

INTRODUCTION: HOW TO USE THIS GUIDE

1. Problems incurred with the NA-5R do not necessarily involve failures in the circuitry. More often, problems are caused by misapplication, misconnection, or shutdown of the NA-5R protective features. Therefore, when a problem is experienced, **first** refer to Section I of this guide (the GENERAL APPLICATION TROUBLESHOOTING GUIDE), and the IM-325 (NA-5R) instruction manual. The instructions in these two guides should solve most problems.
2. If the problem being experienced cannot be solved by using the GENERAL APPLICATION TROUBLESHOOTING GUIDE, the problem may be due to a fault in the control circuitry. To detect and correct this fault, refer to Section II (the COMPREHENSIVE TROUBLESHOOTING GUIDE). The IM-325 instruction manual may be used to identify components and applications, but the troubleshooting information in Section II of this guide cannot be found in the manual.

Before proceeding with Section II, be sure to thoroughly read the introduction to Section II and consult the information in Section III.

3. It can be helpful to review the functions of the NA-5R PC Boards (Section III). If neither Section I nor II contains the exact symptom sought, or if a problem has not been solved after pursuing both sections, a knowledge of board functions may help to narrow down the possible problem areas.

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SECTION I

GENERAL APPLICATION TROUBLESHOOTING GUIDE

WARNING	
	<ul style="list-style-type: none"> • Do not operate with covers removed. • Disconnect welding power source before servicing. • Do not touch electrically live parts. • Only qualified persons should install, use or service this machine.
ELECTRIC SHOCK can kill.	

IA. APPLICATION PROBLEMS

1. Drive rolls turn, but wire will not feed or wire feeding is rough or uneven.

CAUSE:

- a. Wire jammed or kinked on route through head.
- b. Incorrect drive rolls and guide tubes, or incorrect pressure setting.
- c. Worn drive rolls.
- d. Partially flashed or melted contact tip.

WHAT TO DO

- a. Remove wire from head, then feed in new wire. Note any obstruction.
- b. Be sure that the drive rolls and guide tubes are stamped with the wire diameter being used. Replace if necessary. Check for proper pressure setting.
- c. Replace, or reverse, if split-type.
- d. Replace contact tip.

2. Variable or "hunting" arc.

CAUSE:

- a. Contact tip worn or incorrect size.
- b. Worn or undersized work cables or poor connections to work.
- c. Loose electrode connections.
- d. Rusty electrode.

WHAT TO DO

- a. Replace contact tip.
- b. Inspect and repair or replace as necessary.
- c. The following connections must be tight: Electrode cable to wire feeder and power source and work, contact tip to nozzle.
- d. Replace electrode.

3. Unit will not feed wire. Digital meters are not lit.

CAUSE:

- a. CONTROL POWER switch OFF.
- b. Circuit breaker is tripped.
- c. Power Fuse blown.
- d. No 115 V AC supply from power source.

WHAT TO DO

- a. Turn switch ON.
- b. Reset breaker.
- c. Replace fuse.
- d. Check that the power source is ON. If so, check power source AC fuse.

4. Arc can be struck, but unit then shuts down while welding, or power source output is too low to establish an arc. (ACTUAL VOLTS meter reading is low, or zero, when start is pressed.)

CAUSE:	WHAT TO DO
a. Leads 21 and 67 may not be connected for the correct polarity at the terminal strip inside the control box, or not connected to work and electrode.	a. Check the white (work) and black (electrode) leads to the (+) and (-) terminals (per NA-5R wiring diagram).
b. Control leads may be improperly connected at the power source.	b. Check the appropriate power source connection diagram.
c. Welding power source is unable to supply the SET voltage.	c. Reset the output range controls of the power source so that it can supply the desired voltage. See "Automatic Shutdown", Section IB.
d. Power source voltage control switch not set to REMOTE.	d. Voltage control switch of R3S or DC-type power sources must be set to REMOTE.
e. 1/8 A fuse on Voltage PC board* is blown.	e. Refer to Section II. PROBLEM M6 to determine cause of fuse blowing.

* Voltage PC boards built prior to 1983 did not have fuse protection.

5. Poor arc striking with sticking or "blast-offs", weld porosity, narrow and ropy-looking bead, or electrode stubbing into plate while welding.

CAUSE:	WHAT TO DO
a. Improper procedures or techniques.	a. See "How to Make Submerged Arc Welds" (S604) or "Innershield Production Welding Guide" (N675).
b. Improper wire feed acceleration setting for the process in use.	b. See IM-325 manual.
c. Voltage Control response not set properly for the power source and/or process in use.	c. See IM-325 and the appropriate power source connection diagram.

6. Speedmeter readings and or wire feed speed are not accurate.

CAUSE:	WHAT TO DO
a. The Speedmeter Calibration Jumper is connected to the wrong pin.	a. Select the correct pin to match the drive roll and head ratio being used. See Section IC2.
b. Improper drive rolls.	b. Drive rolls must match wire size.

7. NA-5R ACTIVATED INPUT panel lights do not indicate the input signals sent from the remote controller.

CAUSE:	WHAT TO DO
a. Remote input signal leads may be connected incorrectly to the NA-5R Logic Interface.	a. Consult the manual for proper connection of remote switch or 24 volt signals.
b. Logic interface board fuse is blown.	b. Replace 1/8 amp fast-blow fuse, and check 7a., above.

IB. AUTOMATIC SHUTDOWN

If the NA-5R voltage control is unable to supply the 'SET' value of arc voltage while welding, the automatic shutdown circuit will activate. This protection circuit immediately returns the NA-5R control to idle state within a few seconds after the arc voltage discrepancy occurs.

Even though the CYCLE RUN input activation is maintained, if automatic shutdown occurs, the NA-5R will function as if it were removed. To reset the shutdown circuit, the CYCLE RUN Input signal must be momentarily removed.

Typical causes for the activation of this protective shutdown circuit are as follows:

- a. 'SET' value of arc voltage is outside the power source range.
- b. Power source voltage control not set for 'REMOTE'.
- c. Misconnection of NA-5R control cable leads to power source.
- d. Incorrect weld polarity connections, or settings, at NA-5R or power source.
- e. Lost connection of NA-5R voltage sensing leads (#67 and #21) between arc and voltage control.

The conditions of (d) and (e) above would result in the wrong wire feed direction when the weld is started unless voltage board jumper is on "AUTO".

In the case of full range control power sources, such as the DC-600, this protective shutdown could prevent welding under the conditions of (c), (d), and (e) above by holding the power source output at minimum, possibly providing too low of a power source output to even establish an arc, or causing the field fuse to blow because of rapid field reversals.

Although out-of-range shutdown can occur with all power sources when working with very low or very high arc voltages, it is most likely to occur when using the R3S models with the somewhat limited voltage range of the various taps. For instance, if the R3S-400 triangle tap setting is for 31 volts, the range of control from the remote circuit is approximately 7 volts, i.e. 27½ to 34½ volts at nominal input voltage. If the NA-5R controls are set for 29 volts and the input voltage to the R3S goes up, it may not be possible for the NA-5R control circuit to hold the 29 volts so the welding will shut down. By changing to the 27 volt triangle setting, the range will be approximately 23½ to 30½ volts and at high input voltages there will be sufficient control to hold the SET arc voltage. On these machines if the NA-5R stops welding, follow this procedure:

- a. Move the NA-5R voltage set point 2 volts lower than the desired procedure and make a test weld.
 1. If the NA-5R still shuts down, go to Step (b) below.
 2. If the NA-5R keeps welding, change the R3S triangle setting to the next **higher** voltage and reset the NA-5R set point to the desired procedure. R3S

is now set properly unless there is a significant change in input voltage. Skip the following step.

- b. Move the NA-5R voltage set point 2 volts higher than the desired procedure and make a test weld.
 1. If the NA-5R now keeps welding, change the R3S triangle setting to the next **lower** voltage and reset the NA-5R set point to the desired procedure. R3S is now set properly unless there is a significant change in input voltage.
 2. If the NA-5R still shuts down, refer to the following paragraph and the other possible causes previously listed.

In some cases, it is also possible to hold the 'ACTUAL' button pressed while starting the arc. Before the NA-5R shuts down, the actual arc voltage can be read on the digital meter. Comparing this reading to the 'SET' reading will tell what change in the range controls of the power source are required so it can supply the desired voltage. Should the meter read zero, check NA-5R sensing leads (21 & 67) connections. Should the meter read a minus (-) voltage, the polarity connections or settings at the NA-5R or power source are wrong.

This same general procedure can be used on other power sources. For example, if the NA-5R keeps shutting down and the other possible causes have been checked, adjust the SET voltage higher and/or lower than the desired voltage. If the NA-5R continues to weld at one of these voltages, it can then be determined what change in the range controls of the power source are required so it can supply the desired voltage.

IC. NA-5R ACCURACY CHECKS

1. Voltmeter Accuracy

Perform the following checks with the automatic equipment connected to the welding power source per the proper connection diagram. The power source is to be ON and both the power source and automatic equipment properly set up for welding.

- a. Connect a test voltmeter (with at least 3 digits and $\pm 0.5\%$ accuracy, see box below) between work and the electrode cable connection at the welding head.
- b. While welding the test voltmeter reading should match the ACTUAL Volts meter reading within ± 0.5 V (typically ± 0.2 V). If it does not, refer to Section II, COMPREHENSIVE TROUBLE SHOOTING GUIDE.
- c. Remove the test voltmeter and, while welding, compare the SET VOLTS and ACTUAL VOLTS meter readings. Depending upon the arc voltage characteristics of the process being welded, the ACTUAL reading may vary somewhat about an average value. The "average" ACTUAL reading should match the SET reading within ± 0.5 V (typically ± 0.2 V). If it does not, refer to Section II. COMPREHENSIVE TROUBLESHOOTING GUIDE.

The following is a list of digital meters which would meet or exceed the required 0.5% accuracy. To our knowledge, these are dependable and a good value. To perform the meter accuracy check, you must have a meter as accurate as these, (0.5%) or better.

1. Fluke #8022A	John Fluke Mfg. Co. P.O. Box 43220 Mountainlake Terrace, WA 98043
2. Triplet #3400	Triplet Corp. 286 Harmon Road Bluffton, OH 45817
3. Data Precision #935	Data Precision Corp. Electronics Avenue Danvers, MA 01923
4. Keithley Model #169	Keithley Instruments, Inc. 28775 Aurora Road Cleveland, OH 44139

IC2. WIRE SPEED ACCURACY

- a. Check that the Speedmeter Calibration jumper is connected to the proper calibration pin for the head and drive roll system employed, per the appropriate table below:

For NA-5R Wire Drives and standard Speedmeter board:

SPEED-METER CALI-BRATION	HEAD RATIO	DRIVE ROLL PART NUMBER	WIRE SIZE RANGE	RATED SPEED RANGE (IPM)
45	45/1	S-13343-035	Single .030 - .035	80-978*
		S-13343-052	Single .045 - .052	
		S-13343-1/16	Single 1/16	
72F	72/1	S-13343-035	Single .030 - .035	50-611
		S-13343-052	Single .045 - .052	
		S-13343-1/16	Single 1/16	
72	72/1	T-12057-3/32	Single .068 - 3/32	50-600
		T-12057-120	Single 7/64 - .120	

* When using pin "45", the NA-5R Speedmeter may read "EEE" if the Wire Speed Control is set at, or near, maximum. This simply indicates that the Wire Speed setting is greater than 999 IPM, which is above the rated range of control. This will cause no damage, but the control should be lowered to be within the rated range.

