



Stud welding unit N1500i™ Fast Start Manual

For Control Board Firmware Version 1.06 & Higher

(See Nelson representative for full manual)

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Nelson's liability for breach of warranty shall arise only upon return of the defective goods at Buyer's expense after notice to Nelson of the claimed breach, and shall be limited to furnishing a like quantity of such goods free from such defects or, at Nelson's option, to refunding the purchase price (less reasonable depreciation based on actual use); provided, however, that Nelson will not accept receipt of equipment returned unless buyer has previously afforded Nelson's personnel a reasonable opportunity to inspect and repair said equipment at buyer's facility or such other location as is mutually agreeable. Notice to Nelson must be given within 30 days of such defect or failure and within two years or one million welds from the date the equipment was delivered. No compensation or reimbursement for transportation costs of any kind will be allowed.

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Nelson reserves the right to make engineering and/or part changes, at any time without notice, as a result of our commitment to continuous improvement.



WARNING

The following Safety section is for your protection. It summarizes precautionary information from the references listed in the Additional Safety Information section. Before performing any installation or operating procedures, be sure to read and follow the safety precautions listed below as well as all other manuals, material safety data sheets, labels, etc. Failure to observe these precautions can result in injury or death.



PROTECT YOURSELF AND OTHERS

Some welding, cutting, and gouging processes are noisy and require ear protection. The arc, like the sun, emits ultraviolet (UV) rays and other radiation which can harm the skin and eyes. Hot metal can cause burns. Training in the proper use of the processes and equipment is essential to prevent accidents. Therefore:

1. Always wear safety glasses with side shields in any work area, even if welding helmets, face shields and goggles are also required.
2. Use a face shield fitted with filter shade #3 per ANSI Z87.1. Cover sparks and rays of the arc when operating or observing operations. Warn bystanders not to watch the arc and not to expose themselves to the rays of the electric-arc or hot metal.
3. Wear flameproof gauntlet type gloves, heavy long-sleeve shirt, cuffless trousers, high topped shoes, and a welding helmet or cap for hair protection, to protect against arc rays and hot sparks or hot metal. A flameproof apron may also be desirable as protection against radiated heat and sparks.
4. Hot sparks or metal can lodge in rolled up sleeves, trousers cuffs or pockets. Sleeves and collars should be kept buttoned, and open pockets eliminated from the front of clothing.
5. Protect other personnel from arc rays and hot sparks with suitable nonflammable partitions or curtains.
6. Use goggles over safety glasses when chipping slag or grinding. Chipped slag may be hot and can fly far. Bystanders should also wear goggles over safety glasses.



FIRES AND EXPLOSIONS

Heat from flames and arcs can start fires. Hot slag or sparks can also cause fires and explosions. Therefore:

1. Remove all combustible materials well away from the work area or cover the materials with a protective nonflammable covering. Combustible materials include wood, cloth, sawdust, liquid and gas fuels, solvents, paints and coatings, paper, etc.
2. Hot sparks or hot metal can fall through cracks or crevices in floors or wall openings and cause a hidden smoldering fire or fires on the floor below. Make certain that such openings are protected from hot sparks and metal.
3. Do not weld, cut, or perform other hot work until the work piece has been completely cleaned so that there are no substances on the work piece which might produce flammable or toxic vapors. Do not do hot work on closed containers. They may explode.
4. Have appropriate fire extinguishing equipment handy for instant use, such as a garden hose, water pail, sand bucket or portable fire extinguisher. Be sure you are trained for proper use.
5. Do not use equipment beyond its ratings. For example, overloaded welding cable can overheat and create a fire hazard.
6. After completing operations, inspect the work area to make certain there are no hot sparks or hot metal which could cause a later fire. Use fire watchers when necessary.
7. For additional information, refer to NFPA Standard 51B, "Fire Prevention in Use of Cutting and Welding Processes," available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269



ELECTRICAL SHOCK

Contact with live electrical parts and ground can cause severe injury or death. DO NOT use welding current in damp areas, if movement is confined, or if there is danger of falling. Therefore:

1. Be sure the power source frame (chassis) is connected to the ground system of the input power.
2. Connect the work piece to a good electrical ground.
3. Connect the work cable to the work piece. A poor or missing connection can expose you or others to a fatal shock.
4. Use well-maintained equipment. Replace worn or damaged cables..
5. Keep everything dry, including clothing, work area, cables, torch/electrode holder and power source.
6. Make sure that all parts of your body are insulated from work and from the ground.
7. Do not stand directly on metal or the earth while working in tight quarters or a damp area; stand on dry boards or an insulating platform and wear rubbersoled shoes.
8. Put on dry, hole-free gloves before turning on the power.
9. Refer to ANSI/ASC Standard Z49.1 for specific grounding recommendations. Do not mistake the work lead for a ground cable.



ELECTRICAL AND MAGNETIC FIELDS

Electric and magnetic fields may be dangerous. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and cutting current creates EMF around welding cables and welding machines. Therefore:

1. Operators having pacemakers should consult their physician before welding. EMF may interfere with some pacemakers.
2. Exposure to EMF may have other health effects which are unknown.
3. Operators should use the following procedures to minimize exposure to EMF:
 - a. Route the electrode and work cables together. Secure them with tape when possible.
 - b. Never coil the torch or work cable around your body.
 - c. Do not place your body between the torch and work cables. Route cables on the same side of your body.
 - d. Connect the work cable to the work piece as close as possible to the area being welded.
 - e. Keep welding power source and cables as far away from your body as possible.



FUMES AND GASES

Fumes and gases can cause discomfort or harm, particularly in confined spaces. Do not breathe fumes and gases. Shielding gases can cause asphyxiation. Therefore:

1. Always provide adequate ventilation in the work area by natural or mechanical means. Do not weld, cut, or gouge on materials such as galvanized steel, stainless steel, copper, zinc, lead, beryllium, or cadmium unless positive mechanical ventilation is provided. Do not breathe fumes from these materials.
2. Do not operate near degreasing and spraying operations. The heat or arc rays can react with chlorinated hydrocarbon vapors to form phosgene, a highly toxic gas, and other irritant gasses.
3. If you develop momentary eye, nose, or throat irritation while operating, this is an indication that ventilation is not adequate. Stop work and take necessary steps to improve ventilation in the work areas. Do not continue to operate if physical discomfort persists.
4. Refer to ANSI/ASC Standard Z49.1 (see listing on next page) for specific ventilation recommendations.



ELECTRICALLY POWERED EQUIPMENT

Faulty or improperly electrified equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
2. Before performing any work inside a power source, disconnect the power source from the incoming electrical power using the disconnect switch at the fuse box before working on the equipment.
3. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
4. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.



