions, if not properly set, undesirable performance can occur.

1. OPERATE MODE SET UP FUNCTIONS - Pressing the SET UP key on the M-227 panel when on the STATUS SCREEN or WELD SCREEN with the System Mode set to OPERATE will access the first of three SET UP screens that contain the following functions:
 1. CALCULATE - Pressing the F key under this choice will access a prompt screen for calculating Tungsten Length or RPM or Weld Time. Follow the instruction on the screen to make these calculations. These features can be very helpful when creating new weld procedures.
 2. WELD SELECT - This feature is used to select up to 4 different weld schedules to be accessible by M-227-RP Remote Pendant. Press the F key under Weld Select and follow the instructions on the display.
 3. COOLANT FAULT - If the Coolant Fault is ON the M-227 will look to see if an optional M227/207-CW or M207-CW Cooling Unit is connected. If it is then the M-227 will require that coolant be flowing or else it will create a fault. If for some reason the Cooling Unit is connected but not being used the operator can change this Coolant Fault Set Up to OFF and no coolant fault will be detected.

CAUTION

Severe damage to the weld head and cables can occur if you have the Coolant Fault turned OFF and are operating a weld head that needs coolant and then you forget to turn the cooler on or to make the connections.

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5.7 SET UP FUNCTIONS

1. OPERATE MODE SET UP SCREENS

4. REV - Pressing the F key under this will show the current software REVISION installed. This can be important when discussing problems or features with an AMI representative.

NOTE

The following SET UP functions are accessed by pressing NEXT SCREEN from the first SET UP screen.

5. Print EMM - Pressing the F key under this choice will create a Print out of the LIBRARY contained in M-207-EMM Option (EMM must be installed).
6. AMP - TIME - This feature allows the user to change the programmable increments of LEVEL AMPS or LEVEL TIME from 000 (whole numbers) to 000.0 (tenths) .

NOTE

This is not on an individual WELD # basis. All WELD # will be changed automatically. If a WELD # was originally programmed for 87.7 amperes and this is changed to whole numbers the WELD # when accessed will then call for 87 amperes (it will drop the digit, not round off).

7. ARC V FAULT - This feature can turn this FAULT ON or OFF. When ON a STUB OUT will be created if the ARC VOLTAGE goes below 5 V or a HIGH VOLTS fault if the VOLTAGE goes over 20 V . These conditions only occur in automatic welding if something is wrong . However, in manual welding these conditions can occur without anything being wrong . THIS FEATURE NEEDS TO BE SET TO OFF FOR MANUAL WELDING .

NOTE

The following SET UP functions are accessed by pressing NEXT SCREEN from the second SET UP screen.

8. OPERATOR ID - This feature allows the Operator to enter his name into system memory and the M-227 will record that name onto every print out run after a weld sequence.
9. SERIAL NUMBER - This feature allows the entry of the Power Supply Serial number into system memory and the M-227 will record that SN# onto every print out run after a weld sequence.

5.8

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5.7 SET UP FUNCTIONS

2. PROGRAM MODE SET UP FUNCTIONS - If the System Mode Key is set to PROGRAM these additional functions can be shown after the first three SET UP screens, press the NEXT SCREEN key to access.

1. SENSORS - The M-227 FAULT detection system has an EXTERNAL input feature that allows the user to monitor up to 3 external functions (such as an Oxygen Analyzer) and create a M-227 FAULT if that external feature should fail .

Pressing the F key under this will allow the user to turn any or all of the 3 Sensors ON and select whether the FAULT should occur with a LOW input signal or a HIGH input signal. Reference AMI drawing 45B072514 for pin connections and electrical signal information about HIGH and LOW.

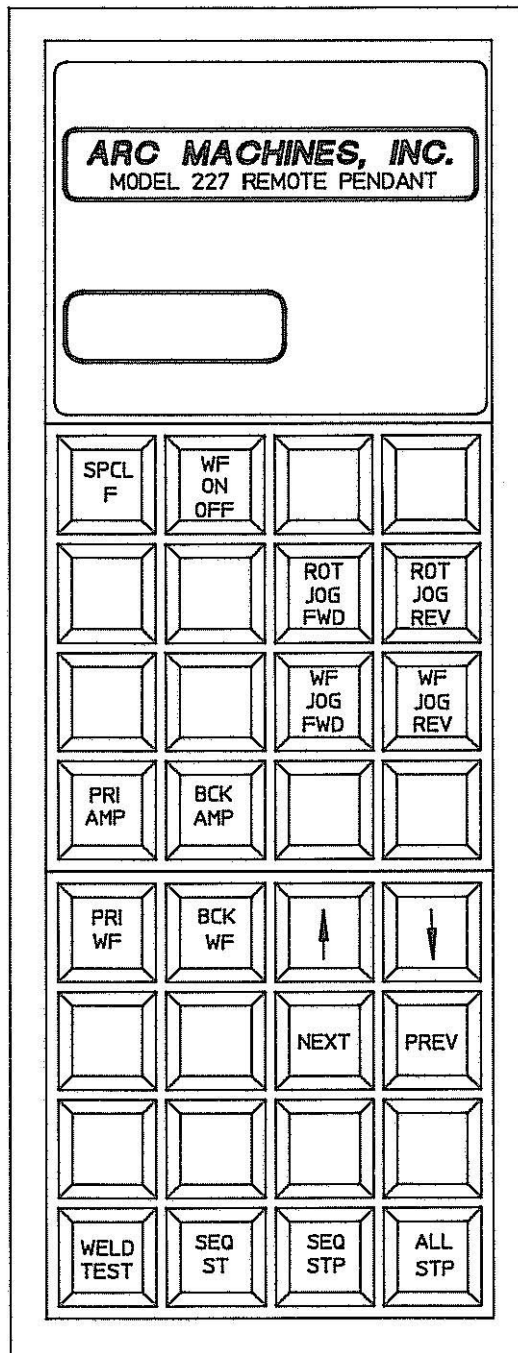
2. PRINTER MODE - The M-227 can be set up to make a print out of the WELD # automatically (AUTO) after every Sequence. If set to MANUAL print will only be made if the PRINT key is pressed after a weld sequence.

NOTE

The following SET UP functions are accessed by pressing the NEXT SCREEN key from the fourth SET UP screen.

3. OSC JOG - Use this feature to set the OSC STEERING speed. Weld Head models with an OSC function can vary as to the motor speed and sensitivity when trying to steer. This feature is used to adjust the movement to optimum for the model being used.
4. DATE RESET - Use this feature to reset the date. Usually required after the BATRAM has been replaced (see section VII).
5. AVC JOG SPEED - Use this feature to set the AVC UP JOG SPEED and the AVC DOWN JOG speed. Weld Head models with an AVC function can vary as to the motor speed. This can cause variations in the Touch Start function. Use this feature to adjust the jog speeds (up and down) to achieve the best Touch Start performance for the model being used.

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STANDARD REMOTE PENDANT

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SECTION V - OPERATION

5.8 REMOTE PENDANT (RP) OPERATION

1. A complete understanding of system operation is needed for proper use of the RP. All previous sections of this manual and all previous steps of this section should be read before proceeding with RP operation.
2. The following functions and features are provided by the standard RP:
 1. Sequence Start key
 2. Sequence Stop key
 3. All Stop key
 4. Travel Jog CW key
 5. Travel jog CCW key
 6. Weld/Test Mode key
 7. Wire Feed Mode key
 8. Wire Feed Jog key
 9. Wire Retract Jog key
 10. Osc IN Jog key
 11. Osc OUT Jog key
 12. AVC UP Jog key
 13. AVC DOWN Jog key
 14. Primary Amp Override key
 15. Background Amp Override key
 16. Primary Wire Feed Override key
 17. Background Wire Feed Override key
 18. Arrow Up key
 19. Arrow Down key
 20. Special Function key
 21. Next key
 22. Prev key
 23. Primary Pulse Time Override key
 24. Background Pulse Override key
 25. Primary Travel Speed Override key
 26. Background Tvl Override key
 27. Primary AVC Override key
 28. Background AVC Override key
 29. Osc Amplitude Override key
 30. Excursion Time Override key
 31. IN Dwell time Override key
 32. OUT Dwell time Override key
 33. 8 character digital status display
2. Items 1 to 13 above are duplicates of keys contained on the M-227 panel. They work exactly the same as the keys on the panel. When the RP is connected these keys and the identical ones on the M-227 panel are active at the same times. Pressing either key will perform the function desired .
3. The 8-character digital display is used to indicate to the operator what particular mode or area of a weld schedule the system is in.