For optional NA-5 Automatic Head and Speedmeter Board:

SPEED-METER CALI-BRATION	HEAD RATIO	DRIVE ROLL PART NUMBER	WIRE SIZE RANGE	RATED SPEED RANGE (IPM)
57F	57/1	S-12778	Single .035 - .052	40-778
57	57/1	S-12515	Single 1/16 - 3/32	38-762
95	95/1	S-12514	Single 3/32 - 5/32	22-428
95S	95/1	S-12515	Single 1/16 - 3/32	23-456
		S-13161 - .052	Twin .045 - .052	
		S-13161 - 5/64	Twin 1/16 - 5/64	
		S-14904 (outer)		
			Twin 3/32	
142	142/1	S-14905 (inner)		15-289
		S-12514	Single 3/32 - 7/32	
142T	142/1	S-14904 (outer)		15-300
		S-14905 (inner)	Twin 5/64 - 1/8	

- b. Check for proper inches of wire fed per revolution of drive roll (IPR):

1. Set the Wire Speed Control to any setting between 50 and 125 IPM. Measure the precise length of wire fed by exactly 10 revolutions of the drive roll, while pressing the FEED DOWN button.
2. The measured length should be within the range specified in the appropriate table below, for the drive roll and wire size employed:

For NA-5R Wire Drives:

DRIVE ROLL PART NUMBER	WIRE SIZE RANGE	INCHES OF WIRE FED PER 10 REVOLUTIONS OF DRIVE ROLL
S-13343-035	Single .030 - .035	53-54
S-13343-052	Single .045 - .052	
S-13343-1/16	Single 1/16	
T12057-3/32	Single .068 - 3/32	52-53
T-12057-120	Single 7/64 - .120	

For optional NA-5 Automatic Heads:

DRIVE ROLL PART NUMBER	WIRE SIZE RANGE	INCHES OF WIRE FED PER 10 REVOLUTIONS OF DRIVE ROLL
S-12778	Single .035	53-54
S-12515	Single 1/16 - 3/32	51-53
S-12514	Single 3/32 - 5/32	49-51
S-12515	Single 1/16 - 3/32	51-53
S-13161-052	Twin .045 - .052	53-55
S-13161-5/64	Twin 1/16 - 5/64	53-55
S-14904 (outer)		
	Twin 3/32	51-52
S-14905 (inner)		
S-12514	Single 3/32 - 7/32	49-52
S-14904 (outer)		
	Twin 5/64 - 1/8	51-53
S-14905 (inner)		

3. If the measured length is not within the specified lengths, refer to Section IA.1 and IA.6.

- c. Check for proper drive roll revolutions per minute (RPM):

1. Set the Speed Control to obtain the SET Speedmeter reading specified for the Speedmeter Calibration Pin and head ratio employed per the appropriate table below.
2. While pressing the FEED DOWN button, the Drive Roll RPM (revolutions counted in 60 seconds) and the ACTUAL Speedmeter reading (ACTUAL button pressed) should be as per table and correspond to the SET Speedmeter reading. If accuracy checks do not match per table, refer to Section II. COMPREHENSIVE TROUBLESHOOTING GUIDE.

For NA-5R Wire Drives and standard Speedmeter Board:

SPEED-METER CALIBRATION PIN	DRIVE RATIO	SET SPEED-METER READINGS (IPM)	DRIVE ROLL RPM	ACTUAL SPEED-METER READING (IPM)
45	45/1 (HI SPEED)	268	50 ± 1	268 ± 2
72F	72/1 (STD.)	268	50 ± 1	268 ± 2
72	72/1 (STD.)	263	50 ± 1	263 ± 2

For optional NA-5 Automatic Heads and Speedmeter Board.

SPEED-METER CALIBRATION PIN	DRIVE RATIO	SET SPEED-METER READINGS (IPM)	DRIVE ROLL RPM	ACTUAL SPEED-METER READING (IPM)
57F	57/1	268	50 ± 1	268 ± 2
57	57/1	262	50 ± 1	262 ± 2
95	95/1	249	50 ± 1	249 ± 2
95S	95/1	265	50 ± 1	265 ± 2
142	142/1	250	50 ± 1	250 ± 2
142T	142/1	260	50 ± 1	260 ± 2

2. If power supplies check OK, locate the problem being experienced in the COMPREHENSIVE TROUBLESHOOTING GUIDE INDEX and refer to the section specified by the Index.
3. Locate the ADDITIONAL SYMPTOM best describing the problem being experienced and proceed step-by-step through the troubleshooting instructions given for the specific symptom.
4. Refer to SECTION II INTRODUCTION for proper techniques for performing instructions given by the Guide.

ID. PRELIMINARY POWER SUPPLY CHECKS

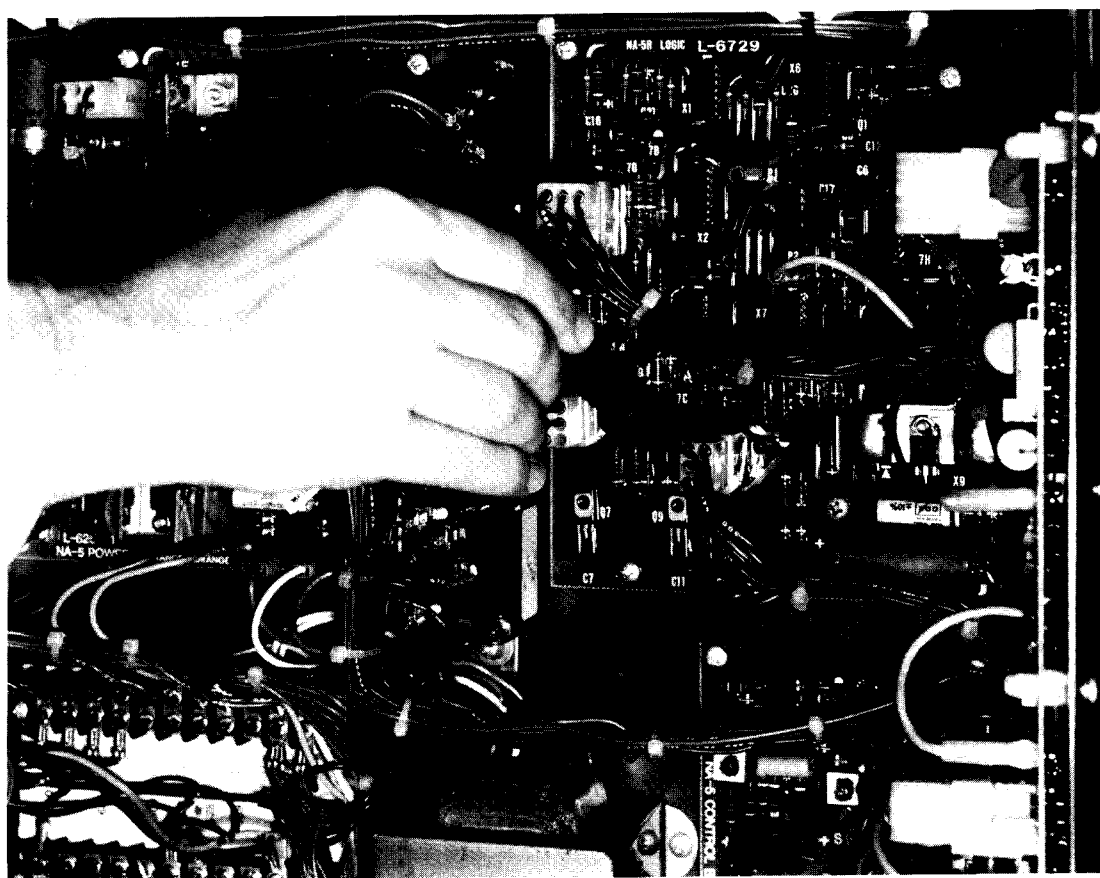
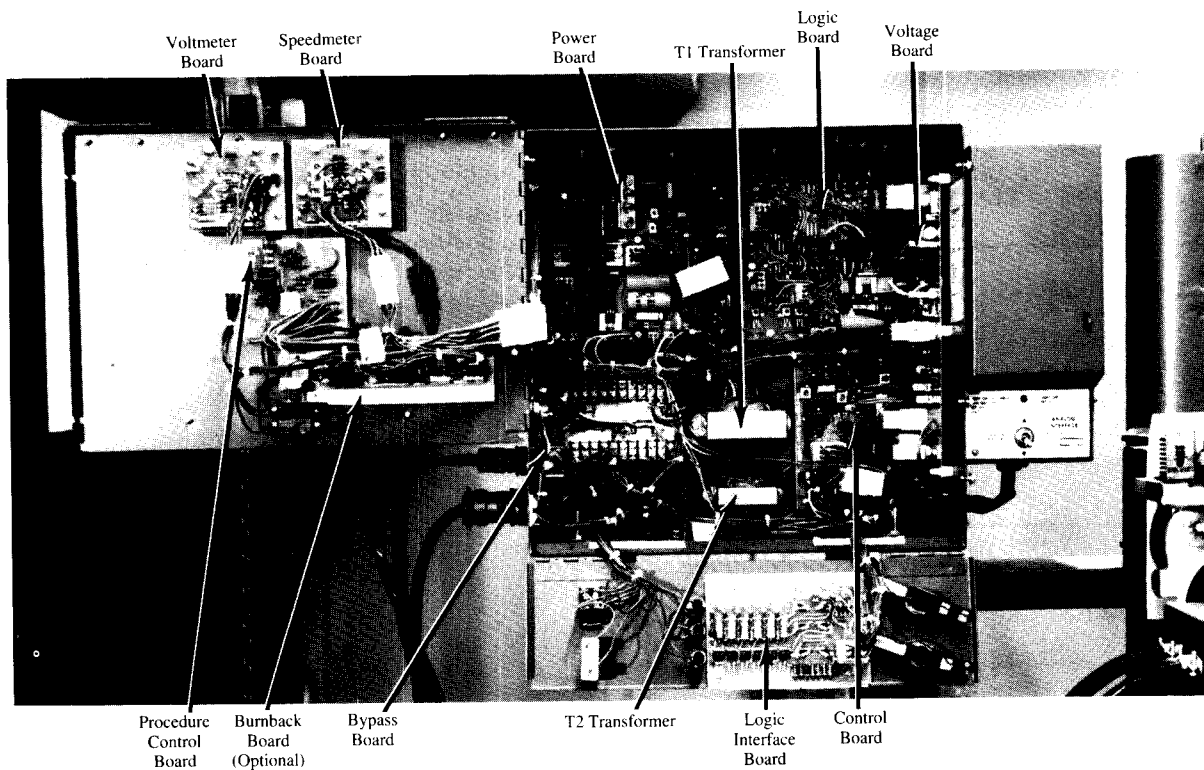
Due to the unpredictable behavior that may result from faulty power supply outputs, the NA-5R Power Supply Lights should be checked before further troubleshooting is attempted.

Be sure that the power source is ON, and CONTROL POWER switch is ON at the NA-5R.

Check each light listed in the table below (see PC Board Location diagram inside NA-5R Control box to help locate the PC Boards and refer to Section III, Drawing 1 for the location of the lights on the PC Boards):

LIGHT	LIGHT LOCATION	SUPPLY PRESENCE INDICATED BY LIGHT ON	SECTION III AA STEP CONSULT IF LIGHT IS OFF OR VERY DIM
1A	Power Board	+ 15 V Analog	1
1B	Power Board	- 10 V Analog	6
1F	Power Board	+ 115 V Relay	8
7A	Logic Board	+ 15 V Logic	10
Speedmeter Display	Front Panel	+ 5 V Speedmeter	13
Voltmeter Display	Front Panel	+ 5 V Voltmeter	12


1. If the lights in the table are all ON, then the power supplies are probably OK. If any lights are OFF or are very dim, go to Section III AA, step indicated, for POWER SUPPLY TROUBLESHOOTING. If all lights are OFF, go to step 4 of Section III AA.



Testing Voltage, Continuity,
or Resistance Readings by
Probe at a Molex Pin

SECTION II COMPREHENSIVE TROUBLE SHOOTING GUIDE

⚠ WARNING



**ELECTRIC SHOCK
can kill.**

- Do not operate with covers removed.
- Disconnect welding power source before servicing.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this machine.

INTRODUCTION

NOTE: Read this entire introductory section before doing anything to the NA-5R. USE SECTION II **only** if the problem cannot be solved by the GENERAL APPLICATION TROUBLESHOOTING GUIDE (Section I).

