System Manual

XM Series

ADVANCED MANUFACTURING ENGINEERING TECHNOLOGIES

WORLD CLASS WELDING AUTOMATION

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1. Foreword

Welcome to the AMET XM series of automated welding products. These systems are designed to meet the most demanding applications. The XM System Automation allows precision digital control over the entire arc welding process in a variety of applications, large and small. This manual is intended to provide users of the AMET XM Systems with general information on the setup, operation, and care of their systems.

1.1. XM Controls Covered

The following manual covers software, electrical, and mechanical information for the following models:

Table 1-1, XM Controls in Manual

Model Number	Description
XMC	XM Weld Controller 2nd Generation, Software: 4.1.10b and later
X-PS	Power Supply Module
X-PS-VP	VP Module
X-VC	AVC Module
X-Linear	Linear Axis Module
X-OSC	Oscillation Module
X-ROTARY	Rotation Module
X-WF	Wire Feed Module
X-DIGITAL	Digital I/O Module
X-HW	Hotwire Module
X-PS-AL	Lincoln Power Supply
X-META	Meta Vision System
X-TR	Turning Roll Module
X-CNC	CNC Module

More or fewer functions may be present in this system depending on the hardware configuration and the age of the software.

1.2. Important Information About This Manual

Throughout this manual these icons will highlight specific information related to each category.

Table 1-2, Information Icons

Icon	Function
	**Caution -** Highlights items that can cause damage to the system and/or injury to operators.
	**Note** - Highlights or reviews important information and general points of interest.
	**Tip** - Identifies programming suggestions and operational information for the XM System.
	**Safety -** Identifies specific safety concerns. These items may vary depending on how the system is equipped; however, general safety practices remain constant in all situations and environments.

1.3. Customer Service Assistance

If you are experiencing difficulty with your system for specific technical issues, or questions concerning the setup, operation, calibration, or maintenance of the XM System, please contact AMET Technical Support at 208-356-7274.

2. General Safety

The following safety precautions are not fully inclusive of all the safety that could be practiced in a welding environment. Please identify and follow the additional regulations applicable for your locale.

2.1. Arc Welding Safety Precautions

It is very important to read and understand all the Material Safety Data Sheets (MSDS) for all substances you work with and around. **This is your responsibility!**

Failure to follow all safety guidelines can cause serious injury or death and may damage the system.

ARC WELDING MAY BE HAZARDOUS.

Protect yourself and others from possible serious injury or death!
Keep children away at all times!
Pacemaker wearers keep away until you have consulted your doctor.

Welding exposes the user to certain hazards. However, this practice can be safe when precautions are taken. The following safety information only summarizes the more complete safety information found in the Principal Safety Standards manuals listed at the end of this section.

ELECTRIC SHOCK CAN KILL

Touching live electrical parts may cause fatal shocks or severe burns. The electrode and work circuit are electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire and torch are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

1. Do not touch live electrical parts.
2. Wear dry, hole-free insulating gloves and body protection.
3. Use dry insulating mats or covers to insulate yourself from work and ground.
4. Disconnect input power before installing or servicing the equipment.
5. Properly install and ground any equipment according to its Owner's Manual and national, state, and local codes.
6. Turn off all equipment when not in use.
7. Ground the work piece to a good electrical (earth) ground.
8. Do not touch electrodes while you are in contact with the work (ground) circuit.
9. Use only well maintained equipment. Repair or replace damaged parts at once.
10. Keep all panels and covers securely in place.

ARC RAYS CAN BURN EYES AND SKIN
NOISE MAY DAMAGE HEARING

Arc rays from the welding process produce intense heat and strong ultraviolet rays that will burn eyes and skin. Noise from some processes can damage hearing.

1. Wear a welding helmet fitted with a proper shade of filter (see ANSI Z49.1 listed in the Safety Standards) to protect your face and eyes when welding or watching.
2. Wear approved safety glasses. Face shields are recommended.
3. Use protective screens or barriers to protect others from flash and glare; warn others not to watch the arc.
4. Wear protective clothing made from durable, flame-resistant material (wool and leather) and foot protection.
5. Use approved earplugs or earmuffs if the noise level is high.

FUMES AND GASES CAN BE HAZARDOUS TO YOUR HEALTH

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

1. Keep your head out of the fumes. Do not breathe fumes.
2. If indoors, ventilate the area and/or exhaust welding fumes and gases from the arc.
3. If ventilation is poor, use an approved air-supplied respirator.
4. Read the Material Safety Data Sheet (MSDS) and the manufacturer's instructions for metals, consumables, coatings, and cleaners.
5. Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Shielding gases used for welding can displace air, causing injury or death. Be sure the breathing air is safe.
6. Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
7. Do not weld on coated metals (such as galvanized, lead, or cadmium plated steel) unless the coating is removed from the weld area, the area is well ventilated, and if necessary, while wearing an air-supplied respirator. The coating and any metals containing these elements can give off toxic fumes if welded.

FLYING SPARKS AND HOT METAL CAN CAUSE INJURY

Chipping and grinding cause flying metal. As welds cool, they can throw slag.

1. Wear approved face shields or safety goggles. Side shields are recommended.

2. Wear proper body protection to protect skin.

WELDING CAN CAUSE FIRE OR EXPLOSION

Sparks and spatter fly off from the welding arc. The flying sparks and hot metal, weld spatter, hot work piece, and hot equipment can cause fires and burns. Accidental contact of electrode or welding wire to metal objects can cause sparks, overheating, or fire.

1. Protect yourself and others from flying sparks and hot metals.
2. Do not weld where flying sparks can strike flammable material.
3. Remove all flammables within a minimum of 35 ft. (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
4. Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
5. Watch for fire and keep a fire extinguisher nearby.
6. Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
7. Welding sealed containers such as tanks or drums is very dangerous. Expanding gases within the container can cause explosions.
8. Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock and fire hazards.
9. Remove stick electrode from holder or cut off welding wire contact tip when not in use.
10. Wear oil-free protective garments such as leather gloves, heavy shirt, cuff-less trousers, high shoes, and a cap.

CYLINDERS CAN EXPLODE IF DAMAGED

Shielding gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

1. Protect compressed gas cylinders from excessive heat, mechanical shocks, and arcs.
2. Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
3. Keep cylinders away from any welding or other electrical circuits.
4. Never allow a welding electrode to touch any cylinder.
5. Use only correct shielding gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
6. Turn face away from valve outlet when opening cylinder valve.
7. Keep protective cap in place over valve except when cylinders are in use or connected for use.
8. Read and follow instructions on compressed gas cylinders, associated equipment, and CGA publication P-1 listed in Safety Standards.
9. Near the top of the tank each cylinder has a label, which identifies its contents by name, and a brief symbol, which identifies safety concerns.

MOVING PARTS CAN CAUSE INJURY

Moving parts, such as fans, rotors, and belts can cut fingers and hands or catch loose clothing.

1. Keep all doors, panels, covers, and guards closed and secured in place.
2. Have only qualified people remove guards or covers for necessary maintenance and troubleshooting.
3. To prevent accidental starting during servicing, shutdown the entire system, which includes turning off the power supply.
4. Keep hands, hair, loose clothing, and tools away from moving parts.
5. Reinstall panels or guards and close doors when servicing is finished and before starting equipment.

HOT PARTS CAN CAUSE SEVERE BURNS

Avoid any contact with all HOT materials and substances.

1. Allow a cooling period before handling, moving, or servicing.
2. Use approved techniques, tools, and safety clothing (gloves, shields, shoes, eye protection, etc.).

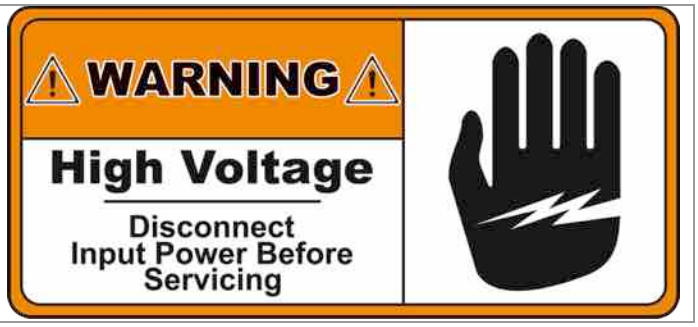
STEAM AND PRESSURIZED HOT COOLANT CAN BURN FACE, EYES, AND SKIN

The coolant in the radiators and pressurized hoses is under pressure and can be very hot.

1. Wear gloves and put a rag over cap area when accessing system.
2. Allow pressure to escape before completely opening system.
3. Treat all hoses, hot or cold, with caution. Pressure can cause injury.

ELECTRICAL SHOCK CAN KILL

This identification label is used to call attention to immediate or imminent conditions, which if not avoided, will result in serious injury or death. Have only QUALIFIED personnel install, operate, repair, or perform any maintenance on this equipment.



AUTOMATED AND ROBOTIC EQUIPMENT MAY MOVE UNEXPECTEDLY AND CAUSE SERIOUS INJURY OR DEATH AT ANY TIME

Observe all perimeter boundaries for all automated equipment at all times.

1. Keep all guards, doors, covers, panels, and shields securely attached at all times.
2. Stop entire system when performing any maintenance, repair, installation, or inspections.
3. Observe all Safety Lines and Limits at all times.
4. Wear appropriate safety gear when operating any function of this equipment.
5. If a malfunction occurs:
    a. Shut down the entire system.
    b. Contact the system manager immediately.
6. If the standard system motion becomes obstructed, DO NOT ATTEMPT to clear the obstruction yourself. Follow procedures described in #5.
7. Shortcuts can cause serious injury or death and may damage the system.
8. In all situations **THINK** before you act.

LASER CAN SEVERELY DAMAGE EYES!

Avoid looking into Laser Eye. Avoid viewing the laser from reflective surfaces.

INHALING TUNGSTEN DUST CAN HAVE SERIOUS LONG-TERM HEALTH RISKS

Electrodes on TIG welding systems are typically made out of tungsten. Do not inhale tungsten grind dust! Avoid grinding stations when possible.

1. Ensure proper ventilation.
2. Wear properly cared for respirator if sufficient ventilation is not available.
3. Protect skin from exposure to tungsten carbide dust by wearing protective gloves.
4. Wear eye protection.

Principal Safety Standards

- Safety in Welding and Cutting, ANSI Standard Z49.1, from American Welding Society, 550 N.W. LeJeune Rd, Miami FL 33126
- Safety and Health Standards, OSHA 29 CFR 1910, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
- Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances, American Welding Society Standard AWS F4.1, from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
- National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
- Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
- Code for Safety in Welding and Cutting, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
- Safe Practices For Occupation And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 1430 Broadway, New York, NY 10018
- Cutting And Welding Processes, NFPA Standard 51B, from National Fire Protection Association, Batterymarch, Quincy, MA 02269

3. System Startup

The following procedure describes the startup process for a typical XM welding system.

Caution: Prior to energizing the system and clearing the E-Stop function be sure to check all moving parts to ensure there are no blockages or obstacles in the way.

The procedure described below is defined for a "typical" XM Control Welding system. Procedural concerns for a specific system may vary; therefore, it is the responsibility of all operators and maintenance personnel to contact the System Manager for "in-house" procedures for safety procedures.

Table 3-1, System Startup Procedure

#	Step	Description
1	Check Power State	Verify the system is in a non-energized condition by confirming that the High Voltage Indication light directly above the Main Disconnect handle is NOT illuminated. If the light is illuminated, the system already has power applied.
2	Press E-Stop Button	Ensure the Emergency Stop (E-Stop) button is depressed on the XM Weld Controller. This prevents any sudden equipment movement when power is applied.
3	Turn On Main Disconnect and SPPD	Switch the Main Power Disconnect (typically on the wall adjacent to the system) to the ON, or up, position. Rotate the power handle on the front door of the Single Point Power Distribution (SPPD), if supplied in the system, or Main Disconnect cabinet (depending on configuration) to the ON position. This will power up the entire system. All electronics should begin their starting sequence at this time. Most XM controls and modules should be up and running within a minute. Additional computers for use of a vision system or other features may add additional time to startup.

4. System Power Down and Lockout Procedure

The following procedure is for powering down the system with a lockout device. If the facility the system is located in does not practice the Lockout/Tagout protocols, then ignore those steps, but be informed that AMET Inc. recommends practicing the Lockout/Tagout procedure to minimize risk of electrical shock. In the case of the facility not practicing the Lockout/Tagout procedure, steps 4 through 10 may be skipped.

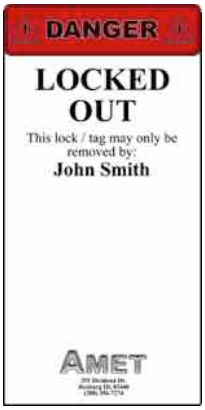
Caution:	When "homing," or moving any axis, ensure all axes are free from obstructions, including cabling, hoses, and tools.

Table 4-1, Power Down and Lockout Procedure

#	Step	Description
1	Press Home All button	From the XM Controller, press the Home All function button to send each of the axes to their mechanical home position.
2	Press E-Stop button	Press the Emergency Stop (E-Stop) button on the XM Weld Controller. The system can now be powered down safely.
3	Turn Off SPPD/Main Disconnect	Rotate the power handle on the front door of the Single Point Power Distribution (SPPD) (if supplied in system) or Main Disconnect cabinet (depending on configuration) to the OFF position. Switch the Main Power Disconnect, typically on the wall adjacent to the system, to the OFF, or down, position. This will power down the entire system.
4	Add Lockout Device	Place a lockout device (Figure 4-1 Item 1) into the disconnect handle if equipped
5	On the Lockout Device:	Place Personnel Lockout / Tagout Danger Tag (Figure 4-2).
6		Check that the personnel information on Lockout / Tagout Danger Tag is current and correct.
7		Update any prudent remarks on the tag
8		Secure the Lockout / Tagout Danger Tag with an approved padlock to the lockout device
9		Remove personnel key from the padlock and place in a secure location
10		Check that the padlock is fully engaged and secure
11	Check Power State	Verify the system is in a non-energized condition by observing that the High Voltage Indication light directly above the Main Disconnect Handle is NOT illuminated.

Figure 4-1, Power Disconnects

Figure 4-2, Typical Lockout Tag



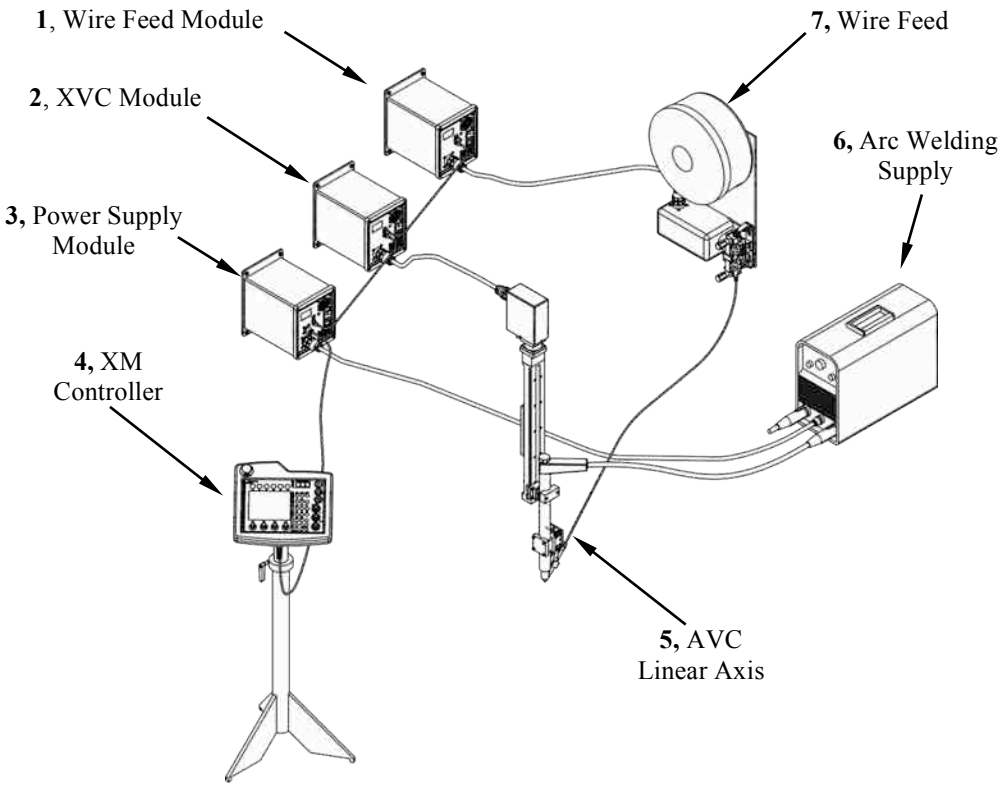
Caution:	It is extremely important that verification of a non-energized condition is performed before any service or maintenance occurs.