When the M-227 is first turned ON the RP display will say NO SEQ. This indicates to the operator that no weld schedule has been selected. When a schedule is selected the display will show 001 TEST. This indicates that PASS # 1 of a Weld Schedule has been called up and that the system is in TEST mode. At other times it may indicate WELD or FLT depending on system status.

NOTE

If the power was turned off while a weld schedule was displayed the system will power up with that schedule displayed again. The NO SEQ display applies to power ON when power OFF occurred without a weld schedule displayed.

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5.8 REMOTE PENDANT (RP) OPERATION

3. (continued)

When the weld sequence is started the display will indicate progression through PURGE, UPSLOPE, LVL 01 (etc.), DOWNSLOPE and then POSTPURGE.

4. The Override Keys allow the operator to change Amps, Volts, TVL, OSC and Wire Values (with-in set limits) . After a Pass is called up pressing one of these keys will change the display to show the value of that function. Using the Arrow Up key will then increase the amount . Using the Arrow Down key will then decrease the amount. The same Operation can also be done DURING SEQUENCE as well.

Overridden values only stay as long as that pass is displayed. If another pass is called up and then the original one is called up again the values will be as originally programmed, not as previously overridden. With the Operate Mode key in PROGRAM it is possible to save or MODIFY the original parameters with the new overridden values . See Special Function Key operation (step 5) for more details.

*Using the Override Keys only **OVERRIDES** the function value in the LEVEL displayed . During Sequence you cannot Override a value in another LEVEL . Before Sequence it can be done by use of the MAN ADV special Function. See Special Function Key operation (step 5) for more details.*

5. **SPECIAL FUNCTION KEY** - The Pendant Special Function key allows access and manipulation of many additional functions. This feature works **ONLY WHEN NOT IN WELD SEQUENCE**. Each time the Special Function key is pressed the display will change in the following order :

1. **PASS** - This allows the user to select the next or previous pass in the Weld Schedule . Pressing the NEXT Key will access the next pass, if there is one. Pressing the PREV Key will access the last pass, if there is one . When pressed the display will leave the Special Function and show the Weld pass # and System mode (002 TEST) as previously described.
2. **PURGE** - Press the NEXT Key to manually change the state of the Gas Solenoid . It will turn ON or OFF depending on its condition . Press the NEXT Key again to return the Gas Solenoid to its original state . You can continue to cycle the Solenoid in this way until another function is chosen (like jogging, etc.).

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5.8 REMOTE PENDANT (RP) OPERATION

5. *SPECIAL FUNCTION KEY* -

3. **PRINT** - Allows printing of Weld Pass from the RP . Press the NEXT key to actuate the print function.
4. **STORE** - If the Operate Mode Key is in the PROGRAM position it is possible to permanently change some programmed values. Accessing the STORE special function at the end of the sequence and pressing the NEXT key will permanently change the functions to the overridden values.
5. **SELECT** - As previously noted, the M-227 can store in memory up to 100 weld schedules . Any 4 of these schedules can be programmed to be selected from the RP . See Section 6 for information on how to set-up which Weld Schedules can be selected . Pressing the NEXT key will replace the existing weld schedule in the SELECT function.
6. **PRE-WRAP** - For use on M-95 series weld heads. Pressing the NEXT key will engage the head Rotation and allow it to wrap the cable one time before starting sequence.
7. **SET** - Used in conjunction with a M-6 Weld Head to move the Torch to a pre-set arc gap prior to arc starting.
8. **OSC MAN** - Used to engage the OSC function and perform the same movement out of sequence that it will perform in sequence. Used to check Amplitude value.
9. **MAN ADV** - For OVERRIDE purposes all weld schedule passes when called up from memory or reset after welding are said to be at Level 1 values. To Override a level 2 or greater function before welding requires the Operator to select this Special Function and use the Next key to Manually Advance to the desire LEVEL.

CAUTION

If left in Level 02 or greater and Weld Sequence is started the system will start at Level 2 or greater. *Unless this is the desired effect* the user ***SHOULD ALWAYS USE THE MAN ADV FUNCTION and PREV Key to return the system to Level 01 before Weld Sequence.***

NOTE

Except for PURGE, anytime a Special Function is actuated with the Next key it will do that function and then return to the 01 TEST display. To repeat that special function (such as pass) or to access another special function will require pressing the Special Function Key again.

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SECTION V - OPERATION

5.9 ROTATION CALIBRATION

NOTE

For proper operation, Weld Head rotation speed must be calibrated for the power supply it is connected to. If weld heads are switched they must be re-calibrated on that system before welding commences .

1. Insure that the weld head is connected per section III. Rotation calibration is done by moving the torch and measuring actual speed. Before proceeding CHECK THAT THE WELD IS FREE TO ROTATE SAFELY.
2. To manually calibrate the user will need to have a Weld Schedule in the Library programmed in accordance to the Calibration Procedure contained in the operation manual for the particular Weld Head being used.
3. A MANUAL calibration schedule will always be run in TEST Mode and usually contains the following:

PRE-PURGE-POST	UP-SLOPE-DOWN	ROT-DLY
000 000	00.0 00.0	CCW 00.0

STR-WFDY-STP	RETRACT	T/MODE
00.0 00.0	0.0	AUTO

LVL	TIME	PRI-AMP-BCK	PRI-PULSE-BCK
1	***	000 000	0.00 0.00

LVL	PULSE	ROT	PRI--RPM--BCK
1	OFF	CONT	*** ***

LVL	PRI-WF-BCK
1	000 000

LVL	TIME	PRI-AMP-BCK	PRI-PULSE-BCK
2	005	000 000	0.00 0.00

LVL	PULSE	ROT	PRI--RPM--BCK
2	2	OFF	0.0 0.0

4. LEVEL 1 TIME needs to be set for the time it will take to rotate ONE REVOLUTION at the selected LEVEL 1 PRI--RPM rate. The RPM rate is usually set at a rate that the head is most frequently used at

LEVEL 2 is added with ROTATION turned OFF. This is to allow the operator time to see if 1 revolution was completed before the “Return to Home” functions engages at the end of the Sequence. LEVEL 2 CAN BE OMITTED FOR WELD HEADS THAT DO NOT HAVE A RETURN HOME FUNCTION .

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SECTION V - OPERATION

5.9 ROTATION CALIBRATION

5. Create or recall from the LIBRARY the appropriate Weld Schedule and connect the Weld Head to be calibrated. Insure that the system is SAFE to rotate and that the System Mode is in TEST. Note the starting position of the Weld Head and Press Sequence Start. At the end of the Sequence the weld head should have rotated the programmed amount.
6. If it has not rotated or moved the correct distance then adjust the Weld Head Rotation Cal Potentiometer
7. Repeat 5 and 6 until the head is calibrated.

5.10 WIRE FEED CALIBRATION

NOTE

For proper operation, weld head Wire Feed speed must be calibrated for the power supply it is connected to. If weld heads are switched they must be re-calibrated on that system before welding commences.