PROCEDURES FOR PERFORMING INSTRUCTIONS GIVEN BY GUIDE

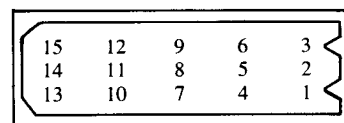
1. Voltage and Resistance Measurement Procedure

WARNING: Voltage checks in the control section of the NA-5R are made with the power on and should be performed carefully and cautiously by qualified personnel. Do not touch exposed metal conductors with your hands or body while making these checks.

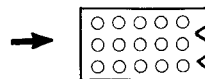
- a. All voltage measurements, unless otherwise specified by guide instruction steps, should be made with a voltmeter (digital, if available) of at least $\pm 2\%$ accuracy, and the full-scale value of the range selected should be as low as possible, but still include the value to be measured.
- b. All voltage measurements are to be made with the NA-5R properly set and connected to the welding power source, which is ON and prepared for welding. (Refer to the proper NA-5R power source connection diagram.)
- c. Make resistance measurements with power OFF at the power source.
- d. Most of the voltage and resistance readings are taken from terminal strips or the plastic Molex plugs. For each Molex plug reading, a diagram has been included in the text, to help you locate the proper pin. These diagrams show the pin location, as the plug is viewed from the back, where the leads come in. Unless you are told to remove the plug, leave it in place and simply insert the meter probe in the back of the appropriate cavity in the plug. This connection should be made with care to avoid damaging the plug or lead. Note that the receptacles on the PC boards are all notched on one edge only. Make sure these notches are in the same relative position as in the drawings in the guide before making any measurement.

For example: In the NA-5R control box, the Control Board connector plug (as viewed from the back) is positioned like this

NOTE:
Always look at plugs from the back.



The plug will be shown like this in this guide.



(To doublecheck that you have the correct pin, the lead number can be found on the wire coming into the plug.)

2. Continuity Checking Procedure

- a. Be sure that power is OFF at the power source.
- b. Set ohmmeter to the R X 10 resistance range. To prevent possible damage to solid state components, do not use R X 1 or ranges of R X 100 or greater.
- c. Be sure that good contact is made at the location specified. (Probe polarity does not matter when checking for continuity.)

3. Procedure for Replacing PC Boards

WARNING: Before making or breaking any connections inside the control box, turn the input power to the control box OFF at the power source.

Before replacing a PC board which is suspected of being defective, visually inspect the PC board in question for any electrical or mechanical damage to any of its components and/or conductors.

- a. If there is no visible damage to the PC board, install a new one and see if this remedies the problem. If the problem is remedied, re-install the old PC board to see if the problem still exists. If it does not exist with the old PC board:
 1. Check the PC board harness connector pins for corrosion, contamination, or looseness.

2. Check leads in the plug harness for loose or intermittent connection.
- b. If PC board is damaged **electrically** (conductors fused open or components blown apart, etc.), before possibly subjecting the new PC board to the same cause of failure, check the following:
 1. Inspect for possible shorts, opens, or grounds caused by:
 - a. Frayed or pinched lead insulation.
 - b. Poor lead termination, such as a poor contact or a short to adjacent connection or surface.
 - c. Shorted or open motor leads, or other external leads.
 - d. Foreign matter or interference behind the PC boards or inside control box.
 2. If any rewiring was done or special connections made, make certain it was done precisely per factory wiring diagrams and/or instruction.
 - c. If a PC board is damaged **mechanically**, inspect for cause, then remedy before installing a replacement PC board.

INDEX

PROBLEM	PAGE	DESCRIPTION
A	11	ACTIVATED INPUT panel lights DO NOT correctly display status of the remote input signals.
B	11-14	ACTIVATED INPUT panel lights DO correctly display status of the remote input signals, BUT outputs do not function properly.
C	14	Continuous wire feed in idle state (with no feed inputs activated).
D	14-15	No wire feed or wrong feed direction with manual FEED buttons.
E	15	No welding output from power source (during weld cycle).
F	16	SET values of wire speed and/or volts are erratic, limited or uncontrollable.
G	16	Wire feeds smoothly and speed CAN be controlled, but accuracy problems or meter display problems exist.
H	17	Wire feeds at the correct time and in the proper direction, but actual speed is limited, erratic, or uncontrollable.
J	17-18	Arc voltage CAN be controlled while welding, but accuracy or stability problems exist.
K	18	Voltage control shuts down while welding.
L	19	Starting or welding problems (Arc starting and/or stability problems).
M	20-21	Protective devices repeatedly shutdown or cannot be reset.
N	21	ARC ESTABLISHED/ELECTRODE TOUCHING WORK output does not function properly.
O	22	AUXILIARY output does not function properly.
P	22	Optional ARC FAILED relay does not function properly.

PROBLEM A: ACTIVATED INPUT PANEL LIGHTS DO NOT CORRECTLY DISPLAY STATUS OF THE REMOTE INPUT SIGNALS.		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
A1 None of the ACTIVATED INPUT panel lights turn on.	A1.1 Check light 7A on Logic Board.	A1.1 If light 7A is off, see Section III AA. If light 7A is on, go to Check A2.1.
A2 One, or more, of the ACTIVATED INPUT panel lights does not turn on.	A2.1 Remove the remote signal lead from one of the malfunctional input tabs, and jumper its SW input tab to the SW COM tab of the Logic Interface Board. A2.2 Check fuse on Logic Interface Board.	A2.1 If the Input panel light turns on, refer to NA-5R IM-Manual for proper remote input signal and connection. If the Input panel light does not turn on, go to Check A2.2. A2.2 If fuse is blown, replace with 1/8 A fast-blow fuse after checking for proper remote signal connection, or a short between SW COM and SIG COM tabs of Logic Interface Board. If fuse is OK, check Logic Interface Board power supplies per Section III AA steps 10 and 16. If power supplies check OK, replace Logic Interface Board.
A3 One, or more, of the ACTIVATED INPUT panel lights does not turn off.	A3.1 Remove the remote signal lead(s) from malfunctional input tab(s).	A3.1 If input light(s) remain on, replace Logic Interface Board. If input light turns off, check remote input signal(s) or connections.

PROBLEM B: ACTIVATED INPUT PANEL LIGHTS DO CORRECTLY DISPLAY STATUS OF THE REMOTE INPUT SIGNALS, BUT OUTPUTS DO NOT FUNCTION PROPERLY.		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
B1 OUTPUTS ENABLED on does not enable (light on), or disable when off, wire feed, power source and auxiliary outputs.	B1.1 Only manual FEED buttons should activate wire feed with OUTPUTS ENABLED off.	B1.1 If manual FEED does not function, see Problem D. If manual FEED OK, replace Logic Board.
B2 AUXILIARY OVERRIDE on does not activate auxiliary output with OUTPUTS ENABLED on.		B2.1 See Problem O.
B3 POST-CYCLE INCH UP on does not activate up wire feed with OUTPUTS ENABLED on.	B3.1 Does manual FEED UP button activate up feed?	B3.1 If not, see Problem D. If so, replace Logic Board.
B4 INCH DOWN on does not activate wire feed with OUTPUTS ENABLED on. ⁽¹⁾	B4.1 Does manual FEED DOWN button activate down feed? B4.2 Check logic board lights 7E and 7B with INCH DOWN on.	B4.1 If not, see PROBLEM D. If so, proceed to B4.2 CHECK. B4.2 If both lights are on, or both off, replace logic board. If 7E and 7B off, proceed to B4.3 CHECK.

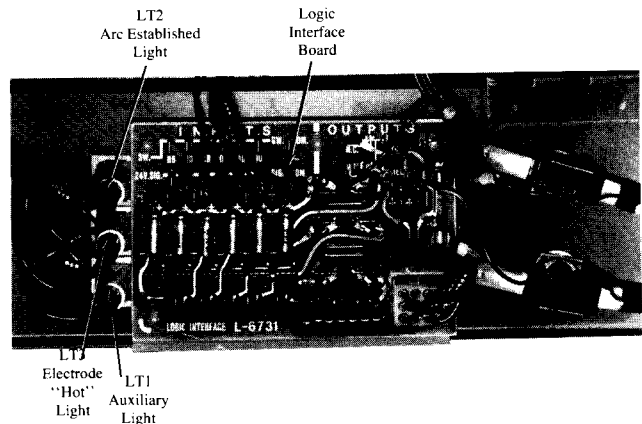
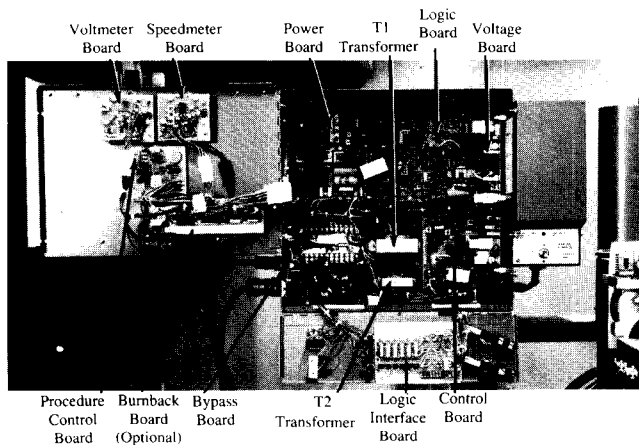
(Continued on next page)

⁽¹⁾ If a DC-400, CV-400, or Pulse Power 500 power source is used, the DIODE OPTION must be installed to permit INCH DOWN to operate. (See NA-5R to DC-400, or CV-400, or P.P. 500 connection diagram for further information.)

PROBLEM B: ACTIVATED INPUT PANEL LIGHTS DO CORRECTLY DISPLAY STATUS OF THE REMOTE INPUT SIGNALS, BUT OUTPUTS DO NOT FUNCTION PROPERLY (Cont.)

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
	<p>B4.3 Temporarily disconnect the white #21 lead from the control box terminal strip (TSI), then activate INCH DOWN</p>	<p>B4.3 If light 7B remains off, check Voltage Board Transformer supply, per Section III AA Step 19. If OK, replace Voltage Board. If light 7B turns on, shut off the NA-5R input power at the power source and check the external resistance across the 21-67 leads (electrode to work). This resistance must be above 500 ohms for the circuit to operate properly. Low resistance could be caused by (1) a circuit lead or object external to the power source or automatic controls between 21-67, (2) a non-Lincoln power source not built with the required output resistance or (3) a defective Lincoln power source (see Operating Manual or Troubleshooting Guide for power source). (4) Improperly insulated wire feed head, wire reel or electrode routing. If resistance OK, replace Voltage Board.</p>
<p>B5 Wire does not stop when it touches work with INCH DOWN on.</p>	<p>B5.1 Is Blue Jumper on Voltage Board connected to "AUTO" tab?</p> <p>B5.2 With INCH DOWN on, does Logic Board light 7B turn off when a jumper is temporarily placed across the "+" (667) and "-" (621) terminals of terminal strip TSI?</p>	<p>B5.1 Blue Jumper must be connected to "COM" tab for Auto-Stop function.</p> <p>B5.2 If 7B does go out, check that the resistance between the white #21 (work) and black #67 (electrode) leads is near 0 ohms when the electrode is touching work. If OK, replace Logic Board.</p> <p>If 7B does not go out, check continuity of #667 and #621 leads to Voltage Board and 1/8A fuse on Voltage Board. If OK, replace Voltage Board.</p>

(Continued on next page)



