

MODEL 415
OPERATION MANUAL

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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 - 1 July 1997
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REV	DCO #	CHANGE DESCRIPTION	DATE	APR
A	3228	Revised pg. iv,2.1,2.2,3.2,3.5,Sect. 5 Add 3.11	1/27/99	GPE
B	3304	Revised pages iv, 2.1, 2.2, 3.5, 5.10 thru 5.20	4/20/99	GPE
C	3518	Revised Sec 5.6, corrected sec # error, added sec 5.18, 5.19, 5.20 updated Index page numbers	12/07/99	GPE
D	3548	Revised pages i, 2.1, 2.2	2/08/00	GPE
E	3632	Revised pages 3.2 and 3.3	5/18/00	GPE
F	3749	Revised page 2.5 Removed algaecide requirement	10/17/00	GPE
G	3779	Revised pages 5.1 to 5.11, Cal clarification	11/28/00	GPE
H	3829	Revised pages 5.1 to 5.8. change volt tolerance	03/15/01	LEC II
J	5229	Replace floppy drive with USB, update Section 3.3, Remove Section 5.18, 5.19, 5.20	12/10/08	BF
K	5097	Correct Terminal Jumper Settings on page 3.5	12/18/08	BF
L	5450	Correct typo's per BPMI-RS-P-02745, Update Input Power Detail Section 2.0	9/29/09	BF
M	6245	Removed description of Neutral Overload (4.4.6)	2/7/12	SM
N	6412	Add CMOS battery replacement procedure section 5.18, reformat pagination	11/05/12	DC

EFFECTIVITY

Features and operation of the Model 415 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 affect this document.

TABLE OF CONTENTS

<i>SECTION</i>	<i>DESCRIPTION</i>	<i>PAGE</i>
<i>SECTION I</i>	<i>INTRODUCTION</i>	
1.0	<i>Introduction</i>	1
1.1	<i>Safety Precautions</i>	1
1.2	<i>Operational Precautions</i>	3
1.3	<i>RF and EMI emissions</i>	4
1.4	<i>Shock Hazard Warning</i>	5
<i>SECTION II</i>	<i>SPECIFICATIONS</i>	
2.0	<i>Electrical</i>	6
2.1	<i>Physical Construction</i>	7
2.2	<i>Current Output</i>	8
2.3	<i>Arc Voltage and Arc Voltage Control Servo</i>	8
2.4	<i>Travel Servo</i>	8
2.5	<i>Wire Feed Servo</i>	8
2.6	<i>Torch Oscillation and Cross-seam Steering Servo</i>	9
2.7	<i>Timing Functions</i>	9
2.8	<i>Arc Starting</i>	9
2.9	<i>Torch Cooling Unit</i>	10
<i>SECTION III</i>	<i>INSTALLATION</i>	
3.0	<i>Installation, General</i>	11
3.1	<i>Training</i>	11
3.2	<i>Inspection</i>	11
3.3	<i>Torch Cooling System Preparation</i>	12
3.4	<i>Primary Power Connection</i>	13
3.5	<i>Operators Pendant Connection</i>	16
3.6	<i>Inert Gas Connection</i>	16
3.7	<i>Weld Head Installation</i>	16
3.8	<i>Initial Turn On</i>	17
<i>SECTION IV</i>	<i>SYSTEM FUNCTIONS</i>	
4.0	<i>Introduction</i>	21
4.1	<i>Multi-Level Functions and Modes</i>	21
4.2	<i>Single Level Functions and Modes</i>	22
4.3	<i>Miscellaneous Non-Programmable Functions</i>	22
4.4	<i>Sensors and Faults</i>	23
4.5	<i>Pendant Controls</i>	23
4.6	<i>Other System Features</i>	24
4.7	<i>Weld Sequence</i>	25

TABLE OF CONTENTS

<i>SECTION</i>	<i>DESCRIPTION</i>	<i>PAGE</i>
<i>SECTION V</i>	<i>OPERATION</i>	
5.0	Introduction	30
5.1	Initial Power-On	30
5.2	Power Supply Calibration Introduction	30
5.3	Required Equipment For Calibration	31
5.4	Main Reference Voltage Calibration	31
5.5	Position Feedback Voltage Calibration	32
5.6	Current Calibration	32
5.7	Arc Voltage Calibration	35
5.8	Weld Head Travel Calibration Introduction	36
5.9	Weld Head Travel Calibration	37
5.10	Weld Head Wire Feed Calibration	38
5.11	System Security	39
5.12	Project Data Recording	40
5.13	General Maintenance	40
5.14	System Fault Corrections	41
5.15	Re-Shipping	42
5.16	Selecting and Creating Languages	43
5.17	Creating and Editing Weld Head Templates	45
5.18	CMOS Battery Replacement	47

LIST OF ILLUSTRATIONS

<i>NUMBER</i>	<i>DESCRIPTION</i>	<i>PAGE</i>
Figure 1	System Configuration	14
Figure 2	AC Power Set Up (Transformer jumpers - International)	15
Figure 2A	AC Power Set Up (Transformer jumpers - Domestic)	18
Figure 3	Cable Connections	19
Figure 4	Status Screen/Initial Turn-On	20
Figure 5	Sequence Timing Chart	29
Figure 6	CMOS battery location on EP811 motherboard	47
Figure 7	CMOS battery location on SBC84710 motherboard	48

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 415 (M-415) 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-415 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-415 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. The M-415 includes an 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.

The M-415 family of options also includes PC or Laptop operation for Remote Welding and a variety of quality assurance options such as project and function data acquisition.



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.

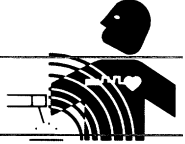








NOTE



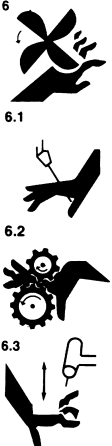
In-depth weld development instructions, weld head set-up, maintenance and troubleshooting are contained in other manuals, documents and training classes and are not included in this manual. Contact your AMI representative for more information about these items.


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.

	<p>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.</p>
	<p>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.</p>

<p>1.2</p> 	<p>WARNING: Magnetic Fields from High Currents can affect pacemakers. PACEMAKER WEARERS KEEP AWAY UNTIL CONSULTING YOUR DOCTOR.</p>
<p>1.3</p> 	<p>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.</p>
<p>2</p> 	<p>WARNING: Welding can cause fires or explosions. Do not weld near FLAMMABLE or EXPLOSIVE MATERIALS. Watch for fire. Have the proper type of extinguisher in your work area.</p>
<p>2.1</p> 	<p>WARNING: Welding Operators should wear non-flammable protective clothing, footwear and head gear.</p>
<p>2.2</p> 	<p>WARNING: Never weld on sealed containers or pipes. This may result in an EXPLOSION.</p>
<p>2.3</p> 	<p>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.</p>
<p>3</p> 	<p>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.</p>
<p>4</p> 	<p>WARNING: Weld materials can emit toxic fumes during welding. WELD ONLY IN AREAS WITH ADEQUATE VENTILATION.</p>
<p>4.1</p> 	<p>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 WITHOUT PROPER VENTILATION OR RESPIRATORS.</p>

	<p>WARNING: AMI factory training is essential for all Welding Operators and Maintenance Technicians who operate AMI equipment.</p>
	<p>WARNING: Before operating, storing or handling, always make sure that the M-415, M-415 Pendant, weld heads and cables are not exposed to rain or standing water. SYSTEM COMPONENTS ARE NOT WEATHER-PROOF.</p>
	<p>WARNING: Keep hands and fingers clear from moving parts such as fans, gears rotors, Wire Feed, Rotation and AVC Mechanisms.</p>

 **WARNING:** The M-415 Power Supply is not intended for pipe thawing or heating in any form.

 **WARNING:** The M-415 Power Supply weighs in excess of 700 lb. (317.5 kg). Be sure to follow your local, OSHA, international and employer guidelines for proper methods of handling 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. To AVOID severe equipment damage VERIFY that the M-415 is connected to the correct Input AC power (see section 3.4).
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-415 is intended for typical GTAW gases ONLY. *NEVER CONNECT OXYGEN OR ACETYLENE TO THE M-415.*
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.

6. Before operating, insure that the M-415 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-415.
10. Do not use acid, corrosives, liquid "Easy Out" or any liquid substance on the M-415 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-415, 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).

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.

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 disrupted. Most interference problems are easily correctable but each one must be looked at on a "case by case basis."

4. EMI SUPPRESSION

The M-415 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-415. 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 tube weld head rotors (M-8, M-9) are 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. Do not depend on them to prevent electrical shock.

"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.

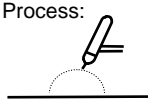


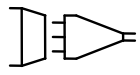
Most AMI Power Supplies feature High Frequency (HF) Arc Starting. This is a High Voltage/High Frequency electrical transmission process. To eliminate any HF shock possibility "AVOID ALL CONTACT" with the Welding WORK (ground), the ELECTRODE or the WELD HEAD during arc start.

SECTION II - SPECIFICATION

The following contains only general specifications about the M-415 Power Supply. More detailed information is available in AMI Specification No. 415.

2.0 ELECTRICAL

1. RATING PLATE DEFINITIONS

1) Company: ARC MACHINES, INC.		Country: USA		3) Model: Model 415	
4) S/N:			DATE:		
8) Process:  G.T.A.W.	10) Type:  DC	23) Shock Rating: 	6) Standards: NEMA EW1 IEC 974-1		
9) Output: Minimum 5A / 5V		Maximum 400A / 30V		11) No-load Voltage: U₀ = 61V	12) Duty Cycle: X = 100% ALL RATED OUTPUTS
15) Input:  3~ 50/60 HZ	18) Voltage: U₁ = 200V U₁ = 240V U₁ = 400V U₁ = 440V U₁ = 480V U₁ = 575V	19) Input Current: I_{1max} = 49A I_{1eff} = 49A I_{1max} = 44A I_{1eff} = 44A I_{1max} = 25A I_{1eff} = 25A I_{1max} = 25A I_{1eff} = 25A I_{1max} = 20A I_{1eff} = 20A I_{1max} = 20A I_{1eff} = 20A		21) Rating: IP21 22) Rating:	

- 1) - Manufacturer and Country of Origin.
- 3) - Model Number Rating Plate applies to.
- 4) - Serial Number and Date of Manufacture.
- 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.
- 10) - Symbol that output is Direct Current (DC) only.
- 11) - Rated No Load Output Voltage (open circuit voltage) is 61 volts.
- 12) - The M-415 is a 100 % Duty Cycle for the rated outputs (9).
- 15) - Input Voltage type contains symbol for three (3) phase Alternating Current (AC) input at 50 or 60 Hz frequency.
- 18) - Nominal Input Voltage value is dependent on Transformer type.
M-415s manufactured before January 1999 are listed as: Domestic, or International. After January 1999 the Universal transformer was released for use in all countries.
- 19) - Rated maximum current required from the AC supply. Given for both I₁ maximum (I_{1max}) and I₁ effective (I_{1eff}). Plate shown above is for the Universal transformer. Consult the rating plate on your Power Supply for actual number.
- 21) - International Protection (IP) rating. The M-415 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-415 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-415 can have 1 of 3 operating ranges:

Voltage	Phase - Freq.	Max Input Current Required	Transformer Type	Model 415 Main Circuit Breaker
200 VAC	3 - 50/60 Hz	50 amperes Service	Universal	60 Ampere-600 VAC
240 VAC	3 - 50/60 Hz	45 amperes Service		60 Ampere-600 VAC
400 VAC	3 - 50/60 Hz	25 amperes Service		60 Ampere-600 VAC
440 VAC	3 - 50/60 Hz	25 amperes Service		60 Ampere-600 VAC
480 VAC	3 - 50/60 Hz	20 amperes Service		60 Ampere-600 VAC
575 VAC	3 - 50/60 Hz	20 amperes Service		60 Ampere-600 VAC

FOR POWER SUPPLIES MADE BEFORE JANUARY 1999				
200 VAC	3 - 50/60 Hz	60 amperes Service	International	60 Ampere-415 VAC
220 VAC	3 - 50/60 Hz	60 amperes Service		60 Ampere-415 VAC
380 VAC	3 - 50/60 Hz	40 amperes Service		60 Ampere-415 VAC
415 VAC	3 - 50/60 Hz	40 amperes Service		60 Ampere-415 VAC

FOR POWER SUPPLIES MADE BEFORE JANUARY 1999				
230 VAC	3 - 50/60 Hz	50 amperes Service	Domestic USA	50 Ampere-600 VAC
240 VAC	3 - 50/60 Hz	40 amperes Service		50 Ampere-600 VAC
440 VAC	3 - 50/60 Hz	40 amperes Service		50 Ampere-600 VAC
480 VAC	3 - 50/60 Hz	40 amperes Service		50 Ampere-600 VAC

3. OUTPUT POWER - Straight polarity, constant current DC regulation intended for GTAW welding only.
 Minimum current Output all cases = 5 Amperes DC
 Maximum current Output = 400 Amperes DC continuous or peak pulse
4. CIRCUIT BREAKER – Also used as ON/OFF switch, is a 60 Amp 3 phase Auto-Trip, with electrical Emergency Stop function available on the Power Supply, Operators Pendant and from an Optional External Hard Wire Command.
5. POWER CABLE -25 foot (7.6 m) Neoprene jacketed harmonized CE approved 4 conductor 8 AWG (10mm²) cordage, rated voltage: 500V.
6. STANDARDS - The M-415 is designed and maintained to meet all applicable IEC and ISO standards as well as all applicable EC Directives.
7. RATED CONDITIONS - The system will meet or exceed the functional ranges and tolerances stated, provided that the following conditions exist:
1. Input Voltage does not deviate greater than +/- 10% from normal voltage.
 2. Ambient operating temperature range is between 0 degree C (32° F) and 40° C (105° F)
 3. Arc Voltage at the power supply terminals is equal to or less than 30 volts.
 4. All electrical performance is based on maximum weld head distance of 200 feet (61 m) from the M-415

2.1 PHYSICAL CONSTRUCTION

1. Cabinet material - aluminum and steel
2. Dimensions (basic Power Supply):
 Height: 39 inches (990.6 mm)
 Width: 26 inches (660.4 mm)
 Depth: 36 inches (914.4 mm)
3. Weight: Less than 700 lb. (317.5 kg) depending on configuration

2.2 CURRENT OUTPUT

NOTE

The following specifications will, in many cases, reference "User Defined". User defined means that the user can set up the actual programmable ranges and functionality of any given function. For specification purposes this means that no actual function range can be given. Where applicable only an absolute maximum or minimum are given.

