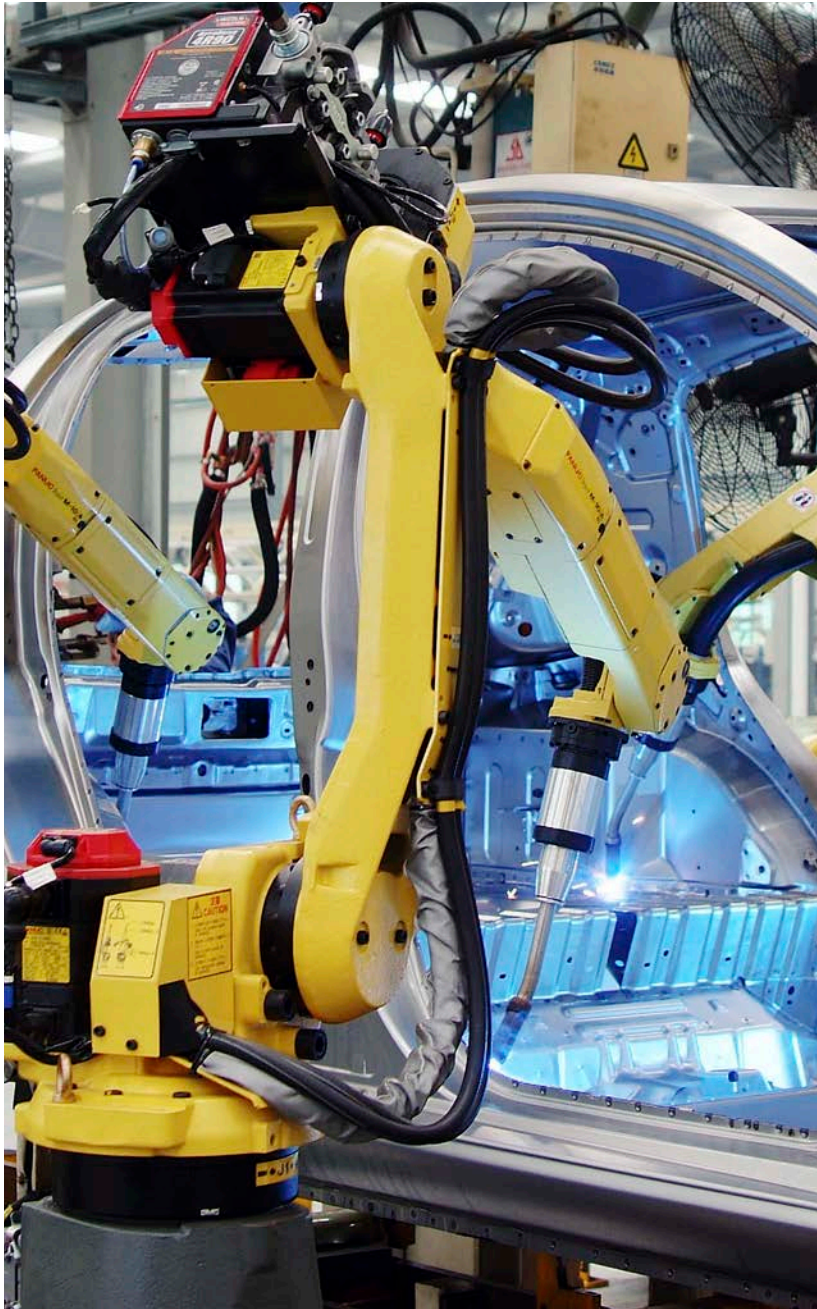


AC-STT™ Weld Process



Overview

AC-STT™ - The Superior Thin-Gauge Solution

- Low spatter
- Controlled Heat Input
- Decreases Burnthrough
- Reduces Distortion

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Process Description

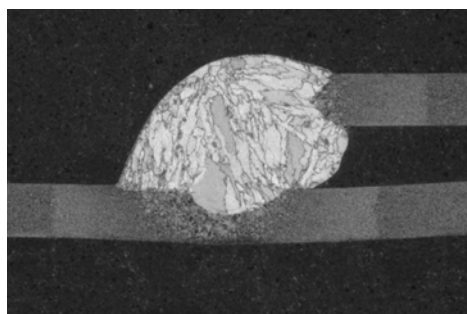
Based off of the patented STT® (Surface Tension Transfer) process, AC-STT™ combines the proven spatter-reducing technology of the STT® waveform with the reduced heat-input characteristics of AC GMAW. AC-STT™ provides

a complete solution for welding thin sheet metal 18 Ga to 24 Ga while accommodating for poor fit up with the resulting gap.