CYLINDER HANDLING

Cylinders, if mishandled, can rupture and violently release gas. Sudden rupture of cylinder, valve, or relief device can injure or kill. Therefore:

1. Use the proper gas for the process and use the proper pressure reducing regulator designed to operate from the compressed gas cylinder. Do not use adaptors. Maintain hoses and fittings in good condition.
2. Always secure cylinders in an upright position by chain or strap to suitable hand trucks, undercarriages, benches, walls, post, or racks. Never secure cylinders to work tables or fixtures where they may become part of an electrical circuit.
3. When not in use, keep cylinder valves closed. Have valve protection cap in place if regulator is not connected. Secure and move cylinders by using suitable hand trucks. Avoid rough handling of cylinders.
4. Locate cylinders away from heat, sparks, and flames. Never strike an arc on a cylinder.
5. For additional information, refer to CGA Standard P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders", which is available from Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202



HEARING PROTECTION

Prolonged Noise from Capacitor Discharge welding applications can damage hearing if levels exceed limits specified by OSHA. Therefore:

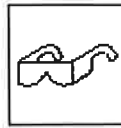
1. Use Approved ear plugs or ear muffs if noise level is high.
2. Warn others nearby about noise hazard.
3. For additional information, refer to OSHA Safety Standards 3074.



MOVING PARTS CAN CAUSE INJURY

Electric fan can start at any time without warning and cause severe injury, therefore:

1. Always disconnect electrical power prior to service to prevent the fan from starting unexpectedly.
2. Keep all doors, panels, covers, and guards closed and securely in place.
3. Have only qualified people remove guards or covers for maintenance and troubleshooting as necessary.
4. Keep hands, hair, loose clothing, and tools away from moving parts.
5. Reinstall panels or guards and close doors when servicing is finished and before reenergizing welder.



EYE PROTECTION

Flying metal can injure eyes. Welding, chipping, wire brushing and grinding can cause sparks and flying metal. As welds cool, they can throw off slag. Therefore:

1. Wear approved safety glasses with side shields even under your welding helmet.
2. Warn others nearby about flying metal hazard.



EQUIPMENT MAINTENANCE

Faulty or improperly maintained equipment can cause injury or death. Therefore:

1. Always have qualified personnel perform the installation, troubleshooting, and maintenance work. Do not perform any electrical work unless you are qualified to perform such work.
2. Before performing any maintenance work inside a power source, disconnect the power source from the incoming electrical power.
3. Maintain cables, grounding wire, connections, power cord, and power supply in safe working order. Do not operate any equipment in faulty condition.
4. Do not abuse any equipment or accessories. Keep equipment away from:
 - heat sources such as furnaces
 - wet conditions such as water puddles and inclement weather
 - oil or grease
 - corrosive atmospheres
5. Keep all safety devices and cabinet covers in position and in good repair.
6. Use equipment only for its intended purpose. Do not



ADDITIONAL SAFETY INFORMATION

For more information on safe practices for electric arc welding, refer to the following publications.

1. ANSI/ASC Z49.1 Safety in Welding and Cutting
2. AWS C5.1 Recommended Practices for Plasma Arc Welding
3. AWS C5.6 Recommended Practices for Gas Metal Arc Welding
4. AWS SP Safe Practices (Reprint) Welding Handbook
5. ANSI/AWS F4.1 Recommended Safe Practices for Welding and Cutting of Containers That Have Held Hazardous Substances

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1 Connection and Installation

1.1 Installation Precautions

Attention must be paid to the fact that the welding unit is installed on horizontal, vibration-free and non-slip floor space. The load-carrying capacity of the floor space should be at least double the weight of the welding unit.

When working in high-lying locations, such as bridges, ladders or platforms the N1500i must be secured against the risk of falling.

The Nelweld N1500i must be adequately protected against the intrusion of liquids. It may not be installed on liquid-bearing pipelines.

In order to guarantee unimpeded temperature exchange with the environment, a minimum clearance of 1 m (39.4 inch) to existing heat sources must be observed.

Attention must be paid to the fact that the ventilation slits on the unit casing are kept free.

1.2 Connection

With the exception of the input power cable all the connecting elements are arranged in a functional manner on the front plate of the N1500i.




1 Welding cable connection (-) X2	4 Gas connection input (bottle)(optional)
2.Welding cable connection (+) X3	5 Control cable connection (X1)
3 Gas connection output (gun) (optional)	6 input power cable connection




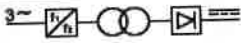
Warning!

Prior to any connection work the Nelweld N1500i welding unit must be switched off. The input power switch of the unit must be in the >>0<< position!

1.2.1 Input Connection

	<p>Warning!</p> <p>Connection to the input power may only be carried out by a qualified electrician in accordance with all local and national electrical codes!</p> <p>Before connecting ensure that the welder grounding conductor is connected to a proper safety (earth) ground!</p>
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The Nelweld N1500i may be operated with an input power voltage of 200-230VAC/50/60Hz or 400-460VAC/50/60Hz as configured by the re-connect internally. The 575V unit can not be configured this way. See rating plate on the back of the unit.

	Nelson Stud Welding, Inc 7900 West Ridge Rd, Elyria, OH 44035 USA	Part Nr. Serial Nr.																																							
Type: 1500I																																									
OUTPUT @ 3 PHASE INPUT		INPUT - 3 phase 50/60 Hz																																							
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FOR SINGLE PHASE OPERATION SEE MANUAL																																									

1.2.2 Single Phase Connections

- Connect to L1 and L3 of the input line switch (black and white wires of the factory - installed input cord if equipped).
- Reconnect instructions for selecting the input voltage still applies whether using 1 phase or 3 phase operation.
- Isolate and securely tape L2 (red wire).

1.2.3 Change Input Voltage (Reconnect)

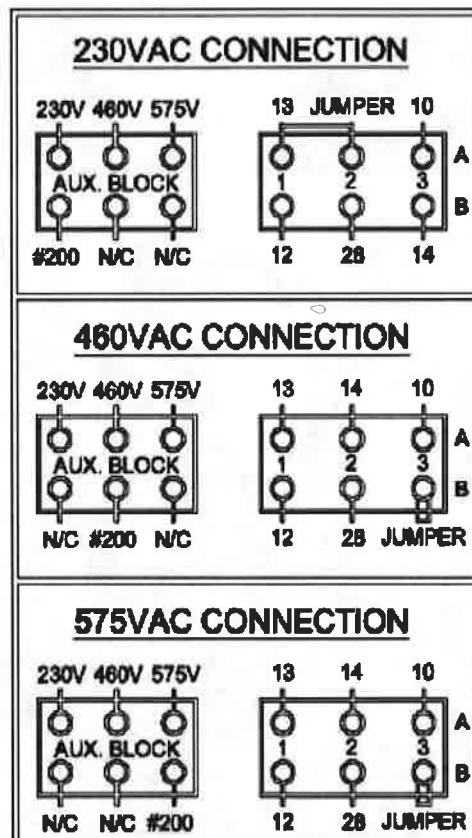


Warning!

Connection to the input power may only be carried out by a qualified electrician in accordance with all local and national electrical codes!

Before connecting ensure that the welder grounding conductor is connected to a proper safety (earth) ground!