1. Insure that the weld head is connected per section III and the Weld Head manual. Wire Feed calibration is done by feeding the wire and measuring actual speed. Before proceeding CHECK THAT THE HEAD IS FREE TO FEED WIRE SAFELY
2. To manually calibrate the user will need to have a Weld Schedule in the Library programmed in accordance to the Calibration Procedure contained in the operation manual for the particular Weld Head being used
3. A MANUAL calibration schedule will always be run in TEST Mode and usually contains the following:

PRE-PURGE-POST	UP-SLOPE-DOWN	ROT-DLY
000	00.0 00.0	CCW 00.0

STR-WFDLY-STP	RETRACT	T/MODE
00.0 00.0	0.0	AUTO

LVL-TIME	PRI-AMP-BCK	PRI-PULSE-BCK
1 060	000 000	0.00 0.00

LVL	PULSE	ROT	PRI--RPM--BCK
1	OFF	OFF	0.0 0.0

LVL	PRI-WF-BCK
01	100 100

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5.10 WIRE FEED CALIBRATION

4. LEVEL 1 TIME needs to be set for 60 seconds (1 minute). PULSE MODE should be OFF so only one Wire Feed Speed is checked (primary). The Wire Feed Primary IPM on most weld Heads should be set to 50 or 100 IPM (what ever rate is closer to actual weld schedules) . Insure that the Wire Mode switch is set to ON.

Note that no Start Delays or Stop Delays are used. It is very important for calibration that the wire start feeding at the beginning of the 60 seconds of Level 1 Time and stop at the end of the Level 1 Time.

5. Create or recall from the LIBRARY the appropriate Weld Schedule and connect the Weld Head to be calibrated. Insure that the system is SAFE to feed wire and that the System Mode is in TEST.
6. Jog the wire until it is at the end of the nozzle but not protruding.
7. Press Sequence Start. Wire should feed out 60 seconds. When Sequence is over cut the wire flush with the nozzle and measure. It should be whatever value was programmed. If it is not adjust the Wire Feed Cal Potentiometer on the Weld Head. Repeat step 6 and 7 until the wire is calibrated.

5.11 MANUAL ADVANCE FUNCTION

All of the previous calibrations were based on the TIMER MODE being in the AUTO position. If the TIMER MODE is in the MAN (manual) Mode the Levels can only be advanced by the operator from the RP. Level Advance from the M-227 panel is not possible

When not in Sequence the Next key on the RP is used in conjunction with the Special Function Key . However, when in WELD SEQUENCE the NEXT Key becomes the MANUAL ADVANCE Key.

If the Timer Mode is MAN the Level will advance, during Sequence, each time the NEXT key is pressed. When in the last Level (could be 01 or 99) pressing the NEXT Key is the same as pressing the SEQ STOP Key.

The Timer Mode (and most other function modes) can be changed by the Operator by using the appropriate F key on the M-227 Panel.

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5.12 WELDING OPERATION

NOTE

Before running a weld schedule the weld head must be calibrated to the M-227. When a weld head is switched from one power supply to another it must be re-calibrated to the new power supply. If the weld head being used has not been calibrated, perform the cal procedure in this section.

All of this step is based on the OPERATE MODE switch being in the OPERATE or Program position.

1. Select the desired weld schedule from the library. Entry of schedules into the library is a programming function and not discussed in this section.
2. Install the weld head per section III and the weld head manual, be sure to connect the Work Ground Clamp also.
3. Install the correct tungsten and the material to be welded into the weld head as described in the weld training manual and weld head manual.
4. Turn on the gas source (at the regulator/ flowmeter). Engage MANUAL PURGE and set the required flow rate for the weld and weld head being used. Continue Manual purge until all lines are filled with the gas and all moisture and impurities have been removed. How long this takes depends on the conditions. When this is done dis-engage the Manual Purge function.
5. When the weld schedule has been selected the upper display will indicate that the system is in the TEST mode. Pressing the SEQ START key at this time will run the complete weld schedule without an arc. First-time operation of the system should be done this way to insure that rotation, wire and all sequence functions are working properly.
6. When all items are prepared properly for welding (not covered in this manual) and system operation has been verified, press the WELD/TEST key. The upper display will now say READY TO WELD. INSURE THAT THE ARC CAN BE STRUCK SAFELY.
7. Press the SEQ START key. The system will start to purge gas and the display will appear a follows:

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5.12 WELDING OPERATION

7. (continued)

(bar-graph meters will appear here)					
PRE-PURGE-POST	UP-SLOPE-DOWN		ROT--DLY**		
60	60	0.0	9.0	CW	1.5

When prepurge starts, the time programmed will start counting down on the screen . The upper display will be bar graphs that will indicate approximate value of current and voltage. Use the Meter Key to access bar graphs for Wire and Rotation speeds.

8. As the sequence progresses (see 4.3) the screens will change to follow its progress.
9. When the sequence is complete (end of postpurge) the Return to Home function will engage (on some heads) and then the system will reset and be ready to make another weld.

5.13 PRINTER OPERATION

1. The printer receives its power from the M-227 and does not require any external manipulations (other than installing the paper roll).
2. The printer is activated by using the PRINT key on the M-227 panel or the PRINT Special Function on the RP . The PRINT function will only activate the printer under the conditions of step 3 (below).
3. The printer will produce a copy of the following information at the following times.
 1. STATUS SCREEN - When the STATUS screen is displayed and the PRINT key is pressed a copy of SYSTEM HOURS, ARC HOURS, DATE and the SOFTWARE REVISION NUMBER will be printed.
 2. LIBRARY SCREEN - When the LIB key is pressed and any of the library screens are being displayed a copy of the descriptions of ALL WELD SCHEDULES in memory can be printed. This print out will include each WELD SCHEDULE NUMBER, OD, WALL, MATERIAL, HEAD and PASS QTY.

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5.13 PRINTER OPERATION

3. (continued)

3. **INDIVIDUAL WELD SCHEDULE** - When a weld schedule has been selected from memory a complete copy of all of the function values can be printed by pressing the PRINT key. This can be done at any portion of the weld schedule is being displayed except during an ACTUAL WELD SEQUENCE.

A statement at the bottom of the print out will show whether ALL PARAMETERS PERFORMED AS PROGRAMMED the last key is pressed after each weld is made, a hard copy record of performance can be kept. The DATE is also included on each print out.

4. An Auto-print function can also be set up to have the system automatically make a print out after each Weld Sequence (in Weld Mode). If this mode is selected the printer will automatically print out a copy of the complete weld pass after the weld sequence.
5. There is another print function contained on the Set-Up Screen. This function is to print a copy of the LIBRARY in the memory of the Optional M227-EMM unit. Access the Set-Up screens for this operation.

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SECTION VI - PROGRAMMING

6.0 INTRODUCTION

Programming is simply the name used to describe the process of entering the values for functions within a particular weld schedule. The PROGRAM mode may be used to CREATE a new weld schedule or to MODIFY (make changes) to an existing weld schedule. The PROGRAM mode is also used to create a new weld schedule by COPYING an existing weld schedule and then MODIFYING the copy of the original with the desired changes.

In addition to the CREATE, MODIFY and COPY functions, the PROGRAM mode also allows the user to make BACK UP copies of the memory. This function provides both security in case of a failure in system memory and provides a method to TRANSFER the memory from one system to another to insure multiple system users of identical weld schedule libraries.

CAUTION

AUTHORIZATION AND ACCESS TO THE "PROGRAM" MODE SHOULD BE CONTROLLED BECAUSE "DELETION" OF WELD SCHEDULES FROM MEMORY IS ALSO A FEATURE OF THIS MODE. To CREATE a schedule the OPERATE mode switch must be in the PROGRAM position. All programming starts from the STATUS screen.

This section explains very basic operation of each of these programming functions. For the most part the M-227 is self teaching because of the instructions on the screens, only general information is given in this section.

6.1 CREATE A WELD SCHEDULE

1. Press the C key until the status screen appears. Press the PRO key and the following screen will appear on the displays.

