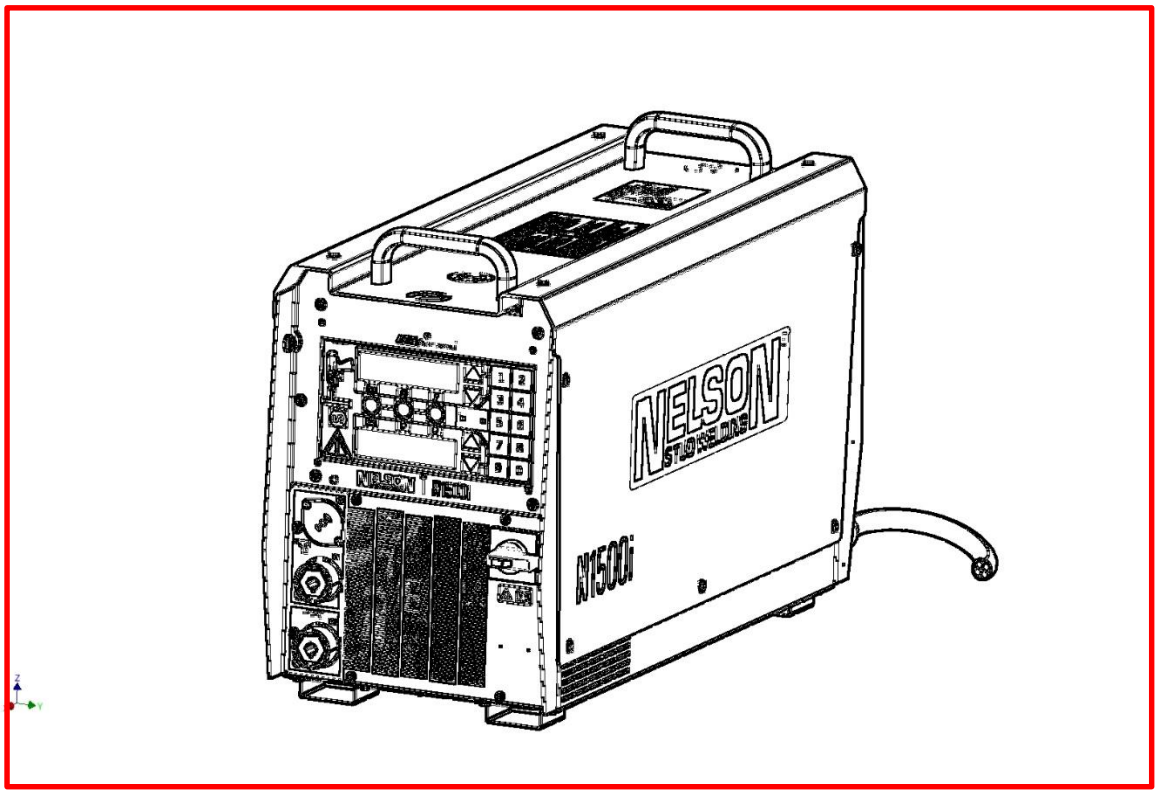
Operating the N1500i FACS Stud Welding System



Operations Manual

(729-110-053)

For Dot Matrix Units Software Version 1.00 and later

CAUTION

These instructions are for experienced operators. If you are not fully familiar with the principles of operation and safe practices for arc welding equipment, we urge you to read AWS SP -"Safe Practices" available from the American Welding Society. **Do not permit untrained persons to install, operate or maintain this equipment. Do not attempt to install or operate this equipment until you have read and fully understand these instructions.** If you do not fully understand these instructions, contact your supplier for further information. Be sure to read the Safety section before utilizing this equipment. .

Part No. 729-110-053 V.1.03

INVERTER LIMITED WARRANTY

Nelson's only warranty is that goods being sold will be free from defects in workmanship and material. This warranty is expressly in lieu of other warranties, expressed or implied and whether statutory or otherwise, including any implied warranty of merchantability or fitness for a particular purpose.

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, whichever comes first. No compensation or reimbursement for transportation costs of any kind will be allowed.

Please note that this warranty does not extend beyond the original registered purchaser, and does not warrant equipment that has been modified by any party other than Nelson, or equipment that has been improperly installed, improperly operated, or misused based upon industry standards, or equipment which has not had reasonable and necessary maintenance, or equipment which has been used for operation outside of specifications for the equipment. Nelson shall never be liable for consequential damages.

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, cuff-less 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 rubber soled 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 manufacture'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

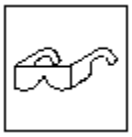
Prolonged Noise from Capacitor Discharge welding applications can damage hearing if levels exceed limits specified by OSHA. Therefore:

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

Contents

1. Connection and Installation

1.1 Installation Precautions

The welder must be installed on a 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 welder.

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

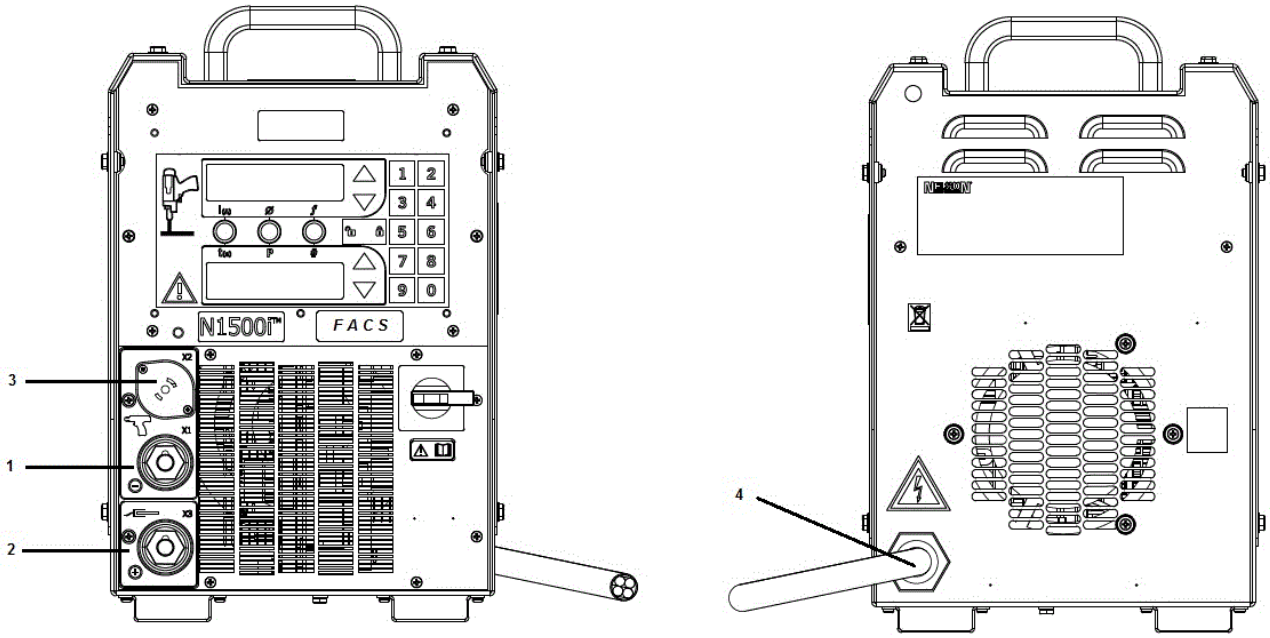
The N1500i must be adequately protected against the intrusion of liquids. It may not be installed on liquid-bearing pipelines.

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	3. Control cable connection (X1)
2.Welding cable connection (+) X3	4. 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!

1.2.1Input Connection

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!

The N1500i may be operated with an input power voltage of 200-230VAC/50/60Hz or 400-460VAC/50/60Hz as configured by the reconnect terminal blocks internally. The 575V unit cannot be configured this way. See rating plate on the back of the unit.

NELSON STUD WELDING

Nelson Stud Welding, Inc
7900 West Ridge Rd,Elyria,OH 44035 USA

Part Nr.
Serial Nr.

Type: 1500I

3~

OUTPUT @ 3 PHASE INPUT

DUTY	AMPS	VOLTS
6%	1500	40
9%	1200	40
12%	1000	40
100%	120	40

FOR SINGLE PHASE OPERATION SEE MANUAL

INPUT - 3 phase 50/60 Hz

INPUT VOLTS	200-230	400-460	575
FUSE	60	30	25
I ph,MAX	183	94	75
kVA MAX	73	75	75
Iph,eff	58	30	24
kVA eff	7.3	7.5	7.5

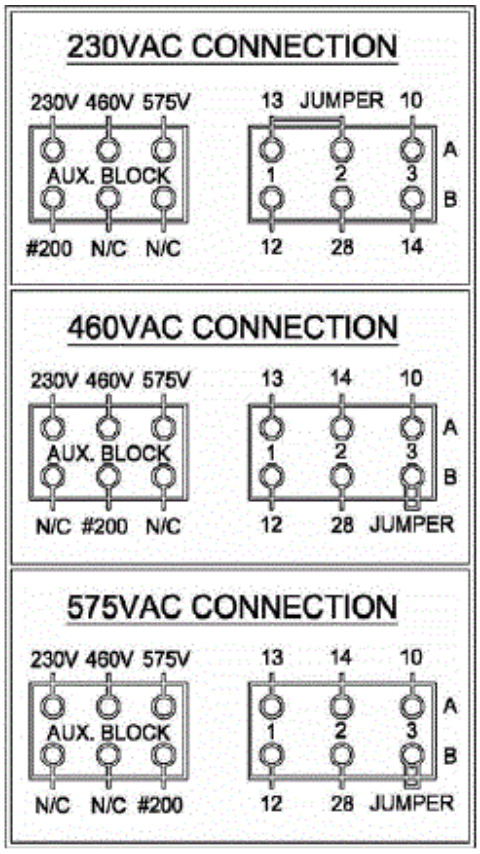
1.2.2 Single Phase Connections

- 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!

The diagram below shows the jumper positions needed for various input voltages (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

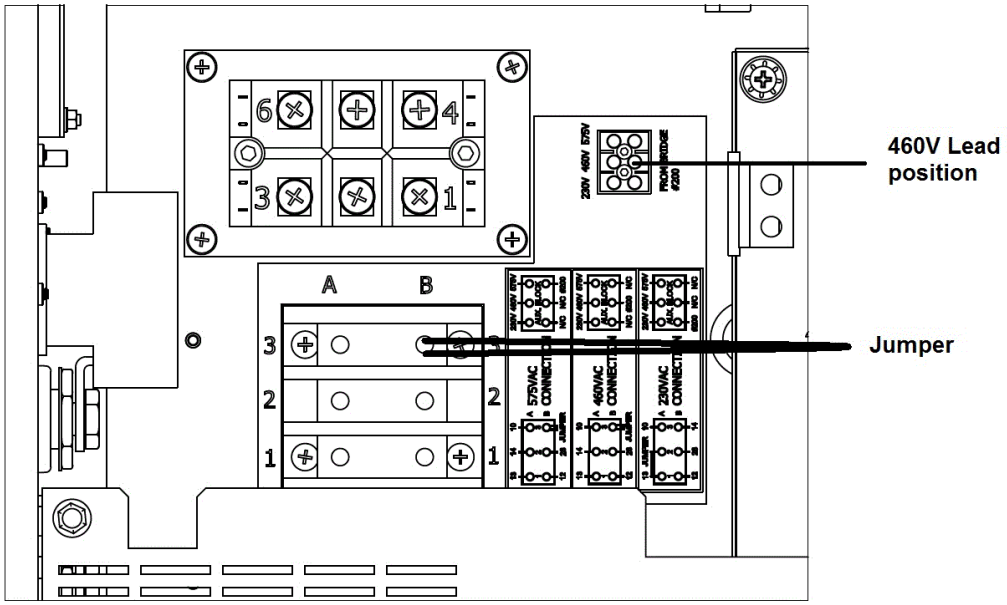
- Make sure unit is disconnected from main power.
- Move lead #200 at small aux. block per graphic for desired voltage.
- Move jumper and lead # 14 on large terminal block per graphic for desired voltage.

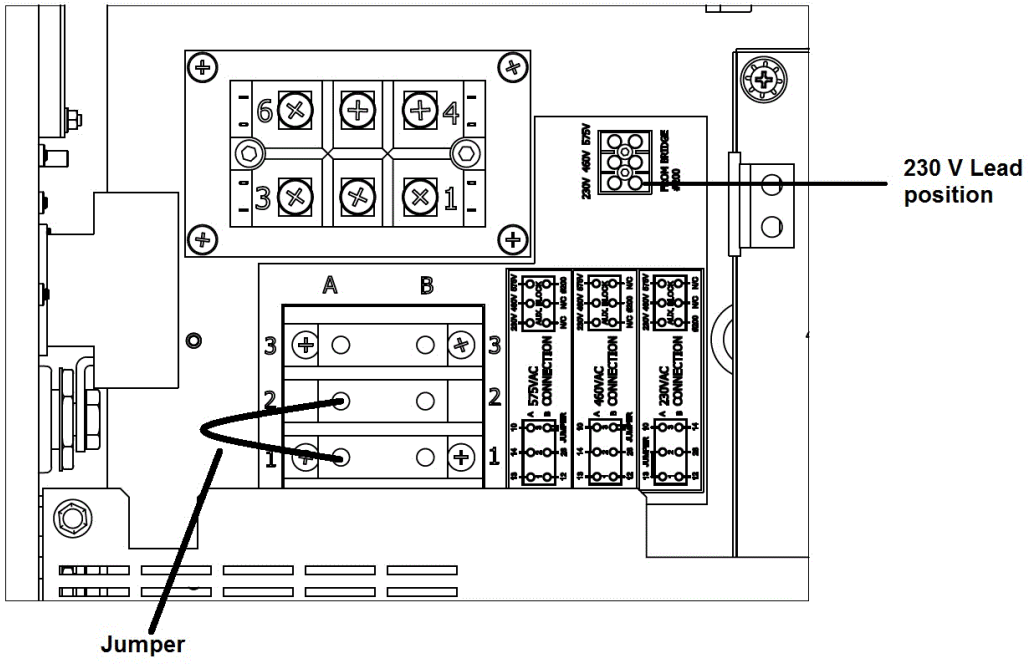
(See photo on next page.)

Voltage Connect Section *575V Not Shown

Jumper & Lead

460 VAC Connection

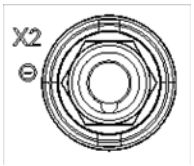




230 VAC Connection Jumper is installed between 1 and 2 on large terminal block (small terminal block, lead moves to end position)

1.2.4 Connection of the Gun Weld 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.



Gun Weld Cable Connection (X2)

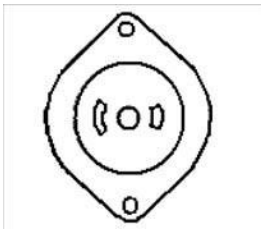
Connect the welding cable plug of the gun to the welding cable socket of the N1500i.

The connection must be secured by a full clockwise turn of the welding cable plug.

1.2.5 Connection of the Control Cable

The female control cable socket accepts the male control cable plug of the gun. The signals to control the gun are transmitted via the control cable.

Mating with the weld gun to be connected, the standard control cable socket on the Nelweld N1500i is 2-pole. An optional 4-pole connector is also available to mate with similarly equipped weld guns.



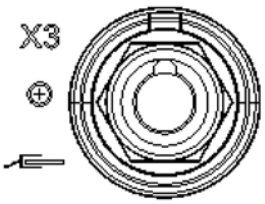
Control Cable Connection (X1)

Silver Pin: White Wire
Brass Pin: Black Wire

1.2.6 Connection of the Workpiece Weld Cable

The welding current returns through the workpiece ground cable, which must be connected to the workpiece ground cable socket of the Nelweld N1500i.

Workpiece Weld Cable Connection (X3)



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

The connection must be secured by a full clockwise turn of the workpiece 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 shielding gas (Option)

Prerequisites:

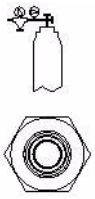
The Nelweld N1500i has an optional shielding gas valve combination kit that can be factory or field installed.

The connected weld gun needs to be equipped with the optional special equipment for shielding gas.

Standard Mode:

When the gun with manual stud-loading is connected, the tubes from the gas source and the weld gun must be directly connected to the Nelweld N1500i.

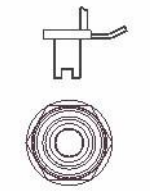
Connection of the shielding gas source:



Shielding gas is provided by the marked coupler plug.

The tubing system with coupler socket (optional) must be pushed into the coupler plug to lock it into place.

Connection of the gun:



The tubing system to the weld gun or to the feeder must be connected to the coupler socket.

The tubing system with coupler plug (optional) must be pushed into the coupler socket to lock it into place.

Should the gas tubes be removed by pressing/pulling the release ring, the self-sealing coupler sockets prevent any shielding gas from escaping.

	**Warning!** Prior to commencing work, the shielding gas tubes must be checked for leaks!

Note!

Use Nelson gas foot to save gas consumption.

1.2.8 Connection of the workpiece

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

1. The workpiece 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 workpiece may, or may not, be connected to earth ground. This will vary with the user's location/facility. A connection from workpiece to earth ground may exist and yet not be visible or apparent to the user.
3. If possible, place the workpiece ground terminals at the same distance from the point of welding when two ground clamps are used.

Note!

Prior to connecting the workpiece ground terminals, the following advice on avoiding arc blowing should be observed.

1.3 Arc Blowing Effect

Blowing effect is the designation for the lateral (sideways) deflection of the arc from a centered position on the end of the stud. Depending on the cause, a distinction is made between the following blowing effects.

Thermal blowing effect:

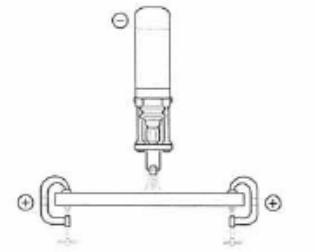
- Deflection of the arc as a result of the expansion and turbulence of heated gases in the combustion area of the arc.

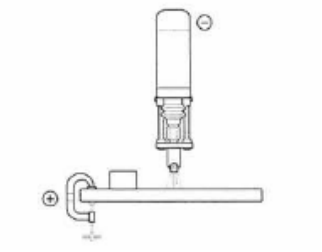
Magnetic blowing effect:

- Deflection of the arc as a result of the influence of magnetic or electromagnetic fields.