PROBLEM B: ACTIVATED INPUT PANEL LIGHTS DO CORRECTLY DISPLAY STATUS OF THE REMOTE INPUT SIGNALS, BUT OUTPUTS DO NOT FUNCTION PROPERLY (Cont.)		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
B6 "ELECTRODE TOUCHING WORK" output signal does not activate when electrode touches work with INCH DOWN on.		B6.1 See PROBLEM N.
B7 AUXILIARY output does not activate when electrode touches work with INCH DOWN and OUTPUTS ENABLED on.		B7.1 See PROBLEM O.
B8 CYCLE RUN on does not activate either power source output or wire feed (up or down) with OUTPUTS ENABLED on. NOTE: If weld cycle shuts down shortly after arc is struck, see Section IA.4.	<p>B8.1 Does ELECTRODE 'HOT' output panel light (LT3) turn on?</p> <p>B8.2 Does ARC ESTABLISHED output panel light (LT2) turn on?</p> <p>B8.3 Check Logic Board lights 7C and 7J in idle mode.</p> <p>B8.4 Temporarily connect Blue Jumper on Voltage Board to "BYPASS" tab.</p>	<p>B8.1 If not, proceed to B8.2 CHECK. If so, are SET VOLTS and SET SPEED set to 000? See PROBLEM F if setting cannot be adjusted.</p> <p>B8.2 If so, unit may be in "dry run" set up mode, indicating OUTPUTS ENABLED is not activating. See PROBLEM B1.</p> <p>B8.3 If 7C and 7J are on, check for shorted current switch (CR4). If 7C is off, and 7J is on, replace Logic Board. If both are off, proceed to B8.4 CHECK.</p> <p>B8.4 If CYCLE RUN now functions, replace Voltage Board. If not, replace Logic Board.</p>
B9 CYCLE RUN on activates power source output, but no wire feed, up or down.	B9.1 Does manual FEED DOWN button activate down feed?	B9.1 If not, see PROBLEM D. If so, replace Logic Board.
B10 CYCLE RUN on activates power source output, but wire feeds up instead of down.	B10.1 Check Logic Board lights 7B and 7F with CYCLE RUN and OUTPUTS ENABLED on.	B10.1 If 7B is on and 7F is off, replace Logic Board. If 7F is on, replace Power Board. If 7B is off, see E2.3 CHECK.
B11 CYCLE RUN on activates wire feed (up or down), but no (or low) power source output.	B11.1 Does ELECTRODE 'HOT' output panel light (LT3) turn on?	B11.1 If not, replace Logic Board. If so, see PROBLEM E.
B12 CYCLE RUN on does not activate AUXILIARY output with OUTPUTS ENABLED on.		B12.1 See PROBLEM O.
B13 CYCLE RUN off does not stop weld cycle outputs.	<p>B13.1 Power Source output and wire feed continue.</p> <p>B13.2 Only wire feed continues.</p> <p>B13.3 Only AUXILIARY output continues.</p> <p>B13.4 Only power source output continues.</p>	<p>B13.1 If INCH DOWN and BURNBACK panel lights are off, replace Logic Board. If not, see PROBLEM A3.</p> <p>B13.2 See PROBLEM C.</p> <p>B13.3 If AUXILIARY OVERRIDE panel light is on, see PROBLEM A3. If not, see PROBLEM O.</p> <p>B13.4 If ELECTRODE 'HOT' output panel light (LT3) is on, replace Logic Board. If LT3 is off, check for stuck CR3 relay contacts*, shorted #2 to #4 leads to power source, or power source pilot circuit. *or faulty K-202 Burnback Timer Option (if used).</p>

(Continued on next page)

PROBLEM B: ACTIVATED INPUT PANEL LIGHTS DO NOT CORRECTLY DISPLAY STATUS OF THE REMOTE INPUT SIGNALS, BUT OUTPUTS DO NOT FUNCTION PROPERLY (Cont.)

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
B14 POST-CYCLE BURNBACK on does not maintain power source output after CYCLE RUN off.	B14.1 BURNBACK on will only maintain power source output if OUTPUTS ENABLED is on and weld current is still flowing. To check for proper operation in idle mode: 1) Place a jumper across the current switch terminals #528 and #500 at terminal strip TSI. 2) Activate OUTPUTS ENABLED input only. 3) Power source output will activate (ELECTRODE 'HOT' light on), and maintain, when BURNBACK is activated.	B14.1 If not, replace Logic Board.

PROBLEM C: CONTINUOUS WIRE FEED IN IDLE STATE (with no feed inputs activated)

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
C1 The following ACTIVATED INPUT panel lights are off: CYCLE RUN INCH DOWN INCH UP If not, see PROBLEM A3.	C1.1 Check with 7G (on the Logic Board). C1.2 If light 7G is OFF, remove a BLUE transformer lead from the Logic Board tab. C1.3 If light 7G is ON, check light 7D.	C1.1 If light 7G is on, go to CHECK C1.3. If light 7G is OFF, go to CHECK C1.2. C1.2 If feed stops, replace Control Board. If feed continues, replace Power Board. C1.3 If light 7D is ON, check for a shorted FEED DOWN panel switch. If light 7D is OFF, check for a shorted FEED UP panel switch. If panel switches are OK, replace Logic Board.

PROBLEM D: NO WIRE FEED OR WRONG FEED DIRECTION WITH MANUAL FEED BUTTONS

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
D1 No feed at all, up or down.	D1.1 Check SET SPEED reading displayed on Speedmeter. D1.2 Check Logic Board light 7A. D1.3 Check Logic Board light 7G when wire should be feeding. D1.4 Check Power Board lights 1C and 1D. D1.5 Check Power Board light 1E when wire should be feeding.	D1.1 If reading is near 000 and cannot be adjusted, see PROBLEM F. D1.2 If light 7A is off, see Section III AA. D1.3 If light 7G is off, replace Logic Board. D1.4 If both are on, replace Power Board. If both are off, check if Field Fuse, F102, on Power Board is blown: If OK, replace Power Board. If blown, see PROBLEM M2. D1.5 If light 1E is off, replace Control Board first, then Power Board. If light 1E is on, check the wire feed motor for worn brushes, bad connections or open cable leads.
D2 No feed with FEED UP, FEED DOWN OK.	D2.1 In idle state, check Power Board light 1D. D2.2 Press FEED UP and check Logic Board light 7G.	D2.1 If light 1D is off, replace Power Board D2.2 If light 7G is off, check continuity of FEED UP switch and leads 586 and 500 to Logic Board.

(Continued on next page)

PROBLEM D: NO WIRE FEED OR WRONG FEED DIRECTION WITH MANUAL FEED BUTTONS (Cont.)		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
D3 No feed with FEED DOWN, FEED UP OK.	D3.1 Press FEED DOWN and check Logic Board lights 7D and 7G. D3.2 Press FEED DOWN and check Power Board lights 1C and 1D.	D3.1 If 7D is on and 7G is off, replace Logic Board. If 7D is off, check continuity of FEED DOWN switch and Leads 593 and 500 to Logic Board. D3.2 If both are off, replace Power Board.
D4 Wire feeds UP when it should feed DOWN and feeds DOWN when it should feed UP.		D4.1 Interchanging leads 626 and 627, or 539 and 541 at terminal strip inside the control box (TS2), or at the feed meter (TS3), will reverse feed directions
D5 Wire feeds UP with either FEED UP or FEED DOWN.	D5.1 Check Logic Board Light 7F while pressing FEED DOWN.	D5.1 If 7F is on, replace Power Board. If 7F is off, replace Logic Board.
D6 Wire feeds DOWN with either FEED DOWN or FEED UP.	D6.1 Check Logic Board light 7F while pressing FEED UP.	D6.1 If 7F is off, replace Power Board. If 7F is on, replace Logic Board.

PROBLEM E: NO WELDING OUTPUT FROM POWER SOURCE (during weld cycle)		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
E1 No power source output at all with CYCLE RUN and OUTPUTS ENABLED on.	E1.1 Does wire feed up or down during weld cycle? E1.2 Does ELECTRODE 'HOT' output panel light (LT3) turn on? E1.3 Is Optional K-202 Burnback Timer installed?	E1.1 If not, see PROBLEM B8. E1.2 If not, replace Logic Board. If so, proceed to E1.3 CHECK. E1.3 If so, disconnect K-202 and re-install the harness receptacle jumper plug shipped with NA-5R. If output now functions, replace K-202. If not, check CR3 operation, check for opened #2 or #4 leads to power source and power source pilot circuit operation.
E2 Power source output is too low to establish a welding arc.	E2.1 With ELECTRODE 'HOT' output panel light (LT3) on, check if Logic Board Light 7H is on. E2.2 Check SET VOLTS reading displayed on NA-5R Voltmeter. E2.3 Check ACTUAL VOLTS reading on NA-5R Voltmeter during weld cycle.	E2.1 If light 7H is off, replace Logic Board. E2.2 If SET VOLTS is too low, or near 00.0, and cannot be increased, see PROBLEM F. E2.3 If ACTUAL VOLTS is negative, check electrode and work polarity connections at the NA-5R terminal strip (TS1) and to the power source. If ACTUAL VOLTS is too low, or zero, check if 1/8A fuse on Voltage Board is blown, or high resistance. If so, see M6. If fuse OK, check voltage sensing circuit continuity per J1.1 CHECK. If continuity OK, replace Voltage Board.



PROBLEM F: SET OF VALUES OF WIRE SPEED AND/OR VOLTS ARE ERRATIC, LIMITED OR UNCONTROLLABLE		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
F1 Selector switch on Optional Procedure Kit (if used) does not function in idle mode.	F1.1 Check that Logic Board light 7K is on during idle, and off during weld cycle (CYCLE RUN on).	F1.1 If not, replace Logic Board. If so, check for a problem with Optional Procedure Kit.
F2 BOTH NA-5R front panel procedure controls have no control, at all, of SET values.	F2.1 Check that the Jumper Plug is properly connected to the Procedure Kit Receptacle located at the bottom right of the control box.	F2.1 If Jumper Plug does not restore control, replace Option Board (Procedure Control).
F3 SET values of WIRE SPEED are erratic, limited or uncontrollable.	F3.1 a) Connect the (-) probe of a test voltmeter (with at least 3-digit, + or - 0.5% accuracy) to pin 8 (lead 510P) of the Procedure Kit receptacle, located at the bottom right of the control box. DO NOT disconnect Jumper Plug or Optional Procedure Kit plug from the receptacle. b) Connect the (+) probe of the test voltmeter to pin 7 (lead 632) of the Procedure Kit receptacle.	F3.1 The min. to max. adjustable range of WIRE SPEED procedure control should result in the test voltmeter reading to linearly and stably change between at least 0.50 V to 6.00 V (for rated max. IPM). If not, check or replace procedure control. If so, see PROBLEM G.
F4 SET values of VOLTS are erratic, limited or uncontrollable.	F4.1 a) Perform F3.1 (a), above. b) Connect the (+) probe of the test voltmeter to pin 5 (lead 635) of the Procedure Kit receptacle.	F4.1 The min. to max. adjustable range of VOLTS procedure control should result in the test voltmeter reading to linearly and stably change between at least 1.20 V to 6.00 V (for rated max. VOLTS). If not, check or replace procedure control. If so, see PROBLEM J.

PROBLEM G: WIRE FEEDS SMOOTHLY AND SPEED CAN BE CONTROLLED, BUT ACCURACY PROBLEMS OR METER DISPLAY PROBLEMS EXIST		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
G1 SET AND ACTUAL Speedmeter readings MATCH within a few IPM, but Wire Speed Accuracy Check (Section IC2) shows that BOTH are in error or that speedmeter display problems exist.	G1.1 Remove the Motor End Cap (4 screws) and the Cover Plate (2 screws) from the end of the Wire Feed Motor assembly, to expose the interior of the molded plastic Tach Housing. Check that the Slotted Disc is secure and rotates freely through the center of the Interrupter Module on the Tach Board. G1.2 Check the Meter Circuit Accuracy per Section III BB.	G1.1 Secure and align disc. G1.2 If Meter Circuit Accuracy is OK, replace the Control Board.
G2 SET and ACTUAL Speedmeter readings DO NOT match within a few IPM, with one or both readings possibly erratic	G2 The Wire Speed Accuracy Check (per Section IC2) shows: G2.1 SET reading is wrong or erratic. G2.2 ACTUAL reading is wrong or erratic.	G2.1 Check the lead and switch continuity of the SET Speedmeter circuit per Section IIIBB. If the continuity is OK, replace the Control Board. G2.2 Check the lead and switch continuity of the ACTUAL Speedmeter circuit per Section III BB. If the continuity is OK, replace the Control Board.

