![Red-D-Arc Weld Automation logo](reddarc.com)
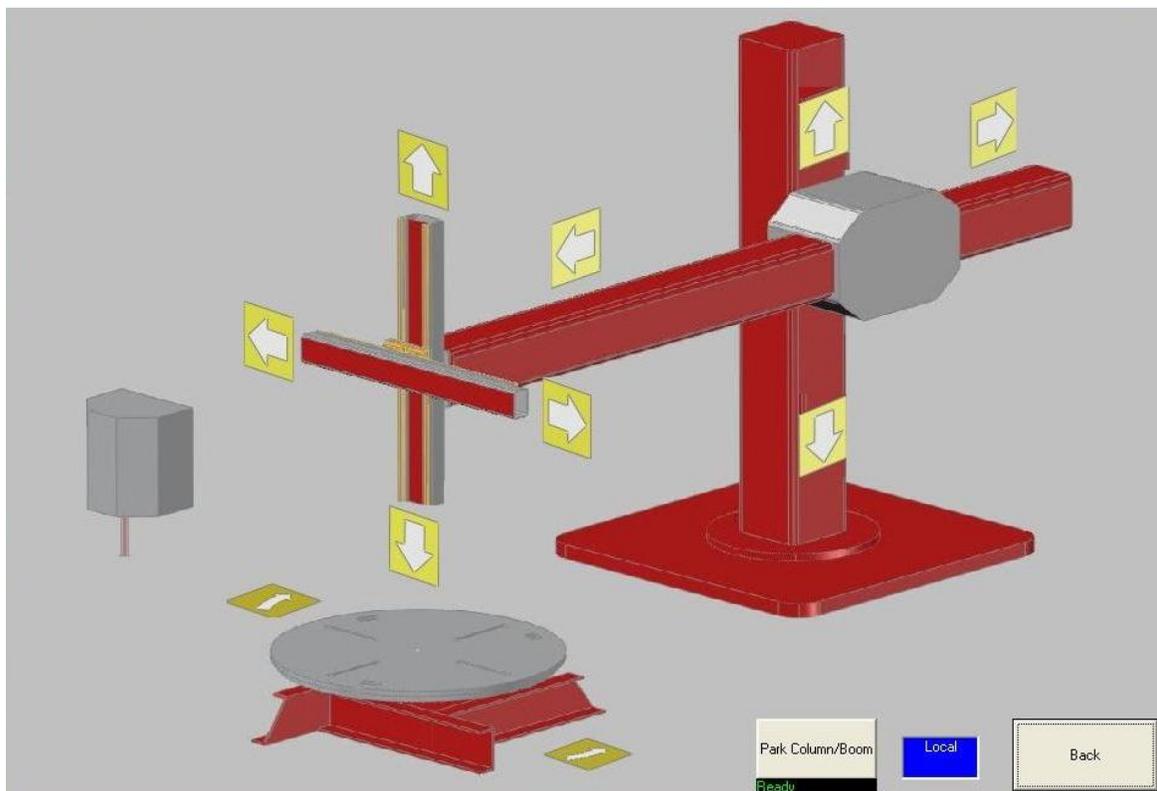
OPERATION MANUAL

# Cladding Station
## Complete with
# Hot Wire TIG Welding Equipment

Contents

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## 1.0 OPERATION

The system is supplied with a touch screen PC control station. This operates all the functions of the machine including the welding equipment. In addition to this there is a remote control pendant with LCD display which allows the operator to access functions of the machine while away from the main station.

Information can be entered directly on the touch screen using the operators finger like a mouse pointer. The system is also supplied with a keyboard for data entry. The keyboard is fitted with a mouse touch pad to enhance navigation of the screens.

### 1.1 Loading of Components onto the Positioner Table

The component which is to be clad, needs to be securely fastened down to the table of the positioner. The centre of bore to be clad should be placed as close as possible to the centre of the table rotation.

Once loaded is the component requires pre-heating, the table can be set in motion (see screens later in this manual) to allow for flame or induction heating. Note is it important that even during induction preheating, the table is rotating. This prevents the slip rings, from sitting in one position for long periods with power running throught them.

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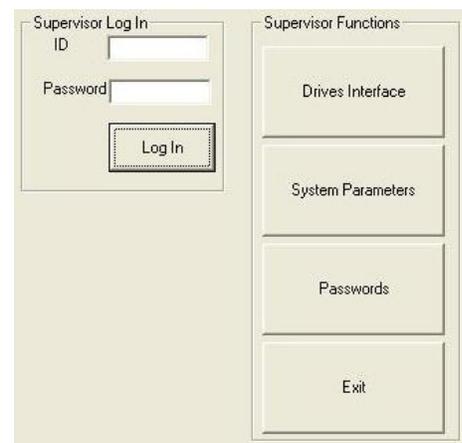Version v1.0

## 1.2 PC Screen Controls

Over the next few pages we will detail the screens that are accessible on the system.

The first screen is the Opening Page for the system. This allows the operator/supervisor to navigate to various other screens in the system.



By pressing or clicking in any of the above buttons this will navigate the user to the appropriate screen, except for exit, which will close down the software.

There are additional screens which can only be accessed by a supervisor. The supervisor must log in using their ID and Password and press the Log In button. This then brings up additional buttons as shown on the image to the right. We will concentrate on these supervisor screens first.

## 2.0 Supervisor Screens

### 2.1 Supervisor Screen - Drives Interface



This screen has been developed for diagnostic purposes and to allow the supervisor to see position readings for all the elements of the system.

The top section of this screen displays all the current values for the drives and encoder positions of the system.

Below this there are Red/Green indicators which show which functions are active or inactive.

When rapid speed is selected a green box will appear on the right hand side of the screen, this will not appear if it is not selected.

At the bottom of the screen are boxes relating to jog speed and scaling. This information can be set and altered from this screen. To change data simply click in the box with the mouse or touch the box on the screen. Then use the keyboard to type in new values.

Once new vales are entered press the update button to confirm the alterations and send these changes to the PLC.

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## 2.2 Supervisor Screen – System Parameters



This screen allows the supervisor to alter various settings on the machine.

