# Red-D-Arc Weld Automation reddarc.com

### **OPERATION MANUAL**

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



Contents	
1.0 OPERATION	3
1.1 Loading of Components onto the Positioner Table	3
1.2 PC Screen Controls	4
2.0 Supervisor Screens	5
2.1 Supervisor Screen - Drives Interface	5
2.2 Supervisor Screen – System Parameters	6
2.3 Supervisor Screen - Passwords	7
2.4 Supervisor Screen – Exit Button	8
3.0 Operator Screens	9
3.1 Operator Screen – Manual Control	9
3.2 Operator Screen – Handsets	10
3.3 Operator Screen – Preheat Settings	11
3.4 Operator Screen – Display Values	12
3.5 Operator Screen – Load Welding Program	15
3.6 Operator Screen – Welder Interface	16
3.7 Operator Screen – Welding Editor	18
3.8 Operator Screen – Macro Editor	21
3.9 Operator Screen – Live Welding Editor	23
3.10 Operator Screen – Live Welding Display	24

#### **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.

#### **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.

Drives Interface
System Parameters
Passwords
Exit

#### 2.0 Supervisor Screens

#### 2.1 Supervisor Screen - Drives Interface

Turntable		Left/Right Slide			Up/Down Slide		13	System Errors
)iamatar mm	365.0	DAC Volts	0.00		DAC Volts	0.00		Emergency Stop
andet Speed mm/min	200.0	Encoder	0		Encoder	0		watchoog Error
ctual Speed mm/min	0	Pulse Difference	0	0.1s	Pulse Difference	0	0.1s	
ulse Difference	0	Actual Speed mm/min	0		Actual Speed mm/min	0		(managed)
peed Demand to Drive	0.00	Target Speed mm/min	0		Target Speed mm/min	0		Clear UD Dist
		Integrator	0		Integrator	0		Beturn to Pos
		l Gain	5	1	l Gain	5		
me Per Rev	5:44	Distance mm	0.00		Distance mm	0.00		Stop Ramps
stance *	0	Ramp State	255		Ramp State	255		
CW Contactor					Enable			Start Slide Ramp
W Contactor	X	Enable	X		Brake (Green = Release	ed) 🔛		- Step
1	X	Brake (Hed = Applied)			Jog Up			Down
og ACW	X	Jog Right	X		Jog Down			
og UW	•	Jog Left			Down Over Travel			
		Right Over Travel	X		Up Over Travel			Print
T	250	Left Uver Travel				2.57 		
og Speed mm/min	200	Jog Speed mm/min	200		Jog Speed mm/min	200		E Stop
ncoder Lines per rev	2027.17	Demand Scaling	0.00804		Demand Scaling	0.00735	_	
Demand Scaling	100	Encoder Lines per rev	2800		Encoder Lines per rev	560		
Sample # Pulses	100				Step Speed	50		
Calibrate TT Speed		Calibrate LR Speed			Calibrate UD Speed			
Calibrate TT Position	Update	Calibrate LR Position	Update		Calibrate UD Position	Update		Back

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 aleterations and send these changes to the PLC.

Welding Voltage	0.1	wie reeu	0.2		Auto Gap			System Errors
Welding Current Reak	10	RetractTime	10.2	s	Touch Speed	60	- mm/min	Emergency Stop
Welding Conent Feature	10	AVC			News Deels Cased	20		watchdog Effor
weiding Current Background	10	Move Speed	60	mm/mir	Move Back Speed	0.5	- mm/min	
Wire Feed Speed Peak	10	Filter Time	5	s	Gap Distance	10.5	mm	-Weld Sequence
Vire Feed Speed Background		Deadhand	0.05		State Ready			in the coqueries
Velding Speed	10	Deaubariu		v	Touching	$\bigcirc$		State
lot Wire Current Peak	5				LB Slide Position	him	mm	
lot Wire Current Background	5				UD Slide Position	0.00		AVC Axis Horizontal
		└ Welding Cable	Voltage I	Drop	OD Slide i Osidori	0.000		TT Move State
		Ub	1	- v	Return To Position			
ore To Bore		Room Drive	12		TT State	0		
Velding Ramp Down Angle	0	Doom Drive		_	UD	0		TT Ramp Times
Across Void Move Speed	350	(0 - 100%)	10	% fs	LB State	0		Bamp Up 3
ucross Void Creen Speed	45	- Column and I	Boom Par	·		-		Bamp Down 1
verses Void Dese Deser Australia	25	Column and i	5000011 0	~	TT Restore Dist	0.0		hamp bown 1
volossi volu namp Down Angle	2	Col Move	2	s	UD Restore Dist	0.0		Watchdog Enable
VC Cut Off Angle	1-	lime	-	100	LR Restore Dist	0.0		The first and g Endblo
		Boom Move	2	S	LR Target Pos	0		1
					UD Target Pos	0		Back
Update	Drint	State Read				-	1	10 22 20 20 20 20 20 20 20 20 20 20 20 20

