Models 217 & 217P

Function Descriptions & Programming Guidelines

AMI®
AN ESAB® BRAND

Index

Introduction

The following contains set up instructions and detailed descriptions of all power supply operations and functionality. In addition to Auto Program Development, guidelines are provided for self-programming.

- Refer to the Model specific power supply or weld head manual for additional equipment details such as specification, maintenance, safety data, etc.

- It should be noted that although there are numerous references to "tube" (except where "pipe" is specifically used) "tube" is used as a generic term for whatever is being welded, tube, pipe, fitting, valve body, etc. The words “schedule” and “program” are both used to describe a set of welding parameters.

CAUTION!
Refer to all safety information contained in the model-specific Operation Manuals before powering up and welding.

Model 217 Initial Set Up

ON/OFF switch
For Back-up gas
(aka I.D. Purge)

Back-up gas (aka I.D. Purge)
Output
Note: No flow unless a
mating male fitting is connected

Power & Ground
¼ turn Connectors

Back-up gas (aka I.D. purge)
Input. **CAUTION, max. 50psi.**
Fits ¼" tube compression
fitting

Arc gas input
CAUTION, max. 50psi.
Fits ¼" tube compression
fitting

Remote pendant
connector

Control connector for AMI heads

Arc gas output to weld head

Note: No flow unless a mating
male fitting is connected

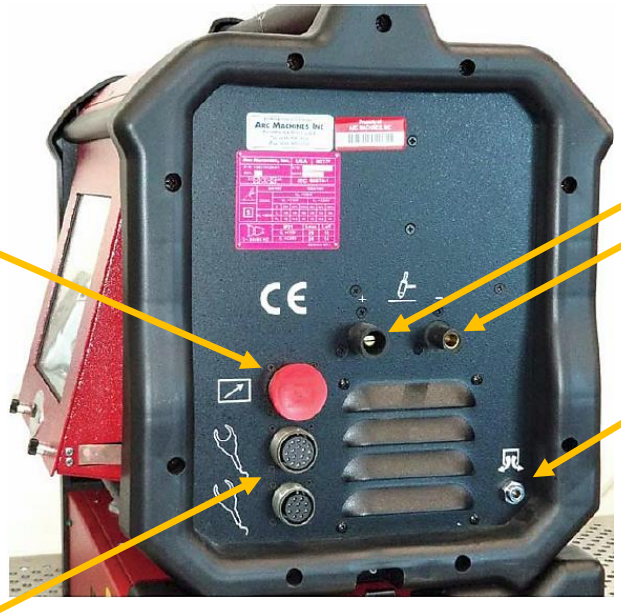
Weld head Control connector

Input AC receptacle
110 VAC, 30 amp
220 VAC, 20 amp
Auto-switching
Single Phase

Ethernet
connector

Main ON/OFF
switch

Model 217P Initial Set Up



Remote Pendant Connector

Positive (1/4-turn) connector
Negative (1/4-turn) ground connector

Arc Gas output
Note: No flow unless a mating male fitting is connected.

Weld Head Motor Control connectors

Right side

Printer

Ethernet connector

USB Port

Cooling unit connector

MAIN ON/OFF Switch

Arc Gas Input
Max. 50 psi
(¼" compression fitting)

Input AC receptacle
110VAC, 30 amp
220VAC, 20 amp
Auto-switching
Single phase

Left side

M217-CW & M217P-CW Cooling Units Set Up

The Models 217-CW and 217P-CW Cooling Units are is designed to provide a recirculating coolant source for cooling both the weld head as well as the power/ground cables. This this extends the life of the weld head and allows for higher duty-cycle welding. Power supply coolants have anti-freeze properties for cold climates , and also inhibit algae growth. The power supply and cooling unit are designed to "nest" together with the cooling unit on the bottom. Before connecting, fill the coolant tank with power supply coolant such as Miller "Industrial Supreme Low Conductivity". Note: coolant will not flow unless IN/OUT fittings are connected.

DO NOT USE AUTOMOTIVE COOLANT

M217-CW

The power connector attaches to the bottom of the power supply.

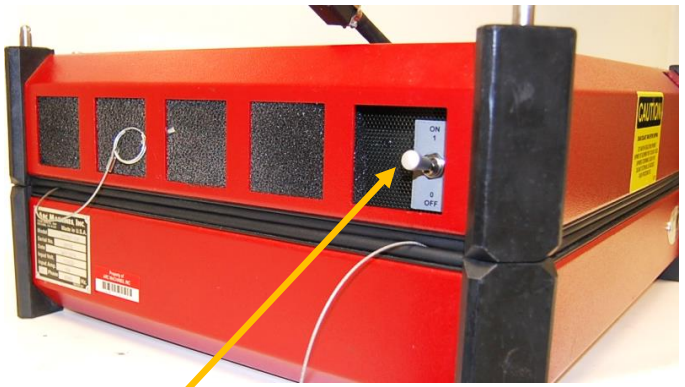
Fill with 1.5 gal. (5.7 Liters) of Supply Coolant or D.I. water.

Important Note:
Always drain coolant before shipping.

Coolant flow indicator

Insert pins into all four corners to secure the power supply to the cooling unit

Right side
Coolant IN/OUT



Left side
ON/OFF switch

M217-CW & M217P-CW Cooling Units Set Up

M217P-CW

Fill with 1.0 gal. (3.8 liters) of Power Supply Coolant or D.I. water.

Important Note:
Always drain coolant before shipping

Secure to power supply using latches on both sides.

ON/OFF switch and 110 VAC 1 ph input connector

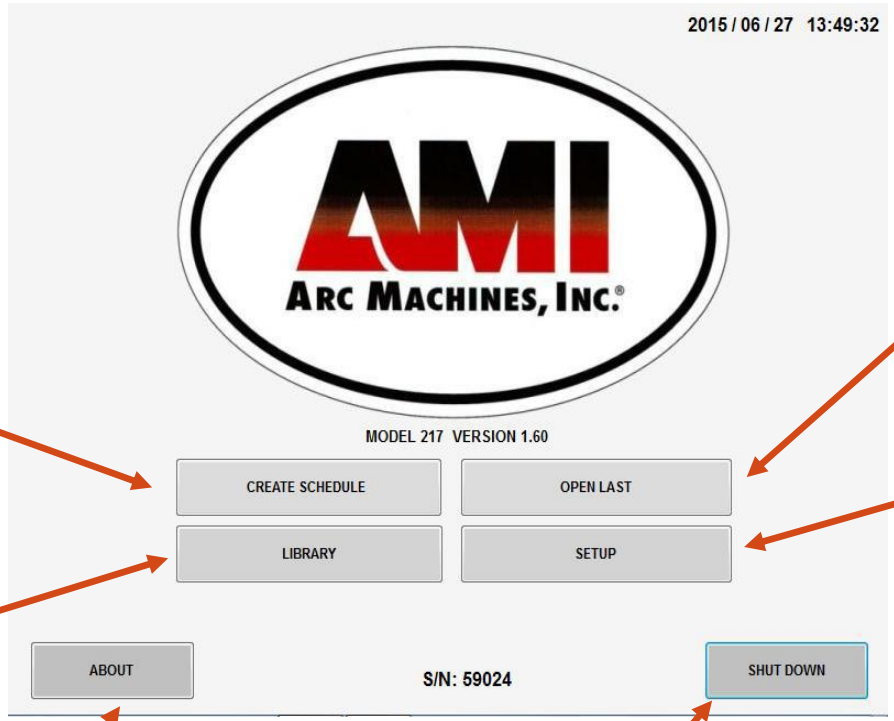
Left side

Coolant IN/OUT

Note: It does not matter which direction the coolant flows to/from the weld head

Right side

HOME screen



CREATE SCHEDULE
This is used to create a new weld schedule. After selecting Create Schedule you can select either Auto Weld Schedule development or Manual Weld schedule entry.
(See pg. 11 – 33)

LIBRARY (See pg. 10)
All of the weld schedules are accessed via the Library. Open the Library to select either LOAD, DELETE or RENAME a weld schedule.
Additionally, if a USB jump drive is connected you can COPY one or all of the schedules to or from the jump drive.

OPEN LAST (weld schedule)
Select this function to open the last weld schedule used.

SETUP
This is used to set:
CLOCK (Time/Date)
UNITS English/Metric
Power Adjust %
(See pg. 9)

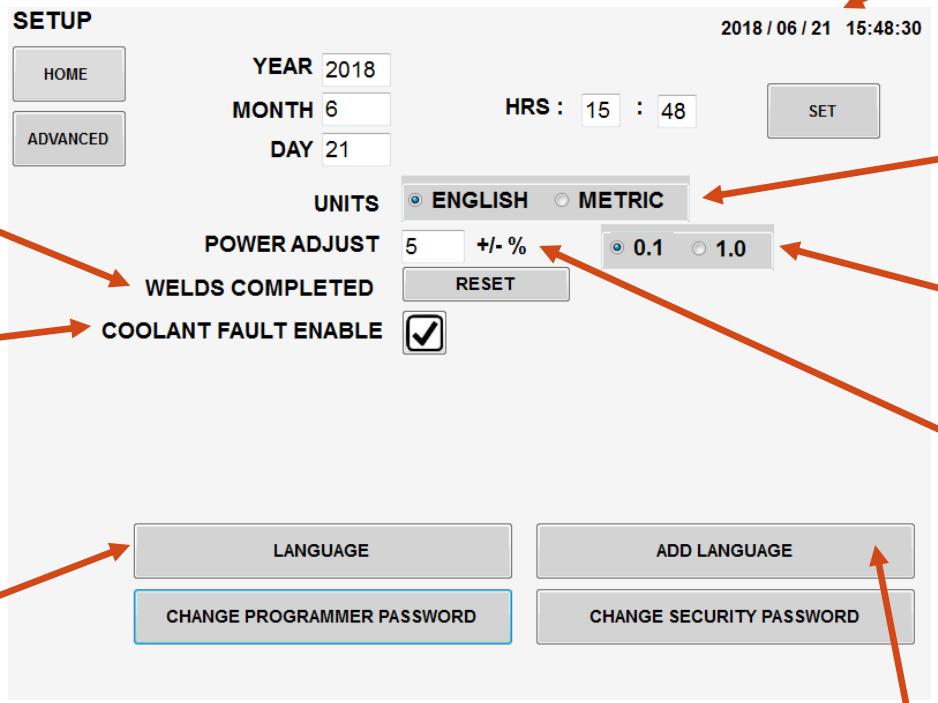
ABOUT
Used to access the machines' serial number, software version, company contact info, System hours (on time) and Arc hours (arc time).

SHUT DOWN
Use this to shut the machine off. After selecting Shut down, wait for the screen to go black before shutting off Main ON/OFF switch, located on the left side of the unit.

SET UP screen

CLOCK (Time/Date)
This info will be used for WDR (Weld Data Recording)

WELDS COMPLETED (reset)
The unit will count all completed welds. This info can be used for tracking production, electrode life or service frequency.



UNITS English/Metric
For tube and electrode dimensions.

0.1 or 1.0
Numerical entries may be in 10ths or whole numbers

COOLANT FAULT ENABLE (on/off)
If a cooling system is connected, and a non-liquid-cooled weld head is being used, set this fault to "off". (box NOT checked)

Power Adjust %
This setting is used when the machine is set up to require a log on. Once logged on, an operators ability to modify amperage settings of a weld schedule will be limited by the Power Adjust% setting. Operator logons do not have access to changing the Power Adjust % setting.

LANGUAGE
Select the language to be used. See pg. 42

CHANGE PROGRAMMER PASSWORD
A "Programmer" has access to **LIBRARY, CREATE SCHEDULE, OPEN LAST** and **SETUP**
To change stored password, enter old then the new password.

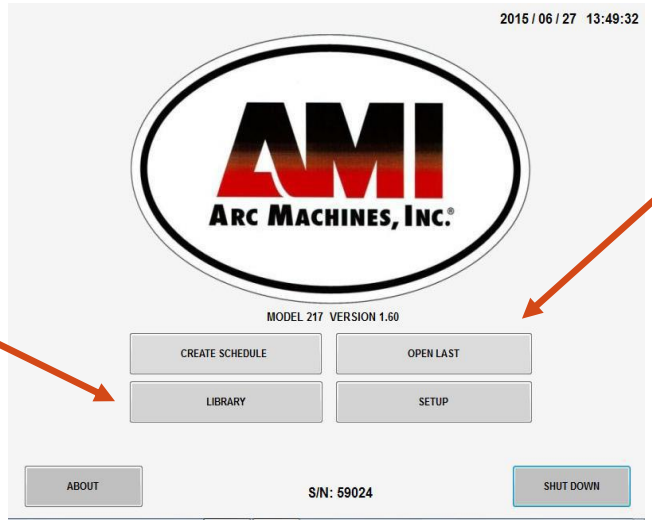
CHANGE SECURITY PASSWORD
"Security" level allows access to **LIBRARY** and **OPEN LAST** only.
To change stored password, enter old then the new password.

ADD LANGUAGE (Pg.)

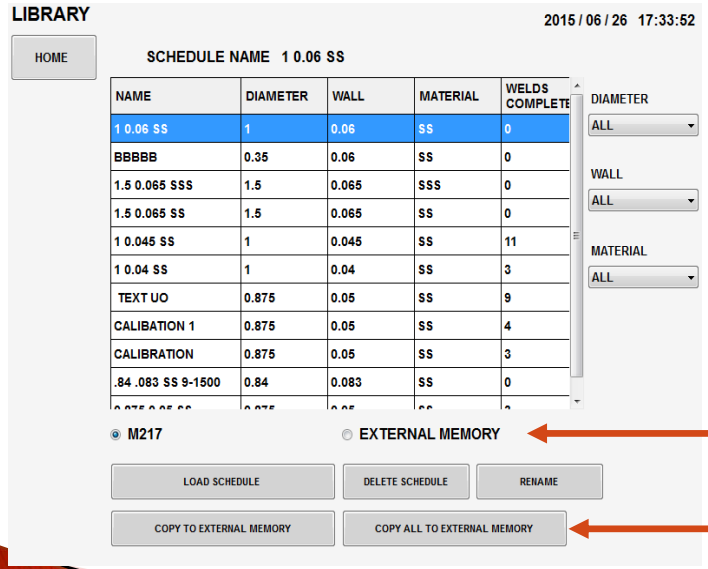
Note
From the factory passwords are blank or none entered.

WELDING WITH AN EXISTING SCHEDULE

LIBRARY
All of the weld schedules are accessed via the Library. Open the Library to select and either LOAD, DELETE or RENAME a weld schedule. Additionally, if a USB jump drive is connected you can COPY one or all of the schedules to or from the jump drive.



From the HOME screen select **OPEN LAST** to use the last program accessed or **LIBRARY** to select from a list of existing programs.
If not already done, once at the WELD screen, use the **PURGE** button to set the Arc Gas flow rate and **CALIBRATE** the weld head .
See page 35 for details



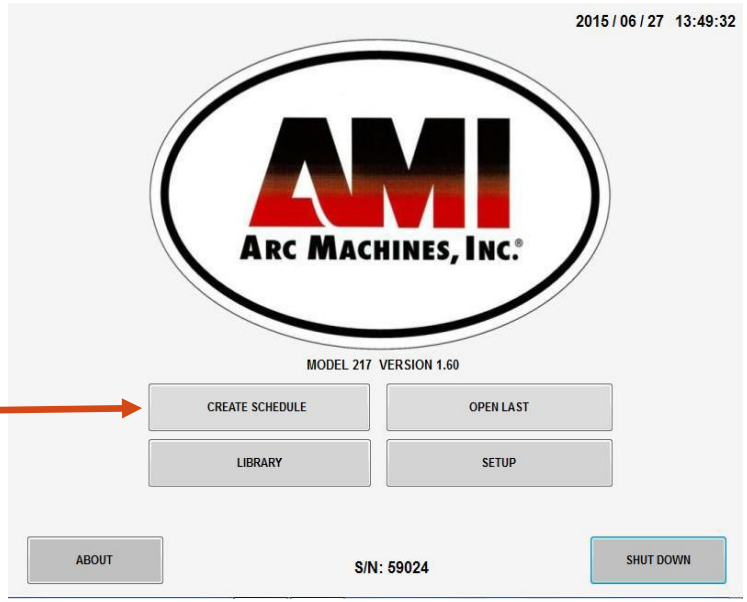
Once you open the **Library** you can use the search criteria to narrow up your search, or use the scroll bar you find the schedule.