The first section *Pendant Variable Increments* allows the setting of the unit increment/decrement value of parameters, each time the increase or decrease button is pressed on the pendant.

For systems which have the bore to bore functionally included, the section *Bore to Bore* allows the traversing speed across the bore to be varied.

The other sections of the screen are fairly self explanatory, alllowing the supervisor to alter settings on the wire feed unit, AVC unit, Auto Gap settings, Boom and Turntable drives and ramping values and return to position settings.

Finally there is a display of error messages on the top right of the sceeen. This can be used to diagnose any faults in the system. Fault monitoring is on when the Watchdog Enable box is ticked.

## 2.3 Supervisor Screen - Passwords



When this screen first opens initially it will not show any current passwords. By pressing the "READ" button a list of all the passwords will appear.

To create a password, simply click into the next blank box in the name column, type in the Supervisors Name, then repeat for their ID and the Passord. Then press the "SAVE" button. This will activat this password on the system.

To edit a password, again simply click into any box in the list and retype the information in that box, again press save to update the password list.

To delete a password for a user, delete all the details in the box for name, ID and Password for that user.

After making any changes be sure to press save to implement them. It is also usefult to keep a separate note of any passwords created in the system.

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## 2.4 Supervisor Screen – Exit Button



The "EXIT" button will shutdown the Cladding HMI program and return the PC to the Windows Desktop. Once at the windows screen the supervisor can press the start button to safely shutdown the system.

Once the PC has closed down the power to the cladding machine can be switched off.

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# 3.0 Operator Screens

## 3.1 Operator Screen – Manual Control
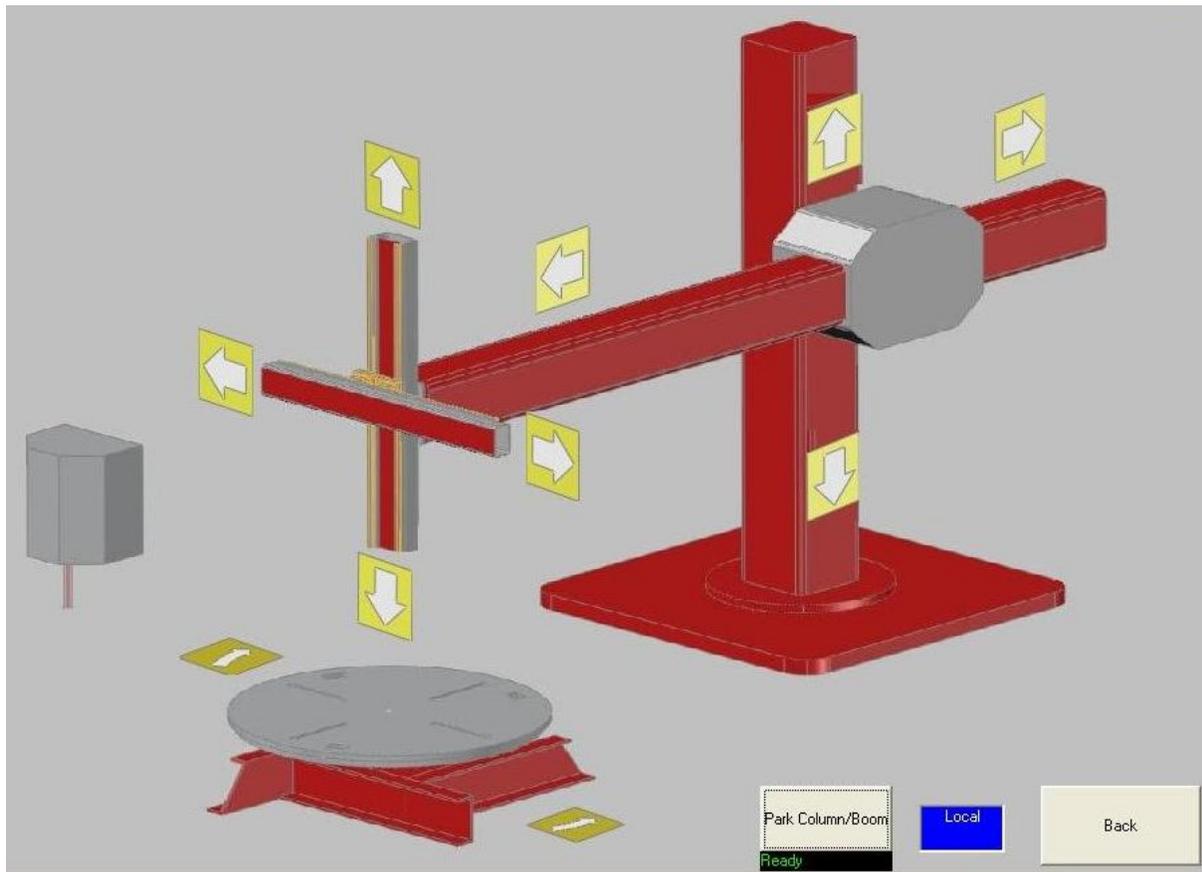


This screen shows a graphical representation of the system. Indicated on it, are each of the movement axis for the Column & Boom, Slides and Table Rotation. By simply pressing any of these arrows will manually drive that item of equipment in the direction indicated.

Some systems will be supplied with a tilting positioner, only the rotation of the table is controlled from this screen.

In the bottom corner of the screen, is a window which shows local. This is indicates that the equipment can be controlled from this screen. If it shows remote (usually during welding) then the axis are being control by a program and the shown controls will be locked out.

The "Park Column/Boom" Button is used after welding is complete. This will drive the torch upwards initially and then the boom retracts backwards for a set number of seconds. This allows the torch to clear the component after cladding.