Tip:	Please refer to OSHA Lockout / Tag Out regulations (29 CFR 1910.147) for specific requirements.

5. Basic Components

An XM system must include at least two components: an XM Weld Controller (XM Controller) and a Power Supply Module. With these two components installed, automated welding can proceed. With each additional module, the XM Controller immediately recognizes the module and enables the module's functions for programming. The modules are connected together in a manner that allows the XM Controller to identify and control each module contained within a system. Figure 5-1 shows a basic XM system with an XM Controller and three XM modules controlling a welding power supply, an AVC linear axis, and a wire feed motor.

Figure 5-1, Basic XM System



5.1. XM Control Modules

Figure 5-2, XM Power Supply Control Module (XPS)

Each XM Control Module (or XM Module) is designed to control a specific component of the system (such as a welding power supply or rotation of a lathe). This makes for powerful real-time monitoring of the system as well as extremely low latency control over all automated processes. All the modules in the

system are “daisy chained” together to connect them to the XM Weld Process Controller. Using CAN bus protocol, all linked modules communicate with the Controller to provide data feedback and command processes throughout the system. Each module is preprogrammed with the necessary software to carry out all the functions required to perform its duties.

On the front panel of each module is an array of receptacles as well as an LCD screen. All models have a power input connector with a corresponding power switch, In/Out Ethernet ports, and a CPC connector. An additional 10-pin connector is present on some models, such as the XPS Power Supply module for the XM Weld Controller to plug into.

5.1.1. XM Module Specifications

Table 5-1, Module Specification Table

Specification	Value	
	Imperial	Metric
Width	6.5 in	16.5 cm
Height	7.75 in	19.7 cm
Depth	9.75 in	24.8 cm
Weight	6 lbs	2.75 Kg
Input Voltage	120 VAC	
Phase	Single Phase	
Frequency	60 hz	
Max Current	5 Amps	

5.2. Remote Modules

Miniaturized versions of XM Control Modules are sometimes used for minimizing the system's footprint as well as cutting down on cabling being run throughout the system. These modules vary by form depending on the application they are used in, but all modes, parameters, and welding sequences on the XM Controller work identically to the standard XM Modules, so no special considerations must be taken in programming.

Figure 5-3, Remote X-Feeder Module

Table 5-2, Remote Module Connections	
Connection	**Description**
Power	DC power is run through this cable.
Can Bus In/Out	Communication to and from the module is run through the In and Out Can Bus connections. Remote modules can be daisy chained together like standard XM modules.

Table 5-3, Remote Module Lights	
Light	**Description**
Power	When this green light is on, power is applied to the module.
E-Stop	When this red light is on, the system is in an emergency stop condition. Pull up all the E-Stop buttons on the system and clear the E-Stop soft button on the XM Weld Controller to resolve the situation.
Fault	When this orange light is on, there is a motor fault or following error on the corresponding axis. If this light comes on, press the Stop sequence button or the E-Stop button. If that does not reset the fault, cycle power to the entire system (be sure to wait at least twenty seconds between power down and startup. If the condition continues, please call AMET Customer Service at (208) 356-7274.
Term	When this amber light is on, the module is last in the module chain and is successfully terminated.

5.3. XM Weld Process Controller

The XM Weld Process Control pendant (or XM Controller or simply the Controller) (Figure 5-4) is the command center of the XM System. XM-integrated automation can be programmed, controlled, and monitored from this intuitive pendant. Weld data with graphical representation of parameters are displayed on the 6.4” TFT screen. Input is entered via the soft buttons, function buttons, sequence buttons, joysticks, and programming knobs.

Figure 5-4, XM Weld Controller

5.3.1. XM Controller Specifications

Table 5-4, Controller Specification Table

Specification	Value	
	Imperial	Metric
Width	12.25 in	31 cm
Height	11.25 in	28.5 cm
Depth	3.25 in	8.25 cm
Weight	6.5 lbs	2.9 kg
Input Voltage	11 – 65 VDC	
Max Current	9.3 A	

6. Using the XM Weld Controller

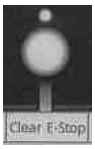
This section describes the XM Controller and how to use it as an automation tool. Controller and module preferences and settings are addressed in Set Up Mode while weld programs (or schedules) are built in Edit Mode, then executed in Weld Mode.

Figure 6-1, XM Weld Controller

6.1. Controls Descriptions

6.1.1. Emergency Stop Button

The Emergency Stop (E-Stop) button (Figure 6-1 Item 1) immediately aborts the weld program, stops weld current output from the power supply, and ceases all servo-controlled motion. The shield gas will remain flowing until the end of the Post Weld segment to prevent oxidization of the weld piece. The system remains inactive until an operator pulls out the Emergency Stop button and pushes the Clear E-Stop soft button.



Caution:	The Emergency Stop button should be used to avoid damaging the system or to avoid injuries. It is not intended as a common procedure for stopping the system.

6.1.2. Soft Buttons

Each soft button (Figure 6-1 Item 2) has a corresponding label or grey area (indicating an inactive button) on the LCD screen. Based on the selected Mode (Weld, Edit, or Set Up) and the screen within that mode, the function of the soft buttons will change. Details are explained in each corresponding section.

6.1.3. Mode Buttons

The Mode buttons (Figure 6-1 Item 3) (Weld, Edit, and Set Up) put the controller into its corresponding mode of operation. Controller and module preferences and settings are addressed in the Set Up Mode while weld programs (or schedules) are built in the Edit Mode, then executed in Weld Mode.

6.1.4. Sequence Buttons

The Sequence (Figure 6-1 Item 4) buttons (Start, Stop, and Advance) are used with the weld program. The Start button activates the current weld program. The Stop button terminates any running process or operation. If depressed during a weld program, the Stop button will advance the current weld segment to the down slope segment. If the program is already in the down slope, pressing the Stop button will terminate the program. The Next (or Advance) button's function depends on the weld program settings and can be depressed to progress to the next programmed event. The Advance button illuminates when it can be used to advance a sequence in the program.

6.1.5. Joystick Controls

The Joystick Controls (Figure 6-1 Item 5) command movement of their assigned axes. The joystick control has a proportional feature, meaning, the farther the physical joystick is moved along its throw, the faster the axis it commands will travel. Each Joystick is divided into two axes of motion: a vertical axis and a horizontal axis with corresponding labels. Each axis has programmable parameters (Command, High Speed, and Low Speed) and can be assigned to any axis. The following table shows a typical joystick setup.

Table 6-1, Joystick Controls Table

Joystick	Vertical Axis	Horizontal Axis
Top Joystick	XVC	X Slide
Middle Joystick	Travel 1	Travel 2
Bottom Joystick	Up/Down	Left/Right

6.1.6. Function Buttons

The Function buttons (Figure 6-1 Item 6) are quick access buttons to move positioners or axes, enable or disable process-specific functions, and control gasses. These buttons are divided into four sections: Disable, Gas, Motion, and Jog.

6.1.6.1 Disable Buttons

Disable buttons illuminate when active and stop the associated function. Pushing the illuminated button again re-enables the function and turns off the light.

Tip: From the Weld/No Weld Mode, the No Weld soft button will automatically activate Wire Disable and AVC Disable**.**

Table 6-2, Disable Button Table

Button	Function
	**Wire Disable** - Stops the wire feed from advancing regardless of the programmed feed rate. If wire is feeding when this button is activated, a programmed wire retract (in Set Up Mode section) is performed.
	**Oscillation Disable** - Suspends the programmed weld torch oscillation until the button is deactivated. The oscillation axis will return to the center (zero) point of the programmed amplitude.
	**AVC Disable -** Suspends AVC Control and allows the user to use the assigned joystick to control torch height.

6.1.6.2 Gas Buttons

Gas buttons illuminate when active and manually control on/off functions of the gas solenoids. Gas flows at the default rate when activated.

Table 6-3, Gas Button Table	
Button	**Function**
	**Plasma Gas** - Activates the plasma gas at the default flow rate. Plasma gas will flow at this rate until the button is deactivated or until the end of the weld program.
	**Back Gas -** Activates the back gas at the default flow rate. Backing gas will flow at this rate until the button is deactivated or until the end of the weld program.
	**Torch Gas -** Activates the torch gas at the default flow rate. Torch gas will flow at this rate until the button is deactivated or until the end of the weld program.

6.1.6.3 Jog Buttons

The Jog buttons incrementally move their assigned axis. When the Continuous Jog button is activated, the axis will continue movement until the same jog button is depressed again.

Table 6-4, Jog Buttons Table	
Button	**Function**
	**Travel Jog -** Incrementally moves or rotates an axis (assigned in Set Up Mode section) in a positive or negative direction.
	**Wire Jog -** Incrementally jogs the wire feed to advance or retract the weld wire.

6.1.6.4 Motion Buttons

The Motion buttons command movement functions on the system.

Table 6-5, Motion Button Table	
Button	**Function**
	**Set Position** - When this button is pressed, the Position 1 and Position 2 buttons are ready for programming. To program, position torch where desired, press Set Position, and then press a Position 1 or Position 2 button. The current position will be saved to the corresponding button.
	**Position 1 and Position 2 -** Moves the torch to a previously saved position (See "Set Position" above for programming). All motion axes involved in torch positioning will be affected.
	**Cross Home -** Moves the Cross Slide, typically the X-axis, to the physical home position and zeros the position readout.
	**XVC Home -** Moves the XVC Slide, typically the Z-axis, to the physical home position and zeros the position.
	**Home All** - Moves all integrated slides (or rotation devices) with Home capabilities to their physical home positions and zeros the position readout.

	**High Speed –** Illuminates when active and changes the jog speed of all motion axes that are controlled by joysticks to the programmed High Speed rate.
	**Continuous Jog** - Illuminates when active and is used in conjunction with the Jog buttons. With the Continuous Jog activated, the Travel Jog or Wire Jog buttons, once pressed, will operate continuously at the programmed rate until canceled. To cancel the Continuous Jog mode, either press the Stop button or deactivate the Continuous Jog button and then press the Travel Jog or Wire Jog button that was used to start the function.
	**Touch Retract** - Retracts the torch a specified distance from the weld piece. Touch Retract parameters (enable/disable and retract distance) are controlled by the weld program.

6.1.7. Soft Programming Knobs

The Soft Programming Knobs (or simply soft knobs) (Figure 6-1 Item 7) override weld program parameters in Weld mode. In Edit and Set Up Mode, the knobs navigate through the screen and adjust the settings. By rotating a knob clockwise or counter-clockwise, the operator can scroll through the display to reach a desired item and then increase or decrease a value. Each knob also acts as a push button by pressing down on the knob, which allows the operator to select different parameters depending on the current mode.

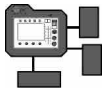
The soft knobs are velocity sensitive, meaning, when turned quickly, the values being adjusted will change at a faster rate. When turned slowly, the values will change as a slower rate. In Weld Mode, the knobs can be used to override weld parameters in real time.

6.1.8. LCD Display

The LCD Display (Figure 6-1 Item 8) presents the graphical interface screens on the 6.4” TFT screen. The Weld, Edit, and Set Up Modes and their program screens are described in detail in Section 6.2 Modes Of Operation.

6.2. Modes Of Operation

The XM Weld Controller has three (3) modes of operation; Weld Mode, Edit Mode, and Set Up Mode. Weld Mode displays the current weld program. All weld parameters are presented on this screen. In Set Up Mode the user can manage files, access network and controller settings, and assign functions to the joysticks. Edit Mode allows the user to create and edit weld programs. Weld mode allows the user to execute a weld program and monitor its progress.



6.2.1. Set Up Mode

Set Up Mode provides a series of menus and screens for the user to adjust and assign module and controller parameters.

To access Set Up Mode, press the Set Up button represented by the icon above. Set Up Mode displays four system Set Up options as soft button tabs: Modules, Meters, Joysticks, and System. Press the desired button to access one of the four screens with its available knob functions.

Table 6-6, Set Up Soft Buttons

Button	Function
Modules	This is the default screen brought up when Set Up Mode is entered. From here, each of the modules recognized by the controller are displayed. The user may calibrate module settings in this screen.
Meters	The Meters soft button allows the user to define each visible meter on the Weld Mode screen.
Joysticks	The Joystick soft button allows the user to define the Joystick and Jog button configurations.
System	The System soft button accesses system information (i.e. non-modular). This information includes: Date / Time, Weld Cell Name, Set Up Screen Password, Setup Screen Password, Ethernet Network, Wireless Network, System Info, and Locale.

6.2.1.1 Set Up > Modules Screen

The Modules screen has four sub-functions: Select Module, Calibrate, Configure, and More. The Calibrate and Configure knobs will not function until a module is selected in the scrolling pane.

Figure 6-2, Set Up > Modules Screen

Table 6-7, Set Up > Modules > Knobs Table	
Knob	**Function**
Select Module	The Select Module knob selects a module from the available modules list. Rotate the Knob to scroll up or down. The selected module is highlighted
Calibrate	Pressing the Calibrate knob brings up the Calibrate Screen. The left side of the screen shows the Parameters that can be adjusted and the Value of the current setting. To change the value of a parameter, rotate the Select Parameter soft knob to highlight the desired parameter, then rotate the Adjust Value soft knob to set the desired value.
Configure	The Configure screen allows the user to adjust the attributes and parameters on each of the modules connected to the Controller. Rotate the Select soft knob to select the desired Module. Press the Customize soft button at the top of the screen to enter the configuration screen.
More	Pressing the More knob brings up a menu with the following options: Download Firmware, Rename Module, Files, or Export Module Config.

(1) Set Up > Modules > Calibrate Soft Knob

Pressing the Calibrate knob enters the Calibrate screen to adjust parameters on the selected module. Parameters within the module can be adjusted to fine tune feedback and motion. AMET recommends that operators do not adjust these values without additional training unless directed by and AMET customer service representative.

Table 6-8, Set Up > Modules > Calibrate Soft Buttons Table	
Button	**Function**
Load	Displays the Load Program screen. This screen allows the operator to select a previously created weld program. The Location, Name, and Date of saved programs are listed in this window. Rotate the Select knob to highlight a weld program. Then press the Load **b**utton, or push the Select **k**nob.
Save	Displays the Save Program screen, enabling the user to save an existing program or create an alphanumeric name for the newly created program. Table 5-34 shows the steps to save a weld program, “AMET Weld Program.”
Close	Returns to the main Set Up screen.

Figure 6-3, Set Up > Modules > Calibrate

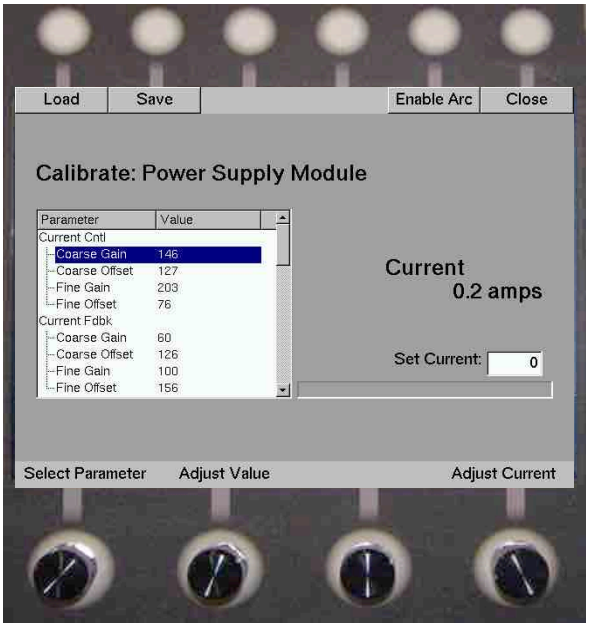


Table 6-9, Set Up > Modules > Calibrate Soft Knobs Table	
Knob	**Function**
Select Parameter	Selects a module-specific parameter to program.
Adjust Value	Adjusts the selected parameter.
Adjust Current	Sets the current to a specified value.

(2) Load Soft Button

The following are the steps (Table 6-10) to load a previously created weld program.

Table 6-10, How to Load a Weld Program	
Step #	**Description**
1	Open the Load screen by pushing the Load button.
2	Press the Cancel button to exit without saving.
3	Select the program to load found either on the internal memory or a USB flash drive.
4	Press the Load soft button

(3) Set Up > Modules > Configure Soft Knob

Pressing this knob enters the Configure screen for the selected module. The screen is divided into two windows. The left window lists the parameters and channels that are customizable. The right window shows the attributes of the parameter and the highlighted value assigned to that attribute. See Table 6-11 for explanations of attributes in modules.