USE F KEYS TO SELECT PROGRAMMING MODE OR USE C KEY TO RETURN TO STATUS SCREEN
--

CREATE	MODIFY	COPY	DELETE	TRANSFER
***	***	***	***	***

NOTE

Use of the C key - Anytime during programming the entire process can be stopped by pressing the C key. If this is done the M-227 will ask the programmer to confirm that cancellation of the programming sequence is desired. If the C key is pressed again, all data ENTERED TO THAT POINT for *THAT* weld schedule will be ignored (not put in memory) and the system will return to the Status Screen. If the C key is pressed by accident then press the CE key to continue programming without a loss of data.

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OPERATION MANUAL**

SECTION VI - PROGRAMMING

6.1 CREATE A WELD SCHEDULE

2. To CREATE a weld schedule press the F key below the word CREATE and the following screen will appear:

ENTER NEW WELD # - THEN PRESS ENTER KEY PRESS C KEY TO CANCEL WELD PROGRAMMING

000

Enter the number using the numeric keys. Look at the lower screen and confirm that the numbers entered are correct; if not, press CE and re-enter the numbers. When correct, press the ENTER key. If the number is already used the system will reject the number and ask the programmer to try again.

3. The description screen will appear when an acceptable weld schedule number has been entered:

ENTER WELD OD - THEN PRESS THE ENTER KEY PRESS C KEY TO CANCEL PROGRAMMING MODE
--

#	OD	WALL	MAT	HEAD
001	0.000	0.00	-----	-----

NOTE

The weld description and all values for LEVEL 1 of the weld schedule must be entered. They cannot be skipped, you must enter a number (even if it is 0) for each item before progressing to the next item.

4. Enter the O.D. (in inches or millimeters) using the numeric keys. Verify the correct number on the screen and then press the ENTER key.
5. After pressing the ENTER key follow the instructions on the screen for entering the wall thickness.
6. The M-227 will then give you a choice of materials. Use the F key to select the proper one and Press Enter.
7. The M-227 will then give you a choice of Weld HEADS. Use the F keys to select the proper head, press ENTER.
8. Single Level functions will then appear:

ENTER VALUE FOR BLINKING ITEM THEN PRESS ENTER KEY

PRE-PURGE-POST	UP-SLOPE-DOWN	ROT--DLY
000	000 00.0	00.0 CCW 00.0

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SECTION VI - PROGRAMMING

6.1 CREATE A WELD SCHEDULE

8. (continued)

Use the numeric keys to enter the prepurge time; verify and then press the ENTER key; then use the same method for postpurge, upslope and downslope; then use the numeric keys again to enter the rotation; then use the F key to select the direction of rotation ; then use the numeric keys again to enter the rotation delay time, wire delay time, wire retract and timer mode. The same method of instruction and entering is used for LEVEL 1 values of pulse mode, travel mode, travel RPM, level time, amperes, wire IPM and pulse times, AVC mode, AVC and Osc values.

NOTE

If pulse mode is set OFF the system will not ask for background functions, backgrounds are only needed when pulsing. However, the M-227 will automatically default a value for pulse times in case the pulse mode should be turned ON later in a modify operation. There must be a value for Pulse Times.

9. As noted, the system follows an exact sequence through LEVEL 1. When the last LEVEL 1 values is entered the screen will ask if you want to create LEVEL 2; if so press the NEXT LEVEL key. If you are done , press the PRO key and go to step 9.

If the NEXT LEVEL is used the system will copy all values of level 1 and switch to the MODIFY mode. In the MODIFY mode you only have to make changes to level 2 functions that are different from level 1. See section 6.2 for MODIFY mode instructions.

10. When the PRO key has been pressed, indicating the end of level programming, the system will display the OVERRIDE Screen.

USE F KEYS TO SELECT ITEM - ENTER % PRESS ENTER KEY WHEN ALL % ARE SET

TIME	AMP	RPM	WF	AVC	OSC	PLS	DLY
100	100	100	100	100	100	100	100

The system automatically defaults to 100 % override. This means the operator can make up to a 100 % change to any of these functions.

If you wish to limit the amount of changes to certain functions then use the F key for that function and use the numeric keys to enter the desired % of change to be allowed. When one F key is pressed, pressing another will turn the first one off and activate the second function. When all Override % are set, press the ENTER key.

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SECTION VI - PROGRAMMING

6.1 CREATE A WELD SCHEDULE

11. The system will then ask if you want to store the weld schedule in memory or to MODIFY it. Remember that until it has been STORED it does not exist in memory. It is usually better to STORE at this time and if changes are needed, recall it from the memory using the MODIFY function. To STORE press the F key under the word STORE and then press ENTER. To MODIFY press the F key under the word MODIFY and then press ENTER and go to step 6.2.

6.2 MODIFY WELD SCHEDULE

The OPERATE mode switch must be in the PROGRAM position to MODIFY. Modifying an existing weld schedule in memory starts from the Status Screen or at the end of LEVEL 1 programming in the CREATE mode. If modifying from the CREATE mode proceed to step 2.

1. Press the PRO key. Use the F key to select MODIFY and then press the ENTER key. The system will then ask you what weld schedule number you wish to MODIFY. Use the numeric keys to enter the number, verify and then press the ENTER key.
2. Modifying a weld schedule works similar to reviewing a weld schedule in the operate mode (see section V). Use the NEXT/PREV SCREEN and EXT/PREV LEVEL keys to find the function and level to be modified.
3. When the function values or mode to be modified is found use the F key above or below it to enable it to be modified. Use the numeric keys to enter the new value, for changes of mode use the F key again.

Verify the correct change and then press the ENTER key. If more changes are needed, find the next item with SCREEN and LEVEL keys and use the same method to modify it.

To DELETE a LEVEL use the NEXT/PREV keys to find the Level Time for the Level to be deleted. Enter 0 time to DELETE the LEVEL. All subsequent Levels will advance one number.

When all items have been modified press the PRO key. The System will ask if you want to STORE or continue MODIFYING. Remember, NONE OF THE CHANGES MADE ARE ENTERED INTO MEMORY UNTIL THEY ARE STORED.

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OPERATION MANUAL**

SECTION VI - PROGRAMMING

6.3 COPY A WELD SCHEDULE

To copy a weld schedule you must start from the STATUS screen and the OPERATE mode switch must be in the PROGRAM position.

1. Press the PRO key. Then use the appropriate F key to select COPY and then press the ENTER key.
2. The screen will then ask you what weld schedule number you wish to COPY. Use the numeric keys, verify and then press the ENTER key. The system will then ask you what weld schedule number should be for the COPY. Use the numeric keys, verify and then press the ENTER key.
3. The system will then proceed to COPY the weld schedule. When it is copied the program screen will appear and MODIFY can be selected to modify the COPIED weld schedule.
4. If you ask for a weld schedule that does not exist or try to COPY it to an existing number the system will notify you that it is an INVALID NUMBER and to press the CE key and try again.

6.4 TRANSFER/RECEIVE WELD SCHEDULE MEMORY

If a user has more than one M-227, it is usually a good idea to keep both libraries identical. This is done by TRANSFERRING a COPY of the LIBRARY of one system into the M-227-EMM; then taking the M-227-EMM to another M-227 and TRANSFERRING a COPY of it into that M-227.

For single-system users it will also be important to have a security copy of the memory that can be stored separate from the M-227. If something should happen to the M-227 memory such as component failure, tampering or accidental deletion, the M-227-EMM copy can then be used to restore the memory in the M-227.

1. The TRANSFER function allows the user to perform the following functions:
 1. TRANSFER the ENTIRE LIBRARY from the M-227 to the M-227-EMM.
 2. RECEIVE the ENTIRE LIBRARY from the M-227-EMM.
 3. RECEIVE an individual weld schedule from the M-227-EMM to the M-227.
2. To perform any of the above, the M-227-EMM must be plugged into the slot provided on the M-227 upper housing.
3. The TRANSFER function must begin from the STATUS screen and OPERATE mode switch must be in PROGRAM.