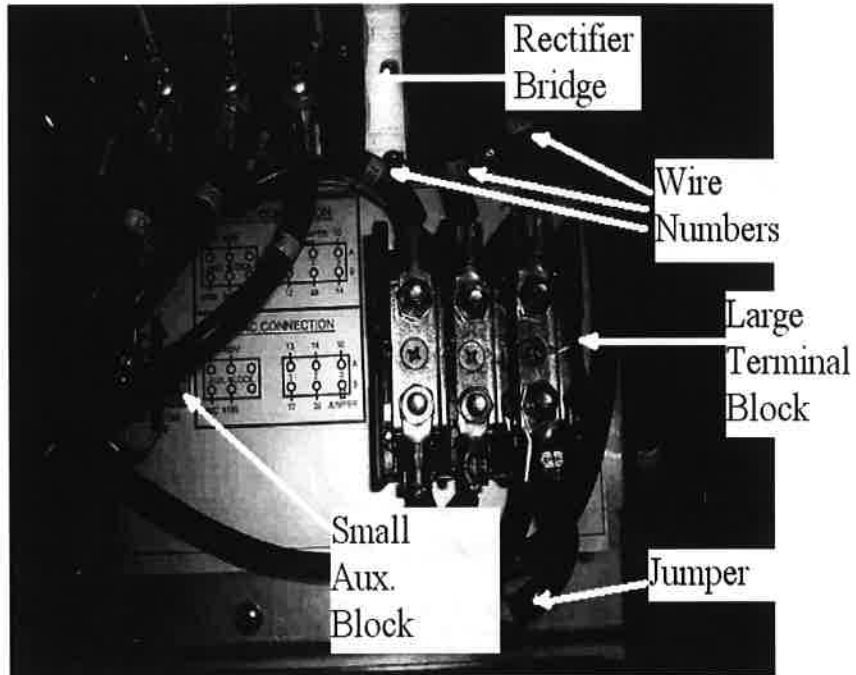
This is how to change input voltage (230V/460V or 230V/460V/575V) on the N1500i with internal reconnect. Re-wiring is needed on both the small "aux. block" and the big terminal block.



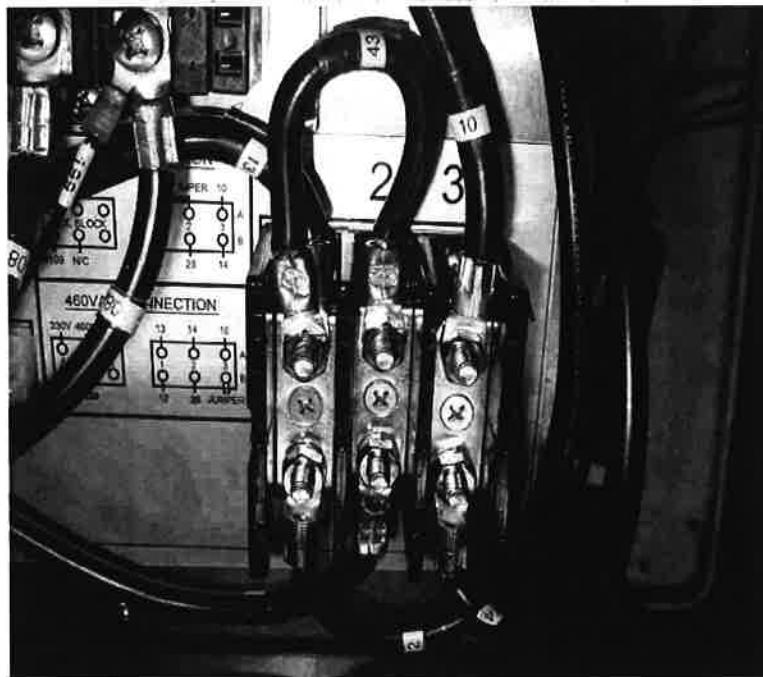
NOT USEABLE
 ON 230V/460V
 ONLY UNITS

- Make sure unit is disconnected from main power.
- Move lead #200 at small aux. block per graphic for desired voltage.
- Move jumper and lead # 14 on large terminal block per graphic for desired voltage. (See photo next page.)

Voltage Connect Section



460VAC Connection



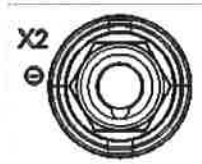
230VAC Connection (small terminal block to left lead moves to far end)

*575V Not Shown

1.2.4 Connection of the Welding Cable

Connection of the welding cable of the gun is effected by means of the welding cable socket of the N1500i which is marked with the gun symbol.

It must be noted that procedurally safe operation of the system can only be guaranteed when NS40 and Light Duty guns are connected.



Welding Cable Connection (X2)

Connect the welding cable plug of the gun to the welding cable socket of the N1500i.

The connection must be secured by a full “turn to the right” of the welding cable plug!

1.2.5 Connection of the Control Cable

The control cable socket serves to take the control cable plug of the gun. The signals to control the gun are transmitted via the control cable.

In keeping with the weld gun to be connected, the control cable socket of the welding unit is 4-pole in design, some may be 2-pole.



Control Cable Connection (X1)

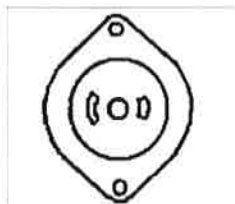
Pin 1: Gun coil (-)

Pin 2: Gun coil (+)

Pin 3: Start button of the gun (+)

Pin 4: Start button of the gun (-)

The connection must be secured by “screwing on” the control cable plug!

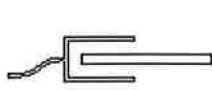


Control Cable Connection (X1)

Silver Pin: White Wire

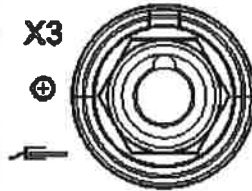
Brass Pin: Black Wire

1.2.6 Connection of the Ground Cable



The welding current return takes place via the earth ground cable, which must be connected as follows to the earth ground cable socket of the Nelweld N1500i.

Earth ground Cable Connection (X3)



Connect the earth ground cable plug into the proper socket of the Nelweld N1500i.

The connection must be secured by a full “turn to the right” of the earth ground cable plug!



Warning!

The welding cable connection cannot be locked. Tight connection must be checked regularly (2 -3 times per shift)!



Note!

Use cable resistance monitor (see section 3.15) to continuously monitor loose connector fault condition in production.

1.2.7 Connection of the workpiece

When connecting the earth ground terminals attention must be paid to the following:

1. The earth ground terminals must be connected directly to the workpiece or to the workpiece fixture (welding bench, welding grid).

Steel constructions, tracks, pipelines, etc. may not be used as current conductors, unless they are themselves the workpiece to be welded.

2. The welding current circuit may not be earth grounded.

Exception: The workpiece itself or the workpiece fixture are earth grounded compulsorily (pipelines, shipbuilding, etc.).

3. Place the earth ground terminals if possible at the same distance from the point of welding when two ground clamps are used.