## 3.2 Operator Screen – Handsets
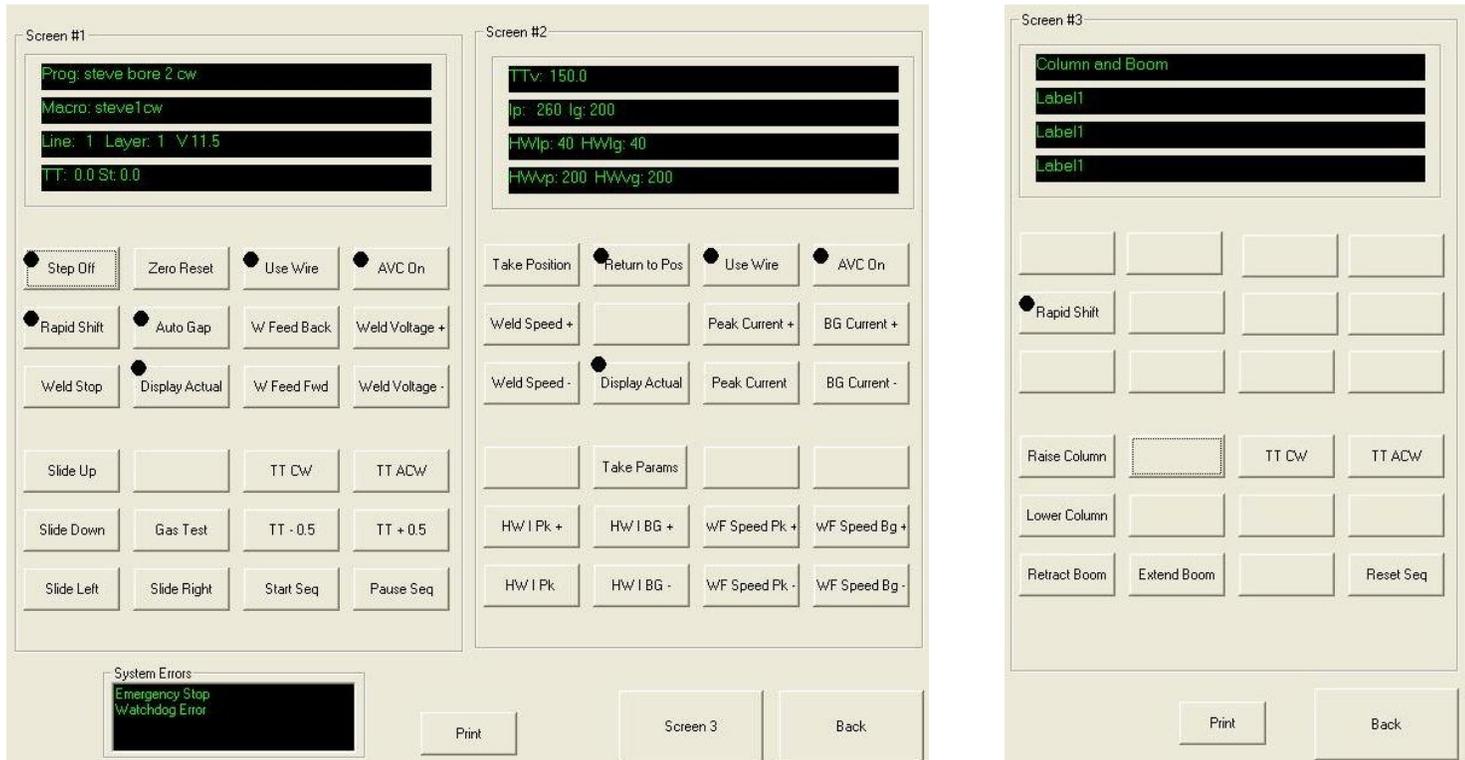


The handset displays an enables the operator to use the hand control pendant on the screen.

This screen comes in two parts. The first screen is shown on the left above shows the first two hand pendant button arrangements. This is because on the pendant some buttons will have more than one function depending on the mode the operator is in. To acess the third screen on the right, press the Screen 3 button at the bottom of the page. There is also a print function that allows the operator to print out either of the screens. At the top of each section is a live display which will show the same data as is being currently shown on the hand pendant.

## 3.3 Operator Screen – Preheat Settings
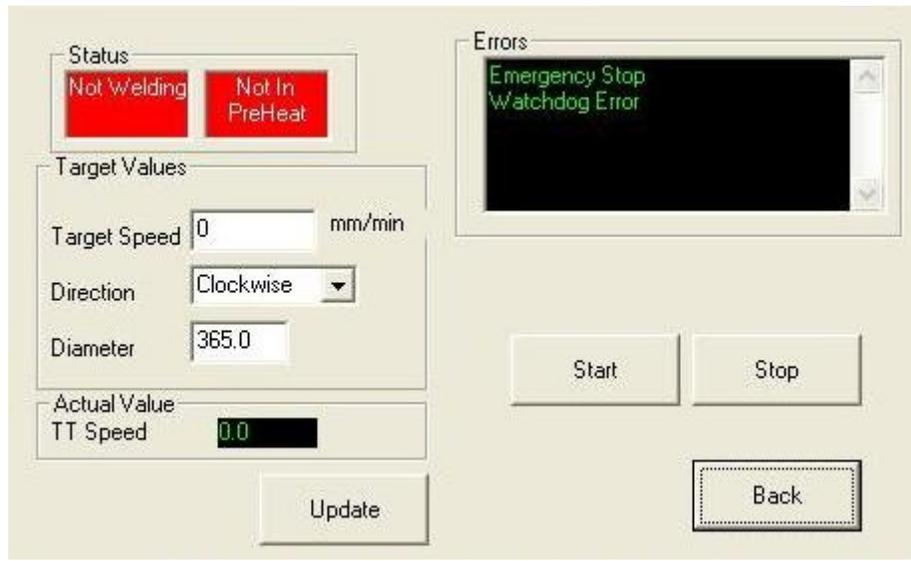


This screen gives the settings for the preheat cycle of the turntable/positioner. The required rotation speed of the outer wall of the component, the rotation direction and the component diamter can be input. The system will calculate the rotation speed in RPM from the wall speed and component diameter. This is used more in flame preheat situations, where the pass speed of the flame and the component needs to be controlled.

Once these values are input, press the "UPDATE" button to send the parameters to the PLC. Then simply press "START" to commence rotation and "STOP" when preheat is finished.

Note that this should be used for both induction and flame preheating. Even though rotation is not logically required for the induction heating, it is recommended that the table is rotating during pre-heating. The situation whereby a current is being drawn through the slip rings, wile the slip rings are stationary for a long period of time should be avoided, so as to prolong the life of the slip rings.