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6.4 TRANSFER/RECEIVE WELD SCHEDULE MEMORY

4. Press the PRO key, then press the F key above or below the word TRANSFER. The Screen will then ask if you want to TRANSFER THE ENTIRE LIB, RECEIVE THE ENTIRE LIB, or RECEIVE ONE WELD #. Use the appropriate F key to select your choice and then press ENTER.

CAUTION

Prior to TRANSFERRING data from the M-227 to the M-227-EMM the M-227-EMM the M-227-EMM memory is erased. Any data stored in the EMM previously will be LOST. The M-227-EMM is intended to copy the ENTIRE memory of an M-227.

Individual weld schedules CANNOT be added one at a time to the M-227-EMM from M-227 (TRANSFER mode). Individual weld schedules CAN BE added one at a time to the M-227 from the M-227-EMM (RECEIVE mode).

6.5 DELETE A WELD SCHEDULE

CAUTION

USE OF THIS FUNCTION WILL RESULT IN THE LOSS OF A WELD SCHEDULE IN MEMORY.

1. The DELETE function must start from the STATUS screen and the OPERATE mode switch must be in the PROGRAM position
2. Press the PRO key; then press the F key above or below the word DELETE. Use the numeric keys to enter the weld schedule number to be DELETED. A WARNING will appear that pressing ENTER will DELETE this Schedule; VERIFY and then press the ENTER key or press the C key if you change your mind.

Another WARNING will be given at this time to confirm that you wish to DELETE this Schedule. Confirm and verify again and then press the Enter key again. THE WELD SCHEDULE WILL BE DELETED at this time.

3. Deletion of a Level within a Schedule is part of the Modify option.

6.6 PROGRAM SELECT FUNCTION

1. To initially set up which schedules can be selected from the M-227-RP press the SET UP key on the M-227 (this operation cannot be done from the RP). The SET UP screen can be obtained from the STATUS screen or a Weld Schedule screen

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SECTION VI - PROGRAMMING

6.6 PROGRAM SELECT FUNCTION

2. Press the F key under WELD SELECT and the screen will then ask what WELD # should be in position 1. Then position 2, 3 and 4. You do not have to select all 4, just the ones you want selectable from the RP . When all choices (up to 4) are made go back to the STATUS screen.
3. The M-227-RP will now be able to select one of the WELD #'s entered by use of the Special Function Key, SELECT function.

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SECTION VII - CALIBRATION

7.0 INTRODUCTION

This procedure is intended for calibration/certification of system performance by the user. Expect for the Current Servo all system functions are controlled by the processor and no calibration points or steps are required. Rotation and Wire Feed calibration are contained in Section V.

An examination of internal electronics will find several adjustment points. These points are "Factory Pre-set" only and ARE NOT adjusted by the user.



WARNING



All personnel attempting to calibrate, trouble-shoot, or repair this system must be familiar with its operation. They must understand the circuits and have a complete understanding of the controls and their interrelationships.

All personnel must be aware of the location of hazardous voltage-carrying conductors terminals, heat sinks, etc., and must employ safety precautions when working with a welding machine.

Any testing or recording instruments connected to any points in the machine or to the welding head may be exposed to extremely high transient voltage at the time the arc starter operates. ENSURE THAT ALL TEST EQUIPMENT IS DISCONNECTED DURING ARC START.

NOTE

Wire Feed and Rotation (Travel) Calibration, in conjunction with a Weld Head, are performed on a frequent basis and are covered as part of Section V (operation).

7.1 EQUIPMENT REQUIRED FOR CALIBRATION

1. Digital Multimeter (DMM), minimum 4 - digit readout. Suggested: Fluke Model 8060A or equal. The meter must have floating inputs (not connected to line or chassis ground) of minimum 1 megohm input impedance. Battery operated devices are recommended.
2. Screwdriver, Calibration, small slot with 6" shaft and a 3/32 Allen Wrench
3. Any Weld Head rated for 100 amps or more pipe that will not melt away with 100 amperes or a manual torch set up on flat plate.
4. External Shunt, 1 mv/amp, PN 13B272504-01 (optional)
5. Dial Calipers

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SECTION VII - CALIBRATION

7.2 CURRENT CALIBRATION

The M-227 contains components for measuring the actual amount of current. Normal calibration is intended for adjusting the circuitry based on measuring these devices.

True verification of current output for Quality Control purposes must be done with an External Calibration Shunt that is calibrated by an independent agency and controlled by a QC or QA department. An external shunt adequate for this use is sold as a M-227 option.

This procedure is written to include both calibration using internal devices for measuring and for using the external shunt option provided by AMI.

A weld schedule is required for calibration. The first time calibration is done it will have to be CREATED. Step 1 of the following schedule has a place for writing in the Weld # when it is created. Six levels shall be programmed, odd numbered levels (1, 3, 5) shall be set to 100 amps and even number level (2, 4, 6) settings will be at 10 amps.

1. Select Weld Schedule Number ____ and verify that it is programmed as follows:

LVL	PULSE	ROT	PRI--RPM-BCK	
1-6	OFF	OFF	0.00	0.00

LEVEL 1

LVL	TIME	PRI-AMP--BCK		PRI-PULSE-BCK	
1, 3, 5	20	100	0	0.00	0.00

LVL	TIME	PRI-AMP--BCK		PRI-PULSE-BCK	
2, 4, 6	20	10	0	0.00	0.00

PRE-PURGE-POST		UP-SLOPE-DOWN		ROT--DLY	
10	10	1.0	1.0	CW	0.0

2. Set up a Weld Head rated for 100 amperes continuous duty and insert a tube or pipe that can withstand 100 amperes of continuous current with no rotation. A copper rod is good for this. If either one of these is not available use a Hand Torch on a large plate with the torch fixed so it cannot change the gap during calibration. It is also possible to purchase a Carbon Pile that will take the place of a torch or weld head. In any case make sure that when an arc is struck nothing will overheat or melt.

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7.2 CURRENT CALIBRATION Cont.

3. The test points and adjustments for Current Calibration are located on the Center Plate under the computer cover (front panel housing). Turn the Power Off and unscrew the two computer cover retaining screws in the front. Lift up on the cover and expose the center plate. Prop the cover up so it will not fall but so you can still operate the system

Locate test points REF. TP. and CUR. TP. Locate Adjustment screw labeled "Current Gain". Turn Power back on.

4. If an External Shunt is to be used connect it between the Work (ground) connector on the Power Supply and the Work (ground) connector of the Weld Head Adapter Cable or manual torch. Current is always measured along the ground return path.
5. Insure everything is ready to strike an arc. Turn M-227 power ON. The system should return to your calibration weld procedure. Set the Weld/Test Mode to WELD.
6. Set up the DMM to read on the 200 mv DC scale if you are using the external shunt. Set it up to read on the 20 VDC scale if you are using the center plate test points.
7. If you are using the external shunt prepare to insert them into the red and black test point on the shunt.
8. If you are using the center plate test points prepare to insert them into REF. TP. (black lead) and CUR. TP. (red).
9. DO NOT INSERT THE PROBES UNTIL AFTER THE ARC IS STRUCK. The high frequency start may damage some meters.
10. Press the SEQ START key.
11. As soon as the arc is struck (after prepurge) insert the Probes into the center plate test points or into the external shunt if it is being used.
12. During Weld Sequence **Odd Levels** the DMM should read as follows:

Center Plate Test Points = 2.00 VDC +/- 0.01 VDC.
(1.99 VDC to 2.01 VDC)

AMI External Shunt = 100 mv DC +/- 0.25 mv DC
(99.75 mv to 100.25 mv)

If out of tolerance adjust the "Current Gain" trim potentiometer adjusting screw on the Center Plate.