If memory is extended with a (plugged-in) USB drive, you can access that drive by selecting EXTERNAL MEMORY.

Programs can be copied to or from the USB drive. These options are only available when a USB drive is connected.

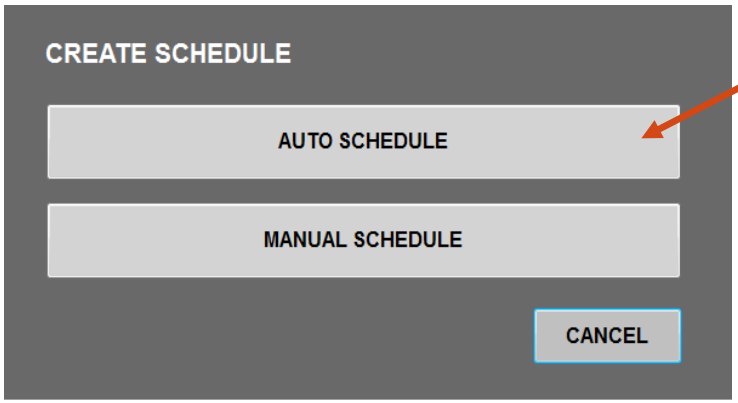
WELD SCHEDULE CREATION

From the HOME screen
select CREATE SCHEDULE



Then select AUTO SCHEDULE or MANUAL SCHEDULE (creation).

In the AUTO mode the power supply will generate a weld schedule that can be used as a starting point. After evaluating a test weld, modifications are made to fine-tune the program.

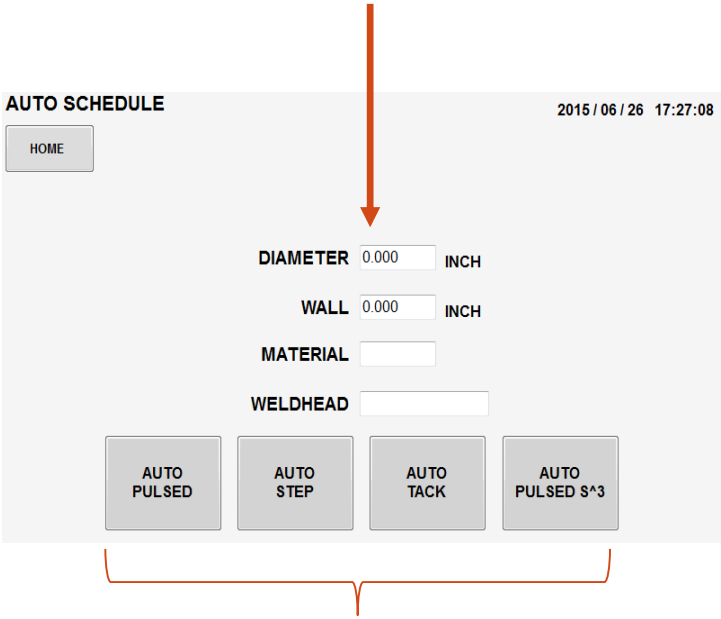


After selecting **AUTO SCHEDULE** you will have a choice of 4 types of programs. See pg. 12

AUTO SCHEDULE creation

AUTO WELD SCHEDULE (creation)
Enter the tube DIAMETER, WALL & MATERIAL, then select the weld head to be used. DIAMETER, WALL and MATERIAL will be used in the LIBRARY as the Weld Schedule Name.

Note: If the machine has been set up to be programmed in English (Inch) or Metric (mm), enter the tube dimensions accordingly.



Select one of the four types of weld programs. The power supply will develop a set of welding parameters based on the tube DIAMETER and WALL. After a test weld, the welding parameters can be manually adjusted to suit.

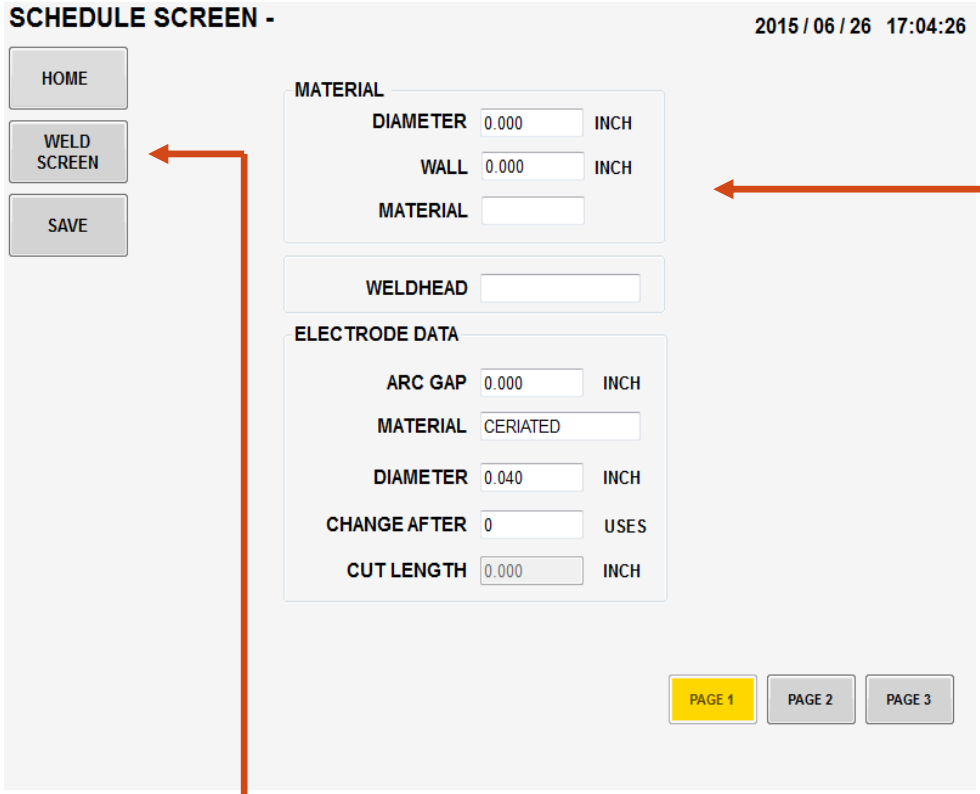
AUTO PULSED
This is a multi-level (typically 4 level), continuous rotation program, commonly used on wall thicknesses below 0.090" (2.3mm) on power supplies **without S3 technology.**

AUTO STEP
This is a multi-level (typically 4 level), stepped rotation program commonly used on wall thicknesses above 0.090" (2.3mm). This is the same as Auto Pulsed, except the electrodes' rotation is programmed to "step" (travel-stop-travel) around the joint. A typical application for this type of programming is on heavy-wall applications, over 0.090" (2.3mm) in thickness. The electrode is programmed to stop (or slow-down) during the PRI-AMP pulse and travel at the normal rate during the BCK-AMP pulse.

AUTO TACK
This creates a tacking program. You can select the number of tacks, the tack amperage and duration, as well as how the tacks are placed, balanced or sequential.

AUTO PULSED S3
This is the most common type of program used in the Models 217 and 217P because of its ease in program creation and modification and uniform weld bead width. It is normally used for tube wall thicknesses below 0.090“ (2.3mm). Using PULSED S3 programming the (pulsed) welding current automatically ramps down from a "start" amp setting to an "end" amp setting, which is reached at (or just past) 360 degrees of electrode rotation.

MANUAL WELD SCHEDULE ENTRY
SCHEDULE screen (Page 1)



WELD SCREEN (button)
Takes you to the screen for starting or stopping a weld program, jogging the rotor, manual purge, calibrate, print etc.

MATERIAL
Enter the tube Diameter, Wall and Material
Note: If the machine has been set up to be programmed in English (Inch) or Metric (mm), enter the tube dimensions accordingly.

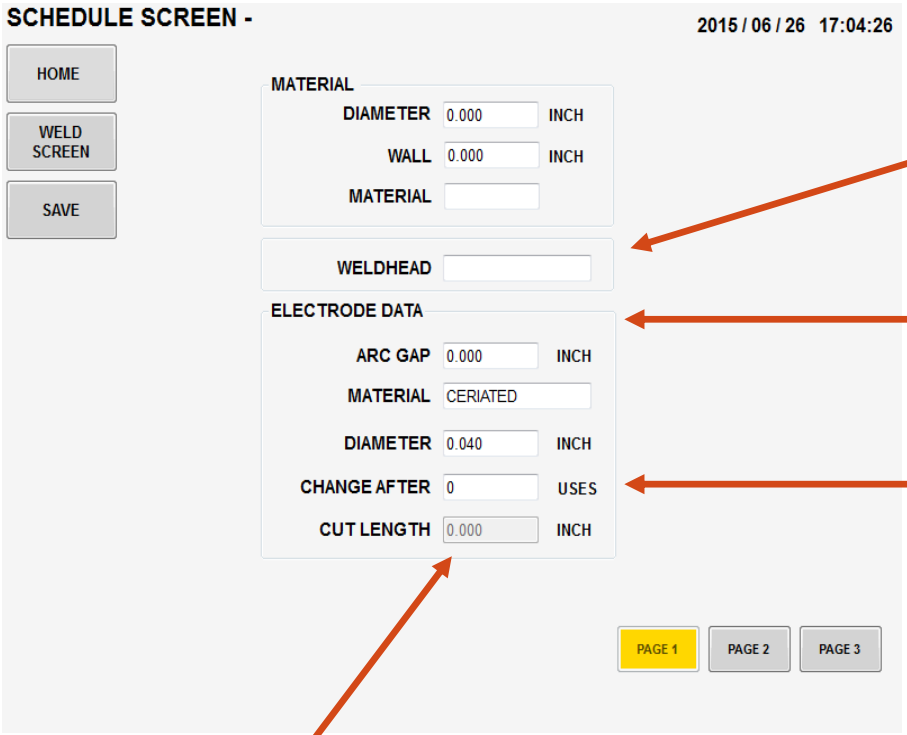
DIAMETER
Enter the tube O.D.
Program to the nearest 0.001" (0.01MM) IN ORDER to have the correct electrode CUT LENGTH determined properly.

WALL
Enter the tube wall thickness.
Note: DIAMETER, WALL & MATERIAL entry will be used as the Weld Schedule Name in the LIBRARY.

MATERIAL
Enter the tube material. ie 316, 316L, 304, Titanium, C22 Hast., etc. If you are tracking material heat numbers you can record this data here as well.

Notes: Material field is used as static data only.
When using the Auto Schedule Development function, the tube Diameter and wall thickness entries are used in the algorithm for calculating welding parameters. Diameter is also used for establishing IPM/RPM settings.

MANUAL WELD SCHEDULE ENTRY
SCHEDULE screen (Page 1)



WELDHEAD (select)
Select the weld head to be used from the list

ELECTRODE DATA
Enter the ARC GAP, MATERIAL (of the Electrode), and electrode DIAMETER.
Note: 2% Ceriated electrodes are recommended.

CHANGE AFTER
This can be used to alert the operator to change the electrode after "X" number of welds have been made.
Sometimes used for QC purposes.

CUT LENGTH
Electrode length is displayed, based on the tube O.D., Arc Gap and weld head model.

ARC GAP & ELECTRODE DIMENSIONS

Use the charts below for Electrode Diameter and Arc Gap guidelines.
Note: Most weld heads hold two electrode sizes.

ELECTRODE DIAMETER

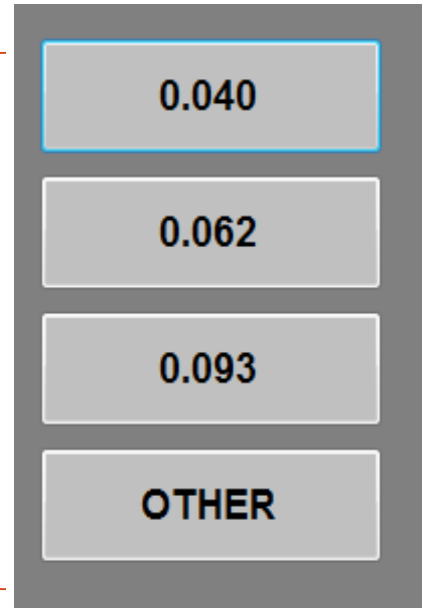
Tube Wall thickness	Recommended Electrode Diameter
0.010“ - 0.049“ (.25-1.2mm)	04 or 0.062"(1/16")
0.050“ - 0.083“ (1.2-2.1mm)	0.062" (1/16")
0.084“ - 0.154“ (2.1-3.9mm)	0.093" (3/32“)

ARC GAP

The ARC GAP is the distance from the tip of the electrode to the tube being welded.

Tube Wall thickness	Recommended Arc Gap
0.020 - 0.034	0.020“
0.035 - 0.049	0.030“
0.050 - 0.083	0.050“
0.084 - 0.154	0.070"

Note: If material is out-of-round by more than half of the arc gap, the arc gap should be increased accordingly. While this is NOT a common issue, due to manufacturing tolerances it is more commonly found in pipe vs tube.

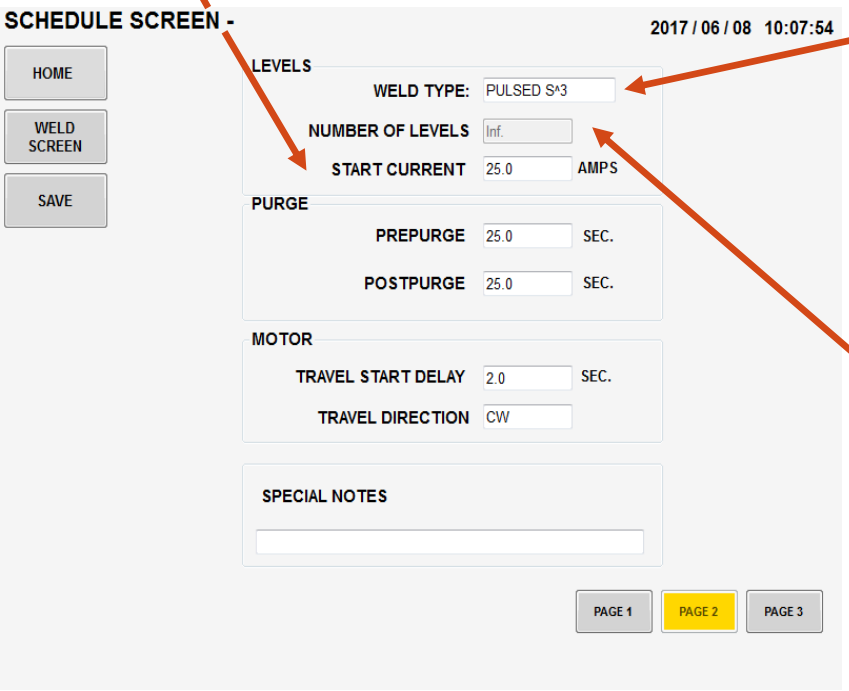


TIP DIAMETER

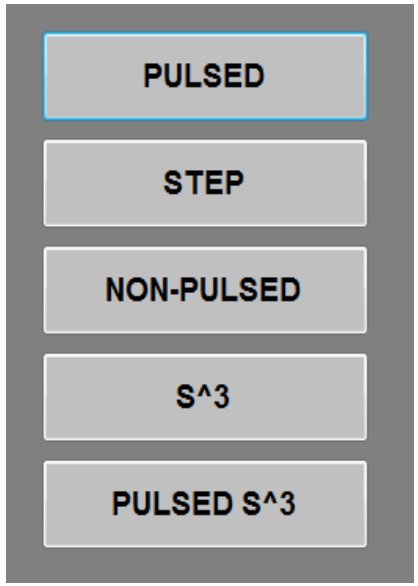
Tube Wall Thickness	Recommended Tip Diameter
0.010” – 0.025” (.25 - .6mm)	0.005” – 0.010” (.1 - .25mm)
0.026” – 0.049” (.7 – 1.2mm)	0.020” – 0.030” (.5 – .8mm)
0.050” – 0.154” (1.3 – 4.0mm)	0.030” – 0.040” (.8 – 1.0mm)

Manual Weld Schedule Entry
SCHEDULE screen (Page 2)

START CURRENT
The START CURRENT value is the amp setting used during the initial strike of the arc, and only lasts for a few milliseconds. 25 amps is the default setting, which is suitable for most applications. **In no case** should this setting exceed the weld schedule Start Amps or Level 1 amps. Doing so will risk burning a hole in the joint and or electrode damage.