THIN GAUGE LAP WELDING WITH STT

	Zero Gap	0.25 mm Gap	0.5 mm Gap		Zero Gap	0.25 mm Gap	0.5 mm Gap
18 Ga (1.3 mm)	DC+	DC+	DC+	18 Ga (1.3 mm)	AC	AC	AC
20 Ga (1.0 mm)	DC+	DC+	DC+	20 Ga (1.0 mm)	AC	AC	AC
22 Ga (0.8 mm)	DC+	DC+	DC+	22 Ga (0.8 mm)	AC	AC	AC
24 Ga (0.8 mm)	DC+	DC+		24 Ga (0.8 mm)	AC	AC	AC

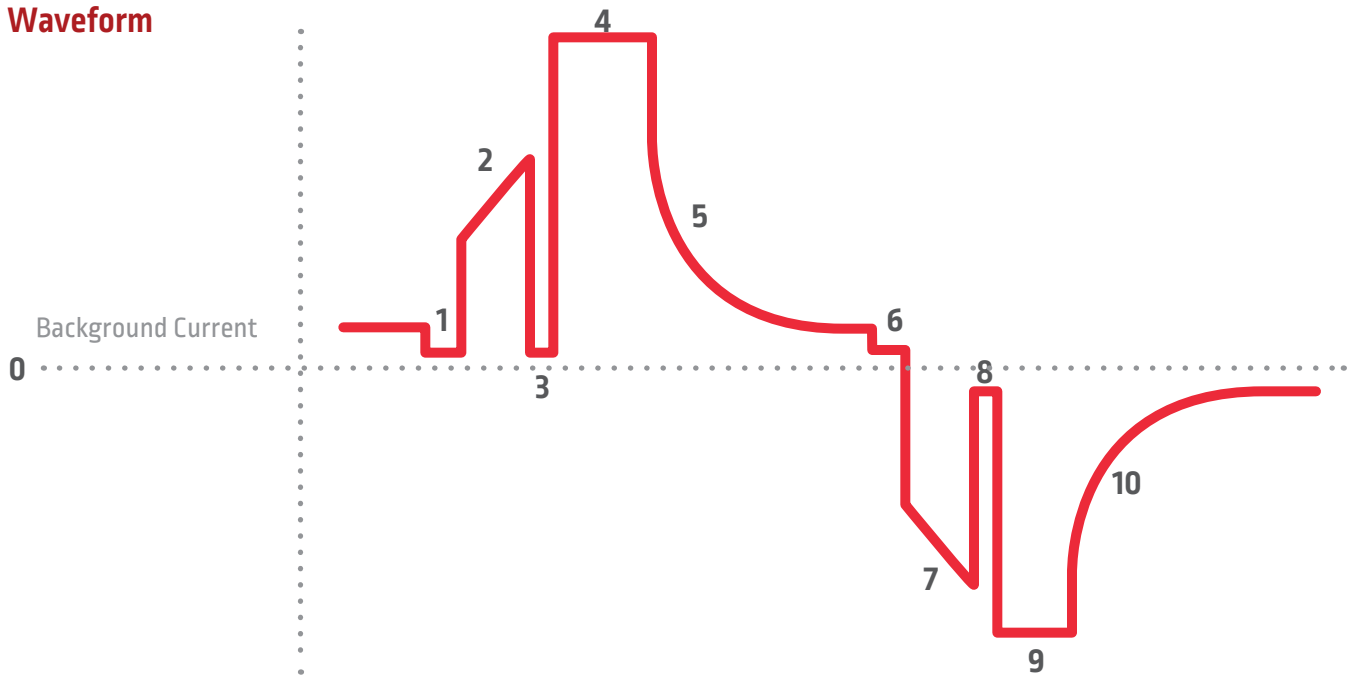
■ Possible ■ Not Possible

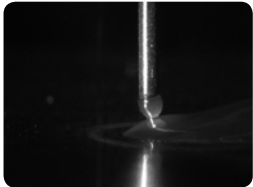
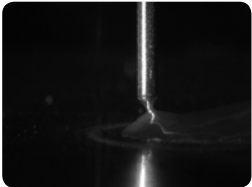
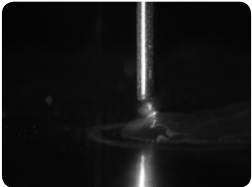
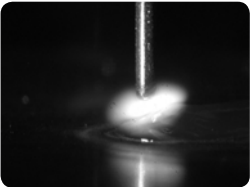
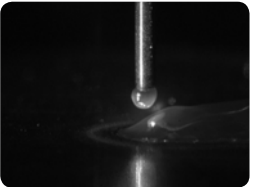
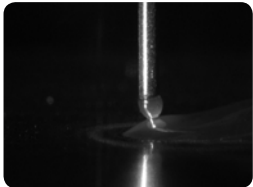
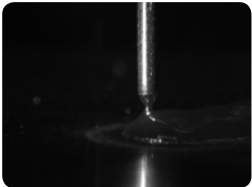
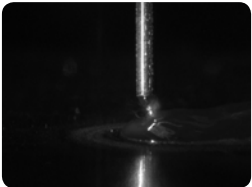
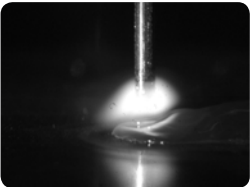


24 Ga to 24 Ga Lap Weld with 0.5 mm gap

AC-STT™ has the unique ability to reverse the polarity of the waveform to adjust Heat Input. The duration of welding in the positive and negative polarity is directly controlled by the operator using the Balance control. A Balance setting of 100% will result in a purely DCEP waveform with the highest heat input, while a setting of 0% will result in a purely DCEN waveform with the lowest heat input. A nominal setting of 50% creates a balanced waveform that alternates cycles of DCEP and DCEN STT. Other settings in between these values can be used to fine tune the heat input and penetration for each application.

Waveform



DC+					
	1. Wet-in	2. Pinch Current	3. Detachment	4. Peak Current	5. Tailout & Background