Figure 6-4, Set Up > Configure Screen > Attributes

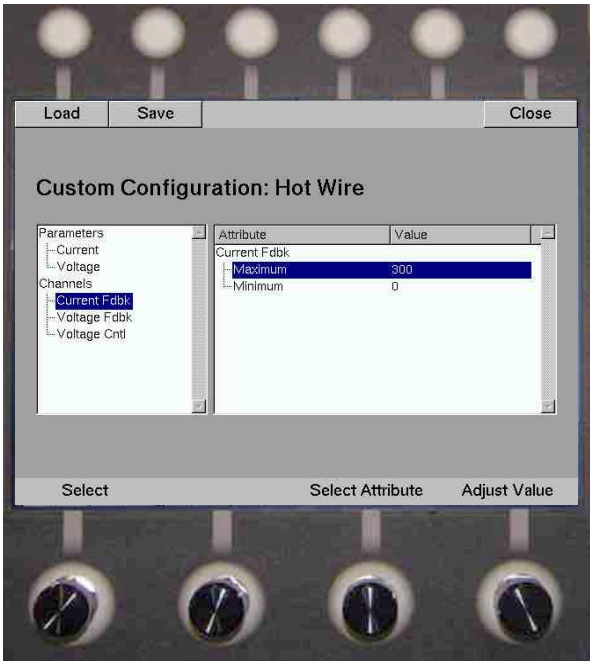


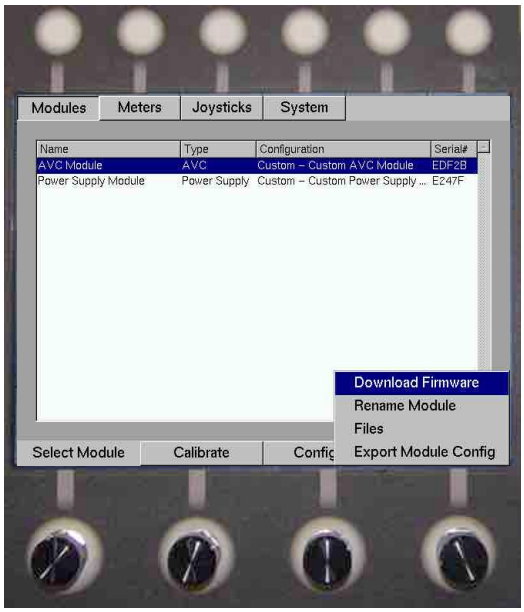
Table 6-11, Set Up > Modules > Configuration Attributes		
Parameter/ Channel	**Attribute**	**Function**
Parameters	Minimum	Defines the minimum input or output of the parameter highlighted. Typically matches the value of the corresponding channel in the Channel section.
	Maximum	Defines the maximum input or output of the parameter highlighted. Typically matches the value of the corresponding channel in the Channel section.
	Increment	Defines the incremental steps used when adjusting the Minimum and Maximum values.
	Default	Defines the default value of the parameter highlighted if not defined in the weld program.
	Meter Active	0 = No, 1 = Yes

Table 6-11, Set Up > Modules > Configuration Attributes		
	Override Active	0 = No, 1 = Yes
	Meter Averaging	Has a range of -4 to +4
Channels	Limit Direction	0 or 1. Defines travel direction of the axis toward the limit closest to the home limit as positive or negative. Dependent on how the slides and/or axes are mounted.
	Home Direction	0 or 1. Defines travel direction toward the home limit as positive or negative. Dependent on how the slides and/or axes are mounted.
	Direction	Defines which direction is positive or negative on the highlighted axis. Dependent on how the slides and/or axes are mounted.
	Default Velocity	Defines the default velocity (speed and direction) of the axis highlighted if not defined in the weld program.
	Default Acceleration	Defines the default acceleration rate of the axis highlighted if not defined in the weld program.
	Home Enable	0 = Home function not enabled 1 = Home function enabled
	Counts/Unit	Defines the encoder count on the accompanying slide.
	Max Velocity	Defines the maximum velocity the highlighted axis will reach.
	Max Travel	Defines the maximum distance the highlighted axis will travel (length of slide).
	Touch Retract Enable	0 = touch retract not enabled, 1 = touch retract enabled
	Arc Number	Defines which arc the highlighted module is assigned to (on multiple torch systems).
	Gas x Type	Defines flow rate of the highlighted gas type.

(4) Set Up > Modules > More Soft Knob

Pressing or rotating the More knob brings up a menu with the following options: Download Firmware, Rename Module, Files, and Export Module Config.

Figure 6-5, Set Up > Modules > More Menu



a) Set Up > Modules > More > Download Firmware

The Download Firmware option loads operating firmware to a module from the Controller. From the main Set Up screen, highlight the desired module. Press the More knob, highlight Download Firmware**,** and push the More knob again**.** A list of firmware loaded on the controller appears.

Use the Select knob to highlight the firmware to be downloaded. Press the Load soft button. A confirmation screen appears. If the information is correct, proceed by pressing the Yes soft button.

The controller tracks the loading process from 0 – 100%. While loading, the module's LCD screen will display a pinwheel-type graphic to indicate firmware being loaded.

Wait until the Controller emits a "Beep" to press the Close soft button. If not, the firmware will not load properly, and the process will need to be repeated.

Table 6-12, Set Up > Modules > More > Download Firmware Soft Buttons

Button	Function
Files	Allows the user to browse previously created weld programs and select one for use.
Load	Loads the selected firmware
Cancel	Returns to the main Set Up screen.

Figure 6-6, Setup > Modules > More > Download Firmware

Table 6-13, Set Up > Modules > More > Download Firmware Soft Knobs	
Knobs	**Function**
Select	Rotate to select the firmware to download onto the XM Controller.

b) Set Up > Modules > More > Rename Module

The Rename Module option displays an alphanumeric list to define a new module name.

Caution:	AMET strongly recommends that only those with proper qualifications and training attempt to Rename a Module. Serious performance problems can occur if not done correctly.

Table 6-14, Set Up > Modules > More > Rename Module Soft Knobs

Knobs	Function
Delete Char	When rotated clockwise, a character to the right is deleted. When rotated counterclockwise, a character to the left is backspaced.
Insert Char	Rotating the knob navigates the input cursor within the text box. Pressing the knob inserts the character that is highlighted below.
Select Char	Navigates the possible characters to insert into the text box. Pressing the knob inserts the character that is highlighted into the position the cursor is located.

c) Set Up > Modules > More > Files

Selecting the Files option will access the Manage Files screen. This allows an operator to locate and select a single file, multiple files, or all files stored on the XM Controller. To select a single file, rotate the "Select File" knob until the desired file is highlighted, then press the knob. To select additional files, highlight each file and press the knob. The selected files will remain highlighted. Files can then be uploaded to or downloaded from an external source thru a USB connection located under the cover on the right side of the XM Controller.

Figure 6-7, USB Ports

NOTE	**AMET** strongly recommends a periodic backup (copy) of all files to an external source. Individuals with the proper qualifications and training should perform this task.

Table 6-15, Set Up > Modules > More > Files Soft Buttons

Soft Button	Function
Show All	Displays all files stored on the source (usb or Controller internal memory).
Rename	Displays a screen to rename a selected file.
Delete	Permanently deletes the currently selected file.

Move	Moves (or transfers) a file from the source to the destination.
Copy	Copies the currently selected file to be saved from the source to the destination.
Close	Returns to the main Set Up screen.

Caution: Deleted files cannot be recovered! Be sure the selected file is supposed to be deleted!

Figure 6-8, Set Up > Modules > More > Files Screen

Table 6-16, Set Up > Modules > More > Files Soft Knob Table	
Knob	**Function**
Select Files	Scrolls through the file list. Press the knob to select a file.
Select All	Selects all the files in the list by pressing or rotating the knob.
Select Source	Displays “internal” unless an external device is attached to usb-1 port.
Select Dest	When an external device is attached, toggles between “internal” or “usb-1” when rotated.

Tip: The Copy/Move button will only function when the system detects an external storage device attached to the Controller, as defined in the Source and Destination fields.

d) Set Up > Modules > More > Export Module Config

The Export Module Configuration sub-function allows the user to create a file that contains all of the module configuration information. When exported to a USB drive, this file can be used in conjunction with XM Offline Editing software or another XM Controller.

Table 6-17, Set Up > Modules > More > Export Module Config	
Soft Button	**Function**
Files	Allows the user to browse previously created weld programs and select one to export.
Save	Saves the firmware to the selected save location.
Cancel	Returns to the main Set Up screen.

Figure 6-9, Set Up > Modules > More > Export Module Configuration Screen

Table 6-18, Set Up > Modules > More > Export Module Config	
Knob	**Function**
Select	Scrolls through the location list. Press the knob to select a save destination.
Delete Char	When rotated clockwise, a character to the right is deleted. When rotated counterclockwise, a character to the left is backspaced.
Insert Char	Rotating the knob navigates the input cursor within the text box. Pressing the knob inserts the character highlighted below.
Select Char	Navigates the possible characters to insert into the text box. Pressing the knob inserts the character that is highlighted.

6.2.1.2 Set Up > Meters Screen

The Meters screen allows the user to define each visible meter on the Weld Mode screen. The Meters screen has two sections: the left side containing meter names (Meter 0 thru Meter 7); the right side listing all available modules and their parameters. The modules only appear if they have a Meter Active setting "1" in the configuration file.

Eight (8) total meters can be defined and are visible in two (2) sets of four (4) at the bottom of the Weld screen. Meter 0 thru Meter 3 are shown by default in the Weld screen, while Meter 4 thru Meter 7 may be accessed by pressing the Meters soft button in the Weld screen. In the illustration, Meter 0 is assigned to the Power Supply Module-Current parameter.

Figure 6-10, Set Up > Meters

Table 6-19, Set Up > Meters Soft Knobs	
Knob	**Function**
Select Meter	Selects a meter to assign a parameter to.
Select Parameter	Selects a programmable parameter for the selected meter.

6.2.1.3 Set Up > Joysticks Screen

The Joystick soft button defines the Joystick and Jog button configurations. The XM Controller features 3 programmable joysticks, each with two axes of direction. The XM Controller also features two sets of Travel Jog function buttons and Wire Jog function buttons.

The Select Joystick knob scrolls through the joystick list on the screen's left side. Highlight a joystick and then use the Select Parameter knob to highlight the desired parameter. Use the Adjust Value knob to select from a list of assignable modules and values.

Table 6-20, Set Up > Joysticks Soft Knobs	
Knobs	**Function**
Select Joystick	Selects a Joystick or jog button to program.
Select Parameter	Selects a programmable parameter for the highlighted joystick.
Adjust Value	Adjusts the value of the selected parameter.

Figure 6-11, Set Up > Joysticks Screen

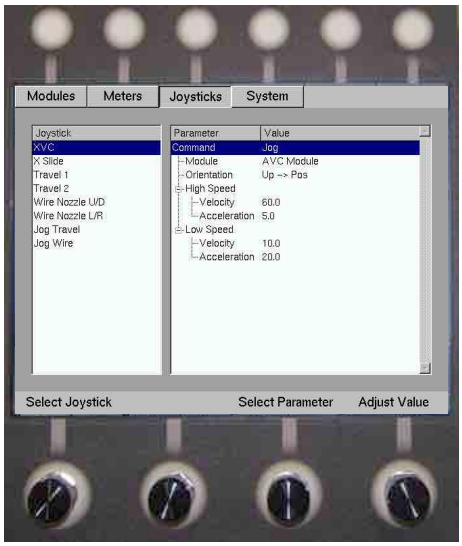


Table 6-21, Set Up > Joysticks Parameters		
Parameter		**Function**
Command		Toggles between a jog-based joystick or a digital output-based joystick.
Module		Assigns the selected joystick to a particular module.
Orientation	Up –> Pos	Up travels in a positive direction.
	Down –> Pos	Down travels in a positive direction.
High Speed	Velocity	Adjusts the high speed velocity
	Acceleration	Adjusts the high speed acceleration
Low Speed	Velocity	Adjusts the low speed velocity.
	Acceleration	Adjusts the low speed acceleration.
Continuous Jog	Yes	The continuous jog function will be enabled when this is selected.
	No	The continuous jog function will be disabled when this is selected.
Curve	xx%	Adjusts the proportional parameters of the joysticks. Leave at 50%.

Set Up > System Screen

The System soft button accesses system information (i.e. non-modular). Use the Select Knob to access the following options: Date / Time, Weld Cell Name, Set Up Screen Password, Setup Screen Password, Ethernet Network, Wireless Network, System Info, and Locale**.** Please refer to Table 6-23.

Figure 6-12, Set Up > System Screen

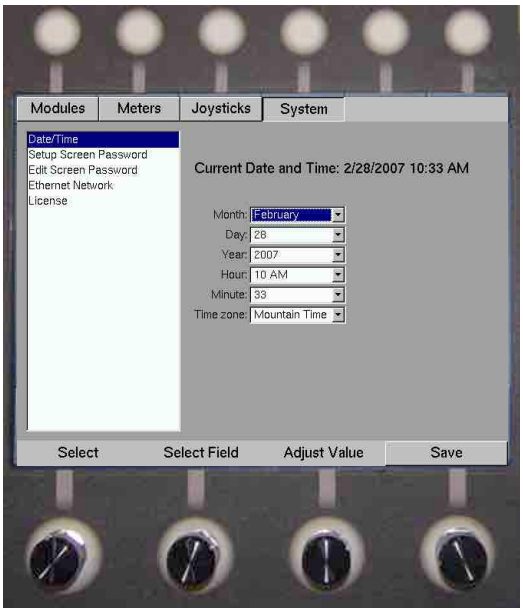


Table 6-22, Set Up > System Soft Knobs	
Knob	**Function**
Select	Scrolls through the list of System items in the left screen.
Select Field	Navigates from one field to the next in the right screen.
Adjust Value	Changes the existing value of a field once it has been selected.
Save	Permanently “saves” the current settings to a file for later retrieval.

Table 6-23, Set Up > System > System Info	
Item	**Description**
Date/Time	The system Date / Time screen sets the current month, day, year, hour, minute, and time zone of your location. Use the Select Field knob to select the field to be edited. Use the Adjust Value knob to enter the correct settings.
Weld Cell Name	Displays the name of the system, or weld cell.
Set Up Screen Password	The Set Up Screen Password screen serves two purposes. First, it displays a 4-digit field and an alphanumeric list to create a password. Second, password protection can be toggled on or off with the Password required for Edit Screen check box. This will prevent unauthorized access to the Set Up mode.
Setup Screen Password	The Edit Screen Password screen also serves two purposes. First, it displays a 4-digit field and an alphanumeric list to create passwords. Second, password protection can be toggled off or on from this screen with the Password required for Edit Screen check box.

	This will prevent unauthorized access to the Edit Mode. Note: The “Save” soft knob must be pressed prior to exiting the password window or the changes will not be remembered in the system.
Ethernet Network	Ethernet Network Access is a license-activated option. An Ethernet cable must be connected to the XM Controller and into an Ethernet port connected to the desired network. See Figure 6-14 and Tables 6-24 and -25 for network information.
Wireless Network	Wireless Network Access is a license-activated option. The same information is displayed in this screen as the Ethernet Network Screen (Tables 6-24, -25) with the addition of wireless network setup information (Select a wireless network and password).
System Info	The System Info screen displays the information found in Table 6-26.
Locale	Allows the user to adjust the language, time zone, and units.

Caution: Once Password protection has been activated, if the password is lost, an AMET representative must be contacted to gain access to the protected screens.