WELD TYPE
Start by selecting the type of program to be created (details on Pg 17-18)



Note: PULSED S3 programming is the easiest and best method of programming for tube wall thicknesses up to 0.090” (.6mm). Use PULSED for Multi-level programs, and STEP (pulsed) for Multi-level, stepped rotation welds, typically used for tube wall thicknesses above 0.090” (2.1mm).

NUMBER OF LEVELS
This is used on for Multi-level programs. Most Multi-level programs have 4 levels, with each set at approximately 90 degrees of electrode rotation. (See Pg. 29)

Manual Weld Schedule Entry
Types of Manual entry Programs

PULSED (Multi-Level)
This type of program is commonly used on power supplies that do not incorporate S3 (current sloping) technology. A typical multi-level program is 4 levels (although up to 99 levels can be programmed). Each of the first 3 levels (in a 4 level program) is programmed for approximately 90 degrees of electrode rotation, with the 4th level traveling 91 - 95 degrees (to provide a small amount of overlap). Further each level is typically programmed at a lower PRI-AMP setting than the previous level. As in S3 technology, this is done in order to compensate for the increase in the tube temperature as the electrode travels.

Although each level can be programmed at different PRI-AMP and BCK-AMP settings, more often than not all levels are set at the same BCK-AMP value while the PRI-AMPS drop from level to level.

STEP (Multi-level)
This is the same as Multi-level, except the electrodes‘ rotation is programmed to "step" (travel-stop-travel) around the joint. A typical application for this type of programming is on heavy-wall applications, typically over 0.090" (2.1mm) in thickness. The electrode is programmed to stop (or slow- down) during the PRI-AMP pulse and travel at the normal rate during the BCK-AMP pulse.

Note: Extra-heavy-wall applications in excess of approximately 0.12" (3.0mm), due to the weight of the weld puddle and the effects of gravity, the weld puddle will be sensitive to pipe orientation (2G, 5G or 6G), and may require a different set of welding parameters for each pipe position.

Example:
A pipe in the 2G (vertical) position has no change in gravitational affect throughout all 360 degrees of electrode rotation. However a pipe in the 5G or 6G (horizontal or 45 degree) position has gravitational changes to the weld puddle. At the 12 o'clock position gravity helps to "push" the molten puddle into the pipe, and at the 6 o'clock position gravity works against the puddle, sometimes requiring amp settings to increase as the electrodes travels across the bottom (4 - 8 o'clock) rather than the typical program that decreases the current from beginning to end.

Manual Weld Schedule Entry
Types of Manual entry Programs

NON PULSED (Multi-Level)
This is the same as a Pulsed, Multi-Level program except there is no BCK-AMP setting as the current is not pulsed.

S3 (NON-PULSED)
This is the same as an S3 program, except weld current is not pulsed, so there is no BCK-AMP setting. This is usually used on extremely thin-walled tube, below 0.018" (.45mm).

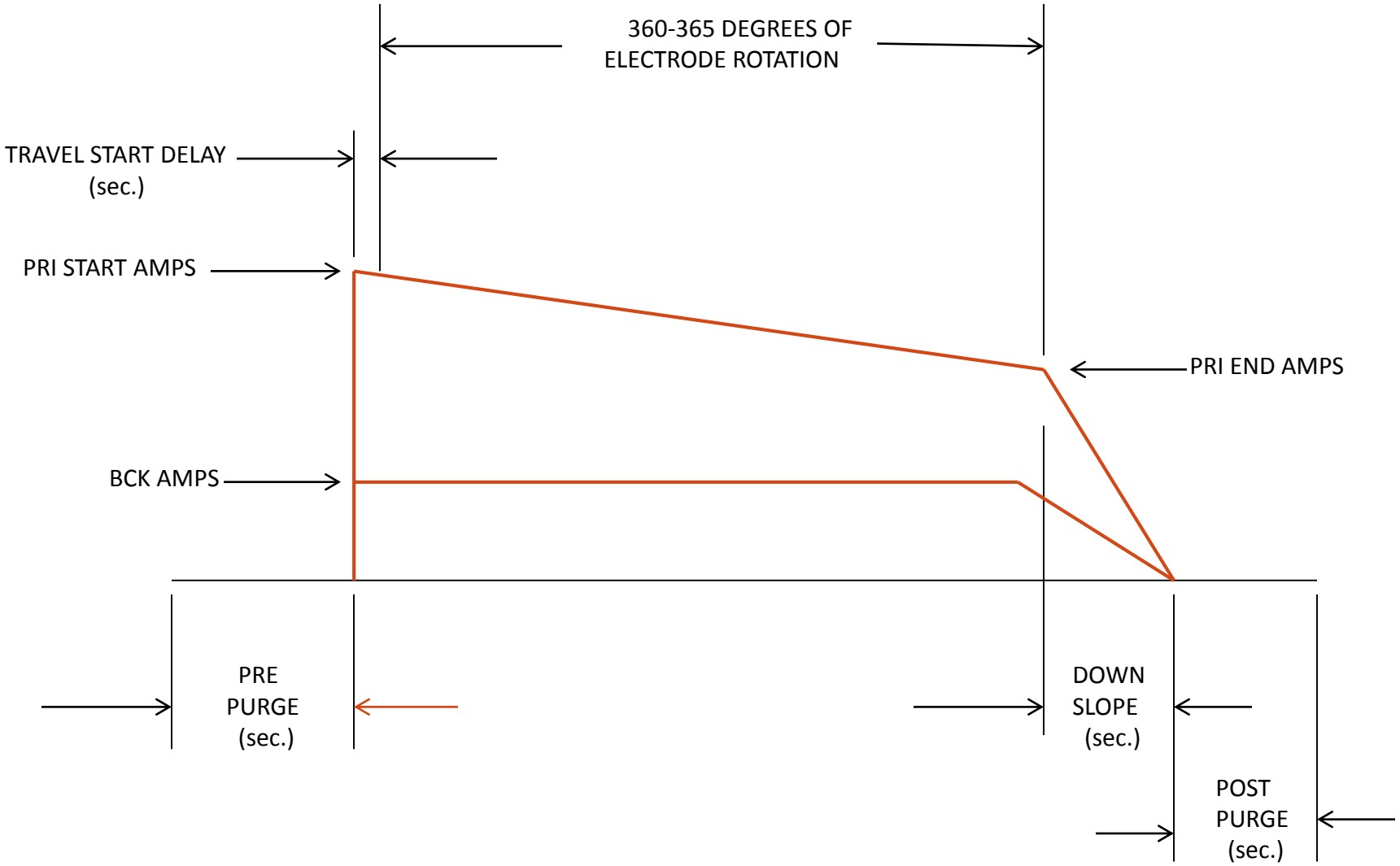
PULSED S3
This is the easiest and most common type of program used in with the Models 217 or 217P for tube wall thicknesses below 0.090" (2.3mm).

Using S3 PULSED programming the (pulsed) welding current ramps down from a “START AMPS“ value to an “END AMPS” value, which is reached at or just past) 360 degrees of electrode rotation.

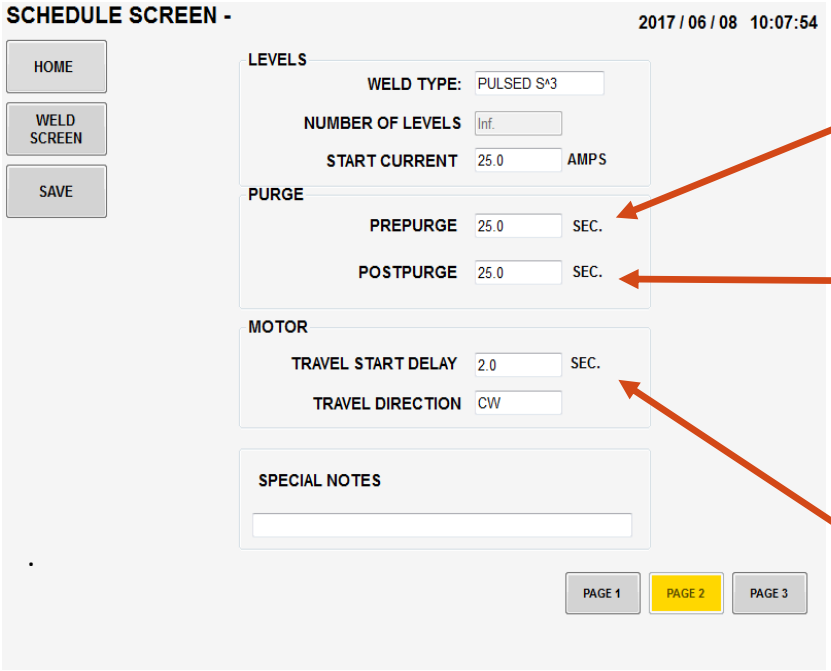
Note: Down slope begins where and when “END AMPS” is reached.

S3 PROGRAM

An S3 program (while pulsing between PRI and BCK current) ramps the PRI current down from START AMPS to END AMPS.



Manual Weld Schedule Entry
SCHEDULE screen (Page 2)



PREPURGE (sec.)
This is the duration that the arc gas will flow from the time the Start sequence button is pressed until arc initiation, however, the gas will not be shut off until the end of Post purge time. Longer PRE PURGE times will result in cleaner welds and longer electrode life.

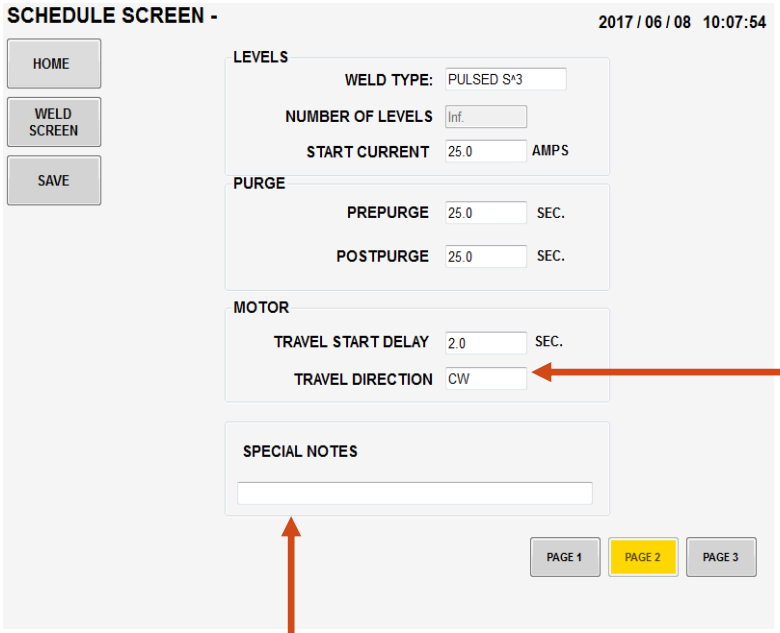
See chart on page 22 for guidelines.

POSTPURGE (sec.)
This is the duration that arc gas will continue to flow after the arc is extinguished (at the end of the Down slope). Longer Post purge times will result in cleaner welds and extended electrode life.

See chart on page 22 for guidelines.

TRAVEL START DELAY (sec.)
This is the amount of time that the electrode will remain stationary, after the arc is established. At the end of "Travel Start Delay" the electrode will begin its rotation. Adjust this time so that the correct depth of penetration is established before the electrode begins to travel.
See pg. 23 for guidelines.

Manual Weld Schedule Entry
SCHEDULE screen (Page 2)



TRAVEL DIRECTION (CW/CCW)
This determines the electrode direction of travel as seen from the weld head cover side. Changing the direction of electrode travel is sometimes done in the case of applications in excess of 0.12“ (3.0mm) wall thickness, being welded in the 5G or 6G position. Depending on the way the weld head is mounted to the pipe the electrode might begin its rotation traveling uphill or downhill. In order to control the direction of travel (when considering gravitational affects) CW or CCW can be selected

SPECIAL NOTES
This field may be used to record additional information such as material heat numbers, purge flow rate and exit orifice size, assembly notes, I.D. pressure, etc.

Recommended
Arc Gas Flow Rates & Minimum Pre Purge time

Refer to the chart below for **ARC GAS flow rates** and recommended **minimum PURGE times**.

Weld Head	Arc Gas Flow Rate CFH	Min. Pre Purge Time (sec.)
9-250	8 – 12	20
9-500/C	10 – 18	20
9-750 (& AFM)	12 – 20	20
9-1500	15 – 30	20
9E-1500	20 – 35	20
9-2500	25 – 40	30
9E-2500	25 – 40	30
9-3500	25 – 40	30
9E-3500	30 – 45	30
9-4500	30 – 45	45
9ER-4500	35 – 45	45
9E-4500	35 – 45	45
9-7500	35 – 45	60
9E-7500	40 – 50	60
8-2000	20 – 35	30
8-4000	25 – 40	30
8-6625	25 – 40	45

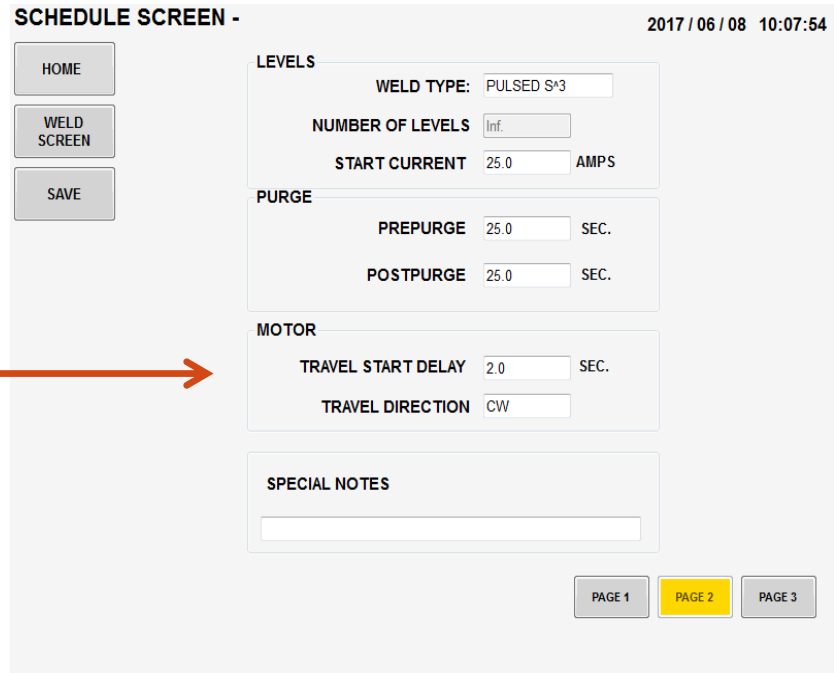
Note: Longer Pre and Post Purge times will result in cleaner welds and longer electrode life.