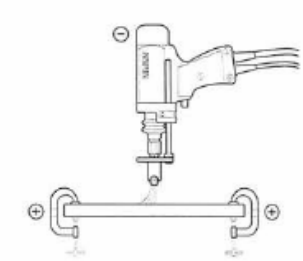
To reduce the thermal blowing effect, strive for precise centering of the stud and chuck.

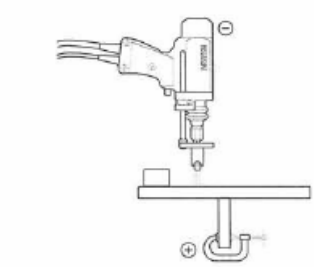
Several remedial measures are available to reduce the magnetic blowing effect, some of which are indicated below.





In order to favorably influence the arc, the work piece ground terminals must be placed as symmetrically as possible to the point of welding.	In the event of a one-sided work piece ground terminal, the arc blows away from the terminal. This condition can be eliminated by additional metal plates.

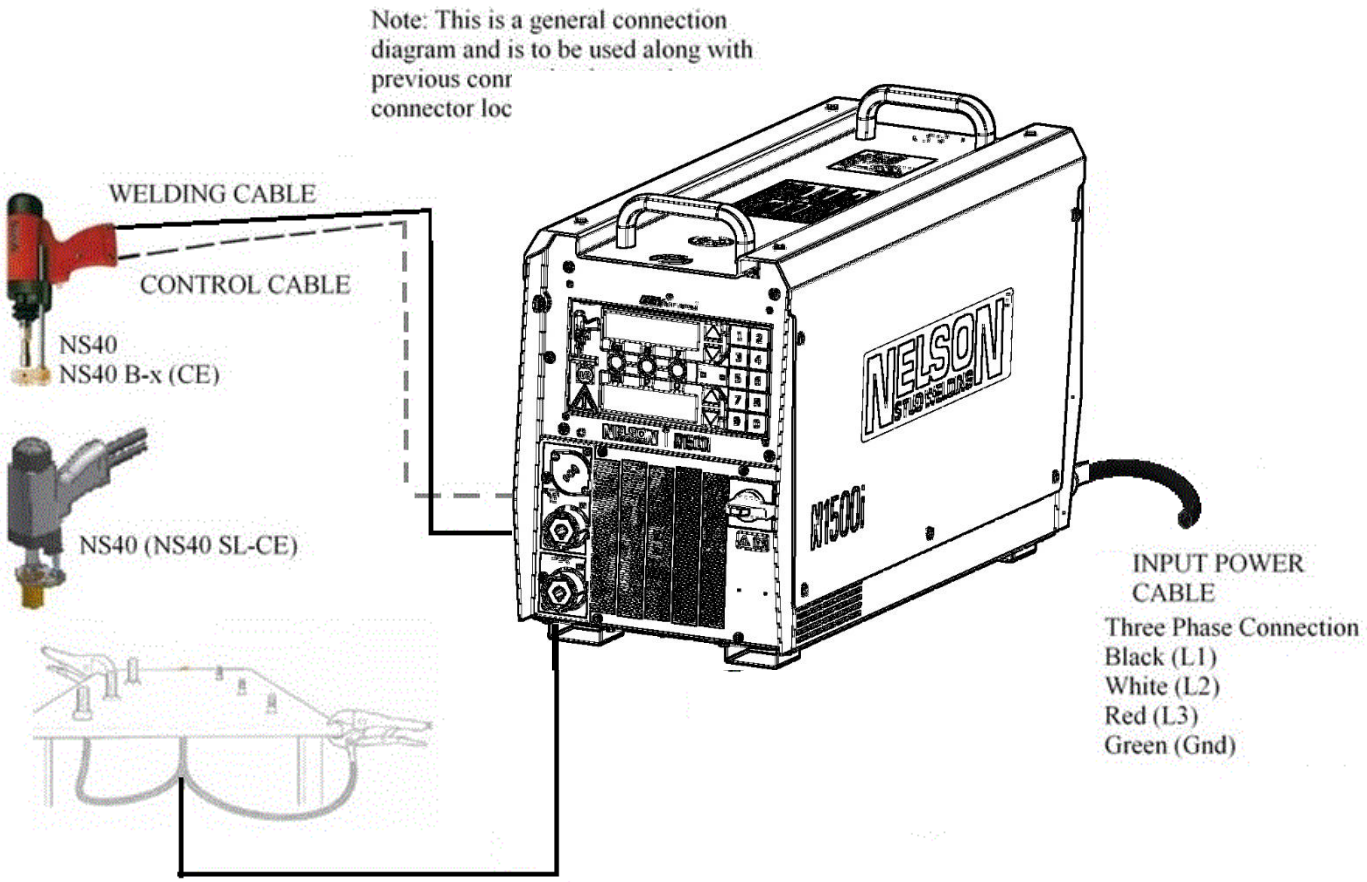




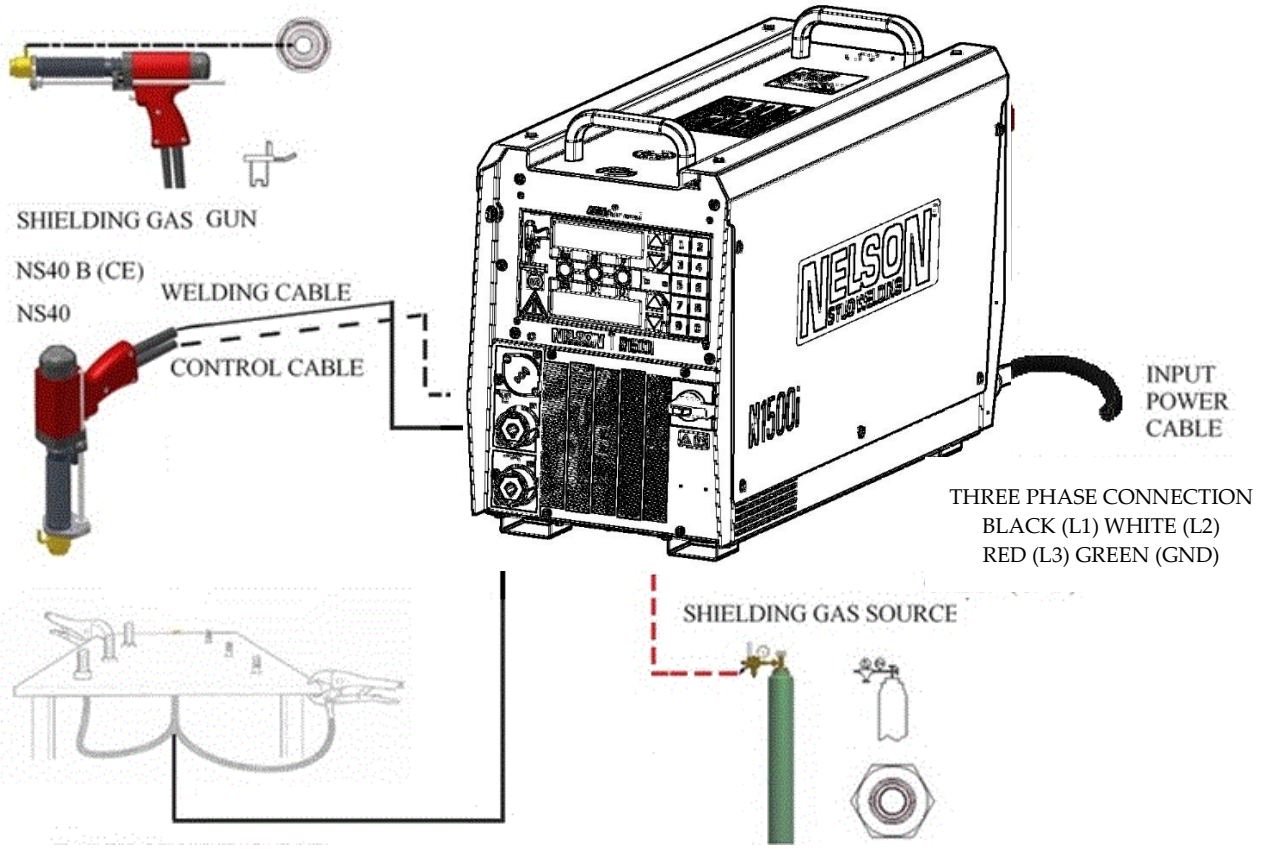
Influence on the arc from the welding cable itself can be minimized by turning the weld gun through 90°.	When welding sections, arc blowing can be reduced by repositioning the work piece ground terminal and additional metal plates.

\+ *The polarity in the illustration refers to ferromagnetic materials. When welding aluminum, attention must be paid to reverse polarity.*

1.4 Connection Diagram Short-Cycle and Drawn Arc Welding



Note: This is a general connection diagram and is to be used along with previous connection instructions as connector locations will not match.



1.5 Additional Cautions

SELECT SUITABLE LOCATION

The N1500i will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

The machine must be located where there is free circulation of clean air such that air movement in the back, out the sides and bottom will not be restricted.

Dirt and dust that can be drawn into the machine should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.

Keep machine dry. Shelter the unit from rain and snow. Do not place on wet ground or in puddles.

Caution!

DO NOT MOUNT OVER COMBUSTUBLE SURFACES. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least 1.6mm (.063 inches) thick, which shall extend not less than 150mm (5.9 inches) beyond the equipment on all sides.

STACKING

- N1500i cannot be stacked.

TILTING

- Place the machine directly on a secure, level surface or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

INPUT AND GROUNDING CONNECTIONS

- Only a qualified electrician should connect the N1500i. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and info detailed below.
- When received directly from the factory, 230/460V machines are internally connected for 460VAC. 575V machines are internally connected for 575V from the factory.
- Open the access panel on the rear of the machine.

POWER CORD CONNECTION

- A power cord is provided and wired into the machine. Follow the power cord connection instructions.

TROUBLESHOOTING WITH COVER OFF

- Do not remove the transparent safety shield inside of welder's top cover, unless absolutely necessary. The N1500i's internal heatsinks carry HIGH VOLTAGE.

Caution!

Incorrect connection may result in equipment damage!

1.6 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	150	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 Specification	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
Unit Length: 28in (71cm)	Storage Temperature: -40 to +60 Degrees c
Width: 10.7in (27cm)	*Efficiency at rated output*: 88%
Open - Circuit Voltage: 75V	Max Lift Height 0.098" (2.5mm) @ +/- 10% rated voltage

1.7 Generator Sizing

Generator Sizing

The N1500i may be supplied with a generator with the following characteristics:

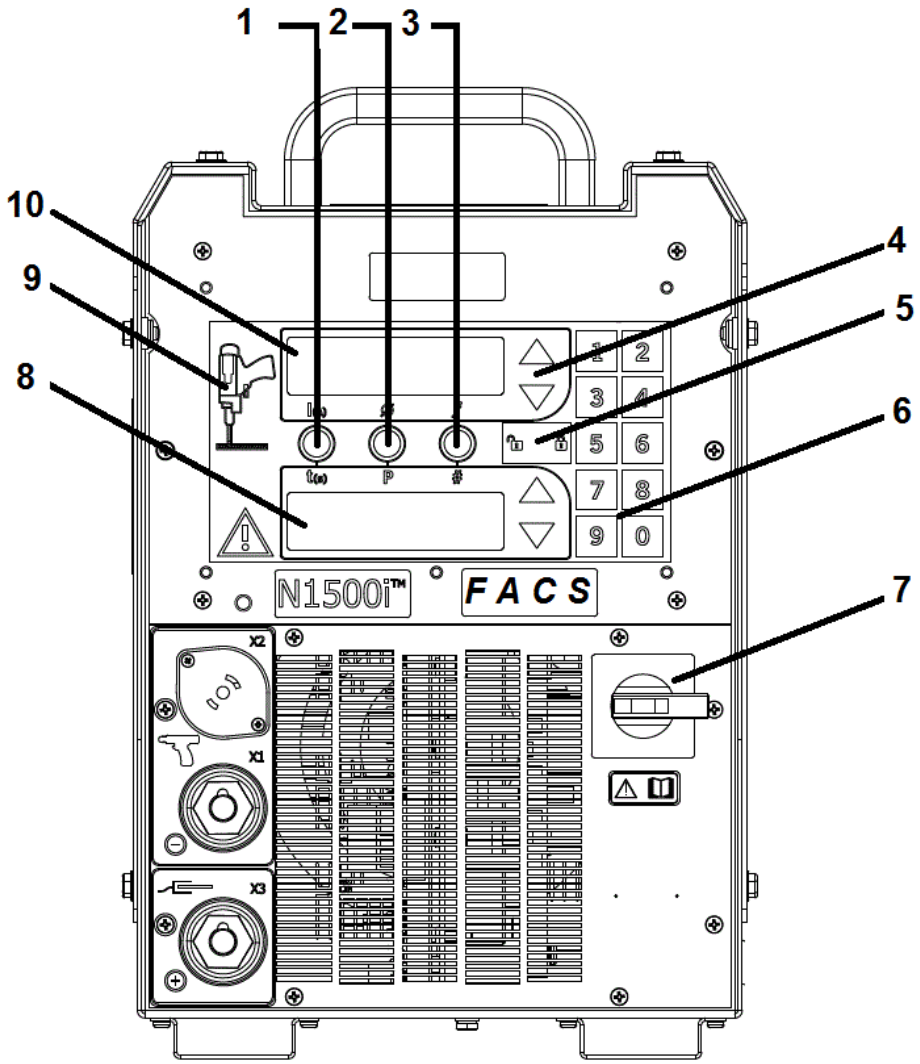
- **Full Power 1500A -** For 1500A weld current using more than 25 ft 4/0 weld cable: Use a 100kW (125 kVA) with at least +/- 1.5% regulation from no-load to full-load, and less than 5% THD wave form distortion to get the full output current.

- **Economy 1500A -** For 1500A weld current using less than 25ft 4/0 weld cable: Use a bare minimum 68kW(85kVA) generator, with at least +/- 1.5% regulation from no-load to full-load, and less than 5% THD waveform distortion.

- **Smaller Studs -** For 800A or less weld current with maximum cable load: Use a 55kW (66kVA), with at least+/-1.5% regulation from no-load to full load, and less than 5% THD waveform distortion.

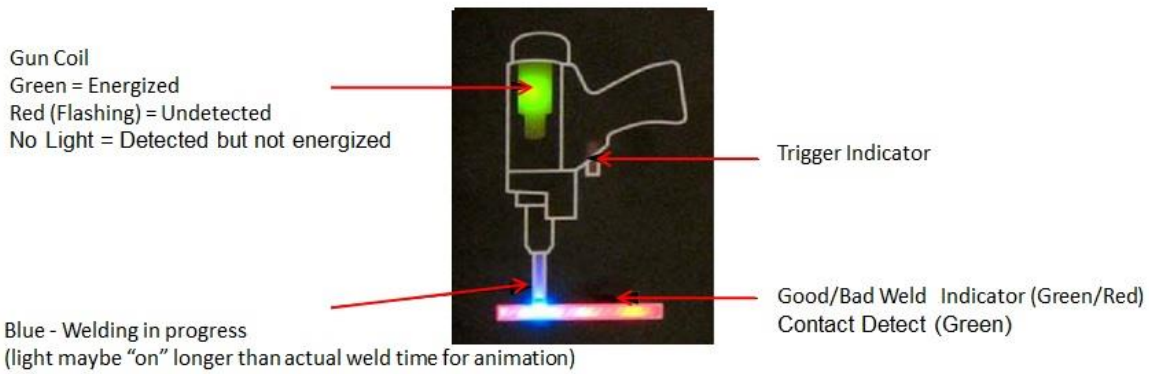
Generators without published datasheets should be oversized (on the order of 125% of what is suggested here) to insure against the possibility of poor voltage regulation by the generator during the heavy pulse loads required when performing stud welds.

2. FACS Dot Matrix User Interface



1	Time/Current Mode	Enables Time/Current weld parameter selection.
2	Stud Expert Mode	Setup selection by stud diameter and other process parameters, 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 4.1.
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.
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	Weld Tool Icon	Graphical representation of gun operation and welding process. (see below for more information)
10	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.

Weld Tool Icon



3. Operation

3.1 Stud Welding Recommendations

Please review the following stud welding recommendations before operating this equipment. They contain information important to achieving good welds.

1. Welding components and workpieces need to be suitable for welding. Only use material combinations which are specified in the operating and service instructions.
2. The welding zone should be smooth and have a bright, metallic finish. Care must be taken not to exceed a welding zone coarseness of 80µm.
3. Impurities in the welding zone such as rust, forging scales, moisture, grease and oils need to be removed prior to commencing welding. Anodized workpiece surfaces must be ground to remove anodizing from weld zone.
4. Workpieces made of aluminum or workpieces with aluminum coating may only be cleaned with a stainless wire brush or scraper to prevent contamination of the aluminum surface.
5. Workpiece should be stationary, and free of vibration. (particularly important in case of large and thin-walled workpieces).
6. Chlorous solvents must be removed from the welding zone. They may not be exposed to the arc radiation.
7. Poor welding quality as a result of arc blow can be avoided by careful grounding techniques, such as using multiple grounding clamps, and symmetrically positioning the grounding clamps.
8. Ensure that there is solid contact (low resistance) in all connection points in the welding circuit (welding cable connections – chuck – grounding clamps).
9. Lay out the welding and workpiece ground cable without loops or snarls to minimize unwanted electromagnetic effects.
10. Check the settings of the N1500i welding unit, and the setup of the connected gun.
11. During the brief stud welding process, maintain the position of the weld gun and the workpiece.
12. Welding on one workpiece with several welding units should be avoided, if possible. If welding on one workpiece with several welding units cannot be avoided, it is not recommended to weld simultaneously.
13. TIG welders are known to generate high frequency electrical interference, and so they must not be used on the same workpiece as the N1500i.

3.2 Basic Setup Procedure

Setting up the N1500i unit is very easy, once the proper electrical connections and gun connections are established:

1. Turn the main power switch on the front of the unit to the "on" position. Wait for the unit to complete its startup sequence.
2. Set the desired current and time settings using one of the following 3 methods:
3. Push Time/Current Mode button (3 in the Front Panel section), and up/down buttons (8) to adjust time and current discretely.
4. Push Stud Expert (TM) Mode button (9 in the Front Panel section), and up/down buttons (8) to adjust stud diameter and weld position (or another process condition) and the welder automatically sets the weld current and time using a database.
5. Push one of the 10 preset buttons (11 in the Front Panel section) to choose one of the factory presets (see next section factory pre-set table).
6. Save any set points, if desired.
7. Adjust other settings by accessing the proper function.
8. Perform a lift check to verify proper gun lift.
9. Lock the unit, if desired.
10. Perform test welds to verify the correct welding settings.
11. After establishing proper setup, production welding may begin.