	Molten ball makes initial contact with weld pool and current is instantly reduced.	As the wire necks down, special circuitry determines that the short is about to break.	The STT Switch quickly reduces the current at the instant the droplet detaches, reducing spatter	Peak Current sets a pre-defined arc length.	Background regulation maintains a consistent molten ball size.
	DC-				
6. Wet-in		7. Pinch Current	8. Detachment	9. Peak Current	10. Tailout & Background
Molten ball makes initial contact with weld pool and current is instantly reduced.		As the wire necks down, special circuitry determines that the short is about to break.	The STT Switch quickly reduces the current at the instant the droplet detaches, reducing spatter	Peak Current sets a pre-defined arc length.	Background regulation maintains a consistent molten ball size.

Synergic Welding

1. Adjust WFS to the desired setting. Based on WFS a preprogrammed nominal voltage is selected. Refer to the Application section for the recommended settings.



Trim, Balance and UltimArc®

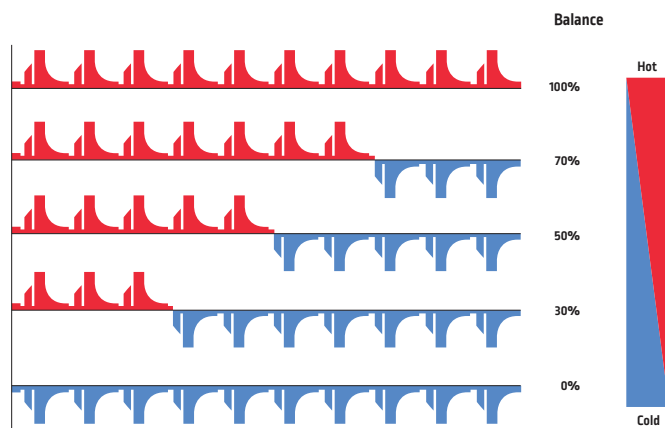
2. Trim: Regulates voltage by adjusting Peak, Background and Tailout.

- When the arc voltage is increased, the shorting frequency lowers, the ball size increases, giving a softer arc with more energy.
- When the arc voltage is lowered, the shorting frequency increases, the ball size decreases, giving a more focused arc with less energy.



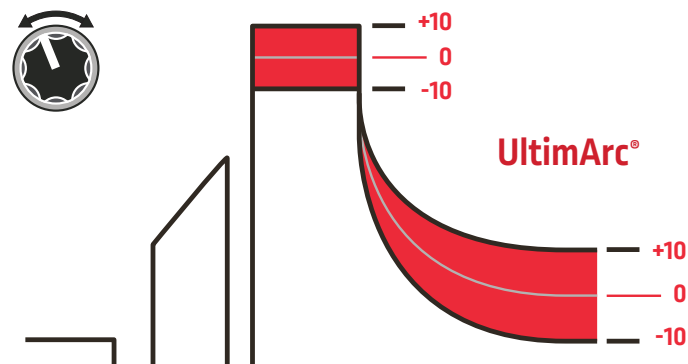
3. Balance: Determines ratio of DCEP and DCEN STT cycles.