Manual Weld Schedule Entry
SCHEDULE screen (Page 2)

TRAVEL START DELAY Guidelines

Tube Wall thickness	Typical Travel Start Delay time (sec.)
0.010" - 0.035" (.25 - 1.0mm)	0.0 - 1.0
0.036" - 0.065" (1.0 - 1.5mm)	1.0 – 2.0
0.066" - 0.090" (1.6 - 2.3mm)	1.5 - 3.5
0.091" - 0.154" (2.3 - 4.0mm)	3.0 - 6.0

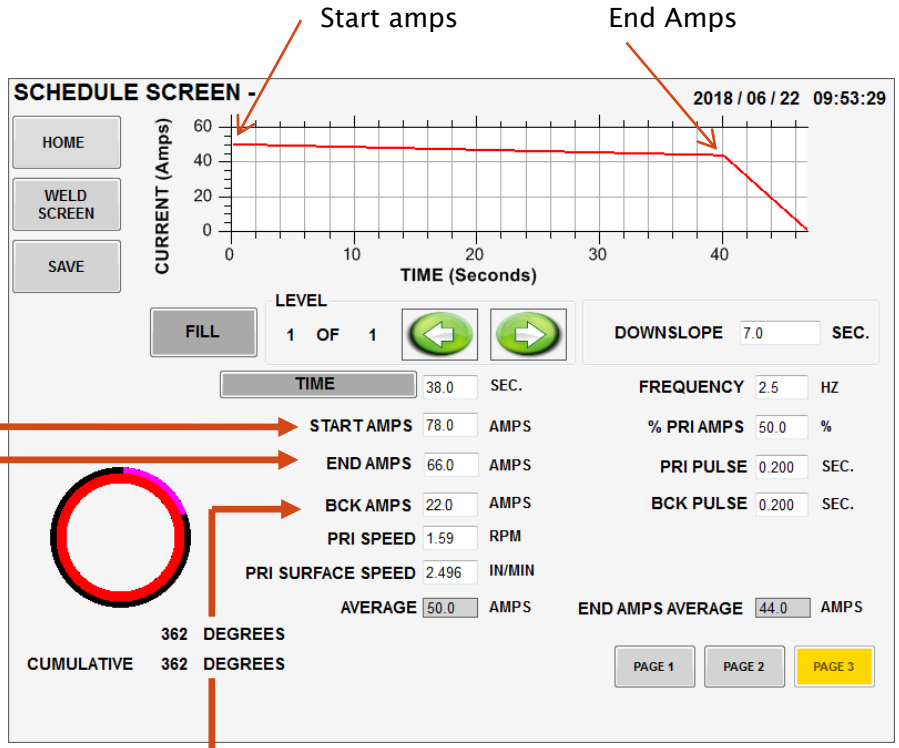
Note: At a given beginning amps setting, the proper Travel Start Delay time will result in a weld that establishes the proper depth of penetration prior to the electrode beginning its rotation.



Manual Weld Schedule Entry
SCHEDULE screen (Page 3)

START AMPS (S3 type programs) **(aka PRI AMPS** on all pulsed current programs)
This is the beginning amp value of an S3 program. Over the course of an S3 program the a amps will ramp down from START AMPS to END AMPS.

Note: A good starting point is approximately:
Tube wall thickness X 1.1 to 1.2
Example: Wall = 0.065
65 X 1.1 = 71
65 X 1.2 = 79
START AMPS = 71 - 79



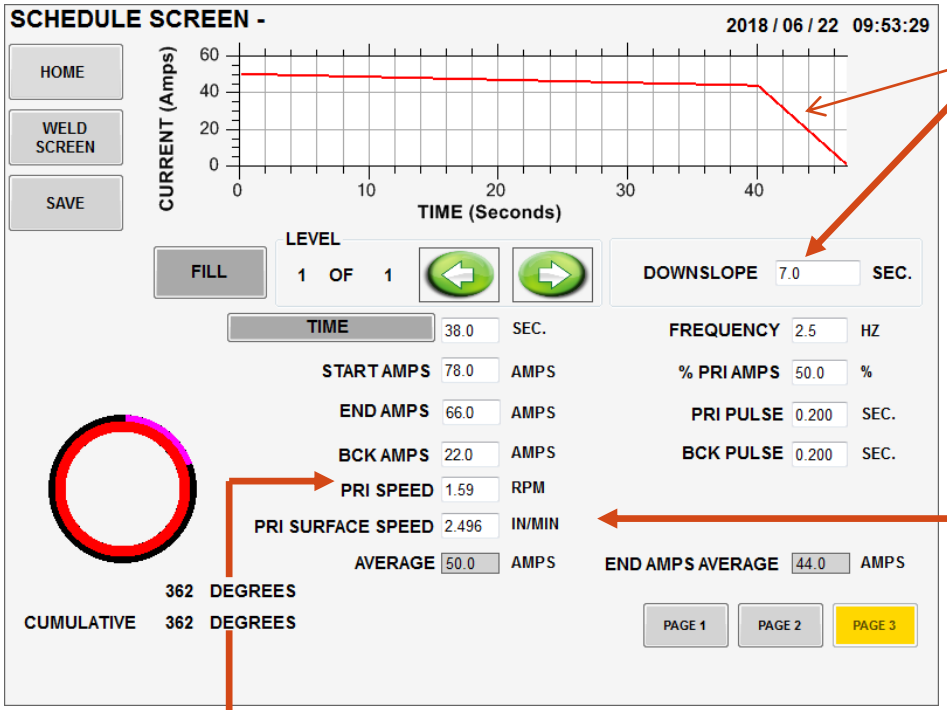
END AMPS (S3 type programs)
This is the level that the amps will ramp down to (from START AMPS), prior to the beginning of the Down slope.
As a guideline, set END AMPS at:
Tube wall x 1.0 to 1.1
Example: Wall = 0.065
65 X 1.0 = 65
65 X 1.1 = 71
START AMPS = 65 - 71

Note: PRI AMP setting in the last level of a multi-level program is calculated in the same manner.

BCK AMPS (all Pulsed Current programs)
This is the Background (low) current setting used on pulsed current programs. In most cases the BCK AMPS remain at the same setting throughout the weld, until Down slope begins.

A good start point is calculated at approximately 20 – 30% of START AMPS (or Level 1 PRI AMPS)
Example: START AMPS set at 78
78 x .2 = 14
78 x .4 = 31
BCK AMPS = 14 - 31

Manual Weld Schedule Entry
SCHEDULE screen (Page 3)



DOWNSLOPE (sec.)
This is the duration the welding amperage will ramp down from the End amps (or last level amps) to the point the arc is extinguished. Down slope is an important function. It prevents the end-of-weld pin hole or crater that can occur if the arc is shut off abruptly.
In no case should the Down slope be less than 2 seconds, and in most
cases Down slope durations more than 4 - 5 seconds are done purely for weld bead cosmetics. For tube sizes 1" (25mm) and above, a 10 second Down slope is common.

PRI SURFACE SPEED (in/min)
This is the speed of the electrode (in IPM, inches/minute) based on the tube O.D. and RPM.

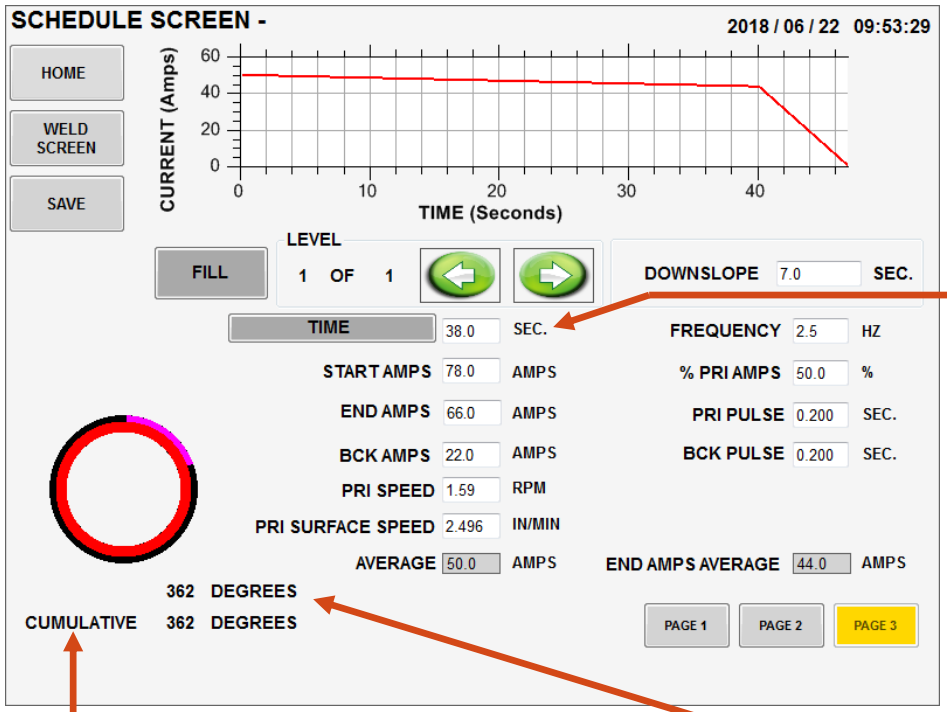
In a STEPPED program this is the speed during the PRI AMP PULSE. In most STEPPED programs this is set to zero (0 IPM) in order to achieve maximum penetration.

The proper travel speed for non-stepped applications is 4 - 7 IPM (inches/minute).

Note: When an IPM entry is made the RPM setting will automatically adjust to suit based on the tube O.D.

PRI SPEED (rpm)
This is the speed of the electrode (in RPM) during the weld or during the PRI AMP pulse of a **STEPPED** weld.

Manual Weld Schedule Entry
SCHEDULE screen (Page 3)



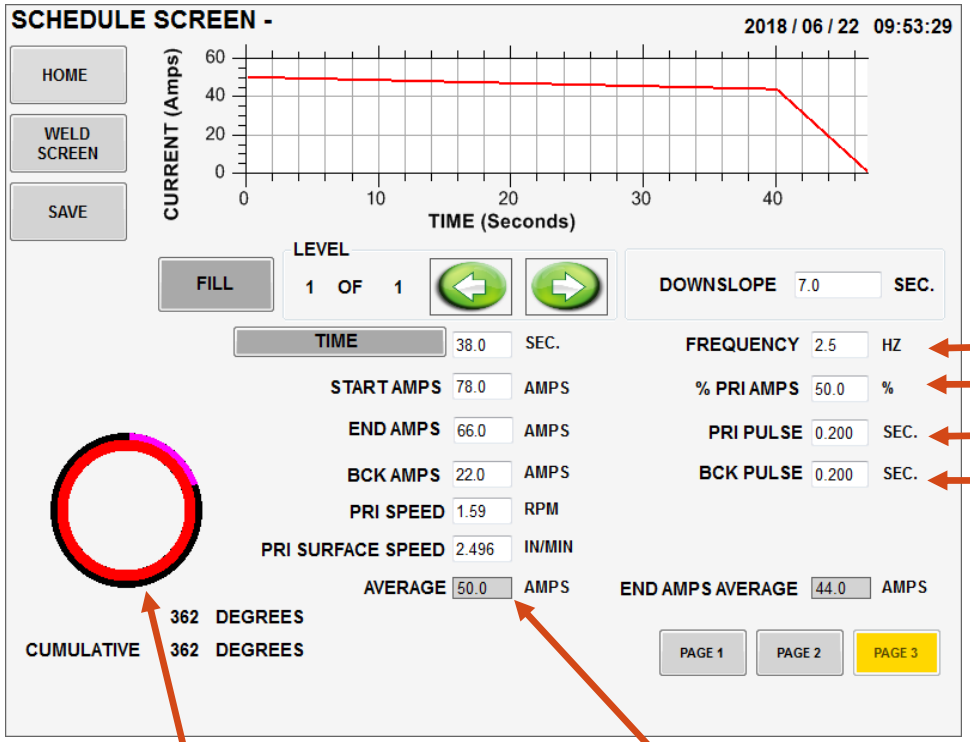
TIME (sec.)
This is the total duration of Travel time (not including Down slope) of an S3 program or of one level of a Multi-level program.

Note : After the IPM or RPM is set, adjust the TIME so the electrode travels the degrees required.

CUMULATIVE DEGREES (Multi-level programs only)
This field indicates electrode travel from start to the end of the level displayed, selected by using the Left and Right arrows.
Downslope travel is not included.

DEGREES (electrode rotation)
This indicates the degrees traveled by the electrode in an S3 program or in a single level of a Multi-level program. It does not include the rotation during Down slope.

Manual Weld Schedule Entry
SCHEDULE screen (Page 3)



FREQUENCY (HZ)(All Pulsed programs)
This represents the Pulse frequency of the PRI AMP and BCK AMPS.

% PRI AMPS (All Pulsed programs)
This represents the amount of time spent at the PRI AMP setting when pulsing between PRI and BCK AMPS.

Example: IF PRI and BCK Pulse times are both set at the same value, then the PRI AMPS is on 50% of the time.

PRI PULSE (sec.) (All Pulsed programs)
The duration of time spent at the PRI AMPS.
See pg. 39 for guidelines

BCK PULSE (sec.) (All Pulsed programs)
The duration of time spent at the BCK AMPS.
See pg. 39 for guidelines

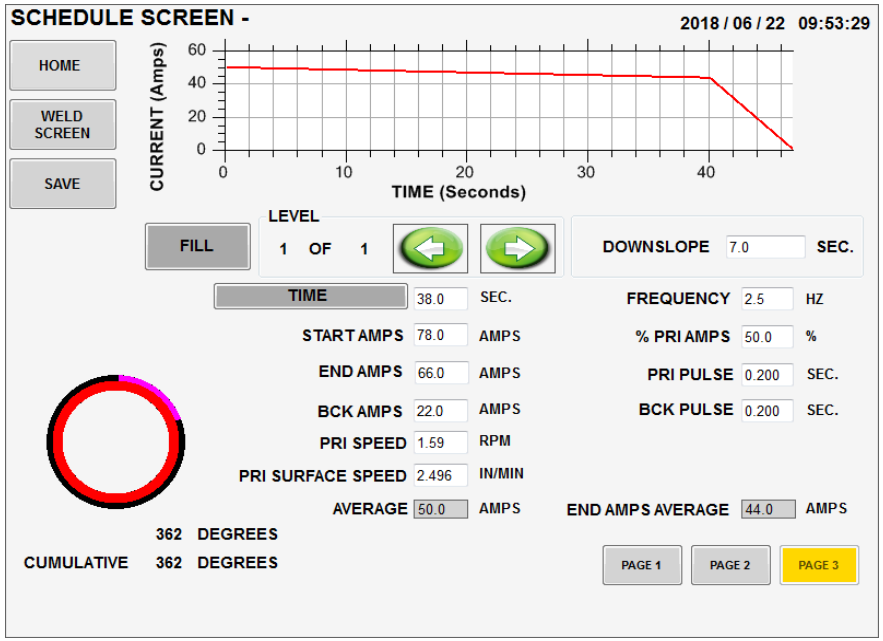
ELECTRODE ROTATION INDICATOR (All programs)
This displays the distance traveled by the electrode. The red circle shows the weld distance traveled and the pink shows the Down Slope. Any gap in the red circle shows that less than 360 degrees is traveled before the beginning of Down slope.

AVERAGE AMPS
Average amps at the beginning and at the end (before Down slope).