1. Range - 5 to 400 Amperes programmable. Programmable increments can be user defined in units of 1 or 0.1 amperes.
2. Type - Continuous or pulsed output DC Straight Polarity for GTAW (TIG) welding only.
3. Regulation - Constant Current closed loop servo using second generation high frequency (60 KHz) series switching regulation.
4. Regulation Response - Response time for correction of current deviation is less than 500 microseconds. Pulsed mode rise time from background current to primary is 1.2 ampere per microsecond.
5. Regulation Tolerance - +/- 0.5% of programmed setting or +/- 1.0 ampere whichever is greater.

2.3 ARC VOLTAGE and ARC VOLTAGE CONTROLLER SERVO

1. Open Circuit Output Voltage - 61 VDC
2. Maximum Output Voltage under load - 30 volts (measured at power supply, not at torch)
3. Arc Voltage Controller Range - (measured at the torch)
Minimum - 5 VDC
Maximum - 25 VDC
Actual programmable range is user defined.
4. AVC Motor Output Current Limit - User defined by weld head type in increments of 0.1 Amperes up to a maximum motor drive current limit of 4.0 Amperes.
5. AVC Motor Output Voltage Limit - 35 VDC
6. Regulation - Closed Loop position servo using arc voltage measured at the torch. Intended for DC permanent magnet type motors only.
7. Regulation Tolerance - +/- 1% of program value or 0.1 VDC, whichever is greater. Based on primary current only with no current pulsation. Measurable accuracy with the current pulsing can be affected by the puddle growth and shrinkage.
8. Regulation Response - Variable and programmable.
9. Jogs - Motor servo provides for UP and DOWN motor jogs. Jog speeds are adjustable.

2.4 TRAVEL (torch rotation) SERVO

1. Range - Programmable range is User defined by weld head type. Unit of measure (IPM or RPM) and increments is user defined by weld head type.
2. Regulation - Closed loop velocity servo using, as standard, analog tachometer feedback of 0 to 5 VDC. Can be set up to regulate using digital tachometer or digital encoder feedback. Intended for DC permanent magnet type motors only.
3. Motor Output Current Limit - User defined by weld head type in increments of 0.1 Amperes up to a maximum motor drive current limit of 4.0 Amperes.
4. Motor Output Voltage Limit - 35 VDC
5. Regulation Tolerance - +/- 1% of program value or +/- 0.1 IPM or RPM whichever is greater. Based on maximum range being at least 10 IPM or RPM.
6. Jogs - Motor servo provides for bi-directional (CW and CCW) motor jogs. Jog speeds are adjustable.

2.5 WIRE FEED SERVO

1. Range - Programmable range is User defined by weld head type. Unit of measure (IPM or mm/min) also user defined by weld head type.
2. Regulation - Closed loop velocity servo using, as standard, analog tachometer feedback of 0 to 5 VDC. Can be set up to regulate using digital tachometer or digital encoder feedback. Intended for DC permanent magnet type motors only.

3. Motor Output Current Limit - User defined by weld head type in increments of 0.1 Amperes up to a maximum motor drive current limit of 4.0 Amperes.
4. Motor Output Voltage Limit - 35 VDC
5. Regulation Tolerance - +/- 2% of program value or +/- 1 inch, whichever is greater. Based on maximum range being at least 100 IPM.
6. Jogs - Motor servo provides for bi-directional (FEED and RETRACT) motor jogs. Jog speeds are Adjustable.

2.6 TORCH OSCILLATION and CROSS-SEAM STEERING SERVO

1. Range - User Defined by weld head type as to maximum programmable amplitude.
2. Regulation - Closed loop position servo using +/- 5 VDC feedback voltage for position information. Feedback device varies with weld head model. Intended for DC permanent magnet type motors only.
3. Motor Output Current Limit - User defined by weld head type in increments of 0.1 Amperes up to a maximum motor drive current limit of 4.0 Amperes.
4. Motor Output Voltage Limit - 35 VDC
5. Regulation Tolerance - +/- 1% of program value or 0.010 inches, whichever is greater. Based solely on M-415 servo specification. Actual response speed and tolerance performance can vary depending on the dynamic loads on the weld head. Consult the weld head specification for each weld head tolerance.
6. Jogs - No jogs are provided. Oscillator is continually seeking desired position. Position is based on input (steering) commands from steering devices (on Pendant and Display).

2.7 TIMING FUNCTIONS

1. Purge Time Range (pre and post) -
000 to 1000 seconds. User can define minimum programmable time.
2. Start Delay Time Range (Travel, Wire, AVC) -
00.0 to 100 seconds in increments of 0.1 seconds.
3. Stop Delay Time Range (Travel, Wire, AVC) -
00 to 100 seconds.
4. Upslope Time Range -
00.0 to 100 seconds. User can define minimum programmable time
5. Downslope Time Range -
00 to 100 seconds. In increments of 1 second
6. Weld Level Time Range (up to 99 levels) -
0000 to 10000 seconds.
7. Pulse Timing Range (Primary/Background) -
0.00 to 100 seconds in increments of 0.01 seconds.
8. Oscillator Timing Range (Dwells and Excursion) -
0.00 to 100 seconds in increments of 0.01 seconds.
9. Primary WF pulse delay -
0.00 to 100 seconds in increments of 0.01 seconds.
10. Timing Resolution -
+/- 0.01 seconds (all timing functions)

2.8 ARC STARTING

1. Starting Methods - Touch or RF (radio frequency)
2. Touch Start provides a smooth, consistent and tungsten inclusion free start with any weld head that has an AVC. Touch and Retract speeds are user defined. User can set up for single start attempt or multiple start attempt.
3. RF Starting provides a method of arc starting without the electrode touching the weld surface. System is designed for best performance under the following conditions:
 1. Minimum first level primary current - 5 Amperes (in Argon only)
 2. Gases - Argon, 95/5 Argon/Hydrogen, Helium or Helium/Argon Mixes.
 3. 1 atmosphere pressure. Consult factory for operation in pressure chambers.
 4. Maximum arc gap - 0.156 inch (4 mm)

5. Cerriated or Thoriated Electrodes with conventional grinds.
6. Cable lengths up to 200 feet.
7. Multiple arc strike attempts.

2.9 TORCH COOLING UNIT - Liquid cooled, forced air heat exchanger with coolant reservoir.

1. Reservoir Capacity - 2.5 gallons (9.46 liters)
2. Maximum Pressure - 60 PSI
3. Flow - 0.3 GPM for 400 Ampere Torches.
0.2 GPM for 300 or less Ampere Torches
4. Head - Up to 100 feet with 200 feet of cable.
5. Duty Cycle - 100 %
6. Distilled or Demineralized Water coolant, (see section 3.3 for use where freezing may occur).
7. Replaceable coolant filter
8. Pressure relief valve and by-pass built-in

2.10 GAS DISTRIBUTION SYSTEM

1. Control - Electrical Solenoid valve.
2. Pressure - Maximum 50 PSI
3. Flow - 5 to 100 CFH

SECTION III - INSTALLATION

3.0 INSTALLATION, GENERAL

The Model 415 Power Supply is designed to provide reliable and repeatable performance within its specified limits. The Model 415 is also, by its nature, something that must be relocated from time to time and be installed, by the user, without Factory Service being required. Because of this, assurance that the Model 415 is working within its specified limits is a “user” responsibility and it begins with INSTALLATION.

This Section of the Operation Manual provides the requirements and procedures for the proper installation and initial turn on of the Model 415.

3.1 TRAINING

The Model 415 is designed to be as easy as possible to install and operate. The instruction of this manual should, in most cases, supply the user with the information needed for Installation and Operation. However, automatic welding systems can be complicated and Arc Machines, Inc. “**STRESSES**” the need for complete FACTORY training involving Installation, Operation, Programming and Maintenance.

This manual does not attempt to cover all possible problems, deviations or usage of the Model 415. In this Manual, where these items might occur, a general instruction is given to consult a Factory Representative.

3.2 INSPECTION

NOTE

The M-415 is shipped new, in a re-usable and factory approved shipping container. This container should be retained and stored carefully in order to re-use in case of a need to re-ship the M-415 to another location.

1. After unpacking, inspect all items for obvious physical damage and loose parts. If damage is evident, contact a factory representative before using. If water condensation is apparent, dry the unit before using.
2. All M-415'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. Inspect the Power Supply Cabinet (See Figure 1, Item 1)
 1. Perform an exterior visual inspection looking for obvious physical problems such as broken connectors, dents or loose components.
 2. There are two Connect Panels on the left side of the Cabinet. These are the Electrical - I/O Connect Panel (left side upper) and the Weld Head Connect Panel (left side rear). Insure that all Protective Dust Covers and Retaining Chains are installed on all electrical multi-pin Connectors (See Figure 1, Item 2).
 3. Remove both the left and right hand SIDE PANEL Retaining Screws and remove the SIDE PANELS (see Figure 1, Item 3, 13). Leave the SIDE PANELS off until the end of Section Step 3.4.
 4. Visually inspect the interior for obvious physical problems such as loose components, dangling wires, foreign (loose) objects, excessive dirt or any standing water, condensation or moisture.
 5. Note the location of the main transformer and tap setting Terminal Strip (See Figure 1, Item 4). This will be set up in Section 3.4.

4. Operator Pendant (see Figure 1, Item 5)
 1. For the remainder of this manual this will be called the RP Pendant or just Pendant.
 2. Perform a visual inspection to insure no obvious shipping damage has occurred. Check Pendant cable for Protective Connector Covers, tight strain relief and no frays or tears in the Cable Jacket.
5. Cables

There are five Standard Cables included with the Model 415. Check each of the following Cables for Protective Covers, proper strain relief and obvious frays or tears.

 1. RP Pendant Extension Cable, 50 foot (15.2 meters) (see Figure 1 Item 6).
 2. Weld Head Adapter Control Cable, 40 foot (12.2 meters) (see Figure 1 Item 7).
 3. Weld Head Adapter Service Cable, 40 foot (12.2 meters) (see Figure 1 Item 8).
 4. Ground cable with "C" Clamp, 50 foot (15.2 meters) (see Figure 1, Item 9).
 5. Input Power Cable, 25 foot (7.6 meters) (see Figure 1, Item 10).
6. Weld Head (see figure 1, Item 11)
 1. Inspect the Weld Head or Heads for obvious physical damage. The Model 415 can operate all AMI Weld Heads. The user will find detailed Weld Head Installation and Inspection information in the Operation Manual for each specific Weld Head.

3.3 TORCH COOLANT SYSTEM PREPARATION

The Model 415 power source is air cooled. However, almost all AMI Torches require liquid cooling. The Coolant System provides coolant for Weld Heads equipped with liquid cooled Torches. The liquid coolant should be a combination of pure de-mineralized, de-ionized or distilled water and pure Ethylene glycol.



If antifreeze is required Arc Machines, Inc. recommends the use of a corrosion inhibitor and algaeside along with water or water mixture. The present recommended water treatment is Optishield Plus manufactured by Opti-Temp Corp. and can be purchased from local welding supply. Glycol mixtures can be purchased from Miller Electric for RF TIG applications, available from local welding supply

CAUTION

It is extremely important to insure proper operation of the Coolant System. The coolant system will operate, for a few weeks or months, with plain tap water as the coolant. After some length of operating in this condition the Coolant System will begin to have problems with bacteria growth, contaminates, poor connections, hoses and pump flow. For the Coolant System to continue to meet the demands of the System Specification it must "**BEGIN**" operations per this procedure.

The following is for initial preparation of the Coolant System after shipment from the FACTORY.

1. The Coolant System reservoir has a capacity of 2.5 gallons (9.46 liters). This reservoir is located on the lower left side of the Power Supply. The left side panel should already be removed (step 3.2.2.2), if not remove the left side panel to access the coolant system.
2. Remove the coolant fill spout cap (Figure 1, Item 12) and add 2.5 gallons of coolant solution or distilled water. **NEVER USE TAP WATER IN THE COOLANT SYSTEM.**
Before Operating be sure to re-install the left side panel (Figure 1, Item 13)..

NOTE

For operation and storage in areas subject to freezing temperatures, use 1.75 gallons of distilled water mixed with 0.75 gallons of pure Ethylene Glycol for a total of 2.5 gallons of coolant.

CAUTION

If antifreeze needs to be added, use only pure Ethylene Glycol. Commercial antifreezes (such as Prestone) contain dyes and additives that are harmful to the Coolant System. DO NOT over-fill the Coolant Reservoir.



When using glycol or coolant additives the optional UV sterilization unit must be disabled by unplugging input power.

3.4 PRIMARY POWER CONNECTION



WARNING



Do not connect the M-415 power supply to any AC power other than the ones listed on the rating plate and on the transformer (see section 2).

The Model 415 is supplied with a 25 foot (7.6 meter), 4 wire Power Cable. One end of this Cable is pre-wired inside the Power Supply, the other end is pigtailed and an appropriate connector or switch box (user supplied) must be wired to this end (see Figure 1, Item 10 for Cable location).