Note!

Prior to connecting the earth ground terminals the following advice on avoiding any arc blowing must be observed!

1.3 Specifications

	Input Volts	Slow-Blow Fuse	Iph. Max	kVA max.	Iph. eff.	kVA eff.
3 Phase 50/60Hz Electrical Specifications	200-300	60	183	73	58	7.3
	400-460	30	94	75	30	7.5
	575	25	75	75	24	7.5
	Output on 3 phase input					
	Duty	6%	9%	12%	100%	
	Amps	1500	1200	1000	120	
	Volts	38	38	38	38	

	Input Volts	Slow-Blow Fuse	Iph. Max	kVA max.	Iph. eff.	kVA eff.
1 Phase 50/60Hz Electrical Specifications	200-300	60	200	51	58	3.5
	400-460	30	112	51	30	3.5
	Output on single phase input					
	Duty				6%	
	Amps				800	
	Volts				38	

Idle watts: 100W or less, fan off	Height: 16.7 (42cm)
Unit Weight: 75lbs (34Kg) (w/cord)	Operating Temperature: -20 to +40 Degrees C
Unit Length: 28in (71cm)	Storage Temperature: -40 to +60 Degrees c
Width: 10.7in (27cm)	Efficiency at rated output: 88%
Open - Circuit Voltage: 75V	

2 Control and Display Elements



2.1 Front Panel Controls and Displays

1	Time/Current Mode	Enables Time/Current weld parameter selection
2	Stud Expert Mode	Setup selection by stud diameter and other process parameter such as weld position
3	Function Mode	Configuration Change or Troubleshooting
4	Up/Down Arrow Keys	Add or subtract numeric values in time or current function
5	Lock/Unlock Keys	The unit has a lockout feature that prevents any changes from being made to the front panel settings. See F19 in section 3
6	Preset Values	Factory presets or storage of custom values
7	On/Off Power Switch	The main switch controls the input power to the machine. Upon powering up, the internal control software performs a series of diagnostic tests to ensure correct connection and operation of the power source.
8	Weld Time/Stud Expert Display/Material Display	The TIME setting is displayed on the front panel LOWER display. It can be changed using the Up/Down arrow keys to the right of the time display in one 1ms increments.
9	Warning alert	This indicator turns ON when a fault condition occurs. Please refer to F1 in the troubleshooting section of this guide for fault condition descriptions and resolution.
10	Weld Tool Icon ¹	Graphical representation of gun operation and welding process. (see below for more information)
11	Weld Current/Stud Diameter Display	The CURRENT setting is displayed on the front panel UPPER display. It can be changed using the + and - arrow keys to the right of the current display in one (1) amp increments.

1. Explanations see next page

Weld Tool Icon

Gun Coil

Green = Energized

Red (Flashing) = Undetected

No Light = Detected but
not energized

Blue - Welding
in progress

(light maybe "on" longer
than actual weld time
for animation)



Trigger Indicator

Contact Detect
(Green)

Good/Bad Weld
Indicator
(Green/Red)

2.2 Weld Parameters

You can program this unit in 2 ways: directly setting the current and time values; or use the Stud Expert (tm) mode based on stud diameter.

2.2.1 Setting Current and Reading the Current Display

The current setting is the current setting during a weld, and can be viewed in the front panel's upper display. It can be changed using Up/Down arrow keys to the right of the current display in one (1) amp increments. As each of these keys are pressed, the current setting will increase or decrease at a faster rate.

After each weld, actual current and time will be displayed briefly before the set values are displayed again.

If the display shows an actual weld time is much longer than programmed, e.g., the sum of the front panel time and F2 (short circuit on-time), a cold plunge may have occurred that can result in a bad weld. If this condition persists, it is recommended to do a gun calibration to set the F31 value, and check the physical condition of the gun for any causes of preventing a normal drop. If the actual weld time is less than the front panel time, it means the arc shorted early, indicating a potential improper gun lift setup.

When the display shows WAIT when the trigger is pulled, it means the rated duty cycle is exceeded during operation (or other fault condition, see section 7.3.19). It is advised to check the value of F2 and possibly reduce the value of F2 to reduce the on-time and increase the studs per minute without cold plunge.

In normal operating modes, the desired setting and the actual current will be the same. In this situation the display does not change during or after a weld. However, in conditions where it is not possible for the power source to deliver the desired current, a warning light will light on the front panel display. This typically occurs when using high currents with small or excessively long weld cables.

2.2.2 Setting the Time and Reading the Time Display

The time setting is displayed on the front panel lower display. It can be changed using Up/Down arrow keys to the right of the time display in one (1) millisecond (0.001 second) increments. As each of these keys reinput power pressed, the time setting will increase or decrease at a faster rate. The time display is used to display both the desired time setting and the actual weld time.

In normal operating modes, the desired setting and the actual weld time will be the same. When this is the case, the display does not change during or after a weld. However, if an error condition occurs, the

proper error code will be displayed on the front panel display. This will typically happen if a weld is aborted early.

2.2.3 Lift distance and plunge distance parameters:

- The mechanical parameters must be set on the respectively connected weld gun NS40 and Light Duty drawn arc gun.
- See the operating instructions of the corresponding weld gun for the settings.
- See the gun operating instructions and diagrams below respectively for the guide values for the welding method.



Note!

The maximum lift height is 0.098" (2.5mm) at +/- 10% or rated input voltage.

Lift Settings

Maximum lift height (at +/-10% of rated input voltage, NS40 and NS20HD): 2.5mm (0.1").

Proper gun lift settings are as follows:

1. All studs within the weld range are listed at 2mm lift and below.
2. The plunge also needs to be appropriately set.
3. When the E009 error appears the lift and plunge should be reviewed.
4. If the error is E004 or E007 it generally means no pilot arc.
5. Check input voltage from unit control panel using F18 and read capacitor voltage.
6. If the lift capability is marginal, i.e. it lifts a low lift height, but fails to lift at slightly higher lift height, consult your Nelson Rep.

2.2.4 Calibrate the gun drop time F31

It is recommended to calibrate the gun so that the welder understands the gun drop time and delivers the precise main arc time programmed. The calibration is a good practice when you exchange the gun, especially when you change process between short cycle mode (maximum main arc time is 100 ms) and drawn arc (minimum main arc time is 100 ms), or change gun type or plunge dampener (shock absorber). Simply go to F31, and shoot a stud. The actual gun speed is measured and the actual drop time is saved in F31.

When you display F31 on the front panel and make a weld, F31 should automatically update with actual drop time from the new weld. The newly updated F31 value should match with tD in F32. Another way is simply read tD in F32 from previous weld and adjust F31 to match it. Generally speaking, this equation should hold within a few milliseconds: Front Panel Time - F31 setting before a weld = tM in F32 - tD in F32.

After calibration, tM in F32 should be fairly close to front panel time within a few milliseconds. If not, then something in your gun, fastener, or else in process is not exactly repeatable.