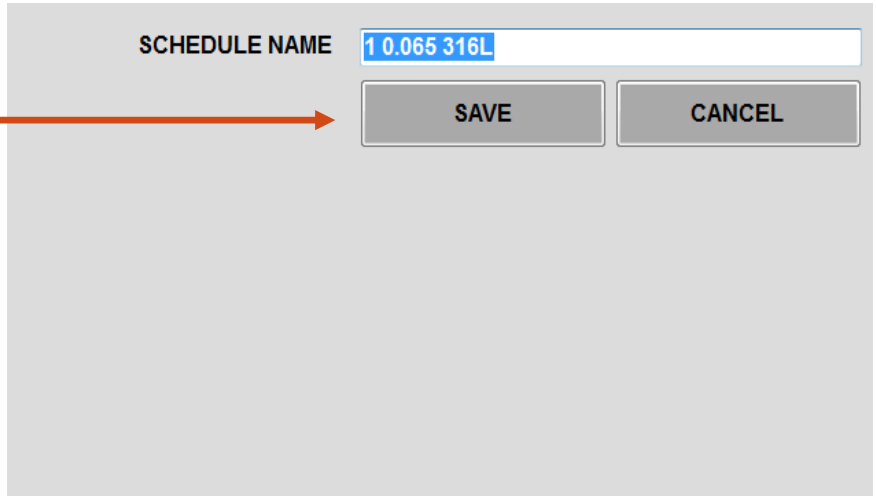
Manual Weld Schedule Entry

Schedule screen Page 3

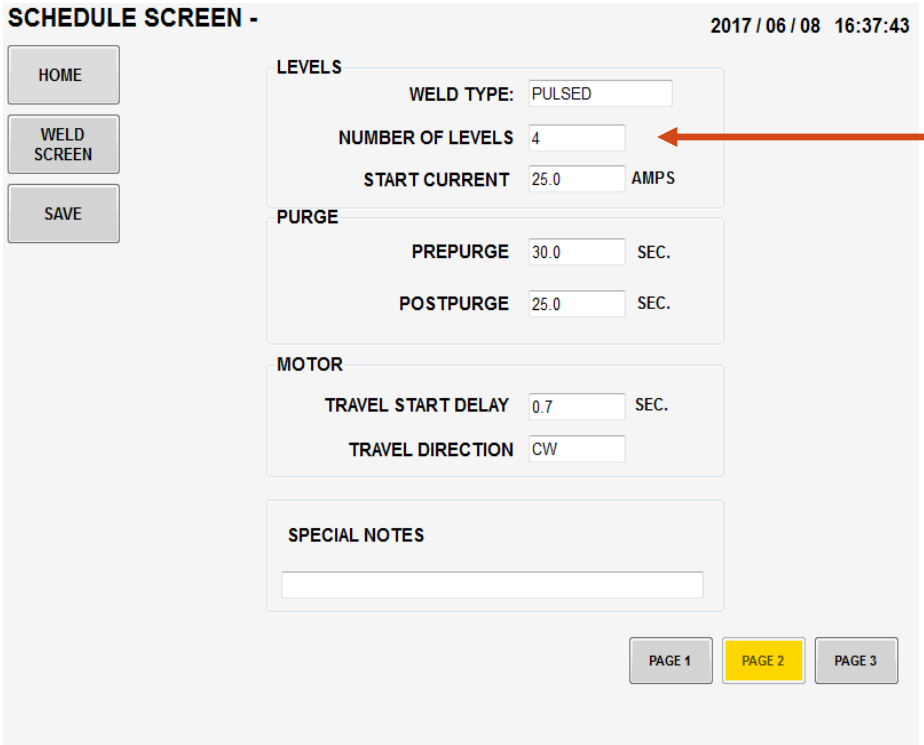
After all data entry have been completed use the **SAVE** button to store the program.



After pressing SAVE, press SAVE on the pop-up screen OR, touch the SCHEDULE NAME field to re-name it before saving.



Manual Weld Schedule Entry
Multi-level Programming



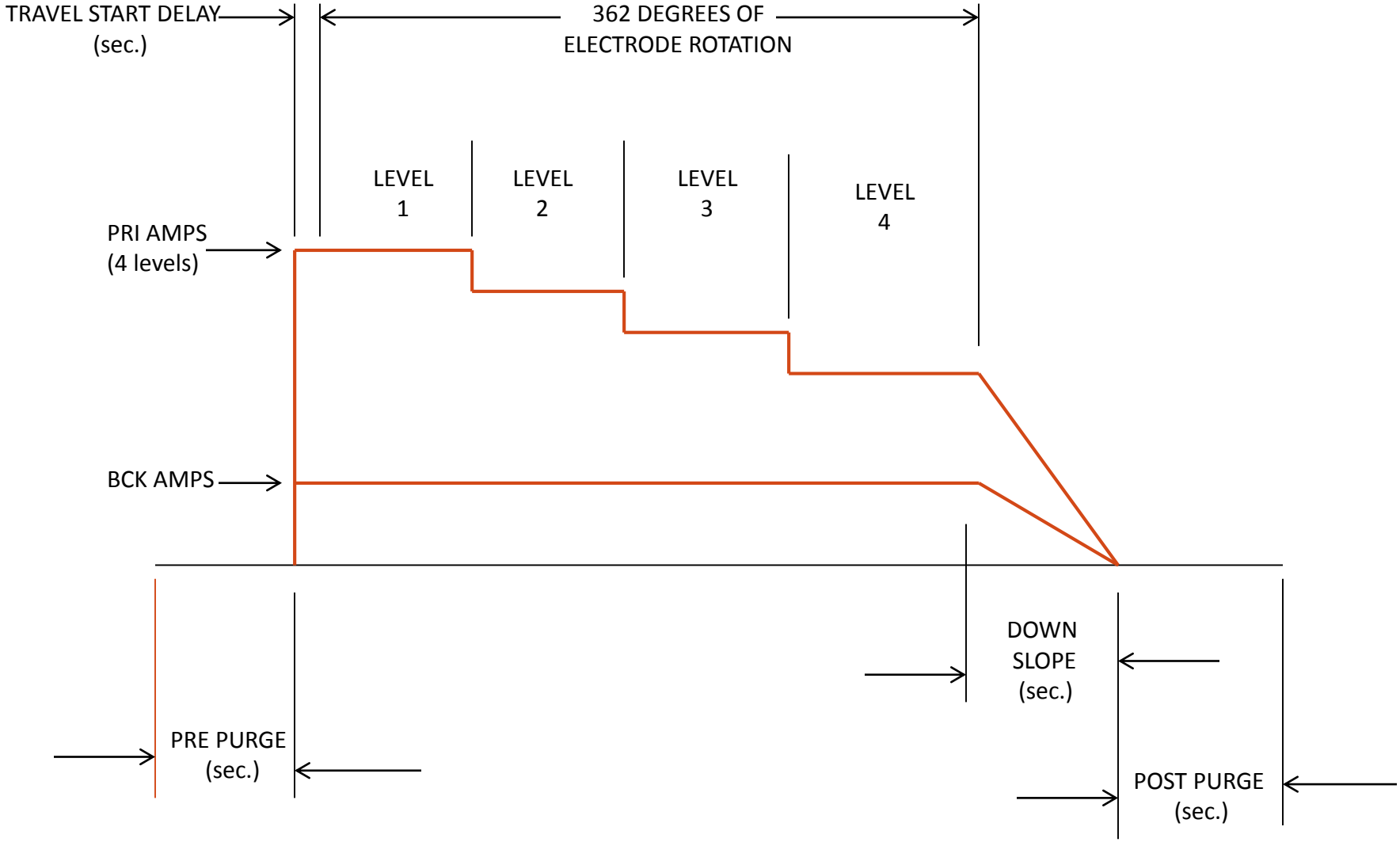
Multiple levels are used primarily to decrease welding current in stages. As the electrode rotates around the joint, the tube gets hotter, therefore less heat is required for penetration.

Four (4) levels is most commonly used, although up to 99 levels can be programmed.

Use of a Pulsed S3 program accomplishes the same thing as a Multi-level program in a simpler and more direct manner.

4 LEVEL PROGRAM

A Multi-level program pulses between PRI and BCK AMPS. 4 levels is typical, each a few amps lower than the previous level.



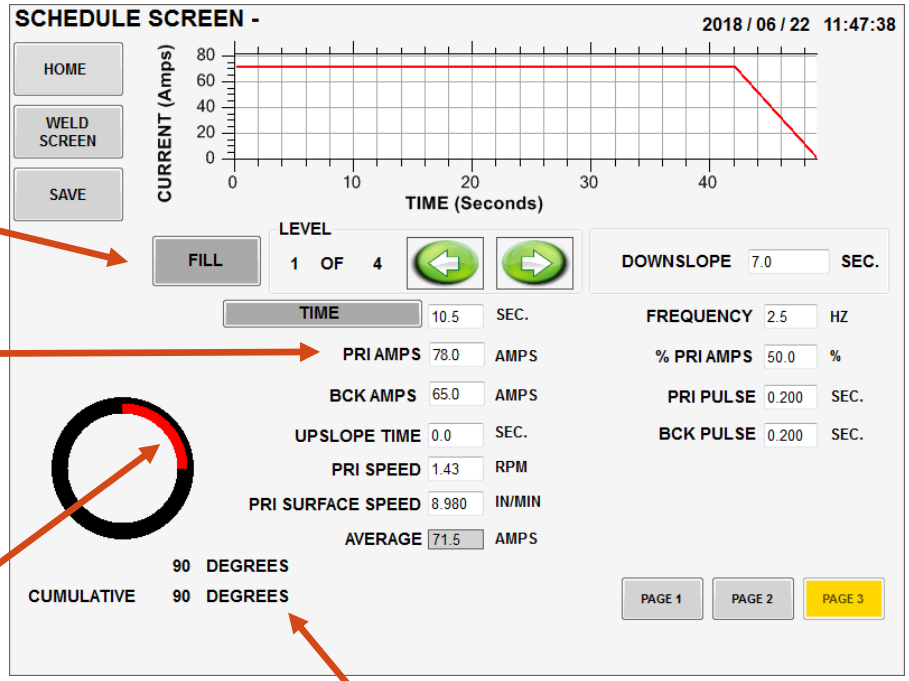
Manual Weld Schedule Entry
Multi-level Programming (Page 3)

FILL (Multi-level programs only)
When developing multi-level programs, this button is used to populate the fields (in all follow-on levels) with the values entered into level 1.

Note: This is useful because in most cases the only the function that changes from level to level is the PRI AMP value.

A good starting point for **PRI AMPS in level 1** is estimated at:
Tube wall thickness (0.065 example) X 1.1 to 1.2
65 X 1.1 = 72
65 X 1.2 = 78
PRI AMPS (level 1) = 72 – 78

PRI AMPS (Levels 2 – 4)
Level 4 is established first, estimated at:
Tube wall thickness (0.065) X 1.0 to 1.1
65 X 1.0 = 65
65 X 1.1 = 72
PRI AMPS LEVEL 4 = 65 – 72 AMPS
Program the PRI AMPS in level 2 and 3 so the AMPS drop in relatively equal steps.
Level 1 PRI AMPS = 78
Level 2 PRI AMPS = 75
Level 3 PRI AMPS = 72
Level 4 PRI AMPS = 69



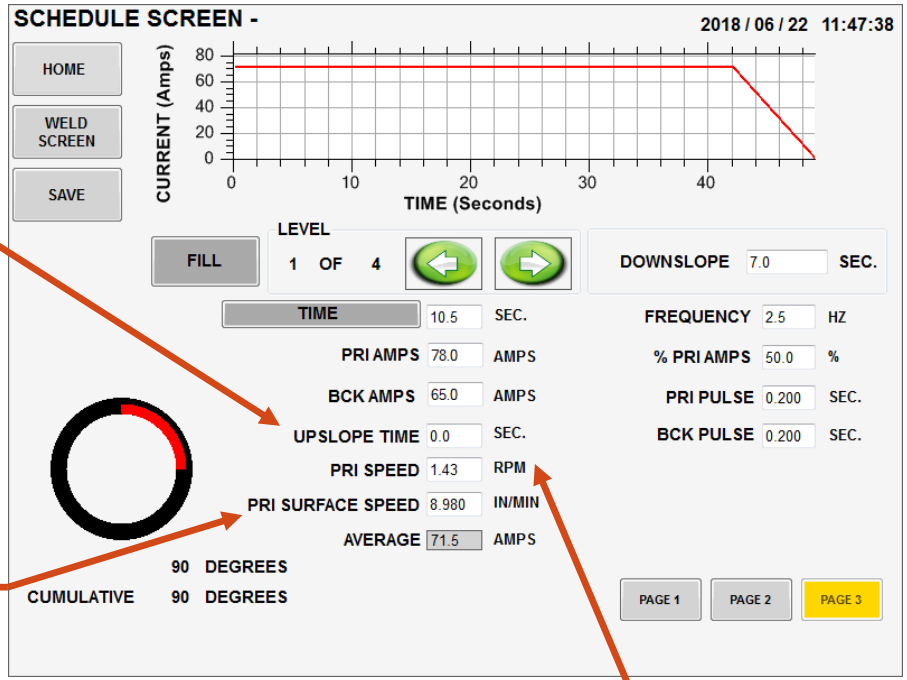
The **CUMULATIVE** Degrees indicate the degrees traveled all levels combined.

The **red arc** displays the distance traveled by the electrode in the level currently on Display (1 of 4). In a typical 4-level program the first 3 levels each contain approximately 90 degrees of electrode rotation, with the last level traveling a little further, to facilitate overlap between the start of the weld and the beginning of Down slope. In other words, the total electrode travel of all levels should be approximately 360 – 364 degrees.

Manual Weld Schedule Entry
Multi Level Programming (Page 3)

UPSLOPE TIME (sec.)
(all program types)
This is the time for the current to "Upslope" (ramp up) from the initial START AMPS setting (typically 25 amps) to the S3 START AMPS or PRI AMPS in a Multi-level program.

Note: In most cases this function is not required, and not used, however it is sometimes used on wall thicknesses below 0.015“ (0.4mm).

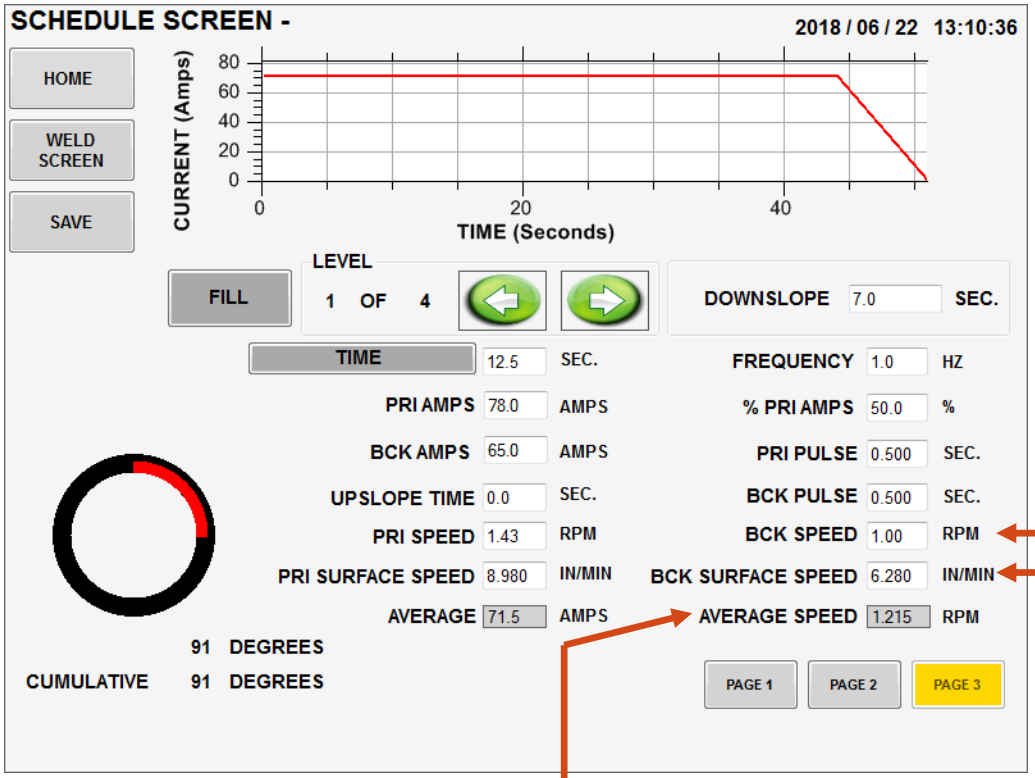


PRI SURFACE SPEED (IN/MIN)
This is the IPM speed of the electrode during the PRI AMP pulse. In a STEPPED program PRI SPEED is usually set at zero (0).