#### 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, allowing 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

	Name	ID	Password	- Program Control
Supervisor ID 1	n	i	Р	
Supervisor ID 2				Save Bac
Supervisor ID 3				
Supervisor ID 4				3 <b>1</b> 1
Supervisor ID 5				
Supervisor ID 6				
Supervisor ID 7				Read
Supervisor ID 8				
Supervisor ID 9				
Supervisor ID 10				
Supervisor ID 11				
Supervisor ID 12				
Supervisor ID 13				Basilian
Supervisor ID 14				Previous
Supervisor ID 15				
Supervisor ID 16				11 A A
Supervisor ID 17				Next
Supervisor ID 18				
Supervisor ID 19				
Supervisor ID 20				
Supervisor ID 21				
Supervisor ID 22				
Supervisor ID 23				
Supervisor ID 24				
Supervisor ID 25				

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.

#### 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.

#### 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**

Screen #1				Screen #2				T	Screen #3			
Prog: steve	e bore 2 cw			TTv: 150.0	)				Column and	Boom		
Macro: stev	ve1cw			lp: 260 lg	200				Labell			
Line: 1 La	ayer: 1 V 11.5			HWIp: 40-1	-1Wlg: 40				Label1			
T: 0.0 St.	0.0			HWVp: 200	) HWvg: 200							
Step Off	Zero Reset	• Use Wire	• AVC On	Take Position	Return to Pos	• Use Wire	AVC On					
•Rapid Shift	• Auto Gap	W Feed Back	Weld Voltage +	Weld Speed +		Peak Current +	BG Current +		Rapid Shift			
Weld Stop	• Display Actual	W Feed Fwd	Weld Voltage -	Weld Speed -	• Display Actual	Peak Current	BG Current -					
Slide Up		TT CW	TT ACW		Take Params				Raise Column		TT CW	TT ACW
Slide Down	Gas Test	TT - 0.5	TT + 0.5	HW1Pk+	HWIBG +	WF Speed Pk +	WF Speed Bg +		Lower Column			
Slide Left	Slide Right	Start Seq	Pause Seq	HWIPk	HW I BG -	WF Speed Pk ·	WF Speed Bg -		Retract Boom	Extend Boom		Reset Seq
rs	iystem Errors		-1									
E	: mergency Stop Watchdog Error		P	rint	Scre	en 3	Back			Print		Back

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**

Not Welding Not In PreHeat	Emergency Stop Watchdog Error	~
Target Values Target Speed 0 mm/min Direction Clockwise		.~
Diameter 365.0	Start	Stop
Update		Back

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.

#### 3.4 Operator Screen – Display Values

Welding Voltage	0.0	20.0	
Welding Current	0.0	Weiding States Welding WM_DFF Turntable Speed WS_DFF Hot Wire Current HWC_LOFF Wire Feed Speed WF_DFF	
Welding Speed	0	Axes Turntable Speed 0.00 Turntable Position 0.00	
Wire Feed Speed	500.0	500.0 LR Position 0.00 False Welding Parameters Current Prog steve bore 2 cw	
Hot Wire Current	0.0	80.0     Current Line     1       Total Layers     22       Current Layer     1	
Hot Wire Voltage	0.0	Step Distance 3.5 Start Angle 0 Stop Angle 360 Status	
Actions Test Start Test Stop Print	Weld Errors	Change Screen Setup Displays Back	

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.

Measured Value	Range	Target	Warning	Limits	Alarm Lirr Min	iits Max	Alarm Actions	Enable
Welding Voltage 🔹	20	20	8	14	6	16	☐ Stop Welding	•
Welding Current 💽	300	300	180	280	170	300	C Stop Welding	•
Welding Speed 📃	300	300	180	290	150	310	☐ Stop Welding	<b>V</b>
Wire Feed Speed 💽	1000	500	200	400	150	500	☐ Stop Welding	Г
Hot Wire Current 🗾	100	80	40	80	30	70	☐ Stop Welding	•
Hot Wire Voltage 🗾	10	10	4	6	3	7	☐ Stop Welding	5
_oad/Save			_	1 FS	elect Meter Valu	es	Update	
Load Save		now Displays	Data Logg	ing 🔽	Use Values on	this Page	Print	Back

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

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.