- When the Balance is increased, the amount of DC+ cycles increases and DC- cycles decreases.
- When the Balance is decreased, the amount of DC- cycles increases and the DC+ cycles decreases.



4. UltimArc®: Fine adjustment of the arc.

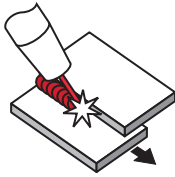
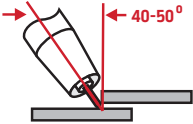
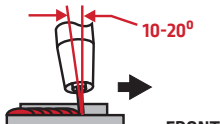
- In the positive direction it will produce a more focused arc by raising the peak, and lowering the background.
- In the negative direction, it will produce a more fluid and softer transfer by lowering the peak, and increasing background.



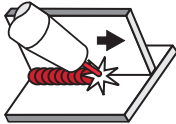
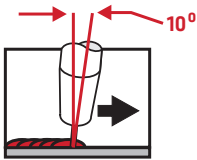
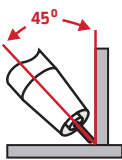
Lap Weld Procedures

NO GAP								
Travel Angle	10-20° Push							
Work Angle	40-50°							
CTWD								
0.625 in	15 mm							
PLATE THICKNESS		WIRE	GAS	WFS in/min (m/min)	TRIM	BALANCE	ULTIMARC	TRAVEL SPEED in/min (cm/min)
18 Ga	1.3 mm	0.035 in, SuperArc® L-56	75% Ar / 25% CO ₂	150 [3.8]	1	100	0	35 [89]
			100% CO ₂	140 [3.5]	1	100	0	35 [89]
		1.0 mm, SupraMig® S-6	80% Ar / 20% CO ₂	135 [3.4]	1	90	0	35 [89]
			100% CO ₂	130 [3.3]	1	90	0	35 [89]
		0.045 in, SuperArc® L-56	75% Ar / 25% CO ₂	120 [3.0]	1	80	0	35 [89]
			100% CO ₂	120 [3.0]	1	70	0	35 [89]
1.2 mm, SupraMig® S-6	80% Ar / 20% CO ₂	110 [2.8]	1	60	0	35 [89]		
	100% CO ₂	110 [2.8]	1	60	0	35 [89]		
20 Ga	1.0 mm	0.035 in, SuperArc® L-56	75% Ar / 25% CO ₂	140 [3.5]	1	70	0	30 [76]
			100% CO ₂	130 [3.3]	1	70	0	30 [76]
		1.0 mm, SupraMig® S-6	80% Ar / 20% CO ₂	125 [3.1]	1	60	0	30 [76]
			100% CO ₂	120 [3.0]	1	40	0	30 [76]
		0.045 in, SuperArc® L-56	75% Ar / 25% CO ₂	120 [3.0]	1	50	0	30 [76]
			100% CO ₂	110 [2.8]	1	40	0	30 [76]
1.2 mm, SupraMig® S-6	80% Ar / 20% CO ₂	105 [2.6]	1	30	0	30 [76]		
	100% CO ₂	100 [2.5]	1	30	0	30 [76]		
22 Ga	0.8 mm	0.035 in, SuperArc® L-56	75% Ar / 25% CO ₂	130 [3.3]	1	50	0	25 [63]
			100% CO ₂	110 [2.8]	1	50	0	25 [63]
		1.0 mm, SupraMig® S-6	80% Ar / 20% CO ₂	115 [2.9]	1	50	0	25 [63]
			100% CO ₂	105 [2.6]	1	30	0	25 [63]
		0.045 in, SuperArc® L-56	75% Ar / 25% CO ₂	105 [2.6]	1	25	0	25 [63]
			100% CO ₂	100 [2.5]	1	25	0	25 [63]
1.2 mm, SupraMig® S-6	80% Ar / 20% CO ₂	95 [2.4]	1	10	0	25 [63]		
	100% CO ₂	95 [2.2]	1	10	0	25 [63]		
24 Ga	0.65 mm	0.035 in, SuperArc® L-56	75% Ar / 25% CO ₂	110 [2.7]	1	40	0	20 [51]
			100% CO ₂	90 [2.2]	1	40	0	20 [51]
		1.0 mm, SupraMig® S-6	80% Ar / 20% CO ₂	95 [2.4]	1	30	0	20 [51]
			100% CO ₂	80 [2.0]	1	30	0	20 [51]
		0.045 in, SuperArc® L-56	75% Ar / 25% CO ₂	90 [2.2]	1	10	0	20 [51]
			100% CO ₂	85 [2.1]	1	10	0	20 [51]
1.2 mm, SupraMig® S-6	80% Ar / 20% CO ₂	80 [2.0]	1	0	0	20 [51]		
	100% CO ₂	75 [1.9]	1	0	0	20 [51]		