PROBLEM H: WIRE FEEDS AT THE CORRECT TIME AND IN THE PROPER DIRECTION, BUT ACTUAL SPEED IS LIMITED, ERRATIC, OR UNCONTROLLABLE

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
H1 SET SPEED reading is adjustable over the rated range and is steady. ACTUAL SPEED reading CORRECTLY reflects the steady, uncontrolled feed speed.	H1.1 Disconnect the harness plug from the Control Board receptacle.	H1.1 If the feed stops, replace the Control Board. If the feed does not stop, replace the Power Board.
H2 SET SPEED reading is adjustable over the rated range and is steady. ACTUAL SPEED reading is incorrect or erratic.	H2.1 Remove the Motor End Cap (4 screws) and the Cover Plate (2 screws) from the end of the Wire Feed Motor Assembly to expose the interior of the molded plastic Tach Housing. Check that the Slotted Disc is secure and rotates freely through the center of the Interrupter Module on the Tach Board. H2.2 While the motor is running, measure the voltage between tab 555 (+) and tab 510 (-), on the Control Board. Do not disconnect any leads from the Control Board while making this measurement.	H2.1 Secure and align disc. H2.2 If the 555-510 voltage IS NOT 4.5 - 10.5 VDC, check the connections and continuity of leads 510, 525, and 555 from the tabs on the Control Board to the in-line connectors inside the box at the Wire Feed Motor. If continuity is OK, replace the Tach Board. If the 555-510 voltage IS 4.5-10.5 VDC, replace the Control Board.

PROBLEM J: ARC VOLTAGE CAN BE CONTROLLED WHILE WELDING, BUT ACCURACY OR STABILITY PROBLEMS EXIST

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
J1 SET VOLTS reading and ACTUAL VOLTS reading MATCH within a few tenths of a volt, but the Voltmeter Accuracy Check (per Section IC1) shows that BOTH are wrong.	J1.1 Turn the power OFF at the power source. Check continuity of 1/8 A Voltage Board fuse, then refer to the appropriate wiring diagram and check the sensing circuit continuity, from Work and the Wire Feed Head Assembly back to the disconnected Voltage Board harness plug:	J1.1 If the fuse sensing circuit continuity is OK, check the Meter Accuracy per Section III BB.
	<div style="border: 1px solid black; padding: 5px;"> <p>FIRST: Work (if connected for + polarity) From OR Electrode (if connected for - polarity) To Pin 12 (lead 621) of Plug A on the Voltage Board</p>  </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>SECOND: Electrode (if connected for + polarity) From OR Work (if connected for - polarity) To Pin 11 (lead 667) of Plug A on the Voltage Board</p>  </div>	
J2 ACTUAL VOLTS reading DOES NOT MATCH SET VOLTS reading within a few tenths of a volt, with one reading possibly erratic, BUT UNIT DOES NOT SHUT DOWN.	J2.1 Force the unit to shut down by switching the power source control switch from Remote to MACHINE control and setting the NA-5R voltage control to minimum. Be sure that the BYPASS Pins on the Voltage Board are not jumpered together.	J2.1 If the unit still does not shut down, replace the Voltage Board.

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








NOTE: NA-5R controls with a G-1556-2 (or higher part no.) Voltage Board do not control the ACTUAL STRIKE voltage to match the SET STRIKE voltage. The ACTUAL STRIKE voltage is a function of the SET STRIKE voltage and the OCV control characteristics of the power source that the NA-5R control is connected to.

NOTE: NA-5R controls with a G-1556-3 (or higher part no.) Voltage Board must have the jumper plug connected to the 4-cavity receptacle on this board, unless the Pulse Power Filter Board option is connected.

PROBLEM J: ARC VOLTAGE CAN BE CONTROLLED WHILE WELDING, BUT ACCURACY OR STABILITY PROBLEMS EXIST (Cont.)

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
	<p>J2.2 Check the Voltmeter Accuracy per Section IC1.</p>	<p>J2.2 If the ACTUAL reading is shown to be in error, check the lead and switch continuity of the ACTUAL Voltmeter circuit per Section III BB.</p> <p>If the SET reading is shown to be in error, check the lead and switch continuity of the SET Voltmeter circuit per Section III BB.</p> <p>If BOTH SET AND ACTUAL Voltmeter readings are shown to be OK, the procedure being welded may be near the range limit of the power source, producing a pulsating arc voltage characteristic which tends to extend the shutdown error allowance.</p> <p>If EITHER OR BOTH readings are shown to be in error, but continuity checks OK for BOTH, replace the Voltage Board.</p>
<p>J3 SET VOLTS reading is adjustable over the rated range and is steady, but ACTUAL VOLTS reading and arc voltage are unstable.</p>	<p>J3.1 Check for loose or intermittent lead conditions per CORRECTIVE ACTION of PROBLEM K1.1 and K1.2.</p>	<p>J3.1 If leads check OK, replace the Voltage Board.</p>

PROBLEM K: VOLTAGE CONTROL SHUTS DOWN WHILE WELDING

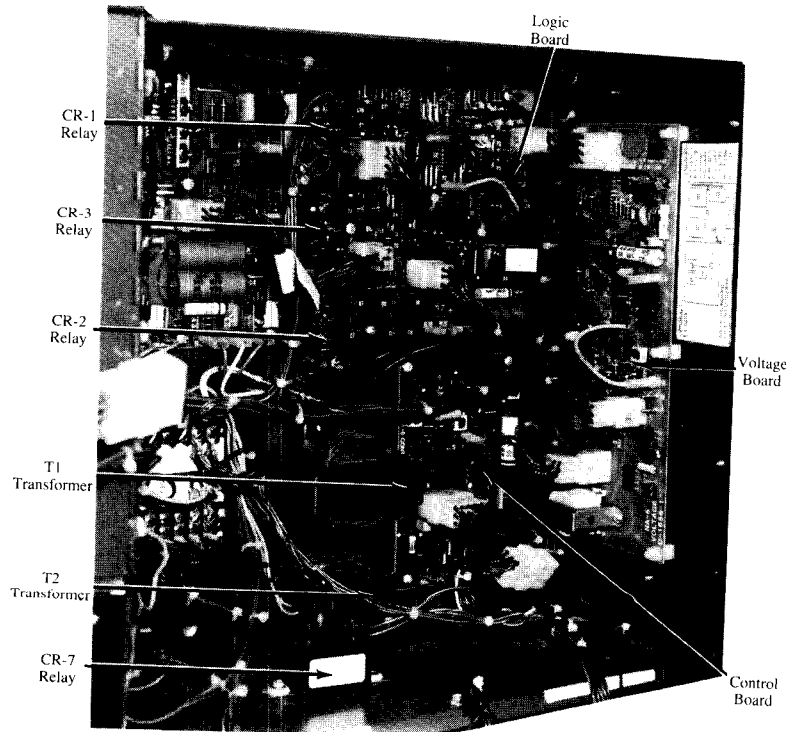
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION										
<p>K1 Unit continues to shut down while welding and normal solutions (see Section IB) do not cure the problem.</p>	<p>K1.1 With wire loaded in the drive rolls, but without allowing the wire to touch work, check whether the ACTUAL VOLTS meter reading displays the correct power source output voltage.</p> <p>K1.2 Move blue jumper on the Voltage Board to the BYPASS tab.</p> <p>Compare the RANGE of voltage control (displayed as ACTUAL VOLTS on the Voltmeter, from min to max) while welding:</p> <ol style="list-style-type: none"> 1) Controlled by the power source control rheostat (power source set for "MACHINE Control"). 2) Controlled by the NA-5R Voltage Control (power source set for "REMOTE Control"). <table border="1" data-bbox="631 1577 946 1923" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Check continuity between:</th> </tr> <tr> <th>Lead</th> <th>Connector Pin</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>6 </td> </tr> <tr> <td>B</td> <td>4 </td> </tr> <tr> <td>C</td> <td>5 </td> </tr> </tbody> </table>	Check continuity between:		Lead	Connector Pin	A	6 	B	4 	C	5 	<p>K1.1 If the ACTUAL VOLTS reading does not match the power source output voltage (+ or -0.5V), check the sensing circuit continuity as described in Problem J1. If the continuity checks OK, replace the Voltage Board.</p> <p>K1.2 If the unit continues to shut down while welding, with the BYPASS tab jumpered, replace the Voltage Board.</p> <p>If the range of control is significantly limited, check the continuity of leads A, B, and C. Disconnect the leads from the power source terminal strip. Check continuity between the lugs on the free (disconnected) end of the cable and the Voltage Board plug "B" pins indicated below center.</p> <p>If both ranges of control (1 and 2) are similar and include the SET Voltage, yet the unit continues to shut down (when the BYPASS jumper is removed), replace the Voltage Board.</p>
Check continuity between:												
Lead	Connector Pin											
A	6 											
B	4 											
C	5 											

PROBLEM L: STARTING OR WELDING PROBLEMS (Arc Starting and/or Stability Problems)

NOTE: If starting or welding problems exist, that cannot be cured by the remedies given in Section I of this guide, the following steps are to be taken, when specified in the section below. To determine if the problem is also experienced when the NA-5R automatic voltage control is removed, perform the following steps:

1. Switch the power source from "REMOTE" back to "MACHINE" control.
2. Remove any "special" terminal strip jumpers required for NA-5R use. When using a DC-1000 or DC-1500 power source, also remove the NA-5R control cable leads B and C from the 74 and 73 terminals of these machines. DO NOT remove any other NA-5R control cable leads.
3. Move the blue Jumper to the BYPASS tab on the Voltage Board.
4. Set up the same welding procedure which presented the problem, using the power source output control on the machine to manually adjust the ACTUAL weld voltage reading on the NA-5R Voltmeter. The NA-5R is then used simply as a wire feeder, not as a voltage control.
5. Investigate whether problem is still present.

ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
L1 Output too low to start or weld.	L1.1 Refer to PROBLEM E.	
L2 Voltage appears to rise too slowly, stubs or blasts at start. Welding is OK.	L2.1 If using Start Response Jumper position "B" on the Voltage Board, change to "A". See Drawing 1 of Section III.	L2.1 If "A" position cures the starting problem, replace the Voltage Board. If not, try higher strike and/or start voltage setting.
L3 Even with lowered strike and/or start voltage setting, voltage seems to be too high or flares excessively at start. Welding is OK.	L3.1 Refer to NOTE above, then remove the NA-5R voltage control as instructed.	L3.1 If the starting problem is eliminated with the power source independent of the NA-5R, replace the Voltage Board. If not, check for possible power source problems.
L4 Unstable, oscillating arc.	L4.1 Refer to PROBLEM J3. L4.2 Refer to NOTE above, then remove the NA-5R voltage control as instructed.	L4.2 If the welding problem is eliminated with the power source independent of the NA-5R, replace the Voltage Board. If not, check for possible power source problems.



PROBLEM M: PROTECTIVE DEVICES REPEATEDLY SHUT DOWN OR CANNOT BE RESET		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
M1 Shutdown occurs persistently during welding.	M1.1 See PROBLEM K.	
M2 Field Fuse (F102) blows repeatedly.		M2.1 Any of the following conditions could cause F102 Field Fuse to blow: 1) Complete or partial motor field short. 2) Frequent motor field polarity changes (lights 1C and 1D both flickering) typically caused by: a) A welding procedure with frequent electrode to puddle shorting. b) Power source output too low to establish an arc. (Refer to PROBLEM E2.)
M3 Circuit breaker trips while activating UP or DOWN feed, or CYCLE RUN.	M3.1 Reset the circuit breaker and observe lights 1C and 1D on Power Board at idle. M3.2 If lights 1C and 1D are both OFF, check the Field Fuse, F102, on the Power Board.	M3.1 If 1C is OFF and 1D is ON, disconnect the motor Amphenol from the control box. Check for open motor field windings or shorted armature windings. The normal field resistance is typically about 700-800 ohms, and the normal armature resistance is about 2 ohms. Also check for broken shaft, gears, or other obstructions that might prevent the motor from running. M3.2 If fuse is OK, replace Power Board. If fuse is blown, see M2 above.
M4 Circuit breaker trips and/or Power Fuse blows when CONTROL POWER is first turned ON, or with unit at idle.	M4.1 If the Power Fuse is blown, determine whether a PC Board is faulty in the following manner: Turn off the CONTROL POWER. Replace F101 (Power Fuse, ½ A, slow-blow). Unplug all boards and Procedure Kit (if used) from the lead harness except the Power Board.	M4.1 Turn on the CONTROL POWER and check the Power Fuse. If it has blown, replace the Power Board. If the fuse still blows with a new Power Board installed, check the harness for shorts between leads, terminals, etc. If the Power Fuse does not blow when the power is turned ON, turn the power OFF, and continue to plug the PC Boards back into the lead harness, one at a time, until the one is found that causes the fuse to blow. Replace that particular board. Re-connect the boards in this order: 1) Control 5) Procedure 2) Voltage 6) Procedure Kit 3) Logic 7) Speedmeter 4) Logic Interface 8) Voltmeter
M5 Circuit breaker trips only after wire has fed (or attempted to feed) for some time.	M5.1 Set WIRE SPEED to about the same value as the WELD SPEED being used. While pressing FEED DOWN, measure the motor armature current in lead 541, at the terminal strip in the control box. M5.2 If there are no signs of excessive loading, press FEED DOWN and check the motor field voltage between terminals 626 and 627 on the terminal strip in the control box.	M5.1 If the 541 current exceeds 2A, average, check for heavy loading such as bent or dirty electrode, milling guide tube, clogged nozzle, etc. M5.2 If the field voltage is 98-130 VDC, check and replace the wire feed motor, if necessary. If the voltage is not 98-130 V, replace the Power Board.