NOTE

The Model 415 is not phase sensitive, when wiring the user must only insure that the GREEN or GREEN with YELLOW stripe wire of the Cable is connected to Protective Earth Ground. The other 3 wires (red, black and white, or blue, brown, and black) can be connected to phase A, B and C in any order.

Remove the right side panel as directed in step 3.2.3.3. Perform the following steps to connect the input power:

1. Set Up the Transformer taps for the input power. The Main Transformer has a number of taps that must be connected via jumpers to set it for the correct input power. Refer to Figure 2 and set the jumpers for the power to be used.

CAUTION

Do not touch or relocate Input Power Terminal Strip jumpers with Power Cable connected to an AC source. **BE SURE NO POWER IS PRESENT ON THE POWER CABLE.**

2. Wire an appropriate connector or switch box to the pigtailed end of the Cable. DO NOT PLUG IN OR TURN ON SWITCH BOX.
3. Verify again that the jumpers are correctly set and reinstall the SIDE PANEL

NOTE

THE MODEL 415 CAN NOW HAVE INPUT POWER APPLIED AND CAN BE TURNED ON. HOWEVER IT IS RECOMMENDED THAT THE PENDANT, GAS AND WELD HEAD INSTALLATION BE COMPLETED BEFORE TURNING ON POWER. INITIAL POWER ON IS DISCUSSED IN STEP 3.8.

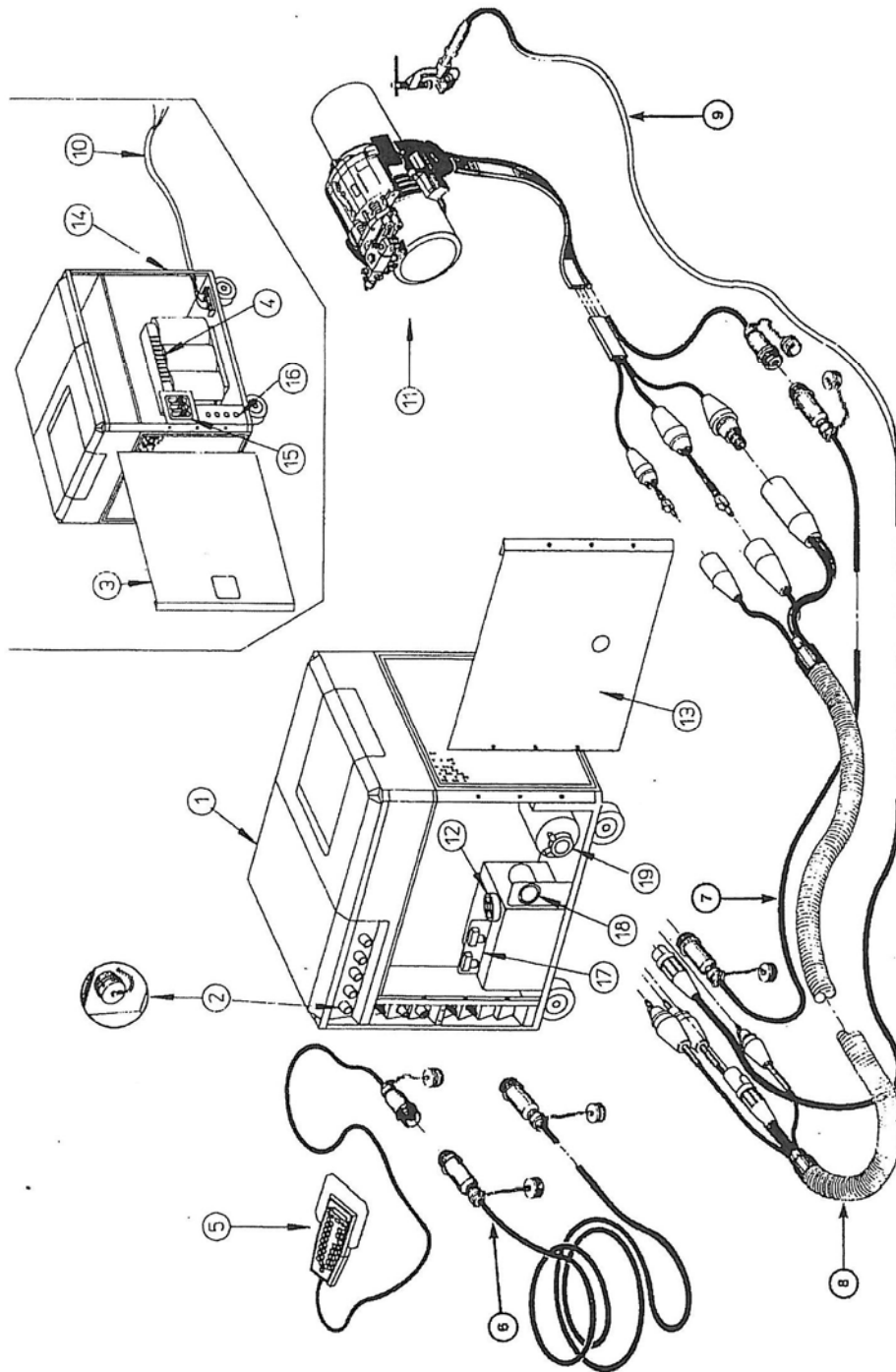
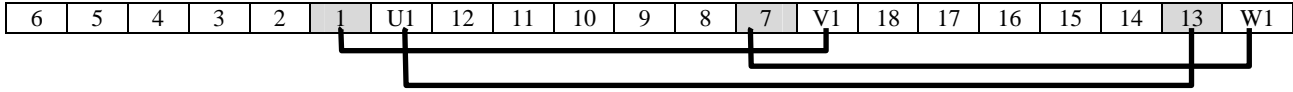


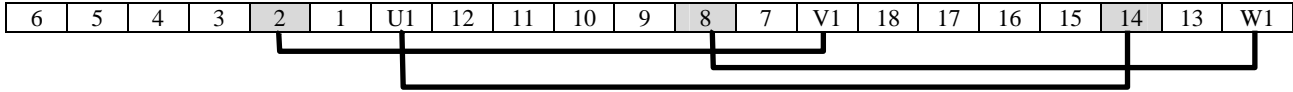
FIGURE 1

INTERNATIONAL TRANSFORMER TERMINAL JUMPER SET UP

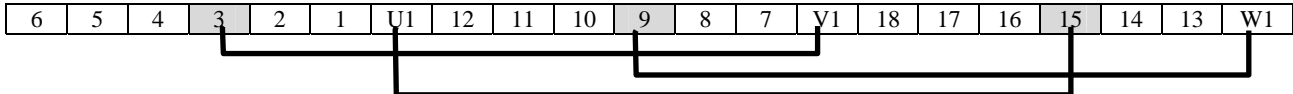
200 VOLT TERMINAL JUMPER SETTINGS



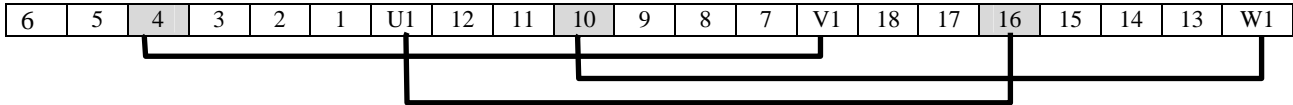
240 VOLT TERMINAL JUMPER SETTINGS



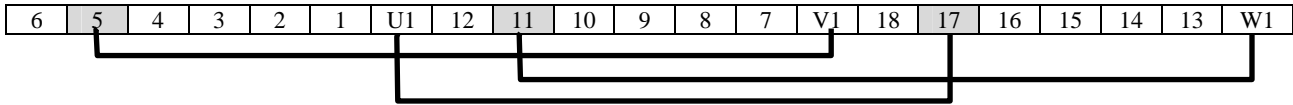
400 VOLT TERMINAL JUMPER SETTINGS



440 VOLT TERMINAL JUMPER SETTINGS



480 VOLT TERMINAL JUMPER SETTINGS



575 VOLT TERMINAL JUMPER SETTINGS



FIGURE 2

.NOTE

During the first production run of M-415s there were two (2) types of transformers offered by AMI. Later production runs were replaced by a single Universal type. If your Power supply was manufactured before January 1999 it may be configured differently than the above figure. Page 3.8 depicts jumper information for the two obsolete versions.

NOTE

3 phase power in most European countries is slowly being changed from 380 VAC to 400 VAC. If the user still has 380 VAC he is advised to use the 400 VAC tap.

3.5 OPERATORS PENDANT CONNECTION

The Model 415 is supplied (standard) to operate Weld Heads and the Pendant up to 70 feet (21 meters) from the Power Supply Cabinet. The Pendant includes a built in 20 foot (7 meters) connection cable and attaches to a 50 foot (15.2 meters) standard Pendant Extension cable. For ease of operation the Pendant can be connected directly to the Power Supply without the use of the 50 foot (15.2 meters) Extension Cable.

Perform the following steps for the installation of the Pendant:

1. Connect the Power Supply end of the 50 foot Pendant Extension Cable to the Model 415 Pendant Connector on the Electrical - I/O Connect Panel (see Figure 1, Item 6).

NOTE

All Weld Head and Power Supply Electrical Connectors are keyed for proper mating. Insure that correct connectors are being used before attempting to install.

2. Connect the Cable on the Pendant to the Extension Cable. (see Figure 1, Item 5, 6).

3.6 INERT GAS CONNECTION

The Model 415 requires for operation, an inert gas source, gas pressure regulator and gas flow meter. These items are not furnished with the Model 415 and must be supplied by the user.

1. Mount a single or double stage pressure regulator (set pressure Maximum 90 PSI) and Flow Meter (able to regulate between 5 and 100 CFH) on an appropriate gas supply.
2. The Model 415 is supplied with a 15 foot Input Gas Hose with a standard 5/8 male NPS fitting on one end and a Bulkhead gas fitting on the other end.
3. Connect the Input Gas Hose to the Flow meter (NPS) and to the BULKHEAD Input Gas Fitting at the rear of the Model 415 (see Figure 1, Item 14).

NOTE

Automatic GTAW welding systems are very sensitive to gas quality (purity). The hose supplied with the Model 415 is specifically selected for its ability not to trap moisture or aspirate oxygen. Rubber, Tygon or most other types of gas hoses are not recommended for use with the Model 415 and will eventually cause welding problems.

CAUTION

The M-415 arc gas solenoid valve is rated at 90 PSI (620 KPa) maximum pressure, DO NOT EXCEED THIS RATING.

3.7 WELD HEAD INSTALLATION

The Model 415 is Supplied standard with 3 weld head connection cables. These cables consist of the following:

1. Weld Head Control Adapter Cable, 40 foot (12.2 meter) - This is the electrical Cable with male multi-pin connector on one end and female on the other end (see Figure 1, Item 7).
2. Weld Head Service Adapter Cable, 40 foot (12.2 meter) - This is the gas, coolant and electrode power cable. Connectors on the Weld Head end are all quick disconnect type and only mate with the correct Weld Head connector. Connectors on the other end are also quick disconnect but only mate with the Power Supply Weld Head Connectors (on Weld Head Connect Panel) or Extension Cables (see Figure 1, Item 8).

3. Ground (work) Cable, 50 feet (15.2 meter)- (see Figure 1, Item 9)

Items 1 and 2 are always connected to the 10 foot (3 meter) Cable attached to all AMI Weld Heads. This allows for standard operation of Weld Head up to 50 feet (15.2 meters) from the Power Supply Cabinet. Appropriate extension cables for each go between the Adapter Cable and the Power Supply. Specific Instructions for Weld Head Installation and operation will be found in the Operation Manual for each Weld Head type.



WARNING



Always turn the power supply off before making any cable or connection changes to the M-415 power supply.

4. Cable Installation
 1. Connect the Weld Head Control Adapter Cable to the Power Supply PIPE Weld Head Connector on the Weld Head Connect Panel (left side top) on the Model 415. This is a keyed connector, insure that the correct end of the Cable is being connected. DO NOT FORCE, connections should be smooth and easy. See Figure 3, Item 1 and 2.
 2. Connect the Electrode, Coolant Out, Coolant Return and Torch Gas Connectors of the Weld Head Service Adapter Cable to the appropriate connectors on the Weld Head Connect Panel.
 3. Connect the Cam-Loc connector of the Ground Cable to the Ground (work) Connector on the Weld Head Connect Panel (see Figure 3, Items 3 and 4).
 4. Connect the Control Adapter Cable (weld head end) to the Weld Head Control Cable Connector.
 5. Connect the Service Adapter Cable (weld head end) to the Weld Head Service Cable (gas, coolant and electrode quick disconnects). Be sure to install the Protective Boots on Fittings (see Figure 3, Items 5 and 6).
 6. Connect the Ground Cable "C" Clamp to the pipe or object to be welded.
 7. Mount the Weld Head on the pipe or object to be welded. Consult the Weld Head Operation Manual for details about Weld Head mounting.

3.8 INITIAL TURN ON

AFTER COMPLETING ALL OF THE INSPECTION AND INSTALLATION STEPS, DO THE FOLLOWING:

1. Circuit Breaker CB-1 is located on the Right Side of the Model 415 (Figure 1, Item 15) CB-1 is the Main Power Switch. It should be in the OFF or down position.
2. Connect the Input Power Cable to the appropriate AC source (see power connection 3.4).
3. Raise the Display Panel to the "UP" Position.
4. Set the Main circuit Breaker CB-1 to the "ON" or up position.
5. When the Power is turned on the Model 415 will take a few seconds before information is shown on the display and on the pendant screen. During this time the system is making internal checks to verify correct working condition of critical Systems functions.
6. The first display on the screen is called the LOGO/START UP display and should look similar to Figure 4. The Start Up Pop Up Menu may appear where the AMI Logo is in the Figure. If it does not, touch the control panel icon (last one) on the tool bar and the Start Up menu will appear. Touching the "show easy Start" box will make the Start Up box appear on start up instead of the AMI logo (user choice).