Lap Weld Procedures

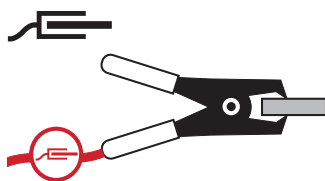
GAP (0.5 mm)								
Travel Angle	10-20° Push	NOTE: For lap weld procedures with a gap, position the electrode directly into the joint.						
Work Angle	40-50°							
CTWD								
0.625 in	15 mm							
PLATE THICKNESS	WIRE	GAS	WFS in/min (m/min)	TRIM	BALANCE	ULTIMARC	TRAVEL SPEED in/min (cm/min)	
18 Ga	1.3 mm	0.035 in, L-56	75% Ar / 25% CO ₂	200 [5.0]	1	60	0	25 [63]
			100% CO ₂	185 [4.6]	1	60	0	25 [63]
		1.0 mm, S-6	80% Ar / 20% CO ₂	180 [4.5]	1	50	0	25 [63]
			100% CO ₂	165 [4.0]	1	50	0	25 [63]
		0.045 in, L-56	75% Ar / 25% CO ₂	160 [4.1]	1	40	0	25 [63]
			100% CO ₂	150 [3.8]	1	40	0	25 [63]
1.2 mm, S-6	80% Ar / 20% CO ₂	145 [3.6]	1	30	0	25 [63]		
	100% CO ₂	135 [3.4]	1	30	0	25 [63]		
20 Ga	1.0 mm	0.035 in, L-56	75% Ar / 25% CO ₂	155 [3.9]	1	50	0	25 [63]
			100% CO ₂	140 [3.5]	1	50	0	25 [63]
		1.0 mm, S-6	80% Ar / 20% CO ₂	140 [3.5]	1	40	0	25 [63]
			100% CO ₂	130 [3.3]	1	30	0	25 [63]
		0.045 in, L-56	75% Ar / 25% CO ₂	125 [3.1]	1	20	0	25 [63]
			100% CO ₂	115 [2.9]	1	20	0	25 [63]
1.2 mm, S-6	80% Ar / 20% CO ₂	115 [2.9]	1	10	0	25 [63]		
	100% CO ₂	105 [2.6]	1	10	0	25 [63]		
22 Ga	0.8 mm	0.035 in, L-56	75% Ar / 25% CO ₂	130 [3.3]	1	40	0	20 [51]
			100% CO ₂	105 [2.6]	1	40	0	20 [51]
		1.0 mm, S-6	80% Ar / 20% CO ₂	115 [2.9]	1	30	0	20 [51]
			100% CO ₂	105 [2.6]	1	20	0	20 [51]
		0.045 in, L-56	75% Ar / 25% CO ₂	95 [2.4]	1	10	0	20 [51]
			100% CO ₂	90 [2.2]	1	10	0	20 [51]
1.2 mm, S-6	80% Ar / 20% CO ₂	85 [2.1]	1	0	0	20 [51]		
	100% CO ₂	80 [2.0]	1	0	0	20 [51]		
24 Ga	0.65 mm	0.035 in, L-56	75% Ar / 25% CO ₂	105 [2.6]	1	20	0	20 [51]
			100% CO ₂	90 [2.2]	1	20	0	20 [51]
		1.0 mm, S-6	80% Ar / 20% CO ₂	95 [2.4]	1	20	0	20 [51]
			100% CO ₂	85 [2.1]	1	20	0	20 [51]
		0.045 in, L-56	75% Ar / 25% CO ₂	85 [2.1]	1	10	0	20 [51]
			100% CO ₂	80 [2.0]	1	10	0	20 [51]
1.2 mm, S-6	80% Ar / 20% CO ₂	75 [1.9]	1	0	0	20 [51]		
	100% CO ₂	70 [1.7]	1	0	0	20 [51]		