PRI SPEED (RPM) (STEPPED PROGRAMS)
This is the speed of the electrode during the PRI AMP pulse. In a STEPPED program PRI SPEED is usually set to zero (0).

Note: This is provide enough time in one spot to penetrate, before moving to the next spot, traveling during the BCK PULSE.

Manual Weld Schedule Entry
STEPPED Multi Level Programs (Page 3)



BCK SPEED (RPM)
This is the speed of the electrode during the BCK AMP pulse in a multi-level **STEPPED** program.

Note: Typical RPM speed (based on diameter) will equal a surface travel speed of 4 – 7 **IPM**. The right combination of BCK SPEED and BCK PULSE (time) will allow the electrode to travel far enough to allow the last PRI PULSE to solidify, but not too far as to not achieve at least 60% pulse bead overlap.

AVERAGE SPEED (RPM)
The average speed is the average of the PRI SPEED and BCK SPEED.

BCK SURFACE SPEED (IPM) (STEPPED PROGRAMS)
This is the speed of the electrode during the BCK AMP pulse. In a STEPPED program BCK SURFACE SPEED is set between 4 – 7 IPM.

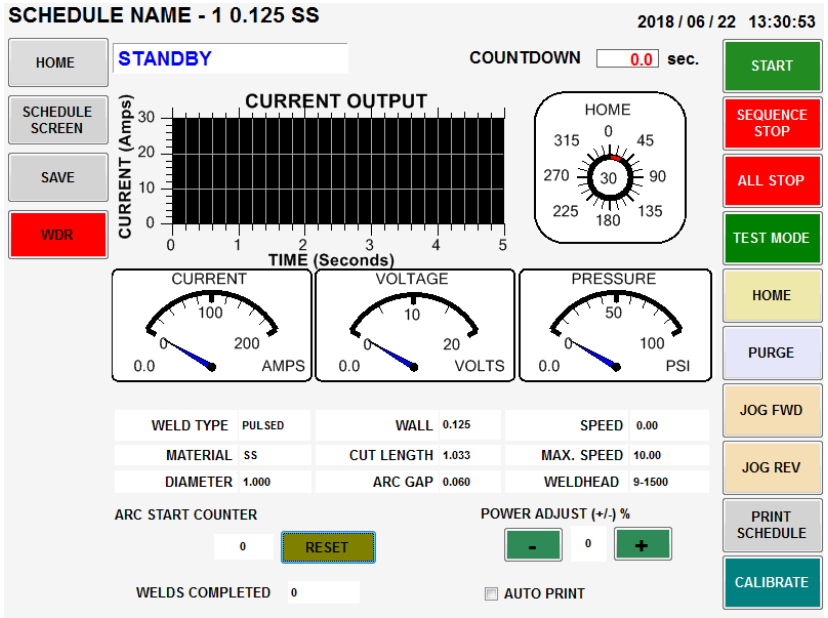
Note: After the last PRI PULSE, this provides enough time for the electrode to move to the next PRI PULSE position, which should overlap the last pulse by at least 60%.

WELD screen

HOME (button)
Return to “HOME” screen

SCHEDULE SCREEN (button)
The SCHEDULE SCREEN consists of all of the programmable parameters of a weld schedule.
It is comprised of 3 pages of data

SAVE (button)
Use this to "SAVE" any changes that have been made to a weld schedule



WDR (Weld Data Recording) (See pg. 41)
Weld Data Recording is used to record a numbered and time/date stamped record of a specific weld. Actual amps, travel speed and arc volts will be recorded. In addition multiple static data fields such as material info, job info, project number, equipment used, user name (if Logon used) etc. will become a part of the record.
The data is recorded onto a (connected) USB drive.

START (button)
Initiates the weld schedule to go on sequence

SEQUENCE STOP (button)
Causes the program to go directly to Downslope. Rotor returns to Home position at end of Downslope.

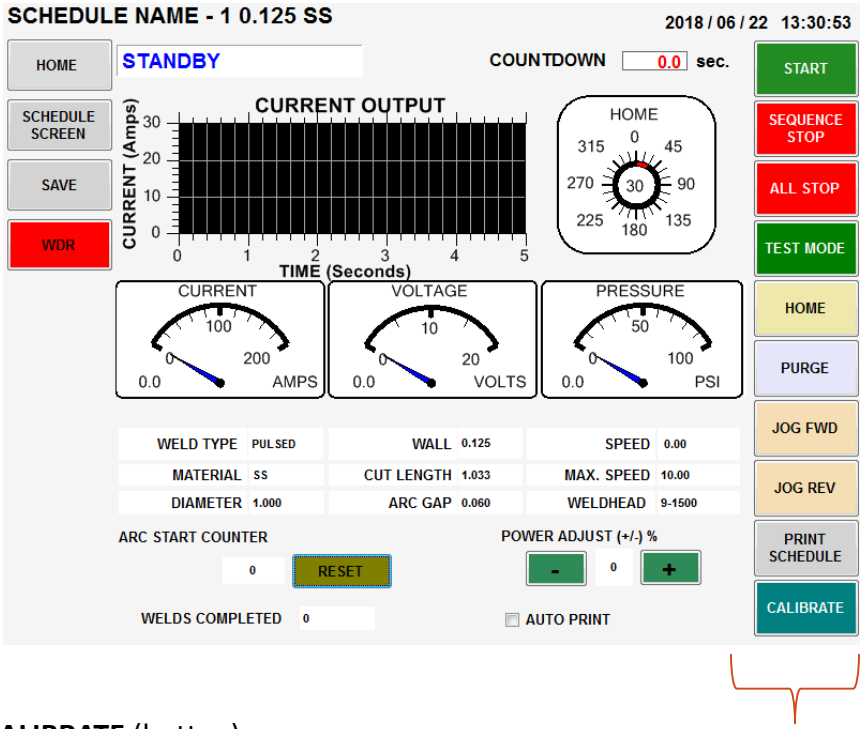
ALL STOP (button)
May be used as emergency stop. The weld will cease immediately and the program will go directly to Post purge. Travel stops and the rotor stays in place; will not go to Home position until HOME is activated

WELD/TEST (button)
This button toggles between WELD and TEST.
Important... Machine should be in the TEST mode if unattended, during electrode or tooling changes or any time a weld is not set up and ready.

HOME (button)
This is used to return the rotor back to the HOME (centered in the weld head) position.

CAUTION!
Do not press the HOME button until it is safe to do so.

WELD screen



CALIBRATE (button)
This is used to calibrate the weld head motor to the power supply rotation controller. Once a weld head has been calibrated to the power supply it will remain in calibration until another weld head is calibrated.
CAUTION! Keep fingers and tools clear.
Note: Calibration is NOT serial number specific. This means if another weld head (even of the same Model as the previous unit) is connected, it will still require calibration**. If at any time there is doubt, re-calibrate.**

PURGE (button)
This is the manual purge button used for Arc Gas, the gas flowing to the weld head. Toggling this button will open and close the arc gas solenoid. Use it for setting the flow rate to the weld head, or for extended gas flow, overriding the Pre and Post purge timers.

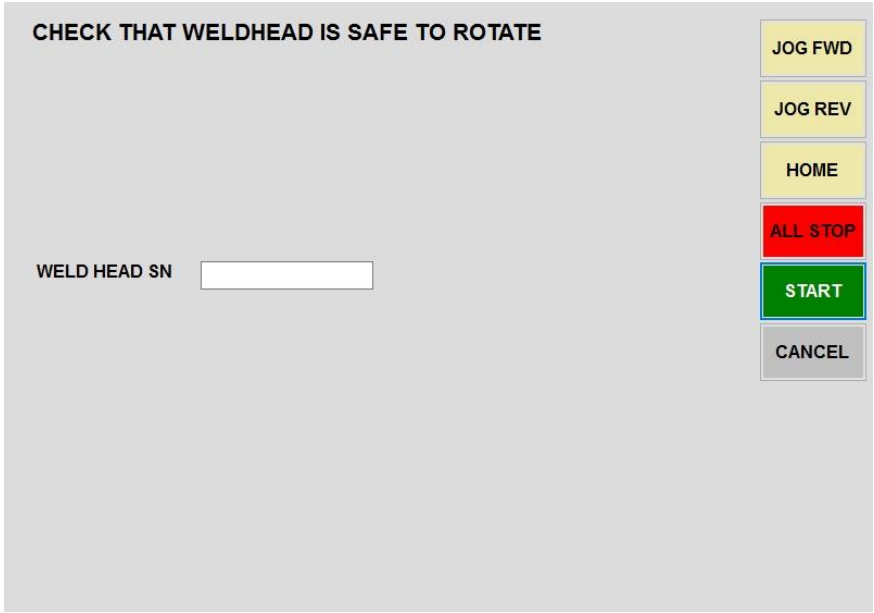
Note: It is recommended that manual purge be used for a few minutes prior to welding if the machine has been unused for an hour or more, or if the gas source has been changed.

JOG FWD (button)
Use this to manually jog the weld head rotor for electrode service or rotor cleaning.
CAUTION! Keep fingers and tools clear when jogging rotor.

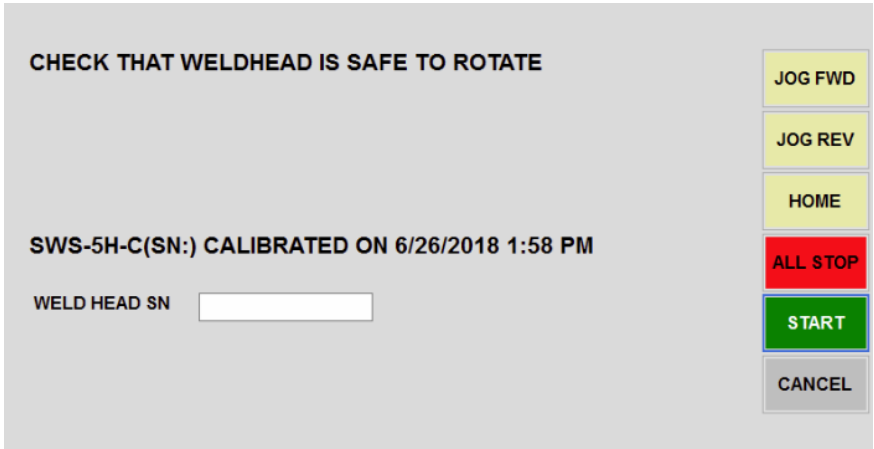
JOG REV (button)
Use this to manually jog the rotor for electrode service or rotor cleaning.
CAUTION! Keep fingers and tools clear.

PRINT SCHEDULE (button)
The welding parameters will be printed on the built in printer.

Travel Calibration screen

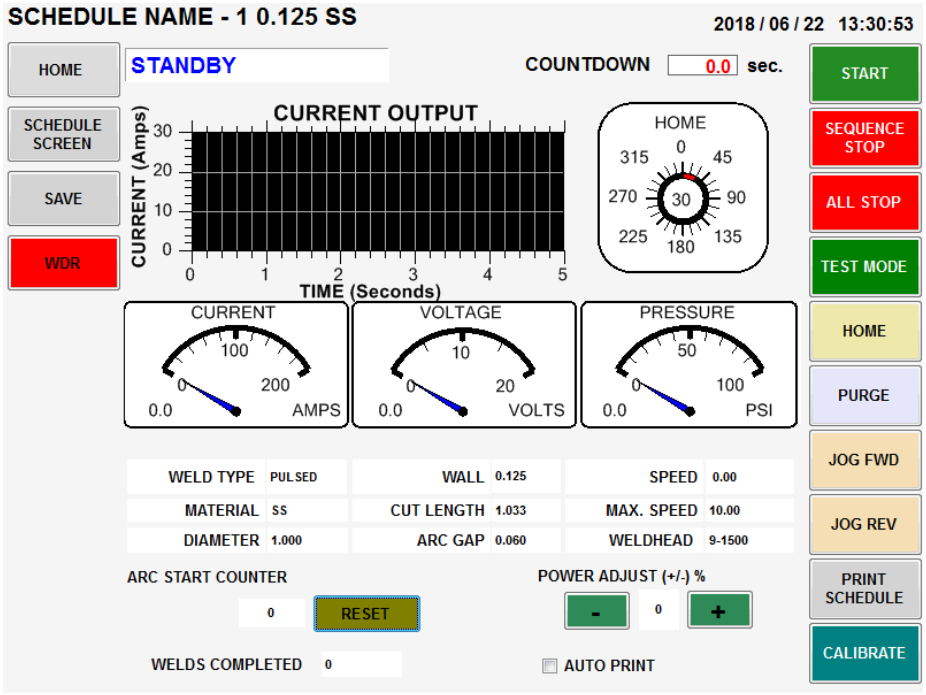


TRAVEL CALIBRATION
Upon pressing the CALIBRATE button in the WELD screen, the weld head serial number may be saved for future reference



Information regarding the previous calibration in the form of weld head serial number and date of calibration are displayed next time the calibration screen is opened

WELD screen



ARC START COUNTER (RESET)
Reset the count of arc starts to zero. Can be used for tracking electrode life.

WELDS COMPLETED
The unit will count all completed welds. This info can be used for tracking production, electrode life or Service frequency.

POWER ADJUST %
Use to increase or decrease amps by a % of the programmed value. Increases both PRI AMPS & BCK AMPS across entire weld.

AUTO PRINT
Checking the AUTO PRINT box will print a copy of the weld schedule (with time/date) after each weld. This is sometime used by QA/QC.

FINE-TUNING the WELDING PARAMETERS

Fine-tuning a weld program is done to adjust the heat input so the depth of penetration is correct, and the weld bead width is relatively uniform throughout the entire weld.

After the first test weld is completed, evaluate the overall penetration. Virtually all specifications require 100% penetration. This will be evident by looking at I.D. of the weld. If any part of the seam is un-welded and still visible, there is less then 100% penetration. If however any part of the O.D. is excessively concave (specs differ) that depicts over-penetration.

Correcting under or over-penetration is done by adjusting heat input. Use less heat if it's over-penetrated (O.D. concave) and more heat if it's under-penetrated (I.D. not fused or bead too narrow).

There are three parameters that can be used to adjust heat input:
ELECTRODE ROTATION SPEED
PRI and BCK PULSE rate
PRI and BCK AMPS
When modifying a Multi-level program the Electrode Rotation Speed and the PULSE RATE should be uniform throughout the weld.

AMP settings can be throughout all 360 degrees the weld by raising or lowering START or END AMPS of an S3 program or in each individual segment of a Multi-level program.

PULSE RATE adjustments can be used to adjust heat input

Consider the **PRI PULSE** time and **BCK PULSE** time like the **HOT** and **COLD** valves of a faucet.