Figure 6-13, Set Up > System > Setup Screen Password Screen

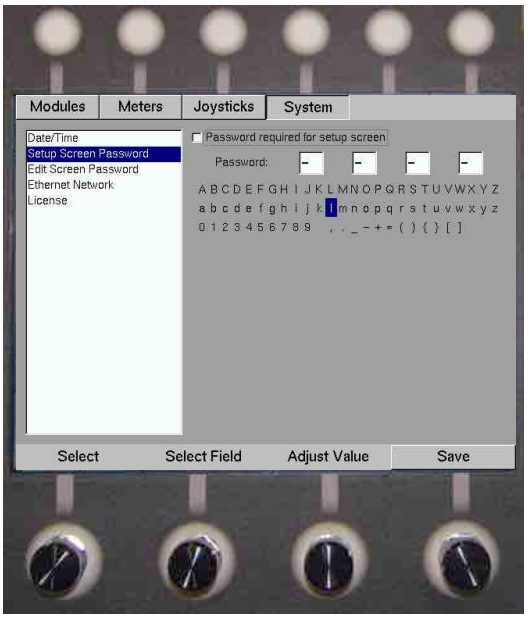


Figure 6-14, Setup > System > Ethernet Network Screen

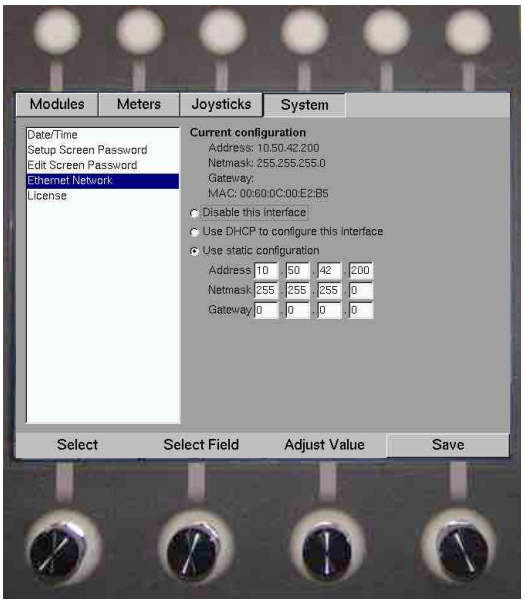


Table 6-24, Ethernet Network Information	
Parameter	**Description**
Address	Shows the current XM Controller Ethernet address
Netmask	Shows the current XM Controller Ethernet Netmask.
Gateway	Shows the current XM Controller Ethernet Gateway.
MAC	Shows the current XM Controller Ethernet MAC address

Table 6-25, Ethernet Network Options	
Option	**Description**
Disable this Interface	Disables the Ethernet Network on the Controller.
Use DHCP to Configure this Interface	Uses DHCP (Dynamic Host Configuration Protocol) to configure the Ethernet Network
Use Static Configuration	Uses the previously established Address, Netmask, and Gateway.

Table 6-26, Set Up > System > System Info		
Section	**Parameter**	**Description**
Controller Information	Controller Version	Displays the XM Controller version number.
	Serial Number	Displays the XM Controller Serial Number.
	Controller Temperature	Displays the CPU and Power Supply temperatures within the XM Weld Controller
Features	Automation	Displays whether or not the XM Controller has this capability.
	Offline Editing	Displays whether or not the XM Controller has this capability.
	Data Acquisition	Displays whether or not the XM Controller has this capability.
	Virtual Alignment	Displays whether or not the XM Controller has this capability.
	PLC	Displays whether or not the XM Controller has this capability.
CAN Bus Status	Bus Off	0 = OK, 1 = Error

	Passive	0 = OK, 1 = Error
	Warning	0 = OK, 1 = Error
	Bus error	0 = OK, 1 = Error

6.2.2. Edit Mode

Edit Mode defines each weld schedule segment and each module's function during the segment. The Edit screen is divided into information sections as shown in Figure 6-15.

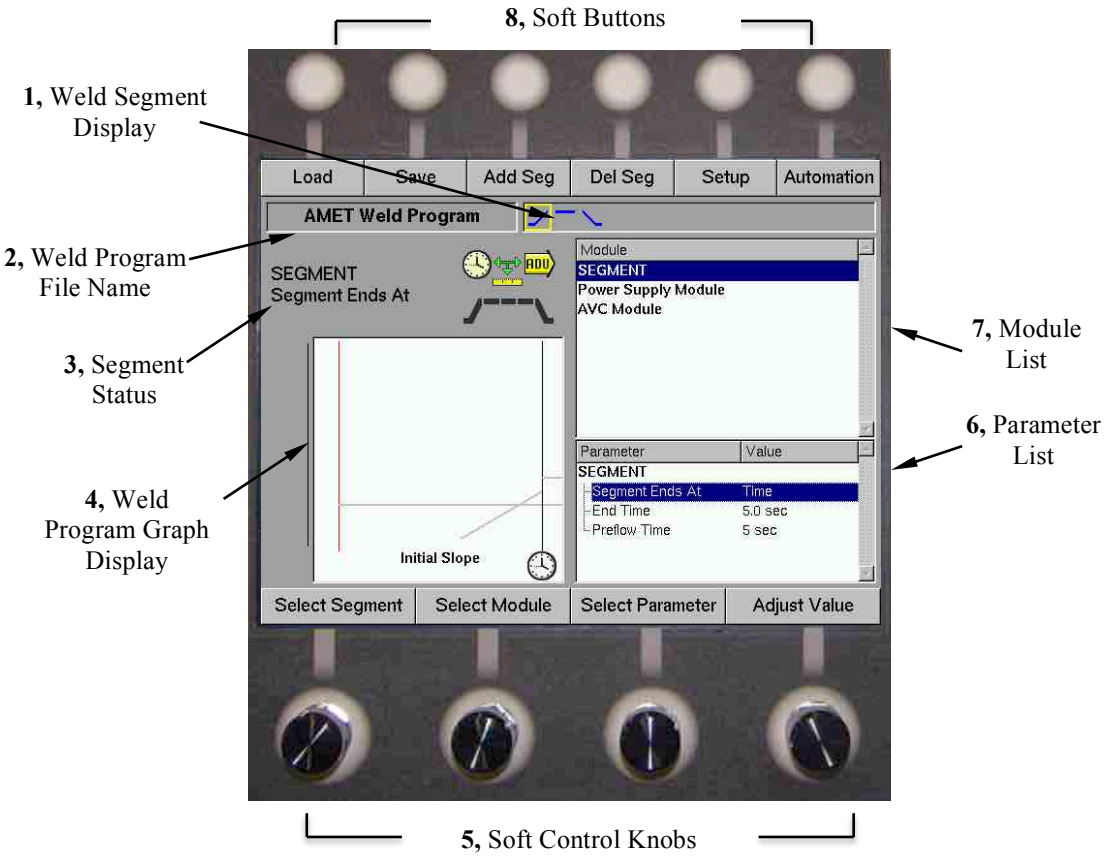
To access Edit Mode, press the Edit Mode button represented by the icon above.

> **Tip:** All input and changes made from the Edit screen will only affect the weld program currently loaded and displayed in the Weld Schedule File Name location. Changes are not permanent until a file Save action is performed.

From the Edit screen, an operator can create or edit weld programs (schedules), set up program Override Limits, define Data Acquisition parameters (license activation required), and set up pre- and post-weld Automation (license activation required).

A weld schedule consists of these 5 stages: Pre-Flow, Initial Slope, Weld Segments (minimum of 1), Down Slope, and Post-Flow.

Figure 6-15, Edit Mode Screen



6.2.2.1 Edit Mode Screen

The Edit Mode screen (Figure 6-15) displays the following:

(1) Weld Segment Display

The Weld Segment Display (Figure 6-15 Item 1, Figure 6-16) graphically represents the weld program in segments. A yellow box highlights the created or selected segment that is currently ready for programming.

Figure 6-16, Weld Segment Display

(2) Weld Program File Name

The Weld Program File Name (Figure 6-15 Item 2, Figure 6-17) displays the name of the loaded weld program. In this example, the name of the current weld schedule is “AMET Weld Program.”

Figure 6-17, Weld Program File Name

(3) Segment Status

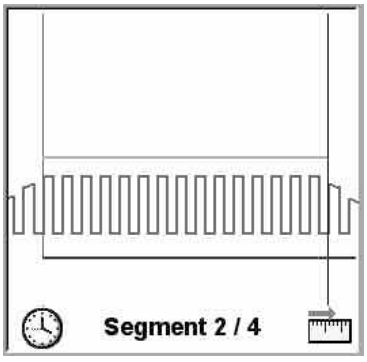
The Segment Status (Figure 6-15 Item 3) describes (verbally and pictorially) what kind of segment is currently selected.

(4) Weld Program Graph Display

The Weld Program Graph Display (Figure 6-15 Item 4, Figure 6-18) displays the programmed weld parameters for each segment. The illustration below depicts what a segment program may look like. The lower section identifies the segment number followed by the total number of segments. On the left is an icon describing the previous segment. On the right is an icon describing the active segment.

In this example, the clock icon indicates that the previous segment is Time based. The ruler icon with an arrow indicates the active segment is a Position based segment. See Table 6-28 for more segment information.

Figure 6-18, Weld Program Graph Display



(5) Programming Knobs

Soft Control Programming Knobs (Figure 6-15 Item 5, Figure 6-19) allow the user to scroll through lists and/or change values.

Figure 6-19, Programming Knobs

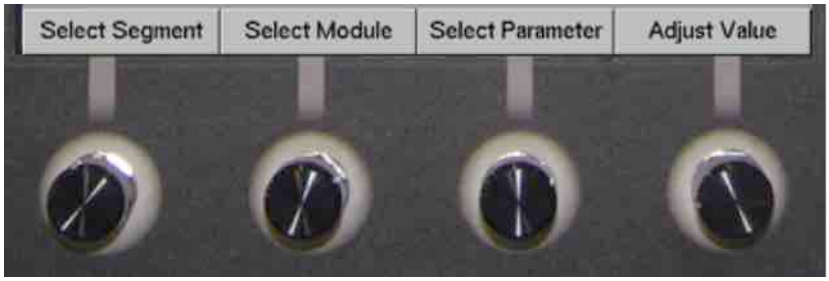


Table 6-27, Edit Mode > Soft Programming Knobs	
Knob	**Function**
Select Segment	Navigates the weld segments. The Weld Segment Display shows a yellow box to indicate the selected segment's position within the weld schedule
Select Module	Navigates the module list.
Select Parameter	Navigates the parameter list.
Adjust Value	Changes the highlighted parameter value.

(6) Parameter List

The Parameter List (Figure 6-15 Item 6, Figure 6-20) displays the programmable parameters of a module selected from the Module List. Some parameters will have a sub-list containing the programmable elements for that parameter, a value and/or options, which can be adjusted depending on the result desired. The module specific parameter lists are listed in the Module Parameters Section. Figure 6-20 shows the parameter list for "Segment" options in the module list.

Figure 6-20, Parameter List

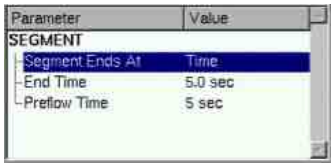
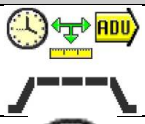
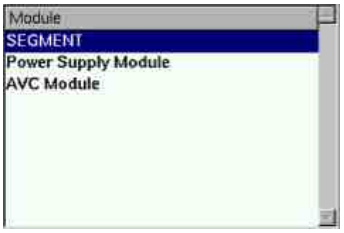


Table 6-28, Segment Parameter Types	
Icon	**Function**
	**Segment Ends At -** Segment termination has five options: Time, Position, Absolute Position, Digital Input, and Advance (pressing the Advance button). After defining a segment, the available parameters can be programmed for that segment.
	**Time Based Segments** - End after a specified time in seconds.
	**Position Based Segments** - End when a given position is reached. The position can be in inches (linear) or degrees (rotation) depending on which axis is selected for the end axis.
	**Advance Based Segments** - Continue indefinitely until the Advance button is pressed.

(7) Module List

The Module List (Figure 6-15 Item 7, Figure 6-21) posts all the currently installed XM Modules available for programming. Navigate the Module List with the Select Module knob. The Module List displays the word “Segment”, which is used to program how the segment will end. The modules in the system are listed below. The different programming options for “Segment” are defined in Table 6-29.

Figure 6-21, Module List



(8) Soft Buttons

The soft buttons (Figure 6-15 Item 8, Figure 6-22) in Edit Mode are shown and described below.

Figure 6-22, Soft Button Labels

Table 6-29, Edit Mode > Soft Button Functions	
Button	**Function**
Load	Displays the Load Program screen (Figure 6-23). This screen allows the operator to select a previously created weld program. The Location, Name, and Date of saved programs are listed in this window. Rotate the Select knob to highlight a weld program. Then press the Load button, or push the Select knob.
Save	Displays the Save Program screen (Figure 6-24), enabling the user to save an existing program or create an alphanumeric name for the newly created program. Table 6-30 outlines the steps to save a weld program.
Add Seg	Inserts a new segment before the active (selected) segment. With the Select Segment knob, place the yellow highlight box over the Segment icon or Final Slope icon. Press the Add Seg button to add.
Del Seg	Deletes the highlighted segment.
Set Up	Displays a sub-menu screen. This screen displays Override Limits and Data Acquisition soft buttons, as well as the Bore Controller (if this option is purchased).
Automation	A License Activated option. This screen allows the programmer to create automated sequences of Pre-weld and Post-weld events.

Figure 6-23, Load Program Screen

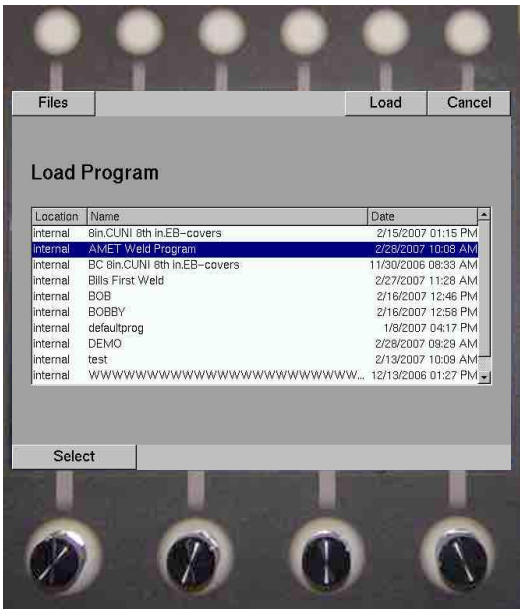


Figure 6-24, Save Program Screen

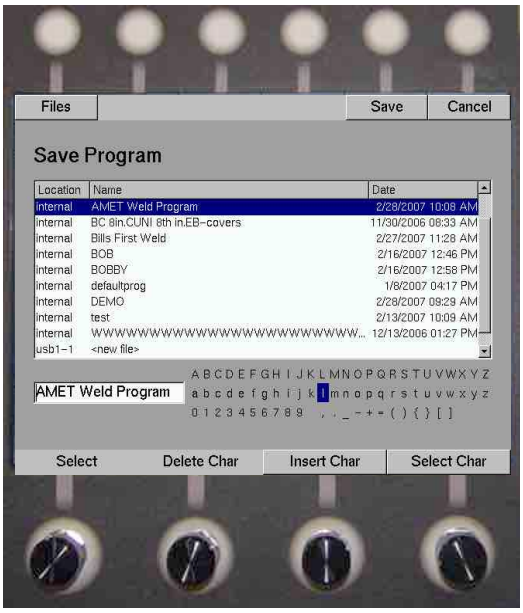


Table 6-30, Saving A Program	
Step	**Description**
1. Open Save Screen	Open the Save Screen by pressing the Save soft button. To exit the Save screen without saving, press the Cancel soft button
2. Create File	Either create a new file or create one from an existing file. To create a new file, highlight the <new file> option with the Select knob. To create from an existing file, select a previously saved program with the Select knob and press the Save button.
3. Rename File	Rename the file with the Programming Knobs (functions shown in Table 6-31)
4. Save File	Once the new file is properly named, press the Save button.
5. Manage Files	Press the Files soft button to enter the Manage Files screen. In the Manage Files screen, the operator can move, copy, and delete files on the internal or USB memory.

Tip:	Renaming a previously saved program with a different name will create a new file. The old program will not be overwritten.

Tip:	When editing a weld program with the XM Controller, changes are automatically saved to the controller upon exiting Edit Mode. You do not have to push the Save button to activate changes. However, it is recommended you save a created program to verify a proper save function has been completed.

Table 6-31, Edit Mode > Rename File > Programming Knob Table	
Programming Knob	**Function**
Delete Char	When rotated clockwise, a character to the right is deleted. When rotated counterclockwise, a character to the left is backspaced.
Insert Char	Rotating the knob navigates the input cursor within the text box. Pressing the knob inserts the character highlighted below.
Select Char	Navigates the possible characters to insert into the text box. Pressing the knob inserts the character that is highlighted.

(9) Edit Mode > Set Up Screen

Table 6-32, Edit Mode > Set Up > Override Limits Soft Button	
Button	**Function**
Override Limits	Displays the Override Limits screen. This screen allows the programmer to set limits for each selected module parameter. In the illustration, the “Power Supply Module” has been selected. The display parameter list contains all override parameters for that module and their values.

Figure 6-25, Override Limits Screen

NOTE

Each parameter value is set to the default “inf” or infinite. This means no Override Limit is set and the operator has the full range of override capabilities for that weld schedule.

The Select Parameter knob scrolls through the parameter list. The Adjust Value knob defines the parameter limit. When finished, press the Close soft button to return to the Set Up screen. The values are automatically saved.

a) Edit Mode > Set Up > Data Acquisition

Data acquisition (license activated) allows the user the ability to record and save the real time data that is gathered during the welding process. In the Data Acquisition Screen the user can set up the capture frequency, parameters to record, and where to save the data.