Fillet Weld Procedures

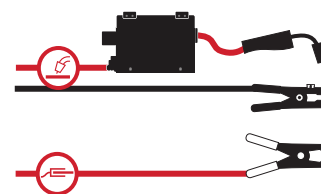
NO GAP								
Travel Angle	15° Push							
Work Angle	50°							
CTWD								
0.625 in	15 mm							
PLATE THICKNESS		WIRE	GAS	WFS in/min (m/min)	TRIM	BALANCE	ULTIMARC	TRAVEL SPEED in/min (cm/min)
18 Ga	1.3 mm	0.035 in, L-56	75% Ar / 25% CO ₂	185 [4.6]	1	100	0	25 [63]
			100% CO ₂	165 [4.0]	1	100	0	25 [63]
		1.0 mm, S-6	80% Ar / 20% CO ₂	160 [4.1]	1	100	0	25 [63]
			100% CO ₂	160 [4.1]	1	100	0	25 [63]
		0.045 in, L-56	75% Ar / 25% CO ₂	135 [3.4]	1	80	0	25 [63]
			100% CO ₂	130 [3.3]	1	70	0	25 [63]
1.2 mm, S-6	80% Ar / 20% CO ₂	120 [3.0]	1	70	0	25 [63]		
	100% CO ₂	115 [2.9]	1	70	0	25 [63]		
20 Ga	1.0 mm	0.035 in, L-56	75% Ar / 25% CO ₂	155 [3.9]	1	60	0	25 [63]
			100% CO ₂	130 [3.3]	1	80	0	25 [63]
		1.0 mm, S-6	80% Ar / 20% CO ₂	135 [3.4]	1	60	0	25 [63]
			100% CO ₂	120 [3.0]	1	70	0	25 [63]
		0.045 in, L-56	75% Ar / 25% CO ₂	115 [2.9]	1	60	0	25 [63]
			100% CO ₂	100 [2.5]	1	60	0	25 [63]
1.2 mm, S-6	80% Ar / 20% CO ₂	105 [2.6]	1	50	0	25 [63]		
	100% CO ₂	90 [2.2]	1	50	0	25 [63]		
22 Ga	0.8 mm	0.035 in, L-56	75% Ar / 25% CO ₂	115 [2.9]	1	50	0	20 [51]
			100% CO ₂	95 [2.4]	1	70	0	20 [51]
		1.0 mm, S-6	80% Ar / 20% CO ₂	100 [2.5]	1	50	0	20 [51]
			100% CO ₂	80 [2.0]	1	60	0	20 [51]
		0.045 in, L-56	75% Ar / 25% CO ₂	85 [2.1]	1	50	0	20 [51]
			100% CO ₂	75 [1.9]	1	60	0	20 [51]
1.2 mm, S-6	80% Ar / 20% CO ₂	75 [1.9]	1	50	0	20 [51]		
	100% CO ₂	70 [1.7]	1	50	0	20 [51]		

Sense Leads

A work (-) sense lead is required and should be connected directly to the workpiece without being in the path of current flow.



The work (-) sense lead should be separated away from welding cables to minimize interference.



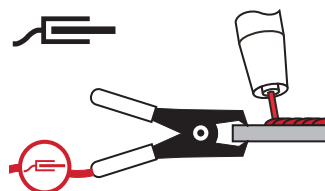
DO NOT connect either sense lead to a welding stud as this may result in erratic arc or increased spatter.



DO NOT route sense lead cable close to high current welding cables as this may distort the sense lead signal.



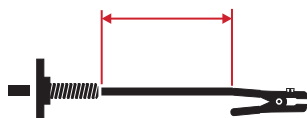
For best performance, connect the work (-) sense lead close to the welding arc.



For non-**Lincoln Electric Power Feeders** assistance, call the **Lincoln Electric Application Engineering Group** staffed by experienced engineers, technologists and technicians in **Cleveland, OH, USA** at **+1 866 635 4709**.

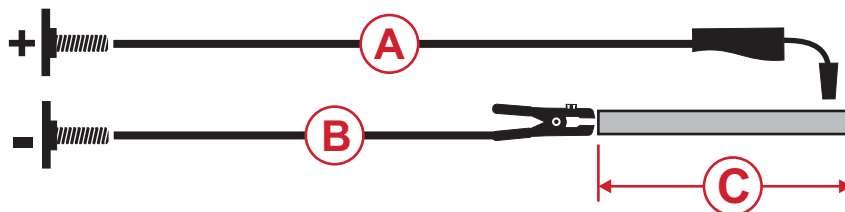
Work Leads

Connect the work lead to the negative stud on the power source and directly to the work piece. Maintain the shortest connection length possible.