HOT
or
PRI PULSE time

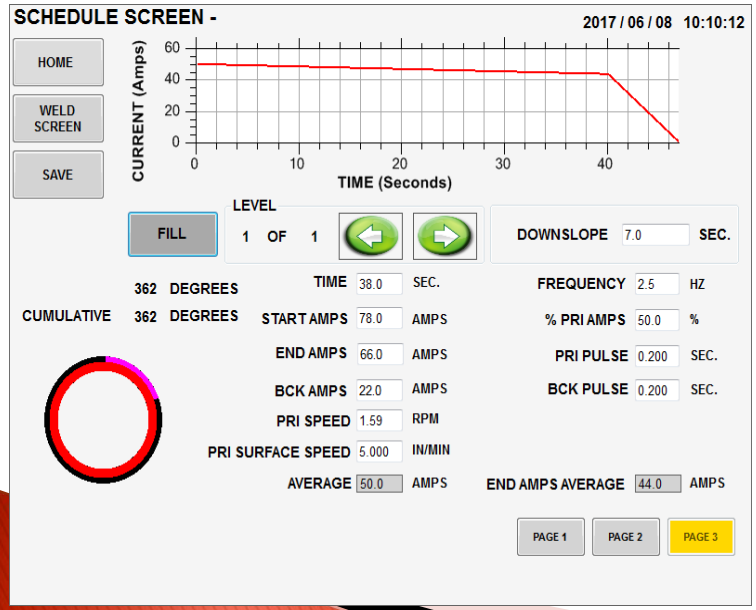
COLD
or
BCK PULSE time

Increasing the HOT (**PRI PULSE** time) = Hotter (more penetration) weld

Decreasing HOT (PRI PULSE time) = Colder (less penetration) weld

Increasing COLD (BCK PULSE time) = Colder (less penetration) weld

Decreasing COLD (BCK PULSE time) = Hotter (more penetration) weld



PULSE RATE Guidelines

Tube Wall Thickness	Typical PULSE RATE
0.010” - 0.035” (.25 – .9mm)	0.00 – 0.10 (sec.)
0.036” – 0.065” (.9 – 1.6mm)	0.10 – 0.25 (sec.)
0.066” – 0.090” (1.6 – 2.3 mm)	0.25 – 0.40 (sec.)
0.091” – 0.154” (2.3 – 3.9mm)	0.30 – 1.0 (sec.)

Password Access

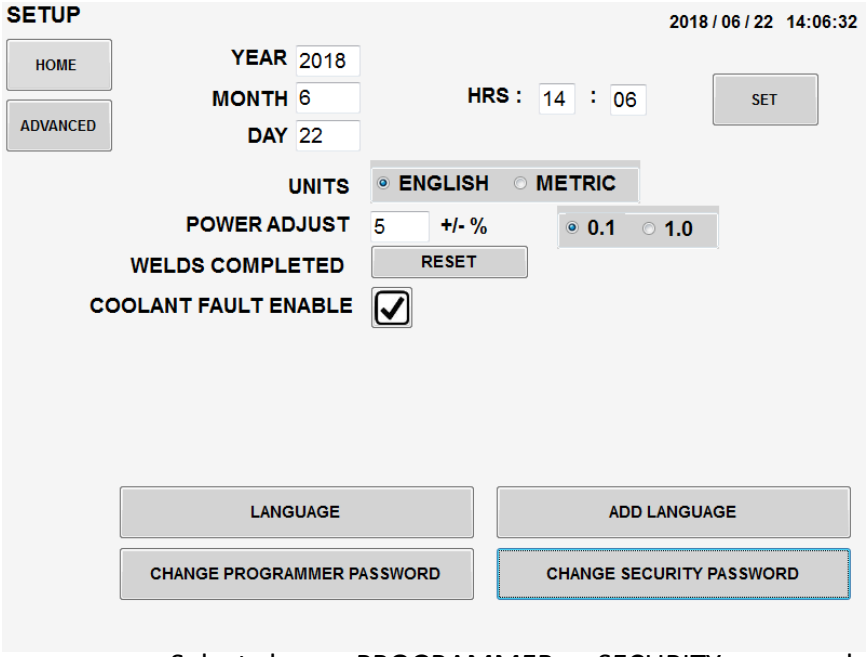
The unit can be set up to require a login PASSWORD before use. There are two levels of access, SECURITY and PROGRAMMER.

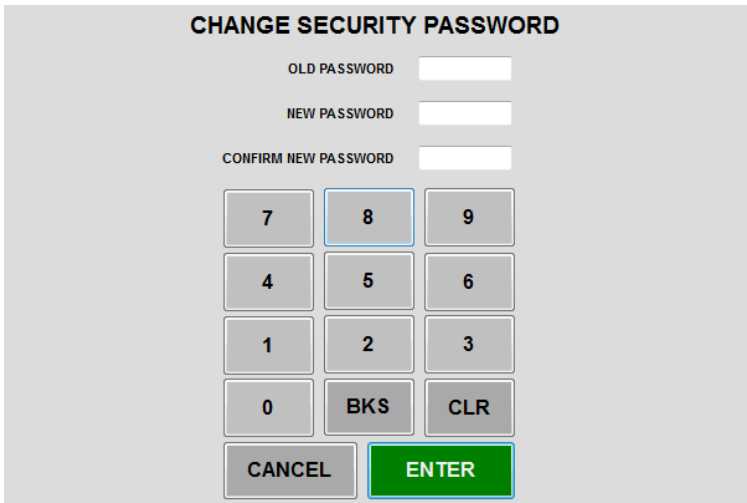
The **SECURITY** clearance allows access to all programs in the library, but does NOT allow modifications to these programs or the creation of new programs.

A **PROGRAMMER** has access to ALL controls.

In order to use either of these two access levels, BOTH passwords must be created.

From the HOME screen press SET UP





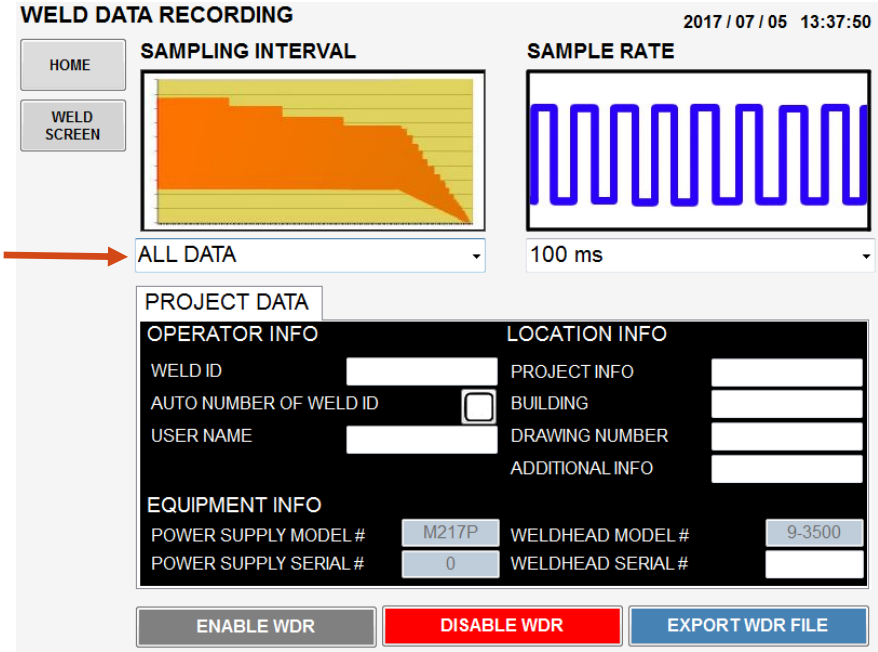
Select change PROGRAMMER or SECURITY password, then enter the old and new passwords.

WDR (Weld Data Recording)

WDR (Weld Data Recording) is used to record actual amps, arc volts and electrode travel speed of a specific weld. Each record is time/date “stamped” and can include additional static data such as material info, job info, project number, equipment used, user name (if Logon used) etc. will become a part of the record. The data is recorded onto a USB drive.

While welding the unit will record multiple snapshots of the data. The frequency of the data recording is based on the SAMPLE RATE. Before using WDR select a sample rate.

Select recording of the entire weld (ALL DATA) or without the down slope.



Sample rate options are
1 sec.
500 ms
200 ms
100 ms

Note: The WDR of a 20 second weld will contain 20 lines of data if the sample rate is set to 1 second. Setting the sample rate to 500 ms will record 40 lines of data, and a sample rate of 100 ms will record 200 lines of data, or a line of data every 1.8 degrees.

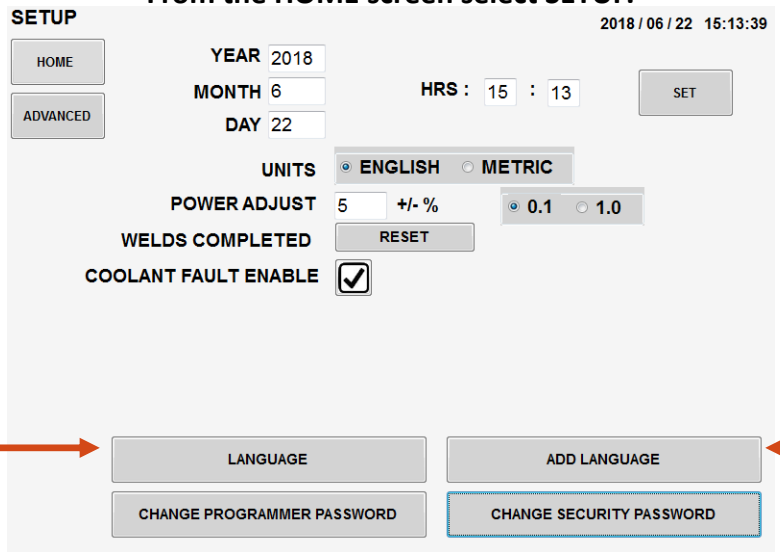
Viewing the Weld Data Records

Connect the USB drive to a PC, and open the records as EXEL files.

LANGUAGE
SELECTION or MODIFICATION

The software can be displayed in multiple languages. In addition, individual words within a language can be changed (creating a new language).

From the HOME screen select SETUP.

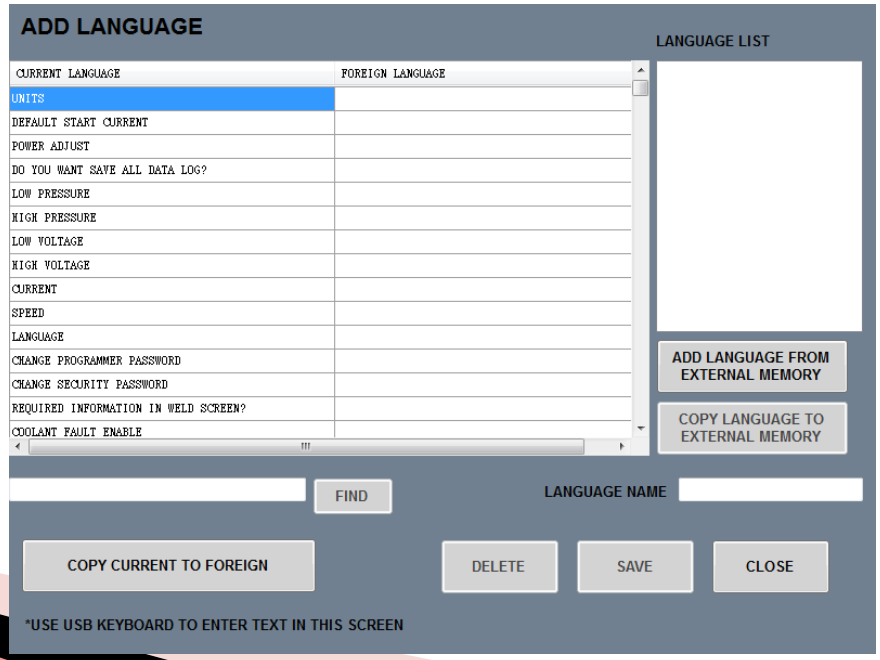


To select a language from the canned languages press LANGUAGE, then select from the drop-down menu.

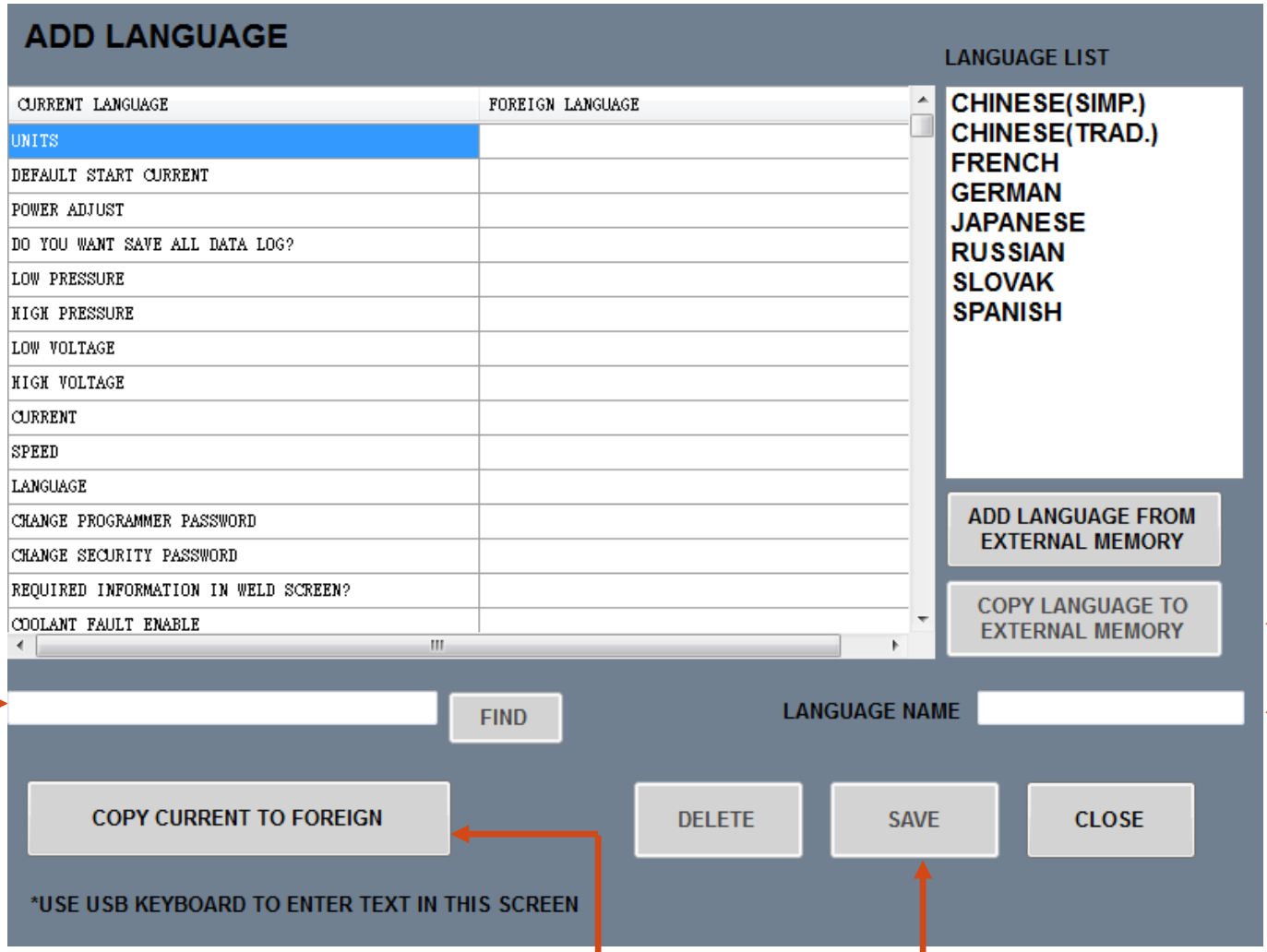
To create a new language or modify one or more words of an existing language, press ADD LANGUAGE

NOTE: In order to use the ADD LANGUAGE feature, a USB keyboard must be connected.