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## 3.4 Operator Screen – Display Values



The majority of this screen is taken up with a live display of welding parameters, in the form of a bar chart. The actual values and required values are displayed. Alerts and alarms will warn of any parameter which fall out of the required range as set by the weld procedure. These are displayed at the bottom of the page.

On the right hand side of the screen, is a list of parameters and current values for them, along with any system alrams.



By pressing the "Setup Displays" button you are navigated to another screen. In the left hand column is a list of the parameters which are displayed on the bar chart on the main display screen. These can be selected from a drop down list.

In the next three columns the range and target values for the selected parameter can be set. The next column alows the maximum and minimum limits for the parameter before a warning, advising that the value is going out of range, is displayed. The next column gives the maximum and minimum limits for an alarm to be activated. In the

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next column "Alarm Actions" the operator can select the option to stop welding when the alarm is activated. To do this, click on the box and a tick will appear.

The enable column on the right shows which rows will be displayed on the bar chart on the main screen. If the box is ticked then that parameter will be displayed. If not it will not be monitored.

Once the operator has done this for each parameter they want to monitor, press the save button and this will store the settings in the PLC. By pressing load, the previous settings on this page will be restored.

Before exiting this page, press the update button and this will make the changes to the live display.

To go back to the display press the "Show Display" button.

To print a hard copy of thid page press print. (Note a suitable printer must be installed and connected to the PC)

By pressing the "Data Logging" button the screen to the right will open.

This screen allows the operator to set which parameters are logged by the system during a weld.

In the top box the operator should give a filename for the data log that will be created.

The list of parameters on the left show which are selected for logging. By clicking on the box the parameter can be selected or deselected.

The sample rate per minute can be input in the box below this.
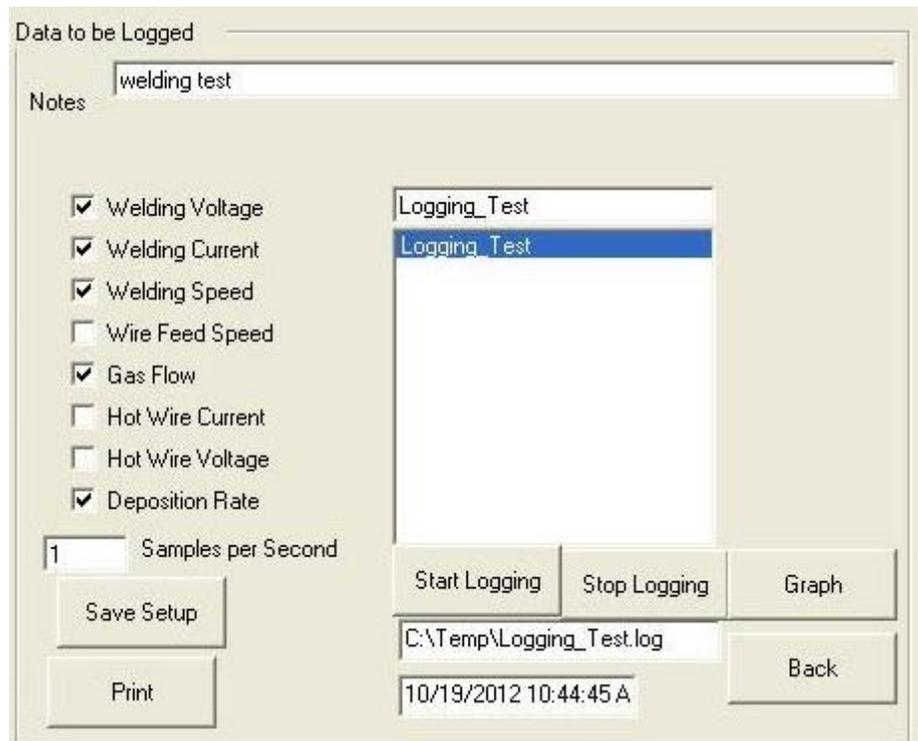
These settings can then be saved. The logged data will be saved under the filename given, in directory C:\Temp as shown as default.

To log data for a weld, press the "Start Logging" just before welding starts, and press "Stop Logging" just after the welding process is completed.