- At this point, operations can begin.

NOTE

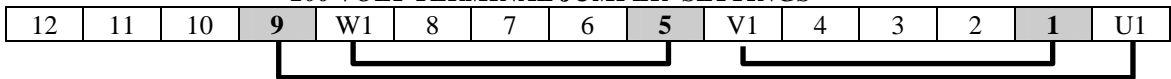
After the system is turned on, and cabling is connected for the first time, some of the cooling system reservoir contents will be used to fill the cooling cables. Sometime after initial turn on be sure to check the reservoir level and add coolant mixture again.

NOTE

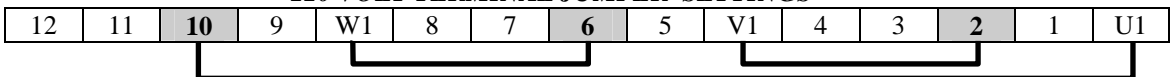
During the first production run of M-415s there were two (2) types of transformers offered by AMI. If your Power Supply was manufactured before January 1999 the below figure may be used for Transformer terminal setup.

INTERNATIONAL TRANSFORMER TERMINAL JUMPER SET UP

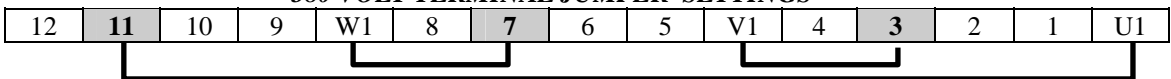
200 VOLT TERMINAL JUMPER SETTINGS



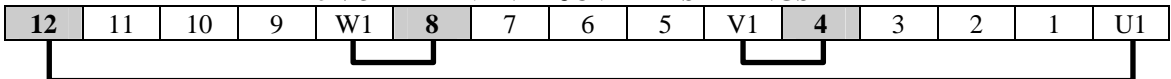
220 VOLT TERMINAL JUMPER SETTINGS



380 VOLT TERMINAL JUMPER SETTINGS

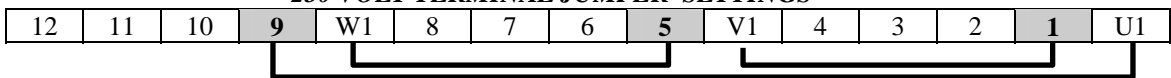


415 VOLT TERMINAL JUMPER SETTINGS

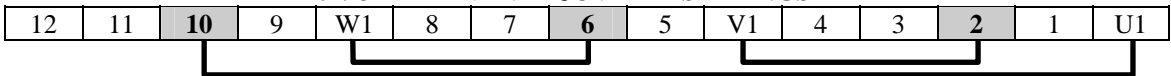


DOMESTIC USA TRANSFORMER TERMINAL JUMPER SET UP

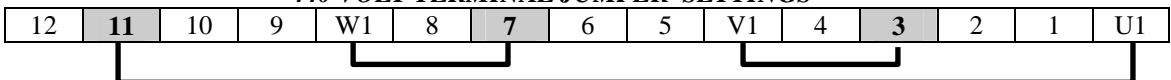
230 VOLT TERMINAL JUMPER SETTINGS



240 VOLT TERMINAL JUMPER SETTINGS



440 VOLT TERMINAL JUMPER SETTINGS



480 VOLT TERMINAL JUMPER SETTINGS

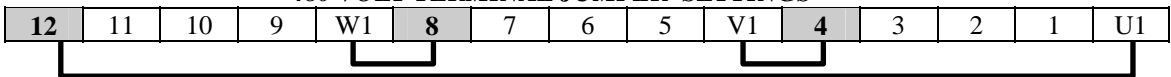


FIGURE 2A

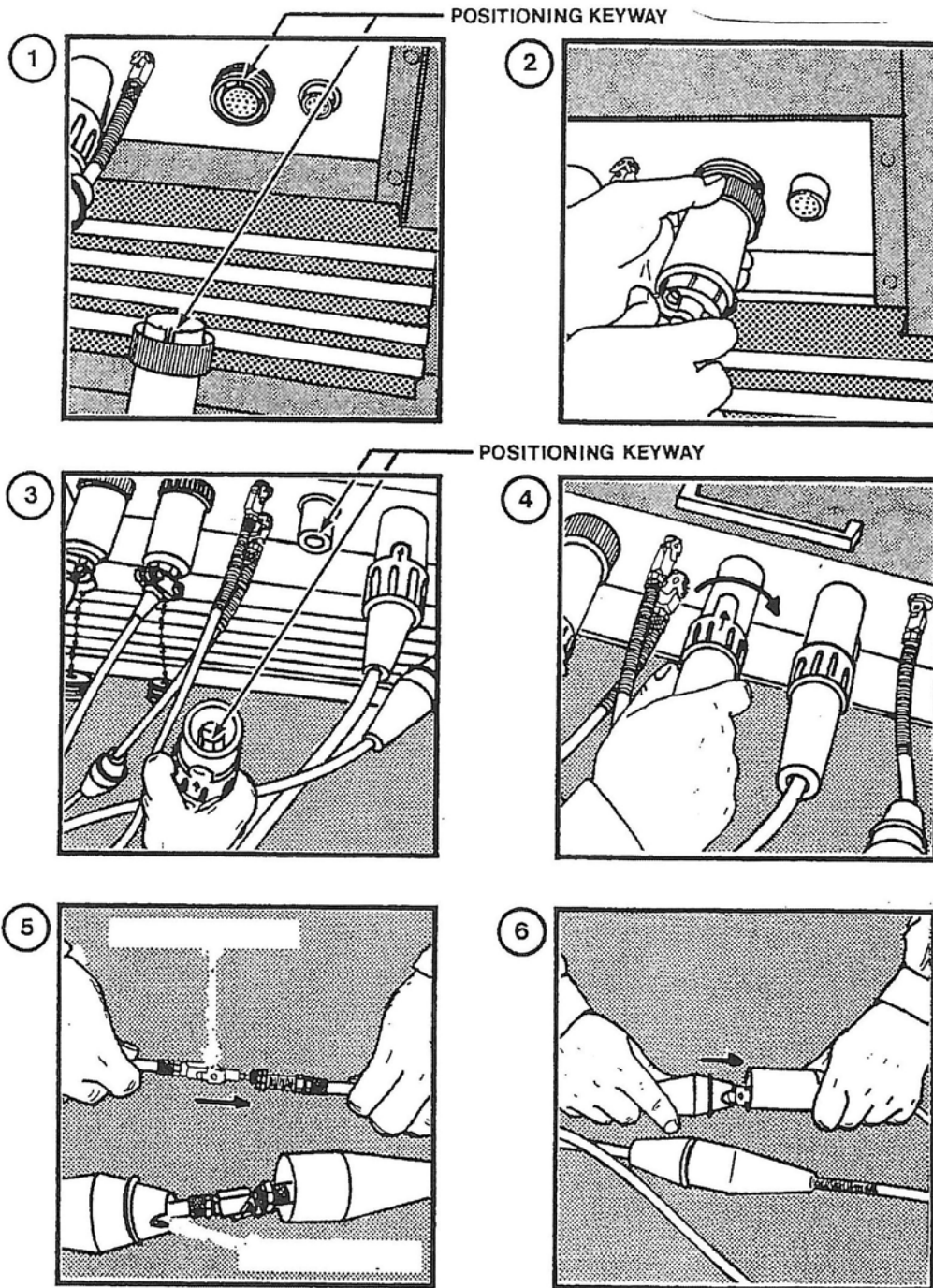


FIGURE 3

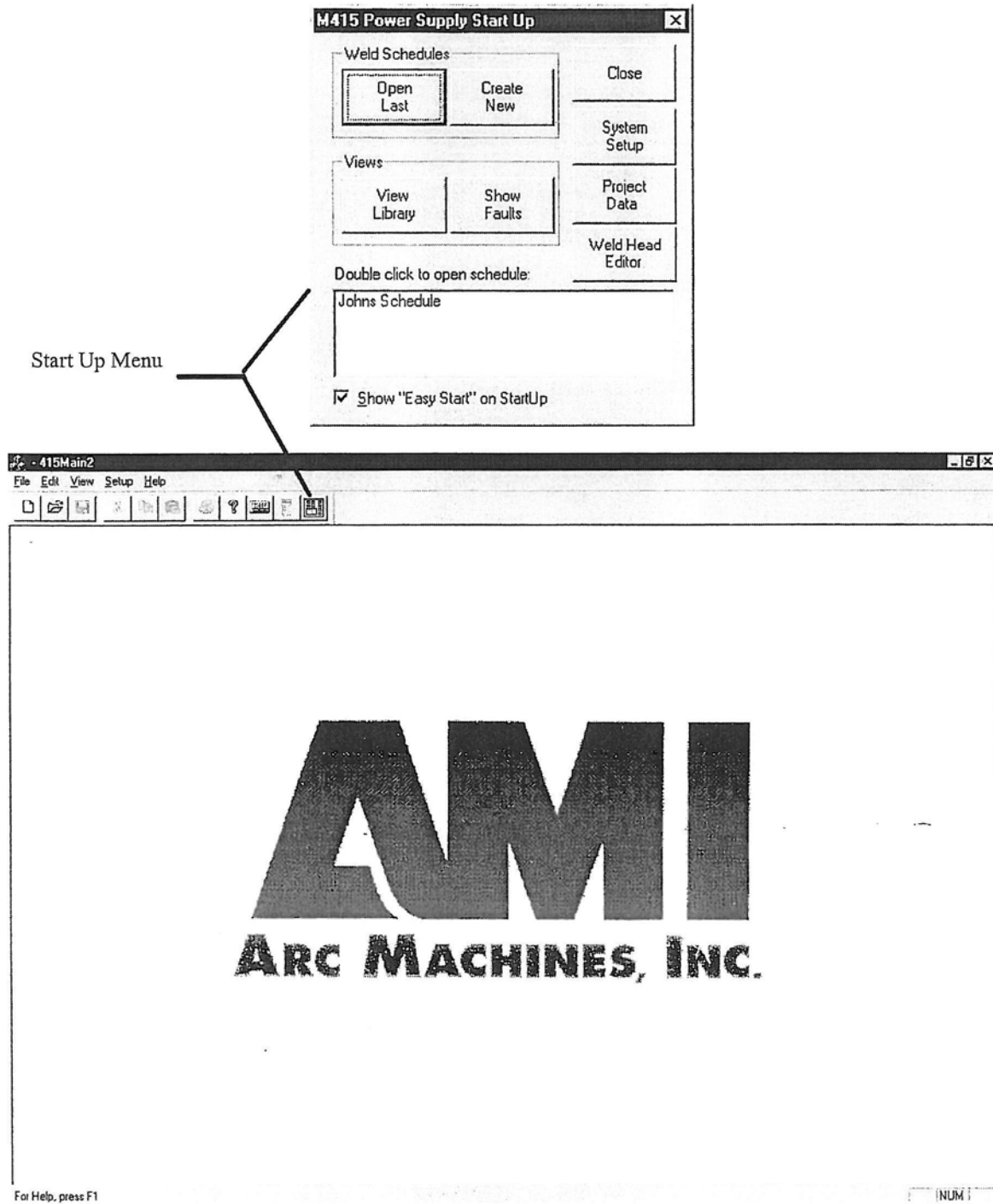


FIGURE 4

SECTION IV - SYSTEM FUNCTIONS

4.0 INTRODUCTION

The M-415 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.

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. 415.

4.1 MULTI-LEVEL FUNCTIONS and MODES

Most M-415 functions have the ability to be programmed to change during a weld sequence. This change of parameters is contained within LEVELS. The M-415 provides up to 100 levels for the following functions and modes.

1. **PRIMARY CURRENT** - Sets the value of current in each level during the PRIMARY PULSE time.
2. **BACKGROUND CURRENT** - Sets the value of current in each level during the BACKGROUND PULSE time.
3. **PRIMARY PULSE TIME** - Sets the length (time) for primary pulse functions.
4. **BACKGROUND PULSE TIME** - Sets the length (time) for background pulse functions.
5. **PULSE MODE**
OFF - Provides continuous functions only, no pulsing, primary values only
ON - Pulses from primary to background based on the PULSE TIME settings.
SYNC - Synchronizes the pulsing to the OSC movement. Dwell times are primary and Excursion time is background
EXT - Will pulse from primary to background based on an external timing signal.
6. **LEVEL MODE**
AUTO - Uses Level time to determine when to switch to the next level.
MANUAL - Levels switch only from Pendant command manually made by operator.
POSITION - Allows levels to advance based on weld head position in degrees or inches.
EXT - Allows levels to advance based on an external input signal.
7. **LEVEL TIME** - Sets the time each level will be used before advancing to the next level if LEVEL MODE is set to AUTO..
8. **LEVEL POSITION** - Set the position in degrees or inches that will determine when the levels will change if LEVEL MODE is set to POSITION.
9. **PRIMARY TRAVEL SPEED** - Sets the Travel Speed value in each level during the PRIMARY PULSE time.
10. **BACKGROUND TRAVEL SPEED** - Sets the Travel Speed value in each level during the BACKGROUND PULSE time.
11. **TRAVEL STEP MODE**
ON - Allows the System to pulse between the PRIMARY TRAVEL and the BACKGROUND TRAVEL.
OFF - Travel moves continuously at the primary rate regardless of pulsing or pulse mode.
12. **PRIMARY WIRE FEED SPEED** - Sets the Wire Feed value in each level during the PRIMARY PULSE time.
13. **BACKGROUND WIRE FEED SPEED** - Sets the Wire Feed value in each level during the BACKGROUND PULSE time.
14. **WIRE PULSE MODE**
OFF - Wire Feed is continuously the Primary value regardless of pulse mode.
ON - Wire Feed will pulse from Primary to Background values based on the pulse mode time.
15. **PRIMARY AVC** - Sets the Arc Voltage value in each level during the PRIMARY PULSE time.