7.3

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7.2 CURRENT CALIBRATION (continued)

14. During Weld Seq. **Even Levels** the DMM should read as follows:

Center Plate Test Points = 0.20 VDC +/- 0.001 VDC.
(0.199 VDC to 0.201 VDC)

AMI External Shunt = 10 mv DC +/- 0.025 mv DC
(9.97 mv to 10.02 mv)

If out of tolerance adjust the “Current Off Adj.” Current offset trimming potentiometer adjusting screw on the Center Plate.

15. Repeat steps 13 and 14 until no adjustments are required.
16. Press the SEQ STOP key.
17. After Postpurge turn the power off, remove all test leads. If calibration is complete lower the computer cover and install the retaining screws

7.3 ARC VOLTAGE CONTROLLER (AVC) CALIBRATION

A weld schedule is required for AVC calibration. The first time calibration is performed this schedule will have to be CREATED. Step 1 (next page) has a place for writing in the Weld # after it has been created.

NOTE

The adjustment for AVC Calibration is located on the Center Plate under the computer cover (front panel housing). Turn the Power OFF and unscrew the two computer cover retaining screws in the front. Lift up on the cover and expose the center plate. Prop the cover up so it will not fall but make sure you can still operate the system. Locate the adjustment screw labeled “TR3” and turn the power back ON..

1. Select Weld Schedule Number ____ and verify that the FIRST PASS it is programmed as follows:

LVL	TIME	PRI-AMP--BCK		PRI-PULSE-BCK	
1	20	100	100	0.00	0.00

LVL	PULSE	ROT	PRI--IPM-BCK	
1	OFF	OFF	0.00	0.00

LVL	PRI-WF-BCK		PRI-AVC-BCK		AVC MODE
1	000	000	10.0	10.0	CONT

7.4

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7.3 ARC VOLTAGE CONTROLLER (AVC) CALIBRATION Cont.

LVL	OSC AMPL	IN	EXC	OUT
1	.500	0.5	0.5	0.5

PRE-PURGE-POST	UP-SLOPE-DOWN	ROT--DLY
5	10	1.0
		CW
		1.0

STR WFDLY STP	RETRACT	T/MODE	STLV	OSC
0.0	0.0	0.0	MAN	25
				OFF

STR AVDLY STP	STR/ MODE	RESPONSE
1.0	0.0	TOUCH
		3

2. Prepare the system to strike an arc.
3. Set up a Weld Head on a pipe or plate adequate to withstand 100 amperes without rotation.
4. Prepare to install the DMM positive lead on to the Guide Ring and the negative lead to the electrode on the torch. If using RF start instead of Touch Start **DO NOT** connect the DMM until after the arc is established.
5. Set WELD/TEST Mode (on RP or Panel) to WELD.
6. Press SEQUENCE START. After the arc is established and meter is connected the DMM should read 10.0 VDC +/- 0.1 VDC.
7. If out of Tolerance adjust TR-3 on the center plate until the reading is correct.
8. When Arc Voltage is correct press Sequence Stop.

7.4 TORCH OSCILLATION (OSC) AMPLITUDE CALIBRATION

A weld schedule is required for OSC calibration. The first time calibration is performed this schedule will have to be CREATED. Step 1 (next page) has a place for writing in the Weld # after it has been created.

NOTE

The adjustment for OSC Calibration is located on the Center Plate under the computer cover (front panel housing). Turn the Power OFF and unscrew the two computer cover retaining screws in the front. Lift up on the cover and expose the center plate. Prop the cover up so it will not fall but so you can still operate the system. Locate the adjustment screw labeled "TR4" and turn the power back to ON.

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7.4 TORCH OSCILLATION (OSC) AMPLITUDE CALIBRATION Cont.

1. Select Weld Schedule Number ____ and verify that the FIRST PASS it is programmed as follows:

LVL	TIME	PRI-AMP--BCK		PRI-PULSE-BCK	
1	0	100	100	0.00	0.00

LVL	PULSE	ROT		PRI--IPM-BCK	
1	OFF	OFF	OFF	0.00	0.00

LVL	PRI-WF-BCK		PRI-AVC-BCK		AVC MODE
1	000	000	10.0	10.0	CONT

LVL	OSC AMPL	IN	EXC	OUT
1	.500	0.5	0.5	0.5

PRE-PURGE-POST		UP-SLOPE-DOWN		ROT--DLY	
3	3	0.0	0	CW	1.0

STR WFDLY STP	RETRACT	T/MODE	STLV	OSC	
0.0	0.0	0.0	MAN	25	OFF

STR	AVDLY	STP	STR/ MODE	RESPONSE
1.0	0.0		TOUCH	3

2. Insure that the Torch is free to Oscillate without obstructions.
3. Set the WELD/TEST mode (RP or Panel) to TEST. Using Jog Keys center Torch in the middle of its stroke.
4. Using the Dial Caliper prepare to measure the total movement of the Torch from its furthest IN position (toward the Head) to its furthest OUT position. How this can be done will vary from Weld Head Model to Weld Head Model.
5. Press Sequence Start and after prepurge measure the full Oscillator movement. It should be 0.500 inch +/- 0.005. If out of tolerance adjust TR4 on the center plate.
6. When measurement and adjustment is complete press All Stop.

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7.5 GENERAL MAINTENANCE INSTRUCTION



WARNING



Always disconnect the AC power cable from the line voltage before attempting to work with this welding power supply.

1. **AIR FILTER** - The M-227 power supply has one (1) foam air filter. Inspect this air filter regularly. The foam filters may be washed in water and detergent, dried and reused or replaced. Do not operate unit without filter in place. There is a similar filter on the M227/207-CW or M207-CW Cooling Unit that requires the same inspection and cleaning.
2. **COOLANT** - The water tank in the optional M227/207-CW OR M207-CW unit holds approximately three (3) U.S. gallons. Check water level periodically. Using different weld heads will remove water from tank over a period of time. Fill the tank per instructions of Section VIII.
3. **Cleaning exterior and interior surfaces** - Prolonged use in dusty shop or outside environments may cause the outside surfaces to accumulate a coating of dirt and dust. Do not use shop air (usually too wet) to blow dust particles away from panels. Either wipe it off with a damp cloth or use a vacuum cleaner with a soft brush. Where a vacuum brush cannot reach, use clean, soft paint brush and then vacuum.

CAUTION

Always disconnect the power input cable from the junction box or wall-plug before cleaning.

DO NOT USE ANY SOLVENTS, SPRAY-ON CLEANERS OR WATER on any of the inside parts. All outside surfaces may be cleaned with a soft cloth or sponge, damp, NOT SOAKED, with a mild detergent solution.

4. **INPUT/OUTPUT PANEL CONNECTIONS** - Periodic inspection of the M-227 panel and cable electrode, gas and water return quick-disconnects should be performed. Damaged, dented or deformed connectors may cause poor or unsafe operation and water or gas leakage.

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7.6 SYSTEM FAULT CORRECTIONS

When a System Fault occurs prior to or during welding it is required for the operator to clear the fault condition before welding. When a fault occurs during sequence or attempting to sequence the FAULT SCREEN will appear.

Some faults are only temporary and the fault is corrected when the arc goes out but all faults will cause the fault screen to appear and let the operator know why the sequence was stopped.

The following is a general description of the cause of each type of fault and some recommendations for correction. In all cases, when the fault is corrected the operator must press the C key to clear the FAULT SCREEN. If the fault is truly corrected the system will automatically return to the weld schedule it was on when the fault occurred.

1. TEMP - The M-227 has internal temperature probes. If the Power Supply gets hot the a fault occurs. This can occur only if there is some type of blockage of air circulation, fan failure or component failure within the Power Supply OR THE SYSTEM IS BEING OPERATED IN AN AMBIENT AIR TEMPERATURE BEYOND ITS RATED 110 DEGREES F.

This Fault should only occur during an actual weld sequence. If it occurs when the machine is not welding then a serious internal problem exists. In this case turn the Power Supply OFF and call an AMI service representative.

If it occurs during welding, check for blockage of the air intakes on the side of the machine and for cleanliness of the filters. They may need cleaning. If no blockage exists and the filters are clean then cease all welding operations and call an AMI Service representative.