Figure 6-26, Data Acquisition Screen

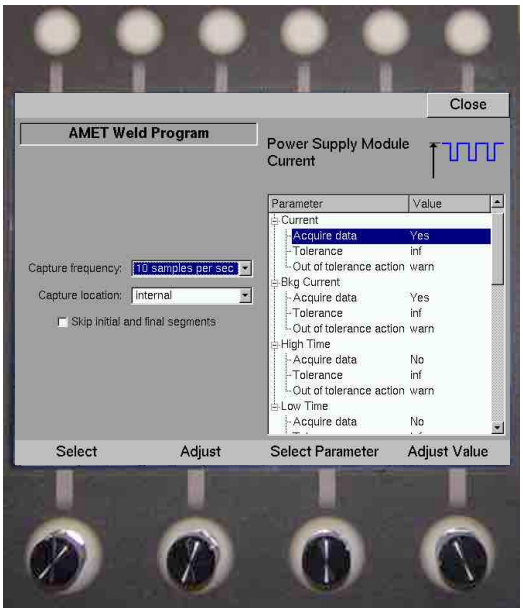


Table 6-33, Data Acquisition Option Table

Data Acquisition Options	Description
Capture Frequency	Determines how often data is acquired and saved to memory.
Capture Location	Determines where the acquired data is saved. Can be saved to Internal or USB.
Skip Initial and Final Segments	Check the box to skip data acquisition for the initial and final segments.
Acquire Data	Determines whether the memory captures data for that parameter.
Tolerance	Sets the minimum and maximum values for the selected parameter that gives a plus-or-minus tolerance for the established setting.
Out of Tolerance Action	When the acquired data exceeds the tolerance level, this option tells the weld program to stop the weld program or warn the user.

b) Edit Mode > Set Up > Automation Screen

The Automation screen (Figure 6-27) is where the user sets up the automated functions in the system for pre- and post-weld segments in the weld program. The user selects an automation slot on the left (with the leftmost select knob) to apply a function, and then selects the desired parameter in the right screen (with the Select and Adjust Value knobs on the right). The process is repeated for each subsequent automation step.

Table 6-34, Automation Soft Button Table	
Knob	**Function**
Delete Slot	Deletes the selected automation command in the sequence.
Move Up	Moves the selected automation command up one spot in the sequence.
Move Down	Moves the selected automation command down one spot in the sequence.
Close	Returns to Edit Mode.

Figure 6-27, Automation Screen

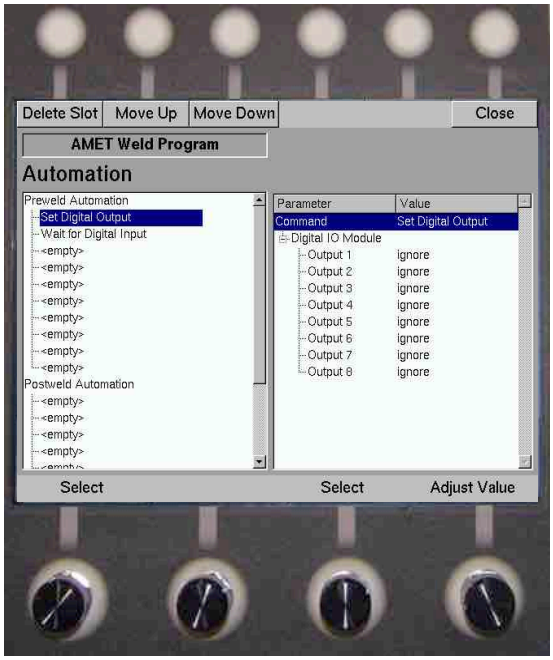


Table 6-35, Automation Soft Knobs Table	
Button	**Function**
Select	Navigates the automation steps in the left hand section.
Select	Navigates the parameters for each automation step in the right hand section.

Adjust Value	Navigates the functions available for each automation parameter in the right hand section.

(i) Left Hand Window

The left-hand window shows the sequence of Preweld and Postweld automation events. The system will adhere to this list of directions before and after a weld.

Select a slot with the furthermost left Select knob. You can delete or move a slot position with the soft buttons described in Table 6-34.

(ii) Right Hand Window

The right-hand window shows the available commands with their respective parameters. To select a command to place in the Automation sequence, rotate or push the Adjust Value knob.

Select the desired command by rotating the Adjust Value knob. Select a programmable parameter with the Select knob and program the parameter with the Adjust Value knob.

Figure 6-28, Automation Screen Options

Table 6-36, Automation Function Table

Automation Option	Sub Options	Function
Delay	Allow Advance	If “Yes” is selected, the operator can press the “Advance” button to skip over this step in the Automation Sequence.
	Wait for Operator	Waits for the Operator to press the “Advance” button.
	Time	Delays for a specific amount of time.
Home	Allow Advance	If “Yes” is selected, the operator can press the “Advance” button to skip over this step in the Automation Sequence.
	Module Select	If “Yes” is selected next to a specific module, that axis

Table 6-36, Automation Function Table		
Automation Option	**Sub Options**	**Function**
		will home when this step is run in the Automation Sequence.
Relative Move	Allow Advance	If “Yes” is selected, the operator can press the “Advance” button to skip over this step in the Automation Sequence.
	Time for Move	Sets the time that is allotted for the Relative Move in the Automation Sequence. The system will automatically set the acceleration and velocity for each axis. This is relative to the amount of time that is set and the distance the axis must travel during the Relative Move step in the Automation Sequence.
	Set Axis Lengths	Sets the length that a specific axis will travel during this Relative Move step in the Automation Sequence. A Relative move is a distance from the current axis location.
Absolute Move	Allow Advance	If selected this allows the operator to press the “Advance” button and it will skip over this step in the Automation Sequence.
	Time for Move	Sets the time allotted for the Absolute Move in the Automation Sequence. This function will automatically set the acceleration and velocity for each axis depending on the amount of time that is set and the distance the axis must travel during the Absolute Move step in the Automation Sequence.
	Module Position/ Enable Select	If “Enabled” is set to “No” then that specific axis will not move during this step of the Automation Sequence. If “Enabled” is set to “Yes” then the axis will perform an Absolute Move (from zero position) based on the “Position” value that is set.
Set Digital Output	Digital Selection	Allows the operator to select a specific Digital Output to perform a function on and then select one of the following functions: “Ignore” performs no action with a specific Digital Output. “Set” turns on a specific Digital Output. “Clear” turns off a specific Digital Output.
Wait for Digital Input	Allow Advance	If selected this allows the operator to press the “Advance” button and it will skip over this step in the Automation Sequence.
	Digital Selection	Allows the operator to select a specific Digital Input to and then select one of the following functions for that Digital Input: “Ignore” performs no action with the Digital Input. “Set” waits for the Digital Input to be set. “Clear” waits for the Digital Input to be cleared.
Gas	Gas Selection	Allows the Operator to select a specific Gas Output and then perform one of the following functions: “Ignore” performs no action with the Gas Output. “Set” turns on the Gas Output. “Clear” turns off the Gas Output.
Touch Retract	Allow Advance	If selected this allows the operator to press the “Advance” button to skip over this step in the Automation Sequence.
	Module Selection	If set to “No” then no Touch Retract function is performed on that specific module. If set to “Yes” then a

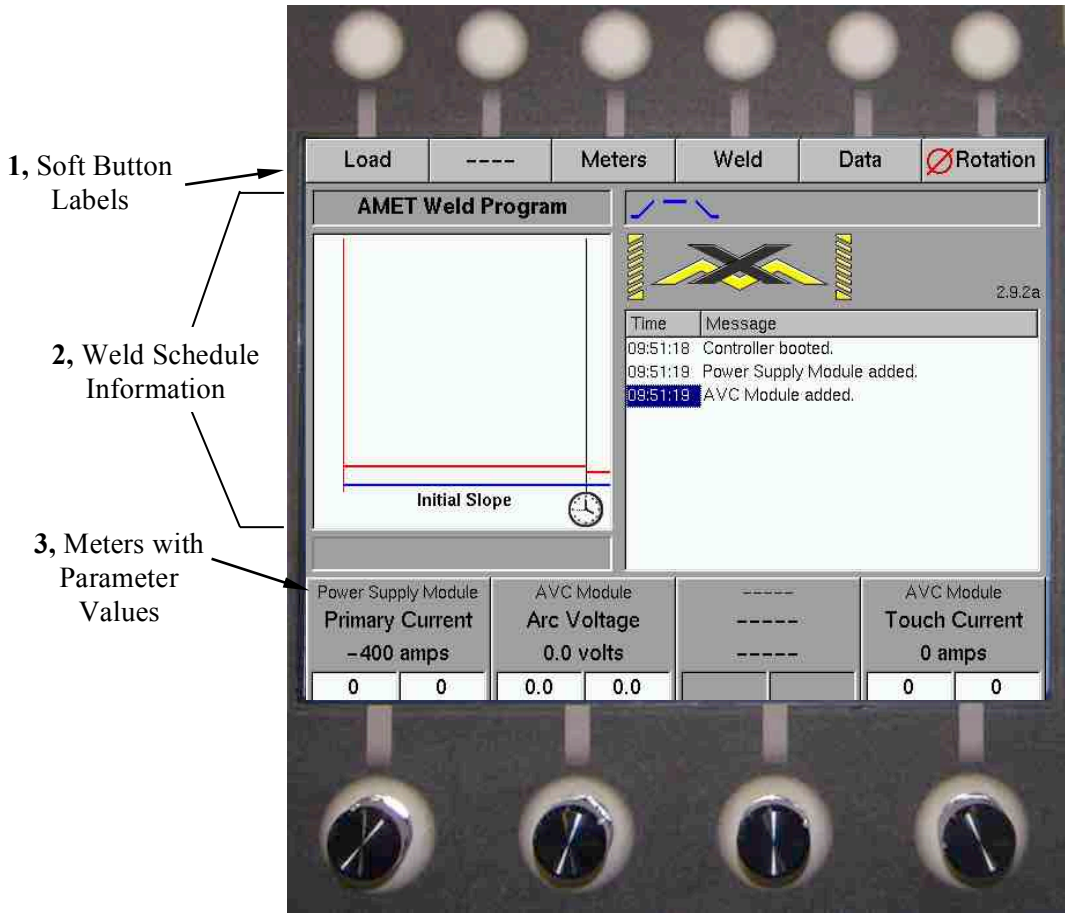
Table 6-36, Automation Function Table		
Automation Option	**Sub Options**	**Function**
		Touch Retract is performed.
Torch Probe	Probe Module	Allows the Operator to select the AVC Module that will be used to sense the voltage for the “Torch Probe”
	Axis 1	Allows the operator to select which axis will move in order to perform the “Touch Retract”.
	Velocity 1	Sets the speed that the selected “Axis” will move at in order to perform the “Touch Retract”.
	Axis 2	Allows the operator to select which axis will move in order to perform the “Touch Retract”.
	Velocity 2	Sets the speed that the selected “Axis” will move at in order to perform the “Touch Retract”.
Digital Interlock	Mode	If set to “Check” the Digital Interlock function will only look for Input 1 and 2 to be satisfied momentarily. If set to “Continuous” the Digital Interlock function will be active throughout the entire weld program and will require both Input 1 and 2 to be satisfied throughout this period. If set to “Disable” it will ignore the Digital Interlock function.
	Input 1	Sets the first digital input to monitor for the Digital Interlock function.
	Input 2	Sets the second digital input to monitor for the Digital Interlock function.
Call PLC Function	Allow Advance	If selected this allows the operator to press the “Advance” button to skip over this step in the Automation Sequence.
	Function	Allow the operator to select a PLC Program that will begin to run at this point in the automation sequence. This is a license-activated option and the PLC program is a factory created program that is system specific.
Find Edge	Module	Allows the operator to select the SeamTracker module.
	Scan Axis	Sets the axis that will move in order to perform the scan.
	Velocity	Sets the velocity that the scan axis will move during the scan.
	Span	Sets the distance that the scan axis will move to find an edge. If the edge is not found during this span, a fault will occur.
	Threshold	Sets the voltage threshold that dictates the voltage variance that is required to sense and edge.
Find Center	Module	Allows the operator to select the SeamTracker module.
	Velocity	Sets the velocity that the SeamTracker module will move during the scan.
	Span	Sets the distance that the scan axis will move to find and edge. If the edge is not found during this span then a fault will occur.
	Threshold	Sets the voltage threshold that dictates the voltage variance that is required to sense the center of a seam.

Table 6-36, Automation Function Table		
Automation Option	**Sub Options**	**Function**
Set Position	Enabled	If set to “No” no position will be set for a specific axis. If set to “Yes” then the position meter will be set to the value that is input into the “Position” parameter.
	Position	This value will be placed into the position meter for a specific axis as long as the “Enabled” parameter is set to “Yes”.
Return To Start	Enable	Enables a specific module and once the program is complete this function will return the selected axis to their weld start position.
Torch Probe Center	Probe Module	Allows the Operator to select the AVC Module that will be used to sense the voltage for the “Torch Probe”
	Axis	Allows the operator to select which axis will move in order to perform the “Touch Retract”. This function will probe in two directions and then find the center of the seam based on these probes.
	Velocity	Sets the speed that the selected “Axis” will move at in order to perform the “Touch Retract”.
Look Ahead	Enables laser tracking on the torch head.	

6.2.3. Weld Mode

To access Weld Mode, press the Weld Mode button represented by the icon to the left. The Weld screen is divided into three main sections. The top section contains the soft button labels. The center section contains weld schedule graphical information and a text message area. The bottom section displays the program Meters. Each Meter will display weld program parameter information and parameter override data**.**

Figure 6-29, Weld Mode Screen



6.2.3.1 Weld Mode Screen

The Weld Mode screen (Figure 6-29) consists of the following sections:

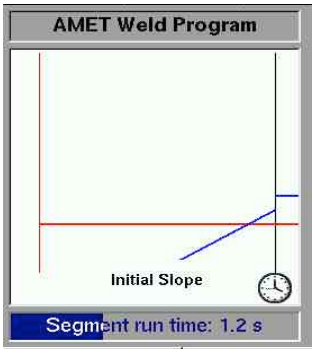
(1) Weld Schedule File Name

Displays the loaded weld program. In this example, the name of the current weld schedule is “AMET Weld Program.”

(2) Weld Graphic Display

Displays each weld parameter for each weld program segment. While executing the weld program, the display advances as each segment completes.

Figure 6-30, Weld Graphic Display



(3) Segment Status

Alphanumerically displays the segment status. It displays both the segment condition (“Segment run time”) and the segment’s current progress (“1.2 s”). The Segment Status section also illustrates progress with a progressive task bar, which changes color as it advances.

(4) Segment Sequence

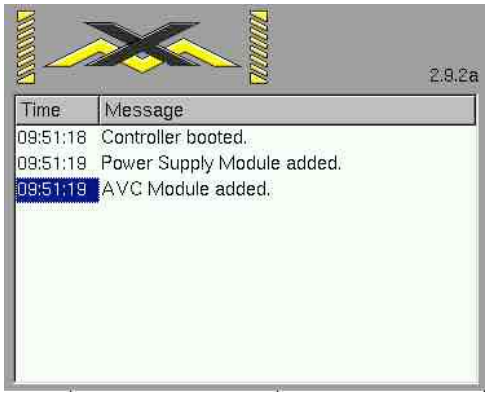
Indicates the segment being executed. The current segment has a highlighted red box and completed segments have a distinctive darkened background. A weld schedule must contain at least three weld segments: The Initial Slope, a Weld Segment, and a Final Slope. Additional Weld Segments can be added or deleted in the Edit mode.

Figure 6-31, Segment Sequence

(5) System Messages

Displays error and status messages. Messages are not stored and cannot be replaced.

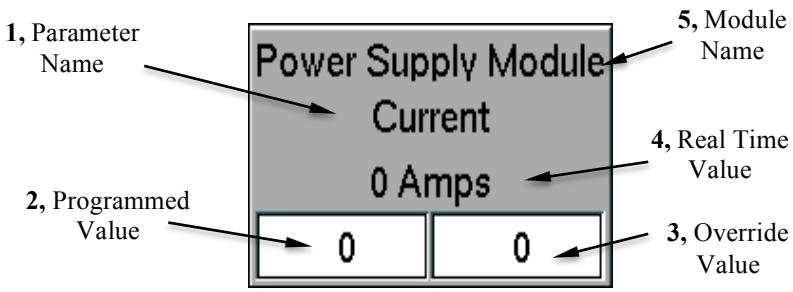
Figure 6-32, System Messages



(6) Meters

Displays four (4) parameter meters at one time. Each meter can display the following: Module name, parameter name, real time value of the parameter, the unit of measure, programmed parameter value, and +/- Override value (operator input).