16. **BACKGROUND AVC** - Sets the Arc Voltage value in each level during the BACKGROUND PULSE time.
17. **AVC MODE**
CONTINUOUS - Regulates the Arc Voltage to the Primary AVC value during primary and regulates the arc voltage to the Background AVC value during the background pulse.
SAMPLE ON THE PRIMARY - Regulates the arc voltage servo to the Primary AVC value during Primary pulse and turns the AVC servo (and motor) OFF during the Background.
SAMPLE ON THE BACKGROUND - Regulates the arc voltage servo to the Background AVC value during the Background pulse and turns the AVC servo (motor) OFF during the Primary pulse.
OFF - Turns the AVC servo OFF and does not attempt to regulate the Arc Voltage.
18. **AVC RESPONSE** - Sets a value that determines how fast the AVC responds to errors in the arc voltage value versus the programmed AVC value (primary and/or background).
19. **OSC IN DWELL TIME** - Sets the time that the Oscillator will be in the IN Dwell position
20. **OSC OUT DWELL TIME** - Sets the time that the Oscillator will be in the OUT Dwell position
21. **OSC EXCURSION TIME** - Sets the time that the Oscillator will take to move from the IN to the OUT and the OUT to the IN.
22. **OSC AMPLITUDE** - Set the distance that the Oscillator moves from OUT to IN and IN to OUT. User defines by weld head type the amplitude range.
23. **OSC MODE** -
ON - Allows the Oscillator to move at the Dwell/Excursion rate and Amplitude distance.
OFF - The OSC servo is only used for steering and does not move during sequence.

4.2. SINGLE LEVEL FUNCTIONS and MODES

1. **PREPURGE** - The time that gas flows to the torch after Sequence Start and before arc start.
2. **START MODE** - Can be set to RF Start or Touch Start.
3. **TRAVEL MODE** - Determines which direction Clockwise or Counter Clockwise or OFF the Travel Servo will drive the motor when the Travel Servo is enabled.
4. **UPSLOPE** - Sets the time that the Current and the Oscillator will take to rise to Level I maximum values after arc start.
5. **TRAVEL START DELAY** - Sets the time from Arc Start until the Travel Servo is enabled.
6. **WIRE FEED START DELAY** - Sets the time from Arc Start until the Wire Feed Servo is enabled.
7. **PRIMARY WIRE FEED PULSE DELAY** - Sets the amount of time the Wire Feed can be delayed from changing to the Primary value from the Background value.
8. **AVC START DELAY** - Sets the time from Arc Start until the AVC Servo is enabled.
9. **DOWNSLOPE** - Sets the time that the Current and Oscillator will take to fall to minimum programmable values before the arc goes out and Postpurge begins.
10. **TRAVEL STOP DELAY** - Sets the time the Travel Servo remains enabled after the beginning of Downslope.
11. **WIRE FEED STOP DELAY** - Sets the time the Wire Feed Servo remains enabled after the beginning of Downslope.
12. **AVC STOP DELAY** - Sets the time the AVC Servo remains enabled after the beginning of Downslope.
13. **POSTPURGE** - Sets the time that gas continues to flow to the torch after the end of Downslope and the arc has gone out.

4.3 MISCELLANEOUS NON-PROGRAMMABLE FUNCTIONS

1. **Return to Home** - System can be set up, by weld head type, to automatically at the end of Post Purge, jog the Travel Servo and move the torch to the mount/dismount position or starting position for next pass.
2. **Autowrap function** - System can be set up, by weld head type to allow the operator to engage the autowrap function and wrap the cables prior to the start of weld sequence.

3. **Wire Slope** - During the period of Wire Feed Stop Delay the Wire will be sloping toward 0 IPM. When the Wire Feed Stop Delay is complete the Wire will stop running completely.
4. **Set Function** - System can be set up, by weld head type to allow the operator to engage the Set Function which will automatically position the torch (via the AVC servo) to the correct gap for arc starting.
5. **Torch Position Indicator** - Can be set up by Weld head Type to display the position of the torch in relationship to the center of the Oscillator.
6. **Weld Head Position Indicator** - Can be set up by weld head type to display the position of the Torch in relation to Travel movement (can be in inches, mm or degrees).
7. **Override Limits** - User can define how great a change an operator can make to any overridable function.

4.4. SENSORS and FAULTS

1. **Torch Gas Flow** - An analog flow sensor provides a signal equal to the Flow rate (CFH) and the M-415 displays this flow rate and compares it against a program value and creates an Sequence Stop condition if it is not correct during a weld and prevents sequence if not correct during Pre-purge. Function is calibratable for Argon Torch gas only.
2. **Coolant Flow Sensors** - Monitor coolant flow rate and creates a Sequence Stop if below 0.2 GPM. Fault can be disabled by weld head type.
3. **Coolant Level Sensor** - Senses if coolant level in reservoir is low and displays to the operator that the level is low. No fault is created.
4. **Over Temperature Sensors** - Located on critical assemblies will create ALL STOP conditions if certain assemblies get to hot.
5. **Ground Fault** - Creates an ALL STOP condition if no ground return path is connected.
6. **AVC Mechanical Limit** - Creates a Sequence Stop if a weld head attempts to exceeds its AVC stroke. User can disable function by weld head type.
7. **OSC Mechanical Limit** - Creates a Sequence Stop if a weld head attempts to exceed its Oscillator stroke. User can disable function by weld head type.
8. **STUB OUT Detect** - Creates an ALL STOP if arc voltage goes below 5 VDC. Can be disabled by Weld head type.
9. **Over Voltage protection** - Creates an ALL STOP if power supply output voltage during a weld sequence exceeds 30 VDC.
10. **External Fault** - Allows the user to input up to 2 outside signals that will, when actuated from an external signal, create either an ALL STOP, Sequence Stop or WARNING as defined by the user.
11. **Power Supply Air Flow Fault** - Detects a loss of forced air cooling through the Power Source and creates an ALL STOP condition.

4.5 PENDANT CONTROLS

The M-415 comes standard with an Operators Pendant. This Pendant has all the controls necessary to Select Weld Schedules and passes, set up the weld head for operation, start/stop the weld, reset faults and make overrides before and during the weld.

1. **LIBRARY (LBRY)** - Key is used to access Weld Schedules.
2. **CLEAR (CLR)** - Used to clear entries and reset faults.
3. **ENTER (ENT)** - Used to engage an entry.
4. **ID#** - Used to enter the Weld Identification number.
5. **PRE WRAP** - Used to engage the Auto Wrap Function
6. **SET** - Used to engage the Set Function.
7. **OSC MAN** - Used to engage Oscillator Manual Mode which will, when not in sequence, cause the Oscillator to move at the weld schedule program rate and amplitude.
8. **MAN PURGE** - Used to engage the Gas Solenoid when not in sequence.
9. **WELD TEST** - Sets system to TEST Mode or WELD Mode.
10. **LAMP** - Used to turn the illuminating lamps on and off for torches with vision systems.

11. **TVL MODE** - Allows operator to change Travel Direction or turn Travel OFF.
12. **WIRE ON/OFF** - Allows operator to turn Wire Feed On or OFF.
13. **SEQ START** - Used to Start Weld Sequence.
14. **MAN ADV** - Used to advance the Sequence from one level to the next level.
15. **STEERING** - Thumb Wheel is used to steer or set the Torch Oscillator Position.

16. **SEQ STOP** - Used to Stop the Weld Sequence and engage Downslope
17. **ALL STOP** - Used in welding emergency to stop the weld sequence and engage Postpurge.
18. **ARROW UP/DOWN** - Used for changing values during overrides.
19. **AMPS** - Used for overriding Current.
20. **AVC** - Used for overriding AVC setting.
21. **EXC** - Used to override Osc Excursion time and/or Osc Amplitude
22. **DWL** - Used to override Osc IN and/or OUT Dwell time.
23. **TVL** - Used to override Travel Speed.
24. **WIRE** - Used to override Wire Feed Speed.
25. **AVC RESP** - Used to change AVC Response Setting.
26. **PLS TIME** - Used to override Pulse Times.
27. **TVL CW JOG** - Used to jog the Travel in the CW direction
28. **TVL CCW JOG** - Used to jog the Travel in the CCW direction
29. **WIRE FEED JOG** - Used to manually FEED wire.
30. **WIRE RETR JOG** - Used to manually RETRACT wire.
31. **AVC UP JOG** - Used to move the Torch (AVC) UP.
32. **AVC DOWN JOG** - Used to move the Torch (AVC) DOWN.
33. **EMERGENCY STOP** - Electronically turns the main breaker on the M-415 OFF.

4.6 OTHER SYSTEM FEATURES

1. **PRINTING** - The M-415 can be connected to any Windows 95 compatible parallel port printer and hard copies of all weld schedules can be made. An auto print feature can be set up to allow the system to automatically print a copy of the Weld Parameters used (including overrides) after each sequence.
2. **MEMORY MEDIUMS** - The M-415 has a Built-in 1 GB (or greater) hard drive.
3. **DATA BACK UP** - All information contained in the system hard drive can be backed up through a variety of methods.
4. **PASSWORD/SECURITY lockouts** - If desired various degrees of security can be set up to control who can change what.
5. **CALCULATE FUNCTIONS** - System can auto create Fusion weld schedules and also provides a weld calculator to help with the common math functions associated with weld schedule development.
6. **SOFTWARE UPGRADES** are done via Floppy or PC Option download via USB.
7. **METRIC/ENGLISH CONVERSIONS** - Most functions that have units of measure can be set to be programmable in both English or Metric units.
8. **LANGUAGES** - The user can set up different language files and translate any or all English text to their language or languages of choice.
9. **PROJECT DATA** - As standard the M-415 can collect information about a weld including the following:
 1. Weld Identification Number
 2. Welder/Operator Identification name or number
 3. Date, and time of weld pass
 4. Date and time of print out.
 5. Weld Head Model and serial number used.
 6. Power Supply Serial numberThis information can be printed along with the weld parameter after a Weld Sequence.
10. **FUNCTION DATA ACQUISITION** - As standard the M-415 provides the following Weld Data Collection and/or outputs.

1. Standard 6 function analog output connector for chart recorders (Amps, Travel, Wirefeed, AVC, OSC, Arc Voltage at the power supply)
2. Post Sequence Print capability with Program values/over-ridden values and actual peak/min/average values for that pass.
11. INPUT/OUTPUTS (I/O) - The M-415 will provides the following input and output signals.
 1. External Sequence Start Input
 2. External Sequence Stop input
 3. External Emergency Stop Input
 4. External Osc Steering Input
 5. Remote Fixture Start output
 6. Remote Fixture Desired Speed analog output
 7. External Hot Wire PS Sequence Start Output
 8. Desired Gas Flow Rate Output
12. SYSTEM and ARC HOURS - Electronically records the System ON time and Arc Hours.

4.7 WELD SEQUENCE

Although the M-415 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 must be obtained before the arc is initiated. The time it flows before the arc is struck is called the PREPURGE TIME.
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-415 will stay in LEVEL 1 until this time is complete. If the TIMER MODE is set to MANUAL or POSITION or EXT 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 (MAN ADV) or the Weld Head reaches the programmed position or an external command is received to advance to the next Level.
 2. WELD CURRENT START LEVEL - As the arc is established the weld current will jump to a small value. This 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 (from the Start Level value) 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.
 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 struck 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.
 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.

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.