2. INPUTAC - Monitors the available line current. If the system cannot supply the desired DC amperage of the weld schedule it looks to see if the line voltage is adequate for the amount of current.

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7.6 SYSTEM FAULT CORRECTIONS

3. GAS - This fault will only occur at the beginning of or during a Weld Sequence. If the arc Gas Flow through the system should stop or be too low a fault will occur.

Check the Gas Source (user supplied) is turned on and that adequate gas is available. Check all Gas Hoses and connections for free flow this is usually the problem.

If there is no problem with the source or with hoses and connection then an internal failure of the flow switch, solenoid or internal housing is possible. Contact an AMI Service representative.

4. LVPS - The system continuously monitors its internal Low Voltage (DC) Power Supplies. If they are not up to standard then the system may not be able to perform to specification

There are several ways this could occur. The most common would be too low of an AC input voltage. Check the line voltage to see that it is correct and that the Power Supply is set up for that voltage (see section 3)

The other reason would be a failure of the LVPS. Always check the AC input first and if that is OK call an AMI Seville representative.

5. COOL - Monitors the coolant flow out of the M227/207-CW or M207-CW cooling unit. If it is not at least 0.2 GPM a fault will occur. This fault will only exist if the CW unit is turned ON. IF it is off no fault will occur.

Check the hoses and flow path of coolant to and from the weld head this is usually the problem. If all looks good then an internal failure of the CW pump or flow switch is possible, contact an AMI Service Representative.

6. SENSOR 1, 2, 3 - These faults must be turned on and set up by the user. Contact whoever set them up.

7. STUB OUT - This fault will only occur when an arc is present and will no longer exist when the arc goes out. If the arc voltage gets to low or the electrode should touch the weld puddle then a fault will occur. It creates an ALL STOP but does not operate the "return to home" function after Postpurge.

The operator should check to see if the electrode is stuck to the tube being welded. Clear the obstruction and jog the rotor to open position and remove the tube and replace the electrode and then press the C key to clear the fault.

Check the required tungsten length and arc gap required for the weld. Something caused the arcgap to get too small. This FAULT can be "turned OFF" by use of the SET UP screens. It is recommended to turn it OFF when MANUALLY welding.

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7.6 SYSTEM FAULT CORRECTIONS

8. **HIGH VOLTS** - If the arc voltage gets too high during a weld sequence this fault will occur. It usually occurs if a hole should be made in the weld and the arc can extend over to the opposite side of the weld, Check the weld procedure and the arc gap required for the weld. This FAULT can be “turned off” by use of the set up screens.

Turn this feature OFF when MANUALLY welding or when using large ARC Gaps (0.050”) and low current in HELIUM or HELIUM mixed gases . These conditions tend to create very high ARC Voltages and could cause an undesirable FAULT if this option is left ON.

9. **BAD START** - If for any reason the M-227 cannot achieve a stable Arc at the end of PREPURGE the system will display this statement.

There can be several reasons for this to occur. The most common are poor cable, ground and electrode connections, bad gas, bad tungstens, dirty tungstens, etc. The RF is transmitted from the M-227 to the electrode, if anything creates resistance or an alternate path for the RF the start can be weak.

When a BAD START occurs check the electrode connection and electrode condition first. Also check to insure that CERRIATED electrodes are being used. They have proven to be much more effective than THORIATED electrodes for RF transmission and longer life.

BAD STARTS can also be caused by not having the START LEVEL set. See Section V for START LEVEL information.

RF starting problems can be very difficult to solve because of all the items that can cause problems. If continued RF problems occur call the AMI Service Dept. for help in finding the problem .

CAUTION

Another cause for a BAD START indicator is to press Sequence Start near the end of the POSTPURGE but before “Return to Home” and system reset. The M-227 will sometimes try and strike another arc. ALWAYS ALLOW THE M-227 TO FINISH AN OPERATION COMPLETELY BEFORE ATTEMPTING TO START ANOTHER.

10. **NO DISPLAYS/DISPLAYS SCRAMBLED** - The LVPS FAULT is meant to detect Low Voltage. However, if the Voltage is really low the Displays will not even turn on or the information being displayed can be scrambled.

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7.6 SYSTEM FAULT CORRECTIONS Cont.

10. Cont.

In these cases check the input AC voltage first and insure that the M-227 is set for the correct input Voltage. Another possible reason for no display or scrambled displays is RF interference. Although the M-227 is protected against this, certain conditions are still possible to occur that can cause this

Outside RF from another type or source such as a HF welding machine or a radio transmitter near by could cause a problem. If these conditions continue contact the AMI service Dept. for possible solutions.

7.7 ERROR MESSAGES

1. MEMORY CHECK

At Power On the weld schedule memory storage is checked for any type of corruption. If any of the checks fail the system will display the following:

LIBRARY MEMORY ERROR RELOAD FROM EMM
PRESS PRINT FOR MEMORY STATUS REPORT

NOTE

When the print key is pressed any weld schedule with a directory or link error will automatically be “**DELETED**”. Any schedule with a sum check error will be flagged corrupted on the print out and the user should call up that weld schedule and verify the parameter values.

A typical print out could look like this:

```
ARC MACHINES, INC.                COPYRIGHT 1996
      AMIWELD 227 1.5
SYS HOURS - xxxxx.x              ARC HOURS - xxxxx.x
      15 AUG 1996
SCHEDULE xxx DELETED
SCHEDULE xxx CORRUPTED           PLEASE VERIFY
SCHEDULE xxx DELETED
SCHEDULE xxx DELETED
```

Use the M-227-EMM to restore the deleted schedules.

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7.8 MISCELLANEOUS MAINTENANCE ITEMS

1. BATRAM - The system BATRAM has a life of from 2 to 5 years. The following describes what happens to the BATRAM settings and functions when the BATRAM is replaced:
 1. System Hours and Arc Hours - Will reset to 0.
 2. Day/Date information - Will have to be reset.
 3. Last Language used - Will default to English until reset.
 4. Remote Sensor set ups will have to be reset.
5. Whole or Tenth increments for Amps and Level Time will reset to whole.
6. Operators Name will clear.
7. Power Supply Serial Number will clear.

Replacing the BATRAM requires accessing the inside of the M-227. A complete replacement procedure is available in the M-227 Maintenance Manual.

2. RS232 COMMUNICATIONS

The M-227 can shut down the RS232 port on it own if it detects non-intelligent information on it. This can be caused by ambient light or improper set up. The RS232 port will not be re-activated until the power has been re-set. If you are having problems with RS232 communications, re-set the power and try again.

NOTE

Always keep the plastic dust covers on the RS232 port when not in use.

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SECTION VIII - OPTIONS

8.0 INTRODUCTION

The following are installation and operation instructions for some M-227 options.

WARNING

Always turn the power supply OFF before making any cable or connection changes to the M-227 power supply.

8.1 M227/207-CW & M207-CW COOLING UNIT SPECIFICATIONS/INSTALLATION

1. Specifications -
 1. AC Input Power - supplied from the M-227 power supply.
 2. Coolant capacity - 3 gallons (11.4 liters).
 3. Circulation - 0.3 GPM (1.1 lpm) with most M-9 Heads.
2. Physical Construction -
 1. Material - aluminum cabinet/Polyethylene tank.
 2. Height - 14.00 inches (355.6 mm)
 3. Width - 22.75 inches (577.9 mm)
 4. Depth - 19.25 inches (489.0 mm)
 5. Weight - 70 lbs. (31.75 kg) M227/207-CW filled
- 50 lbs. (22.7 kg) M207-CW filled
3. Pump- Both M227/207-CW & M207-CW water pumps have a built-in pressure regulators set at 60 PSI, along with an external flow rate FAULT detect switches.
4. Installation
 1. Insure that the M-227 is OFF, remove the power cable from the M-227 and set the CW ON/OFF switch to the OFF position.
 2. The cooling unit is shipped dry and requires 3 gallons (11.4 liters) of **CLEAN DISTILLED** or **DE-IONIZED** water. In areas where freezing temperatures are expected, add 2 gallons (7.6 liters) of **CLEAN DISTILLED** or **DE-IONIZED** water and 1 gallon (3.8 liters) of pure ethylene glycol. **DO NOT USE AUTOMOTIVE ANTI-FREEZE**

NOTE

All cooling systems are subject to problems from mineral buildup, algae and bacteria. Frequent changes of coolant and flushing of the system are necessary to keep any cooling system running efficiently. Frequency of changes is strictly dependent on the environment and quality of coolant used. Monitor your cooling system carefully and often.