Figure 6-33, Meter Display



To override a parameter value, turn the associated knob directly below to reach the desired value. To view the next available parameter for that module, press its knob.

Tip: The **Meters** soft button toggles the meters between the 4 primary and 4 auxiliary meters.

(7) Soft Buttons

Each soft button has a corresponding label on the LCD screen. Based on the selected Mode (Weld, Edit, or Set Up), the function of the soft buttons will change.

Table 6-37, Weld Mode Soft Buttons

Button	Function
Load	Opens the Load Screen to select a previously created weld program from the File Manager screen. In this illustration, the name of the current weld schedule is “AMET Weld Program.”
- - - - Clear E-Stop	Only displayed when the Emergency Stop button has been activated. To clear an E-Stop condition, pull the Emergency Stop button out (non-active position) and press the Clear E-Stop soft button.
Meter	Toggles the Meters between the 4 primary and 4 auxiliary meters.
No Weld Weld	In the Weld state, the weld schedule performs as programmed. In the No Weld state, the weld schedule proceeds without weld current and disables the Wire Feed and AVC. All other remaining weld parameters are still active.

Tip: The two far right soft buttons are reserved for special applications and may not be available on your system.

7. Module Parameters

In the XM Series of welding systems, there are many modules available to control different aspects of the welding and automation processes. In Edit Mode, weld parameters are set in each segment of the weld program for all modules involved in the weld. This section describes these parameters for each XM Module. The weld segment that is highlighted (Figure 7-1 Item 1) is in the editing stage. The module that is highlighted (Item 7) will have its available parameters listed below (Item 6).

Figure 7-1, Edit Mode Screen

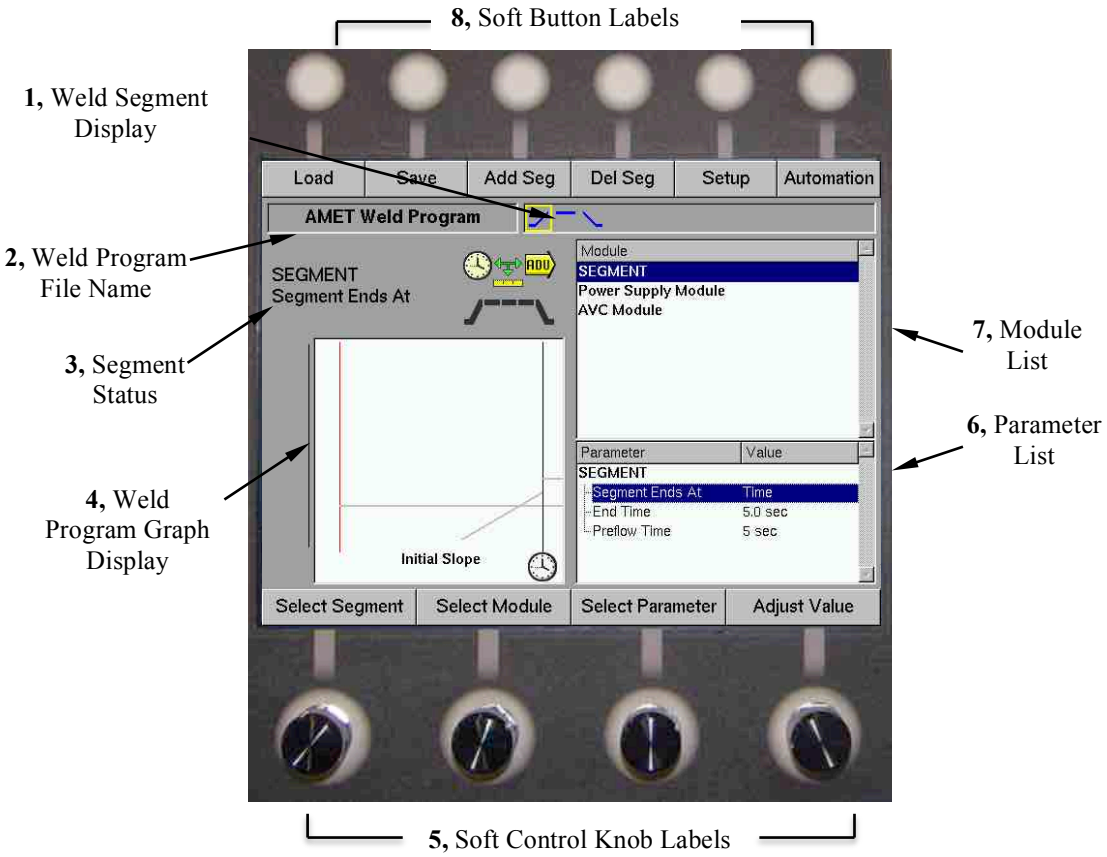
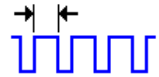
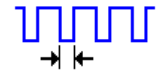


Table 7-1, Some Module Types		
Module Name	**Acronym**	**Section**
Power Supply Module	X-PS	7.1
VP Module	X-PS-VP	7.2
AVC Module	X-VC	7.3
Linear Axis Module	X-Linear	7.4
Oscillation Module	X-OSC	7.5
Rotation Module	X-ROTARY	7.6
Wire Feed Module	X-WF	7.7
Digital I/O Module	X-DIGITAL	7.8
Hotwire Module	X-HW	7.9
Lincoln Power Supply	X-PS-AL	7.10
Meta Vision System	X-META	7.11
Turning Roll Module	X-TR	7.12
CNC Module	X-CNC	7.13
Standalone Module	XMS	7.14

7.1. Power Supply Module (X-PS)

A Power Supply Module functions as the control unit for the arc welding supply in the system as well as the power supply for the XM Weld Process Controller. This module dictates the current and frequency delivered by the welding power supply; controls gas flow and senses gas faults; toggles the arc starter (if supplied); and activates the weld contactor of the welding power supply.

Table 7-2, Power Supply Module Parameters	
Symbol	**Description**
	**Mode:**
	Independent - Allows the power supply settings to operate without input from other modules. Pulsation is specified in terms of Background Current, High Time, and Low Time.
	Sync to Oscillation - Synchronizes the power supply with the oscillation settings
	No Pulse - Disables the pulsation settings for that segment and outputs straight current.
	**Current** - Has two programmable elements Initial and Final. Note: Operator terminated segments cannot be sloped.
	**Background Current** - Has two programmable elements: Initial and Final.
	**High Time** – Time the current is straight. Programmed in seconds
	**Low Time –** Time the current is time spent in background current. Programmed in seconds

7.2. Variable Polarity Module (X-PS-VP)

A Variable Polarity module acts as a power supply module (Section 7.1) but controls a VP enabled welding power supply, thus enabling many more welding possibilities.

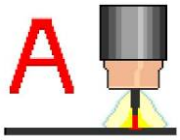
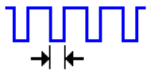
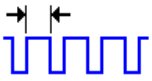
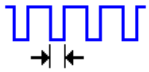
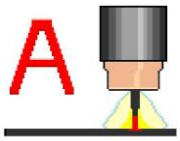
Table 7-3, VP Power Supply Module Parameters	
Parameter	**Description**
	**VPC Mode:**
	Disabled – only Primary Current, and Pulse Mode are available
	Enabled – Primary Current, Reverse Current, Straight Time, Reverse Time, and Pulse Mode available when VPC Mode is enabled.
	Mixed – Primary Current, Reverse Current, Straight Time, Reverse Time, Penetration Cycle, Cleaning Cycle, and Pulse Mode available in Mixed Mode.
	**Primary Current** – Has two programmable elements in in the upslope and downslope segments, Initial and Final. Measured in Amps Note: Operator terminated segments cannot be sloped.
	**Reverse Current** - Has two programmable elements in in the upslope and downslope segments, Initial and Final. Measured in Amps Note: Operator terminated segments cannot be sloped.
	**Straight Time** – The positive amplitude of the wave. Measured in milliseconds.
	**Reverse Time** - The negative amplitude of the wave. Measured in milliseconds.
	**Penetration Cycle** – Measured in milliseconds
	**Cleaning Cycle** – Measured in milliseconds
	**Pulse Mode** – Has two possible states, No Pulse and Independent. No pulse disables pulse mode. Independent Mode adds Backing Current, High Time, and Low Time.
	Backing Current – Measured in Amps
	High Time – Measured in seconds
	Low Time - Measured in seconds

Figure 7-2, Variable Polarity Waveform

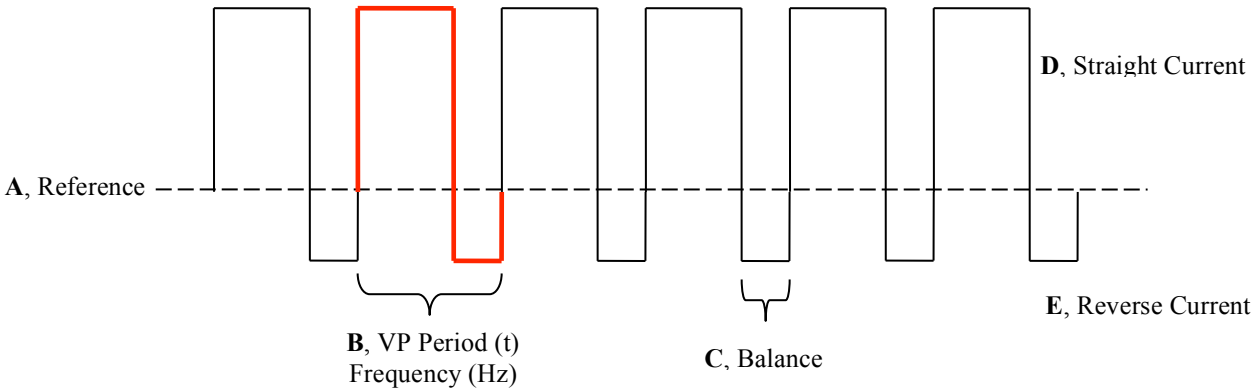


Figure 7-3, VP Mixed Mode Waveform

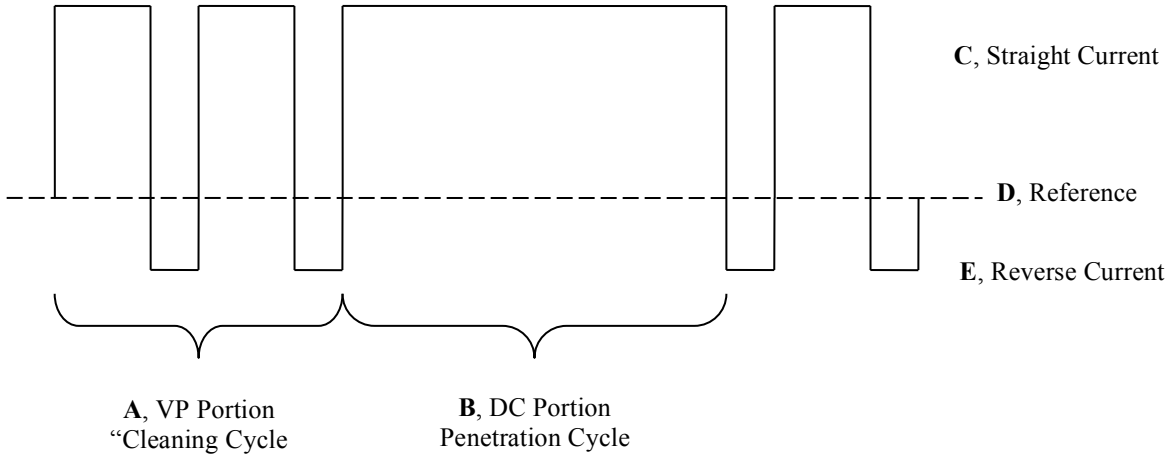
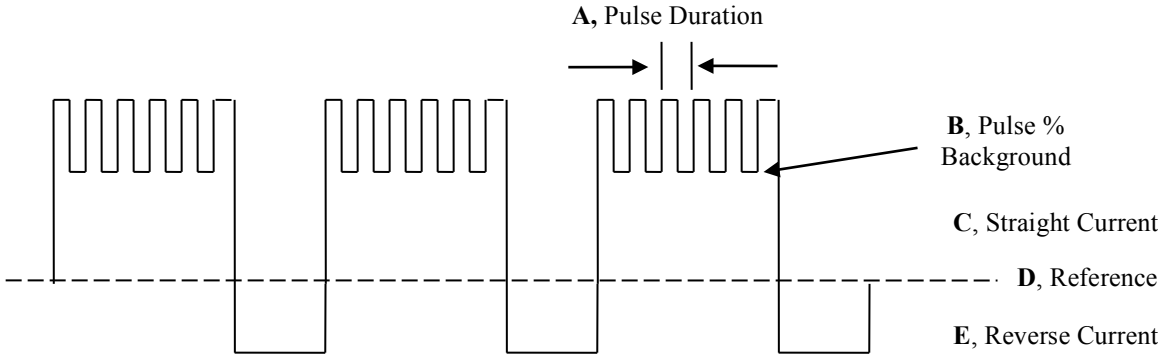
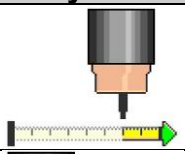
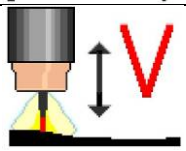
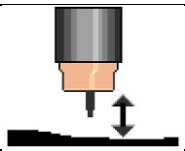
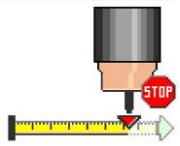
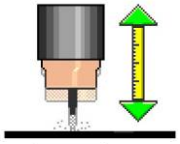
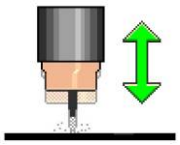


Figure 7-4, VP Pulsed Mode Waveform



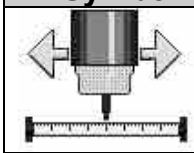
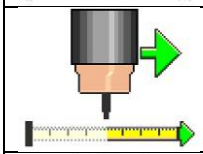
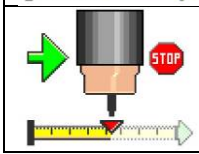
7.3. Arc Voltage Control Module (X-VC)

An XVC Module works in conjunction with the slide attached to the weld torch. The module controls the linear motion of the slide as well as the AVC (touch retract) function.

Table 7-4, XVC Module Parameters	
Symbol	**Description**
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the automatic voltage control begins.
	**Mode:**
	Continuous AVC - AVC is always active.
	Primary Only AVC - AVC is active on high current pulse only.
	Background Only AVC - AVC is active on low current pulse only.
	Disabled - AVC is disabled for the segment.
	**Sensitivity** - Controls how the AVC responds to a change in voltage. It can be set from +95 to -95. The number is dimensionless and is typically determined at the factory.
	**Early Stop** - Sets when the AVC turns off (in seconds) before the segment ends.
	**Distance** - Sets the retract distance measured from the tip of the electrode to the contact point on the work piece.
	**Mode:**
	Touch Retract - Touches the work piece and retracts the specified distance to allow HF starts.
	Touch Start - Touches the work piece, starts the arc, then retracts the specified distance to start the weld.
	Touch Current - Sets the current level during a Touch Start operation.

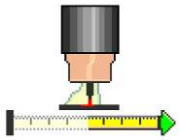
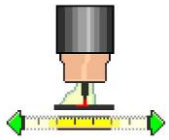
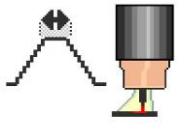
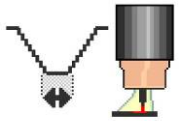
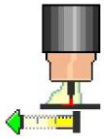
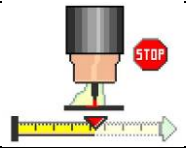
7.4. Linear Axis Module (X-LINEAR)

A Linear Motion Module will drive a single linear axis actuator (i.e. a travel slide) in positive and negative directions. Position, velocity, and acceleration encoder feedback is provided to the XM Controller.

Table 7-5, Linear Axis Module Parameters	
Symbol	**Description**
	**Mode**
	Linear Travel - Programs the linear motion.
	Velocity - Sets the velocity for a linear travel move in inches per minute.
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed linear motion begins.
	**Early Stop** - Sets when the linear motion stops (in seconds) before the segment ends.

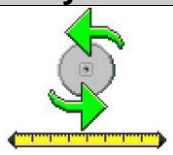
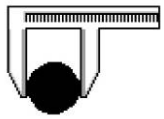
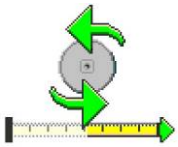
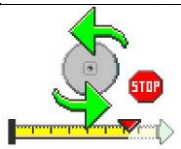
7.5. Oscillation Module (X-OSC)

An Oscillation Module will drive a single axis actuator (i.e. a travel slide) in positive and negative directions. This module is used primarily to move the weld torch back and forth along the weld seam to increase the width of the weld.