(Continued on next page)

PROBLEM M: PROTECTIVE DEVICES REPEATEDLY SHUT DOWN OR CANNOT BE RESET (Cont.)		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
M6 1/8 A fuse on Voltage PC Board repeatedly blows.	M6.1 Shut off the power source supplying the NA-5R, replace the 1/8 A fast-blow fuse and remove the black and white polarity leads from the NA-5R terminal strip (leads #67 and #21). Refer to the NA-5R wiring diagram, and check for low resistance (<1 K ohms) between the NA-5R case grounding screw and each of the following NA-5R leads: 510A, 510P, 500, 515 and 525.	M6.1 Detect and clear ground faulted NA-5R.


PROBLEM N: ARC ESTABLISHED/ELECTRODE TOUCHING WORK OUTPUT DOES NOT FUNCTION PROPERLY		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
N1 ARC ESTAB./ELECTRODE TOUCHING WORK output panel light (LT2) turns on properly, but output relay contacts do not operate.		N1.1 Check CR2 (or optional ARC ESTABLISHED Relay) 110 VDC relay operation and contact/lead continuity to Logic Interface Board per wiring diagram. Replace if necessary.
N2 ARC ESTAB. output panel light (LT2) does not turn on when welding arc is established.	N2.1 With OUTPUTS ENABLED input off, activate CYCLE RUN and check if ARC ESTAB. panel light turns on for "dry run" weld test. N2.2 Check Logic Board lights 7B and 7C when welding arc is established.	N2.1 If not, replace Logic Board. If so, proceed to N2.2 CHECK. N2.2 If 7B and 7C are BOTH on, replace Logic Board. If 7C is off, check if current switch (CR4) is closing with weld current. If 7B is off, see E2.3 CHECK.
N3 ELECTRODE TOUCHING WORK output panel light (LT2) does not turn on when electrode touches work with INCH DOWN input on.	N3.1 Does electrode stop when it touches work with INCH DOWN and OUTPUTS ENABLED inputs on?	N3.1 If not, see B5 of PROBLEM B. If so, replace Logic Board.
N4 ARC ESTAB./ELECTRODE TOUCHING WORK output is activated continuously, even in idle mode, or before arc is struck with OUTPUTS ENABLED input on.	N4.1 Is output panel light (LT2) also on?	N4.1 If so, replace Logic Board. If not, check CR2 relay (or optional ARC ESTABLISHED relay) for faulty contacts or leads from contacts per wiring diagram.

PROBLEM O: AUXILIARY OUTPUT DOES NOT FUNCTION PROPERLY		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
O1 AUXILIARY output panel light (LT1) turns on properly, but the 115 VAC external load does not activate.		O1.1 Check CR1 110 VDC relay operation and contact/lead continuity per wiring diagram. If OK, check if 115 VAC load is operating properly.
O2 AUXILIARY output panel light does not turn on with AUXILIARY OVERRIDE and OUTPUTS ENABLED inputs on.		O2.1 Replace Logic Board.
O3 AUXILIARY output panel light does not turn on with CYCLE RUN and OUTPUTS ENABLED inputs on.	O3.1 Is Red Jumper on Logic Board connected to pin P1?	O3.1 If so, replace Logic Board.
O4 AUXILIARY output panel light does not turn on when electrode touches work with INCH DOWN and OUTPUTS ENABLED inputs on.	O4.1 Does electrode stop when it touches work? O4.2 Is White Jumper on Logic Board connected to pin P2?	O4.1 If not, see B5 of PROBLEM B. O4.2 If so, replace Logic Board.
O5 AUXILIARY output is activated continuously, even in idle mode.	O5.1 Is AUXILIARY OVERRIDE panel light on? O5.2 Is AUXILIARY output panel light (LT1) also on?	O5.1 If so, see A3 of PROBLEM A. O5.2 If so, replace Logic Board. If not, check CR1 relay for shorted contacts or leads from contacts per wiring diagram. Replace if necessary.

PROBLEM P: OPTIONAL ARC FAILED RELAY DOES NOT FUNCTION PROPERLY		
ADDITIONAL SYMPTOMS	CHECK	CORRECTIVE ACTION
P1 Optional ARC FAILED relay (CR7) does not activate typically 2-4 seconds after CYCLE RUN input is turned on AND arc is not established.	P1.1 Does CYCLE RUN input light turn on? P1.2 Does ARC ESTABLISHED output panel light (LT2) turn on before arc is struck? P1.3 Remove electrode from wire drive, turn on OUTPUTS ENABLED input and measure DC voltage across Logic Board tabs 610 (+) and 680 (-) with CR7 relay connected.	P1.1 If not, see PROBLEM A. P1.2 If so, see N4 of PROBLEM N. P1.3 If voltage is about 110 VDC typically 2-4 seconds after CYCLE RUN is also turned on, check for faulty CR7 relay operation or contacts. If voltage remains low, or activates outside the 2-4 second range, replace Logic Board.
P2 Optional ARC FAILED relay (CR7) does not de-activate with CYCLE RUN input off or when arc is established.	P2.1 Does ARC ESTABLISHED output panel light (LT2) turn on when arc is established? P2.2 Check voltage per CHECK P1.3 above, but with electrode in wire drive.	P2.1 If not, see PROBLEM N. P2.2 If voltage is not low, or zero, with CYCLE RUN off or while welding, replace Logic Board. If voltage is low, or zero, check for shorted CR7 relay contacts or leads.

SECTION III APPENDIX











⚠ WARNING



ELECTRIC SHOCK
can kill.

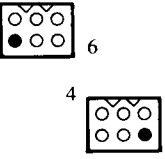
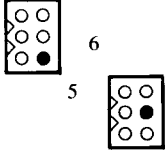
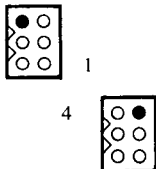
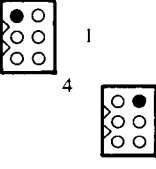
- Do not operate with covers removed.
- Disconnect welding power source before servicing.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this machine.

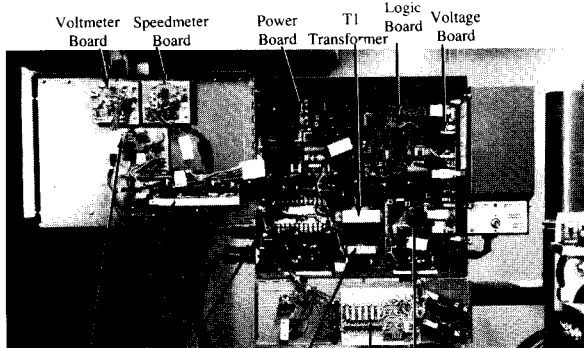
AA POWER SUPPLY TROUBLESHOOTING CHART

STEP	CHECKPOINT LOCATION (See Drawing 1 for Plug Location)	VOLTAGE CHECKPOINT			ACCEPTABLE VOLTAGE		IF READING IS OK, IF READING IS OK,	IF READING IS NOT OK, GO TO STEP . . .
		Connector Plug Pin Number	Lead Number	Probe Polarity	Min.	Max.		
1	Power Board Connector Plug "B"	 7	525	+	14.0	16.0	Check connections and wiring between Power and Control Boards.	2
		 9	510	-				
2	Power Board Tabs	Red to Red Red to White	— —	AC AC	34 17	42 21	Replace the Power Board.	3
3	Terminal Strip	—	531B	AC	105	130	Check transformer T1 wiring; if OK, replace T1.	4
		—	532	AC				
4	Power Board Connector Plug "C"	 5	531A	AC	105	130	Check the Power Fuse, F101, on the Power Board. If OK, replace the Power Board.	18
		 2	532					
5	Power Board Connector Plug "B"	 4	525	+	14.0	16.0	Check connections and wiring between Power and Voltage Boards.	2
		 8	510	-				
6	Power Board Connector Plug "B"	 9	510	+	9.0	11.0	Check connections and wiring between Power and Control Boards.	2
		 5	500	-				
7	Power Board Connector Plug "B"	 8	510	+	9.0	11.0	Check connections and wiring between Power and Voltage Boards.	2
		 6	500	-				

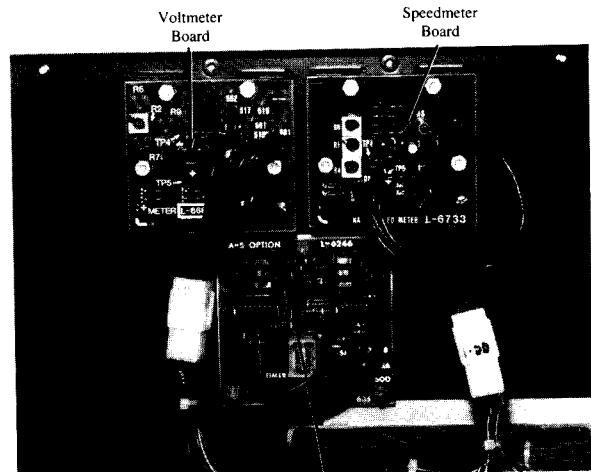
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AA POWER SUPPLY TROUBLESHOOTING CHART (Cont.)

STEP	CHECKPOINT LOCATION (See Drawing 1 for Plug Location)	VOLTAGE CHECKPOINT			ACCEPTABLE VOLTAGE		IF READING IS OK, IF READING IS OK,	IF READING IS NOT OK, GO TO STEP . . .
		Connector Plug Pin Number	Lead Number	Probe Polarity	Min.	Max.		
8	Power Board Connector Plug "C"	 6 4	610 500	+ -	90	135	Check wiring between Power and Logic Boards, relays, Electrode Hot light, etc.	9
9	Power Board Tabs	Orange to Orange	—	AC	105	140	Replace the Power Board.	17
10	Logic Board Connector Plug "D"	 6 5	515 500	+ -	14.0	16.0	Check connections and wiring between Logic and Logic Interface Board and Procedure Kit Receptacle.	11
11	Logic Board Tabs	Blue to Blue	—	AC	18.0	25.0	Replace the Logic Board.	3
12	Voltmeter Board	Test Point TP5 Test Point 510P/C	510P	+ -	4.75	5.25	Voltmeter Power Supply is OK. If meter is not lit, check meter connection to Meter Board. If OK, replace Digital Meter.	14
13	Speedmeter Board	Test Point TP5 Test Point 510P	510P	+ -	4.75	5.25	Speedmeter Power Supply is OK. If meter is not lit, check meter connection to Meter Board. If OK, replace Digital Meter.	15
14	Voltmeter Board Connector Plug	 1 4	601 602	AC	9	11	Replace the Voltmeter Board. AND step 15 checks OK, check wiring between meter Boards.	
15	Speedmeter Board Connector Plug	 1 4	601 602	AC	9	11	Replace the Speedmeter Board.	3



Voltmeter Board Speedmeter Board Power Board T1 Transformer Logic Board Voltage Board