3.3 Weld Parameters

You can set welding parameters on this unit in 2 ways:

1. Directly set the current and time values.
2. Use the Stud Expert mode based on stud diameter.

3.3.1 Setting Weld Current and Reading the Weld Current Display

The weld 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 the 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 that is much longer than the set value - e.g., the sum of the front panel time and F2 (short circuit on-time) - then a cold plunge may have occurred, which can result in a bad weld. If this condition persists, it is recommended to perform a gun calibration to set the F31 value, and check the physical condition of the gun for any possible cause which could have prevented a normal drop.

If the actual weld time is much less than the front panel time, then it means that the arc shorted early. This could indicate an improper gun lift setup.

When the display shows WAIT when the trigger is pulled, it means the rated duty cycle was exceeded during operation (or other fault condition, see Section 4.2). 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 current setting and the actual current will be the same or very close. 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 weld cables having a small diameter, or cables that are excessively long.

3.3.2 Setting the Weld Time and Reading the Weld Time Display

The time setting is shown 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 are 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 or very close. 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.

3.3.3 Lift distance and plunge distance parameters

- These mechanical parameters must be set on the connected NS40 or 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.

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: maximum of 2mm lift.
2. The plunge also needs to be appropriately set.
3. When the E009 error appears, the lift and plunge settings 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, then consult your Nelson Rep.

3.3.4 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 then weld a stud. During this weld, the actual gun speed is measured, and the actual drop time is then displayed in F31.

When you display F31 on the front panel and make a weld, F31 should automatically update with the actual drop time from the new weld. The newly updated F31 value should match with t_D in F32. Another way is simply read t_D in F32 from the 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 = t_M in F32 - t_D in F32.

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

Special cases:

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

In each case, F31 does not update. F32 (t_D) shows each of these cases in text. If the arc shorts out 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 arc shorts out 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.

3.3.5 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.

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 depend on the selected weld method (short cycle, drawn arc).

3.3.6 Recommended Weld Parameters

The values specified in the tables and diagrams must be used only as guide values, which were developed under optimized welding conditions.

The best possible weld parameters will 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.

The trial welds will allow qualification of weld parameters which factor in the real conditions in the current production process.

Upon suspicion of faulty welds, the settings on the welding unit and the weld gun should be reviewed.

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.

3.3.7 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 (Drawn Arc)

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

Nelson Stud Type	Stud Diameter (inches)	Current (Amps)	Time (ms)
Drawn arc stud	3/16	300	150
Drawn arc stud	1/4	450	170
Drawn arc stud	5/16	500	250
Drawn arc stud	3/8	550	330
Drawn arc stud	7/16	675	420
Drawn arc stud	1/2	800	550
Drawn arc stud	5/8	1200	670
Drawn arc stud	3/4	1500	840
Drawn arc stud	3/4	1500	840
Drawn arc stud	3/4	1500	840

3.3.8 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, workpiece 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.

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

3.3.9 Parameter for drawn arc procedure

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, prevent welding, and E011 will be displayed on the front panel. The welder will resume normal operation, and allow welding, once the temperature has returned to its safe operating range.

Drawn Arc Welding

*Assuming 3 phase input power and a short circuit on - time of 100ms

Stud Weld Rate Parameters listed are those used during 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

3.3.10 Stud Expert™ weld table

The following Stud Expert weld table is programmed into the welder control system. It provides automatic weld settings, based on stud type and diameter.

Note!

There are conditions that will filter the table for selection, or reveal only a subset of the table to the user.

- In the case of the N1500i, studs requiring more than 1500A of weld current will not appear in the list for selection.
- Input Power - If the maximum current on the N1500i is limited to 800A due to single phase input power, studs requiring >800A will not display in the list.

Stud	$I_{standard}$	$t_{standard}$	$I_{aluminum}$	$t_{aluminum}$	Process
3mm Pitch Base	200,	100,	100,	160	Drawn Arc
3mm Full Base	220,	100,	110,	170,	Drawn Arc
3mm IS-Bolzen	200,	150,	200,	150,	Drawn Arc
3mm SC-Bolzen M3	400,	15,	400,	15,	Short Cycle
3/16” Pulse	160,	200,	160,	200,	Drawn Arc
3/16" Pitch Base	280,	140,	150,	230,	Drawn Arc
3/16" Full Base	310,	150,	160,	250,	Drawn Arc

Stud	$I_{standard}$	$t_{standard}$	$I_{aluminum}$	$t_{aluminum}$	Process
4mm Pitch Base	240,	120,	130,	200,	Drawn Arc
4mm Full Base	270,	130,	140,	220,	Drawn Arc
4mm IS-Bolzen	280,	200,	280,	200,	Drawn Arc
4mm SC-Bolzen M4	500,	15,	500,	15,	Short Cycle
5mm Pitch Base	290,	140,	150,	240,	Drawn Arc
5mm Full Base	320,	160,	170,	270,	Drawn Arc
5mm IS-Bolzen	350,	230,	350,	230,	Drawn Arc
5mm SC-Bolzen M5	600,	20,	600,	20,	Short Cycle
5mm ATC M5	600,	20,	600,	20,	Short Cycle
6mm Pitch Base	340,	170,	180,	280,	Drawn Arc
6mm Full Base	370,	190,	200,	320,	Drawn Arc
6mm SD6,MR M8,S6	410,	250,	410,	250,	Drawn Arc
6mm SC-Bolzen M6	700,	25,	700,	25,	Short Cycle
6mm WTOP M6	1150,	40,	1150,	40,	Short Cycle
6mm ATC M6	730,	30,	730,	30,	Short Cycle
1/4" Pitch Base	360,	180,	190,	300,	Drawn Arc
1/4" Full Base	400,	210,	210,	340,	Drawn Arc
1/4” Pulse	200,	300,	200,	300,	Drawn Arc
7mm Pitch Base	390,	200,	210,	340,	Drawn Arc
7mm Full Base	430,	230,	230,	390,	Drawn Arc
7mm MP(F) M8	470,	300,	470,	300,	Drawn Arc
5/16" Pitch Base	440,	230,	240,	390,	Drawn Arc
5/16" Full Base	490,	260,	270,	450,	Drawn Arc
5/16” Pulse	250,	400,	250,	400,	Drawn Arc
8mm Pitch Base	440,	230,	240,	400,	Drawn Arc
8mm Full Base	500,	270,	270,	460,	Drawn Arc
8mm MR M10,S8	550,	300,	550,	300,	Drawn Arc
8mm SC-Bolzen M8	700,	25,	700,	25,	Short Cycle
8mm WTOP M8	1250,	80,	1250,	80,	Short Cycle
8mm ATC M8	920,	80,	920,	80,	Short Cycle
3/8" Pitch Base	530,	290,	280,	500,	Drawn Arc
3/8" Full Base	600,	330,	320,	580,	Drawn Arc
3/8” Pulse	300,	600,	300,	600,	Drawn Arc
3/8” Pulse TH	325,	425,	325,	425,	Drawn Arc
9mm Full Base	560,	310,	300,	540,	Drawn Arc
9mm MP(F) M10	650,	300,	650,	300,	Drawn Arc
10mm Pitch Base	560,	300,	300,	530,	Drawn Arc
10mm Full Base	630,	350,	340,	620,	Drawn Arc
10mm SC-Bolzen M10	1100,	40,	1100,	40,	Short Cycle
10mm SD10,MR M12,S10	750	350,	750,	350,	Drawn Arc
11mm Pitch Base	620,	340,	330,	600,	Drawn Arc
11mm Full Base	710,	400,	380,	720,	Drawn Arc
7/16" Pitch Base	630,	350,	340,	610,	Drawn Arc
7/16" Full Base	720,	400,	380,	730,	Drawn Arc
7/16” Pulse	375,	675,	375,	675,	Drawn Arc

12mm Pitch Base	680,	380,	370,	690,	Drawn Arc
12mm Full Base	780,	440,	420,	820,	Drawn Arc
12mm MM12, S12	950,	450,	950,	450,	Drawn Arc
12mm SC-Bolzen M12	1300,	50,	1300,	50,	Short Cycle
1/2" Pitch Base	730,	410,	390,	750,	Drawn Arc
1/2" Full Base	840,	480,	450,	890,	Drawn Arc
1/2” Pulse	450,	850,	450,	850,	Drawn Arc
13mm Pitch Base	750,	420,	400,	770,	Drawn Arc
13mm Full Base	860,	500,	460,	920,	Drawn Arc

If the vertical position is selected, selection of some studs will provide a 10% increase in current and 15% reduction of weld time from the values shown above.

3.3.11 Performing a Lift Check

The gun lift can be measured by holding the gun trigger for a few seconds:

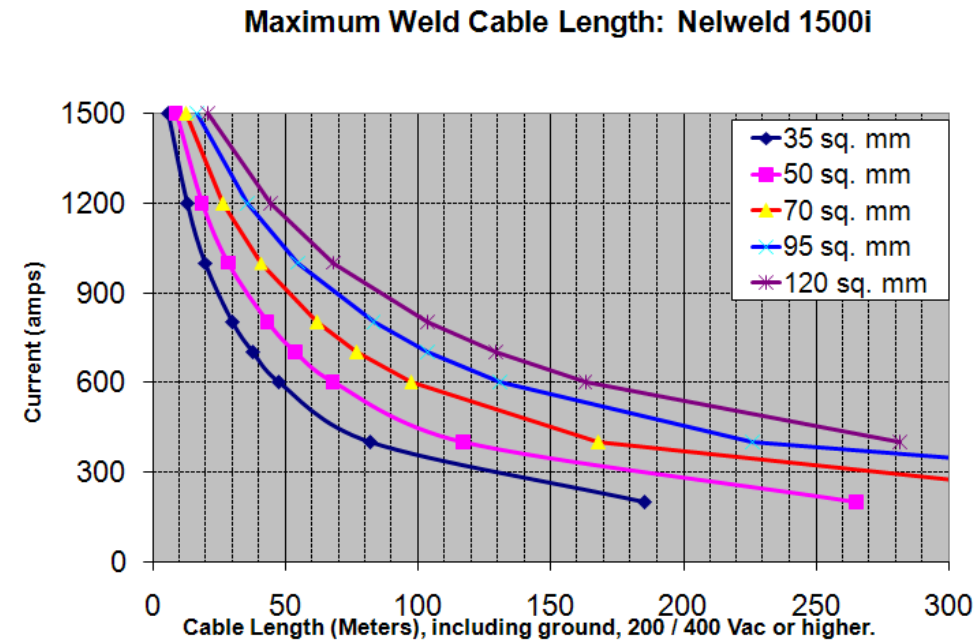
- Isolate the gun (so as not to start weld).
- Pull and hold down the trigger. The gun will lift and release for the programmed weld time. (Continue holding the trigger for 2 more seconds)
- The gun will lift for 2 seconds then release. During the 2 seconds, a manual measurement may be taken.

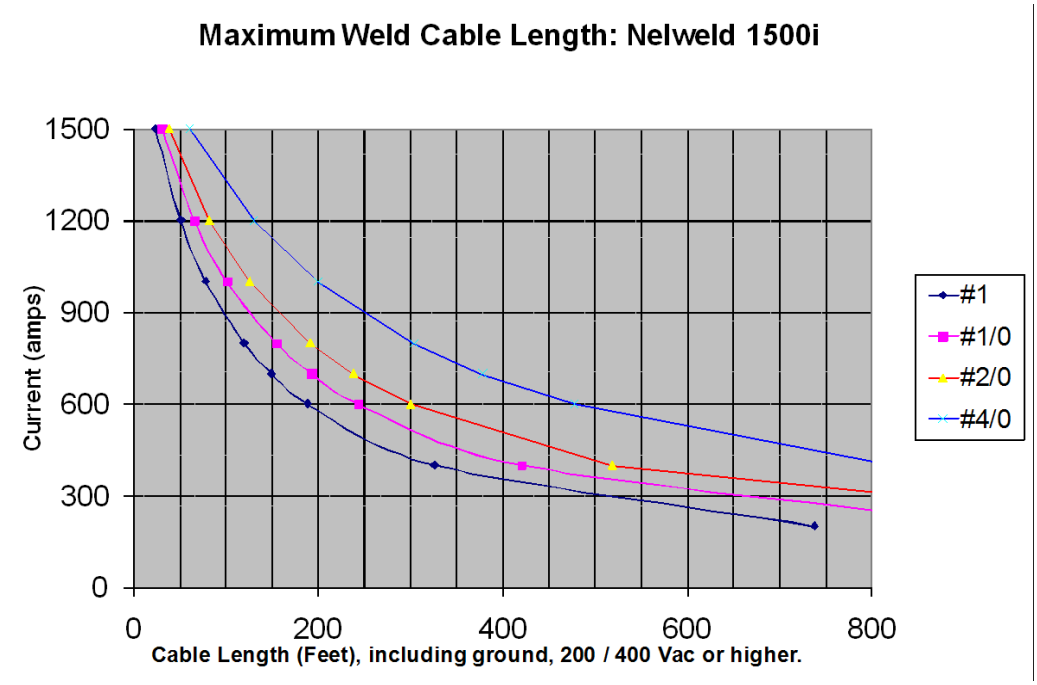
Warning!

Press the gun against an insulated solid surface. Do not do air trigger as lift check.

3.4 Rating Charts

3.4.1 Maximum Weld Cable Length

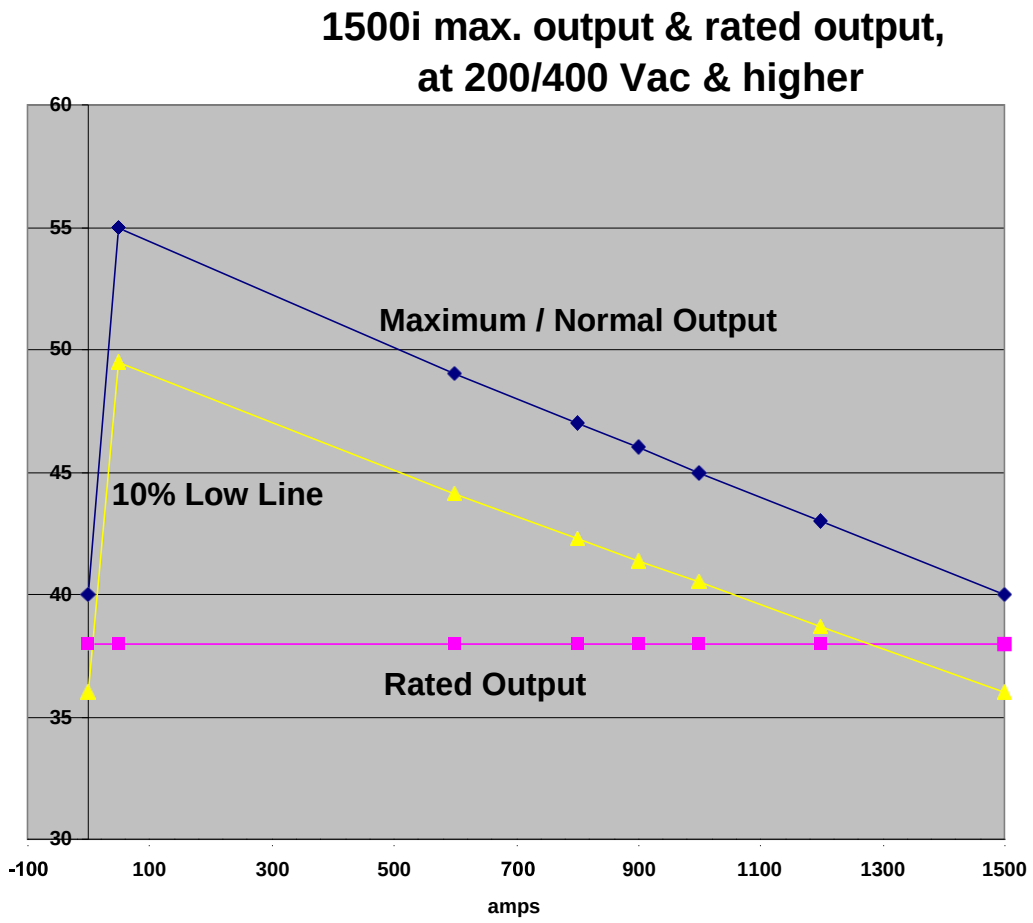




Check with Nelson representative for a weld cable length calculator

3.4.2 Maximum Output & Rated Output

1500i max. output & rated output, at 200/400 VAC input & higher



3.4.3 Energy Consumption

Inverters can realize significant electricity saving over its life time. Use the following online calculator to compute the savings:
http://www.nelsonstud.com/calculator/energy.html

3.4.4 Supply Cable Lengths

This includes facility wiring back to a high current buss/main supply.

208-230 Vac	
Up To X feet (M)	AWG Cable (mm2)
40 (12.192)	6 (13.3)
70 (21.336)	4 (21.2)
110 (33.528)	2 (33.6)

400-460 Vac	
Up To X feet (M)	AWG Cable (mm2)
60 (18.288)	10 (6)
100 (30.48)	8 (10)
190 (57.912)	6 (13.3)
300 (91.44)	4 (21.2)
480 (146.304)	2 (33.6)

575 Vac	
Up To X feet (M)	AWG Cable (mm2)
70 (21.34)	10 (6)
115 (35.05)	8 (10)
220 (67.06)	6 (13.3)
340 (103.63)	4 (21.2)
550 (167.64)	2 (33.6)

- Based on 3% drop and max. 7% below nominal at input power connection during weld

The same guideline applies to power drops from the input power high current buss to disconnect boxes for machine connection. Even though slow-blow fuse size may be smaller than nominal for the cable size, the high peak currents of stud welding necessitate appropriate cables. This table is based on a 1500 Amp output.

3.5 N1500i Weld Cycle Timing

This section explains how the N1500i controls weld current, timing, and the weld gun. It further explains what factors affect drop time.

For short cycle welding, the gun drop time and plunge time are critical components in the weld timing, so they must be configured, understood, and used correctly to get the optimum results.