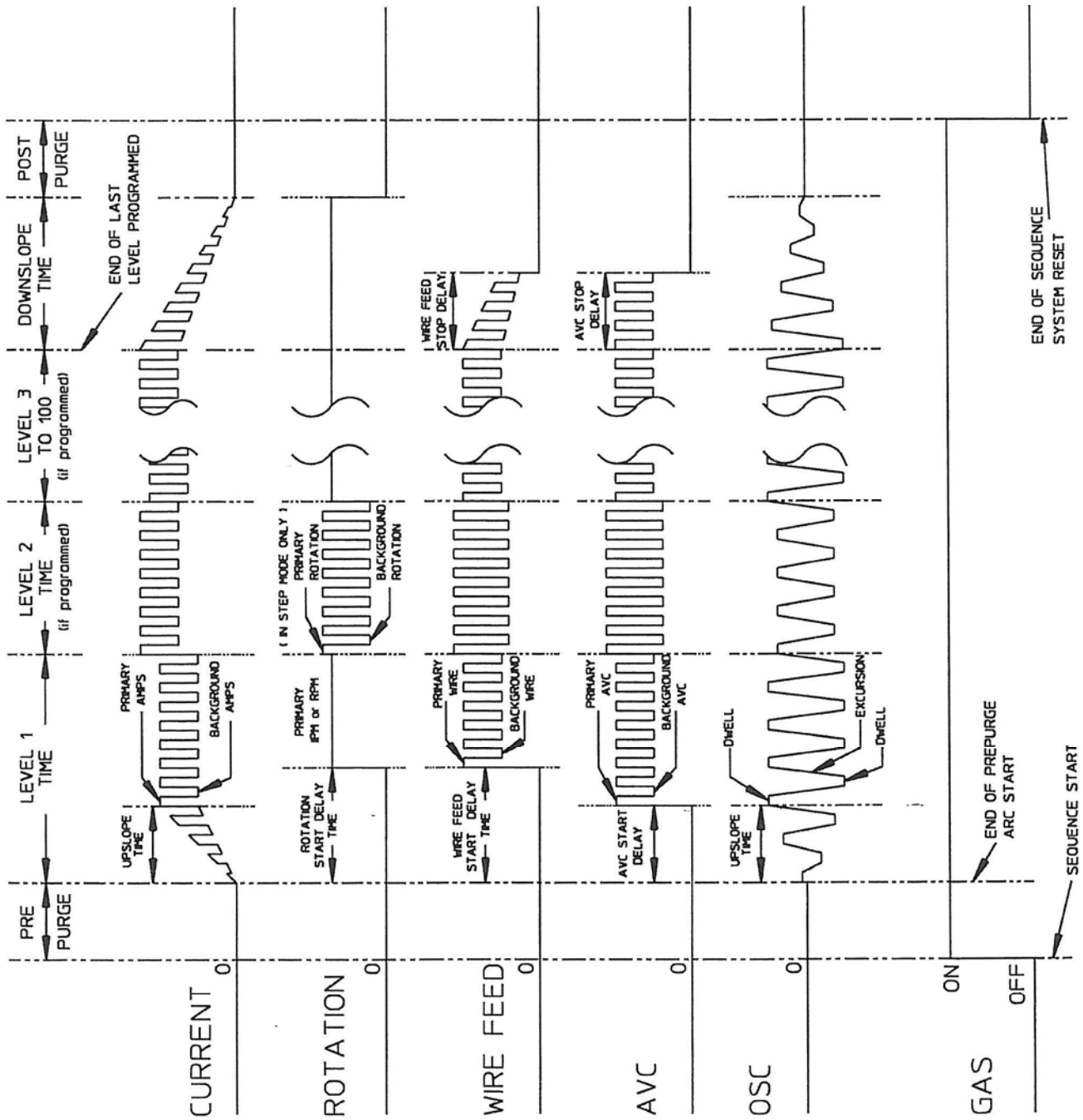
13. LEVEL 1 PRIMARY AVC - After the AVC START DELAY time is complete and the AVC MODE is in CONT or SAMP/PRI. the AVC will maintain this value during the Primary current.
14. LEVEL 1 BACKGROUND AVC - After the AVC START DELAY time is complete and the AVC MODE is in CONT or SAMP/BCK the AVC will maintain 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.
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 amp) 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 amp 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.
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, etc.) 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.



SEQUENCE TIMING CHART

FIGURE 5

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 operators have INSTALLED the M-415 per section 3 and that they have a good understanding of functions from section 4. Function explanations are not covered in this section.

The M-415 uses a 640 by 480 Color VGA LCD Touch screen display 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-415 TRAINING CLASS.**

5.1 INITIAL POWER ON/LOGO SCREEN

1. Before connecting or energizing the AC power; verify that all input power set up and installation requirements of Section 3 of this manual have been complied with.



WARNING



MAKE SURE THE INPUT POWER SET UP IS CORRECT FOR THE POWER BEING USED.

2. The M-415 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 3.
3. Plug in the AC power cable to the AC source. Move the circuit breaker (CB-1) to the ON position.
4. After a few seconds the LOGO SCREEN will appear as shown in Figure 4. From this screen all system operations will begin.

NOTE

If the input power is too low it is possible for the screens not to turn on or be scrambled. If these conditions occur recycle CB-1. If they continue to occur check the input power and the power setup of the M-415.

5.2 POWER SUPPLY CALIBRATION INTRODUCTION

The following M-415 Power Supply calibration procedure is intended for calibration and certification of system performance by the user. Except Current and AVC Servos all system operations are controlled by microprocessor and do not require field calibration. Any time repairs or replacements are done to the Current servo, AVC, or reference voltage PCB, calibrations must be checked. It is also good practice to check calibration after shipping from one location to another.



WARNING



All personnel attempting to calibrate, trouble-shoot, or repair this power supply must be familiar with its operation. They must understand the circuits and have a complete understanding of their controls and interrelationships. Components in these circuits are static sensitive, basic electronic procedures must be followed to prevent handling damage!

All personnel must be aware of the location of hazardous voltage-carrying conductors, terminals, and heat sinks. Any recording equipment connected to any points in the machine or to the weld head may be exposed to extremely high transient voltages at the time of arc initiation. ***ENSURE ALL TEST EQUIPMENT IS DISCONNECTED DURING ARC START.***

This procedure is considered a guideline and should only be performed ***AFTER HAVING ATTENDED AN AMI M-415 MAINTENANCE TRAINING CLASS.***

5.3 REQUIRED EQUIPMENT FOR M-415 CALIBRATION.

1. Digital Multi-meter (DMM) with a minimum of a 4 ½ digit readout. Suggested: Fluke Model 87 or equivalent with clip lead attachments. The meter must have floating inputs (not connected to input power or chassis ground) of a minimum of one (1) Megohm impedance. Battery operated devices are preferred.
2. Adjusting screw driver or slotted trim pot adjusting tool (4 inches long or less).
3. Any Weld Head, resistive load or hand torch able to sustain 400 Amperes for several minutes and a pipe or surface that can sustain the welding current without melting away. For AVC calibration the Weld Head must have the AVC function (400 Amp rating required).
4. In place of the above mentioned weld heads or hand torch AMI makes an Optional External Current Shunt with or without a Variable Carbon Resistive Load (call AMI Sales Dept. for part number and availability).

5.3.1 REQUIRED EQUIPMENT FOR WELD HEAD CALIBRATION

1. Dial Calipers.
2. Tape Measure.

5.4 MAIN REFERENCE VOLTAGE CALIBRATION

NOTE

To access internal PCBs remove the rear top cover of the M-415 Power Supply. This can be achieved by removing of the two (2) rear eyebolts and four (4) Phillips screws located at the sides of the panel. This will expose the upper deck section so that calibration test points and adjustment can be accessed.

1. Insure that the Power Supply is connected per section III of the M415 Operation Manual. Main Reference Voltage Calibration is done on the Analog I/O PCB, located under the Servo boards mounting plate. Three holes are provided in the plate between the C 0/1 and D 0/1 Servo mounting positions allowing access to test points and calibration potentiometer adjustment screw (Diagram 1).
2. Insert the positive probe into test point J-1 and the negative into J-15 (Ref. Drawing 13D150302-01).
3. Voltage reading should be 4.096 VDC \pm 0.001 VDC in the power up condition. If out of tolerance adjust the R9 Trim pot.

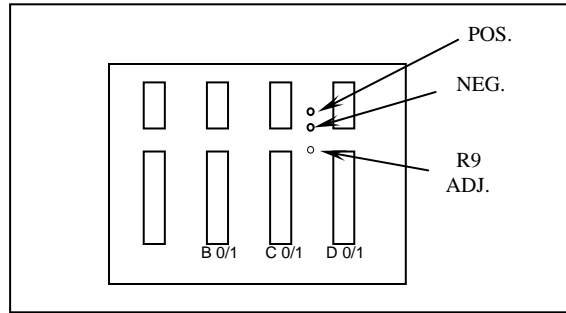


DIAGRAM 1

5.5 POSITION FEEDBACK REFERENCE CALIBRATION

1. Locate the PCB labeled **INTERFACE** on the Servo Mounting plate (13D150317-01).
2. Insert the positive probe of the DMM into TP-1 and negative probe into TP-2 (Diagram 2).
3. DMM should read 5.000 VDC \pm 0.010 VDC. If out of tolerance adjust the R-4 trim pot.

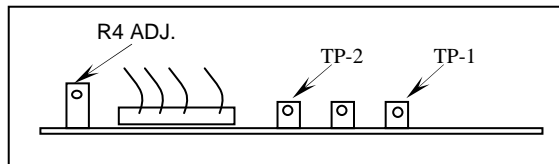


DIAGRAM 2

5.6 CURRENT CALIBRATION

NOTE

True verification of M-415 Power Supply current output for Quality Control purposes must be done with an External Calibration Shunt that is calibrated by an independent agency to a national standard. An External shunt adequate for this use is available through AMI as an option.

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

A weld schedule is required for the following calibrations. The first time a calibration is done, it will be necessary to CREATE a Calibration Weld Schedule. Each section will outline all pertinent schedule elements need. It is recommended that a single schedule be made with each calibration section programmed as a separate pass.

1. Insure that the Weld Head or Hand Torch is connected per section III of the M415 Operation Manual. (Tip: Use a copper block as a work piece.)
2. To calibrate Current the user will need to have a Weld Schedule in the Library for the M-415 and applicable Weld Head, (Pass 1). If using the optional AMI Carbon Load or Hand Torch Welding voltage must be maintained between 9 and 15 volts (approximately 1/8th inch Arc Gap). Also the template will have the following differences:

- **THE STUBOUT MODE MUST BE SET TO OFF**
- **THE GAS FLOW MUST BE SET TO 0 CFH**
- **THE START MODE SHOULD BE SET TO RF**

3. The Weld Current calibration schedule will be run in **WELD** Mode and will contain the following:

Onelevel Functions

Prepurge	10	Torch Gas Rate	40*
Upslope	1.0	Start Level	25
<hr/>		Num Starts	1
Postpurge	20	Level Advance	Manual
Downslope	5.0	Stubout Mode	On*
Start Mode	Touch*		

Multilevel Level 1 Functions

Pri Amps	200	Bck Pulse	10.0
Bck Amps	200	Pulse Mode	OFF
Pri Pulse	10.0	Travel Step	OFF

Multilevel Level 2 Functions

Pri Amps	400*	Bck Pulse	10.0
Bck Amps	400*	Pulse Mode	OFF
Pri Pulse	10.0	Travel Step	OFF

*Maximum torch value of 300 amps – use 300 amps here. Step 5.6-6-9 value would then be 3.75 VDC +/- 0.037 VDC.

4. Level Time will be in the Manual Mode requiring the operator to Sequence stop the M-415 after measurements and any required adjustments are done. Pulse Mode should be OFF so only the Primary Current Amps is checked. The Primary Amps should be set to 200 for the Initial measurement. Insure that the Travel Mode switch is set to OFF. It is very important the calibration measurements are done quickly, so not to melt the work piece. **A suggestion is to make the necessary connections to the PCB test points and disconnect the test leads at the DMM until an arc is established.**
5. Recall from the LIBRARY the appropriate Calibration Weld Schedule.
6. CURRENT CALIBRATION WITHOUT EXTERNAL SHUNT
1. Connect the negative test lead to TP-2 and the positive test lead to TP-1 of the weld current servo. The Current Servo (P/N 13D150300-01) can be accessed through an opening in the upper deck plate just below the Interface PCB.

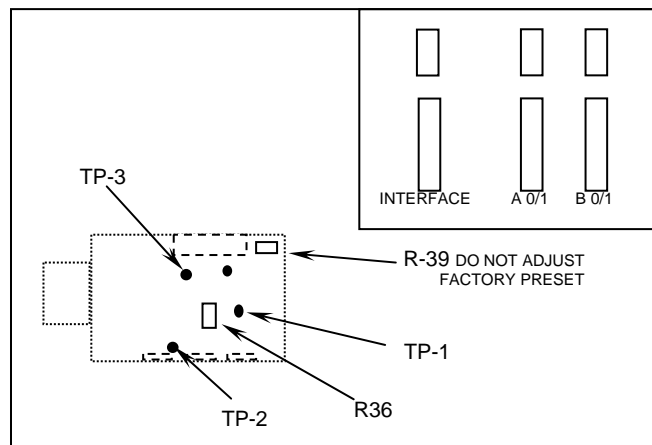


DIAGRAM 3

2. Set the System Mode to WELD. Press Sequence Start.
3. The DMM should read $5.000 \text{ VDC} \pm 0.010 \text{ VDC}$. If out of tolerance call AMI Service for "DAC" calibration instructions.
4. Press SEQ. STOP key to end Welding Sequence.
5. Move the positive test lead to TP-3.
6. Set the System Mode to WELD. Press Sequence Start.
7. The DMM should read $2.50 \text{ VDC} \pm 0.025 \text{ VDC}$. If out of tolerance adjust trim pot R-36.
8. Press MAN ADV. to level 2.
9. The DMM should read $5.00 \text{ VDC} \pm 0.05 \text{ VDC}$. If out of tolerance call AMI Service..
10. Press SEQ. STOP key to end Welding Sequence.

7. CURRENT CALIBRATION WITH EXTERNAL SHUNT

1. The following current calibration procedure outlines a second method using a certified optional External Shunt available from AMI (P/N 1368246-01 shunt only or 1368248-01 shunt/ load bank kit). Following voltages and tolerances assume that shunt is 1 amp/mV at 0.1%.
2. Connect External Shunt into ground path cabling of weld head or load.
3. DMM test leads must be connected only after Welding Current is established!
4. Set the System Mode to WELD. Press Sequence Start.
5. Insert the DMM positive test lead into red test jack and the negative lead into the black test jack of the Shunt after Welding Current is established.
6. The DMM should read $200 \text{ mV DC} \pm 2 \text{ mV}$. If out of tolerance adjust trim pot R-36.
7. Press MAN ADV. key to select level 2 (400 amps).
8. The DMM should read $400 \text{ mV DC} \pm 4 \text{ mV}$. If out of tolerance call AMI Service.
9. Press SEQ. STOP key to end Welding Sequence.
10. Move the positive test lead to TP-3 and negative lead to TP-2.
11. Set the System Mode to WELD. Press Sequence Start.
12. The DMM should read $2.50 \text{ VDC} \pm 0.025 \text{ VDC}$. If out of tolerance adjust trim pot R-39.
13. Press SEQ. STOP key to end Welding Sequence.