Special cases:

If the stud shorts before the gun coil is de-energized, or, if the stud shorts after the weld current is shut off, the drop time (tD) can't be measured.

In each case, F31 does not update. F32 (tD) shows each of these cases in text. If the stud shorts before the gun coil is de-energized, adjust weld energy (lift, current, time) so that the stud does not short during the weld. If the stud shorts after the weld current is shut off, increase F2 to give the machine a chance to measure drop time (tD).



Note!

Exit the F31 screen for production welding. Otherwise, F31 may be continuously changing after each weld resulting in inconsistent settings in production.

If you accidentally recall a preset, F31 value can be changed to the value associated with the preset. Check F31.

2.2.5 Weld Parameter Presets

The power source has ten available preset configurations. Each of these is assigned a time and current setting for commonly welded stud sizes. To select a preset, simply press key 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. When a preset is selected, the time and current are displayed on the front panel, and the LED on the selected preset key lights.

Nelweld users are not restricted to pre-programmed presets, but may save more usable weld settings. To do so, first select the desired time and current settings using the corresponding Up/Down arrow. Then press and hold the desired preset key for 4 seconds. The preset values

will be replaced by the desired custom values. When the orange LED of the preset button being pressed turns ON, the selected preset has been successfully programmed.



Note!

The weld parameter presets depends on to chosen weld method (short cycle, drawn arc).

2.2.6 Recommended Weld Parameters

The values specified in the tables and diagrams respectively must be seen merely as guide values, which were achieved under optimized welding conditions.

The best possible weld parameters must always be determined with proper attention to factors such as the material and surface quality of the workpiece, plate thickness, welding position, stud type, stud dimensions, etc. in trial welds.

Attention must be paid to the fact that the trial welds are for the most part equivalent to the real conditions in the current production process.

In obtaining the best welding result, the electrical and mechanical weld parameters must be precisely adjusted to the respective welding task.

Upon suspicion of faulty welds the settings on the welding unit and the weld gun must be optimized.



Note!

The weld parameters in the tables and in Stud Expert are provided as is, without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular application. Performance suitability for any specific application should be determined by the user. The user assumes all liability of the use or the results of the use of the recommended weld parameters.

Nelson cannot assume any responsibility for updating or correcting the welding advice or guide values once they have been given, nor does the provision of information create, expand or alter any warranty with respect to the sale of our products.

2.2.7 Weld Parameters and Settings



Note!

Weld parameters and settings below are developed using Nelson equipment and Nelson studs. It is recommended to use fasteners from one manufacturer (Nelson studs) to ensure weld consistency and compatibility.

Factory Preset Weld Settings (Short Cycle)

	Preset	Nelson Stud Type	Stud Size Ø	Current (Amps)	Time (ms)
Preset Bank 2 *	1	SC-Studs [3.0 M3]	4 mm	400	15
	2	SC-Studs [4.0 M4]	5 mm	500	15
	3	SC-Studs [5.0 M5]	6 mm	600	20
	4	SC-Studs [6.0 M6]	7 mm	700	25
	5	SC-Studs [6.0 M6]	7 mm	700	25
	6	SC-Studs [6.0 M6]	7 mm	700	25
	7	SC-Studs [6.0 M6]	7 mm	700	25
	8	SC-Studs [6.0 M6]	7 mm	700	25
	9	SC-Studs [6.0 M6]	7 mm	700	25
	0	SC-Studs [6.0 M6]	7 mm	700	25

The duty cycle limits for the Nelweld N1500i can be seen in the Stud Weld Rate table below. If the duty cycle is exceeded, and a weld is attempted, a "Wait" prompt will be displayed. "Wait" will disappear when the unit is ready for another weld. If the unit reaches an abnormally high temperature, a failsafe thermal sensor will protect the unit and display E011. The unit will resume operation once the temperature has returned to safe operating range.

Factory Preset Weld Settings (Drawn Arc)

	Preset	Nelson Stud Type	Stud Size Ø	Current (Amps)	Time (ms)
Preset Bank 1**	1	IS-Studs	3 mm	200	150
	2	IS-Studs	4 mm	280	200
	3	IS-Studs	5 mm	350	230
	4	SD6, MR M8, S6	6 mm	410	250
	5	MP (F) M8	7 mm	470	300
	6	MR M10, S8	8 mm	550	300
	7	MP (F) M10	9 mm	650	300
	8	SD10, MR M12, S10	10 mm	750	350
	9	M12, S12	12mm	950	450
	0	S16, SD16	16mm	1400	550

	Preset	Nelson Stud Type	Stud Size Ø	Current (Amps)	Time (ms)
Preset Bank 0**	1	Drawn arc stud	3/16"	300	150
	2	Drawn arc stud	1/4"	450	170
	3	Drawn arc stud	5/16"	500	250
	4	Drawn arc stud	3/8"	550	330
	5	Drawn arc stud	7/16"	675	420
	6	Drawn arc stud	1/2"	800	550
	7	Drawn arc stud	5/8"	1200	670
	8	Drawn arc stud	3/4"	1500	840
	9	Drawn arc stud	3/4"	1500	840
	0	Drawn arc stud	3/4"	1500	840

* Preset bank 2 is loaded (such that presets 0-9 are as described above) when in short cycle mode.

** Prest bank 0 or 1 are loaded (such that presets 0-9 are as described above) when in drawn arc mode.

Bank 0 is loaded when a 2 - wire gun interface is used.

Bank 1 is loaded when a 4 - wire gun interface is used.

Note: The preset bank may be selected manually using Function Code F44.

2.2.8 Parameters for short - cycle procedure



Note!

The following parameters are only starting points (*guide values*) which must be adjusted to specific application conditions (base material, work piece surface condition, weld position, gun type, weld circuit inductance and grounding etc.). It is recommended to perform weld robustness test (current-time tolerance graph) using the values below as center points to determine optimum welding parameters for the application.

Preset	Stud Size Ø		Current (Amps)	Time (msec)	Lift (mm)	Plunge (mm)
1	3/16"	5mm	300	15	.062	.125
2	1/4"	6mm	400	17	.062	.125
3	5/16"	8mm	450	25	.062	.125
4	3/8"	10mm	500	33	.062	.125
5	7/16"	11mm	625	42	.062	.125
6	1/2"	13mm	750	55	.062	.125
7	5/8"	16mm	1100	67	.093	.187
8	3/4"	19mm	1400	84	.093	.187
9	3/4"	19mm	1400	84	.093	.187
0	3/4"	19mm	1400	84	.093	.187

2.2.9 Parameter for drawn - arc procedure

Drawn Arc Welding

*Assuming 3Ø Input Power and a short circuit on - time of 100ms

Stud Weld Rate				
Parameters listed as those used testing, and should be used only when considering operating duty cycle				
Stud Size		Time (sec)	Current (A)	Weld Rate (Studs Per Minute)
(in)	mm			Nelweld 1500i
3/16"	5mm	0.15	300	261
1/4"	6mm	0.17	400	171
5/16"	8mm	0.25	450	105
3/8"	10mm	0.33	500	70
7/16"	11mm	0.42	625	38
1/2"	13mm	0.55	750	21
5/8"	16mm	0.67	1100	8
3/4"	19mm	0.84	1400	4