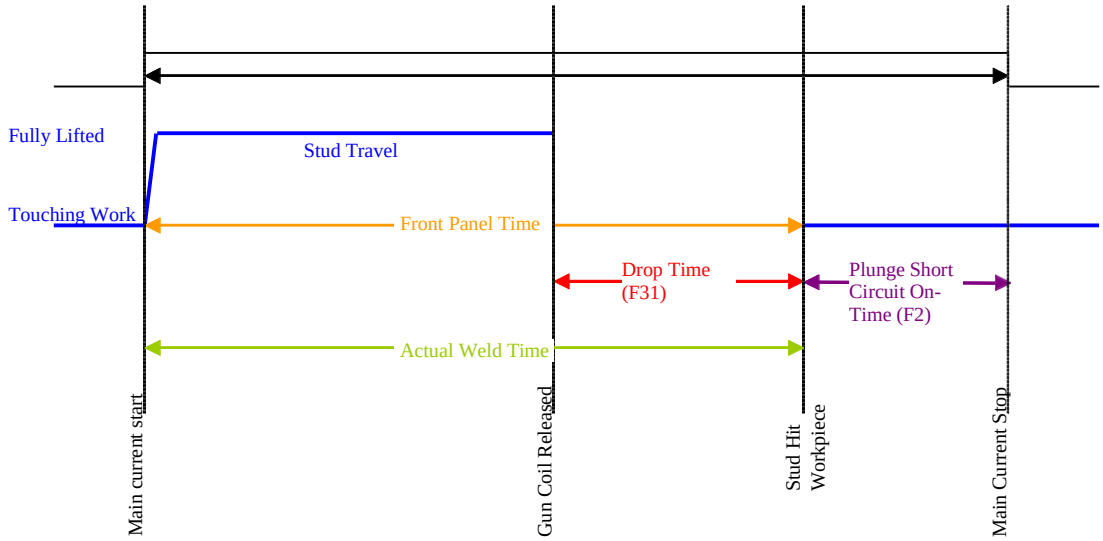
Here are the relevant settings for welding on the N1500i:

- F31 – Drop time. Use this function to measure \ configure the drop time of the gun. While viewing this function (that is, with F31 on the display), attempt a weld. The gun will lift and drop, but no weld current will pass. The gun's drop time is measured, stored, displayed, and used in weld timing as will be described later in this document.
- F2 – Plunge short circuit on-time. This is the time that the weld current continues after the stud is calculated to have hit the workpiece.
- Front Panel Time – This is the (weld) time set on the front panel.

Here are some other definitions:

- Main current time = Front panel time + Plunge short circuit on-time (F2.) The main current time is the total time that weld current is delivered. See below.

Under normal conditions, critical times and events throughout the main current time can be described as:

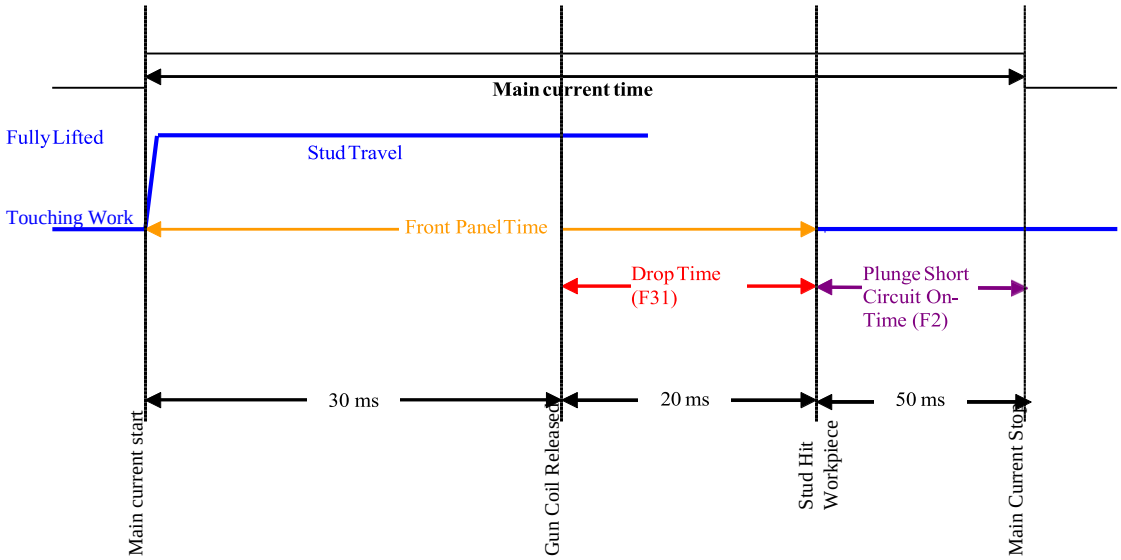


The Actual Weld Time is the time from the start of the main current to the time that the stud hits the workpiece. Under normal conditions, it will be equivalent to the Front Panel Time. This time measurement is reported after the weld is complete.

For example:

- Front Panel Time = 50ms
- Drop Time (F31) = 20ms
- Plunge short circuit on-time (F2) =

50ms The weld profile would look like this:



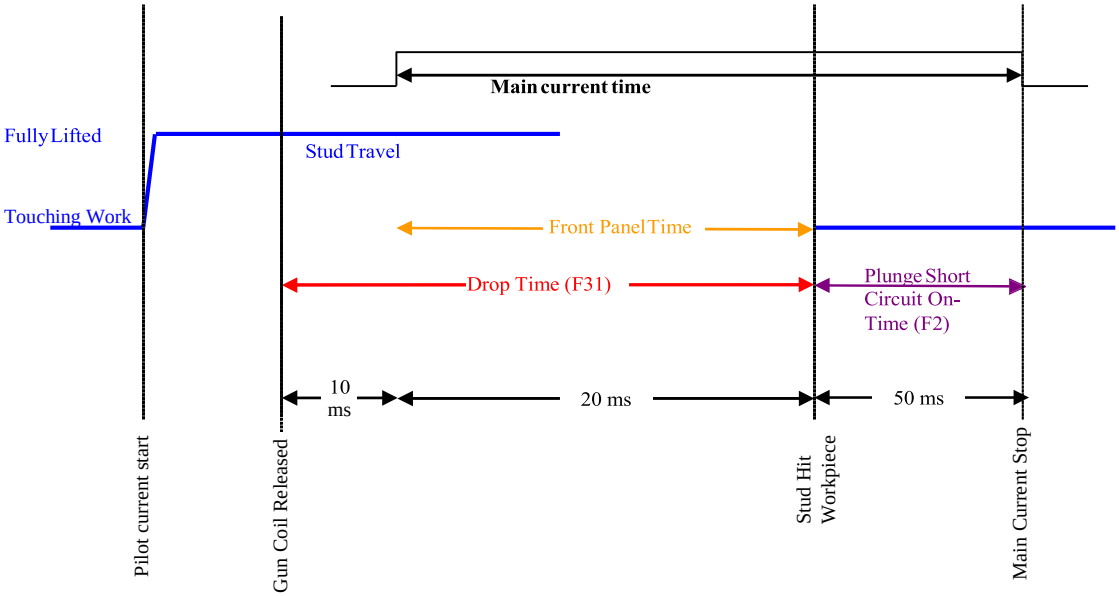
The resulting Actual Weld Time is 50 ms. The main current would be on for the Front Panel Time + Plunge short circuit on-time (F2) = 50ms+50ms=100ms, but the arc would exist only during the Actual Weld Time, or 50ms.

The important thing to note is that normally, the stud begins to drop at Front Panel Time – Drop Time. But if the Drop Time exceeds the Front Panel Time, the stud would need to begin to drop prior to the start of the weld in order to make the Actual Weld Time to be the same as the Front Panel Time. This is done by releasing the gun coil during the pilot arc stage.

For example:

- Front Panel Time = 20ms
- Drop Time (F31) = 30ms
- Plunge short circuit on-time (F2) = 50ms

Since [20ms – 30ms] < 0, the, the gun coil is released prior to starting the main current. So the weld profile would look like this:



The resulting Actual Weld Time is 20ms. The stud would still take 30ms to drop, but the main current and main arc would only be 20ms.

3.6 Drop Time Variables

This section describes several different conditions that affect drop time. This time duration will vary under many different conditions as outlined in the text below.

Power Source Gun Control and Trigger Switch Circuit:

The rate in which the gun coil energy is removed plays a large part in how fast the stud will drop. If the coil ***only*** has an anti-parallel diode (in either the gun itself or inside the power source), it will drop much later than a configuration with a diode/resistor since the energy is dissipated in the resistor after the coil is de-energized.

Plunge Dampener:

Tranquil Arc plunge dampeners are meant to slow the rate of stud travel speed (in the downward direction). Dampeners can adjust this rate for up to a few hundred milliseconds of travel time.

Temperature:

As temperatures rise, dampeners have less of an impact. They allow the stud to fall nearly 65% faster at 90 degrees F than at 0 degrees F.

Molten Stud Shape:

As the stud melts during the weld, it has the potential to change shape. It may elongate or even drip. The molten shape of the stud will vary as the weld heat varies. These factors can change the timing of the weld short circuit.

Troubleshooting Inconsistent Drop Times

1. Eliminate excessive lift. Too much lift increases the possibility of stud ‘hang up’.
2. Be sure the weld energy is appropriate for the application.
3. Inspect foot alignment – Adjust if necessary. A misaligned foot will almost guarantee stud ‘hang-up’. Make sure the stud is centered in the ferrule.
4. Inspect chuck – Replace if necessary. Check for a good grip of the stud in the chuck. A good grip is needed to eliminate stud slippage.
5. Tighten foot-retaining screws. These screws hold the foot in place during a weld while pressure is placed on the foot. Slippage of the foot will lead to a faster drop time.
6. Inspect and clean gun housing and related parts – replace parts as needed. Debris in this housing will resist travel.

3.7 Inspection and testing of the weld

To assure the quality of stud welds, the following testing must be carried out before, during and after production:

- standard work testing
- simplified work testing
- continuous production monitoring

Standard work testing:

For welding according to the drawn-arc and short-cycle methods, ten studs must be welded and the following tests carried out on them:

- Visual inspection (all studs[1])
- Bending test (5 studs)
- Macro section (2 studs)

The test results must be documented and attached to the quality documentation.

Simplified work testing:

In order to check the setting and functionality of the unit, three studs must be welded prior to beginning the shift and the following tests are to be carried out on them:

- Visual inspection (all studs)
- Bending test (all studs)

The test results must be documented and attached to the quality documentation.

Continuous production monitoring:

In continuous production monitoring visual inspection of all welded studs is in general sufficient. On suspicion of a faulty weld, a bending test or a tension test must be carried out.

If the requirements are not met, a bending or tension test must be carried out on the three previous and on the three subsequent welds.

The test results must be recorded in the production log.

Warning!

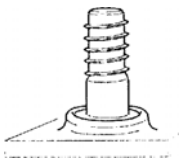
Welding may only be continued when the test results are satisfactory!

1. See the following pages for information on visual inspection

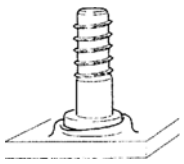
3.7.1 Short-Cycle Process- Visual inspection

Inspection and testing of the weld is restricted in these operating and service instructions to the visual inspection of welds. A description of the mechanical and technological tests would go beyond the scope of these operating and service instructions.

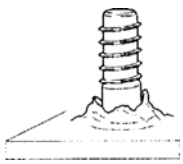
+ *See EN ISO 14555[1] for detailed information in this regard.*



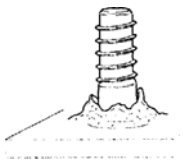
1. Perfect weld
   - Even weld flash ring, no perceptible errors. Corrective measures: Not necessary. No alteration to the electrical and mechanical parameters.



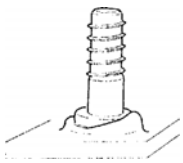
2. Faulty weld
   - Cross section not fully welded. Corrective measures: Increase weld current and/or weld time, possibly change polarity.



3. Faulty weld
   - Large, uneven weld flash. Corrective measures: Reduce weld time



4. Faulty weld
   - Pores in weld flash. Corrective measures: Reduce weld time or increase weld current, weld in shielding gas.



5. Faulty weld
   - Weld flash single-sided. Corrective measures: Eliminate blowing effect by applying corrective measures described in Section 1.3.

1. EN ISO 14555: „Welding Arc stud welding of metallic materials“ (2006)

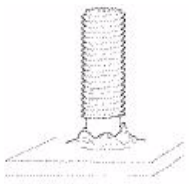
3.7.2 Drawn Arc Process - Visual Inspection

Inspection and testing of the weld is restricted in these operating and service instructions to the visual inspection of welds. A description of the mechanical and technological tests would go beyond the scope of these operating and service instructions.

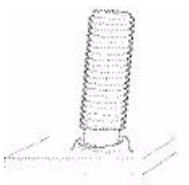
\+ *See EN ISO 14555[1] for detailed information in this regard.*

1. Perfect weld
   - Weld flash is even, glossy and closed. Stud length after welding within tolerance. Corrective measures: Not necessary. No alteration to the electrical and mechanical parameters.

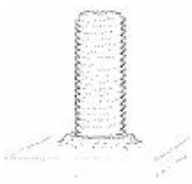
2. Faulty weld
   - Constriction of the weld, stud too long. Corrective measures: Increase plunge distance, check lift, check centering of the ceramic ferrule. Decrease weld current and/or weld time.



3. Faulty weld
   - Weakly formed, uneven weld flash with a dull surface. Stud too long. Corrective measures: Increase weld time and weld current. Possibly dry ceramic ferrules in oven.



4. Faulty weld
   - Weld flash single-sided, undercutting. Corrective measures: Eliminate blowing effect by applying corrective measures described in Section 1.3. Check centering.



5. Faulty weld
   - Weld flash low, surface glossy with intense spattering. Stud too short. Corrective measures: Decrease weld time and weld current, adjust plunge distance and/or damping.

1. EN ISO 14555: „Welding Arc stud welding of metallic materials“ (2006)

3.8 Weld Process Monitor

This welder has a built-in weld process monitor to identify suspect welds, also known as Not In Order (NIO) welds. This function works without the use of a Personal Computer (PC). It monitors actual weld process signals. When programmed as such, it will compare weld process parameters to target values and report bad weld when the actual signals deviate from the target values. The actual welding current and voltage are recorded at 1 Amp and 1 millisecond resolution, and the arc energy and gun drop time are calculated for each weld.

3.8.1 Actual weld process signals

Actual process signals are recorded and displayed after each weld, shown in F32, weld results. Use the up / down button to scroll through current, voltage, main current time, energy, drop time, pilot time and pass/fail indicator. F32 is refreshed after each weld, and no weld history is recorded. To save actual signals for all welds in production permanently as record keeping, contact Nelson for Nelware™ PC software.

3.8.2 Set up weld monitor tolerance

Two tolerances must be configured: F34 gun drop time tolerance and F35 weld energy tolerance.

F34 sets up a drop time tolerance in milliseconds. For example, if F34 is set to 10ms, it means the actual drop time can deviate from the target by ±10ms and the weld is still considered good weld.

F35 is a percentage tolerance of arc energy. For example, if F35 is set to 10%, and a bad weld will be reported if the actual energy deviates from target by more than ±10% of the target.

When either the drop time tolerance is exceeded, or the weld energy tolerance is exceeded, the weld will be marked as bad or NIO. These settings are global for all preset targets.

3.8.3 Set up good weld target

To save target without preset association (i.e. for welding without any preset), exit any presets by manually changing the time and/or current if necessary, so that no preset buttons are backlit. Make a good weld, go to F32, press and hold the "Lock" key until the display says the target is saved.

A target can be created for each preset. Choose a preset, make a good weld, and go to F32. While viewing F32, press and hold the "Lock" key until the display says the target is saved for the backlit preset.

To clear a target stored in a preset, exit F mode by selecting I\t mode, then press both the Lock button and the desired preset button simultaneously.

To clear a target that doesn't have a preset association, exit any preset by manually changing the time\current, exit F mode by selecting I\t mode, then press both the Lock button and the Time-down arrow simultaneously.

3.8.4 Notification options for bad welds

When a bad weld is detected, the User Panel icon for the weld plate (below the gun icon) will turn red briefly after welding. It displays green after a good weld.

To generate an error code after a bad weld, enable F36, which does not disable welding but will flash the red triangle icon and error message on the display. To disable the welder upon a bad weld, enable F33. The welder will flash "weld error" after seeing a NIO weld, and no more welding can be performed thereafter until the user enters a password.

The password is the same as in Lock mode 2 or 3 (F19), and default password is 123456. After entering the password, welding can resume, even though the red triangle icon is still flashing. It is not necessary to try to clear the error E013 (Weld Out-of-Tolerance) before resuming welding.

Usage Example

The user would like the unit to be locked and for the internal process control to require a password when a failed weld is detected.

Setup:

1. Perform a successful weld.
2. View F32 (Weld Results). Press and hold the 'Lock' key to save the weld as a target. The word 'SAVED' will appear on the display.
3. Set the lock mode to 2 or 4 using F19 (Lock Mode). Set F35 (Weld Tolerance) as desired. Set F36 (Process Monitor Error code on Failed Weld) to ON. Set F33 (Disable Welding on Error) to ON.
4. From the Time\Current or Stud Expert mode, lock the unit by pressing the 'LOCK' key. Enter a password that will be used to both unlock the unit and also will allow welding to resume if a failed weld occurs. Press 'LOCK' again as the Enter key.

Use:

The unit is now locked and ready to weld. When a weld is out of tolerance, the unit will flash the red triangle icon and display 'WELD ERROR - ENTER PASSWORD'.

Enter the password to resume welding. Once the password is entered, the triangle will still be flashing, but the user can resume welding.

If any weld settings are to be changed or F code configurations are to be accessed, the unit must be unlocked before doing so.

4. Operational Function Codes & Error Codes

Dot Matrix Firmware version 1.00

4.1 Function Codes

F code	Description	Possible Values	Default	Unit	Notes
F0	Language	ENGLISH,GERMAN, ITALIAN,SPANISH, FRENCH, POLISH	ENGLISH	x	
F1	Error Display	E--- to E021	E---	x	
F2	Plunge Short Circuit On-Time	0 to 150	20	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.
F7	Output Board Calibration Gain	95-105		%	Used by manufacturing. Do not change
F8	Chuck Saver	OFF ON	ON	x	
F9	Gas Enable	OFF ON	OFF	x	
F10	Gas Pre-flowTime	10 to 2000	500	ms	
F11	Gas Post-flow 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.
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.