By pressing the "Graph" button you can see a graph of the parameter values agaist the time of the weld. This can be used for later analysis of the weld procedure.
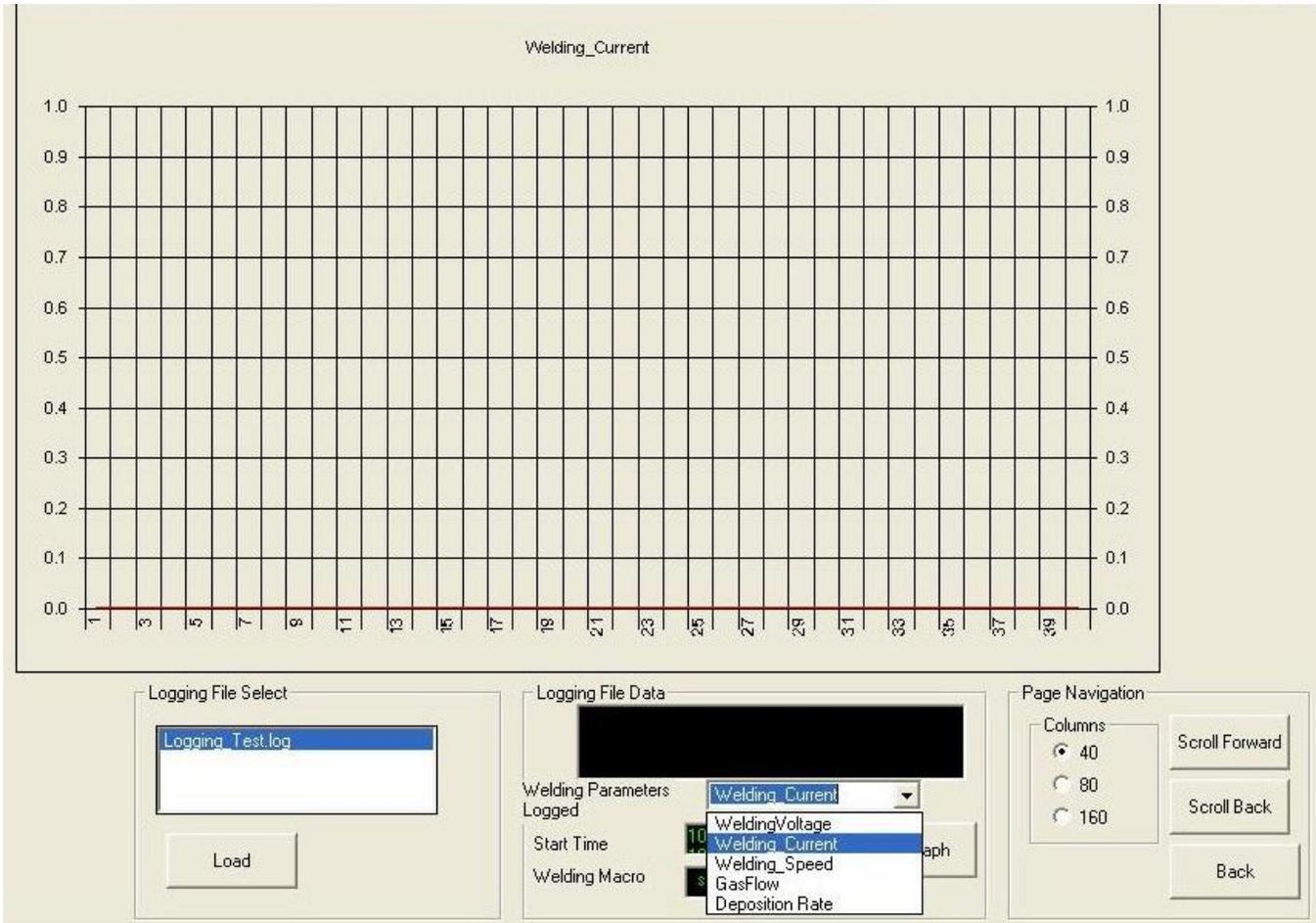
To display a graph for a weld. First select the data log file by pressing load, and selecting the filename for that particular weld.

You will then have a choice of parameters that can be selected for display in the graph. These are chosen from a drop down list. The choice will be limited to the parameters that were selected for this data log.

The graph of this parameter over time will be displayed on the screen. By choosing the number of columns displayed on the screen the scale of the graph can be altered. On the graph shown above the first 40 minutes of the weld will be displayed (1-40) if 80 columns are selected then the x-axis scale will alter to show 80 minutes on one screen.

If you then wish to view the graph for 81-160 minutes, you press the "Scroll Forward" button, and conversely to go back press the "Scroll Back" button.

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## 3.5 Operator Screen – Load Welding Program
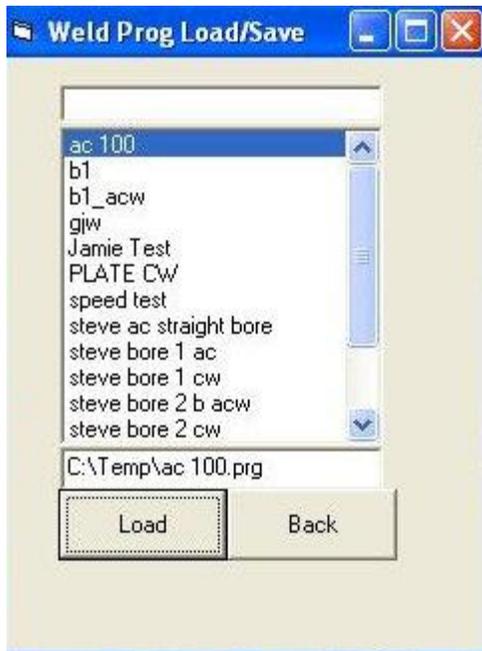
This allows you to load a previously saved welding program into the software. Simply select the file that you require from the list and press "Load".

Once this is done press the "Back" button to close this window.

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## 3.6 Operator Screen – Welder Interface
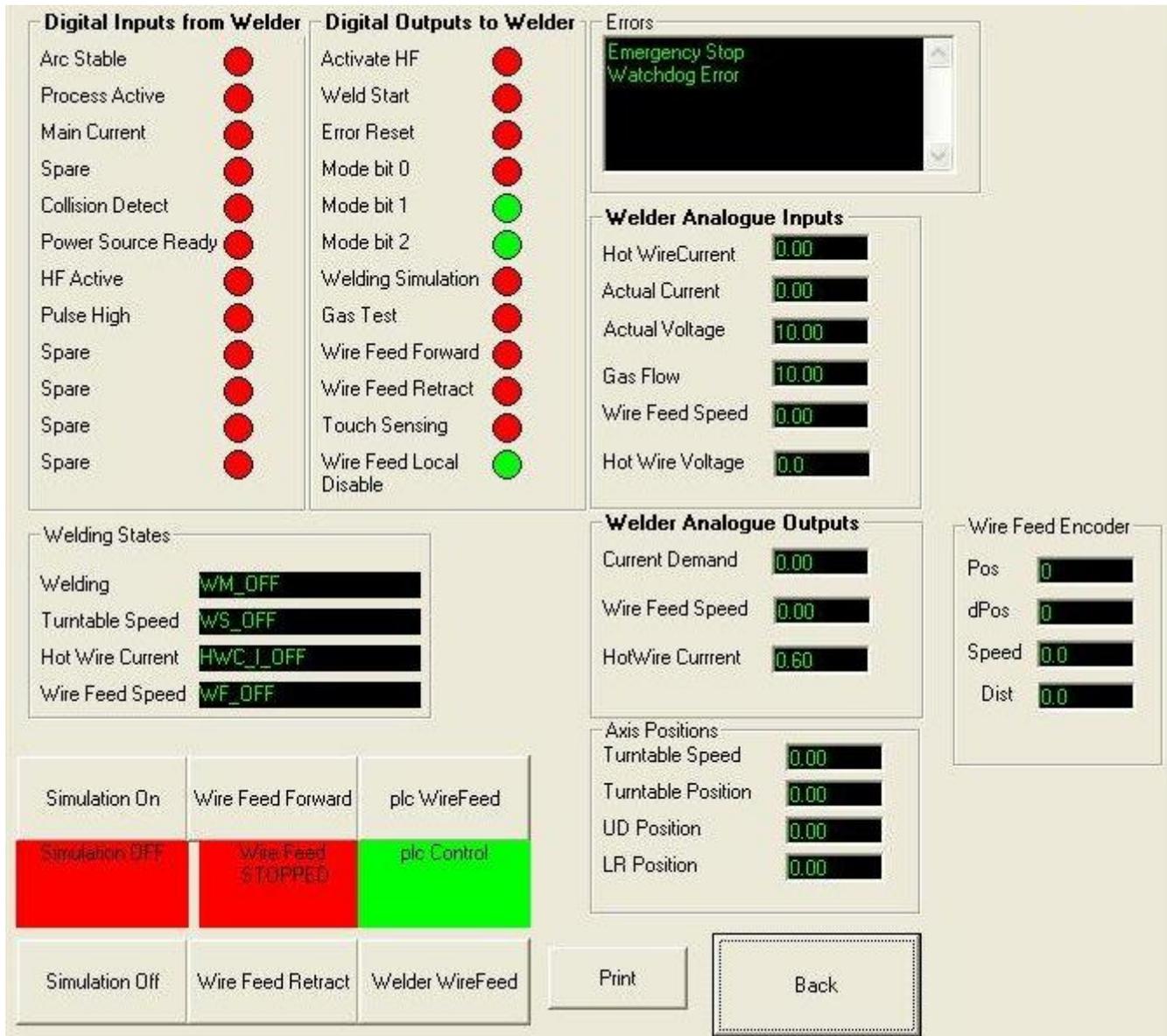