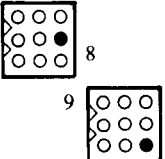


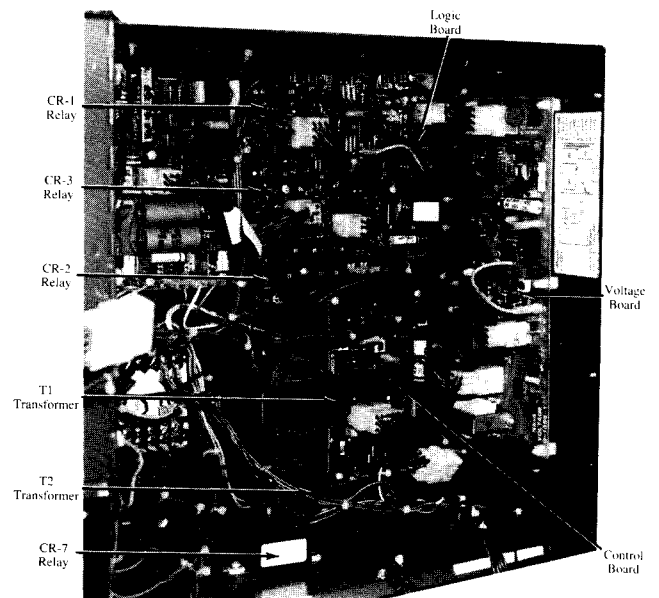
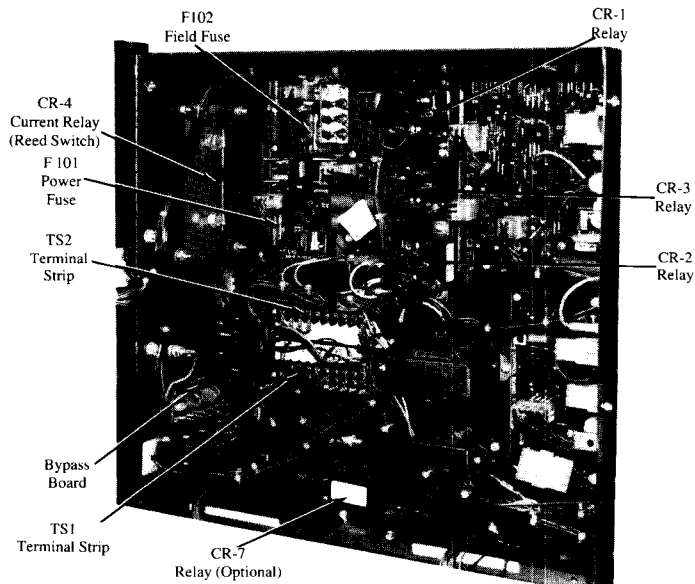
Voltmeter Board Speedmeter Board

Procedure Control Board Burnback Control Board (Optional) Bypass Board T2 Transformer Logic Interface Board Control Board

Procedure Control Board Burnback Board (Optional)

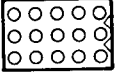

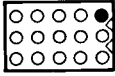

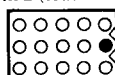

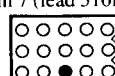

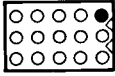

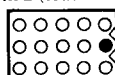

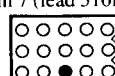

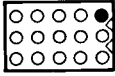

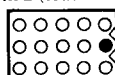

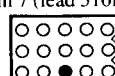

AA POWER SUPPLY TROUBLESHOOTING CHART (Cont.)

STEP	CHECKPOINT LOCATION (See Drawing 1 for Plug Location)	VOLTAGE CHECKPOINT			ACCEPTABLE VOLTAGE		IF READING IS OK, IF READING IS NOT OK, GO TO STEP . . .
		Connector Plug Pin Number	Lead Number	Probe Polarity	Min.	Max.	
16	Logic Interface Board Pins	Red to Red	—	AC	22.5	27.5	Check fuse on the Logic Interface Board. If OK, replace Board.
17	Terminal Strip	— —	531B 532	AC	105	130	Check transformer T2 wiring; if OK, replace T2.
18	Terminal Strip	— —	531 532	AC	105	130	Check the circuit breaker on the front panel. If tripped, reset breaker. If not tripped, check breaker for defects. Then check wiring, etc.
19	Voltage Board Connector Plug "C"		531B 532	AC	105	130	Voltage Board transformer input supply is OK.

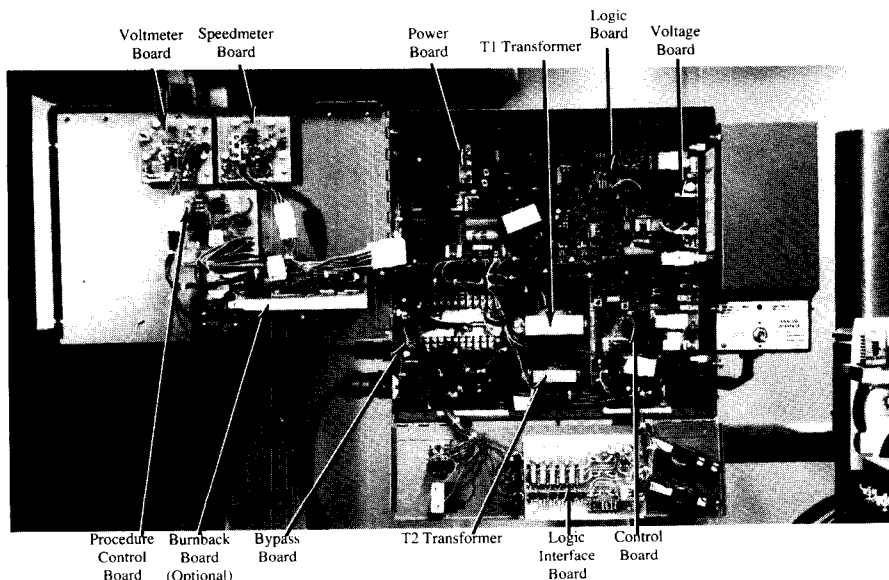



BB. COMPREHENSIVE METER CIRCUIT CHECKS


NOTE: These checks should be performed only when referred to by COMPREHENSIVE GUIDE instructions.

CHECK	PROCEDURE	TESTPOINTS AND EXPECTED RESULTS														
1 Meter power supply.	1 Check meter power supply per Section III AA, step 12 for Voltmeter, step 13 for Speedmeter.															
2.1 Speedmeter circuit lead and switch continuity.	2.1 With power OFF, disconnect the Control Board and Speedmeter Board connector plugs and check continuity between the disconnected Molex plugs per the appropriate wiring diagram and the table on the right.	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>2.1 Control Board Plug</p>  <p>(From the Back)</p> </div> <div style="text-align: center;"> <p>Speedmeter Board Plug</p>  <p>(From the Back)</p> </div> </div> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">SET- ACTUAL BUTTON POSITION</th> <th colspan="2">CONTINUITY EXISTS . . .</th> </tr> <tr> <th>FROM Control Board Plug</th> <th>TO Speedmeter Board Plug</th> </tr> </thead> <tbody> <tr> <td>SET</td> <td>Pin 3 (lead 511) </td> <td>Pin 5 (lead 519) </td> </tr> <tr> <td>ACTUAL (PRESS BUTTON)</td> <td>Pin 2 (lead 512) </td> <td>Pin 5 (lead 519) </td> </tr> <tr> <td>EITHER</td> <td>Pin 7 (lead 510P) </td> <td>Pin 3 (lead 510) </td> </tr> </tbody> </table>	SET- ACTUAL BUTTON POSITION	CONTINUITY EXISTS . . .		FROM Control Board Plug	TO Speedmeter Board Plug	SET	Pin 3 (lead 511) 	Pin 5 (lead 519) 	ACTUAL (PRESS BUTTON)	Pin 2 (lead 512) 	Pin 5 (lead 519) 	EITHER	Pin 7 (lead 510P) 	Pin 3 (lead 510) 
SET- ACTUAL BUTTON POSITION	CONTINUITY EXISTS . . .															
	FROM Control Board Plug	TO Speedmeter Board Plug														
SET	Pin 3 (lead 511) 	Pin 5 (lead 519) 														
ACTUAL (PRESS BUTTON)	Pin 2 (lead 512) 	Pin 5 (lead 519) 														
EITHER	Pin 7 (lead 510P) 	Pin 3 (lead 510) 														
2.2 Speedmeter Digital Meter accuracy. NOTE: See Section I for recommended meters to perform this test and test 2.3.	2.2 Connect the (-) probe of a test voltmeter (with at least 3-digit, $\pm 0.5\%$ accuracy) to Speedmeter board testpoint 510P, and the (+) probe to Speedmeter Board testpoint TP4. (Do not disconnect plug.)	<p>2.2 The test voltmeter readings should match per table below, with the Speedmeter reading the SET values of Wire Speed specified in table:</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>SET SPEED READING (IPM)</th> <th>TEST VOLTMETER READING (V)*</th> </tr> </thead> <tbody> <tr> <td>150</td> <td>.150 + OR - .004</td> </tr> <tr> <td>300</td> <td>.300 + OR - .004</td> </tr> </tbody> </table> <p>IF NOT, remove the Speedmeter board and replace the digital meter.</p>	SET SPEED READING (IPM)	TEST VOLTMETER READING (V)*	150	.150 + OR - .004	300	.300 + OR - .004								
SET SPEED READING (IPM)	TEST VOLTMETER READING (V)*															
150	.150 + OR - .004															
300	.300 + OR - .004															

* Test voltmeter reading tolerances on charts include inaccuracy of the test voltmeter being used. The Speedmeter circuit accuracy is more tightly held.



CHECK	PROCEDURE	TESTPOINTS AND EXPECTED RESULTS																																				
2.3 Speedmeter Board Accuracy.	2.3 Connect the (-) probe of a test voltmeter (with at least 3-digit, $\pm 0.5\%$ accuracy) to speedmeter Board testpoint 510P, and the (+) probe to speedmeter Board connector plug pin 5 (lead 519). (Do not disconnect plug.)  Pin 5 (Lead 519)	2.3 The test voltmeter readings should match per table below for the speedmeter calibration pin being used, with the Speedmeter reading the SET values of Wire speed specified in table. <table border="1"> <thead> <tr> <th>SPEEDMETER CALIBRATION PIN</th> <th>SET SPEED READING (IPM)</th> <th>TEST VOLTMETER READING (V)*</th> </tr> </thead> <tbody> <tr> <td>45</td> <td>978</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>72F</td> <td>611</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>72</td> <td>600</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>Optional</td> <td>57F</td> <td>778</td> </tr> <tr> <td>57</td> <td>762</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>NA-5</td> <td>95</td> <td>428</td> </tr> <tr> <td>95</td> <td>428</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>Speedmeter Board</td> <td>95S</td> <td>456</td> </tr> <tr> <td>142</td> <td>289</td> <td>6.00 + OR - .06</td> </tr> <tr> <td>Only</td> <td>142T</td> <td>300</td> </tr> <tr> <td></td> <td></td> <td>6.00 + OR - .06</td> </tr> </tbody> </table> IF NOT, replace Speedmeter PC Board.	SPEEDMETER CALIBRATION PIN	SET SPEED READING (IPM)	TEST VOLTMETER READING (V)*	45	978	6.00 + OR - .06	72F	611	6.00 + OR - .06	72	600	6.00 + OR - .06	Optional	57F	778	57	762	6.00 + OR - .06	NA-5	95	428	95	428	6.00 + OR - .06	Speedmeter Board	95S	456	142	289	6.00 + OR - .06	Only	142T	300			6.00 + OR - .06
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CHECK	PROCEDURE	TESTPOINTS AND EXPECTED RESULTS														
3.1 Voltmeter circuit lead and switch continuity.	3.1 With power OFF, disconnect Voltage Board Connector Plug "A" and the Voltmeter Board connector plug and check continuity between the disconnected Molex plugs per the appropriate wiring diagram and the table on the right: NOTE: Check plugs from the back, where the leads come in, but with the plugs disconnected from the board receptacle.	3.1 <table border="1"> <thead> <tr> <th rowspan="2">SET- ACTUAL BUTTON POSITION</th> <th colspan="2">CONTINUITY EXISTS . . .</th> </tr> <tr> <th>FROM Voltage Board Plug "A"</th> <th>TO Voltmeter Board Plug</th> </tr> </thead> <tbody> <tr> <td>SET</td> <td>Pin 2 (lead 514)</td> <td>Pin 5 (lead 517)</td> </tr> <tr> <td>ACTUAL (PRESS BUTTON)</td> <td>Pin 9 (lead 516)</td> <td>Pin 5 (lead 517)</td> </tr> <tr> <td>EITHER</td> <td>Pin 8 (lead 510P)</td> <td>Pin 3 (lead 510P)</td> </tr> </tbody> </table>	SET- ACTUAL BUTTON POSITION	CONTINUITY EXISTS . . .		FROM Voltage Board Plug "A"	TO Voltmeter Board Plug	SET	Pin 2 (lead 514)	Pin 5 (lead 517)	ACTUAL (PRESS BUTTON)	Pin 9 (lead 516)	Pin 5 (lead 517)	EITHER	Pin 8 (lead 510P)	Pin 3 (lead 510P)
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ACTUAL (PRESS BUTTON)	Pin 9 (lead 516)	Pin 5 (lead 517)														
EITHER	Pin 8 (lead 510P)	Pin 3 (lead 510P)														
3.2 Voltmeter Digital Meter accuracy. NOTE: See Section I for recommended meters to perform this test and test 3.3.	3.2 Connect the (-) probe of a test voltmeter (with at least 3-digit, $\pm 0.5\%$ accuracy) to Voltmeter Board testpoint 510 P/C, and the (+) probe to Voltmeter Board testpoint TP4. (Do not disconnect plug.)	3.2 The test voltmeter readings should match per table below, with the Voltmeter reading the SET values of Voltage specified in table: <table border="1"> <thead> <tr> <th>SET VOLTS READING (V)</th> <th>TEST VOLTMETER READING (V)*</th> </tr> </thead> <tbody> <tr> <td>15.0</td> <td>.150 + OR - .004</td> </tr> <tr> <td>30.0</td> <td>.300 + OR - .004</td> </tr> <tr> <td>60.0</td> <td>.600 + OR - .006</td> </tr> </tbody> </table> IF NOT, remove the Voltmeter board and replace the Digital Meter.	SET VOLTS READING (V)	TEST VOLTMETER READING (V)*	15.0	.150 + OR - .004	30.0	.300 + OR - .004	60.0	.600 + OR - .006						
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* Test voltmeter reading tolerances on charts include inaccuracy of the test voltmeter being used. The Voltmeter circuit accuracy is more tightly held.