F code	Description	Possible Values	Default	Unit	Notes
F17	Load bank 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 cannot 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.
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)
F24	Stud Expert Mode Unit Selection	English, metric, or both	English	x	Allows the user to 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.
F25	Software Versions			x	Time-up/down to see all 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.
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.

F code	Description	Possible Values	Default	Unit	Notes
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	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.
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.
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%.
F45	Output Board Calibration Offset	700 to 1300	1000	X	Used by manufacturing. Do not change.

F code	Description	Possible Values	Default	Unit	Notes
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	800	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 10	5	ms	This is the time the weld will deliver the front panel current (F50 current).
F52	Pulse Weld Low Time	20 to 25	25	ms	This is the time the weld will deliver the low current.
F68	Input Board Gain	95-105	100	%	Factory Only
F69	Input Board Offset	700-1300	1000	X	Factory Only

4.2 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 boot-up 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-**
E008	PRIMARY OVERCURRENT ERROR	A primary overcurrent occurred.	x	On-board control PCB failure **-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
E009	NO GUN LIFT DURING PI- LOT 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 TO- LERANCE	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 setup accordingly. **-See troubleshooting-**
E014	NO STUD HIT DETECTION	The stud is expected to hit the workpiece after the gun coil is de-energized, but be- fore 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
E017	PILOT ARC BLEW OUT DU-RING 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 CYC-LE	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
E019	MACHINE TYPE UNDEFINED	Jumper plug in user interface is not present	X	
	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-**

4.3 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. Consult Section 2.6 to ensure proper current and time settings are being used. Reduce the current setting and perform weld inspections as described in Sections 2.7.4, and 2.7.5.
	Plunge is too short.	Plunge is measured by the amount of stud protruding beyond the bottom edge of the ferrule. Consult Section 2.6 to 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.
Weld appears “cold”	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. Consult Section 2.6 to 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.
	Inconsistent gun lift.	Perform a Lift Check, as specified in Section 4.5.14. Consult Section 2.6 to ensure proper lift settings are being used. Correct the lift to the proper setting if the lift is improperly set. Perform weld inspections as described in Sections 2.7.4 and 2.7.5.
	Inconsistent gun lift.	Perform a Lift Check, as specified in Section 4.5.14, several times. Consult Section 2.6 to 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. Consult Section 2.6 to ensure proper plunge settings are being used, and correct, if necessary.

Problem	Possible Cause	Solution
Stud „hangs-up“ during the weld	Plunge dampening is too little.	If the gun is a Heavy Duty gun, it is equipped with Tranquil Arc®. Screw in the clear plastic plunge dampener housing to decrease the free travel.
	Plunge is too short.	Plunge is measured by the amount of stud protruding beyond the bottom edge of the ferrule. Consult Section 2.6 to ensure proper plunge settings are being used, and correct, if necessary.
	Mechanical bind in accessories or ferrule.	Position the foot or ferrule grip of the gun so that the stud is centered in the ferrule opening. If the stud is off-center, it can restrict the plunging motion of the stud during welding.
	Time setting or current set-ting 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. Consult Section 2.6 to ensure proper current and time settings are being used. Correct the settings and perform weld inspections as described in Sections 2.7.4 and 2.7.5.
	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 increase the free travel.
	Mechanical bind in gun.	Manually depress chuck adaptor and release. Chuck adaptor must return to the full out position rapidly without binding. If necessary, disassemble and clean the gun. On Heavy Duty guns, ensure that the weld cable is centered between the legs and does not rub on them.
	Base material contamination.	Contamination of the base plate or stud may cause the arc to become erratic. Ensure that there is no rust, scale, oil, water, residue, paint, galvanization, etc. present between the stud and the workpiece. Welding to a clean plate can help diagnose if there is any foreign substance on the base material or studs.
	Incorrect ferrule.	Ensure that the ferrule being used is the proper ferrule for the stud size and application.
Actual main arc time is different than the programmed weld time set-point. No error is displayed.	F31 gun drop time is not calibrated against the gun in use. Go to F31 and perform calibration. If the welder is expected to be used for both short cycle and drawn arc in production; or be used together with guns with and without plunger dampener ,it is recommended to set F48 to “auto” or “average” to match the welder and gun seamlessly.	Short circuit in the middle of a weld, due to low lift height, out of position welding, or welding into angle iron. Short longer than 100ms will generate E012 error code. If the problem occurs only with long weld cables and/or small diameter weld cables, upgrade firmware to V1.06 or higher.

5. Maintenance

5.1 Care and Cleaning

See the operating instructions specific to the units for the necessary cleaning work to the gun and if need be to the feeder.

The cleaning work specified below is necessary for the Nelweld N1500i unit. In this connection, pay attention to the following:

Warning!

Prior to starting any cleaning work, the welding unit must be switched off, disconnected from the input power and secured against restart.

Perform preventive maintenance procedures at least once every six months. It is good practice to keep a preventive maintenance record; a record tag attached to the machine works best.

- Do not use aggressive solvents, alcoholic agents, or combustible liquids for the cleaning work.
- The case of the Nelweld N1500i should be wiped down with a dry cloth. Rating plate and safety warnings must be very legible.
- The front plate of the Nelweld N1500i should be cleaned with a mild, oil-dissolving cleansing agent. The LED display elements must be recognizable.
- The electrical connecting cables must be cleaned with a dry cloth. Inspect for scorching or mechanical faults.
- Cleaning inside the unit is required to maintain the intended operating conditions.
- Impurities inside the welding unit, such as metallic dust or conductive debris, must be wiped off or vacuumed out.

Warning!

Opening the welding unit, as well cleaning inside the unit may only be carried out by an authorized electrical specialist.

Blowing out the welding unit with pressurized air is not recommended, due to injury risks.

5.2 Routine Maintenance

Warning!

Prior to starting any maintenance work, the welding unit must be switched off, disconnected from the input power and secured against restart.

Only a qualified electrician should perform any work inside the unit's case. Any work done should be made in accordance with all local and national electrical codes. Failure to do so may result in bodily injury or death.

1. Remove the machine wrap-around top cover after disconnecting input connector.
2. Keeping the machine clean will result in cooler operation and higher reliability. Be sure to clean the following areas. See Section 6 for component locations.
   - •Power and control printed circuit boards
   - •Power switch
   - •Input rectifier
   - •Heat sink fins

Warning!

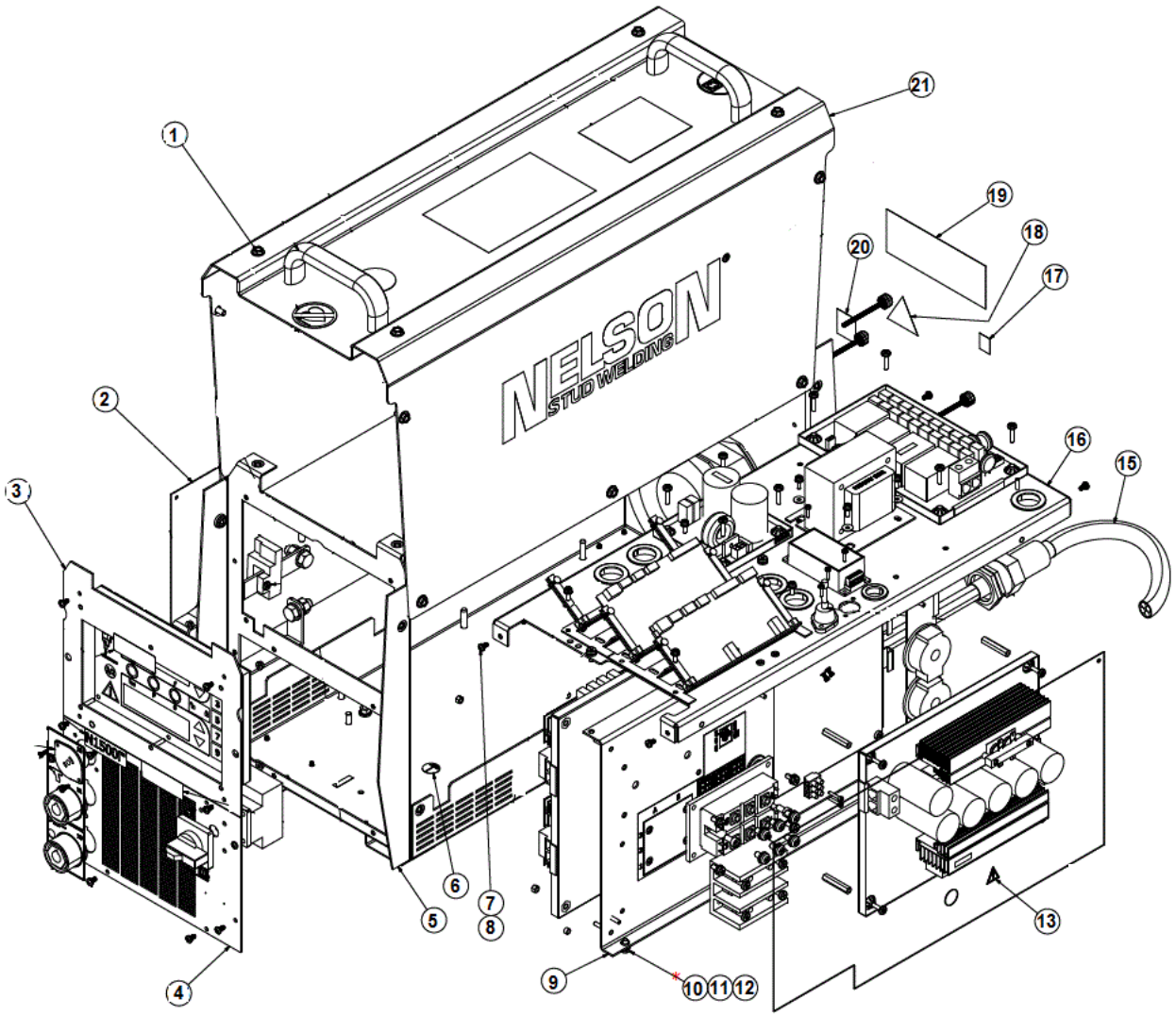
Heat sinks can carry high voltage, and/or be at high temperature.

   - •Output terminals
3. Examine capacitors for leakage or oozing. Replace boards if needed.
4. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to ensure that high voltage parts are protected and correct spacing is maintained. All external sheet metal screws must be in place to assure case strength and electrical ground continuity.
5. Replace machine cover and screws.

When PCB connectors are disconnected, please use a silicone-free electrical grade grease (Nygogel 760G from Nye Lubricants) to all PCB connectors prior to reconnecting. This forms a corrosion\moisture barrier that will protect the contacts for reliable operation.

6. Drawings and parts lists

6.1 Final Assembly N1500i



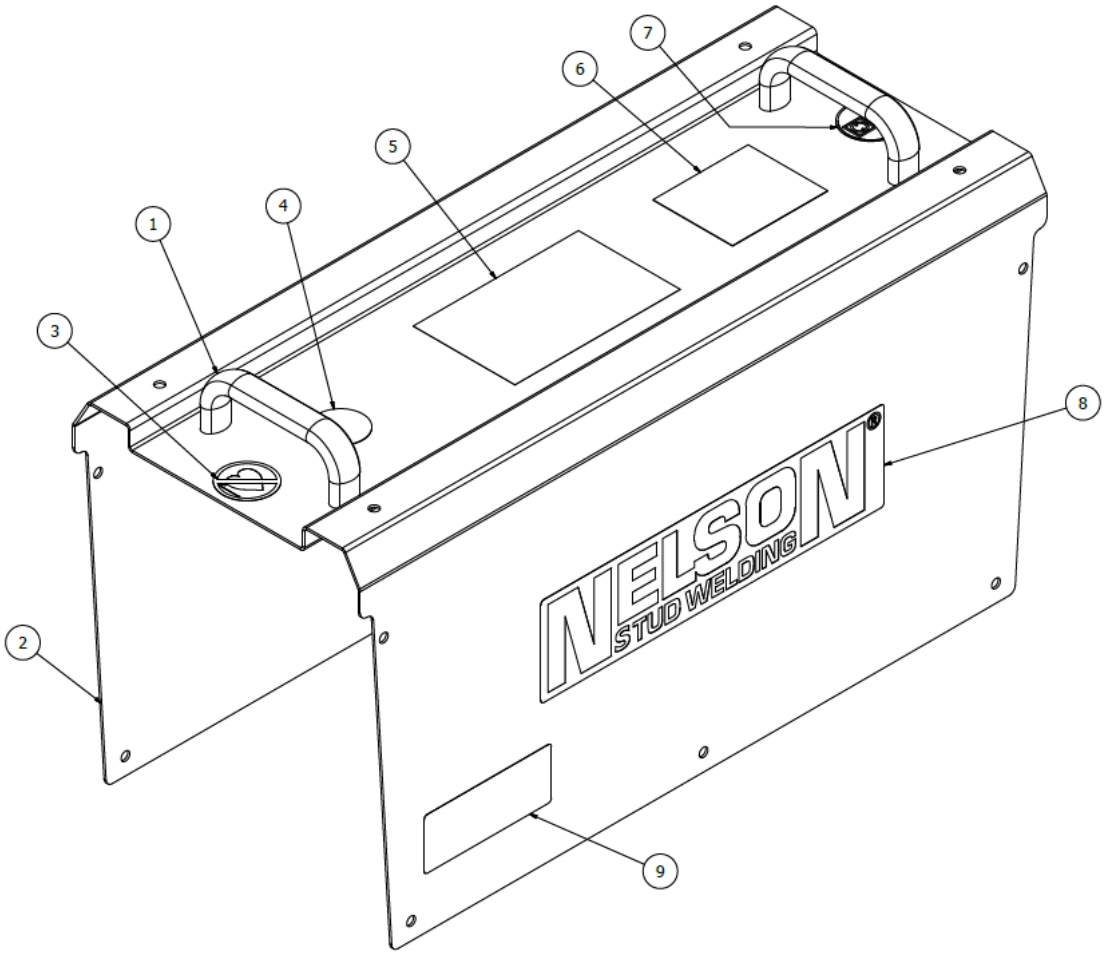
6.1.1 Parts List Final Assembly N1500i

Comment:

Sp = Spare part; **Stp** = Standard part; **W** = Wear part;
Ssp = Stud-specific part

Item	Part Number	Qty	Comment	Description
1	524-005-350	14		SCREW, M6 X 12 HWHCS, BLK OXIDE SS
2	750-651-106	2		SAFETY SHIELD,SIDE,N1500i FACS
3	750-652-113	1		PANEL, DOT MATRIX DISPLAY
4	750-651-104	1		FRONT CONNECTOR PANEL,N1500i FACS,DINSE/HUBBELL
5	750-651-100	1		CHASSIS, SUB-ASSEMBLY
6	724-485-010	2		LABEL,ELECTRICAL GROUND,ROHS
7	524-005-344	20		SCREW, M4 X 8 PHMS, BLACK SS
8	524-002-619	20		WASHER, #8 LOCK, BLACK SS
9	750-651-102	1		VERTICAL, MAIN PANEL 1500i FACS
10	524-005-124	14		SCREW,M5X12 PHCRMS SS
11	524-005-291	10		WASHER, FLAT, M5, SS
12	524-005-304	14		WASHER,M5,SPRING LOCK,SS
13	724-485-015	2		LABEL,SMALL,HIGH VOLTAGE
15	721-313-002	1		CABLE,PRIMARY POWER,N1500i
16	750-651-101	1		HORIZONTAL SHELF, 1500I FACS
17	724-569-013	1		LABEL, TRASH CAN, CE,ROHS
18	87-07-86	1		LABEL,HIGH VOLTAGE SYMBOL
19	724-572-001	1		DECAL,RATING INFO,N1500i,400-480V
20	724-576-015	1		DECAL, MADE IN USA, NCD+
21	750-615-201	1		COVER,RED,N550c,STD

6.2 Cover Assembly



TORQUE Bolt to 4 N-M (35-40 IN-Lbs)

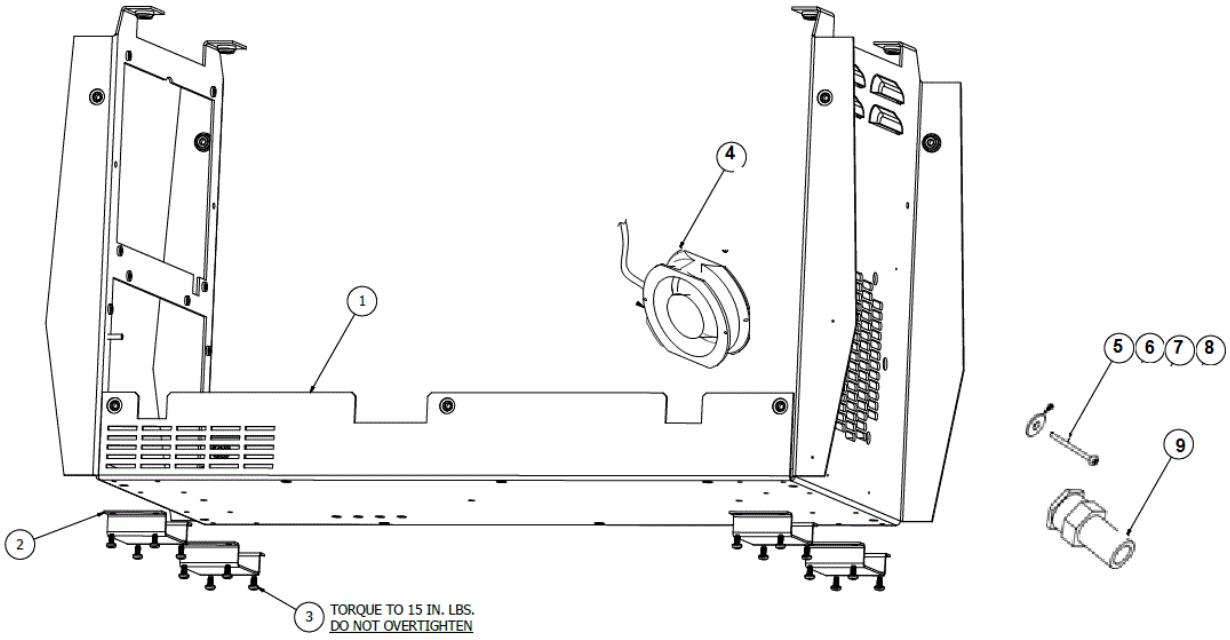
6.2.1 Parts list cover assembly

Comment:

Sp = Spare part; **Stp** = Standard part; **W** = Wear part;
Ssp = Stud-specific part

Item	QTY	Part Number	Comment	Description
1	2	729-114-103	Stp	HANDLE ASSEMBLY
2	1	750-615-201	Stp	COVER
3	1	87-09-35	Stp	LABEL, CARDIAC PACEMAKER
4	1	724-485-012	Stp	LABEL,TWO PERSON LIFT,ROHS
5	1	724-569-000	Stp	DECAL,WARNING
6	1	724-572-004	Stp	DECAL,LIFTING INSTRUCTION
7	1	87-05-19	Stp	LABEL, POWER PLUG BEFORE OPEN
8	2	724-569-004	Stp	DECAL,NELSON LOGO
9	2	724-572-021	Stp	DECAL, SIDE, N1500i

6.3 Chassis Sub ASM



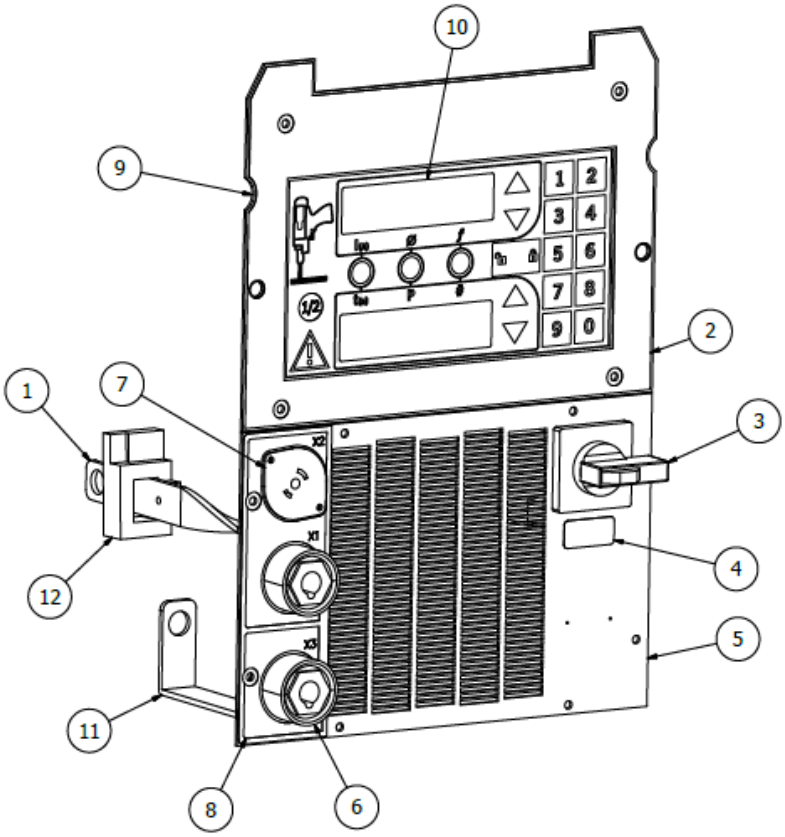
6.3.1 Parts list chassis sub ASM

Comment:

Sp = Spare part; **Stp** = Standard part; **W** = Wear part;
Ssp = Stud-specific part

Item	QTY	Part Number	Comment	Description
1	1	750-651-110		CHASSIS, N1500i FACS
2	1	750-615-206	W, Sp	FOOT, CHASSIS
3	16	524-002-620		SCREW, 8-32 X 3/8 THREADFORM
4	1	717-999-013		FAN, COOLING
5	4	524-005-292		SCREW, M4 X 70 PHMS
6	4	524-005-284		WASHER, FENDER, M4, SS
7	4	524-005-153		NUT, M4, WITH NYLON INSERT
8	4	717-140-010		GROMMET, RUBBER
9	4	86-44-38 OR		CABLE GLAND
NS	1	721-313-001		FAN CABLE
NS	1	86-44-39		STRAIN RELIEF NUT

6.4 Front panel assemblies

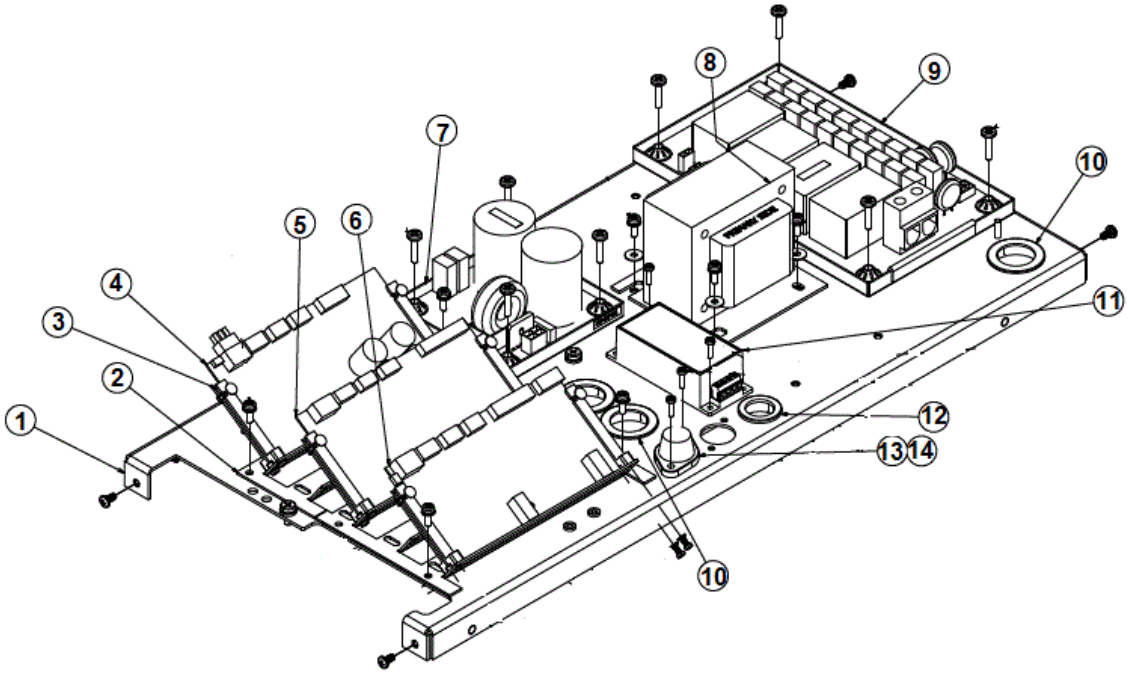


6.4.1 Parts list Front panel assemblies

Comment: Sp = Spare part; **Stp** = Standard part; **W** = Wear part; **Ssp** = Stud-specific part

Item	QTY	Part Number	Comment	Description
1	1	750-610-326		BUSBAR,WORK,N1500i
2	1	724-577-014		DECAL, DOT MATRIX DISPLAY, N1500i FACS
3	1	709-256-015		SWITCH,POWER,ROTARY,63A,N1500i
4	1	724-572-013		LABEL, MANUEL/WARNING ISO
5	1	750-651-104		FRONT CONNECTOR PANEL, DINSE/HUBBELL
6	2	714-166-099		DINSE,FEMALE,PANEL MOUNT,MEDIUM SKT
7	1	714-174-004		CONNECTOR,3 PIN,FEMALE PANEL
8	1	724-572-012		LABEL,CON,PANEL,N1500i,FACS,DINSE/HUBBELL
9	1	750-652-113		PANEL, DOT MATRIX DISPLAY
10	1	750-649-065		PCB ASM,USER PANEL,N1500i FACS,DOT MATRIX
11	1	750-610-327		BUSBAR,GUN,N1500i
12	1	701-142-003		TRANSDUCER,CURRENT,600A NOM

6.5 Horizontal panel assembly



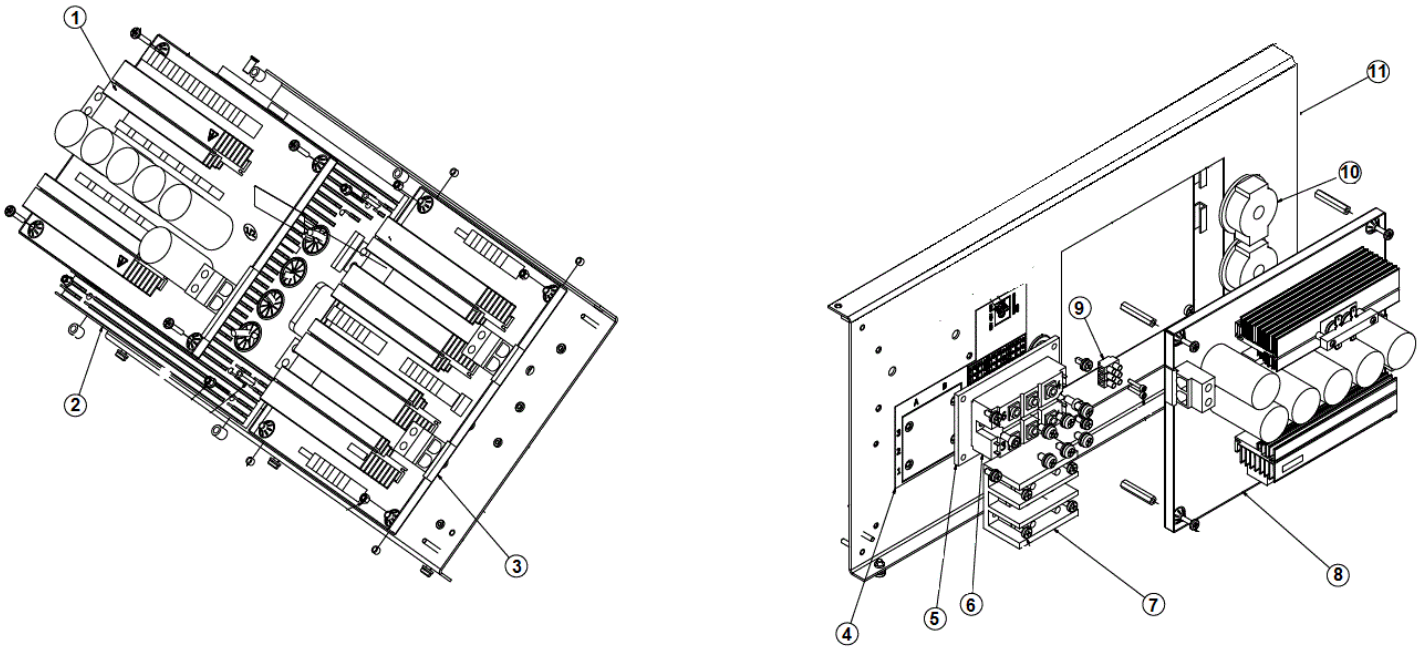
6.5.1 Parts list Horizontal panel assembly

Comment:

Sp = Spare part; **Stp** = Standard part; **W** = Wear part;
Ssp = Stud-specific part

Item	QTY	Part Number	Comment	Description
1	1	750-651-101		SHELF, 1500i FACS
2	1	750-615-095		MOUNT, PCB, FACS
3	6	708-152-000		CARD GUIDE, VERTICAL
4	1	750-649-040		PCB,FACS,GUN/LIFT
5	1	750-649-045		PCB,FACS,INPUT
6	1	750-649-035		PCB,FACS,WELD OUTPUT A
7	1	750-610-062		PCB,PILOT ARC ASM,N15/800i
8	1	700-149-010		TRANSFORMER,CONTROL,N1500i FACS
9	1	750-610-022	Sp	INPUT PCB ASM
10	5	714-028-004		CABLE BUSHING,SNAP,26MM ID
11	1	700-149-021		POWER SUPPLY, AS-DC 24V
12	2	714-028-005		CABLE BUSHING,SNAP,19MM ID
13	1	708-143-003		FUSE HOLDER
14	1	715-039-001	W, Sp	SLOW-BLOW FUSE, 1.5A, 600V

6.6 Vertical panel assembly



6.6.1 Parts list Vertical panel assembly

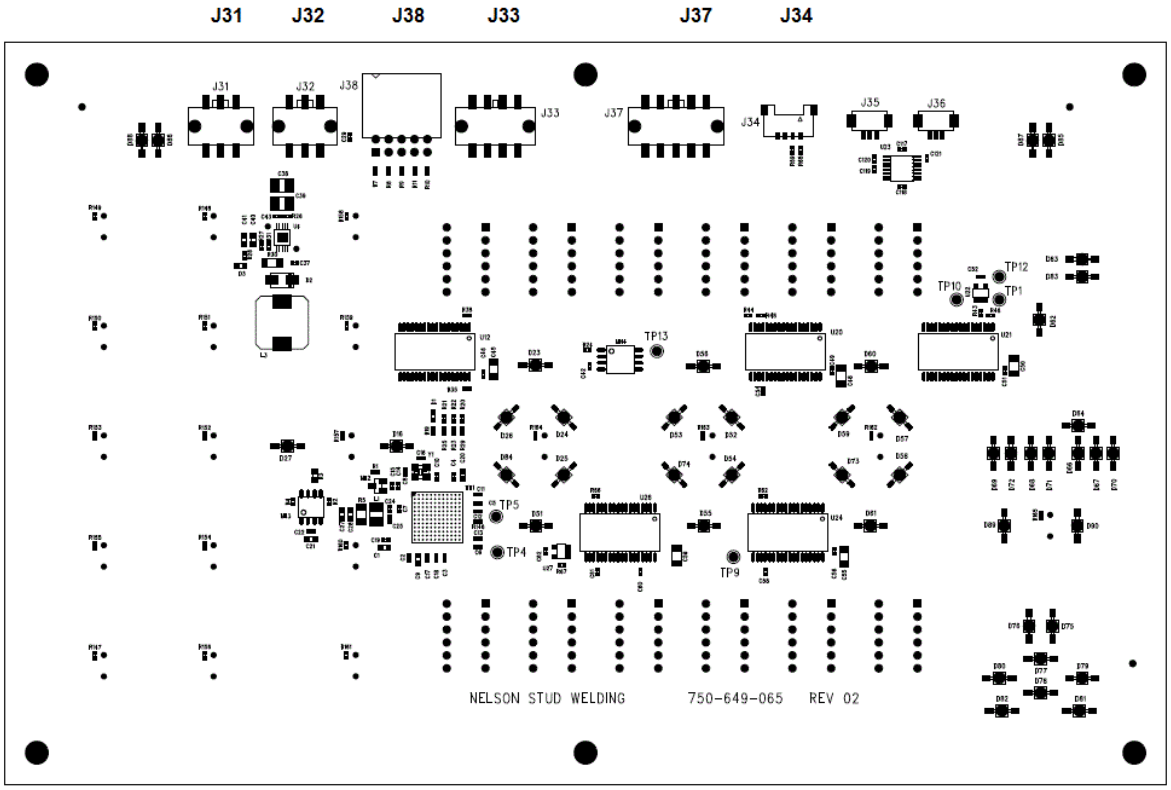
Comment:

Sp = Spare part; **Stp** = Standard part; **W** = Wear part;
Ssp = Stud-specific part

Item	QTY	Part Number	Comment	Description
1	1	750-610-054		PCB,SWITCHING ASM,N1500i,ROHS
2	1	750-610-408		MAIN TRANSFORMER SUB ASM
3	1	750-610-034	Sp	OUTPUT RECTIFIER PCB ASM, POHS
4	1	724-572-015		LABEL, RE-CONNECT INST. N1500i FACS
5	1	750-651-111		PLATE,3 PHASE BRIDGE,N1500i FACS
6	1	701-175-000		INPUT BRIDGE,215A,3PH,1600VAC
7	1	708-149-000	Sp	TERMINAL BLOCK, LARGE, 3 POS
8	1	750-610-055		PCB,SWTCH ASM W/THML,N15i,ROHS
9	1	708-150-000		TERMINAL BLOCK, SMALL, 3 POS
10	2	723-242-021		C.T. SUB ASM
11	1	750-610-206		VERTICAL CHASSIS

7. FACS Board Set

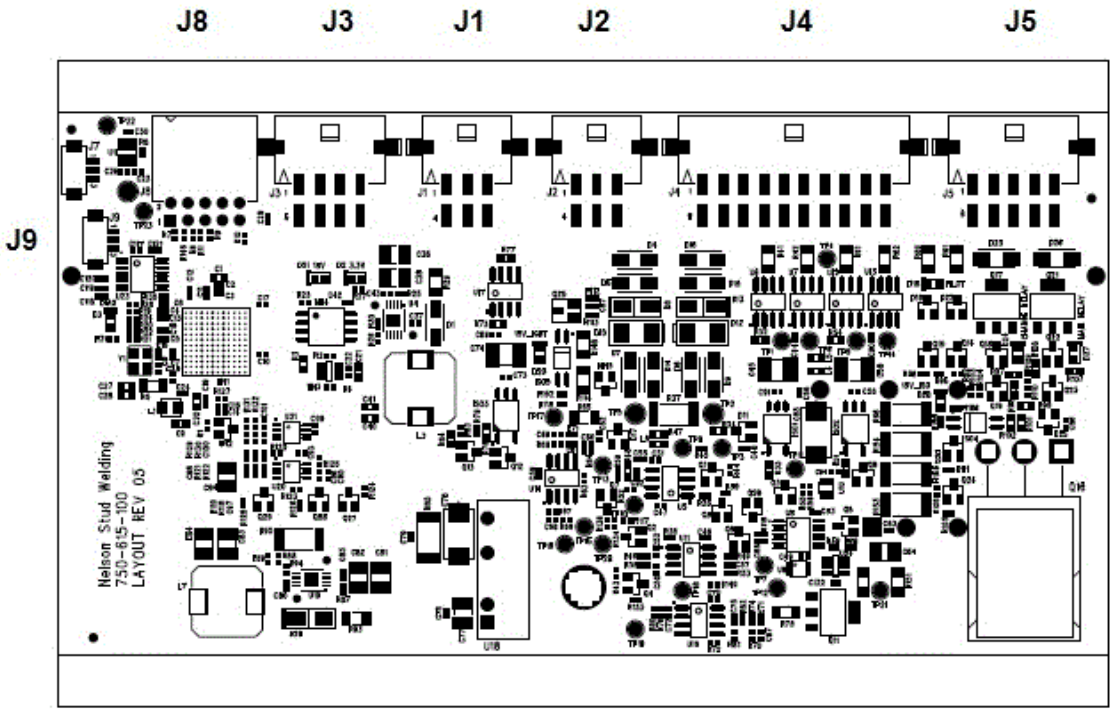
7.1 Dot Matrix User Interface



Dot Matrix Connections	
J31	CAN Bus \ 24V supply
J32	CAN Bus \ 24V supply
J33	Address jumper
J34	Product variant
J37	Product type jumper
J38	JTAG (programming)
J36	Debug