This screen displays all the readings for the weld sets in the system.

The top left section displays Red/Green Indicators against the weld set functions, green means active and red means inactive.

In the top right of the screen is a display of all of the returned values from the welding set.

Beneath this on the left are 3 pairs of wire feed control buttons, with an idicator between them.

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| SimulateOn | WireFeedForward | plc Wire Feed |
| Simulation OFF | Wire Feed STOPPED | plc Control |
| SimulateOff | WireFeedRetract | Welder Wire Feed |
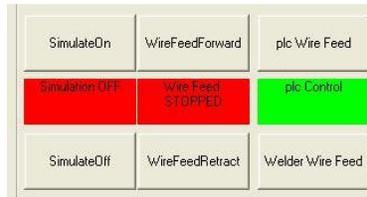
By pressing any of the 3 buttons, the action on the button will be selected. The green/red indicator between the two buttons will then change to display which mode is selected.

To the right of this is a display of the encoder positions for the wire feed unit, and the turntable and slide positions.

Data is also shown for the weld parameter readings.

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## 3.7 Operator Screen – Welding Editor

Current Program: steve ac straight bore

| Line | Welding Macro | Start | Stop | Step | Layer | Downslope | System Errors |
|------|---------------|-------|------|------|-------|-----------|---------------|
| 1 | acw | 360.0 | 0.0 | 0 | 2 | None | Text1 |
| 2 | acw | 360.0 | 0.0 | 3.5 | 10 | None | |
| 3 | | 0.0 | 0.0 | 0 | 0 | None | |
| 4 | | 0.0 | 0.0 | 0 | 0 | None | |
| 5 | | 0.0 | 0.0 | 0 | 0 | None | |
| 6 | | 0.0 | 0.0 | 0 | 0 | None | |
| 7 | | 0.0 | 0.0 | 0 | 0 | None | |
| 8 | | 0.0 | 0.0 | 0 | 0 | None | |
| 9 | | 0.0 | 0.0 | 0 | 0 | None | |
| 10 | | 0.0 | 0.0 | 0 | 0 | None | |
| 11 | | 0.0 | 0.0 | 0 | 0 | None | |
| 12 | | 0.0 | 0.0 | 0 | 0 | None | Bore to Bore |
| 13 | | 0.0 | 0.0 | 0 | 0 | None | |
| 14 | | 0.0 | 0.0 | 0 | 0 | None | Delete Line |
| 15 | | 0.0 | 0.0 | 0 | 0 | None | |
| 16 | | 0.0 | 0.0 | 0 | 0 | None | New Line |
| 17 | | 0.0 | 0.0 | 0 | 0 | None | |
| 18 | | 0.0 | 0.0 | 0 | 0 | None | Actual Prog |
| 19 | | 0.0 | 0.0 | 0 | 0 | None | |
| 20 | | 0.0 | 0.0 | 0 | 0 | None | |

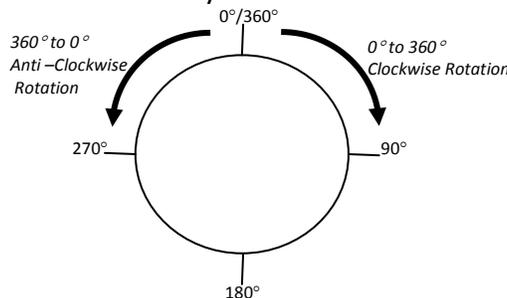Load | Save | New | Line + | Line - | Page + | Page - | Print | Back

The Welding Editor screen allows the operator to create and modify welding programs.

The screen is split into several columns. The first column shows the line number of the program. During welding the system completes the operations in line 1, then moves to line 2 and goes through the program sequentially.

The second column allows you to choose from a drop down list a Welding Macro to be used for this line of the program. The Welding Macro is a set of parameters for the welding equipment. We will describe how to create and modify Welding Macros in section 3.8.

The next two columns are the start and stop positions, for the weld. By convention the weld starts at either 0° or 360° depending on the direction of the weld. If you start at 0° and rotate to 360° you will turn in a clockwise direction, if you rotate from 360° to 0° you will rotate in an anti-clockwise direction.