Table 7-6, Oscillation Module Parameters	
Symbol	**Mode**
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed Oscillation will begin.
	**Amplitude** - Defines the overall oscillation width (in inches) for the weld segment.
	**In Dwell** - Sets the time (in seconds) spent on the positive extreme side of the oscillation.
	**Out Dwell** - Sets the time (in seconds) spent on the negative extreme side of the oscillation.
	**Slew Time** - Sets the time (in seconds) to travel from in dwell to out dwell.
	**Early Stop** - Sets when the oscillation stops (in seconds) before the segment ends.

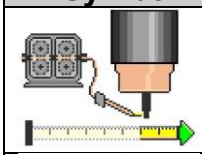
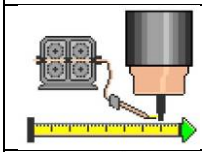
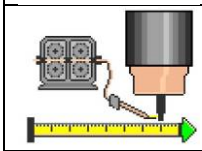
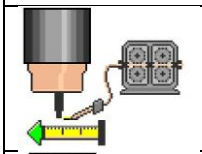
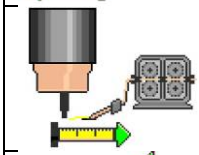
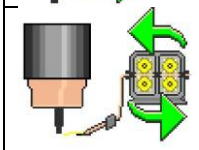
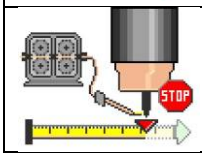
7.6. Rotation Module (X-ROTARY)

A Rotary Module will drive and control a rotational motor such as a rotary positioner or lathe headstock. This module may also have an optional remote pendant to control rotational direction and include an additional E-Stop button.

Table 7-7, Rotation Module Parameters	
Symbol	**Mode**
	**Mode** - Measures speed in either “rpm” or “ipm.” If “ipm” is selected, Part Diameter will show in the parameter list. In either mode, Initial value and Final value are programmable.
	**Part Diameter** - Specifies the diameter of the part surface to be welded. Measures speed in inches per minute and is only available if the rotation mode is set to in/min in the up slope segment.
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed rotation begins.
	Velocity – Sets the speed at which the rotation will travel.
	**Early Stop** – Sets the time (in seconds) when the rotary motion stops before the segment ends.

7.7. Wire Feed Module (X-WF)

A Wire Feed Module controls the direction and rotation speed of a wire feeder. This control module also provides dabbing control if supported by the XM Controller.

Table 7-8, Wire Feed Module Parameters	
Symbol	**Mode**
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed Wire Feed begins.
	**Continuous** – When selected, feeds the wire at a continuous rate.
	Sync to Current - Synchronizes the wire feed rate to the power supply current.
	**Feed Rate -** Has two programmable elements: Initial and Final. Each is programmed in inches per minute (ipm).
	**Low Rate** - Has two programmable elements: Initial and Final. Each is programmed in inches per minute (ipm).
	**Retract Distance** - Retracts the wire (in inches) after a weld completes.
	**Retract Speed** - Determines the retraction speed (in inches per minute).
	**Early Stop** - Sets when the wire feed will stop before the segment ends.

7.8. Digital IO Module (X-DIGITAL)

Settings for the Digital IO Module will appear in Automation. Open the Automation Screen (Edit Mode > Automation) and place Set Digital Output or Wait for Digital Input in the Preweld and Postweld sequences.

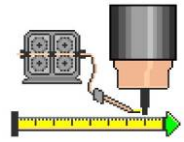
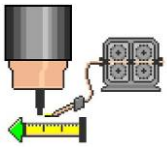
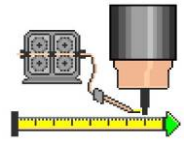
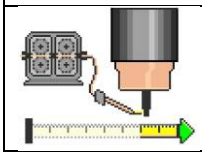
Set Digital Outputs (1 – 8)
Wait for Digital Input (1 – 8)

Table 7-9, Digital IO Module Parameters

Parameter	Description
Ignore	Ignores digital input/output.
Set	Turns digital input/output on.
Clear	Turns digital input/output off.
Allow Advance	Turn this option to on in order to enable the **Advance** button, which will skip over this specific step in the automation.

7.9. Hotwire Module (X-HW)

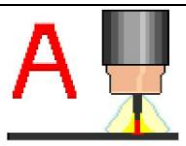
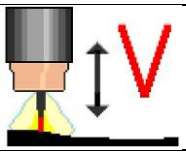
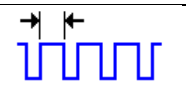
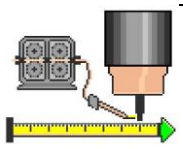
The Hotwire Power Supply Module is not a standard XM module. It is essentially a welding power supply that energizes the weld wire so it is already “hot” before it reaches the weld puddle. This allows for lower arc current as well as a greater deposition rate. This module can also run the wire feeder associated with it if desired.

Table 7-10, Hotwire Module Parameters	
Symbol	**Description**
	**Mode**
	Enabled – Enables contactor for output
	Disabled – Disables the hotwire contactor.
	**Feed Rate:**
	Initial Value – Sets the starting rate (in/min) at which the wire will feed.
	Final Value – Sets the end rate (in/min) at which the wire will feed.
	**Voltage:**
	Initial Value – Sets the starting voltage.
	Final Value – Sets the end voltage.
	**Stop Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed Wire Feed begins.

7.10. Lincoln Power Supply (X-PS-AL)

The PowerWave series of Lincoln Electric power supplies communicates with the XM Weld Controller via Lincoln's ArcLink software protocol. By linking with the power supply, the XM Controller is able to control all the weld parameters without adjusting anything on the physical PowerWave.

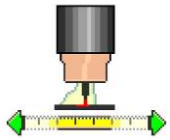
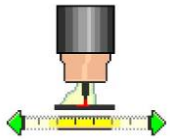
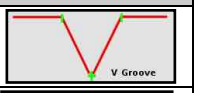
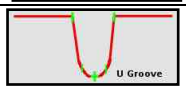
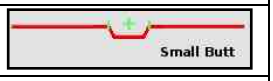
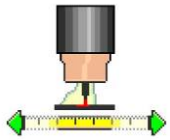
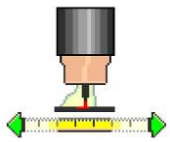
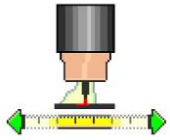
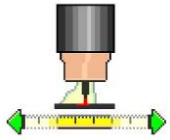
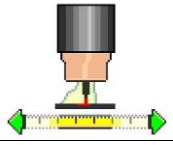
Table 7-11 Lincoln Power Supply Parameters

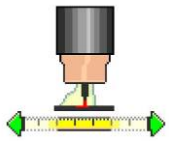
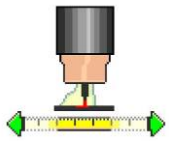
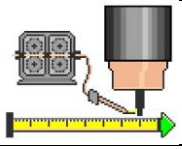
Symbol	Description
	**Mode** **Disabled** **CC 60 Hz Sine** **CC 50 Hz Sine** **CV DC-** **CV DC+** **CV Square Wave** **CC DC-** **CC DC+** **CC Square Wave** These modes are configured in the configuration file for the Power Supply Module and are pre-programmed in the Lincoln Power Supply. When you select one of these modes the XM Controller is telling the Lincoln Power Supply which mode to run in. Please refer to the included Lincoln power supply manual for more details on the modes and their function and uses.
	**Wire Runin -** sets the Wire Runin in inches per minute. This value is usually lower than the actual welding wire travel speed.
	**Current -** sets the current (in Amps) and is used by the Lincoln Power Supply, along with the Arc Voltage setting, to determine the speed of the wire feeder during welding.
	**Arc Voltage -** sets the arc voltage in volts and is used by the Lincoln Power Supply, along with the Current setting, to determine the speed of the wire feeder during welding.
	**DC Offset -** sets the DC offset and is only used during AC welding.
	**Frequency -** sets the frequency in hertz and is only used during AC welding.
	**Burnback time -** sets the burnback time in seconds. The burnback time is the amount of time that the wire stops feeding before the end of the weld. During the time the wire is not feeding, the current is still flowing from the Lincoln Power Supply therefore burning back the wire.
	**Phase -** only used with multiple Lincoln Power Supplies during AC welding. This function allows the user to offset the phases of the AC signals by changing the offset in degrees.

7.11. Meta Vision System (X-META)

The META Module interfaces with META vision control system to control camera functions provide feedback to the XM Weld Controller, and display visual feedback on an additional operator console monitor if supplied in the system.

Table 7-12, Meta Vision System Parameters

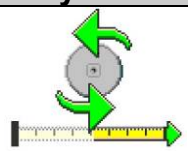
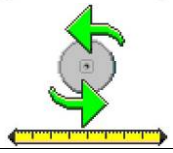
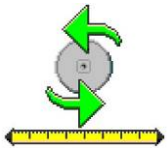
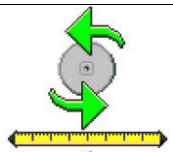
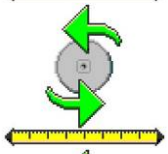
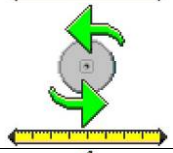
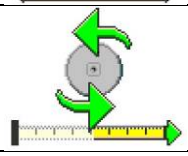
Symbol	Description
	**Weld Type**
	Circumferential – Welds two cylindrical parts together around the circumference.
	Longitudinal – Welds along the length of a longitudinal seam.
	**Groove Type**
	V-Type – Tracking is on scan surface between bottom corners 
	U – Type - Tracking is on scan surface between bottom corners 
	Butt Joint - Tracks the scan surface between the top corners. In Cap layer type, it draws a line between the top corners, and uses a point on that line. 
	Narrow Butt (small butt) - Tracking is on a line, drawn between the top corners. 
	**Part Thickness –** Enter the thickness of the part to determine rotational speed of the turning rolls and penetration depth of the weld head.
	**Laser Mode**
	Disabled – disables the Meta Vision System Tracking.
	Manual – not used.
	Tracking – this mode uses the Meta System to track the joint by the use of the XM System axis.
	**Layer Type**
	Root – Single pass layer with different location calculation if in V joint, with a groove position of 50%. In this case it calculates top and bottom corners, calculates a line from the top corner to the bottom corner. Extends the two sidewall lines and calculates their intersection.
	Single – Used for running a single pass.
	Tandem – Used for running a tandem pass or passes.
	Cap – Used for running a cap pass or passes.
	**Groove Position -** sets the groove position as a percentage. This is only used when running a Single layer type.
	**Layers -** sets the number of layers that will be welded in a segment. If this value is set to Automatic then the Meta System determines when the layer is complete based on depth of the weld.
	**Passes -** sets the number of passes per layer during a segment. If this value is set to Automatic then the Meta System determines when a pass is complete based on the width of the weld.

	**Horizontal Offset -** sets the horizontal offset in inches. This offset is a distance from the tracking position of the Meta System in the horizontal axis.
	**Vertical Offset -** sets the vertical offset in inches. This offset is a distance from the tracking position of the Meta System in the vertical axis.
	**Sidewall Offset -** sets the sidewall offset in inches. This offset is the distance from the sidewall of the groove toward the center of the groove.

7.12. Turning Rolls (X-TR)

The Turning Roll Module will drive and control the drive rolls in a turning roll set. This module may also have an optional remote pendant in addition to or separate from the XM Controller to control rotational direction and include an additional E-Stop button. The drive rolls can be integrated with the XM Controller to provide scheduled rotation and consistency to the welding process. If not XM-integrated, these parameters will not apply.

Table 7-13, Turning Rolls Parameter

Symbol	Description
	**Start Delay** - Sets the time (in seconds) from the beginning of the segment until the programmed rotation begins. If this value is set to Initiate the Turning Rolls will start when the fill wire begins feeding. A delay of 0 will start rotation when arc is initiated.
	**Mode**
	Internal encoder - used for a motor mounted encoder.
	External encoder – used for an encoder that is not connected directly to the motor. This encoder is usually riding on the part to give actual travel distance and speed.
	**Weld Mode**
	Od – used if welding on the outside diameter of the part.
	Id – used if welding on the inside diameter of the part.
	Depending on which Weld Mode is selected the direction of the rotation will change.
	**Part Diameter -** Specifies the Outside Diameter (OD) of the part. It programs in inches per minute and is only available if the rotation mode is set to in/min in the up slope segment.
	**Effective Diameter -** sets the effective diameter in inches. The effective diameter is the actual welding surface of the part.
	**Velocity**
	Initial value - sets the initial value in inches per minute.
	Final value - sets the final value in inches per minute.
	**Early Stop** - Sets when the rotary motion stops before the segment ends (in seconds).

7.13. CNC Module (X-CNC)

The CNC Module controls the complex coordinated motion necessary for curved or irregular weld seams where it is necessary for the weld head to follow a curved path. The module communicates with external amplifiers over EtherCAT protocol to coordinate the paths of the corresponding axes to follow a programmed route or weld seam.

At this point the CNC module is a customized module with system-specific software. The parameters are configured on a by-system basis. More detail will be in the documentation provided with the system.

7.14. Standalone (Rotation, Power Supply, Linear) (XMS)

The XMS Standalone System includes an XMS Standalone Hand Held Remote, a specialized XM Standalone Module, and an external assembly to be controlled. Functions the module can control range from manipulating an axis slide to magnetic oscillation.

The Hand Held Remote controls all of the functionality in the Standalone system. Schedules can be programmed to assign start, stop, speed, and various other parameters within the local system. Refer to the Standalone Manual if your system is equipped with this function for more information on the Hand Held Remote.

8. Creating a Weld Program

Table 8-1, Weld Program Creation	
Step	**Description**
1	Enter “Edit Mode” on the XM Controller.
2	Select the “defaultprog” weld program.
3	Highlight the upslope segment of the weld program.
4	Set the “Segment” parameters according to your needs.
5	Select the “Power Supply” module and adjust the parameters according to your programming needs.
6	Select the remaining modules and adjust the associated parameters according to your programming needs.
7	Highlight the next segment in the weld program and repeat steps 5 and 6. Repeat this step until all weld program segment parameters are set according to your programming needs.
8	Press the “Automation” button and add any automation sequences that are required for your welding process. “Automation” is a license-activated option that may not be included with your system but is not necessary to run a weld program.
9	Press the “Setup” button and set the values for “Override Limits”.
10	Press the “Setup” button and set the values for the “Data Acquisition” feature. “Data Acquisition” is a license-activated option that may not be included with your system but is not necessary to run a weld program.
11	Press the “Save” button to save the modified weld program. You will have the option to change the name of the weld program from “defaultprog” to any alphanumeric name that you desire.

9. Creating a Bore Clad Program

The Bore Cladding option is a license-activated feature. This option allows the user to control multi-axis slides and turntables to weld-clad surfaces such as the interior of pipe and circumferential flat surfaces such as the face of a flange. Upgrading the XM Controller software license activates this option.

To build a weld schedule, enter the Edit Mode. Set the welding parameters and set main segment to end at “Next Bore.” The Bore Cladding weld parameters, values and functions are described in Table 9-2, Bore Controller Menu. When setting the weld parameters, use the Select Programming knob to highlight the desired parameter and the Adjust Programming knob to set the desired value.