7.2 Output SMPS

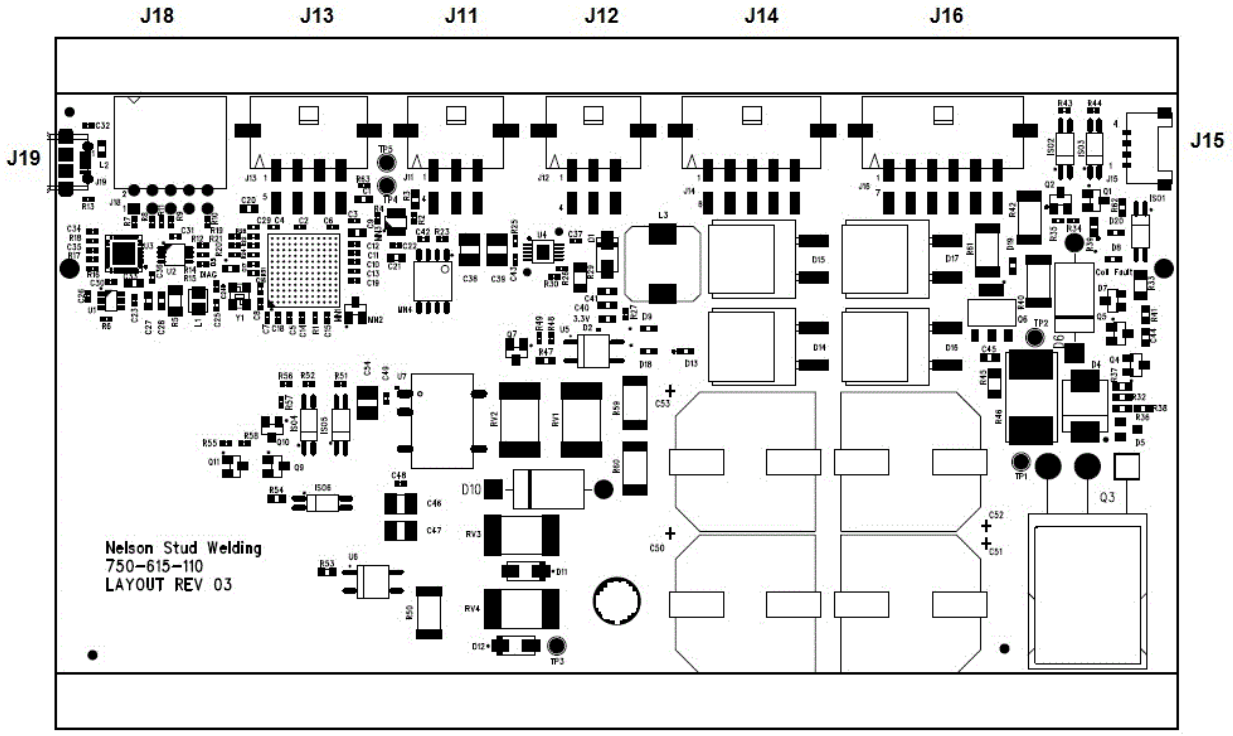
Contains specific drivers that interface with power components such as the (1) SCR, (3) IGBTs, Pilot arc control, Charge \ Discharge



750-649-035

SMPS Output Connections	
J1	CAN Bus \ 24V supply
J2	CAN Bus \ 24V supply
J3	Address jumper
J4	CTs, gate drives, input analog signals
J5	Pilot output, relay drivers, capacitor sensing
J8	JTAG (programming)
J9	Debug

7.3 Gun Interface

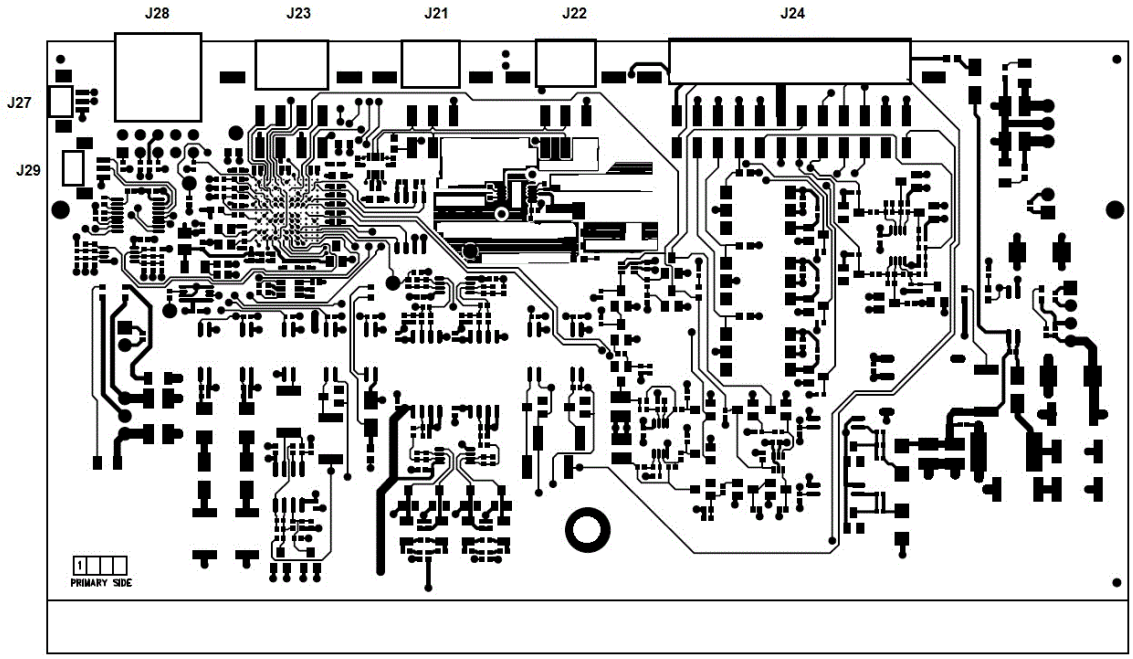


Handles trigger and coil, 2 – 4 wire systems 750-649-040

Gun Interface Connections	
J11	CAN Bus \ 24V supply
J12	CAN Bus \ 24V supply
J13	Address jumper
J14	Product Type
J15	Product Variant
J16	Gun Trigger, Gun Coil, Gun AC input
J18	JTAG (programming)
J19	Debug

7.4 Sensing Monitor

Current, voltage, arc voltage, capacitor voltage, and other internal sensing (4) Isolated analog, (1) contact detect, programmable shutdown mechanism, redundant voltage – on – terminal sensor, phase detection, capacitor voltage V-F, slope compensation



750-649-045

Input Sensing Connections	
J21	CAN Bus \ 24V supply
J22	CAN Bus \ 24V supply
J23	Address jumper
J24	Thermal input, current sense input, phase sensing, capacitor V-F inputs, contact sensing, single phase sensing, analog output, weld terminal voltage input
J27	Battery voltage sense, case ground sense
J28	JTAG (programming)
J29	Debug

8. Troubleshooting

8.1 How to use Troubleshooting guide

Warning!

Service and Repair should only be performed by Nelson Factory Trained Personnel. Unauthorized repairs performed on this equipment my result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

Warning!

Heat sinks on the switch boards have HIGH VOLTAGE.

DO NOT remove plexi-glass when the power is on.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the procedure listed below.

1. LOCATE PROBLEM (SYMPTOM)

- Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. If the problem is accompanied by a flashing warning symbol, see the error code section for more details.

Step 1. POSSIBLE CAUSE

- The second column labeled "POSSIBLE CAUSE" lists the obvious external possibilities that may contribute to the machine symptom.

Step 2. SOLUTION RECOMMENDED

- This column provides a course of action for the Possible Cause, generally it states to contact your local Nelson Authorized Field Service Facility.

Note!

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Nelson Authorized Field Service Facility. Replace plexi-glass after service!

+ *Note: Replace transparent safety shield after service!*

8.2 Problems / Possible Cause / Solution

Problems	Possible Cause	Solution
Major physical or electrical damage is evident when the sheet metal covers are removed.	▪ Contact your local authorized Nelson Field Service Facility for technical assistance	If all recommended adjustments have been checked and the problem persists, contact your local Nelson Authorized Field Service Facility.
Input fuses keep blowing, or input breaker keeps tripping.	▪ Make certain that the fuses or breakers are properly sized. See rating section of the manual for recommended fuse and breaker size. ▪ Welding procedure is drawing too much output current, or duty cycle is too high. Reduce output current, duty cycle, or both. ▪ There is internal damage to the power source. Contact an Authorized Nelson Field Service Facility	
Machine will not power up (no lights)	▪ Make certain that the power switch is in the "ON" position. ▪ The 1.5 amp fuses may have opened. Check fuses. *Fuses are located inside the unit. 1.5A, 600V, Part-No. 715- 039-001. See chapter* **6.5** *„Explosion drawing Horizontal Panel Assembly N1500i".* **Warning!** + Opening the welding unit may only be carried out by an authorized electrical specialist!	
Machine wont weld, can't get any output	▪ If the displays are not lit refer to machine will not power up section. ▪ If the thermal symbol is lit refer to the thermal section.	

Warning!

Defective slow-blow fuses must always be replaced by slow-blow fuses of the same model with identical nominal values.

+ *If for any reason you do not understand the test procedures or are unable to person the tests/repairs safely, contact your Local Nelson Authorized Field Service Facility for technical troubleshooting assistance before you proceed.*

8.3 Welding Problems

Problems	Possible Cause	Solution
Poor welding, weld settings drift, or output power is low	▪ Make sure the machine settings are correct for the weld process being used. ▪ Check for loose or faulty welding cables.	If all recommended adjustments have been checked and the problem persists, contact your local Nelson Authorized Field Service Facility.
Poor welding performance	▪ Check for loose or faulty welding cables. ▪ Make sure the machine settings are correct for the weld process being used. ▪ Are input cables correct size? (See table 4.3.4)	
The thermal light and fan keep turning on and off	▪ Check the input voltage section ▪ Check for blockage of vents, which restricts air flow into or out of the machine. ▪ Blow air in the rear louvers to remove dirt from around fan.	

Observe all Safety Guidelines detailed throughout this manual

+ *If for any reason you do not understand the test procedures or are unable to person the tests/repairs safely, contact your Local Nelson Authorized Field Service Facility for technical troubleshooting assistance before you proceed.*

Warning!

Opening the welding unit as well as work inside the casing may only be carried out by authorized electrical specialists!

Prior to any work on the N1500i the welding unit must be switched off. The master switch of the welding unit must be in the "0" position!

8.3.1 E001 Shorted Control Cable-Fix Control Cable and/or Gun

Shorted Control Cable	E001

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> Yes

Description:

The gun drive circuit sensed a current surge of 10A or greater for at least 10us. When this condition is sensed, the gun drive turns off and the user interface displays this error. The gun may be retriggered and the unit does not need to be powered down.

Likely problems or items to check - in order from most likely to least likely:

1. A cable short in the combo cable external to the unit
2. A wiring or switch short in the gun
3. Internal wiring from the gun driver board to the weld output board, weld output board to the front panel gun connector
4. Failure of the gun driver board.

8.3.2 E002 Primary Voltage Dip too Low-Check Primary Voltage

Primary Voltage Dip Too Low	E002

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> Yes

Description: The FACS input board senses the +15VDC gate drive power supply generated on-board from the 24VDC input. When the gate supply falls below 13VDC (1ms during a weld, or 20ms while idle), this error will be displayed and if welding, the weld will stop immediately. +15VDC and ground is located at U15 pin 3 and TP14, respectively, of FACS output SMPS board.

The error will be further classified into E002 (A) or E002 (B)

- E002 (A): A brownout has occurred while the unit was not welding. Check the +15VDC power supply on the control board with a meter then trace it back through the system components per below. Likely items to check in order from most likely to least:
  - FACS Input board
  - Switch board(s)
  - Wiring to the FACS Input board.

- E002 (B): The brownout occurred while the unit was welding. A scope would be needed to see the voltage dip as it is too fast for a meter. Likely items to check in order from most likely to least:
  - Switch board(s)
  - FACS Input board
  - Wiring to the FACS Input board.

8.3.3 E003 Capacitor Voltage Imbalance

Capacitor Voltage Imbalance	E003

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: When (and only when) running the unit on the high range 400, the primary capacitor bank has the potential to go out of balance such that they are not the same voltage. When they are >20VDC out of balance for 10ms, the weld will be aborted to protect the power unit. When operating the unit with very low current and/or very short cable load, unit will have the most opportunity for this imbalance. Use F18 and the lower up\down arrows to check left and right voltages.

Likely problems or items to check - in order from most likely to least likely:

- Try reducing F2, which gives the most opportunity for delivering current through a minimal load.
- Confirm by multi-meter that each switch board is truly out of balance. If not out of balance, replace switch board(s)

8.3.4 E004 Regulation Error-Arc Went Out

Regulation Error- Arc Went Out	E004

Fatal, meaning you have to power down to continue welding

>> No

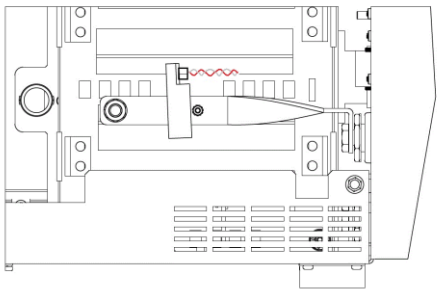
Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: If the FACS output SMPS board senses that the current was more than 50% lower than the set point while the control to the power system was at the maximum output for >15ms, it will abort the weld and display this error. This will happen if the current sensing fails for any reason (wiring, power supply, etc.), but is most likely caused by the arc actually popping out.

Likely problems or items to check - in order from most likely to least likely:

1. Arc actually popped out. Check gun lift, Check for surface contaminants / try again. If it is consistent, it is an internal failure.
2. Damaged/Broken connection from the current sensor (See picture below) to J24 of FACS input board.



3. Pilot arc circuit - Look for evidence of a pilot arc. If no pilot arc mark on the work material, replace the pilot arc board.
4. Check that the main relay pulled in during the start-up process. When the main relay is closed, there should be 0V between the two power terminals of the power input relay board. If the voltage is higher, the input board main relay is not energized. Replace the *power* input relay board.

8.3.5 E005 Regulation Error - Short circuit

Regulation Error- Short	E005

Fatal, meaning you have to power down to continue welding

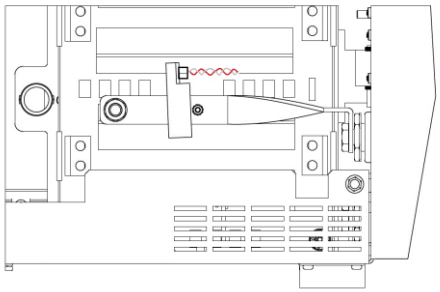
>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> Yes

Description: If the FACS output SMPS board senses that the current was 150% or higher of the current setting while the control to the power system was at the minimum output for >15ms, it will abort the weld and display this error. This will happen if the current sensing fails for any reason (wiring, power supply, etc.).

- Damaged connection from the current sensor (see picture below) to J24 of the FACS Input board 750-649-045.
- Missing power supplies at current sensor. Check at J24 of the FACS Input board 750-649-045 for +15VDC (pin 18) and -15VDC (pin 6).



8.3.6 E006 Input Voltage Too High

Input Voltage Too High	E006

Fatal, meaning you have to power down to continue welding

>> Yes

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: When power is initially applied to the system, it goes through a series of relay closures / opens and watches the primary voltage closely. If the voltage is sensed to be a damaging level (>470VDC on the capacitor banks - J1 on each switch board of the N1500i, J1, J4), the relays are turned off and this error is displayed. They system must be powered down and examined/ fixed prior to anything else.

Likely problems or items to check - in order from most likely to least likely:

1. Measure the primary AC voltage and make sure it is within the correct range for the system and the voltage setting. The DC voltage on the switch boards must be between 225VDC and 470VDC..
2. Improper adjustment of voltage-to-frequency circuit to switch board. Each switch board (1 board in the case of the N800i) has a pair of wires to provide an open-collector signal to the FACS input board.

These pairs carry a pulsed 15V signal with a frequency in the 3000Hz range representing the primary voltage. The signal is controlled by the switch board. If this frequency is below 1000Hz. Once this error occurs, the control may not update the frequency on the display. The reading must be in the normal range for this adjustment to be made. If calibrating, observe F18 on the user interface of both left and right sides' readings to tune it in to the measured voltage on J1 of the switch board. If this error occurs and you suspect an adjustment is needed, turn the potentiometer to half way of the full scale and tune from there. You'll have to get past this error to tune the voltage readings correctly, which will involve some power down/up cycles.

3. Broken connection from FACS Input board to the switch board in V-F circuit. Check 750-649-045 FACS Input board, J24 pins 14,2 for one pair, pins 15,3 for the other.
4. If the input voltage measures to be correct and the switch boards V-F signal cannot be calibrated, replace the switch board.
5. If the V-F signal is in a range of (2314Hz and 4529Hz or 250V - 470V) and when first powered up, you still get this error, replace the FACS Input board.

8.3.7 E007 Input Voltage Too Low

Input Voltage Too Low	E007

Fatal, meaning you have to power down to continue welding

>> Yes

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: When power is initially applied to the system, it goes through a series of relay closures / opens and watches the primary voltage closely. If the voltage is sensed to be too low (<225VDC on the capacitor banks" - J1 on each switch board of the N1500i, J1, J4 of the N800i), the unit will re-main in this state. The system must be powered down and examined/ fixed prior to anything else. That is, no welding can be done in this state.