5.7 ARC VOLTAGE CONTROL (AVC) CALIBRATION

NOTE

A weld schedule is required for the following calibration. The first time a calibration is done it will be necessary to CREATE a Calibration Weld Schedule. This section will outline all pertinent schedule elements needed. (Pass 2)

1. Insure that a Weld Head with AVC is connected per section III of the M415 Operation Manual.

NOTE

A weld schedule is required for the following calibration. The first time a calibration is done it will be necessary to CREATE a Calibration Weld Schedule. This section will outline all pertinent schedule elements needed. (Pass 2)

2. Insure that a Weld Head with AVC is connected per section III of the M415 Operation Manual.
3. The AVC Calibration is done on the AVC / OSC PCB (P/N 13D150313-01) located on the Servo PCB mounting plate in labeled slot B 0/1. Locate the AVC adjustment trim pot R-40 on the PCB (diagram 4). **DO NOT ADJUST TRIM POTS R-80 AND R-81** (these are factory calibrated for use with special application weld heads or fixtures not discussed in this section).

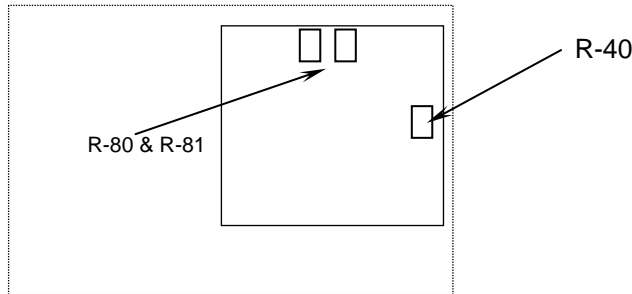


DIAGRAM 4

4. To calibrate the AVC the user will need to have a Weld Schedule in the Library for the M-415 and applicable Weld Head, (Pass 2).
5. The AVC calibration schedule will be run in the **WELD** Mode and will contain the following:

Onelevel Functions

Prepurge	010	Torch Gas Rate	20
Upslope	01.0	Start Level	25
AVC Start Delay	1.0	Num Starts	1
<hr/>		Level Advance	Manual
Postpurge	010	Stubout Mode	On
Downslope	05.0	Start Mode	Touch
AVC Stop Delay	1.0	AVC Resp	15**
		Osc Mode	OFF

**Note: For M-415 Software Revisions prior to Rev. 1.43, use an AVC Response of five (5) in place of the pictured AVC Resp 15.

Multilevel Level 1 Functions

Pri Amps	200	Bck AVC	10.0
Bck Amps	200	Pulse Mode	OFF
Pri AVC	10.0	AVC Mode	Cont.

- Level Time will be in the Manual Mode requiring the operator to Sequence Stop the M-415 after measurements and any required adjustments are done. Pulse Mode should be OFF so only the Primary AVC is checked. The Primary Amps should be set to 200 for the AVC measurement. Insure that the Travel Mode switch is set to OFF. It is very important for calibration measurements are done quickly, so not to melt the work piece. Since the AVC measurement is taken from an exposed section of the torch like water power connectors(-) to the work ground (+). Find a position that allows access without getting arc flash during voltage measurements.
- Recall from the LIBRARY the appropriate Calibration Weld Schedule.
- Set the System Mode to WELD. Press Sequence Start.
- ATTACH THE DMM LEADS AFTER ARC INITIATION!** The DMM should read 10.0 VDC \pm 0.1 VDC. If out of tolerance adjust trim pot R-40 of AVC/OSC Servo.
- Press SEQ. STOP key to end Welding Sequence.



WARNING

DO NOT ADJUST ANY TRIM POTS INSIDE THE M-415 THAT ARE NOT OUTLINED IN THIS SECTION! Trim pots not out lined in this section are factory presets that **DO NOT REQUIRE FIELD CALIBRATION.** If you think someone has made adjustments to a factory preset trim pot call **AMI Service Department** for immediate support.

5.8 WELD HEAD CALIBRATION INTRODUCTION

The following general weld head calibration procedure depends on a fully calibrated M-415 Power Supply. Once a weld head's Wire Feed and Travel Tachometers are calibrated to a M-415 it can be moved from one M-415 to another M-415 without needing to be re-calibrated. However, if any motor assembly components are repaired, replaced or calibrated to a different Model Power Supply (M-227, M-215) they must be re-calibrated. If in doubt calibration should always be checked to insure correct operation. To check the Travel or Wire Feed calibration of a Weld Head perform the following steps:



WARNING

Before doing any calibrations on the Weld Head you must verify that the **POWER SUPPLY "SERVO CALIBRATION ADJUST" SETTINGS ARE SET TO ZERO!** On the M-415 Tool Bar select "Tools" then unlock tools, select "Calibration". The screen should display the "Servo Calibration Adjust. Note any values for future reference. Reset any value to be calibrated to zero (0). Save and proceed with the calibration.

- Insure that the weld head is connected per section III. Travel calibration is done by moving the torch and measuring actual speed, Wire Feed is done by running wire and measuring. Before proceeding **CHECK THAT THE WELD IS FREE TO OPERATE SAFELY.**

- 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.

5.9 WELD HEAD TRAVEL CALIBRATION

- A Travel calibration schedule will always be run in **TEST** Mode and usually contains the following:

Onelevel Functions

Prepurge	000	Level Advance	Time 1.0
Upslope	00.0	Start Mode	RF
Wirefeed Start Delay	00.0	WF Retract	0.0
Travel Start Delay	00.0	Travel Direction	CCW

Postpurge	000		
Downslope	00.0		
Wirefeed Stop Delay		00	
Travel Stop Delay	00		

Multilevel Functions (Level 1)

Level Time	***	Pri Amps	005
Pulse Mode	OFF	Pri Wirefeed	000
Pri Travel	***	Travel Step	CONT

Multilevel Functions (Level 2) For weld Heads with the return to home function Only!

Level Time	005	Pri Amps	005
Pulse Mode	OFF	Pri Wirefeed	000
Pri Travel	0.0	Travel Step	OFF

INSURE THAT THE WELD/TEST MODE IS IN TEST

- ***Level 1 Time needs to be set for rotating weld heads (programmed in RPM) the time to rotate ONE REVOLUTION at the selected LEVEL 1 Primary Travel Speed. For weld heads programmed in IPM (such as a Model 15), the Level 1 Time needs to be set to give a measurable travel distance in inches or millimeters. It is suggested to check calibration at a speed close to typical welding speeds being used and adjust the Level 1 time accordingly.

Level 2 is added with Travel turned OFF. This allows the operator time to see if the distance traveled is correct before the "Return to Home" function engages at the end of the Sequence (on some heads). LEVEL 2 CAN BE OMITTED FOR WELD HEADS THAT DO NOT HAVE A RETURN HOME FUNCTION .

- 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 or traveled the programmed amount.
- If it has not rotated or moved the correct distance then adjust the Weld Head Rotation/ Travel Calibration Potentiometer.
- Repeat 5 and 6 until the head is calibrated.

5.10 WELD HEAD WIRE FEED CALIBRATION

NOTE

Once a weld head has had its Wire Feed and Travel Tachometers calibrated to an M-415 it can be moved from one M-415 to another M-415 without needing to be re-calibrated. However, if the motor assemblies have been repaired, replaced or calibrated to a different Model Power Supply (M-227, M-215) they may need to be re-calibrated. If in doubt they should always be checked to insure that they are calibrated. To check the Wire Feed calibration of a Weld Head perform the following steps:

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 Wire Feed calibration schedule will always be run in TEST Mode and usually contains the following:

Onelevel Functions

Prepurge	000	Level Advance	Time 1.0
Upslope	00.0	Start Mode	RF
Wirefeed Start Delay	00.0	Wirefeed Retract	0.0
Travel Start Delay	00.0	Travel Direction	CCW
<hr/>			
Postpurge	000		
Downslope	00.0		
Wirefeed Stop Delay	00		
Travel Stop Delay	00		

Multilevel Functions

Level Time	60	Pri Travel	0.0
Pri Amps	000	Travel Step	CONT
Pri Wirefeed	100 (IPM)	Pulse Mode	OFF

NOTE

Insure that all other programmable functions are not active or used during calibration.

INSURE THAT THE WELD/TEST MODE IS IN TEST

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 or equivalent meters (or a rate closer to actual weld schedules being used) . 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 of the 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 for 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 SYSTEM SECURITY

1. SECURITY LEVELS

Authorization and access to the CREATE, MODIFY and DELETE functions should be controlled. This control can be done via the password and login methods. There are 3 levels of System access:

1. **Programmer** = Allows the user to set up or alter all user defined and controlled items including Weld Head Templates, changing and adding passwords.
2. **Supervisor** = Allows the user to create and edit weld schedules, libraries and groups and add other operators to the system. The supervisor level cannot alter Weld Head Templates or add other supervisors or superuser's to the system.
3. **Operator** = Is limited to only selecting and operating weld schedules and standard system features. Operator level security prevents the user from making any permanent changes to weld schedules or creating new weld schedules.

CAUTION

If you do not set up password and security levels then anyone can DELETE or alter Weld Schedule information.

2. CHANGING/EDITING/ADDING LOGON and PASSWORDS

NOTE

The M-415 is shipped defaulted to the Supervisor level of security and logging in is not required. It is recommended to create a new programmer Logon at once and delete AMI superuser.

The following steps are for initial set up upon installation. Once the Superuser Logon and password have been changed these steps will not work as written.

1. From the AMI Logo Screen Main Menu go to the "File" and select "Log On". A dialogue box titled "User Logon" will appear. Enter the Logon name of **ami** (lower case) and the password of **superuser** (also lower case). Select OK.
2. A dialogue box with confirming date and access level will appear. Select OK. The Main Logo screen will reappear and changes to Security can now be made.
3. From the Main Menu go to "Edit" and select "Edit Users". A dialogue box titled M415 Security Administration will appear and the list box will show only one user named "Default Logon" with a logon of **ami** and a security level classification of Programmer.
4. Select Edit User, a dialogue box titled "M415 Security User Profile" will appear. use this box to overwrite the default ami/superuser logon information with your new superuser user name/logon/password. Be sure to keep the access classification as Programmer. Select OK. A password confirmation screen will appear, enter your new password again. Select OK.
5. The Security List box will now show your new name/Logon and Classification.
6. Once you have entered your new "programmer" level logon and password you can now use the "Add User" function to add more users. The process is the same as above.

7. At this time you should also decide whether or not everyone should logon or if you want to allow a certain level of access without logon. As the system was supplied from the factory no logon is required and everyone can have "Supervisor" Level of security.
8. If you wish to change this, from the M415 Security Administration dialogue box select "Advanced". A log on required check box and two default logon radio buttons will appear. Selecting Logon Required will require everyone to have a logon and password just to operate the system. If you do not want everyone to logon then select the level (supervisor or operator) that they will have without logon.

5.12 PROJECT DATA RECORDING

The M-415 has the ability to record the following information and automatically print out this information, along with the weld parameters used, at the end of each weld sequence:

1. Weld Head Model Number used.
2. Weld Head Serial Number used.
3. Weld Name or ID number.
4. Power Supply Serial Number used.
5. Note field
6. Date and Time of Printout
7. Date and Time of Weld Pass Sequence in WELD mode.

Items 1, 2, 3, 4 and 5 must be supplied by the user. To enter this information touch the control panel icon (farthest right on tool bar) and then touch PROJECT DATA.

5.13 GENERAL MAINTENANCE

NOTE

Calibration of the entire M-415 system is contained in the calibration section of the M-415 Maintenance Manual. Weld Head Travel and Wire Feed Calibration is contained in steps 5.10 and 5.11 of this section.



WARNING



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

1. AIR FILTERS - The M-415 power supply has two (2) foam air filters behind a single screen in the front of the power supply. Inspect these air filters regularly. To inspect, remove the two captive screws at the top of the screen and tilt the screen forward to expose the filters. The foam filters may be removed, washed in water and detergent, dried and reused or replaced. Do not operate unit without filters in place.
2. COOLANT - The coolant tank in the M-415 holds approximately 2.5 gallons. Check coolant level periodically. Using different weld heads will remove coolant from the tank over a period of time. Fill the tank per instructions of section 3.
3. Cleaning exterior and interior surfaces - Prolonged use in a 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 input power 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-415 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 and must be replaced.

5.14 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.

1. TEMP - The M-415 has internal temperature probes. If the Power Supply exceeds maximum operating temperature 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. 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.

3. COOLANT - Monitors the coolant flow out of the torch cooling unit. If it is not at least 0.2 GPM a 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 pump or flow switch is possible, contact an AMI Service Representative.

4. SENSOR 1, 2, - These faults must be turned on and set up by the user. Contact whoever set them up.
5. 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, 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 arc gap to get too small in the first place.

6. 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.
7. BAD START - If for any reason the M-415 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 tungsten, dirty tungsten, etc. The RF is transmitted from the M-415 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 properly.

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.

8. ILLEGAL OPERATION – From time to time the Windows Operating system has been known to perform an "illegal Operation" which will essentially freeze the processor and prevent any type of operator input or control. Every effort has been made to eliminate as many of these as possible. However, it is still possible for an "illegal Operation" to occur. If it does the system, if in Sequence, will automatically create a downslope and display the "illegal Operation" dialogue box.

If not in weld sequence just the dialogue box will appear. If this occurs the user must turn the power supply off and then on again to re-boot the system.

5.15 RE-SHIPPING

CAUTION

DRAIN COOLANT from POWER SUPPLY AND ALL HOSES BEFORE SHIPPING.

1. The Coolant Tank on the Model 415 Power Supply is not designed as a shipping container. If the machine is tipped or oscillated coolant liquid may be released into the power supply workings, damaging internal components.
2. The Coolant in hoses may freeze causing tubing to split during transportation.

CAUTION

Used Coolant is considered a hazardous waste. Dispose of used coolant and or materials used to clean up coolant spills or leaks in a manner approved by your local governmental regulations.

3. The M-415 is shipped new in a re-usable shipping container. This container should be saved and re-used when ever transporting the M-415. If the original container is not available then consult a factory service representative for approved shipping and packing methods.