Logging_Test	_	
Logging_Test		
Chart Lagaring	o	<b>c</b> 1
Statt Lugging	Stop Logging	Graph
	Logging_Test Logging_Test	Logging_Test Logging_Test Start Logging Stop Logging

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.

#### 3.5 Operator Screen – Load Welding Program

ac 100	~
bl bl acw	
giw	
Jamie Lest PLATE CW	
speed test	
steve ac straight bore steve bore 1 ac	1
steve bore 1 cw	
steve bore 2 b acw steve bore 2 cw	~
C:\Temp\ac 100.prg	
lasd	Paak

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.

#### 3.6 Operator Screen – Welder Interface

Digital Inputs from Welder	-Digital Outputs to Welde	er prors	
Arc Stable 🔴	Activate HF 🛛 🔴	Emergency Stop	
Process Active	Weld Start 🔴	Watchoog Elitor	
Main Current 🥚	Error Reset		
Spare 🔴	Mode bit 0 🔴		
Collision Detect	Mode bit 1	Welder Analogue Inputs	
Power Source Ready 🔴	Mode bit 2	Hot WireCurrent	
HF Active	Welding Simulation 🔴	Actual Current 0.00	
Pulse High 🥚	Gas Test 🥚	Actual Voltage	
Spare	Wire Feed Forward	Gas Flow	
Spare	Touch Sensing	Wire Feed Speed 0.00	
Spare	Wire Feed Local	Hot Wire Voltage 0.0	
Welding States		-Welder Analogue Outputs	Wire Feed Encoder
Welding WM OFF		Current Demand 0.00	Pos <b>Dimensio</b>
Turntable Speed WS_OFF		Wire Feed Speed 0.00	dPos <b>Dimensio</b>
Hot Wire Current HWC_I_OFF		HotWire Currrent 0.60	Speed 0.0
Wire Feed Speed WF_OFF			Dist 0.0
-p		Axis Positions Turntable Speed	
Simulation On Wire Feed For	ward plc WireFeed	Turntable Position	
Similation OFF	nic Control	UD Position	
STOPP:	Processing.	LR Position 0.00	
Simulation Off	Iract Welder WireFeed	Print Del	

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.



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.

Line	Welding Macro	Start	Stop	Step	Layer	Downslope	System Errors
	acw	▼ 360.0	0.0	0	2	None	▼ Text1
	acw	360.0	0.0	3.5	10	None	¥.
		• 0.0	0.0	0	0	None	
		• 0.0	0.0	0	0	None	•
Ĩ		• 0.0	0.0	0	0	None	•
1		• 0.0	0.0	0	0	None	•
		• 0.0	0.0	0	0	None	•
		• 0.0	0.0	0	0	None	•
		• 0.0	0.0	0	0	None	•
ţ. Û		• 0.0	0.0	0	0	None	<b>•</b>
		• 0.0	0.0	0	0	None	1
2		0.0	0.0	0	0	None	<b>T</b>
E T		• 0.0	0.0	0	0	None	Bore to Bore
		• 0.0	0.0	0	0	None	Delete Line
i.		• 0.0	0.0	0	0	None	
5		• 0.0	0.0	0	0	None	▼ New Line
1		• 0.0	0.0	0	0	None	<b>•</b>
}	1	• 0.0	0.0	0	0	None	Actual Prog
j.		• 0.0	0.0	0	0	None	
)	7): c.	• 0.0	0.0	0	0	None	-

#### 3.7 Operator Screen – Welding Editor

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  $0^{\circ}$  or  $360^{\circ}$  depending on the direction of the weld. If you start at  $0^{\circ}$  and rotate to  $360^{\circ}$  you will turn in a clockwise direction, if you rotate from  $360^{\circ}$  to  $0^{\circ}$  you will rotate in an anti-clockwise direction.



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 1Torch steps up 0mmLayer 2Welds from 360° to 0° anticlockwise then steps up 0mmLine 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)

On the right of the screen are four more buttons

ms where the bore to bore function has been overed in a later section of this manual.
line of the program that is being edited.
the current line being edited
ogram in the PLC.