Likely problems or items to check - in order from most likely to least likely:

1. Measure the primary voltage and make sure it is within the correct range as defined by the voltage setting on the back of the unit.
2. Improper adjustment of voltage-to-frequency circuit to switch board. Each switch board has a pair of wires to provide an open- collector signal to the FACS input board. These pairs carry a pulsed 15V signal with a frequency in the 3000Hz range that represents the primary voltage. The signal is controlled by the switch board. If this frequency is below 1000Hz, it will be read by the control as zero (0Hz). Once this error occurs, the control may not update the frequency on the display. The reading must be in the normal range for this adjustment to be made. As you turn the potentiometer on the switch board to adjust the V-F measurement, observe F18 on the user interface on both left and right sides to tune it in to the measured voltage on J1 of the switch board. Press the time up/ down arrows to switch from left/right measurements and to display. If this error occurs and you suspect an adjustment is needed, turn the potentiometer to half way of the full scale and tune from there. You'll have to get past this error to tune the voltage readings correctly, which will involve some power down/up cycles.
3. Broken connection from FACS input board to the switch board in V-F circuit. Check control board JP1 pins 1, 9 for one pair, 2, 10 for the other.
4. If the input voltage measures to be correct and the switch boards V-F signal cannot be calibrated replace the switch board.
5. If the V-F signal is in a range of (2314Hz and 4529Hz or 250V - 470V) and when first powered up, you still get this error, replace the FACS input board.

8.3.8 E008 Primary Overcurrent Error

Primary Overcurrent Error	E008

Fatal, meaning you have to power down to continue welding

>> Yes

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: When a very high primary current is sensed (by means of the current transformer sensors in the back of the unit near the fan plenum), the control will quickly disable the output of the power section to prevent damage. This should only happen due to internal failures.

Likely problems or items to check - in order from most likely to least likely:

1. Replace the power output rectifier board.
2. Replace the switch boards (both).
3. Replace the FACS output SMPS boards.

8.3.9 E009 Could Not Establish Pilot Arc

Could Not Establish Pilot Arc	E009

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: At the beginning of the weld, the pilot arc supply is turned on and the gun is energized. The gun has 20ms to lift (usually lifts in 3ms) and to draw a pilot arc. If no stud voltage is sensed after 20ms, it is assumed that the gun didn't lift and the control throws this error. Note - If the gun lifts and no arc exists, it will try to turn the main current on (and will end up with an E004 because no arc exists).

If the error is consistent, check that the workpiece is directly clamped to the output of the unit.

Check for a small burn mark on the workpiece. If the mark is not there, replace the pilot arc board.

Lift height is too high or plunge depth (stick-out) is too much. Perform a lift test by pressing the gun against an insulated surface. Air lift test will not fully test the lift capability of the welder gun coil circuit.

Workpiece vibration is snuffing out the pilot arc.

8.3.10 E010 Capacitor Voltage Could Not Be Read

Capacitor Voltage Could Not Be Read	E010

Fatal, meaning you have to power down to continue welding
>> No
Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)
>> No

Description: The voltage-to-frequency signals as provided by the switch boards to the FACS input board are not within a 'window' defined by the control board (indicating that they are invalid or caused by noise on the signal line).

Likely problems or items to check - in order from most likely to least likely:

1. Inspect V-F wiring from switch board to FACS input board. Keep wiring away from high power wires.
2. Eliminate possible sources of external electrical noise on the same circuit as this welder.
3. Replace switch board.
4. Replace FACS input board.

8.3.11 E011 Unit Too Hot-Please Wait

Unit Too Hot - Please Wait	E011

Fatal, meaning you have to power down to continue welding
>> No
Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)
>> No

Description: When the internal temperature sensor trips, the control disables welding so as not to allow damage to the unit. This error is displayed while the unit is in the over-temperature condition and disappears when it is ready for more welding. The normally closed temperature sensor is located on the output board and connects to pins 1 and 13 of J24 of the FACS input board. The sensor opens when it reaches 80 deg C.

Likely problems or items to check - in order from most likely to least likely:

1. Fan is not functional or is blocked. Check that fan can physically turn and the wiring to the fan. Short the fan sensor to manually activate the fan. Make sure it works.
2. Inspect wiring from over-temp thermostat to the FACS input board (J24 on FACS input board pins 1 and 13). Measure ~22VDC while open, near 0VDC while closed.
3. Scroll on user interface using time up\down arrows for other errors that may indicate another problem. Measure 20VDC supply on weld output terminals with connectors disconnected.
4. Replace thermal sensor
5. Replace wiring

8.3.12 E012 Short Circuit-Check Gun Lift Setting

Short Circuit- Check Gun Lift Setting	E012

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: If the stud voltage of the power unit is less than 20V while welding for over 100ms, the output is considered shorted. When the unit is shorted, it has the potential for the capacitor banks to go out of balance and damage the unit (if operated this way or with the voltage on one side above the rating of the switch board 400VDC). The unit aborts welds and displays this error if this condition occurs during the main arc time. If this occurs during the plunge time, the error is not displayed, but the weld is aborted - as this is expected to happen during plunge time.

Likely problems or items to check - in order from most likely to least likely:

1. Gun lift setting is causing too many or too large of material transfers, which are shorting the arc for over 100ms. If this happens, the lift should be adjusted to overcome the transfers. If the unit were to continue to deliver current through a short.
2. Determine if it is an internal problem by trying different types of studs and gun settings. If the unit consistently reports this error, it is internal.
3. Inspect wiring from FACS input board J24 pins 11 and 12 to the weld outputs. Make sure the control can sense the voltage appropriately.
4. Replace control board.

8.3.12 E013 Weld Failed - Out of Tolerance

Weld Failed - Out of Tolerance	E013

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: If the unit is configured to compare each weld results (Actual current, voltage, time, etc.) to a given weld 'target', it will display this error when the last weld is out of the configured tolerance range. Change weld setup as appropriate, set a new target, or disable this error as necessary.

Likely problems or items to check - in order from most likely to least likely:

1. Change the weld setup as appropriate.
2. Configure new target. To do this, select F32 and hold the lock button.
3. Adjust tolerance (weld energy F35 or drop time F34)

8.3.14 E014 Warning - Cold Plunge - Stud Hit After Current Was Shut Off

Cold Plunge - Stud Hit After Current Was Shut Off	E014

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: The gun coil was de-energized and the stud did not hit the molten pool before current was shut off. This lends itself to cold welds. Adjustments should be made to the unit settings to avoid this condition.

- Re-configure drop time (F31). Perform a weld while viewing F31. The unit will measure the new drop time and use it in weld timing.
- Increase the short circuit on time (F2). This is extra assurance that even with varying gun drop times, the current will stay on long enough to overcome the variation.

8.3.15 E017 Warning - Pilot Blew Out

Warning - Pilot Blew Out	E017

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: During the pilot arc stage, the gun lifted as expected. The arc voltage would be within a window of 12V and 60V (typically 30-40V). This error is generated if the arc voltage exceeds 60V, representing a condition where the pilot arc blew out.

For this condition, check surface conditions and clean the workpiece of any ferrule dust or debris.

8.3.16 E018 Warning - Drop Time is too long for Short Cycle

Warning - Drop Time is too long for Short Cycle	E018

Fatal, meaning you have to power down to continue welding

>> No

Acknowledge, meaning the error will exist as long as the unit is powered on. (Note, welding can continue while the error exists)

>> No

Description: The Configuration 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.

8.3.17 Additional Warning - WAIT is on upper display and CYCLE or CAP is on lower display

Additional Warning - Wait is on upper display and CYCLE or CAP is on lower display

Description: ‘WAIT’ will display for the following 3 reasons:

6. Weld duty cycle is being exceeded
7. Switch board is out of calibration
8. Switch board malfunctioned

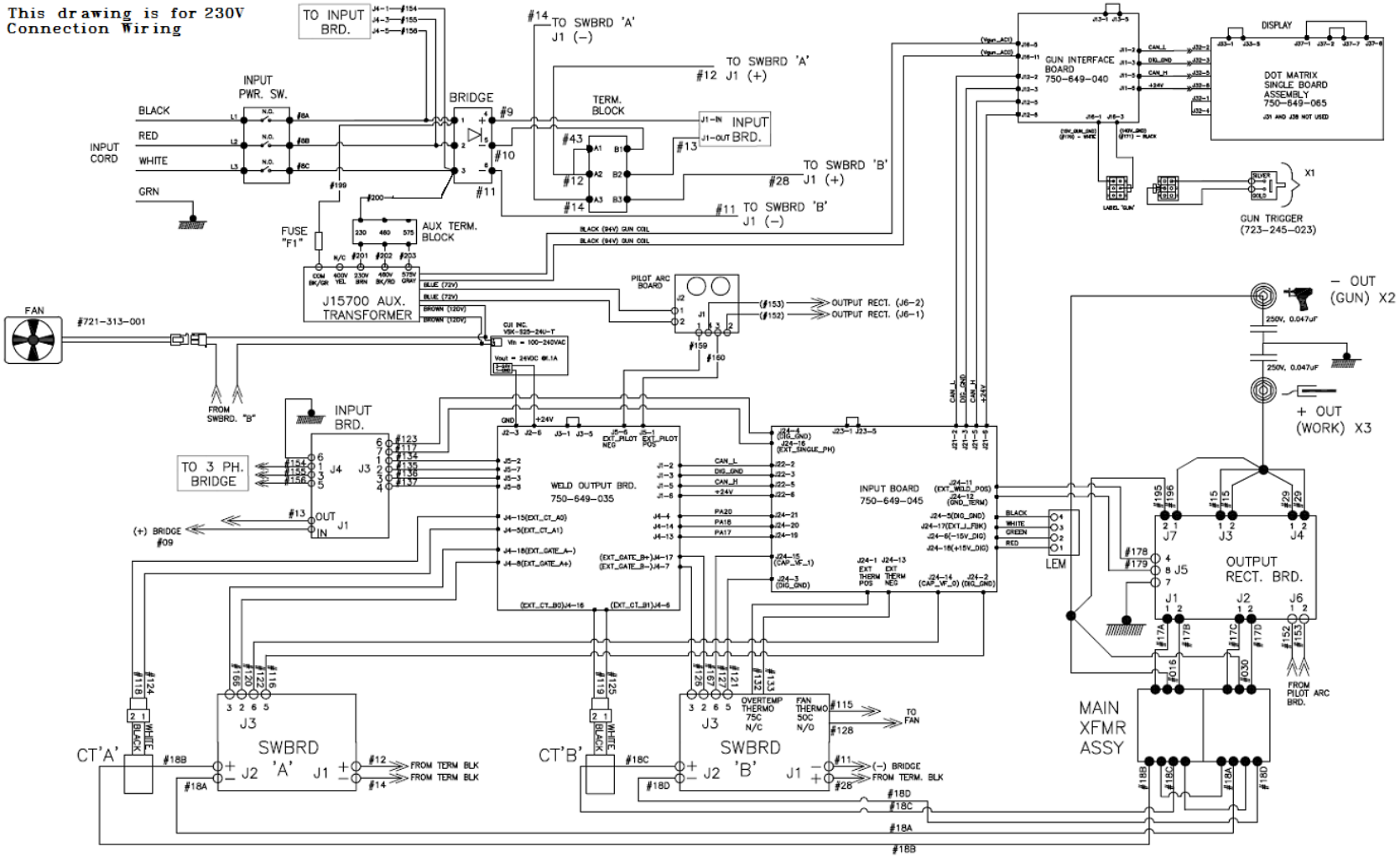
If lower display reads “CYCLE”,
Check Duty Cycle of the power unit.

If lower display reads “CAP”,

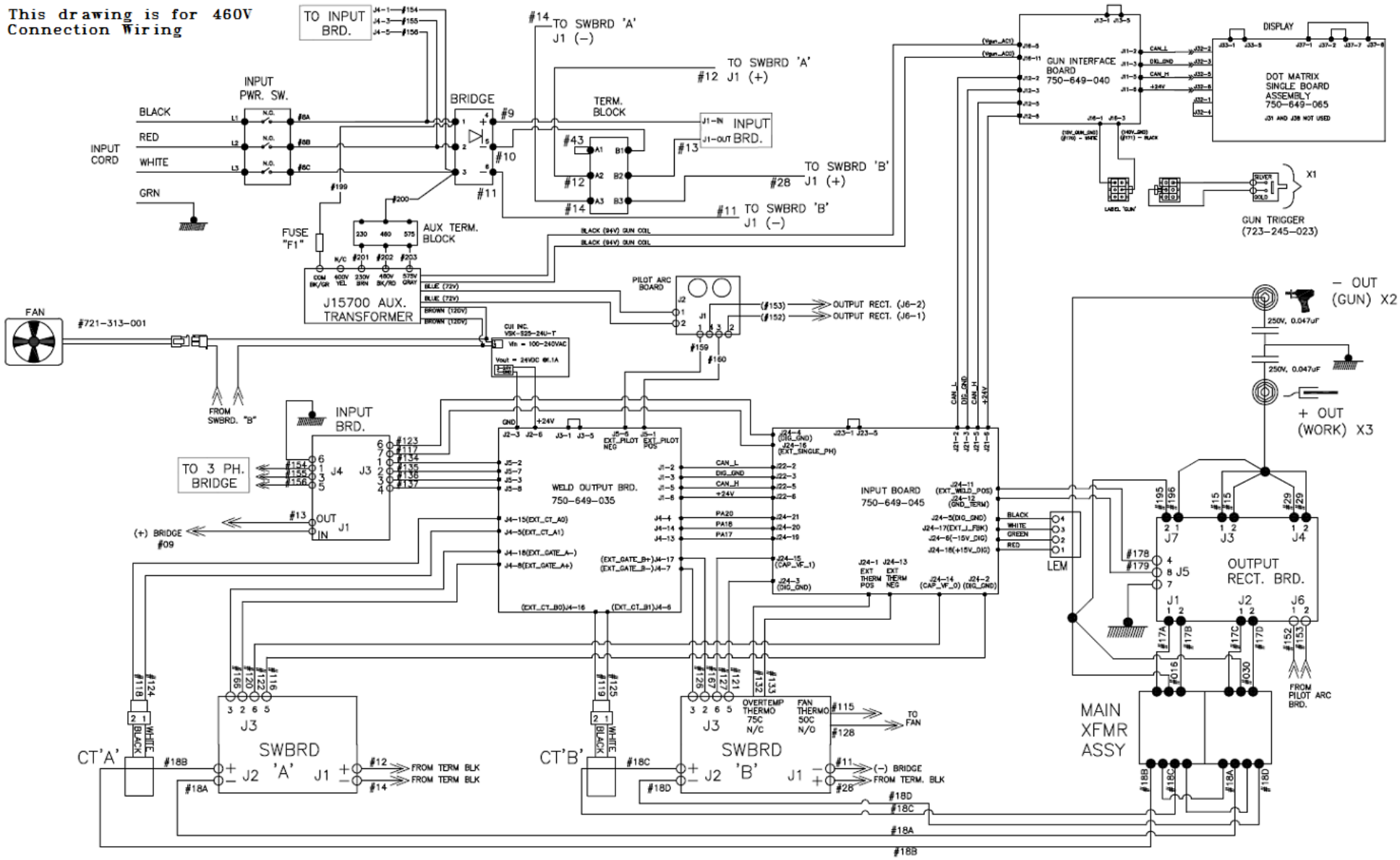
Step 1: Check Switch Board Calibration: Switch boards generate a signal representing the capacitor voltage for the FACS input board.

Step 2: Switch Board Malfunction: If re-calibration of the switch board fails, exchange the switch board.

9. Wiring Diagram Nelweld N1500i



For 575 units: move the #200 wire, add the #203 wire, and change the rating plate to PN 724-574-00



For 575 units: move the #200 wire, add the #203 wire, and change the rating plate to PN 724-574-000

10. Spare Parts List for N1500i

Part Number	Description
750-610-054	Switchboard A
750-610-055	Switchboard B
709-256-015	Main Power Switch
750-510-022	Input Board
750-610-062	Pilot Arc Board
750-649-065	Dot Matrix User Interface
750-649-035	SMPS Output Board
750-649-045	Input Sensing Board
750-649-040	Gun Interface Board
701-175-000	3 Phase Bridge Rectifier
750-610-034	Output Rectifier Board

Contact Information

North America Sales Offices and Warehouses			
***Chicago** 18601 Graphic Court Tinley Park, IL 60477 **Phone:** 708.430.3770 **Fax:** 708.444.8450	***Philadelphia** 260 Boot Road Downingtown, PA 19335 **Phone:** 610.873.0012 **Fax**: 610.873.2550	****Elyria** 7900 West Ridge Road Elyria, OH 44036-2019 **Phone:** 440.329.0400 **Fax:** 440.329.0526	***Westlake** 821 Sharon Drive Westlake, OH 44145 **Phone:** 440.250.9242
***Dallas** 2211 Century Center Blvd. Suite 105 Irving, TX 75062 **Phone:** 972.721.9055 **Fax:** 972.438.7883	***San Francisco** 23765 Foley Street Hayward, CA 94545 510.293.0660 **Phone:** 800.635.9353 **Fax:** 510.293.0677	***Toronto** 6199A Danville Rd. Mississauga, Ontario Canada L5T 2H7 **Phone:** 905.795.8277 800.635.9353 905.795.8275	***Los Angeles** 20621B East Valley Blvd. Walnut, CA 91789-2731 **Phone:** 909.468.2105 800.635.9353 **Fax:** 909.468.2112

Subsidiaries	International
England *Nelson U.K. Ltd.* 47-49 Edison Rd. Rabans Lane Industrial Estate Aylesbury HP19 8TE, UK **Phone:** 44.1296.433500 **Fax:** 44.1296.487930	***Middle East & Asia/Pacific*** 7900 West Ridge Rd. Elyria, OH 44036-2019 USA Phone: 440.329.0400 **Fax:** 440.329.0526 **E-mail:** Nelson.Sales@NelsonStud.com
France *Nelson Soudage de Goujons* Z.1 du chemin vert 8 rue de l'Angoumois Argenteuil F-95100, France **Phone:** 33.1.3411.9400 **Fax:** 33.1.3411.2033	***Central & South America*** P.O. Box 3990 Seminole, FL 33775 USA **Phone:** 727.596.9600 **Fax:** 727.593.3494
Germany *Nelson Stud Welding* Flurstrasse 7-19 Gevelsberg D-58285, Germany **Phone:** 49.2332.661.125 **Fax:** 49.2332.661.159	**For Distributors in specific areas call:** **440.329.0400** ***General Offices*** 7900 West Ridge Rd. Elyria, OH 44036-2019 USA **Phone**: 440.329.0400 **Fax:** 440.329.0526 **World Wide Web:** NelsonStudWelding.com **E-mail:** Nelson.Sales@NelsonStud.com
Italy *Nelson Stud Welding* Via Miraflores, 20 Nichelino, (TO) I-10042 Italy **Phone:**39.011.6059238 **Fax:** 39.011.6050015	