Firmware version 1.06

F code	Description	Possible Values	Default	Unit	Notes
F0	Language	ENGLISH,GERMAN, ITALIAN, SPANISH, FRENCH, POLISH	ENGLISH	x	
F1	Error Display	E--- to E018	E---	x	
F2	Plunge Short Circuit On-Time	0 to 150	80	ms	When short cycle mode is enabled, this defaults to 20ms. When disabled, this defaults to 80ms for 2-wire gun interface, 20ms for 4-wire gun interface.
F3	Stud Expert Mode Easy Access	POSITION, MATERIAL, PROCESS	POSITION	x	
F4	Stud Expert Mode Position	DOWNHAND, VERTICAL, OVERHEAD	DOWN HAND	x	
F5	Stud Expert Mode Material	MILD STEEL, STAINLESS STEEL, ALUMINUM	MILD STEEL	x	
F6	Stud Expert Mode Process	STUD WELD	STUD WELD	x	
F7	Calibration Values	700 to 850	750	Clock cycles	Used by manufacturing. Do not change
F8	Chuck Saver	OFF ON	ON	x	
F9	Gas Enable	OFF ON	OFF	x	
F10	Gas Preflow Time	10 to 2000	500	ms	
F11	Gas Postflow Time	10 to 2000	500	ms	
F12	Stud Feed Enable	OFF ON	OFF	x	This automatically turns on 'short cycle mode' when enabled. Disabling it does not disable 'short cycle mode'.
F13	Stud Feed Time	10 to 2000	50	ms	Pulse width of stud feed signal. This only applies when stud feed is enabled.
F14	Stud Feed Normal Level	NORMAL CLOSED, NORMAL OPEN	NORMAL OPEN	x	This only applies when stud feed is enabled.
F15	Stud Feed Style	AFTER CONTACT BREAK, AFTER WELD	AFTER CONTACT BREAK	x	When to get the signal. This only applies when stud feed is enabled.

F code	Description	Possible Values	Default	Unit	Notes
F16	Stud Feed on Air Trigger	OFF ON	OFF	x	To feed a stud even when triggering the gun while not welding. This only applies when stud feed is enabled.
F17	Loadbank Enable	OFF	OFF	x	For manufacturing. This is a read-only function used for burn-in testing.
F18	Capacitor V-F Readings	0-65535	NA	Hz	Time-up/down to see both sides
F19	Lock Mode	1 to 4	1	x	Mode 1: Use the lock key to toggle blocking on all keys - no password protection. Mode 2: Use the lock key to enter a password, lock key as 'enter'. From there, all keys are blocked until you press lock again. It will prompt for the same password entered when originally locked. Password can be up to 9 characters. Mode 3: Same as mode 2, except user can toggle between presets and can not change the value of presets. Mode 4: Same as mode 3, except user can vary the time and current by the percentage as set by F57.
F20	Debug	ENTER DEBUG MODE	ENTER DEBUG MODE	x	Used by manufacturing and service.
F21	User Counter	0 to 4.3G	0	Welds	While in this F code, press and hold the time-down button to reset the counter
F22	Total Counter	0 to 4.3G	0	Welds	(Non-resettable)
F23	Chuck Stripper	OFF ON	OFF	x	Lets user select which units are displayed as stud sizes while in Stud Expert mode. This defaults to English with 2-wire gun interfaces and Metric with 4-wire gun interfaces.
F24	Stud Expert Mode Unit Selection	English, metric, or both	English	x	
F25	Software Versions	A: DSP version B: Coldfire version	A: DSP version	x	Time-up/down to see both versions
F26	Restore Factory Defaults	HOLD TIME DOWN BUTTON	HOLD TIME DOWN BUTTON	x	While in this F code, press and hold the time-down button to reset all F codes to default.
F27	Scroll Speed	100 to 500	150	ms	Controls text scrolling speed

F code	Description	Possible Values	Default	Unit	Notes
F28	Pilot Arc Extension	0 to 10	0	ms	This is the time the control will wait to start the main arc after establishing a stable pilot arc.
F29	Chuck Change Counter	OFF to 1000000	OFF	Welds	Increments by 1000; Press down key until value equals OFF to disable. This function counts down and turns the chuck change indicator ON when it reaches zero.
F30	Short Cycle Mode	OFF ON	OFF	X	Turn this on to limit weld time to 100ms. This is automatically turned on when 'stud feed' is enabled, but not automatically turned off. Changing this mode affects other F codes. See section on 'which F codes change automatically'.
F31	Drop Time	0 to 100	35	ms	This is a drop time measurement function THAT DOES AN ACTUAL WELD . If F48 (Drop Time Configuration) is in either Manual or Auto mode, the measurement taken during the weld (while viewing this function) will be stored in this function and used in weld timing. The measured value may be overridden by using the arrow keys. This value changes automatically depending on F30 (short cycle mode) and the gun interface installed in the unit.
F32	Weld Results	I= Current (Amps) V= Voltage (Volts) tM=Main current time (ms) E= Energy (Joules) tD=Drop Time (ms) tP=Pilot Time (ms) Pass \ Fail indicator Cable Resistance (milliohms)	NA	x	This F code gives information about the last weld. To save these weld results as the target (for weld comparison), press and hold the 'Lock' key. To clear targets, exit to time \ current mode and click the 'Lock' key + the desired preset key at the same time. For the main preset (no preset), use the 'Lock' key + the time-down arrow key.

F code	Description	Possible Values	Default	Unit	Notes
F33	Disable Welding on Weld Error	OFF ON	OFF	X	Turn this on to disable welding when a weld error occurs or when a weld is out of specified weld energy \ drop time range. Flashes 'WELD ERROR!' and requires a password to continue. Password is 123456 by default, but can be changed to any number up to 9 digits. Use lock mode 2 or 3 to set the password.
F34	Drop Time Tolerance	0 to 1000	100	ms	This defines the tolerance allowed from target weld drop time for determining good/bad weld.
F35	Weld Energy Tolerance	1 to 20	10	%	This defines the tolerance allowed from target weld energy for determining good/bad weld.
F36	Process Monitor Error Code on Failed Weld	OFF ON	OFF	X	When enabled, an error code is given when the weld is out of tolerance.
F37	Pulse Cleaning Enable	OFF ON	OFF	X	When enabled, the weld current will pulse high current and low current before the weld.
F38	Pulse Cleaning Threshold Voltage	0.00 to 50.00	30.00	Volts	Threshold voltage to stop pulsing and begin the main weld. When voltage is less than this value, it terminates pulsing and starts the weld.
F39	Pulse Cleaning Maximum Pulses	1 to 36	4	Pulses	Maximum number of pulses before starting main weld.
F40	Pulse Cleaning Time to Subtract for Each Pulse	0 to 500	10	ms	Time to remove from the main weld time per pulse done prior to the weld.
F41	Passing Weld Counter	0 to 4.3B	0	Welds	When process monitor is used, this holds a count of 'passing' welds. Hold the time down arrow to reset.
F42	Failed Weld Counter	0 to 4.3B	0	Welds	When process monitor is used, this holds a count of 'failed' welds. Hold the time down arrow to reset.
F43	Diagnostic Data	# Phases, PWM AVG, ABORT code, Capacitor imbalance, or Duty Cycle	# Phases	X	This gives extra diagnostic data after each weld. If the power unit is at the maximum output in voltage and current, PWM AVG will be 100%.