FUNCTIONS OF THE NA-5R PC BOARDS

Power Board

Supplies fused power to the primaries of transformers T1 and T2.

Regulates the low-voltage DC power (derived from secondary T1A) to operate the analog circuitry on other boards.

Derives 115 V DC power (from secondary T2A) to operate the relays in the NA-5R control box.

Develops motor field voltage and switches wire feed direction upon command from the Logic Board.

Powers motor armature through SCR's, as directed by the Control Board.

Tachometer ("TACH") Board

Develops a square-wave signal, the frequency of which is proportional to motor speed. This square-wave signal is processed by the Control Board to develop the ACTUAL SPEED signal.

Control Board

Provides a precision reference voltage to the Wire Speed and Voltage potentiometers (located on the Procedure and Option Boards), to develop the SET signals.

Routes power to the Tach Board.

Processes the square wave from the Tach Board to develop the ACTUAL SPEED signal.

Compares the ACTUAL SPEED signal to the SET SPEED signal and develops firing pulses (that drive the armature SCR's on the Power Board) to maintain ACTUAL SPEED very close to SET SPEED.

Controls the initial acceleration of the wire. Fixed "fast" or "slow" rates may be user-selected.

Supplies SET SPEED and ACTUAL SPEED signals for display on the digital Speedmeter.

Bypass Board

Provides high frequency noise bypass to case ground for the NA-5R motor field, auxiliary output and arc voltage sensing leads to prevent operational interference when the NA-5R is used with high frequency starting.

Speedmeter Board

Regulates power (from Secondary T1B) for the digital Speedmeter.

Scales the speed signals to match the appropriate wire feed head. The proper scale factor must be selected by the user if the gearbox ratio or drive roll is changed.

Voltage Board

Compares the ACTUAL VOLTAGE signal to the SET VOLTAGE signal and develops a control signal (sent to the power source via leads A, B and C) to maintain ACTUAL VOLTAGE very close to SET VOLTAGE while welding.

Monitors conditions that prevent ACTUAL VOLTAGE from matching SET VOLTAGE while welding and shuts down the wire feed and power source output when such conditions occur.

Controls arc voltage response. Fixed "fast" or "slow" responses must be user-selected to suit the various power sources and welding processes.

Additional circuitry is included on the Voltage Board to provide the inch down "AUTO-STOP", "ELECTRODE TOUCHING WORK" and "COLD STARTING" features of the NA-5R (unless the "AUTO" tab is jumpered).

Voltmeter Board

Regulates power (from secondary T1B) for the digital Voltmeter.

Scales the voltage signals for display in the proper units.

Logic Board

Accepts command signals from the front-panel feed switches, Logic Interface Board and the weld current and voltage sensors, and makes logic decisions related to set up, "dry run" and welding outputs.

Allows user-selection of alternate modes of auxiliary output via a jumper lead.

Regulates low-voltage DC power (derived from secondary T1C) to operate the logic circuitry on the Logic, Logic Interface Board and Optional Procedure Kit.

Logic Interface Board

Provides for connection of external digital input control signals, either switches or 24 volt AC or DC, for each of the six NA-5R remote input functions.

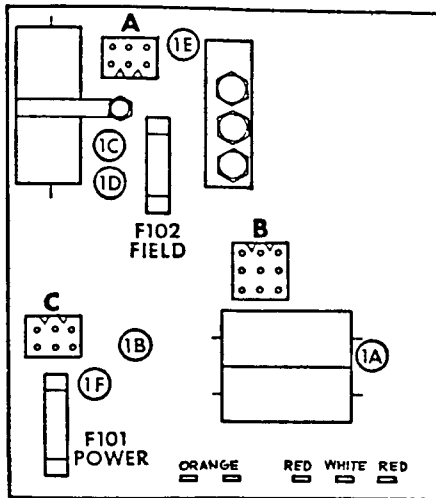
The Logic Interface Board provides total isolation and fuse protection of the remote input signals from the NA-5R control and power supply circuitry and outputs the selected input to the NA-5R Logic Board, as indicated by the Logic Interface Board's ACTIVATED INPUT status lights exposed on the front panel of the NA- 5R.

This board also provides for external lead connections to the ARC ESTABLISHED output signal (CR2) relay contacts.

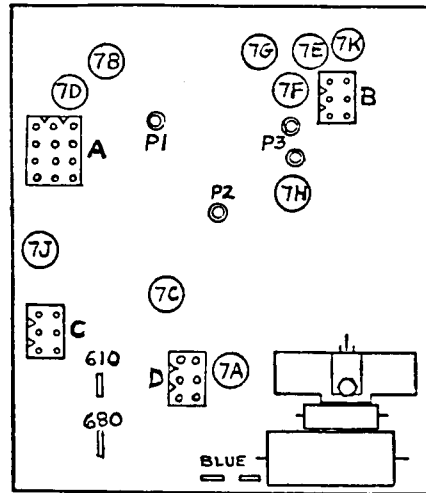
Option (Procedure) Board

Includes potentiometers for setting SPEED and VOLTS for basic NA-5R procedure control, and switching circuits for selection with Optional Procedure Kits.

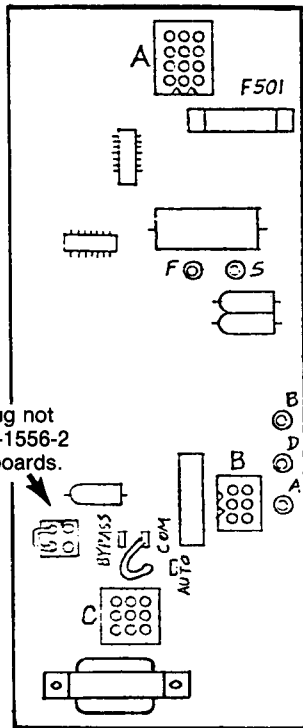
**DRAWING 1
PC BOARD COMPONENT LOCATIONS**



POWER BOARD

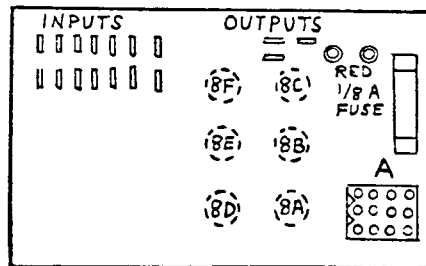


LOGIC BOARD



Jumper plug not used on G-1556-2 or earlier boards.

VOLTAGE BOARD



LOGIC INTERFACE BOARD

LIGHT STATUS TABLE

NA-5R LIGHT STATUS TABLE	SET UP AND WELD																			
	MODE:					"DRY RUN" TEST					REMOTE SIGNALS									
	INPUT SOURCE:					FRONT PANEL SWITCHES					REMOTE SIGNALS									
	OUTPUTS ENABLED INPUT STATUS:					OFF					ON									
FUNCTION INDICATED BY LIGHT	ACTIVATED INPUTS:					OFF					ON									
	LIGHT NUMBER	CONDITIONS:	NONE	FEED UP	FEED DOWN	POST-CYCLE INCH UP	ELEC. TRODE OFF WORK	ELEC. TRODE ON WORK	AUXILIARY OVER-RIDE	CYCLE RUN	POST-CYCLE BURN-BACK	POST-CYCLE INCH UP	ELEC. TRODE OFF WORK	ELEC. TRODE TOUCHING WORK	AUXILIARY OVER-RIDE	PRIOR TO ARC STRIKE	CYCLE RUN	ARC ESTABLISHED	ARC ON (4)	IDLE (READY)
POST-CYCLE INCH UP Signal Applied	8A	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
OUTPUTS ENABLED Signal Applied	8B	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
INCH DOWN Signal Applied	8C	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
AUXILIARY OVERRIDE Signal Applied	8D	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
CYCLE RUN Signal Applied	8E	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
POST-CYCLE BURNBACK Signal Applied	8F	LOGIC INTER-FACE BOARD (FRONT PANEL)	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
15 V Logic Supply Present	7A	LOGIC BOARD	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Electrode Voltage Present	7B (1)	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Electrode Current Present	7C	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
FEED DOWN Panel Switch Closed	7D	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Apply Auto-Stop Signal	7E	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Apply Down (Forward) Field	7F	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Feed Enabled	7G	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Voltage Hold-Low Disabled	7H	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Auto. Shut Down Enabled	7J	LOGIC BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Procedure Kit Switch Enabled	7K	LOGIC BOARD	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
+15 V Analog Supply Present	1A	POWER BOARD	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
-10 V Analog Supply Present	1B	POWER BOARD	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Down Field Voltage Applied	1C	POWER BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Up Field Voltage Applied	1D	POWER BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
Armature Voltage Applied	1E	POWER BOARD	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
110 V Relay Supply Present	1F	POWER BOARD	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
AUXILIARY Output Activated	LT1	FRONT PANEL	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
ARC ESTABLISHED or ELECTRODE TOUCHING WORK Output Activated	LT2	FRONT PANEL	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x
ELECTRODE "HOT" Output Activated	LT3	FRONT PANEL	x	x	x	ON	x	x	x	x	ON	x	x	x	x	x	x	x	x	x

(1) Light 7B will be ON in ALL modes if Voltage Board blue jumper connected to "AUTO" tab. However, INCH DOWN will always function in the ELECTRODE OFF WORK condition even if the electrode is touching work.
 (2) Only if Logic Board White Jumper connected to pin P2.
 (3) Only if Logic Board red jumper connected to pin P1. If not, AUXILIARY OVERRIDE input must be used.
 (4) If arc goes out before POST-CYCLE BURNBACK input is deactivated, status will change to IDLE ("READY") except light 8F will be ON.



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