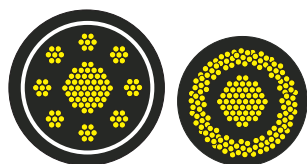


Test cable inductance levels using the **Power Wave® Manager** software exclusively from **Lincoln Electric® Software**. Available at www.powerwavesoftware.com.

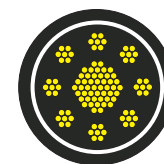
The total length of the welding current loop [A+B+C] should be minimized to reduce inductance. Route cables [A,B] close together to further reduce cable inductance.



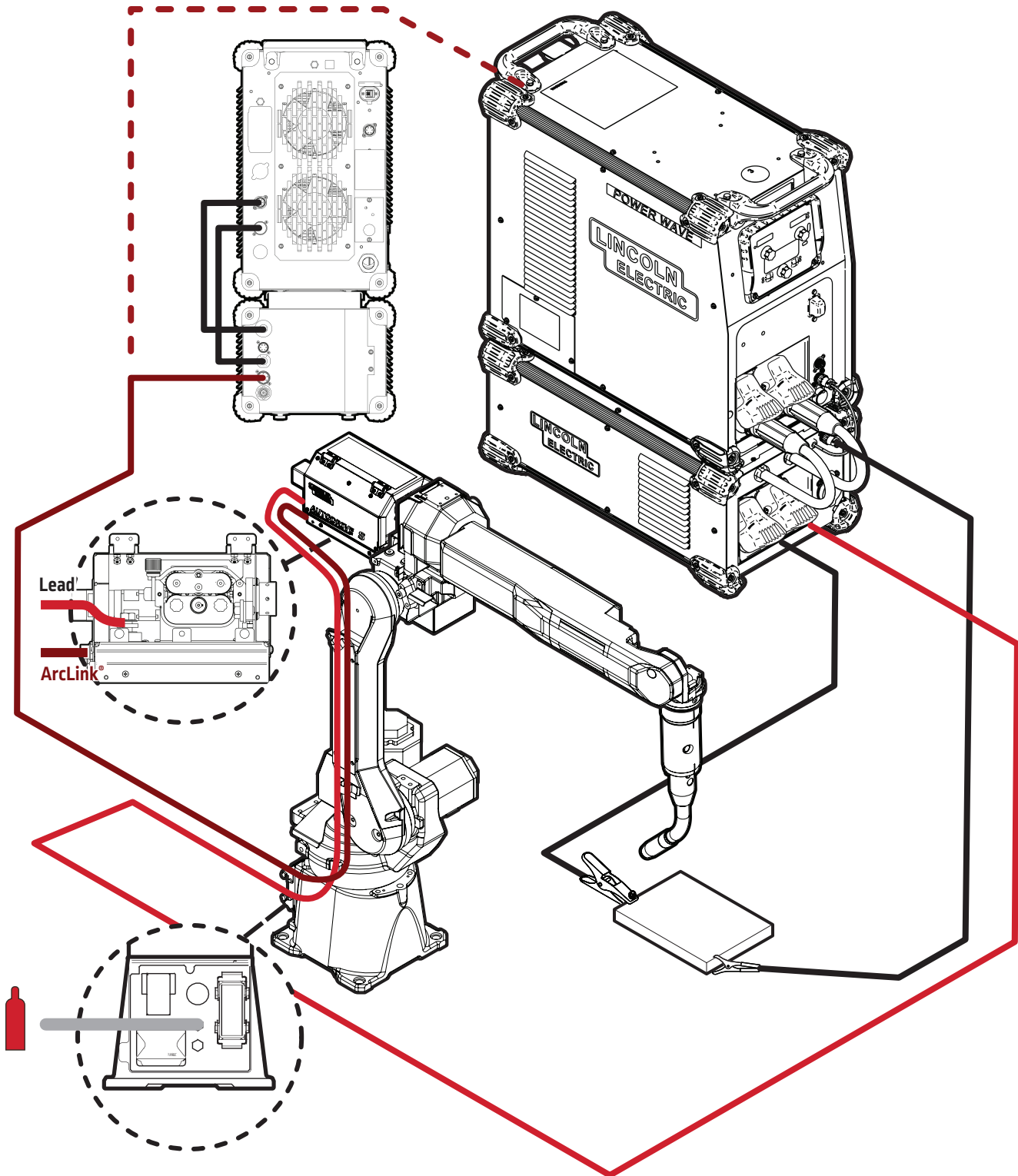
For configurations with excessive inductance, use **Lincoln Electric®** patented coaxial welding cables.