5.16 SELECTING AND CREATING LANGUAGES - CUSTOMIZING SCREEN/FUNCTION NAMES

Some of the text that appears on the M-415 display is derived from Windows but most of the text seen is contained in the M-415 Operating (or Remote) Software. This software also contains a program called "Language Translation". This program allows a user to either customize text to their own preference or to change the text to another language file that can be used instead of English

NOTE

Text that is derived from Windows can be changed to another language only by changing the Windows version (French, German, etc.) or by selecting the language in the Pan European Windows version.

1. SELECTING A LANGUAGE – Many languages are already contained in the Language Folder and can be selected to be displayed instead of English. Perform the following steps to Select the Language File of choice.

NOTE

These steps are the same for M-415 Operating Software using the M-415 Display or for M-415 Remote Software using a PC.

1. From the AMI Logo Screen main menu select "Setup". From the drop down menu select "System". A dialogue box titled "M415 Power Supply – System Setup" will appear.
2. Use the combo box located under "Language" to select the language file you wish to change to.
3. Press OK. A "Message Box" will appear noting that you need to exit the program and re-start it before the new language will appear.

NOTE

If the language file you want does not appear in the combo box then it either does not exist or has not been transferred from the "Language Translation" Program. See 5.17.2 (next) and 5.17.3 for instructions on how to create and transfer language files.

2. CREATING or EDITING A LANGUAGE FILE

NOTE

A Language file can only be created or edited on a PC using M-415 Remote Software. A Language file cannot be created or edited on a M-415 Power Supply itself.

To translate the English text to another language or to create custom function names a language file must be created.

1. From the "Start" button select Programs and then select "M415 Power Supply" and then select "Language Translation"
2. After the program loads go to "file" and pick "open". A list box will appear showing all of the existing language files. A new language file cannot be created from scratch. It must be copied from an existing file and then edited.
3. Select the language file you wish to edit or copy and then select "Open".

4. A List Box will appear that contains every individual line of text contained in the M-415 software. Use the scroll bar to move up and down and find the text you wish to edit. (if your creating a new language just start at the first line). Using the mouse, double click (left key) on the line to be edited.
5. A dialogue box called "Edit Language Text" will appear with the text to be edited and a line to enter the translation or custom name. Type the changes desired and then select OK. Scroll to the next line to be edited. Continue until all desired lines have been edited.
6. When done, go to "file" and select "save as". The "Save As" dialogue box will appear and you can then type the new "file name" in (such as "Russian.Ing") and then select "Save".

NOTE

This program does not feature "Auto Save". Be sure to save your work frequently and always save before exiting the program.

3. TRANSFERRING A LANGUAGE FILE FROM THE LANGUAGE PROGRAM TO THE M-415

Once a Language File has been created it must be transferred to the M-415 and to the M-415 Remote Software (on the PC).

1. ON THE PC

1. Using M-415 Remote Software logo screen main menu select "Tools". Then select "Language File Transfer"
2. A dialogue box titled "Select Files to Copy and Press Open" will appear. The list box will show the language files that are available. Select the language file that is not already in the program (such as the one you just edited or created) then select "Open".

Another dialogue box will open titled (Select Destination Folder). In the list box next to "Look in:" use the scroll key and find "Program Files – Arc Machines, Inc – Languages". Select OK. This will put the new language file into the Language Folder and make it selectable.

You will now be able to follow the steps of 5.17.1 (Selecting a Language) to select the new language. Do not forget that after you have done that you must exit the program and re-start in order for the new language file be in effect.

2. ON THE M-415 POWER SUPPLY

1. Insert a USB data storage device with the desired language file into the M-415 USB port.
2. From the AMI Logo Screen Main Menu select "Tools" then select "Language File Transfer". A dialogue box will appear. In the list box labeled "Look in" use the scroll function and go to "3-1/2 Floppy (A:) and select the desired files and press open.

Another dialogue box will open titled (Select Destination Folder). In the list box next to "Look in:" use the scroll key and find "Program Files – Arc Machines, Inc – Languages". Select OK. This will put the new language file into the Language Folder and make it selectable.

You will now be able to follow the steps of 5.17.1 (Selecting a Language) to select the new language. Do not forget that after you have done that you must exit the program and re-start in order for the new language file be in effect.

5.17 CREATING AND EDITING WELD HEAD TEMPLATES

When creating a weld schedule the system will ask you to select what weld head (model/name) the weld schedule will be used with. This determines the degree of weld schedule functionality (current only, wire feed, avc, levels, sensors, etc) and special features. If the model number you have does not appear and no other model number has the same exact features then a new Weld Head Template must be created.

NOTE

Creating and editing a Weld Head Template can only be done by someone with a "programmer" level of Logon and Password entry.

1. CREATING A WELD HEAD TEMPLATE

1. After using the correct Logon and Password select "Setup" from the main menu. Then select "Edit Weld Heads". A "Weld Head Wizard" dialogue box will appear.
2. Select "File" in the active menu and then select "New". A "Create New Weld Head" box will appear. Enter the Weld Head name or Model number to be used.
3. Under head type there are three buttons. If the Weld Head to be created is a typical pipe Weld Head (Travel, AVC, OSC, Wire Feed), etc. then select "Typical Pipe". If the Weld Head is typical Tube (rotation only for fusion welding) select "Typical Tube". If almost everything about the weld head is unique then select "Blank". When done select OK.

A dialogue box called "Weld Head Wizard – (the model number you entered)" will appear. Setting up the Weld Head Wizard is now basically an "Editing function". At this point proceed to 5.18.2.3 for editing information.

2. EDITING A WELD HEAD TEMPLATE

1. After using the correct Logon and Password select "Setup" from the main menu. Then select "Edit Weld Heads". A "Weld Head Wizard" dialogue box will appear.
2. Select "File" in the active menu and then select "Open". An "Open Weld Head" box will appear. Use the scroll bar to find the weld head you wish to edit. Highlight it and select OK. This will open the Weld Head Template for editing.
3. When a Weld Head Template has been opened the Weld Head Wizard will display a box that defines the weld head functionality. From this box the user can:
 1. Define "Coolant Used" – If the weld head is liquid cooled this box should be checked.
 2. Define "GND Fault Used" – If the weld head has a ground fault sense this box should be checked.
 3. Define "Start Mode" – Some weld heads are RF start only. Some are Touch start only and some are capable of both. Select the button that applies.
 4. Define "Head Position" - If the weld head has a feedback device for displaying weld head position then check the "Enabled" box. If checked then select "Edit" under the box to Unit of Measure, Digital or analog feedback and feedback voltage scale.
 5. Add notes – Select this button to note any special conditions or information about this weld head.

4. Using the Main Menu of this same Weld Head Wizard Box the user can:

1. Add a servo – Select "Edit" and then select "Add Servo". A "Create New Servo" box will appear and you will need to fill in the:
 1. Servo Name
 2. Servo Slot – There are a possible 8 servo positions in the M-415 (AO,A1,B0,B1,C0,C1,D0,D1). Enter the position being added.
 3. Servo Function – This box will set the basic servo to a Position type, velocity type, jog only type, etc. Select the type of servo it is and then select OK.
2. Edit a servo – Highlight the servo (in the combo box) to be edited. Select "Edit" and then select "Edit Servo". A Tab dialogue box will appear with multiple tab selections to set Unit of Measure, feedback type and range, programmable range, Jog functions and speed. Go through each tab and make the settings that match the weld head being entered.
3. Delete a servo – Highlight the servo (in the combo box) to be deleted. Select "Edit" and then select "Delete Servo". A dialogue box will appear and ask you to confirm that you wish to delete the servo. Select OK..
4. Set Manipulator functions – With the optional Manipulator Card installed there are up to 8 open loop/current limited servos that can be used for motor functions such as jogging, pre-positioning and locking. They are typically used to operate wire feed manipulator motors for wire position adjustment during welding. These servos must be defined as to their function, voltage range and current limits.

To set a manipulator select "Edit" and then select "Manipulators Defs". A tab box with 8 tabs (one for each manipulator slot) will appear. Select the tab for the Manipulator to be activated then check the "Used" box. This will activate the definition slots to define name, program value for voltage and current limits. Program as required and then select OK.

5. Set Pendant 4 way arrow Button function – On the pendant there is a 4 way arrow button that is intended, but not limited too, control of Wire Feed Manipulator Jogging. Which Manipulators are controlled (and when) by this switch are set with this feature. Select "Edit" and then select "Pendant Buttons". A tab dialogue box will appear.

There is a tab for "Travel CW". This sets the switch functions when the weld head is traveling in the clock-wise direction. There is a tab for "Travel CCW". This sets the functions when the weld head is traveling in the counter clock-wise direction. There is also a tab for "OFF". This sets the functions when the weld head is not moving (travel OFF).

Select the "Travel CW" tab. There are 4 button positions (up, down, left right), across from each is a Manipulator box with popdown choices and a Direction Box with popdown choices.

The choices that appear are based on the Manipulators that have been set to "Used" (see 5.18.4.4). Across from "Up" select which manipulator and which direction you want the function to move when the "Up" arrow is pressed while the head is rotating CW. Continue this process for Down, Left, Right and then repeat for CCW and OFF travel directions.

6. Set Preferences – Whether or not a function is programmable as a single or multi-level value is determined by the "Preferences" section of the Weld Head.

Preferences can also be used to change the order that they appear on the screen.

To set preferences select "Edit" and then select "Preferences". A combo box with the functions that can be changed will appear. Highlight the function to be changed and select "Edit" (under the box). A dialogue box with buttons for One Level, Multi-level or Eliminated will appear. Select the desired button and select OK.

Select "Next" and a combo box will appear showing all the multi-level and single level functions in the order they appear on a weld schedule. To change the order, click and drag the function to the desired order of appearance. Select "Finished".

5.18 CMOS Battery Replacement

1. Required Equipment

#2 Phillips screw driver
CR2032 battery
Document 45D150143

2. Procedure

Power off the M415 Power Supply

Using the screwdriver, remove the front and rear top covers

Locate the CMOS battery on the motherboard (Note: the M415 will have either an EP811 or a SBC84710 motherboard – reference Figures 6 and 7)

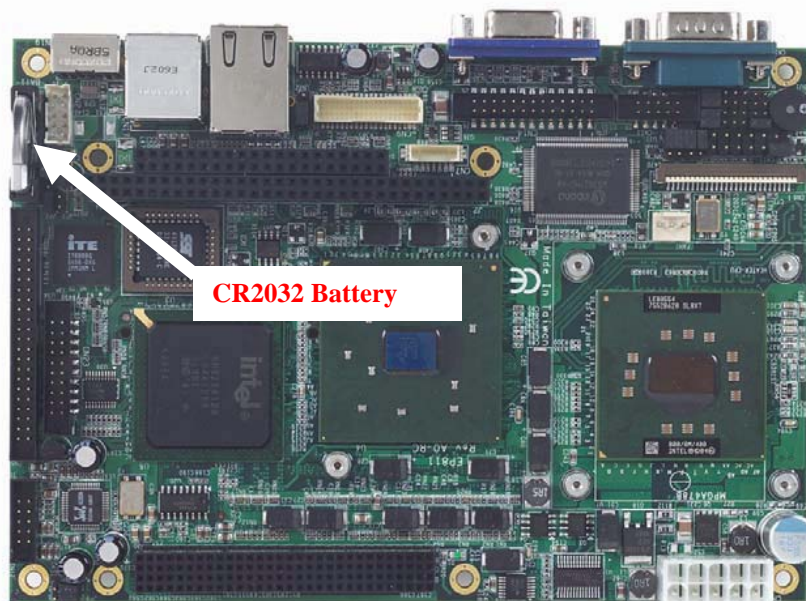


Figure 6 EP811 Motherboard

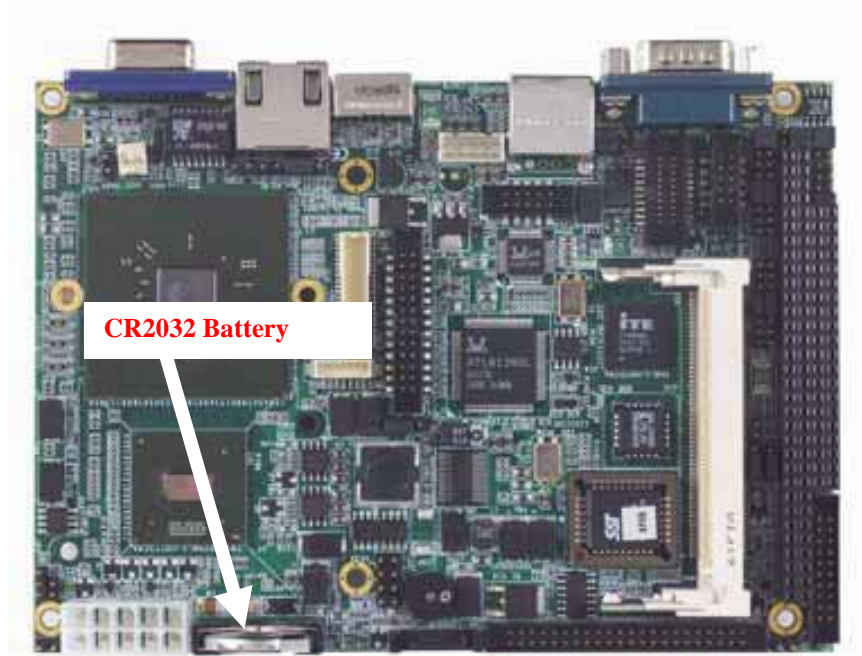


Figure 7 SBC84710 Motherboard

Replace the battery

Replace the front and rear top covers

Referencing document 45D150143, power on the M415 and enter the BIOS settings to reconfigure the motherboard.

When the boot up is complete verify that the M415 is fully functional

It is recommended to replace this battery annually