#### 3.8 Operator Screen – Macro Editor

Macro Description       Vert bore cw       Macro Name       accw         bed       Diameter       360       mm         Welding Speed       200       mm/min       Gas Pre Flow Time       2         Angle       0       degree       Turntable Start Up Delay       0.5       \$         Outward       0       degree       Ustowerd       0.5       \$         Write Speed Peak       275       cm/min       \$         Vire Speed Peak       275       cm/min         Ustowerd       Note Outward       0.5       \$         Velding Current Peak       200       \$       \$         Velding Current Duration       200       \$       \$         Outward       Not Outward       0.5       \$         Velding Current Duration       200       \$       \$         Outward       Not Outward       0.5       \$         Macto Net Duration       200       \$       \$         Outward       Not Outward       0.5       \$         Velding Current Duration       20       \$       \$         Downslope Duration       2.5       \$       \$         Current Duration       2       \$       \$     <
Diameter       360       mm         Welding Speed       200       mm/min         Turntable Start Up Delay       0.2       s         Angle       0       degree         Dutward       0       degree         Turntable Direction       Anti-Clockwi         ETR Direction       Note       welding Current Peak         Outward       Not Dutward         Angle       0         Outward       Not Dutward         Angle       0         Angle       0         Outward       Not Dutward         Angle       0         0
☐ ISync

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.

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 dependent 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.



Line	Welding Macro	Start	Stop	Step	Layer	Downslope	System Errors
	steve1cw 💌	0.0	360.0	3.5	22	None 👻	Emergency Stop Watchdog Ettor
	steve1cw 💌	0.0	84.9	3.5	1	Stationary 👻	
	steve1cw 💌	95.1	360.0	3.5	1	None 👻	
	steve1cw 💌	0.0	81.8	3.5	1	Stationary 👻	Verify Weld Program
ĥ	steve1cw 💌	98.2	360.0	3.5	1	None 👻	Verifying
	steve1cw 💌	0.0	79.9	3.5	1	Stationary 💌	Index = 30
Î	steve1cw 💌	100.1	360.0	3.5	1	None 💌	Start U Stop 266.3
	steve1cw 💌	0.0	78.6	3.5	1	Stationary 👻	Step 3.5
. 1	steve1cw 💌	101.4	360.0	3.5	1	None 💌	D/S 1
	steve1cw 💌	0.0	77.8	3.5	1	Stationary 👻	
1	steve1cw 💌	102.2	360.0	3.5	1	None 👻	
Ś.	steve1cw 💌	0.0	77.2	3.5	1	Stationary 👻	
6	steve1cw 💌	102.8	360.0	3.5	1	None 👻	
	steve1cw 💌	0.0	76.9	3.5	1	Stationary 👻	
i	steve1cw 💌	103.1	360.0	3.5	1	None 💌	1
	steve1cw 💌	0.0	76.9	3.5	1	Stationary 💌	I
1	steve1cw 💌	103.1	360.0	3.5	1	None 👻	
1	steve1cw 💌	0.0	77.1	3.5	1	Stationary 👻	Back
l	steve1cw 💌	102.9	360.0	3.5	1	None 💌	
)	steve1cw 👻	0.0	77.7	3.5	1	Stationary 👻	

#### 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

Macro Name acw					Emergency Stop		
Macro Description					Watchdog Error		
Feed Diameter Welding Speed Turntable Start Up Delay Angle Turntable Direction ETR Direction Outward Angle O	360     mm       200     mm/min       0.2     s       0     degree       Outward       Anti-Clockwis       None       Not Outward       Angle	Torch Torch Voltage Gas Pre Flow Time Starting Current Start Current Duration Upslope Time Welding Current Peak Welding Current Packground Peak Current Duration Background Current Duration Downslope Duration	12.5 2 120 0.5 260 210 200 200 0.5	V s A s A A ms ms s	Wire Wire Start Delay Wire Feed Upslope Time Wire Speed Peak Wire Speed Background Hot Wire Current Peak Hot Wire Current Background Wire Feed Downslope Time Wire Type Wire Ty	0.5 1 275 275 60 60 0 0	s cm/min cm/min A A s
VC VC AVC Axis  Horiz	: Delay Reverse	End Current End Current Duration Duration of Gas Post Flow	20 2 2	A s s	Discillation Discillation Speed to Left Oscillation Speed to Right Dwell time at Left Dwell time at Right Move Distance to Left Move Distance to Right	0 0 0 0 0	mm/mir mm/mir s s mm mm
Take Parameters -	Print		Ba	ck	Oscillation Offset	0	mm

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 Enter filename and click Save or

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.

TakeParams	2
	-
	Save
	L