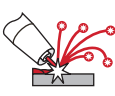
















Lincoln Electric coaxial cables combine the positive and negative welding leads into one cable to minimize cable inductance.

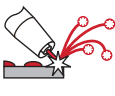


















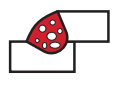






Connection Diagram – Advanced Module












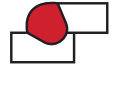










Troubleshooting


 SPATTER	Check ▶	 Volts	 Travel Speed	 Contact Tip to Work Surface	 Wire Feed Speed	 Gas Coverage	 Push Angle	 UltimArc®	 Work Sense Lead
	Action ▶								

 ERRATIC ARC	Check ▶	 Travel Speed	 Proper Feeding	 Trim	 Wire Feed Speed	 Push Angle	 Tip	 Surface Contaminates	 Work Sense Lead
	Action ▶								








 POROSITY	Check ▶	 Gas Coverage	 Surface Contaminates	 Contact Tip to Work Surface
	Action ▶			











 CONCAVE BEAD	Check ▶	 Volts	 Wire Feed Speed	 Contact Tip to Work Surface	 Push Angle
	Action ▶				











 CONVEX BEAD	Check ▶	 Travel Speed	 Wire Feed Speed	 Volts	 Contact Tip to Work Surface	 Push Angle
	Action ▶					





			
Increase	Decrease	Inspect & Replace	Important

Troubleshooting






























 UNDER CUT	Check ▶	 Volts	 Travel Speed	 Wire Feed Speed
	Action ▶			

 BURN THROUGH	Check ▶	Balance	 Travel Speed	 Wire Feed Speed	 Contact Tip to Work Surface	 Push Angle
	Action ▶					

 POOR PENETRATION	Check ▶	Balance	 Travel Speed	 Wire Feed Speed	 Contact Tip to Work Surface	 Push Angle
	Action ▶					

 Increase	 Decrease	 Inspect & Replace	 Important
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Icons

 Wire Type	 Gas	 Material Thickness	 Wire Feed Speed	 Travel Speed	 Volts	 Amps	 Contact Tip to Work Surface	 Push Angle	 Arc Length
 Control Knob	 Weld Stud	 Torch	 Work Sense Lead	 Work Clamp	 Torch Nozzle	 Spatter	 Erratic Arc	 Proper Feeding	 Stop / Avoid
 Gas Coverage	 Porosity	 Concave Bead	 Burn Through	 Under Cut	 Convex Bead	 Poor Penetration	 UltimArc®	 Surface Contaminates	

Technical Terms

Cable Inductance	Resistance to change in current. Should not exceed 65 μ H.
GMAW	Gas metal arc welding including metal inert gas (MIG) and metal active gas (MAG) welding.
Porosity	Gas entrapped in solidifying metal forms spherical or elongated pores in the weld.
Push Angle	The angle at which the electrode leads the weld pool relative to the direction of travel.
Synergic	A mode of control which automatically selects a preprogrammed nominal voltage based on the wire feed speed (WFS) set by the operator.
Work Angle	The angle of the electrode, off perpendicular, relative to the work piece surface.

Procedure Notes

All listed procedures are starting points and may require some adjustment depending on the specific application.

Torch angle, electrode placement, contamination, mill scale, joint fit up, and joint consistency are factors that may require special consideration depending on the specific application.

At higher travel speeds, joint fit up, wire placement, and contamination all become factors that are more significant.

The result of welding at higher travel speeds is a tendency to produce more spatter, less penetration, more undercut, and a less desirable bead shape. Depending on the limitations / requirements of the actual application, slower travel speeds and higher arc voltages may be required.

As the travel speed increases in fast follow applications (1/4" to 14 Gauge), a tighter arc length must be maintained so that the puddle properly follows the arc. Operators typically reduce the arc length control (Voltage) to achieve this. At faster travel speeds, the bead-shape can become very convex (or ropy), and the weld will not "wet" well. There is a point at which the arc is set so short that the arc will become unstable and stubbing will occur. This forms a limitation of just how fast the travel speed can be raised.

It is ultimately the responsibility of the end user to ensure the proper weld deposition rate, bead profile, and structural integrity of a given weld application.

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