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8.1 M227/207-CW & M207-CW COOLING UNIT SPECIFICATIONS/INSTALLATION

4. Installation

3. Before mounting the M227/207-CW or M207-CW on to the M-227 remove the fill cap and add the water. Replace the fill cap. Remove the pins attached to each corner post (see figure 9). Locate the CW Power Cord exiting a hole in the top of the CW unit. Pull enough of the cord out so it dangles over the side of the unit.
4. Move the M-227 onto the CW unit and insert the corners onto the posts of the CW Unit. Locate the M-227 Coolant Unit Connector located on the panel on the AC Input side of the M-227. Insert the CW cable connector into the M-227 connector. Secure the CW unit with the pins that were removed (figure 9).
5. Install the adapter cable coolant hoses per section III. Re-connect the M-227 power cable.

5. Operation

1. When all connections have been made per Section III and a coolant flow path is created, turn the M-227 ON and set the CW ON/OFF switch to ON. The pump should start circulating coolant.

WARNING

DO NOT OPERATE the water cooling unit WITHOUT coolant in the tank OR WITHOUT a water flow path (water OUT to IN through a weld head).

2. Both CW units contain a flow sensor. If the Set Up Screen Coolant Fault Mode is ON the M-227 will look to see if the Cooling Unit is connected. If it is, the M-227 will require that coolant be flowing or else it will create a fault. If for some reason the Cooling Unit is connected but not being used the operator can change the Coolant Fault Set Up to OFF and no coolant fault will be detected.

CAUTION

Severe damage to the weld head and cables can occur if you have the Coolant Fault turned OFF and are operating a weld head that needs coolant and then you forget to turn the cooler on or to make the connections.

3. The above is the basic operation. The only decision to be made is whether COOLANT is required. Some weld heads need it, some do not, depending on the type of weld and duty cycle. Consult with an AMI representative as to cooling requirements.

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8.2 M-227-EMM EXTERNAL MEMORY MODULE

1. The M-227-EMM is used to TRANSFER a COPY of the library of one M-227 to another M-227 to maintain identical libraries for multiple system users. It is also used as a security device to retain a copy of the library which cannot be changed accidentally.

WARNING

Always turn the power supply OFF before making any cable or connection changes to the M-227 power supply.

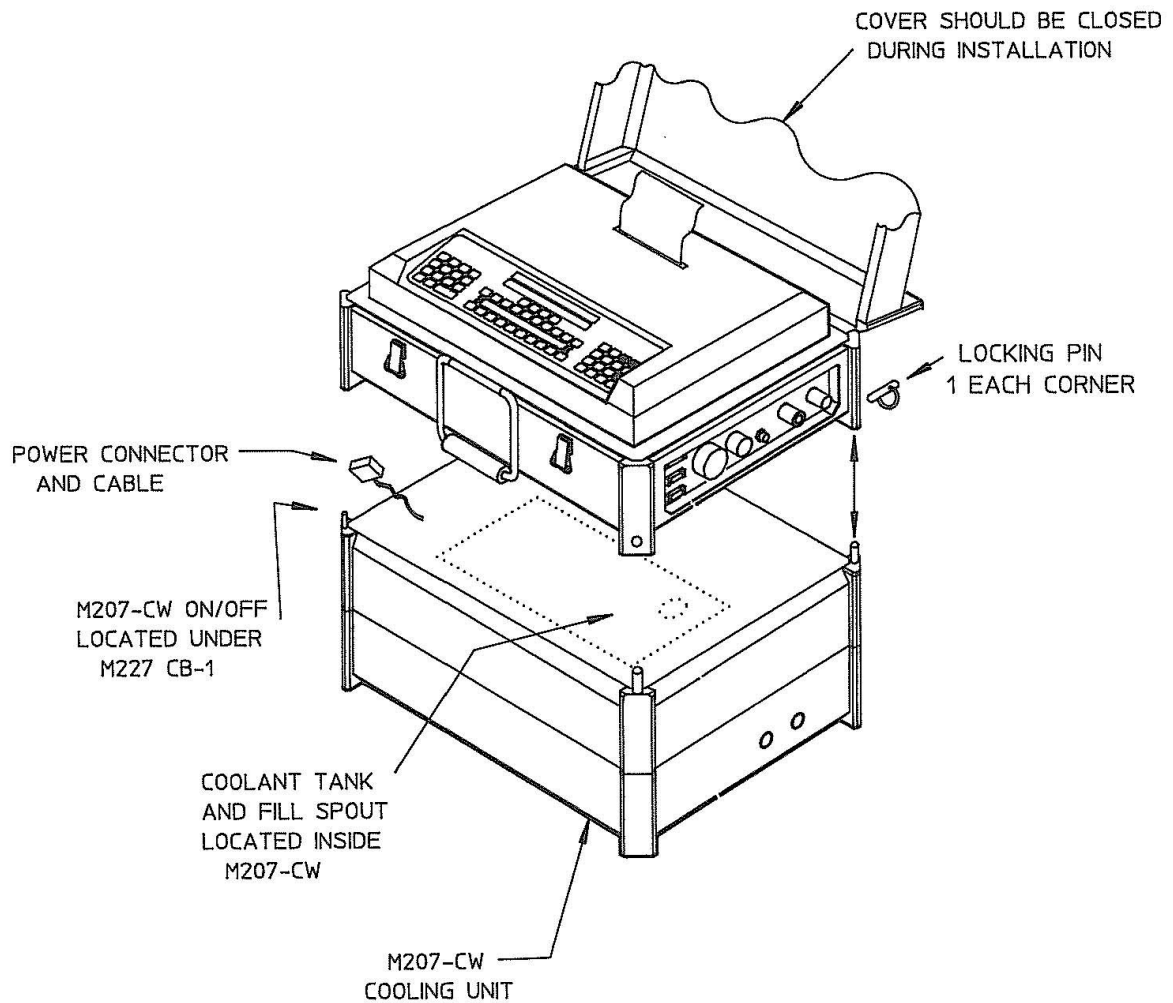
2. To install the EMM, turn the M-227 OFF. The EMM has a connector on one side of the module. This connector should be inserted into the slot on the side of the M-227 labeled EMM. It is keyed and can only be inserted one way. When installed, turn the M-227 ON and perform the desired TRANSFER or RECEIVE functions as described in Section VI of this manual.
3. When finished with the EMM it should be stored in a secure, dry location away from any large magnetic or electrical sources.
4. The EMM uses a type of memory that does not require batteries and has an unlimited shelf life. However, it does have a limited number of erase cycles. Erasing occurs anytime you are COPYING from a M-227 to the EMM. Erasing of the EMM memory does not occur when you are TRANSFERRING from the EMM to the M-227. Eventually the EMM will require replacement. However, this is not anything to be particularly concerned with. Even if you erased the EMM every day (very high usage) it would last 27 years.
5. A copy of the EMM Library can be printed by using the EMM PRINT function on the SET UP screen, see Section 5.6.1.

CAUTION

The M-227-EMM and the M-207-EMM look alike (although labeled differently). ***Do not confuse them and attempt to use an M-227-EMM with a M-207A.***

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M227/207-CW OR M207-CW INSTALLATION