360° to 0°
Anti –Clockwise Rotation

0° to 360°
Clockwise Rotation

0°/360°

270°

90°

180°

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Note when running in the anticlockwise direction. The fist line of the programe should be as the screen shown on the previous page, 2 layers with a zero step. This is because when running in anti-clockwise mode, the step up function is carried out first before the rotation. Also when a step up is carried out a layer is said to have been completed. So the first line runs as such using the welding parameters as set up in Macro "acw";

        Layer 1        Torch steps up 0mm

        Layer 2        Welds from 360° to 0° anticlockwise then steps up 0mm

        Line one of program is completed.

The next column allows you to enter a distance in mm for the step. Once the weld has gone from the start position to the stop position you can step up to do the next weld pass, or repeat the current pass adding a second weld on top of the first one.

The next column Layer, means how many steps there are in this part of the cladding process. Basically it means how many thimes this line of the program will be repeated.

The final column, Downslope can have three different settings;

      None   -           The weld head steps as normal when it reaches the stop point.

      Stationary -      The step up will be ignored (vertical axis is will remain stationary). This is a quick way of modifying an existing program where you have the same geometry but just want to remove the stepping functions.

      Travelling   -        Not welding, just a transition.

The second line of the program on the previous screen, will automatically operate straight after Line 1 is completed. Again Macro acw is being used. The fist line of the programe has laid down one bead of weld around the inner circumference of a tube. The second line carried this on

        Layer 1        Step up 3.5mm

        Layer 2        Rotate and Weld from 360° to 0° anticlockwise, then step up 3.5mm

This will be repeated 9 (Layer 2 to Layer 10) stepping up 3.5mm each time. The program is then complete and the weld will stop.

The at the bottom of the screen are buttons, the functions of the buttons are as follows

      Load   -         Load an existing program

      Save   -         Save the current program

      New   -         Create a new program (current program will be cleared from the screen)

      Line+ -         Scroll down the program one line at a time

      Line-  -         Scroll up the program one line at a time

      Page+ -         Scroll down the program one page at a time

      Page-  -         Scroll up the program one page at a time

      Print   -         print out the current screen (suitable printer needs to be installed)

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On the right of the screen are four more buttons

| | | |
|---|---|---|
| Bore to Bore | - | Only active on systems where the bore to bore function has been ordered. If installed this is covered in a later section of this manual. |
| Delete Line | - | Deletes the current line of the program that is being edited. |
| Insert Line | - | Inserts a line below the current line being edited |
| Actual Prog | - | Loads the current program in the PLC. |

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## 3.8 Operator Screen – Macro Editor



This screen, as mentioned in the previous section, relates to the creation of a welding Macro. This is a set of parameters relating to the settings that are required for the weld as determined by the users weld procedure.

Again the buttons at the bottom of the screen will allow you to "Load" and existing macro, "Save" the current macro you are working on and give it a name. Or by pressing "New" you can create a new macro. By pressing Act. Macro you will load in the active macro that is currently in the PLC memory.

There is also a "Sketch" button we will come back to this later.

The Feed section of the screen allows you to set up the geometry of the object to be clad. This includes the diameter of the bore to be clad. The welding speed required for the torch. Start up delay for the rotation of the table. The angles are for non linear bores so that the increase or decrease in diameter can be calculated as the torch steps through the bore. The rotational direction can also be determined. This should always be the same as the direction as specified in the weld programs this macro is used in.

Below this are settings for the AVC, relating to which axis the AVC is operating on, and allowing the AVC to be reversed.

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The next section related to all the parameters to be used by the weld set, again this it dermined by the users welding procedure.

The next section related to the wire and wire feed settings. Again these need to be set to meet the requirements of the welding procedure.

The final section related to torch oscillation functions. As before these settings are fairly straight forward and are dependant on the the weld procedure.

Please note that the oscillator functions will only operate where the additional oscillator add on has been requested. Otherwise the data in this box should remain at 0.

By pressing "Print" a hard copy of this screen can be printed out, if a suitable printer is connected and installed on the system.

If the "Sketch" button is pressed this brings up the following chart.