Table 9-1, Bore Clad Creation	
Step	**Description**
1	Press “Setup” soft button at the top of the Edit mode screen. Press “Prgm Cntrl” soft button. Press "Bore Controller" soft button.
2	Set value for the "Diameter" which is the diameter of the bore surface that you will be welding.
3	Set value for the "Z Pitch", which is the amount of Z-Axis travel during each 360-degree rotation. This move is linear therefore creating a spiral-clad result on the work piece.
4	Set value for the "Z Height", which is the total height of the bore that is to be clad. NOTE: The weld will continue until this value has been reached.
5	Set value for “Step Size”, which allows for step cladding instead of spiral cladding. This is the lateral distance the torch will travel to cover the Z-Pitch (the longer the step size, the shallower the angle of the step.
6	Set value for "Origin Angle", which is the position in degrees (0-360) where the rotation axis will be when the weld begins. NOTE: The rotation axis will move to this position before the weld starts.
7	Set value for "Origin Z", which is the position in inches from 0 (home) where the Z-Axis will be when the weld begins. NOTE: The Z-Axis will move to this position before the weld starts.
8	Set "Rotation Axis". Here you will select the rotation axis that you want to use for the cladding process.
9	Set "Z Axis". Here you will select the linear axis that you want to use for the cladding process.
10	Set value for "Start Offset" and "Stop Offset". These values are used to adjust the start and stop position (in degrees) when you have an intersecting bore. These values are not used if there are no intersecting bores. If there are intersecting bores these values should be left at 0 until the program has been started and an intersecting bore has been reached. At this time if adjustments are needed the program can be stopped, the offsets changed, and then the program can be restarted from its current position in the bore.
11	Set value for "Rotation Direction." This is the direction that the rotation axis will travel during the welding process. NOTE: The wire feed is typically behind the torch for hotwire systems.
12	Set value for "Rotation" under the "No Weld Velocity". This is the velocity that the rotation axis will travel while not welding in an intersecting bore. This parameter must be a non-zero value.
13	Set value for "Z" under the "No Weld Velocity". This is the velocity that the Z Axis will travel while it is not welding in an intersecting bore This parameter must be a non-zero value.
To continue without adding intersecting bores, continue to step 20.	
14	Press the "Add" soft button at the top of the screen. Each time you press "Add" another intersecting bore will be added.
15	Set "Angle" for each intersecting bore. This is the angle in degrees (0-360) where the intersecting bore is located from the origin. The reference for this value is the rotation angle origin of the weld.
16	Set the "Diameter" of the intersecting bore.
17	Set the "Z Offset" of the intersecting bore. This is the position of the intersecting bore within the main bore. The reference for this value is the rotation angle origin of the weld. (See Figure 9-1)
18	Set the "Tilt" of each intersecting bore. This is the angle at which the intersecting bore intersects the main bore. (See Figure 9-2)
19	Set the "Center Offset" of each intersecting bore. This is the offset from the center of the main bore. If the centerline of the intersecting bore does not intersect the centerline of the main bore then this value must be changed from 0. (See Figure

	9-3)
20	Press "Close" at the top of the screen.
21	Press "Save" at the top of the "Edit" mode screen and save your program.
22	Enter "Weld" mode to run the program.
23	Remove Intersecting Bore(s) if needed. To remove an intersecting bore and its parameters from the program, highlight any parameter in the intersecting bore to be removed and press the “Remove” soft button. Any remaining intersecting bore programs will be renumbered accordingly.

By moving the system axis to the location on the part where you want to begin the weld and then pressing the "Set Origin" soft button at the bottom of the screen you can avoid manually entering the "Origin Angle" and the "Origin Z" in Steps 6 and 7.

Table 9-2, Bore Controller Menu

Parameter	Function
Main Bore	
Diameter	This is the diameter of the bore surface that you will be welding.
Z Pitch	This is the amount of Z-Axis travel during each 360-degree rotation. This move is linear therefore creating a spiral-clad result on the work piece.
Z Height	This is the total height of the bore that is to be clad.
Origin Angle	This is the position in degrees (0-360) where the rotation axis will be when the weld begins.
Origin Z	This is the position in inches from 0 (home) where the Z-Axis will be when the weld begins.
Settings	
Rotation Axis	Here you will select the rotation axis (X, Y, or Z) that you want to use for the cladding process.
Z Axis	Here you will select the Linear Axis that you want to use for the cladding process.
Start Offset	These values are used to adjust the start and stop position (in degrees) when you have an intersecting bore. These values are not used if there are no intersecting bores.
Stop Offset	
Rotation Direction	This is the direction that the rotation axis will travel during the cladding process.
[-] No weld velocity	
Rotation	This is the velocity that the Rotation Axis will travel while not welding in an intersecting bore. If no intersecting bores are programmed, this must be a non-zero value.
Z	This is the velocity that the Z Axis will travel while not welding in an intersecting bore. If no intersecting bores are programmed, this must be a non-zero value.

It is important to note that the point at which the centerline of the secondary bore intersects the centerline of the main part determines the intersecting bore position.

Table 9-3, Bore Controller Intersecting Bore Menu

Parameter	Function
Intersecting Bore	
Angle	This is the angle in degrees (0-360) where the intersecting bore is located.

Diameter	The diameter of the intersecting bore
Z Offset	This is the position of the intersecting bore within the main bore.
Center Offset	This is the distance from the center of the main bore.

Figure 9-1, 90-Degree Intersecting Bore

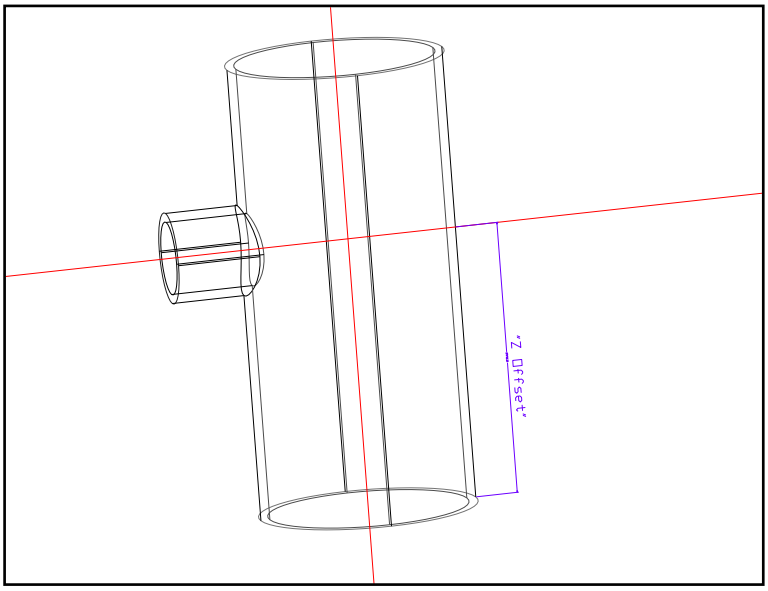


Figure 9-2, 30-Degree Off-Angle Intersecting Bore

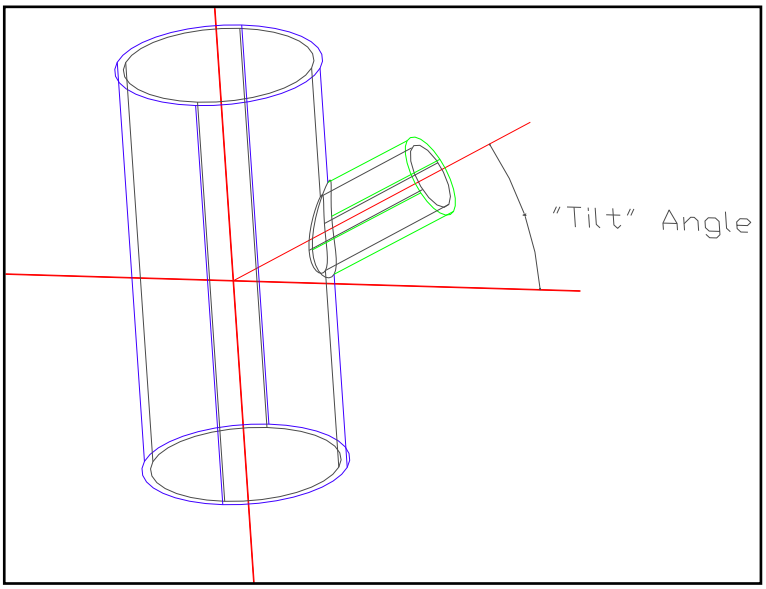
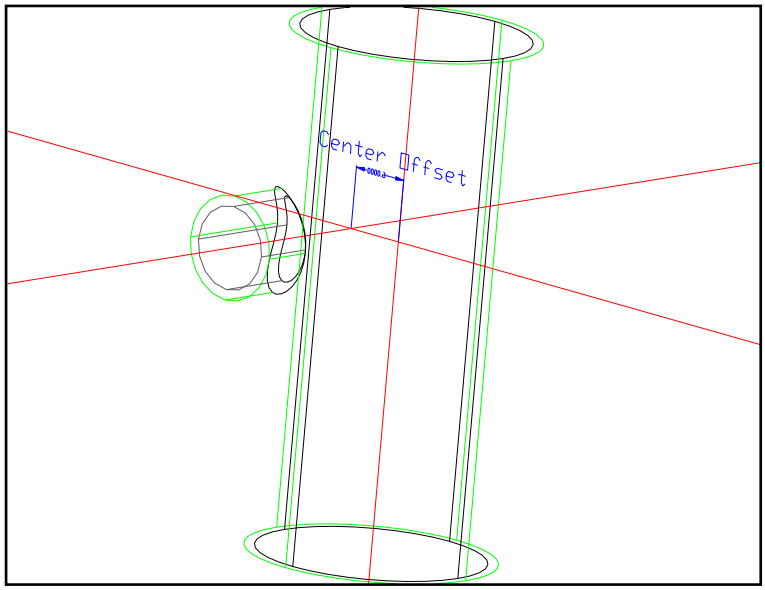


Figure 9-3, Offset Center, 90-Degree Intersecting Bore



NOTE

If the programming needs to accommodate intersecting bores, the parameters for each intersecting bore will be added to the Bore Controller Menu following the Main Bore and will be identified as Intersecting Bore 1, Intersecting Bore 2, etc. Table 9-3, Bore Controller Intersecting Bore Menu, describes the additional parameters and functions.

10. Programming the Controller to Clad a Flat Surface

(See Table 10-1, Flat Clad Control Menu, for a description of the weld parameters, values and functions.)

Table 10-1, Clad a Flat Surface	
Step	**Description**
1	Press "Flat Clad Cntrl"
2	Set value for "Origin Diameter." This is the starting diameter of the horizontal weld surface.
3	Set value for "Stop Diameter." This is the ending diameter of the horizontal weld surface.
4	Set value for "Origin Angle." This is the position in degrees (0-360) where the rotation axis will be when the weld begins. NOTE: The rotation axis will move to this position before the weld starts.
5	Set value for "Origin X." This is the position in inches from 0 (home) where the X-Axis will be when the weld begins. NOTE: The X-Axis will move to this position before the weld starts.
6	Set value for the "Pitch." This is the amount of X-Axis travel during each 360-degree rotation.
7	Set value for "Rotation Direction." This is the direction that the rotation axis will travel during the cladding process. NOTE: The wire feed is typically behind the torch.
8	Set "Rotation Axis." Here you will select the rotation axis that you want to use for the cladding process.
9	Set "X Axis." Here you will select the Linear Axis that you want to use for the cladding process.
10	Press "Close" at the top of the screen.
12	Press "Save" at the top of the "Edit" mode screen and save your program.
13	Enter "Weld" mode to run the program.

By moving the system axis to the location on the part where you want to begin the weld and then pressing the "Set Origin" button at the bottom of the screen you can avoid manually entering the "Origin Angle" and the "Origin X" in Steps 4 and 5.

Table 10-2, Flat Clad Control Menu	
Parameter	**Function**
Origin Diameter	This is the starting diameter of the horizontal surface to be welded.
Stop Diameter	This is the ending diameter of the horizontal surface to be welded.
Origin Angle	This is the position in degrees (0-360) where the rotation axis will be when the weld begins.
Origin X	This is the position in inches from 0 (home) where the X-Axis will be when the weld begins.
Pitch	This is the amount of X-Axis travel during each 360 degree rotation
Rotation Direction	The rotation axis that you want to use for the cladding process.
Rotation Axis	(Not available)
X Axis	Linear Axis (not available)

11. Additional Remote Pendants

Sometimes manipulators or external components are not integrated into the XM system or additional control is desired. In these cases a remote pendant is provided to give this control. Due to the diversity of XM-controlled systems and customization in some cases, all pendants cannot be covered in this manual. Some of the more common pendants are described below.

11.1. Rotary Positioner (Figure 11-1)

Some rotary positioners have buttons on the top of the base while others have an external pendant. The tilt of the positioner is typically controlled while the rotation is controlled via the XM controller.

Figure 11-1, Positioner Pendant

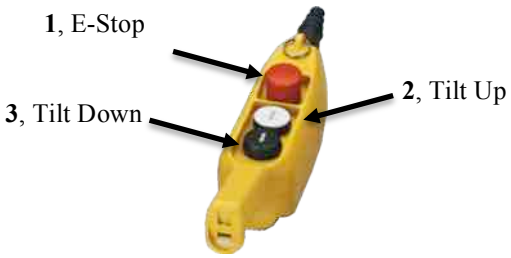


Table 11-1, Rotary Positioner Pendant Buttons			
Button	**Figure**	**Item**	**Description**
E-Stop	11-1	1	The Emergency Stop (E-Stop) button immediately stops all movement on the Boom and Travel Cart. Pulling up on the red E-Stop button clears the e-Stop.
Tilt Up		2	Positions the turntable into the upright position for loading.
Tilt Down		3	Positions the turntable into the horizontal position for welding.

11.2. Driven Turning Rolls on Track (Figure 11-2)

This Pendant controls the Turning Rolls' rotation, and Transverse Cart (Bogey) jogging.

Figure 11-2, 8-Button Pendant

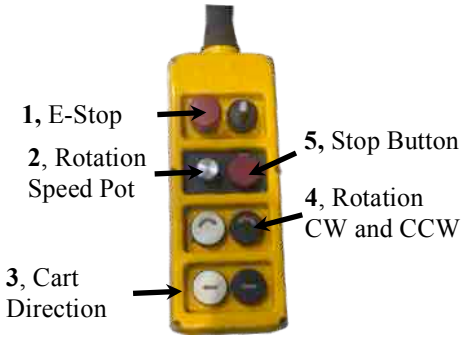


Table 11-2, Driven Turning Rolls Pendant Buttons			
Button	**Figure**	**Item**	**Description**
E-Stop	11-2	1	The Emergency Stop (E-Stop) button (Figure 11-2 Item 1) immediately stops all movement on the Boom and Travel Cart. Pulling up on the red E-Stop button clears the e-Stop.
Rotation Speed		2	The Rotation Speed Pot (Figure 11-2 Item 2) adjusts the rotation speed by turning the potentiometer. CW increases turning roll

			velocity, CCW decreases.
Rotation Direction		3	These buttons rotate the drive rolls in the clockwise and counterclockwise directions. The CW and CCW directional enables start rotation when pushed. **Note:** Turning Roll Rotation continues until the Rotation Stop button is pressed.
Transverse Cart Direction		4	The Left and Right directional enables start cart motion when pushed. Motion is stopped when the directional button is released.
Stop Button		5	Stops turning roll rotation.

11.3. Column and Boom 5-Button Pendant (Figure 11-3)

This pendant is for a column and boom manipulator on a travel cart. The pendant controls the up and down movement of the boom along the mast and moving the travel cart along the track.

Figure 11-3, CBM Pendant

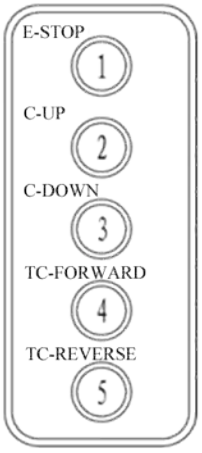


Table 11-3, Driven Turning Rolls Pendant Buttons

Button	Figure	Item	Description
E-Stop	11-3	1	The Emergency Stop (E-Stop) button (Figure 11-3 Item 1) immediately stops all movement on the Boom and Travel Cart. Pulling up on the red E-Stop button clears the e-Stop.
Column Up		2	Pressing the Column Up button (Figure 11-3 Item 2) moves the Boom upward along the column. Releasing the button stops movement.
Column Down		3	Pressing the Column Down button (Figure 11-3 Item 3) moves the Boom downward along the column. Releasing the button stops movement.
Travel Cart Forward		4	Pressing the Travel Cart Forward button (Figure 11-3 Item 4) moves the Travel Cart forward along the Transverse track. Releasing the button stops movement.
Travel Cart Reverse		5	Pressing the Travel Cart Reverse button (Figure 11-3 Item 5) moves the Travel Cart in reverse along the Transverse track. Releasing the button stops movement.

12. Troubleshooting Basics

Due to the complexity and diverse system configurations built and supported by AMET Inc, it is extremely difficult to cover all possible malfunctions or faults possible in an XM welding system. The following table covers the basics of troubleshooting the weld system. Additional rows are included in case additional issues and solutions are discovered and remedied.

Table 12-1, Troubleshooting Basics Table

Problem	Possible Cause	Possible Solution
System will not start up	No power is applied	Ensure the main power is connected. Ensure the XM Control Modules and pertinent devices have the power switch in the “ON” position. Ensure all fuses are intact.
No axis will move	Emergency Stop button is engaged	Clear E-Stop by pulling up on all E-Stop buttons in the system (complex systems may have more than one) and pressing the “Clear E-Stop” soft button on the XM Controller
Jumping arc	Poor gas pressure	Ensure the gas is flowing from a pressure-regulated source (without a flow meter) into the flow meter mounted to the equipment skid.
	Incorrect shielding gas	Ensure the correct shield gas is being used and attached to the correct flow meter.
Filler material will not flow	Incorrect filler material	Ensure the correct filler material is loaded on the system.