F code	Description	Possible Values	Default	Unit	Notes
F44	Preset Bank	0 to 3	0	Bank	This determines which preset the 0-9 buttons are accessing. By selecting the preset bank, up to 40 presets can be accessed. For example, if the preset bank is set to 0, preset button 5 will access preset 5. If preset bank is set to 1, preset button 5 will access preset 15. This F code changes automatically depending on short cycle mode and the gun interface installed in the power unit.
F45	Calibration Offset Value	0 to 250	50	X	Used by manufacturing. Do not change.
F46	Plunge Current Enable	OFF ON	OFF	X	When enabled, the current will change to the selected value while the stud is plunging.
F47	Plunge Current	50 to MAX_CURRENT	200	Amps	When Plunge Current (F46) is enabled, this current will be used during the plunge state. MAX_CURRENT will depend on the power unit model (N1500i or N800i) and power input (3 phase or single phase).
F48	Drop Time Configuration	Manual, Auto, or Average	Manual	X	In Manual mode, F31 (Drop Time Function) is the only way to configure the drop time. In Auto mode, F31 automatically gets a new value taken from the first weld done after power-up and after the gun is reconnected. In Average mode, the average of the last 10 welds' drop times are used and displayed in F31.
F49	Pulse Weld Enable	OFF ON	OFF	X	Enable this to use pulse welding, where the main current pulses to a high and low current setting at variable time settings per F codes F50-F52.
F50	Pulse Weld High Current	50 to MAX_CURRENT	300	Amps	This is the current used for as the lower of the two currents during the weld. (The front panel current setting will be the high current). MAX_CURRENT is that maximum current the unit can deliver given the power conditions and model.
F51	Pulse Weld High Time	5 to 1000	1000	ms	This is the time the weld will deliver the front panel current (F50 current).
F52	Pulse Weld Low Time	5 to 1000	1000	ms	This is the time the weld will deliver the low current.

F code	Description	Possible Values	Default	Unit	Notes
F53	Cold Plunge Prevention Enable	OFF ON	OFF	X	Enable this to continue delivering weld current beyond the same time settings if the stud does not short circuit before the weld current is scheduled to shut off. It will extend until a short circuit is detected or until 100ms passess (20ms in short cycle mode).
F54	Near Maximum Output Warning Enable	OFF ON	ON	X	Enable this to throw an error code E015 when the unit is near the maximum output power capability (>=95%)
F55	Cable \ Connector Monitor Enable	OFF ON	OFF	X	Enable this to compare each weld's cable drop to a target value. To save a target value, press the LOCK key while viewing this function. Do this after making a weld.
F56	Cable \ Connector Monitor Tolerance	1 to 100	40	%	Percentage cable resistance from the saved target value that is considered acceptable. If out of tolerance, an E016 error will be generated.
F57	Lock Mode 4 Adjustment Percentage	1 to 20	10	%	Percentage the user may adjust the front panel time and current from the preset parameters while locked in lock mode 4.
F58	Keep Gun Lift Enable	OFF ON	OFF	X	Keeps the lifted after the weld for 5 seconds for the purpose of troubleshooting applications.
F59	Delay: Pilot current start to gun lift	0 to 10	0	ms	Delay from the time the gun coil is energized to the time the pilot arc is turned on.
F60	Constant Energy Enable	OFF ON	OFF	X	Enable this to deliver constant energy to a weld referenced by a target weld (stored as a preset).
F61	Pulse Cleaning Contaminant to Be Cleaned	Zinc or Galvanized to Primer Paint, Oil or Oxide	Primer Paint...	X	Use this function to designate how the pulse cleaning function determines aborts pulsing and begins the main arc. Select 'Zinc \ Galvanized' to start the main arc when the sensed voltage is above the threshold set in F38.
F62	Gun as Remote	OFF ON	OFF	X	Enable this to make the gun select presets based on the gun trigger as an input. Press and hold the gun trigger 2 seconds beyond the lift check to increment presets within a preset bank.

F code	Description	Possible Values	Default	Unit	Notes
F63	Pecker Mode	0 to 20	0	# of Pecks	Increase the number of pecks to perform a series of lift-plunge actions prior to the weld. The inverter will attempt a weld as soon as it detects contact between the stud and work piece or after the number of pecks is performed. When zero, pecking is disabled.
F64	Fieldbus Selection	OFF, Van Rob, Ford, GM	OFF	X	For automated systems, select the appropriate fieldbus selection to determine the IO map and sequence of signals. For standard mode, disable this F code.
F65	Weld Complete 24V Signal	OFF ON	OFF	X	For automated systems, this output signal is given after each weld to indicate that the weld was successful. The signal is 24VDC (unregulated), active high, 500ms long.
F66	Diagnostic Mode	0 to 4	0	X	Factory use only.

Other features:

- To enter/exit demo mode, press 1,2, and 3 simultaneously. This will disable welding and flash LEDs.

3.2 Diagnostic Error Codes

Error Number	Error Display	What this really means	Fatal – meaning you have to power down to reset. Otherwise, you weld again to reset.	Likely problem
E - - -	E - - -: NO ERRORS	Really, no errors.		NA
E001	SHORTED CONTROL CABLE- FIX CONTROL CABLE AND/ OR GUN	The gun control cables were shorted or the gun coil resistance is too low.		Shorted cable-external wiring problem in the gun circuit -See troubleshooting-
E002	BROWNOUT CONDITION - CHECK PRIMARY VOLTAGE	The input voltage dipped low enough to drop out auxiliary supplies. Welding is stopped until power is restored so as to prevent internal damage.		Brown out on input power line E002(A) Brownout while idle E002(B) Brownout while welding -See troubleshooting-
E003	CAPACITOR VOLTAGE IM- BALANCE	The capacitors could not be balanced for some unknown reason. The difference between the caps is greater than 10% (usually around 30V).		Remove the upgrade to v1.02 software -See troubleshooting-
E004	REGULATION ERROR-ARC WENT OUT	The control sensed that the current was more than 50% low and the control is applying the maximum allowable pulse width for 10ms.		Current sensor wiring or extremely high load -See troubleshooting-
E005	REGULATION ERROR- SHORT CIRCUIT-COULDN'T CONTROL CURRENT	The control sensed that the current was more than 50% high and the control is applying the minimum allowable pulse width for 10ms.		Current sensor wiring or dead short circuit -See troubleshooting-
E006	INPUT VOLTAGE TOO HIGH	This happens if the capacitor voltage exceeds 470V during bootstrap process.	x	Input voltage is too high -See troubleshooting-
E007	INPUT VOLTAGE TO LOW	On boot-up only, after closing the charge relay, the caps have 10 seconds to get the proper voltage.	x	Incorrect voltage setting or broken/bad V-F signal from one or more switch boards. -See troubleshooting-