Connect a USB keyboard to one of the ports on the front panel.



LANGUAGE
SELECTION or MODIFICATION



In order to import a language, a USB drive containing the language must be connected to the power supply

Enter the new language Name.

Use the FIND box to locate a specific word.

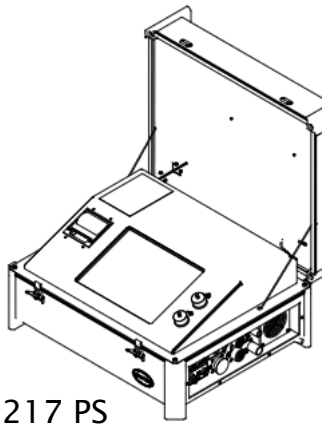
If you will be changing only a few words of an existing language, use this feature to copy all of the words of a canned language into the new language.
Then enter the changed words into the “Foreign Language” field.

Press SAVE when finished.

Switch Box: DUAL WELD HEAD CONTROLLER

The optional **Switch Box** is a dual fusion weld head controller that enables the operation of two weld heads alternately with the push of a button. This greatly increases productivity by allowing one weld head to be set up while the other is welding.

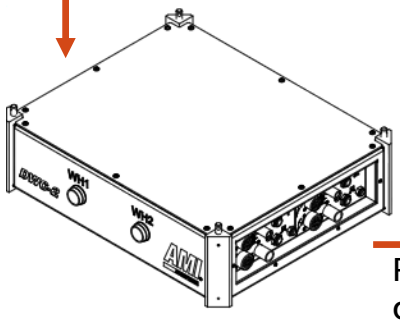
System Interconnection



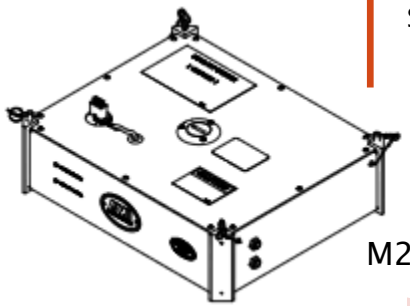
M217 PS

Ethernet cable for smart communication

Cable Assembly, Fusion Weld Head Switch Box

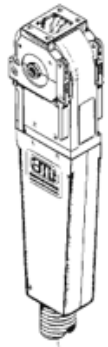


Switch Box Assembly

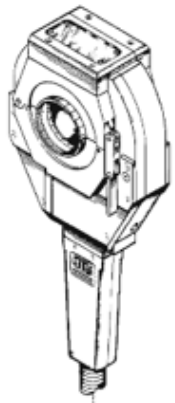


M217-CW

Regular adapter cables



Weld Head 1



Weld Head 2

Switch Box: DUAL WELD HEAD CONTROLLER

Input Panel

Main Power Switch

Input AC receptacle
110 or 220 VAC
Auto-switching
Single phase

Remote Pendant connector

Ethernet connector

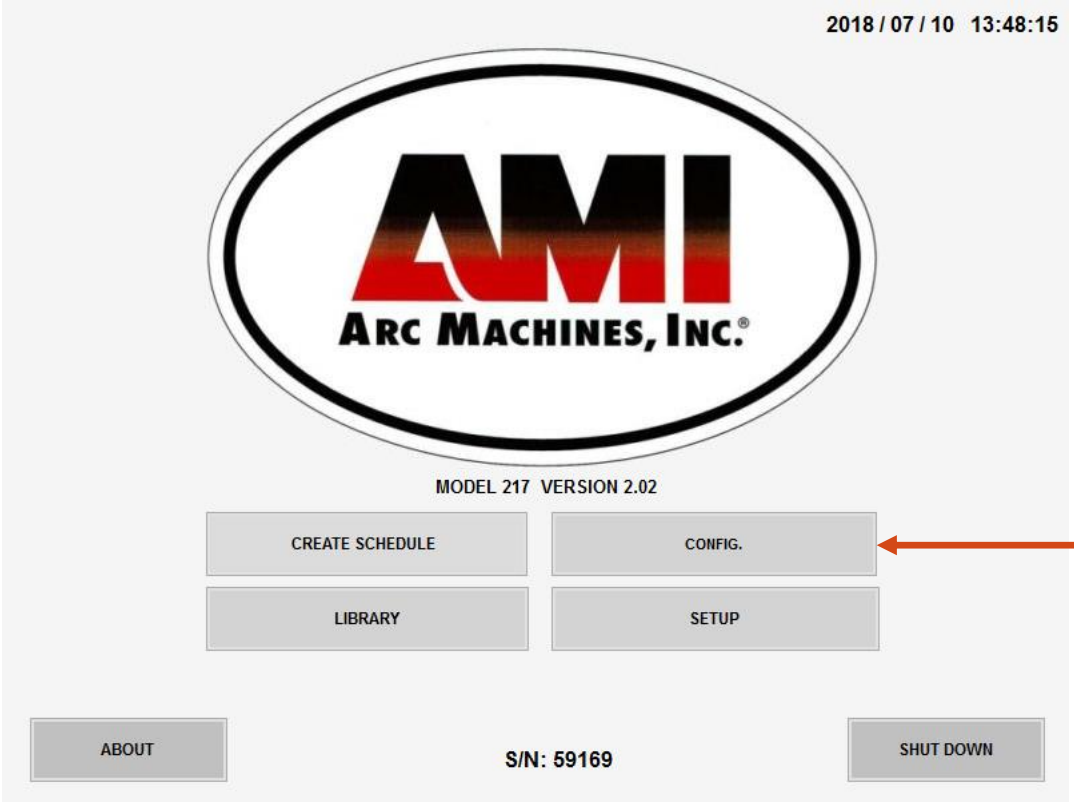
Input connectors for weld head control, gas, coolant and weld power coming from the M217 PS and M217-CW

Output Panel

Weld Head 1 Weld Head 2

Output connectors
Connect respective weld head adapter cables for weld head control, gas, coolant and weld power output

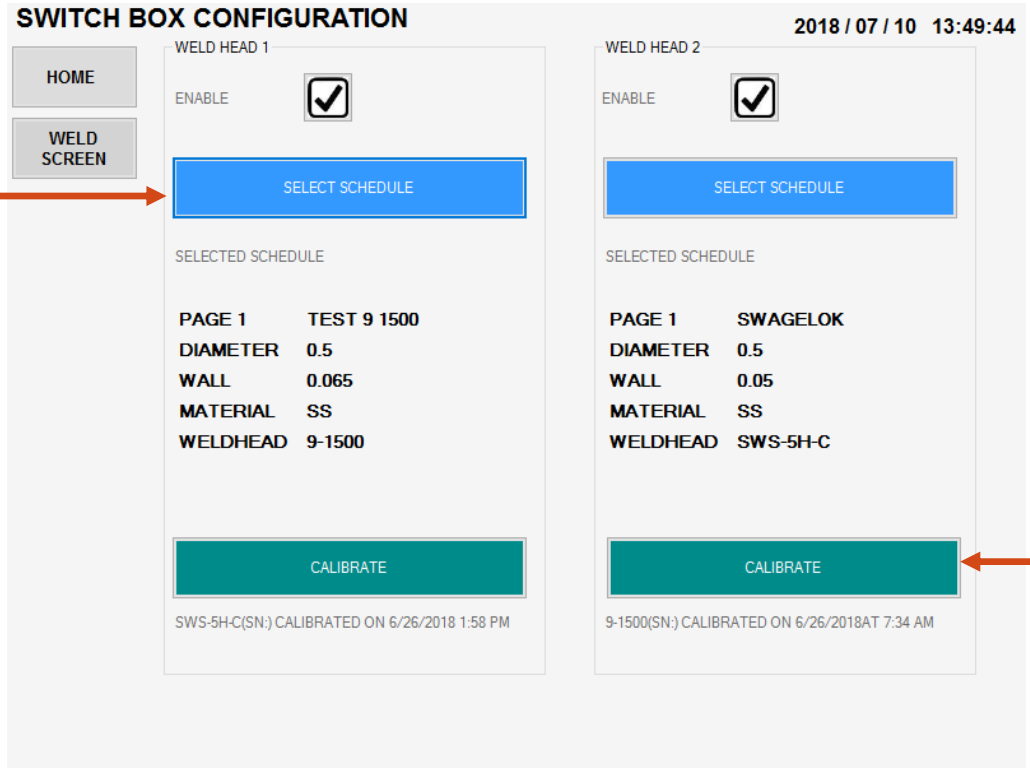
CONFIG Screen



Upon power up, the M217 will automatically detect when a powered Switch Box is connected.
Press the CONFIG button to bring up the Switch Box Configuration screen

Switch Box Configuration Screen

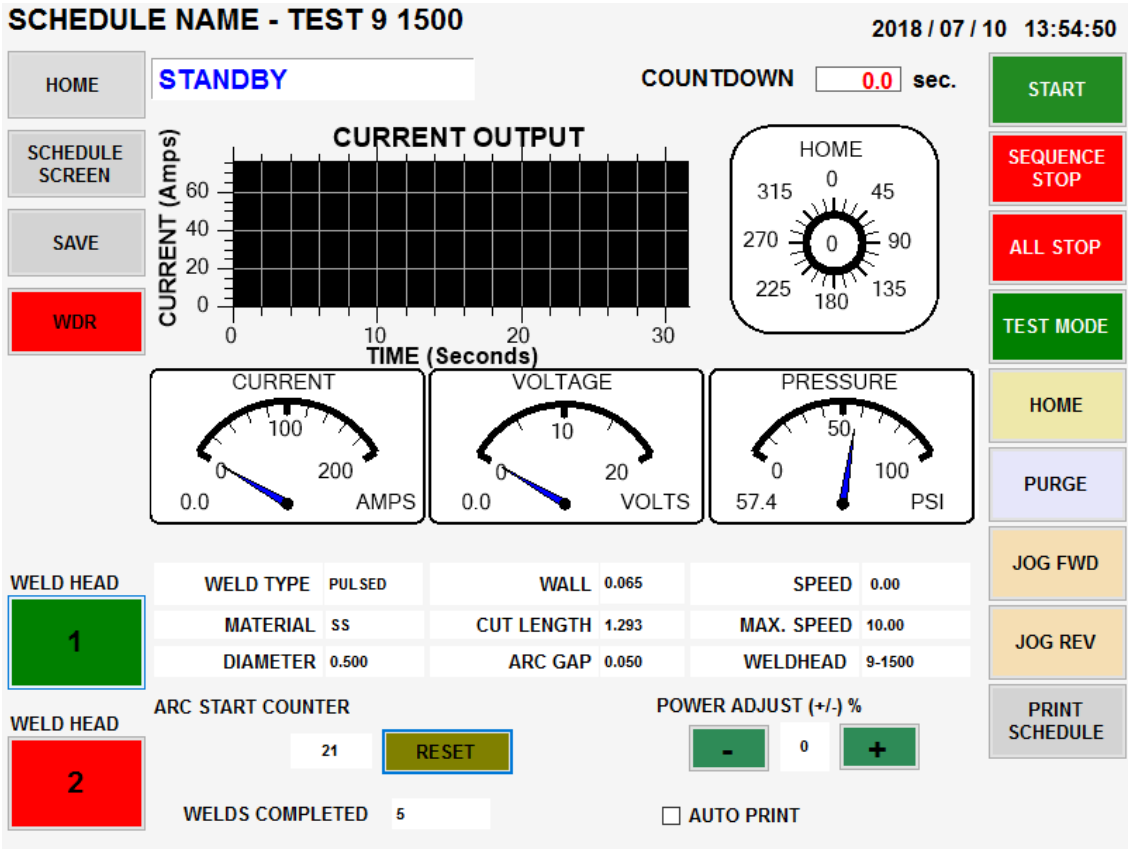
After selecting schedule and calibrating each weld head, press WELD SCREEN to go to the next screen



SELECT SCHEDULE will bring up the LIBRARY. Select desired weld schedule to run with Weld Head 1, then repeat procedure for Weld Head 2

CALIBRATE will open the Travel Calibration screen.
Perform travel calibration at this point since, for dual weld head operation, the Calibration button is not available at the Weld Screen

Weld Screen for Dual Weld Head Operation



Weld Head Selector Buttons
Green indicates active weld head. **Weld Head 1** will run with the schedule displayed at Sequence Start

Red means **Weld Head 2** is inactive and may be set up while welding with Weld Head 1

Press **Weld Head 2** button to make it active. The weld schedule previously selected will be displayed

Active weld head selection may also be done using the switches on the Switch Box front panel. Selected weld head switch will be illuminated

Glossary

Arc Machines, Inc.

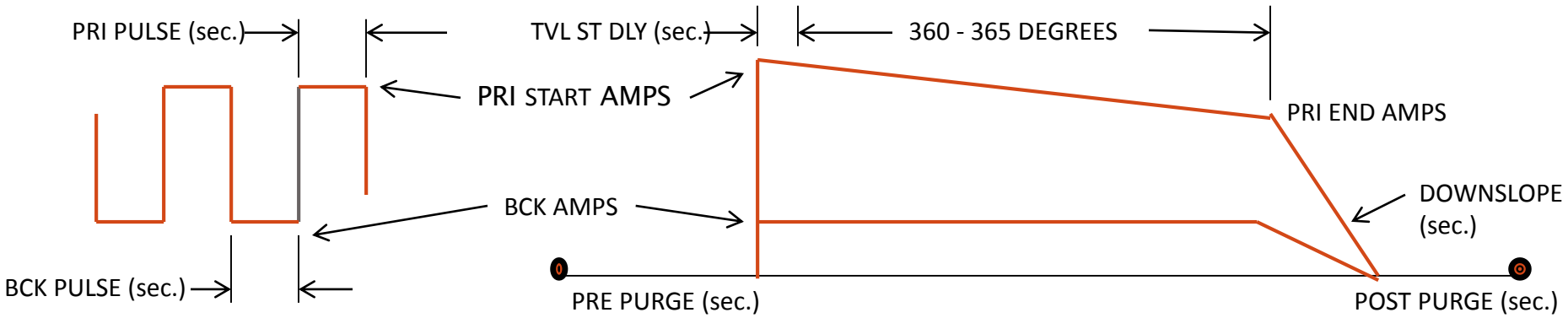
World-class Automatic Orbital Welding Systems

14320 Arminta Street
Panorama City, CA 91402
818-896-9556
www.arcmachines.com

ARC MACHINES, INC.
MODEL 217 & 217P S3 PROGRAM

NAME _____

DIAMETER _____ **WALL** _____ **MATERIAL** _____ **WELD HEAD** _____



ELECTRODE DIAMETER_____ TIP DIAMETER_____ ARC GAP_____(IN/MM) LENGTH_____(IN/MM)

ARC GAS TYPE _____ ARC GAS FLOW RATE_____ (CFH/LPM) B/U GAS TYPE _____

B/U GAS FLOW RATE_____ (CFH/LPM) B/U GAS VENT DIAMETER_____(IN/MM) B/U PRESSURE _____ (IWC)

START CURRENT_____ (AMPS) DEGREES _____ DOWN SLOPE_____(sec.)

PRE PURGE _____ (sec.) PRI START AMPS _____ FREQUENCY_____ (Hz)

POST PURGE _____ (sec.) PRI END AMPS _____ % PRI AMPS_____

TRAVEL START DELAY_____(sec.) BCK AMPS_____ PRI PULSE_____(sec.)

TRAVEL DIRECTION_____(sec.) PRI SPEED_____ (RPM) BCK PULSE_____(sec.)

PRI SURFACE SPEED_____(IPM) BCK SURFACE SPEED_____(IPM)

Notes_____