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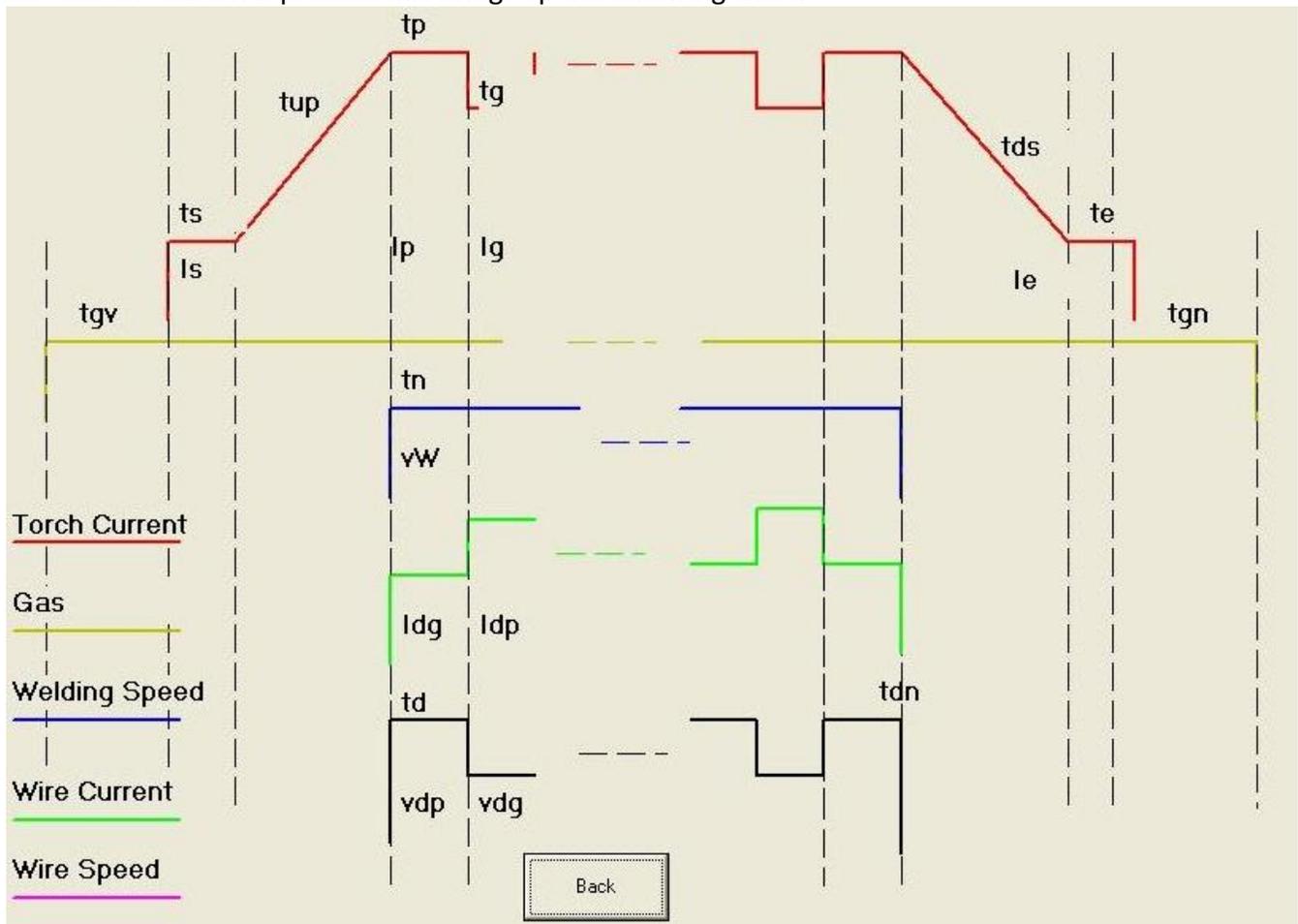
## 3.9 Operator Screen – Live Welding Editor
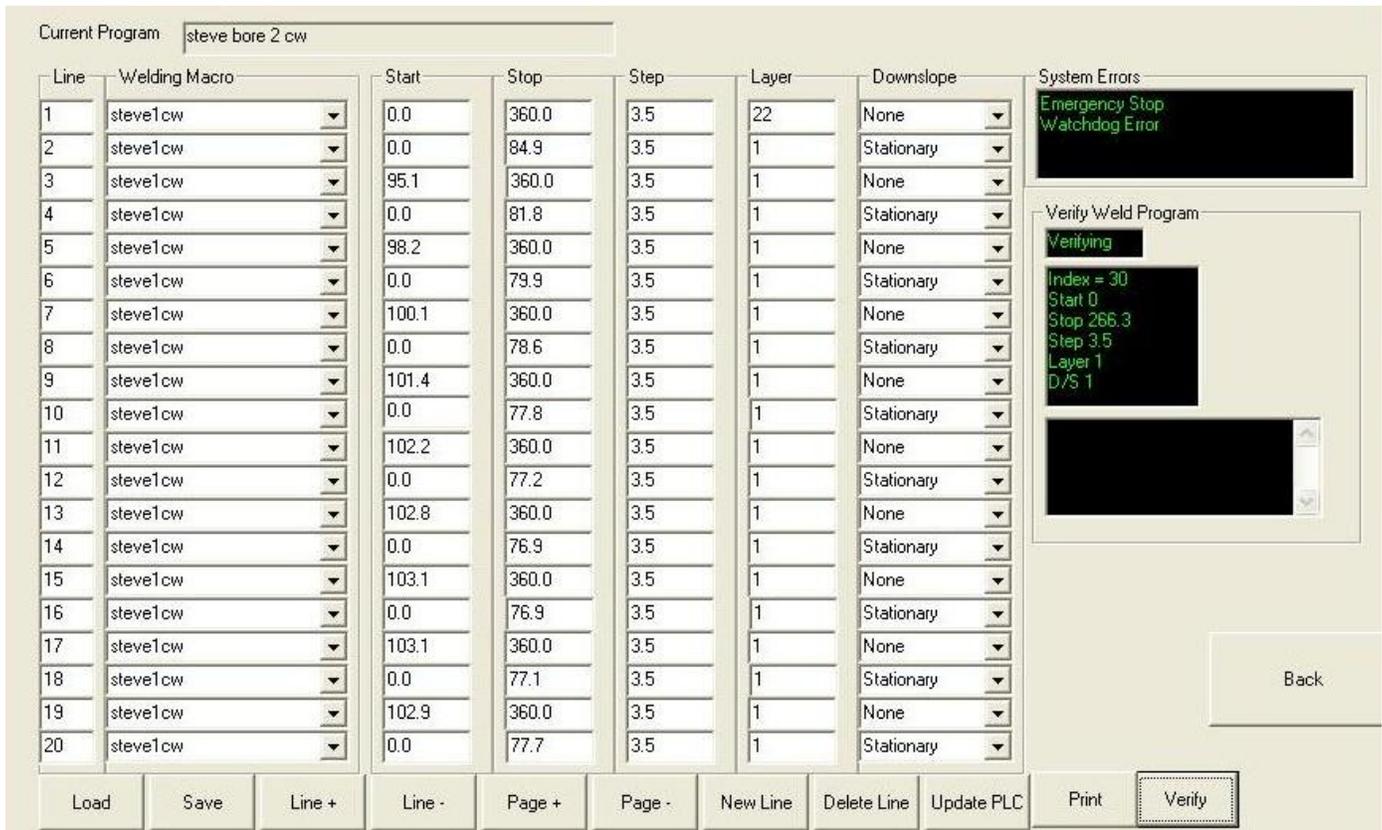


This screen is basically the same as the Welding Editor screen, except this shows the current program during welding. In this screen you are able to make changes and even delete lines from the programe while the system is welding, except for any lines which have already been completed or started.. On the right hand side of the screen there is an additional box that shows at what point the system is in the current program. There is also a "Verify" button that checks that any amendments can be accepted at the current position in the program.

Once the program changes are varified, press the "Update PLC" button to send the new instructions to the PLC so that they take effect. You can save the modified program by pressing the "Save" button.

## 3.10 Operator Screen – Live Welding Display



Like the Live Welding Editor in the previous section, this screen allows the user to diplay the current welding macro during the welding process. Any of the values can be altered to the current macro then the user should press the button "Take Parameters".

The operator should then save the modified parameters as a new macro. Then go to the Live Welding Editor and changethe macro on lines of the program where these new settings are to be used.