Error Number	Error Display	What this really means	Fatal – meaning you have to power down to reset. Otherwise, you weld again to reset.	Likely problem
E008	PRIMARY OVERCURRENT ERROR	A primary overcurrent occurred.	x	On-board control PCB failure -See troubleshooting-
E009	NO GUN LIFT DURING PILOT ARC PERIOD	The gun did not lift within the pilot arc period		Shorted gun control cable, mechanical binding of the gun, pilot arc pcb failure, or excessive contaminants on work surface. -See troubleshooting-
E010	CAPACITOR VOLTAGE COULD NOT BE READ	The sensed capacitor V-F signal is not within the acceptable bounds.		Check V-F signal from Switch Boards -See troubleshooting-
E011	UNIT TOO HOT PLEASE WAIT	The thermal sensor was tripped. This error will disappear when the sensor resets.		Thermal sensor on output PCB heatsink has been activated. Wait for it to cool down. -See troubleshooting-
E012	SHORT CIRCUIT- CHECK GUN LIFT SETTING	If a short circuit was detected for at least 100ms, the weld aborts to protect the power unit.		Check the gun lift setting. Under normal welding conditions, this should not happen. -See troubleshooting-
E013	WELD FAILED –OUT OF TOLERANCE	The last weld was out of tolerance from the target weld by weld energy or drop time.		The error display will determine and display the offending parameter. Change the weld wetup accordingly. -See troubleshooting-
E014	NO STUD HIT DETECTION	The stud is expected to hit the workpiece after the gun coil is de-energized, but before the main current is turned off. If it is not detected, this error will occur.		Incorrect weld parameter setup. Check drop time, weld time, and plunge time. Press LOCK button to clear error. -See troubleshooting-

Error Number	Error Display	What this really means	Fatal – meaning you have to power down to reset. Otherwise, you weld again to reset.	Likely problem
E015	WARNING - NEAR MAXIMUM WELDING OUTPUT CAPACITY	If the unit is delivering 95% of the maximum power capacity, it will display this warning. It will not damage the unit to operate at this level, but is intended to inform the user. If the output voltage is at the maximum (due to long or small cables, high lift), the actual current may start to drop below the desired current. This warning can be disabled using F54		Small weld cable, long weld cable -See troubleshooting-
E016	WARNING - CHECK WELD CABLES AND CONNECTORS - PRESS LOCK TO CLEAR	The measured cable \ connector voltage drop was out of tolerance from the target setting. Check the cables and connections.		Loose connection in weld circuit. -See troubleshooting-
E017	PILOT ARC BLEW OUT DURING PILOT STAGE	Arc voltage was detected to have been higher than 60V after the gun lifted, which is too high to still have an arc.		Debris on the work material.
E018	WARNING - DROP TIME IS TOO LONG FOR SHORT CYCLE	The configurations of the drop time(F31) and the front panel time make it such that the pilot arc supply must be on for more than 40ms. The maximum time the pilot arc will stay on is 40ms, so it is possible the arc will go out before the main arc starts. For consistent welds, reconfigure the drop time and \ or front panel time to satisfy the equation		F code \ Front panel configuration
	ADDITIONAL WARNING - WAIT ON UPPER DISPLAY AND CYCLE OR CAP ON LOWER DISPLAY	1. Weld duty cycle is exceeded 2. Switch board out of calibration 3. Switch board malfunction	X	1 of 3 reasons. -See troubleshooting-

3.2.1 Notes on which F codes change automatically

4-Wire Gun Interfaces

Action	Result	F31 - Drop Time	F2 - Plunge Short Circuit On-Time	F44 - Preset Bank	F30 - Short Cycle Enable	weld max	weld min	Other Notes
F30	Short Cycle Mode = ON	7ms	20ms	2 (Short Cycle Values)	-	100ms	5ms	Limits Stud Expert studs, Limits presets to 100ms max weld time.
F30	Short Cycle Mode = OFF	12ms	20ms	1 (Drawn Arc Metric Values)	-	1000ms	100ms	Limits Stud Expert studs, Limits presets to 100ms min weld time.
F12	Sud Feed Enable = ON	-	-	-	ON	-	-	

2-Wire Gun Interfaces

Action	Result	F31 - Drop Time	F2 - Plunge Short Circuit On-Time	F44 - Preset Bank	F30 - Short Cycle Enable	weld max	weld min	Other Notes
F30	Short Cycle Mode = ON	35ms	20ms	2 (Short Cycle Values)	-	100ms	5ms	Limits Stud Expert studs, Limits presets to 100ms max weld time.
F30	Short Cycle Mode = OFF	35ms	100ms	0 (Drawn Arc English Values)	-	1000ms	100ms	Limits Stud Expert studs, Limits presets to 100ms min weld time.
F12	Sud Feed Enable = ON	-	-	-	ON	-	-	

For firmware version 1.06 and higher.

3.3 Weld Process Problems

Problem	Possible Cause	Solution
Weld appears "hot"	Time setting or current setting is too high.	Check the stud burn-off. If the burn-off is much greater than what is typical for that diameter stud, the time and current settings may not be correct. Ensure proper current and time settings are being used. Reduce the current setting and perform weld inspections.
	Plunge is too short.	Plunge is measured by the amount of stud protruding beyond the bottom edge of the ferrule. Ensure proper plunge settings are being used, and correct, if necessary.
	Incorrect ferrule.	Ensure that the ferrule being used in the welding process is the proper ferrule for the stud size and application.
	Plunge dampening is too great.	If the gun is a Heavy Duty gun, it is equipped with Tranquil Arc®. Back out the clear plastic plunge dampener housing to decrease the free travel.
	Time setting or current setting is too low.	Check the stud burn-off. If the burn-off is much less than what is typical for that diameter stud, the time and current settings may not be correct. Ensure proper current and time settings are being used.
	Incorrect ferrule.	Ensure that the ferrule being used in the welding process is the proper ferrule for the stud size and application.
Weld appears "cold"	Inconsistent gun lift.	Perform a Lift Check. Ensure proper lift settings are being used. Correct the lift to the proper setting if the lift is improperly set. Perform weld inspections.
	Inconsistent gun lift.	Perform a Lift Check, several times. Ensure proper lift settings are being used. If lift results are inconsistent, disassemble and clean the gun.
	Too much plunge.	Plunge is measured by the amount of stud protruding beyond the bottom edge of the ferrule. Ensure proper plunge settings are being used, and correct, if necessary.